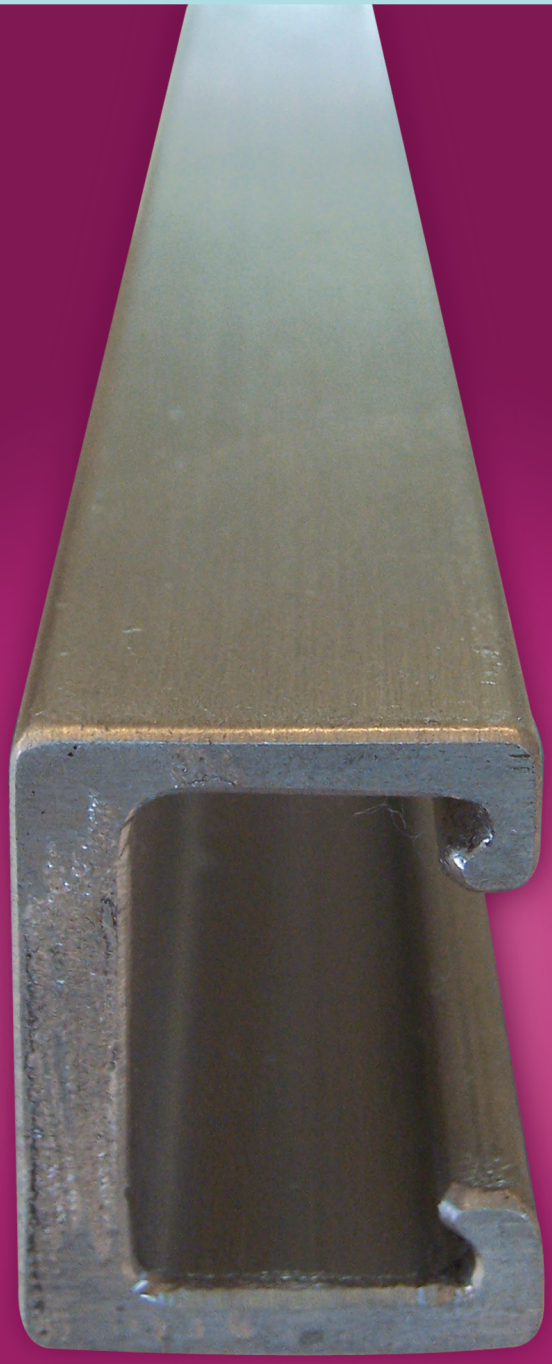
CBar

Engineered Conductor System

TransTech™
POWER TRANSFER SYSTEMS



Ideal for Lower Current Capacities

Compact Designs

Aluminum or Copper Material

Curved Applications

Easy Installation Using Common Hand Tools

Moving Electrification *Forward*

St. Louis Arch Tram

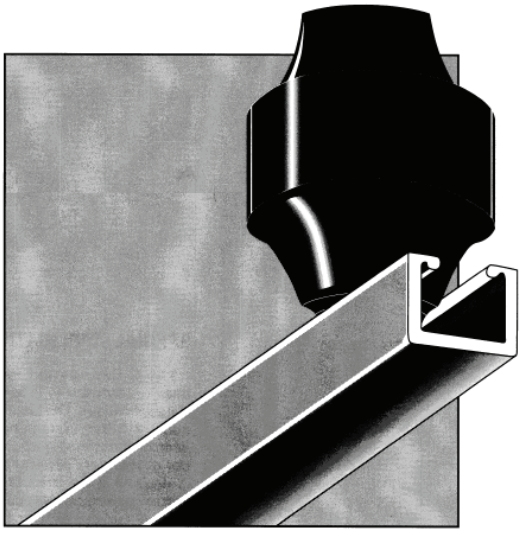
Features

- Aluminum or copper extrusion based on current capacity and environmental requirements
- Full range of standard components including hangers, anchors, feeders, splice joints, expansion joints, isolation joints and isolation joints
- Conventional single arm, double arm and pantograph current collectors available
- Curved sections can be produced with a radius as small as 30 inches in both the vertical and horizontal axes
- Systems are engineered to customer specifications, including system layout and installation support
- Lightweight and compact with easy installation

Moving Electrification Forward

Compact and Lightweight Crane Conductor System

The C-Bar Conductor System is a medium capacity system for use where load current requirements do not warrant the use of our high capacity integrated systems. The compactness, rugged design, and economy make this an ideal Conductor System for all types of A.C. and D.C. current collection applications. C-Bar may be mounted with the conductor surface in any plane. Under and side running are the most common mounting positions. The C-Bar Conductor is available in 350 Amp. Bronze Conductor, 450 Amp. Aluminum Conductor and 550 Amp. Copper Conductor. Standard Collectors are available from 25 to 275 ampere capacities.



This entire system is supplied as a package complete with insulators, hangers, conductors and collectors, ready to mount on building or structural supports.

Lightweight design and erection simplicity reduces installation costs in comparison to other types of systems. No field welding, drilling or cutting is required. Assembly is accomplished by means of standard hex wrenches. Conductors are furnished in factory pre-cut lengths to fit your requirements. Installation and application drawings, engineered for the job, accompany each system and locate the various components for erection.

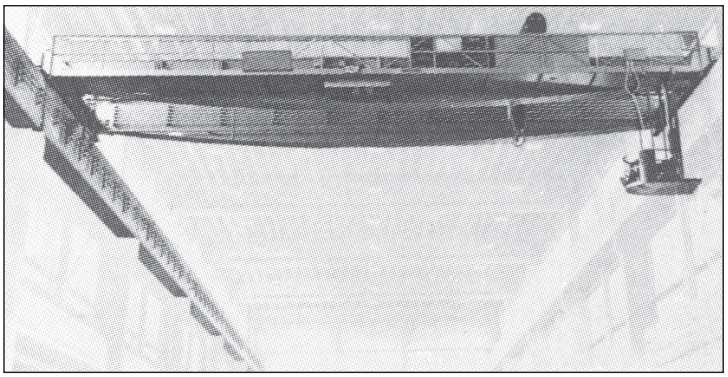
Our sales personnel and engineering staff are available for aiding in the selection of the most economical system for your present and future requirements.

