3M™ Aluminum Conductor Composite Reinforced (ACCR)
Technical Summary

Proven Solutions to Increase Capacity

More amps on the same size wires, for your most challenging applications

3M

The strong, lightweight, high capacity conductor

3M™ Aluminum Conductor Composite Reinforced (ACCR) is an all-aluminum-based conductor designed to improve transmission capacity, even in challenging situations and environments.

The tremendous advantages of 3M ACCR are due to innovations in the materials used. Compared to conventional steel core conductors, the 3M ACCR core has:

- Equivalent strength and durability,
- Less weight,
- Better corrosion resistance,
- Equivalent modulus,
- Higher electrical conductivity, and
- Lower thermal expansion.

This permits the use of higher operating temperatures, which in turn leads to higher ampacities. Both the core and the outer aluminum-zirconium strands contribute to the overall conductor strength and conductivity.

Physical Properties	Unit	Linnet 336	Ibis 397	Hawk 477	Dove 557	Grosbeak 636
Designation		ACCR_340-T16	ACCR_405-T16	ACCR_470-T16	ACCR_573-T16	ACCR_637-T16
Stranding		26/7	26/7	26/7	26/7	26/7
Diameter						
Indiv Core Wire	in	0.089	0.097	0.105	0.116	0.122
Indiv Al Wire	in	0.114	0.125	0.134	0.149	0.156
Total Core	in	0.267	0.291	0.314	0.347	0.365
Total Conductor	in	0.724	0.791	0.852	0.941	0.991
Area						
Aluminum	in^2	0.267	0.318	0.369	0.450	0.500
Total Area	in^2	0.310	0.370	0.429	0.524	0.581
Weight						
Core	lbs/ft	0.066	0.078	0.090	0.110	0.122
Aluminum	lbs/ft	0.320	0.382	0.443	0.540	0.599
Total Weight	lbs/ft	0.385	0.460	0.533	0.650	0.721
Strength	lbs	13,900	16,500	19,200	23,100	25,600
Thermal Elongation						
Core	10^{-6}/°C	6.3	6.3	6.3	6.3	6.3
Aluminum	10^{-6}/°C	23.0	23.0	23.0	23.0	23.0
Complete Cable	10^{-6}/°C	16.7	16.7	16.7	16.7	16.7
Heat Capacity						
Core	W-sec/ft-°C	10	11	13	16	18
Aluminum	W-sec/ft-°C	139	165	192	234	259
Electrical Properties						
Resistance						
DC @ 20°C	ohms/mile	0.2568	0.2153	0.1855	0.1521	0.1370
AC @ 25°C	ohms/mile	0.2629	0.2204	0.1899	0.1558	0.1403
AC @ 50°C	ohms/mile	0.2889	0.2422	0.2087	0.1712	0.1542
AC @ 75°C	ohms/mile	0.3150	0.2640	0.2275	0.1866	0.1681
AC @ 100°C	ohms/mile	0.3410	0.2858	0.2463	0.2020	0.1820
AC @ 210°C	ohms/mile	0.4555	0.3818	0.3290	0.2699	0.2431
AC @ 240°C*	ohms/mile	0.4867	0.4080	0.3516	0.2884	0.2597
Geometric Mean Radius	ft	0.0245	0.0267	0.0288	0.0318	0.0335
Reactance (1 ft spacing, 60hz)						
Inductive Xa	ohms/mile	0.450	0.439	0.430	0.418	0.412
Capacitive X'a		0.1039	0.1012	0.0990	0.0961	0.0945
Ampacity						
210° C	amps	942	1,058	1,167	1,331	1,426
240° C*	amps	1,010	1,135	1,253	1,430	1,533

To learn more about 3M ACCR, or to download the PLS-CADD™ data files, visit us at www.3M.com/ACCR

* Emergency operating temperature, 1,000 hours cumulative. Ampacity ratings were calculated using IEEE Std. 738-1993, with inputs of 40°C air temperature, 2.0 ft/s wind, and emissivity and absorptivity of 0.5, at sea level.

