



# Spectra Series™ and 8000-Line Motor Control Centers

## Application Data

### Approximate Motor Full-Load Current Ratings

#### Full-Load Current for EPAC Compliant Motors Average Expected Values

For three-phase, 60 Hertz, GE Type KE (NEMA Design B) drip-proof, normal starting torque, continuous 40°C ambient (1.15 service factor) horizontal induction motors.

| Motor HP       | Synchronous Speed, RPM | Average Expected Values of Full-load Currents |      |      |      |
|----------------|------------------------|---|------|------|------|
|                |                        | 200V  | 230V | 460V | 575V |
| ¼ <sup>Ⓛ</sup> | 1800                   | 1.6   | 1.4  | 0.70 | 0.56 |
|                | 1200                   | 1.7   | 1.5  | 0.75 | 0.60 |
| ½ <sup>Ⓛ</sup> | 3600                   | 2.0   | 1.7  | 0.85 | 0.68 |
|                | 1800                   | 1.7   | 1.5  | 0.75 | 0.60 |
| ¾              | 1200                   | 2.0   | 1.7  | 0.85 | 0.68 |
|                | 3600                   | 2.0   | 1.8  | 0.88 | 0.70 |
|                | 1800                   | 2.3   | 2.0  | 1.0  | 0.80 |
|                | 1200                   | 2.3   | 2.0  | 1.0  | 0.80 |
| 1              | 900                    | 3.2   | 2.8  | 1.4  | 1.4  |
|                | 3600                   | 2.8   | 2.4  | 1.2  | 0.96 |
|                | 1800                   | 3.2   | 2.8  | 1.4  | 1.1  |
|                | 1200                   | 3.7   | 3.2  | 1.6  | 1.3  |
| 1½             | 900                    | 4.4   | 3.8  | 1.9  | 1.5  |
|                | 3600                   | 3.7   | 3.2  | 1.6  | 1.3  |
|                | 1800                   | 4.1   | 2.2  | 1.6  | 1.4  |
|                | 1200                   | 4.4   | 4.6  | 2.3  | 1.5  |
| 2              | 900                    | 5.5   | 4.8  | 2.4  | 1.9  |
|                | 3600                   | 5.3   | 4.8  | 2.4  | 1.8  |
|                | 1800                   | 6.0   | 4.4  | 2.2  | 2.1  |
|                | 1200                   | 6.0   | 4.6  | 2.3  | 2.1  |
| 3              | 900                    | 7.1   | 6.2  | 3.1  | 2.5  |
|                | 3600                   | 6.9   | 6.0  | 3.0  | 2.4  |
|                | 1800                   | 7.1   | 5.8  | 2.9  | 2.5  |
|                | 1200                   | 7.6   | 6.2  | 3.1  | 2.6  |
| 4              | 900                    | 10.6  | 9.2  | 4.6  | 3.7  |
|                | 3600                   | 9.4   | 8.0  | 4.0  | 3.3  |
|                | 1800                   | 9.9   | 7.9  | 3.9  | 3.4  |
|                | 1200                   | 12.0  | 8.6  | 4.3  | 4.2  |
| 5              | 900                    | 15.4  | 13.4 | 6.7  | 5.4  |
|                | 3600                   | 15.4  | 12.2 | 6.1  | 5.4  |
|                | 1800                   | 14.4  | 12.6 | 6.3  | 5.7  |
|                | 1200                   | 19.3  | 14.0 | 7.0  | 6.7  |
| 7½             | 900                    | 19.8  | 17.2 | 8.6  | 6.9  |
|                | 3600                   | 21.4  | 18.0 | 9.0  | 7.5  |
|                | 1800                   | 23.7  | 18.0 | 9.3  | 8.2  |
|                | 1200                   | 26.0  | 19.8 | 9.9  | 9.0  |
| 10             | 900                    | 28.5  | 24.0 | 12.4 | 9.9  |
|                | 3600                   | 27.4  | 24.0 | 12.0 | 9.5  |
|                | 1800                   | 27.0  | 23.8 | 11.9 | 10.9 |
|                | 1200                   | 32.7  | 25.8 | 12.9 | 11.4 |
| 15             | 900                    | 33.1  | 28.8 | 14.4 | 11.5 |
|                | 3600                   | 42.6  | 36.0 | 18.0 | 14.8 |
|                | 1800                   | 40.3  | 35.0 | 17.6 | 16.2 |
|                | 1200                   | 45.1  | 33.0 | 19.1 | 15.7 |
| 20             | 900                    | 47.6  | 41.4 | 20.7 | 16.6 |
|                | 3600                   | 62.3  | 45.4 | 22.7 | 21.7 |
|                | 1800                   | 53.2  | 46.2 | 23.1 | 20.6 |
|                | 1200                   | 56.6  | 50.0 | 25.0 | 19.7 |
|                | 900                    | 63.9  | 55.6 | 27.8 | 22.2 |

Ⓛ Open, Type K, general purpose, NEMA SF, solid base, rolled-steel-shell, GE induction motors.

| Motor HP | Synchronous Speed, RPM | Average Expected Values of Full-load Currents |       |      |      |
|----------|------------------------|---|-------|------|------|
|          |                        | 200V  | 230V  | 460V | 575V |
| 25       | 3600                   | 72.0  | 56.0  | 28.0 | 25.0 |
|          | 1800                   | 71.3  | 60.0  | 30.0 | 24.8 |
|          | 1200                   | 73.8  | 63.2  | 31.6 | 25.7 |
| 30       | 900                    | 82.6  | 71.8  | 35.9 | 28.7 |
|          | 3600                   | 85.6  | 67.8  | 33.9 | 29.8 |
|          | 1800                   | 81.7  | 71.2  | 35.6 | 29.9 |
| 40       | 1200                   | 88.6  | 73.8  | 36.9 | 30.8 |
|          | 900                    | 92.2  | 80.2  | 40.1 | 32.1 |
|          | 3600                   | 101   | 89.0  | 44.6 | 39.2 |
| 50       | 1800                   | 112   | 97.8  | 48.9 | 40.3 |
|          | 1200                   | 114   | 99.6  | 48.5 | 39.8 |
|          | 900                    | 122   | 105.8 | 52.9 | 42.3 |
| 60       | 3600                   | 140   | 129   | 64.5 | 48.9 |
|          | 1800                   | 142   | 122   | 61.1 | 49.4 |
|          | 1200                   | 144   | 125.2 | 61.0 | 50.1 |
| 75       | 900                    | 159   | 138.2 | 69.1 | 55.3 |
|          | 3600                   | 163   | 145.6 | 72.8 | 56.6 |
|          | 1800                   | 172   | 147.4 | 73.7 | 59.9 |
| 100      | 1200                   | 172   | 149.2 | 69.8 | 59.7 |
|          | 900                    | 176   | 153.4 | 76.7 | 61.4 |
|          | 3600                   | 206   | 181   | 90.5 | 71.5 |
| 125      | 1800                   | 207   | 180.0 | 91.6 | 72.0 |
|          | 1200                   | 206   | 179.2 | 86.7 | 71.7 |
|          | 900                    | 221   | 191.8 | 95.9 | 76.7 |
| 150      | 3600                   | 262   | 238   | 119  | 91.2 |
|          | 1800                   | 281   | 232   | 116  | 97.7 |
|          | 1200                   | 283   | 246   | 118  | 98.4 |
| 200      | 900                    | 296   | 258   | 129  | 103  |
|          | 3600                   | 338   | 290   | 139  | 116  |
|          | 1800                   | 340   | 296   | 143  | 118  |
| 250      | 1200                   | 352   | 306   | 149  | 122  |
|          | 900                    | 370   | 322   | 161  | 129  |
|          | 3600                   | 398   | 346   | 164  | 138  |
| 300      | 1800                   | 412   | 348   | 169  | 143  |
|          | 1200                   | 419   | 364   | 177  | 146  |
|          | 900                    | 435   | 378   | 189  | 151  |
| 350      | 3600                   | —   | 446   | 217  | 178  |
|          | 1800                   | —   | 468   | 226  | 187  |
|          | 1200                   | —   | 482   | 239  | 193  |
| 400      | 3600                   | —   | 574   | 287  | 230  |
|          | 1800                   | —   | 590   | 295  | 236  |
|          | 1200                   | —   | 594   | 297  | 238  |
| 450      | 3600                   | —   | 676   | 338  | 270  |
|          | 1800                   | —   | 686   | 340  | 274  |
| 500      | 3600                   | —   | 774   | 387  | 310  |
|          | 1800                   | —   | 792   | 396  | 317  |
| 600      | 3600                   | —   | 890   | 445  | 356  |

Note: The listed data is based on approximate full-load current ratings of standard, open, 1.15 service factor, continuous rated General Electric motors. Full-load current ratings of similar motors of other manufacturers may vary considerably. Therefore, whenever possible use actual full-load current rating given on motor nameplate. Contact motor manufacturer for full-load currents of single-phase and DC motors.



## Mag-Break Magnetic Circuit Breaker Trip Set Positions

The greatest degree of protection is provided when the magnetic trip setting is just above the motor starting inrush current. It is therefore recommended that the magnetic trip position be adjusted to a setting one position higher than the setting that

carries the motor starting current. For recommended continuous-current ratings, see overload heater tables on pages J-7 through J-15.

| Cat No.<br>3 Pole | Continuous<br>Amperes | Trip Setting Positions |      |      |      |      |      |      |
|-------------------|-----------------------|------------------------|------|------|------|------|------|------|
|                   |                       | Lo                     | 2    | 4    | 6    | 8    | 10   | Hi   |
| TEC36003          | 3                     | 8                      | 13   | 18   | 23   | 28   | 33   | 38   |
| TEC36007          | 7                     | 18                     | 30   | 42   | 54   | 66   | 78   | 90   |
| TEC36015          | 15                    | 42                     | 68   | 94   | 120  | 146  | 172  | 198  |
| TEC36030          | 30                    | 90                     | 140  | 190  | 240  | 290  | 340  | 390  |
| TEC36050          | 50                    | 180                    | 260  | 340  | 420  | 500  | 580  | 660  |
| TEC36100          | 100                   | 300                    | 468  | 636  | 804  | 972  | 1140 | 1300 |
| TEC36150          | 150                   | 600                    | 950  | 1300 | 1650 | 2000 | 2350 | 2700 |
| TFC36225          | 225                   | 600                    | 780  | 1020 | 1200 |      |      | 1400 |
| TFC36225A         | 225                   | 1000                   | 1200 | 1630 | 1920 |      |      | 2250 |
| TJC36400B         | 400                   | 1200                   | 1400 | 1850 | 3250 |      |      | 4000 |
| TJC36400E         | 400                   | 330                    | 435  | 600  | 860  |      |      | 1100 |
| TJC36400F         | 400                   | 550                    | 720  | 945  | 1280 |      |      | 1670 |
| TJC36400G         | 400                   | 1000                   | 1280 | 1780 | 2360 |      |      | 3300 |
| TJC36600G         | 600                   | 1000                   | 1280 | 1780 | 2360 |      |      | 3300 |
| TJC36600H         | 600                   | 1800                   | 2100 | 2600 | 3600 |      |      | 6000 |

## Spectra RMS Circuit Breaker Current Ratings

| Frame | Max. Frame<br>Amps | Rating<br>Plug<br>Amps | Instantaneous Trip Setting, Nominal RMS Sym. Amperes |       |       |        |       |       |       |
|-------|--------------------|------------------------|--|-------|-------|--------|-------|-------|-------|
|       |                    |                        | Trip Setting Adjustment Position                     |       |       |        |       |       |       |
|       |                    |                        | Min.   | 2     | 3     | 4      | 5     | 6     | Max.  |
| SE    | 7                  | 3                      | 11   | 13    | 16    | 19     | 24    | 31    | 39    |
|       |                    | 7                      | 22   | 27    | 35    | 43     | 56    | 71    | 90    |
|       | 30                 | 15                     | 43   | 55    | 69    | 86     | 111   | 143   | 182   |
|       |                    | 20                     | 58   | 74    | 93    | 116    | 151   | 196   | 254   |
|       |                    | 25                     | 73   | 93    | 117   | 147    | 193   | 253   | 332   |
|       |                    | 30                     | 87   | 112   | 142   | 179    | 237   | 314   | 415   |
|       | 60                 | 40                     | 118  | 150   | 188   | 237    | 308   | 394   | 501   |
|       |                    | 50                     | 148  | 187   | 236   | 296    | 386   | 498   | 637   |
|       |                    | 60                     | 178  | 224   | 284   | 355    | 464   | 604   | 777   |
|       |                    | 70                     | 206  | 261   | 329   | 411    | 534   | 684   | 863   |
|       | 100                | 80                     | 236  | 299   | 377   | 472    | 614   | 787   | 999   |
|       |                    | 90                     | 267  | 338   | 426   | 532    | 694   | 892   | 1,138 |
|       |                    | 100                    | 297  | 376   | 475   | 593    | 775   | 998   | 1,280 |
|       |                    | 110                    | 328  | 415   | 524   | 654    | 857   | 1,105 | 1,426 |
|       | 150                | 125                    | 374  | 474   | 598   | 745    | 979   | 1,265 | 1,640 |
|       |                    | 150                    | 450  | 570   | 720   | 897    | 1,181 | 1,528 | 1,991 |
|       |                    |                        | Min.   | 2     | 3     | 4      | 5     | Max.  |       |
|       | SF                 | 250                    | 70   | 205   | 260   | 330    | 410   | 535   | 700   |
|       |                    |                        | 90   | 265   | 335   | 425    | 530   | 690   | 900   |
|       |                    |                        | 100  | 295   | 375   | 470    | 590   | 765   | 1,000 |
| 110   |                    |                        | 325  | 410   | 520   | 650    | 845   | 1,100 |       |
| 125   |                    |                        | 370  | 465   | 570   | 740    | 960   | 1,250 |       |
| 150   |                    |                        | 440  | 560   | 705   | 885    | 1,150 | 1,500 |       |
| 175   |                    |                        | 515  | 655   | 825   | 1,035  | 1,345 | 1,750 |       |
| 200   |                    |                        | 590  | 750   | 940   | 1,180  | 1,535 | 2,000 |       |
| 225   |                    |                        | 665  | 840   | 1,050 | 1,330  | 1,730 | 2,250 |       |
| 250   |                    |                        | 740  | 935   | 1,180 | 1,480  | 1,920 | 2,500 |       |
| 125   |                    |                        | 380  | 480   | 620   | 765    | 990   | 1,275 |       |
| 150   |                    |                        | 455  | 575   | 740   | 920    | 1,185 | 1,530 |       |
| SG    | 400                | 175                    | 530  | 670   | 865   | 1,070  | 1,385 | 1,785 |       |
|       |                    | 200                    | 605  | 765   | 990   | 1,225  | 1,580 | 2,040 |       |
|       |                    | 225                    | 680  | 860   | 1,115 | 1,375  | 1,780 | 2,295 |       |
|       |                    | 250                    | 755  | 955   | 1,235 | 1,530  | 1,975 | 2,550 |       |
|       |                    | 300                    | 905  | 1,145 | 1,480 | 1,835  | 2,370 | 3,060 |       |
|       |                    | 350                    | 1,060  | 1,340 | 1,730 | 2,140  | 2,765 | 3,570 |       |
|       | 400                | 1,210                  | 1,530  | 1,980 | 2,445 | 3,160  | 4,080 |       |       |
|       | 600                | 250                    | 765  | 965   | 1,215 | 1,500  | 1,960 | 2,530 |       |
|       |                    | 300                    | 915  | 1,155 | 1,455 | 1,800  | 2,355 | 3,035 |       |
|       |                    | 350                    | 1,070  | 1,350 | 1,700 | 2,100  | 2,745 | 3,545 |       |
| 400   |                    | 1,200                  | 1,540  | 1,940 | 2,400 | 3,135  | 4,050 |       |       |
| SK    | 800                | 450                    | 1,375  | 1,735 | 2,185 | 2,695  | 3,530 | 4,555 |       |
|       |                    | 500                    | 1,525  | 1,925 | 2,425 | 2,995  | 3,920 | 5,060 |       |
|       |                    | 600                    | 1,830  | 2,310 | 2,910 | 3,595  | 4,705 | 6,075 |       |
|       |                    | 300                    | 940  | 1,150 | 1,445 | 1,795  | 2,375 | 3,015 |       |
|       |                    | 400                    | 1,255  | 1,535 | 1,930 | 2,395  | 3,165 | 4,015 |       |
|       |                    | 500                    | 1,570  | 1,915 | 2,410 | 2,990  | 3,955 | 5,020 |       |
|       | 1,200              | 600                    | 1,875  | 2,290 | 2,895 | 3,610  | 4,740 | 6,195 |       |
|       |                    | 700                    | 2,155  | 2,665 | 3,375 | 4,240  | 5,525 | 7,420 |       |
|       |                    | 800                    | 2,440  | 3,035 | 3,860 | 4,875  | 6,305 | 8,705 |       |
|       |                    | 600                    | 1,825  | 2,310 | 2,905 | 3,685  | 4,730 | 6,110 |       |
| 700   | 2,125              | 2,695                  | 3,390  | 4,300 | 5,515 | 7,125  |       |       |       |
| 800   | 2,430              | 3,080                  | 3,870  | 4,910 | 6,305 | 8,145  |       |       |       |
| 1,000 | 3,040              | 3,850                  | 4,840  | 6,140 | 8,880 | 10,180 |       |       |       |
| 1,200 | 3,650              | 4,620                  | 5,805  | 7,370 | 9,455 | 12,215 |       |       |       |



### Thermal Magnetic Trip Ratings for Motor Circuits

These selections are based on 1999 National Electric Code requirements for squirrel-cage motors without code letters or with code letter through G. Lower trip ratings may be required for motor with code letter A and higher trips for motors with code

letters H to V. Local code or specific application requirements may necessitate special selection. Thermal-magnetic circuit breaker combination motor control units are not recommended for motors with full-load currents of 3.8 amperes or less.

