

# GEOPHYSICAL CABLES

National Wire & Cable has decades of real-world experience designing and manufacturing the toughest, most dependable geophysical cables in the world. Our engineers have the technical knowledge to deliver cable that meets or exceeds your specifications no matter how harsh the environment.

## CAPABILITIES

### **Cable Design**

- \* Any mix of: insulated copper wires
- \* coax
- \* twisted pairs
- \* subcables
- \* optical fibers
- \* Tubing, hose, tension members metal or synthetic
- \* Jacket-embedded braid for crush/cut resistance

### **Conductor Wires**

- \* Any mix of: Regular annealed copper
- \* High-strength copper-alloys
- \* Copper-jacketed steel
- \* Extra-high strand counts

### **Wire Insulation**

- \* Polypropylene
- \* HDPE
- \* LDPE
- \* Tefzel®
- \* TFE Polytetrafluoroethylene (PTFE)
- \* FEP Polytetrafluoroethylene (PTFE)
- \* PFA Polytetrafluoroethylene (PTFE)
- \* PVC
- \* RoHS-compliant-PVC
- \* Silicone
- \* Polyurethane
- \* Polyolefin
- \* TPR®
- \* TPE
- \* cross-linked XLPE
- \* XLPVC
- \* Double-insulated wires a specialty.
- \* Wet-immersion-tested insulations
- \* High IR insulations
- \* Striped or number-printed insulation

### **RFI-Shielding**

- \* Braided wire shields
- \* one or more layers
- \* over wires
- \* cabled wire-bundle.
- \* In copper
- \* tinned copper
- \* silver-plated copper
- \* nickel-plated copper
- \* Conetic alloys
- \* Foil Shields with drain wire
- \* Using Alum./Polyester
- \* Copper/Polyester
- \* Copper foil
- \* Conetic
- \* Fernet magnetic foils
- \* Combinations of the above layers to reduce EMP effects.

### **Cable Jackets**

- \* Polyurethane
- \* HDPE
- \* LDPE
- \* PVC
- \* Hytrel
- \* TPR®
- \* TPE
- \* RoHS-compliant PVC
- \* Belted (fully pressure-filled round) cable jackets
- \* Jackets with embedded re-enforcing braid for cut/crush resistance.
- \* Double-Layer-Bonded Jackets. Multi-colored.
- \* Ribbed or Splined jacket outer surface.
- \* National's "Easy-Drag" splined-surface cable jackets a specialty.

### **Cable-Forming**

- \* Many cabling, of many sizes
- \* Planetary cable forming
- \* Unilay single-direction forming, all layers
- \* Planetary cable forming
- \* Contra-helical alternating direction each layer
- \* Specialty: Patented close-balance pair twisting for digital signaling.
- \* Pair, Trio, Quad, Quint, Sub-cabling for maximized flexing lifetime.

### **Cable-Interstice-Filling**

- \* Vistanex®
- \* WaterGard®
- \* DPR,
- \* SecretSauce.

# GEOPHYSICAL CABLES

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# GEOPHYSICAL CABLE

## ROUGH USAGE CABLES


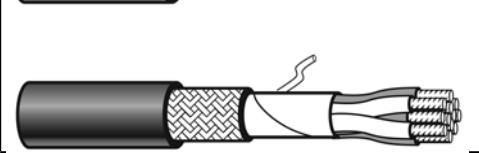

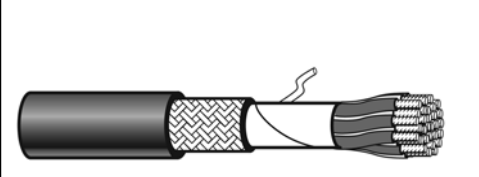


### CABLE CLASS DESCRIPTIONS FOR

- Electronic Multi-conductor Instrumentation Cables
- Special-Purpose Oil Rig Cables
- Seismic-Search Cables
- Water & Oil Resistant Cables

