



Dow Wire & Cable

Global High Voltage Solutions



Global market challenges and opportunities

Whatever the challenge or opportunity, Dow Wire & Cable offers innovative global solutions for current and next-generation high voltage (HV) wire and cable products -- 66-170 kV, as defined by International Electromechanical Commission (IEC) standards. Our materials exhibit mechanical strength, flexibility, electrical properties and aging stability, and continue to set HV industry standards worldwide for cleanliness, consistency, reliability and overall quality.

Dow Wire & Cable technical support extends from formulation through fabrication. We work extensively with global testing institutions and end users to understand how best to support cable manufacturers, power generation sources, utilities and the communities they serve with the expertise and materials to build, replace or refurbish reliable HV power delivery systems.

Our solutions for HV cables are predominantly used for power transmission systems. This complements the Dow Wire & Cable medium and low voltage solutions for power distribution, and our halogen-free flame retardant solutions, which are used in power consumption.

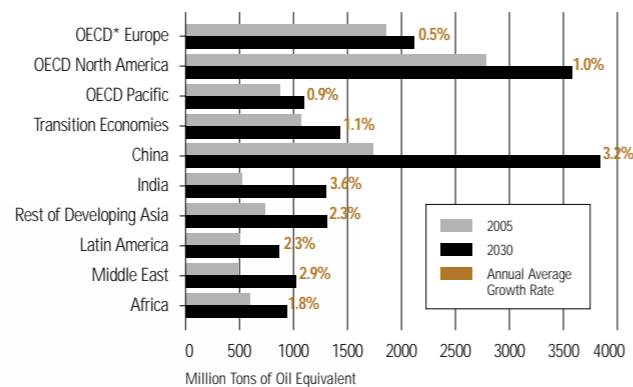
Key drivers of global HV power demand

Several issues now lead the demand for quality HV power cables:

- Growth in global electricity consumption
- Replacement, refurbishment and building of new transmission networks
- Need for interconnection of rural, urban, regional and country power grids to ensure security, reliability and longevity of power supply
- Growth of underground (UG) cable installation versus overhead lines (OHL) due to rights of way, natural obstacles, weather threats, installer/consumer safety and aesthetics

Potential impact of energy use trends in developing markets

Primary Energy Demand by Region



Growth in power demand is driven by gross domestic product in developing and established geographies.



Global advancements in HV power delivery systems

The Route to Long-life Cables

It's becoming standard practice to evaluate the total cost of a new system, including installation, testing and energizing costs, rather than simply making system-wide decisions based only on the cost of cables. Future costs, those that are incurred after installation, are also becoming important considerations and can include:

- Operation costs
- Replacement costs
- Other costs associated with premature failures
- Costs associated with loss of service (revenue, intangibles, etc.)

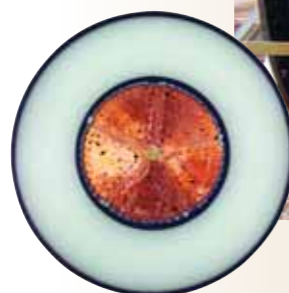
UG power cable materials demonstrate history of success, longevity

For HV power transmission, UG cables are an ideal solution to support the efficient and reliable transmission of power across:

- *Densely populated urban areas*
- *Rivers and other natural obstacles*
- *Areas where land is unavailable or planning consent is difficult for OHL*
- *Land with outstanding natural or environmental heritage*
- *Land with value that must be maintained for future urban expansion*

Increasingly, UG cables are being recognized for technical advantages and consistent performance, including:

- *30 percent lower power loss, partly attributed to the use of copper vs. aluminum*
- *Increased protection against external factors such as weather, vandalism, theft, etc.*
- *Lower visual impact, which increases value of surrounding regions vs. OHL*
- *Smaller right of way (require only narrow band of land for installation) and faster approval of applications for installation*
- *Less emission of electric field or noise*
- *Lower short- and long-term maintenance costs than OHL*



Source: Maillefer Pictures: HongTai

four



five

Dow's global HV commitment

Dow Wire & Cable has the high-purity resins and compounds, quality testing and validation expertise, manufacturing excellence, longevity in the market and industry commitment to provide complete solutions throughout the HV power cable value chain. As a long-term commitment to our global customers, we will continue to develop our product offering and focus our efforts on high quality, high performance and sustainability.

Growth and expansion also is an ongoing part of our focus. Dow Wire & Cable is enlarging its global reach with new and updated manufacturing and R&D facilities as well as increasing the number of industry-experienced personnel in technical service, R&D, marketing and sales.

