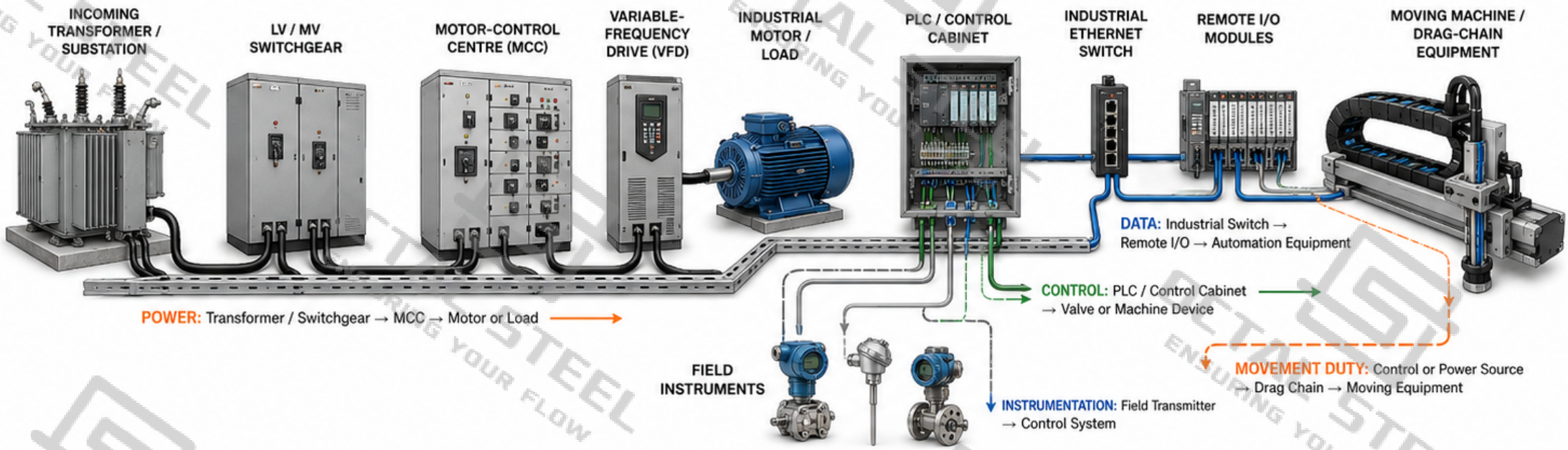
Industrial Cable Types and System Position



1 POWER CABLES

Transfer electrical power between transformers, switchgear, distribution equipment, motors and industrial loads.

2 CONTROL CABLES

Carry operating, interlocking and status signals between control panels and field devices.

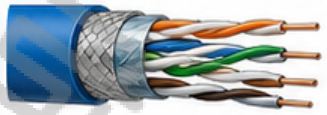
3 INSTRUMENTATION CABLES

Carry measurement signals through identified pairs or triads.

4 VFD AND MOTOR CABLES

Connect variable-frequency drives to motors under a switching environment.

5 INDUSTRIAL DATA AND BUS CABLES



Carry protocol-specific digital communication between industrial devices.

6 FLEXIBLE AND MOVING CABLES

Supply equipment exposed to repeated bending, torsion, reeling or machine movement.

FUNCTIONAL CATEGORIES

Power | Control | Instrumentation | Data | Movement Duty

CONSTRUCTION OPTIONS

Screened | Armored | LSZH | Fire-Resistant | Oil-Resistant | Outdoor

Cable function defines the main family. Screening, armor, sheath and fire performance are selected as construction options.

Representative Technical Data and Selection Boundaries

REFERENCE BASIS

The values below are representative catalogue references for different cable constructions.
They support preliminary comparison and must not be combined into one universal specification.

CONSTRUCTION-SPECIFIC VALUES

PRELIMINARY COMPARISON ONLY

01 ELECTRICAL PERFORMANCE

Rated voltage, test voltage and insulation resistance belong to the referenced construction shown in each row.

