HTLSC & OPGW

High Temperature Low Sag Conductor & Optical Ground Wire

LS Cable & System

THE WORLD BEST CABLE SOLUTION LEADER

LS Cable & System supplies various cables and materials used for power grids and communication networks around the world across all industries providing its top class technology and excellent quality. The company has also developed state of the art products, such as superconductors, HVDC and submarine cables that will lead the future energy industry.

LS spun off from LG in 2003 as a group specializing in electronics, electrical systems, energy and materials.

LS

- **LS Cable & System**
  Transmission Cable
  Distribution Cable
  Submarine Cable
  Telecommunication Cable
  Industrial Cable
  Industrial Material
- **LS ELECTRIC**
  Electric & Automatic Equipments
- **LS-Nikko Copper**
  Copper Refinement
- **LS Mtron**
  Mechanical & Electronic Parts
- **yesco**
  LNG
- **E1**
  LPG
- **GAON**
  Power & Communication Cables

High Temperature & Low Sag Conductor

To address the ever-changing demands in everyday life as well as in the industries, we never stop researching, designing, developing, and manufacturing more variety of products with new materials to bring a better interconnection system to our customers. In this catalog, we proudly present new overhead electric transmission conductors, made of whole new materal, which show high effectiveness and efficiency in high current transmission. Our refinement for the enhanced quality of aluminium alloy conductors and our knowledge in the industry will provide high quality service to our customers.
We will bring the solutions to your everyday challenges.

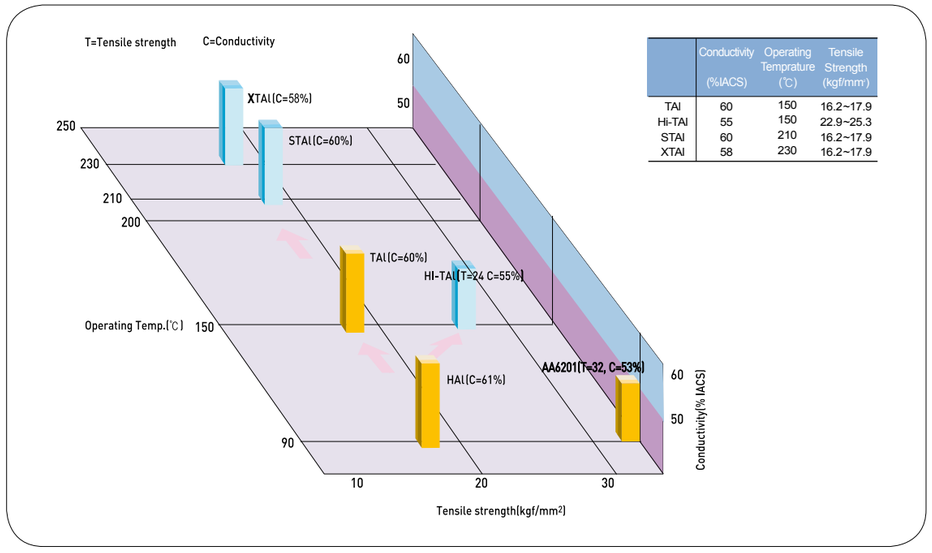
Contents

HTLS

Trend in Developing Aluminum Conductors

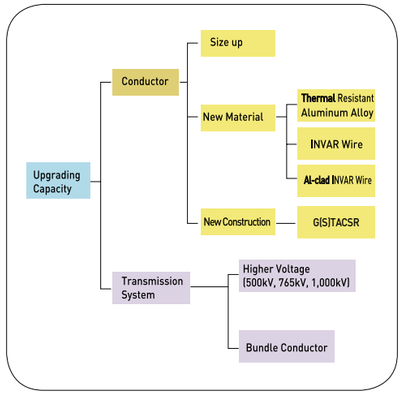
- Our thermal resistant aluminum alloy conductors offer excellent performance and advantages with improved techniques, especially in the higher grade thermal resistant aluminum alloy conductors which is also reasonable in price.
- We have vast experience in producing thermal resistant aluminum alloy conductors as well as bare copper wires and aluminum conductors.

Kinds of Unique Aluminum Conductor Materials

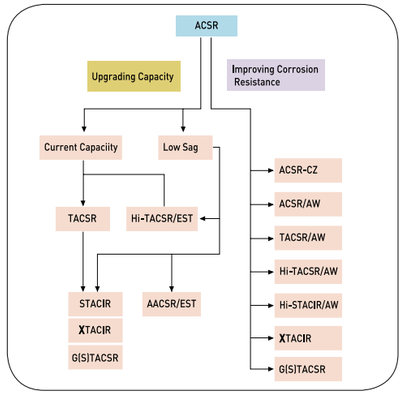


	Conductivity (%IACS)	Operating Temprature (℃)	Tensile Strength (kgf/mm²)
TAI	60	150	16.2~17.9
Hi-TAI	55	150	22.9~25.3
STAI	60	210	16.2~17.9
XTAI	58	230	16.2~17.9

Approaching to the Upgrading Capacity



Flow of Developing the Overhead Transmission Conductor



Thermal Resistant Aluminum Alloy Conductors, Steel (Aluminum-clad Steel) Reinforced

TACSR (/ AW)

Application

TACSR (/AW) is used for overhead electric power transmission lines. Big city, seaside district, moisture area etc.

Standard

IEC, ASTM, JEC 3406

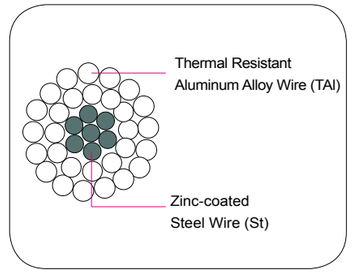
Construction

- Core(St, AW): Zinc-coated Steel Wire / Aluminum-clad Steel Wire(AW) : 14% ~ 40% AW
- Conductor(TAI) : Thermal Resistant Aluminum Alloy Wire used for continuously allowable temperature up to 150°C

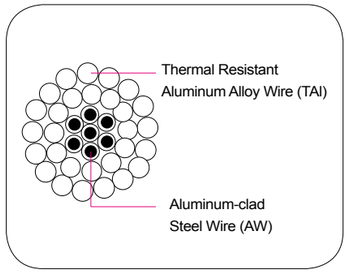
Characteristics

AW Type has excellent rustless characteristics.

TACSR



TACSR/AW



Thermal Resistant Aluminum Alloy Conductors, Steel (Aluminum-clad Steel) Reinforced

LS Cable & System Standard (60% IACS)

TACSR

Conductor Size	Stranding (Nos./mm)		Min. Breaking Load	Reference												
				Cross-sectional Area (㎟)			Overall Diameter (mm)		Weight (kg/km)			DC Resistance at 20℃ (Ω/km)	Modulus of Elasticity (kgf/㎟)	Coefficient of Linear Expansion (10⁻⁶/℃)	Standard Length (m)	Current Carrying Capacity (A)
(㎟)	TAI	ST	(kgf)	TAI	ST	Total	TAI	ST	TAI	ST	Total					
58	6/3.5	1/3.5	1,980	57.73	9.621	67.35	10.5	3.5	158.1	75.04	233.1	0.505	8,400	18.9	1,000	343
80	6/4.2	1/4.2	2,770	83.10	13.85	96.95	12.6	4.2	227.5	108.0	335.5	0.350	8,400	18.9	1,000	430
95	6/4.5	1/4.5	3,810	95.40	15.90	111.3	13.5	4.5	261.2	124.0	385.2	0.306	8,400	18.9	1,000	478
80	15/2.6	4/2.6	4,720	79.64	21.24	100.9	13.0	7.8	219.2	166.5	385.7	0.368	9,390	17.6	2,000	448
100	15/2.9	4/2.9	5,580	99.08	26.42	125.5	14.5	8.7	272.8	207.1	479.9	0.296	9,390	17.6	2,000	517
120	15/3.2	4/3.2	5,550	120.6	32.17	152.8	16.0	9.6	332.2	252.2	584.4	0.243	9,390	17.6	2,000	590
120	30/2.3	7/2.3	5,540	124.7	29.09	153.8	16.1	6.9	345.7	228.0	573.7	0.237	9,080	18.0	2,000	598
160	30/2.6	7/2.6	6,980	159.3	37.16	196.5	18.2	7.8	441.5	291.3	732.8	0.185	9,080	18.0	2,000	706
200	30/2.9	7/2.9	8,640	198.2	46.24	244.4	20.3	8.7	549.3	362.4	911.7	0.149	9,080	18.0	2,000	816
240	30/3.2	7/3.2	10,210	241.3	56.29	297.6	22.4	9.6	668.9	441.3	1,110	0.122	9,080	18.0	2,000	932
330	26/4.0	7/3.1	10,950	326.8	52.84	379.6	25.3	9.3	905.4	414.2	1,320	0.0904	8,360	19.0	2,000	1,128
410	26/4.5	7/3.5	13,910	413.4	67.35	480.8	28.5	10.5	1,145	527.9	1,673	0.0714	8,360	19.0	2,000	1,322
480	45/3.7	7/2.47	11,260	483.8	33.54	517.34	29.6	7.41	1336.1	262.9	1,599	0.0610	7,250	20.8	2,000	1,425
520	54/3.5	7/3.5	15,600	519.5	67.35	586.9	31.5	10.5	1,441	527.9	1,969	0.0569	7,990	19.5	1,600	1,504
610	54/3.8	7/3.8	18,350	612.4	79.38	691.8	34.2	11.4	1,698	622.2	2,320	0.0481	7,990	19.5	1,600	1,682
680	54/4.0	7/4.0	19,810	678.8	87.99	766.8	36.0	12.0	1,882	689.8	2,572	0.0436	7,990	19.5	1,600	1,797
680	45/4.4	7/2.9	15,580	684.5	46.24	730.7	35.1	8.7	1,898	362.4	2,260	0.0431	7,250	20.8	1,600	1,787
810	45/4.8	7/3.2	18,480	814.5	56.29	870.8	38.4	9.6	2,259	441.3	2,700	0.0363	7,250	20.8	1,600	2,004
1,160	84/4.2	7/4.2	27,830	1.163	96.95	1,260	46.2	12.6	3,236	759.8	3,996	0.0254	7,430	20.5	1,200	2,573
1,520	84/4.8	7/4.8	36,390	1.520	126.7	1,647	52.8	14.4	4,228	993.3	5,222	0.0195	7,430	20.5	1,200	3,035