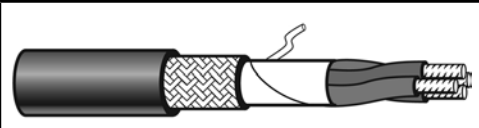
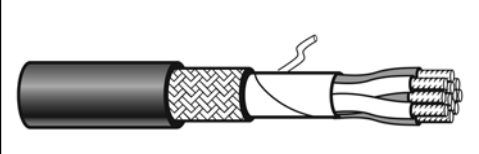
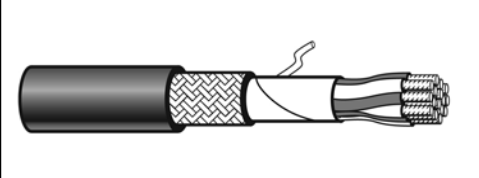
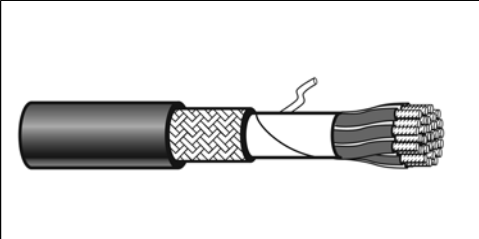
### Annealed Tinned Copper

Call 323-225-5611 for gauge sizes and conductor counts

<b>800 Series:</b> Tough	Conductors are stranded tinned copper; Polypropylene-insulated, helically cable-formed, Polyurethane outer jacket. Very flexible.	
<b>820 Series:</b> Tension Member	Same as 800 Series, + Central Kevlar Tension Member. Conductors are stranded tinned copper; Polypropylene-insulated, helically cable-formed, Polyurethane outer jacket. Very flexible.	
<b>840 Series:</b> Tough + Tension Member + Waterblock	Same as 820 Series, + waterblocking gel. Conductors are stranded tinned copper; Polypropylene-insulated, helically cable-formed, Polyurethane outer jacket. Very flexible.	
<b>860 Series:</b> Tough + Tension Member + Waterblock + Reinforced jkt	Same as 840 Series, + Reinforcing braid between bonded 2-layer PU jacket. Highly cut-resistant and torque-resistant. Conductors are stranded tinned copper; Polypropylene-insulated, helically cable-formed, Polyurethane outer jacket. Very flexible.	

### Ultra High-Strength Cables with high-strength alloy copper conductors

Call 323-225-5611 for gauge sizes and conductor counts

<b>900 Series:</b> Tough + High-strength metal	Conductors are stranded high-strength alloy copper, Polypropylene-insulated, helically cable-formed, Polyurethane outer jacket. Very flexible.	
<b>920 Series:</b> Tough + High-strength metal + Tension Member	Same as 900 Series, + Central Kevlar Tension Member. Conductors are stranded high-strength alloy copper, Polypropylene-insulated, helically cable-formed, Polyurethane outer jacket. Very flexible.	
<b>940 Series:</b> Tough + High-strength metal + Tension Member + Waterblock	Same as 920 Series, + Central Kevlar Tension Member + waterblocking gel. Conductors are stranded high-strength alloy copper, Polypropylene-insulated, helically cable-formed, Polyurethane outer jacket. Very flexible.	
<b>960 Series:</b> Tough + High-strength metal + Tension Member + Waterblock + Reinforced jkt	Same as 940 Series, + Central Kevlar Tension Member + Filled with waterblocking gel + Cut-resistant and torque-resistant reinforcing braid between bonded 2-layer PU jacket. Conductors are stranded high-strength alloy copper, Polypropylene-insulated, helically cable-formed, Polyurethane outer jacket. Very flexible.	

# NV & NVP CABLES

Suitable for Rough Usage - 20 AWG

- AWM Style 20233
- 80°C, 300 Volt, VW-1
- CSA AWM II A/B, 80°C, 300 V, FT-1

National Wire & Cable Corporation manufactures a family of highly flexible miniature **rough-usage** low-voltage instrument control cable. These are available as cabled pairs or singles, with optional overall shield of foil with drain wire.

Conductors are stranded tinned copper with .011" wall of super-tough extruded polypropylene primary insulation, having excellent electrical properties. Wires are color coded using ten std. colors + stripes. The color table for cabled twisted pairs can be viewed in the National Wire Cable Designers Guide, page 7-13.

