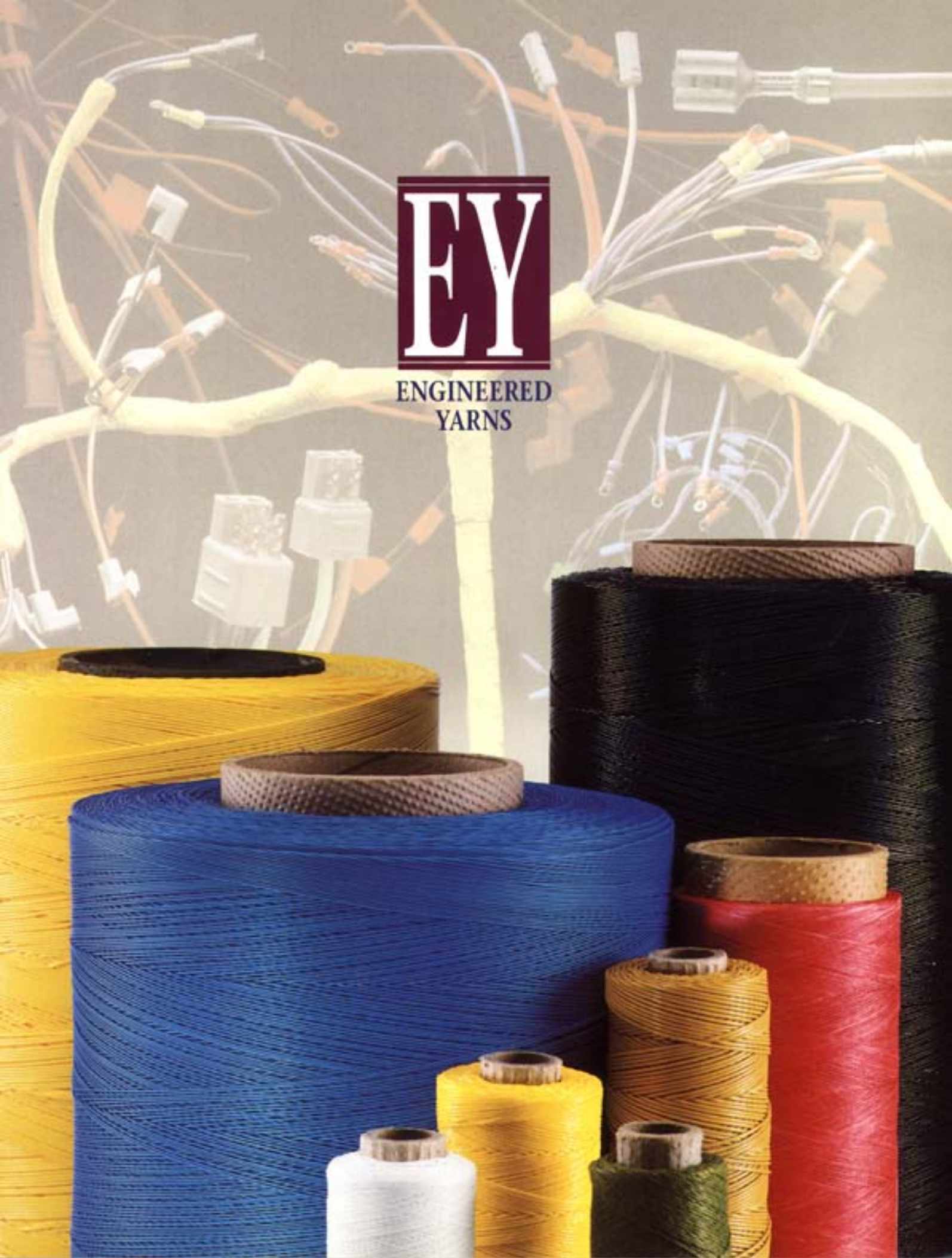

EY
ENGINEERED
YARNS

# BRAID CONSIDERATIONS

## MATERIALS SELECTION:

Engineered Yarns' wide selection of materials assures that the most appropriate substrate, and/or coating will be readily available for the manufacturing of each customer's particular product. An ecologically minded company, Engineered Yarns relies on environmentally friendly technologies for their production processes.