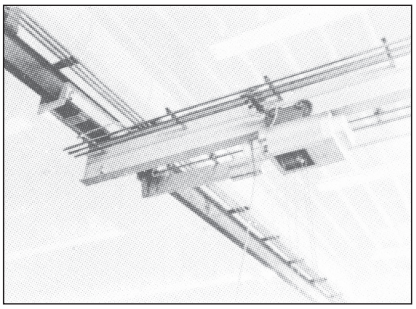
Project Engineering and On-Site Installation Support

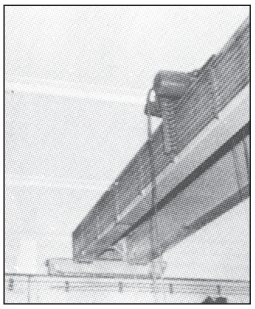
TransTech's engineers custom-configure our products and systems to meet each customer's unique application requirements. We provide on-site technical installation support and layout drawings to our customers and their installation teams.

Typical Installations

The C-Bar Conductor System, due to its medium capacity can serve a wide range of applications. It is ideal for applications inside or outside, on main runway and cross travel for traveling cranes, material handling units, machine tools, rotary kiln temperature recording, etc.



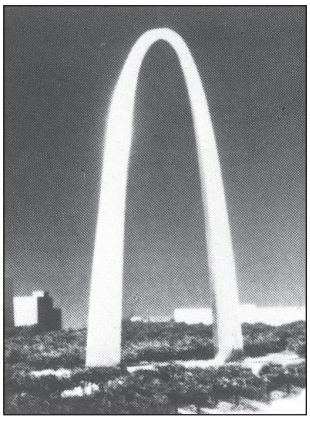




Special Applications

The C-Bar system has been widely used to fit special applications. The Senate Subway C-Bar system has been in operation for a number of years. Its application is unusual since the C-Bar system powers subway cars around curves. A later installation was the House of Representatives subway that also required curved track sections.

An interesting and unusual application is the St. Louis Arch. Passengers are loaded In cars below the base and transported to the top of the Arch. These cars receive their power from a C-Bar system that is curved for almost the entire length of the system.



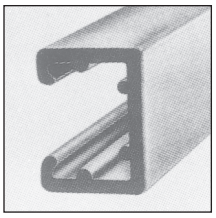
St. Louis Arch

Senate Subway

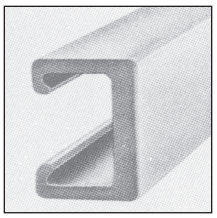
Conductor

The C-Bar Conductor section is available in three materials; Bronze, Aluminum, and Copper, with nominal 350, 450, and 550 ampere capacity, respectively. Ampere ratings are based on a 30˚C rise over a 40˚C ambient in still but unconfined air. The box-like construction provides high mechanical rigidity and allows a large surface area for heat dissipation and current collection. Conductors are of non-magnetic materials to reduce voltage drop.

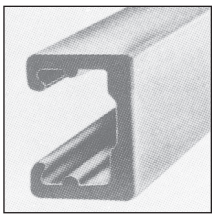
Conductors are normally furnished in 30 foot lengths. "L" as specified in catalog number is length-hence, the catalog number for a 30 foot copper conductor section would be 99341-30. Shorter lengths are available for use where system clearances will not allow insertion of the standard 30 foot length. Fractions of a foot should be avoided; i.e.: if a 16'6" section is required, order a 17 foot section and cut to required size.



Bronze



Aluminum



Copper

Conductor Characteristics

Conductor		Bronze	Aluminum	Copper
Catalog Number		99823-L	99418-L	99341-L
Cross-Sectional Area		355 MCM	457 MCM	355 MCM
D.C. Resistanc /1,000 ft. @ 20˚C-OHMS.		.10426	.04125	.02945
Conductivity % IACS 20 C		28	56	99
A.C. Resistance / 1,000 ft. @ 20˚C-OHMS.		.10582	.0421	.0300
Self GMD (Ds) inches		.51	.491	.48
Current Ratings* Continuous	30˚C over 40˚C	350	450	550
	40˚C over 40˚C	450	550	650
	70˚C over 40˚C	550	650	750
Weight per foot - lbs.		1.07	.428	1.07

*Ratings are based on the average indicated temperature rise of new conductors in still but unconfined air.

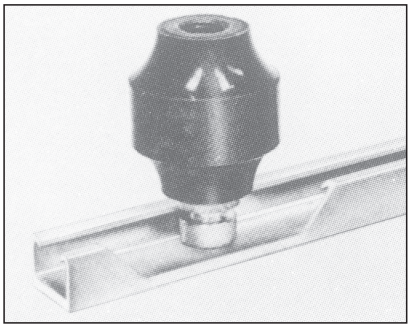
Insulated Hanger

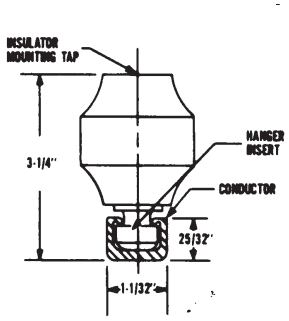
The Insulated Hanger is used to support the conductor section and to electrically insulate it from the supporting structure.

The Insulated Hanger is positioned within the C-Bar Conductor; as shown in the C-Bar cut away. The conductor can slide freely over the hanger to allow movement from expansion and contraction due to temperature changes.

It is normally recommended that insulated hangers be used every five (5) feet along the conductor run.

The insulators are polyester fiberglass, with a $^{5}/_{8}$" mounting tap, and are recommended for indoor or outdoor installations.





Insulator Material		Polyester Fiberglass
Catalog Number		105430
Standard Color		Red
Creepage Distance - Inches		$2^{1}/_{2}$
Dielectric Strength	Dew Flashover	15
KV	Dry, S. T.	38
Tensile Strength - Lbs.		3,500
Cantilever Strength - Lbs.*		1,000

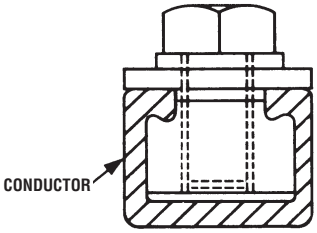
*Measured at center line of hanger insert.

