



## LIGAS À BASE DE COBRE

| NORMAS |          | COMPOSIÇÃO QUÍMICA (%) |      |      |      |      |      |      |      |     |      |      |      |      |       |     |     | PROPRIEDADES MECÂNICAS |      |                |                  |                 |             |
|--------|----------|------------------------|------|------|------|------|------|------|------|-----|------|------|------|------|-------|-----|-----|------------------------|------|----------------|------------------|-----------------|-------------|
| SAE    | ASTM/UNS | Cu                     |      | Sn   |      | Pb   |      | Zn   |      | Fe  |      | Ni   |      | Al   |       | Mn  |     | Si                     |      | R.TRAÇÃO (Mpa) | ESCOAMENTO (Mpa) | ALONGAMENTO (%) | DUREZA (HB) |
| 40     | C83600   | 84,0                   | 86,0 | 4,0  | 6,0  | 4,0  | 6,0  | 4,0  | 6,0  |     |      |      |      | 1,0  |       |     |     |                        |      | 207            | 97               | 20              | 70          |
|        | C83800   | 82,0                   | 83,8 | 3,3  | 4,2  | 5,0  | 7,0  | 5,0  | 8,0  |     |      |      |      | 1,0  |       |     |     |                        |      | 207            | 90               | 20              | 60          |
|        | C84400   | 78,0                   | 82,0 | 2,3  | 3,5  | 6,0  | 8,0  | 7,0  | 10,0 |     |      |      |      | 1,0  |       |     |     |                        |      | 200            | 90               | 18              |             |
|        | C84800   | 75,0                   | 77,0 | 2,0  | 3,0  | 5,5  | 7,0  | 13,0 | 17,0 |     |      |      |      | 1,0  |       |     |     |                        |      | 193            | 83               | 16              |             |
| 41     | C85200   | 70,0                   | 74,0 | 0,7  | 2,0  | 1,5  | 3,8  | 20,0 | 27,0 |     |      |      |      |      |       |     |     |                        |      | 241            | 83               | 25              |             |
|        | C85400   | 65,0                   | 70,0 | 0,5  | 1,5  | 1,5  | 3,8  | 24,0 | 32,0 |     |      |      |      |      |       |     |     |                        |      | 207            | 76               | 20              | 50          |
|        | C85700   | 58,0                   | 64,0 | 0,5  | 1,5  | 0,8  | 1,5  | 32,0 | 40,0 |     |      |      |      |      |       |     |     |                        |      | 276            | 97               | 15              |             |
| 430A   | C86200   | 60,0                   | 66,0 |      | 0,2  |      | 0,2  | 22,0 | 28,0 | 2,0 | 4,0  |      |      | 3,0  | 4,9   | 2,5 | 5,0 |                        |      | 621            | 310              | 18              | 150         |
| 430B   | C86300   | 60,0                   | 66,0 |      | 0,2  |      | 0,2  | 22,0 | 28,0 | 2,0 | 4,0  |      |      | 5,0  | 7,5   | 2,5 | 5,0 |                        |      | 758            | 414              | 12              | 180         |
|        | C86400   | 56,0                   | 62,0 | 0,5  | 1,5  | 0,5  | 1,5  | 34,0 | 42,0 | 0,4 | 2,0  |      |      | 0,5  | 1,5   | 0,1 | 1,0 |                        |      | 414            | 138              | 15              |             |
| 43     | C86500   | 55,0                   | 60,0 |      | 1,0  |      | 0,4  | 36,0 | 42,0 | 0,4 | 2,0  |      |      | 0,5  | 1,5   | 0,1 | 1,5 |                        |      | 448            | 172              | 20              | 100         |
|        | C86700   | 55,0                   | 60,0 |      | 1,5  | 0,5  | 1,5  | 30,0 | 38,0 | 1,0 | 3,0  |      |      | 1,0  | 3,0   | 1,0 | 3,5 |                        |      | 552            | 221              | 15              |             |
|        | C87400   | 79,0                   |      |      |      |      | 1,0  | 12,0 | 16,0 |     |      |      |      |      |       |     |     | 2,5                    | 4,0  | 345            | 145              | 18              |             |
|        | C87500   | 79,0                   |      |      |      |      | 0,5  | 12,0 | 16,0 |     |      |      |      |      |       |     |     | 3,0                    | 5,0  | 414            | 165              | 16              |             |
|        | C87600   | 88,0                   |      |      |      |      | 0,5  | 4,0  | 7,0  |     |      |      |      |      |       |     |     | 3,5                    | 5,5  | 414            | 207              | 16              |             |
| 620    | C90300   | 86,0                   | 89,0 | 7,5  | 9,0  |      | 0,3  | 3,0  | 5,0  |     |      | 1,0  |      |      |       |     |     |                        |      | 276            | 124              | 20              | 75          |
| 62     | C90500   | 86,0                   | 89,0 | 9,0  | 11,0 |      | 0,3  | 1,0  | 3,0  |     |      | 1,0  |      |      |       |     |     |                        |      | 276            | 124              | 20              | 80          |