Along with our industry-dedicated resources, we leverage the resources of The Dow Chemical Company to support customers and cable makers and users who benefit from our collective expertise.

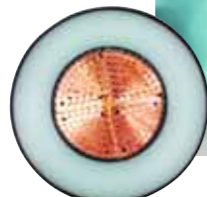
More than a decade of global HV installations

Between 2005 and 2007, more than 19,000 km of cable fabricated with HV materials from Dow Wire & Cable were installed worldwide. For instance, Southwire, one of the USA's largest cable manufacturers, has been installing HV cables made with Dow Wire & Cable materials since 1998. Southwire currently utilizes approximately 1,200 km of operating HV cable in about 12 separate North American projects. Our HV materials have been used in more than 20 projects on four continents since 2000.

Examples of Installations with Dow Wire & Cable HV Materials

Project Location	kV	Installed
Europe (submarine)	400	2006
Far East	500	2008
Persian Gulf	400	2004
Persian Gulf	400	2006
Europe (34 km)	400	1997
USA (submarine, 60 km)	138	2007-8
Europe (submarine, 42 km)	170	2002
USA	245	2008
Far East	345	2008-9
Middle East	220	2004
Middle East	220	2008

Data above represents installation of Dow Wire & Cable's HFDA-0801 HV material.



Source: Maillefer Pictures: Hong Tai

Cleanliness is essential for performance and reliability

HV cables operate at high electrical stress levels and contaminant issues at these levels can cause the cables to fail. It is recommended that you use SC materials in order to ensure the reliable and durable functioning of the cable.

SC materials are produced and tested in a clean-room environment which enables quality control of the raw materials, production process, testing, and packaging. After our SC compound is produced, it is packed, delivered and introduced into the customer's manufacturing operation with the same quality and cleanliness it had when it left Dow Wire & Cable plants.



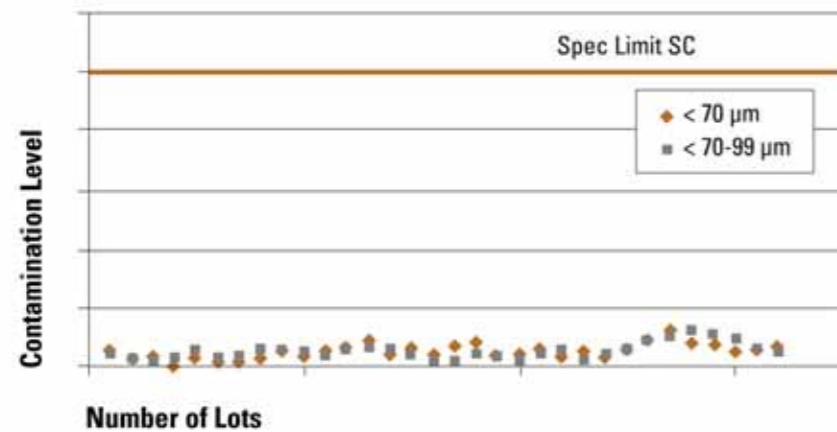
Source: Maillifer Pictures: HongTai



Advanced packaging techniques

Our UNICLEAN™ sealed-system and NUCLEAN™ packaging and delivery processes help maintain maximum cleanliness and fiber-free material handling. For HV materials, big bags and octabins are filled in controlled-environment clean rooms. After leaving the clean rooms, the containers are robotically sealed in preparation for warehousing. The containers are then moved through an automated, enclosed conveyor system to our temperature-controlled warehouse. Our modern packaging and temperature-regulated storage techniques help preserve the maximum shelf life required for dependable use in HV power applications.