| NEMA Size | Motor HP | CB Type   | 200/208V Trip | 230V Trip | 380V Trip | 460V Trip | 575V Trip |     |
|-----------|----------|-----------|---------------|-----------|-----------|-----------|-----------|-----|
| 1         | 2        | SE        | 15            | 15        | 15        | 15        | 15        |     |
|           | 3        |           | 20            | 15        | 15        | 15        | 15        |     |
|           | 5        |           | 30            | 30        | 20        | 15        | 15        |     |
|           | 7.5      |           | 50            | 30        | 30        | 20        | 20        |     |
|           | 10       |           |               |           | 30        | 20        | 20        |     |
| 2         | 10       | SE        | 50            | 50        |           |           |           |     |
|           | 15       |           |               | 70        | 50        | 40        | 30        |     |
|           | 20       |           |               |           |           | 70        | 50        | 40  |
|           | 25       |           |               |           |           | 70        | 60        | 50  |
| 3         | 15       | SE        | 70            |           |           |           |           |     |
|           | 20       |           | 100           | 100       |           |           |           |     |
|           | 25       |           | 100           | 100       |           |           |           |     |
|           | 30       |           |               |           | 125       | 100       | 70        | 50  |
|           | 40       |           |               |           |           | 100       | 100       | 70  |
|           | 50       |           |               |           |           |           | 125       | 100 |
| 4         | 30       | SF<br>SGL | 125           |           |           |           |           |     |
|           | 40       |           | 200           | 150       |           |           |           |     |
|           | 50       |           |               | 200       |           |           |           |     |
|           | 60       |           |               |           |           | 150       | 125       | 100 |
|           | 75       |           |               |           |           | 200       | 200       | 125 |
|           | 100      |           |               |           |           |           | 200       | 150 |

| NEMA Size | Motor HP | CB Type | 200/208V Trip | 230V Trip | 380V Trip | 460V Trip | 575V Trip |         |     |
|-----------|----------|---------|---------------|-----------|-----------|-----------|-----------|---------|-----|
| 5         | 50       | SGL     | 200/250       |           |           |           |           |         |     |
|           | 60       |         | 300           | 225/250   |           |           |           |         |     |
|           | 75       |         | 350           | 300/350   |           |           |           |         |     |
|           | 100      |         |               |           | 400       | 225/250   |           |         |     |
|           | 125      |         |               |           |           | 300       | 225/250   | 225/250 |     |
|           | 150      |         |               |           |           |           | 300/350   | 300     | 250 |
|           | 200      |         |               |           |           |           |           | 350/400 | 300 |
| 6         | 100      | SGL/SKL | 500           |           |           |           |           |         |     |
|           | 125      |         | 800           |           |           |           |           |         |     |
|           | 150      |         | 800           | 800       |           |           |           |         |     |
|           | 200      |         |               | 1000      | 500       |           |           |         |     |
|           | 250      |         |               |           | 800       | 500       | 400       |         |     |
|           | 300      |         |               |           |           | 800       | 600       | 500     |     |
|           | 350      | SKL     |               |           |           |           | 800       | 800     |     |
|           | 400      |         |               |           |           |           | 1000      | 800     |     |

### Motor Selection Table for Spectra Motor Circuit Protectors

| Max HP per System Voltage |      |      |      |      | Starter Size       | Rating Plug |               | CB Sensor | CB Frame  |
|---------------------------|------|------|------|------|--------------------|-------------|---------------|-----------|-----------|
| 208V                      | 230V | 380V | 460V | 575V |                    | Amps        | CAT#          |           |           |
| 0.5                       | 0.5  | 1.0  | 1.0  | 1.5  | 1                  | 3           | SRPE7A3       | 7         | SE<br>150 |
| 1.0                       | 1.5  | 3.0  | 3.0  | 3.0  |                    | 7           | SRPE7A7       |           |           |
| 2.0                       | 3.0  | 5.0  | 5.0  | 7.5  |                    | 15          | SRPE30A15     |           |           |
| 3.0                       | 5.0  | 10.0 | 10.0 | 10.0 |                    | 20          | SRPE30A20     |           |           |
| 5.0                       |      |      |      |      |                    | 25          | SRPE30A25     |           |           |
| -                         | 7.5  |      |      |      |                    | 30          | SRPE30A30     |           |           |
| 7.5                       |      |      |      |      |                    | 40          | SRPE60A40     |           |           |
|                           |      |      |      | 15   | 2                  | 25          | SRPE30A25     | 30        |           |
|                           |      |      | 15   | 20   |                    | 30          | SRPE30A30     |           |           |
|                           |      | 15   |      | 25   |                    | 40          | SRPE60A40     |           |           |
| 10                        | 10   | 25   | 25   |      |                    | 50          | SRPE60A50     |           |           |
|                           | 15   |      |      |      |                    | 60          | SRPE60A60     |           |           |
|                           |      |      | 25   | 30   |                    | 3           | 50            |           |           |
|                           |      | 30   | 30   | 40   | 70                 |             | SRPE100A70    |           |           |
| 25                        | 25   | 50   | 50   | 50   | 100                |             | SRPE100A100   |           |           |
|                           | 30   |      |      |      | 150                |             | SRPE150A150   |           |           |
|                           |      |      |      | 60   | 4RVAT <sup>①</sup> | 100         | SRPE150A100   | 150       |           |
| 40                        | 50   | 75   | 100  | 100  |                    | 150         | SRPE150A150   |           |           |
|                           |      | 60   | 60   | 75   | 4STD               | 150         | SRPF250A150   | 200       |           |
| 40                        | 50   | 75   | 100  | 100  |                    | 200         | SRPF250A200   |           |           |
| 50                        | 50   | 100  | 125  | 150  |                    | 250         | SRPG400A250   |           |           |
| 60                        | 60   | 125  | 150  |      | 5                  | 300         | SRPG400A300   | 400       |           |
| 75                        | 75   | 150  |      | 200  |                    | 350         | SRPG400A350   |           |           |
|                           | 100  |      | 200  |      |                    | 400         | SRPG400A400   |           |           |
|                           |      |      |      | 250  |                    | 400         | SRPG800A400   |           |           |
| 100                       |      | 200  | 250  | 300  | 6                  | 500         | SRPG800A500   | 600       |           |
| 150                       | 150  | 300  | 350  | 400  |                    | 800         | SRPK1200A800  |           |           |
|                           | 200  |      | 400  |      |                    | 1000        | SRPK1200A1000 |           |           |

① Size 4 RVAT with SF CB requires an additional 6" height extension.



## Overload Heater Tables

### Heaters for Ther-Mag Controllers

For continuous rated motors with a service factor of 1.15 to 1.25, select heaters from the heater table. For continuous rated motors with a service factor of 1.0, multiply the motor full-load current by 0.9 and use this value to select heaters.

Overload relay tripping current in 40°C ambient is the minimum value of full load current multiplied by 1.25.

**WARNING:** Overload relays with automatic reset may automatically start a motor connected to a 2-wire control circuit. When automatic restarting is not desired, use a 3-wire control circuit.

Provide short circuit protection in accordance with the National Electrical Code.

### Size 0 and 1 (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 |
|--|-------------------------|--|-------------------------|
| .41-.45                                | C054A                   | 4.96-5.49                              | C592A                   |
| .46-.49                                | C060A                   | 5.50-5.91                              | C630A                   |
| .50-.53                                | C066A                   | 5.92-6.47                              | C695A                   |
| .54-.59                                | C071A                   | 6.48-7.20                              | C778A                   |
| .60-.65                                | C078A                   | 7.21-8.22                              | C867A                   |
| .66-.76                                | C087A                   | 8.23-8.72                              | C955A                   |
| .77-.84                                | C097A                   | 8.73-9.67                              | C104B                   |
| .85-.93                                | C109A                   | 9.68-10.4                              | C113B                   |
| .94-1.04                               | C118A                   | 10.5-11.0                              | C125B                   |
| 1.05-1.15                              | C131A                   | 11.1-12.4                              | C137B                   |
| 1.16-1.27                              | C148A                   | 12.5-13.2                              | C151B                   |
| 1.28-1.39                              | C163A                   | 13.3-15.4                              | C163B                   |
| 1.40-1.55                              | C184A                   | 15.5-17.1                              | C180B                   |
| 1.56-1.73                              | C196A                   | 17.2-18.0                              | C198B                   |
| 1.74-1.89                              | C220A                   | <b>Size 1</b>                          |                         |
| 1.90-2.05                              | C239A                   |  |                         |
| 2.06-2.28                              | C268A                   | 17.2-18.1                              | C198B                   |
| 2.29-2.47                              | C301A                   | 18.2-20.0                              | C214B                   |
| 2.48-2.79                              | C326A                   | 20.1-21.5                              | C228B                   |
| 2.80-3.31                              | C356A                   | 21.6-22.5                              | C250B                   |
| 3.32-3.70                              | C379A                   | 22.6-23.9                              | C273B                   |
| 3.71-4.06                              | C419A                   | 24.0-26.3                              | C303B                   |
| 4.07-4.47                              | C466A                   | 26.4-27.0                              | C330B                   |
| 4.48-4.95                              | C526A                   |  |                         |

### Size 2 (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 |
|--|-------------------------|--|-------------------------|
| 5.48-5.85                              | C630A                   | 16.8-17.9                              | C180B                   |
| 5.85-6.47                              | C695A                   | 18.0-18.7                              | C198B                   |
| 6.48-7.35                              | C778A                   | 18.8-20.4                              | C214B                   |
| 7.36-8.06                              | C867A                   | 20.5-22.7                              | C228B                   |
| 8.07-9.03                              | C955A                   | 22.8-24.7                              | C250B                   |
| 9.04-9.61                              | C104B                   | 24.8-26.3                              | C273B                   |
| 9.62-10.5                              | C113B                   | 26.4-29.5                              | C303B                   |
| 10.6-11.6                              | C125B                   | 29.6-32.5                              | C330B                   |
| 11.7-12.5                              | C137B                   | 32.6-36.7                              | C366B                   |
| 12.6-13.6                              | C151B                   | 36.8-41.9                              | C400B                   |
| 13.7-16.7                              | C163B                   | 42.0-43.2                              | C440B                   |
|  |                         | 43.3-45.0                              | C460B                   |

**WARNING:** Opening of the circuit breaker may be an indication that a fault current has been interrupted. To provide continued protection against fire or shock hazard, all current-carrying parts and other components of the motor controller should be examined and replaced if damaged. If heater burnout occurs, the complete overload relay must be replaced.

### Size 3 (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 |
|--|-------------------------|--|-------------------------|
| 19.0-19.3                              | F233B                   | 17.8-18.4                              | F233B                   |
| 19.4-22.1                              | F243B                   | 18.5-21.1                              | F243B                   |
| 22.2-23.4                              | F270B                   | 21.2-22.1                              | F270B                   |
| 23.5-27.0                              | F300B                   | 22.2-26.1                              | F300B                   |
| 27.1-29.1                              | F327B                   | 26.2-28.0                              | F327B                   |
| 29.2-31.8                              | F357B                   | 28.1-31.3                              | F357B                   |
| 31.9-33.9                              | F395B                   | 31.4-33.3                              | F395B                   |
| 34.0-37.6                              | F430B                   | 33.4-34.3                              | F430B                   |
| 37.7-41.9                              | F487B                   | 34.4-40.9                              | F487B                   |
| 42.0-47.7                              | F567B                   | 41.0-44.7                              | F567B                   |
| 47.8-52.1                              | F614B                   | 44.8-51.0                              | F614B                   |
| 52.2-55.8                              | F658B                   | 51.1-52.0                              | F658B                   |
| 55.9-59.7                              | F719B                   | 52.1-55.4                              | F719B                   |
| 59.8-68.1                              | F772B                   | 55.5-63.3                              | F772B                   |
| 68.2-71.5                              | F848B                   | 63.4-66.1                              | F848B                   |
| 71.6-78.2                              | F914B                   | 66.2-73.5                              | F914B                   |
| 78.3-87.5                              | F104C                   | 73.6-82.2                              | F104C                   |
| 87.6-90.0                              | F114C                   | 82.3-90.0                              | F114C                   |

### Size 4 (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 |
|--|-------------------------|--|-------------------------|
| 27.1-32.2                              | F357B                   | 28.8-32.0                              | F357B                   |
| 32.3-34.0                              | F395B                   | 32.1-34.2                              | F395B                   |
| 34.1-36.8                              | F430B                   | 34.3-36.7                              | F430B                   |
| 36.9-44.6                              | F487B                   | 36.8-43.9                              | F487B                   |
| 44.7-48.4                              | F567B                   | 44.0-46.6                              | F567B                   |
| 48.5-53.9                              | F614B                   | 46.7-52.6                              | F614B                   |
| 54.0-57.4                              | F658B                   | 52.7-55.6                              | F658B                   |
| 57.5-60.0                              | F719B                   | 55.7-58.7                              | F719B                   |
| 60.1-69.5                              | F772B                   | 58.8-67.1                              | F772B                   |
| 69.6-71.7                              | F848B                   | 67.2-70.6                              | F848B                   |
| 71.8-79.9                              | F914B                   | 70.7-76.3                              | F914B                   |
| 80.0-92.3                              | F104C                   | 76.4-88.7                              | F104C                   |
| 92.4-97.0                              | F114C                   | 88.8-93.4                              | F114C                   |
| 97.1-108                               | F118C                   | 93.5-105                               | F118C                   |
| 109-118                                | F133C                   | 106-114                                | F133C                   |
| 119-131                                | F149C                   | 115-128                                | F149C                   |
| 132-135                                | F161C                   | 129-131                                | F161C                   |
|  |                         | 132-135                                | F174C                   |

### Size 5 (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 |
|--|-------------------------|--|-------------------------|
| 109-118                                | C592A                   | 185-200                                | C104B                   |
| 119-128                                | C630A                   | 201-221                                | C113B                   |
| 129-138                                | C695A                   | 222-237                                | C125B                   |
| 139-155                                | C778A                   | 238-262                                | C137B                   |
| 156-168                                | C867A                   | 263-270                                | C151B                   |
| 169-184                                | C955A                   |  |                         |



### Overload Heater Tables

#### Heaters for Mag-Break Controllers

The Mag-Break protector is factory adjusted to the minimum trip setting.

**WARNING:** To maintain overload, short circuit, and ground fault protection, use the following instructions to select heaters and to adjust the Mag-Break trip setting.

For continuous rated motors with a service factor of 1.15 to 1.25, select heaters from the heater table. For continuous rated motors with a service factor of 1.0, multiply motor full-load current by 0.9 and use this value to select heaters.

Use the heater table to verify that the Mag-Break and current limiter rating is correct for the motor full-load current. Then set the Mag-Break trip setting to the recommended value.

If the Mag-Break trips when starting the motor, increase trip setting one step at a time until the motor can be consistently started.

#### Size 0 and 1 (Standard)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| .65-.74                                | C087A                   | 3                    | LO                     | LO   |
| .75-.84                                | C097A                   | 3                    | LO                     | LO   |
| .85-.92                                | C109A                   | 3                    | LO                     | 1    |
| .93-1.02                               | C118A                   | 3                    | LO                     | 1    |
| 1.03-1.10                              | C131A                   | 3                    | LO                     | 2    |
| 1.11-1.23                              | C148A                   | 3                    | LO                     | 2    |
| 1.24-1.38                              | C163A                   | 3                    | LO                     | 3    |
| 1.39-1.49                              | C184A                   | 3                    | LO                     | 4    |
| 1.50-1.67                              | C196A                   | 3                    | 1                      | 4    |
| 1.68-1.79                              | C220A                   | 3                    | 1                      | 5    |
| 1.80-1.98                              | C239A                   | 3                    | 1                      | 6    |
| 1.99-2.24                              | C268A                   | 3                    | 2                      | 7    |
| 2.25-2.43                              | C301A                   | 3                    | 3                      | 8    |
| 2.25-2.43                              | C301A                   | 7                    | LO                     | 1    |
| 2.44-2.75                              | C326A                   | 7                    | LO                     | 2    |
| 2.76-3.25                              | C356A                   | 7                    | LO                     | 3    |
| 3.26-3.43                              | C379A                   | 7                    | LO                     | 4    |
| 3.44-4.03                              | C419A                   | 7                    | 1                      | 4    |
| 4.04-4.43                              | C466A                   | 7                    | 1                      | 5    |
| 4.44-4.94                              | C526A                   | 7                    | 2                      | 6    |
| 4.95-5.36                              | C592A                   | 7                    | 2                      | 7    |
| 5.37-5.77                              | C630A                   | 7                    | 3                      | 6    |
| 5.37-5.77                              | C630A                   | 15                   | LO                     | 2    |
| 5.78-6.35                              | C695A                   | 15                   | LO                     | 2    |
| 6.36-6.92                              | C778A                   | 15                   | LO                     | 3    |
| 6.93-7.99                              | C867A                   | 15                   | LO                     | 3    |
| 8.00-8.47                              | C955A                   | 15                   | 1                      | 4    |
| 8.48-9.19                              | C104B                   | 15                   | 1                      | 5    |
| 9.20-10.0                              | C113B                   | 15                   | 1                      | 6    |
| 10.1-10.7                              | C125B                   | 15                   | 2                      | 6    |
| 10.8-12.0                              | C137B                   | 15                   | 2                      | 7    |
| 10.8-12.0                              | C137B                   | 30                   | LO                     | 2    |
| 12.1-12.9                              | C151B                   | 15                   | 3                      | 8    |
| 12.1-12.9                              | C151B                   | 30                   | LO                     | 2    |
| 13.0-15.1                              | C163B                   | 30                   | LO                     | 3    |
| 15.2-16.3                              | C180B                   | 30                   | LO                     | 4    |
| 16.4-17.9                              | C198B                   | 30                   | 1                      | 4    |
| <b>Size 1</b>                          |                         |                      |                        |      |
| 18.0-19.7                              | C214B                   | 30                   | 1                      | 5    |
| 19.8-21.2                              | C228B                   | 30                   | 1                      | 6    |
| 21.3-22.3                              | C250B                   | 30                   | 2                      | 7    |
| 22.4-23.5                              | C273B                   | 30                   | 2                      | 8    |
| 23.6-25.5                              | C303B                   | 30                   | 3                      | 8    |
| 23.6-25.5                              | C303B                   | 50                   | LO                     | 3    |
| 25.6-27.0                              | C330B                   | 50                   | LO                     | 3    |

Do not exceed the maximum trip setting shown in the heater table.