Conductors are planetary cabled and helically laid for optimum flexibility, with a barrier tape under braids, if used.

Shielded cables have 100% coverage aluminum-foil shield in contact with a stranded drain wire for easy termination. Optional tinned copper braid of >90% coverage per MIL-C-7078, with braid angles below 40° for easy pushback is available on special order.

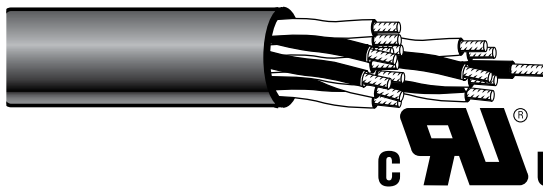
Outer jacket is highly flexible poly-ether-urethane thermoplastic, very resistant to oils, fuels, flame, and UV. Polyurethane is noted for outstanding resistance to scuffing and tearing.

Standard cable has super-durable black polyurethane jacket, or may be supplied with blue outer jacket for use in "Intrinsically Safe" applications. (Ref. National Electric Code, Chapter 5, Section 504.)

Finished cable meets the UL Vertical Flame Test type VW-1 and CSA FT-1 flame test.

Finished cable is UL Recognized and meets all requirements of Appliance Wiring Material Style 20233 which bears the agency intended-use of "External connection of electronic equipment."

Widely used for molded-connector assemblies due to uniform controlled diameter. All cables bear printed marks for UL rated voltage (300 V.), temperature (+80°C), and flame resistance (UL VW-1). **Available in other conductor counts, sizes, stranding, from 28 AWG through 10 AWG, and mixed AWG. Please consult factory.**



Property	Technical Data for 20 AWG
Agency Cable Style	UL AWM Style 20233
Agency voltage rating	300 Volts
Agency temperature rating	+80°C.
Agency Flame Rating	UL VW-1 and also Canadian CSA FT-1
Factory HiPot test volts	1500 VAC each conductor to all others & shield, connected in common.
Factory spark test (dry) individual wires	100 % of all wire passes 3400 VAC "spark test" before processing.
Cold Bending	Passes cold bend (180° over 2x mandrel) at -20°C. Storage OK at -40°C.
Conductor Resistance, single, not pair	9.5 ohms per 1000 feet; (3.1 ohms per 100 meter) (20 awg)
Conductor Resistance, single, in a pair	10 ohms per 1000 feet; (3.3 ohms per 100 meter) (20 awg)
Wire Insulation Resistance (IR)	3,000 megohms per 100 meters, from one conductor to all else in common + shield, nom.
Jacket Insulation Resistance (Wet IR)	100 megohm per 100 meters from conductor group + shield to water bath electrode, nom.
Jacket Capacitance (Fully immersed)	95 nFd per 100 meters from wires & shield, grouped, to bath electrode.
Capacitance, one wire to group + shield	17 nFd per 100 meters @ 1000 Hz, nominal (20 awg)
Pair Capacitance wire-wire	9.7 nFd per 100 meters @ 1000 Hz, nominal (20 awg)
Pair Inductance, 2-wire Loop	.064 milli-Henry per 100 meters @ 1000 Hz, nominal. (20 awg)
Pair Impedance, wire-wire	90 ohm diff. impedance, for pairs, nominal (20 awg)
Single conductor Inductance	3.33 milli-Henry per 100 m, end-to-end, @ 1000 Hz. nominal. (20 awg)

## NV FAMILY OF CABLED SINGLE WIRES

UNSHIELDED CABLED SINGLE WIRES					20 AWG OVERALL FOIL-SHIELDED OVER CABLED SINGLE WIRES				
Part No.	No. of Wires	Wire AWG & Strands	Diameter Inch   mm	Weight Lb/M   kg/km	Part No.	No. of Wires	Wire AWG & Strands	Diameter Inch   mm	Weight Lb/M   kg/km
NV220J	2	20(19)	.184   4.7	16   24	NV220FSJ	2	20(19)	.186   4.7	20   30
NV320J	3	20(19)	.193   4.9	21   31	NV320FSJ	3	20(19)	.195   5.0	25   37
NV420J	4	20(19)	.207   5.3	26   39	NV420FSJ	4	20(19)	.209   5.3	30   45
NV520J	5	20(19)	.225   5.7	31   47	NV520FSJ	5	20(19)	.227   5.8	35   52
NV620J	6	20(19)	.242   6.1	37   55	NV620FSJ	6	20(19)	.244   6.2	40   60
NV920J	9	20(19)	.300   7.6	53   79	NV920FSJ	9	20(19)	.302   7.7	57   84
NV1220J	12	20(19)	.309   7.9	67   99	NV1220FSJ	12	20(19)	.311   7.9	71   105



