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CABLE 101

The Basics of Wire & Cable

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KEY TERMS

- AWG
- Solid
- Stranded
- Drawing
- Annealing
- Conductors
- Unilay
- Concentric
- Bunched
- Flexibility
- Flex life
- Lay
- Breaking strength
- Skin effect

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CONDUCTORS

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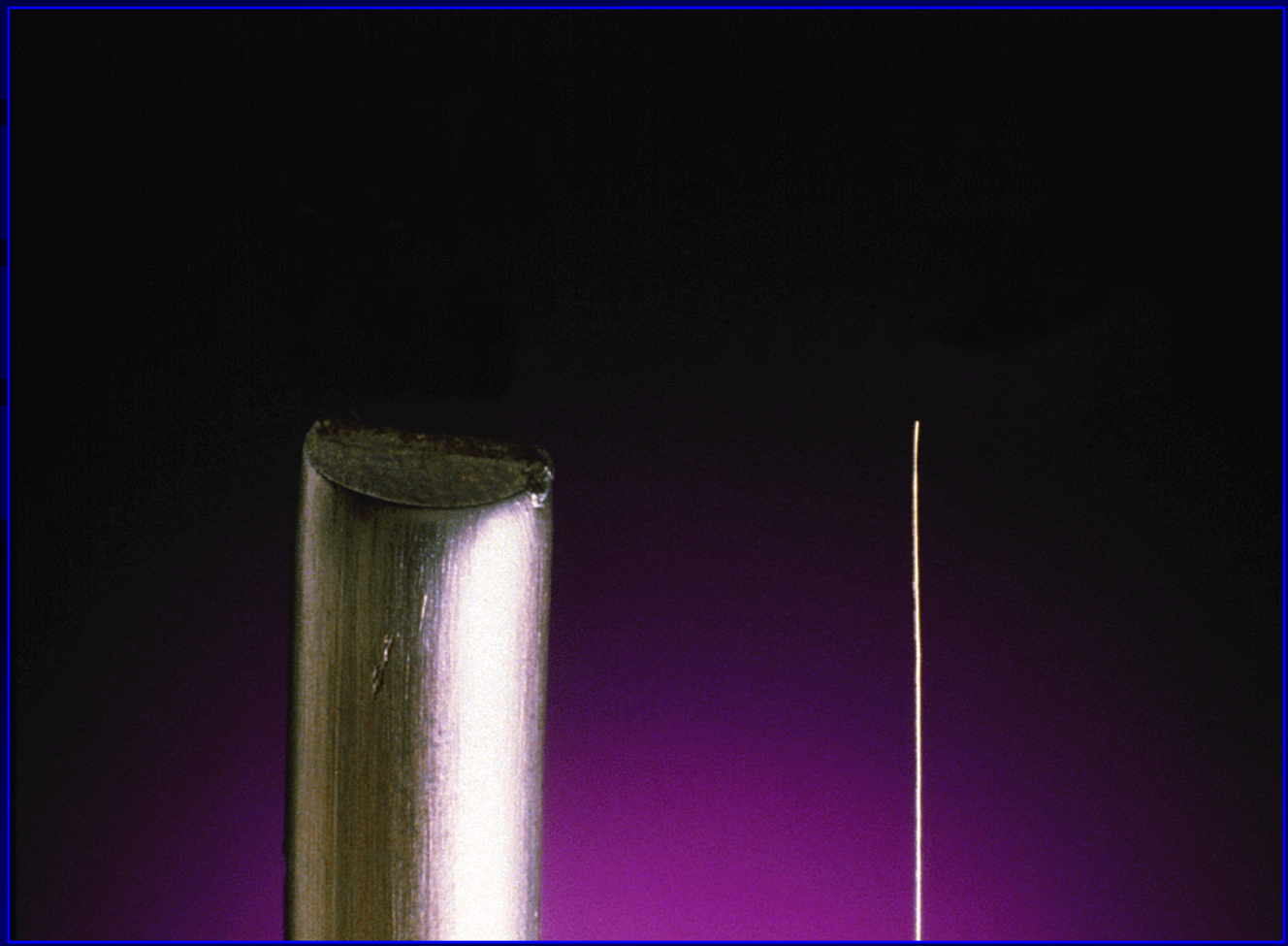
AWG SIZE



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CONDUCTOR MATERIALS

- Copper
- Copper covered steel
- Copper alloys
- Aluminum
- Plating: Tin, silver

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TIN OR SILVER COATED

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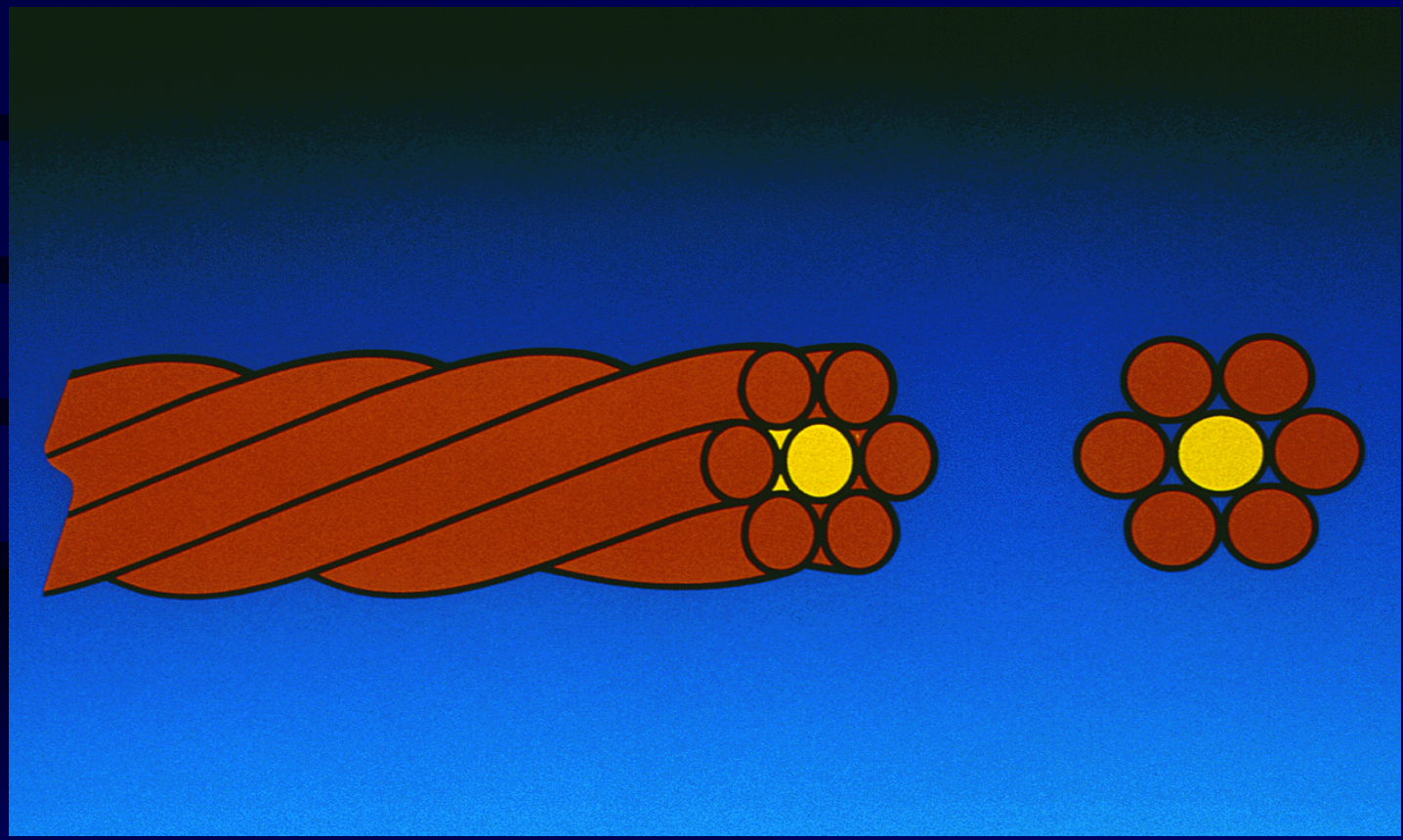
STRANDING



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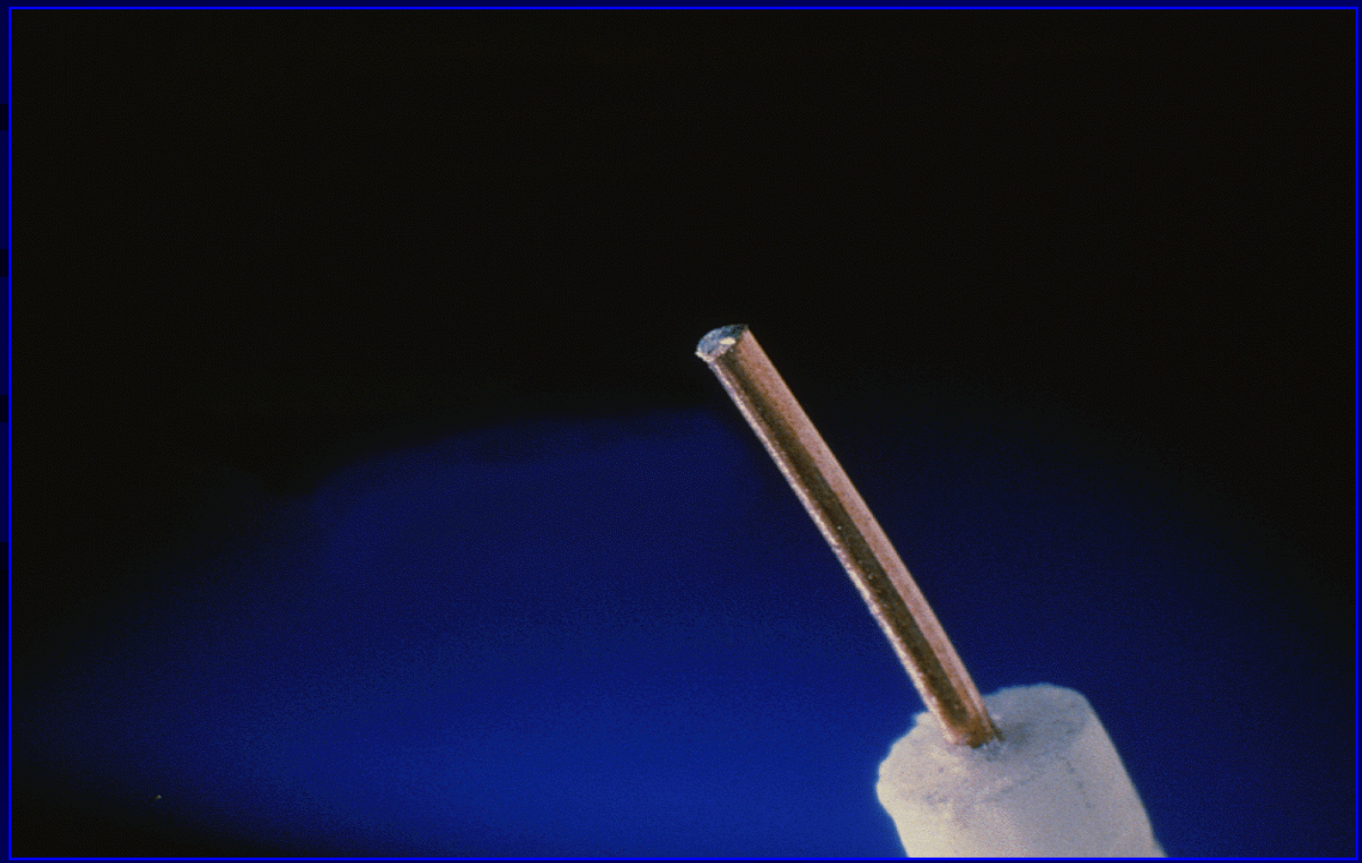
SOLID



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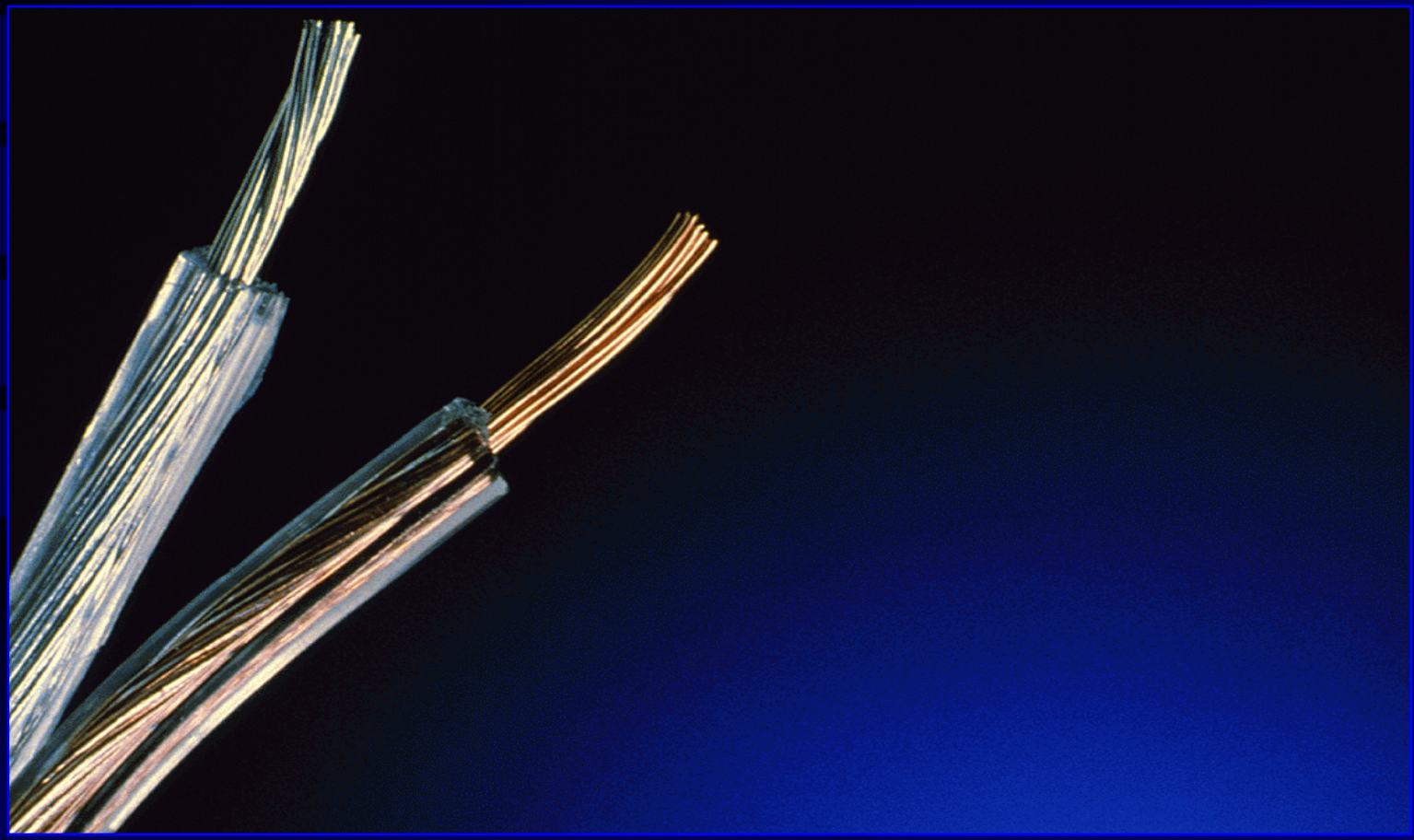
STRANDED



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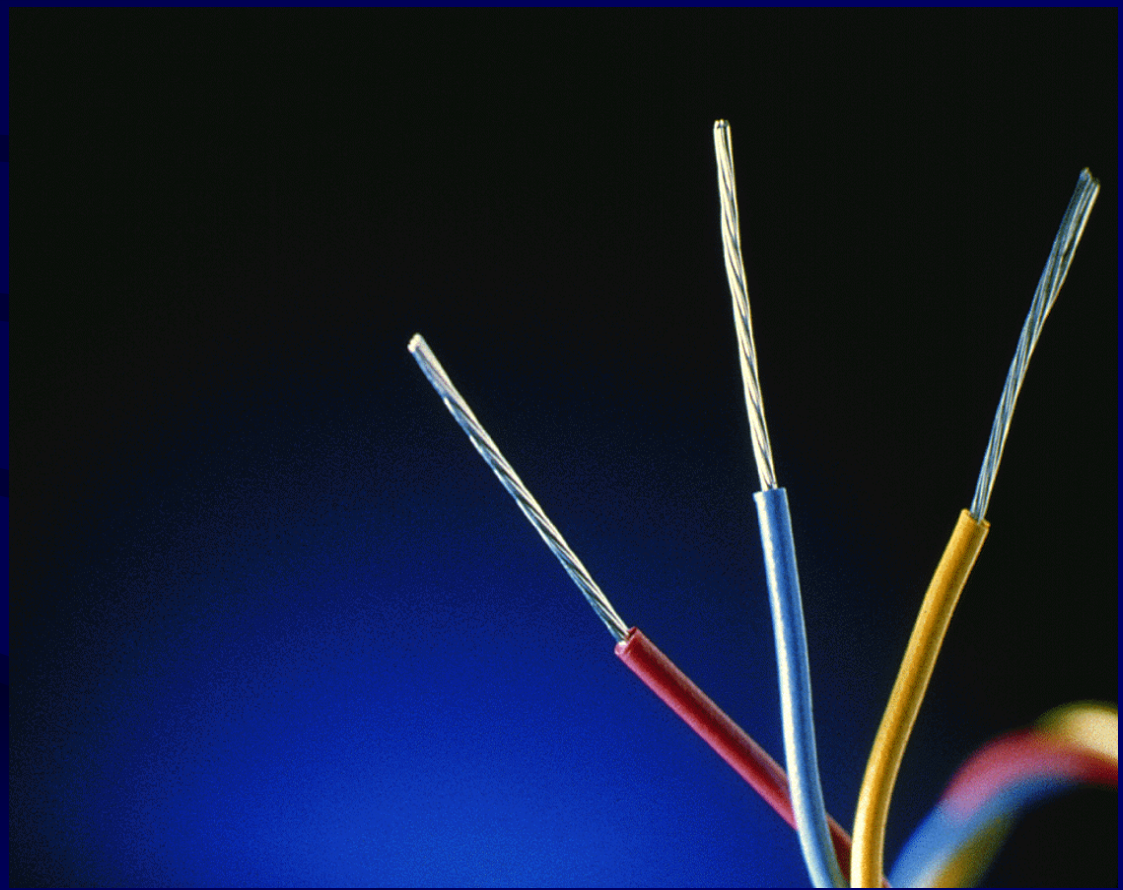
CONDUCTOR COMPOSITION

- Solid
- Stranded
- Concentric
- Unilay
- Bunch
- Unistrand



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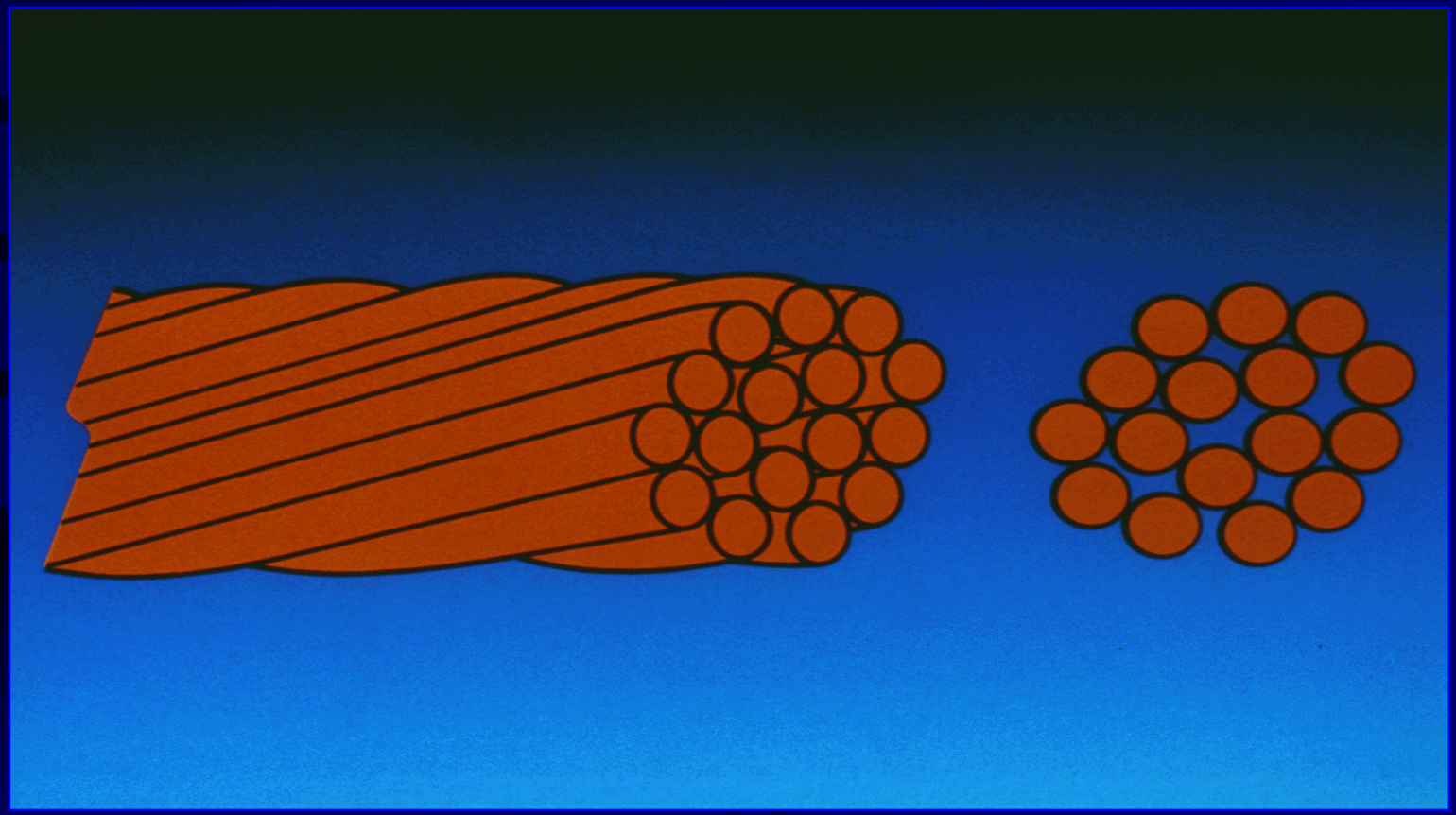
BUNCH STRANDING



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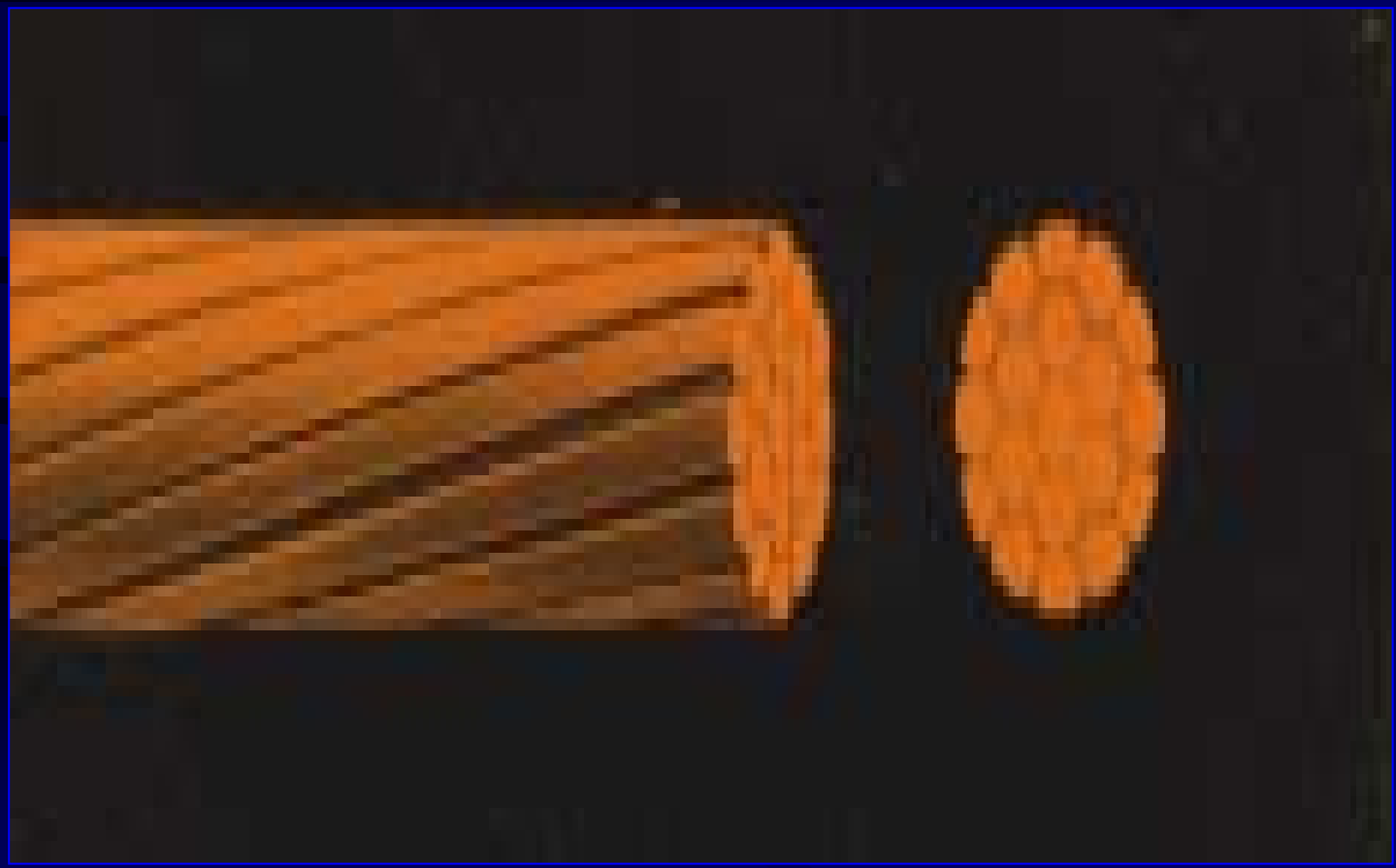
CONCENTRIC