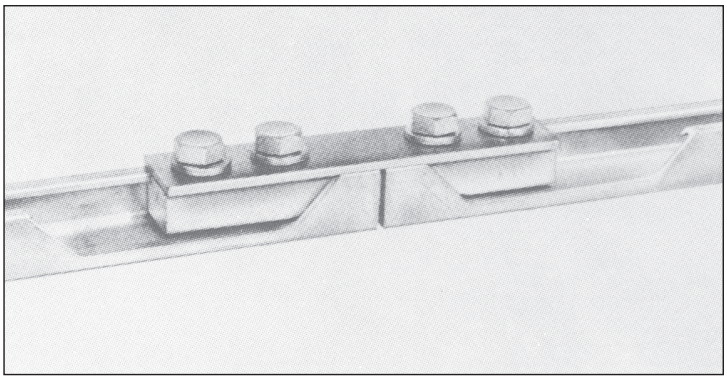
Splice Joint Assembly

The Splice Joint joins the C-Bar Conductor as shown in the cutaway view.

The splice joint assembly is used to join and align adjacent conductor sections. It is easily installed with no drilling required.

The splice joint maintains positive alignment and provides electrical continuity. The two adjacent conductors are solidly clamped between a tongue-like bar and a clamping plate. Four high strength bolts insure a firm mechanical and electrical connection.





System	Splice Joint Catalog No.	Splice Joint Rating*
Aluminum	96945	450
Copper/ Bronze	98361	550
*Based on a 30˚C rise over 40˚C ambient, still air.		

Anchor Assembly

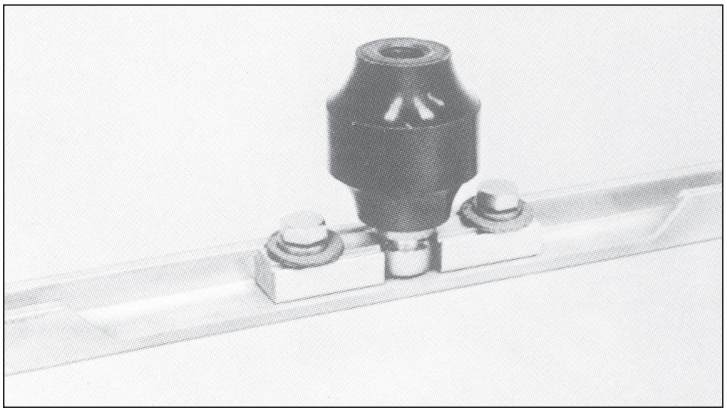
The Anchor Assembly shown in the cutaway view illustrates the mechanical barriers within the C-Bar Conductors which are used in conjunction with an insulated hanger to secure the conductor at some pre-determined point in the system.

Anchors are used in conjunction with Insulated Hangers to restrict the longitudinal movement of the conductors. They prevent creeping of the conductor and unnecessary stressing of the Insulated Hangers throughout the system.

On systems under 200 feet long, anchors are placed at the center of the system.

On systems over 200 feet long, anchors used in conjunction with expansion joints are employed to control the direction of expansion and contraction of conductor sections.

Note: The insulated hanger is not included with the anchor assembly and must be ordered separately.



System	Anchor Catalog Number
Bronze	98752
Aluminum	98746
Copper	98752

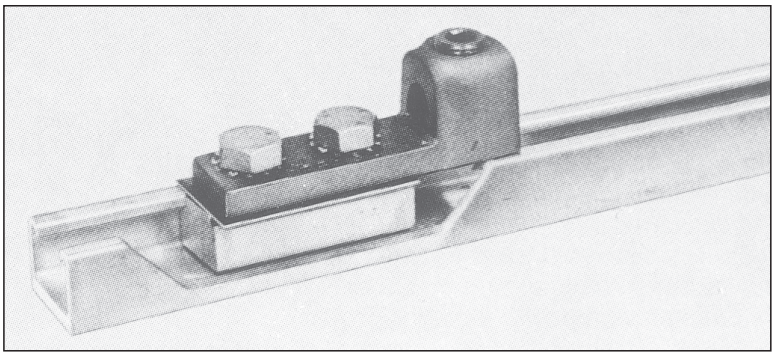
Feeder Assembly

The Feeder Assembly is shown in the cutaway view installed in the C-Bar Conductor.

The Feeder Assembly provides electrical connections to the C-Bar Conductor System.

It may be located at any point in the system, but should be kept at least six (6) inches away from nearest component (hangers, etc.), as contact with these components will prevent free sliding of the conductor during expansion and contraction.

Feeder Assembly includes feeder lug, hardware, and clamping bar.



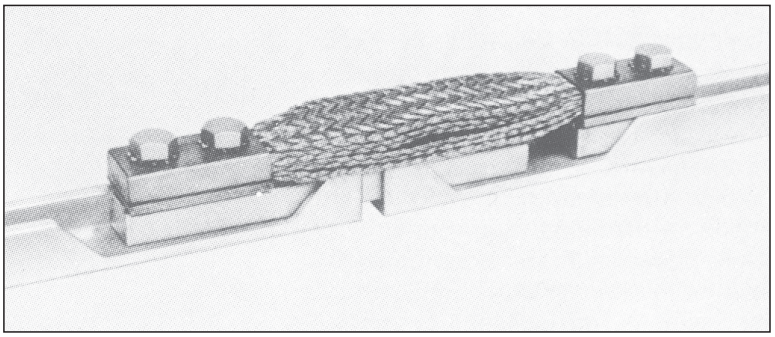
Feeder Wire Size	Feeder Assembly Catalog No. Aluminum, Bronze & Copper Systems
#16 to #14 #12 to #10 #8 Solid to #6 Str. #4 Solid to #1 Str. #2 to 2/0 Str. 1/0 to 4/0 Str. 3/0 to 300 MCM 300 to 500 MCM 500 to 800 MCM	Contact Trans Tech

Expansion Joint Assembly

The Expansion Joint Assembly illustrated in the cutaway view shows how it joins conductors and maintains electrical continuity by means of a flexible copper braided conductor.