TACSR/AW (20.3% Conductivity AW)

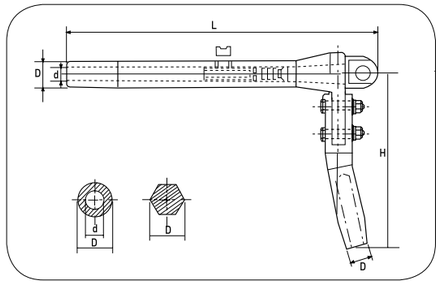
Conductor Size	Stranding (Nos./mm)		Min. Breaking Load	Reference									
				Cross-sectional Area (㎟)		Overall Diameter (mm)		Weight	DC Resistance at 20℃ (Ω/km)	Modulus of Elasticity (kgf/㎟)	Coefficient of Linear Expansion (10⁻⁶/℃)	Standard Length (m)	Current Carrying Capacity (A)
(㎟)	TAI	AW	(kgf)	TAI	AW	TAI	AW	(kg/km)					
120	30/2.3	7/2.3	5,540	124.7	29.08	16.1	6.9	536.5	0.219	8,100	19.2	2,000	624
160	30/2.6	7/2.6	6,980	159.3	37.16	18.2	7.8	685.4	0.171	8,100	19.2	2,000	734
200	30/2.9	7/2.9	8,640	198.2	46.24	20.3	8.7	852.8	0.138	8,100	19.2	2,000	847
210	30/3.2	7/3.2	10,160	241.3	56.29	22.4	9.6	1,038	0.113	8,100	19.2	2,000	968
330	26/4.0	7/3.1	11,200	326.8	52.84	25.3	9.3	1,252	0.0856	7,620	20.0	2,000	1,159
410	26/4.5	7/3.5	14,230	413.4	67.35	28.5	10.5	1,587	0.0676	7,630	20.0	2,000	1,358
480	45/3.7	7/2.47	11,260	483.84	33.54	29.6	7.4	1,561	0.0595	6,910	21.5	2,000	1,437
520	54/3.5	7/3.5	15,920	519.5	67.35	31.5	10.5	1,883	0.0544	7,390	20.4	1,600	1,537
610	54/3.8	7/3.8	18,730	612.4	79.38	34.2	11.4	2,219	0.0461	7,330	20.4	1,600	1,717
680	45/4.4	7/2.9	15,580	684.5	46.24	35.1	8.7	2,201	0.0422	6,900	21.5	1,600	1,805
810	45/4.8	7/3.2	18,730	814.5	56.29	38.4	9.6	2,628	0.0354	6,910	21.5	1,600	2,028
950	84/3.8	7/3.8	23,780	952.6	79.38	41.8	11.4	3,170	0.0302	7,030	21.2	1,200	2,292
1,160	84/4.2	7/4.2	28,720	1,163	96.95	46.2	12.6	3,872	0.0247	7,030	21.2	1,200	2,606
1,520	84/4.8	7/4.8	37,520	1,520	126.7	52.8	14.4	5,060	0.0189	7,030	21.2	1,200	3,075

TACSR/AW (23% Conductivity AW)

Conductor Size	Stranding (Nos./mm)		Min. Breaking Load	Reference									
				Cross-sectional Area (㎟)		Overall Diameter (mm)		Weight	DC Resistance at 20℃ (Ω/km)	Modulus of Elasticity (kgf/㎟)	Coefficient of Linear Expansion (10⁻⁶/℃)	Standard Length (m)	Current Carrying Capacity (A)
(㎟)	TAI	AW	(kgf)	TAI	AW	TAI	AW	(kg/km)					
120	30/2.3	7/2.3	7/2.3	124.7	29.08	16.1	6.9	528.9	0.217	7,980	19.4	2,000	625
160	30/2.6	7/2.6	7/2.6	159.3	37.16	18.2	7.8	675.7	0.170	7,980	19.4	2,000	736
200	30/2.9	7/2.9	7/2.9	198.2	46.24	20.3	8.7	840.7	0.136	7,980	19.4	2,000	854
210	30/3.2	7/3.2	7/3.2	241.3	56.29	22.4	9.6	1,024	0.112	7,980	19.4	2,000	973
330	26/4.0	7/3.1	7/3.1	326.8	52.84	25.3	9.3	1,238	0.085	7,540	20.2	2,000	1,163
410	26/4.5	7/3.5	7/3.5	413.4	67.35	28.5	10.5	1,570	0.0671	7,550	20.2	2,000	1,363
480	45/3.7	7/2.47	7/2.47	483.84	33.54	29.6	7.4	1,550	0.0592	6,880	20.6	2,000	1,441
520	54/3.5	7/3.5	7/3.5	519.5	67.35	31.5	10.5	1,865	0.0541	7,330	20.6	1,600	1,541
610	54/3.8	7/3.8	7/3.8	612.4	79.38	34.2	11.4	2,198	0.0458	7,320	20.6	1,600	1,722
680	45/4.4	7/2.9	7/2.9	684.5	46.24	35.1	8.7	2,189	0.0420	6,860	21.6	1,600	1,809
810	45/4.8	7/3.2	7/3.2	814.5	56.29	38.4	9.6	2,613	0.0353	6,880	21.6	1,600	2,031
950	84/3.8	7/3.8	7/3.8	952.6	79.38	41.8	11.4	3,149	0.0300	6,980	21.3	1,200	2,299
1,160	84/4.2	7/4.2	7/4.2	1,163	96.95	46.2	12.6	3,847	0.0246	6,980	21.3	1,200	2,611
1,520	84/4.8	7/4.8	7/4.8	1,520	126.7	52.8	14.4	5,027	0.0189	6,980	21.3	1,200	3,075

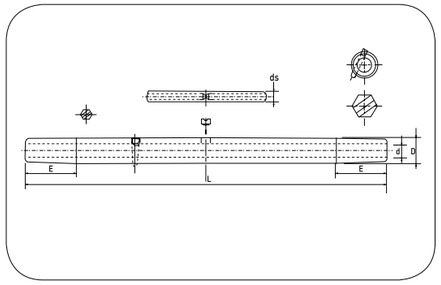
Conductor Fittings

Compression Type Dead-end Clamp



Conductor Size (㎟)		Dimension (mm)			
		L	D	d	H
TACSR (/AW)	120	400~440	25~35	16~20	270~290
	160	400~440	25~35	18~22	270~290
	200	460~500	30~40	20~24	290~330
	240	500~530	35~42	22~26	310~330
	330	520~560	40~45	24~29	320~340
	410	600~630	46~50	28~32	170~390
	520	640~670	50~55	31~35	370~390
	610	700~740	57~63	34~38	380~410
	680	700~740	62~67	35~38	400~420
	810	720~760	65~70	38~42	430~440
	1,160	800~830	73~78	46~50	530~550
	1,520	940~1,000	87~93	52~57	600~620

Compression Type Joint Sleeve



Conductor Size (㎟)		Dimension (mm)				
		L	D	d	E	ds
TACSR (/AW)	120	470~530	25~35	16~20	55~65	7~8
	160	470~530	25~35	18~22	55~65	8~9
	200	500~560	30~40	20~24	65~75	9~10
	240	570~630	33~43	22~26	70~80	10~11
	330	610~670	37~47	25~29	80~90	9~10.5
	410	710~770	43~53	28~32	90~100	10.5~11.7
	610	900~960	55~65	34~38	115~125	11~13
	680	850~910	60~70	35~38	125~135	9~10
	810	910~970	63~73	38~42	130~140	10~11
	1,160	1,070~1,130	63~73	46~50	135~145	13~14
	1,520	1,310~1,370	85~95	53~57	175~185	14.5~15.5

High Tensile Strength Thermal Resistant Aluminum Alloy Conductors, Extra High Tensile Strength Steel Reinforced

Hi-TACSR / EST

Application

Hi-TACSR / EST is used for electric power transmission lines.
River-crossing area, long span area, moisture area etc.

