SEACON®

Technical Bulletin
No. 1005

AMPACITY

We are often asked to provide the Ampacity of a cable, or a contact, or a connector used in our product line. This is not an easy thing to do and often no one knows why. The following is a description of Ampacity and how it is determined.

Ampacity is more of a heat transfer problem than it is an electrical calculation. Heat is generated by the flow of electricity through a conductor. This heat must be transferred through the electrical insulation (which is not a good conductor of heat) and into the fluid surrounding the insulation, which can be air or water. There are many variables affecting the heat flow, including the temperature of the conductor, the insulation thickness, the heat transfer coefficient of the insulation, the fluid surrounding the insulation, the temperature of the fluid, the state of motion of the fluid and the orientation of the wire in the fluid. The number of conductors in a cable will also have a strong effect. With this number of variables it is no wonder why Ampacity data are hard to find and of a highly variable nature when they are found.

The best reference we have found for this data is the National Electric Code (NEC). The Ampacity values cover 18 AWG and larger gages of copper wire that operates at 90°C. These values are for insulated copper conductors where the copper has reached a steady state temperature of 90°C and the wire is horizontal in quiescent air, which is at a temperature of 30°C. The wire is cooled only by convection. Further, the wire has a life limitation of 40 years, minimum, at these conditions (the NEC is designed for use in buildings). The temperature at which the insulation will degrade over a 40-year period usually limits the Ampacity. These Ampacity values are very conservative, very reproducible and consistent. There are two Ampacity tables of interest in the NEC: Table 310-16 for not more than three conductors in a cable and Table 310-17 for individual conductors.

Now when a wire or cable (a wire is a single insulated conductor while a cable is several wires bundled together with an overall jacket) is immersed in water the thermal conductivity is significantly increased. It is higher in the Polar Regions than in equatorial regions. The Ampacity gain is a function of the cable design and the water temperature and is therefore not quantifiable in general terms. In oceanographic use the phenomena may be of limited value, for a majority of the cable may be on a reel, located on deck and in the sun. Cooling the cable reel with water may boost the Ampacity. Often in Ocean Engineering there are several high Ampacity conductors and many low Ampacity data conductors and the water temperature can be highly variable as well. The NEC has correction charts for cables having many conductors as well as correction charts for different temperatures. These correction factors are all designed to allow the cable to last for 40 years. By using the Arrhenius relationship that increasing the temperature by 10°C will cause the reaction rate to double, one can design cables that carry more Amperage but have a shorter life.

The above indicates how difficult it is to make a categorical statement about the Ampacity of a conductor. We use the NEC Ampacity and allow our customers to make any adjustment necessary. Use any Amperage that does not cause the conductor maximum temperature to exceed 90°C.

In order to simplify this as much as possible, we have put together the following Ampacity Chart. The Ampacity of a connector is similar to that of a cable and is very complex. We have taken the temperature rise into consideration with our contact ratings. While this applies to most of our contacts in most of our connectors, it will not apply across the board. For example, the MING-10#22-CCP can handle 2 ½ amps per contact or 25 amps through the connector. On the other hand, each of the contacts in the MINR-131#22-CCP can handle 2 ½ amps, the whole connector is not capable of handling 327 ½ amps (2 ½ x 131). This can be very complex but let's keep it simple. In general the Ampacity column will apply, but some common sense must also apply.

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SEA CON® CONTACT AMPACITY

AWG	Connector Series	PIN Diameter (inch)	Ampacity
28	MM	.015	½
26	MM	.020	1 ½
22	MM, MINI, MSS	.030	2 ½
20	MM. MINI. MSS. XS	.040	4
16	MM, MINI, MSS, XS, RM	.062	13
14	MINI, MSS, XS, RM	.093	16
12	AW	.109	19
10	MINI, MSS, XS, RM	.125	23
8	MSS, XS, RM	.156	50
6	MSS, XS, RM	.218	65
4	MSS, XS, RM	.255	90
2	MSS, XS, RM	.315	120
1/0	MSS, XS, RM	.355	200

MM = MicroMinicon™, **MINI** = Minicon™ , **MSS** = Metal Shell Series,
XS = GRE series, **RM** = Rubber Molded, **AW** = All Wet™

For additional information, contact our Technical Sales Department at (619) 562-7071.