

High Thermal and HTLS Conductors

TAAAC – Thermal Resistant All Aluminium Alloy Conductor JEC 3406-95	2
TACSR TACSR/AW – Thermal Resistant Aluminum-alloy Conductor Steel Reinforced	3
GTACSR/GZTACSR – Gap type thermal-resistant aluminum alloy conductor steel reinforced	8
STACIR – Super Thermal Alloy Conductor Invar Reinforced	12
KTACSR – High Strength Heat Resistant Aluminum Alloy Conductor Steel Reinforced	14

TAAAC – Thermal Resistant All Aluminium Alloy Conductor JEC 3406-95

Application

TAAAC - The full name: Thermal Resistant Aluminum-alloy Conductors. Urban network capacity transformation, substation, power plant construction and general lines

Standard

JEC 3406-95

Construction

Thermal resistant aluminum alloy wires (TAL), concentric stranded

Characteristics

(Compared with conventional ACSR)

- 1.Long-term working temperature of 150℃, short-term temperature up to 180℃, so that the continuous allowable carrying capacity of the same specification of ordinary wire 1.5~1.6 times.
- 2.Under normal temperature, with ordinary aluminum wire has the same strength, high temperature operation mechanical strength retention rate can be maintained at more than 90%.
- 3.Compared with ordinary aluminum wire, it has the same creep properties at room temperature or high temperature.
- 4.There is no significant difference between the salt spray test in laboratory and the outdoor air exposure test.
- 5.Installation and maintenance are the same as ordinary wire installation procedures, without any special tools, tooling, installation and maintenance are convenient, and the cost is low.

Construction Parameters

Nominal Cross section area	Structure [number x diameter of wire]		Calculation area cross section	Approx. Diameter of conductor	Min.breaking strength	DC Resistance of conductor at 20℃	Approx Mass of conductor	Current Carrying capacity
mm ²	n	mm	mm ²	mm	kN	Ω/km	Kg/km	A
120	19	2.80	117.0	14.00	17.5	0.2493	320.1	566
150	19	3.15	148.1	15.75	22.2	0.1970	405.1	659
200	19	3.65	198.8	18.25	29.2	0.1467	543.9	798
240	19	4.00	238.8	20.00	34.2	0.1220	654.5	897
300	37	3.20	297.6	22.40	44.5	0.0986	816.0	1036
400	37	3.70	397.8	25.90	58.0	0.0737	1097.0	1258
510	37	4.20	512.6	29.40	73.3	0.0571	1413.0	1491
660	61	3.70	655.9	33.30	95.6	0.0448	1812.0	1753
850	61	4.20	845.1	37.80	120.9	0.0342	2334.0	2073
980	61	3.70	978.4	40.70	142.7	0.0302	2714.0	2272
1030	91	3.80	1032.1	41.80	150.5	0.0286	2864.0	2353
1260	91	4.20	1260.8	46.20	180.3	0.0234	3499.0	2672
1600	127	4.00	1595.9	52.00	228.5	0.0186	4440.0	3083

2020	127	4.50	2019.5	58.50	289.0	0.0147	5616.0	3540
2500	127	5.00	2493.7	65.00	357.0	0.0118	6937.0	3988

TAAAC Conductor-Thermal Resistant Aluminum-alloy Conductors JEC 197

Cross Sectional area	Na/Dia of wire	Approximately		DC conductor Resistance at 20°C, max	Calculated breaking load min		Current Carrying capacity	Standard Delivery length
		Overall diameter	Net weight					
mm ²	Pcs/mm	mm	Kg/km	Ω/km	kgf	n	A	m
150	19/3.20	16	419	0.1910	2270	22268	700	5000
200	19/3.70	18.5	560	0.1430	3030	29724	850	5000
240	19/4.00	20	655	0.1220	3490	34236	945	3000
300	37/3.20	22.4	821	0.0958	4430	43458	1090	3000
400	37/3.70	25.9	1097	0.0737	5890	57780	1325	2000
510	37/4.20	29.4	1414	0.0571	7460	73182	1565	2000
660	61/3.70	33.3	1812	0.0448	9720	95353	1840	1500
850	61/4.20	37.8	2335	0.0347	12300	120663	2175	1000
980	91/3.70	40.7	2716	0.0302	14500	142245	2380	1000
1030	91/3.80	41.8	2865	0.0286	15320	150289	2465	1000
1260	91/4.20	46.2	3501	0.0234	18350	180013	2800	500

TACSR TACSR/AW – Thermal Resistant Aluminum-alloy Conductor Steel Reinforced

Application

The TACSR (thermal resistant aluminum-alloy conductor steel reinforced) could withstand high tensile load to be used mainly for overhead transmission lines, overhead distribution wires.

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

TACSR Conductors are very similar in construction to a conventional ACSR conductor but the EC Grade Aluminum wires are replaced with Hard Drawn Aluminum wires of Heat Resistant Aluminum Alloy (generally known as TAL). TACSR can be safely operated continuously above 150oC enabling to pump more current through the conductor. Where there is a need to transmit higher power but restrictions on getting new power corridors approved, various Types of TAL conductors are one of the best creative solution options to utilities. Ability of the Zirconium doped aluminum alloy to maintain its electrical and mechanical properties at elevated temperatures makes these conductors a very cost effective solution in refurbishing the existing lines with enhanced capacity.

Construction

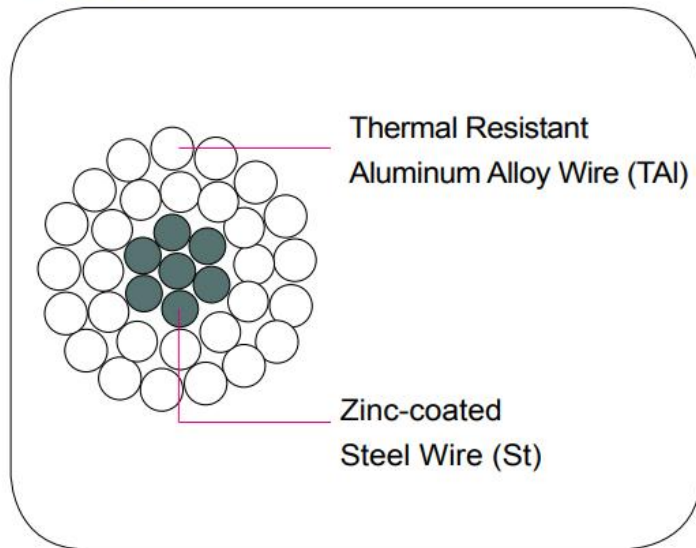
Core(St, AW): Zinc-coated Steel Wire / Aluminum-clad Steel Wire(AW) : 14% ~ 40% AW

Conductor(TAI) : Thermal Resistant Aluminum HIGH TEMPERATURE CONDUCTOR Alloy Wire used for continuously allowable temperature up to 150oC.

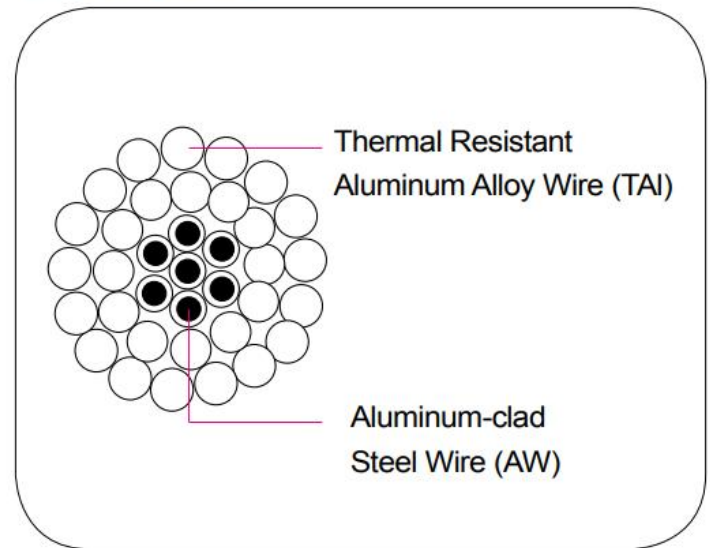
The center wire or wires are of galvanized steel and the outer layer or layers of thermal-resistant aluminum-alloy. TACSR conductors are very

similar in construction to a conventional ACSR conductor, but the EC Grade aluminum wires are replaced with hard drawn aluminum wires of heat resistant aluminum alloy (generally known as TAL).

