SUMITOMO ELECTRIC INDUSTRIES, LTD.

[Head Office]

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Room 2624-2637, Sun Hung Kai Centre, 30 Harbour Road,
Wanchai, Hong Kong.
Tel : +(852)-2576-0080 Fax : +(852)-2576-6412

Sumitomo Electric Europe Ltd.
Unit 220 Centennial Park, Elstree Hertfordshire WD6 3SL United Kingdom
Tel : +(44)-208-953-8118 Fax : +(44)-208-953-8228

Sumitomo Electric USA., Inc. New York Office
360 Lexington Ave., 24th Floor
New York, NY 10017-6502
Tel : +(1)-212-490-6610 Fax : +(1)-212-490-6620

Sumitomo Electric Industries, Ltd. Middle East Office
Dubai Airport Free Zone, Bldg. 4WA, Office 702 P.O. Box 54890, Dubai, UAE
Tel : +(971)-4-701-7338 Fax : +(971)-4-701-7342

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P.O. BOX 3121, Safat 13032, Kuwait
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Sumitomo Electric Asia Pacific Pte. Ltd.
Creative Resource 31 International Business Park
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B.B.Bldg. 15F, 54 Sukhumvit 21 Road, Soi Asoke, North Klongtoey,
Wattana, Bangkok 10110, Thailand
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SEI (Philippines) Incorporated
5F, King's Court 1 Building, 2129 Chino Roces Ave.,
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http://global-sei.com

No.ED01 2016.07

SUMITOMO ELECTRIC

Product and Service for Extra High Voltage System

SUMITOMO ELECTRIC GROUP

Sumitomo Electric Industries, Ltd.

Leading Manufacturer of High Voltage Power Cable and Overhead Conductor

Since the founding of Sumitomo Electric Industries, Ltd. (SEI) in 1897 with copper wire production, we have developed many new technologies and products through innovative R&D activities based on SEI's manufacturing expertise for electric wires and power cables.
Now a Fortune Global 500 company with more than 350 subsidiaries worldwide, we continue to provide a wide variety of products and remain active in support of the rising demanding for sophisticated high voltage applications of cable and wire systems. We are one of the leading manufacturers in the world.

The Sumitomo Spirit

The Sumitomo Spirit grew out of the guiding principles set down by Sumitomo founder Masatomo Sumitomo in his "Monjuin Shiigaki" (the Aphorisms of Monjuin). This corporate spirit has been developed, deepened, and handed down over generations in the Sumitomo Family enterprise, and its essence was distilled in the Rules Governing the Sumitomo family established in 1882, and formulated into two business principles in 1891. Although there were some corrections to the wording, the Business Principles have been inherited with no change in the contents up to now.

- Sumitomo shall achieve prosperity based on solid foundation by placing prime importance on integrity and sound management in the conduct of its business.
- Sumitomo's business interest must always be in harmony with public interest; Sumitomo shall adapt to good times and bad times but will not pursue immoral business.

Total Engineering

Sumitomo Electric Industries

Research and Development

SEI has a research and development center.
We believe that creative research and development is the vehicle for sustained growth.

Design

SEI can propose any kind of cable system according to our customer's needs through our vast experience. We can design any overhead conductor, power cable system, their accessories and construction from the low voltage to the extra high voltage class.

Manufacturing

SEI is Pioneer and World's leading manufacturer for O/H conductor and HV cables up to 800kV. Our products are manufactured in four major works in Japan and overseas works in Saudi Arabia and India etc.

Construction

You can choose whatever type of cable construction method you need from SEI. We are the well-experienced FTK contractor from design to installation.

Product Lineup

SUPPLY RECORD

Prestigious Acclaim and Trust Surrounds SEI throughout the World as the Leader in Power Cable Supply and Development

Our supply record, built upon the base of our highly intensive development capability places us No.1 in the world. Regardless of insulation method, be it Fluid-Filled cable, XLPE cable or overhead wire or nor its location, be it overhead, underground or submarine, we offer and implement products and services tailored to the customers needs and objective. The following are just a few epoch examples from our countless successes and achievements.

