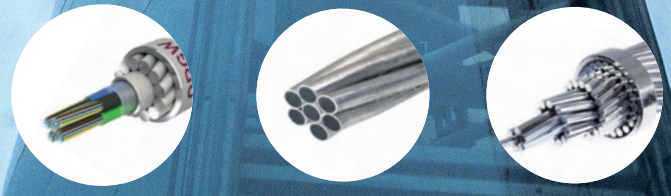
Taihan
FIBER OPTICS

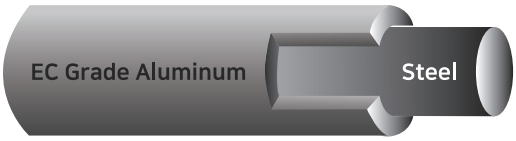
Aluminum Clad Steel Wire



TFO Networks

Description

Aluminum-clad steel wire, commonly abbreviated as AW or AS or AC or ACS, is an electrical conductor composed of an inner steel core and outer Aluminum cladding. Aluminum clad steel wire is a bimetallic in which aluminum covers on the steel core continuously and evenly.



Aluminum-clad Steel Wire

Aluminum-clad Stranded Steel Wire

Standards

ASTM B415, ASTM B416, ASTM B502, IEC 61232, , AS 3607 and other International Standards as well as the customized solutions to meet customer requirements.

What we can supply to our customers

TFO Networks can supply either semi-finished products such as single wire and stranded wire or finished products such as ACSR A/W, HSTACIR/AW to cable manufacturers.

Application

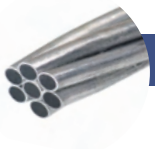
The aluminum clad steel wire is widely used in long-span transmission line, coastal areas and island as well as other hot and humid regions, salt fog regions and heavily polluted regions where the high corrosion resistance strand is needed.
It is used as the core of ACSR/AW, overhead ground conductor, extra high voltage overhead conductor, optical fiber composite overhead ground line, self-damping conductor line, bare overhead conductor, OPGW, ground wire, messenger wire, guy wire formed wire for protecting, terminating and splicing transmission and distribution lines, fence, barber wire and hardware, etc.

High Durability (For OPGW)

Our goal is to make ACS Wires break-free, especially for the OPGW manufacturing, which will satisfy our customers. TFON ACS Wire is produced with a special heat treatment in order to increase its toughness and durability.

1) High Short Circuit Capacity Type(HC)

2) High Tensile Strength Type(HS)



Various Conductivity (For ACSR/AW)

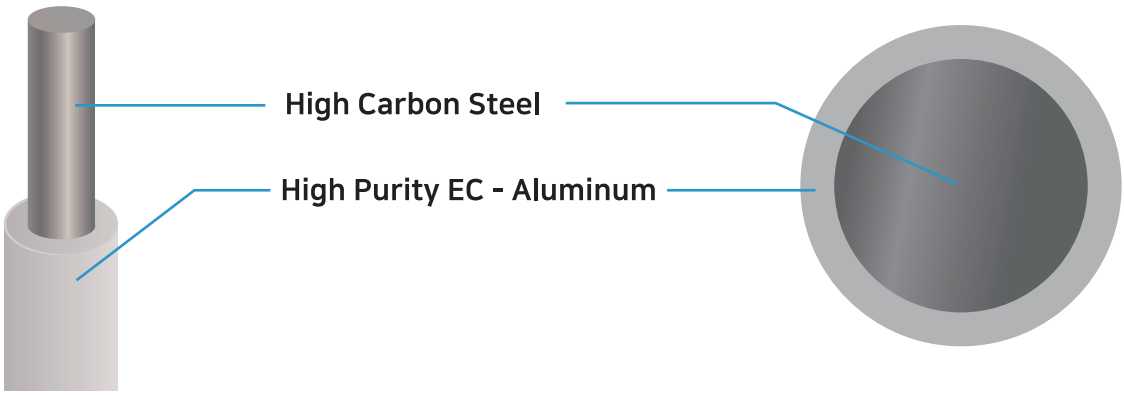
We can meet the various demand of conductivity levels for our customer's demanding from 14% up to 40% IACS. This thick concerntric layer of aluminum is used to provide much higher conductivity, formability and excellent corrosion resistance in combination with good tensile strength