TACSR



TACSR/AW



Characteristics

AW Type has excellent rustless characteristics.

Thermal-resistant Aluminum Alloy Conductors Steel Reinforced used in the 35KV 110KV 220KV 330KV 500KV 750KV 1000KV substation project, the wire alloying, improve high-temperature performance products, wire section, increase the carrying capacity, high temperature resistance, high conductivity, low loss, reduce power loss, improve the safety of equipment operation. Installation and maintenance are the same as ordinary Aluminum Conductors Steel Reinforced installation procedures, without any special tools, installation, installation, convenient maintenance and low cost.

Construction Parameters

TACSR LS Cable & System Standard (60% IACS)

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°C (Ω/km)	Modulus of Elasticity (kgf/mm2)	Coefficient of Linear Expansion (10-6/°C)	Standard Length (m)	Current Carrying Capacity (A)
	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	4,72 0	79. 64	21. 24	100 .9	13 .0	7. 8	219 .2	16 6.5	38 5.7	0.368	9,390	17.6	2,00 0	448
100	15/ 2.9	4/2 .9	5,58 0	99. 08	26. 42	125 .5	14 .5	8. 7	272 .8	20 7.1	47 9.9	0.296	9,390	17.6	2,00 0	517
120	15/ 3.2	4/3 .2	5,55 0	12 0.6	32. 17	152 .8	16 .0	9. 6	332 .2	25 2.2	58 4.4	0.243	9,390	17.6	2,00 0	590
120	30/ 2.3	7/2 .3	5,54 0	12 4.7	29. 09	153 .8	16 .1	6. 9	345 .7	22 8.0	57 3.7	0.237	9,080	18.0	2,00 0	598
160	30/ 2.6	7/2 .6	6,98 0	15 9.3	37. 16	196 .5	18 .2	7. 8	441 .5	29 1.3	73 2.8	0.185	9,080	18.0	2,00 0	706
200	30/ 2.9	7/2 .9	8,64 0	19 8.2	46. 24	244 .4	20 .3	8. 7	549 .3	36 2.4	91 1.7	0.149	9,080	18.0	2,00 0	816
240	30/ 3.2	7/3 .2	10,2 10	24 1.3	56. 29	297 .6	22 .4	9. 6	668 .9	44 1.3	1,1 10	0.122	9,080	18.0	2,00 0	932
330	26/ 4.0	7/3 .1	10,9 50	32 6.8	52. 84	379 .6	25 .3	9. 3	905 .4	41 4.2	1,3 20	0.090 4	8,360	19.0	2,00 0	1,128
410	26/ 4.5	7/3 .5	13,9 10	41 3.4	67. 35	480 .8	28 .5	10 .5	1,1 45	52 7.9	1,6 73	0.071 4	8,360	19.0	2,00 0	1,322
480	45/ 3.7	7/2 .47	11,2 60	48 3.8	33. 54	517 .34	29 .6	7. 41	133 6.1	26 2.9	1,5 99	0.061 0	7,250	20.8	2,00 0	1,425
520	54/ 3.5	7/3 .5	15,6 00	51 9.5	67. 35	586 .9	31 .5	10 .5	1,4 41	52 7.9	1,9 69	0.056 9	7,990	19.5	1,60 0	1,504
610	54/ 3.8	7/3 .8	18,3 50	61 2.4	79. 38	691 .8	34 .2	11 .4	1,6 98	62 2.2	2,3 20	0.048 1	7,990	19.5	1,60 0	1,682
680	54/ 4.0	7/4 .0	19,8 10	67 8.8	87. 99	766 .8	36 .0	12 .0	1,8 82	68 9.8	2,5 72	0.043 6	7,990	19.5	1,60 0	1,797
680	45/ 4.4	7/2 .9	15,5 80	68 4.5	46. 24	730 .7	35 .1	8. 7	1,8 98	36 2.4	2,2 60	0.043 1	7,250	20.8	1,60 0	1,787
810	45/ 4.8	7/3 .2	18,4 80	81 4.5	56. 29	870 .8	38 .4	9. 6	2,2 59	44 1.3	2,7 00	0.036 3	7,250	20.8	1,60 0	2,004
1,160	84/ 7/4	7/4	27,8	1.1	96.	1,2	46	12	3,2	75	3,9	0.025	7,430	20.5	1,20	2,573

	4.2	.2	30	63	95	60	.2	.6	36	9.8	96	4			0	
1,520	84/ 4.8	7/4 .8	36,3 90	1.5 20	12 6.7	1,6 47	52 .8	14 .4	4,2 28	99 3.3	5,2 22	0.019 5	7,430	20.5	1,20 0	3,035

TACSR/AW (20.3% Conductivity AW)

Conduct or Size (mm ²)	Stranding (Nos./mm)		Min. Break ing Load (kgf)	Reference									
				Cross-section al Area (mm ²)		Overall Diameter (mm)		Weig ht (kg/k m)	DC Resista nce at 20°C (Ω/km)	Modulus of Elast icity (kgf/mm ²)	Coeffi cient of Linear Expan sion (10-6/ °C)	Standard Length (m)	Current Carryin g Capacit y (A)
	TAI	AW		TAI	AW	TAI	AW						
120	30/ 2.3	7/2. 3	5,540	124.7	29.0 8	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	37.1 6	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	46.2 4	20.3	8.7	852.8	0.138	8,100	19.2	2,000	847
210	30/ 3.2	7/3. 2	10,16 0	241.3	56.2 9	22.4	9.6	1,038	0.113	8,100	19.2	2,000	968
330	26/ 4.0	7/3. 1	11,20 0	326.8	52.8 4	25.3	9.3	1,252	0.0856	7,620	20.0	2,000	1,159
410	26/ 4.5	7/3. 5	14,23 0	413.4	67.3 5	28.5	10.5	1,587	0.0676	7,630	20.0	2,000	1,358
480	45/ 3.7	7/2. 47	11,26 0	483.8 4	33.5 4	29.6	7.4	1,561	0.0595	6,910	21.5	2,000	1,437
520	54/ 3.5	7/3. 5	15,92 0	519.5	67.3 5	31.5	10.5	1,883	0.0544	7,390	20.4	1,600	1,537
610	54/ 3.8	7/3. 8	18,73 0	612.4	79.3 8	34.2	11.4	2,219	0.0461	7,330	20.4	1,600	1,717
680	45/ 4.4	7/2. 9	15,58 0	684.5	46.2 4	35.1	8.7	2,201	0.0422	6,900	21.5	1,600	1,805

810	45/ 4.8	7/3. 2	18,73 0	814.5	56.2 9	38.4	9.6	2,628	0.0354	6,910	21.5	1,600	2,028
950	84/ 3.8	7/3. 8	23,78 0	952.6	79.3 8	41.8	11.4	3,170	0.0302	7,030	21.2	1,200	2,292
1,160	84/ 4.2	7/4. 2	28,72 0	1,163	96.9 5	46.2	12.6	3,872	0.0247	7,030	21.2	1,200	2,606
1,520	84/ 4.8	7/4. 8	37,52 0	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)

