

# TECHNICAL DATA



# COMPARISON OF HARMONIZED CABLES WITH IEC, DIN VDE AND HD

PVC-insulated cables according to DIN VDE 0281 in comparison with IEC and HD

| Designation                | accord. To VDE part... | short designation new | short designation old VDE 0250 | nominal cross section (mm <sup>2</sup> ) | nominal voltage U <sub>0</sub> /U (V) | according to HD | comparative design to IEC |
|----------------------------|------------------------|-----------------------|--------------------------------|------------------------------------------|---------------------------------------|-----------------|---------------------------|
| PVC-wiring cables          |                        |                       |                                |                                          |                                       |                 |                           |
| Single wires               | 0281 part 3            | H05V-U                | NYFA, NYA                      | 0,5 to 1,0                               | 300/500                               | HD 21.3 S3      | 227 IEC 01                |
| Fine wires                 | 0281 part 3            | H05V-K                | NYFAF, NYAF                    |                                          |                                       |                 | 227 IEC 01                |
| PVC-insulated cables       |                        |                       |                                |                                          |                                       |                 |                           |
| Single wires               | 0281 part 3            | H07V-U                | NYA                            | 1,5 to 10                                | 450/750                               | HD 21.3 S3      | 227 IEC 01                |
| Multi stranded wires       | 0281 part 3            | H07V-R                | NYA                            | 1,5 to 400                               |                                       |                 | 227 IEC 01                |
| Fine wires                 | 0281 part 3            | H07V-K                | NYAF                           | 1,5 to 240                               |                                       |                 | 227 IEC 02                |
| Light PVC-Twin cables      | 0281 part 5            | H03VH-Y               | NLYZ                           | 0,1                                      | 300/300                               | HD 21.3 S3      | 227 IEC 41                |
| Twin cables                | 0281 part 5            | H03VH-H               | NYZ                            | 0,5÷0,75                                 | 300/300                               | HD 21.3 S3      | 227 IEC 42                |
| PVC-sheathed cables 03VV-F |                        |                       |                                |                                          |                                       |                 |                           |
| Round                      | 0281 part 5            | H03VV-F               | NYLHY rund                     | 0,5÷0,75                                 | 300/300                               | HD 21.3 S3      | 227 IEC 43                |
| Flat                       | 0281 part 5            | H03VH2-F              | NYLHY flach                    | 0,5÷0,75                                 |                                       |                 | 227 IEC 43                |
| PVC-sheathed cables 05VV-F |                        |                       |                                |                                          |                                       |                 |                           |
| Round                      | 0281 part 5            | H05VV-F               | NYMHY rund                     | 0,75 to 2,5                              | 300/500                               | HD 21.3 S3      | 227 IEC 53                |
|                            |                        |                       | NYMHY rund                     | 1 to 2,5                                 |                                       |                 |                           |
| Flat                       | 0281 part 5            | H05VH2-F              | NYMHY flach                    | 0,75                                     | 300/500                               |                 | 227 IEC 53                |
| PVC-Flat-cable 05VV-H6     | 0281 part 5            | H05VH6-F              | NYFLY                          | 0,75 to 1                                | 300/500                               | -               | -                         |
| PVC-Flat-cable 05VV-H6     | 0281 part 5            | H05VH6-F              | NYFLY                          | 1,5 to 25                                | 450/750                               |                 | -                         |

## CABLE IDENTIFICATION SYMBOLS ACCORDING TO VDE STANDARDS

| Cable part or feature           | Symbol | Description                          |
|---------------------------------|--------|--------------------------------------|
| Conductor                       | Li     | Flexible multicore conductor         |
| Insulation sheath and materials | G      | Natural rubber                       |
|                                 | Y      | PVC                                  |
|                                 | 2Y     | Polyethylene                         |
|                                 | 2X     | Cross-linked polyethylene            |
|                                 | 11Y    | Polyurethane                         |
|                                 | 9Y     | Polypropylene                        |
| Jackets and shields             | C      | Tinned copper braid shield           |
|                                 | (Si)   | Aluminium/Polyester tape shield      |
|                                 | (Z)    | Galvanized steel braid armour        |
| COLOUR CODING                   | -J     | With protective ground Y/G conductor |
|                                 | -O     | Without protective ground conductor  |
|                                 | Z      | Numbered cores                       |
|                                 | B      | Coloured cores                       |

# CURRENT RATINGS General for flexible cables

## AMBIENT TEMPERATURE UP TO 30 °C

| Nominal<br>cross section<br>mm <sup>2</sup> | Group 1           |                      | Group 2           |                      | Group 3           |                      |
|---------------------------------------------|-------------------|----------------------|-------------------|----------------------|-------------------|----------------------|
|                                             | power rating<br>A | protective fuse<br>A | power rating<br>A | protective fuse<br>A | power rating<br>A | protective fuse<br>A |
| 0,05                                        | 1                 | -                    | 1                 | -                    | -                 | -                    |
| 0,14                                        | 2                 | -                    | 2                 | -                    | 3,5               | -                    |
| 0,25                                        | 4                 | -                    | 4,5               | -                    | 6                 | -                    |
| 0,34                                        | 6                 | -                    | 6                 | -                    | 9                 | -                    |
| 0,5                                         | 9                 | -                    | 9                 | -                    | 12                | -                    |
| 0,75                                        | 12                | -                    | 12                | 10                   | 15                | 10                   |
| 1                                           | 15                | 10                   | 15                | 10                   | 19                | 16                   |
| 1,5                                         | 18                | 16                   | 18                | 16                   | 24                | 20                   |
| 2,5                                         | 26                | 25                   | 26                | 25                   | 32                | 25                   |
| 4                                           | 34                | 25                   | 34                | 25                   | 42                | 35                   |
| 6                                           | 44                | 35                   | 44                | 35                   | 54                | 50                   |
| 10                                          | 61                | 50                   | 61                | 50                   | 73                | 63                   |
| 16                                          | 82                | 80                   | 82                | 63                   | 98                | 80                   |
| 25                                          | 108               | 100                  | 108               | 80                   | 129               | 100                  |
| 35                                          | 135               | 125                  | 135               | 100                  | 158               | 125                  |
| 50                                          | 168               | 160                  | 168               | 125                  | 198               | 160                  |
| 70                                          | 207               | 200                  | 207               | 160                  | 245               | 200                  |
| 95                                          | 250               | 250                  | 250               | 200                  | 292               | 250                  |
| 120                                         | 292               | 250                  | 292               | 250                  | 344               | 315                  |
| 150                                         | 335               | 315                  | 335               | 315                  | 391               | 355                  |
| 185                                         | 382               | 355                  | 382               | 355                  | 448               | 400                  |
| 240                                         | -                 | -                    | 453               | 425                  | 528               | 500                  |
| 300                                         | -                 | -                    | 523               | 500                  | 608               | 600                  |
| 400                                         | -                 | -                    | -                 | -                    | 726               | 630                  |