Power Transfer Capability Increase (STACIR/HSTACIR)

Aluminum conductor INVAR reinforced is a completely different conductor compared to the conventional ACSR in capacity and thermal expansion keeping its size, weight and tensile strength. Aluminum conductor INVAR reinforced can carry twice as much conductor as that of ACSR of the same size while maximum sag and maximum working tension are the same as those of ACSR

Aluminum Clad Steel Wire

ACSW(Aluminum Clad Steel Wire)



Physical Constants

Conductivity (%)	Density at 20℃	Modulus of elasticity	Coefficient of linear expansion	Temperature coefficient of resistance
20.3	0.2381 lb/in^3 (6.59 g/cm^3)	23.5×106 psi (162 GPa)	0.0000072/ (12.6×10^{-6}/)	0.0020/ (0.0036/)
27	0.2135 lb/in^3 (5.91 g/cm^3)	20.5×106 psi (140 GPa)	0.0000077/ (13.4×10^{-6}/)	0.0020/ (0.0036/)
30	0.2027 lb/in^3 (5.61 g/cm^3)	19.1×106 psi (132 GPa)	0.0000079/ (13.8×10^{-6}/)	0.0021/ (0.0038/)
40	0.1676 lb/in^3 (4.64 g/cm^3)	15.8×106 psi (109 GPa)	0.0000089/ (15.5×10^{-6}/)	0.0022/ (0.0040/)

ACSW - ASTM B502

Nominal diameter		Stress at 1.0% extension		Ultimate tensile strength		Elongation (250mm)	Resistivity value at 20℃
mm	inch	MPa	psi	MPa	psi	%	Ω•mm^2/m
1.956~3.274	0.0770~0.1289	1,206	175,000	1,344	195,000	1.5	0.08480
3.275~3.477	0.1290~0.1369	1,172	170,000	1,310	190,000	1.5	
3.478~3.665	0.1370~0.1443	1,137	165,000	1,275	185,000	1.5	
3.666~3.934	0.1444~0.1549	1,103	160,000	1,241	180,000	1.5	
3.935~4.115	0.1550~0.1620	1,103	160,000	1,206	175,000	1.5	
4.116~4.392	0.1621~0.1729	1,068	155,000	1,172	170,000	1.5	
4.393~4.620	0.1730~0.1819	1,034	150,000	1,137	165,000	1.5	
4.621~4.775	0.1820~0.1880	1,000	145,000	1,103	160,000	1.5	