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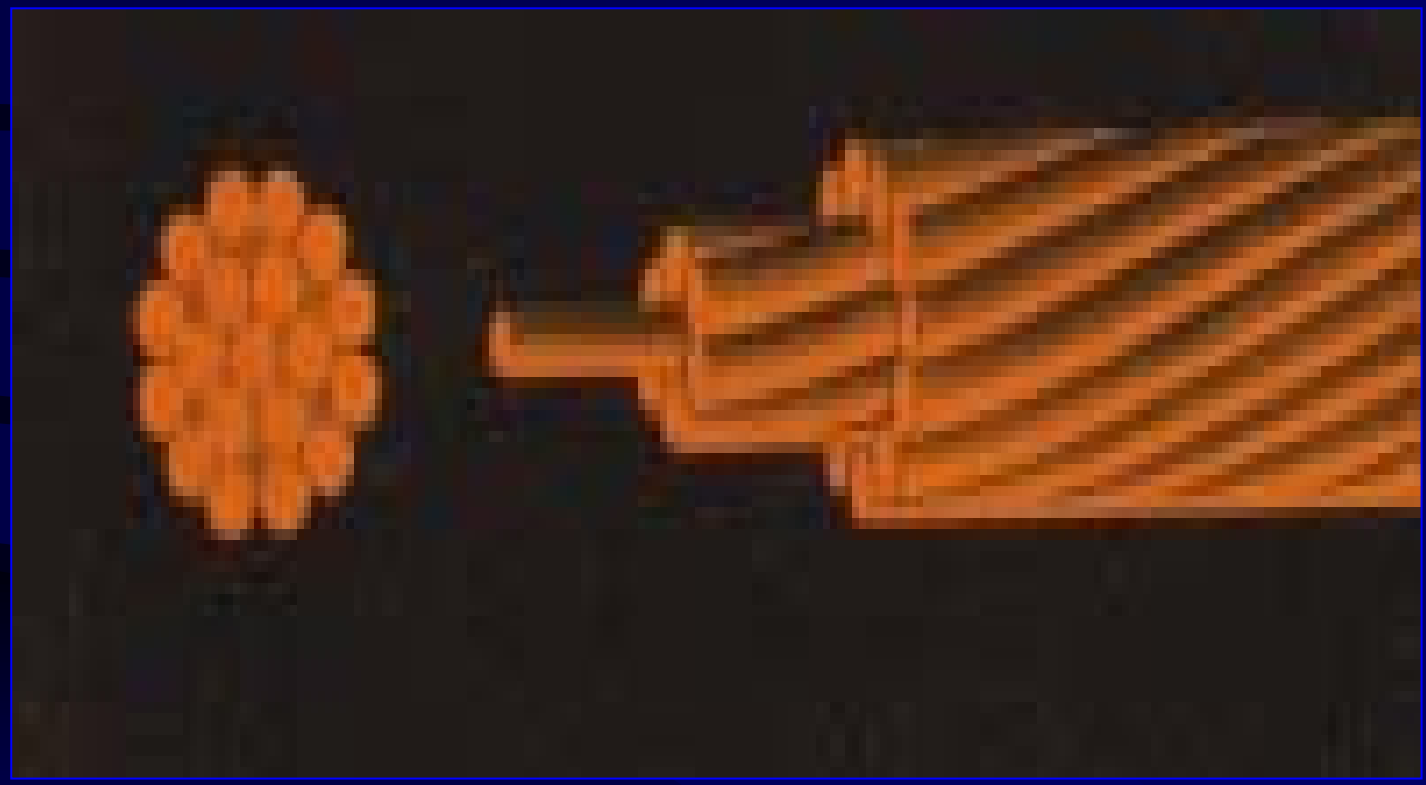
UNILAY



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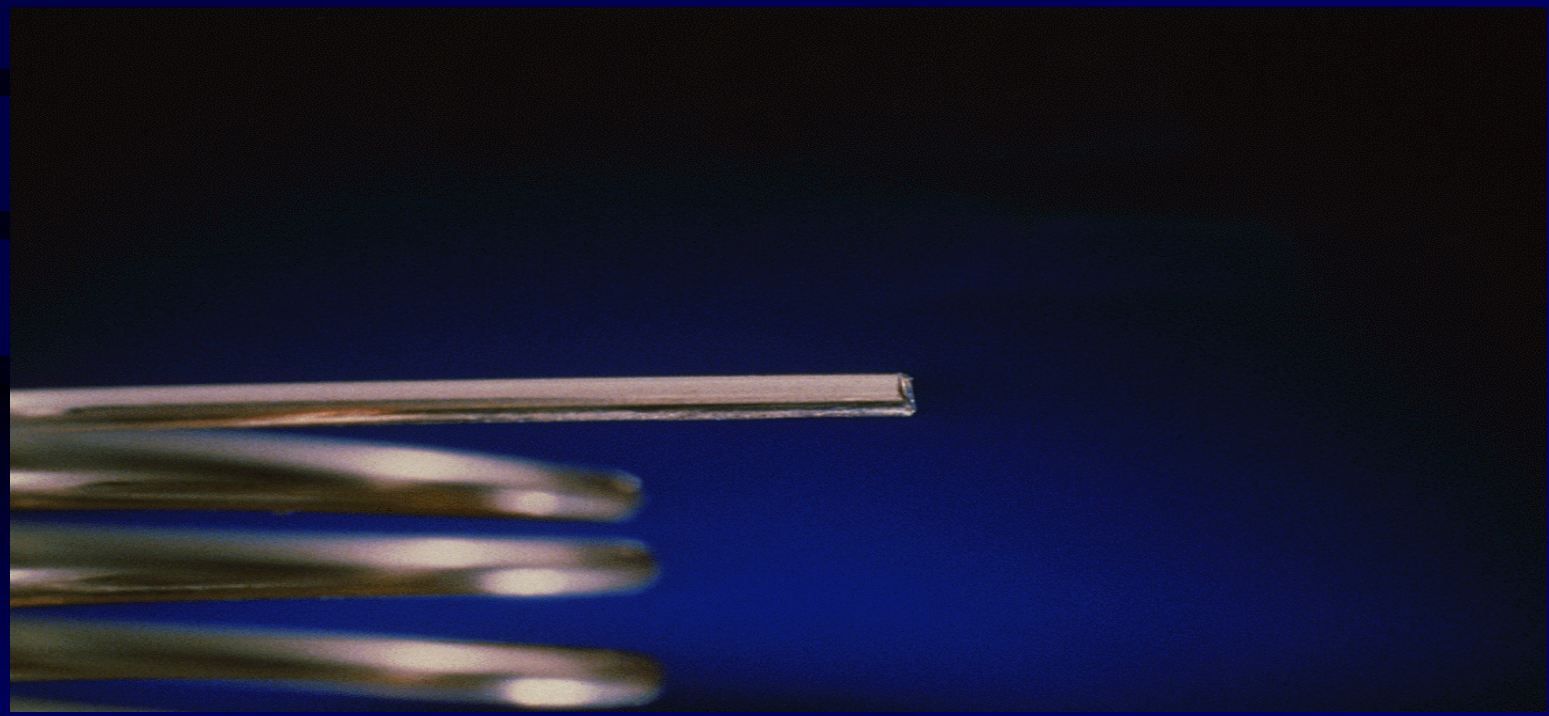
FLEXIBILITY

- The ease with which a conductor can be bent.



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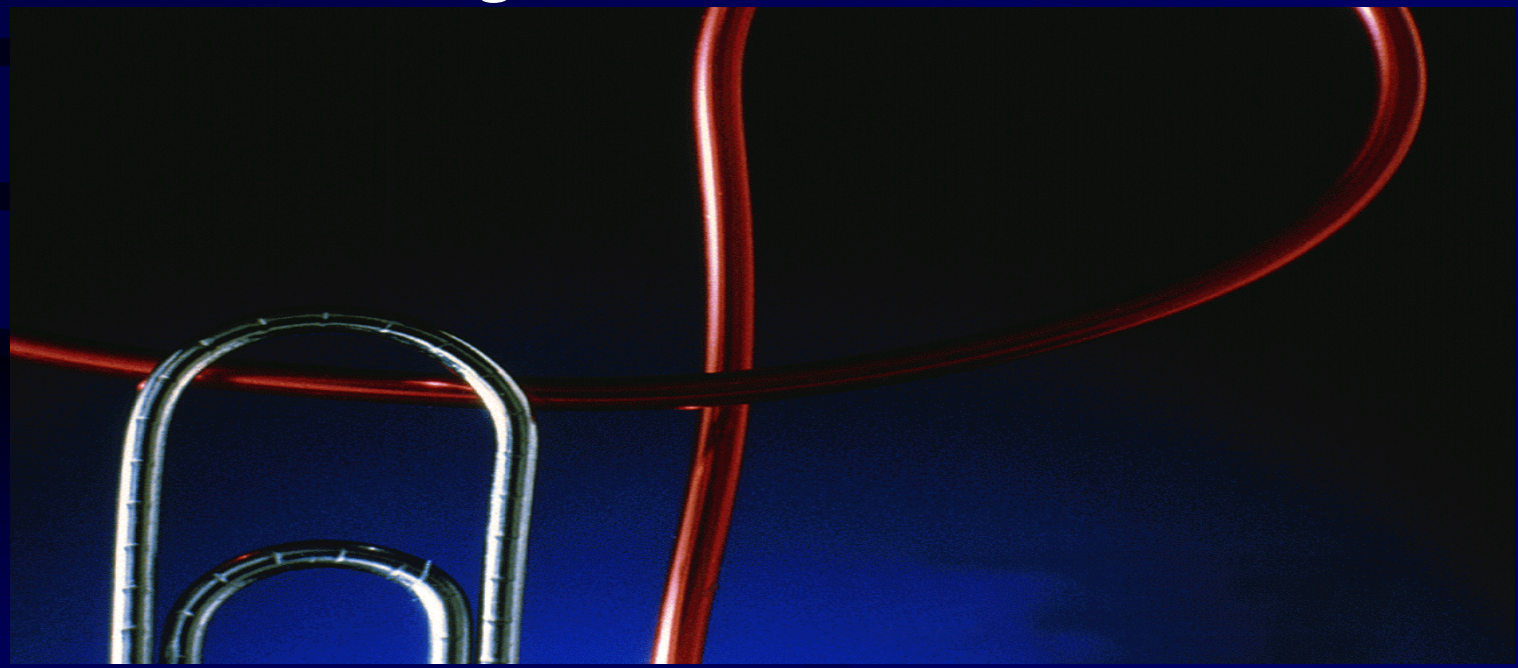
FLEX LIFE

- The ability of the conductor to bend repeatedly without breaking.



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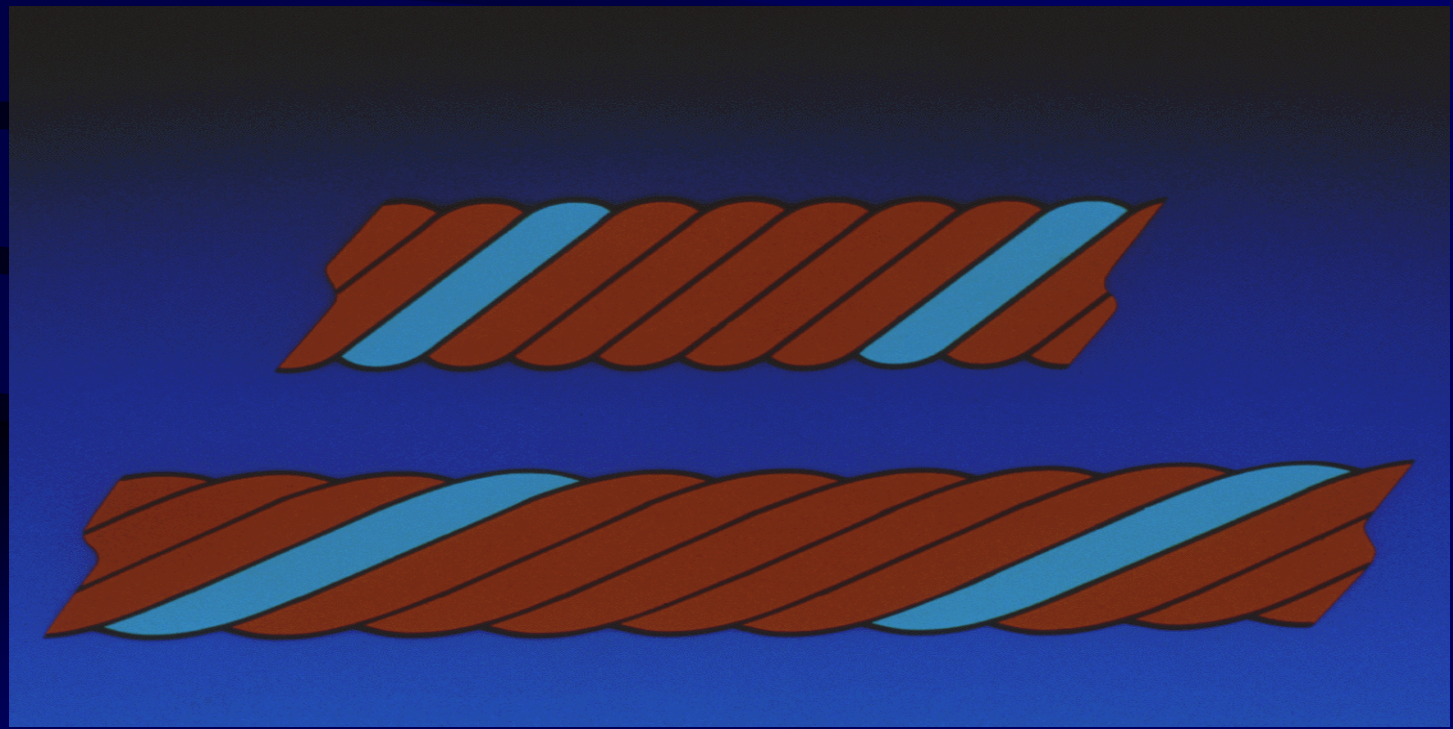
LENGTH OF LAY

- The number of twists in a conductor.



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Increasing the number of strands increases:

- Flexibility
- Flex life
- Cost

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BREAKING STRENGTH

- The pulling force, expressed in pounds, that will cause a conductor to fracture.

SKIN EFFECT

- As the frequency increases, the flow of electrons move to the surface or skin of the conductor.
  - Bare Copper
  - Copper Covered Steel
  - Silver plated copper covered steel

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CABLE 101

The Basics of Wire & Cable

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KEY TERMS

- Insulations
- Jacket
- Capacitance
- Attenuation
- Velocity of propagation
- Dielectric strength
- Dielectric constant
- Working voltage
- Elongation
- Tensile strength
- Flexibility
- Flammability
- Resistance
- Specific gravity
- Dielectric

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KEY MATERIALS

- Halogens
- Non-Halogens
- Thermoplastic
- Thermosetting
- PVC
- Polyethylene
- Polyurethane
- Polypropylene
- Silicone rubber
- FEP
- Tefzel ®
- Neoprene ®
- Hypalon®

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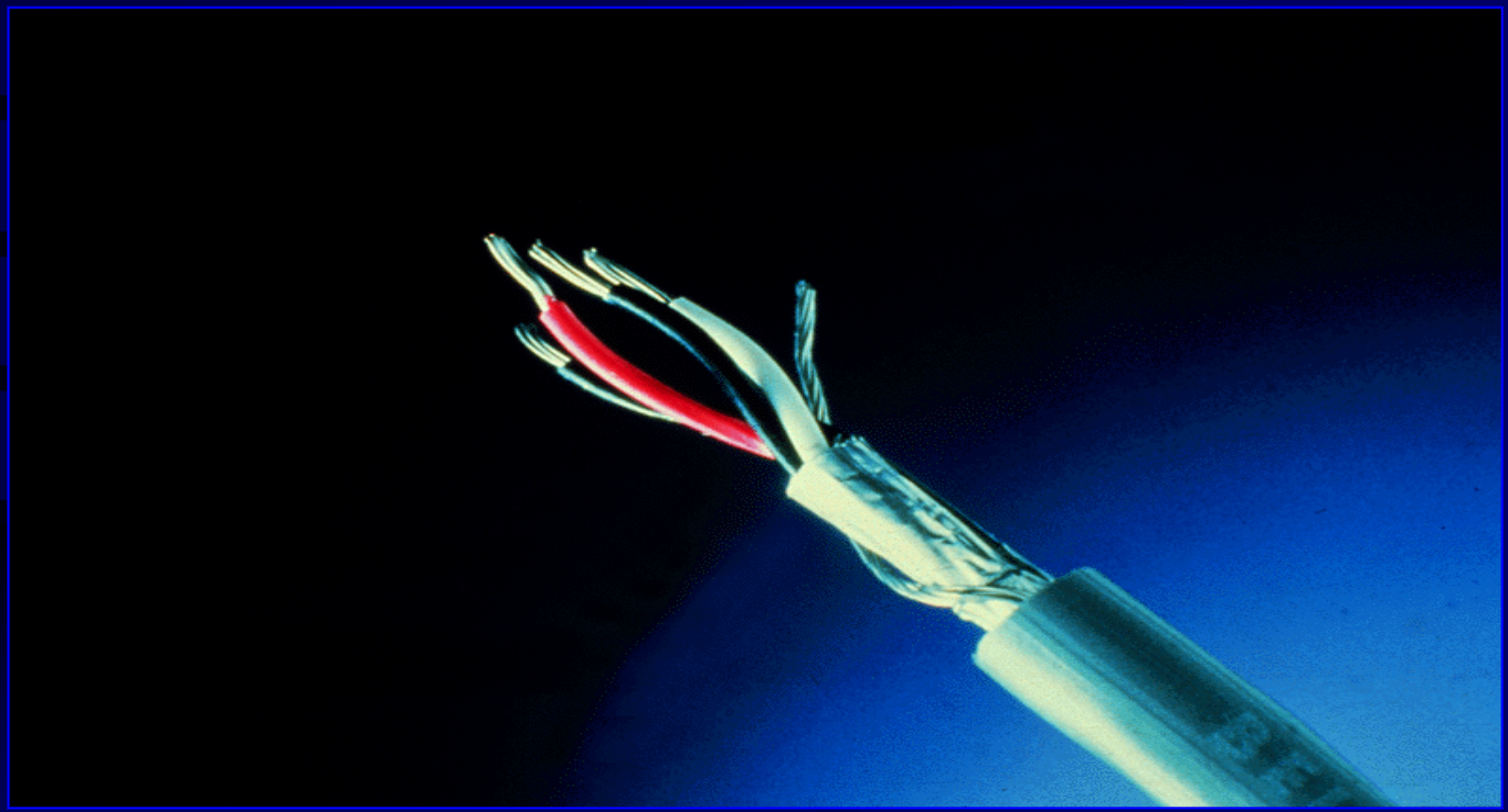
INSULATIONS & JACKETS



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INSULATION

- Insulation separates conductors, electrically and physically, within a cable.

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ELECTRICAL CHARACTERISTICS

- Primary Insulation
  - Capacitance
  - Attenuation
  - Velocity of propagation
  - Dielectric strength
  - Working voltage
  - Dielectric constant

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CAPACITANCE

- A measure of the insulation's ability to store electrical energy.
- Generally, lower capacitance (pf/ft) equates to higher performance cable.
- Expressed in picofarads per foot--and compounded linearly with length.

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ATTENUATION

- A measure of the cable's loss of electrical energy.
- Expressed in dB/unit length and is compounded linearly with length.

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VELOCITY OF PROPOGATION

- The transmission speed of an electrical signal through a length of cable compared to the speed of light in a vacuum.
- Expressed as a percentage of the speed of light.
- High Velocity % = Lower losses

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DIELECTRIC CONSTANT

- Electrical property used to determine Capacitance, Velocity of Propagation, Impedance and relative performance of the insulating material.

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DIELECTRIC CONSTANT

- Symbol: Er
- Very important for electronic cables
- Lower Er = Lower *capacitance*, Higher *impedance*, Lower *attenuation*.
- Air is best dielectric (Er = 1)
- Adding air to (foaming) any material lowers its dielectric constant.

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DIELECTRIC STRENGTH

- The material's ability to withstand voltage breakdown.
- Expressed in Volts (V) or Kilovolts (KV)

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WORKING VOLTAGE

- Maximum voltage allowable by UL to be applied to the cable.
- Expressed as AC Volts (V) or Kilovolts (KV)

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PHYSICAL CONSIDERATIONS

- Elongation
- Tensile strength
- Temperature rating
- Flexibility
- Flammability
- Resistance
- Specific gravity

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ELONGATION

- Description of how far the material will stretch before breaking.
- Expressed as a percentage (%)
- Ultimate elongation = breaking point

TENSILE STRENGTH

- Description of how much force it takes to break the insulation or jacket material.
- Expressed in pounds per square inch (PSI)
- Ultimate tensile strength = breaking point

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TEMPERATURE RATING

- The range of temperatures at which the material can be used without degradation.
- Expressed in degrees (C).

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FLEXIBILITY

- Ability of a cable to bend.
- Not to be confused with flex life.

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FLAMMABILITY

- Ability of a cable to burn.
- Construction dependent.
- Industry standards apply.

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WEATHERABILITY

- Materials' ability to withstand abrasion, chemicals, water and weather
- See Technical Section in Master Catalog

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SPECIFIC GRAVITY

- The weight of material compared to water
- Indicates density of materials used

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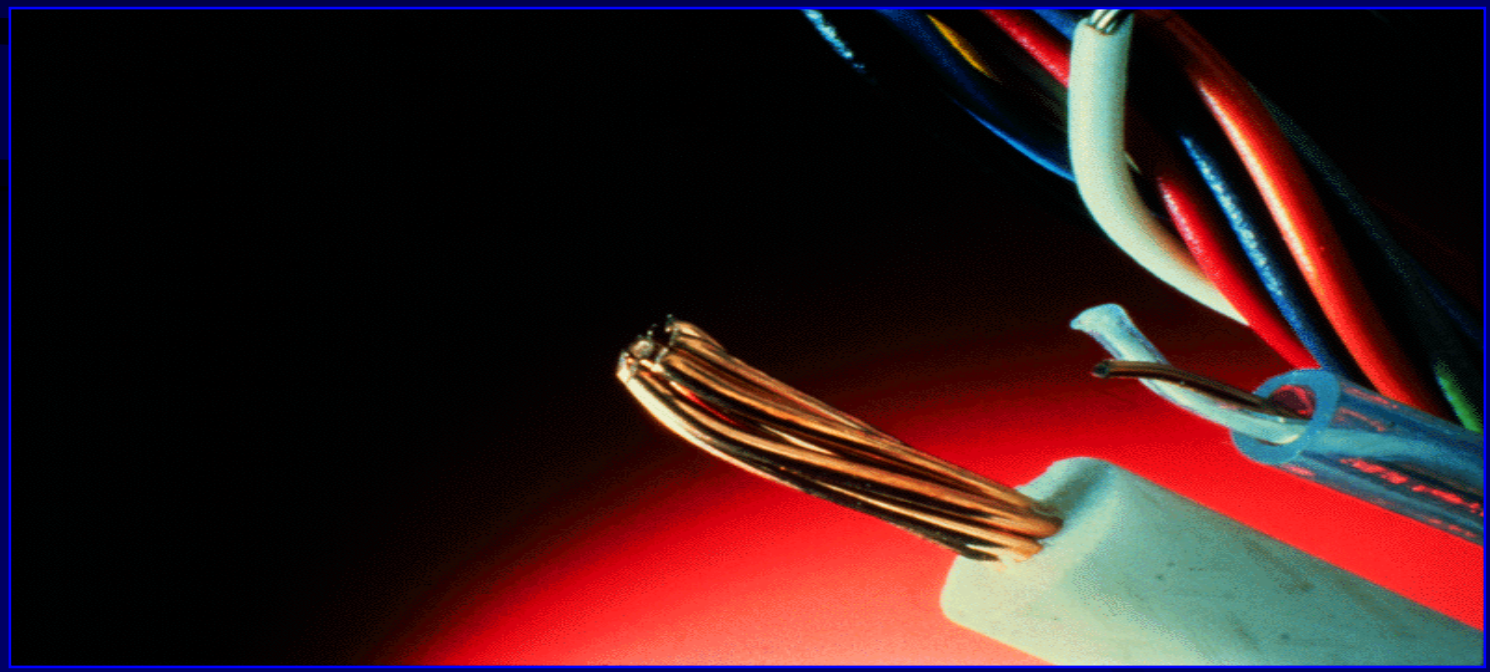
FORMS OF INSULATIONS

- Solid
- Foam (cellular)
- Semi-Solid (air gap)



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SOLID DIELECTRIC

- Easiest to apply
- Most common

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FOAMED DIELECTRIC

- Does not apply to jackets
- Nominally 50% voids
- Velocity of Propagation 70-84%
- Dielectric constant 1.64

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SEMI-SOLID DIELECTRIC

- Does not apply to jackets
- Lowest dielectric constant 1.4
- Mostly air
- Used on RG-8 coax, RG62 type coax

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PROPERTIES

- Voltage resistant
- Quiet
- Oil resistant
- Low loss
- Low gloss
- Low Temperature
- Flame resistant
- U. V. stable
- High temperature
- Bright colors
- Critter “proof”
- Low signal emission
- Abrasion resistance
- Burial cable
- Glow in the dark

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HALOGENS VS NON HALOGENS

- HALOGENS
  - Efficient
  - Good electricals
  - Good dielectric
  - Good physicals
  - "Easy" to compound
  - Processable
- NON-HALOGENS
  - Inefficient
  - Poor electricals
  - Poor dielectric
  - BIG effect on physicals
  - Low smoke
  - "No" acid

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THE JACKET

- The jacket physically protects the internal components of a cable, improves the cable's appearance and provides flame retardancy.
  - Protects from the environment
  - Protects from the rigors of installation

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THERMOPLASTIC

- Thermo = Heat
- Plastic = Formable
- Thermoplastic materials will melt when hot enough

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THERMOPLASTIC

- Lower in cost
- Lighter weight
- Easier to color
- Better electrically
- Most popular

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THERMOPLASTIC

- PVC
- Polyethylene
- Polypropylene
- Polyurethane
- PVDF
- Halar
- Tefzel
- FEP
- TFE

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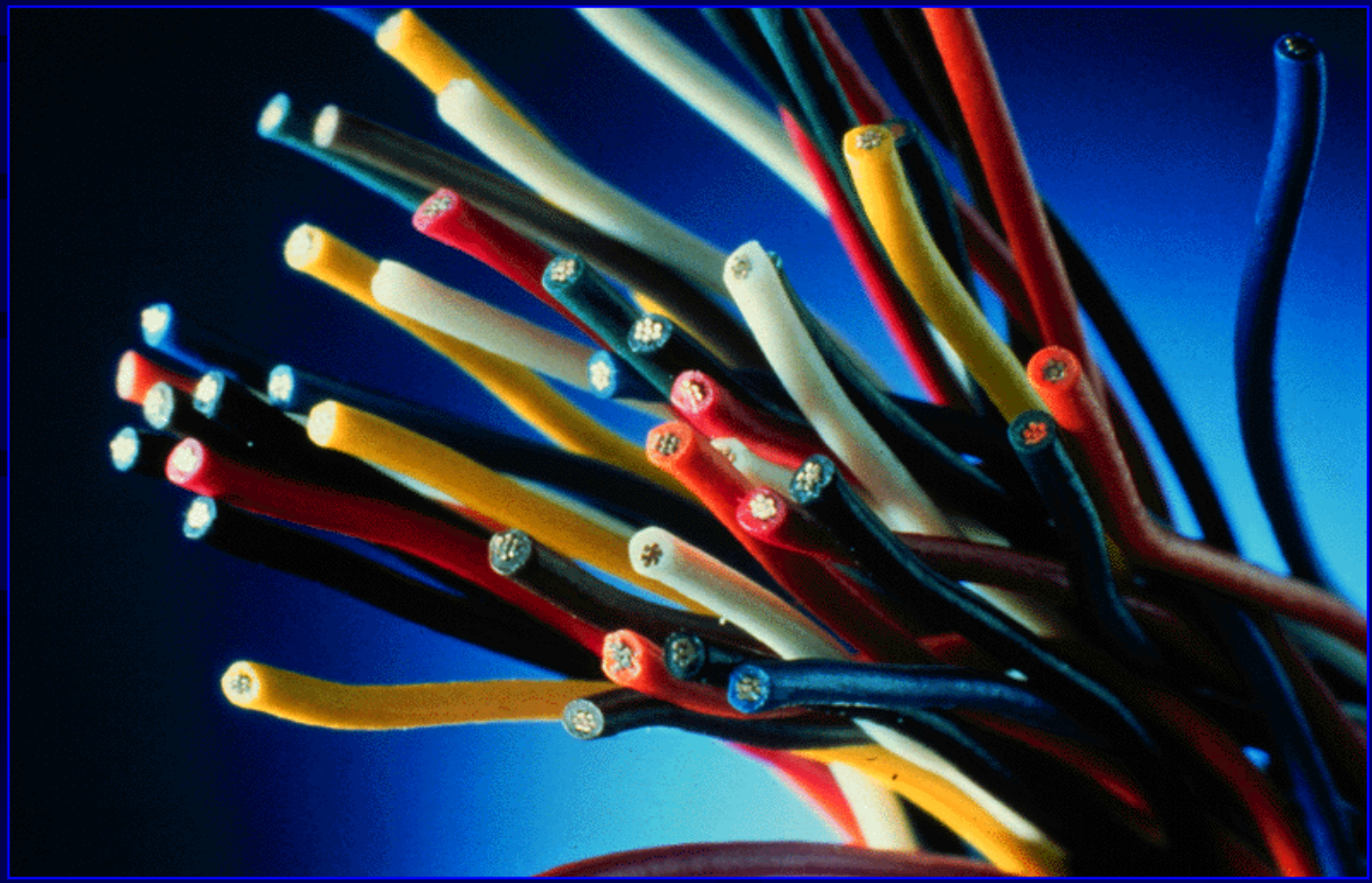
PVC