Conduc tor Size (mm ²)	Stranding (Nos./mm)		Min. Break ing Load (kgf)	Reference									
				Cross-Sectiona l Area (mm ²)		Overall Diameter (mm)		Weig ht (kg/k m)	DC Resistan ce at 20 (/k m)	Modul us of El asticity (kgf/m m ²)	Coeffici ent of Linear Expansi on (10-6/)	Stand ard Lengt h (m)	Curre nt Carryi ng Capac ity (A)
	TAL	AW		TAL	AW	TAL	AW						
120	30/ 2.3	7/2. 3	5,410	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	6,810	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	8,440	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	10,21 0	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	10,95 0	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	13,91 0	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	11,11 0	483.8 4	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	15,60 0	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	18,35 0	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	15,60 0	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	18,48 0	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	23,10 0	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	28,27 0	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	36,96 0	1,520	126.7	52.8	14.4	5,027	0.0189	6,980	21.3	1,200	3,075

GTACSR/GZTACSR – Gap type thermal-resistant aluminum alloy conductor steel reinforced

Application

High Temperature Thermal Resistant Alloy Conductor : Aluminum-Zirconium wires (Type-AT1 or AT3), concentrically stranded over a steel core having a small gap between the Steel core & thermal-resistant aluminum alloy layer. These combination offers best Mechanical as well as Electrical Characteristics. Extra High Strength Galvanized Steel (EST); or aluminum-clad Extra High Strength Steel (AW). Additional corrosion protection is achieved as High Temperature Grease is applied in Between GAP of Conductor.

Standard

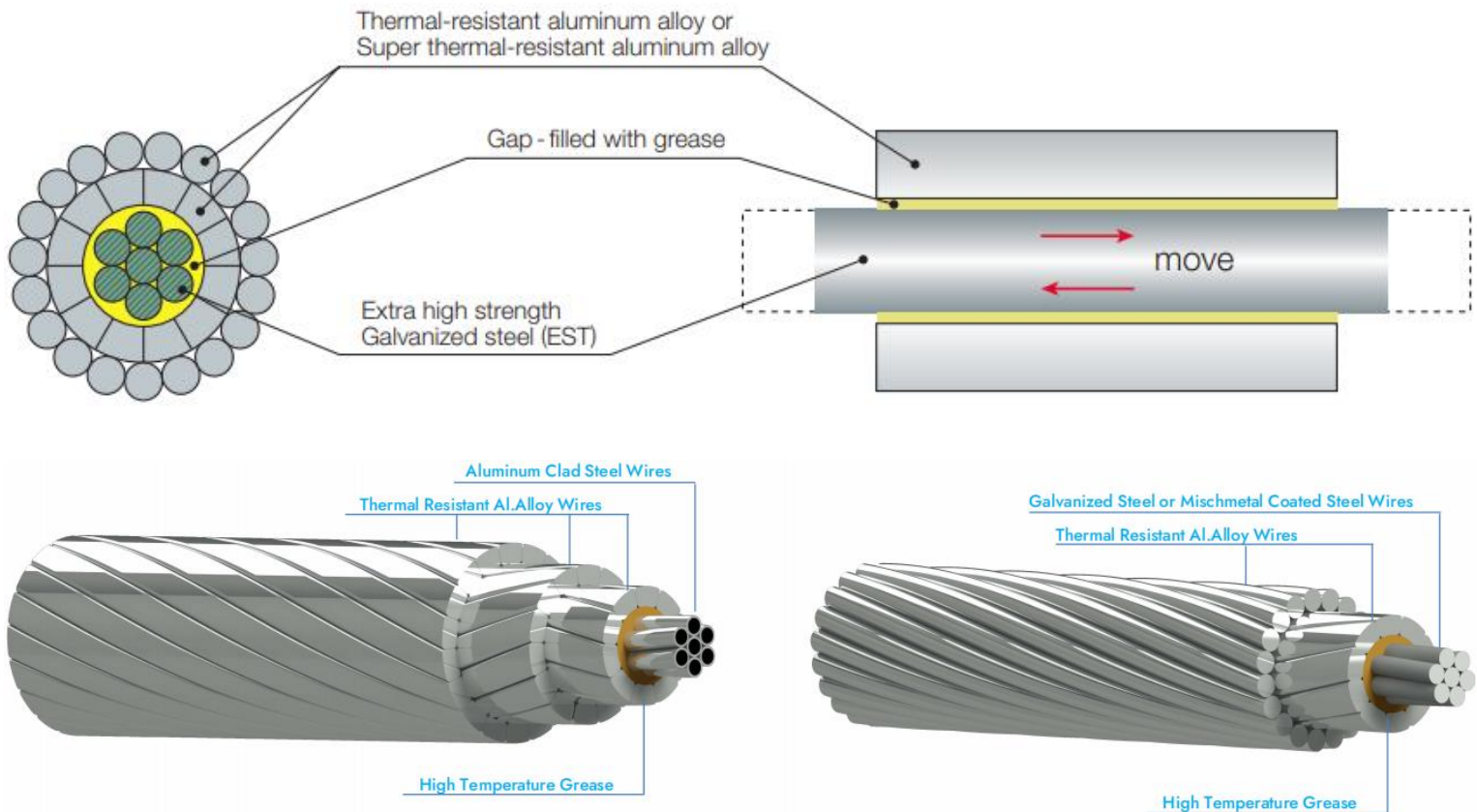
Basic design to:

Thermal-resistant aluminium alloy wires (Type-AT3 or AT1) for overhead line conductor as per IEC 62004

- Concentric lay stranded overhead electrical conductors IEC 61089, IEC 62420
- Zinc-coated steel wires for stranded conductors IEC 888, ASTM B957 & more
- Zinc – 5% Aluminum-Mischmetal Alloy-Coated Steel Core Wire EN 50540, ASTM B802, ASTM B803 or ASTM B958.
- Aluminium Clad Steel Wires, IEC 61232, ASTM B415, EN 50540 & More

Construction

Aluminium-Zirconium wires (Type-AT3 or AT-1), concentrically stranded over a steel core maintaing gap between the Steel core and first Aluminium Layer.



Features:

- These can operate upto 210°C with specified strength loss,
- Can carry 100~150% more current as that of ACSR of the same size.
- For uprating lines, no modifications or reinforcement is required to the existing towers
- Limiting the sag increase with the increase of the temperature by the thermal expansion coefficient above knee-point related to the steel core

Construction Parameters

GTACSR & GZTACSR

Conductor Size	Stranding				Cross-Sectional Area			Diameter of Complete Conductor	Weight			Rated Strength		DC Resistance @20°C
	No. of Wires		Wire diameter		TAL	Steel	Total		TAL	Steel	Total with Grease	Extra High Strength	Ultra High Strength	
	TAL	Steel	TAL	Steel										
(mm²)	(No.)	(No.)	(mm)	(mm)	(mm²)	(mm²)	(mm²)	(mm)	(Kg/Km)	(Kg/Km)	(Kg/Km)	(KN)	(KN)	(Ω/Km)
175	8/12	7	3.35 (TW)	2.10	176.20	24.25	200.45	17.50	486.98	189.44	691.42	66.14	66.87	0.1668
190	12/16	7	2.92 (TW)	2.30	187.30	29.08	216.38	18.20	517.66	227.24	761.90	74.44	75.46	0.1569

