Cavicel

Conducting Value

INCOCEL

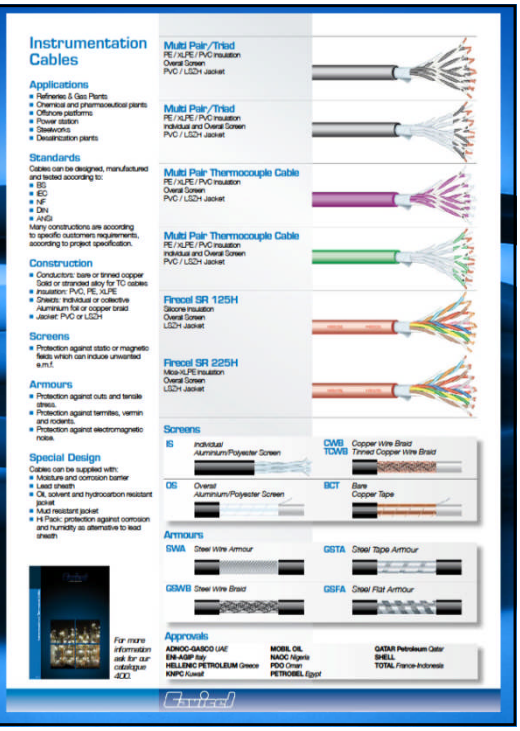
Problem Solving

Il mercato Internazionale dei cavi strumentazione è stato fortemente caratterizzato da un vasto numero di tipologie di prodotti con una tendenza in ulteriore aumento.

Caratteristiche generali di riferimento dei cavi strumentazione INCOCEL:

- Idonei per applicazioni gravose ed installazioni critiche.
- Ampia gamma di materiali e costruzioni.
- Approvazioni dei principali Contractors, EPC e Clienti finali.
- Cavi in versione std. (NON propaganti la fiamma-incendio) e FR
- Completamente progettati du specifiche e necessità del Cliente

When a Specialist is needed, Cavicel is always there to help.



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Matrice selezione materiali:

- Isolamenti
- Guaine Interne
- Guaine esterne

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	Insulation	Sheath	Temperature range °C	Abrasion resistance	Oil resistance	Solvent resistance	Water resistance	Nuclear radiation resistance	Flame retardancy	Flexibility
PVC	■	■	-40 +105	▮▮▮	▮▮▮	▮▮	▮▮▮	▮▮	▮▮▮	▮▮▮
Polyethylene	■	■	-40 +80	▮▮▮	▮▮	▮▮▮	▮▮▮▮	▮▮	▮	▮▮
Polypropylene	■		-40 +105	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮	▮	▮▮
Nylon		■	-70 +120	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮	▮▮	▮	▮▮
Polyurethane		■	-40 +80	▮▮▮▮	▮▮▮▮	▮▮	▮▮▮	▮▮▮	▮▮▮	▮▮▮
XLPE	■		-60 +90	▮▮	▮▮▮	▮▮▮	▮▮▮	▮▮	▮	▮▮
Fluoropolymer FEP	■	■	-80 +205	▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮	▮▮▮▮	▮▮
Fluoropolymer PTFE	■	■	-80 +260	▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮	▮▮▮▮	▮▮
Fluoropolymer PFA	■	■	-80 +260	▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮	▮▮▮▮	▮▮
Fluoropolymer MFA	■	■	-80 +240	▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮	▮▮▮▮	▮▮
Fluoropolymer ETFE	■	■	-80 +155	▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮	▮▮▮▮	▮
Fluoropolymer ECTFE	■	■	-60 +160	▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮	▮▮▮▮	▮▮
Hytrel®	■	■	-40 +80	▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮	▮	▮	▮▮
Peek®	■	■	-60 +250	▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮
Kapton®	■	■	-75 +200	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮▮▮▮	▮
Technopolymer LSZH	■		-30 +90	▮▮	▮▮▮	▮▮	▮▮▮▮	▮▮▮▮	▮▮▮	▮▮
G10	■		-40 +90	▮▮	▮▮	▮	▮▮▮	▮▮▮	▮▮▮	▮▮▮
Silicone Rubber	■	■	-60 +200	▮▮	▮▮	▮	▮▮▮	▮▮▮	▮▮▮	▮▮▮▮
Thermoplastic Rubber		■	-55 +125	▮▮▮▮	▮▮▮	▮▮	▮▮▮	▮	▮▮▮	▮▮▮▮
Neoprene	■	■	-40 +90	▮▮▮▮	▮▮▮	▮▮	▮▮▮	▮▮	▮▮▮	▮▮▮▮
EPR	■		-50 +90	▮▮▮	▮▮	▮	▮▮▮	▮▮▮	▮	▮▮▮
LSZH		■	-30 +90	▮▮	▮▮▮	▮▮	▮▮▮	▮▮▮	▮▮▮	▮▮