Reference Construction	Rated Voltage	Test Voltage	Insulation Resistance
Flexible PVC Power and Control Cable	300/500 V or 450/750 V	2500 V for 5 min	>20 MΩ·km
Flexible Industrial Control Cable	450/750 V	3000 V for 5 min	>20 MΩ·km
Flexible Power or Motor Cable	600/1000 V	4000 V for 5 min	>20 MΩ·km
Screened Drag-Chain Control Cable	300/500 V or 450/750 V	2500 V for 5 min	>20 MΩ·km
Drag-Chain Data Cable	350 V	1500 V for 1 min	>20 MΩ·km
Fluoropolymer-Insulated High-Temperature Cable	Maximum voltage reference: 900 V	2500 V for 5 min	>500 MΩ·km for PFA/FEP; >1500 MΩ·km for ETFE

02 INSTALLATION AND OPERATING LIMITS

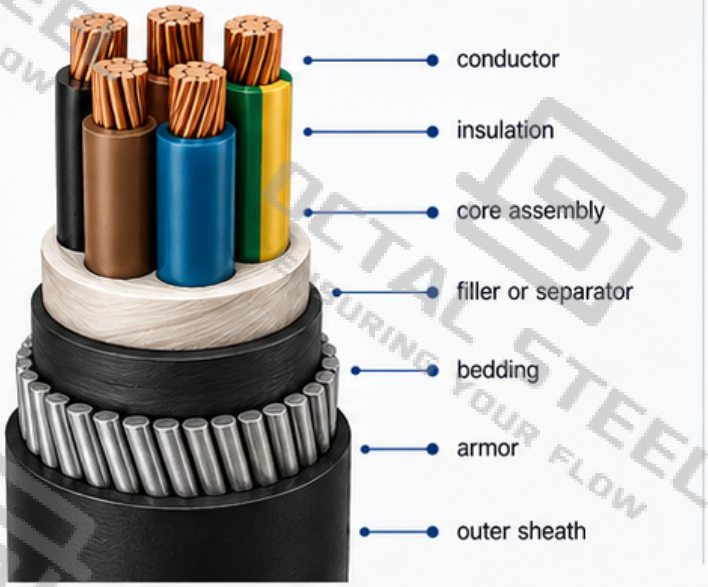
D = finished cable diameter. Movement values are construction-specific catalogue references.

Reference Construction	Temperature Reference	Minimum Bending Radius	Additional Control
Flexible PVC Power and Control Cable	Fixed: -30 to 80°C; Moving: -5 to 80°C	Fixed: 6D; Moving: 12D	Core identification and specified flame requirement
Flexible Industrial Control Cable	Fixed: -30 to 80°C; Moving: -5 to 80°C	Fixed: 6D; Moving: 12D	Multicore numbered construction
Flexible Power or Motor Cable	Fixed: -30 to 80°C; Moving: -5 to 80°C	Fixed: 6D; Moving: 12D	Oil- and UV-resistant options where specified
Screened Drag-Chain Control Cable	Fixed: -30 to 80°C; Moving: -5 to 80°C	7.5D	Up to 180 m/min; 7 m/s²; transfer impedance ≤250 Ω/km at 30 MHz in the referenced construction
Drag-Chain Data Cable	Fixed: -30 to 80°C; Moving: -5 to 80°C	7.5D	Working capacitance ≤150 nF/km; inductance approximately 0.65 mH/km; up to 180 m/min and 7 m/s²
Fluoropolymer-Insulated High-Temperature Cable	PFA: -100 to 250°C; FEP: -100 to 205°C; ETFE: -70 to 155°C	Fixed: 4D; Moving: 10D	Material system must match temperature and chemical exposure