Off-loading power cable for transshipment for Lamma Project

Cable installation of DC250kV XLPE cable for Hokkaido-Honshu Project

Loading on cable laying Barge for Russky Project

XLPE Cable Marine

No.	Location	System Voltage (kV)	Conductor Size (mm²)	Cable Length (km)	Installed Year
1	Abu Dhabi Oil / U.A.E.	8	3x80	19	1973
2	Puerto Rico	40	3x1AWG	20	1977
3	Bahrain	66	3x220	10	1977
4	Hong Kong	132	1x2000	6	1989
5	Mexico	34.5	1x300	60	1999
6	Saudi Arabia	69	3x1000KCM	30	2009
7	Hokkaido-Honshu / Japan	DC±250	1x600	45	2010
8	Russky / Russia	220	3x500	9	2011
9	Taiwan / Penghu Island	161	1x630	350	2016
10	Tay loch / Scottland	33	3x50	2	2016
11	San Fransisco / USA	230	1x1400	14	2015
12	TenneT / Germany	155	3x630	16	2016
13	NEMO / England-Belgium	DC±400	1x1100	283	2019

XLPE Cable Land

No.	Location	System Voltage (kV)	Conductor Size (mm²)	Cable Length (km)	Installed Year
14	Pennsylvania Power and Light / U.S.A.	138	1x253	9	1971
15	Nagoya S/S / Japan	275	1x800	0.4	1979
16	Shajiao / China	220	1x1200	9	1984
17	Shimogo Pumped Storage P/S / Japan	500	1x800	0.6	1986
18	Minami Ikegami / Japan	275	1x1400	5	1986
19	Beijing / China	220	1x630	9	1991
20	Koyna Hydro P/S / India	420	1x800	7	1997
21	Tin Wan / Hong Kong	275	1x400	0.3	1997
22	Nanjing / China	220	1x800	45	1999
23	Shin Keiyo Toyosu Line / Japan	500	1x2500	119	2000
24	LADWP / U.S.A.	230	1x2500KCM	26	2001
25	Mississipi River Crossing / U.S.A.	230	2500	10	2004
26	Abu Dhabi / U.A.E.	400	1x2500	18	2009
27	Doha / Qatar	400	1x2500	67	2009
28	VCCT / Canada	242	1x1600, 2000	24	2012
29	Wolf Bay Crossing / U.S.A.	115	2500	8	2013
30	TransGrid / Australia	330	2000	108	2013
31	GECOL / Libya	245	1x1000, 1200	103	2013

Fluid-filled Cable Marine

No.	Location	System Voltage (kV)	Conductor Size (mm²)	Cable Length(km)	Installed Year
32	Sydney / Australia	132	1x225	30	1961
33	Grand CouleeDam / U.S.A.	525	1x1267	20	1977
34	Lamma Island / Hong Kong	275	1x1300	38	1981
35	Lantau Island / Hong Kong	132	3x630	8	1991
36	Hokkaido-Honshu / Japan	DC±250	1x600	62	1992
37	Leyte-Luzon / Philippines	DC±350	1x1000	22	1994
38	Kii Channel / Japan	DC±500	1x3000	98	1998
39	Leyte-Cebu / Philippines	230	1x630	70	2005
40	Vancouver / Canada	242	1x1600	49	2008
41	Lamma Island / Hong Kong	275	1x1300	38	2008
42	Xiamen / China	220	1x2500	12	2009

Fluid-filled Cable Land

No.	Location	System Voltage (kV)	Conductor Size (mm²)	Cable Length(km)	Installed Year
43	Sydney / Australia	330	1x1200	60	1979
44	Maracaibo / Venezuela	230	1x830	29	1979
45	Honshu-Shikoku / Japan	500	1x2500	23.9	1987
46	Hydro Quebec / Canada	DC±500	1x1400	31	1991
47	Hydro Quebec / Canada	800	1x2000	0.1	1993
48	Hong Kong	275	1x1100	37	1993
49	PG / Singapore	400	1x2000	3.2	1997
50	MEW / Kuwait	132	1x630	250	2000
51	Sydney / Australia	330	1x1600	84	2002
52	Singapore	400	1x2500	40	2009
53	MEW / Kuwait	300	1x1600	47	2012

O/H Conductor Supply Up to December, 2015

•HTLS (High Temp. Low Sag) Conductor

Supplied Area	Size (mm²)	Supplied Year	Length (km)
○ Gap type Conductor	150 ~ 1019	1971 ~	27,455
◎ Invar type Conductor	79 ~ 610	1981 ~	8,499
Total			35,954

•Low Loss type Conductor

Supplied Area	Size (mm²)	Supplied Year	Length (km)
Domestic	70 ~ 1160	1982 ~	13,377
◉ Overseas	230 ~ 550	2012~	1,286
Total			14,663

