



**PDHonline Course E276 (2 PDH)**

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## **Conduit Fill Calculations**

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**TABLE 1 - Percent of Cross Section of Conduit and Tubing for Conductors**

| <b>Qty. of Conductors</b> | <b>Percent of Cross Section</b> |
|---------------------------|---------------------------------|
| 1                         | 53                              |
| 2                         | 31                              |
| Over 2                    | 40                              |

**TABLE 2 - Electrical Metallic Tubing (EMT) - Dimensions and % Fill**

| <b>Conduit<br/>Nominal Size<br/>(inch)</b> | <b>Nominal<br/>Outside<br/>Diam. (inch)</b> | <b>Nominal Wall<br/>Thickness<br/>(inch)</b> | <b>Nominal<br/>Internal<br/>Diam. (inch)</b> | <b>100% of<br/>Internal<br/>Area (in<sup>2</sup>)</b> | <b>Nipples: 60%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>1 Wire: 53%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>2 Wires: 31%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>3+ Wires: 40%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> |
|--|---|--|--|---|---|--|---|--|
| 1/2  | 0.706                                       | 0.042  | 0.622  | 0.304   | 0.182   | 0.161  | 0.094   | 0.122  |
| 3/4  | 0.922                                       | 0.049  | 0.824  | 0.533   | 0.320   | 0.283  | 0.165   | 0.213  |
| 1  | 1.163                                       | 0.057  | 1.049  | 0.864   | 0.519   | 0.458  | 0.268   | 0.346  |
| 1-1/4                                      | 1.510                                       | 0.065  | 1.380  | 1.496   | 0.897   | 0.793  | 0.464   | 0.598  |
| 1-1/2                                      | 1.740                                       | 0.065  | 1.610  | 2.036   | 1.221   | 1.079  | 0.631   | 0.814  |
| 2  | 2.197                                       | 0.065  | 2.067  | 3.356   | 2.013   | 1.778  | 1.040   | 1.342  |
| 2-1/2                                      | 2.875                                       | 0.072  | 2.731  | 5.858   | 3.515   | 3.105  | 1.816   | 2.343  |
| 3  | 3.500                                       | 0.072  | 3.356  | 8.846   | 5.307   | 4.688  | 2.742   | 3.538  |
| 3-1/2                                      | 4.000                                       | 0.083  | 3.834  | 11.545  | 6.927   | 6.119  | 3.579   | 4.618  |
| 4  | 4.500                                       | 0.083  | 4.334  | 14.753  | 8.852   | 7.819  | 4.573   | 5.901  |

**TABLE 3 - Intermediate Metal Conduit (IMC) - Dimensions and % Fill**

| <b>Conduit<br/>Nominal Size<br/>(inch)</b> | <b>Nominal<br/>Outside<br/>Diam. (inch)</b> | <b>Nominal Wall<br/>Thickness<br/>(inch)</b> | <b>Nominal<br/>Internal<br/>Diam. (inch)</b> | <b>100% of<br/>Internal<br/>Area (in<sup>2</sup>)</b> | <b>Nipples: 60%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>1 Wire: 53%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>2 Wires: 31%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>3+ Wires: 40%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> |
|--|---|--|--|---|---|--|---|--|
| 1/2  | 0.815                                       | 0.078  | 0.660  | 0.342   | 0.205   | 0.181  | 0.106   | 0.137  |
| 3/4  | 1.029                                       | 0.083  | 0.864  | 0.586   | 0.352   | 0.311  | 0.182   | 0.235  |
| 1  | 1.290                                       | 0.093  | 1.105  | 0.959   | 0.575   | 0.508  | 0.297   | 0.384  |
| 1-1/4                                      | 1.638                                       | 0.095  | 1.448  | 1.647   | 0.988   | 0.873  | 0.510   | 0.659  |
| 1-1/2                                      | 1.883                                       | 0.100  | 1.683  | 2.225   | 1.335   | 1.179  | 0.690   | 0.890  |
| 2  | 2.360                                       | 0.105  | 2.150  | 3.630   | 2.178   | 1.924  | 1.125   | 1.452  |
| 2-1/2                                      | 2.857                                       | 0.150  | 2.557  | 5.135   | 3.081   | 2.722  | 1.592   | 2.054  |
| 3  | 3.476                                       | 0.150  | 3.176  | 7.922   | 4.753   | 4.199  | 2.456   | 3.169  |
| 3-1/2                                      | 3.971                                       | 0.150  | 3.671  | 10.584  | 6.351   | 5.610  | 3.281   | 4.234  |
| 4  | 4.466                                       | 0.150  | 4.166  | 13.631  | 8.179   | 7.224  | 4.226   | 5.452  |