Standard

IEC, ASTM, JCS1363

Construction

• Core (ESt) : Extra High Strength Steel Wire
• Conductor (Hi-TAl) : High Tensile Strength Thermal Resistant Aluminum Alloy Wire used for continous allowable temperature up to 150°C
• If necessary, Coductor could be filled with grease (150°C grade)

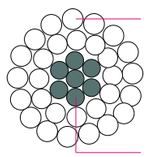
Characteristics

Tenisile strength of Hi-TAL wire is show in the below

Wire Diameter (mm)	Tensile Strength (kgf/mm²)	Wire Diameter (mm)	Tensile Strength (kgf/mm²)
4.2~5.0	Min. 22.9	2.9	Min. 25.0
4.0	Min. 24.3	2.6	Min. 25.3
3.2~3.8	Min. 24.6		

• Low sag & High tension characteristics
• High current carrying capacity characteristics
• Hi-TACSR/EST has high breaking load

Hi-TACSR / ESt



High Tensile Strength Thermal Resistant Aluminum Alloy Wire (Hi-TAl)

Extra High Tensile Strength Steel Wire (ESt)

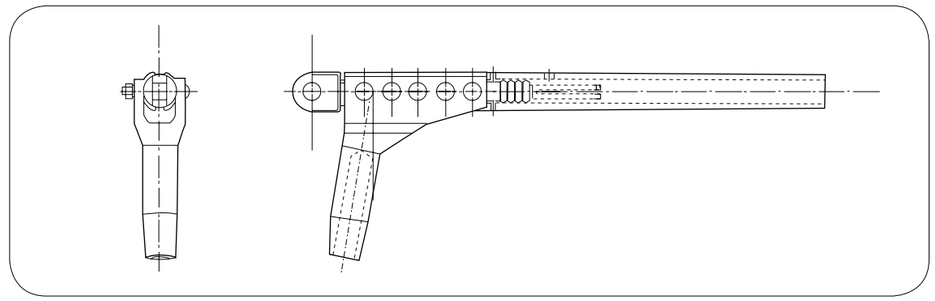
LS Cable & System Standard

Hi-TACSR / EST

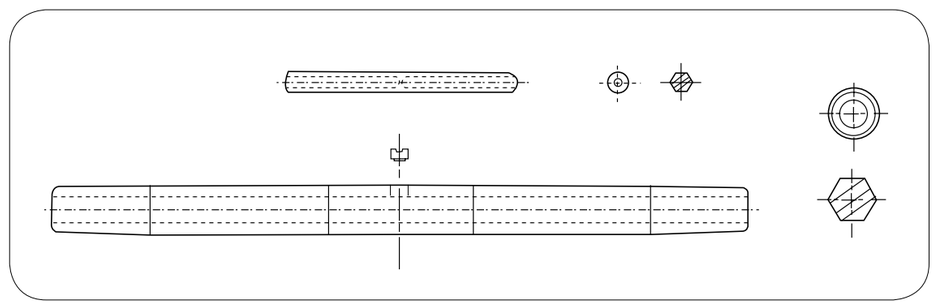
Conductor Size (mm²)	Stranding (Nos./mm)		Min. Breaking Load (kgf)	Reference							
				Cross-Sectional Area (mm²)		Overall Diameter (mm)		Weight (kg/km)	DC Resistance at 20℃ (Ω/km)	Standard Length (m)	Current Carrying Capacity (A)
	Hi-TAl	ESt		Hi-TAl	ESt	Hi-TAl	ESt				
79	12/2.9	7/2.9	9,280	79.26	46.24	14.5	8.7	580.4	0.403	1,600	427
97	12/3.2	7/3.2	11,270	96.50	56.29	16.0	9.6	706.8	0.331	1,600	486
120	12/3.5	7/3.5	13,460	115.5	67.35	17.5	10.5	845.6	0.277	1,600	548
150	12/4.0	7/4.0	16,780	150.8	87.99	20.0	12.0	1,105	0.211	1,600	657
120	30/2.3	7/2.3	7,600	124.7	29.09	16.1	6.9	573.7	0.258	2,000	573
160	30/2.6	7/2.6	9,640	159.3	37.16	18.2	7.8	732.8	0.202	2,000	675
240	30/3.2	7/3.2	14,480	241.3	56.29	22.4	9.6	1,110	0.134	2,000	889
330	26/4.0	7/3.1	15,710	326.8	52.84	25.3	9.3	1,320	0.0983	2,000	1,082
410	26/4.5	7/3.5	19,420	413.4	67.35	28.5	10.5	1,673	0.0777	2,000	1,268
480	45/3.7	7/2.47	16,140	483.8	33.57	29.61	7.41	1,600	0.0664	2,000	1,362
610	54/3.8	7/3.8	25,720	612.4	79.38	34.2	11.4	2,320	0.0525	1,600	1,612
680	45/4.4	7/2.9	21,590	684.5	46.24	35.1	8.7	2,260	0.0470	1,600	1,715
810	45/4.8	7/3.2	25,900	814.5	56.29	38.4	9.6	2,700	0.0395	1,600	1,926
1160	84/4.2	7/4.2	38,770	1,163	96.95	46.2	12.6	3,996	0.0277	1,200	2,474
1520	84/4.8	7/4.8	50,700	1,520	126.7	52.8	14.4	5,222	0.0212	1,200	2,928

Conductor Fittings for Hi-TACSR/AW (ESt)

Compression Type Dead-end Clamp



Compression Type Joint Sleeve



High Tensile Strength Thermal Resistant Aluminum Alloy Conductors, Aluminum-clad Steel Reinforced

Hi-TACSR / AW

Application

Hi-TACSR/AW is used for electric power transmission lines.
River-crossing area, seaside district and overseas area, long span,mountain area etc.

Standard

IEC, ASTM, JCS1363

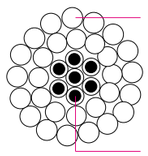
Construction

- Core (AW) : Aluminum-clad Steel Wire
- Conductor (Hi-TAI) : High Tensile Strength Thermal Resistant Aluminum Alloy Wire used for continuous allowable temperature up to 150℃

Characteristics

- Excellent rustless characteristics
- Low sag & high tension characteristics
- High current carrying capacity characteristics

Hi-TACSR / AW



LS Cable & System Standard

Hi-TACSR / AW (20.3% Conductivity AW, 135kgf/mm²)

Conductor Size	Stranding (Nos./mm)		Min. Breaking Load	Reference								
				Cross-sectional Area (mm²)		Overall Diameter (mm)		Weight	DC Resistance at 20℃	Modulus of Elasticity	Coefficient of Linear Expansion	Standard Length	Current Carrying Capacity
(mm²)	Hi-TAI	AW	(kgf)	Hi-TAI	AW	Hi-TAI	AW	(kg/km)	(Ω/km)	(kgf/mm²)	(x10⁻⁶/℃)	(m)	(A)
79	12/2.9	7/2.9	7,400	79.26	46.24	14.5	8.7	521.4	0.331	9,930	16.9	1,600	471
97	12/3.2	7/3.2	9,010	96.50	56.29	16.0	9.6	634.9	0.272	9,930	16.9	1,600	536
120	12/3.5	7/3.5	10,750	115.5	67.35	17.5	10.5	759.7	0.227	9,930	16.9	1,600	605
150	12/4.0	7/4.0	14,000	150.8	87.99	20.0	12.0	992.5	0.173	9,930	16.9	1,600	728
120	30/2.3	7/2.3	6,420	124.7	29.09	16.1	6.9	536.5	0.237	8,260	19.2	2,000	598
160	30/2.6	7/2.6	8,140	159.3	37.16	18.2	7.8	685.0	0.186	8,260	19.2	2,000	704
240	30/3.2	7/3.2	12,210	241.3	56.29	22.4	9.6	1,038	0.123	8,260	19.2	2,000	928
330	26/4.0	7/3.1	13,560	326.8	52.84	25.3	9.3	1,252	0.0927	7,790	20.1	2,000	1,114
410	26/4.5	7/3.5	16,710	413.4	67.35	28.5	10.5	1,587	0.0732	7,800	20.0	1,600	1,306
610	54/3.8	7/3.8	23,200	612.4	79.38	34.2	11.4	2,219	0.0501	7,570	20.5	1,600	1,649
680	45/4.4	7/2.9	19,710	684.5	46.24	35.1	8.7	2,201	0.0458	7,090	21.5	1,600	1,736
810	45/4.8	7/3.2	23,630	814.5	56.29	38.4	9.6	2,628	0.0385	7,100	21.5	1,600	1,950
1,160	84/4.2	7/4.2	35,750	1,163	96.95	46.2	12.6	3,872	0.0269	7,220	21.2	1,200	2,507
1,520	84/4.8	7/4.8	46,670	1,520	126.7	52.8	14.4	5,060	0.0206	7,210	21.2	1,200	2,964

Hi-TACSR / AW (23% Conductivity AW, 130kgf/mm²)

Conductor Size	Stranding (Nos./mm)		Min. Breaking Load	Reference								
				Cross-sectional Area (mm²)		Overall Diameter (mm)		Weight	DC Resistance at 20℃	Modulus of Elasticity	Coefficient of Linear Expansion	Standard Length	Current Carrying Capacity
(mm²)	Hi-TAI	AW	(kgf)	Hi-TAI	AW	Hi-TAI	AW	(kg/km)	(Ω/km)	(kgf/mm²)	(x10⁻⁶/℃)	(m)	(A)
79	12/2.9	7/2.9	7,190	79.26	46.24	14.5	8.7	509.3	0.323	9,710	17.2	1,600	476
97	12/3.2	7/3.2	8,750	96.50	56.29	16.0	9.6	620.2	0.265	9,710	17.2	1,600	543
120	12/3.5	7/3.5	10,430	115.5	67.35	17.5	10.5	742.0	0.222	9,710	17.2	1,600	612
150	12/4.0	7/4.0	13,560	150.8	87.99	20.0	12.0	969.4	0.169	9,710	17.2	1,600	734
120	30/2.3	7/2.3	6,290	124.7	29.09	16.1	6.9	528.9	0.235	8,150	19.4	2,000	601
160	30/2.6	7/2.6	7,970	159.3	37.16	18.2	7.8	675.7	0.184	8,150	19.4	2,000	707
240	30/3.2	7/3.2	11,960	241.3	56.29	22.4	9.6	1,024	0.122	8,150	19.4	2,000	932
330	26/4.0	7/3.1	13,320	326.8	52.84	25.3	9.3	1,238	0.0920	7,710	20.2	2,000	1,118
410	26/4.5	7/3.5	16,390	413.4	67.35	28.5	10.5	1,570	0.0727	7,720	20.2	1,600	1,310
610	54/3.8	7/3.8	22,820	612.4	79.38	34.2	11.4	2,198	0.0497	7,500	20.7	1,600	1,656
680	45/4.4	7/2.9	19,510	684.5	46.24	35.1	8.7	2,189	0.0457	7,050	21.6	1,600	1,738
810	45/4.8	7/3.2	23,380	814.5	56.29	38.4	9.6	2,613	0.0384	7,060	21.6	1,600	1,952
1,160	84/4.2	7/4.2	35,310	1,163	96.95	46.2	12.6	3,847	0.0267	7,170	21.4	1,200	2,516
1,520	84/4.8	7/4.8	46,100	1,520	126.7	52.8	14.4	5,027	0.0205	7,170	21.4	1,200	2,971