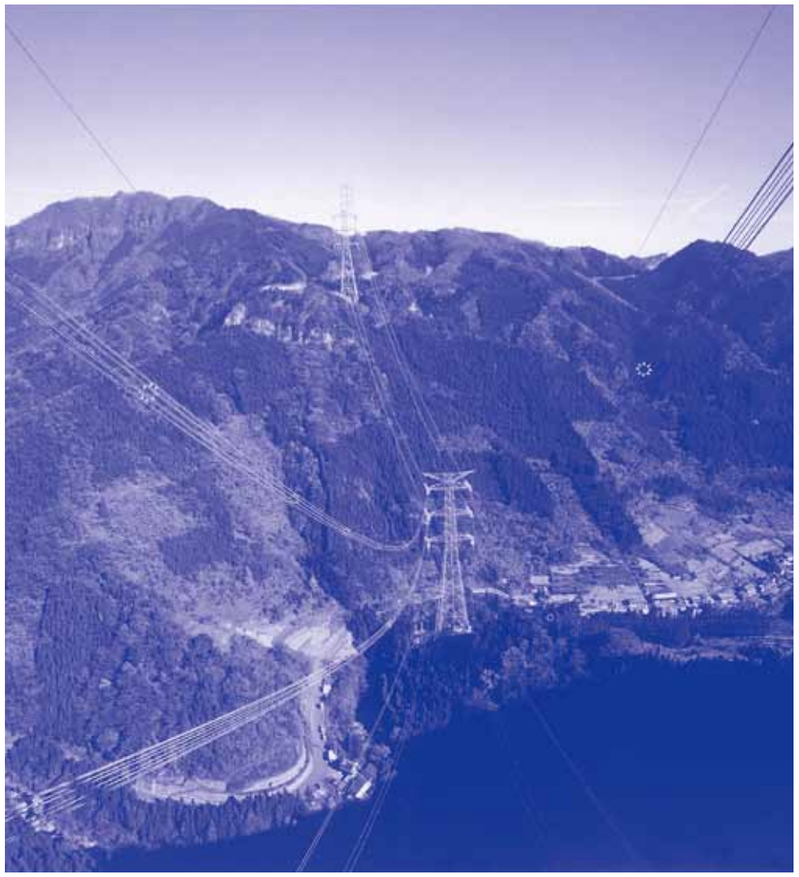
•OPGW

Supplied Area	Size (mm²)	Supplied Year	Length (km)
Domestic	50 ~ 500	1982 ~	19,050
Overseas	42 ~ 350	1983 ~	17,761
Total			36,811

Overhead Aluminum Conductor & Wire

For the Advancement and Prosperity of a Society Utilizing High Level Technology

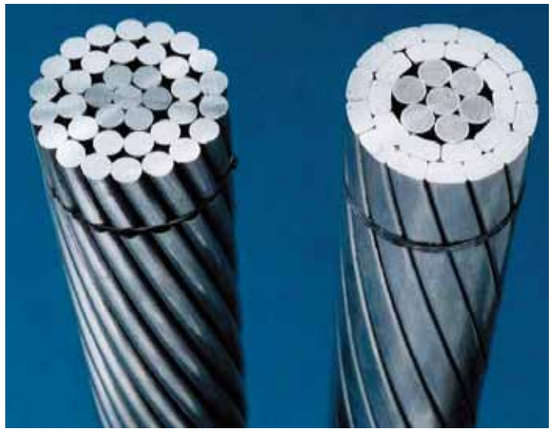
GTACSR (Gap Type Conductor) and ZTACIR (INVAR Conductor) are unique conductors to up-rate existing transmission lines' capacity with similar sag by simply replacing the existing ACSR.
To cope with new challenges, such as harmony with the environment and application for telecommunication in several transmission line project, NS-TACSR (Noise-suppressed conductor), OPGW (Composite fiber optic overhead ground wire) and LL-ACSR/AS (Low Loss conductor) have been developed.
LL-ACSR/AS can reduce transmission losses by roughly 25% compared to conventional ACSR. Transmission lines adopting LL-ACSR/AS can operate more efficiently, reducing the need of electricity from fossil-fuel power stations.
AS wires (Aluminum-clad Steel wires) have been used for conventional ground wire, component wire of OPGW or as the core wire of LL-ACSR/AS conductor.