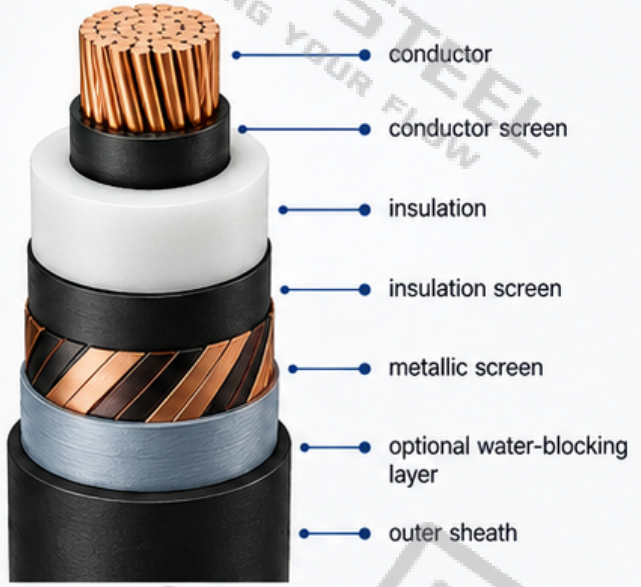
SELECTION WARNING | A high-temperature cable is not automatically a drag-chain cable. A flexible PVC cable is not automatically suitable for continuous high-speed speed cycling.

Cable Construction by Circuit Function

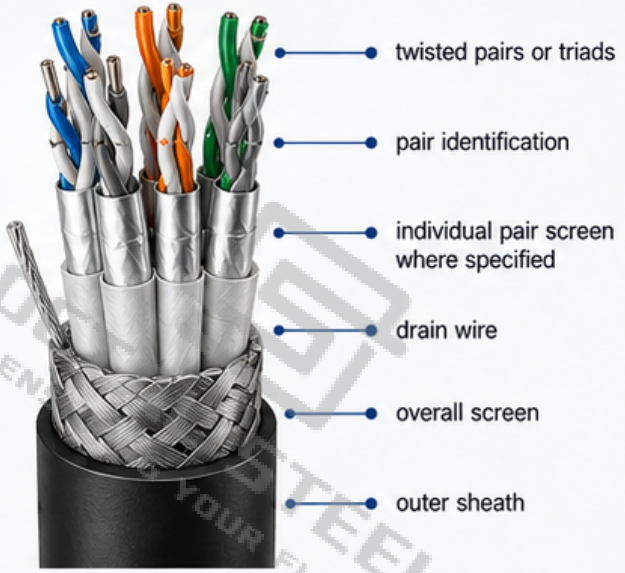
ARMORED LOW-VOLTAGE POWER CABLE



SCREENED MEDIUM-VOLTAGE POWER CABLE



SCREENED INSTRUMENTATION CABLE



LAYER FUNCTION MATRIX

	Layer	Main Function	Used Where Applicable
1	Conductor	Carries electrical current or signal	All power, control, instrumentation and data cables
2	Conductor Screen	Controls electrical stress at the conductor surface	Medium-voltage power cables
3	Insulation	Electrically isolates the conductor or core	All cable families
4	Insulation Screen	Controls electrical stress at the insulation boundary	Medium-voltage power cables
5	Pair or Triad Assembly	Maintains signal pairing and circuit organization	Instrumentation and some data cables
6	Electrical Screen	Limits electromagnetic interference and provides a screening path	Screened control, instrumentation, VFD and data cables
7	Bedding	Separates inner components from armor and supports cable geometry	Armored constructions
8	Armor	Provides mechanical protection and impact resistance	Armored cables where specified
9	Outer Sheath	Provides environmental and mechanical outer protection	All cable families
10	Fire Barrier	Supports circuit integrity or flame-performance requirements	Fire-resistant constructions where specified

Changing one construction layer can affect overall diameter, flexibility, bending behaviour, gland selection, termination and fire performance.