▮▮▮▮ very good ▮▮▮ good ▮▮ fair ▮ poor

Conducting Value

Conductors of Insulated Cables EN 60288:

- Classe 1: Rigido
- Classe 2: Semi-Flessibile
- Classe 5: Flessibile

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Conductors

For instrumentation cables conductors are generally copper for signal transmission or special alloy, for thermocouple /compensating cables. Conductors can generally be according to EN 60288:

class 1 solid

class 2 stranded

class 5 flexible

Type of conductors are chosen according to electrical characteristics, required flexibility, type of connection systems or specific installation conditions, for example:

- in presence of vibration or movement or reduced bending radius is preferable class 5 flexible conductor,
- class 1 solid conductor is preferable for permanent installation, crimping termination,
- in presence of corrosive atmosphere, high temperature or to facilitate the soldering is preferable tinned conductor.

Conducting Value

INCOCEL Problem Solving

Cavi Termocoppia

Compensazione ed Estensione

IEC 60584 / ANSI MC 96.1 / DIN 43710

- Cavi TC **compensati**
leghe conduttori **identiche** alle leghe termocoppia.

- Cavi TC **estensione**
leghe conduttori **differenti** dalle leghe termocoppia.

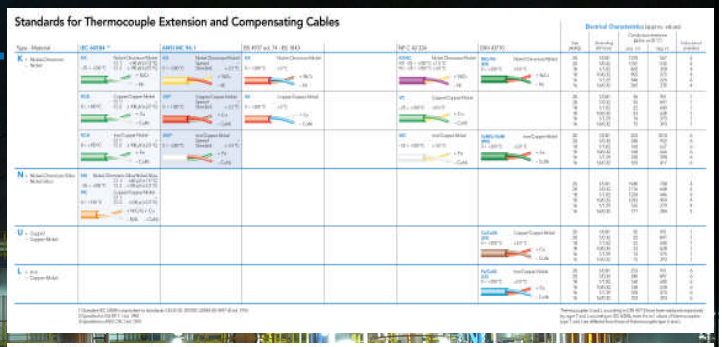
- Deviazione Classe 1 e Classe 2 (IEC 60854)

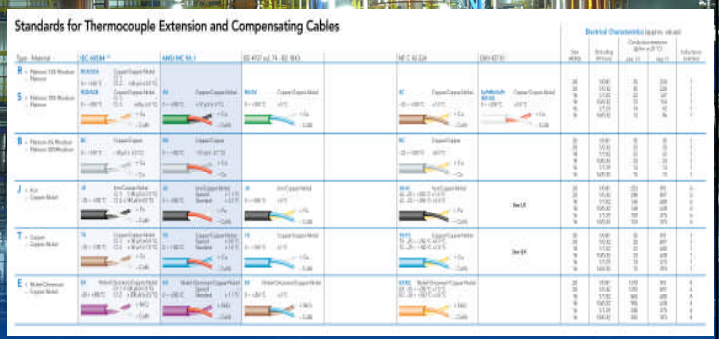
- Special e Standard (ANSI MC 96.1)

Criticità di fornitura:

- Tempi di consegna produttori leghe. (4/6 Settimane)

- Quantitativi minimi fornibili. (10-50 km per polo)





Conducting Value

Problem Solving

Schermi

Gli schermi sono spesso utilizzati in cavi di strumentazione per prevenire o ridurre possibili interferenze con i segnali trasmessi.

I principali fenomeni di disturbo sono:

«Cross-Talk Noise» introdotto da coppie, terne e quarte adiacenti che compongono il cavo stesso.

«Common Mode Noise» provocato da potenziali di terra diversi nei vari punti del circuito (Installazione)

«Static Noise» causato da campi elettrici esterni.