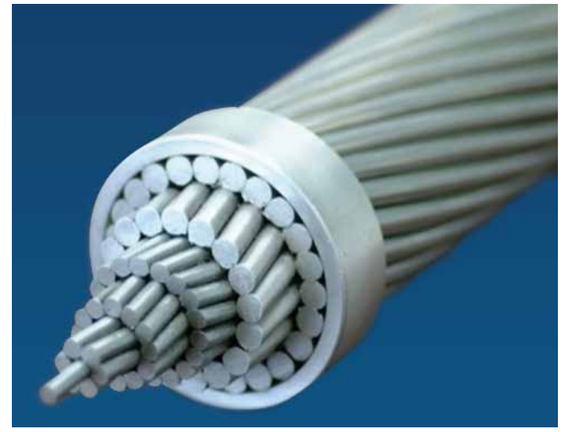
500kV transmission line using Aeolian noise suppressed conductor (NS-TACSR)

Channel Crossing Long Span Application

Wind tunnel facility to develop Aeolian noise suppressed conductor



INVAR Conductor



High Strength conductor for Long Span Crossing

Composite fiber optic overhead ground wire (OPGW)

Corona Cage
(Corona Noise Observation)

Typical View of Compression Type Dead End Clamps

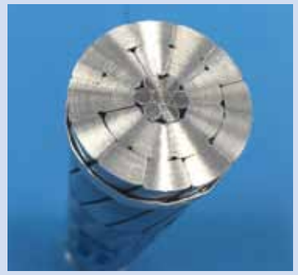
AS Wire

Gap Type Conductor (Low Sag Up-rating Conductor)

Unique Technology

The Development of Unique Conductors to Satisfy Various Needs.

In collaboration with Japanese electrical power companies, SEI and JPS have continuously developed wide variety of unique new technologies and products, such as Aluminum-clad steel wire (AS wire), OPGW, ACSR/AS, NS-TACSR, GTACSR or ZTACIR, LL-ACSR/AS and built a reputation as a pioneer and leading manufacturer in the overhead conductor industry.
SEI will create new products that will provide society with solutions which not only assure a stable energy supply but are also better for the environment.



11 Low Loss Conductor
(Reduce Transmission Loss)

Subsea Cable

The Leading Company for Extra High Voltage Submarine Cable & Mass-Impregnated Cable

SEI is capable of providing comprehensive services from production to installation of submarine cables, contributing to power transmission infrastructure development in Japan and throughout the world. Likewise in the field of submarine cables, since having installed the worlds longest submarine cable at that time of 21km in 1921, we have to date manufactured and installed over 5,850km* of submarine cables.

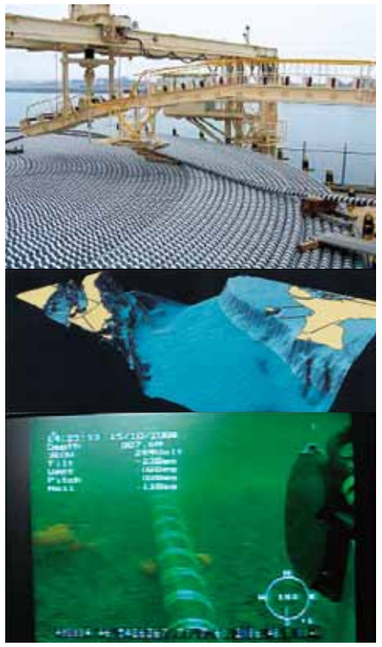
In addition to XLPE cable, SEI can supply MI (Mass Impregnated Paper Insulated Cable) and SCFF submarine cable. This new technology of using PPLP MI enables us to bring further capability into cable market whereby longer distance and larger power transmission is made possible. This is because oil feeding equipment which is mandatory for fluid filled cable systems is not needed and higher temperature operation is allowed than conventional MI.

* Combined records of JPS, SEI and HCL as of 2015

15kV 3core semi-wet type submarine cable

Unloading of MV submarine cable for oil platform

・Loading onto the DP Cable laying Barge "KAIYO" (by courtesy of Nippon Salvage)
・It was the first shipment only one month after Tsunami hit by the Great East Japan Earthquake in 2011
*230kV 3core submarine cable for Russky Is



Submarine cable in deep sea by ROV in Vancouver Is

Submarine cable installation under high tidal current by DP-II vessel "Ndurance" in Bali Straight (by courtesy of VBMS)

Three cable simultaneous laying and embedding by water jet plow in Hong Kong

Unique Technology

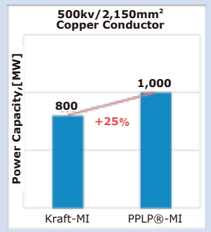
The Development of PPLP and 800kV Extra High Voltage Cable.