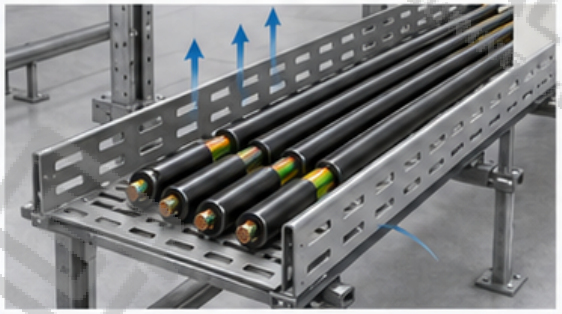
Not every industrial cable contains every layer shown.

Conductor Sizing and Installation Conditions

1 TOP SELECTION FLOW

CIRCUIT FUNCTION → SYSTEM VOLTAGE → OPERATING CURRENT → VOLTAGE DROP → SHORT-CIRCUIT DUTY → PROTECTIVE-DEVICE CLEARING TIME → INSTALLATION METHOD → ENVIRONMENTAL DERATING → TERMINATION COMPATIBILITY

2.1 OPEN TRAY OR FREE AIR



Controls:

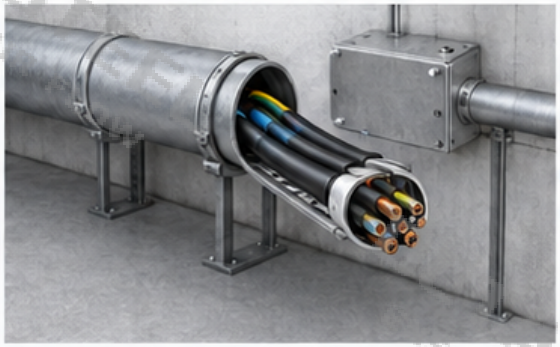
- heat dissipation;
- solar or ambient exposure;
- cable spacing;
- mechanical support.

2.2 GROUPED OR ENCLOSED TRAY

Controls:

- loaded-circuit grouping;
- restricted ventilation;
- tray fill;
- local ambient temperature.

2.3 DUCT OR CONDUIT



Controls:

- pulling route;
- fill;
- heat dissipation;
- pulling tension;
- bend transitions.

2.4 UNDERGROUND OR SOIL

Controls:

- soil thermal condition;
- moisture;
- water ingress;
- burial protection;
- route joints.

3 PROJECT INPUTS

- Load Current
- Circuit Length
- Fault Current
- Protection-Clearing Time
- Air or Soil Temperature
- Grouping
- Harmonic Loading Where Applicable
- Pulling Route
- Terminal and Gland Size

A conductor that carries the operating current in open air may not retain the same usable rating when grouped, enclosed or installed in hot soil.

Conductor size must not be selected from load current alone.

Flexible and Drag-Chain Cable Selection

1 TOP MOVEMENT-CLASS COMPARISON

FIXED INSTALLATION

Moved during installation and then remains stationary.

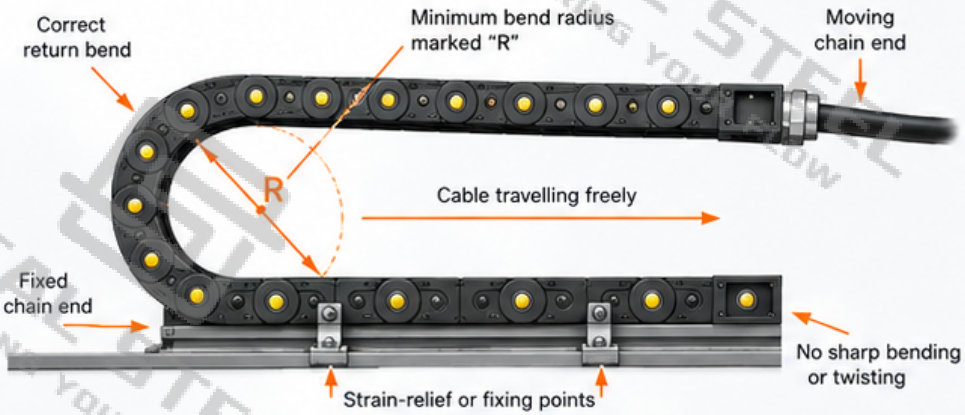
OCCASIONAL FLEX

Moves during limitited equipment operation.

