Society of Cable Telecommunications Engineers

**ENGINEERING COMMITTEE**
**Interface Practices Subcommittee**

# AMERICAN NATIONAL STANDARD

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# Ampacity of Coaxial Telecommunications Cables

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## 1.0 SCOPE

This document provides the current carrying capacity or AMPACITY of coaxial cables used in the Telecommunications industry. The method used to calculate the tabulated ampacities is a thermodynamic model of a cable installed indoors in air and considers the heat flow from the inner and outer conductor through the dielectric and jacket materials. It assumes that the conductors carrying current reach an operating temperature of 65°C based on the cables ability to dissipate heat. This temperature was chosen to substantially minimize the possibility of accelerated thermal aging of the dielectric and jacket materials. System designers are encouraged to consider the effect of this operating temperature on conductor resistance (R), voltage drop (IR) and power consumption ($I^2R$).

The National Electric Code (NEC) considers the most convenient and expeditious method of defining the ampacity of cables to be through the use of tables. The tabular format included in this document illustrates the ampacity of trunk, distribution and drop type coaxial cables commonly used in the Telecommunications industry. This procedure shall not be used to determine ground conductor size as referenced in NEC Article 810, 820 or 830 as applicable.

The ampacity provided for trunk and distribution coaxial cables are for copper-clad aluminum center conductors and solid (smooth wall) aluminum outer conductors. Drop coaxial cable ampacity relate to cables with a copper-clad steel center conductor and a combination of aluminum tape(s) and braid(s), which represent the outer conductor.

## 2.0 Ampacity Reference Tables

**Table 1:**

| Trunk and Distribution Cable Ampacity (Amperes) | | |
|---|---|---|
| **Cable Series** | **Current in Both Conductors** | |
| | **20°C (68°F) Ambient** | **40°C (104°F) Ambient** |
| 412-F | 33 | 25 |
| 440-D | 41 | 31 |
| 500-F | 43 | 32 |
| 500-D | 49 | 36 |
| 540-F | 50 | 37 |
| 565-F | 50 | 38 |
| 625-F | 54 | 40 |
| 650-D | 64 | 48 |
| 700-F | 66 | 49 |
| 715-F | 68 | 51 |
| 750-F | 67 | 50 |
| 750-D | 79 | 59 |
| 840-F | 79 | 59 |
| 860-F | 84 | 62 |
| 875-F | 81 | 60 |
| 1000-F | 94 | 71 |
| 1000-D | 108 | 80 |
| 1125-F | 112 | 83 |
| 1160-F | 117 | 87 |

F=FOAM, D=DISC & AIR

**Table 2**

| Drop Cable Ampacity (Amperes) | | |
|---|---|---|
| **Cable Series** | **Current in Both Conductors** | |
| | **20°C (68°F) Ambient** | **40°C (104°F) Ambient** |
| **59 Series** | | |
| Tape & Braid | 6 | 4 |
| | | |
| | | |
| Tri-Shield | 6 | 4 |
| | | |
| Quad-Shield | 6 | 5 |
| **6 Series** | | |
| Tape & Braid | 8 | 6 |
| | | |
| Tri-Shield | 8 | 6 |
| | | |
| Quad-Shield (Braid) | 8 | 6 |
| **7 Series** | | |
| Tape & Braid | 10 | 7 |
| Tri-Shield (Braid) | 10 | 8 |
| Quad-Shield (Braid) | 10 | 8 |
| **11 Series** | | |
| Tape & Braid | 13 | 10 |
| | | |
| Tri-Shield | 13 | 10 |
| Quad-Shield | 13 | 10 |
| | | |

## 3.0 Engineering Supervision

When calculating the ampacity of coaxial cables the worst case condition is typically considered. Since indoor cables do not benefit from cooling from wind, it is assumed cables installed indoors or in enclosed areas represent the worst case scenario.

Under engineering supervision and guidance, ampacities for coaxial cables can be calculated by solving the following simultaneous equations:

$$I = \sqrt{\frac{t_c - t_s}{(R_{ic} - R_{eoc}) * (R_{th})}}$$

and

$$I = \sqrt{\frac{0.182 * \varepsilon * D * (t_s - t_a) + 0.0714 * D^{0.75} * (t_s - t_a)^{1.25}}{(R_{ic} - R_{eoc}) * (n)}}$$

The ampacities calculated from these general equations are considered to represent current flowing in both the center *and* outer conductors of a coaxial cable.

In the provided equations, $R_{eoc}$ is the effective increase in center conductor resistance due to the effects of the outer conductor and is calculated as follows:

$$R_{eoc} = \frac{R_{th} - R_i}{R_{th}} * R_{oc}$$

$R_{th}$ is the total thermal resistance to heat flow from the center conductor to the ambient air and is calculated by summing the insulation and jacket thermal resistance. The metallic components of the cable construction are considered to be isotherms and therefore disregarded.

$$R_{th} = R_i + R_j$$

Where

$$R_i = 0.00522 * \rho_i * \ln \frac{C}{d}$$

and

$$R_j = 0.00522 * \rho_j * \ln \frac{D}{D_s}$$

The variables used in the previous equations are defined as follows:

I = Ampacity (Amperes)
$t_c$ = Conductor operating temperature (°C)
$t_a$ = Ambient temperature (°C)
$t_s$ = Cable surface temperature (°C)
$R_{ic}$ = Inner conductor resistance (Ω/ft at $t_c$)
$R_{oc}$ = Outer conductor resistance (Ω/ft at $t_c$)
$R_{eoc}$ = Increase in $R_{ic}$ due to outer conductor
$R_{th}$ = Total thermal resistance of circuit (°C/watt/ft)
$R_i$ = Thermal resistance of dielectric (°C/watt/ft)
$R_j$ = Thermal resistance of jacket (°C/watt/ft)
$\varepsilon$= Surface emissivity (jacketed=0.95, bare=0.35)
$\rho_i$ = Thermal resistivity of the dielectric material
= 1300 °C/watt/ft for both foam and disc & air dielectrics
$\rho_j$ = Thermal resistivity of the jacket material
= 400 °C/watt/ft for polyethylene (PE) jackets
= 350 °C/watt/ft for polyvinylchloride (PVC) jackets
ln = Natural logarithm
n = Number of cables
d = Center conductor diameter (inches)
C = Insulation diameter (inches)
$D_s$ = Outer conductor diameter (inches)
D = Jacket diameter (inches)

## 4.0 References:


TFC Technical Note 1075, Alan J. Amato, Times Fiber Communications.

The National Electric Code Handbook.

The Calculation of the Temperature Rise and Load Capability of Cable, J.H. Neher and M.H. McGrath, AIEE, March 1957.

The Current Carrying Capacity of Rubber Insulated Conductors, S.J. Rosch, AIEE, 4/38.