MAN-MADE FIBER SELECTION INCLUDES:

- Nylon
- Polyester
- Aramid
- Fiberglass
- High Molecular Weight Polyethylene
- Carbon

RESINS:

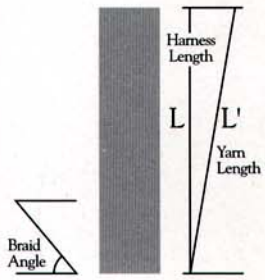
- PVC
- Polyester
- Nylon
- Polyurethane
- Polyvinylidene Fluoride
- Polypropylene
- Polyethylene

## MACHINE SELECTION:

The following can be used as a guide to braid machine selection:

| QUANTITY OF CARRIERS IN BRAIDER | WIRE BUNDLE RANGE DIAMETER | |
|---|---|---|
| | INCHES | MM |
| 24 | 1/4" to 1/2" | 6.35 to 12.7 |
| 32 | 5/8" to 3/4" | 15.8 to 19 |
| 48 | 3/4" to 1 1/2" | 19 to 38.1 |
| 64 | 1 1/2" & Larger | 38.1 & Larger |

HOW TO ESTIMATE AMOUNT OF BRAID YARN REQUIRED FOR A HARNESS:
The following relationship may be applied.




$\phi$ - Braid Angle  L - Harness Length  L' - Yarn Length

$$\text{Total Yarn Length, } L' = \frac{\#\text{ Carriers, N} \times \text{Dia. Braid, D} \times 3.14}{\cos \phi}$$

$$\text{Pounds Req'd, W} = \frac{\text{Total Yarn Length, Yds.}}{\text{*Yds./ Lb.}}$$

*Yield - Braid Yarn
Vinyl 0.028 inches = 1,000 Yds./Lb.
Vinyl 0.040 inches = 550 Yds./Lb.

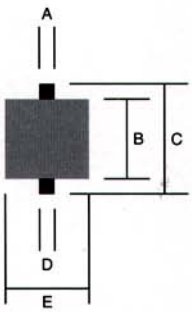
Example:

$$L' = \frac{16 \times 1 \times 3.14}{0.71}$$

L' = 70.8 in. Yarn Per Inch of Braid

Cos 45° = 0.71

$$\frac{70.8 \text{ - } 36 \text{ in/yd}}{1000 \text{ YPP}} = 0.002 \text{ lbs. Per Inch of Harness}$$




## PACKAGING:

Vinyl braid yarns are available on the following standard packages:

| | BULK TUBE | BRAIDER TUBE |
|---|---|---|
| A. | 3.43" (87 mm) | .875" (22 mm) |
| B. | 10" (254 mm) | 5" (127 mm) |
| C. | 11" (279 mm) | 5.5" (140 mm) |
| D. | 3.25" (83 mm) | .625" (16 mm) |
| E. | 9.25" (235 mm) | 1.75" (44 mm) |

## STANDARD WEIGHTS:

15 lbs. (6.80 kg.)  0.3 lbs. (.136 kg.)

## BRAID YARNS DESIGNED FOR SPECIAL APPLICATIONS

| | |
|---|---|
| EY-1877 | Thermoplastic polyester elastomer coating over high tenacity polyester multifilament. Especially designed for immersion in hydraulic fluid, while meeting a service temperature range of -50°F to 280°F (-45°C to 138°C). |
| EY-2693 | Polyurethane elastomer coating over Nylon multifilament, for applications requiring increased flexibility and high surface friction with good abrasion resistance. |
| EY-3071 | Nylon 6-6 coating over high tenacity polyester multifilament. This yarn provides superior abrasion resistance, good heat stability and toughness. |
| EY-3023 | Polyvinylidene fluoride extruded over high tenacity polyester multifilament. Designed to meet very demanding conditions within engine valve covers, with a temperature tolerance of -65°F to 300°F (-54°C to 150°C) |