HFDK-4201 SC Cleanliness Performance meets IEC 60840

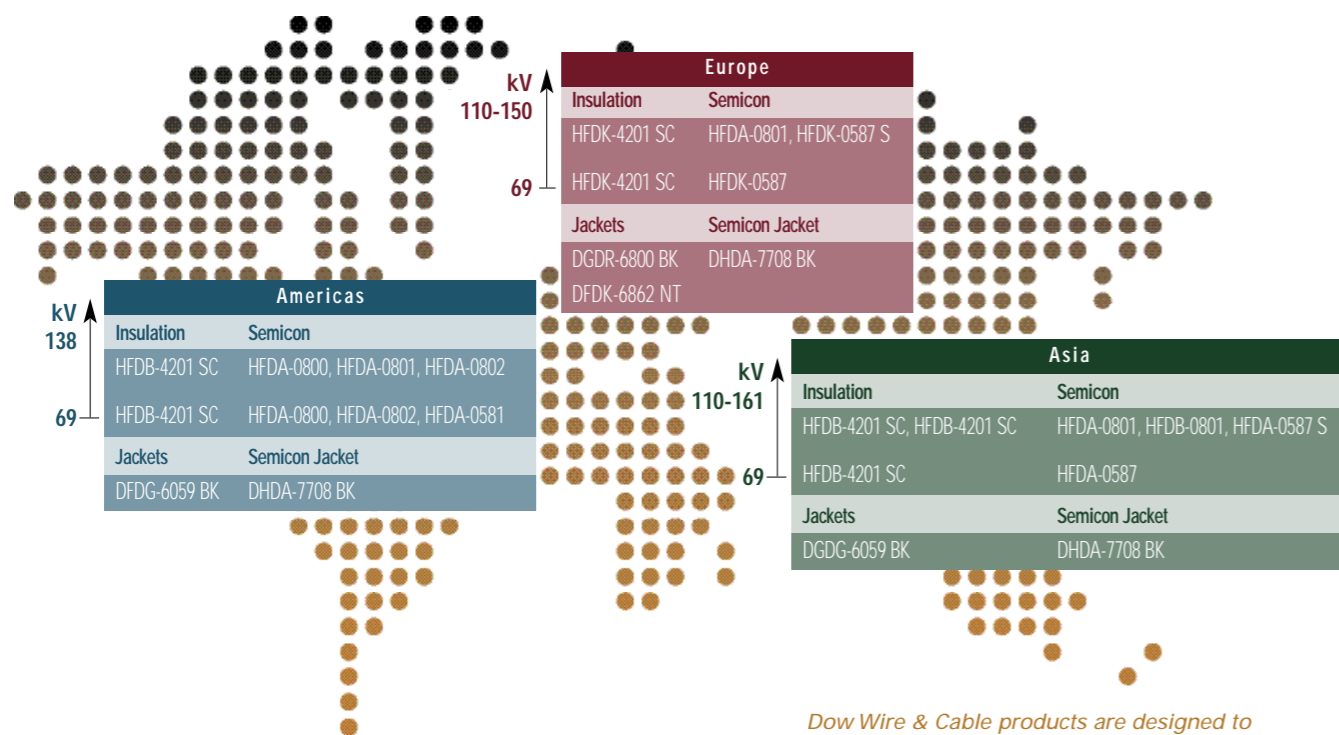


Focused product offerings backed by solid technology

Dow Wire & Cable provides a broad range of insulation, shields and jackets, and a systems approach to ensuring long-life cable performance and reducing total life-cycle costs.

We will help you meet or exceed industry standards at a competitive cost while helping to minimize the risks of cable failure. To achieve this level of performance and reliability, we recommend that you call your Dow Wire & Cable sales representative to discuss how we can help you and your customers succeed.