Aluminum Clad Steel Wire

ACSW - ASTM B415

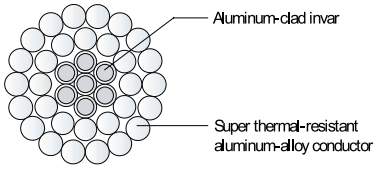
Conductiviy % IACS	Size AWG	Nominal Diameter		Ultimate tensile strengh		Breaking stength		Calculated weight		Calculated resistance at 20℃		Nominal Cross - section		
		in.	mm	psi	Mpa	lb	kN	lb/1.000ft	kg/km	Ω/1.000ft	Ω/km	cmils	in^2	mm^2
20.3	4	0.2043	5.189	155,000	1,070	5,081	22.6	93.63	139.40	1.222	4.009	41,740	0.03278	21.150
		0.1880	4.775	160,000	1,100	(4,441)	(19.7)	(79.32)	(118.00)	(1.443)	(4.735)	(35,340)	(0.02776)	(17.910)
	5	0.1819	4.620	165,000	1,140	4,290	18.1	74.25	110.40	1.541	5.060	33,090	0.02599	16.760
		0.1729	4.392	170,000	1,170	(3,991)	(17.1)	(67.09)	(99.84)	(1.706)	(5.597)	(29,900)	(0.02348)	(15.150)
	6	0.1620	4.114	175,000	1,210	3,608	16.0	58.88	87.58	1.943	6.381	26,240	0.02061	13.290
		0.1549	3.934	180,000	1,240	(3,392)	(15.1)	(53.83)	(80.13)	(2.126)	(6.974)	(24,000)	(0.01884)	(12.160)
	7	0.1443	3.665	185,000	1,250	3,025	13.5	46.69	69.52	2.450	8.038	20,820	0.01635	10.550
		0.1369	3.477	190,000	1,310	(2,797)	(12.4)	(42.06)	(62.57)	(2.722)	(8.931)	(18,740)	(0.01472)	(9.495)
	8	0.1285	3.264	195,000	1,340	2,529	11.2	37.03	55.14	3.089	10.140	16,510	0.01297	8.367
	9	0.1144	2.906	195,000	1,340	2,005	8.9	29.37	43.71	3.896	12.780	13,090	0.01028	6.633
	10	0.1019	2.588	195,000	1,340	1,590	7.1	23.29	34.66	4.912	16.120	10,380	0.00816	5.260
	11	0.0907	2.304	195,000	1,340	1,261	5.6	18.47	27.47	6.194	20.340	8,230	0.00646	4.169
	12	0.0808	2.052	195,000	1,340	1,000	4.5	14.65	21.79	7.811	25.640	6,530	0.00513	3.307
27	4	0.2043	5.189	125,000	862	4,098	18.2	84.00	125.00	0.920	3.019	41,740	0.03278	21.150
		0.1880	4.775	129,000	889	(3,581)	(15.9)	(71.12)	(105.80)	(1.087)	(3.566)	(35,340)	(0.02776)	(17.910)
	5	0.1819	4.620	133,000	917	3,457	15.4	66.59	99.05	1.161	3.810	33,090	0.02599	16.760
		0.1729	4.392	137,000	945	(3,217)	(14.3)	(60.16)	(89.54)	(1.285)	(4.215)	(29,900)	(0.02348)	(15.150)
	6	0.1620	4.114	141,000	972	2,906	12.9	52.80	78.54	1.464	4.805	26,240	0.02061	13.290
		0.1549	3.934	145,000	1,000	(2,733)	(12.2)	(48.27)	(71.87)	(1.600)	(5.252)	(24,000)	(0.01884)	(12.160)
	7	0.1443	3.665	150,000	1,034	2,453	10.9	41.89	62.35	1.845	6.053	20,820	0.01635	10.550
		0.1369	3.477	154,000	1,062	(2,267)	(10.1)	(37.71)	(56.12)	(2.050)	(6.726)	(18,740)	(0.01472)	(9.495)
	8	0.1285	3.264	156,000	1,076	2,023	9.0	33.23	49.45	2.326	7.632	16,510	0.01297	8.367
	9	0.1144	2.906	156,000	1,076	1,604	7.1	26.34	39.20	2.934	9.628	13,090	0.01028	6.633
	10	0.1019	2.588	156,000	1,076	1,272	5.7	20.89	31.09	3.700	12.140	10,380	0.00816	5.260