GROUP 1 - One or more single core cables and insulated wires laid in duct i. e. PVC-sheathed single cores H03V.. /H05V.. /H07V.. According to VDE 0281.

GROUP 2 - Multi core cables, i. e. light PVC-sheathed cables, flexible cables, metal-clad wiring cables in open or ventilated conduits.

GROUP 3 - Single core cables, laid open in air with a spacing at least equal to cable diameter, such as single core wirings for switch-and distribution cabinets and rail line distributors.

## CONVERSION FACTORS For deviating ambient temperature

### Ambient Temperature over 30

Conversion factors, applied to the above current ratings table

| Ambient Temperature<br>°C | RUBBER insulation<br>conversion factors up to 60°C | PVC insulation<br>conversion factors up to 60°C |
|---------------------------|----------------------------------------------------|-------------------------------------------------|
|                           | conversion factors up to 60°C                      | conversion factors up to 60°C                   |
| over 30 bis 35            | 0,91                                               | 0,94                                            |
| over 35 bis 40            | 0,82                                               | 0,87                                            |
| over 40 bis 45            | 0,71                                               | 0,79                                            |
| over 45 bis 50            | 0,58                                               | 0,71                                            |
| over 50 bis 55            | 0,41                                               | 0,61                                            |
| over 55 bis 60            | -                                                  | 0,50                                            |
| over 60 bis 65            | -                                                  | 0,35                                            |

### Ambient Temperature over 50 (heat resistant)

Conversion factors, applied to the above current ratings table

| conversion factors up to 90°C |      |                  |      | conversion factors up to 110°C |      |                  |      |
|-------------------------------|------|------------------|------|--------------------------------|------|------------------|------|
| over 50 bis 55                | 0,94 | over 50 bis 55   | 1    | over 50 bis 55                 | 0,94 | over 50 bis 55   | 1    |
| over 55 bis 60                | 0,87 | over 55 bis 60   | 1    | over 55 bis 60                 | 0,87 | over 55 bis 60   | 1    |
| over 60 bis 65                | 0,79 | over 60 bis 65   | 1    | over 60 bis 65                 | 0,79 | over 60 bis 65   | 1    |
| over 65 bis 70                | 0,71 | over 65 bis 70   | 1    | over 65 bis 70                 | 0,71 | over 65 bis 70   | 1    |
| over 70 bis 75                | 0,61 | over 70 bis 75   | 1    | over 70 bis 75                 | 0,61 | over 70 bis 75   | 1    |
| over 75 bis 80                | 0,5  | over 75 bis 80   | 1    | over 75 bis 80                 | 0,5  | over 75 bis 80   | 1    |
| over 80 bis 85                | 0,35 | over 80 bis 85   | 0,91 | over 80 bis 85                 | 0,35 | over 80 bis 85   | 0,91 |
| over 85 bis 90                | -    | over 85 bis 90   | 0,82 | over 85 bis 90                 | -    | over 85 bis 90   | 0,82 |
|                               |      | over 90 bis 95   | 0,71 | over 90 bis 95                 |      | over 90 bis 95   | 0,71 |
|                               |      | over 95 bis 100  | 0,58 | over 95 bis 100                |      | over 95 bis 100  | 0,58 |
|                               |      | over 100 bis 105 | 0,41 | over 100 bis 105               |      | over 100 bis 105 | 0,41 |
|                               |      | over 105 bis 110 | -    | over 105 bis 110               |      | over 105 bis 110 | -    |

TABLE I - Permissible currents (ambient temperature 40 °C)

| Maximum permissible<br>temperature | 180°C                                       | 200°C                                       | 250°C                                              | 450°C                                               | 450°C                         |
|------------------------------------|---------------------------------------------|---------------------------------------------|----------------------------------------------------|-----------------------------------------------------|-------------------------------|
| Cross-section mm <sup>2</sup>      | Red or tinned<br>copper core<br>NF C 31-111 | Silver-plated<br>copper core<br>NF C 31-111 | Nickel-plated<br>copper core class<br>2 ASTM B 355 | Nickel-plated<br>copper core class<br>27 ASTM B 355 | Nickel core<br>200 ASTM B 160 |
| 0,5                                | 11,1                                        | 12,4                                        | 14,4                                               | 16,5                                                | 7,7                           |
| 0,75                               | 14,6                                        | 16,3                                        | 18,8                                               | 21,5                                                | 10,1                          |
| 1                                  | 17,8                                        | 19,8                                        | 22,7                                               | 26,0                                                | 12,1                          |
| 1,5                                | 23,4                                        | 26,0                                        | 29,5                                               | 33,8                                                | 15,8                          |
| 2,5                                | 33,0                                        | 36,7                                        | 41,2                                               | 47,2                                                | 22,1                          |
| 4                                  | 45,4                                        | 50,4                                        | 56,0                                               | 64,1                                                | 30,0                          |
| 6                                  | 59,7                                        | 66,3                                        | 72,9                                               | 83,5                                                | 39,1                          |