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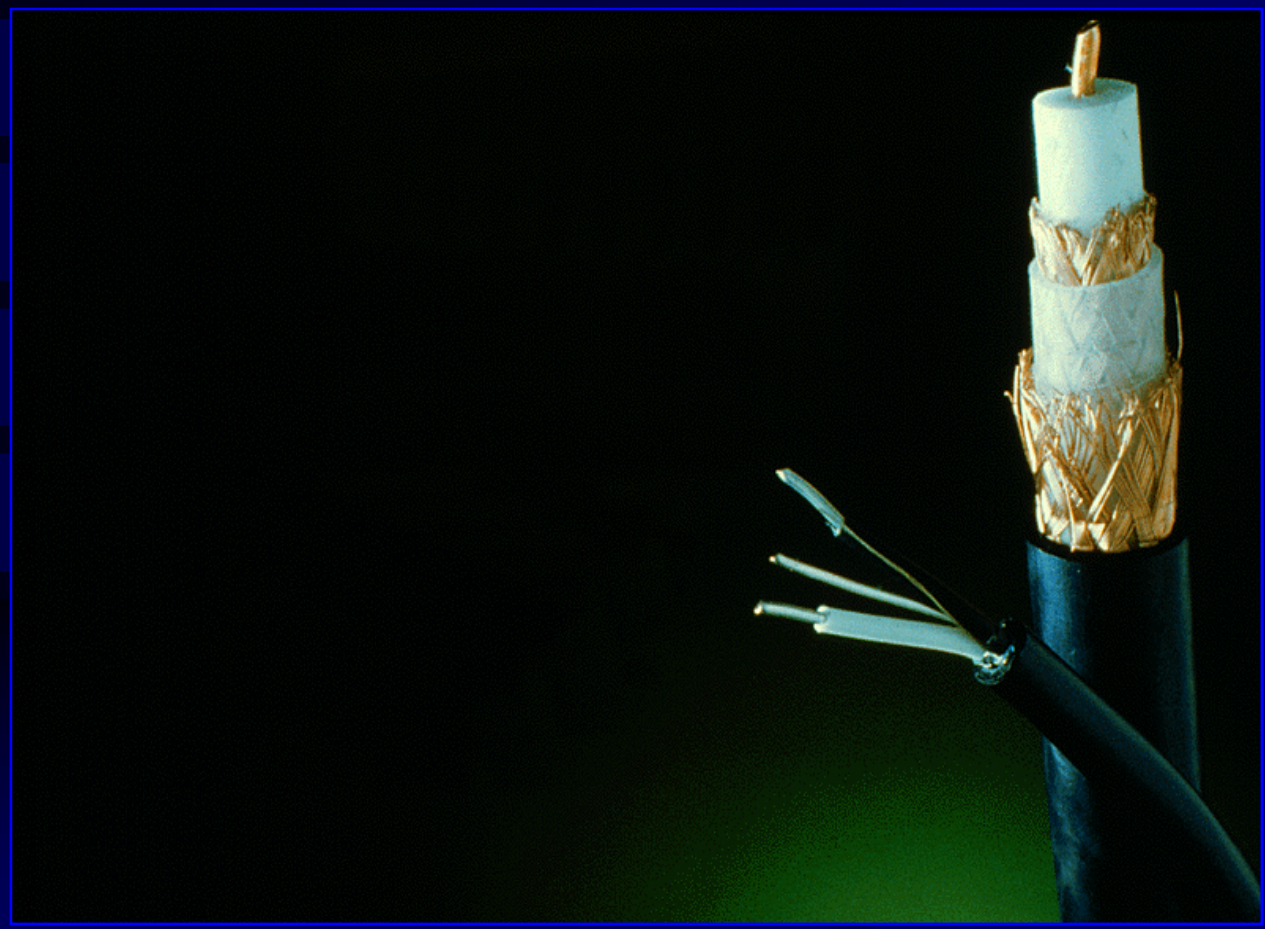
POLYETHYLENE



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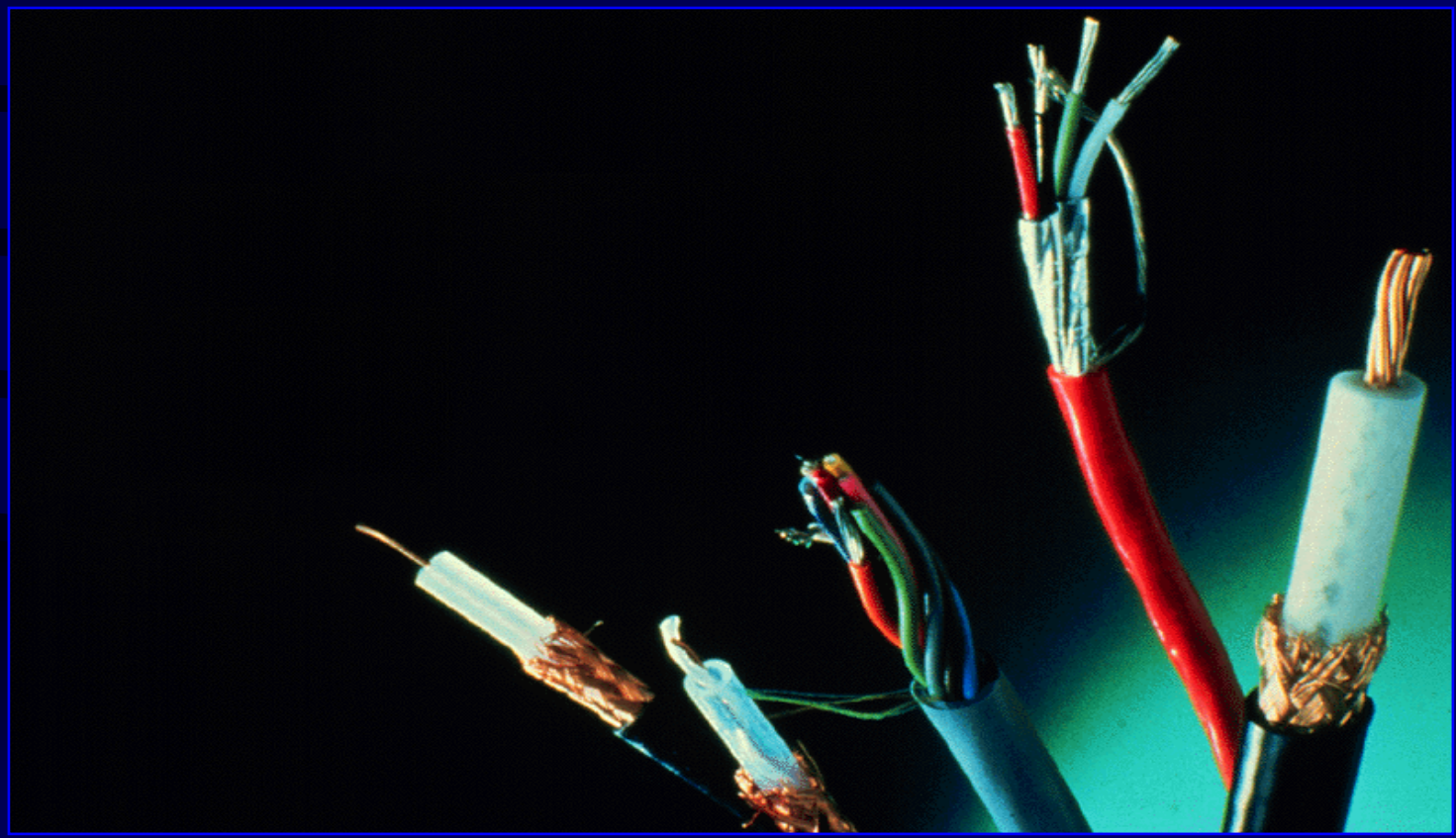
POLYPROPYLENE



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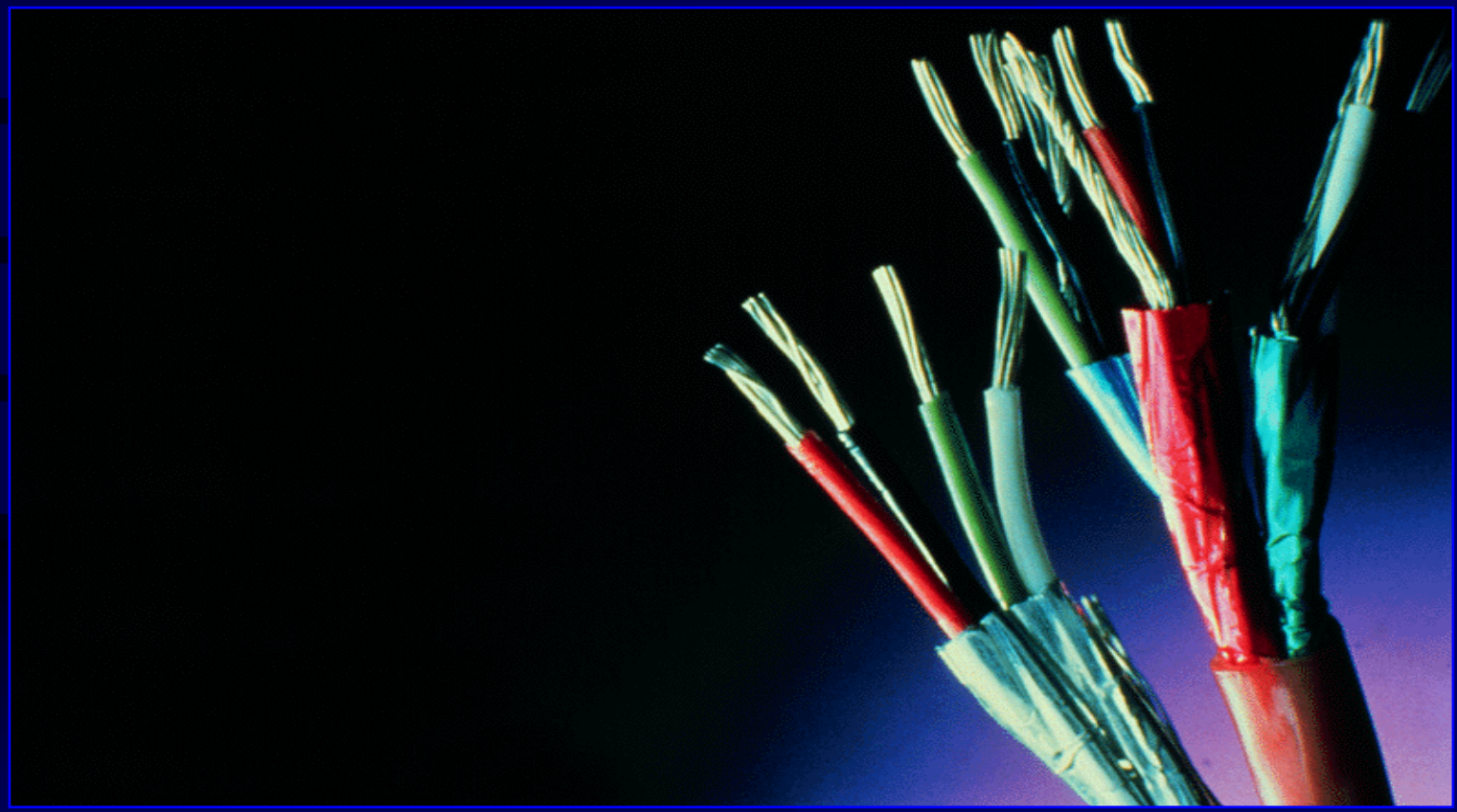
FEP



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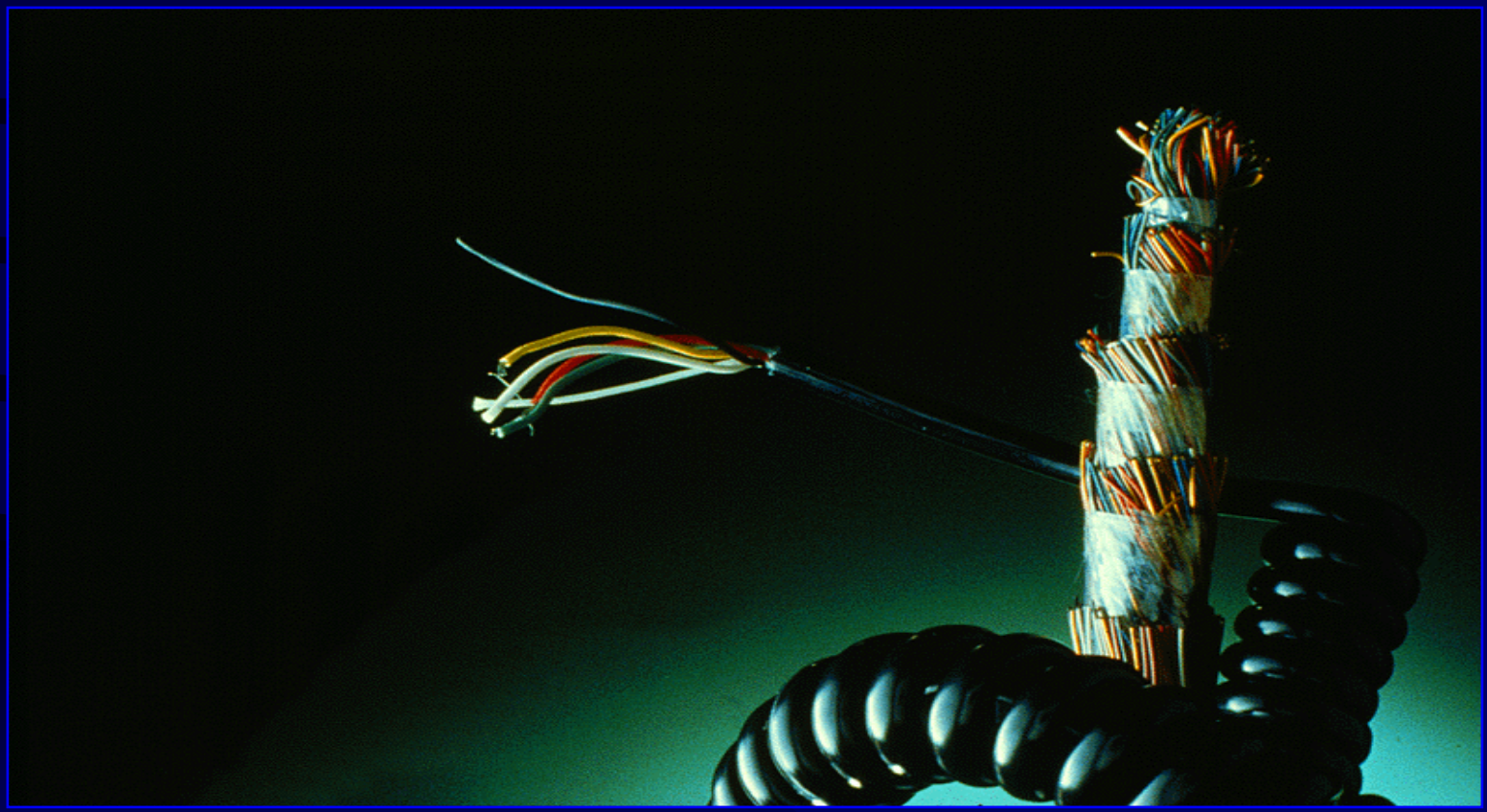
POLYURETHANE



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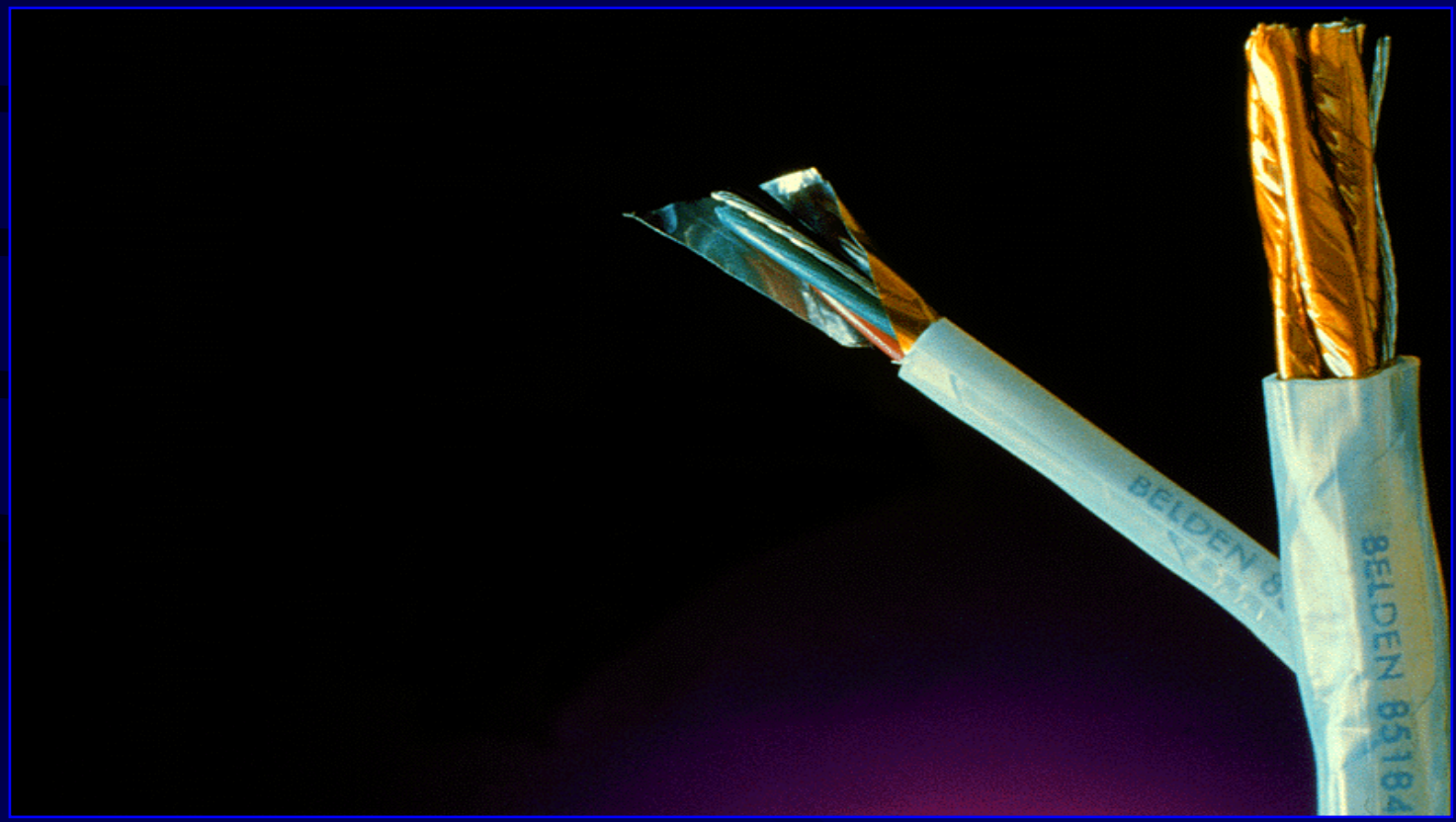
TEFZEL®



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THERMOSET

- Thermo = Heat
- Set = fixed
- Thermoset materials do not melt when heated
- Once “cured” cannot be recycled like thermoplastics

THERMOSET

- More flexible (at room and lower temperatures)
- Limp and lay flat

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THERMOSET

- Natural rubber
- SBR
- Neoprene
- Hypalon®
- EPDM
- Silicone rubber

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SILICONE RUBBER

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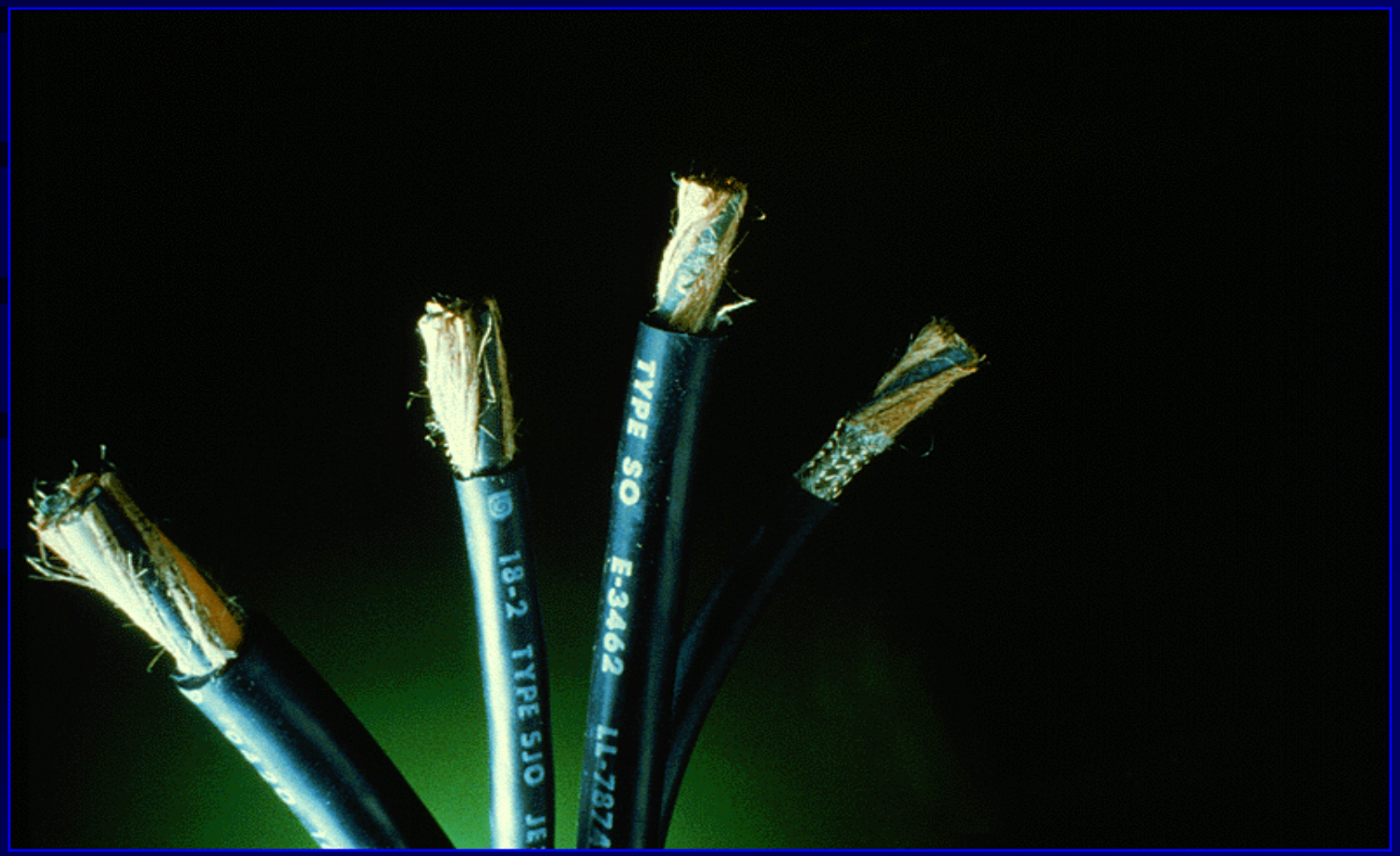
NEOPRENE®



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HYPALON®

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A New Benchmark In Multimedia Cable Performance

MediaTwist

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Imagine…

A UTP cable that supports

- Telephone
- Fax
- T-1
- Switched 56
- ISDN
- 100baseT
- FDDI/TP-PMD
- Gigabit Ethernet

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Imagine...