## NVP FAMILY OF CABLED TWISTED PAIRS

UNSHIELDED CABLED PAIRS					20 AWG OVERALL FOIL-SHIELDED OVER CABLED PAIRS				
Part No.	No. of Wires	Wire AWG & Strands	Diameter Inch   mm	Weight Lb/M   kg/km	Part No.	No. of Wires	Wire AWG & Strands	Diameter Inch   mm	Weight Lb/M   kg/km
NVP220J	2	20(19)	.261   6.7	20   30	NVP220FSJ	2	20(19)	.263   6.8	24   36
NVP320J	3	20(19)	.277   7.1	26   38	NVP320FSJ	3	20(19)	.279   7.2	29   44
NVP420J	4	20(19)	.301   7.9	31   47	NVP420FSJ	4	20(19)	.303   8.0	35   53
NVP520J	5	20(19)	.330   8.8	37   56	NVP520FSJ	5	20(19)	.332   8.8	41   62
NVP620J	6	20(19)	.360   9.7	43   65	NVP620FSJ	6	20(19)	.362   9.7	47   71
NVP920J	9	20(19)	.458   11.2	62   93	NVP920FSJ	9	20(19)	.460   11.2	66   99
NVP1220J	12	20(19)	.474   12.1	77   115	NVP1220FSJ	12	20(19)	.476   12.2	81   121

# NV & NVP CABLES

Suitable for Rough Usage - 20 AWG



AWM Style 20233

## RoHS COMPLIANT PRODUCTS:

all RoHS products have the letter "R" written into the second position of the Part No.

### NV FAMILY OF CABLED SINGLE WIRES

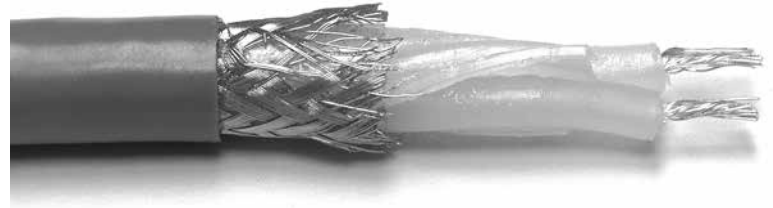
UNSHIELDED CABLED SINGLE WIRES					20 AWG OVERALL FOIL-SHIELDED OVER CABLED SINGLE WIRES				
Part No.	No. of Wires	Wire AWG & Strands	Diameter Inch   mm	Weight Lb/M   kg/km	Part No.	No. of Wires	Wire AWG & Strands	Diameter Inch   mm	Weight Lb/M   kg/km
NRV220J	2	20(19)	.184   4.7	16   24	NRV220FSJ	2	20(19)	.186   4.7	20   30
NRV320J	3	20(19)	.193   4.9	21   31	NRV320FSJ	3	20(19)	.195   5.0	25   37
NRV420J	4	20(19)	.207   5.3	26   39	NRV420FSJ	4	20(19)	.209   5.3	30   45
NRV520J	5	20(19)	.225   5.7	31   47	NRV520FSJ	5	20(19)	.227   5.8	35   52
NRV620J	6	20(19)	.242   6.1	37   55	NRV620FSJ	6	20(19)	.244   6.2	40   60
NRV920J	9	20(19)	.300   7.6	53   79	NRV920FSJ	9	20(19)	.302   7.7	57   84
NRV1220J	12	20(19)	.309   7.9	67   99	NRV1220FSJ	12	20(19)	.311   7.9	71   105