Dow Wire & Cable Global Product Range for HV Compounds



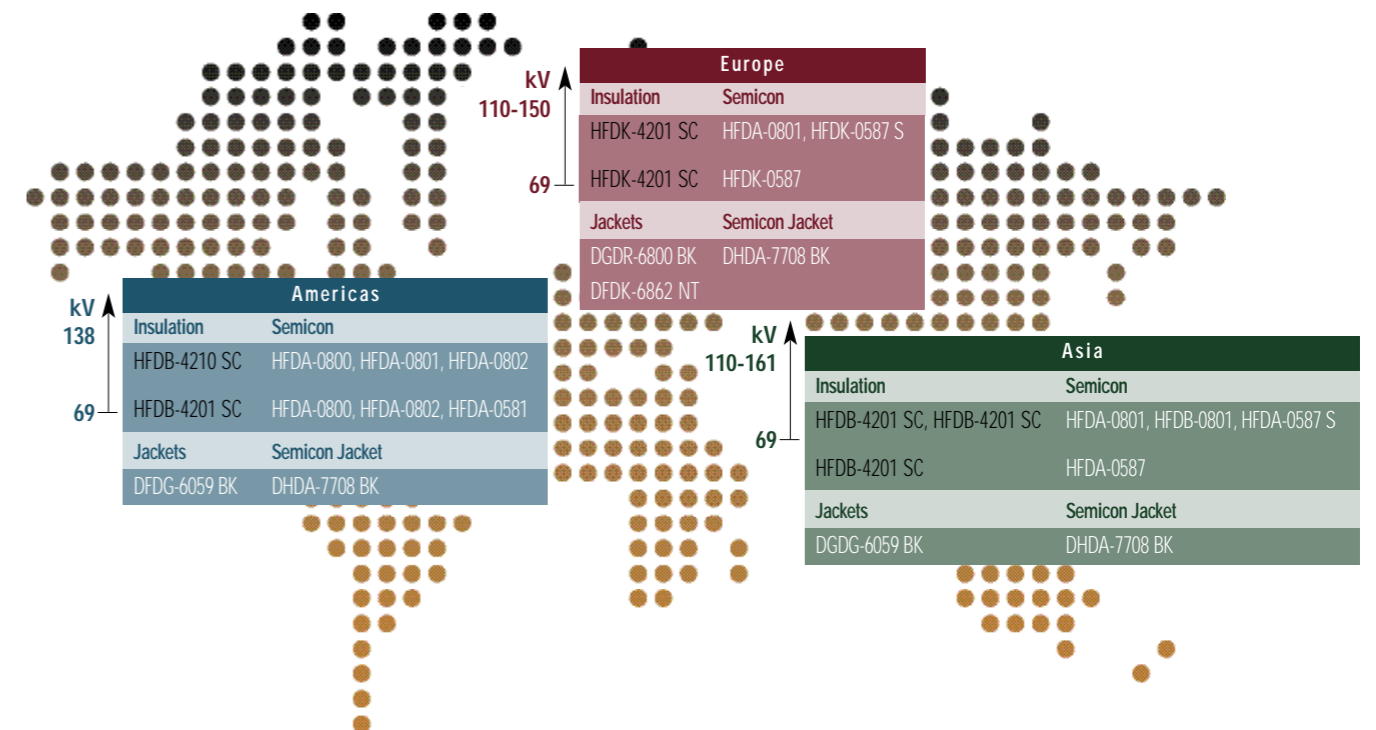
Dow Wire & Cable products are designed to work together, optimizing the performance of each material. Our super-clean (SC) insulation compounds work best when paired with the appropriate semiconductive shield, depending on the requirements you want to meet. Adding a Dow Wire & Cable protective jacket followed by a semiconductive jacket enhances the performance and longevity of the finished cable.

HV insulation materials

Dow Wire & Cable offers three regionalized versions of our SC crosslinked polyethylene (XLPE) insulation compounds. All three are widely

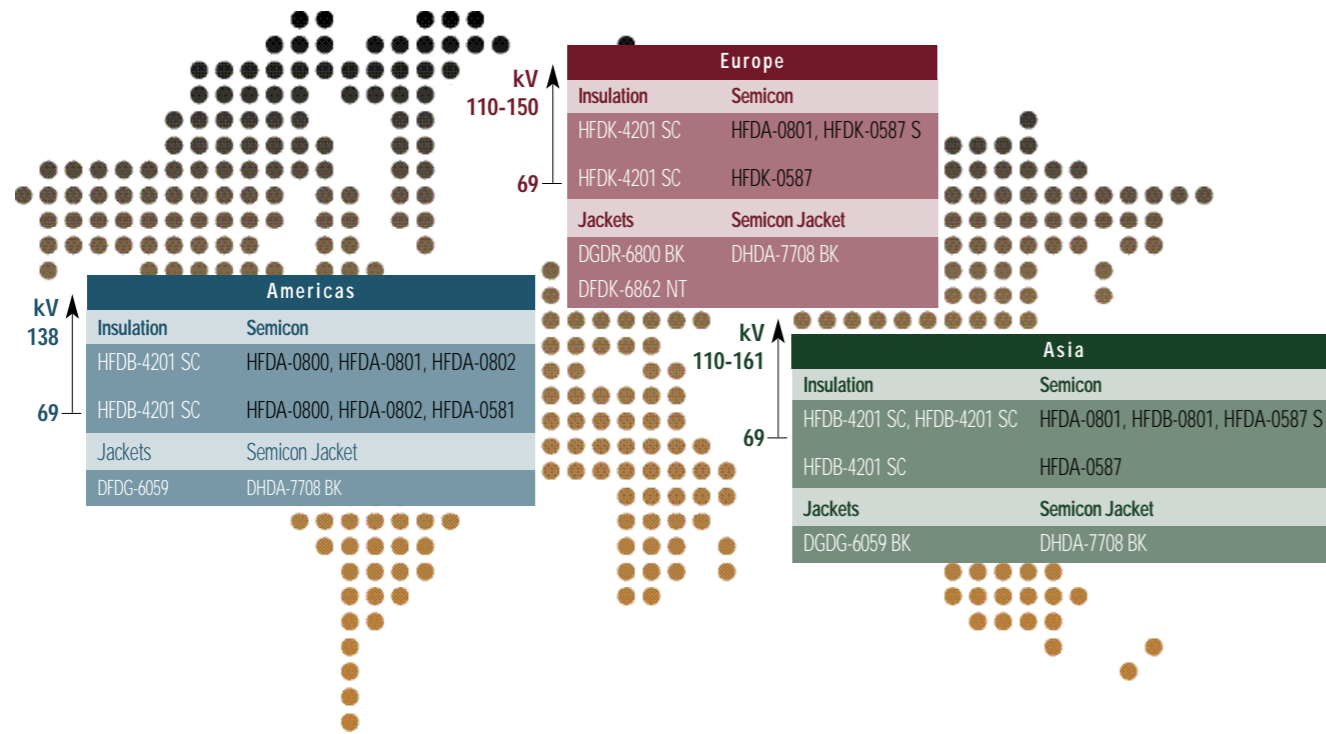
accepted as proven high-performance materials for UG HV cable constructions. All three of the 4201 SC products from Dow Wire & Cable meet global testing standards including IEC 62067 for extra-high voltage and IEC 60840 for HV. See regional product identification information for further details.