TABLE II - Correction factors

| Ambient °C | 180°C | 200°C | 250°C | 450°C |
|------------|-------|-------|-------|-------|
| 41-50      | 0,96  | 0,97  | 0,98  | 0,99  |
| 51-60      | 0,91  | 0,94  | 0,95  | 0,99  |
| 61-70      | 0,87  | 0,90  | 0,93  | 0,96  |
| 71-80      | 0,81  | 0,87  | 0,90  | 0,95  |
| 81-90      | 0,77  | 0,83  | 0,87  | 0,93  |
| 91-100     | 0,65  | 0,72  | 0,85  | 0,92  |
| 101-120    | 0,62  | 0,71  | 0,79  | 0,89  |
| 121-140    | 0,50  | 0,61  | 0,71  | 0,86  |
| 141-160    | 0,35  | 0,50  | 0,65  | 0,84  |
| 161-180    | -     | 0,35  | 0,58  | 0,81  |
| 181-200    | -     | -     | 0,49  | 0,78  |
| 201-225    | -     | -     | 0,35  | 0,74  |
| 226-250    | -     | -     | -     | 0,69  |
| 251-275    | -     | -     | -     | 0,65  |
| 276-300    | -     | -     | -     | 0,60  |
| 301-325    | -     | -     | -     | 0,55  |
| 326-350    | -     | -     | -     | 0,49  |
| 351-375    | -     | -     | -     | 0,42  |
| 376-400    | -     | -     | -     | 0,34  |

## STRAND MAKE-UP

According to DIN VDE 0295, IEC 60228 and HD 383

| Cross<br>Section<br>mm <sup>2</sup> | Stranded wires<br>Class 2 DIN VDE 0295 | Multi-stranded wires            | Fine wires<br>Class 5 DIN VDE 0295 | Extra fine wires                              |                                  |                                  |                                  |
|-------------------------------------|----------------------------------------|---------------------------------|------------------------------------|-----------------------------------------------|----------------------------------|----------------------------------|----------------------------------|
|                                     | Column 1                               | Column 2                        | Column 3                           | Class 6 DIN VDE 0296                          | Column 5                         | Column 6                         | Column 7                         |
|                                     | no of wires3 x single wire<br>mm       | no of wires x single wire<br>mm | no of wires1 x single wire2<br>mm  | Column 4<br>no of wires1 x single wire2<br>mm | no of wires1 x single wire<br>mm | no of wires1 x single wire<br>mm | no of wires1 x single wire<br>mm |
| 0,14                                |                                        |                                 | 18 x 0,1                           | 18 x 0,1                                      | 18 x 0,1                         | 36 x 0,07                        | 72 x 0,05                        |
| 0,25                                |                                        |                                 | 14 x 0,15                          | 32 x 0,1                                      | 32 x 0,1                         | 65 x 0,07                        | 128 x 0,05                       |
| 0,34                                |                                        | 7 x 0,25                        | 19 x 0,15                          | 42 x 0,1                                      | 42 x 0,1                         | 88 x 0,07                        | 174 x 0,05                       |
| 0,38                                |                                        | 7 x 0,27                        | 12 x 0,2                           | 21 x 0,15                                     | 48 x 0,1                         | 100 x 0,07                       | 194 x 0,05                       |
| 0,50                                | 7 x 0,30                               | 7 x 0,3                         | 16 x 0,2                           | 28 x 0,15                                     | 64 x 0,1                         | 131 x 0,07                       | 256 x 0,05                       |
| 0,75                                | 7 x 0,37                               | 7 x 0,37                        | 24 x 0,2                           | 42 x 0,15                                     | 96 x 0,1                         | 195 x 0,07                       | 384 x 0,05                       |
| 1,00                                | 7 x 0,43                               | 7 x 0,43                        | 32 x 0,2                           | 56 x 0,15                                     | 128 x 0,1                        | 260 x 0,07                       | 512 x 0,05                       |
| 1,50                                | 7 x 0,52                               | 7 x 0,52                        | 30 x 0,25                          | 84 x 0,15                                     | 192 x 0,1                        | 392 x 0,07                       | 768 x 0,05                       |
| 2,50                                | 7 x 0,67                               | 19 x 0,41                       | 50 x 0,25                          | 140 x 0,15                                    | 320 x 0,1                        | 651 x 0,07                       | 1280 x 0,05                      |
| 4,00                                | 7 x 0,85                               | 19 x 0,52                       | 56 x 0,3                           | 224 x 0,15                                    | 512 x 0,1                        | 1040 x 0,07                      |                                  |
| 6,00                                | 7 x 1,05                               | 19 x 0,64                       | 84 x 0,3                           | 192 x 0,2                                     | 768 x 0,1                        | 1560 x 0,07                      |                                  |
| 10,00                               | 7 x 1,35                               | 49 x 0,51                       | 80 x 0,4                           | 320 x 0,2                                     | 1280 x 0,1                       | 2600 x 0,07                      |                                  |
| 16,00                               | 7 x 1,70                               | 49 x 0,65                       | 128 x 0,4                          | 512 x 0,2                                     | 2048 x 0,1                       |                                  |                                  |
| 25,00                               | 7 x 2,13                               | 84 x 0,62                       | 200 x 0,4                          | 800 x 0,2                                     | 3200 x 0,1                       |                                  |                                  |
| 35,00                               | 7 x 2,52                               | 133 x 0,58                      | 280 x 0,4                          | 1120 x 0,2                                    |                                  |                                  |                                  |
| 50,00                               | 7 x 3,02 / 19 x 1,83                   | 133 x 0,69                      | 400 x 0,4                          | 705 x 0,3                                     |                                  |                                  |                                  |
| 70,00                               | 19 x 2,17                              | 189 x 0,69                      | 356 x 0,5                          | 990 x 0,3                                     |                                  |                                  |                                  |
| 95,00                               | 19 x 2,52                              | 259 x 0,69                      | 485 x 0,5                          | 1340 x 0,3                                    |                                  |                                  |                                  |
| 120,00                              | 37 x 2,03                              | 336 x 0,67                      | 614 x 0,5                          | 1690 x 0,3                                    |                                  |                                  |                                  |
| 150,00                              | 37 x 2,27                              | 392 x 0,69                      | 765 x 0,5                          | 2123 x 0,3                                    |                                  |                                  |                                  |
| 185,00                              | 37 x 2,52                              | 494 x 0,69                      | 944 x 0,5                          | 1470 x 0,4                                    |                                  |                                  |                                  |
| 240,00                              | 61 x 2,24                              | 627 x 0,7                       | 1225 x 0,5                         | 1905 x 0,4                                    |                                  |                                  |                                  |
| 300,00                              | 61 x 2,50                              | 790 x 0,7                       | 1530 x 0,5                         | 2385 x 0,4                                    |                                  |                                  |                                  |
| 400,00                              | 61 x 2,89                              |                                 | 2035 x 0,5                         |                                               |                                  |                                  |                                  |
| 500,00                              | 61 x 3,23                              |                                 | 1768 x 0,6                         |                                               |                                  |                                  |                                  |