### NVP FAMILY OF CABLED TWISTED PAIRS

UNSHIELDED CABLED PAIRS					20 AWG OVERALL FOIL-SHIELDED OVER CABLED PAIRS				
Part No.	No. of Wires	Wire AWG & Strands	Diameter Inch   mm	Weight Lb/M   kg/km	Part No.	No. of Wires	Wire AWG & Strands	Diameter Inch   mm	Weight Lb/M   kg/km
NRVP220J	2	20(19)	.261   6.7	20   30	NRVP220FSJ	2	20(19)	.263   6.8	24   36
NRVP320J	3	20(19)	.277   7.1	26   38	NRVP320FSJ	3	20(19)	.279   7.2	29   44
NRVP420J	4	20(19)	.301   7.9	31   47	NRVP420FSJ	4	20(19)	.303   8.0	35   53
NRVP520J	5	20(19)	.330   8.8	37   56	NRVP520FSJ	5	20(19)	.332   8.8	41   62
NRVP620J	6	20(19)	.360   9.7	43   65	NRVP620FSJ	6	20(19)	.362   9.7	47   71
NRVP920J	9	20(19)	.458   11.2	62   93	NRVP920FSJ	9	20(19)	.460   11.2	66   99
NRVP1220J	12	20(19)	.474   12.1	77   115	NRVP1220FSJ	12	20(19)	.476   12.2	81   121

# GEOPHYSICAL CABLE

## BOTTOM TELEMETRY



**D-2436 TWINAX (Bottom Telemetry):** shielded twisted pair cables with 135-ohm controlled impedance, for digital signal use, one of our specialties: National is recognized in the seismic industry for our trouble-free D2436/D2440 Twinax using our proprietary “Self-Healing Dielectric” in our “Industry Standard Twinax” widely used to carry digital telemetry in ocean-bottom seismic-search cables.

(NWC: Dynatronic Cable Engineering Division)

### Technical Data on Seismic Digital Telemetry Data Twinax Type D-2436-X

Qualified for use with the Sercel/Syntron “Syntrak” system bottom cables

#### MECHANICAL

Jacket Material:	Polyethylene	Polyethylene
Diameter over jacket:	0.370 inch, nom.	9.4 mm
Temperature Range:	-50 °C to + 80 °C	-50 °C to + 80 °C
Suggested Min. Bend radius:	6 x Cable diameter	6 x Cable Durchmesser
Weight (Dry, in air):	74 pounds/1000 feet	110. KG/KM

#### ELECTRICAL

Characteristic Impedance:	135 Ohms	135 Ohms
Capacitance:	13.6 Picofarads/ Foot	44.6 Picofarads/ Meter
RF Loss at 20. Mhz:	1.35 db/100 feet	4.42 db/100 Meter
High Voltage Tested at:	5000 VAC 60 Hz	5000 VAC 60 Hz

#### Notes:

- 1- Every length is RF sweep-tested to verify performance. A RF Loss plot is provided with each length.
- 2- All product goes through our proprietary “Normalization” process.
- 3- All materials are essentially unaffected by immersion in Vistanex.
- 4- Colors: This cable product is available with a choice of colors for the outer jacket. The part number to specify a given color is shown below.

Part No.	Jacket Color	Pair Color
D2436-5	Green	Green, Paired with Natural Trans.
D2436-6	Blue	Green, Paired with Natural Trans.

# GEOPHYSICAL CABLE

## STREAMER CABLE TELEMETRY



### D-2520 Preferred Seismic Towed Streamer Telemetry Twisted Pair (unshielded):

D-2520 Streamer Telemetry pair presents a low-loss 135-ohm impedance when oil-immersed in Kerosene, or Niroma. This product has been tested and qualified for use with Sercel/Syntron digital marine repeaters. Widely used in US-made original-equipment towed streamer cables. A preferred rugged replacement telemetry pair for use with Sercel/Syntron digital marine repeaters.