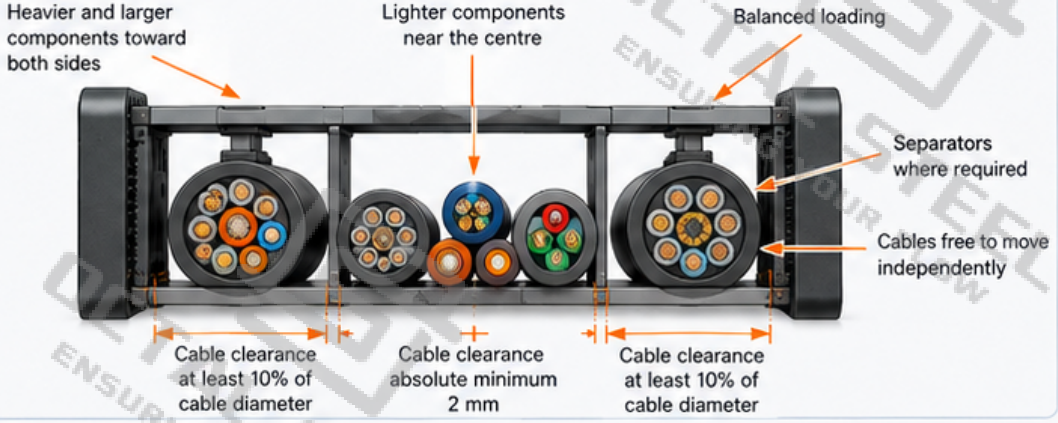
CONTINUOUS MOVEMENT

Repeatedly bends, accelerates, reels or twists during normal service.

2 MAIN DRAG-CHAIN SIDE VIEW



3 MAIN DRAG-CHAIN CROSS-SECTION



4 REFERENCE PERFORMANCE

Minimum Bending Radius	7.5D
Maximum Reference Speed	180 m/min
Maximum Reference Acceleration	7 m/s²
Temperature Reference	Fixed: -30 to 80°C Moving: -5 to 80°C

Representative construction-specific values.

5 SELECTION INPUTS

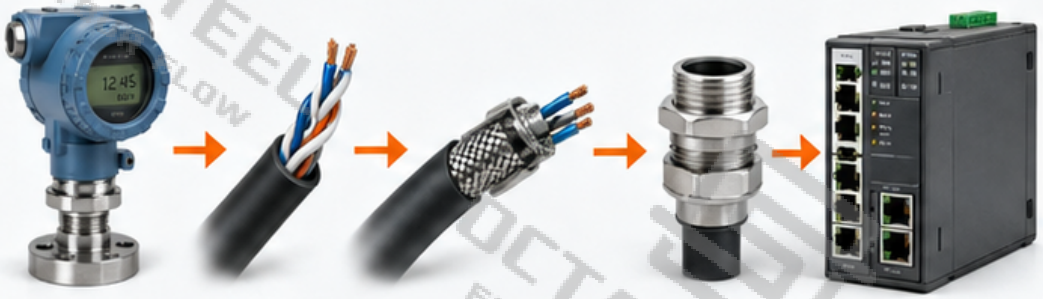
- Travel Distance
- Bend Radius
- Speed
- Acceleration
- Torsion
- Reeling Tension
- Unsupported Length
- Cycle Duty
- Abrasion and Impact

A fine-stranded conductor does not automatically make the complete cable suitable for continuous drag-chain operation.