**TABLE 4 - Rigid Metal Conduit (RMC) [GRS & Aluminum] - Dimensions and % Fill**

| <b>Conduit<br/>Nominal Size<br/>(inch)</b> | <b>Nominal<br/>Outside<br/>Diam. (inch)</b> | <b>Nominal Wall<br/>Thickness<br/>(inch)</b> | <b>Nominal<br/>Internal<br/>Diam. (inch)</b> | <b>100% of<br/>Internal<br/>Area (in<sup>2</sup>)</b> | <b>Nipples: 60%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>1 Wire: 53%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>2 Wires: 31%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>3+ Wires: 40%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> |
|--|---|--|--|---|---|--|---|--|
| 1/2  | 0.840                                       | 0.104  | 0.632  | 0.314   | 0.188   | 0.166  | 0.097   | 0.125  |
| 3/4  | 1.050                                       | 0.107  | 0.836  | 0.549   | 0.329   | 0.291  | 0.170   | 0.220  |
| 1  | 1.315                                       | 0.126  | 1.063  | 0.887   | 0.532   | 0.470  | 0.275   | 0.355  |
| 1-1/4                                      | 1.660                                       | 0.133  | 1.394  | 1.526   | 0.916   | 0.809  | 0.473   | 0.610  |
| 1-1/2                                      | 1.900                                       | 0.138  | 1.624  | 2.071   | 1.243   | 1.098  | 0.642   | 0.829  |
| 2  | 2.375                                       | 0.146  | 2.083  | 3.408   | 2.045   | 1.806  | 1.056   | 1.363  |
| 2-1/2                                      | 2.875                                       | 0.193  | 2.489  | 4.866   | 2.919   | 2.579  | 1.508   | 1.946  |
| 3  | 3.500                                       | 0.205  | 3.090  | 7.499   | 4.499   | 3.974  | 2.325   | 3.000  |
| 3-1/2                                      | 4.000                                       | 0.215  | 3.570  | 10.010  | 6.006   | 5.305  | 3.103   | 4.004  |
| 4  | 4.500                                       | 0.225  | 4.050  | 12.882  | 7.729   | 6.828  | 3.994   | 5.153  |
| 5  | 5.563                                       | 0.245  | 5.073  | 20.212  | 12.127  | 10.713   | 6.266   | 8.085  |
| 6  | 6.625                                       | 0.266  | 6.093  | 29.158  | 17.495  | 15.454   | 9.039   | 11.663   |