«Magneti Noise» provocato da campi magnetici esterni provenienti da motori elettrici, trasformatori, apparecchiature elettriche e cavi di potenza.

La schermatura viene solitamente disposta come filo di continuità con foglio rivestito in alluminio. Questo soluzione è sufficiente nella maggior parte dei casi. La schermatura con fili di rame intrecciati migliora l'efficacia della schermatura per impulsi in gamme di frequenza più basse.

Screening

Screens are often used in instrumentation cables to prevent or reduce possible interference in cables that can be caused by the following reasons:

- Cross-talk from adjacent pairs or triples;
- Interference induced by external source such as electrical equipments, machinery, power line.

Screens can be:

Aluminium/polyester tape
with a tinned copper drain wire, the most popular construction

Copper/polyester tape
with a tinned copper drain wire, for a better screen effect

Bare copper braid
for electromagnetic interference or when the cable is subject to movements

Tinned copper braid
for electromagnetic interference in presence of corrosive atmosphere or high temperature

Aluminium/polyester or copper/polyester tapes normally have a total thickness from 25 to 100 µm, according to standards and are wrapped with an overlap > 125% to assure a full coverage even in case of bending.
In continuous contact with metallic side there is a drain wire, normally tinned copper, 0.5 sqmm, stranded or solid.
Copper braid normally has a coverage from 80% to 95%. This type of screen presents a lower electrical resistance, a very good protection also to electromagnetic noises and a higher mechanical resistance compared to aluminium/polyester tape. It is suitable for mobile applications.
Screens can be applied to each pair/triples (individual screen) and/or on the bundle of the cable (overall screen).

Conducting Value

Problem Solving

Armouring

Metallic armour are used when cables have to be installed direct buried, or if mechanical protection is required.
Following points must be considered:

- Required tensile load
- Expected pressure on cable during service
- Protection against rodent
- Protection against accidental damage
- Minimum required bending radius.

SWA: single layer of galvanized steel wires, with diameters according to relevant standards, coverage min. 90%. This armour assures a very good mechanical protection and tensile strength. An additional counterspiral tape increases solidity, if required.

GSWB: galvanized steel wire braid, diameter of wire: 0.20 – 0.25 – 0.30 – 0.40 mm, with coverage of > 80%. It assures a good mechanical resistance, allowing a lower bending radius compared to other armour. It is preferable when there is movement or vibration.
For special application is possible to use stainless steel, tinned copper or special alloy wires.

GSTA: galvanized steel tape armour, composed by two tapes with overlapped edge; thickness of each tape: 0.20 – 0.30 – 0.40 mm, according to cable diameter. It grants a coverage > 100%. Very good crush resistance, but fair tensile strength.
Brass tape of minimum thickness 0.075 mm can be used for special applications.

GSFA: galvanized steel flat armour. It is composed by flat wire of thickness 0.6 mm or 0.8 mm, it is similar to SWA, but with higher mechanical protection.

Protection

In addition to mechanical protections, special protections can be considered for specific installations:

Moisture barrier
If moisture barrier is specified it shall be applied over the total cabling of elements and is possible to choose two alternatives:

Water swellable tapes

Laminated sheath, consisting of a longitudinal overlapped metallic foil, bonded to an extruded sheath.

Lead Sheath
It is applied between two other sheaths and is the best protection against aggressive chemicals. This is an expensive solution, increases weight and bending radius. It presents poor vibration resistance and normally an armour is required to protect it from crushing.

Hi-Pack
It is an alternative to Lead Sheath and is composed by a longitudinal overlapped aluminium copolimer coated tape bonded to HDPE jacket and additional special alloy of polyamide/polypropylene sheath.

- Excellent protection against corrosion and humidity.
- Excellent impact resistance that in some cases prevents the use of the armour.

This protection has a lower weight compared to lead sheath, cables have a smaller diameter, with a reduction of costs.
Hi-Pack is the right choice to protect the environment.