Hi-TACSR / AW (23% Conductivity AW, 125kgf/mm²)

Conductor Size	Stranding (Nos./mm)		Min. Breaking Load	Reference								
				Cross-sectional Area (mm²)		Overall Diameter (mm)		Weight	DC Resistance at 20℃	Modulus of Elasticity	Coefficient of Linear Expansion	Standard Length	Current Carrying Capacity
(mm²)	Hi-TAI	AW	(kgf)	Hi-TAI	AW	Hi-TAI	AW	(kg/km)	(Ω/km)	(kgf/mm²)	(x10⁻⁶/℃)	(m)	(A)
79	12/2.9	7/2.9	6,990	79.26	46.24	14.5	8.7	509.3	0.323	9,710	17.2	1,600	476
97	12/3.2	7/3.2	8,500	96.50	56.29	16.0	9.6	620.2	0.265	9,710	17.2	1,600	543
120	12/3.5	7/3.5	10,120	115.5	67.35	17.5	10.5	742.0	0.222	9,710	17.2	1,600	612
150	12/4.0	7/4.0	13,190	150.8	87.99	20.0	12.0	969.4	0.169	9,710	17.2	1,600	734
120	30/2.3	7/2.3	6,160	124.7	29.09	16.1	6.9	528.9	0.235	8,150	19.4	2,000	601
160	30/2.6	7/2.6	7,800	159.3	37.16	18.2	7.8	675.7	0.184	8,150	19.4	2,000	707
240	30/3.2	7/3.2	11,710	241.3	56.29	22.4	9.6	1,024	0.122	8,150	19.4	2,000	932
330	26/4.0	7/3.1	13,080	326.8	52.84	25.3	9.3	1,238	0.0920	7,710	20.2	2,000	1,118
410	26/4.5	7/3.5	16,080	413.4	67.35	28.5	10.5	1,570	0.0727	7,720	20.2	1,600	1,310
610	54/3.8	7/3.8	22,510	612.4	79.38	34.2	11.4	2,198	0.0497	7,500	20.7	1,600	1,656
680	45/4.4	7/2.9	19,300	684.5	46.24	35.1	8.7	2,189	0.0457	7,050	21.6	1,600	1,738
810	45/4.8	7/3.2	23,130	814.5	56.29	38.4	9.6	2,613	0.0384	7,060	21.6	1,600	1,952
1,160	84/4.2	7/4.2	34,860	1,163	96.95	46.2	12.6	3,847	0.0267	7,170	21.4	1,200	2,516
1,520	84/4.8	7/4.8	45,540	1,520	126.7	52.8	14.4	5,027	0.0205	7,170	21.4	1,200	2,971

Super-Thermal Resistant Aluminum Alloy Conductors, Aluminum-clad Invar Reinforced

Hi-STACIR / AW, STACIR / AW

Application

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

Standard

IEC, ASTM, JCS 1405

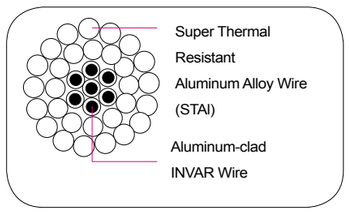
Construction

- Core Wire (INVAR) : Aluminum-clad INVAR Wire/High Tensile Strength Aluminum-clad INVAR Wire
- Conductor (STAI) : Super Thermal Resistant Aluminum Alloy Wire used for continuous allowable temperature up to 210℃

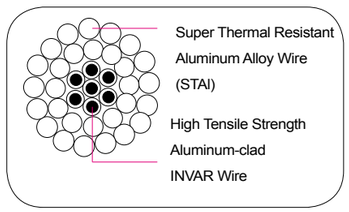
Characteristics

- Double current carrying capacity of the same size ACSR
- No limitation for application area : Heavy wind, snow & galloping area
- Equivalent Sag-tension properties to conventional ACSR
- No modification & reinforcement on existing tower
- Easy installation with same method & equipments as ACSR's
- Low cost and short construction period
- Proved long-term reliability

STACIR/AW



Hi-STACIR / AW



* INVAR : INVARiable to change of temperature
(a kind of Nickel-Ferrous Alloy)

Introduction of Hi-STACIR/AW, STACIR/AW

- 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.
- The Hi-STACIR/AW, STACIR/AW makes it possible to approximately double the capacity of overhead power transmission lines by simply changing the electrical conductor without remodeling the steel towers.
- High conductive -(60%) and super thermal resistant aluminum alloy wires used for conductor layer can continuously be operated at higher temperature-210℃ without degradation.
- when building new transmission line is inevitably accompanied not only by rights-of-way problems with the landowners but also by ecological and environmental impacts. Building new transmission lines is viewed to counter the current trend of preservation of environment in some area. Then the utilization of existing line with the right-of-way already obtained would be the solution to problem.
- Aluminum conductor strength INVAR reinforced is sure to satisfy you in terms of time, economy, and ecology because it can carry doubled conductor current of a conventional ACSR of the same size and this special feature realizes to double the load capability of the existing line utilizing the existing line facilities. It will set you free from right-of-way problems, tower modification, civil work and help preserve environment.
- High tensile strength INVAR wires (an Iron-Nickel alloy having very small thermal expansion property nearly 1/3 that of the steel) are used for the core that allow small thermal expansion resulting in small conductor sags. The INVAR wires are aluminum-clad so that the resistance against corrosion is improved.
- Now you will understand why mere replacement of existing ACSR with INVAR conductor can make the load capability of the existing line twofold.

Conclusion

Applying upgraded conductor

For the existing Line

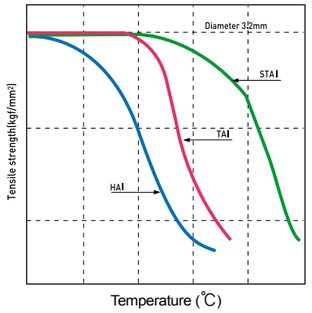
- Double current carrying capacity
- No modification/ reinforcement on existing tower
- Short construction period with low cost

For New Line

- Reducing tower height
- Reducing tower site

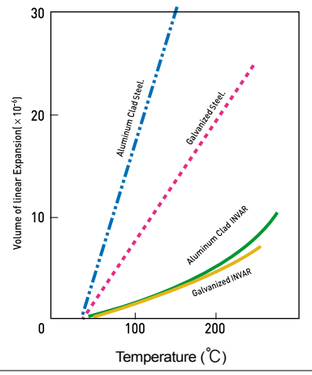
Introduction to Hi-STACIR / AW, STACIR / AW

Characteristics of STAI and INVAR



STAI Wire

Mechanical Characteristics According to Temperature of Thermal Resistant Aluminum Alloy



INVAR Wire

Linear Expansion Curve

INVAR Wire

Item	Tensile Strength (kgf/mm²)	Coefficient of Linear Expansion (x10⁻⁶/℃)	Modulus of Elasticity (kgf/mm²)	Applied Conductors
Galvanized INVAR Wire	105~110	2.8	16,500	STACIR
Al-clad INVAR Wire	105~110	3.7	15,500	STACIR/AW
High tensile strength Al-clad INVAR Wire	120~125	3.7	15,500	Hi-STACIR/AW

LS Cable & System Standard

STAI Wire

Standard Diameter (mm)	Tolerance of Dia. (mm)	Tensile Strength (kgf/mm²) Min.	Tensile Strength (kgf/mm²) Avg	Elongation on 250mm(%) Min	Reference: Cross-sectional Area (mm²)	Reference: Weight (kg/km)	Reference: breaking Load (kgf) Min.	Reference: breaking Load (kgf) Avg (Min.)	Reference: DC Resistance at 20℃ (Ω/km)
2.6	±0.03	17.2	18.3	1.5	5.309	14.33	91.3	97.2	5.41
3.2	±0.04	16.5	17.6	1.7	8.042	21.71	133	142	3.57
3.38	±0.04	16.5	17.6	1.7	8.973	24.23	148	158	3.20
3.7	±0.04	16.5	17.2	1.8	10.75	29.03	177	185	2.67
4.0	±0.04	16.2	16.9	1.9	12.57	33.94	204	212	2.29
4.5	±0.04	16.2	16.9	2.0	15.90	42.93	258	269	1.81

Aluminum-clad INVAR Wire

Standard Diameter (mm)	Tolerance of Dia. (mm)	Tensile Strength (kgf/mm²)	Elongation Min. (%)	No. of Twists (Nos.)	Conductivity (%IACS)	Properties of Aluminum: Thickness (mm)	Properties of Aluminum: Wrapping	Reference: Aluminum Thickness (mm)	Reference: Cross-sectional Area (mm²)	Reference: Weight (kg/km)	Reference: breaking Load (kgf)	Reference: Coefficient of Linear Expainsion 15℃~230℃ (x10⁻⁶/℃)	Reference: Coefficient of Linear Expainsion 230℃~290℃ (x10⁻⁶/℃)	Reference: Modulus of Elasticity (kgf/mm²)
2.47	±0.05	110	1.5	20	14	0.06	No separation between aluminum and invar core or no breakage	0.15	4.790	34.02	527	3.7	10.8	15,500
2.6	±0.05	110	1.5	20	14	0.06		0.15	5.309	37.69	584	3.7	10.8	15,500
3.1	±0.06	110	1.5	20	14	0.07		0.17	7.548	53.48	830	3.7	10.8	15,500
3.2	±0.06	110	1.5	20	14	0.07		0.17	8.042	57.10	885	3.7	10.8	15,500
3.38	±0.07	110	1.5	20	14	0.08		0.18	8.973	63.71	987	3.7	10.8	15,500
3.5	±0.07	110	1.5	20	14	0.08		0.18	9.621	68.31	1.060	3.7	10.8	15,500