**TABLE 5 - Rigid PVC Conduit (RNC) Schedule 40 - Dimensions and % Fill**

| <b>Conduit<br/>Nominal Size<br/>(inch)</b> | <b>Nominal<br/>Outside<br/>Diam. (inch)</b> | <b>Nominal Wall<br/>Thickness<br/>(inch)</b> | <b>Nominal<br/>Internal<br/>Diam. (inch)</b> | <b>100% of<br/>Internal<br/>Area (in<sup>2</sup>)</b> | <b>Nipples: 60%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>1 Wire: 53%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>2 Wires: 31%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> | <b>3+ Wires: 40%<br/>of Internal<br/>Area (in<sup>2</sup>)</b> |
|--|---|--|--|---|---|--|---|--|
| 1/2  | 0.840                                       | 0.119  | 0.602  | 0.285   | 0.171   | 0.151  | 0.088   | 0.114  |
| 3/4  | 1.050                                       | 0.123  | 0.804  | 0.508   | 0.305   | 0.269  | 0.157   | 0.203  |
| 1  | 1.315                                       | 0.143  | 1.029  | 0.832   | 0.499   | 0.441  | 0.258   | 0.333  |
| 1-1/4                                      | 1.660                                       | 0.150  | 1.360  | 1.453   | 0.872   | 0.770  | 0.450   | 0.581  |
| 1-1/2                                      | 1.900                                       | 0.155  | 1.590  | 1.986   | 1.191   | 1.052  | 0.616   | 0.794  |
| 2  | 2.375                                       | 0.164  | 2.047  | 3.291   | 1.975   | 1.744  | 1.020   | 1.316  |
| 2-1/2                                      | 2.875                                       | 0.215  | 2.445  | 4.695   | 2.817   | 2.488  | 1.455   | 1.878  |
| 3  | 3.500                                       | 0.229  | 3.042  | 7.268   | 4.361   | 3.852  | 2.253   | 2.907  |
| 3-1/2                                      | 4.000                                       | 0.240  | 3.521  | 9.737   | 5.842   | 5.161  | 3.018   | 3.895  |
| 4  | 4.500                                       | 0.251  | 3.998  | 12.554  | 7.532   | 6.654  | 3.892   | 5.022  |
| 5  | 5.563                                       | 0.274  | 5.016  | 19.761  | 11.856  | 10.473   | 6.126   | 7.904  |
| 6  | 6.625                                       | 0.297  | 6.031  | 28.567  | 17.140  | 15.141   | 8.856   | 11.427   |

**TABLE 6 - Rigid PVC Conduit (RNC) Schedule 80 - Dimensions and % Fill**

| Conduit Nominal Size (inch) | Nominal Outside Diam. (inch) | Nominal Wall Thickness (inch) | Nominal Internal Diam. (inch) | 100% of Internal Area (in <sup>2</sup> ) | Nipples: 60% of Internal Area (in <sup>2</sup> ) | 1 Wire: 53% of Internal Area (in <sup>2</sup> ) | 2 Wires: 31% of Internal Area (in <sup>2</sup> ) | 3+ Wires: 40% of Internal Area (in <sup>2</sup> ) |
|-----------------------------|------------------------------|-------------------------------|-------------------------------|--|--|---|--|---|
| 1/2                         | 0.840                        | 0.157                         | 0.526                         | 0.217                                    | 0.130  | 0.115   | 0.067  | 0.087   |
| 3/4                         | 1.050                        | 0.164                         | 0.722                         | 0.409                                    | 0.246  | 0.217   | 0.127  | 0.164   |
| 1                           | 1.315                        | 0.190                         | 0.936                         | 0.688                                    | 0.413  | 0.365   | 0.213  | 0.275   |
| 1-1/4                       | 1.660                        | 0.203                         | 1.255                         | 1.237                                    | 0.742  | 0.656   | 0.383  | 0.495   |
| 1-1/2                       | 1.900                        | 0.212                         | 1.476                         | 1.711                                    | 1.027  | 0.907   | 0.530  | 0.684   |
| 2                           | 2.375                        | 0.231                         | 1.913                         | 2.874                                    | 1.725  | 1.523   | 0.891  | 1.150   |
| 2-1/2                       | 2.875                        | 0.293                         | 2.290                         | 4.119                                    | 2.471  | 2.183   | 1.277  | 1.647   |
| 3                           | 3.500                        | 0.318                         | 2.864                         | 6.442                                    | 3.865  | 3.414   | 1.997  | 2.577   |
| 3-1/2                       | 4.000                        | 0.337                         | 3.326                         | 8.688                                    | 5.213  | 4.605   | 2.693  | 3.475   |
| 4                           | 4.500                        | 0.357                         | 3.786                         | 11.258                                   | 6.755  | 5.967   | 3.490  | 4.503   |
| 5                           | 5.563                        | 0.398                         | 4.768                         | 17.855                                   | 10.713   | 9.463   | 5.535  | 7.142   |
| 6                           | 6.625                        | 0.458                         | 5.709                         | 25.598                                   | 15.369   | 13.567  | 7.935  | 10.239  |