| 65     | C90700   | restante               |      | 10,0 | 12,0 |      | 0,5  |      | 0,5  |     | 0,15 |      | 0,5  |      | 0,005 |     |     | 0,005                  |      | 345            | 193              | 12              | 95          |
|        | C90800   | restante               |      | 11,0 | 13,0 |      | 0,25 |      | 0,25 |     | 0,15 |      | 0,5  |      | 0,005 |     |     | 0,005                  |      | 345            | 193              | 12              | 95          |
|        | C91600   | restante               |      | 9,7  | 10,8 |      | 0,25 |      | 0,25 |     | 0,2  | 1,2  | 2,0  |      | 0,005 |     |     | 0,005                  |      | 310            | 172              | 10              | 85          |
|        | C91700   | restante               |      | 11,3 | 12,5 |      | 0,25 |      | 0,25 |     | 0,2  | 1,2  | 2,0  |      | 0,005 |     |     | 0,005                  |      | 345            | 193              | 12              | 95          |
| 622    | C92200   | 86,0                   | 90,0 | 5,5  | 6,5  | 1,0  | 1,2  | 3,0  | 5,0  |     |      |      |      | 1,0  |       |     |     |                        |      | 234            | 110              | 22              | 70          |
|        | C92300   | 85,0                   | 89,0 | 7,5  | 9,0  | 1,0  | 1,2  | 2,5  | 5,0  |     |      |      |      | 1,0  |       |     |     |                        |      | 248            | 110              | 18              |             |
|        | C92900   | restante               |      | 9,0  | 11,0 | 2,0  | 3,2  |      | 0,25 |     | 0,2  | 2,8  | 4,0  |      | 0,005 |     |     | 0,005                  |      | 310            | 172              | 8               | 75          |
|        | C93200   | 81,0                   | 85,0 | 6,3  | 7,5  | 6,0  | 8,0  | 2,0  | 4,0  |     |      |      |      | 1,0  |       |     |     |                        |      | 207            | 97               | 15              | 60          |
| 66     | C93500   | 83,0                   | 86,0 | 4,3  | 6,0  | 6,0  | 8,0  | 2,0  | 4,0  |     |      |      |      | 1,0  |       |     |     |                        |      | 193            | 83               | 15              | 60          |
|        | C93600   | 79,0                   | 83,0 | 6,0  | 8,0  | 11,0 | 13,0 |      | 1,0  |     |      |      |      | 1,0  |       |     |     |                        |      | 221            | 110              | 15              |             |
| 64     | C93700   | 78,0                   | 82,0 | 9,0  | 11,0 | 8,0  | 11,0 |      | 0,8  |     |      |      |      | 1,0  |       |     |     |                        |      | 207            | 83               | 15              | 70          |
| 67     | C93800   | 75,0                   | 79,0 | 6,3  | 7,5  | 13,0 | 16,0 |      | 0,8  |     |      |      |      | 1,0  |       |     |     |                        |      | 179            | 97               | 12              | 50          |
|        | C94300   | 67,0                   | 72,0 | 4,5  | 6,0  | 23,0 | 27,0 |      | 0,8  |     |      |      |      | 1,0  |       |     |     |                        |      | 165            |                  | 10              |             |
| 68A    | C95200   | 86,0                   |      |      |      |      |      |      |      | 2,5 | 4,0  |      |      | 8,5  | 9,5   |     |     |                        |      | 450            | 170              | 20              | 110         |
| 68B    | C95300   | 86,0                   |      |      |      |      |      |      |      | 0,8 | 1,5  |      |      | 9,0  | 11,0  |     |     |                        |      | 450            | 170              | 20              | 110         |
| 68C    | C95400   | 83,0                   |      |      |      |      |      |      |      | 3,0 | 5,0  |      | 1,5  | 11,0 | 11,5  |     | 0,5 |                        |      | 515            | 205              | 12              | 150         |
|        | C95410   | 83,0                   |      |      |      |      |      |      |      | 3,0 | 5,0  | 1,5  | 2,5  | 10,0 | 11,5  |     | 0,5 |                        |      | 515            | 205              | 12              | 150         |
| 68D    | C95500   | 78,0                   |      |      |      |      |      |      |      | 3,0 | 5,0  | 3,0  | 5,5  | 10,0 | 11,5  |     | 3,5 |                        |      | 620            | 275              | 6               | 190         |
|        | C95520   | 74,5                   |      |      |      |      | 0,03 |      |      | 4,0 | 5,5  | 4,2  | 6,0  | 10,0 | 11,5  |     | 1,5 |                        | 0,15 |                |                  |                 |             |
|        | C95800   | 79,0                   |      |      |      |      | 0,03 |      |      | 3,5 | 4,5  | 4,0  | 5,0  | 8,5  | 9,5   | 0,8 | 1,5 |                        | 0,1  | 585            | 240              | 15              | (após TT)   |
|        | C95900   | restante               |      |      |      |      |      |      |      | 3,0 | 5,0  |      | 0,5  | 12,0 | 11,5  |     | 1,5 |                        |      |                |                  |                 |             |