High Tensile Strength Aluminum-clad INVAR Wire

Standard Diameter (mm)	Tolerance of Dia. (mm)	Tensile Strength (kgf/mm²)	Elongation Min. (%)	No. of Tweists (Nos.)	Conductivity (%IACS)	Properties of Aluminum: Thickness (mm)	Properties of Aluminum: Wrapping	Reference: Aluminum Thickness (mm)	Reference: Cross-sectional Area (mm²)	Reference: Weight (kg/km)	Reference: breaking Load (kgf)	Reference: Coefficient of Linear Expainsion 15℃~230℃ (x10⁻⁶/℃)	Reference: Coefficient of Linear Expainsion 230℃~290℃ (x10⁻⁶/℃)	Reference: Modulus of Elasticity (kgf/mm²)
2.47	±0.05	125	1.5	20	14	0.06	No separation between aluminum and invar core or no breakage	0.15	4.790	34.02	599	3.7	10.8	15,500
2.6	±0.05	120	1.5	20	14	0.06		0.15	5.309	37.69	637	3.7	10.8	15,500
3.1	±0.06	120	1.5	20	14	0.07		0.17	7.548	53.48	906	3.7	10.8	15,500
3.2	±0.06	120	1.5	20	14	0.07		0.17	8.042	57.10	965	3.7	10.8	15,500
3.38	±0.07	120	1.5	20	14	0.08		0.18	8.973	63.71	1.077	3.7	10.8	15,500
3.5	±0.07	120	1.5	20	14	0.08		0.18	9.621	68.31	1.155	3.7	10.8	15,500

LS Cable & System Standard

STACIR / AW

Conductor Size (mm²)	Stranding (Nos./mm)		Min. Breaking Load (kgf)	Overall Diameter (mm)	Reference									
					Cross-sectional Area (mm²)			Weight (kg/km)			Modulus of Elasticity (kgf/mm²)	Coefficient of Linear Expansion (10⁻⁶/℃)	DC Resistance at 20℃ (Ω/km)	Current Carrying Capacity (A)
	STAI	INVAR			STAI	INVAR	Total	STAI	INVAR	Total				
160	30/2.6	7/2.6	6,140	18.20	159.30	37.16	196.46	441.7	265.2	706.9	8,040	16.0	0.1745	909
240	30/3.2	7/3.2	9,170	22.40	241.30	56.29	297.59	669.1	401.7	1070.8	8,040	16.0	0.1159	1,203
330	26/4.0	7/3.1	10,000	25.30	326.80	52.84	379.64	905.1	377.0	1282.1	7,580	17.5	0.0869	1,452
410	26/4.5	7/3.5	12,720	28.50	413.40	67.35	480.75	1145.5	480.6	1626.1	7,590	17.5	0.0686	1,708
480 (Rail)	45/3.7	7/2.47	10,500	29.61	483.84	33.54	517.38	1340.7	239.3	1580.0	6,900	20.0	0.0600	1,812
480 (Cardinal)	54/3.38	7/3.38	13,280	30.42	484.52	62.81	547.33	1343.5	452.2	1795.7	7,470	18.3	0.0591	1,846

Hi-STACIR/AW

Conductor Size (mm²)	Stranding (Nos./mm)		Min. Breaking Load (kgf)	Overall Diameter (mm)	Reference									
					Cross-sectional Area (mm²)			Weight (kg/km)			Modulus of Elasticity (kgf/mm²)	Coefficient of Linear Expansion (10⁻⁶/℃)	DC Resistance at 20℃ (Ω/km)	Current Carrying Capacity (A)
	STAI	INVAR			STAI	INVAR	Total	STAI	INVAR	Total				
160	30/2.6	7/2.6	6,500	18.20	159.30	37.16	196.46	441.7	265.2	706.9	8,040	16.0	0.1745	909
240	30/3.2	7/3.2	9,700	22.40	241.30	56.29	297.59	669.1	401.7	1070.8	8,040	16.0	0.1159	1,203
330	26/4.0	7/3.1	10,500	25.30	326.80	52.84	379.64	905.1	377.0	1282.1	7,580	17.5	0.0869	1,452
410	26/4.5	7/3.5	13,300	28.50	413.40	67.35	480.75	1145.5	480.6	1626.1	7,590	17.5	0.0686	1,708
480 (Rail)	45/3.7	7/2.47	11,000	29.61	483.84	33.54	517.38	1340.7	239.3	1580.0	6,900	20.0	0.0600	1,812
480 (Cardinal)	54/3.38	7/3.38	13,800	30.42	484.52	62.81	547.33	1343.5	452.2	1795.7	7,470	18.3	0.0591	1,846

Comparison with Conventional ACSR

Conductor Size (mm²)	Stranding (Nos./mm)			Weight (kg/km)	Overall Diameter (mm)	Breaking Load (kgf)	DC Resistant at 20℃ (Ω/km)	Modulus of Elasticity ① (kgf/mm²)	Coefficient of Linear Expansion ② (x10⁻⁶/℃)	Continuous Current Capacity (A)
160	ACSR	HAI	30/2.6	732.8	18.2	6,990	0.182	9,080	18.0	454 (90℃)
		St	7/2.6							
	Hi-STACIR/AW	STAI	30/2.6	706.9	18.2	6,500	0.1745	8,040 (15,500)	16.0 (3.7)	909 (210℃)
		INVAR	7/2.6							
240	ACSR	HAI	30/3.2	1,110	22.4	10,210	0.139	9,080	18.0	593 (90℃)
		St	7/3.2							
	Hi-STACIR/AW	STAI	30/3.2	1,070.8	22.4	9,700	0.1159	8,040 (15,500)	16.0 (3.7)	1,203 (210℃)
		INVAR	7/3.2							
330	ACSR	HAI	26/4.0	1,260	25.3	10,950	0.0873	8,360	19.0	714 (90℃)
		St	7/3.1							
	Hi-STACIR/AW	STAI	26/4.0	1,282.1	25.3	10,500	0.0869	7,580 (15,500)	17.5 (3.7)	1,452 (210℃)
		INVAR	7/3.1							
410	ACSR	HAI	26/4.5	1,673	28.5	13,890	0.0702	8,360	19.0	829 (90℃)
		St	7/3.5							
	Hi-STACIR/AW	STAI	26/4.5	1,626.1	28.5	13,300	0.0686	7,590 (15,500)	17.5 (3.7)	1,708 (210℃)
		INVAR	7/3.5							
480 (Rail)	ACSR	HAI	45/3.7	1,599	29.61	11,800	0.05994	7,250	20.8	891 (90℃)
		St	7/2.47							
	Hi-STACIR/AW	STAI	45/3.7	1,580	29.61	11,000	0.0600	6,900 (15,500)	20.0 (3.7)	1,812 (210℃)
		INVAR	7/2.47							
480 (Cardinal)	ACSR	HAI	54/3.38	1,836	30.42	15,300	0.0599	7,990	19.5	899 (90℃)
		St	7/3.38							
	Hi-STACIR/AW	STAI	54/3.38	1,795.7	30.42	13,800	0.0591	7,470 (15,500)	18.3 (3.7)	1,846 (210℃)
		INVAR	7/3.38							

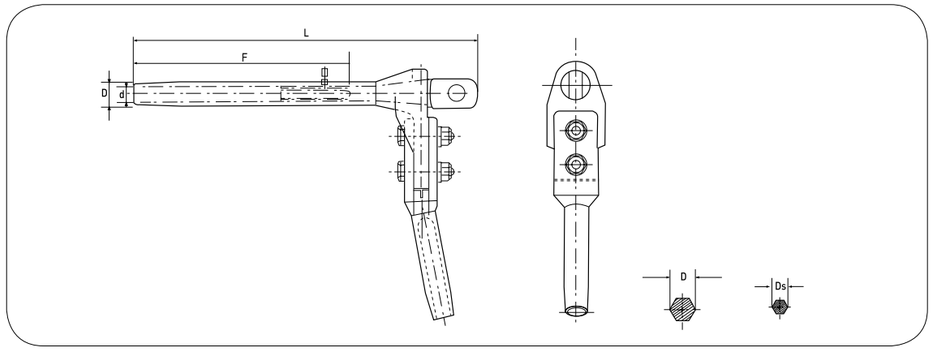
① ( ) ; Modulus of Elasticity above the transition (knee) point temperature

② ( ) ; Coefficient of linear expansion above the transition (knee) point temperature

Conductor Fittings

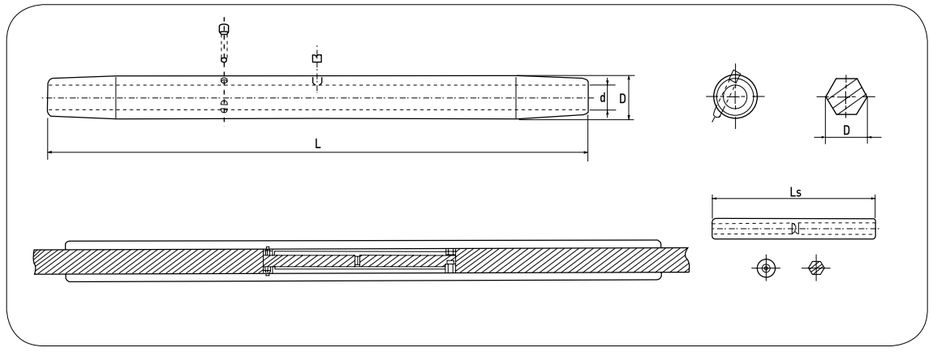
Compression Type Dead-end Clamp

Conductor size (mm²)		Dimension (mm²)				
		L	D	d	F	Ds
Hi-STACIR / AW STACIR (/AW)	160	470 ~ 520	36 ~ 40	18 ~ 22	160 ~ 170	16 ~ 20
	240	505 ~ 560	40 ~ 44	22 ~ 26	175 ~ 185	20 ~ 24
	330	530 ~ 600	46 ~ 50	25 ~ 29	190 ~ 200	20 ~ 24
	410	620 ~ 680	50 ~ 54	31 ~ 35	195 ~ 205	22 ~ 26
	480	670 ~ 720	50 ~ 54	29 ~ 33	195 ~ 205	17 ~ 21



Compression Type Joint Sleeve

Conductor size		Dimension (mm²)			
		L	D	d	Ds
Hi-STACIR / AW STACIR (/AW)	160	550 ~ 640	36 ~ 40	18 ~ 22	160 ~ 200
	240	590 ~ 690	40 ~ 44	22 ~ 26	180 ~ 220
	330	650 ~ 750	46 ~ 50	25 ~ 29	180 ~ 220
	410	810 ~ 910	50 ~ 54	28 ~ 32	220 ~ 260
	480	850 ~ 880	50 ~ 54	29 ~ 33	220 ~ 260



Extra Thermal Resistant Aluminum Alloy Conductors Aluminum-clad INVAR Reinforced

XTACIR / AW

Application

XTACIR is normally used to up-rate an existing transmission line by simply replacing
the existing conductor without tower modification or reinforcement.