Signal Integrity, Screening and Environmental Protection

1 SIGNAL-PATH OVERVIEW AND CONTROL POINTS

FIELD SENSOR OR TRANSMITTER → TWISTED PAIR OR TRIAD → SCREENED CABLE → GLAND OR CONNECTOR → PLC / DCS / INDUSTRIAL SWITCH



1 PAIR OR TRIAD ARRANGEMENT
Maintains grouping and electrical balance

2 WORKING CAPACITANCE AND INDUCTANCE
Affect circuit loading and transmission behaviour

3 CHARACTERISTIC IMPEDANCE
Must match the specified network protocol where applicable

4 TRANSFER IMPEDANCE
Indicates screen performance at the stated frequency

5 SCREEN CONTINUITY
Must remain continuous through the termination

6 CONNECTOR COMPATIBILITY
Cable geometry and shielding must match the connector interface

REFERENCE DATA*

Rated Voltage	Test Voltage	Insulation Resistance	Working Capacitance	Inductance
350 V	1500 V for 1 min	>20 MΩ·km	≤150 nF/km	Approximately 0.65 mH/km

Representative drag-chain data-cable reference only.

2 PROTECTION COMPARISON

ARMOR	ELECTRICAL SCREEN
Mechanical protection	EMI or electrical-field control
	
Protects against mechanical impact, crushing, abrasion and external damage.	Controls electromagnetic interference and provides a defined return path for high-frequency currents.

Armor and screening perform different functions.

3 SHEATH-SELECTION PANEL

PVC
General industrial wiring under defined conditions

PE
Outdoor, underground or moisture-exposed fixed routes

PUR / TPU
Movement, abrasion, impact and oil exposure

LSZH
Limited smoke and halogen-related emissions where specified

SILICONE
Flexible elevated-temperature service where mechanically suitable

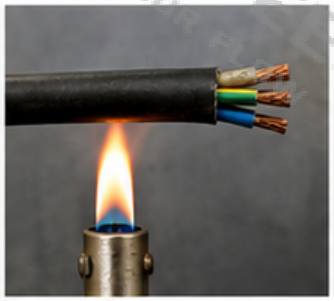
PFA / FEP / ETFE
High-temperature or chemically demanding applications

Material name alone does not establish oil, UV, chemical, movement or fire performance.

Fire Performance, Standards and Enquiry Inputs

TOP FIRE-PERFORMANCE COMPARISON

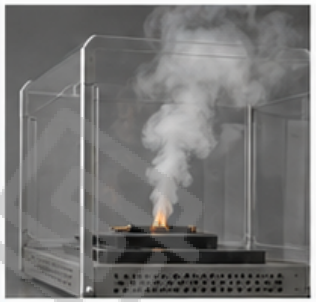
FLAME-RETARDANT



Evaluated for limited flame propagation under the specified test method.

Relevant family:
IEC 60332 series

LSZH



Evaluated for smoke and halogen-related emissions under the specified methods.

Relevant families:
IEC 60754 series
IEC 61034 series

FIRE-RESISTANT

Evaluated for continued circuit integrity under a defined fire condition.

Relevant family:
IEC 60331 series

Flame-retardant, LSZH and fire-resistant are not interchangeable. Do not describe cable as generically fireproof.

STANDARDS MATRIX

STANDARD	PURPOSE OR SCOPE
IEC 60228	Conductor construction and resistance
IEC 60227 Series	Applicable lower-voltage PVC-insulated cables
IEC 60502-1	Applicable 1 kV and 3 kV extruded-insulation power cables
IEC 60502-2	Applicable medium-voltage extruded-insulation power cables
IEC 60811 Series	Dimensional, physical and material test methods
IEC 60332 Series	Flame propagation
IEC 60754 Series	Gas and halogen-related emissions
IEC 61034 Series	Smoke density
IEC 60331 Series	Circuit integrity under fire conditions

ENQUIRY INPUT FLOW

CABLE FUNCTION → RATED VOLTAGE → CONDUCTOR → CIRCUIT DATA → INSTALLATION → ENVIRONMENT → MOVEMENT DUTY → SCREEN AND ARMOR → FIRE PERFORMANCE → APPLICABLE STANDARD → ACCESSORIES → DRUM LENGTH AND DELIVERY

Final manufacture requires an approved cable datasheet and cable schedule. Regional approval must be supported by the applicable product documents.