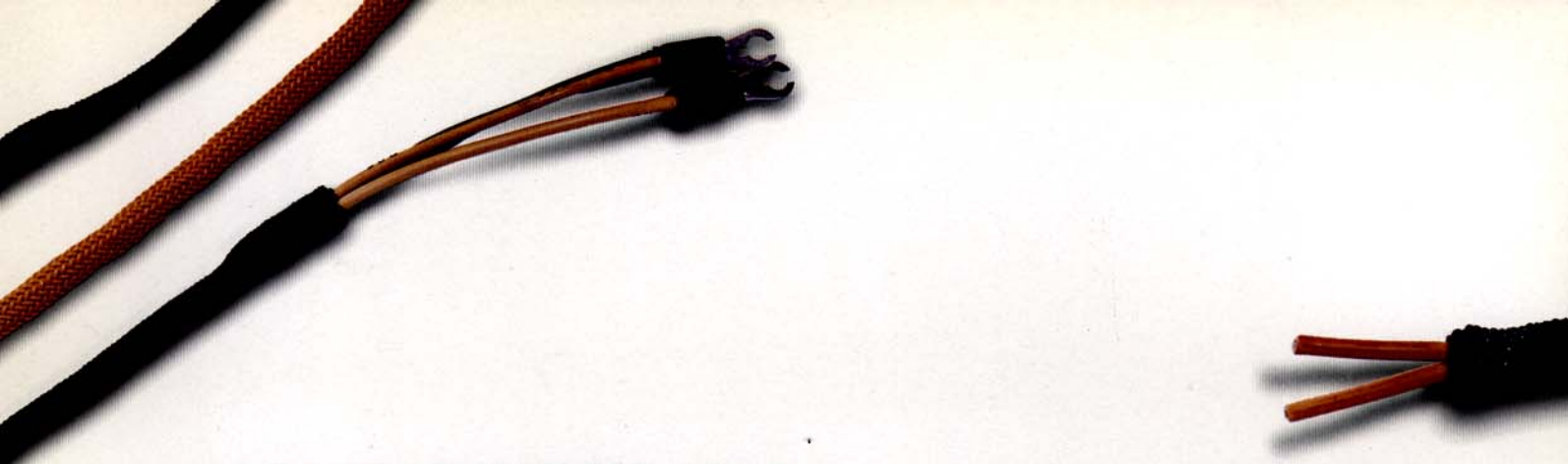
### PHYSICAL PROPERTIES:

| | EY-1877 | EY-2693 | EY-3071 | EY-3023 |
|---|---|---|---|---|
| COATING: | Polyester Elastomer | Urethane Elastomer | Nylon 6-6 | Polyvinylidene Fluoride |
| Diameter, in. (mm) | 0.028 (0.71) | 0.022 (0.56) | 0.028 (0.71) | 0.028 (0.71) |
| Tensile Strength, lbs. (kg) | 16 (7.3) | 16 (7.3) | 16 (7.3) | 16 (7.3) |
| Flexural Modulus, 73°F (23°C), PSI | 30,000 | 10,000 | 270,000 | 200,000 |
| Yield, yds./lb. (m/kg) | 1273 (2550) | 1702 (3400) | 1100 (2200) | 1000 (2000) |

### RELATIVE CHEMICAL RESISTANCE:

| | | | | |
|---|---|---|---|---|
| Acids | 2 | 3 | 3 | 1 |
| Base | 1 | 3 | 2 | 1 |
| Hydrocarbons | 1 | 1 | 1 | 1 |
| Abrasion Resistance | 2 | 3 | 1 | 2 |

Fluid Rating System: 0 = No Effect 5 = Significant Embrittlement
Abrasion Rating System: 0 = No Effect 5 = Significant Abrasion



# PVC COATED HARNESS YARNS

## PHYSICAL PROPERTIES:

| | VN-4400 | VN-4000 | VN-4000S |
|---|---|---|---|
| Diameter, in. (mm) | 0.028" (0.71mm) | 0.040" (1.02 mm) | 0.040" (1.02 mm) |
| Tensile Strength, lbs. (kg) | 15 lbs. (6.80 kg.) | 22 lbs. (9.97 kg.) | 22 lbs. (9.97 kg.) |
| Yield, yds./lb. (m/kg) | 1000 (2000 m/kg.) | 550 (1100 m/kg) | 550 (1100 m/kg) |

## THERMAL PROPERTIES:

| | VN-4400 °F (°C) | VN-4000 °F (°C) | VN-4000S °F (°C) |
|---|---|---|---|
| Cold Flex Tolerance | -40 (-40) | -40 (-40) | -65 (-54 ) |
| Recommended Max. Serv. Temp. | 175 (79) | 175 (79) | 280 (138) |
| Short Term Temp.Tolerance | 225 (107) | 225 (107) | 280 (138) |