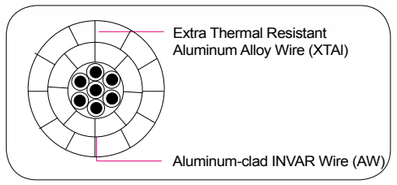
Standard

IEC, ASTM, JCS 1404

Construction

- Core wire (INVAR) : Aluminum-clad INVAR Wire
- Conductor (XTAI) : Extra Themal Resitant Aluminum Alloy wire used for continuous allowable temperature up to 230℃

XTACIR / AW



Characteristics

Conductor Size (mm²)	Stranding (Nos./mm)		Min. Breaking Load (kN)	Reference														
				Cross-sectional Area (mm²)			Overall Diameter (mm)		Weight (kg/km)			Modulus of Elasticity (kgf/mm²)		Coefficient of Linear Expainsion (x10⁻⁶/℃)			DC Resistance at 20℃ (Ω/km)
	XTAI	INVAR		XTAI	INVAR	Total	XTAI	INVAR	XTAI	INVAR	Total	Up to transition point temperature	Over transition point temperature	Up to transition point temperature	Transition point temperature ~230℃	Over 230℃	
160	24/(2.85)	7/3.0	68.6	153.1	49.48	202.6	17.3	9.0	421.5	353.1	774.6	83.8	152.0	14.5	3.7	10.8	0.184
200	24/(3.15)	7/3.4	83.4	187.0	63.55	250.6	19.2	10.2	515.1	453.5	968.6	84.7	152.0	14.2	3.7	10.8	0.150
240	24/(3.45)	7/3.8	102.8	224.4	79.38	303.8	21.2	11.4	617.9	566.4	1,184	85.4	152.0	14.0	3.7	10.8	0.124
320	24/(4.05)	7/3.8	114.3	309.1	79.38	388.5	23.8	11.4	851.4	566.4	1,418	80.2	152.0	15.5	3.7	10.8	0.0924
400	24/(4.50)	7/4.3	139.8	381.6	101.6	483.2	26.6	12.9	1,051	725.3	1,776	80.8	152.0	15.4	3.7	10.8	0.0747
600	28/(5.10)	7/5.0	197.1	572.0	137.5	709.5	32.2	15.0	1,575	980.7	2,556	79.3	152.0	15.8	3.7	10.8	0.0503

Gapped (Super) Thermal Resistant Aluminum Alloy Conductors, Extra High Tensile Sthrength Steel Reinforced

GTACSR, GSTACSR

Application

GAP conductor, i.e. GTACSR and GSTACSR is normally used to up-rate an existing overhead transmission lines by simply replacing the existing conductor without tower modification or reinforcement.

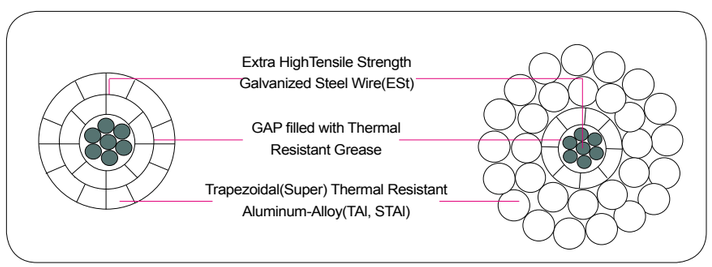
Standard

- IEC 61089 – Round wire concentric lay overhead electrical stranded conductors
- IEC 62219 – Overhead electrical conductors - Formed wire, concentric lay, stranded conductors
- IEC 60888 – Zinc-coated steel wires for stranded conductors
- IEC 62004 – Thermal-resistant aluminum alloy wire for overhead line conductor

Construction

GAP conductor consists of Extra High Tensile Strength Galvanized Steel Wires in the center , (super) thermal-resistant aluminum alloy wires in conductor part and thermal-resistant grease in ‘GAP’ between steel core and aluminum inner layer.
To maintain ‘GAP’ between steel core and aluminum inner layer, the aluminum inner layer shall be trapezoidal shaped.
Whereas outer aluminum layer could be round shaped or trapezoidal shaped in case of alternative compact designs.

- Core (ESt) : Extra High Tensile Strength Galvanized Steel Wire
- Conductor (TAI, STAI) : (Super) Thermal Resistant Aluminum Alloy Wire
- Thermal-resistant grease in ‘GAP’ between steel core and aluminum inner layer
  - Provide water proofing
  - Protection for galvanizing coating on steel core
  - Lubrication between steel core and inner aluminum layer



Characteristics

Conductor Size	Stranding (Nos./mm)		Min. Breaking Load	Reference										
				Cross-Sectional Area (mm^2)			Overall Diameter (mm)		Weight	DC Resistance at 20℃	Modulus of Elasticity (kgf/mm^2)	Coefficient of Linear Expainsion ($x10^{-6}$/℃)	Current Carrying Capacity (A)	
(mm^2)	(S)TAI	ESt	(kgf)	(S)TAI	ESt	Total	Conductor	ESt	(kg/km)	(Ω/km)	ESt	ESt	GTACSR	GSTACSR
150	10/TW (2.82) 14/TW (2.94)	7/2.0	6,030	157.5	21.99	179.5	16.4	6.0	624	0.1874	8,110	21,000	699	843
180	9/TW (3.03) 15/3.12	7/2.1	6,660	179.6	24.25	203.9	18.44	6.3	704	0.1640	8,050	21,000	773	934
200	11/TW (3.17) 18/2.8	7/2.4	8,160	197.6	31.67	229.3	19.7	7.2	813	0.1490	8,510	21,000	827	1,001
240	10/TW (3.69) 15/TW (3.46)	7/2.4	8,820	247.9	31.67	279.6	20.6	7.2	954	0.1188	7,970	21,000	939	1,137
290	10/TW (3.85) 16/3.75	7/2.6	10,370	293.1	37.17	330.3	23.3	7.8	1,124	0.1005	7,950	21,000	1,059	1,285
330	11/TW (3.98) 17/3.8	7/3.1	13,450	329.7	52.83	382.5	25.1	9.3	1,350	0.0893	8,330	21,000	1,149	1,396
370	9/TW (4.57) 15/4.35	7/2.7	11,950	370.6	40.08	410.7	26	8.1	1,363	0.0795	7,730	21,000	1,230	1,496
410	10/TW (4.58) 15/4.6	7/3.0	14,090	414.0	49.48	463.5	27.6	9.0	1,563	0.0711	7,870	21,000	1,324	1,612
480	10/TW (3.85) 17/3.4, 23/3.4	7/2.6	13,140	479.6	37.17	516.8	29.3	7.8	1,640	0.0614	7,360	21,000	1,418	1,728
540	11/TW (3.98) 18/3.5, 24/3.5	7/3.1	16,660	540.9	52.83	593.7	31.5	9.3	1,939	0.0545	7,610	21,000	1,539	1,877

① Other size are available if required.

② TW : Trapezoidal Wire

③ Current Carrying Capacity was calculated in accordance with IEEE Std 738 (2006) "Current-Temperature of Bare Overhead Conductors"
- Ambient air temp. : 40℃, Wind speed : 0.61m/s, Wind direction : 90o, Solar radiation : 0.1W/cm^2, Absorptivity & Emissivity : 0.5

Accessories

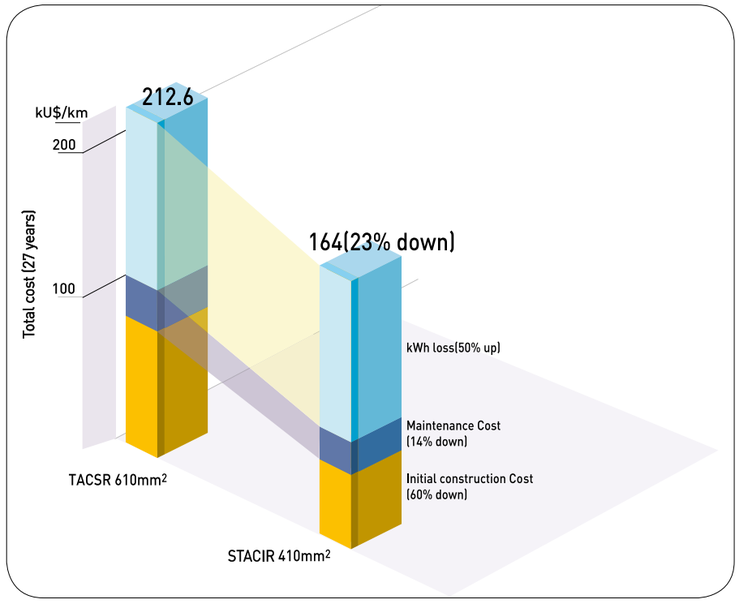
Appropriate design for dead-end clamp to carry large current is needed to reduce current heating and enhance heat radiation.
Other line hardware fittings are the same as conventional ACSR.
LS Cable & System provides line hardware fittings for use with GAP conductor.