The expansion joint, in conjunction with anchors, is used to accommodate the difference in expansion between the conductor and the structure on which the system will be supported.

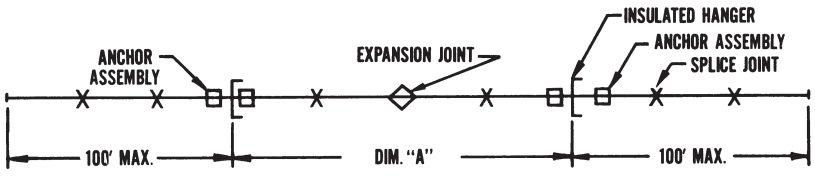
The expansion joint will accommodate a maximum movement of $^{3}/_{4}$". The flexible copper braid carries the current across the gap between conductors.



System	Expansion Joint Cat. No.	Rating*	Dim. "A" Maximum	
			Indoor	Outdoor
Bronze	96059	350	200'	140'
Aluminum	96035	450	150'	100'
Copper	96079	550	200'	140'
*Based on a 30˚C. rise over 40˚C. ambient, still air.				

TYPICAL APPLICATION

NOTE: Conductor gap setting is based on both the ambient temperature at the time of installation and the expected temperature variation to which the system will be exposed.



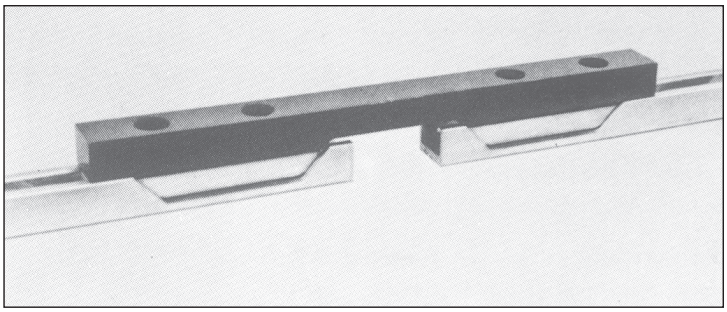
Isolating Joint

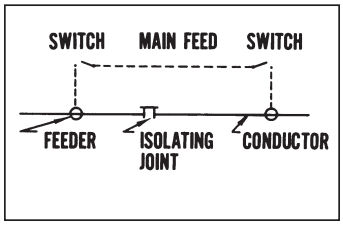
The Isolating Joint is used to insulate adjacent conductor sections from each other without interfering with collector travel. It allows portions of the system to be electrically disconnected while operations continue on other live sections. The air gap between C-Bar Conductors should be 1 1/4" maximum.

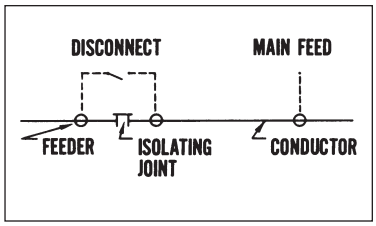
At installations where more than one crane will be operated on a single conductor system, the isolating joint is used to create maintenance and repair bays.

The isolating joint may be inserted at any point along the system in place of a standard splice joint assembly. When properly installed, it assures correct alignment between adjacent conductors.

There are two methods of feeding the conductor system at isolation joints. Each side can be fed individually through adequate safety switches, or the isolation joint can be by-passed with the use of feeder assemblies and a suitable switch.





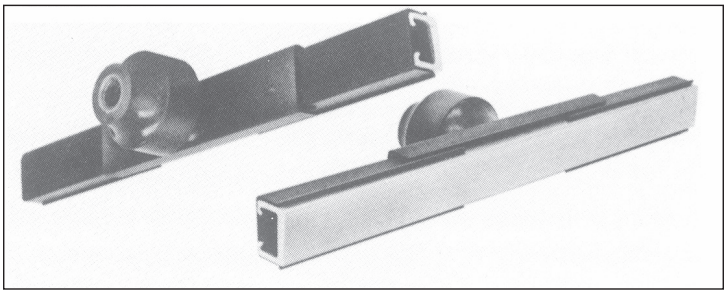


System	Insulating Joint Catalog No.*
Aluminum	9955201
Copper/Bronze	9955202
*Isolating Joint Assembly does not include feeder assemblies or switches, but is complete with hardware .	

Covered C-Bar Conductor System

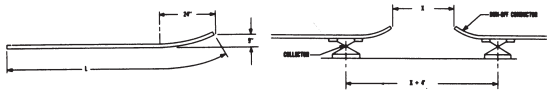
Insulated C-Bar Conductor Systems are available. They provide protection with an extremely tough electrical grade thermoplastic jacket suitable for indoor or outdoor installation.

Conductor sections up to 30 feet in length are furnished assembled with jacket, hangers, or other components required for the particular application. The jacket is red in color for safety purposes and can be removed without disturbing the system.



Run-Off Conductor

Run-off Conductors are used to provide a break in the conductor system where runways are interrupted by railroad crossings, roads, etc.



Two collectors are required to insure continuous operation across the runway interruption. Only cross-arm collectors can be used on systems with run-off conductors.

Power must be supplied to both sides of the runway interruption in a manner similar to that illustrated in the isolating joint wiring diagrams.