195	20/12	7	2.40(R) 2.8 8(TW)	2.2 0	168. 80	26. 61	195. 41	18.06	466. 53	207. 91	690. 44	69.51	70.31	0.1741
218	18/12	7	2.78(R) 2. 94(TW)	2.2 5	190. 50	27. 83	218. 33	19.10	526. 51	217. 47	759. 98	74.47	75.31	0.1542
240	8/12	7	4.02 (TW)	2.4 0	253. 40	31. 67	285. 07	20.60	700. 35	247. 43	964. 78	88.34	89.45	0.1159
248	12/8	7	3.71(TW)	2.4 0	216. 12	31. 67	247. 79	19.40	597. 32	247. 43	862. 75	83.00	84.11	0.1360
287	18/12	7	3.15(R) 3. 43(TW)	2.5 5	251. 00	35. 75	286. 75	21.77	693. 72	279. 33	993. 04	94.85	96.10	0.1171
287	20/12	7	2.90(R) 3.5 5(TW)	2.5 5	251. 00	35. 75	286. 75	21.77	693. 72	279. 33	993. 04	95.33	96.58	0.1171
310	16/12	7	3.90(R) 3.6 9(TW)	2.8 0	319. 40	43. 10	362. 50	24.40	882. 76	336. 78	1241 .54	116.1 0	117.6 0	0.0920
400	18/12	7	3.90(R) 4.4 5(TW)	2.8 0	401. 40	43. 10	444. 50	26.90	1109. 40	336. 78	1468 .18	129.1 6	130.6 7	0.0732
410	14/12	7	4.90(R) 3.9 9(TW)	3.0 0	414. 00	49. 48	463. 48	27.60	1144. 22	386. 61	1554 .83	138.9 5	140.6 8	0.0710
439	15/12	7	4.50(R) 4. 04(TW)	2.9 0	392. 50	46. 24	438. 74	26.84	1084 .80	361. 27	1469 .07	132.4 4	134.0 6	0.0749
462	14/12	7	4.90(R) 3.9 9(TW)	2.9 5	414. 30	47. 84	462. 14	27.60	1145. 05	373. 83	1542 .88	136.4 7	138.1 4	0.0709
540	24/14 /10	7	3.55(R) 3.9 8(TW)	3.1 0	536. 20	52. 83	589. 03	31.30	1483 .12	412. 81	1920 .93	164.1 5	166.0 0	0.0548
620	16/12 /12	7	4.80(TW) 4.75(TW) 3.47(TW)	3.2 0	615. 70	56. 30	672. 00	31.50	1703 .01	439. 88	2168 .89	177.9 6	179.9 3	0.0478

GTACSR/AW & GZTACSR/AW

Con duct	Cross-Sectional Area	Stranding	Diame ter of	Weight	Rated Strength	DC Resist
-------------	----------------------	-----------	-----------------	--------	-------------------	--------------

or Size	STAL	Steel	Total	No. of ST AL Wires	No. of STA L Layers	No. of Steel Wires	Dia. of Steel Wire s	Compl ete Condu ctor	STAL	Steel	Total	High Stren gth	Extra High Stren gth	ance @20° C
(mm ²)	(mm²)	(m m²)	(mm²)	(No .)	(No.)	(No .)	(mm)	(mm)	(Kg/ Km)	(Kg/ Km)	(Kg/ Km)	(KN)	(KN)	(Ω/Km)
175	8/12	7	3.35 (TW)	2.1 0	176. 20	24. 25	200. 45	17.50	486. 98	160. 46	647. 44	57.65	62.26	0.1593
190	12/16	7	2.92 (TW)	2.3 0	187. 30	29. 08	216. 38	18.20	517. 66	192. 48	710. 14	65.28	69.93	0.1490
195	20/12	7	2.40(R) 2. 88(TW)	2.2 0	168. 80	26. 61	195. 41	18.06	466. 53	176.1 1	642. 64	60.20	65.25	0.1652
218	18/12	7	2.78(R) 2. 94(TW)	2.2 5	190. 50	27. 83	218. 33	19.10	526. 51	184. 21	710. 72	64.73	70.02	0.1470
240	8/12	7	4.02 (TW)	2.4 0	253. 40	31. 67	285. 07	20.60	700. 35	209. 59	909. 94	78.36	83.43	0.1112
248	12/8	7	3.71(TW)	2.4 0	216. 12	31. 67	247. 79	19.40	597. 32	209. 59	806. 91	73.03	78.09	0.1295
287	18/12	7	3.15(R) 3. 43(TW)	2.5 5	251. 00	35. 75	286. 75	21.77	693. 72	236. 60	930. 32	83.59	89.31	0.1117
287	20/12	7	2.90(R) 3. 55(TW)	2.5 5	251. 00	35. 75	286. 75	21.77	693. 72	26.6 0	720. 32	84.07	89.79	0.1117
310	16/12	7	3.90(R) 3. 69(TW)	2.8 0	319. 40	43. 10	362. 50	24.40	882. 76	285. 27	1168. 03	102.5 2	109.4 1	0.0880
400	18/12	7	3.90(R) 4. 45(TW)	2.8 0	401. 40	43. 10	444. 50	26.90	1109. 40	285. 27	1394 .67	115.5 9	122.4 8	0.0706
410	14/12	7	4.90(R) 3. 99(TW)	3.0 0	414. 00	49. 48	463. 48	27.60	1144. 22	327. 48	1471 .70	123.3 6	131.2 8	0.0682
439	15/12	7	4.50(R) 4. 04(TW)	2.9 0	392. 50	46. 24	438. 74	26.84	1084 .80	306. 00	1390 .80	117.8 7	125.2 7	0.0720
462	14/12	7	4.90(R) 3. 99(TW)	2.9 5	414. 30	47. 84	462. 14	27.60	1145. 05	316. 65	1461 .70	121.4 0	129.0 5	0.0682
540	24/14 /10	7	3.55(R) 3. 98(TW)	3.1 0	536. 20	52. 83	589. 03	31.30	1483 .12	349. 67	1832 .79	149.3 6	156.2 3	0.0536

620	16/12 /12	7	4.80(TW) 4.75(TW) 3.47(TW)	3.2 0	615. 70	56. 30	672. 00	31.50	1703 .01	372. 60	2075 .61	162.1 9	169.5 1	0.0467
-----	--------------	---	----------------------------------	----------	------------	-----------	------------	-------	-------------	------------	-------------	------------	------------	--------

STACIR – Super Thermal Alloy Conductor Invar Reinforced

Application

Super Thermal Alloy Conductor Invar Reinforced (STACIR) conductor has outer layers composed of Super Thermal Aluminium (STAL) alloy wires that can operate up to 210°C (410°F). The inner core is composed of aluminium clad INVAR wires. INVAR is a metal alloy with 36% Ni in steel.

STACIR/AW conductors are suited for re-conductoring **applications**. The capacity of existing transmission line can be enhanced by simply replacing the existing conductor without any modification to the tower.