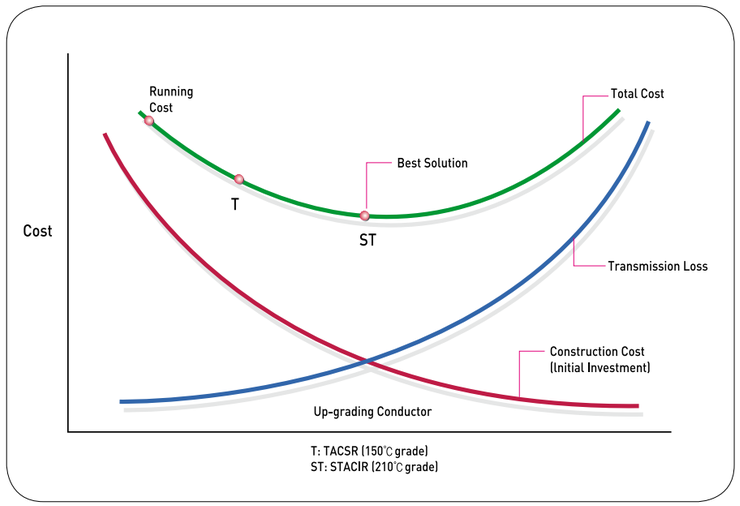
*) If necessary semi-strain assembly is required for suspension tower to put additional tensioning function onto suspension tower to keep the low sag properties.

Installation

Installation method and procedure of GAP conductor is basically similar to those of conventional ACSR. Particular attention and a special sagging method is required to apply all tension to steel core only at sagging stage.
During period of installation, an experienced specialist from LS Cable & System can supervise and assist the installation work.

Cost Comparison Between STACIR and TACSR





LS OPGW System

LS Cable & System is the world's leading supplier of Optical Ground Wire (OPGW) including all the components that the system requires end to end. The technology used by LS Cable & System in the manufacture of OPGW has demonstrated its high quality and reliability since 1986. Furthermore, the ongoing research in new materials and the experience gained ensure the continuous development of our products.

An OPGW cable is typically placed at the highest point of power utility high voltage structures, and perform duel functions. On one hand, it must function as an earthing conductor, i.e. conduct short-circuit currents that result from faults in the electrical system to earth, and safeguard the transmission line from lightning. On the other hand, it must protect the optical fibers from extend force and harsh environment conditions, such as extreme temperature, wind and ice loads. By combining these functions in one cable, OPGW considerably reduces loads on tower.

Contents

Aluminum Loose Tube / Plastic Loose Tube Type

Features & Benefits

- Our high quality standards for designing, testing and manufacturing with the highest grade materials available to ensure long-term reliability.
- Maximum fiber counts up to 72 fibers with minimized cable diameter due to variable designs.
- Superior optical performance over a broad temperature range from -40℃ to +85℃.
- Engineering support, supervising and providing its own line of accessory hardware.
- Excellent tensile performance under cable elongation and contraction due to extreme tension and variation of temperature.
- Moisture-proof jelly filled core for superior protection to the optical fibers due to hydrogen generation in metal structure.
- Continuous and seamless tube for superior protection to the optical fibers from moisture and extreme environmental conditions such as lateral force.

The Main Design Parameters

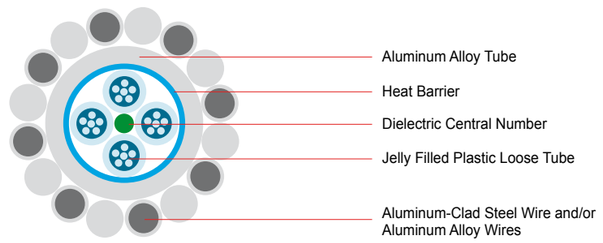
- **Mechanical**
  - Minimum Breaking Load
  - Maximum Permissible Weight & Diameter
  - Minimum Modulus of Elasticity & Maximum Coefficient of LinearExpansion
- **Electrical**
  - Minimum Short-Circuit Capacity & Lightning Resistance
  - Minimum Ohmic Resistance
- **Optical**
  - The Number &Type of Optical Fibers
  - Transmission Capacity & Distance

Applicable Standards

- **Optical Fiber**
  - ITU-T G.650 / ITU-T G.652
  - ITU-T G.653 / ITU-T G.655
  - IEC 60793
- **Aluminum-Clad Steel Wire**
  - IEC 61232 / ASTM B 415
- **Aluminum Alloy Wire**
  - IEC 60104 / ASTM B 398
- **Complete OPGW**
  - IEC 61089 / IEC 60794
  - IEC 60794-4-1
  - ASTM B 416 / IEEE 1138

Construction

Optical core is composed of a dielectric central strength member, optical fibers are protected in a copolymer loose buffer tube jelly filling and subjection tapes. The optical unit is covered by an extruded aluminum alloy tube. And it is protected by a aluminum-clad steel wires and/or aluminum alloy wires.



- Number of Fibers : 6 to 72 Nos.
- Overall Diameter : 12 mm ~ 23.9 mm
- Standard Weight : 550 kg/km ~ 1400 kg/km
- Nominal Breaking Strength : 4,500 kgf ~ 19,530 kgf
- Short Circuit Current Capacity : 50 kA^2 .sec ~ 640 kA^2 .sec
- Maximum Allowable Temperature : 180℃
- The values indicated above are provided as an example. Other requirements subject to assessment.

Stainless - Steel Loose Tube Type

Features & Benefits

- Our high quality standards for designing, testing and manufacturing with the highest grade materials available to ensure long-term reliability.
- Maximum fiber counts up to 288 fibers with minimized cable diameter due to variable designs.
- Superior optical performance over a broad temperature range from -40℃ to +85℃.
- Engineering support, supervising and providing its own line of accessory hardware.
- Compact design light weight & small out diameter for low wind and ice loading, reducing the need for tower reinforcement and additional costs.
- High crush resistance due to the metallic tube design.
- Sealed tube for superior protection to the optical fibers from moisture and extreme environmental conditions such as lightning.
- Simple installation with the same method as conventional ground wire.

The Main Design Parameters

- **Mechanical**
  - Minimum Breaking Load
  - Maximum Permissible Weight & Diameter
  - Minimum Modulus of Elasticity & Maximum Coefficient of Linear Expansion
- **Electrical**
  - Minimum Short-Circuit Capacity & Lightning Resistance
  - Minimum Ohmic Resistance
- **Optical**
  - The Number & Type of Optical Fibers
  - Transmission Capacity & Distance

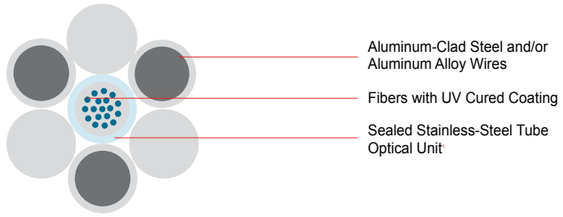
Applicable Standards

- **Optical Fiber**
  - ITU-T G.650 / ITU-T G.652
  - ITU-T G.653 / ITU-T G.655
  - IEC 60793
- **Aluminum-Clad Steel Wire**
  - IEC 61232 / ASTM B 415
- **Aluminum Alloy Wire**
  - IEC 60104 / ASTM B 398
- **Complete OPGW**
  - IEC 61089 / IEC 60794
  - IEC 60794-4-1
  - ASTM B 416 / IEEE 1138

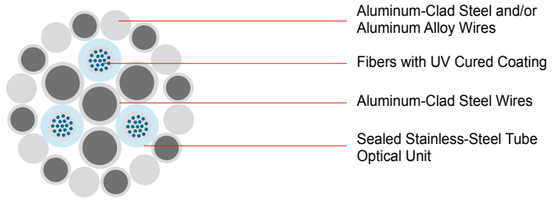
Construction

The optical fibers loosely places in a hermetically sealed stainless-steel tube.

- **Central Construction Type**
  Aluminum-clad steel wires are stranded together around the central stainless-steel tube.



- **Lay Construction Type**
  One or more stainless-steel tube shall be stranded together with aluminum clad steel and/or aluminum alloy wires.

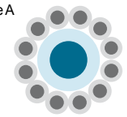
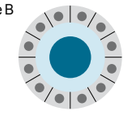
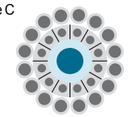
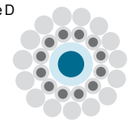


- Number of Fibers : 12 to 288 Nos.
- Overall Diameter : 9 mm ~ 20 mm
- Standard Weight : 300 kg/km ~ 1,000 kg/km
- Nominal Breaking Strength : 4,000 kgf ~ 8,550 kgf
- Short Circuit Current Capacity : 25 kA^2 .sec ~ 210 kA^2 .sec
- Maximum Allowable Temperature : 180℃
- The values indicated above are provided as an example. Other requirements subject to assessment.

[1] Note : Aluminum covered stainless-steel tube optical unit available to improve corrosion properties.

Metal Protection & Type Test

Metal Protection

Conductor Type	Sectional Area (mm^2)	Conductor (Individual)			Remark
		Type	Conductivity (%)	Tensile Strength (kg/mm^2)	
Type A 	50 ~ 120	Round AW and/or Al-Alloy	14 ~ 40	70 ~ 160	Standard
Type B 	50 ~ 120	Smooth Body AW	30 ~ 40	70 ~ 90	Reduced Diameter
Type C 	170 ~ 290	First Layer : Smooth Body AW Second Layer : Round AW	14 ~ 40	70 ~ 160	Reduced Diameter Large Cross-Section
Type D 	170 ~ 290	First Layer : Round AW Second Layer : Al-Alloy	AW : 14 ~ 40 Al-Alloy : 52.5	AW : 70 ~ 160 Al-Alloy : 33.15	Large Cross-Section

Type Test

The type test according to the latest IEEE 1138 and IEC 60794-4-1 was successfully completed.