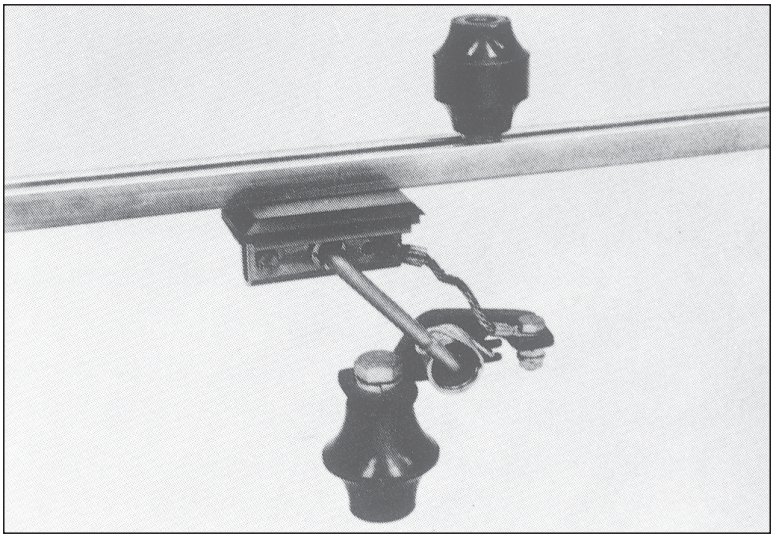
"L" as specified in catalog number is length in feet; hence, a 20 foot aluminum run-off conductor would be 14-00181-20. Fractions of a foot should be avoided.

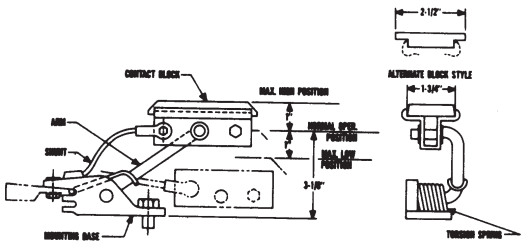
RUN-OFF Conductor			
	Bronze	Aluminum	Copper
Catalog Number	Contact Trans Tech		

Single-Arm Collectors

Single-arm collectors are available for various current ratings, depending on such factors as shoe material, conditions of service, type of installation, etc.

All single-arm collectors listed are identical except for the contact blocks and mounting arrangement. The contact blocks are interchangeable between all collectors. They are quickly removed by loosening two bolts on the assembly. Replaceable contact blocks are listed separately. Contact shoe pressure is controlled by adjusting the spring location in the slots of the collector base. Power connection (by customer) is to be made at shunt connection on mounting base. Mounting insulators or insulated mounting boards are not included with the collector assembly and must be ordered separately.





Collector Cat. No.	Conductor System	Current Rating** 40˚C. Ambient			Inches		Contact Block Material	Contact Block Cat. No.
		30˚C. Rise	40˚C. Rise	50˚C. Rise	A min.	B		
99389-01	Bronze Aluminum Copper	25 25 30	30 30 35	50 50 60	3	2	Electro-graphitic Carbon*	1 3/4 wide 99412
99389-02	Bronze Aluminum Copper	75 100 125	100 125 150	150 200 250	3	2	Metal graphite	1 3/4 wide 99413
99389-05	Bronze Aluminum Copper	25 25 30	30 30 35	50 50 60	3 1/2	2 1/2	Electro-graphitic Carbon*	2 1/2 wide
99389-06	Bronze Aluminum Copper	75 100 125	100 125 150	150 200 250	3 1/2	2 1/2	Metal graphite	2 1/2 wide 99715

*Indoor System Only.

**The ratings given are based on the average indicated temperature rise over a 40˚C. Ambient in still, but unconfined air. Conductors spaced at 3".

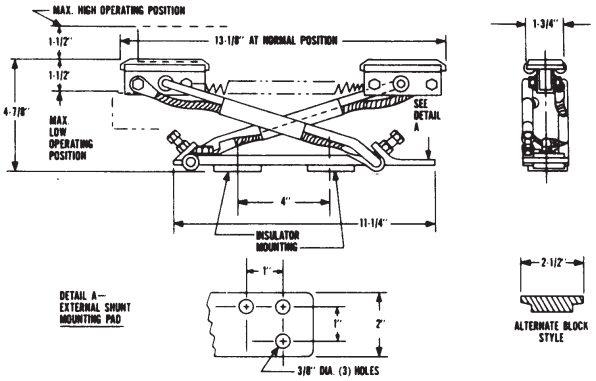
Cross-Arm Collectors

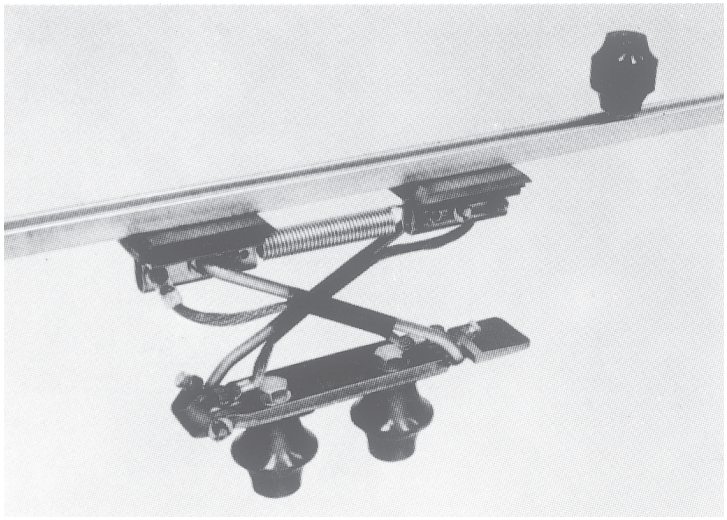
Cross-arm collectors are available for various current ratings, depending on such factors as shoe material, conditions of service, type of installation, etc.

All cross-arm collectors listed are identical except for the contact shoe blocks and mounting arrangement. The contact blocks are interchangeable between all single and cross-arm collectors. They are quickly removed by loosening two bolts on the assembly. Replacement contact blocks are listed separately.

Contact shoe pressure is controlled by spring force adjustment. This is accomplished by relocating the spring in the holes provided in the contact block holder. Adjustable stops are provided to control maximum operating height for run-off applications on interrupted crane runways.

Mounting insulators or insulated mounting boards are not included with the collector assembly and must be ordered separately.