Overload relay tripping current in 40°C ambient is the minimum value of heater full-load current multiplied by 1.25.

**WARNING:** Overload relays with automatic reset may automatically start a motor connected to a 2-wire control circuit. When automatic restarting is not desired, use a 3-wire control circuit.

**WARNING:** Tripping of the Mag-Break may be an indication that a fault current has been interrupted. To provide continued protection against fire or shock hazard, all current-carrying parts and other components of the motor controller should be examined and be replaced if damaged. If heater burnout occurs, the complete overload relay must be replaced.

#### Size 0 and 1 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| .66-.76                                | C087A                   | 3                    | LO                     | LO   |
| .77-.84                                | C097A                   | 3                    | LO                     | LO   |
| .85-.93                                | C109A                   | 3                    | LO                     | 1    |
| .94-1.04                               | C118A                   | 3                    | LO                     | 1    |
| 1.05-1.15                              | C131A                   | 3                    | LO                     | 2    |
| 1.16-1.27                              | C148A                   | 3                    | LO                     | 2    |
| 1.28-1.39                              | C163A                   | 3                    | LO                     | 3    |
| 1.40-1.55                              | C184A                   | 3                    | LO                     | 4    |
| 1.56-1.73                              | C196A                   | 3                    | 1                      | 4    |
| 1.74-1.89                              | C220A                   | 3                    | 1                      | 5    |
| 1.90-2.05                              | C239A                   | 3                    | 2                      | 6    |
| 2.06-2.28                              | C268A                   | 3                    | 2                      | 7    |
| 2.29-2.47                              | C301A                   | 3                    | 3                      | 8    |
| 2.29-2.47                              | C301A                   | 7                    | LO                     | 1    |
| 2.48-2.79                              | C326A                   | 7                    | LO                     | 2    |
| 2.80-3.31                              | C356A                   | 7                    | LO                     | 3    |
| 3.32-3.70                              | C379A                   | 7                    | LO                     | 4    |
| 3.71-4.06                              | C419A                   | 7                    | 1                      | 5    |
| 4.07-4.47                              | C466A                   | 7                    | 1                      | 5    |
| 4.48-4.95                              | C526A                   | 7                    | 2                      | 6    |
| 4.96-5.49                              | C592A                   | 7                    | 2                      | 7    |
| 4.96-5.49                              | C592A                   | 15                   | LO                     | 1    |
| 5.50-5.91                              | C630A                   | 7                    | 3                      | 8    |
| 5.50-5.91                              | C630A                   | 15                   | LO                     | 2    |
| 5.92-6.47                              | C695A                   | 15                   | LO                     | 2    |
| 6.48-7.20                              | C778A                   | 15                   | LO                     | 3    |
| 7.21-8.22                              | C867A                   | 15                   | LO                     | 3    |
| 8.23-8.72                              | C955A                   | 15                   | 1                      | 4    |
| 8.73-9.67                              | C104B                   | 15                   | 1                      | 5    |
| 9.68-10.4                              | C113B                   | 15                   | 1                      | 6    |
| 10.5-11.0                              | C125B                   | 15                   | 2                      | 7    |
| 11.1-12.4                              | C137B                   | 15                   | 2                      | 7    |
| 11.1-12.4                              | C137B                   | 30                   | LO                     | 2    |
| 12.5-13.2                              | C151B                   | 30                   | LO                     | 2    |
| 13.3-15.4                              | C163B                   | 30                   | LO                     | 3    |
| 15.5-17.1                              | C180B                   | 30                   | LO                     | 4    |
| <b>Size 1</b>                          |                         |                      |                        |      |
| 17.2-18.1                              | C198B                   | 30                   | 1                      | 5    |
| 18.2-20.0                              | C214B                   | 30                   | 1                      | 5    |
| 20.1-21.5                              | C228B                   | 30                   | 2                      | 6    |
| 21.6-22.5                              | C250B                   | 30                   | 2                      | 7    |
| 22.6-23.9                              | C273B                   | 30                   | 2                      | 8    |
| 22.6-23.9                              | C273B                   | 50                   | LO                     | 2    |
| 24.0-26.0                              | C303B                   | 30                   | 3                      | 8    |
| 24.0-26.0                              | C303B                   | 50                   | LO                     | 3    |
| 26.1-27.0                              | C330B                   | 50                   | LO                     | 4    |



### Overload Heater Tables

Heaters for Mag-Break Controllers

#### Size 2 (Standard)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| 8.81-9.27                              | C104B                   | 15                   | 2                      | 5    |
| 9.28-9.99                              | C113B                   | 15                   | 2                      | 6    |
| 10.0-11.1                              | C125B                   | 15                   | 3                      | 6    |
| 11.2-12.1                              | C137B                   | 15                   | 3                      | 7    |
| 11.2-12.1                              | C137B                   | 30                   | LO                     | 2    |
| 12.2-13.0                              | C151B                   | 15                   | 4                      | 8    |
| 12.2-13.0                              | C151B                   | 30                   | LO                     | 2    |
| 13.1-15.5                              | C163B                   | 30                   | 1                      | 3    |
| 15.6-16.8                              | C180B                   | 30                   | 1                      | 4    |
| 16.9-18.0                              | C198B                   | 30                   | 2                      | 5    |
| 18.1-19.7                              | C214B                   | 30                   | 2                      | 5    |
| 19.8-21.6                              | C228B                   | 30                   | 2                      | 6    |
| 21.7-23.9                              | C250B                   | 30                   | 3                      | 7    |
| 21.7-23.9                              | C250B                   | 50                   | LO                     | 2    |
| 24.0-25.5                              | C273B                   | 30                   | 3                      | 8    |
| 24.0-25.5                              | C273B                   | 50                   | LO                     | 3    |
| 25.6-26.0                              | C303B                   | 30                   | 3                      | 9    |
| 25.6-28.2                              | C303B                   | 50                   | LO                     | 3    |
| 28.3-31.6                              | C330B                   | 50                   | 1                      | 4    |
| 31.7-34.7                              | C366B                   | 50                   | 2                      | 5    |
| 34.8-37.8                              | C400B                   | 50                   | 2                      | 6    |
| 37.9-40.6                              | C440B                   | 50                   | 3                      | 7    |
| 40.7-43.4                              | C460B                   | 50                   | 3                      | 8    |

#### Size 2 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| 9.04-9.61                              | C104B                   | 15                   | 2                      | 5    |
| 9.62-10.5                              | C113B                   | 15                   | 2                      | 6    |
| 10.6-11.6                              | C125B                   | 15                   | 3                      | 7    |
| 11.7-12.5                              | C137B                   | 15                   | 3                      | 8    |
| 11.7-12.5                              | C137B                   | 30                   | LO                     | 2    |
| 12.6-13.0                              | C151B                   | 15                   | 4                      | 9    |
| 12.6-13.6                              | C151B                   | 30                   | LO                     | 3    |
| 13.7-16.7                              | C163B                   | 30                   | 1                      | 3    |
| 16.8-17.9                              | C180B                   | 30                   | 1                      | 5    |
| 18.0-18.7                              | C198B                   | 30                   | 2                      | 5    |
| 18.8-20.4                              | C214B                   | 30                   | 2                      | 6    |
| 20.5-22.7                              | C228B                   | 30                   | 2                      | 7    |
| 22.8-24.7                              | C250B                   | 30                   | 3                      | 8    |
| 22.8-24.7                              | C250B                   | 50                   | LO                     | 2    |
| 24.8-26.0                              | C273B                   | 30                   | 4                      | 9    |
| 24.8-26.3                              | C273B                   | 50                   | LO                     | 4    |
| 26.4-29.5                              | C303B                   | 50                   | LO                     | 4    |
| 29.6-32.5                              | C330B                   | 50                   | 1                      | 4    |
| 32.6-36.7                              | C366B                   | 50                   | 2                      | 6    |
| 36.8-41.9                              | C400B                   | 50                   | 2                      | 7    |
| 42.0-43.2                              | C440B                   | 50                   | 3                      | 9    |
| 43.3-43.4                              | C460B                   | 50                   | 3                      | 9    |

#### Size 3 (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| 17.8-18.4                              | F233B                   | 30                   | 1                      | 5    |
| 18.5-21.1                              | F243B                   | 30                   | 1                      | 6    |
| 21.2-22.1                              | F270B                   | 30                   | 2                      | 7    |
| 22.2-26.0                              | F300B                   | 30                   | 3                      | 7    |
| 26.1-28.0                              | F327B                   | 50                   | LO                     | 4    |
| 28.1-31.3                              | F357B                   | 50                   | LO                     | 4    |
| 31.4-33.3                              | F395B                   | 50                   | 1                      | 5    |
| 33.4-34.3                              | F430B                   | 50                   | 1                      | 6    |
| 34.4-40.9                              | F487B                   | 50                   | 1                      | 6    |
| 41.0-43.4                              | F567B                   | 50                   | 2                      | 8    |
| 43.5-44.7                              | F567B                   | 100                  | LO                     | 3    |
| 44.8-51.0                              | F614B                   | 100                  | LO                     | 3    |
| 51.1-52.0                              | F658B                   | 100                  | 1                      | 4    |
| 52.1-55.4                              | F719B                   | 100                  | 1                      | 4    |

#### Size 3 (Standard and Ambient Comp.) cont.

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| 55.5-63.3                              | F772B                   | 100                  | 1                      | 5    |
| 63.4-66.1                              | F848B                   | 100                  | 2                      | 6    |
| 66.2-73.5                              | F914B                   | 100                  | 2                      | 6    |
| 73.6-82.2                              | F104C                   | 100                  | 2                      | 7    |
| 82.3-86.9                              | F114C                   | 100                  | 3                      | 9    |

#### Size 4 (Standard)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| 28.8-32.0                              | F357B                   | 50                   | 1                      | 4    |
| 32.1-34.2                              | F395B                   | 50                   | 2                      | 5    |
| 34.3-36.7                              | F430B                   | 50                   | 2                      | 6    |
| 36.8-43.4                              | F487B                   | 50                   | 3                      | 7    |
| 43.5-43.9                              | F487B                   | 100                  | 1                      | 3    |
| 44.0-46.6                              | F567B                   | 100                  | 1                      | 3    |
| 46.7-52.6                              | F614B                   | 100                  | 1                      | 3    |
| 52.7-55.6                              | F658B                   | 100                  | 1                      | 4    |
| 55.7-58.7                              | F719B                   | 100                  | 2                      | 5    |
| 58.8-67.1                              | F772B                   | 100                  | 2                      | 5    |
| 67.2-70.6                              | F848B                   | 100                  | 3                      | 6    |
| 70.7-76.3                              | F914B                   | 100                  | 3                      | 7    |
| 70.7-76.3                              | F914B                   | 150                  | LO                     | 1    |
| 76.4-86.9                              | F104C                   | 100                  | 4                      | 8    |
| 76.4-88.7                              | F104C                   | 150                  | LO                     | 2    |
| 88.8-93.4                              | F114C                   | 150                  | 1                      | 3    |
| 93.5-102                               | F118C                   | 150                  | 1                      | 3    |
| 103-110                                | F133C                   | 150                  | 1                      | 4    |
| 111-122                                | F149C                   | 150                  | 1                      | 4    |
| 123-131                                | F161C                   | 150                  | 2                      | 5    |

#### Size 4 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| 28.8-32.0                              | F357B                   | 50                   | 2                      | 4    |
| 32.1-34.2                              | F395B                   | 50                   | 2                      | 5    |
| 34.3-36.7                              | F430B                   | 50                   | 2                      | 6    |
| 36.8-43.4                              | F487B                   | 50                   | 3                      | 7    |
| 36.8-43.8                              | F487B                   | 100                  | LO                     | 2    |
| 43.9-46.6                              | F567B                   | 100                  | 2                      | 3    |
| 46.7-52.6                              | F614B                   | 100                  | 1                      | 3    |
| 52.7-55.6                              | F658B                   | 100                  | 1                      | 4    |
| 55.7-58.7                              | F719B                   | 100                  | 2                      | 5    |
| 58.8-67.1                              | F772B                   | 100                  | 2                      | 5    |
| 67.2-70.6                              | F848B                   | 100                  | 3                      | 6    |
| 70.7-76.3                              | F914B                   | 100                  | 3                      | 7    |
| 76.4-86.9                              | F104C                   | 100                  | 4                      | 8    |
| 76.4-88.7                              | F104C                   | 150                  | LO                     | 2    |
| 88.8-93.4                              | F114C                   | 150                  | 1                      | 3    |
| 93.5-105                               | F118C                   | 150                  | 1                      | 3    |
| 106-114                                | F133C                   | 150                  | 1                      | 4    |
| 115-128                                | F149C                   | 150                  | 2                      | 5    |
| 129-130                                | F161C                   | 150                  | 2                      | 6    |

#### Size 5 (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR 123 | TEC & TECL<br>Rating | Mag-Break Trip Setting |      |
|--|-------------------------|----------------------|------------------------|------|
|  |                         |                      | Rec.                   | Max. |
| 106-115                                | C592A                   | 550-1670             | 2                      | 6    |
| 116-125                                | C630A                   | 550-1670             | 3                      | 7    |
| 126-135                                | C695A                   | 550-1670             | 3                      | 7    |
| 126-135                                | C695A                   | 1000-3300            | LO                     | 3    |
| 136-151                                | C778A                   | 1000-3300            | LO                     | 3    |
| 152-164                                | C867A                   | 1000-3300            | LO                     | 4    |
| 165-179                                | C955A                   | 1000-3300            | 1                      | 5    |
| 180-195                                | C104B                   | 1000-3300            | 2                      | 5    |
| 196-215                                | C113B                   | 1000-3300            | 2                      | 6    |
| 216-231                                | C125B                   | 1000-3300            | 3                      | 6    |
| 232-255                                | C137B                   | 1000-3300            | 4                      | 7    |
| 256-270                                | C151B                   | 1000-3300            | 4                      | HI   |





# Spectra Series™ and 8000-Line Motor Control Centers

## Application Data

### Overload Heater Tables

Heaters for Mag-Break Controllers

#### Size 0 and 1 (Standard)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| .65-.74                                | C087A                  | 3                 | LO                     | LO   |
| .75-.84                                | C097A                  | 3                 | LO                     | LO   |
| .85-.92                                | C109A                  | 3                 | LO                     | LO   |
| .93-1.02                               | C118A                  | 3                 | LO                     | 2    |
| 1.03-1.10                              | C131A                  | 3                 | LO                     | 2    |
| 1.11-1.23                              | C148A                  | 3                 | LO                     | 2    |
| 1.24-1.38                              | C163A                  | 3                 | LO                     | 3    |
| 1.39-1.49                              | C184A                  | 3                 | LO                     | 4    |
| 1.50-1.67                              | C196A                  | 3                 | LO                     | 4    |
| 1.68-1.79                              | C220A                  | 3                 | LO                     | 5    |
| 1.80-1.98                              | C239A                  | 3                 | 2                      | 5    |
| 1.99-2.24                              | C268A                  | 3                 | 3                      | 5    |
| 2.25-2.43                              | C301A                  | 3                 | 3                      | 6    |
| 2.44-2.75                              | C326A                  | 7                 | LO                     | 3    |
| 2.76-3.25                              | C356A                  | 7                 | LO                     | 4    |
| 3.26-3.43                              | C379A                  | 7                 | LO                     | 4    |
| 3.44-4.03                              | C419A                  | 7                 | 2                      | 4    |
| 4.04-4.43                              | C466A                  | 7                 | 2                      | 5    |
| 4.44-4.94                              | C526A                  | 7                 | 3                      | 5    |
| 4.95-5.36                              | C592A                  | 7                 | 3                      | 6    |
| 5.37-5.77                              | C630A                  | 7                 | 4                      | 6    |
| 5.37-5.77                              | C630A                  | 15                | LO                     | 3    |
| 5.78-6.35                              | C695A                  | 15                | LO                     | 3    |
| 6.36-6.92                              | C778A                  | 15                | LO                     | 4    |
| 6.93-7.99                              | C867A                  | 15                | 2                      | 4    |
| 8.00-8.47                              | C955A                  | 15                | 2                      | 5    |
| 8.48-9.19                              | C104B                  | 15                | 3                      | 5    |
| 9.20-10.0                              | C113B                  | 20                | 2                      | 4    |
| 10.1-10.7                              | C125B                  | 20                | 2                      | 5    |
| 10.8-12.0                              | C137B                  | 20                | 2                      | 5    |
| 12.1-12.9                              | C151B                  | 20                | 3                      | 5    |
| 13.0-15.1                              | C163B                  | 20                | 4                      | 6    |
| 15.2-16.3                              | C180B                  | 25                | 3                      | 5    |
| 16.4-17.9                              | C198B                  | 25                | 3                      | 6    |

#### Size 1 (Standard)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 18.0-19.7                              | C214B                  | 30                | 3                      | 5    |
| 19.8-21.2                              | C228B                  | 30                | 3                      | 5    |
| 21.3-22.3                              | C250B                  | 30                | 3                      | 6    |
| 22.4-23.5                              | C273B                  | 40                | 2                      | 5    |
| 23.6-25.5                              | C303B                  | 40                | 3                      | 5    |
| 25.6-27.0                              | C330B                  | 40                | 3                      | 5    |