Cable Test Type	Applicable Standard
Water Ingress Test	IEEE 1138 / IEC 60794-4
Seepage of Flooding Compound	IEEE 1138 / IEC 60794-4
Short Circuit Test	IEEE 1138 / IEC 60794-4
Aeolian Vibration Test	IEEE 1138 / IEC 60794-4
Galloping Test	IEEE 1138 / IEC 60794-4
Sheave Test	IEEE 1138 / IEC 60794-4
Crush Test	IEEE 1138 / IEC 60794-4
Impact Test	IEEE 1138 / IEC 60794-4
Creep Test	IEEE 1138 / IEC 60794-4
Fiber Strain Test	IEEE 1138 / IEC 60794-4
Strain Margin Test	IEEE 1138 / IEC 60794-4
Stress Strain Test	IEEE 1138 / IEC 60794-4
Cable Cut-Off Wavelength	IEEE 1138 / IEC 60794-4
Temperature Cycle Test	IEEE 1138 / IEC 60794-4
Cable Self Damping	EIA / TIA-455-16A / IEC 60794-4
Lightning Test	IEEE Std 4 / IEC 60794-4

Optical Fibers

The optical fibers are used primarily in telecommunication networks characterized by long distance links and high capacity. The optical fibers in cable are designed and manufactured to provide optimum transmission services.

Dual Window Single Mode Fiber (ITU-T G.652)

- **Application**
  - General application fiber suitable for most uses
- **Attenuation**
  - Attenuation Coefficient at 1310 nm : 0.35~0.40 dB/km
  - Attenuation Coefficient at 1550 nm : 0.21~0.30 dB/km
- **Dispersion**
  - Dispersion Coefficient at 1310 nm : 3.5 ps/nm.km, Maximum
  - Dispersion Coefficient at 1550 nm : 18 ps/nm.km, Maximum

Dispersion Shifted Single Mode Fiber (ITU-T G.653)

- **Application**
  - Fiber optimized for transmission in the third window (1550 nm wavelength), recommended in very high speed and long distance applications
- **Attenuation**
  - Attenuation Coefficient at 1550 nm : 0.23 dB/km, Maximum
- **Dispersion**
  - Dispersion Coefficient at 1550 nm : 3.5 ps/nm.km, Maximum

Non-Zero Dispersion Shifted Single Mode Fiber (ITU-T G.655)

- **Application**
  - Fiber designed for DWDM applications. It is characterized by very low dispersion at 1550 nm and a high effective area, which prevents the non-linear effects of high speed in this type of transmission, offering improved service in comparison to the previous fibers.
- **Attenuation**
  - Attenuation Coefficient at 1550 nm : 0.22~0.25 dB/km
  - Attenuation Coefficient at 1625 nm : 0.25 dB/km, Maximum
- **Dispersion**
  - Dispersion Coefficient at 1550 nm : 1.0 to 6.0 ps/nm.km or 1.0 to 10.0 ps/nm.km
  - Dispersion Coefficient at 1625 nm : 4.5 to 11.2 ps/nm.km
- Above values indicated are provided as an example. Other requirements subject to assessment.

General Installation

Complete Fiber Optic Solution

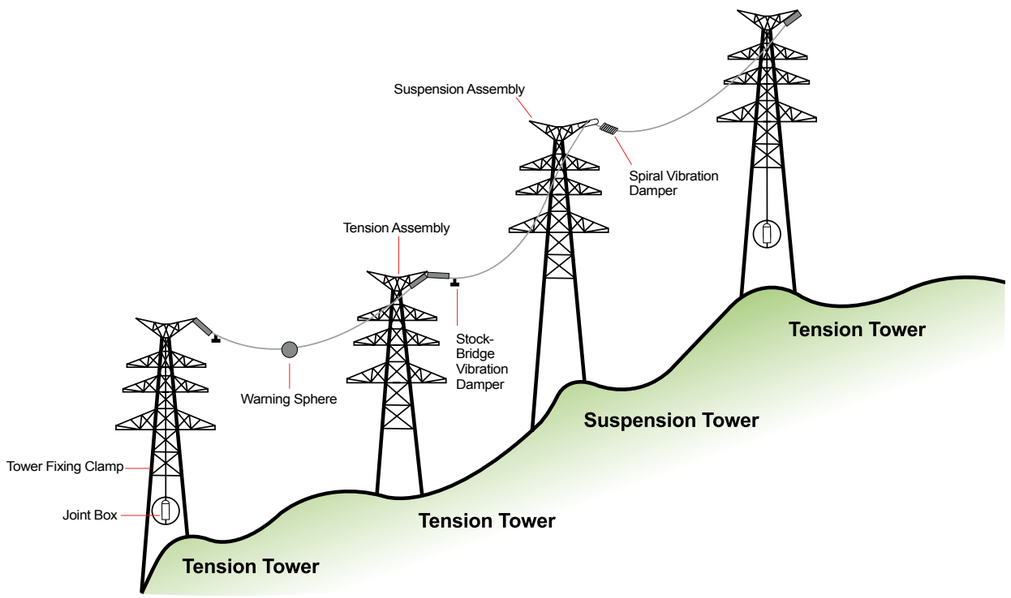
We supply a complete fiber optic solution. LS Cable is ready to provide whatever assistance you require to install and integrate fiber technology into your aerial cable system.

Engineering & Installation Service

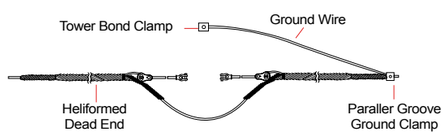
- Pre-Installation Planning
- Complete Turn-Key Installation
- Training / Commissioning
- Sag and Tension Calculations

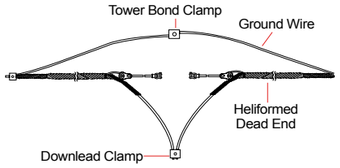
Hardware & Accessories

All Hardware & Accessories necessary for installation.

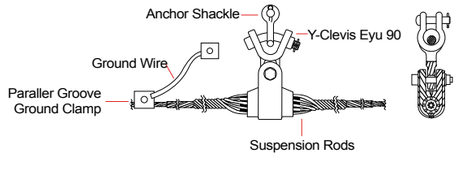


Tension Assembly Set



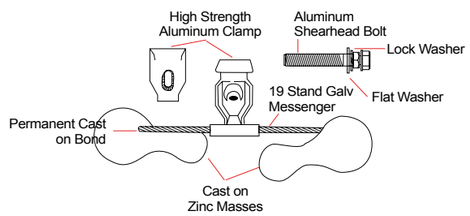


Suspension Assembly Set

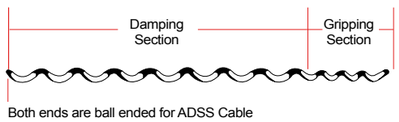


Vibration Damper

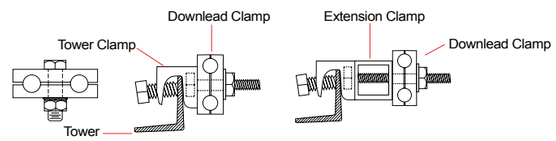
- Stock-Bridge Type



- Spiral Type



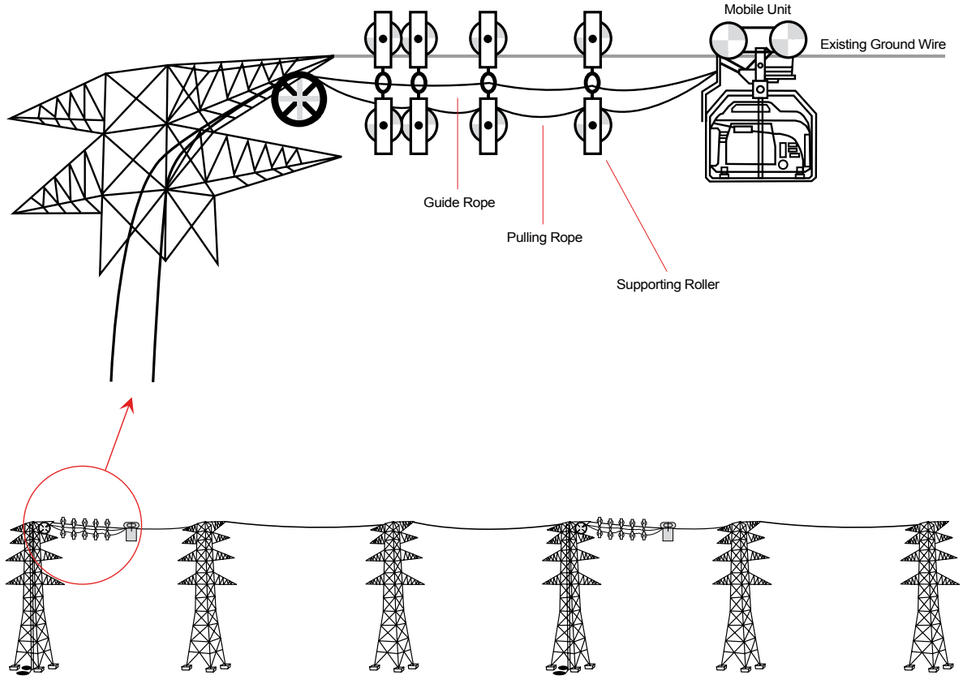
Tower Fixing & Earthing



Live-Line Installation

Features

- Preparation
- Analysis of Safety
- Attaching & Developing Supporting Roller
- Stringing & Turning-Over
- Recovering Existing Ground Wire
- Recovering & Supporting Roller & Rope
- Splicing & Testing



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HTLSC & OPGW

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