Collector Cat. No.	Conductor System	Current Rating** 40˚C. Ambient			Inches		Contact Block Material	Contact Block Cat. No.
		30˚C. Rise	40˚C. Rise	50˚C. Rise	A min.	B		
99634-01	Bronze Aluminum Copper	50 50 60	60 60 75	100 100 120	3	2	Electro-graphitic Carbon*	1 3/4 wide 99412
99634-02	Bronze Aluminum Copper	175 225 275	200 250 300	350 450 550	3	2	Metal graphite	1 3/4 wide 99413
99634-05	Bronze Aluminum Copper	50 50 60	60 60 75	100 100 120	3 1/2	2 1/2	Electro-graphitic Carbon*	2 1/2 wide
99634-06	Bronze Aluminum Copper	175 225 275	200 250 300	350 450 550	3 1/2	2 1/2	Metal graphite	2 1/2 wide 99715

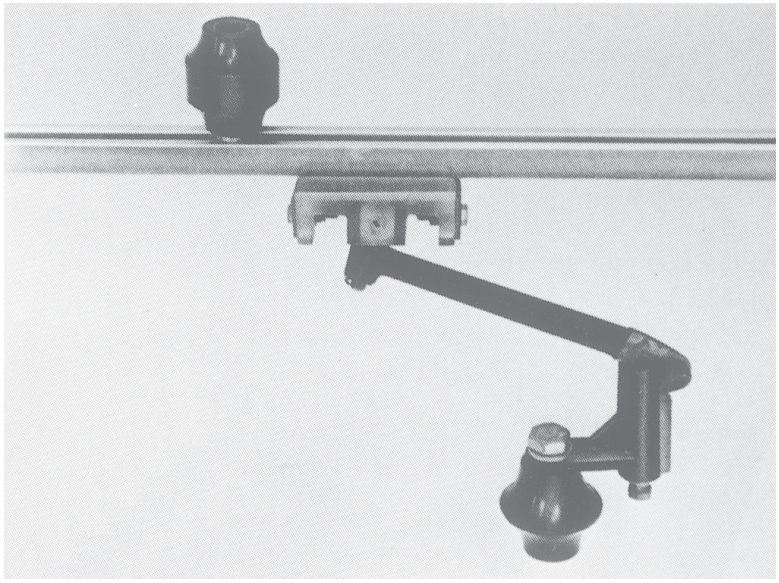
*Indoor System Only.
**The ratings given are based on the average indicated temperature rise over a 40˚C.
Ambient in still, but unconfined air. Conductors spaced at 3".

Tracking Shoe Collector

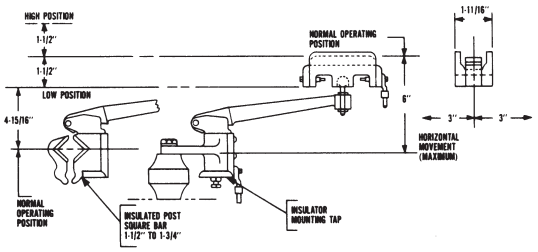
The tracking shoe collectors are recommended for curved rail systems or systems where extreme horizontal misalignment is present. The collectors are not recommended for side running operation.

The contact force is adjustable to meet special operating conditions.

Mounting insulators or insulated mounting boards are not included with the collector assembly and must be ordered separately.

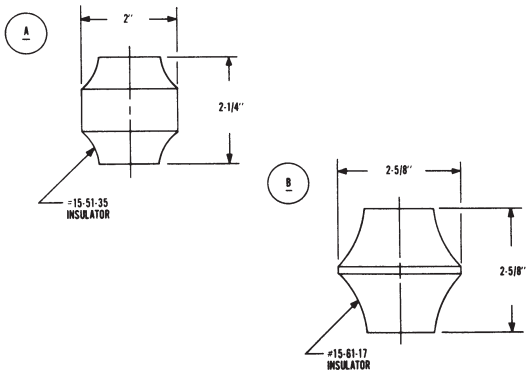


Tracking Shoe Collector



Collector Cat. No.	Conductor System	Current Rating** 40˚C. Ambient			Inches A min.	Contact Block Material	Contact Block Cat. No.
		30˚C. Rise	40˚C. Rise	50˚C. Rise			
105396	Bronze Aluminum Copper	75 100 125	100 125 150	150 200 250	3	Metal Graph-ite	1" wide 105385
**The ratings given are based on the average indicated temperature rise over a 40˚C. Ambient in still, but unconfined air. Conductors spaced at 3".							

Collector Mounting Insulators



Insulator Catalog Number		A Red-Poly #15-51-35	B Red-Poly #15-61-17
Material		Polyester Fiberglass	
Creepage Distance -Inches-		2 1/2"	3
Dielectric Strength KV	Dew-KY Flashover	15	17
	Dry-KV Short-Time	38	40
Tensile Strength — Lbs.		3,500	5,000
Cantilever Strength Inch-Pounds		3,000	4,500

TECHNICAL DATA

CONDUCTOR SIZE CALCULATION

There are two accepted methods of determining the maximum ampere demand of one or more cranes on a single runway.

Method A

Maximum load equals the sum of all main and auxiliary hoist H.P. plus one-half ($^1/_2$) the sum of all bridge motor and trolley H.P.

Method B

Maximum load equals one-half ($^1/_2$) the sum of all motor and accessory H.P.

CALCULATION

Load H.P. (Method A or B) x amperes per H.P. (Table A) = maximum ampere demand.

Maximum ampere demand x crane factor (Table C) = adjusted maximum ampere demand.

VOLTAGE DROP CALCULATION

Symbols

VL = Line Voltage at Feeder (Source).

VD = Voltage Drop.

I = Load Amperes.

L = Effective System Length in Feet. Maximum distance from feeder to end of system.

Roc = D. C. Resistance-ohms/1000 feet.

K = Voltage Drop Multiplier (Table B). A factor derived from tests which accounts for variables such as A. C. resistance, inductive reactance, power factor, phase spacing, and conductor shape factors.

Formulas

Direct Current

$$VD = \frac{ILRoc}{500}$$

Alternating Current - Three Phase
(80 percent Power Factor-Flat Spacing)
VD=I L K (Line to Line*)

*For Line to Neutral Voltage Drop divide by 1.73.