1. The n° of individual wires are without obligation. 2. The diameters of the single wires for each conductor are not allowed to exceed the values stated to DIN VDE 0295 the singles wires of a stranded conductors must have all the same nominal diameters. 3. Minimum number of single wires of stranded conductor. the singles wires of a stranded conductors must have all the same nominal diameters.

## AMERICAN STRANDINGS

| Size<br>AWG | Section<br>mm2 | Stranding (n x mm) |               |               |               | Solid<br>mm |
|-------------|----------------|--------------------|---------------|---------------|---------------|-------------|
|             |                | 150°               |               | 200°          |               |             |
|             |                | E.U. (n x mm)      | U.S.A.(n/awg) | E.U. (n x mm) | U.S.A.(n/awg) |             |
| 24          | 0,21           | 7 x 0,20           | 7/32          | 1 x 0,50      | 1/24          | 1 x 0,5     |
| 23          | 0,26           | 8 x 0,20           |               | 1 x 0,60      |               | 1 x 0,6     |
| 22          | 0,32           | 11 x 0,20          | 7/30          | 1 x 0,70      | 1/22          | 1 x 0,7     |
| 21          | 0,41           | 13 x 0,20          |               | 1 x 0,72      |               | 1 x 0,72    |
| 20          | 0,52           | 16 x 0,20          | 10/30         | 5 x 0,40      | 1/20          | 1 x 0,81    |
| 18          | 0,82           | 26 x 0,20          | 16/30         | 7 x 0,40      | 7/26          | 1 x 1,02    |
| 16          | 1,31           | 42 x 0,20          | 26/30         | 11 x 0,40     | 7/24          | 1 x 1,3     |
| 15          | 1,65           | 33 x 0,25          |               | 13 x 0,40     |               | 1 x 1,45    |
| 14          | 2,08           | 42 x 0,25          | 41/30         | 17 x 0,40     | 7/22          | 1 x 1,62    |
| 13          | 2,63           | 53 x 0,25          |               | 21 x 0,40     |               | 1 x 1,82    |
| 12          | 3,31           | 67 x 0,25          | 65/30         | 27 x 0,40     | 19/0,0185"    | 1 x 2,04    |
| 11          | 4,17           | 59 x 0,30          |               | 33 x 0,40     |               | 1 x 2,3     |
| 10          | 5,26           | 74 x 0,30          | 105/30        | 42 x 0,40     | 19/0,0234"    | 1 x 2,6     |
| 9           | 6,63           | 93 x 0,30          |               | 52 x 0,40     |               | 1 x 2,9     |
| 8           | 8,36           | 118 x 0,30         | 133/29        | 66 x 0,40     | 54/25         | 1 x 3,3     |
| 7           | 10,55          | 148 x 0,30         |               | 84 x 0,40     |               |             |
| 6           | 13,3           | 106 x 0,40         | 133/27        | 106 x 0,40    | 84/25         |             |
| 5           | 16,77          | 133 x 0,40         |               | 133 x 0,40    |               |             |
| 4           | 21,15          | 168 x 0,40         | 133/25        | 168 x 0,40    | 133/25        |             |
| 3           | 26,67          | 212 x 0,40         |               | 212 x 0,40    |               |             |
| 2           | 33,62          | 267 x 0,40         | 259/26        | 267 x 0,40    | 259/26        |             |
| 1           | 42,41          | 337 x 0,40         | 259/25        | 337 x 0,40    | 259/25        |             |
| 1/0         | 53,49          | 425 x 0,40         | 259/24        | 425 x 0,40    | 259/24        |             |
| 2/0         | 67,43          | 536 x 0,40         | 259/23        | 536 x 0,40    | 259/23        |             |
| 3/0         | 85,01          | 676 x 0,40         | 259/22        | 676 x 0,40    | 259/22        |             |
| 4/0         | 107,2          | 853 x 0,40         | 259/21        | 853 x 0,40    | 259/21        |             |
| 250 MCM     | 127            | 1011 x 0,40        | 427/22        | 1011 x 0,40   | 427/22        |             |
| 300 MCM     | 152            | 1210 x 0,40        |               | 1210 x 0,40   |               |             |
| 350 MCM     | 177            | 1409 x 0,40        | 427/21        | 1409 x 0,40   | 427/21        |             |
| 400 MCM     | 203            | 1616 x 0,40        |               | 1616 x 0,40   |               |             |
| 450 MCM     | 228            | 1815 x 0,40        | 427/20        | 1815 x 0,40   | 427/20        |             |
| 500 MCM     | 253            | 2014 x 0,40        | 427/0,0341"   | 2014 x 0,40   | 427/0,0341"   |             |