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

Standard

Basic design to IEC, ASTM, JCS 1405 standard

Construction

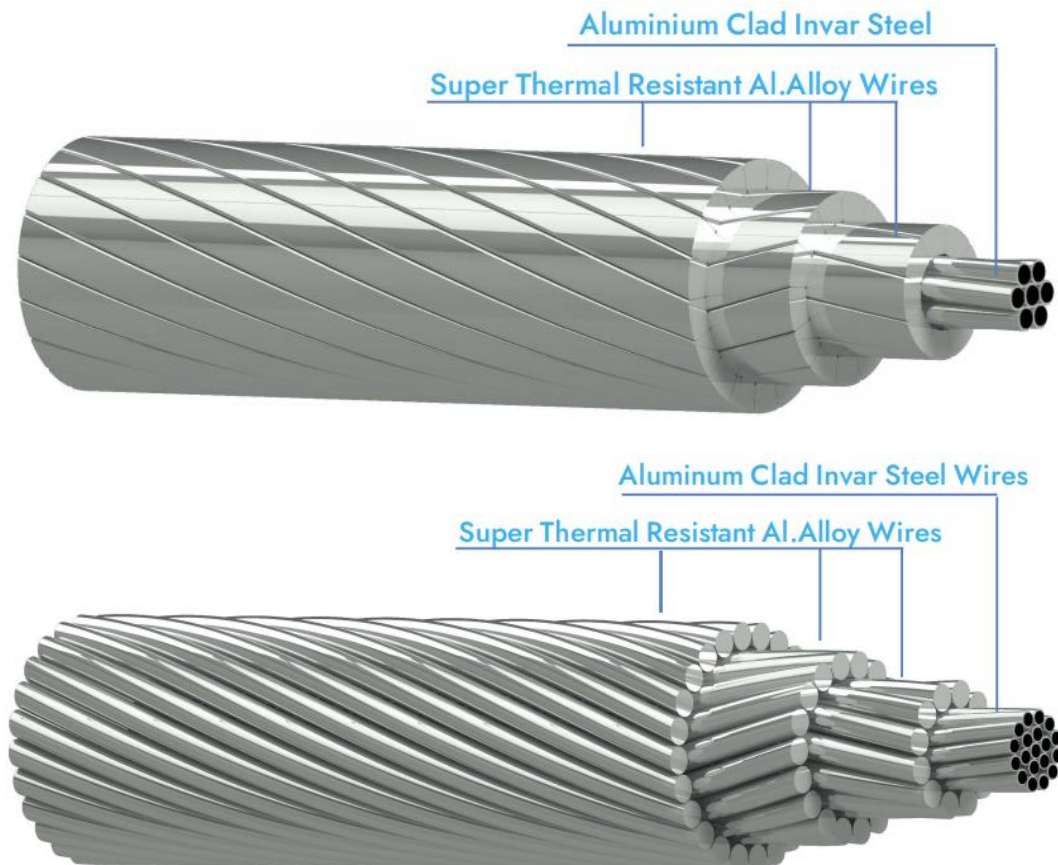
Core Wire (INVAR) : Aluminum-clad INVAR Wire/High Tensile Strength Aluminum-clad INVAR Wire

Conductor (STAI) : Super Thermal Resistant Aluminum Alloy Wire used for continuous allowable temperature up to 210°C

Benefits

Can carry 100% more current than that of ACSR of the same size, while maximum sag and maximum working tension remain the same as that of ACSR.

No modification or reinforcement is required to existing towers for uprating transmission and distribution lines.



Construction Parameters

SUPER THERMAL RESISTANT ALUMINUM ALLOY CONDUCTOR, ALUMINUM CLAD INVAR REINFORCED (STACIR)

Conductor Size	Stranding				Cross-Sectional Area			Diameter of Complete Conductor	Weight			Rated Strength	DC Resistance @ 20°C	Current Capacity		
	No. of Wires		Wire diameter		STAL	Invar	Total		STAL	Steel	Total			@ 85°C	@ 150°C	@ 210°C
	STAL	Invar	STAL	Invar												
(mm²)	(No.)	(No.)	(mm)	(mm)	(mm²)	(mm²)	(mm²)	(mm)	(Kg/Km)	(Kg/Km)	(Kg/Km)	(KN)	(Ω/Km)	(Ampere)	(Ampere)	(Ampere)
200	30	7	2.60	2.60	159.28	37.17	196.44	18.20	439.31	265.01	704.32	65.38	0.1746	403	690	850
240	30	7	2.90	2.90	198.16	46.24	244.39	20.30	546.54	329.69	876.23	79.92	0.1403	460	794	980
300	30	7	3.20	3.20	241.27	56.30	297.57	22.40	665.47	401.43	1066.90	94.82	0.1153	518	901	1114
300	30	7	3.20	3.20	241.27	56.30	297.57	22.40	665.47	401.43	1066.90	94.82	0.1153	518	901	1114
380	26	7	4.00	3.10	326.73	52.83	379.56	25.30	902.22	376.73	1278.95	104.26	0.0866	612	1076	1335
380	26	7	4.00	3.10	326.73	52.83	379.56	25.30	902.22	376.73	1278.95	104.26	0.0866	612	1076	1335
480	26	7	4.50	3.50	413.51	67.35	480.86	28.50	1141.87	480.23	1622.10	132.42	0.0684	704	1253	1559
480	26	7	4.50	3.50	413.51	67.35	480.86	28.50	1141.87	480.23	1622.10	132.42	0.0684	704	1253	1559
520	45	7	3.70	2.47	483.85	33.54	517.39	29.61	1337.00	239.17	1576.17	113.10	0.0597	748	1336	1665
520	45	7	3.70	2.47	483.85	33.54	517.39	29.61	1337.00	239.17	1576.17	113.10	0.0597	748	1336	1665
590	54	7	3.50	3.50	519.54	67.35	586.89	31.50	1437.04	480.23	1917.27	150.84	0.0549	790	1419	1771
600	54	7	3.53	3.53	528.49	68.51	596.99	31.77	1461.78	488.50	1950.28	152.20	0.0540	797	1434	1791
630	54	19	3.63	2.18	558.85	70.92	629.77	32.68	1545.78	507.40	2053.17	163.93	0.0511	824	1486	1857
690	54	7	3.80	3.80	612.42	79.39	691.81	34.20	1693.95	566.08	2260.03	176.38	0.0466	869	1576	1972
710	54	19	3.85	2.31	628.65	79.63	708.27	34.65	1738.82	569.72	2308.54	182.37	0.0454	883	1602	2006
730	45	7	4.40	2.90	684.24	46.24	730.48	35.10	1890.75	329.69	2220.44	155.82	0.0423	914	1663	2084
770	54	7	4.00	4.00	678.59	87.96	766.55	36.00	1876.95	627.24	2504.19	193.40	0.0421	922	1682	2108
800	54	19	4.09	2.45	709.47	89.57	799.04	36.79	1962.37	640.86	2603.23	205.51	0.0403	946	1729	2169
900	54	19	4.34	2.61	798.85	101.65	900.50	39.09	2209.60	727.30	2936.90	230.40	0.0357	1014	1868	2348

SUPER THERMAL RESISTANT ALUMINUM ALLOY CONDUCTOR, ALUMINUM CLAD INVAR REINFORCED (STACIR/TW)

Conductor Size	Cross-Sectional Area			Stranding				Diameter of Complete Conductor	Weight			Rated Strength	DC Resistance @ 20°C	Current Capacity		
	STAL	Invar	Total	No. of STAL Wires	No. of STAL Layer	No. of Invar Wires	Dia. of Invar Wire		STAL	Invar	Total			@ 85°C	@ 150°C	@ 210°C
(mm²)	(mm²)	(mm²)	(mm²)	(No.)	(No.)	(No.)	(mm)	(mm)	(Kg/Km)	(Kg/Km)	(Kg/Km)	(KN)	(Ω/Km)	(Ampere)	(Ampere)	(Ampere)
3206	322.2	52.49	374.75	20	2	7	3.09	22.88	888.49	374.31	1262.80	100.95	0.0876	596	1039	1287
3405	336.8	54.90	391.75	20	2	7	3.16	23.38	928.73	391.46	1320.19	105.55	0.0838	612	1069	1324
3905	389.2	50.81	440.06	20	2	7	3.04	24.72	1073.18	362.29	1435.47	109.47	0.0731	662	1163	1442
405	402.8	52.15	454.98	20	2	7	3.08	25.14	1110.62	371.89	1482.51	112.86	0.0706	676	1189	1475