Realizing the achievement of 800kV-class PPLP Fluid-Filled cable was a great technological milestone. The incorporation of our innovative PPLP expertise into mass-impregnated (MI) cable development is our vision having mindset to attain higher power transmission capacity.
The utilization of PPLP-MI cable offers significant advantages over conventional MI in super length power transmission of HVDC for better cost and capacity performance.

Projects

Mass-Production for HVDC 500kV Kraft-MI for subsea cable project between Italy-Montenegro was commenced in 2014 (Press release). The aspiration towards greater achievements inspired us to forge ahead with the completion of PPLP®-MI development for higher power capacity.

PPLP-MI cable



Typical capacity increment

XLPE Cable (AC and DC)

Sophisticated Technical Knowhow from Accessories to Installation Engineering

XLPE cable is now dominant in new transmission lines for both land and submarine applications. Utilizing the broad base in technological and product development knowhow accumulated from the first pioneering steps in this field way back in the 1960's, SEI has been leading extra high voltage XLPE cable development including DC application. In 2000, we commissioned the world's first long distance 500kV AC XLPE cable system and in 2009 we successfully put into commercial operation the world first 250kV HVDC XLPE cable system in Hokkaido-Honshu Link.
SEI provides full support towards its customers on "Full Turn Key" basis by providing high technology products, its related accessories and facilities from design, development and manufacturing right through to installation planning and implementation. SEI has consistently provided prime quality and efficient engineering in diversified arenas such as underground, submarine and bridge crossings.

VCV tower in Osaka Works

Series resonance type 2,100kV A.C. voltage generator in UHV testing hall

500kV 1x1,400 mm² XLPE cable installed in Imaichi P/S in 1987

±250kV 1 x 600mm² DC-XLPE submarine cable, installed for Hokkaido - Honshu Line in 2012

500kV XLPE cable installation work in Shinkeiyo Toyosu Line in 1996

Cable installation of DC250kV XLPE cable in Hokkaido

77kV XLPE cable installed on the world's longest bridge in 1998

Direct burial cable installation work in Singapore

Vertical snaking for EHV XLPE cable in tunnel

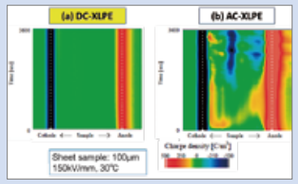
400kV 1 x 1100mm² DC XLPE submarine cable to be installed for NEMO link project

Unique Technology

The Development of HVDC Cable

We developed DC-XLPE insulation material with the best performance. This material enables DC 400kV transmission operation with smaller conductor even under the polarity reversal condition.
In-house made compound with well dispersed special filler can eliminate harmful space charge accumulation such that ultra-high electrical resistivity can be achieved for stable and reliable operation of HVDC cable system.
DC 525kV system is now under development.

DC 400kV XLPE cable (for 1GW bipole LCC & VSC System)



Space charge accumulation measured by PEA method (comparison with conventional (AC) XLPE)

Power Cable Accessories

Reliable Products Assuring Complete and Timely Execution

XLPE cables accessories require advanced technology and expertise in its designing and manufacturing processes. SEI has high capability in this area, developed over a long number of years to provide our customers a complete supply of related accessories required for the installation of power cables. The prefabricated or premolded products developed from the expertise cultivated through our experience of power cables and its installation, enables the elimination/reduction of fabrication time at the site thus contributing to smooth and shorter execution in the field. Quality is also perfected by the strict inspection applied to every product before each delivery. Through the supply of these quality accessories, in conjunction with the quality cables and engineering/ supervision services provided to our customers, we have become a premier provider of EHV systems.

Installed outdoor sealing end

Sealing end for SF6 switchgear in accordance with IEC 62271, 60840, 62067

Outdoor sealing end (Premolded type)

Premolded one-piece type joint (named SPJ)

Y-branch joint for XLPE and FF cable

Prefabricated composite type joint

Power Line Monitoring System

SEI Supplies Total Solution for High Voltage Power Lines

SEI has been developing Monitoring and Sensing Systems for high voltage power line system based on fiber-optic and the latest software technology. They have improved reliability of facilities and contributed modernized maintenance work. SEI intends to go on advancing these systems and assuring our customer's satisfaction.