Voltage Regulation

$$\% \text{ Regulation} = \frac{VD}{VL\text{-}VD} \times 100$$

Example

Length of runway, 200 feet, operating on 440 volts, 3 phase, 60 cycle, phase spacing 3 inches, feeder location-center of runway, one crane on runway. By Method "A," the maximum ampere demand would be calculated as follows:

	ACTUAL H.P.	CALCULATED H.P.
Main Hoist	90	90
Auxiliary Hoist	100	100
Bridge	150	75
Trolley	30	15
		Total 280 H.P.

From Table A multiplier is 1.5. 1.5 x 280 H.P. = 420 maximum ampere demand. Based on a 30˚C rise over 40˚C ambient, you could select the 450 aluminum C-Bar series for this application.

From Table B, the 450 Series with a 3 inch phase spacing has a K multiplier of 115.6 x 10˚ - therefore:

VD (Voltage Drop) = 1 x L x K

VD = 420 x 100 x (115.6) (10^{-6})

= 4.86 volts

$$\% \text{ Regulation} = \frac{VD}{VL\text{-}VD} \times 100$$

$$\text{Regulation} = \frac{4.86}{440\text{-}4.86} \times 100 = 1.12\%$$

TABLE A
Amperes Per Horsepower Conversion

Current	Voltage	Multiplier*
D.C.	115	8
	230	4
	600	1.6
A.C. (3ø)	110	7.0
	220	3.0
	440	1.5
	550	1.2
	2300	0.25
A.C. (2ø)	110	6.0
	220	2.6
	440	1.3
	550	1.1
	2300	0.21

*Average conversion factors calculated from National Electric Code Full Load Current Motor Charts. Motors built for especially low speeds or high torques may require more running current. In which case, name-plate or design current ratings should be used.

TABLE C
CRANE FACTOR (C^F)

Current	Multiplier*
1	1
2	0.95
3	0.91
4	0.87
5	0.84

*In the event there are two or more cranes operating on the same load side of the feeder, the multiplying factors shown in Table C would be applied to the maximum ampere demand calculated by Method A or B.

TABLE B

C-Bar Conductor Series	"K"-Voltage Loss Multiplier X 10^{-6}										
	Conductor Phase Spacing — Inches										
	3	3 1/2	4	4 1/2	5	5 1/2	6	7	8	9	10
Bronze 350	191.5	193.1	194.9	196.1	198.5	200.6	205.4	206.4	210.0	212.3	215.4
Aluminum 450	115.6	119.0	122.6	124.8	127.2	129.6	132.2	135.8	139.0	142.0	144.6
Copper 550	90.4	93.6	96.4	98.9	101.4	103.8	106.0	109.6	112.4	114.9	116.2

Expansion Gap Setting Guide

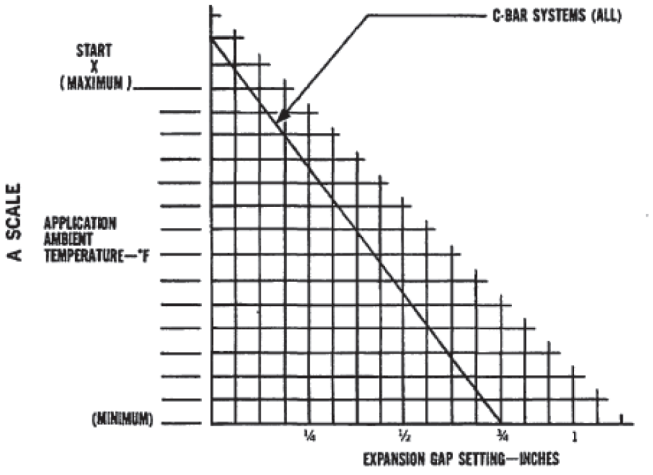
The following chart is provided as a means of determining the initial expansion gap setting, depending upon application ambient conditions.

The chart should be used according to the following procedure:

(a) Determine local ambient temperature range. Example -20 to 100°F.

(b) Starting at point X on A scale, write in the ambient range starting at highest expected ambient and decrease in 10 degree increments to the lowest expected ambient.

(c) Determine ambient temperature at time of gap setting. From the existing ambient temperature, A scale, read across to the curve and down to the gap setting. Adjust conductor accordingly.



TYPICAL SPECIFICATIONS

System - General

Each system shall consist of necessary conductor sections, hanger supports, insulators, anchor supports, expansion joints, joint plates and collectors, as determined from plans and specifications. All component parts shall be of standardized design and fully interchangeable. Engagement of the conductor with all other components of the system shall be effected without drilling, welding, or alteration of the conductor and associated components.

The conductor system shall be of the C-Bar type as manufactured by Trans Tech.

Conductors

The current carrying conductors shall be made of (bronze) (aluminum) (copper) and shall have a continuous current carrying capacity of (350)(450) (550) amperes per rail based on a 30°C rise over a 40°C ambient. The conductors shall have sufficient thermal capacity to sustain a 300% overload for intermittent duty loads. The conductor section shall be a one-piece (bronze) (aluminum) (copper) conductor of uniform extruded cross-section so as to present a smooth, flat surface for current collection. The conductor shall have a minimum cross-sectional area of 355 MCM (bronze), 457 MCM (aluminum), 355 MCM (copper), and shall be of box-like configuration for mechanical rigidity.

The complete rail system shall consist of standard conductor lengths aligned in end-to-end relationship. Aligning and joining means between conductor section shall be accomplished by a special extruded bar which shall engage the conductor sections and provide an interlocking key to eliminate misaligned meeting ends of adjoining rail sections. The conductor shall have a current collection surface one (1) inch wide.

Insulating Hangers

The conductor hanger shall support the conductor section, and shall insulate it from the structure to which it is mounted. The insulator shall be molded of fiberglass reinforced polyester material. The insulated hanger shall provide free sliding of the conductor section due to expansion and contraction throughout the system. All insulating hanger hardware shall be $^{5}/_{8}$ - 11 thread size. The hanger design shall be such that it would be possible to turn the conductor 360 degrees about the vertical axis.