	3																
480	479.6 9	47.20	526.89	35	3	7	2.93	26.98	1329.03	336.55	1665.58	123.00	0.0600	733	1298	1613	
490	489.5 7	63.55	553.13	24	2	7	3.40	27.70	1349.78	453.18	1802.96	136.19	0.0581	759	1347	1676	
525	523.6 7	26.85	550.53	30	3	7	2.21	27.50	1450.88	191.47	1642.35	107.39	0.0556	763	1354	1685	
590	586.7 6	41.28	628.03	33	3	7	2.74	29.40	1625.66	294.31	1919.97	131.16	0.0494	820	1464	1825	
625	625.0 7	79.63	704.69	38	3	19	2.31	31.32	1731.79	569.72	2301.51	177.43	0.0458	862	1549	1935	
640	636.9 7	44.03	681.00	35	3	7	2.83	30.60	1764.78	313.97	2078.75	141.60	0.0455	860	1542	1925	
680	676.2 4	85.95	762.20	39	3	19	2.40	32.58	1873.58	614.97	2488.55	191.75	0.0423	903	1630	2037	
690	688.9 6	47.52	736.48	36	3	7	2.94	31.80	1908.82	338.85	2247.67	151.77	0.0421	899	1620	2024	
725	725.0 9	91.78	816.87	39	3	19	2.48	33.72	2008.91	656.66	2665.57	205.21	0.0395	940	1703	2131	
730	726.4 1	91.78	818.19	39	3	19	2.48	33.75	2012.56	656.66	2669.22	205.41	0.0394	941	1705	2134	
740	737.4 0	51.14	788.54	36	3	7	3.05	32.92	2043.02	364.68	2407.70	162.72	0.0393	936	1692	2117	
780	776.9 2	98.56	875.49	39	3	19	2.57	34.90	2152.52	705.18	2857.70	218.33	0.0368	979	1780	2231	
790	789.1 3	54.55	843.69	36	3	7	3.15	34.05	2186.36	388.98	2575.34	173.95	0.0367	973	1767	2213	
820	821.8 7	108.7 9	930.65	39	3	19	2.70	36.00	2277.05	778.33	3055.38	235.56	0.0348	1012	1847	2316	
840	839.8 0	58.07	897.88	36	3	7	3.25	35.14	2326.74	414.07	2740.81	185.14	0.0345	1008	1837	2304	
880	876.9 0	111.22	988.11	42	3	19	2.73	37.10	2429.50	795.72	3225.22	246.40	0.0326	1050	1923	2414	
890	891.0 8	61.70	952.78	42	3	7	3.35	36.18	2468.81	439.95	2908.76	195.42	0.0325	1043	1907	2394	
900	901.9 3	73.54	975.47	42	3	19	2.22	36.70	2498.85	526.19	3025.04	213.21	0.0320	1054	1931	2425	
980	976.3 6	123.7 7	1100.13	42	3	19	2.88	39.12	2705.08	885.56	3590.64	274.28	0.0293	1115	2056	2587	
990	987.8 6	68.90	1056.7 6	42	3	7	3.54	38.10	2736.95	491.27	3228.22	217.12	0.0293	1105	2035	2560	

KTACSR – High Strength Heat Resistant Aluminum Alloy Conductor Steel Reinforced

Application

High Strength - Heat Resistant Aluminum Alloy Conductor Steel Reinforced (KTACSR & KTACSR/AW)

High Temperature Thermal Resistant Alloy Conductor : These are high ampacity conductors with inner core composed of Galvanized steel or Aluminum clad Steel & outer layer composed of high Strength - thermal resistant aluminium alloy with round or trapezoidal shaped.

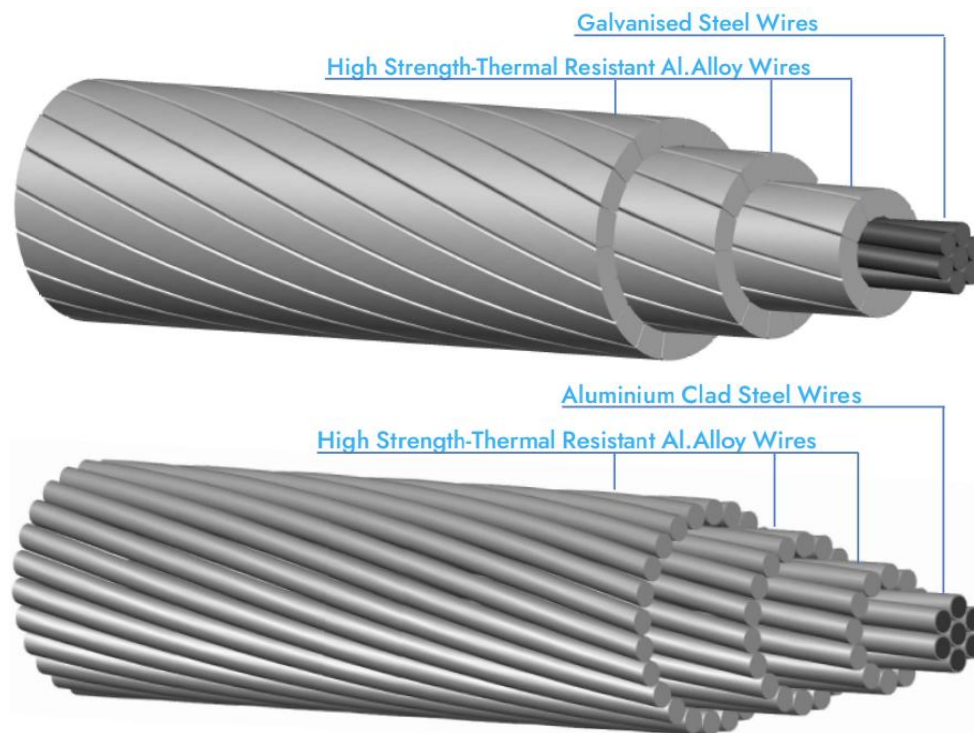
Standard

Basic design to:

- High Strength - Thermal resistant aluminium alloy wires (Type-AT2) for overhead line conductor as per IEC 62004
- Concentric lay overhead electrical stranded conductors IEC 61089, IEC 62219 or ASTM B779
- Zinc-coated steel wires for stranded conductors IEC 888, ASTM B957 & more
- Aluminium Clad Steel Wires, IEC 61232, ASTM B415, EN 50540 & More

Construction

Aluminium-Zirconium wires (Type-AT2), concentrically stranded over a steel core.



Features:

- These can operate upto 150°C with specified strength loss,
- Can carry 50 % to 80 % more current as that of ACSR of the same size.
- For large-crossing sections with reduced wind load of the tower.

Construction Parameters

HIGH STRENGTH-THERMAL RESISTANT ALUMINIUM ALLOY CONDUCTOR STEEL REINFORCED - (KTACSR)

Conductor Size	Stranding				Cross-Sectional Area			Diameter of Complete Conductor	Weight			Rated Strength				DC Resistance @ 20°C	Current Capacity	
	No. of Wires		Wire diameter		KTAL	Steel	Total		KTAL	Steel	Total	Regular Strength	HS	EHS	UHS		@ 85°C	@ 150°C
	KTA	Steel	KTA	Steel														
	L	L	L	L														
(mm²)	(No.)	(No.)	(mm)	(mm)	(mm²)	(mm²)	(mm²)	(mm)	(Kg/Km)	(Kg/Km)	(Kg/Km)	(KN)	(KN)	(KN)	(KN)	(Ω/Km)	(Ampere)	(Ampere)
58	6	1	3.50	3.50	57.73	9.62	67.35	10.50	158.42	74.84	233.26	25.84	27.19	28.15	28.49	0.5512	190	316
80	6	1	4.20	4.20	83.13	13.85	96.98	12.60	228.12	107.75	335.87	34.91	37.26	38.79	39.20	0.3828	238	399