#### Size 0 and 1 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| .66-.76                                | C087A                  | 3                 | LO                     | LO   |
| .77-.84                                | C097A                  | 3                 | LO                     | LO   |
| .85-.93                                | C109A                  | 3                 | LO                     | LO   |
| .94-1.04                               | C118A                  | 3                 | LO                     | 2    |
| 1.05-1.15                              | C131A                  | 3                 | LO                     | 2    |
| 1.16-1.27                              | C148A                  | 3                 | LO                     | 3    |
| 1.28-1.39                              | C163A                  | 3                 | LO                     | 3    |
| 1.40-1.55                              | C184A                  | 3                 | LO                     | 4    |
| 1.56-1.73                              | C196A                  | 3                 | 2                      | 4    |
| 1.74-1.89                              | C220A                  | 3                 | 2                      | 5    |
| 1.90-2.05                              | C239A                  | 3                 | 2                      | 5    |
| 2.06-2.28                              | C268A                  | 3                 | 3                      | 5    |
| 2.29-2.47                              | C301A                  | 3                 | 3                      | 6    |
| 2.48-2.79                              | C326A                  | 7                 | LO                     | 3    |
| 2.80-3.31                              | C356A                  | 7                 | LO                     | 4    |
| 3.32-3.70                              | C379A                  | 7                 | 2                      | 4    |
| 3.71-4.06                              | C419A                  | 7                 | 2                      | 4    |
| 4.07-4.47                              | C466A                  | 7                 | 2                      | 5    |
| 4.48-4.95                              | C526A                  | 7                 | 3                      | 5    |
| 4.96-5.49                              | C592A                  | 7                 | 3                      | 6    |
| 5.50-5.91                              | C630A                  | 7                 | 4                      | 6    |
| 5.50-5.91                              | C630A                  | 15                | LO                     | 3    |
| 5.92-6.47                              | C695A                  | 15                | LO                     | 3    |
| 6.48-7.20                              | C778A                  | 15                | 2                      | 4    |
| 7.21-8.22                              | C867A                  | 15                | 2                      | 4    |
| 8.23-8.72                              | C955A                  | 15                | 2                      | 5    |
| 8.73-9.67                              | C104B                  | 15                | 3                      | 5    |
| 9.68-10.4                              | C113B                  | 20                | 2                      | 4    |
| 10.5-11.0                              | C125B                  | 20                | 2                      | 4    |
| 11.1-12.4                              | C137B                  | 20                | 2                      | 5    |
| 12.5-13.2                              | C151B                  | 20                | 3                      | 5    |
| 13.3-15.4                              | C163B                  | 20                | 4                      | 6    |
| 15.5-17.1                              | C180B                  | 25                | 3                      | 5    |

#### Size 1 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 17.2-18.1                              | C198B                  | 25                | 3                      | 6    |
| 18.2-20.0                              | C214B                  | 30                | 3                      | 5    |
| 20.1-21.5                              | C228B                  | 30                | 3                      | 5    |
| 21.6-22.5                              | C250B                  | 30                | 3                      | 6    |
| 22.6-23.9                              | C273B                  | 40                | 2                      | 5    |
| 24.0-26.0                              | C303B                  | 40                | 3                      | 5    |
| 26.1-27.0                              | C330B                  | 40                | 3                      | 5    |



## Overload Heater Tables

Heaters for Mag-Break Controllers

### Size 2 (Standard)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 8.81-9.27                              | C104B                  | 15                | 3                      | 5    |
| 9.28-9.99                              | C113B                  | 20                | 2                      | 4    |
| 10.0-11.1                              | C125B                  | 20                | 2                      | 5    |
| 11.2-12.1                              | C137B                  | 20                | 3                      | 5    |
| 12.2-13.0                              | C151B                  | 20                | 3                      | 5    |
| 13.1-15.5                              | C163B                  | 20                | 4                      | 6    |
| 15.6-16.8                              | C180B                  | 25                | 3                      | 5    |
| 16.9-18.0                              | C198B                  | 25                | 3                      | 6    |
| 18.1-19.7                              | C214B                  | 30                | 3                      | 5    |
| 19.8-21.6                              | C228B                  | 30                | 3                      | 5    |
| 21.7-23.9                              | C250B                  | 40                | 2                      | 5    |
| 24.0-25.5                              | C273B                  | 40                | 2                      | 5    |
| 25.6-28.2                              | C303B                  | 50                | 2                      | 5    |
| 28.3-31.6                              | C330B                  | 50                | 3                      | 5    |
| 31.7-34.7                              | C366B                  | 50                | 3                      | 6    |
| 34.8-37.8                              | C400B                  | 50                | 3                      | 6    |
| 37.9-40.6                              | C440B                  | 60                | 3                      | 5    |
| 40.7-43.4                              | C460B                  | 60                | 3                      | 6    |

### Size 2 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 9.04-9.61                              | C104B                  | 15                | 3                      | 5    |
| 9.62-10.5                              | C113B                  | 20                | 3                      | 4    |
| 10.6-11.6                              | C125B                  | 20                | 2                      | 5    |
| 11.7-12.5                              | C137B                  | 20                | 3                      | 5    |
| 12.6-13.6                              | C151B                  | 20                | 3                      | 5    |
| 13.7-16.7                              | C163B                  | 20                | 4                      | 6    |
| 16.8-17.9                              | C180B                  | 25                | 3                      | 5    |
| 18.0-18.7                              | C198B                  | 25                | 3                      | 6    |
| 18.8-20.4                              | C214B                  | 30                | 3                      | 5    |
| 20.5-22.7                              | C228B                  | 30                | 3                      | 6    |
| 22.8-24.7                              | C250B                  | 40                | 2                      | 5    |
| 24.8-26.3                              | C273B                  | 40                | 2                      | 5    |
| 26.4-29.5                              | C303B                  | 50                | 2                      | 5    |
| 29.6-32.5                              | C330B                  | 50                | 3                      | 5    |
| 32.6-36.7                              | C366B                  | 50                | 3                      | 6    |
| 36.8-41.9                              | C400B                  | 50                | 3                      | 6    |
| 42.0-43.2                              | C440B                  | 60                | 3                      | 5    |
| 43.3-43.4                              | C460B                  | 60                | 3                      | 6    |

### Size 3 (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 17.8-18.4                              | F233B                  | 30                | 2                      | 5    |
| 18.5-21.1                              | F243B                  | 30                | 3                      | 5    |
| 21.2-22.1                              | F207B                  | 30                | 3                      | 5    |
| 22.2-26.0                              | F300B                  | 40                | 3                      | 5    |
| 26.1-28.0                              | F327B                  | 40                | 3                      | 5    |
| 28.1-31.3                              | F357B                  | 50                | 3                      | 5    |
| 31.4-33.3                              | F395B                  | 50                | 3                      | 5    |
| 33.4-34.3                              | F430B                  | 50                | 3                      | 5    |
| 34.4-40.9                              | F487B                  | 70                | 2                      | 5    |
| 41.0-44.7                              | F567B                  | 70                | 3                      | 5    |
| 44.8-51.0                              | F614B                  | 100               | LO                     | 4    |

### Size 3 (Standard and Ambient Comp.) cont.

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 51.1-52.0                              | F658B                  | 100               | LO                     | 4    |
| 52.1-55.4                              | F719B                  | 100               | 2                      | 5    |
| 55.5-63.3                              | F772B                  | 100               | 3                      | 5    |
| 63.4-66.1                              | F848B                  | 100               | 3                      | 5    |
| 66.2-73.5                              | F914B                  | 100               | 3                      | 6    |
| 73.6-82.2                              | F104C                  | 150               | 2                      | 4    |
| 82.3-86.9                              | F114C                  | 150               | 2                      | 5    |

### Size 4 (Standard)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 28.8-32.0                              | F357B                  | 50                | 3                      | 5    |
| 32.1-34.2                              | F395B                  | 50                | 3                      | 5    |
| 34.3-36.7                              | F430B                  | 70                | 2                      | 5    |
| 36.8-43.9                              | F487B                  | 70                | 3                      | 5    |
| 44.0-46.6                              | F567B                  | 70                | 3                      | 5    |
| 46.7-52.6                              | F614B                  | 100               | 2                      | 4    |
| 52.7-55.6                              | F658B                  | 100               | 2                      | 5    |
| 55.7-58.7                              | F719B                  | 100               | 2                      | 5    |
| 58.8-67.1                              | F772B                  | 100               | 3                      | 5    |
| 67.2-70.6                              | F848B                  | 100               | 3                      | 6    |
| 70.7-76.3                              | F914B                  | 150               | 2                      | 4    |
| 76.4-88.7                              | F104C                  | 150               | 2                      | 5    |
| 88.8-93.4                              | F114C                  | 150               | 3                      | 5    |
| 93.5-102.0                             | F118C                  | 150               | 3                      | 5    |
| 103.0-110.0                            | F133C                  | 150               | 3                      | 5    |
| 111.0-122.0                            | F149C                  | 150               | 4                      | 6    |
| 123.0-131.0                            | F161C                  | 150               | 4                      | 6    |

### Size 4 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SE Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 28.8-32.0                              | F357B                  | 50                | 3                      | 5    |
| 32.1-34.2                              | F395B                  | 50                | 3                      | 5    |
| 34.3-36.7                              | F430B                  | 70                | 2                      | 5    |
| 36.8-43.8                              | F487B                  | 70                | 3                      | 5    |
| 43.9-46.6                              | F567B                  | 70                | 3                      | 5    |
| 46.7-52.6                              | F614B                  | 100               | 2                      | 4    |
| 52.7-55.6                              | F658B                  | 100               | 2                      | 5    |
| 55.7-58.7                              | F719B                  | 100               | 2                      | 5    |
| 58.8-67.1                              | F772B                  | 100               | 3                      | 5    |
| 67.2-70.6                              | F848B                  | 100               | 3                      | 6    |
| 70.7-76.3                              | F914B                  | 150               | 2                      | 4    |
| 76.4-88.7                              | F104C                  | 150               | 2                      | 5    |
| 88.8-93.4                              | F114C                  | 150               | 3                      | 5    |
| 93.5-105.0                             | F118C                  | 150               | 3                      | 5    |
| 106.0-114.0                            | F133C                  | 150               | 3                      | 5    |
| 115.0-128.0                            | F149C                  | 150               | 4                      | 6    |
| 129.0-130.0                            | F161C                  | 150               | 4                      | 6    |

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# Spectra Series™ and 8000-Line Motor Control Centers

## Application Data

### Overload Heater Tables

Heaters for Mag-Break Controllers

#### Size 4 (Standard)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SF Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 28.8-32.0                              | F357B                  | 70                | 2                      | 4    |
| 32.1-34.2                              | F395B                  | 70                | 2                      | 4    |
| 34.3-36.7                              | F430B                  | 70                | 2                      | 5    |
| 36.8-43.9                              | F487B                  | 70                | 2                      | 5    |
| 44.0-46.6                              | F567B                  | 70                | 3                      | 5    |
| 46.7-52.6                              | F614B                  | 100               | 2                      | 4    |
| 52.7-55.6                              | F658B                  | 100               | 2                      | 4    |
| 55.7-58.7                              | F719B                  | 100               | 2                      | 5    |
| 58.8-67.1                              | F772B                  | 150               | LO                     | 4    |
| 67.2-70.6                              | F848B                  | 150               | LO                     | 4    |
| 70.7-76.3                              | F914B                  | 150               | 2                      | 4    |
| 76.4-88.7                              | F104C                  | 200               | LO                     | 4    |
| 88.8-93.4                              | F114C                  | 200               | LO                     | 4    |
| 93.5-102.0                             | F118C                  | 200               | LO                     | 5    |
| 103.0-110.0                            | F133C                  | 200               | 2                      | 6    |
| 111.0-122.0                            | F149C                  | 200               | 2                      | 6    |
| 123.0-131.0                            | F161C                  | 200               | 2                      | 6    |

#### Size 4 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SF Rating<br>Plug | Mag-Break Trip Setting |      |
|--|------------------------|-------------------|------------------------|------|
|  |                        |                   | Rec.                   | Max. |
| 28.8-32.0                              | F357B                  | 70                | 2                      | 4    |
| 32.1-34.2                              | F395B                  | 70                | 3                      | 4    |
| 34.3-36.7                              | F430B                  | 70                | 3                      | 5    |
| 36.8-43.8                              | F487B                  | 70                | 3                      | 5    |
| 43.9-46.6                              | F567B                  | 70                | 3                      | 5    |
| 46.7-52.6                              | F614B                  | 100               | 2                      | 4    |
| 52.7-55.6                              | F658B                  | 100               | 2                      | 4    |
| 55.7-58.7                              | F719B                  | 100               | 2                      | 5    |
| 58.8-67.1                              | F772B                  | 150               | LO                     | 4    |
| 67.2-70.6                              | F848B                  | 150               | LO                     | 4    |
| 70.7-76.3                              | F914B                  | 150               | 2                      | 4    |
| 76.4-88.7                              | F104C                  | 200               | LO                     | 4    |
| 88.8-93.4                              | F114C                  | 200               | LO                     | 4    |
| 93.5-105.0                             | F118C                  | 200               | LO                     | 5    |
| 106.0-114.0                            | F133C                  | 200               | 2                      | 6    |
| 115.0-128.0                            | F149C                  | 200               | 2                      | 6    |
| 129.0-130.0                            | F161C                  | 200               | 2                      | 6    |

#### Size 5 – 300:15 CT (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SG Rating<br>Plug | Instantaneous Trip Setting |      |
|--|------------------------|-------------------|----------------------------|------|
|  |                        |                   | Rec.                       | Max. |
| 106-115                                | C592A                  | 250               | LO                         | 3    |
| 116-125                                | C630A                  | 250               | LO                         | 4    |
| 126-135                                | C695A                  | 250               | 2                          | 4    |
| 136-151                                | C778A                  | 250               | 2                          | 5    |
| 152-164                                | C867A                  | 300               | 2                          | 4    |
| 165-179                                | C955A                  | 300               | 2                          | 5    |
| 180-195                                | C104B                  | 350               | 2                          | 4    |
| 196-215                                | C113B                  | 350               | 2                          | 5    |
| 216-231                                | C125B                  | 400               | 2                          | 4    |
| 232-255                                | C137B                  | 400               | 2                          | 5    |
| 256-270                                | C151B                  | 400               | 3                          | 5    |

#### Size 6 – 600:5 CT (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SG Rating<br>Plug | Instantaneous Trip Setting |      |
|--|------------------------|-------------------|----------------------------|------|
|  |                        |                   | Rec.                       | Max. |
| 181-197                                | C220A                  | 400               | MIN.                       | 4    |
| 198-214                                | C239A                  | 400               | 2                          | 5    |
| 215-238                                | C268A                  | 500               | MIN                        | 4    |
| 239-258                                | C301A                  | 500               | MIN                        | 4    |
| 259-290                                | C326A                  | 500               | 2                          | 5    |
| 291-346                                | C356A                  | 600               | MIN                        | 5    |
| 347-387                                | C379A                  | 600               | 2                          | 5    |
| 388-424                                | C419A                  | 600               | 3                          | MAX  |

#### Size 6 – 600:5 CT (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph, 3 Heater | Heater Number<br>CR123 | SK Rating<br>Plug | Instantaneous Trip Setting |      |
|--|------------------------|-------------------|----------------------------|------|
|  |                        |                   | Rec.                       | Max. |
| 181-197                                | C220A                  | 400               | LO                         | 4    |
| 198-214                                | C239A                  | 400               | 2                          | 4    |
| 215-238                                | C268A                  | 400               | 3                          | 5    |
| 239-258                                | C301A                  | 500               | LO                         | 4    |
| 259-290                                | C326A                  | 500               | 2                          | 5    |
| 291-346                                | C356A                  | 800               | LO                         | 4    |
| 347-387                                | C379A                  | 800               | LO                         | 5    |
| 388-423                                | C419A                  | 800               | 2                          | 5    |
| 424-467                                | C466A                  | 1000              | LO                         | 4    |
| 468-516                                | C526A                  | 1000              | 2                          | 4    |
| 517-540                                | C592A                  | 1000              | 2                          | 5    |



### Overload Heater Tables

#### Overload Relays

##### Electronic Overloads for Circuit Breaker Controllers

Tripping current is 120% of Dial setting. Motors with 1.15-1.25 service factor, set dial to motor FLA Motors with 1.0 service factor, set dial to 0.9 motor FLA.

| NEMA Size | FLA Range in Amps | Catalog Number | Breaker Frame & Type      |
|-----------|-------------------|----------------|---------------------------|
| 1         | 0.8 to 1.59       | CR324CXD       | E Mag. & Thermal Mag.     |
| 1         | 1.6 to 3.19       | CR324CXE       | E Mag. & Thermal Mag.     |
| 1         | 3.2 to 6.49       | CR324CXF       | E Mag. & Thermal Mag.     |
| 1         | 6.5 to 12.8       | CR324CXG       | E Mag. & Thermal Mag.     |
| 1         | 13 to 27          | CR324CXH       | E Mag. & Thermal Mag.     |
| 2         | 13 to 25.6        | CR324DXG       | E Mag. & Thermal Mag.     |
| 2         | 26 to 49.9        | CR324DXH       | E Mag. & Thermal Mag.     |
| 2         | 50 to 100         | CR324DXJ       | E Mag. & Thermal Mag.     |
| 3         | 17 to 34.9        | CR324FXK       | E Mag. & Thermal Mag.     |
| 3         | 35 to 64.9        | CR324FXL       | E Mag. & Thermal Mag.     |
| 3         | 65 to 90          | CR324FXM       | E Mag. & Thermal Mag.     |
| 4         | 17 to 34.9        | CR324FXK       | E,F&G Mag. & Thermal Mag. |
| 4         | 35 to 64.9        | CR324FXL       | E,F&G Mag. & Thermal Mag. |
| 4         | 65 to 135         | CR324FXM       | E,F&G Mag. & Thermal Mag. |
| 5 ①       | 32 to 64.0        | CR324GXN       | G Mag. & Thermal Mag.     |
| 5 ①       | 65 to 129.9       | CR324GXP       | G Mag. & Thermal Mag.     |
| 5 ①       | 130 to 270        | CR324GXQ       | G Mag. & Thermal Mag.     |
| 6 ②       | 130 to 259.9      | CR324HXS       | G,K Mag. & Thermal Mag.   |
| 6 ②       | 260 to 540        | CR324HXT       | K Mag. & Thermal Mag.     |

① 300:15 CT's

② 800:5 CT's

#### Overload Relays for Compact 6" Starter CL45A310MJ, NEMA Size 1

| FLA Range in Amps | Class 10<br>Catalog Number | Class 20<br>Catalog Number | Breaker Frame & Type  |
|-------------------|----------------------------|----------------------------|-----------------------|
| 0.4-.65           | RTN1D                      |                            | E Mag. & Thermal Mag. |
| 0.65-1.1          | RTN1F                      |                            | E Mag. & Thermal Mag. |
| 1-1.5             | RTN1G                      |                            | E Mag. & Thermal Mag. |
| 1.3-1.9           | RTN1H                      |                            | E Mag. & Thermal Mag. |
| 1.8-2.7           | RTN1J                      |                            | E Mag. & Thermal Mag. |
| 2.5-4.1           | RTNIK                      | RT12K                      | E Mag. & Thermal Mag. |
| 4.0-6.3           | RTNIL                      | RT12L                      | E Mag. & Thermal Mag. |
| 5.5-8.5           | RTNIM                      | RT12M                      | E Mag. & Thermal Mag. |
| 8.0-12            | RTNIN                      | RT12N                      | E Mag. & Thermal Mag. |
| 10.0-16           | RTNIP                      | RT12P                      | E Mag. & Thermal Mag. |
| 14.5-18           | RTNIS                      | RT12S                      | E Mag. & Thermal Mag. |
| 17.5-22           | RTNIT                      | RT12T                      | E Mag. & Thermal Mag. |
| 21-26             | RTNIU                      | RT12U                      | E Mag. & Thermal Mag. |



### Overload Heater Tables

#### Heaters for Fused Controllers

The Mag-Break protector is factory adjusted to the minimum trip setting.