…and it also supports

- RS-232
- RS-422
- RS-485
- Smart House
- 10baseT
- Token Ring
- 155/622 ATM
- ISDN

- Analog Audio
- Analog Video
- AES/EBU Digital Audio
- Digital Video
- 270 Mbps Video(135MHz)
- Analog Broadband to Channel 45 (354 MHz) up to Channel 70 (500 MHz)
- Shared Sheath Applications

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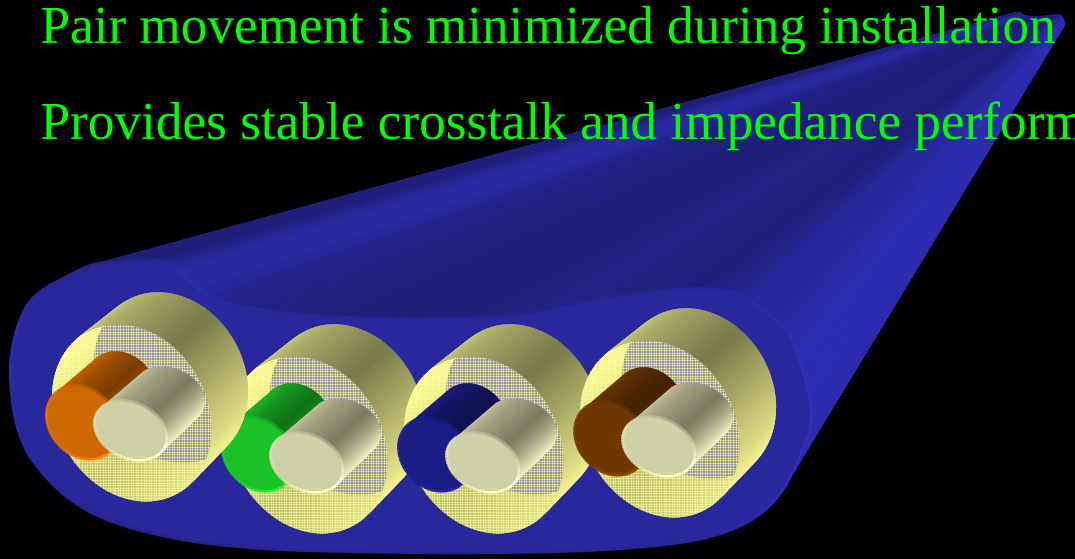
A Breakthrough in Cable Design

Advanced Manufacturing Technology

* **Bonded Pair Technology**
* Unique crescent shape design locks each pair into place
* Pair movement is minimized during installation
* Provides stable crosstalk and impedance performance after installation



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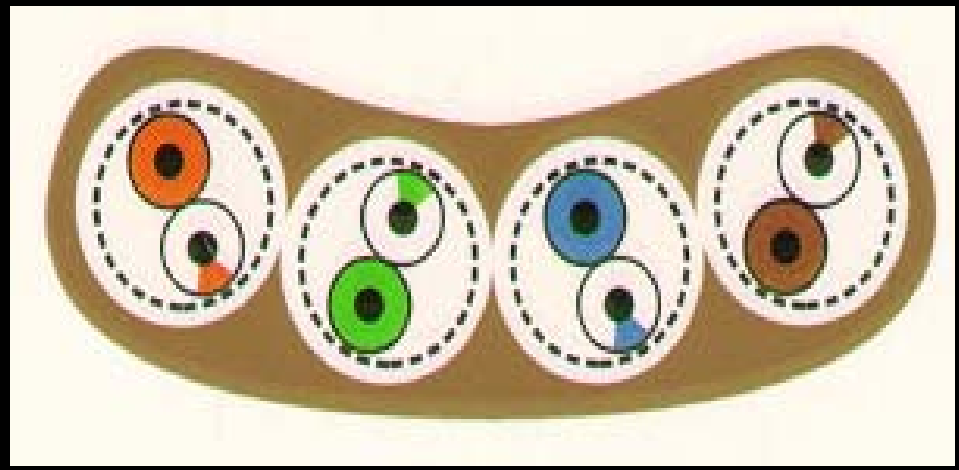
Unique Shape Offers Stable Electricals Even After Installation



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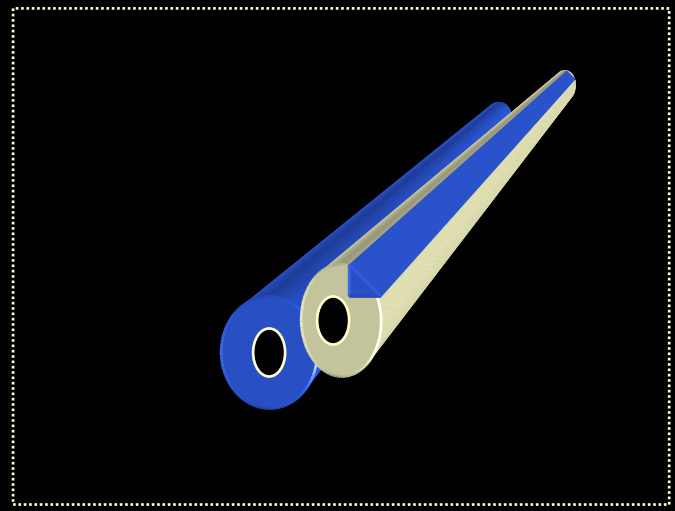
Think of it as Coax

Balanced design



* **Conductors both made together, with identical properties**
* **Provides long term stability and performance**
* **Patented manufacturing process**

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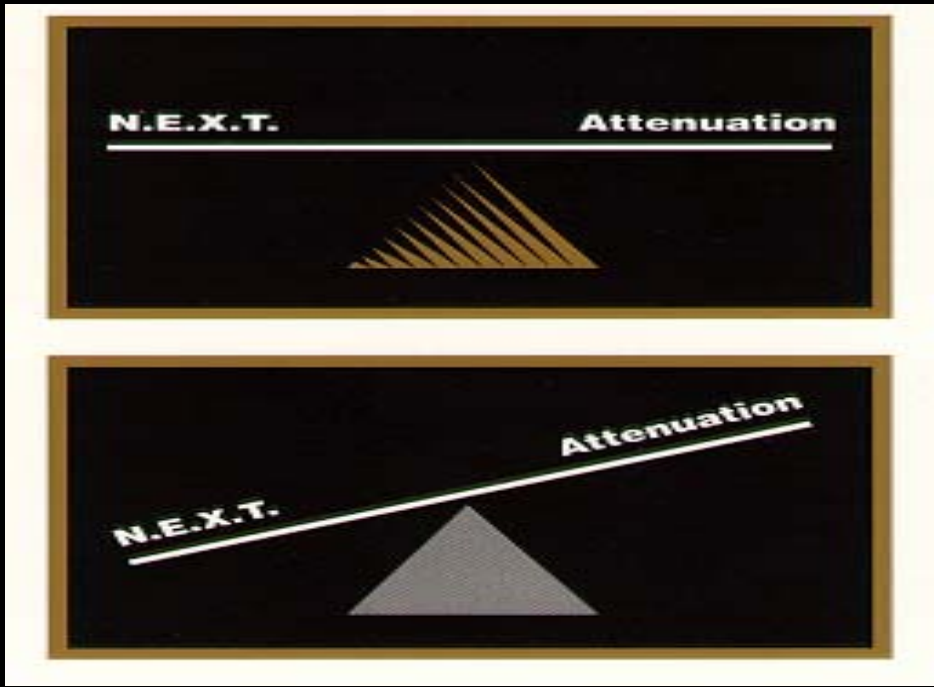
Balancing Crosstalk and Attenuation



Network Equipment Looks For Strong Clean Signals, Not NEXT

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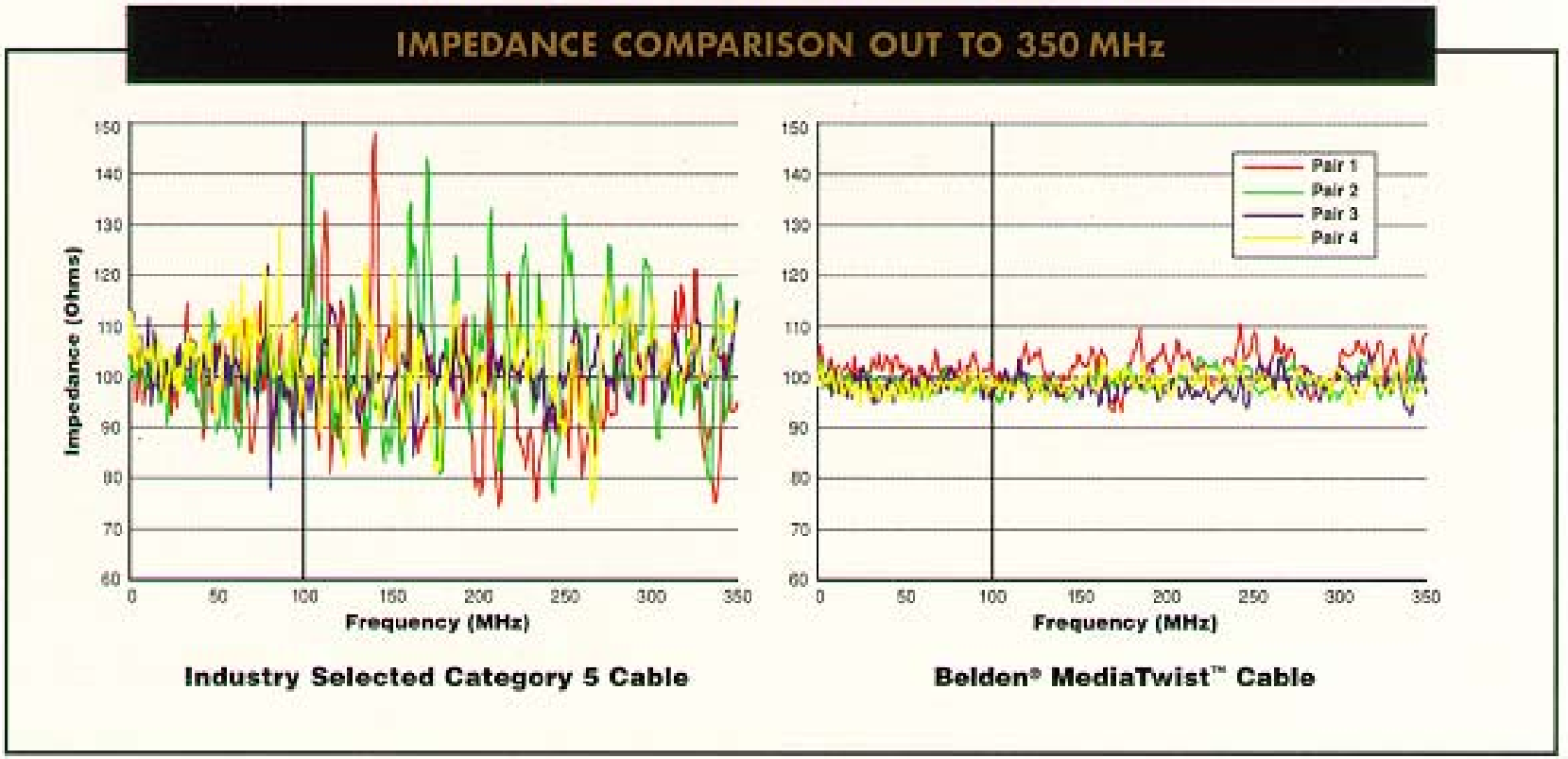
Exceptional Physical Uniformity



Non Impedance Averaged

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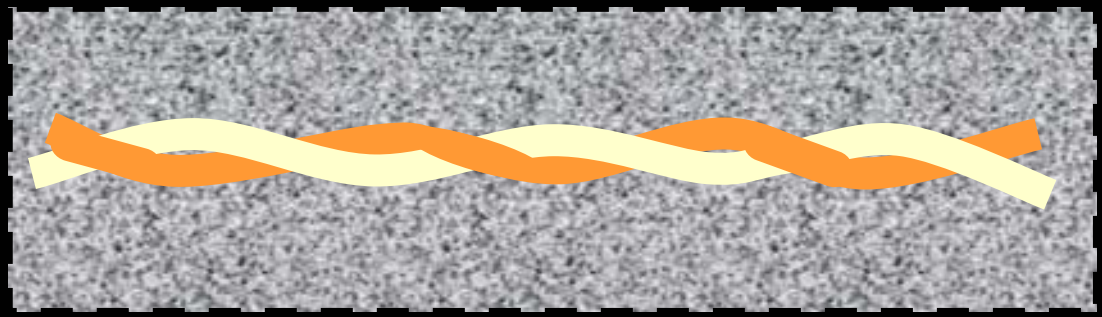
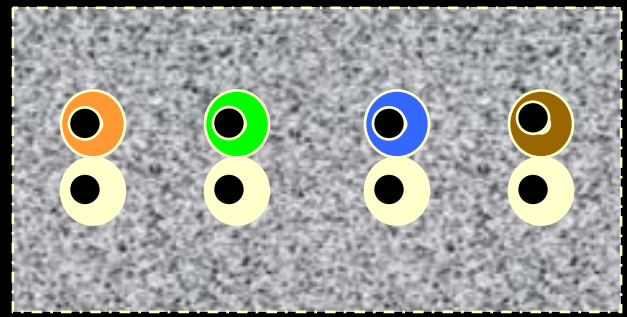
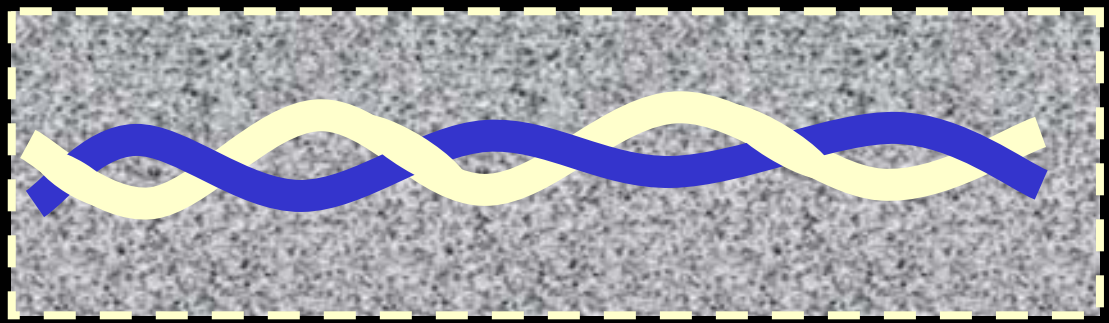
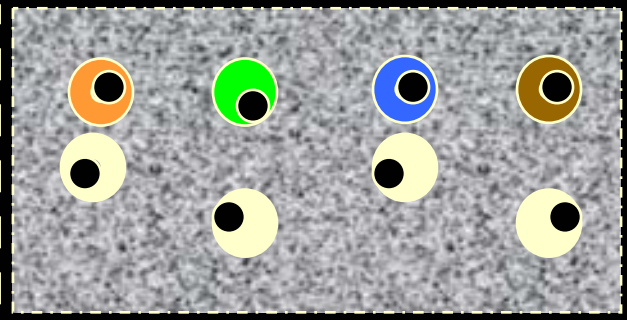
Conductor to Conductor Uniformity

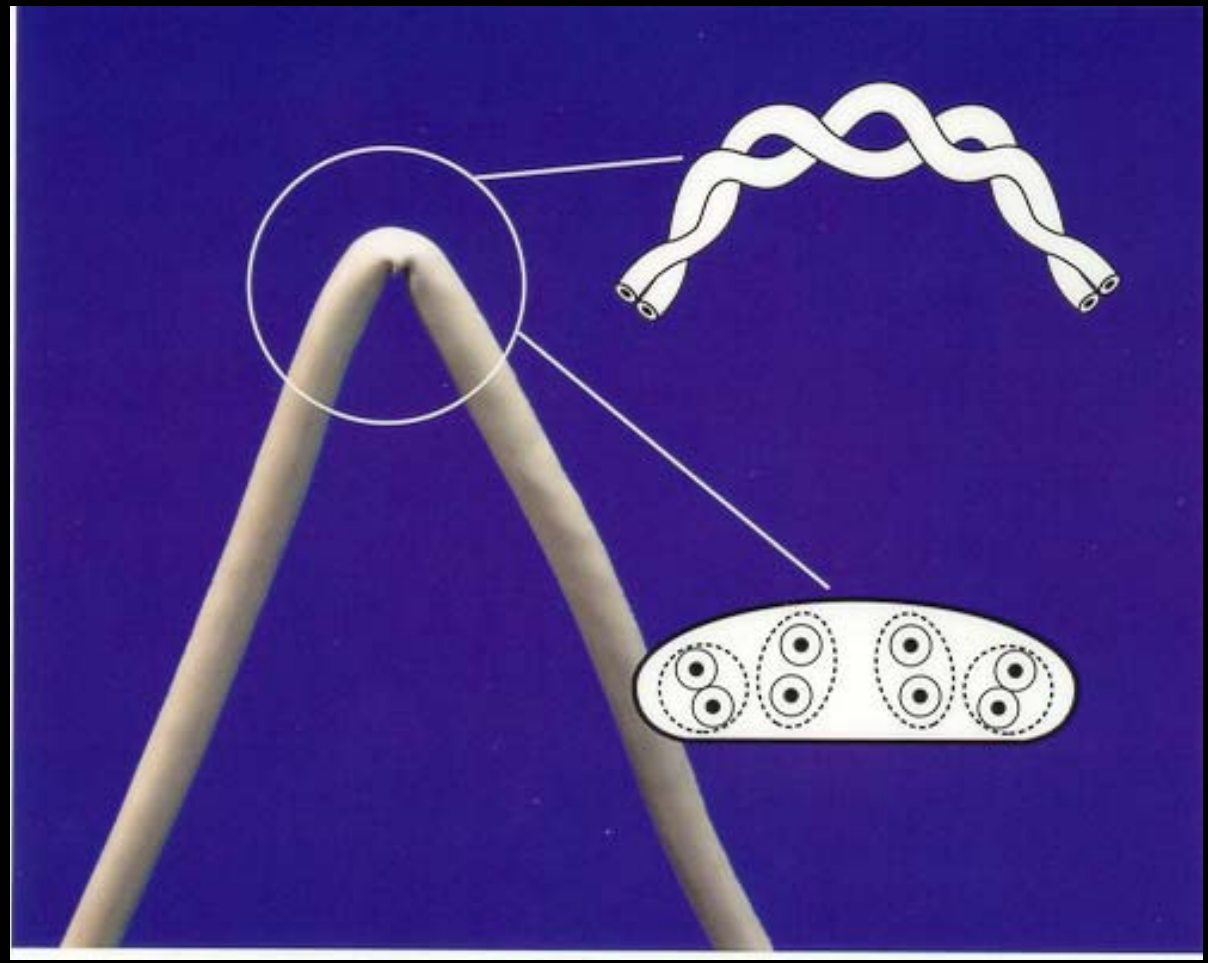








Unbonded Cat 5 After Installation



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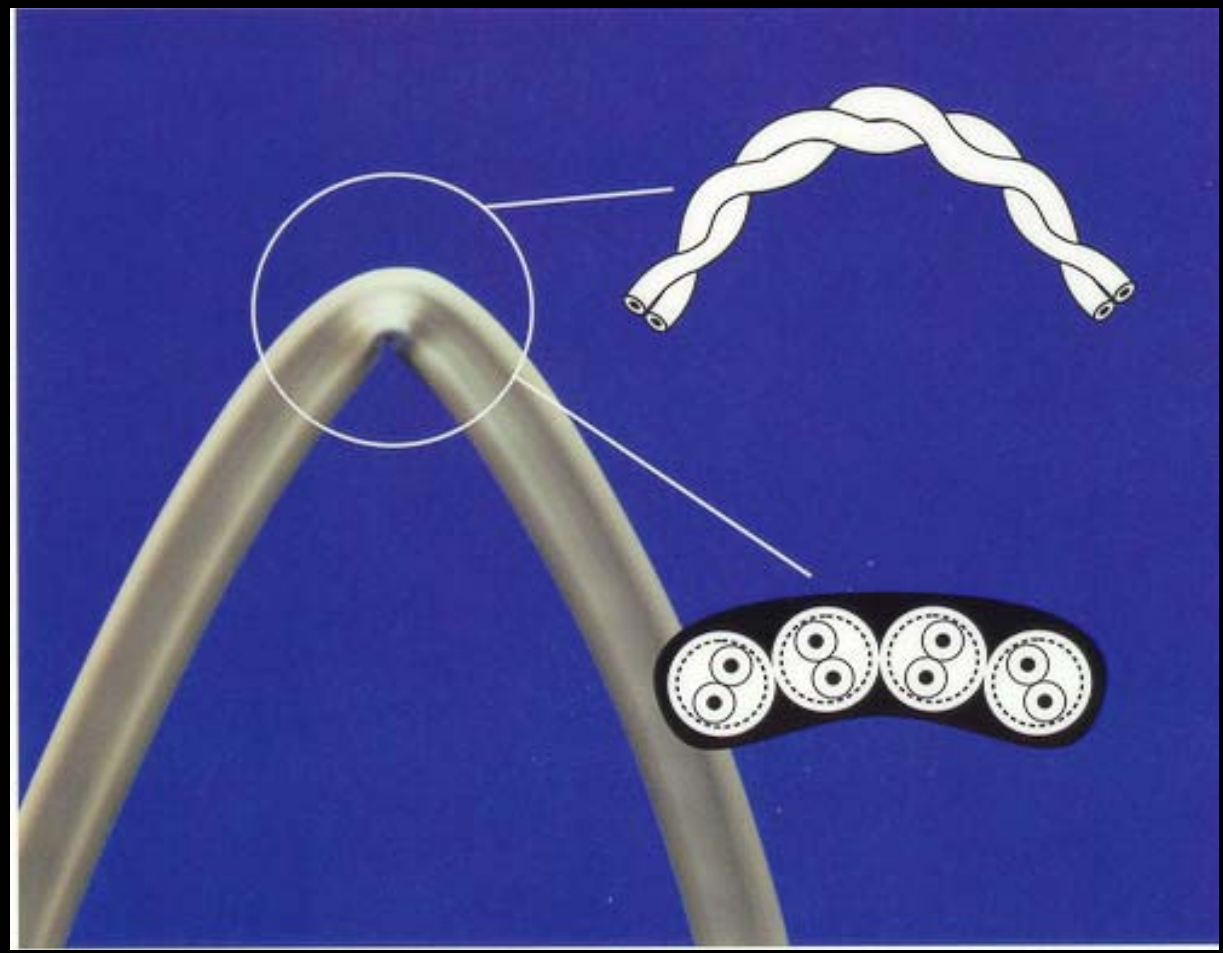
Bonded Cat 5 After Installation



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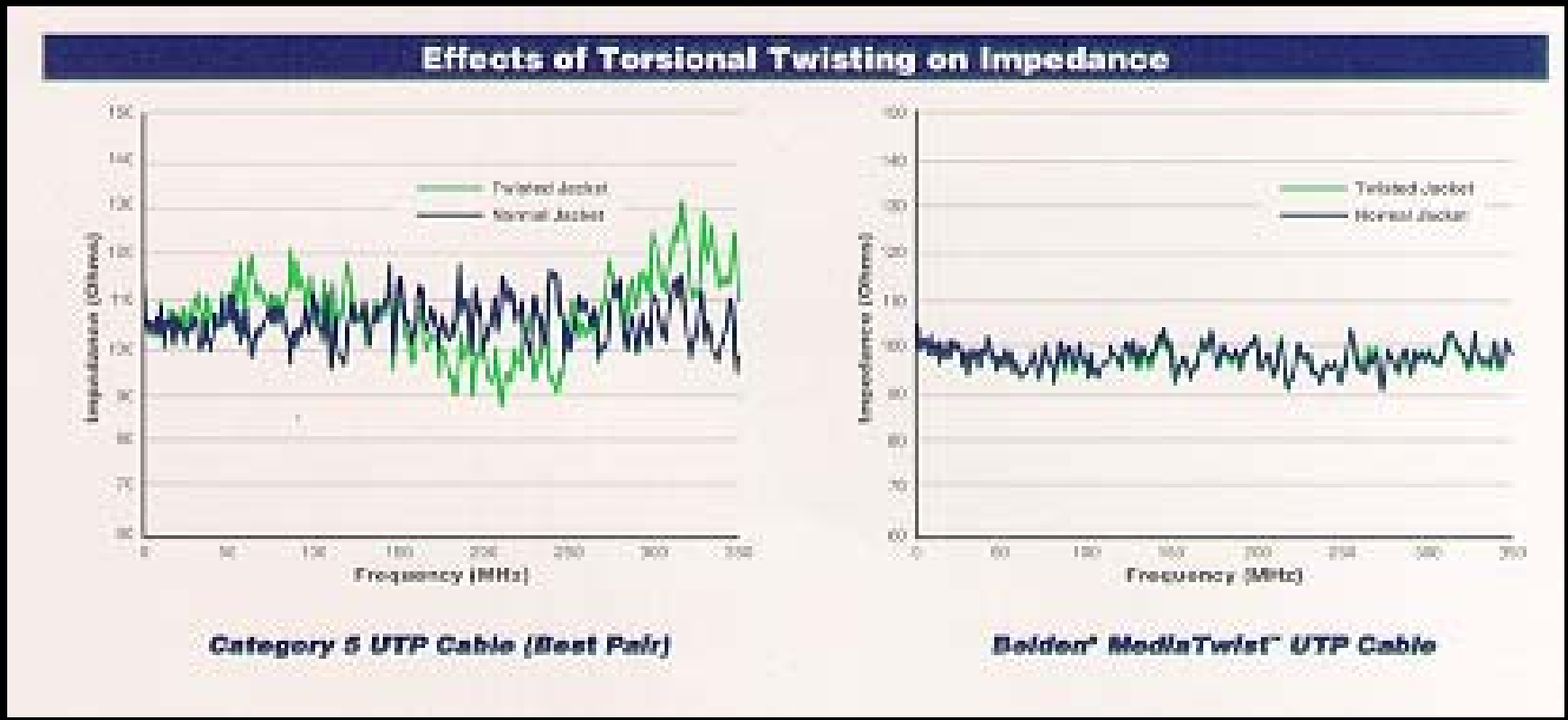
Impedance Stability Even After Installation



Category 5 UTP Cable (Best Pair)

Belden® MediaTwist™ UTP Cable

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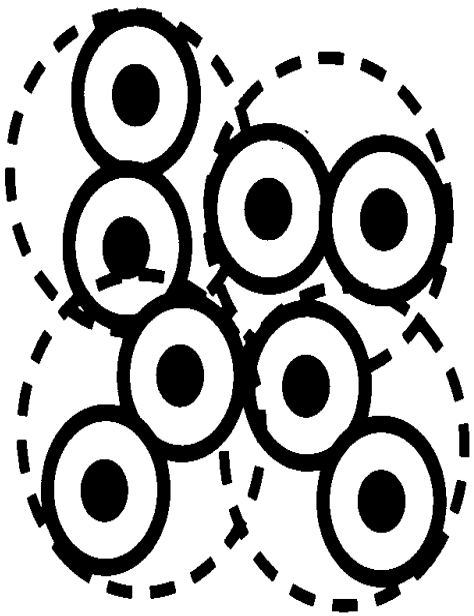
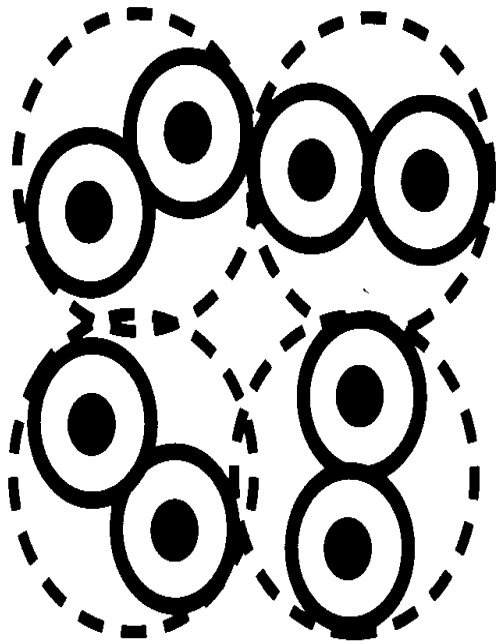
Near End Crosstalk (NEXT)

Cable Without Varied Lays



Cable With Varied Lays



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Underwriters Laboratories Inc.®

EMC Compliance Certificate

Company Name and Location:
Belden Wire & Cable P.O. Box 1980 Richmond, IN 47375-1980

File Number:
NC3239

Date of Report:
27 September 1996

Product Description:
High-Speed, Unshielded Twisted-pair Data Cable

Investigated in accordance with:
Code of Federal Regulations, Title 47, Part 15 Subpart - B for Class A Digital Devices

Model Designation:
Mediatwist

Serial No.:
N/A

Additional Information/Remarks:
Tested and found to be suitable for use in high-speed Audio/Video Systems with data transfer rates of 270Mbits per second, at a fundamental frequency of 135MHz.

A sample of the product described above has been investigated by Underwriters Laboratories Inc. in accordance with the requirements indicated on this Certificate and has been found in compliance with those requirements. It is the responsibility of the company shown above that the products it produces are in compliance with the applicable requirements.

The name of Underwriters Laboratories Inc. (UL), any abbreviation thereof, or any symbol shall not be used on or in connection with the product unless and until specifically authorized by UL.

Tested by: Steve Urbanski
EMC Testing Services

UL EMC

Reviewed by: Mike Windler
EMC Testing Services

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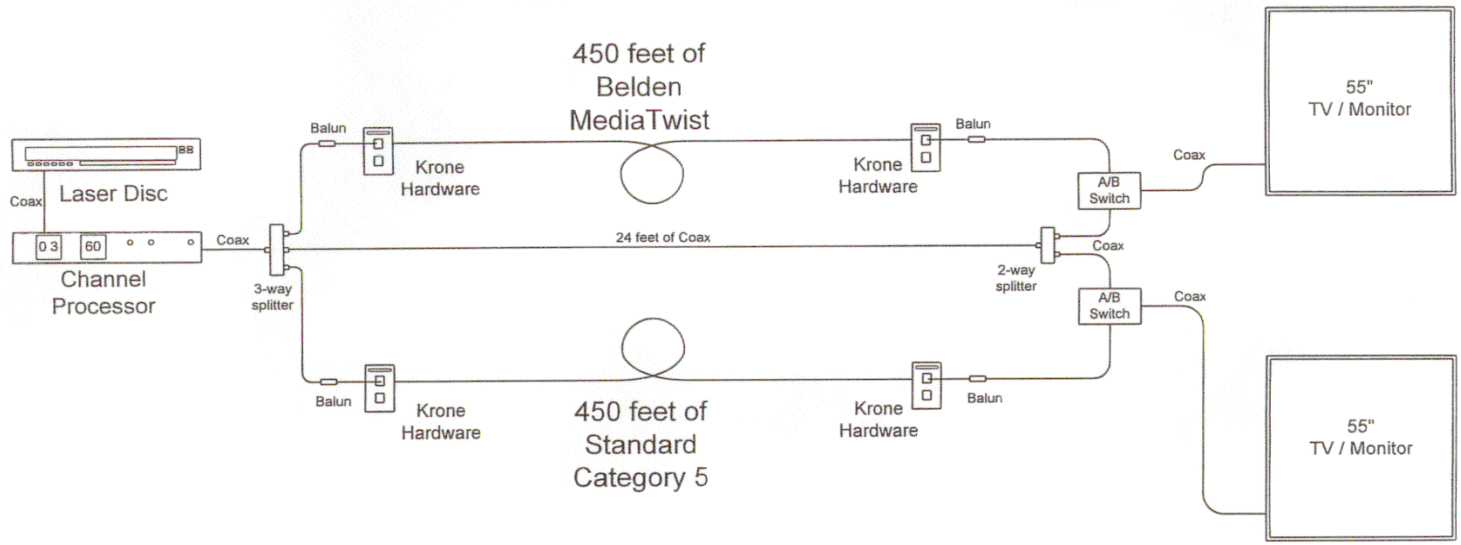
Demo #1 - Broadband Video Over Belden MediaTwist



Purpose:

This demonstration modulates a broadband signal on channel 3 from a laser disc player up to channel 60 (438 - 444 MHz) over two types of unshielded twisted pair cable. The two types of UTP are 450 feet of standard Category 5 cable and 450 feet of Belden's new MediaTwist 4-Pr. cable. Broadband video baluns are used to transition the signal from coax to UTP. A/B switches are included in this demo to reference each UTP link to a short coax sample. Judge the difference between MediaTwist and Category 5 cable youself using the 55" TV's.