| <b>TABLE 7 - Dimensions of Insulated Conductors</b> |                                    |  |  |
|---|------------------------------------|--|--|
| <b>Type</b>   | <b>Size<br/>(AWG or<br/>KCMIL)</b> | <b>Approximate<br/>Diameter<br/>(inch)</b> | <b>Approximate<br/>Area<br/>(in<sup>2</sup>)</b> |
| THHW  | 14                                 | 0.133                                      | 0.0139   |
|   | 12                                 | 0.152                                      | 0.0181   |
|   | 10                                 | 0.176                                      | 0.0243   |
|   | 8                                  | 0.236                                      | 0.0437   |
|   | 6                                  | 0.304                                      | 0.0726   |
|   | 4                                  | 0.352                                      | 0.0973   |
|   | 3                                  | 0.380                                      | 0.1134   |
|   | 2                                  | 0.412                                      | 0.1333   |
|   | 1                                  | 0.492                                      | 0.1901   |
|   | 1/0 or 0                           | 0.532                                      | 0.2223   |
|   | 2/0 or 00                          | 0.578                                      | 0.2624   |
|   | 3/0 or 000                         | 0.630                                      | 0.3117   |
|   | 4/0 or 0000                        | 0.688                                      | 0.3718   |
|   | 250                                | 0.765                                      | 0.4596   |
|   | 300                                | 0.820                                      | 0.5281   |
|   | 350                                | 0.871                                      | 0.5958   |
|   | 400                                | 0.918                                      | 0.6619   |
| 500   | 1.003                              | 0.7901                                     |  |
| THHN<br>& THWN                                      | 14                                 | 0.111                                      | 0.0097   |
|   | 12                                 | 0.130                                      | 0.0133   |
|   | 10                                 | 0.164                                      | 0.0211   |
|   | 8                                  | 0.216                                      | 0.0366   |
|   | 6                                  | 0.254                                      | 0.0507   |
|   | 4                                  | 0.324                                      | 0.0824   |
|   | 3                                  | 0.352                                      | 0.0973   |
|   | 2                                  | 0.384                                      | 0.1158   |
|   | 1                                  | 0.446                                      | 0.1562   |
|   | 1/0 or 0                           | 0.486                                      | 0.1855   |
|   | 2/0 or 00                          | 0.532                                      | 0.2223   |
|   | 3/0 or 000                         | 0.584                                      | 0.2679   |
|   | 4/0 or 0000                        | 0.642                                      | 0.3237   |
|   | 250                                | 0.711                                      | 0.3970   |
|   | 300                                | 0.766                                      | 0.4608   |
|   | 350                                | 0.817                                      | 0.5242   |
|   | 400                                | 0.864                                      | 0.5863   |
| 500   | 0.949                              | 0.7073                                     |  |
| XHHW  | 14                                 | 0.133                                      | 0.0139   |
|   | 12                                 | 0.152                                      | 0.0181   |
|   | 10                                 | 0.176                                      | 0.0243   |
|   | 8                                  | 0.236                                      | 0.0437   |
|   | 6                                  | 0.274                                      | 0.0590   |
|   | 4                                  | 0.322                                      | 0.0814   |
|   | 3                                  | 0.350                                      | 0.0962   |
|   | 2                                  | 0.382                                      | 0.1146   |
|   | 1                                  | 0.442                                      | 0.1534   |
|   | 1/0 or 0                           | 0.482                                      | 0.1825   |
|   | 2/0 or 00                          | 0.528                                      | 0.2190   |
|   | 3/0 or 000                         | 0.580                                      | 0.2642   |
|   | 4/0 or 0000                        | 0.638                                      | 0.3197   |
|   | 250                                | 0.705                                      | 0.3904   |
|   | 300                                | 0.760                                      | 0.4536   |
|   | 350                                | 0.811                                      | 0.5166   |
|   | 400                                | 0.858                                      | 0.5782   |
| 500   | 0.943                              | 0.6984                                     |  |