## AWG/MCM TABLE WIRE GAUGE CONVERSION

| based on solid conductors |                            |                              |                          |              |        | based on solid conductors |                            |                              |                          |              |       | based on solid conductors |                            |                              |                          |              |     |
|---------------------------|----------------------------|------------------------------|--------------------------|--------------|--------|---------------------------|----------------------------|------------------------------|--------------------------|--------------|-------|---------------------------|----------------------------|------------------------------|--------------------------|--------------|-----|
| size<br>awg/mcm           | SECTION<br>mm <sup>2</sup> | normal<br>diameter<br>inches | normal<br>diameter<br>mm | lbs<br>per m | kgs    | size<br>awg/mcm           | SECTION<br>mm <sup>2</sup> | normal<br>diameter<br>inches | normal<br>diameter<br>mm | lbs<br>per m | kgs   | size<br>awg/mcm           | SECTION<br>mm <sup>2</sup> | normal<br>diameter<br>inches | normal<br>diameter<br>mm | lbs<br>per m | kgs |
| 36                        | 0,012                      | 0,0050                       | 0,127                    | 0,0757       | 0,0343 | 21                        | 0,412                      | 0,02846                      | 0,723                    | 2,452        | 1,112 | 2/0                       | 67,5                       | 0,3648                       | 9,27                     | 411          | 186 |
| 35                        | 0,016                      | 0,00561                      | 0,143                    | 0,0954       | 0,0433 | 20                        | 0,519                      | 0,03196                      | 0,812                    | 3,154        | 1,431 | 3/0                       | 85,0                       | 0,4096                       | 10,40                    | 518          | 235 |
| 34                        | 0,020                      | 0,00630                      | 0,160                    | 0,1203       | 0,0546 | 18                        | 0,832                      | 0,04030                      | 1,024                    | 5,015        | 2,275 | 4/0                       | 107,2                      | 0,4600                       | 11,68                    | 653          | 296 |
| 33                        | 0,025                      | 0,00708                      | 0,180                    | 0,1517       | 0,0688 | 16                        | 1,310                      | 0,0508                       | 1,290                    | 7,974        | 3,617 | 250 MCM                   | 136,0                      | 0,4999                       | 12,70                    | 772          | 350 |
| 32                        | 0,032                      | 0,00795                      | 0,202                    | 0,1913       | 0,0868 | 14                        | 2,080                      | 0,0641                       | 1,630                    | 12,68        | 5,752 | 300 MCM                   | 161,0                      | 0,5476                       | 13,70                    | 925          | 420 |
| 31                        | 0,040                      | 0,00893                      | 0,227                    | 0,2413       | 0,1095 | 12                        | 3,310                      | 0,0808                       | 2,050                    | 20,16        | 9,145 | 350 MCM                   | 193,0                      | 0,5917                       | 15,03                    | 1080         | 490 |
| 30                        | 0,050                      | 0,01003                      | 0,255                    | 0,3042       | 0,1380 | 10                        | 5,270                      | 0,1019                       | 2,590                    | 32,06        | 14,54 | 400 MCM                   | 225,0                      | 0,6322                       | 16,06                    | 1236         | 561 |
| 29                        | 0,065                      | 0,01126                      | 0,286                    | 0,3836       | 0,1740 | 9                         | 6,620                      | 0,1144                       | 2,910                    | 40,42        | 18,33 | 450 MCM                   | 257,0                      | 0,7070                       | 17,96                    | 1542         | 699 |
| 28                        | 0,080                      | 0,01264                      | 0,321                    | 0,4837       | 0,2194 | 8                         | 8,350                      | 0,1285                       | 3,260                    | 51,00        | 23,13 | 500 MCM                   | 322,0                      | 0,7744                       | 19,67                    | 1850         | 839 |
| 27                        | 0,102                      | 0,01420                      | 0,361                    | 0,6100       | 0,2767 | 6                         | 13,30                      | 0,1620                       | 4,110                    | 80,90        | 36,70 |                           |                            |                              |                          |              |     |
| 26                        | 0,128                      | 0,01594                      | 0,405                    | 0,7692       | 0,3489 | 4                         | 21,20                      | 0,2043                       | 5,190                    | 129          | 58,50 |                           |                            |                              |                          |              |     |
| 25                        | 0,163                      | 0,01790                      | 0,455                    | 0,9699       | 0,4399 | 3                         | 26,70                      | 0,2294                       | 5,830                    | 162          | 73,50 |                           |                            |                              |                          |              |     |
| 24                        | 0,205                      | 0,02010                      | 0,511                    | 1,223        | 0,5548 | 2                         | 33,6                       | 0,2576                       | 6,54                     | 205          | 93    |                           |                            |                              |                          |              |     |
| 23                        | 0,259                      | 0,02257                      | 0,573                    | 1,542        | 0,6995 | 1                         | 42,4                       | 0,2893                       | 7,35                     | 259          | 117   |                           |                            |                              |                          |              |     |
| 22                        | 0,325                      | 0,02535                      | 0,644                    | 1,945        | 0,8823 | 1/0                       | 53,4                       | 0,3249                       | 8,25                     | 326          | 148   |                           |                            |                              |                          |              |     |