For continuous rated motors with a service factor of 1.15 to 1.25, select heaters from the heater table. For continuous rated motors with a service factor of 1.0, multiply the motor full-load current by 0.9 and use this value to select heaters.

Overload relay tripping current in 40°C ambient is the minimum value of full-load current multiplied by 1.25.

**WARNING:** Overload relays with automatic reset may automatically start a motor connected to a 2-wire control circuit.

When automatic restarting is not desired, use a 3-wire control circuit.

Provide short-circuit protection in accordance with the National Electrical Code, except Fuses are not to exceed the value shown in the table.

Suitable for use in a circuit capable of delivering not more than the maximum RMS symmetrical amperes indicated in the table below, 600-volts maximum, when protected by an appropriate fuse having an interrupting rating not less than the available short-circuit current.

**Table 1—Maximum Fuse and Short-Circuit Rating**

| NEMA Size | Class RK Fuse |                    | Class J Fuse |                    | Class K-1, K-5 Fuse            |                    |
|-----------|---------------|--------------------|--------------|--------------------|--------------------------------|--------------------|
|           | Max. Clip     | Max. RMS Sym. Amps | Max. Clip    | Max. RMS Sym. Amps | Max. Clip                      | Max. RMS Sym. Amps |
| 1         | 30A           | 100,000            | 60A          | 100,000            | Fuse per Overload Heater Table | 5,000              |
| 2         | 60            | 100,000            | 100          | 100,000            |                                | 5,000              |
| 3         | 100           | 100,000            | 200          | 100,000            |                                | 5,000              |
| 4         | 200           | 100,000            | 400          | 100,000            |                                | 10,000             |
| 5         | 400           | 100,000            | 600          | 100,000            |                                | 10,000             |

**WARNING:** Opening of the fuse(s) may be an indication that a fault current has been interrupted. To provide continued protection against fire or shock hazard, all current-carrying

parts and other components of the motor controller should be examined and replaced if damaged. If heater burnout occurs, the complete overload relay must be replaced.

#### Size 0 and 1 (Standard and Ambient Comp.)

| Motor Full-Load Amps 3-Ph., 3-Heater | Heater Number CR123 | Maximum Fuse Rating |
|--------------------------------------|---------------------|---------------------|
| .41-.45                              | C054A               | 3                   |
| .46-.49                              | C060A               | 3                   |
| .50-.53                              | C066A               | 3                   |
| .54-.59                              | C071A               | 3                   |
| .60-.65                              | C078A               | 3                   |
| .66-.76                              | C087A               | 3                   |
| .77-.84                              | C097A               | 3                   |
| .85-.93                              | C109A               | 3                   |
| .94-1.04                             | C118A               | 3                   |
| 1.05-1.15                            | C131A               | 3                   |
| 1.16-1.27                            | C148A               | 3                   |
| 1.28-1.39                            | C163A               | 3                   |
| 1.40-1.55                            | C184A               | 6                   |
| 1.56-1.73                            | C196A               | 6                   |
| 1.74-1.89                            | C220A               | 6                   |
| 1.90-2.05                            | C239A               | 6                   |
| 2.06-2.28                            | C268A               | 6                   |
| 2.29-2.47                            | C301A               | 6                   |
| 2.48-2.79                            | C326A               | 10                  |
| 2.80-3.31                            | C356A               | 10                  |
| 3.32-3.70                            | C379A               | 12                  |
| 3.71-4.06                            | C419A               | 15                  |
| 4.07-4.47                            | C466A               | 15                  |
| 4.48-4.95                            | C526A               | 15                  |
| 4.96-5.49                            | C592A               | 20                  |
| 5.50-5.91                            | C630A               | 20                  |
| 5.92-6.47                            | C695A               | 25                  |
| 6.48-7.20                            | C778A               | 25                  |
| 7.21-8.22                            | C867A               | 30                  |
| 8.23-8.72                            | C955A               | 30                  |
| 8.73-9.67                            | C104B               | 35 <sup>①</sup>     |
| 9.68-10.4                            | C113B               | 35 <sup>①</sup>     |
| 10.5-11.0                            | C125B               | 40 <sup>①</sup>     |
| 11.1-12.4                            | C137B               | 45 <sup>①</sup>     |
| 12.5-13.2                            | C151B               | 50 <sup>①</sup>     |
| 13.3-15.4                            | C163B               | 60 <sup>①</sup>     |
| 15.5-17.1                            | C180B               | 60 <sup>①</sup>     |
| 17.2-18.0                            | C198B               | 60 <sup>①</sup>     |

| Motor Full-Load Amps 3-Ph., 3-Heater | Heater Number CR123 | Maximum Fuse Rating |
|--------------------------------------|---------------------|---------------------|
| <b>Size 1</b>                        |                     |                     |
| 17.2-18.1                            | C198B               | 60 <sup>①</sup>     |
| 18.2-20.0                            | C214B               | 60 <sup>①</sup>     |
| 20.1-21.5                            | C228B               | 60 <sup>①</sup>     |
| 21.6-22.5                            | C250B               | 60 <sup>①</sup>     |
| 22.6-23.9                            | C273B               | 60 <sup>①</sup>     |
| 24.0-26.3                            | C303B               | 60 <sup>①</sup>     |
| 26.4-27.0                            | C330B               | 60 <sup>①</sup>     |

#### Size 2 (Standard and Ambient Comp.)

| Motor Full-Load Amps 3-Ph., 3-Heater | Heater Number CR123 | Maximum Fuse Rating |
|--------------------------------------|---------------------|---------------------|
| 5.48-5.85                            | C630A               | 20                  |
| 5.86-6.47                            | C695A               | 20                  |
| 6.48-7.35                            | C778A               | 25                  |
| 7.36-8.06                            | C867A               | 30                  |
| 8.07-9.03                            | C955A               | 30                  |
| 9.04-9.61                            | C104B               | 35                  |
| 9.62-10.5                            | C113B               | 35                  |
| 10.6-11.6                            | C125B               | 40                  |
| 11.7-12.5                            | C137B               | 45                  |
| 12.6-13.6                            | C151B               | 50                  |
| 13.7-16.7                            | C163B               | 60                  |
| 16.8-17.9                            | C180B               | 60                  |
| 18.0-18.7                            | C198B               | 70 <sup>①</sup>     |
| 18.8-20.4                            | C214B               | 80 <sup>①</sup>     |
| 20.5-22.7                            | C228B               | 80 <sup>①</sup>     |
| 22.8-24.7                            | C250B               | 90 <sup>①</sup>     |
| 24.8-26.3                            | C273B               | 90 <sup>①</sup>     |
| 26.4-29.5                            | C303B               | 100 <sup>①</sup>    |
| 29.6-32.5                            | C330B               | 100 <sup>①</sup>    |
| 32.6-36.7                            | C366B               | 100 <sup>①</sup>    |
| 36.8-41.9                            | C400B               | 100 <sup>①</sup>    |
| 42.0-43.2                            | C440B               | 100 <sup>①</sup>    |
| 43.3-45.0                            | C460B               | 100 <sup>①</sup>    |

<sup>①</sup> See Table 1 for maximum fuse and short-circuit rating.



### Overload Heater Tables

Heaters for Fused Controllers

#### Size 3 (Standard)

| Motor Full-Load Amps<br>3-Ph., 3-Heater | Heater Number<br>CR123 | Maximum Fuse Rating |
|---|------------------------|---------------------|
| 19.0-19.3                               | F233B                  | 70                  |
| 19.4-22.1                               | F243B                  | 80                  |
| 22.2-23.4                               | F270B                  | 80                  |
| 23.5-27.0                               | F300B                  | 90                  |
| 27.1-29.1                               | F327B                  | 100                 |
| 29.2-31.8                               | F357B                  | 110 <sup>①</sup>    |
| 31.9-33.9                               | F395B                  | 125 <sup>①</sup>    |
| 34.0-37.6                               | F430B                  | 125 <sup>①</sup>    |
| 37.7-41.9                               | F487B                  | 150 <sup>①</sup>    |
| 42.0-47.7                               | F567B                  | 175 <sup>①</sup>    |
| 47.8-52.1                               | F614B                  | 175 <sup>①</sup>    |
| 52.2-55.8                               | F658B                  | 200 <sup>①</sup>    |
| 55.9-59.7                               | F719B                  | 200 <sup>①</sup>    |
| 59.8-68.1                               | F772B                  | 200 <sup>①</sup>    |
| 68.2-71.5                               | F848B                  | 200 <sup>①</sup>    |
| 71.6-78.2                               | F914B                  | 200 <sup>①</sup>    |
| 78.3-87.5                               | F104C                  | 200 <sup>①</sup>    |
| 87.6-90.0                               | F114C                  | 200 <sup>①</sup>    |

#### Size 4 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph., 3-Heater | Heater Number<br>CR123 | Maximum Fuse Rating |
|---|------------------------|---------------------|
| 28.8-32.0                               | F357B                  | 110                 |
| 32.1-34.2                               | F395B                  | 125                 |
| 34.3-36.7                               | F430B                  | 125                 |
| 36.8-43.9                               | F487B                  | 150                 |
| 44.0-46.6                               | F567B                  | 175                 |
| 46.7-52.6                               | F614B                  | 175                 |
| 52.7-55.6                               | F658B                  | 200                 |
| 55.7-58.7                               | F719B                  | 225 <sup>①</sup>    |
| 58.8-67.1                               | F772B                  | 225 <sup>①</sup>    |
| 67.2-70.6                               | F848B                  | 250 <sup>①</sup>    |
| 70.7-76.3                               | F914B                  | 275 <sup>①</sup>    |
| 76.4-88.7                               | F104C                  | 300 <sup>①</sup>    |
| 88.8-93.4                               | F114C                  | 350 <sup>①</sup>    |
| 93.5-105                                | F118C                  | 350 <sup>①</sup>    |
| 106-114                                 | F133C                  | 400 <sup>①</sup>    |
| 115-128                                 | F149C                  | 400 <sup>①</sup>    |
| 129-131                                 | F161C                  | 400 <sup>①</sup>    |
| 132-135                                 | F174C                  | 400 <sup>①</sup>    |

#### Size 3 (Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph., 3-Heater | Heater Number<br>CR123 | Maximum Fuse Rating |
|---|------------------------|---------------------|
| 17.8-18.4                               | F233B                  | 70                  |
| 18.5-21.1                               | F243B                  | 80                  |
| 21.2-22.1                               | F270B                  | 80                  |
| 22.2-26.1                               | F300B                  | 90                  |
| 26.2-28.0                               | F327B                  | 100                 |
| 28.1-31.3                               | F357B                  | 110 <sup>①</sup>    |
| 31.4-33.3                               | F395B                  | 125 <sup>①</sup>    |
| 33.4-34.3                               | F430B                  | 125 <sup>①</sup>    |
| 34.4-40.9                               | F487B                  | 150 <sup>①</sup>    |
| 41.0-44.7                               | F567B                  | 150 <sup>①</sup>    |
| 44.8-51.0                               | F614B                  | 175 <sup>①</sup>    |
| 51.1-52.0                               | F658B                  | 200 <sup>①</sup>    |
| 52.1-55.4                               | F719B                  | 200 <sup>①</sup>    |
| 55.5-63.3                               | F772B                  | 200 <sup>①</sup>    |
| 63.4-66.1                               | F848B                  | 200 <sup>①</sup>    |
| 66.2-73.5                               | F914B                  | 200 <sup>①</sup>    |
| 73.6-82.2                               | F104C                  | 200 <sup>①</sup>    |
| 82.3-90.0                               | F114C                  | 200 <sup>①</sup>    |

#### Size 5 – 300:15CT (Standard and Ambient Comp.)

| Motor Full-Load Amps<br>3-Ph., 3-Heater | Heater Number<br>CR123 | Maximum Fuse Rating |
|---|------------------------|---------------------|
| 109-118                                 | C592A                  | 600                 |
| 119-128                                 | C630A                  | 600                 |
| 129-138                                 | C695A                  | 600                 |
| 139-155                                 | C778A                  | 600                 |
| 156-168                                 | C867A                  | 600                 |
| 169-184                                 | C955A                  | 600                 |
| 185-200                                 | C104B                  | 600                 |
| 201-221                                 | C113B                  | 600                 |
| 222-237                                 | C125B                  | 600                 |
| 238-262                                 | C137B                  | 600                 |
| 263-270                                 | C151B                  | 600                 |

#### Size 4 (Standard)

| Motor Full-Load Amps<br>3-Ph., 3-Heater | Heater Number<br>CR123 | Maximum Fuse Rating |
|---|------------------------|---------------------|
| 27.1-32.2                               | F357B                  | 110                 |
| 32.3-34.0                               | F395B                  | 125                 |
| 34.1-36.8                               | F430B                  | 125                 |
| 36.9-44.6                               | F487B                  | 150                 |
| 44.7-48.4                               | F567B                  | 175                 |
| 48.5-53.9                               | F614B                  | 175                 |
| 54.0-57.4                               | F658B                  | 200                 |
| 57.5-60.0                               | F719B                  | 225 <sup>①</sup>    |
| 60.1-69.5                               | F772B                  | 225 <sup>①</sup>    |
| 69.6-71.7                               | F848B                  | 250 <sup>①</sup>    |
| 71.8-79.9                               | F914B                  | 275 <sup>①</sup>    |
| 80.0-92.3                               | F104C                  | 300 <sup>①</sup>    |
| 92.4-97.0                               | F114C                  | 350 <sup>①</sup>    |
| 97.1-108                                | F118C                  | 400 <sup>①</sup>    |
| 109-118                                 | F133C                  | 400 <sup>①</sup>    |
| 119-131                                 | F149C                  | 400 <sup>①</sup>    |
| 132-135                                 | F161C                  | 400 <sup>①</sup>    |

#### Electronic Overload Table for Fusible Controllers

Tripping current is 120% of Dial setting. Motors with 1.15-1.25 service factor, set dial to motor FLA. Motors with 1.0 service factor, set dial to 0.9 motor FLA.

| NEMA Size      | FLA Range in Amps | Catalog Number | Max. Fuse in Amps |              |
|----------------|-------------------|----------------|-------------------|--------------|
|                |                   |                | Class R 30        | Class J 60   |
| 1              | 0.8 to 1.59       | CR324CXD       |                   |              |
| 1              | 1.6 to 3.19       | CR324CXE       |                   |              |
| 1              | 3.2 to 6.49       | CR324CXF       |                   |              |
| 1              | 6.5 to 12.8       | CR324CXG       |                   |              |
| 1              | 13 to 27          | CR324CXH       |                   |              |
| 2              | 13 to 25.6        | CR324DXG       | 60                | 100          |
| 2              | 26 to 49.9        | CR324DXH       |                   |              |
| 2              | 50 to 100         | CR324DXJ       |                   |              |
| 3              | 17 to 34.9        | CR324FXK       | 100               | 200          |
| 3              | 35 to 64.9        | CR324FXL       |                   |              |
| 3              | 65 to 90          | CR324FXM       |                   |              |
| 4              | 17 to 34.9        | CR324FXK       | 200               | 400          |
| 4              | 35 to 64.9        | CR324FXL       |                   |              |
| 4              | 65 to 135         | CR324FXM       |                   |              |
| 5 <sup>①</sup> | 32 to 64.0        | CR324GXN       | 400               | 600          |
| 5 <sup>①</sup> | 65 to 129.9       | CR324GXP       |                   |              |
| 5 <sup>①</sup> | 130 to 270        | CR324GXQ       |                   |              |
| 6 <sup>②</sup> | 130 to 259.9      | CR324HXS       | 600               | Class L 1200 |
| 6 <sup>②</sup> | 260 to 540        | CR324HXT       |                   |              |

① 300:15 CT's

② 800:5 CT's

① See Table 1 (page J-17) for maximum fuse and short-circuit rating.



# Spectra Series™ and 8000-Line Motor Control Centers

## Application Data

### Starter Fuse Selection

The following tables are furnished as a guide. Check vendor fuse characteristics before making final selection.