Components:

- 450 Feet of Belden MediaTwist 4-Pr. Unshielded Twisted Pair Cable
- 450 Feet of Standard Category 5 4-Pr. Unshielded Twisted Pair Cable
- Four Krone Information Outlets
- Four UTP to Coax Broadband Video Baluns
- One Laser Disc set to Channel 3
- One Cadco Channel Processor
- Two 55" TV / Monitors

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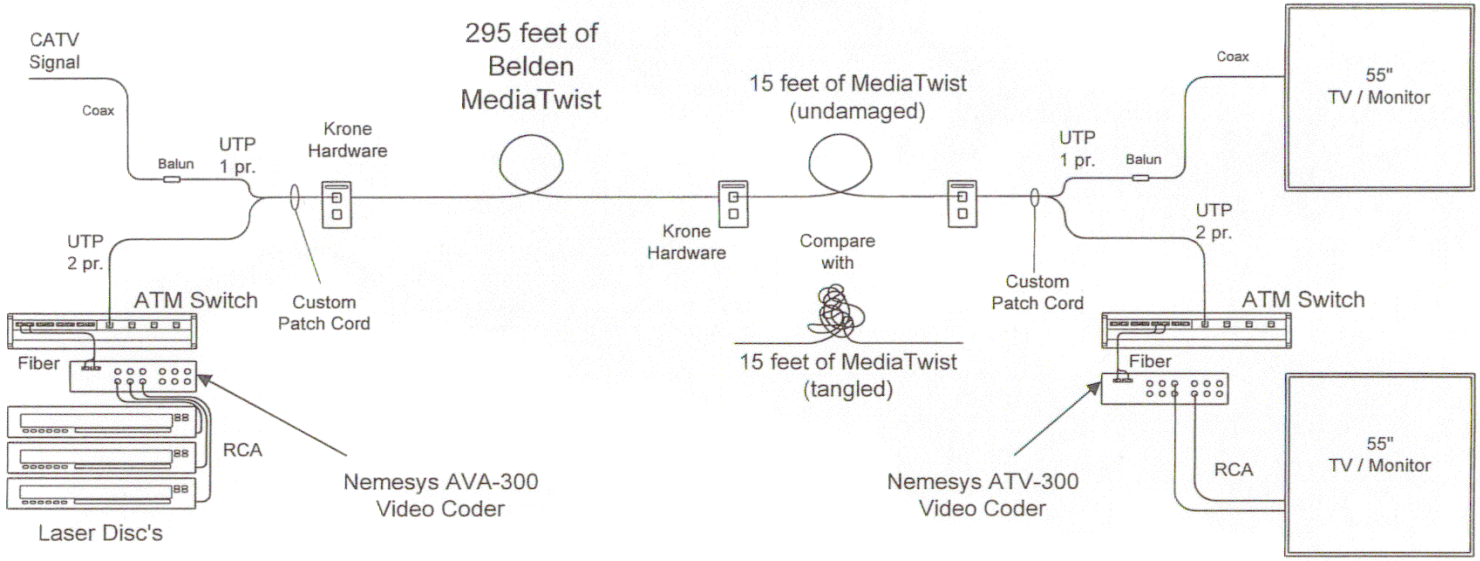
Demo #2 - Shared Sheath Applications Over Belden MediaTwist



Purpose:

This demonstration shows a CATV broadband signal and an encoded digital video signal using ATM switching over a single 4 - pair Unshielded Twisted Pair UTP Cable of 321 feet total. The total length is comprised of 295 feet of Belden's new MediaTwist 4-Pr. cable, an additional 15 foot piece of MediaTwist, and two 8 foot Belden DT 350 custom patch cords. Broadband video baluns are used to transition from coax to UTP. The CATV signal is being transmitted over a single pair while ATM video cells are transmitted over two other pairs within the same cable sheath. Can you see a difference in either signal when replacing the undamaged 15 foot piece of MediaTwist with a signficantly tangled piece?

Components:

- 295 Feet of Belden MediaTwist 4-Pr. Unshielded Twisted Pair Cable
- Two Fore Systems ASX-200BX ATM Switches
- One Nemesys AVA-300 Video Transmitter
- One Nemesys ATV-300 Video Receiver
- Three Krone Information Outlets
- Two UTP to Coax Broadband Video Baluns
- Three Laser Disc
- Two Special Patch Cords (One pair for Broadband Video and Two pairs for Video over ATM)
- Two 55" TV / Monitors

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Belden MediaTwist™ Lifetime Warranty

Belden Wire & Cable Company ("Belden") hereby warrants solely to the end-user set forth below ("End-User") that, subject to the limitations specified in this Warranty, the Belden "MediaTwist™" cable (the "Cable") which is installed in the building (the "Building") at the address and on the date set forth below, shall for the usable life of the Building, under normal and proper use and in all material respects,

(I.) Be free from defects in materials and workmanship; and

(II.) Exceed the electrical specifications of the commercial building telecommunications cabling standard (TIA/EIA 568A category 5) in effect on the date of installation set forth below.

This warranty shall not apply or extend to the Cable if such Cable has been:

(a) installed other than in accordance with TIA/EIA 568-A, 569 and TSB 67 standards;

(b) subject to abuse, neglect, accident, misuse, or natural disaster;

(c) repaired, altered, rewired, de-installed or re-installed; or

(d) installed other than in the United States or Canada.

Belden's Liability

Belden's liability for breach of this Warranty is, upon Belden's determination that the failure of performance of the Cable is properly within the scope and coverage of this Warranty, limited solely to, at Belden's option, either (i) repair or replace the non-conforming Cable or (ii) refund the purchase price of the non-conforming Cable. Claims under this Warranty may only be asserted directly against, and administered by, Belden. End-User must advise Belden in writing immediately upon End-User's discovery of any failure or defect. EXCEPT AS SPECIFICALLY STATED HEREIN, IT IS ACKNOWLEDGED THAT BELDEN HAS GIVEN NO OTHER WARRANTIES, EXPRESS OR IMPLIED. ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED FROM THIS WARRANTY. IN NO EVENT SHALL BELDEN BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES (REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT OR IN TORT, INCLUDING NEGLIGENCE), INCLUDING BUT NOT LIMITED TO DAMAGES FOR LOST PROFITS, DATA, TIME, REVENUES OR THE LIKE, NOR SHALL BELDEN'S LIABILITY FOR ANY CLAIMS OR DAMAGE ARISING OUT OF OR CONNECTED WITH THIS WARRANTY OR THE MANUFACTURE, SALE, DELIVERY OR USE OF THE CABLE EXCEED THE PURCHASE PRICE OF THE CABLE.

Name of End-User: _____ Name of Distributor: _____

Address of Building: _____

Date of Installation: _____

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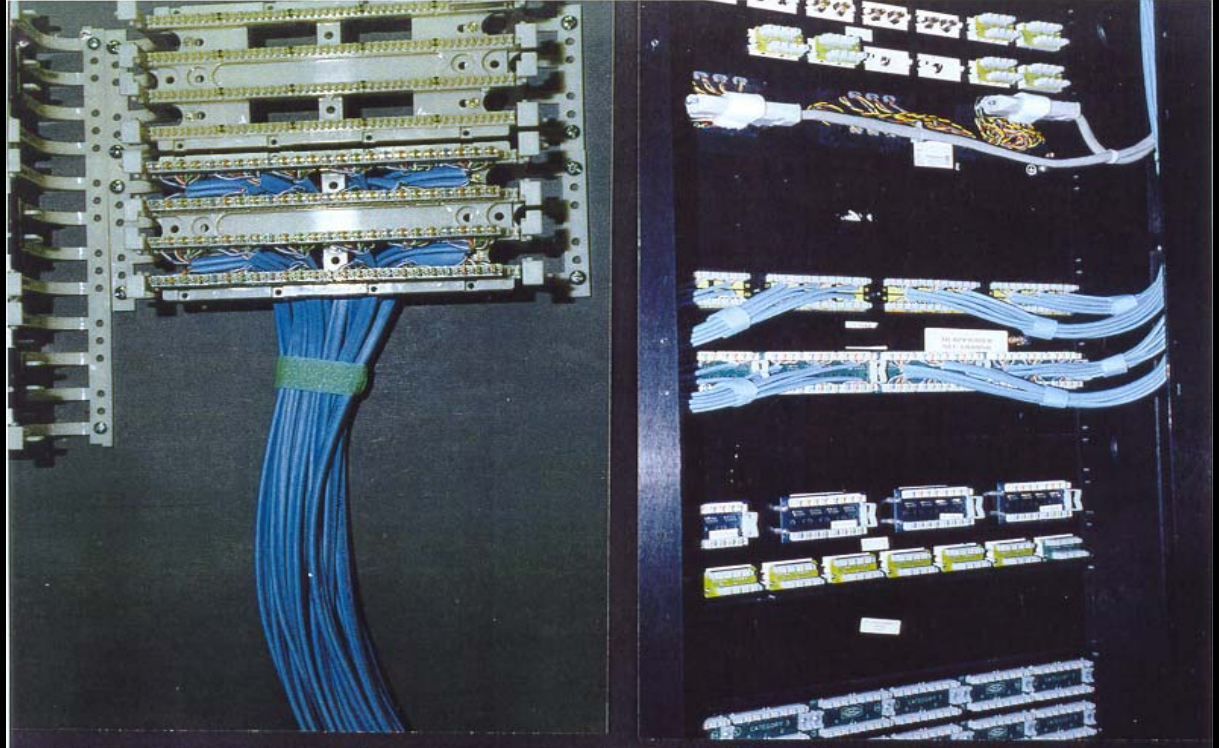
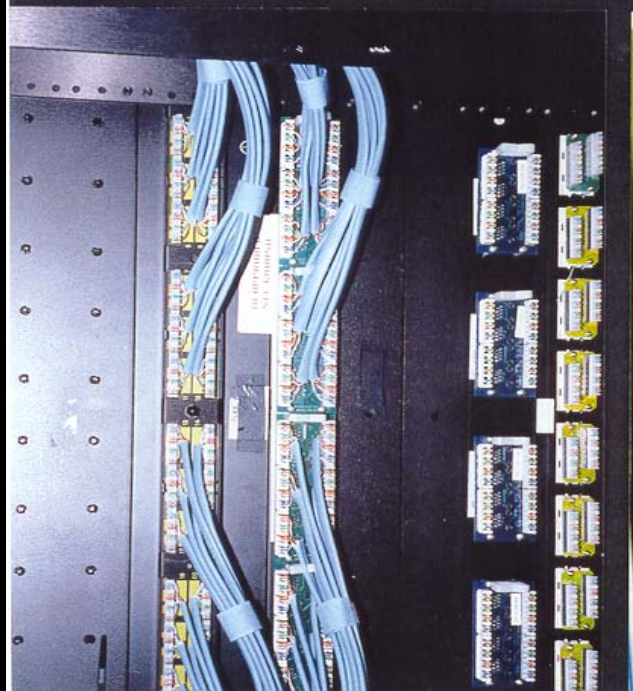
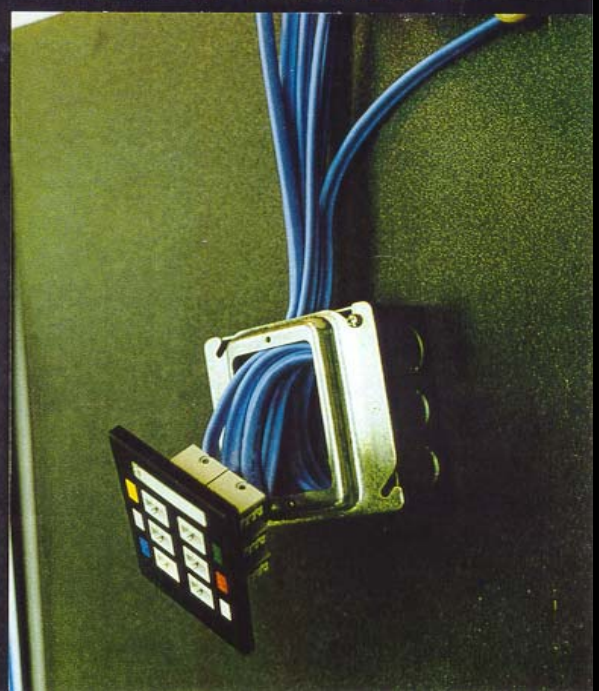
Electrical Improvements Above Category 5

Electrical Attribute	MediaTwist™
Max. DC Resistance Unbalance	100%
Max. Capacitance Unbalance	567%
Max. Skew	125%
Impedance and Structural Return Loss	Up to 50%
Attenuation-to-Crosstalk Ratio	110%
Power Sum Crosstalk	200%
Attenuation	Up to 20%
Frequency Range Verified	250%







MediaTwist Utilizes Standard Connectivity

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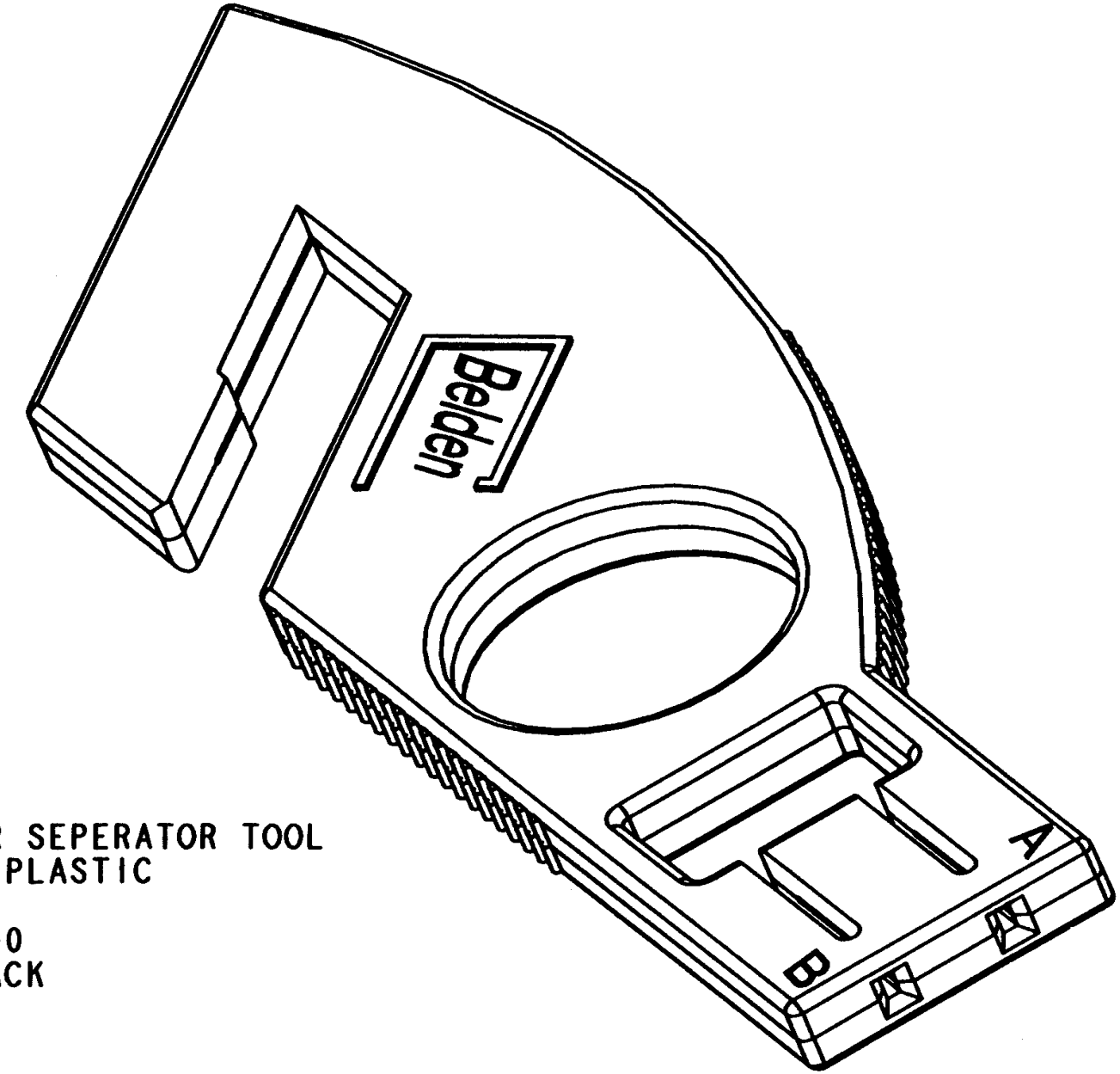

BONDED PAIR SEPERATOR TOOL
MATERIAL: PLASTIC
(1) REQ'D
SCALE 2.000
COLOR: BLACK

Mediatwist Conduit Capacity Chart

MediaTwist Conduit Capacity Chart: 1874A and 1872A						
Size	1/2"	3/4"	1"	1.25"	1.5"	2"
# of feeds*	1	4	7	11	16	28
Size	2.5"	3"	3.5"	4"	4.5"	
# of feeds*	44	64	87	114	144	

* Based off of NEC requirments. TIA/EIA could in some cases restrict it further.

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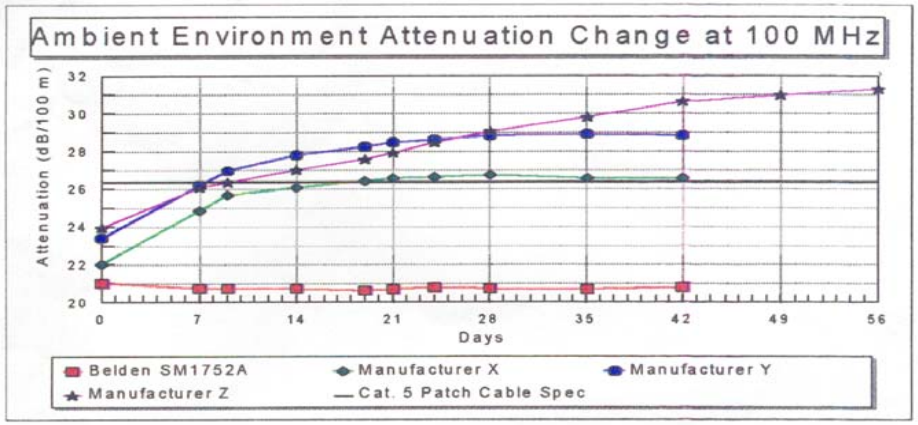

Figure 2

Ambient Environment Attenuation Change at 100 MHz

The first set of samples, as described under "Attenuation Stability Before and After Aging", were measured for attenuation changes over a period of days at ambient conditions and the data collected over time is graphed in Figure 2 above.

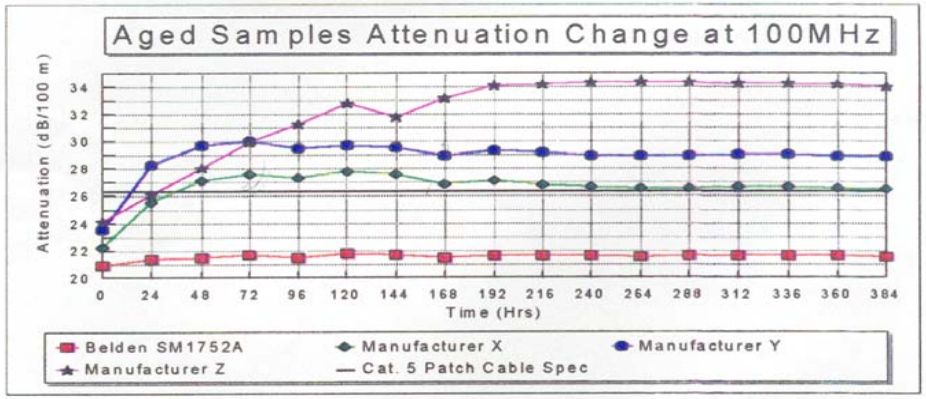

Figure 3

Aged Sample Attenuation at 100MHz

The second set of samples were aged as described under "Attenuation Stability Before and After Aging" and measured for attenuation and these results are shown in Figure 3 above.

Attenuation and Humidity Issues With Patch Cables

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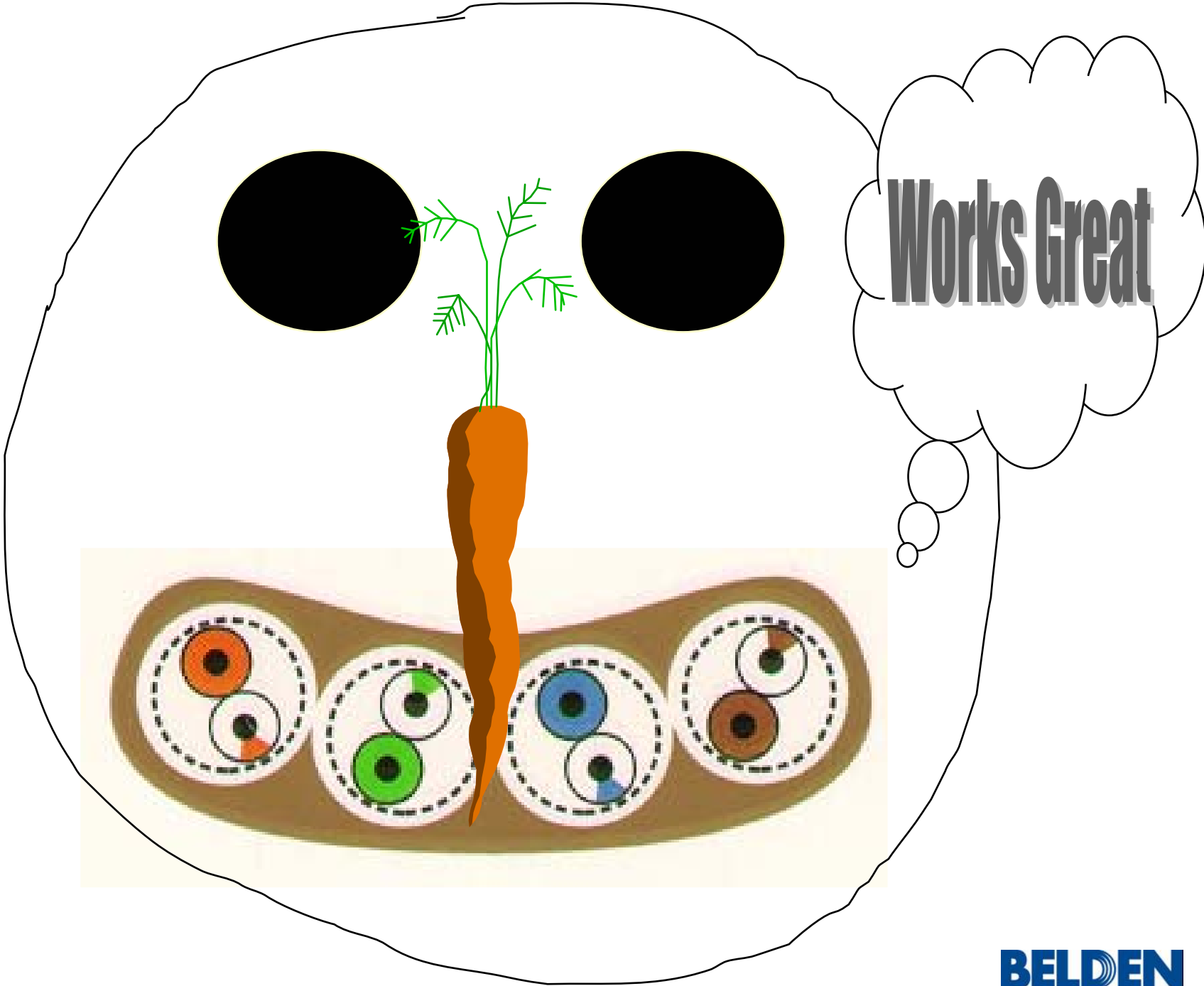

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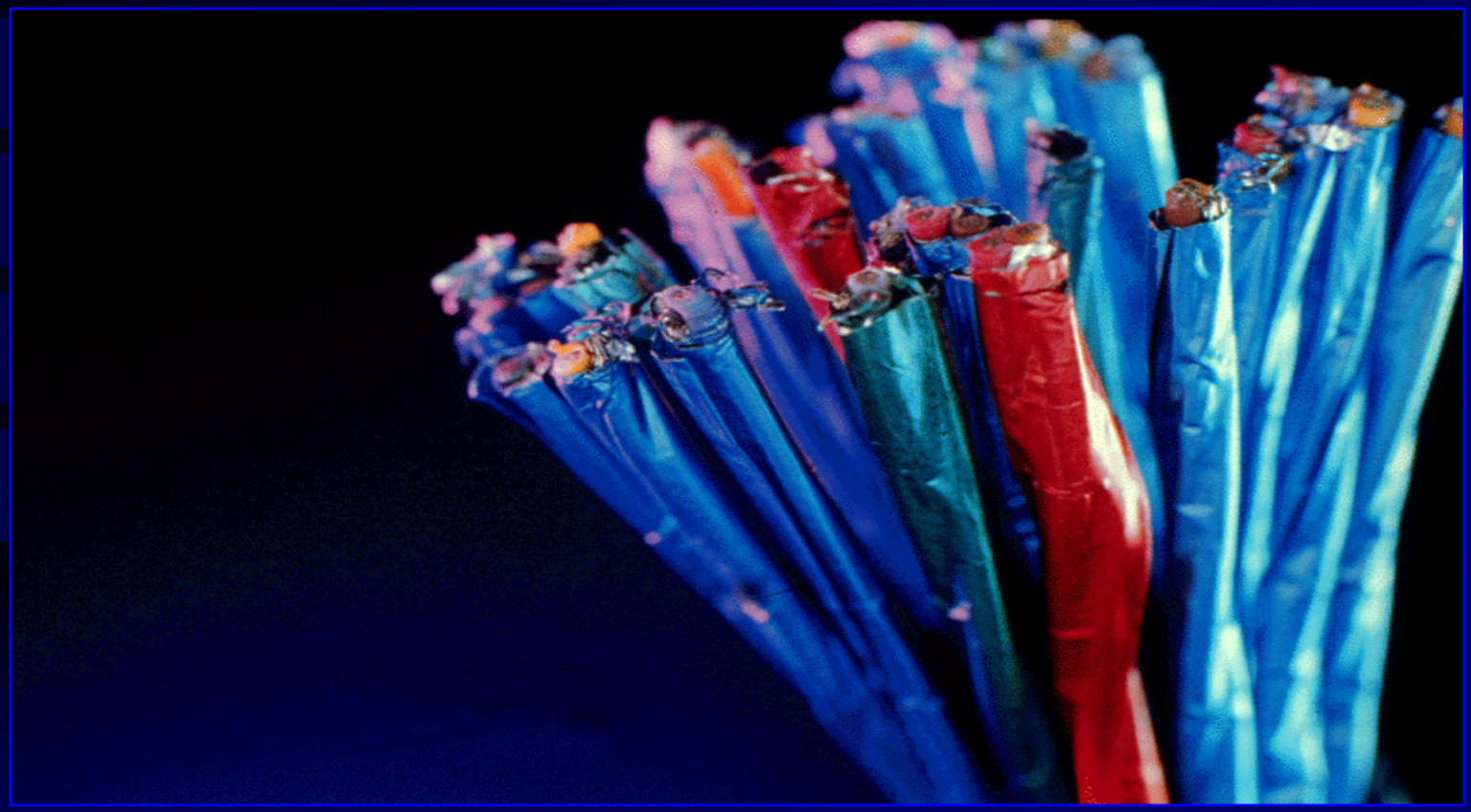
Cable 101

The basics of wire & cable

Key Terms

- Shield
- Shield effectiveness
- Beldfoil®
- Braid shield
- French braid™
- Duofoil ®
- Duobond ®
- Serve shield
- Slot
- Z-fold ®
- Crosstalk
- Coupling

Shielding



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Shield

- Contains electrical energy so that the signal on the cable does not radiate and interfere with signals in other nearby cables and circuitry.
- Protects the signal from external interference.