## TABLE METRIC CONVERSIONS

| to convert from    | to                 | multiply by  | to convert from         | to                         | multiply by |
|--------------------|--------------------|--------------|-------------------------|----------------------------|-------------|
| circular mils      | square inches      | 0,0000007854 | miles                   | kilometers                 | 1,6093      |
| circular mils      | square mils        | 0,7854       | millimeters             | inches                     | 0,03937     |
| circular mils      | square millimeters | 0,0005066    | millimeters             | mils                       | 39,3701     |
| square centimeters | square inches      | 0,155        | mils                    | inches                     | 0,001       |
| square feet        | square meters      | 0,0929       | mils                    | millimeters                | 0,0254      |
| square inches      | circular mils      | 1273240      | yards                   | meters                     | 0,9144      |
| square inches      | square centimeters | 6,4516       |                         |                            |             |
| square inches      | square millimeters | 645,16       |                         |                            |             |
| square inches      | square mils        | 1000000      | kilograms               | pounds                     | 2,205       |
| square meters      | square feet        | 10764        | kilograms per kilometer | pounds per 1000 feet       | 0,6719      |
| square millimeters | square inches      | 0,00155      | ohms per kilometers     | ohms per 1000 feet         | 0,3048      |
| square millimeters | circular mils      | 1973510      | ohms per 1000 feet      | ohms per kilometers        | 3,2808      |
| square mils        | circular mils      | 1273         | ohms per 1000 yard      | ohms per kilometers        | 1,0936      |
| square mils        | square inches      | 0,0000001    | picofarads per foot     | picofarads per meter       | 3,285       |
|                    |                    |              | pounds                  | kilograms                  | 0,4536      |
| centimeters        | inches             | 0,3937       | pounds per 1000 feet    | kilograms per kilometer    | 1,488       |
| centimeters        | feet               | 0,03281      | pounds per 1000 yards   | kilograms per kilometer    | 0,496       |
| feet               | centimeters        | 30,48        | pounds per 1000 yards   | pounds per kilometers      | 1,0936      |
| feet               | meters             | 0,3048       | diam. circle            | circumference circle       | 3,1416      |
| inches             | centimeters        | 2,54         | diam. circle            | side of equal sphere       | 0,8862      |
| inches             | meters             | 0,0254       | diam. sphere-cubed      | volume of sphere           | 0,5236      |
| inches             | millimeters        | 25,4         | u.s. gallons            | imperial gallons (british) | 0,8327      |
| inches             | mils               | 1000         | u.s. gallons            | cubic feet                 | 0,1337      |
| kilometers         | miles              | 0,6214       | u.s. gallons            | pounds of water (20°C)     | 8,33        |
| meters             | feet               | 3,2808       | cubic feet              | pounds of water (4°C)      | 32,427      |
| meters             | inches             | 39,3701      | feet of water (4°C)     | pound per square inch      | 0,4336      |
| meters             | yards              | 1,0936       | inches of mercury (0°C) | pound per square inch      | 0,4912      |
|                    |                    |              | knots                   | miles per hour             | 1,1516      |

## GENERAL INFORMATION - DEFINITIONS OF TERMS

### FLAME-RETARDANT

To be flame-retardant, the cable must withstand the test specified in IEC standard 60332-3 or IEC 60332-1. Flame retardant cables do not propagate fire and are self-extinguishing. The requirement for passing the test is that after the burner has been removed the cables must extinguish themselves.

### IEC 60332-1

Is the flame test for single insulated wire and cable.

### IEC 60332-3

Is the flame test for bunched wires and cables. The burner is directed towards the bunch of cables.

### FIRE-RESISTANT

To be classified as fire-resistant the cables must withstand the test specified in standard IEC 60331-21. The cables must operate for a minimum of 90 minutes while the burner is directed towards the cable.

### SMOKE EMISSION

Smoke emission refers to visibility in a fire. The greater the light transmittance, the better the visibility. When tested in accordance with IEC 61034-1 (test method) and IEC 61034-2 (test requirements) the smoke emission of a cable during fire must not exceed the relative values.

### HALOGEN-FREE

Halogen-free refers to the absence of halogens, such as chlorine and fluorine and is determined on the basis of halogen content and the acidity of gases of a cable.

### IEC 60754-1

Determines the halogen content of the material. To meet the requirements as halogen-free the halogen content of the material may not exceed 0,5% or 5 mg/g.

### IEC 60754-2

Determines the degree of acidity of gases evolved during combustion. The limit values are 4,3 for pH and 10 mikroS for conductivity.