	11	0.0907	2.304	156,000	1,076	1,008	4.5	16.55	24.64	4.667	15.320	8,230	0.00646	4.169
	12	0.0808	2.052	156,000	1,076	800	3.6	13.14	19.54	5.882	19.310	6,530	0.00513	3.307
30	4	0.2043	5.189	102,000	703	3,344	14.9	0.83	118.70	0.828	2.717	41,740	0.03278	21.150
		0.1880	4.775	106,000	731	(2,942)	(13.1)	(0.98)	(100.50)	(0.978)	(3.209)	(35,340)	(0.02776)	(17.910)
	5	0.1819	4.620	110,000	758	2,859	12.7	1.05	94.02	1.045	3.429	33,090	0.02599	16.760
		0.1729	4.392	114,000	786	(2,677)	(11.9)	(1.16)	(84.99)	(1.156)	(3.793)	(29,900)	(0.02348)	(15.150)
	6	0.1620	4.114	114,000	786	2,350	10.5	1.32	74.56	1.317	4.324	26,240	0.02061	13.290
		0.1549	3.934	118,000	814	(2,224)	(9.9)	(1.44)	(68.22)	(1.440)	(4.726)	(24,000)	(0.01884)	(12.160)
	7	0.1443	3.665	122,000	841	1,995	8.9	1.66	59.19	1.660	5.447	20,820	0.01635	10.550
		0.1369	3.477	126,000	869	(1,855)	(8.3)	(1.85)	(53.27)	(1.845)	(6.053)	(18,740)	(0.01472)	(9.495)
	8	0.1285	3.264	128,000	883	1,660	7.4	2.09	46.94	2.094	6.869	16,510	0.01297	8.367
	9	0.1144	2.906	128,000	883	1,316	5.9	2.64	37.21	2.642	8.664	13,090	0.01028	6.633
	10	0.1019	2.588	128,000	883	1,044	4.5	3.33	29.51	3.329	10.930	10,380	0.00816	5.260
	11	0.0907	2.304	128,000	883	827	3.7	4.20	23.39	4.203	13.790	8,230	0.00646	4.169
	12	0.0808	2.052	128,000	883	657	2.9	5.30	18.55	5.296	17.380	6,530	0.00513	3.307
40	4	0.2043	5.189	80,000	552	2,622	11.7	0.62	98.14	0.621	2.038	41,740	0.03278	21.150
		0.1880	4.775	84,000	579	(2,332)	(10.4)	(0.73)	(83.10)	(0.734)	(2.406)	(35,340)	(0.02776)	(17.910)
	5	0.1819	4.620	88,000	607	2,287	10.2	0.78	77.77	0.784	2.572	33,090	0.02599	16.760
		0.1729	4.392	92,000	634	(2,160)	(9.6)	(0.87)	(70.30)	(0.867)	(2.845)	(29,900)	(0.02348)	(15.150)
	6	0.1620	4.114	96,000	662	1,979	8.8	0.99	61.67	0.988	3.243	26,240	0.02061	13.290
		0.1549	3.934	96,000	662	(1,809)	(8.1)	(1.08)	(56.42)	(1.080)	(3.544)	(24,000)	(0.01884)	(12.160)
	7	0.1443	3.665	98,000	676	1,602	7.1	1.25	48.95	1.245	4.085	20,820	0.01635	10.550
		0.1369	3.477	98,000	676	(1,443)	(6.4)	(1.38)	(53.27)	(1.384)	(4.539)	(18,740)	(0.01472)	(9.495)
	8	0.1285	3.264	99,500	686	1,290	5.7	1.57	38.82	1.571	5.151	16,510	0.01297	8.367
	9	0.1144	2.906	99,500	686	1,023	4.6	1.98	30.78	1.981	6.498	13,090	0.01028	6.633
	10	0.1019	2.588	99,500	686	811	3.6	2.50	24.41	2.498	8.194	10,380	0.00816	5.260
	11	0.0907	2.304	99,500	686	643	2.9	3.15	19.35	3.151	10.340	8,230	0.00646	4.169
	12	0.0808	2.052	99,500	686	510	2.3	3.97	15.34	3.971	13.030	6,530	0.00513	3.307