Shield Effectiveness

- A shields ability to maintain signal integrity in a noisy environment:
  - Industrial factory floor
  - High concentration of electrical equipment
  - Secure communications

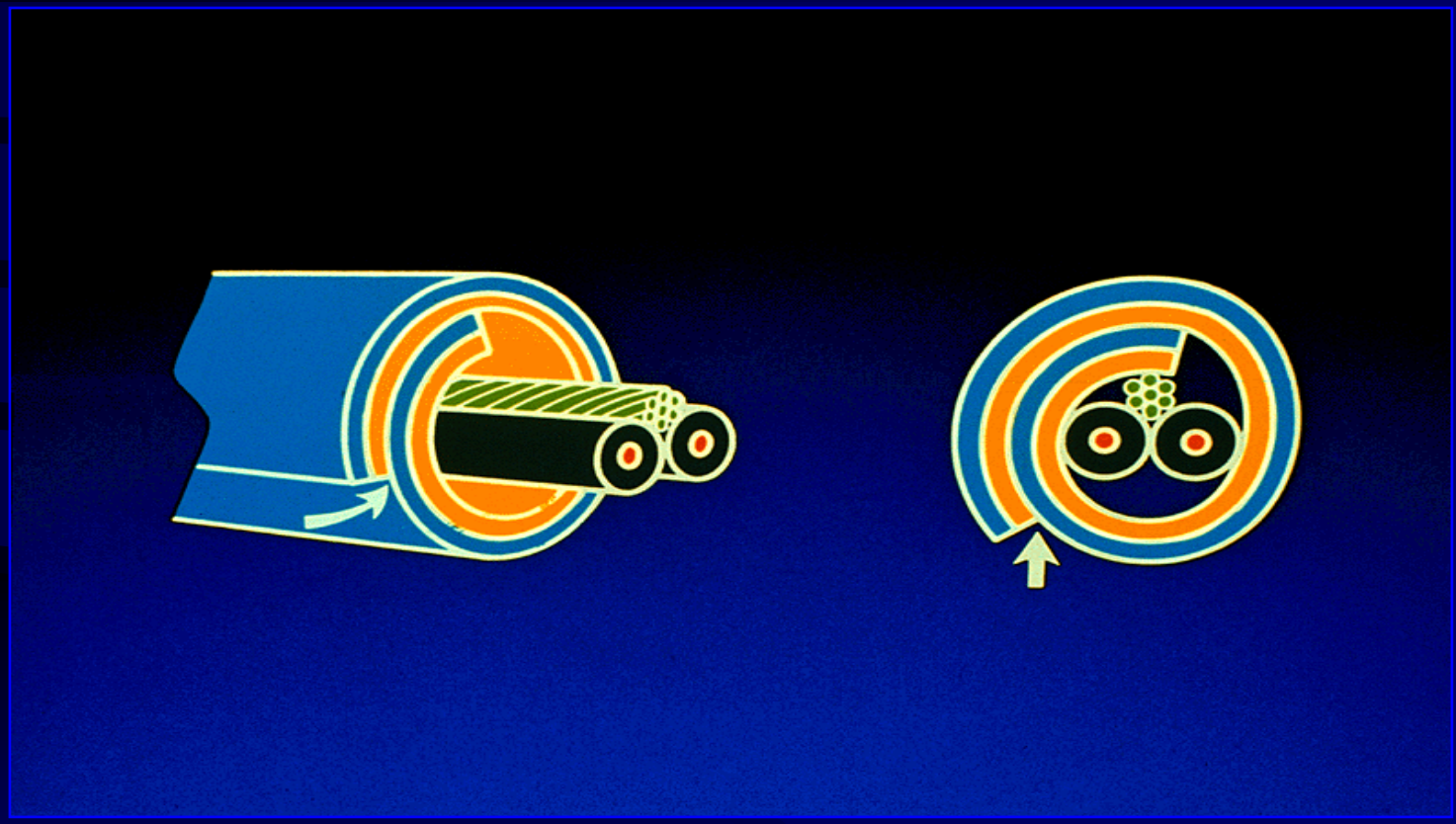
Shielding Materials

- Metallic foil
- Braid
- French braid™
- Spiral (serve)
- Semi-conductive

Selection Factors

- Required shield effectiveness
- Flexibility
- Flex life
- Ease of stripping and termination
- Mechanical strength
- Resistance to corrosion
- Temperature requirements
- Cost

Beldfoil® Shield

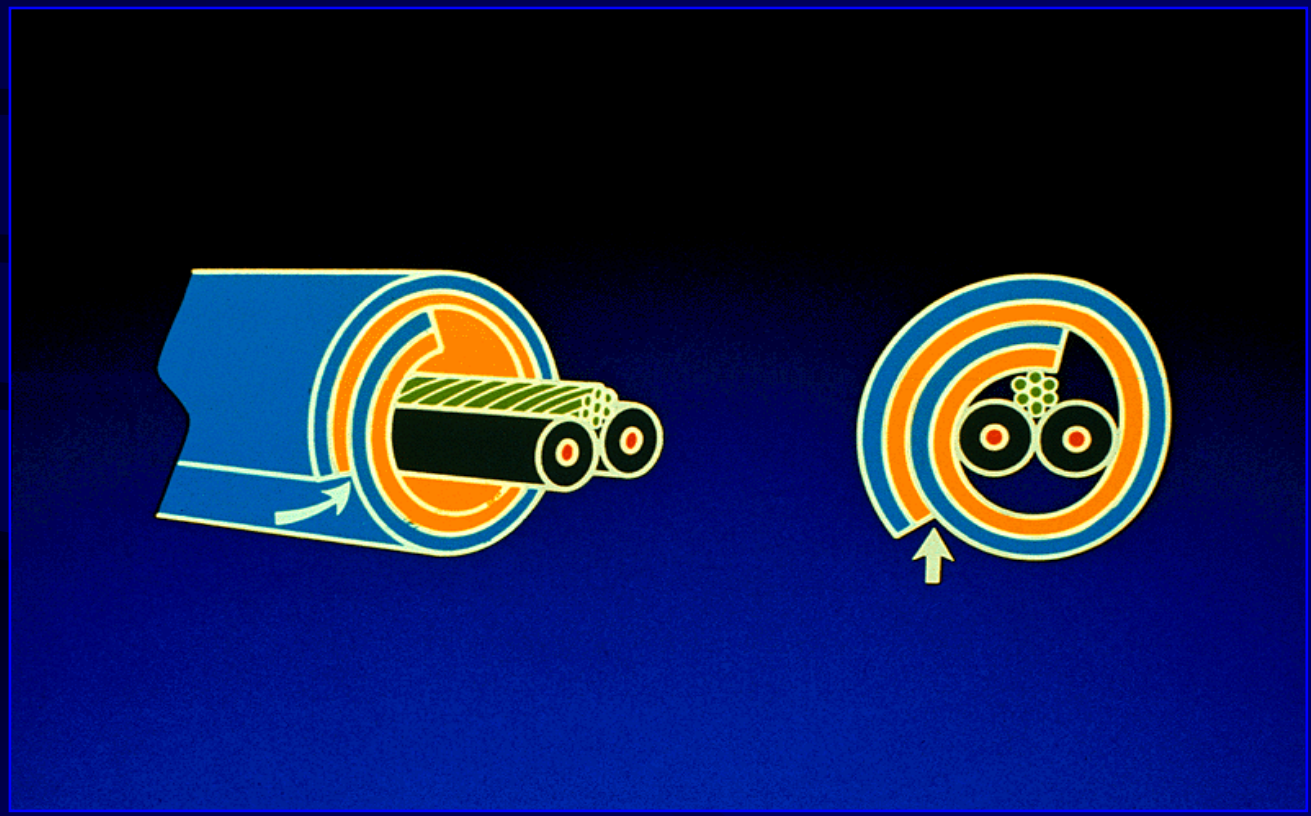


BELDFOIL® SHIELD

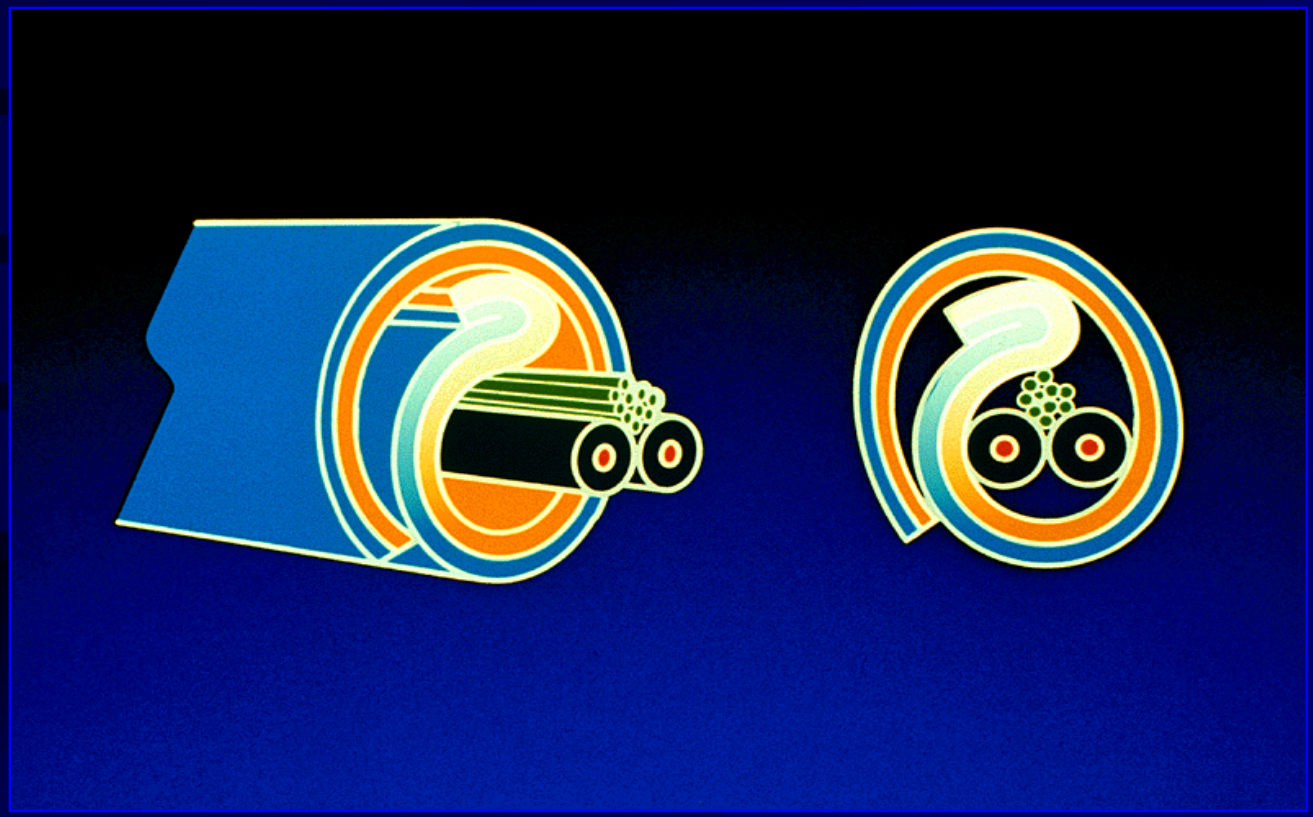
- 100% coverage
- Low cost
- Thin and light weight
- Easy to terminate
- Can be color coded
- Most effective at high frequencies
- Very good flexibility and good repeated flex life

BELDEN
SENDING ALL THE RIGHT SIGNALS

SLOT

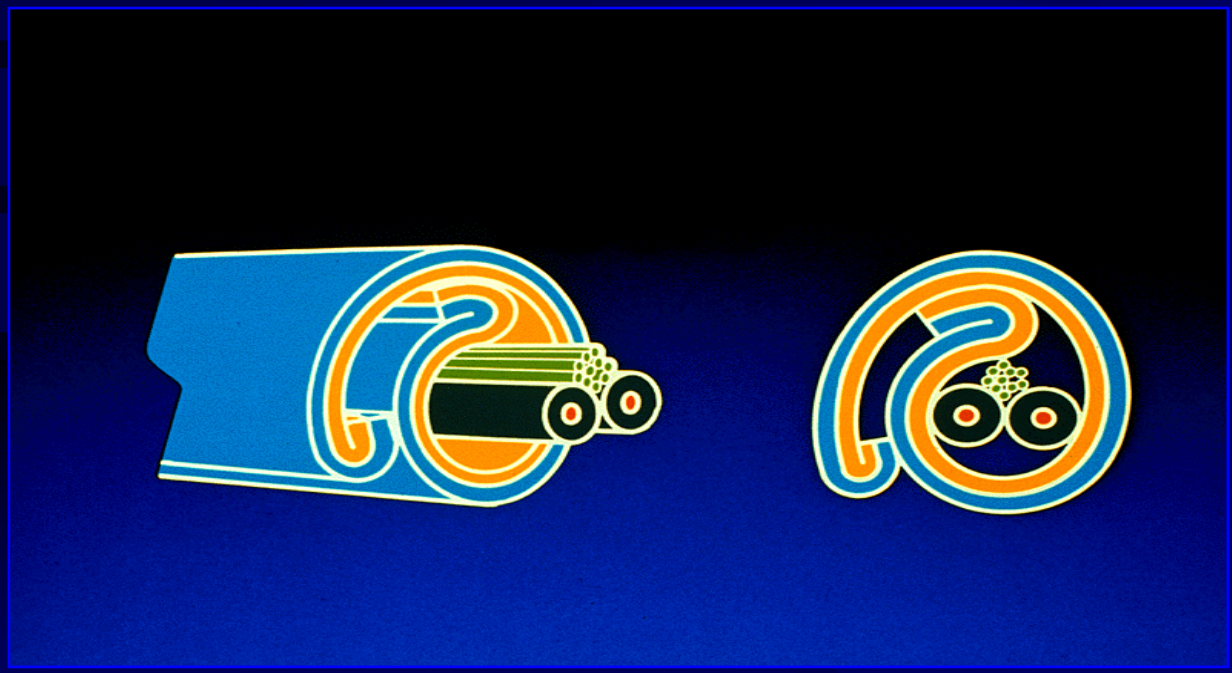


SHORTING FOLD



Z-FOLD®

- Patented Design
- Superior Shield Effectiveness



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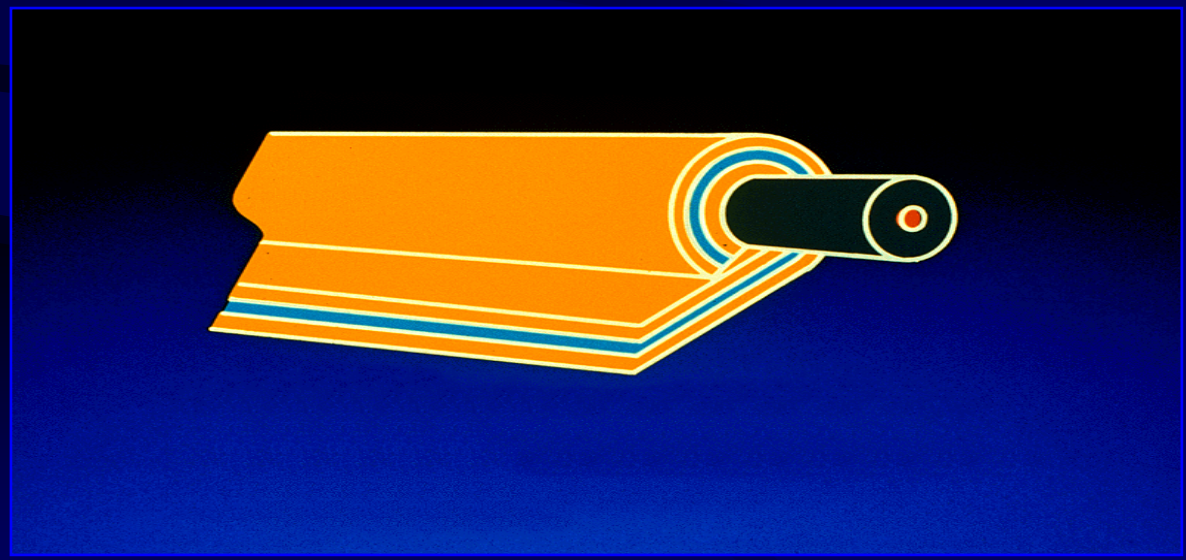
DUOFOIL® SHIELD

- Improved Shield Reliability and Flex Life
- Provides an Additional Interference Barrier
- Lower Shield Resistance



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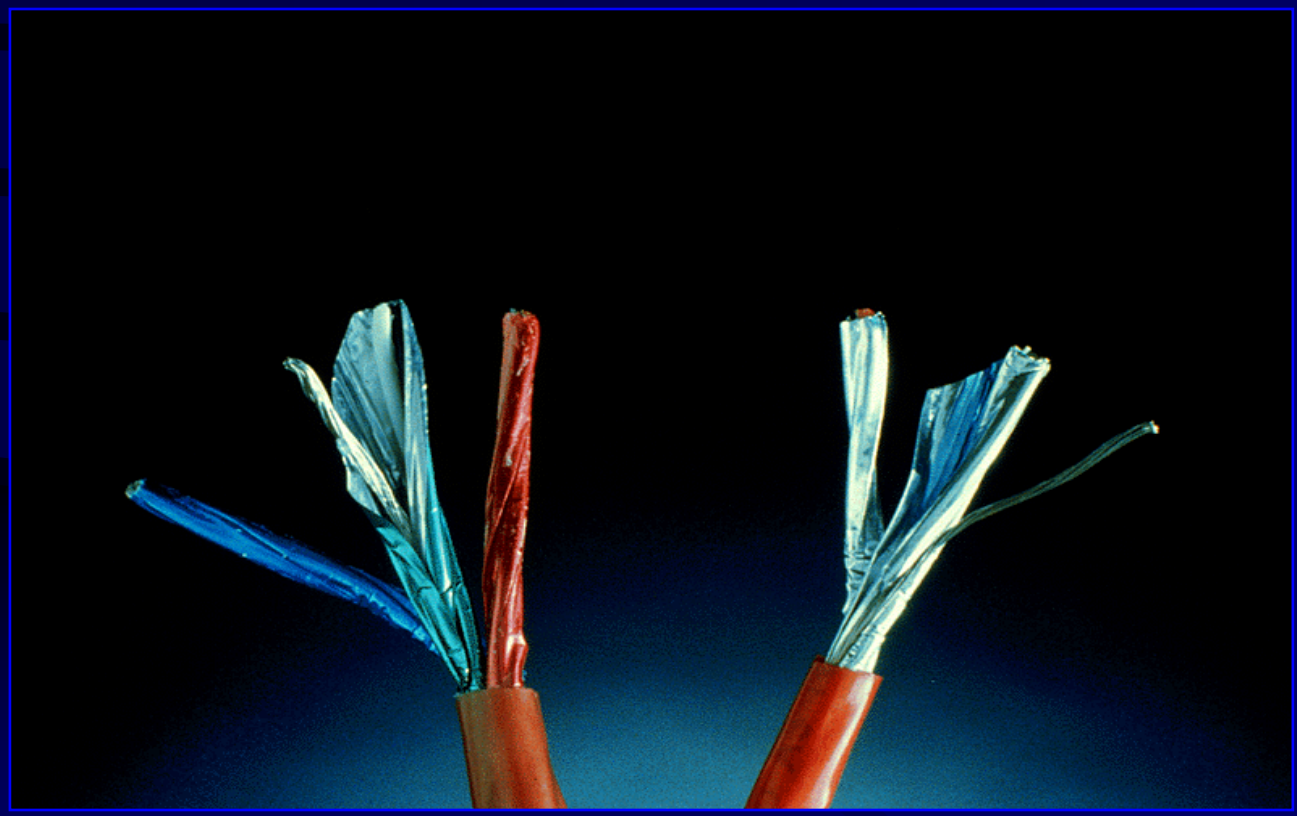
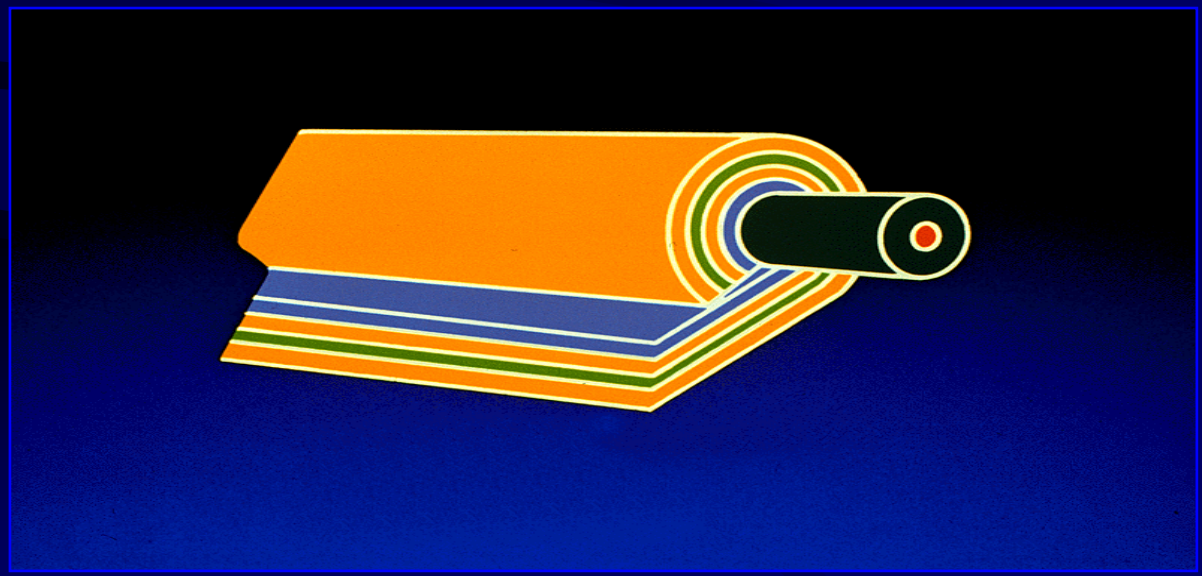
- **FOIL IN & FOIL OUT**



BELDEN
SENDING ALL THE RIGHT SIGNALS

DUOBOND® SHIELDS

- Faster, easier, reliable termination
- Maintains integrity
- Prevents moisture



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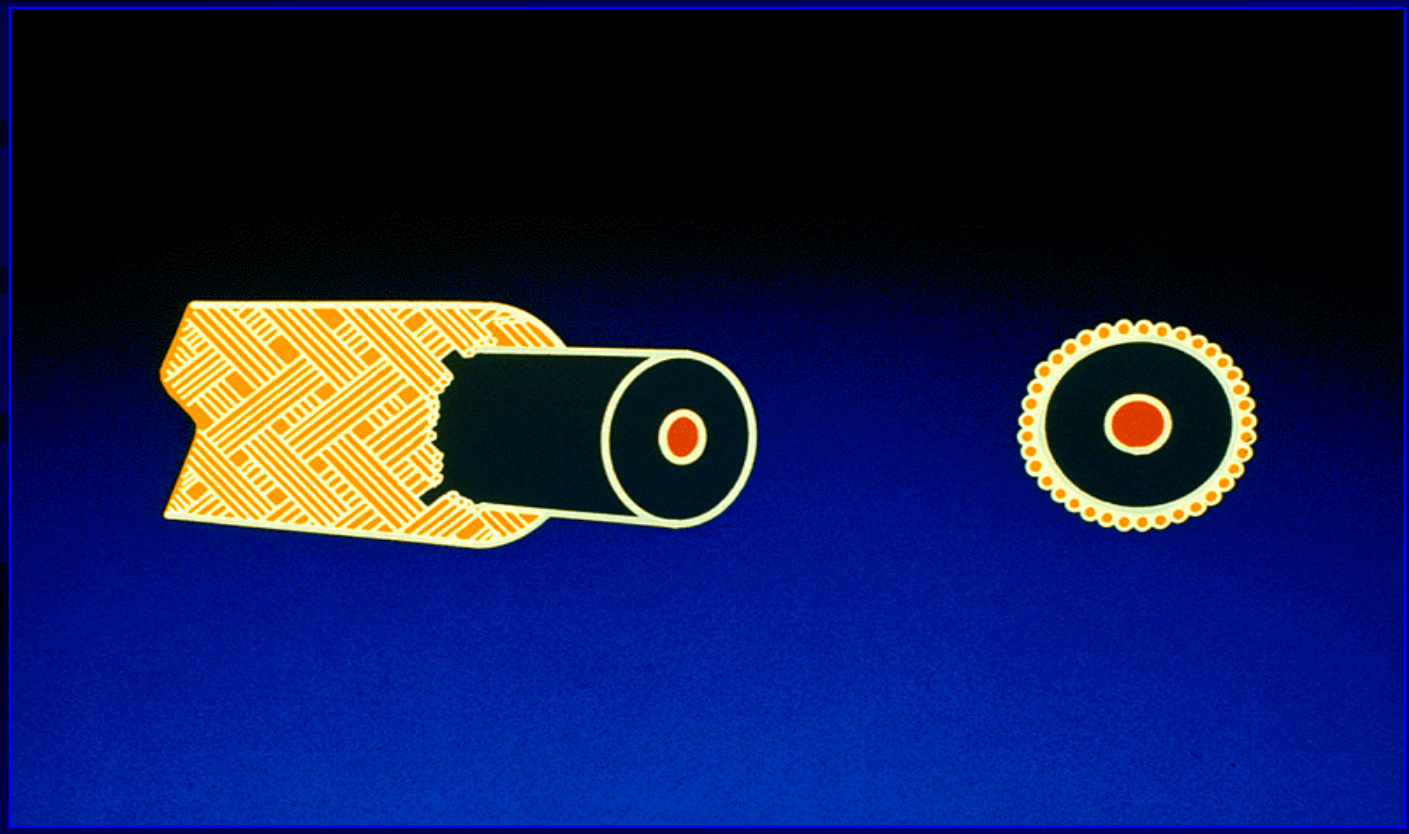
CROSSTALK

- Undesirable transfer of energy from one cable member to another.