(NWC: Dynatronic Cable Engineering Division)

### Technical Data on Seismic Digital Telemetry Data Twinax Type D-2520-X

Qualified for use with the Sercel/Syntron "Syntrak" system streamer cables

<b>MECHANICAL</b>		
Outer Covering:	Free-flooding braid	Free-flooding braid
Insulation Type:	Modified Polyolefin	Modified Polyolefin
Diameter over cover:	0.272 inch, nom.	6.9 mm
Temperature Range:	-50.°C. to + 80.°C	-50.°C. to + 80.°C
Weight (Dry, in air):	17. pounds/1000 feet	25.3 KG/KM
Installation Tension per wire:	16. pounds suggested max	7.3 KG suggested max.
<b>ELECTRICAL</b>		
Characteristic Impedance:	135 Ohms	135 Ohms
Capacitance in air, reeled:	12.1 Picofarads/ Foot	39.7 Picofarads/ Meter
RF Loss at 20. Mhz, dry:	-1.25 db/100 feet	-4.1 db/100 Meter
High Voltage Tested at:	5000 VAC 60 Hz	5000 VAC 60 Hz

### Notes:

- 1- Every length is RF sweep-tested to verify performance. A RF Loss plot is provided with each length.
- 2- All cable goes through our proprietary "Normalization" process. OK in Niroma, Isopar M, Streamer 9
- 3-Color Code: This cable is available with a choice of colors for the two paired wires. The part number suffix (-X) shown below is used to specify a given color combination. Colors will be pastel.

Pair Color	Part Dash #
Natural Trans. Paired with Black:	-0
Natural Trans. Paired with Brown:	-1
Natural Trans. Paired with Red:	-2
Natural Trans. Paired with Orange:	-3
Natural Trans. Paired with Yellow:	-4

Pair Color	Part Dash #
Natural Trans. Paired with Green:	-5
Natural Trans. Paired with Blue:	-6
Natural Trans. Paired with Violet:	-7
Natural Trans. Paired with Gray:	-8
Natural Trans. Paired with White:	-9

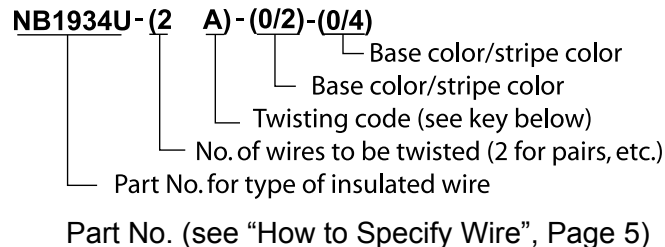




# HOW TO SPECIFY PAIRS

WE RECOMMEND THE FOLLOWING FORMAT WHEN SPECIFYING TWISTED PAIRS AND TRIOS:

## EXAMPLE



## KEY TO TWISTING CODE

- A = SHORT TWINNER LAY
- B = STANDARD TWINNER LAY
- C = SHORT PLANETARY LAY
- D = STANDARD PLANETARY LAY

THE "SHORT" LAY IS DEFINED AS EQUAL TO  $5 \times D \times N$  AND THE "STANDARD" LAY IS DEFINED AS  $10 \times D \times N$  WHERE  $D$  = CONDUCTOR DIAMETER,  $N$  = NO. OF CONDUCTORS

## DIFFERENCES IN PAIR TWISTING

THE MOST COMMON COMMERCIAL PAIR-FORMING MACHINES ARE CALLED "TWINNERS." THIS TYPE OF PAIR-FORMING IS THE LEAST EXPENSIVE WAY TO FORM TWISTED PAIRS. HOWEVER, PAIRS FORMED ON THIS TYPE OF EQUIPMENT HAVE BEEN KNOWN TO EXPERIENCE DEFORMATION OF THE STRANDED COPPER, STRAIN IN THE INSULATION AND POOR ELECTRICAL BALANCE.

THE SUPERIOR METHOD OF PAIR-FORMING IS BY USE OF A PLANETARY OR TUBULAR CABLING MACHINE IN SUCH A MANNER THAT NO RESIDUAL TWIST IS IMPARTED TO THE INDIVIDUAL WIRES FORMING THE TWISTED GROUP. THIS RESULTS IN BETTER ELECTRICAL BALANCE AND IMPROVES FLEXIBILITY.

NATIONAL IS EQUIPPED FOR ALL OF THE ABOVE DESCRIBED TECHNIQUES. CHOOSE THE METHOD BEST SUITED FOR YOUR PARTICULAR APPLICATION.