CT (Current Transformer) Sensor for Fault Locating System

Controllable camera for monitoring overhead lines

Weather Observation System

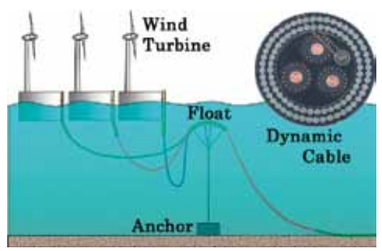
Cable temperature monitoring by Fiber-Optic Sensor

Fiber-Optic Distributed Temperature Sensing System (OPTHERMO®) for power, oil and other industries

Research & Development

Keeping apace with these times of increasing global energy needs and environmental awareness, we are actively developing new products and systems to include advanced materials such as ecological and recyclable materials. We are also endeavouring to improve the characteristics and reliability of energy transmission and distribution systems so that a more stable supply of electricity may be ensured for future needs whilst respecting an environment in the 21st century. New products include large-capacity transmission cables and lines, low loss power cables, high-efficiency transmission systems, and various maintenance systems to support these infrastructures.

Electrical test laboratory at SEI's factory



Application of dynamic cable for floating wind turbine

Tensile bending test (CIGRE test)

FTIR (Fourier Transform Infrared Spectroscopy) Analysis System, to investigate the new insulation material

DC±500kV extruded submarine cable

Corporate Data

Company Name :		Sumitomo Electric Industries, Ltd.
Head Office :		4-5-33, Kitahama, Chuo-ku, Osaka, Japan
Established :		April 1897
Business	Manufacture and sales of products related to :	automotive, electronics, info communications, industrial materials, and environment & energy
Capital Stock :		99,737 million yen
Net Sales	Consolidated :	2,933,089 million yen
	Non-Consolidated :	928,976 million yen
Employees	Consolidated :	240,865
	Non-Consolidated :	4,984
President :		Masayoshi Matsumoto

(as of 31 March, 2016)

*Sumitomo Electric Industries, Ltd. and Hitachi Cable has established J-Power Systems (JPS) as joint venture in 2001. In 2014, JPS has become 100% subsidiary of SEI and this year most of the divisions, except for manufacturing division of JPS have been transferred to SEI. JPS functions now as a manufacturer are for manufacturing of cable and accessories under the name of SEI.

Organization

**Sumitomo Electric Industries, Ltd.
Organizational Chart of Power Cable business
as of 24th June, 2016**

- **Sumitomo Electric Industries, Ltd.**
  - **Social Infrastructure Sales & Marketing Unit**
    - Power Projects Business Div.
  - **Electric Wire & Cable Energy Business Unit**
    - New Energy Project Promotion Office
    - Safety & Environment Management Dept.
    - Plant Engineering Dept.
    - Quality Assurance Dept.
    - Technology Development Dept.
    - Planning & Administrative Dept.
    - Global Power Cable Project Engineering Division
    - Power Cable Division
    - Power Cable Accessories Division
    - Power Cable Engineering & Construction Division
    - Overhead Transmission Line Division
    - Industrial Wire & Cable Division

Manufacturing Affiliates

[Domestic]

■Toyoura Works
4-10-1 Kawajiri-cho,Hitachi-shi, Ibaraki 319-1411, JAPAN
Product : ACSR and OPGW, and monitor control system for power lines.

■Hitaka Works
5-1-1 Hitaka-cho, Hitachi-shi, Ibaraki 319-1414, JAPAN
Product : XLPE cables, power distribution wires and cables, power transmission and distribution accessories, and Fluid-Filled cables.

■Minato Works
4-5862-2 Kuji-cho, Hitachi-shi, Ibaraki 319-1222, JAPAN
Product : Submarine Cable

■Osaka Works
1-1-3 Shimaya, Konohana-ku, Osaka 554-0024, JAPAN
Product : Submarine cables, Fluid-Filled cables, XLPE cables, power distribution wires and cables, and power transmission and distribution cable accessories.

[Abroad]

■FINOLEX J-POWER SYSTEMS LTD.
26-27, Mumbai-Pune Road,
Pimpri, Pune - 411018, India
Product : Land Cable

■J-Power Systems Cable Accessories (Shanghai) Corp.
No. 546, Xinyu Road, No.2 Plant, Songjiang District,
Shanghai, China
Product : Cable Accessories

■J-Power Systems Saudi Co., Ltd.
5th Floor, Eastern Cement Tower, Khobar, King A. Aziz St.
P.O. Box 519, Al khobar 31952 Saudi Arabia
Product : Submarine Cable

■High Voltage Systems and Solutions LLC
1st Floor, Ducab HV, Jebel Ali, PO Box 683, Dubai, UAE
Product : Engineering Service