## EFFECTS OF COMMON VEHICLE FLUIDS:

| 24 Hours @ 200°F (93°C) | VN-4400 / VN-4000 | VN-4000S |
|---|---|---|
| Grease | 4 | 0 |
| Motor Oil 10 w 30 | 4 | 1 |
| Battery Acid | 2 | 2 |
| Anti Freeze | 4 | 0 |
| Winshield Wiper Fluid | 4 | 2 |
| Hydraulic Fluid | 0 | 0 |
| Gunk | 1 | 0 |
| Relative Abrasion Resistance | 2 | 2 |

| | | |
|---|---|---|
| Fluid Rating System: | 0 = No Effect | 5 = Significant Embrittlement |
| Abrasion Rating System: | 0 = No Effect | 5 = Significant Abrasion |

Both grades of vinyl are compounded to provide outstanding properties at their rated service temperature. These performance properties include:

- Weathering
- Moisture Resistance
- Abrasion Resistance
- Fire Resistance with Retardance
- Resistance to degradation from oil, grease and other common engine fluids.

## CORE YARN:

EY braid yarns are constructed with high tenacity, nylon multifilament. The tensile properties are essentially unaffected by temperatures up to 300°F (150°C) and are likewise tolerant to most engine fluids that may penetrate the vinyl coating. (One caution is that concentrated acids do degrade nylon.)

## COLORS:

Standard colors include Black, Yellow and Gold.

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# PVC COATED HARNESS YARNS

PVC has long been recognized for Exceptional Weathering Performance, Moisture Resistance and Abrasion Resistance.

Engineered Yarns builds on these basic properties by compounding additives for cold flexibility, fire resistance, and resistance to engine fluids. PVC also provides abrasion resistance and a uniform surface for ease of braiding for protection of wire assemblies.

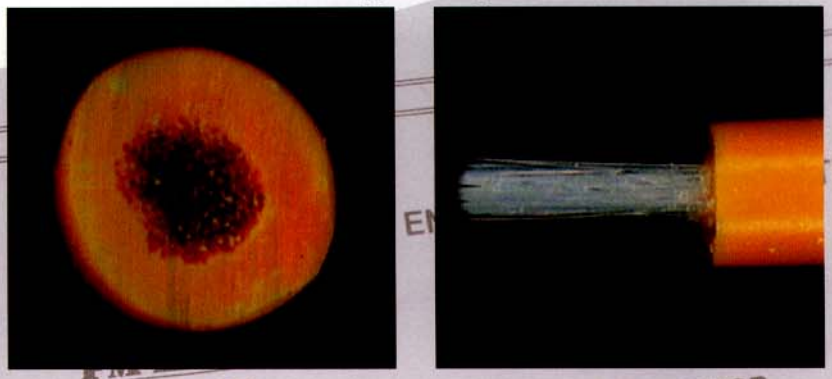
## GRADES AVAILABLE:

REGULAR PERFORMANCE: VN-4400 & VN-4000 both are vinyl coated nylon yarn designed for the braiding of harness type constructions of electrical wiring systems. The vinyl coating is fire resistant and contributes sufficient fire retardancy to the yarn.

HIGH PERFORMANCE: VN-4000S Vinyl coated nylon yarn performs at higher temperatures for extended periods of time while retaining the properties of high fire retardancy, abrasion and oil resistance.

| PRODUCT CODE | EY PART NUMBER |
|---|---|
| VN-4400 | 55VN02853164010068 |
| VN-4000 | 55VN04054164019162 |
| VN-4000S | 55VN04054154009158 |

*The combination of a high tenacity, multifilament core yarn and selected polymer coatings enables Engineered Yarns to custom engineer braid yarns to meet the application requirements.*



# COATINGS TO ENHANCE YARN PERFORMANCE

*Large enough to provide a full range of services, yet small enough to remain flexible.*

Engineered Yarns is a custom-engineering group providing creative answers to your industrial yarn requirements.

Our team of talented professionals is supported by highly trained and dedicated plant personnel and customer service representatives. Laboratory, testing and manufacturing facilities are located in our modern 40,000 squarefoot Massachusetts headquarters. Engineered Yarns has the equipment, the technology and the experience to develop and produce efficient solutions that fit the needs of a growing list of original equipment manufacturers.

Engineered Yarns' products are linear composite materials based on man-made fiber substrates, usually treated with polymeric systems to enhance functional properties. Product end-markets include electrical equipment, paper machine clothing, transportation, telecommunications and composite industries.

*FRONT COVER BACKGROUND PHOTOGRAPH:*
*A special thank you to WHITE PRODUCTS B.V. of the Netherlands for use of their original color photograph.*

**ENGINEERED YARNS**

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