Dow Wire & Cable Insulation Compounds for HV Compounds



HV shield materials

Dow Wire & Cable Semiconductive Shields for HV Compounds



Dow Wire & Cable provides a broad range of materials for shields to help meet different electrical stress levels which are compatible with our insulation products.

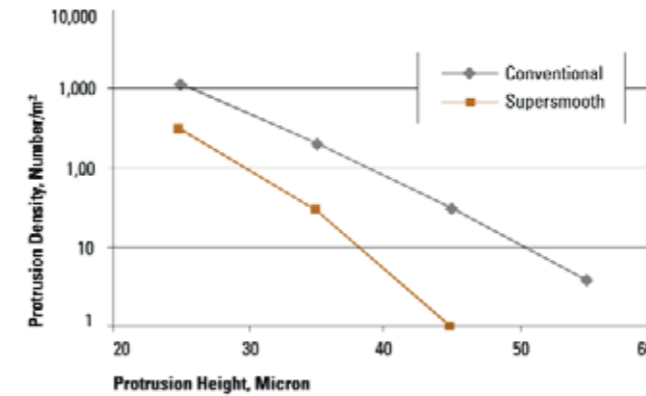
Designed for use in HV power cable applications in transmission and distribution systems, our HFDA-0587 and HFDA-0801 conductor shield and bonded insulation shield compounds help provide improved processing characteristics and are designed to be compatible with current semiconductive extrusion processing equipment.

Supersmooth materials are used in HV cables because they can allow consistent and smooth flow of the electrical current. Dow's innovative polymer chemistry and the inclusion of clean furnace black provide exceptional cleanliness, smoothness and scorch resistance for consistently good-quality cable production.

Recommended Dow Wire & Cable Products for Specific Stress Levels

Electrical Stress Level	Product
4	HFDA-0801, HFDB-0801
5	HFDK-0587 S, HFDA-0587 S
6	HFDK-0587, HFDA-0587