Aluminum Clad Steel Wire

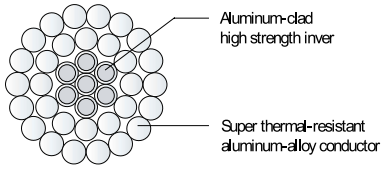
ACSW - ASTM B416

Size	Nominal diameter of wire		Stranded diameter		Breaking strength		Weight		Resistance at 20℃		Nominal cross-section		
Nos/AWG	in.	mm	in.	mm	lb	kN	lb/1,000ft	kg/km	Ω/1,000ft	Ω/km	cmils	in^2	mm^2
37/5	0.1819	4.620	1.270	32.340	142,800	636.2	2,802	4,168	0.04247	0.1395	1,225,000	0.9619	620.10
37/6	0.1620	4.115	1.130	28.800	120,200	535.9	2,222	3,308	0.05356	0.1758	971,300	0.7629	492.10
37/7	0.1443	3.665	1.010	25.660	100,700	449.7	1,762	2,624	0.06754	0.2216	770,300	0.6050	390.40
37/8	0.1285	3.264	0.899	22.850	84,200	373.4	1,398	2,081	0.08516	0.2794	610,900	0.4798	390.60
37/9	0.1144	2.906	0.801	20.340	66,770	296.0	1,108	1,650	0.10740	0.3525	484,400	0.3805	245.40
37/10	0.1019	2.588	0.713	18.120	52,950	234.7	879	1,308	0.13540	0.4445	384,200	0.3017	194.60
19/5	0.1819	4.620	0.910	23.100	73,350	326.7	1,430	2,128	0.08224	0.2701	628,900	0.4940	318.40
19/6	0.1620	4.115	0.810	20.570	61,700	275.2	1,134	1,689	0.10370	0.3403	498,800	0.3917	252.70
19/7	0.1443	3.665	0.721	18.330	51,730	230.9	900	1,339	0.13080	0.4289	395,500	0.3107	200.50
19/8	0.1285	3.264	0.642	16.320	43,240	191.7	714	1,062	0.16490	0.5408	313,700	0.2464	159.00
19/9	0.1144	2.906	0.572	14.530	34,290	152.0	566	842	0.20790	0.6824	248,800	0.1954	126.00
19/10	0.1019	2.588	0.509	12.940	27,190	120.5	449	668	0.26220	0.8604	197,300	0.1549	99.94
7/5	0.1819	4.620	0.546	13.860	27,030	120.4	525	781	0.22640	0.7302	231,700	0.1820	117.30
7/6	0.1620	4.115	0.486	12.340	22,730	101.4	416	620	0.28030	0.9200	183,800	0.1443	93.10
7/7	0.1443	3.665	0.433	11.000	19,060	85.1	330	492	0.35350	1.1598	145,700	0.1145	73.85
7/8	0.1285	3.264	0.385	9.792	15,930	70.6	262	390	0.44580	1.4623	115,600	0.0908	58.57
7/9	0.1144	2.906	0.343	8.717	12,630	56.0	208	309	0.56210	1.8447	91,650	0.0720	46.43
7/10	0.1019	2.588	0.306	7.765	10,020	44.4	165	245	0.70880	2.3261	72,680	0.0571	36.82
7/11	0.0907	2.304	0.272	6.911	7,945	35.2	131	194	0.89380	2.9352	57,590	0.0452	29.18
7/12	0.0808	2.052	0.242	6.156	6,301	27.9	104	154	1.12700	3.6997	45,710	0.0359	23.15
3/5	0.1819	4.620	0.392	9.957	12,230	54.5	225	334	0.51770	1.7000	99,310	0.0780	50.28
3/6	0.1620	4.115	0.349	8.868	10,280	45.9	178	265	0.65280	2.1423	78,750	0.0619	39.90
3/7	0.1443	3.665	0.311	7.899	8,621	38.5	141	210	0.82320	2.7007	62,450	0.0491	31.65
3/8	0.1285	3.264	0.277	7.034	7,206	32.0	112	167	1.03800	3.4055	49,530	0.0389	25.10
3/9	0.1144	2.906	0.247	6.263	5,715	25.3	89	132	1.30900	4.2954	39,280	0.0309	19.90
3/10	0.1019	2.588	0.220	5.578	4,532	20.1	70	105	1.65100	5.4169	31,150	0.0245	15.78

STACIR/AW



HSTACIR/AW



Description

Aluminum conductor INVAR reinforced is a completely different conductor compared to conventional ACSR in capacity and thermal expansion, while keeping its size, weight, and tensile strength. Aluminum conductor INVAR reinforced can carry twice as much conductor as ACSR of the same size, while maximum sag and maximum working tension are the same as those of ACSR.

Application

HSTACIR/AW, STACIR/AW is normally used to up-rate an existing transmission line by simply replacing the existing conductor without tower modification or reinforcement.