Splice Joints and Expansion Joints

Splice and expansion joints shall be provided to join adjacent conductor sections as required. The joints shall consist of special extruded bars which slip inside the conductor to provide an interlocking key to eliminate misalignment. In the standard joint assembly, the adjacent conductor sections shall be rigidly connected. In the expansion joint assemblies, the joint shall include a conductive flexible braid. All components shall be of sufficient size and electrical capacity to be compatible with the conductor rating. All joint assemblies shall have an electrical efficiency of greater than one hundred (100) percent.

Collectors

Collectors shall be rated on the basis of a 30°C rise over a 40°C ambient. The collectors shall have sufficient overload capacity to carry 300% of the rated current for starting and surge loads.

All collector assemblies shall be constructed of high quality material and shall be of sufficient size to withstand the abuse of the intended service conditions.

The contact shoes shall consist of a mounting support and interchangeable contact inserts. Contact shoe pressure shall be adjustable. All collector springs shall be cadmium plated. The contact shoes shall be capable of transversing all breaks and expansion gaps smoothly with a minimum of arcing.

Special Components

Isolating joint assemblies can be provided to allow shutdown of portions of the system while operations continue on other sections. The isolating joint assembly shall provide a $1^{1}/_{4}$ inch air gap between conductors, shall maintain positive alignment between them, and shall not hinder the passage of the collector contact shoes across the air gap.

Notes

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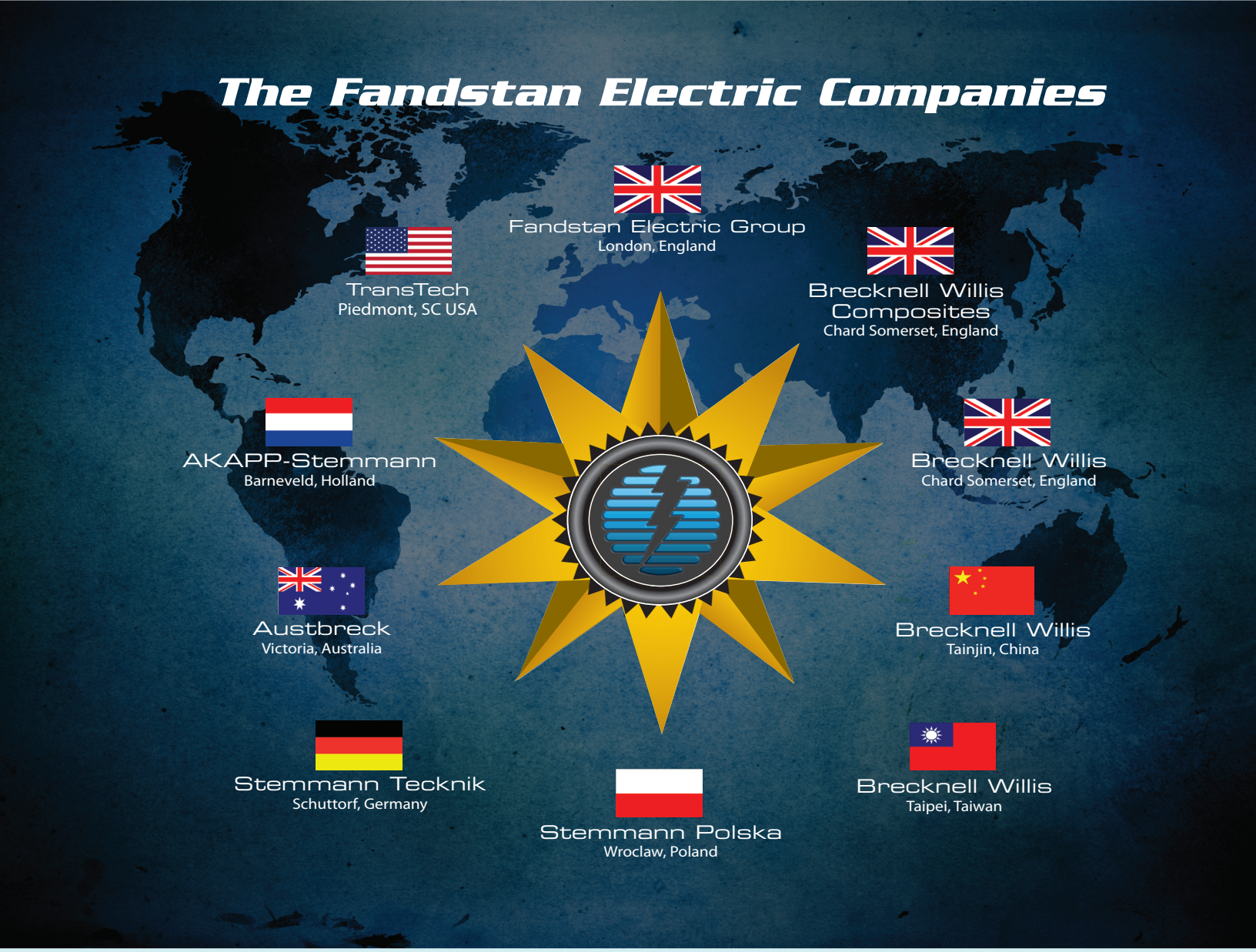

Fandstan Electric Group

The Fandstan Electric Group specializes in engineering solutions for the supply of electrical power and data to moving objects, both linear and rotary. Applications are as wide ranging as public mass transit, mobile cranes, industrial equipment, robots and wind turbines. The Group's Knowledge of the electrical interface is unrivalled. Fandstan is an independent, privately owned, electrical engineering group with major subsidiaries in Europe, America, Asia (including China) and Australia. The Group, which was founded in 1979, has grown both organically and by acquisition and now employs over 700 people, manufactures across four continents and sells throughout the world. The global positioning of the companies within the Group enables Fandstan Electric to supply close support to the customer and operator.

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POWER TRANSFER SYSTEMS

The Leaders In Power Transfer Technology

TransTech is a subsidiary of Fandstan Electric, a global group of companies focusing on energy transfer systems with installations in over 100 countries. Working synergistically with our European sister companies such as Brecknell-Willis, Stemmann and AKAPP, we are able to leverage a broad product portfolio and a wealth of technical expertise. Our goal is to better serve our power transfer markets by continuing to provide solutions that improve product life, performance, and reliability.

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