#### 200 and 208 Volts

| Size | Hp | Typical<br>FLA | Switch<br>Amp | UL Class J |      |                   |      | Time-Delay RK-5 |             |      |      |
|------|----|----------------|---------------|------------|------|-------------------|------|-----------------|-------------|------|------|
|      |    |                |               | Time Delay |      | No Time Delay/BMC |      | FRN             | CSC<br>Clip | TR   | Clip |
|      |    |                |               | CSC# AJT   | Clip | CSC# A4J          | Clip |                 |             |      |      |
| 1    | ½  | 2.3            | 30            | 3          | 30   | 10                | 30   | 2.8             | 30          | 3.5  | 30   |
|      | ¾  | 3.2            | 30            | 5          | 30   | 10                | 30   | 4               | 30          | 4.5  | 30   |
|      | 1  | 3.9            | 30            | 6          | 30   | 15                | 30   | 5               | 30          | 6.25 | 30   |
|      | 1½ | 5.3            | 30            | 8          | 30   | 20                | 30   | 7               | 30          | 8    | 30   |
|      | 2  | 7.1            | 30            | 10         | 30   | 25                | 30   | 9               | 30          | 12   | 30   |
|      | 3  | 10.6           | 30            | 15         | 30   | 30                | 30   | 12              | 30          | 15   | 30   |
|      | 5  | 16.3           | 30            | 25         | 30   | 45                | 60   | 20              | 30          | 25   | 30   |
| 2    | 7½ | 25.3           | 30            | 30         | 30   | 60                | 60   | 30              | 30          | 30   | 30   |
|      | 10 | 31.3           | 60            | 50         | 60   | 90                | 100  | 40              | 60          | 40   | 60   |
| 3    | 15 | 45.1           | 100           | 60         | 60   | 110               | 200  | 60              | 60          | 60   | 60   |
|      | 20 | 591            | 100           | 90         | 100  | 150               | 200  | 70              | 100         | 90   | 100  |
|      | 25 | 731            | 100           | 100        | 100  | 175               | 200  | 90              | 100         | 100  | 100  |
| 4    | 30 | 881            | 200           | 125        | 200  | 200               | 200  | 100             | 100         | 125  | 200  |
|      | 40 | 120            | 200           | 175        | 200  | 225               | 400  | 150             | 200         | 175  | 200  |
| 5    | 50 | 150            | 400           | 225        | 400  | 300               | 400  | 175             | 200         | 225  | 400  |
|      | 60 | 174            | 400           | 250        | 400  | 350               | 400  | 200             | 200         | 225  | 400  |
|      | 75 | 210            | 400           | 300        | 400  | 450               | 600  | 250             | 400         | 300  | 400  |

BMC—Bussman Fuse

CSC—Chase Shawmut Fuse

#### 230 Volts

| Size | Hp  | Typical<br>FLA | Switch<br>Amp | UL Class J |      |               |      | Time-Delay RK-5 |             |     |             |
|------|-----|----------------|---------------|------------|------|---------------|------|-----------------|-------------|-----|-------------|
|      |     |                |               | Time Delay |      | No Time Delay |      | BMC<br>FRN      | CSC<br>Clip | TR  | CSC<br>Clip |
|      |     |                |               | CSC# AJT   | Clip | CSC# A4J      | Clip |                 |             |     |             |
| 1    | ½   | 2.0            | 30            | 3          | 30   | 10            | 30   | 2.5             | 30          | 3   | 30          |
|      | ¾   | 2.8            | 30            | 4          | 30   | 15            | 30   | 3.5             | 30          | 4   | 30          |
|      | 1   | 3.4            | 30            | 6          | 30   | 15            | 30   | 4               | 30          | 5.6 | 30          |
|      | 1½  | 4.6            | 30            | 8          | 30   | 30            | 30   | 6.25            | 30          | 8   | 30          |
|      | 2   | 6.2            | 30            | 10         | 30   | 25            | 30   | 8               | 30          | 10  | 30          |
|      | 3   | 9.2            | 30            | 15         | 30   | 30            | 30   | 12              | 30          | 15  | 30          |
|      | 5   | 14.2           | 30            | 25         | 30   | 45            | 60   | 17.5            | 30          | 25  | 30          |
| 2    | 7½  | 22.0           | 30            | 30         | 30   | 60            | 60   | 25              | 30          | 30  | 30          |
|      | 10  | 27.2           | 60            | 40         | 60   | 90            | 100  | 35              | 60          | 40  | 60          |
| 3    | 15  | 39.2           | 60            | 60         | 60   | —             | —    | 50              | 60          | 60  | 60          |
|      | 15  | 39.2           | 100           | 60         | 60   | 110           | 200  | —               | —           | —   | —           |
|      | 20  | 51.4           | 100           | 80         | 100  | 150           | 200  | 60              | 60          | 80  | 100         |
| 4    | 25  | 63.6           | 100           | 100        | 100  | 175           | 200  | 80              | 100         | 100 | 100         |
|      | 30  | 76.6           | 100           | 100        | 100  | 200           | 200  | 100             | 100         | 100 | 100         |
| 5    | 40  | 104            | 200           | 150        | 200  | 225           | 400  | 125             | 200         | 150 | 200         |
|      | 50  | 130            | 200           | 200        | 200  | 300           | 400  | 150             | 200         | 200 | 200         |
| 6    | 60  | 151            | 400           | 225        | 400  | 350           | 400  | 175             | 200         | 225 | 400         |
|      | 75  | 183            | 400           | 300        | 400  | 400           | 400  | 225             | 400         | 300 | 400         |
|      | 100 | 240            | 400           | 350        | 400  | 600           | 600  | 300             | 400         | 350 | 400         |
| 7    | 125 | 296            | 600           | 450        | 600  | 600           | 600  | 350             | 400         | 450 | 600         |
|      | 150 | 348            | 600           | 500        | 600  | —             | —    | 450             | 600         | 500 | 600         |
|      | 200 | 468            | 600           | —          | —    | —             | —    | 500             | 600         | 600 | 600         |



# Spectra Series™ and 8000-Line Motor Control Centers

## Application Data

### Starter Fuse Selection

#### 460 Volts

| Size | Hp  | Typical<br>FLA | Switch<br>Amp | UL Class J |      |               |      | Time-Delay K-5 |      |            |      |
|------|-----|----------------|---------------|------------|------|---------------|------|----------------|------|------------|------|
|      |     |                |               | Time Delay |      | No Time Delay |      | BMC<br>FRS     | Clip | CSC<br>TRS | Clip |
|      |     |                |               | CSC# AJT   | CLIP | CSC# A4J      | CLIP |                |      |            |      |
| 1    | ½   | 1.0            | 30            | 1.5        | 30   | 3             | 30   | 1.25           | 30   | 1.4        | 30   |
|      | ¾   | 1.4            | 30            | 2          | 30   | 3             | 30   | 1.6            | 30   | 2          | 30   |
|      | 1   | 1.7            | 30            | 3          | 30   | 6             | 30   | 2              | 30   | 2.5        | 30   |
|      | 1½  | 2.3            | 30            | 4          | 30   | 6             | 30   | 2.8            | 30   | 4          | 30   |
|      | 2   | 3.1            | 30            | 5          | 30   | 10            | 30   | 3.5            | 30   | 5          | 30   |
|      | 3   | 4.6            | 30            | 8          | 30   | 15            | 30   | 5              | 30   | 7          | 30   |
|      | 5   | 7.1            | 30            | 10         | 30   | 25            | 30   | 9              | 30   | 10         | 30   |
|      | 7½  | 11.0           | 30            | 15         | 30   | 35            | 60   | 15             | 30   | 15         | 30   |
| 2    | 10  | 13.6           | 30            | 20         | 30   | 40            | 60   | 17.5           | 30   | 20         | 30   |
|      | 15  | 19.6           | 60            | 30         | 30   | 50            | 60   | 25             | 30   | 30         | 30   |
|      | 20  | 25.7           | 60            | 40         | 60   | 90            | 100  | 35             | 60   | 40         | 60   |
|      | 25  | 31.8           | 60            | 50         | 60   | 100           | 100  | 40             | 60   | 50         | 60   |
| 3    | 30  | 38.3           | 100           | 60         | 60   | 110           | 200  | 45             | 60   | 60         | 60   |
|      | 40  | 52.0           | 100           | 80         | 100  | 125           | 200  | 60             | 60   | 75         | 100  |
|      | 50  | 65.0           | 100           | 100        | 100  | 150           | 200  | 80             | 100  | 100        | 100  |
| 4    | 60  | 75.5           | 200           | 110        | 200  | 175           | 200  | 90             | 100  | 110        | 200  |
|      | 75  | 91.5           | 200           | 150        | 200  | 225           | 400  | 110            | 200  | 150        | 200  |
|      | 100 | 120            | 200           | 175        | 200  | 225           | 400  | 150            | 200  | 175        | 200  |
| 5    | 125 | 148            | 400           | 225        | 400  | 300           | 400  | 200            | 200  | 225        | 400  |
|      | 150 | 172            | 400           | 250        | 400  | 350           | 400  | 225            | 400  | 250        | 400  |
|      | 200 | 224            | 400           | 300        | 400  | 500           | 600  | 300            | 400  | 350        | 400  |
| 6    | 250 | 295            | 600           | 450        | 600  | 600           | 600  | 350            | 400  | 400        | 400  |
|      | 300 | 343            | 600           | 500        | 600  | -             | -    | 400            | 400  | 500        | 600  |
|      | 350 | 396            | 600           | 600        | 600  | -             | -    | 450            | 600  | 600        | 600  |
|      | 400 | 453            | 600           | -          | -    | -             | -    | 500            | 600  | 600        | 600  |

#### 575 Volts

| Size | Hp  | Typical<br>FLA | Switch<br>Amp | UL Class J |      |               |      | Time-Delay K-5 |      |            |      |
|------|-----|----------------|---------------|------------|------|---------------|------|----------------|------|------------|------|
|      |     |                |               | Time Delay |      | No Time Delay |      | BMC<br>FRS     | Clip | CSC<br>TRS | Clip |
|      |     |                |               | CSC# AJT   | CLIP | CSC# A4J      | CLIP |                |      |            |      |
| 1    | ½   | .8             | 30            | 1.5        | 30   | 3             | 30   | 1.25           | 30   | 1.4        | 30   |
|      | ¾   | 1.1            | 30            | 2          | 30   | 3             | 30   | 1.25           | 30   | 1.6        | 30   |
|      | 1   | 1.4            | 30            | 2          | 30   | 6             | 30   | 1.6            | 30   | 2          | 30   |
|      | 1½  | 1.8            | 30            | 3          | 30   | 6             | 30   | 2.25           | 30   | 3          | 30   |
|      | 2   | 2.5            | 30            | 4          | 30   | 10            | 30   | 2.8            | 30   | 4          | 30   |
|      | 3   | 3.7            | 30            | 6          | 30   | 15            | 30   | 4.5            | 30   | 6          | 30   |
|      | 5   | 5.7            | 30            | 10         | 30   | 20            | 30   | 7              | 30   | 9          | 30   |
|      | 7½  | 8.8            | 30            | 15         | 30   | 30            | 30   | 10             | 30   | 15         | 30   |
| 2    | 10  | 10.9           | 30            | 15         | 30   | 35            | 60   | 15             | 30   | 15         | 30   |
|      | 15  | 15.7           | 60            | 25         | 30   | 45            | 60   | 20             | 30   | 25         | 30   |
|      | 20  | 20.6           | 60            | 35         | 60   | 60            | 60   | 25             | 30   | 35         | 60   |
|      | 25  | 25.4           | 60            | 40         | 60   | 80            | 100  | 35             | 60   | 40         | 60   |
| 3    | 30  | 30.6           | 100           | 45         | 60   | 100           | 100  | 40             | 60   | 45         | 60   |
|      | 40  | 41.6           | 100           | 60         | 60   | 110           | 200  | 45             | 60   | 60         | 60   |
|      | 50  | 52.0           | 100           | 80         | 100  | 125           | 200  | 60             | 60   | 80         | 100  |
| 4    | 60  | 60.4           | 200           | 90         | 100  | 150           | 200  | 70             | 100  | 90         | 100  |
|      | 75  | 73.2           | 200           | 125        | 200  | 175           | 200  | 90             | 100  | 125        | 200  |
|      | 100 | 96.0           | 200           | 150        | 200  | 225           | 400  | 110            | 200  | 150        | 200  |
| 5    | 125 | 118            | 400           | 175        | 200  | 225           | 400  | 150            | 200  | 175        | 200  |
|      | 150 | 138            | 400           | 225        | 400  | 300           | 400  | 175            | 200  | 225        | 400  |
|      | 200 | 179            | 400           | 300        | 400  | 400           | 400  | 225            | 400  | 300        | 400  |
| 6    | 250 | 236            | 600           | 350        | 400  | 500           | 600  | 300            | 400  | 350        | 400  |
|      | 300 | 274            | 600           | 450        | 600  | 600           | 600  | 350            | 400  | 450        | 600  |
|      | 350 | 317            | 600           | 500        | 600  | -             | -    | 400            | 400  | 500        | 600  |
|      | 400 | 363            | 600           | 600        | 600  | -             | -    | 450            | 600  | 600        | 600  |







### Control Transformer Fusing

| CPT<br>VA | Primary Fuse Amps |      |      |      |      | Sec. Fuse Amps |      |
|-----------|-------------------|------|------|------|------|----------------|------|
|           | 208V              | 240V | 380V | 480V | 600V | 120V           | 240V |
| 60        | 1                 | 1    | 1    | 0.5  | 0.5  | 0.6            | 0.3  |
| 100       | 2                 | 2    | 1.25 | 1    | 1    | 1              | 0.5  |
| 150       | 3                 | 3    | 2    | 1.5  | 1.25 | 1.6            | 0.8  |
| 200       | 4                 | 4    | 2    | 2    | 1.5  | 2              | 1    |
| 250       | 5                 | 5    | 2    | 2    | 2    | 2.5            | 1.25 |
| 300       | 6                 | 6    | 3.5  | 2    | 2    | 3.2            | 1.6  |
| 500       | 6                 | ①    | 6    | 5    | 4    | 5              | 2.5  |
| 750       | ①                 | ①    | 8    | 7    | 6    | 7              | 3.5  |
| 1000      | ①                 | ①    | ①    | ①    | 8    | 10             | 5    |

Primary Fuses—Class CC Or Equivalent (GOULD #ATM-R STD)  
Secondary Fuses— Class H Or Equivalent (GOULD #TR STD)

① Requires class RK-5 time delay or equivalent.

| Typical CPT Ratings (480V/120V Shown) |      |      |                                 |
|---------------------------------------|------|------|---------------------------------|
| VA                                    | %R   | %X   | Open Circuit<br>Secondary Volts |
| 60                                    | 9.05 | 1.03 | 131.9                           |
| 100                                   | 6.39 | 1.18 | 129.4                           |
| 150                                   | 5.02 | 1.01 | 127.3                           |
| 200                                   | 5.09 | 1.06 | 126.2                           |
| 250                                   | 6.81 | .88  | 127.8                           |
| 300                                   | 5.15 | .73  | 126.4                           |
| 500                                   | 5.84 | 1.45 | 128.7                           |

### Heat Loss Considerations

In determining the heat loss of a motor control center for air conditioning requirements, 250 watts per foot of lineup is a reasonable assumption.

Actual heat loss will vary due to section loading and diversity factors. A typical motor control center may operate normally at 60 percent of maximum possible loading.

Fully rated circuit breaker starters with CPT's, approximate losses are:

- Size 1— 27 Watts
- Size 2— 57 Watts
- Size 3—130 Watts
- Size 4—200 Watts
- Size 5—300 Watts
- Size 6—650 Watts

Heat losses for feeders and mains vary depending on frame size, loading and type of trip with electronic trips having lower losses. The following table provides a general guide for estimating losses assuming 80 percent loading. For critical applications refer to the Company.

| Rating (Amps) | Loss (Watts) |
|---------------|--------------|
| 50            | 15           |
| 100           | 20           |
| 150           | 25           |
| 225           | 40           |
| 400           | 50           |
| 600           | 80           |
| 1200          | 150          |

Typical losses for transformers:

- 1 kVA, 1-Ph 75 Watts
- 5 kVA, 1-Ph 190 Watts
- 9 kVA, 3-Ph 295 Watts
- 15 kVA, 3-Ph 460 Watts
- 30 kVA, 3-Ph 1000 Watts

Horizontal and vertical bus losses, when loaded to capacity are approximately 100 watts per section.

Solid State Starters or VFDs will typically generate 3 watts per ampere of load during operation.



### Motor Loads

#### NEMA Contactor Ratings

| Description  |          | Normal Starting Duty HP/KW rating by NEMA Size |         |         |        |         |         |
|--------------|----------|--|---------|---------|--------|---------|---------|
|              |          | 1  | 2       | 3       | 4      | 5       | 6       |
| Single Phase | 115V     | 2  | 3       | 7.5     | –      | –       | –       |
|              | 230V     | 3  | 7.5     | 15      | –      | –       | –       |
| Three Phase  | 200V     | 7.5/5.5  | 10/7.5  | 25/18.5 | 40/30  | 75/55   | 150/110 |
|              | 230V     | 7.5/5.5  | 15/11   | 30/22   | 50/37  | 100/75  | 200/150 |
|              | 380/415V | 10/7.5   | 25/18.5 | 50/37   | 75/55  | 150/110 | 300/260 |
|              | 460V     | 10/7.5   | 25/18.5 | 50/37   | 100/75 | 200/150 | 400/260 |
|              | 575V     | 10/7.5   | 25/18.5 | 50/37   | 100/75 | 200/150 | 400/260 |

### Non-Motor Loads

When selecting contactors for non-motor loads, the following load characteristics should be considered:

1. Voltage and maximum continuous current.
2. Maximum peak inrush current and duration.
3. RMS current and duration of maximum current on cyclic loads.
4. Frequency of operation.
5. Maximum interrupting current, voltage, power factor and wave form.
6. Available short-circuit current.

Non-motor load ratings are based on the use of two poles to control single-phase loads and three poles to control three-phase loads.

Capacitor switching, requires special considerations. A discharged capacitor acts essentially like a short circuit, and the inrush current is limited by the impedance connected in series

with the capacitor which includes connecting cables. Therefore, the maximum capacitance which can be switched by a contactor will increase with higher series impedance. Switching more than one capacitor or capacitor bank in close electrical proximity to each other should be avoided as the energized capacitor bank can increase the inrush current to the second bank when it is energized. Reactors or resistors may be required between the two capacitor banks to limit inrush currents.

NEMA Standards require shunt capacitors to operate satisfactorily at 135 percent of rated KVAR due to manufacturing tolerances and other variations. The higher inrush and steady state currents associated with these capacitors should be taken into consideration.

NEMA Publication ICS2-210 covers non-motor loads.