BRAID SHIELDS

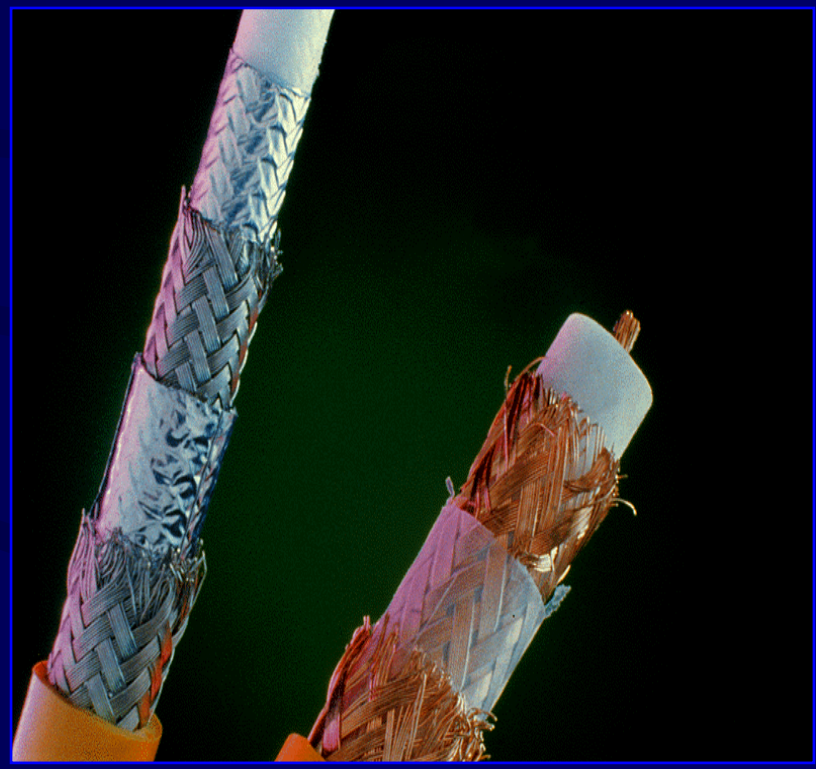
- Good flexibility and flex life
- Most effective at low frequencies

BRAID SHIELDS



BRAID SHIELDS

- **Good strength, flexibility, and flex life**
- **40% - 98% Coverage**



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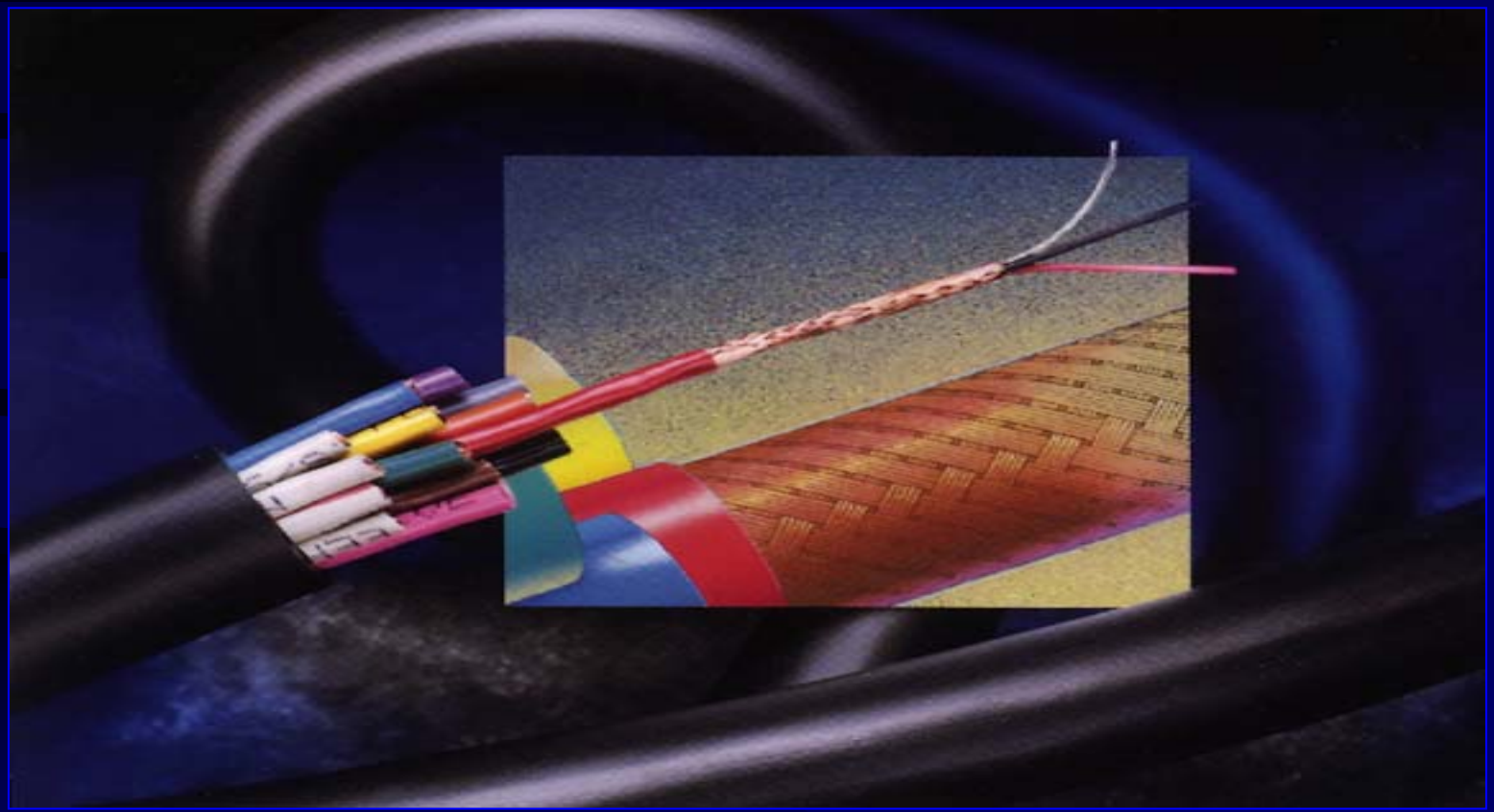
FRENCH BRAID™

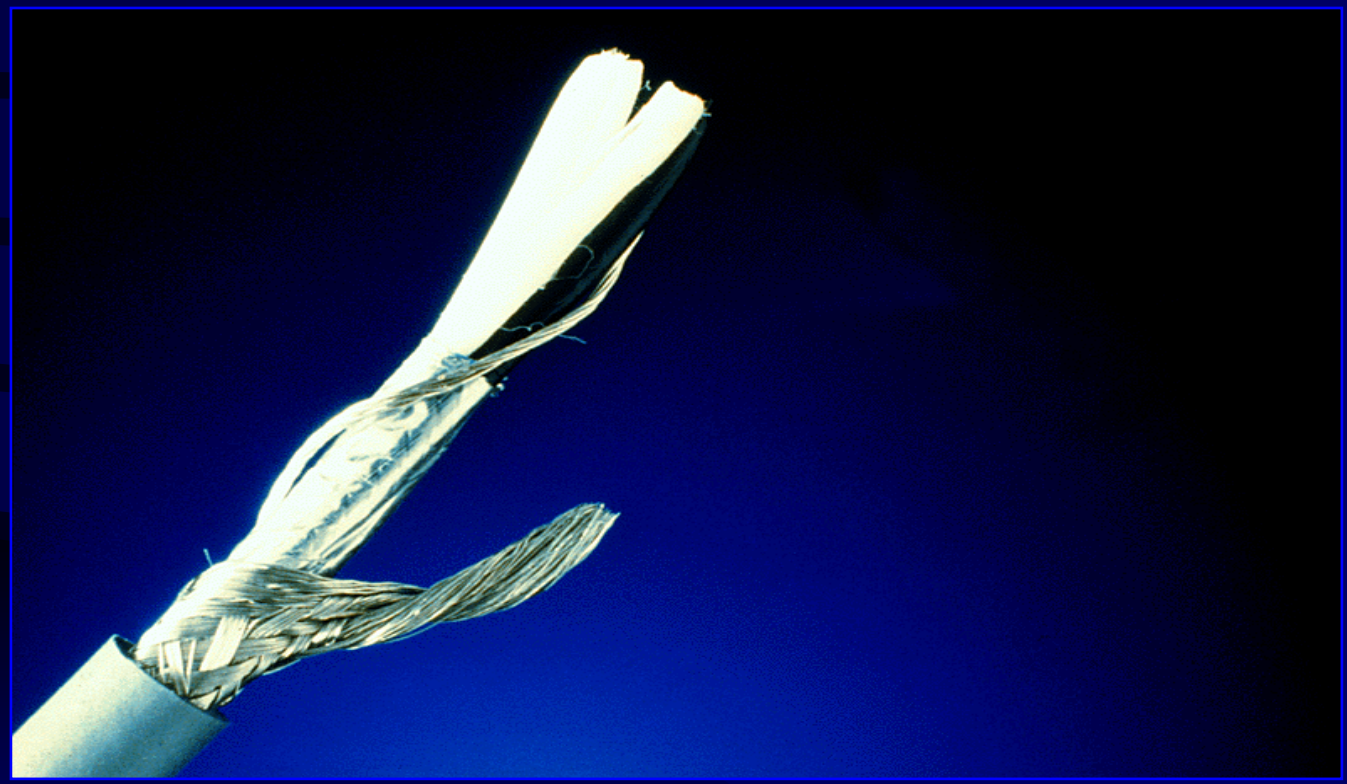


BELDEN
SENDING ALL THE RIGHT SIGNALS

FRENCH BRAID™

- Belden patented design
- Combines benefits of serve and braid
- Superior flex life & flexibility of serve
- Coverage and consistency of braid
- Ease of termination

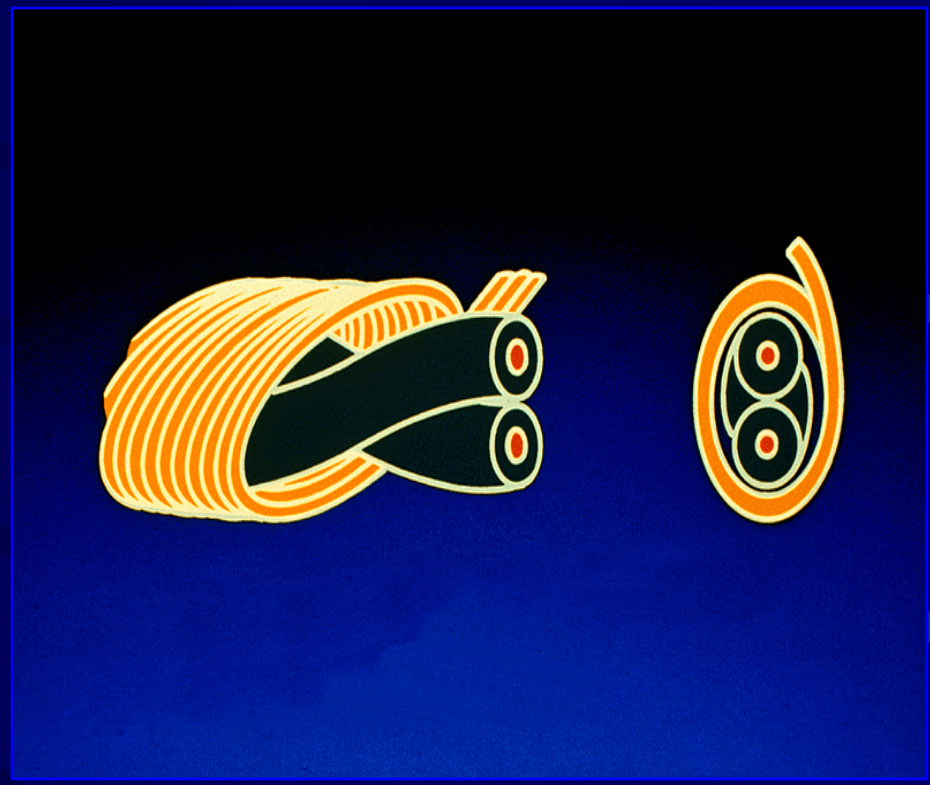
PIG TAILING



BELDEN
SENDING ALL THE RIGHT SIGNALS

SPIRAL (Serve) SHIELDS

- **Superior flexibility and flex life**
- **Up to 97% coverage**
- **Audio applications only**



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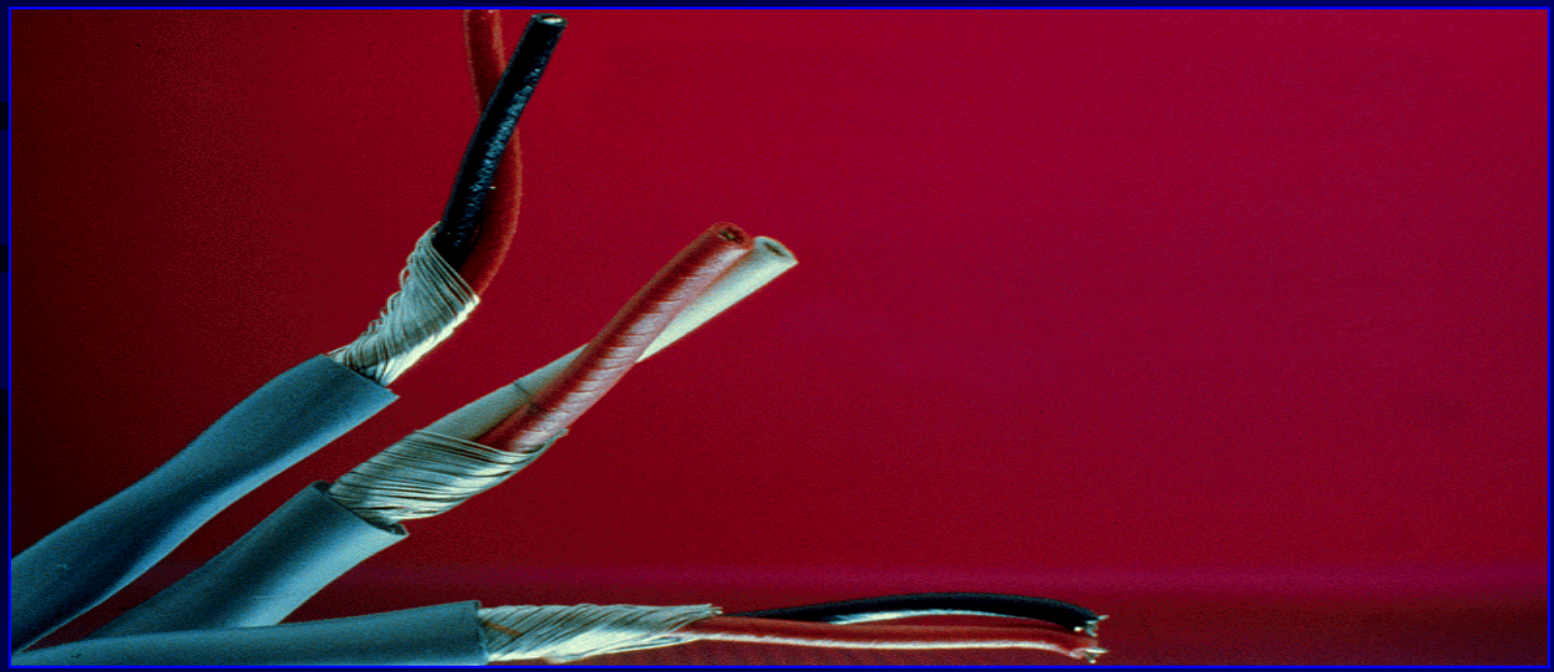
SPIRAL or SERVE SHIELDS

- Audio applications only



BELDEN
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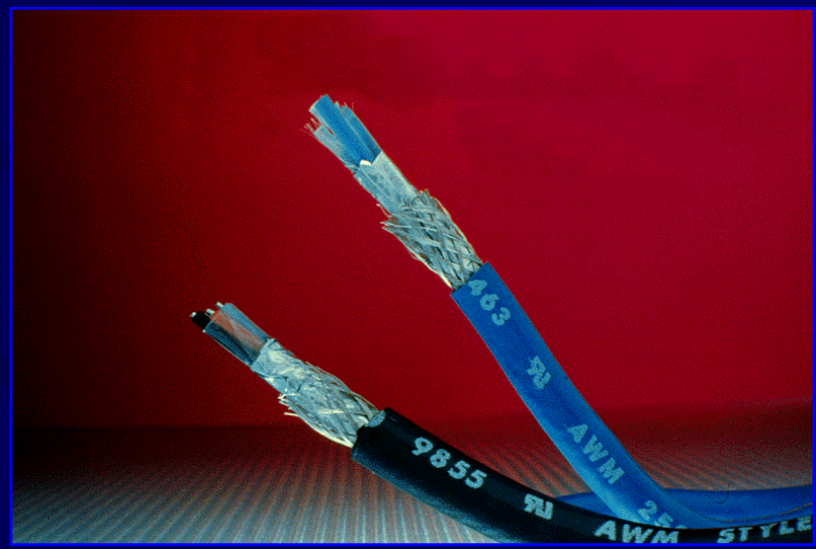
COMBINATION FOIL & TINNED COPPER BRAID SHIELDS

- Maximum shield effectiveness
- 100% foil coverage
- Strength
- Low DC resistance



BELDEN
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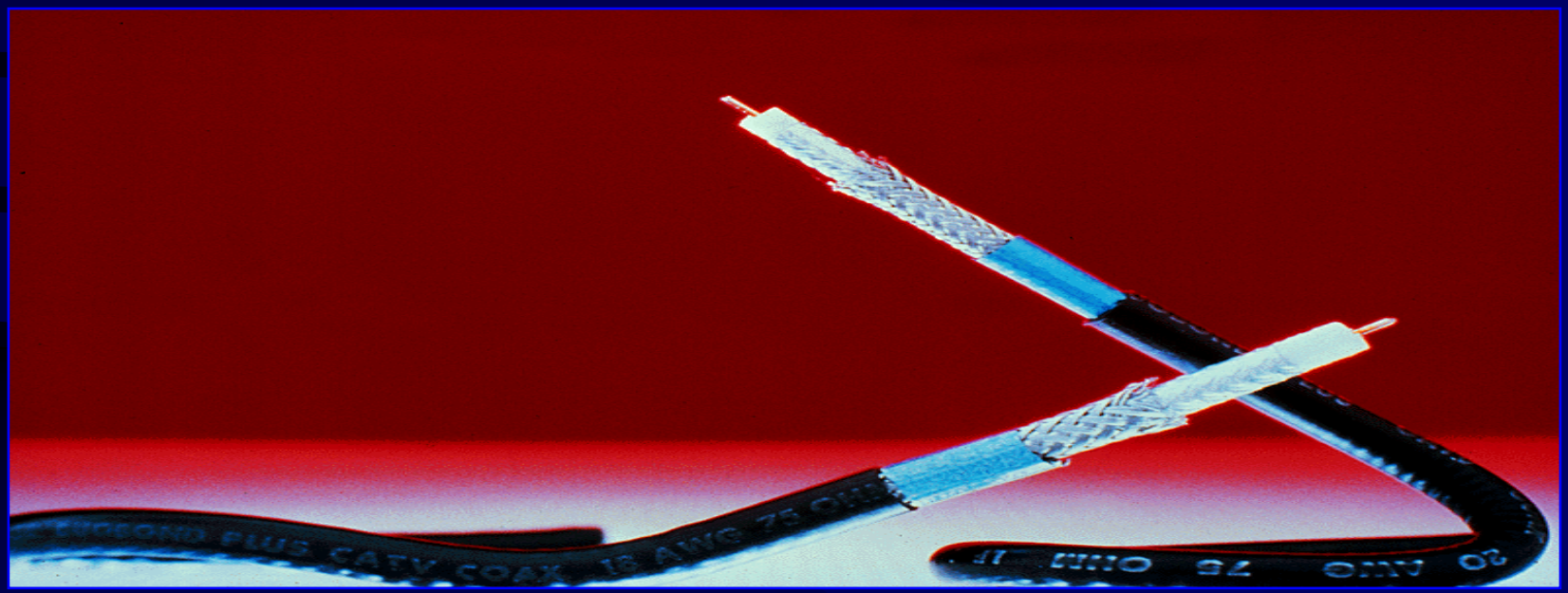
DUOBOND PLUS®

- Exceptional high shield integrity



BELDEN
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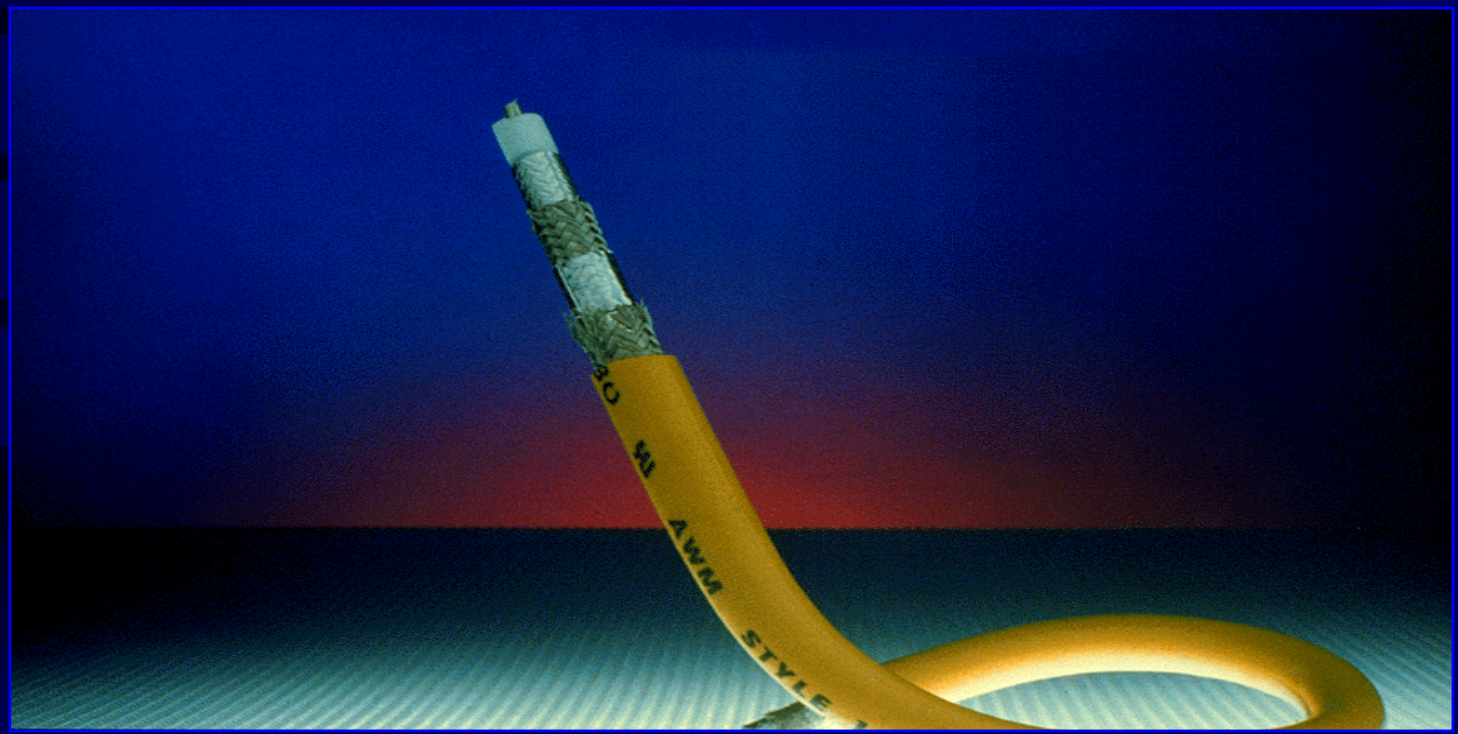
FOIL/BRAID/FOIL/BRAID COMBINATION



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TYPES OF INTERFERENCE

- **EMI**
- **RFI**

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EMI

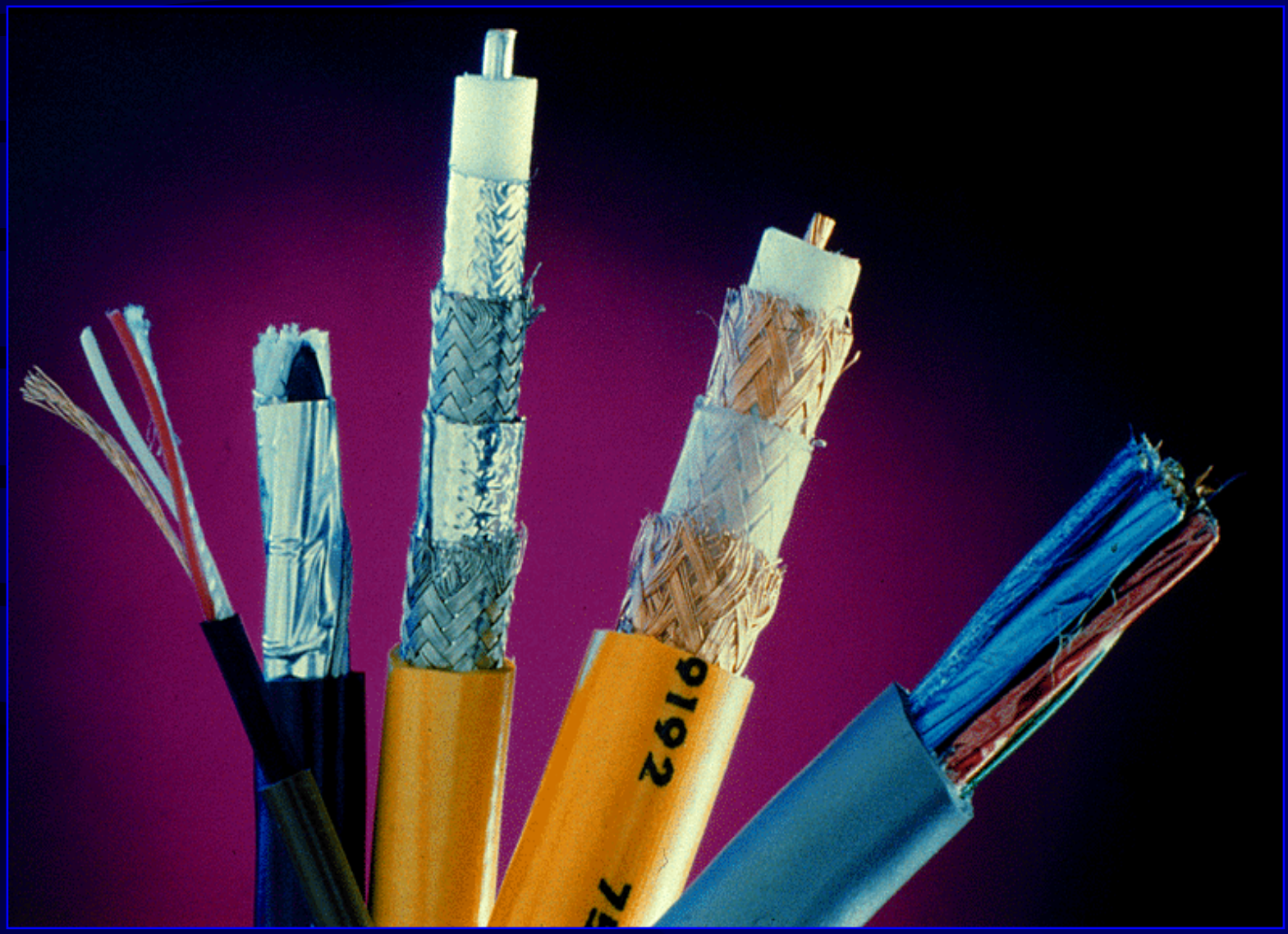
- Braid shields most effective
- For very lowest frequencies only conduit is effective
- Resistance of shield critical
- Foil shield resistance is too high (foil is thin)

RFI

- Foil shields most effective
- Braid shields become “wavelength dependent”
- Holes in braid let high frequencies in or out.