80	15	4	2.60	2.60	79.64	21.24	100.88	13.00	219.14	168.22	387.36	46.94	49.70	51.93	52.67	0.4007	234	394
95	6	1	4.50	4.50	95.43	15.90	111.33	13.50	261.87	123.70	385.57	40.07	42.78	44.53	45.00	0.3335	258	436
100	15	4	2.90	2.90	99.08	26.42	125.50	14.50	272.63	209.25	481.88	58.09	61.53	64.30	65.23	0.3221	267	453
120	15	4	3.20	3.20	120.64	32.17	152.81	16.00	331.96	254.79	586.75	68.97	73.47	76.69	77.81	0.2645	301	514
120	30	7	2.30	2.30	124.64	29.08	153.72	16.10	343.77	227.22	570.99	67.26	71.04	74.09	75.11	0.2566	327	559
160	30	7	2.60	2.60	159.28	37.17	196.45	18.20	439.32	290.43	729.75	87.08	91.91	95.81	97.11	0.2008	380	655
200	30	7	2.90	2.90	198.16	46.24	244.40	20.30	546.55	361.29	907.84	107.74	113.75	118.60	120.22	0.1614	433	753
240	30	7	3.20	3.20	241.27	56.30	297.57	22.40	665.46	439.90	1105.36	127.96	135.84	141.47	143.44	0.1326	488	855
330	26	7	4.00	3.10	326.73	52.83	379.56	25.30	902.23	412.78	1315.01	143.27	150.67	155.95	157.80	0.0980	581	1029
410	26	7	4.50	3.50	413.51	67.35	480.86	28.50	1141.86	526.24	1668.10	176.55	185.98	192.72	195.08	0.0774	669	1199
480	45	7	3.70	2.47	483.85	33.54	517.39	29.61	1337.01	262.06	1599.07	162.93	167.29	170.81	171.98	0.0662	718	1292
520	54	7	3.50	3.50	519.54	67.35	586.89	31.50	1437.04	526.24	1963.28	208.72	218.15	224.89	227.24	0.0617	753	1363
560	54	19	3.63	2.18	558.85	70.92	629.77	32.68	1545.77	556.01	2101.78	227.59	237.52	244.61	246.74	0.0574	786	1428
610	54	7	3.80	3.80	612.42	79.39	691.81	34.20	1693.94	620.31	2314.25	240.48	253.98	262.71	265.09	0.0524	829	1513
630	54	19	3.85	2.31	628.65	79.63	708.28	34.65	1738.83	624.29	2363.12	251.55	261.90	270.26	273.05	0.0510	842	1540
680	45	7	4.40	2.90	684.24	46.24	730.48	35.10	1890.74	361.29	2252.03	213.14	219.15	224.01	225.63	0.0468	879	1610
680	54	7	4.00	4.00	678.59	87.96	766.55	36.00	1876.97	687.27	2564.24	264.42	279.37	289.05	291.69	0.0473	880	1616
710	54	19	4.09	2.45	709.47	89.57	799.04	36.79	1962.38	702.22	2664.60	274.28	285.92	295.33	298.46	0.0452	904	1663
800	54	19	4.34	2.61	798.85	101.65	900.50	39.09	2209.60	796.93	3006.53	309.85	323.07	333.74	337.30	0.0402	968	1793
810	45	7	4.80	3.20	814.30	56.30	870.60	38.40	2250.14	439.90	2690.04	244.89	252.77	258.40	260.37	0.0394	972	1798
1120	72	19	4.45	1.78	1119.81	47.28	1167.09	44.50	3097.07	370.67	3467.74	313.89	320.51	325.24	326.66	0.0286	1172	2214
1160	84	7	4.20	4.20	1163.77	96.98	1260.75	46.20	3221.17	757.75	3978.92	375.31	391.80	402.47	405.38	0.0276	1203	2283
1250	84	19	4.35	2.61	1248.39	101.65	1350.04	47.85	3455.38	796.93	4252.31	411.00	424.21	434.89	438.45	0.0257	1251	2385
1520	84	7	4.80	4.80	1520.03	126.67	1646.70	52.80	4207.25	989.73	5196.98	475.01	487.68	510.48	514.28	0.0211	1387	2687

HIGH STRENGTH-THERMAL RESISTANT ALUMINIUM ALLOY CONDUCTOR, ALUMINUM CLAD STEEL REINFORCED - (KTACSR/AW)

Conductor Size	Stranding				Cross-Sectional Area			Diameter of Complete Conductor	Weight			Rated Strength		DC Resistance @ 20°C	Current Capacity	
	No. of Wires		Wire diameter		KTAL	Steel	Total		KTAL	Steel	Total	High Strength	Extra High Strength		@ 85°C	@ 150°C
	KTAL	Steel	KTAL	Steel												
(mm ²)	(No.)	(No.)	(mm)	(mm)	(mm ²)	(mm ²)	(mm ²)	(mm)	(Kg/Km)	(Kg/Km)	(Kg/Km)	(KN)	(KN)	(Ω/Km)	(Ampere)	(Ampere)
58	6	1	3.50	3.50	57.73	9.62	67.35	10.50	158.42	63.39	221.81	24.88	26.71	0.5380	192.57	320.32
80	6	1	4.20	4.20	83.13	13.85	96.98	12.60	228.12	91.27	319.39	33.53	36.71	0.3737	240.40	404.22
80	15	4	2.60	2.60	79.64	21.24	100.88	13.00	219.14	142.49	361.63	45.24	48.64	0.3647	245.01	412.77
95	6	1	4.50	4.50	95.43	15.90	111.33	13.50	261.87	104.78	366.65	37.85	42.14	0.3255	261.45	441.51
100	15	4	2.90	2.90	99.08	26.42	125.50	14.50	272.63	177.24	449.87	55.98	60.21	0.2932	279.75	474.62
120	15	4	3.20	3.20	120.64	32.17	152.81	16.00	331.96	215.82	547.78	67.68	71.86	0.2408	315.24	538.43
120	30	7	2.30	2.30	124.64	29.08	153.72	16.10	343.77	192.47	536.24	64.93	69.58	0.2363	341.17	582.97
160	30	7	2.60	2.60	159.28	37.17	196.45	18.20	439.32	246.01	685.33	84.10	90.05	0.1849	395.76	682.28
200	30	7	2.90	2.90	198.16	46.24	244.40	20.30	546.55	306.03	852.58	104.03	111.43	0.1486	451.57	785.07
240	30	7	3.20	3.20	241.27	56.30	297.57	22.40	665.46	372.61	1038.07	125.71	133.02	0.1220	508.49	891.13
330	26	7	4.00	3.10	326.73	52.83	379.56	25.30	902.23	349.64	1251.87	141.16	148.02	0.0925	598.14	1059.45
410	26	7	4.50	3.50	413.51	67.35	480.86	28.50	1141.86	445.75	1587.61	169.82	182.61	0.0730	688.93	1233.87
480	45	7	3.70	2.47	483.85	33.54	517.39	29.61	1337.01	221.98	1558.99	156.85	162.22	0.0646	726.87	1307.22
520	54	7	3.50	3.50	519.54	67.35	586.89	31.50	1437.04	445.75	1882.79	201.98	214.78	0.0589	770.64	1394.24
560	54	19	3.63	2.18	558.85	70.92	629.77	32.68	1545.77	470.96	2016.73	219.79	233.26	0.0548	804.18	1460.53
610	54	7	3.80	3.80	612.42	79.39	691.81	34.20	1693.94	525.43	2219.37	234.92	250.80	0.0500	848.50	1548.62
630	54	19	3.85	2.31	628.65	79.63	708.28	34.65	1738.83	528.80	2267.63	245.17	257.91	0.0487	861.64	1574.88
680	45	7	4.40	2.90	684.24	46.24	730.48	35.10	1890.74	306.03	2196.77	209.44	216.84	0.0457	889.44	1629.05
680	54	7	4.00	4.00	678.59	87.96	766.55	36.00	1876.97	582.15	2459.12	258.26	275.85	0.0451	901.03	1653.98
710	54	19	4.09	2.45	709.47	89.57	799.04	36.79	1962.38	594.81	2557.19	267.12	281.45	0.0432	923.84	1700.10
800	54	19	4.34	2.61	798.85	101.65	900.50	39.09	2209.60	675.03	2884.63	301.72	317.98	0.0384	989.12	1833.39
810	45	7	4.80	3.20	814.30	56.30	870.60	38.40	2250.14	372.61	2622.75	242.63	249.95	0.0384	983.55	1820.68
1120	72	19	4.45	1.78	1119.81	47.28	1167.09	44.50	3097.07	313.97	3411.04	308.70	317.68	0.0282	1179.57	2228.93
1160	84	7	4.20	4.20	1163.77	96.98	1260.75	46.20	3221.17	641.85	3863.02	365.62	387.92	0.0268	1219.59	2314.31
1250	84	19	4.35	2.61	1248.39	101.65	1350.04	47.85	3455.38	675.03	4130.41	402.86	419.13	0.0250	1266.16	2415.49
1520	84	7	4.80	4.80	1520.03	126.67	1646.70	52.80	4207.25	838.34	5045.59	453.47	491.48	0.0205	1403.81	2722.06