|        | C97300   | 53,0                   | 58,0 | 1,5  | 3,0  | 8,0  | 11,0 | 17,0 | 25,0 |     | 1,5  | 11,0 | 14,0 |      |       |     |     |                        |      | 207            | 103              | 8               |             |
|        | C97600   | 63,0                   | 67,0 | 3,5  | 4,5  | 3,0  | 5,0  | 3,0  | 9,0  |     | 1,5  | 19,0 | 21,5 |      |       |     |     |                        |      | 276            | 117              | 10              |             |
|        | C97800   | 64,0                   | 67,0 | 4,0  | 5,5  | 1,0  | 2,5  | 1,0  | 4,0  |     | 1,5  | 24,3 |      |      |       |     |     |                        |      | 345            | 152              | 10              |             |



## LIGAS À BASE DE ALUMÍNIO

| NORMAS |        |        | COMPOSIÇÃO QUÍMICA (%) |     |     |      |      |     |      |      |      |      |      |     |      |     |     |     |    | PROPRIEDADES MECÂNICAS |                  |                |                 |             |
|--------|--------|--------|------------------------|-----|-----|------|------|-----|------|------|------|------|------|-----|------|-----|-----|-----|----|------------------------|------------------|----------------|-----------------|-------------|
|        |        |        |                        |     |     |      |      |     |      |      |      |      |      |     |      |     |     |     |    | T.TÉRMICO              | ESCOAMENTO (Mpa) | R.TRAÇÃO (Mpa) | ALONGAMENTO (%) | DUREZA (HB) |
| SAE    | ANSI   | UNS    | Si                     |     | Fe  |      | Cu   |     | Mn   |      | Mg   |      | Cr   |     | Ni   |     | Zn  |     | Ti |                        |                  |                |                 |             |
| 322    | 355.0  | A03550 | 4,5                    | 5,5 | 0,6 | 1,0  | 1,5  | 0,5 | 0,4  | 0,6  | 0,25 | 0,35 | 0,25 | T6  | 140  | 220 | 2   | 80  |    |                        |                  |                |                 |             |
|        |        |        |                        |     |     |      |      |     |      |      |      |      |      | T51 | 125  | 170 |     | 65  |    |                        |                  |                |                 |             |
|        |        |        |                        |     |     |      |      |     |      |      |      |      |      | T71 | 150  | 205 |     | 75  |    |                        |                  |                |                 |             |
| 323    | 356.0  | A03560 | 6,5                    | 7,5 | 0,6 | 0,25 | 0,35 | 0,2 | 0,45 | 0,4  | 0,3  | F    | 65   | 130 | 2    | 55  |     |     |    |                        |                  |                |                 |             |
|        |        |        |                        |     |     |      |      |     |      |      |      | T6   | 140  | 205 | 3    | 70  |     |     |    |                        |                  |                |                 |             |
|        |        |        |                        |     |     |      |      |     |      |      |      | T7   | 215  |     | 75   |     |     |     |    |                        |                  |                |                 |             |
| 326    | 319.0  | A03190 | 5,5                    | 6,5 | 1,0 | 3,0  | 4,0  | 0,5 | 0,1  | 0,35 | 1,0  | 0,25 | F    | 90  | 160  | 1,5 | 70  |     |    |                        |                  |                |                 |             |
|        |        |        |                        |     |     |      |      |     |      |      |      |      | T5   | 170 |      | 80  |     |     |    |                        |                  |                |                 |             |
|        |        |        |                        |     |     |      |      |     |      |      |      |      | T6   | 140 | 215  | 1,5 | 80  |     |    |                        |                  |                |                 |             |
| 327    | 328.0  | A03280 | 7,5                    | 8,5 | 1,0 | 1,0  | 2,0  | 0,2 | 0,6  | 0,2  | 0,6  | 0,35 | 0,25 | 1,5 | 0,25 | F   | 95  | 170 | 1  | 80                     |                  |                |                 |             |
|        |        |        |                        |     |     |      |      |     |      |      |      |      |      |     |      | T6  | 145 | 235 | 1  | 80                     |                  |                |                 |             |
| 329    |        |        | 5,5                    | 6,5 | 1,2 | 3,0  | 4,0  | 0,8 | 0,1  | 0,5  | 0,5  | 1,0  | 0,25 | F   |      | 147 | 1   | 70  |    |                        |                  |                |                 |             |
| 335    | C355.0 | A33550 | 4,5                    | 5,5 | 0,2 | 1,0  | 1,5  | 0,1 | 0,4  | 0,6  | 0,1  | 0,2  | T6   | 170 | 250  | 2,5 |     |     |    |                        |                  |                |                 |             |