Smoothness of Conventional and Supersmooth Shields



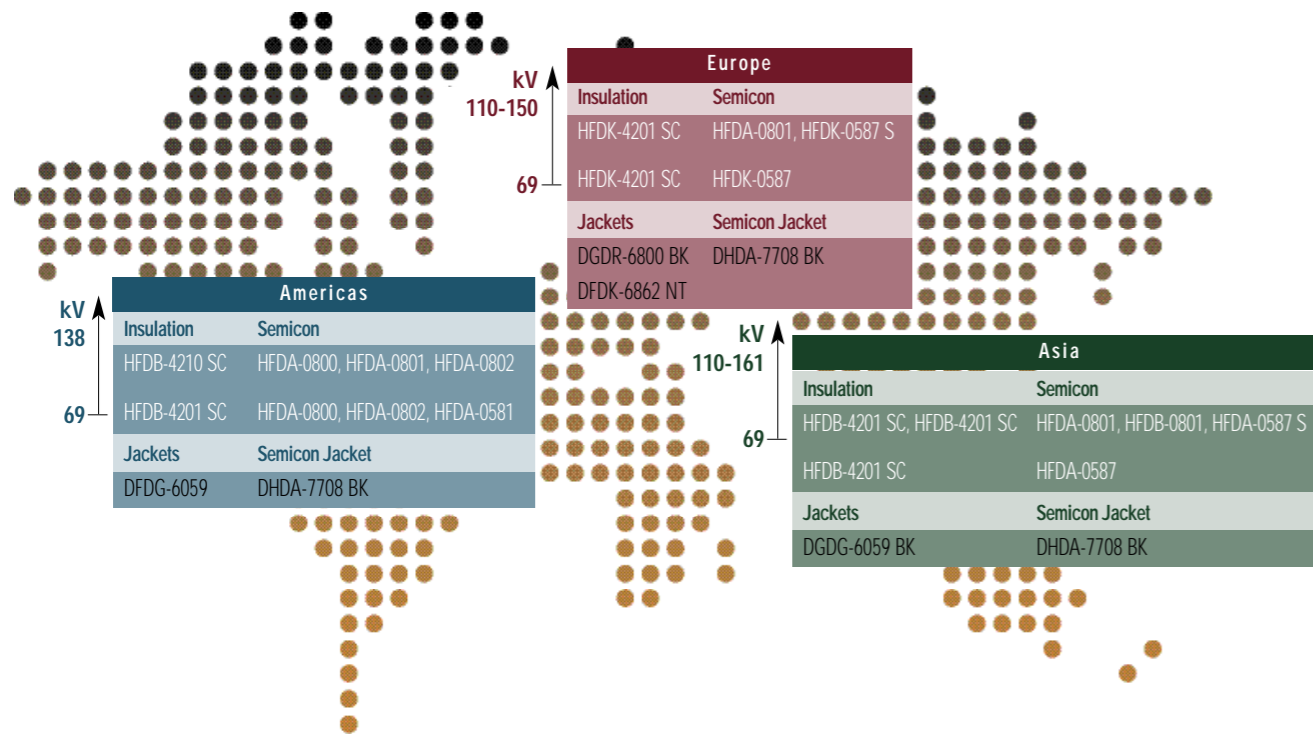
Semiconductive conductor/insulation shield layers provide a smooth, continuous, conductive and iso-potential interface between the conductor and insulation, and between the insulation and the ground. One of the performance requirements is smoothness. This is particularly important for the interface conductor shield/insulation. Any protrusions will lead to stress enhancement which can cause insulation damage and lead to shorter cable life.

Tests indicate that with our world-class manufacturing technology, customers can expect fewer interfacial surface defects and reduced electrical stress. Cable volume resistivity for Dow Wire & Cable conductor and bonded insulation shield compounds meet or exceed industry expectations specified in the IEC cable standards. With lower ionic impurities than competitive shield materials, cable wet electrical performance is excellent.



HV jacket materials

Dow Wire & Cable Protective and Semiconductive Jackets for HV Compounds



Dow Wire & Cable also offers a full line of protective and semiconductive jacket compounds for use in different HV cable constructions around the world. In North America, for example, Dow Wire & Cable provides linear low-density polyethylene (LLDPE) where greater flexibility for the protective jacket layer is desired. Conversely, in Europe, high-density polyethylene (HDPE) jacket compounds provide the best solution for ST-7-rated cable jackets.

Protective jacket compounds

An inner, or protective, jacket guards HV cables during transportation, installation and operation. Minimum requirements for a protective jacket are described in industry standards such as IEC 60840 and IEC 62067. Typical requirements include mechanical strength, puncture resistance, stress crack resistance, UV resistance, abrasion resistance, and moisture barrier and corrosion protection for metallic screens.

In the protective jacket category, Dow Wire & Cable offers DGDR-6800 BK and DGDK-6862 NT (colorable) for European cable standards. Our protective jacket compound DFDG-6059 BK is formulated for cable jackets in other regions.

Mechanical Property Balance, HV jackets

Property	DGDR-6800 BK	DGDK-6862 NT	DFDG-6059 BK
Melt Index	0.55	0.8	0.6
Density	0.957	0.941	0.932
Carbon Black Level	2.5	-	2.6

Property	DGDR-6800 BK	DGDK-6862 NT	DFDG-6059 BK
Tensile Strength (MPa)	~100	~100	~100
Elongation at Break (%)	~100	~100	~100
Elongation at Break after Aging (%)	~100	~100	~100
Flex. Modulus (MPa)	~100	~100	~100
Hardness Shore D	~100	~100	~100
Vicat A	~200	~200	~200

DGDK-6862 NT Combines:

- HDPE hardness and thermal resistance
- MDPE*-like stiffness
- Lower shrinkage

DGDR-6800 BK:

- Offers excellent properties
- Black compounded

*Medium-density polyethylene

Semiconductive jacket compounds

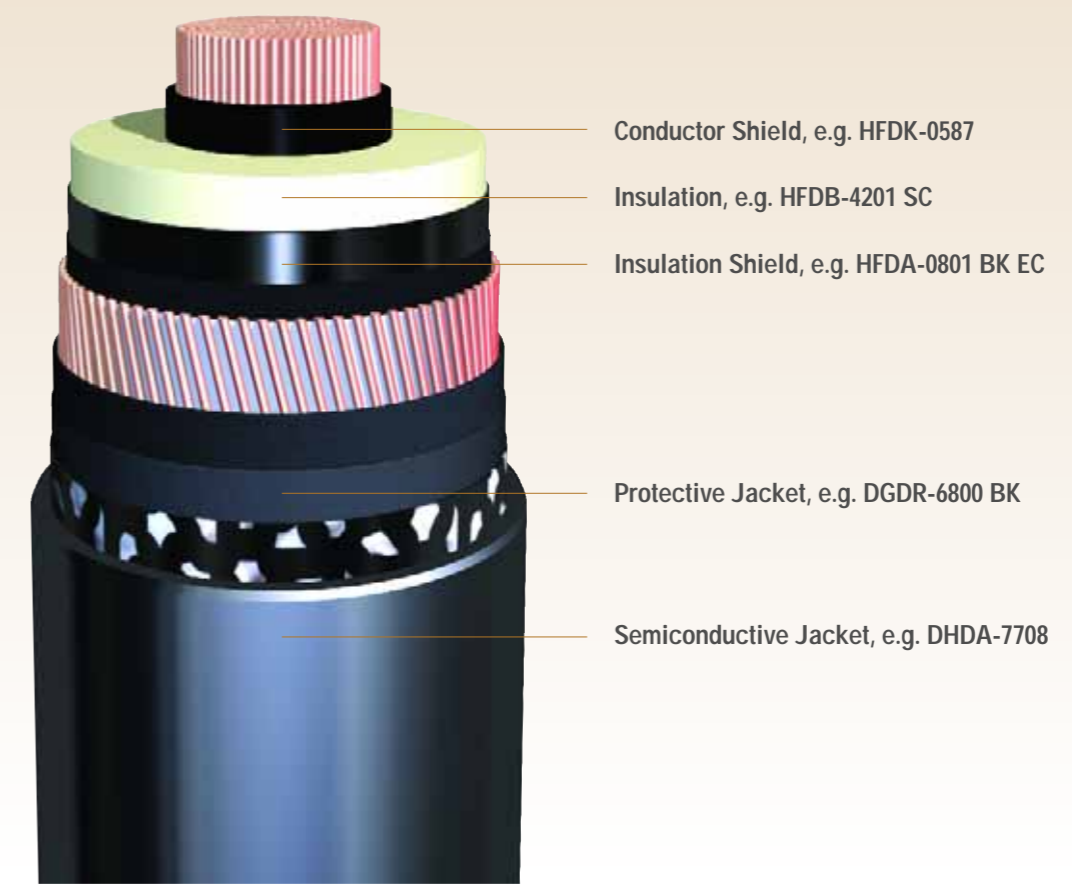
The primary purpose of an outer semiconductive jacket layer is for cable diagnostics. Using a partial discharge test, cable makers can verify the integrity of the cable at various stages – during production, transportation, during and after installation and for periodic checks.

Our semicon jacket compounds use highly conductive carbon black to impart typical volume resistivity of $< 10^2 \Omega \text{ cm}$. When extruded with the protective jacket, the resulting jacket provides superior electrical and structural properties versus alternatives, like graphite paint.

DHDA-7708 semiconductive jacket is available globally, offers excellent mechanical and physical properties, and provides excellent processability. It imparts very good environmental stress crack resistance (ESCR) values.



Photo courtesy of Southwire HV Solutions



Dow Wire & Cable global assets

To support a growing European market, we have expanded our modern, state-of-the-art, manufacturing center in Central Germany to produce local, world-class XLPE and semiconductive compounds. We have also expanded our manufacturing capability in Asia through our joint venture, Nippon Unicar (NUC). The modern, state-of-the-art operation in Kawasaki, Japan is 100 percent dedicated to the wire and cable industry and produces world-class polyolefins and other compounded resins for the growing Asia market.

Global Technology Centers

The Global Technology Center and the Materials Transformation Group in the USA, along with Dow Wire & Cable's global satellite facilities, have the scientists and engineers, equipment and technologies to provide one of the highest levels of customer-focused services.