#### NEMA Contactor Ratings

| Size of Contactor | Cont. Amps | Maximum Inrush Current (Amps Peak) | Tungsten <sup>①</sup> Lamps | Resistive Loads <sup>②</sup> | Transformer Primary Switching (kVA)                               |     |     |     |                   |     |     |     |   |     |     |     |                   |     |     |     |
|-------------------|------------|------------------------------------|-----------------------------|------------------------------|---|-----|-----|-----|-------------------|-----|-----|-----|---|-----|-----|-----|-------------------|-----|-----|-----|
|                   |            |                                    |                             |                              | Transformers having inrush currents of not more than 20 times FLA |     |     |     |                   |     |     |     | Transformers having inrush currents of over 20 through 40 times FLA |     |     |     |                   |     |     |     |
|                   |            |                                    |                             |                              | Single-Phase Volts  |     |     |     | Three-Phase Volts |     |     |     | Single-Phase Volts  |     |     |     | Three-Phase Volts |     |     |     |
|                   |            |                                    |                             |                              | 120   | 240 | 480 | 600 | 208               | 240 | 480 | 600 | 120   | 240 | 480 | 600 | 208               | 240 | 480 | 600 |
| 0                 | 18         | 140                                | 10                          | 18                           | 0.6   | 1.2 | 2.4 | 3   | 1.8               | 2.1 | 4.2 | 5.2 | 0.3   | 0.6 | 1.2 | 1.5 | 0.9               | 1.0 | 2.1 | 2.6 |
| 1                 | 27         | 288                                | 15                          | 27                           | 1.2   | 2.4 | 4.9 | 6.2 | 3.6               | 4.3 | 8.5 | 11  | 0.6   | 1.2 | 2.5 | 3.1 | 1.8               | 2.1 | 4.3 | 5.3 |
| 2                 | 45         | 483                                | 30                          | 45                           | 2.1   | 4.1 | 8.3 | 10  | 6.3               | 7.2 | 14  | 18  | 1.0   | 2.1 | 4.2 | 5.2 | 3.1               | 3.6 | 7.2 | 8.9 |
| 3                 | 90         | 947                                | 60                          | 90                           | 4.1   | 8.1 | 16  | 20  | 12                | 14  | 28  | 35  | 2.0   | 4.1 | 8.1 | 10  | 6.1               | 7.0 | 14  | 18  |
| 4                 | 135        | 1581                               | 120                         | 135                          | 6.8   | 14  | 27  | 34  | 20                | 23  | 47  | 59  | 3.4   | 6.8 | 14  | 17  | 10                | 12  | 23  | 29  |
| 5                 | 270        | 3163                               | 240                         | 270                          | 14  | 27  | 54  | 68  | 41                | 47  | 94  | 117 | 6.8   | 14  | 27  | 34  | 20                | 24  | 47  | 59  |
| 6                 | 540        | 6326                               | 480                         | 540                          | 27  | 54  | 108 | 135 | 81                | 94  | 188 | 234 | 14  | 27  | 54  | 68  | 41                | 47  | 94  | 117 |

- ① 300-volts maximum, Tungsten lamp loads include infrared lamps having Tungsten filaments.
- ② Resistive loads include electric discharge lamps such as fluorescent, mercury, vapor, etc.



### Non-Motor Loads

#### NEMA Contactor Ratings for Single Capacitor or Capacitor Bank Switching

| Size of Controller            | Continuous Ratings RMS Amperes | Three-Phase Rating of Capacitor   |      |        |        |        |        |
|-------------------------------|--------------------------------|---|------|--------|--------|--------|--------|
|                               |                                | Maximum Size of Three-Phase Capacitor in kVAR or Available Current <sup>①</sup> in Amperes RMS Sym. |      |        |        |        |        |
|                               |                                | 3000  | 5000 | 10,000 | 14,000 | 18,000 | 22,000 |
| <b>At 230 Volts, 60 Hertz</b> |                                |   |      |        |        |        |        |
| 2                             | 45                             | 12  | 8    | 4      | 3      | 2      | 2      |
| 3                             | 90                             | 27  | 27   | 15     | 11     | 9      | 7      |
| 4                             | 135                            | 40  | 40   | 40     | 30     | 24     | 20     |
| 5                             | 270                            | 80  | 80   | 80     | 80     | 80     | 75     |
| 6                             | 540                            | 160   | 160  | 160    | 160    | 160    | 160    |
| <b>At 460 Volts, 60 Hertz</b> |                                |   |      |        |        |        |        |
| 2                             | 45                             | 25  | 16   | 8      | 6      | 4      | 4      |
| 3                             | 90                             | 53  | 53   | 31     | 23     | 18     | 15     |
| 4                             | 135                            | 80  | 80   | 80     | 61     | 49     | 41     |
| 5                             | 270                            | 160   | 160  | 160    | 160    | 160    | 149    |
| 6                             | 540                            | 320   | 320  | 320    | 320    | 320    | 320    |
| <b>At 575 Volts, 60 Hertz</b> |                                |   |      |        |        |        |        |
| 2                             | 45                             | 31  | 20   | 10     | 7      | 6      | 5      |
| 3                             | 90                             | 67  | 67   | 39     | 29     | 23     | 19     |
| 4                             | 135                            | 100   | 100  | 100    | 77     | 61     | 51     |
| 5                             | 270                            | 200   | 200  | 200    | 200    | 200    | 189    |
| 6                             | 540                            | 400   | 400  | 400    | 400    | 400    | 400    |

#### NEMA Contactor for Heating Loads

| NEMA Size | Continuous Current Rating Amps | Maximum kW Ratings <sup>②</sup> |             |             |             |             |             |             |             |
|-----------|--------------------------------|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|           |                                | 575 Volts                       |             | 460 Volts   |             | 230 Volts   |             | 115 Volts   |             |
|           |                                | 2-Pole 1-Ph                     | 3-Pole 3-Ph | 2-Pole 1-Ph | 3-Pole 3-Ph | 2-Pole 1-Ph | 3-Pole 3-Ph | 2-Pole 1-Ph | 3-Pole 3-Ph |
| 00        | 9                              | 5                               | 9           | 4           | 7           | 2           | 3.5         | 1           | 1.75        |
| 0         | 18                             | 10                              | 18          | 8           | 14          | 4           | 7           | 2           | 3.5         |
| 1         | 27                             | 15                              | 25          | 12          | 20          | 6           | 10          | 3           | 5           |
| 2         | 45                             | 25                              | 43          | 20          | 34          | 10          | 17          | 5           | 8.5         |
| 3         | 90                             | 50                              | 86          | 40          | 68          | 20          | 34          | 10          | 17          |
| 4         | 135                            | 75                              | 130         | 60          | 105         | 30          | 52          | 15          | 26          |
| 5         | 270                            | 150                             | 260         | 120         | 210         | 60          | 105         | 30          | 52          |
| 6         | 540                            | 300                             | 515         | 240         | 415         | 120         | 210         | 60          | 105         |
| 7         | 810                            | 450                             | 775         | 360         | 625         | 180         | 315         | 90          | 155         |
| 8         | 1215                           | 700                             | 1200        | 540         | 960         | 270         | 480         | 135         | 240         |
| 9         | 2250                           | 1290                            | 2200        | 1020        | 1740        | 510         | 880         | 255         | 440         |

#### Application of Starters for Heating and Lighting Loads

1. No Tungsten lamp loads, No transformer loads.
2. Contactor loading must meet table above.
3. Overload heaters may be sized for maximum<sup>③</sup>.
4. Disconnect must be thermal magnetic or fused switch rated per NEC @ 125% of load amps.

① Available at capacitor terminals.

② Applicable only to resistive loads having inrush currents not exceeding 1.5 times the continuous current rating.

③ Spectra CB will permit deletion of overload heaters for these loads.



### Non-Motor Loads

#### Application Rated

#### Maximum kVA of Transformer for Primary Switching (50/60Hz)a

| Catalog Number | Max. Peak Closing Current | Phase | Inrush = 20 x Normal |       |      |      |      | Inrush = 40 x Normal |      |      |      |      |
|----------------|---------------------------|-------|----------------------|-------|------|------|------|----------------------|------|------|------|------|
|                |                           |       | 120V                 | 208V  | 240V | 480V | 600V | 120V                 | 208V | 240V | 480V | 600V |
| CL00           | 450 Amps                  | 1     | 0.6                  | 1     | 1.2  | 1.7  | 2.1  | 0.3                  | 0.5  | 0.6  | 0.8  | 1    |
|                |                           | 3     | 1.1                  | 1.9   | 2.2  | 3.1  | 3.8  | 0.5                  | 0.9  | 1.1  | 1.5  | 1.9  |
| CL01           | 450 Amps                  | 1     | 0.8                  | 1.4   | 1.7  | 2.4  | 3.0  | 0.4                  | 0.7  | 0.8  | 1.2  | 1.5  |
|                |                           | 3     | 1.5                  | 2.6   | 3.0  | 4.2  | 5.2  | 0.7                  | 1.3  | 1.5  | 2.1  | 2.6  |
| CL02           | 450 Amps                  | 1     | 1.2                  | 2.0   | 2.5  | 3.5  | 4.4  | 0.6                  | 1.0  | 1.2  | 1.7  | 2.2  |
|                |                           | 3     | 2.2                  | 3.8   | 4.5  | 6.3  | 7.7  | 1.1                  | 1.9  | 2.2  | 3.1  | 3.8  |
| CL25           | 550 Amps                  | 1     | 1.8                  | 3.1   | 3.7  | 5.2  | 6.4  | 0.9                  | 1.5  | 1.8  | 2.6  | 3.2  |
|                |                           | 3     | 3.2                  | 5.5   | 6.5  | 9.1  | 11.2 | 1.6                  | 2.7  | 3.2  | 4.5  | 5.6  |
| CL04           | 550 Amps                  | 1     | 2.2                  | 3.8   | 4.5  | 6.3  | 7.8  | 1.1                  | 1.9  | 2.2  | 3.1  | 3.9  |
|                |                           | 3     | 4.0                  | 7.0   | 8.0  | 11.2 | 13.7 | 2.0                  | 3.5  | 4.0  | 5.6  | 6.8  |
| CL45           | 550 Amps                  | 1     | 2.8                  | 4.8   | 5.7  | 8.0  | 9.7  | 1.4                  | 2.4  | 2.8  | 4.0  | 4.8  |
|                |                           | 3     | 5                    | 8.6   | 10   | 14.0 | 17   | 2.5                  | 4.3  | 5    | 7.0  | 8.5  |
| CL06           | 1000 Amps                 | 1     | 3.4                  | 5.9   | 6.8  | 9.5  | 12   | 1.7                  | 2.9  | 3.4  | 4.7  | 6    |
|                |                           | 3     | 6                    | 10.4  | 12   | 16.8 | 21   | 3                    | 5.2  | 6    | 8.4  | 10.5 |
| CL07           | 1000 Amps                 | 1     | 4.2                  | 7.2   | 8.5  | 12   | 14.2 | 2.1                  | 3.6  | 4.2  | 6.0  | 7.1  |
|                |                           | 3     | 7.5                  | 13    | 15   | 21   | 25   | 3.7                  | 6.5  | 7.5  | 10.5 | 12.5 |
| CL08           | 1000 Amps                 | 1     | 5.7                  | 10    | 11.4 | 16   | 20   | 2.8                  | 5.0  | 5.7  | 8.0  | 10   |
|                |                           | 3     | 10                   | 17.3  | 20   | 28   | 35   | 5                    | 8.6  | 10   | 14   | 16   |
| CL09           | 1280 Amps                 | 1     | 7.1                  | 12.3  | 14.2 | 20   | 22.8 | 3.5                  | 6.1  | 7.1  | 10   | 11.4 |
|                |                           | 3     | 12.5                 | 21.6  | 25   | 35   | 40   | 6.2                  | 10.8 | 12.5 | 17.5 | 20   |
| CL10           | 1280 Amps                 | 1     | 8.5                  | 14.7  | 17.1 | 24   | 28.5 | 4.2                  | 7.3  | 8.5  | 12   | 14.2 |
|                |                           | 3     | 15                   | 26    | 30   | 42   | 50   | 7.5                  | 13   | 15   | 21   | 25   |
| CK75           | 1850 Amps                 | 1     | 10                   | 17.2  | 20   | 28   | 31.3 | 5                    | 8.6  | 10   | 14   | 15.6 |
|                |                           | 3     | 17.5                 | 30.3  | 35   | 49   | 55   | 8.75                 | 15.1 | 17.5 | 24.5 | 27.5 |
| CK08           | 1850 Amps                 | 1     | 11.4                 | 19.7  | 22.8 | 32   | 34.2 | 5.7                  | 9.8  | 11.4 | 16   | 17.1 |
|                |                           | 3     | 20                   | 34.6  | 40   | 56   | 60   | 10                   | 17.3 | 20   | 28   | 30   |
| CK09           | 2500 Amps                 | 1     | 14.2                 | 24.6  | 28.5 | 40   | 48.5 | 7.1                  | 12.3 | 14.2 | 20   | 24.2 |
|                |                           | 3     | 25                   | 43.3  | 50   | 70   | 85   | 12.5                 | 21.6 | 25   | 35   | 42.5 |
| CK95           | 3700 Amps                 | 1     | 18.5                 | 32.0  | 37.1 | 52   | 62.8 | 9.2                  | 16.0 | 18.5 | 26   | 31.4 |
|                |                           | 3     | 32                   | 55.4  | 65   | 91   | 110  | 16                   | 27.7 | 32   | 45   | 55   |
| CK10           | 7000 Amps                 | 1     | 22.8                 | 39.5  | 45.7 | 64   | 85.7 | 11.4                 | 19.7 | 22.8 | 32   | 42.8 |
|                |                           | 3     | 40                   | 69.3  | 80   | 112  | 150  | 20                   | 34.6 | 40   | 56   | 75   |
| CK11           | 7000 Amps                 | 1     | 28.5                 | 49.4  | 57.1 | 80   | 97.1 | 14.2                 | 24.7 | 28.5 | 40   | 48.5 |
|                |                           | 3     | 50                   | 86.6  | 100  | 140  | 170  | 25                   | 43.3 | 50   | 70   | 85   |
| CK12           | 8400 Amps                 | 1     | 45.7                 | 79.2  | 91.4 | 128  | 160  | 22.8                 | 39.6 | 45.7 | 64   | 80   |
|                |                           | 3     | 80                   | 138.6 | 160  | 224  | 280  | 40                   | 69.3 | 80   | 112  | 140  |

#### Maximum Three-Phase kVAR Rating for Switching Capacitors

| Catalog Number | 10,000 Amps RMS                 |      |      |      | 22,000 Amp RMS                  |      |      |      |
|----------------|---------------------------------|------|------|------|---------------------------------|------|------|------|
|                | Maximum Available Fault Current |      |      |      | Maximum Available Fault Current |      |      |      |
|                | 200V                            | 230V | 460V | 575V | 200V                            | 230V | 460V | 575V |
| CL00           | 3                               | 3    | 5    | 5.7  | 1.5                             | 1.5  | 2.5  | 2.8  |
| CL01           | 435                             | 4.5  | 9.5  | 11   | 2.2                             | 2.2  | 4.5  | 5.5  |
| CL02           | 6.5                             | 6.5  | 11   | 12.5 | 3.2                             | 3.2  | 5.5  | 6.2  |
| CL025          | 9                               | 9    | 15   | 17.5 | 4.5                             | 4.5  | 7.5  | 8.2  |
| CL04           | 12.5                            | 12.5 | 21   | 24   | 6.2                             | 6.2  | 10.5 | 12   |
| CL45           | 17                              | 17   | 30   | 35   | 8.5                             | 8.5  | 15   | 17.5 |
| CL06           | 22                              | 22   | 40   | 50   | 11                              | 11   | 20   | 25   |
| CL07           | 25                              | 25   | 45   | 65   | 12.5                            | 12.5 | 22.5 | 32.5 |
| CL08           | 30                              | 30   | 50   | 70   | 15                              | 15   | 25   | 35   |
| CL09           | 40                              | 40   | 65   | 95   | 20                              | 20   | 32.5 | 47.5 |
| CL10           | 50                              | 50   | 80   | 120  | 25                              | 25   | 40   | 60   |
| CK75           | 60                              | 60   | 100  | 150  | 60                              | 60   | 100  | 150  |
| CK08           | 70                              | 70   | 130  | 175  | 70                              | 70   | 130  | 175  |
| CK09           | 95                              | 95   | 165  | 230  | 95                              | 95   | 165  | 230  |
| CK95           | 105                             | 105  | 190  | 288  | 105                             | 105  | 190  | 288  |
| CL10           | 135                             | 135  | 260  | 370  | 135                             | 135  | 260  | 370  |
| CL11           | 190                             | 190  | 325  | 450  | 190                             | 190  | 325  | 450  |
| CK12           | 250                             | 250  | 400  | 600  | 250                             | 250  | 400  | 600  |

J



### Non-Motor Loads

#### Application Rated

#### Utilization in Category AC-1, General Use

| 3-pole Contactors  |      |   | CL Contactors |    |    |    |    |    |    |     |     |     | CK Contactors |     |     |     |     |     |     |     |
|--|------|---|---------------|----|----|----|----|----|----|-----|-----|-----|---------------|-----|-----|-----|-----|-----|-----|-----|
|  |      |   | 00            | 01 | 02 | 25 | 04 | 45 | 06 | 07  | 08  | 09  | 10            | 75  | 08  | 09  | 95  | 10  | 11  | 12  |
| Max. operational current at ambient temperature of: (for all voltages) | 40°C | A | 25            | 25 | 32 | 32 | 54 | 55 | 80 | 100 | 102 | 120 | 120           | 150 | 175 | 200 | 310 | 500 | 600 | 650 |
|  | 55°C | A | 25            | 25 | 32 | 32 | 54 | 55 | 80 | 100 | 102 | 120 | 120           | 150 | 175 | 200 | 310 | 425 | 510 | 546 |
|  | 70°C | A | 20            | 20 | 25 | 25 | 41 | 44 | 62 | 78  | 81  | 80  | 80            | 130 | 155 | 175 | 270 | 335 | 432 | 468 |

| 4-pole Contactors  |      |   | CL Contactors |    |    |    |    |     |     | CK Contactors |     |     |     |     |     |     |
|--|------|---|---------------|----|----|----|----|-----|-----|---------------|-----|-----|-----|-----|-----|-----|
|  |      |   | 01            | 02 | 03 | 04 | 06 | 07  | 08  | 09            | 08  | 09  | 95  | 10  | 11  | 12  |
| Max. operational current at ambient temperature of: (for all voltages) | 40°C | A | 25            | 32 | 40 | 54 | 70 | 100 | 110 | 120           | 175 | 200 | 310 | 500 | 550 | 650 |
|  | 55°C | A | 25            | 32 | 40 | 54 | 70 | 100 | 110 | 120           | 175 | 200 | 310 | 425 | 462 | 543 |
|  | 70°C | A | 20            | 25 | 28 | 41 | 52 | 78  | 88  | 80            | 155 | 175 | 270 | 335 | 462 | 468 |