BROAD BAND COVERAGE

- Braid for low frequencies
- Foil for high frequencies



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CABLE 201

Structured Cabling for the University Environment

BELDEN
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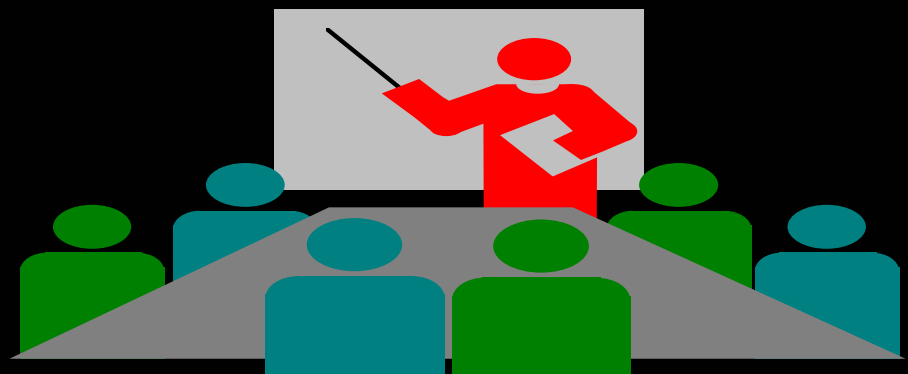
KEY TERMS

- Downtime
- Installation proof
- MediaTwist™
- Bonded pairs
- TIA/EIA 568A
- ACR
- Headroom
- Zo Fit impedance
- NEXT

Reading, Writing, Arithmetic, and Belden

Structured Cabling for the University Environment



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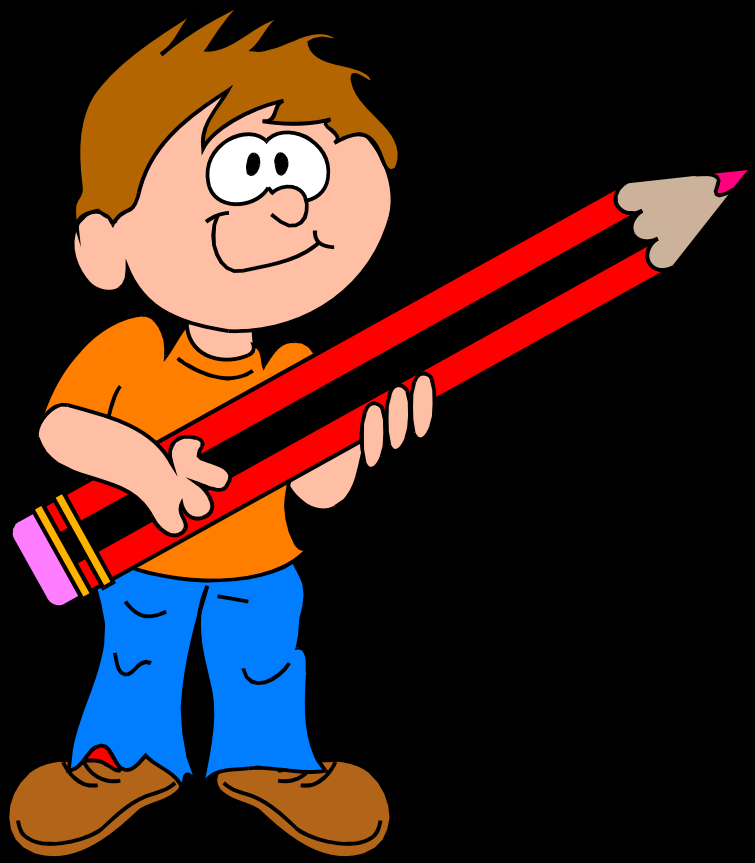
Technology Gains Have Changed the Educational Environment Forever



- **State of the art networks for students and faculty**
- **Dorms, lecture halls, and administration areas conducive to high tech learning**
- **Laptops for incoming students**
- **Implementation of campus wide Intranets**
- **Data, Video, and Voice accessible to all**

BELDEN
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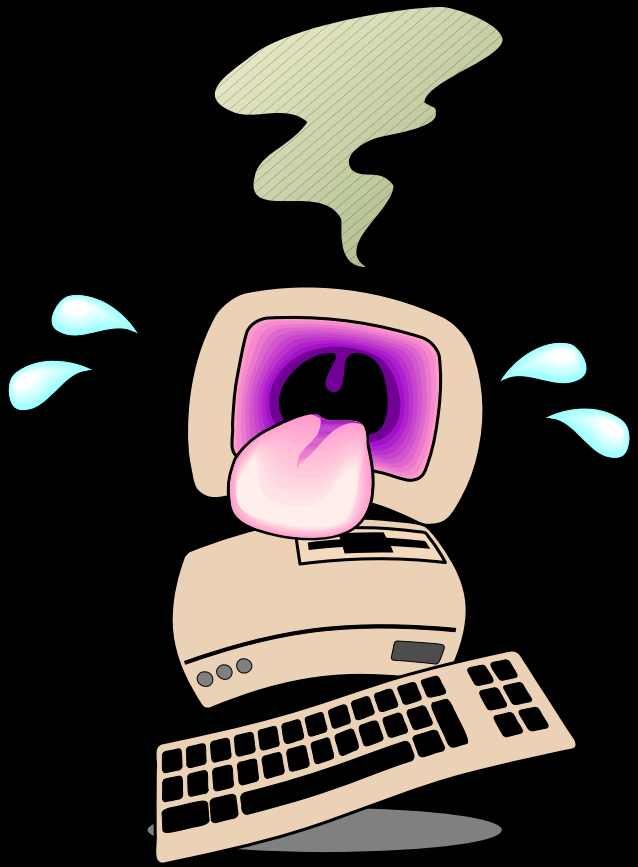
As the Network Improves, So Should Your Infrastructure



- Cabling represents 70% of downtime
- 5% of network cost is cable related
- The average system crashes 23.6 times a year
- Downtime costs range from $1,000 to $50,000 per hour

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Proper Cable Selection Will Lower the Life Cycle Cabling Cost

- What is your network migration plan?
- What is important when choosing a cable?
- Is Category 5 cabling the best for you?
- Do you have a warranty on your current cabling infrastructure?
- Has your cable been installed in accordance with standards?

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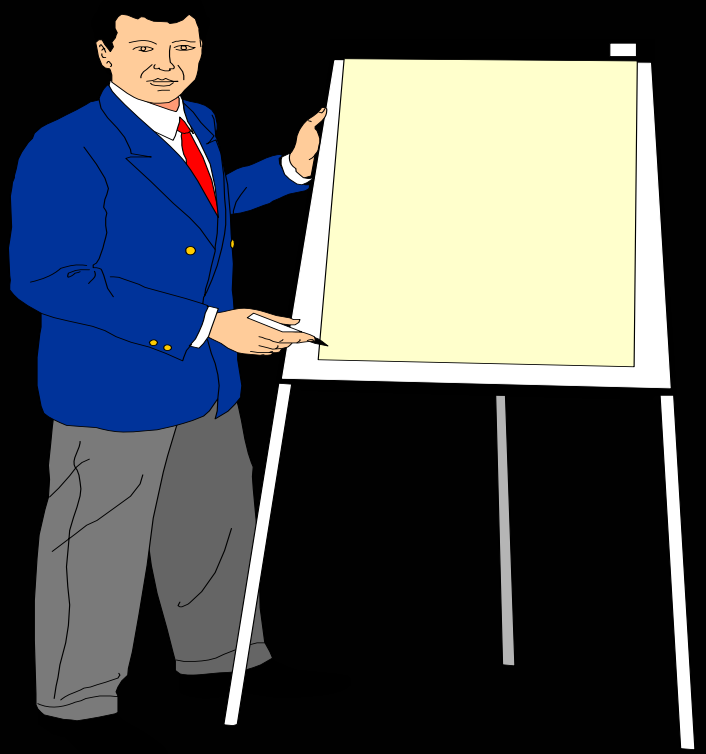
Belden Adds Value to Your Infrastructure



- New patented technology
- Installation proof cable
- Long term performance
- End user is focus of newest products

BELDEN
SENDING ALL THE RIGHT SIGNALS

Imagine...

- One cable that handles all of your UTP needs
- One cable that outperforms all other UTP designs
- One cable that adds value to your infrastructure
- One cable that has proven performance above the current standard

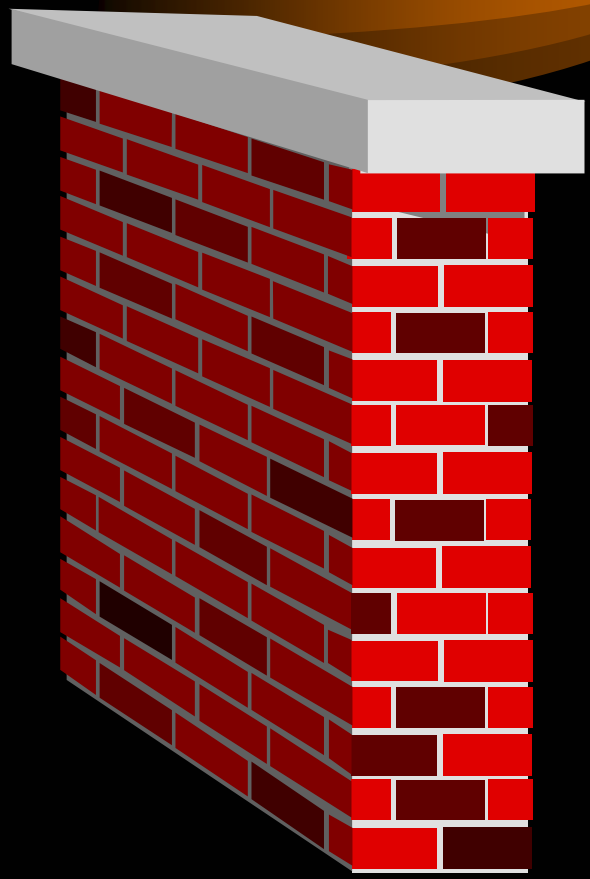
BELDEN
SENDING ALL THE RIGHT SIGNALS

Introducing...

BELDEN
SENDING ALL THE RIGHT SIGNALS

The Industry Standard TIA/EIA 568A

- Minimum based standard
- Distance limited
- Frequency limited
- Category 5 cabling has hit a wall
- Applications demand higher performance criteria on UTP cables



BELDEN
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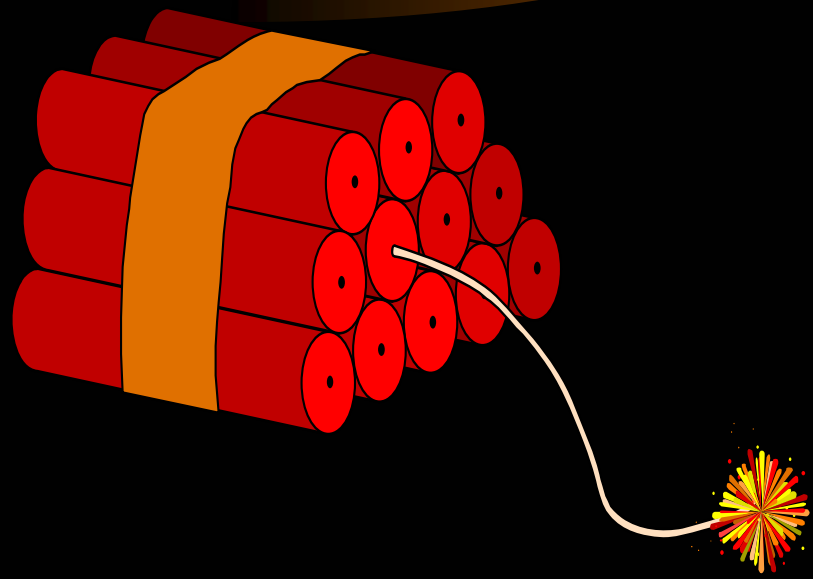
MediaTwist Breaks the Barriers

- Proven Performance above 100MHz
- Electrical Performance Unmatched
- Distance Gains
- Multimedia Applications
- Lifetime Warranty



BELDEN
SENDING ALL THE RIGHT SIGNALS

Proven Performance Beyond Category 5

- 135 MHz Digital Video
- 155MHz ATM
- 167MHz Gigabit Ethernet*
- Broadband Video to 550MHz/77 channels

*Proposed transmission scheme. Under review by standards committee

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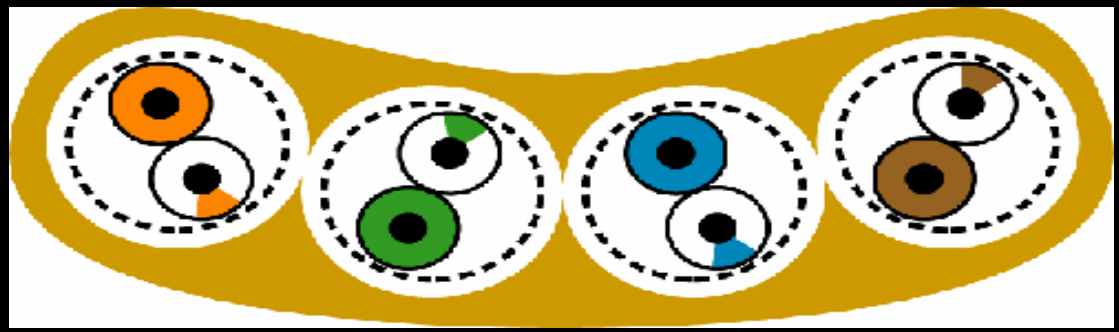
SENDING ALL THE RIGHT SIGNALS

A New Crescent Shaped Design



Performance is “locked” in place

“Lock” in with Belden

- All four pairs are isolated from each other
- Pairs movement restricted inside jacket when cable is installed
- Cable is not susceptible to the rigors of installation practices
- Cable can be bent and flexed more than any traditional round design

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Electrical Advantages to MediaTwist

- Improved Attenuation
- Improved Power Sum Crosstalk
- True ACR/Headroom
- Impedance Control Offered Only by Belden

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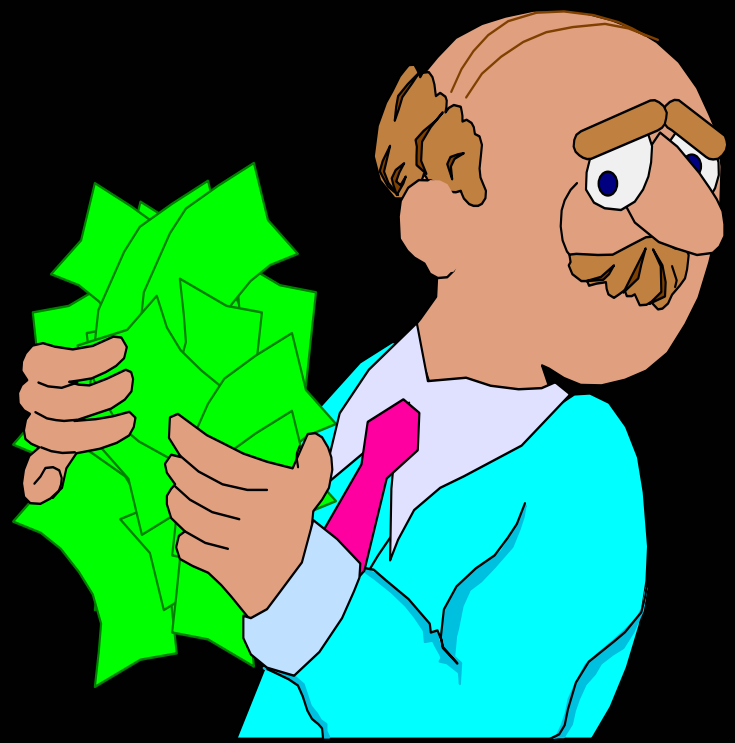
ATTENUATION

- Loss of signal strength
- Measured in Decibels (db)
- 3db represents a 50% loss of signal strength
- Lower Attenuation equates to a stronger signal
- Length dependent
- As frequency increases, Attenuation increases exponentially

MediaTwist Improves Attenuation



- Optimal Insulations
- 5 to 20% improvement in Signal Strength
- Longer distances
- Higher Frequencies
- Secures your financial investment

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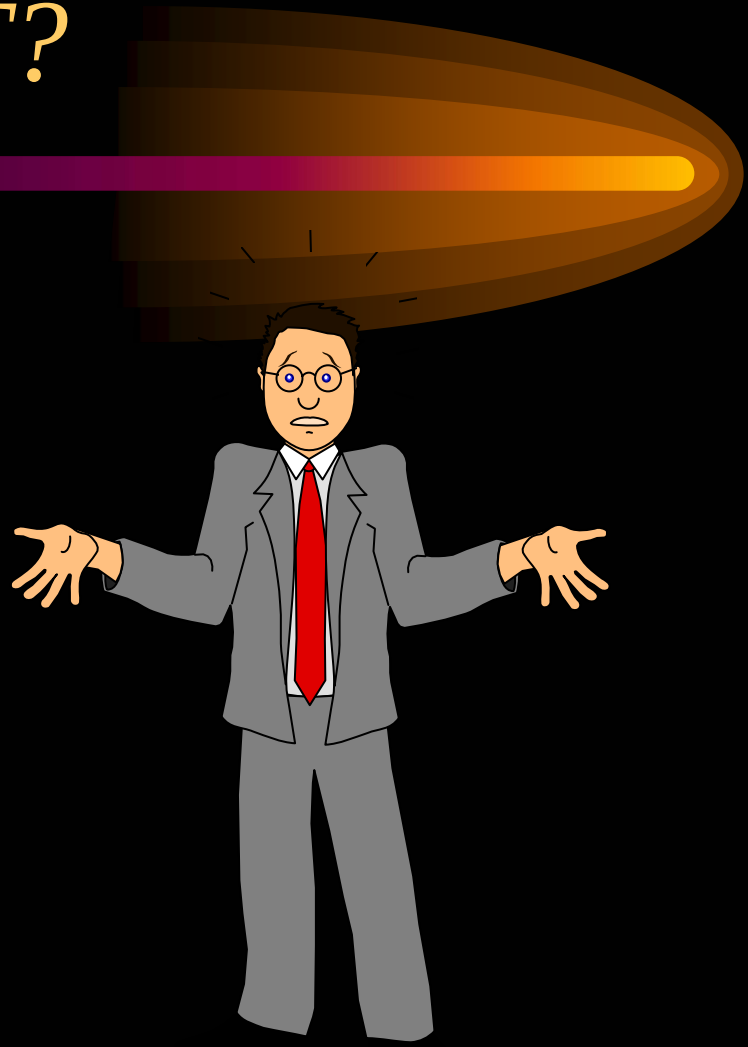
Near End Cross Talk (NEXT)

- The coupling of a signal from one pair to adjacent pair or pairs
- Measured in Decibels (db)
- Higher NEXT means less noise interference
- As frequency increases, NEXT increases exponentially

How Do We Achieve Better NEXT?

- Proximity of pairs
- Varied lay lengths
- Tighter twists



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Belden Improves NEXT

- 200% improvement over typical “enhanced” CAT 5 cables
- Pair proximity improved through isolation
- Acts like four cables under one jacket
- Ideal design for simultaneous applications

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ACR and Headroom

- Attenuation to Crosstalk ratio
- Measured in Decibels (db)
- High ACR represents a strong signal and low noise
- Headroom represents enhanced ACR above Category Five standard
- True ACR is a balance of attenuation and NEXT

Belden Provides a True Gain in ACR and Headroom

- Improvements in both Attenuation and NEXT
- Many manufacturers improve only NEXT
- Don’t be fooled by the ***illusion*** of their claims to improving ACR/Headroom

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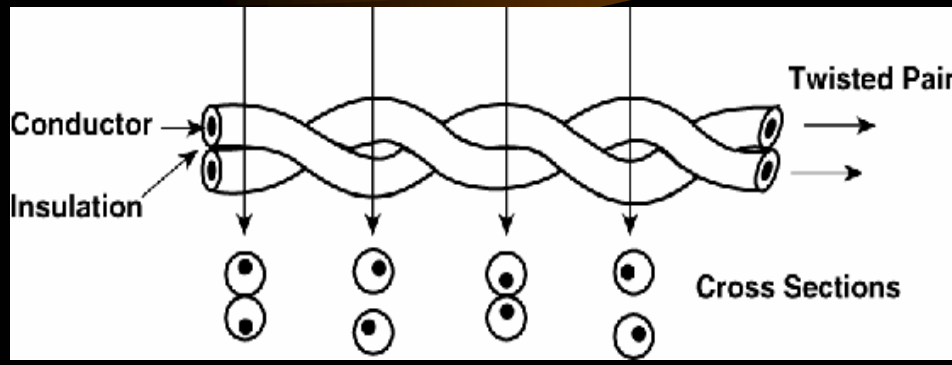
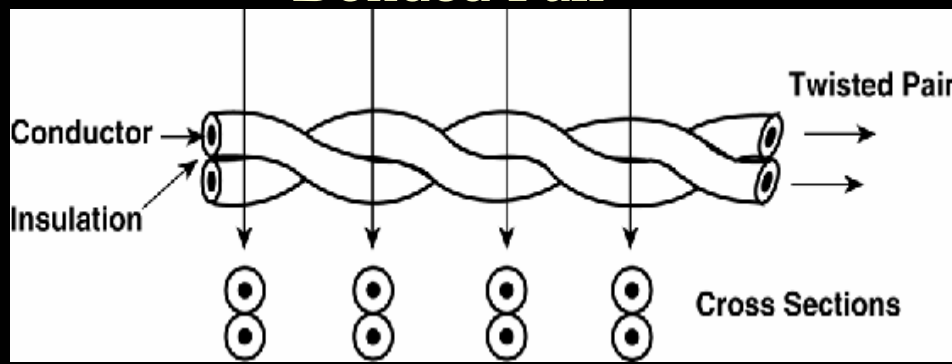
Physicals=Electricals

- Traditional manufacturing designs allow for wavering conductor to conductor spacing
- Tension placed on conductors may not be consistent
- Pairs can loosen up during manufacturing, installation, and connectorization
- Center to center spacing can easily change on unbonded constructions

Unbonded Pair



Bonded Pair



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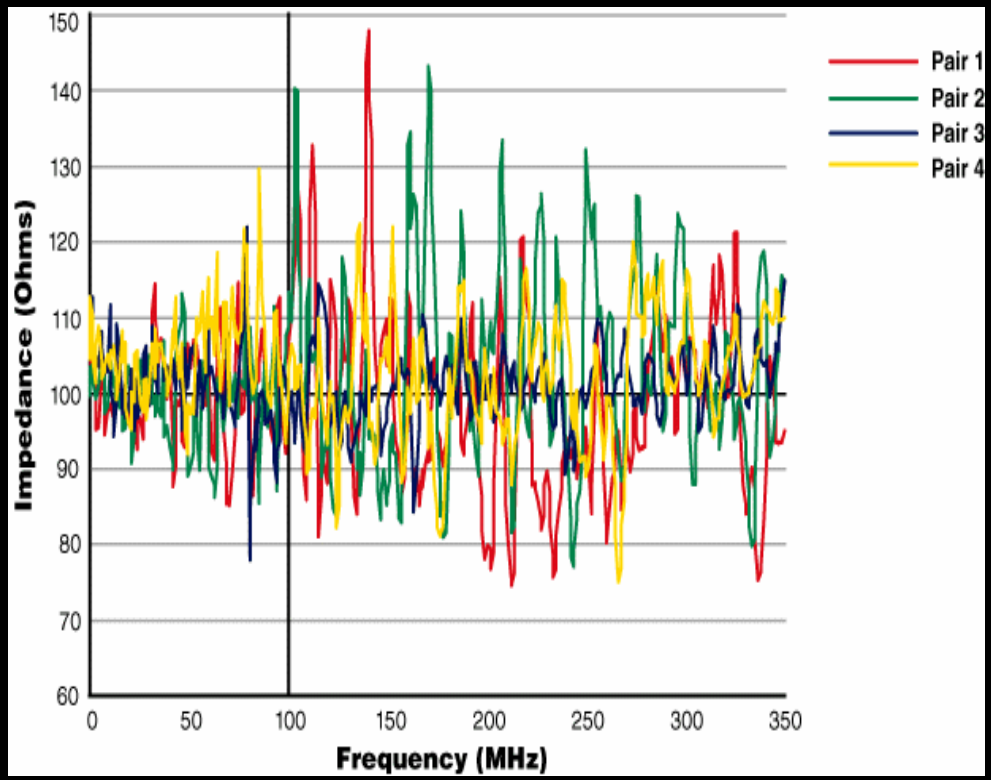
Impedance

- Measured in Ohms
- Cabling dimensions must be controlled to insure stable impedance
- Frequency NOT length dependent
- It’s what the other guys don’t like to talk about

Impedance Values Can Be Misleading to the Customer



- Zo-fit Impedance
- Illusion of a passing cable
- Averaged Impedance just doesn’t cut it at high frequencies
- Graded on a curve

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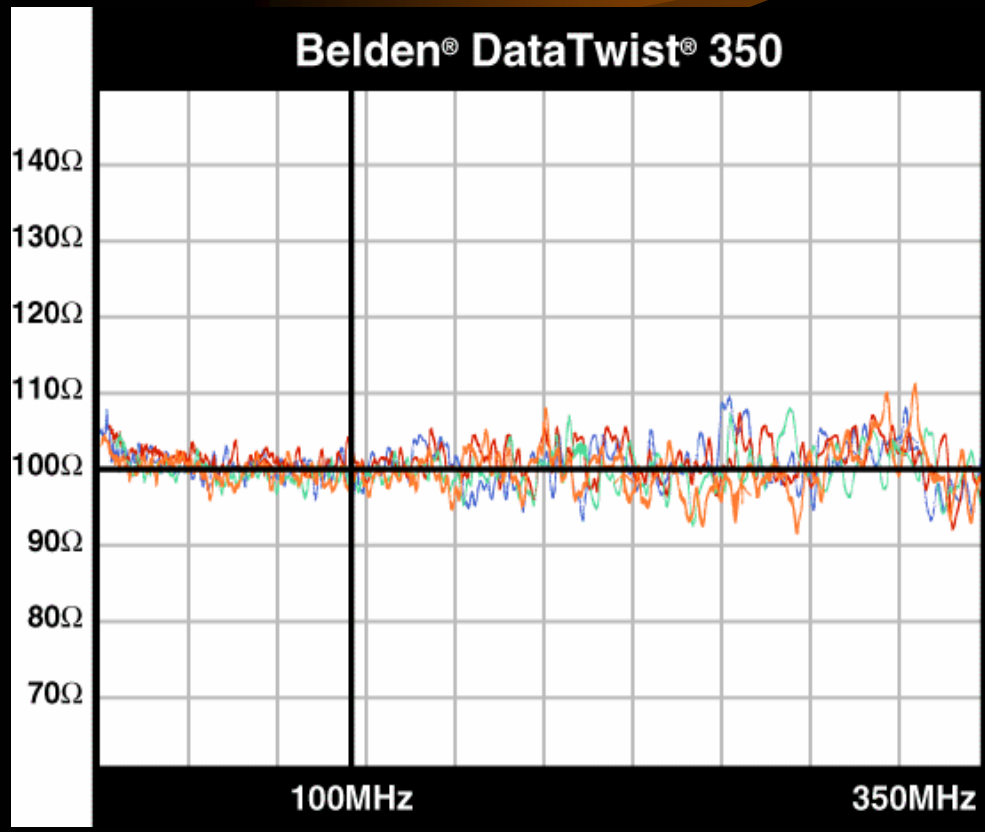
With Belden, Why Be Averaged?

- Uses no computer aided function
- Values are true representation of cables impedance
- Most balanced cable on the market
- Easy migration to high frequencies



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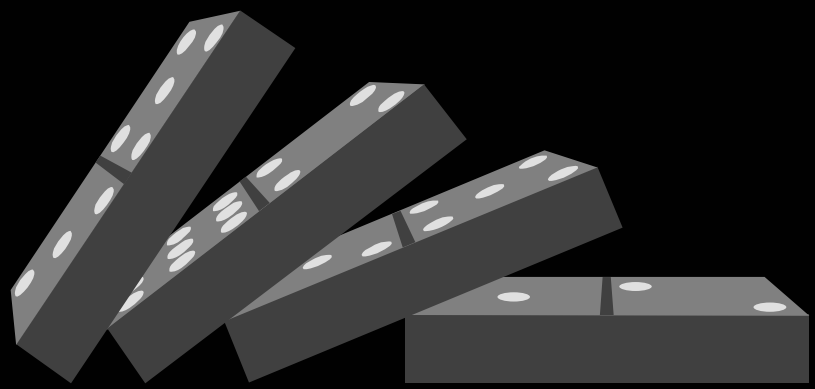
MediaTwist
Can You Top This?



- Up to 20% better Attenuation
- 567% improvement in capacitance unbalance
- 200% improvement in power sum NEXT
- 110% improvement in Attenuation-to-Crosstalk Ratio

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Belden Has the Future in Mind

- Applications over 100Mhz
- Bulletproof during installation
- Electrical characteristics unsurpassed
- Lifetime Warranty
- Ideal for shared sheath

MEDIA TWIST™

CABLE WITH CONFIDENCE™

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Graduate with Honors

Cable with Confidence