Standards

KEPCO and other International Standards as well as the customized solutions to meet customer requirements.

High Strength Aluminum Clad Invar Steel Wire (Thermal Resistant ACS Wire)

Nominal Diameter	Diameter Tolerance	Ultimate Tensile Strength	Elongation	Torsion	Conductivity	Aluminum Thickness		Calculated Weight	Nominal Cross-section
						Min.	Ave.		
mm	mm	Kgf/mm^2	%	times	%	mm	mm	kg/km	mm^2
2.47	±0.05	125	1.5	20	14	0.06	0.15	34.02	4.790
3.10	±0.06	120	1.5	20	14	0.07	0.17	53.48	7.548
3.20	±0.06	120	1.5	20	14	0.07	0.17	57.10	8.042
3.50	±0.07	120	1.5	20	14	0.08	0.18	68.31	9.621

※ Physical Constants
- Density : 7.1g/cm^3
- Coefficient of linear expansion : 3.7x10^{-6}/ at 15~230, 10.8x10^{-6}/ at 230~290
- Elastic Coefficient : 15,500kg/mm^2

STACIR/AW

Nominal Cross Sectional Area (㎟)	No. and Dia. of Strands (mm)		Tensile Load (above) (kgf)	Reference											
				Calculated Cross Sectional Area (㎟)		Outside Dia. (㎜)		Weight (kg/km)	Electric Resistance (Ω/km, 20℃)	Modulus of Elasticity (kg/mm^2)		Coefficient of Linear Expansion (×10-6/℃)			Standard Length (m)
	ST-Al Alloy	Al-clad Invar		ST-Al Alloy	Al-clad Invar	ST-Al Alloy	Al-clad Invar			Up to Transition Point Temperature	Above Transition Point Temperature	Up to Transition Point Temperature	Above Transition Point Temperature to 230℃	Above 230℃	
240	30/3.2	7/3.2	9,170	241.3	56.29	22.4	9.6	1,070	0.1159	8,040	15,500	16.0	3.7	10.8	2,000
330	26/4.0	7/3.1	10,000	326.8	52.84	25.3	9.3	1,285	0.0869	7,580	15,500	17.5	3.7	10.8	2,000
410	26/4.5	7/3.5	12,720	413.4	67.35	28.5	10.5	1,625	0.0686	7,580	15,500	17.5	3.7	10.8	2,000
480	45/3.70	7/2.47	10,500	483.84	33.54	29.61	7.41	1,580	0.0600	6,900	15,500	20.0	3.7	10.8	2,000

HSTACIR/AW

Nominal Cross Sectional Area (㎟)	No. and Dia. of Strands (mm)		Tensile Load (above) (kgf)	Reference											
				Calculated Cross Sectional Area (㎟)		Outside Dia. (㎜)		Weight (kg/km)	Electric Resistance (Ω/km, 20℃)	Modulus of Elasticity (kg/mm^2)		Coefficient of Linear Expansion (×10-6/℃)			Standard Length (m)
	ST-Al Alloy	Al-clad High-Strength Invar		ST-Al Alloy	Al-clad High-Strength Invar	ST-Al Alloy	Al-clad High-Strength Invar			Up to Transition Point Temperature	Above Transition Point Temperature	Up to Transition Point Temperature	Above Transition Point Temperature to 230℃	Above 230℃	
240	30/3.2	7/3.2	9,700	241.3	56.29	22.4	9.6	1,070	0.1159	8,041	15,500	15.96	3.7	10.8	2,000
330	26/4.0	7/3.1	10,500	326.8	52.84	25.3	9.3	1,285	0.0869	7,581	15,500	17.51	3.7	10.8	2,000
410	26/4.5	7/3.5	13,300	413.5	67.35	28.5	10.5	1,625	0.0686	7,589	15,500	17.48	3.7	10.8	2,000
480	45/3.7	7/2.47	11,000	483.8	33.54	29.61	7.41	1,580	0.0600	6,896	15,500	20.19	3.7	10.8	2,000