## MATERIAL FEATURES

| Int. l name        | Materials                       | Temp. rating<br>°C | Density<br>g/cm <sup>3</sup> | Oxygen index<br>% | Tensile strength<br>N/mm <sup>2</sup> | Dielectric const.<br>(1 MHz) | Dielectric strength<br>kV/mm | Flexibility | Abrasion resist. |
|--------------------|---------------------------------|--------------------|------------------------------|-------------------|---------------------------------------|------------------------------|------------------------------|-------------|------------------|
| Thermoplastics     |                                 |                    |                              |                   |                                       |                              |                              |             |                  |
| PVC                | Polyvinylchloride               | -30 + +70/90       | 1,25 / 1,60                  | 25 / 30           | 10 / 25                               | 3,3 / 4,5                    | 30 / 60                      | good        | good             |
| PVC150             | Polyvinylchloride               | -30 + +70/90       | 1,25 / 1,60                  | 25 / 30           | 10 / 25                               | 3,3 / 4,5                    | 30 / 60                      | good        | good             |
| LDPE               | Low Density Polyethylene        | -60 + +70          | 0,92 / 0,96                  | 18,00             | 14,00                                 | 2,27                         | 20 / 30                      | average     | average          |
| HDPE               | High Density Polyethylene       | -60 + +110         | 0,92 / 0,96                  | 18,00             | 14,00                                 | 2,27                         | 17 / 24                      | poor        | good             |
| XLPE               | Crosslinked polyethylene        | -80 + +115         | 0,91 / 0,92                  | 18,00             | 14 / 40                               | 2,3 / 2,8                    | 20 / 24                      | average     | good             |
| PA                 | Polyamide Nylon Rilsan          | -30 + +105         | 0,90                         | 18,00             | 50 / 60                               | 4,00                         | 20 / 30                      | average     | very good        |
| PP                 | Polypropylene                   | -30 + +105         | 0,90                         | 18,00             | 15 / 34                               | 2,1 / 2,2                    | 26 / 30                      | average     | good             |
| PUR                | Polyurethane                    | -40 + +100         | 1,20                         | 19,00             | 30 / 60                               | 3,5 / 6,0                    | 15,00                        | good        | very good        |
| TR                 | Thermoplastic rubber            | -55 + +125         | 0,98 / 1,24                  | 20 / 25           | 8 / 10                                | 2,10                         | 22,00                        | good        | good             |
| ETFE               | Ethylene tetrafluoroethylene    | -100 + +155        | 1,73 / 1,76                  | 31,00             | 40 / 50                               | 2,6 / 2,7                    | 20,00                        | average     | very good        |
| FEP                | Fluoroethylenepropylene         | -100 + +200        | 2,15                         | 90 / 95           | 20 / 30                               | 2,1 / 2,2                    | 24,00                        | average     | average          |
| MFA                | Methylvinyletherfluoroalkoxy    | -100 + +230        | 2,12 / 2,17                  | > 95              | 23,00                                 | 2,00                         | 30 / 35                      | good        | good             |
| PFA                | Perfluoroalkoxy                 | -190 + +260        | 2,17                         | 95,00             | 20 / 30                               | 2,10                         | 80,00                        | good        | good             |
| PTFE               | Polytetrafluoroethylene         | -190 + +260        | 2,17 / 2,2                   | 95,00             | 14 / 40                               | 2,10                         | 24,00                        | poor        | good             |
| PEEK               | Polyethylethylketone            | -65 + +200         | 1,2 / 1,32                   | 35 / 48           | 34 / 92                               | 3,0 / 3,3                    | 16 / 21                      | poor        | very good        |
| Elastomers         |                                 |                    |                              |                   |                                       |                              |                              |             |                  |
| CR                 | Neoprene                        | -30 + +115         | 1,25                         | 30 / 35           | 15,00                                 | 12,00                        | 20,00                        | very good   | good             |
| EPM<br>EPR         | Ethylene-Polypropilene Copol.   | -30 + +115         | 0,85                         | 30 / 35           | 5                                     | 3,3                          | 35                           | very good   | good             |
| EVA                | Vinylethileneacetate, Levaprene | -50 + +125         | 0,98 / 1,24                  | 20 / 25           | 6,00                                  | 5,00                         | 15,00                        | very good   | average          |
| SIR                | Silicone rubber                 | -55 + +180/250     | 1,1 / 1,3                    | 20,00             | 7,00                                  | 3,2 / 3,3                    | 26,00                        | very good   | average          |
| Mineral insulators |                                 |                    |                              |                   |                                       |                              |                              |             |                  |
| GL                 | Glass fiber                     | -55 + +200 / 400   | 2,80                         | -                 | 2400,00                               | 3,80                         | -                            | average     | poor             |

## ITALIAN vs EUROPEAN STANDARDS

| 1. CEI<br>Standards | TITLE OF STANDARDS                                                                                                                          | 2. VDE<br>Standards | 3. IEC<br>Publications | 4. European<br>Harmonizations |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------|-------------------------------|
| CEI 20-11           | Technical characteristics and test requirements for insulation and sheath compound of electric cables                                       | 0207                | -                      | -                             |
| CEI 20-14           | PVC insulated cables for electrical systems with rated voltage between 1 kV and 3 kV                                                        | 0271                | 227                    | -                             |
| CEI 20-20           | PVC insulated cables for electrical systems with rated voltage up to including 450/750V                                                     | 0281                | 227                    | HD 21.1                       |
| CEI 20-22           | Test on electric cables under fire conditions.<br>Part 2: fire propagation.<br>Part 3: test on bunched wires of cables                      | 0482-266            | 332-3                  | EN 50266                      |
| CEI 20-29           | Conductors for insulated cables                                                                                                             | 0295                | 228                    | HD 383                        |
| CEI 20-34           | Common test methods for insulating and sheathing materials for electric cables                                                              | 0472                | 811                    | EN 60811                      |
| CEI 20-35           | Test on gases evolved during combustion of materials from cables                                                                            | 0482-266            | 332-1                  | EN 50265                      |
| CEI 20-36           | Test for electric cables under fire conditions                                                                                              | 0472-814            | 331                    |                               |
|                     | Specifications for harness cables and telecommunications cables                                                                             | 0812                |                        |                               |
| CEI 46-4            | Low frequency cables and wires with PVC insulation and PVC sheath. General tests and measuring methods                                      |                     | 189-1                  |                               |
| CEI 46-6            | Low frequency cables and wires with PVC insulation and PVC sheath. Equipment wires with solids or stranded conductors, single, pairs, terms |                     | 189-3                  |                               |

1 - CEI: Italian electrotechnical committee; 2 - VDE: Verband Deutscher Elektrotechniker;

3 - IEC International Electrotechnical Commission; 4 - CENELEC: European Committee for Electrotechnical Standardizations.