Drake 795	Cardinal 954	Curlew 1033	Finch 1113	Pheasant 1272	Martin 1351	Falcon 1590
ACCR_824-T16	ACCR_967-T13	ACCR_1036-T13	ACCR_1117-T13	ACCR_1267-T13	ACCR_1334-T13	ACCR_1594-T13
26/19	54/19	54/19	54/19	54/19	54/19	54/19
0.083	0.080	0.083	0.086	0.092	0.094	0.103
0.178	0.134	0.139	0.144	0.153	0.157	0.172
0.416	0.402	0.416	0.432	0.460	0.472	0.516
1.128	1.205	1.247	1.295	1.379	1.415	1.547
0.648	0.760	0.814	0.877	0.995	1.048	1.252
0.751	0.856	0.917	0.989	1.121	1.180	1.411
0.154	0.144	0.154	0.166	0.195	0.206	0.245
0.776	0.915	0.980	1.057	1.197	1.260	1.506
0.930	1.059	1.134	1.223	1.392	1.466	1.751
32,200	33,200	35,600	38,400	43,000	45,300	53,600
6.3	6.3	6.3	6.3	6.3	6.3	6.3
23.0	23.0	23.0	23.0	23.0	23.0	23.0
16.5	17.1	17.1	17.1	17.4	17.4	17.4
23	21	23	25	28	29	35
336	396	424	457	520	548	655

0.1060	0.0920	0.0859	0.0796	0.0703	0.0667	0.0558
0.1085	0.0942	0.0879	0.0815	0.0719	0.0683	0.0572
0.1192	0.1035	0.0966	0.0896	0.0791	0.0751	0.0628
0.1300	0.1128	0.1053	0.0977	0.0862	0.0819	0.0685
0.1407	0.1221	0.1140	0.1057	0.0933	0.0886	0.0741
0.1880	0.1632	0.1523	0.1413	0.1246	0.1184	0.0990
0.2009	0.1743	0.1628	0.1509	0.1332	0.1265	0.1058
0.0346	0.0372	0.0385	0.0400	0.0426	0.0437	0.0478
0.408	0.399	0.395	0.390	0.383	0.380	0.369
0.0907	0.0887	0.0877	0.0866	0.0847	0.0840	0.0813
1,691	1,855	1,941	2,042	2,219	2,298	2,588
1,820	1,997	2,090	2,199	2,392	2,477	2,792

For a complete library of lab and field tests, organized by both conductor size and test subject, visit our website: www.3M.com/ACCR

Conformance to National Standards

All materials shall conform to the applicable American National Standards Institute (ANSI) C119.4; American Society for Testing and Materials (ASTM) Standards B193, B557, B941; or International Annealed Copper Standard (IACS).

Physical Characteristics

Aluminum Strands

The aluminum strands are composed of an aluminum-zirconium alloy and are round in shape, although trapezoidal is also available. The minimum conductivity of any individual aluminum strand is not less than 60 percent of the International Annealed Copper Standard (IACS).

The aluminum-zirconium strands are a hard drawn aluminum with mechanical properties very similar to 1350-H19 aluminum (23-25 ksi, 158-172 MPa) ultimate tensile strength. This is NOT a soft annealed aluminum. The addition of a small amount of zirconium to the aluminum confers the property of heat resistance. That is, the aluminum-zirconium may be heated to high temperatures, without softening (annealing) and losing its strength like 1350-H19 aluminum would. Thus when the aluminum-zirconium cools to ambient temperatures, it retains its strength.

Core Strands

The core strands contain aluminum oxide fibers embedded in high-purity aluminum forming a wire. This type of material is called a fiber reinforced metal matrix. It contains NO polymers or plastic: the base material is metallic aluminum. This material confers the properties that make 3M ACCR conductor lightweight, while performing with high strength and low sag at high temperatures. This is because the fiber reinforced metal matrix composite has strength equivalent to steel, with weight (density) similar to aluminum, but with less thermal expansion than steel and strength retention at high temperatures. Additionally, some of the secondary properties are also favorable. These include low creep, high electrical conductivity (from the aluminum constituent), and corrosion resistance (similar to aluminum).

Conductor Stranding

3M ACCR uses constructions that are very similar to ACSR. It uses most of the same dimensions for wire sizes and conductor sizes. Aluminum-zirconium layers are helically stranded using the same lay lengths and lay directions as ACSR. The core wires are also helically stranded but use longer lay lengths than the steel cores found in ACSR.

3M™ Aluminum Fiber Core

Each strand of 3M ACCR core wire is reinforced with tens of thousands of ultra-high-strength aluminum oxide fibers. The result is a solution specifically designed for high-temperature operation – providing dramatic ampacity gains with significantly less sag than standard options.

Closeup of 3M ACCR core material, consisting of aluminum oxide fibers embedded in high-purity aluminum.

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