HIGH STRENGTH - THERMAL RESISTANT ALUMINIUM ALLOY CONDUCTOR STEEL REINFORCED - (KTACSR/TW)

Conduct or Size	Cross-Sectional Area			Stranding				Diameter of Complete Conduct or	Weight			Rated Strength				DC Resistanc e @ 20°C	Current Capacity	
	KTAL	Steel	Total	No. of KTA L Wire s	No. of KTAL Layer s	No. of Steel Wire s	Dia. of Steel Wire s		KTAL	Steel	Total	Regula r Strengt h	HS	EHS	UHS		@ 85°C	@ 150°C
(mm²)	(mm²)	(mm²)	(mm²)	(No.)	(No.)	(No.)	(mm)	(mm)	(Kg/Km)	(Kg/Km)	(Kg/Km)	(KN)	(KN)	(KN)	(KN)	(Ω/Km)	(Amper	(Amper

									)	)	)						e)	e)
170	170.4 5	9.46	179.91	14	2	1	3.47	15.60	469.95	73.57	543.52	52.30	53.62	54.57	54.90	0.1876	380	648
205	205.2 6	11.70	216.97	14	2	1	3.86	17.12	565.93	91.04	656.97	59.88	61.87	63.16	63.51	0.1558	425	730
240	241.7	39.19	280.89	18	2	7	2.67	19.44	666.37	306.23	972.60	104.55	109.6 4	113.7 6	115.1 3	0.1323	474	822
280	281.9 8	45.92	327.90	20	2	7	2.89	21.00	777.43	358.78	1136.2 1	122.22	128.1 9	133.0 1	134.6 2	0.1133	521	908
290	289.6 8	37.74	327.42	18	2	7	2.62	21.00	798.67	294.87	1093.5 4	110.59	115.4 9	119.4 6	120.7 8	0.1104	527	919
320	322.2 6	52.49	374.75	20	2	7	3.09	20.45	888.49	410.16	1298.6 5	134.38	141.7 2	146.9 7	148.8 1	0.0993	553	962
340	336.8 5	54.90	391.75	20	2	7	3.16	22.94	928.73	428.95	1357.6 8	140.50	148.1 8	153.6 7	155.5 9	0.0949	579	1017
390	389.2 5	50.81	440.06	20	2	7	3.04	24.35	1073.1 8	396.99	1470.1 7	146.69	153.8 0	160.6 6	162.4 4	0.0821	630	1112
405	402.8 3	52.15	454.98	20	2	7	3.08	24.75	1110.6 2	407.51	1518.1 3	151.28	158.5 8	163.8 0	165.6 2	0.0794	642	1136
480	479.6 9	47.20	526.89	35	3	7	2.93	26.64	1329.0 3	368.78	1697.8 1	168.34	174.4 8	179.4 4	181.0 9	0.0670	692	1224
490	489.5 7	63.55	553.13	24	2	7	3.40	27.28	1349.7 8	496.58	1846.3 6	184.06	192.9 6	199.3 2	201.5 4	0.0653	705	1249
525	523.6 7	26.85	550.53	30	3	7	2.21	27.28	1450.8 8	209.81	1660.6 9	147.76	151.5 2	154.2 1	155.0 1	0.0613	726	1287
590	586.7 6	41.28	628.03	33	3	7	2.74	29.10	1625.6 6	322.50	1948.1 6	178.99	184.3 6	188.6 9	190.1 3	0.0548	778	1387
625	625.0 7	79.63	704.69	38	3	19	2.31	30.80	1731.7 9	624.28	2356.0 7	236.31	246.6 7	255.0 3	257.8 1	0.0514	812	1457
640	636.9 7	44.03	681.00	35	3	7	2.83	30.30	1764.7 8	344.04	2108.8 2	193.31	199.0 3	203.6 6	205.2 0	0.0504	816	1462
680	676.2 4	85.95	762.20	39	3	19	2.40	32.02	1873.5 8	673.87	2547.4 5	255.41	266.5 8	275.6 1	278.6 2	0.0476	850	1530
690	688.9 6	47.52	736.48	36	3	7	2.94	31.52	1908.8 2	371.30	2280.1 2	208.95	215.1 3	220.1 2	221.7 8	0.0467	854	1536
725	725.0 9	91.78	816.87	39	3	19	2.48	33.15	2008.9 1	719.55	2728.4 6	273.37	285.3 0	294.9 4	298.1 5	0.0443	886	1602
730	726.4 1	91.78	818.19	39	3	19	2.48	33.18	2012.5 6	719.55	2732.1 1	273.65	285.5 8	295.2 2	298.4 3	0.0442	887	1604
740	737.4	51.14	788.54	36	3	7	3.05	32.60	2043.0 2	399.61	2442.6 3	221.96	229.1 2	234.2 4	236.0 3	0.0435	890	1606
780	776.9 2	98.56	875.49	39	3	19	2.57	34.30	2152.5 2	772.72	2925.2 4	293.20	306.0 2	316.3 6	319.8 1	0.0413	923	1675
790	789.1	54.55	843.69	36	3	7	3.15	33.74	2186.3	426.24	2612.6	237.31	244.9	250.4	252.3	0.0407	925	1676

	3								6		0		5	1	1			
820	821.8 7	108.7 9	930.65	39	3	19	2.70	35.40	2277.0 5	852.87	3129.9 2	315.95	330.0 9	341.5 1	345.3 2	0.0391	954	1736
840	839.8	58.07	897.88	36	3	7	3.25	34.80	2326.7 4	453.73	2780.4 7	252.57	260.7 0	266.5 0	268.5 4	0.0383	958	1742
880	876.9 2	111.2	988.11	42	3	19	2.73	36.45	2429.5 0	871.93	3301.4 3	330.89	345.3 4	357.0 2	360.9 1	0.0367	989	1806
890	891.0 8	61.70	952.78	42	3	7	3.35	35.86	2468.8 1	482.08	2950.8 9	268.09	276.7 3	282.9 0	285.0 6	0.0361	991	1808
900	901.9 3	73.54	975.47	42	3	19	2.22	36.28	2498.8 5	576.58	3075.4 3	290.26	300.5 5	307.9 1	310.1 1	0.0357	999	1825
980	976.3 6	123.7 7	1100.1 3	42	3	19	2.88	38.48	2705.0 8	970.38	3675.4 6	368.35	384.4 4	397.4 3	401.7 7	0.0329	1053	1936
990	987.8 6	68.90	1056.7 6	42	3	7	3.54	37.76	2736.9 5	538.32	3275.2 7	293.00	304.7 2	314.3 6	316.7 7	0.0325	1051	1932
1090	1092. 4	88.84	1181.2 9	64	4	19	2.44	39.91	3041.4 7	696.52	3737.9 9	348.59	360.1 4	369.4 7	372.5 8	0.0296	1136	2116
1330	1331. 3	108.7 9	1440.0 4	64	4	19	2.70	44.07	3706.3 3	852.87	4559.2 0	425.47	439.6 1	451.0 3	454.8 4	0.0242	1268	2396