Armoring & Protections:

- GSWA (Galvanized Steel Wire Armoring)
- GSWB (Galvanized Steel Wire Braid)
- GSTA (Galvanized Steel Tape Armoring)
- GSFA (Galvanized Steel Flat Armoring)

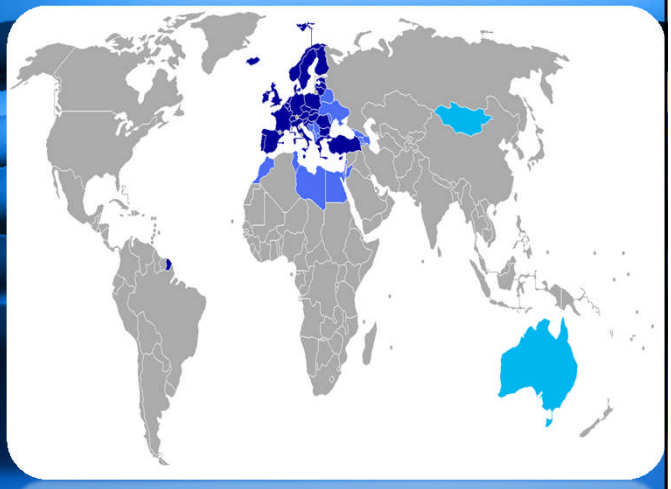
- Moisture Barrier
- Lead Sheath
- Hi-Pack

Problem Solving

Conducting Value

From BS 5308 to EN 50288-7 2005
European Standardisation Organisation CENELEC.

- Nuovo standard Europeo per cavi strumentazione BS 5308 Part 1 & 2 da Settembre 2005.
- E' diventato standard Nazionale nei paesi membri CENELEC.
- Opzioni costruttive di progetto che includono a livello Mondiale la gran parte della gamma prodotti, con materiali coordinati e standard per i test.
- Paragonabile con IEC 605021 per cavi di potenza bassa tensione
- Non standardizza prodotti finiti ma singoli elementi del cavo.



Members *Affiliates* *Partner Standardisation Bodies*

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Problem Solving

Conducting Value

EN 50288 vs BS 5308: Conductors & Insulation

	EN 50288-7	BS 5308
Copper Conductors	Solid; Stranded; Flexible (HD383=IEC 60288 class 1, 2, 5) Plain annealed or metal coated	Solid; Stranded; Flexible (BS 6360) Plain annealed
Dimensions mm²	0.5; 0.75; 1.0; 1.5; 2.0; 2.5; (4.0)	0.5; 0.75; 1.0; 1.5
Resistance	Comparable values	
Materials	EN 50290-2 (21-29) PVC; PE; XLPE	Part 1: PE to BS 6234 Part 2: PVC to BS 7655
T° Range	From 70°C up to 105°C	Temp. range max. 65°C
Tension Rating	300V 500V	300/500 V
Thickness	Comparable values	

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Acronimi costruttivi di uso comune:

- **U**= Solid Conductor (t) tinned
- **R**= Stranded Conductor (t) tinned
- **F**= Flexible Conductor (t) tinned
- **PVC**= PVC (All: Std; HT Resistance, Oil Resistance)
- **PE** = Polyethylen
- **HDPE**= High Density PE
- **XLPE**= Cross Linked Polyethylen Insulation
- **mXLPE**= Mica Tape+Cross Linked polyethylen insul.
- **SR**= Silicon Rubber Insulation
- **LSZH**= Low Smoke Zero Halogen (LSZH) sheathing material
- **IS**= Individual Screen
- **OS**= Overall Screen
- **SWA**= Steel Wire Armour
- **GSWB**= Steel Wire Braid
- **GSTA**= Flat Steel Tape Armour
- **CTWB**= Copper Tinned Wire Braid
- **GSFA**= Galvanized Steel Flat Armour
- **LM**= Lead Sheath
- **HIPK**= Hi-Pack

Ex: ***R(t)/mXLPE/IS/OS/LSZH/GSWA/PVC***

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Problem Solving

Conducting Value

Colour Code EN 50288 vs BS 5308:

	EN 50288-7		BS 5308	
	300 V	500 V	PE insulated	PVC insulated
Pairs	 (Pairs are identically coded)		 (Pairs >1 are differently coded)	
Triples			Not Defined	
Quads			Not Defined (Exception: 2 pairs are as quad construction)	
Remarks:	- 300 V cables: Continuously numbered on white core. - 500 V Continuously numbered on blue core		Pairs differentation is defined through distinct color codes pair or numbered PET foil around pairs.	