#### Horsepower/kilowatt ratings are shown below

| Catalog Number | General Purpose Ratings | Max. FLA               | 1 Phase-HP A |          | 3 Phase-HP A |           |           |           | Power In 380/400V kW A |
|----------------|-------------------------|------------------------|--------------|----------|--------------|-----------|-----------|-----------|------------------------|
|                |                         |                        | 115V         | 230V     | 200V         | 230V      | 460V      | 575V      |                        |
| CL00           | 25                      | 10                     | .5 (9.8)     | 1.5 (10) | 3 (11)       | 3 (9.6)   | 5 (7.6)   | 7.5 (9)   | 4 (9)                  |
| CL01           | 25                      | 13.8                   | .75 (13.8)   | 2 (12)   | 3 (11)       | 3 (9.6)   | 7.5 (11)  | 10 (11)   | 5.5 (12)               |
| CL02           | 32                      | 17.5                   | 1 (16)       | 3 (17)   | 5 (17.5)     | 5 (15.2)  | 10 (14)   | 15 (17)   | 7.5 (18)               |
| CL25           | 32                      | 22,22,17 <sup>①</sup>  | 1.5 (20)     | 3 (17)   | 5 (17.5)     | 7.5 (22)  | 15 (21)   | 15 (17)   | 11 (25)                |
| CL04           | 54                      | 32A                    | 2 (24)       | 5 (28)   | 10 (32)      | 10 (28)   | 20 (27)   | 25 (27)   | 16 (32)                |
| CL45           | 55                      | 34,34,27 <sup>①</sup>  | 3 (34)       | 5 (28)   | 10 (32)      | 10 (28)   | 25 (34)   | 25 (27)   | 18.5 (40)              |
| CL06           | 80                      | 48                     | 3 (34)       | 7.5 (40) | 15 (48)      | 15 (42)   | 30 (40)   | 40 (41)   | 22 (50)                |
| CL07           | 100                     | 62                     | 5 (56)       | 10 (50)  | 20 (62)      | 20 (54)   | 40 (52)   | 50 (52)   | 30 (65)                |
| CL08           | 110(O) 102 (E)          | 68                     | 5 (56)       | 15 (68)  | 20 (62)      | 25 (68)   | 50 (65)   | 60 (62)   | 37 (80)                |
| CL09           | 140 (O) 120 (E)         | 80                     | 7.5 (80)     | 15 (68)  | 25 (78)      | 30 (80)   | 60 (77)   | 75 (77)   | 45 (95)                |
| CL10           | 140 (O) 120 (E)         | 104,96,80 <sup>①</sup> | 10 (100)     | 20 (88)  | 30 (92)      | 40 (104)  | 75 (96)   | 75 (77)   | 55 (105)               |
| CK75           | 150                     | 140                    | 10 (100)     | 25 (110) | 40 (120)     | 50 (130)  | 100 (124) | 125 (125) | 75 (154)               |
| CK08           | 175                     | 156                    | 15 (135)     | 30 (136) | 50 (149.5)   | 60 (145)  | 125 (156) | 125 (125) | 90 (185)               |
| CK09           | 200                     | 192                    | -            | -        | 60 (169.4)   | 75 (192)  | 150 (180) | 150 (144) | 132 (250)              |
| CK95           | 310                     | 302                    | -            | -        | 100 (285)    | 100 (248) | 250 (302) | 300 (289) | 160 (310)              |
| CK10           | 500                     | 398                    | -            | -        | 125 (358)    | 150 (360) | 300 (361) | 400 (382) | 220 (420)              |
| CK11           | 600                     | 480                    | -            | -        | 150 (414)    | 200 (480) | 400 (477) | 500 (472) | 280 (550)              |
| CK12           | 650(E) 750 (O)          | 602                    | -            | -        | 200 (552)    | 250 (602) | 500 (590) | 600 (574) | 375 (700)              |



### Publication References

#### Construction Equipment and Components

| Publication  | Description  | Stocking Location |
|--|--|-------------------|
| GEP-1100F  | Buylog Catalog—Covers Full Line of Products                      | Bloomington       |
| <b>Molded Case Circuit Breakers</b>                |  |                   |
| GET-2779   | Application and Selection Guide for Molded Case Circuit Breakers | Bloomington       |
| GEZ-7000   | MCCB Time-Current Curves   | Bloomington       |
| GET-7002   | Spectra RMS Molded Case Circuit Breakers                         | Bloomington       |
| <b>Power Break Insulated Case Circuit Breakers</b> |  |                   |
| GET-6211   | Selection and Application  | Bloomington       |
| GEZ-7001   | Time-Current Curves  | Bloomington       |
| <b>Low Voltage Power Circuit Breakers</b>          |  |                   |
| GEI-86150  | Installation and Operation Instructions                          | Bloomington       |
| GEK-7310   | Maintenance Manual   | Bloomington       |
| GEZ-7002   | Type AKR Time-Current Curves                                     | Bloomington       |
| GES-6227   | Type AKR MicroVersaTrip RMS-9 Time Current Curves                | Bloomington       |
| GES-6228   | MicroVersaTrip Ground Fault Time-Current Curves                  | Bloomington       |
| <b>Disconnect Switches</b>                         |  |                   |
| GET-6205   | Type HPC High-Pressure Contact Switches, Technical               | Bloomington       |
| GEZ-7003   | Type HPC Time-Current Curves                                     | Bloomington       |
| <b>Ground Fault Protective Products</b>            |  |                   |
| GET-2964   | Ground Break Systems   | Bloomington       |
| GEZ-7003   | Ground Break Time-Current Curves                                 | Bloomington       |
| <b>Panelboards</b>                                 |  |                   |
| GET-6592   | "A" series Tech. Specifications                                  | Bloomington       |
| GEA-11316  | A Series   | Bloomington       |

#### Factory Automation Products

| Publication <sup>①</sup>                   | Description                     | Stocking Location |
|--|---------------------------------|-------------------|
| <b>GE Fanuc Programmable Logic Control</b> |                                 |                   |
| GFW-0067                                   | Automation Solutions Catalog    | Charlottesville   |
| <b>GE Fanuc I/O</b>                        |                                 |                   |
| GEK-90486                                  | Genius I/O System User's Manual | Charlottesville   |
| GFA-089                                    | Genius I/O System               | Charlottesville   |
| GFA-150                                    | Field Control™                  | Charlottesville   |
| GFT-298                                    | VersaMax I/O                    | Charlottesville   |
| GFA-180                                    | VersaMax                        | Charlottesville   |

#### Motor Control Center Equipment

| Publication                             | Description                                 | Stocking Location |
|---|---|-------------------|
| <b>Spectra Series and 8000-Line MCC</b> |   |                   |
| DEA-036                                 | Spectra Series Product Brochure             | Bloomington       |
| GEF-4628                                | 8000-Line Renewal Parts Bulletin            | Bloomington       |
| GEH-4961                                | Installation and Maintenance (Instructions) | Bloomington       |

① For more information visit our website at [www.gefanuc.com/default2.htm](http://www.gefanuc.com/default2.htm)





### Publication References

#### General Purpose Controls

| Publication                              | Description   | Stocking Location |
|--|---|-------------------|
| GEP-1260                                 | Control Catalog—Covers Full Line of Products        | Bloomington       |
| <b>Magnetic Motor Starters</b>           |   |                   |
| GEA-10928                                | 300-Line Magnetic Motor Starters, Descriptive       | Bloomington       |
| GEH-4756                                 | 300-Line Instructions, Nema Size 1, FVNR            | Bloomington       |
| GEH-4774                                 | 300-Line Instructions, Nema Size 2, FVNR            | Bloomington       |
| GEH-4806                                 | 300-Line Instructions, Nema Size 3, FVNR            | Bloomington       |
| GEH-4789                                 | 300-Line Instructions, Nema Size 4, FVNR            | Bloomington       |
| GEH-4869                                 | 300-Line Instructions, Nema Size 5, FVNR            | Bloomington       |
| GEH-5108                                 | 300-Line Instructions, Nema Size 6-9, FVNR          | Bloomington       |
| GEH-4757                                 | 300-Line Instructions, Nema Size 1, FVR and 2-Speed | Bloomington       |
| GEH-4775                                 | 300-Line Instructions, Nema Size 2, FVR and 2-Speed | Bloomington       |
| GEH-4806                                 | 300-Line Instructions, Nema Size 3, FVR and 2-Speed | Bloomington       |
| GEH-4807                                 | 300-Line Instructions, Nema Size 4, FVR and 2-Speed | Bloomington       |
| GEH-4839                                 | 300-Line Instructions, Nema Size 5, FVR and 2-Speed | Bloomington       |
| <b>Pilot Devices</b>                     |   |                   |
| GEA-10877                                | CR104P Push-buttons and Pilot Lights                | Bloomington       |
| <b>Relays and Timers</b>                 |   |                   |
| GEA-10639                                | CR122B, CR122BT, Series A Relays                    | Bloomington       |
| GEH-4115                                 | CR120B AC Relays                                    | Bloomington       |
| GEH-4120                                 | CR120B Latched Relays                               | Bloomington       |
| GEH-4147                                 | CR122B Time-Delay Relays                            | Bloomington       |
| GEH-4139                                 | CR122BP Time-Delay Relays                           | Bloomington       |
| GEH-6435                                 | Spectra ECM Instructions                            | Bloomington       |
| DET-069                                  | Spectra ECM Product Brochure                        | Bloomington       |
| <b>Variable Speed Drives<sup>①</sup></b> |   |                   |
| GEI-100364                               | AF 300P User Guide                                  | Fort Wayne        |
| GEI-100363                               | AF 300G User Guide                                  | Fort Wayne        |
| <b>Solid State Starters</b>              |   |                   |
| DET-024                                  | ASTAT-CD  | Bloomington       |
| GEH-5951                                 | ASTAT-CD Installation Instructions                  | Bloomington       |
| GEH-6533                                 | ASTAT-CD Service Instructions                       | Bloomington       |
| DEH-195                                  | ASTAT-IBP   | Bloomington       |
| DEH-208                                  | ASTAT-IBP Service Instructions                      | Bloomington       |

#### Web Access

① G11/P11 Drives — [www.ge.com/industrialsystem/drives/catalog/af300g11/index.htm](http://www.ge.com/industrialsystem/drives/catalog/af300g11/index.htm)



### Electrical Data

Motor horsepower output may also be calculated as follows:

$$HP = \frac{V \times A \times Pf \times EFF}{746}$$

#### Rules of Thumb (Approximation)

- At 1800 RPM, a motor develops a 3 lb. - ft. per HP.
- At 1200 RPM, a motor develops 4.5 lb - ft. per HP.
- At 460 volts, a 3-phase motor draws 1.25 amp per HP.
- At 230 volts, a 3-phase motor draws 2.5 amp per HP.

#### Conversion Formulas

| To find                                       | Alternating Current Three-Phase                            |
|---|--|
| Amperes when Horsepower is known              | $\frac{HP \times 746}{1.73 \times V \times Eff \times fp}$ |
| Amperes when Kilowatts is known               | $\frac{Kw \times 1000}{1.73 \times V \times pf}$           |
| Amperes when Kva is known                     | $\frac{Kva \times 1000}{1.73 \times V}$                    |
| Kilowatts                                     | $\frac{1.73 \times A \times V \times pf}{1000}$            |
| Kva   | $\frac{1.73 \times A \times V}{1000}$                      |
| Horsepower - (Output)                         | $\frac{1.73 \times A \times V \times Eff \times pf}{746}$  |
| KW (alternating current) = KVA x Power Factor |  |
| KW (direct current) = V x A x .001            |  |
| KWH = KW x Hours                              |  |
| HP = $\frac{KW}{\text{Motor Efficiency}}$     |  |

| Values                  | Ohms Law |
|-------------------------|----------|
| V=Volts                 | I=E/R    |
| A or I = Amperes (amps) | R=E/I    |
| Work/P = Watts/Power    | E=IXR    |
| KW=Kilowatts            | P=IXE    |
| KwH=Kilowatt Hours      | P=IXIXR  |
| KVA=Kilovolt Amperes    |          |
| Pf=Power Factor, Table  |          |
| Ph= Phase Factor, Table |          |

#### kVAR Calculation When Motor Operating

##### Characteristics are Known

If motor HP, full-load power factor (PF) and efficiency (eff) are known, its easy to calculate the correct kVAR necessary to improve PF to any value.

**Example:** 75HP, 3600 RPN, NEMA B motor with full-load PF of 87% and eff. of 92% corrected to 95%PF

Original PF = .87 Cos: Tan: = .567  
 Desired PF = .95 = Cos: Tan: = .329  
 Difference = .238

$$KW = \frac{HP \times 746}{Eff.} \text{ or } \frac{75 \times 746}{.902} = 62$$

$$.238 \times 62 = 14.8 \text{ kVAR (use 15 kVAR)}$$

#### Defining the Load

| Rotating Motion  | Linear Motion  |
|--|--|
| <b>Horsepower</b>  |  |
| $HP = \frac{T \times N}{5250}$   | $HP = \frac{F \times V}{33,000}$   |
| Where: T = Torque (lb-ft)<br>N = Speed (RPM)   | Where: F = Force or Tension (lb)<br>V = Velocity (FPM)   |
| $HP = \frac{T \times N}{63,000}$   | $HP = \frac{F \times V}{396,000}$  |
| Where: T = Torque (lb-in)<br>N = Speed (RPM)   | Where: F = Force or Tension (lb)<br>V = Velocity (in/min)  |
| <b>Accelerating Torque/Force</b>   |  |
| $T_A = \frac{WK^2 \times N}{308t}$   | $F_A = \frac{W \times V}{1933t}$   |
| Where: T <sub>A</sub> = Accelerating torque (lb ft)<br>WK <sup>2</sup> = Total system inertia that must be accelerated.<br>This includes motor rotor, speed reducer (if used), and load. (lb-ft <sup>2</sup> ) | Where: F <sub>A</sub> = Accelerating Force (lb-ft)<br>W = Weight (lb)<br>V = Change in velocity (FPM)<br>t = Time (sec.) |

#### Torque

$$T = F \times R$$

Where: T = Torque (lb-ft)  
F = Force (lb)  
R = Radius (ft)

WK<sup>2</sup> – reflected

$$\text{Reflected } WK^2 = \frac{WK^2 \text{ of Load}}{(\text{Reduction Ratio})^2}$$

This is for either belt or gear reductions.

FPM to RPM

$$RPM = \frac{FPM}{.262 \times (\text{diameter in inches})}$$





### Electrical Data

#### Centrifugal Loads

|                            |   |
|----------------------------|---|
| <b>Flow Rate:</b>          | $\text{Flow}_1 = \text{RPM}_1$<br>$\text{Flow}_2 = \text{RPM}_2$  |
| <b>Torque:</b>             | $\frac{\text{Torque}_1}{\text{Torque}_2} = \left(\frac{\text{RPM}_1}{\text{RPM}_2}\right)^2$  |
| <b>Pressure:</b>           | $\frac{\text{Pres}_1}{\text{Pres}_2} = \left(\frac{\text{RPM}_1}{\text{RPM}_2}\right)^2$  |
| <b>Horsepower:</b>         | $\frac{\text{BHP}_1}{\text{BHP}_2} = \left(\frac{\text{RPM}_1}{\text{RPM}_2}\right)^3$  |
| <b>Fans &amp; Blowers:</b> | $\text{BHP} = \frac{\text{CFM} \times \text{PSF}}{3300 \times (\text{fan efficiency})}$<br><br>$\text{BH} = \frac{\text{CFM} \times \text{PIW}}{6350 \times (\text{fan efficiency})}$<br><br>$\text{BHP} = \frac{\text{CFM} \times \text{PSI}}{229 \times (\text{fan efficiency})}$ |
| <b>Pumps:</b>              | $\text{BHP} = \frac{\text{GPM} \times \text{TH} \times (\text{specific gravity})}{3960 \times (\text{pump efficiency})}$<br><br>$\text{BHP} = \frac{\text{GPM} \times \text{PSI} \times (\text{specific gravity})}{1713 \times (\text{pump efficiency})}$                           |
| <b>Where:</b>              | BHP = Brake horsepower<br>PSF = Pounds per square foot<br>PIW = Pressure in inches of water guage<br>PSI = Pounds per square inch<br>GPM = Gallons per minute<br>TH = Total head (including friction)   |

#### Other Useful Formulas

|  |
|--|
| <b>Gear Ratio - Most Favorable</b>   |
| $\text{GR} = \sqrt{\frac{\text{WK}^2}{\text{WKM}^2} + \frac{\text{Tf}^2}{\text{TM}^2} + \frac{\text{Tf}}{\text{Tm}}}$  |
| Where: WK <sup>2</sup> = WK <sup>2</sup> of the load<br>WK <sup>2</sup> <sub>M</sub> = WK <sup>2</sup> of the motor<br>T <sub>f</sub> = Friction torque of the laod<br>T <sub>M</sub> = Average motor torque during acceleration |
| If friction torque is low compared to accelerating torque this can be reduced to:  |
| $\text{GR} = \sqrt{\frac{\text{WK}^2}{\text{WK}^2}}$   |
| <b>Duty Cycle Calculations</b>   |
| $\text{HP}_{\text{RMS}} = \sqrt{\frac{\text{HP}_1^2 t_1 + \text{HP}_2^2 t_2 + \text{HP}_3^2 t_3 + \text{etc}}{t_1 + t_2 + t_3 + \text{etc}}}$  |