World-class research and development

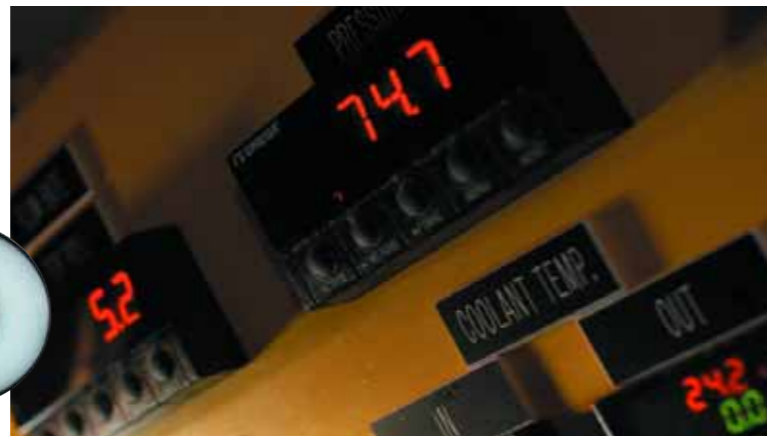
Dow Wire & Cable also leverages a Dow-operated R&D center in Kawasaki and will have industry-dedicated personnel at the R&D center currently under construction in Shanghai. As with

all Dow Wire & Cable sites, our direct access to ultra-clean base resins, as well as dedicated on-site compounding, confirms that we will consistently deliver reliable high-quality HV products. We also have HV technical experts in all regions.

Quality assurance, testing and validation

To maintain consistent quality in our manufacturing process, we begin by mandating a stringent Raw Materials Quality Assurance Program, working closely with suppliers to make sure that their raw materials and additives are clean and consistent. Internally, we continually run audits, random sampling and technical reviews to help ensure that all materials meet our demanding specifications. We also make regular visits to customer sites to assess your specific needs and requirements so our materials are optimized for use with your equipment and facilities.

Testing at customer locations and by various industry labs demonstrates that Dow Wire & Cable materials deliver sustainable performance in real-world conditions.



Source: Maillefer Pictures: HongTai

Global locations

Global locations

Bound Brook, New Jersey, USA

Global Technology Center

Mexico City, Mexico

*Central America, Caribbean, Columbia,
Equador, Venezuela technical center*

Freeport Texas, USA

Manufacturing/Technical facility

Horgen, Switzerland

European technical center

Houston, Texas, USA

World headquarters/Manufacturing facility

Kawasaki, Japan

Manufacturing facility

Oyster Creek, Texas, USA

Manufacturing facility

Plaquemine, Louisiana, USA

Manufacturing facility

Prentiss, Canada

Manufacturing facility

Sao Paulo, Brazil

South America technical center

Schkopau, Germany

Manufacturing facility

Seadrift, Texas, USA

Manufacturing facility

Singapore, Republic of Singapore

Asia Pacific technical center

St. Charles, Louisiana, USA

Manufacturing facility

Tarragona, Spain

Manufacturing facility

Tessengerlo, Belgium

Manufacturing facility

Proven performance in the global arena

Dow Wire & Cable is a leading supplier of quality semiconductive, insulation and jacketing compounds for HV power distribution cables. Our internationally recognized products are the preferred standard at North American utilities and are gaining rapid acceptance in other global markets. Cables made with Dow Wire & Cable insulation and semiconductive shields demonstrate consistently high performance that meets or exceeds industry requirements.

We will be happy to provide a detailed list of published literature that attests to the proven performance of our materials. Please visit www.dowwireandcable.com and contact your Dow Wire & Cable sales representative for additional information.



For more information on products, innovations, expertise and other services available to you from Dow's Plastics business group, visit: www.dowwireandcable.com, www.dowplastics.com, and choose your region, or contact us as indicated below.

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- permanent (Long-term) contact with internal body fluids or internal body tissues. Long term is a use which exceeds 72 continuous hours (except 30 days for PELLETHANE™ Polyurethane Elastomers);
- use in cardiac prosthetic devices regardless of the length of time involved (cardiac prosthetic devices include, but are not limited to, pacemaker leads and devices, artificial hearts, heart valves, intra-aortic balloons and control systems and ventricular bypass-assisted devices);
- use as a critical component in medical devices that support or sustain human life; or
- use specifically by pregnant women or in applications designed specifically to promote or interfere with human reproduction.

Additionally, all Products intended for use in pharmaceutical applications, other than pharmaceutical packaging, must pass the then current Pharmaceutical Liability Guidelines.

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