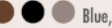
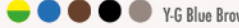
## DESIGNATION SYSTEM ACCORDING TO HAR

| Cable part or feature | Symbol   | Description                                                                        |
|-----------------------|----------|------------------------------------------------------------------------------------|
| Potentiality          | Number   | Number of the main cores in cable                                                  |
|                       | X        | Separation code for cables without yellow/green protection                         |
|                       | G        | Separation code for cables with yellow/green protection conductor                  |
|                       | Section  | Nominal section in mm <sup>2</sup> of conductors                                   |
| Conductor             | F        | flexible round stranded copper conductor                                           |
| Insulation            | R        | PVC compound                                                                       |
| Cable shape           | O        | Cores assembled in round shape                                                     |
| Shield                | H        | Aluminium tape                                                                     |
|                       | H1       | Copper tape                                                                        |
|                       | H2       | Copper braid                                                                       |
| Protective covering   | R        | Sheath with PVC compound                                                           |
| Metallic protection   | A        | Steel with braid armour                                                            |
|                       | F        | Round wire steel armour                                                            |
|                       | N        | Steel tape armour                                                                  |
| Sheath                | R        | PVC compound                                                                       |
| Working voltage       | 300/500V | Nominal voltage<br>U <sub>0</sub> = 300V phase to earth<br>U= 500V phase to phase  |
|                       | 450/750V | Nominal voltage<br>U <sub>0</sub> = 450V phase to earth<br>U= 750V phase to phase  |
|                       | 0,6/1 kV | Nominal voltage<br>U <sub>0</sub> = 600V phase to earth<br>U= 1000V phase to phase |
|                       |          |                                                                                    |
|                       |          |                                                                                    |
|                       |          |                                                                                    |
|                       |          |                                                                                    |
|                       |          |                                                                                    |

## COLOUR CHART

\*\* only for special applications

CEI UNEL 00722 / HD 308

| WITH GROUNDING CONDUCTOR |     |                                                                                                               | WITHOUT GROUNDING CONDUCTOR |                                                                                                                       |  |
|--------------------------|-----|---------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------|--|
| conductors               | 2   |  Blue, Brown               | 2                           |  Blue, Brown                     |  |
| conductors               | 3   |  Y-G, Blue, Brown          | 3                           |  Brown, Black, Grey              |  |
| conductors               | 4   |  Y-G, Brown, Black, Grey   | 3**                         |  Blue, Brown, Black              |  |
| conductors               | 4** |  Y-G, Blue, Brown, Black   | 4                           |  Blue, Brown, Black, Grey        |  |
| conductors               | 5   |  Y-G Blue Brown Black Grey | 5                           |  Blue, Brown, Black, Grey, Black |  |
| conductors and more      | 6   | black numbered conductors + Y/G                                                                               | 6                           | black numbered conductors                                                                                             |  |

## COLOUR CODING TELEPHONE ALARM and CONTROL CABLE

| Couple | Alarm Domestic<br>(pairs) | CEI 46-5 Telephone cable (pairs) | Alarm cable<br>NEN 1597<br>(pairs) | DIN47100<br>(pairs) |                | DIN47100 Multicore<br>(conductors) |
|--------|---------------------------|----------------------------------|------------------------------------|---------------------|----------------|------------------------------------|
| 1      | WHITE-RED                 | WHITE-BLUE                       | WHITE-RED                          | WHITE               | BROWN          | WHITE                              |
| 2      | YELLOW-GREEN              | WHITE-ORANGE                     | WHITE-BLUE                         | GREEN               | YELLOW         | BROWN                              |
| 3      | GREY-ORANGE               | WHITE-GREEN                      | WHITE-YELLOW                       | GREY                | PINK           | GREEN                              |
| 4      | L.BLUE-BROWN              | WHITE-BROWN                      | WHITE-GREEN                        | BLUE                | RED            | YELLOW                             |
| 5      | VIOLET-BLACK              | WHITE-GREY                       | WHITE-BLACK                        | BLACK               | VIOLET         | GREY                               |
| 6      | BLUE-PINK                 | RED-BLUE                         | WHITE / RED-RED                    | GREY / PINK         | RED / BLUE     | PINK                               |
| 7      | W/BROW-W/VIOLET           | RED-ORANGE                       | WHITE / RED-BLUE                   | WHITE / GREEN       | BROWN / GREEN  | BLUE                               |
| 8      | W/GREEN-W/BLUE            | RED-GREEN                        | WHITE / RED-YELLOW                 | WHITE / YELLOW      | YELLOW / BROWN | RED                                |
| 9      | W/GREY-W/YELLOW           | RED-BROWN                        | WHITE / RED-GREEN                  | WHITE / GREY        | GREY / BROWN   | BLACK                              |
| 10     | W/BLA-W/RED               | RED-GREY                         | WHITE / RED-BLACK                  | WHITE / PINK        | PINK / BROWN   | VIOLET                             |
| 11     |                           | BLACK-BLUE                       |                                    | WHITE / BLUE        | BROWN / BLUE   | GREY / PINK                        |
| 12     |                           | BLACK-ORANGE                     |                                    | WHITE / RED         | BROWN / RED    | RED / BLUE                         |
| 13     |                           | BLACK-GREEN                      |                                    | WHITE / BLACK       | BROWN / BLACK  | WHITE / GREEN                      |
| 14     |                           | BLACK-BROWN                      |                                    | GREY / GREEN        | YELLOW / GREY  | BROWN / GREEN                      |
| 15     |                           | BLACK-GREY                       |                                    | PINK / GREEN        | YELLOW / PINK  | WHITE / YELLOW                     |
| 16     |                           | YELLOW-BLUE                      |                                    | GREEN / BLUE        | YELLOW / BLUE  | YELLOW / BROWN                     |
| 17     |                           | YELLOW-ORANGE                    |                                    | GREEN / RED         | YELLOW / RED   | WHITE / GREY                       |
| 18     |                           | YELLOW-GREEN                     |                                    | GREEN / BLACK       | YELLOW / BLACK | GREY / BROWN                       |
| 19     |                           | YELLOW-BROWN                     |                                    | GREY / BLUE         | PINK / BLUE    | WHITE / PINK                       |
| 20     |                           | YELLOW-GREY                      |                                    | GREY / RED          | PINK / RED     | PINK / BROWN                       |

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