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August Herzog Maschinenfabrik GmbH & Co. KG

- Founded 1861
- Family owned in 5th Generation
- Situated in Oldenburg i. O., Germany
- Market- and technology leader in winding- and braiding machines
- Over 13,000 m² state-of the art production facility
- Over 500 different braiding machines available for different applications
- 140 highly skilled workers
Braiding theory

Braids are textile constructions which yarns cross each other in diagonal direction.

Round braids: Round braids have a round or oval cross section. The products made are cords (general), laces (for clothes), cables (electro) or ropes (heavy braids).
Main specifications of the braid

a) Cable diameter  
b) Lay length or pitch (Density in Inch)  
c) Used material (yarn type und yarn thickness)

Braid pick  
Lay length
The density can be defined differently:

a) Picks per engl. Inch (Inch = 25,4 mm)
b) Picks per french Inch (Inch = 27 mm)
c) Lay length in mm.

The calculation is as follows:

Example: 24 carrier braid, diameter: 10 mm

Lay length = 31,4 mm
12 Picks = 1 carrier revolution on braiding machine
31,4 mm : 12 carriers = 2,6 mm per pick
25,4 mm : 2,6 mm per Pick = 9,76 picks/ engl. Inch
Production calculation

Main formula for endless braids:

Braid in metres per hour = Lay length x horngear speed x 4 x 0,06
numbers of carriers

Example: Harness diameter 10 mm, lay length 31,4 mm;
used machine KBB 1/24-100; (horn gear speed 250 rpm)

Braid in metres per hour = \(31,4 \, \text{mm} \times 250 \, \text{rpm} \times 4 \times 0,06\)
\[= 78,5\]
24 carriers

Braid in metres per hour = 78,5
(without joints and set-up time)
Production calculation

Example harness production:

Harness tree: main arm 3 m length, diameter 15 mm, side arms 6 x 0,5 m, diameter 8 mm.

Production (main arm) = 15 mm x Pi x 250 rpm x 4 x 0,06 / 24 carriers
Production (main arm) = 117,8 m/h -> 3 m = 1,5 mins

Production (side arm) = 8 mm x Pi x 250 rpm x 4 x 0,06 / 24 carriers
Production (side arm) = 62,83 m/h -> (6 x 0,5 m) = 3,2 mins

Estimated handling time (side arm/ each): 30 sec. per arm
Estimated handling time (side arm/total) = 6 arms x 30 sec. = 3,0 mins

Production time = 1,5 mins (main arm) + 3,2 mins (side arms) + 3 mins handling
= 7,7 = 8 mins plus set-up time
Production calculation

Product length in relation to yarn length
Product length = yarn length on bobbin x sin braiding angle

Example: Shortage factor for the following angles

Product length (35°) = Yarn length x 0.5735 (sin 35°)
Product length (45°) = Yarn length x 0.7071 (sin 45°)
Product length (55°) = Yarn length x 0.8191 (sin 55°)
Product length (65°) = Yarn length x 0.9063 (sin 65°)
Working time with one set of bobbins:

Working time = Yarn length in metres x shortage factor
production speed per hour

Example with bobbin with 265 ccm = 237 m yarns 1-ply:

Working time = \( \frac{237 \text{ Meter} \times 0.7071}{117 \text{ metres per hour}} \)

Working time = 1.4 hours

Shortage factor 35° = 0.5735
Shortage factor 45° = 0.7071
Shortage factor 55° = 0.8191
Shortage factor 65° = 0.9063
Example:
Surface of the harness cable set: \( A = 78 \, \text{mm}^2 \)

\[
\text{Surface} = \text{Diameter}^2 \times \frac{\pi}{4} \\
78 \, \text{mm}^2 = \text{Diameter}^2 \times \frac{3.14}{4} \\
78 \, \text{mm}^2 \times 4 = \text{Diameter}^2 \\
3.14 \\
99.36 \, \text{mm}^2 = \text{Diameter}^2 \\
\textbf{9.96 mm} = \text{Diameter}
\]

Yarn length (per lay length) = \frac{\text{Numbers of carriers} \times \text{Diameter braid} \times 3.14}{\cos \text{ braiding angle}}

Yarn length (per lay length) = \frac{24 \, \text{carriers} \times 9.96 \, \text{mm} \times 3.14}{0.7071}

Yarn length (per lay length) = 1.061 \, \text{mm}
Yarns consumption per meter harness cable

Calculation (per meter harness cable) = $1.061 \text{ mm} \times 1.000 \text{ mm} \times \frac{9.96 \text{ mm}}{\pi} \approx 33.908 \text{ mm yarn}$

Calculation (per meter harness cable) = 34 metres yarn
### Recommended machine sizes depending on the harness diameter

<table>
<thead>
<tr>
<th>Numbers of carriers:</th>
<th>24</th>
<th>32</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineered Yarns:</strong></td>
<td>6 - 13 mm</td>
<td>16 - 19 mm</td>
<td>19 - 40 mm</td>
</tr>
<tr>
<td><strong>Herzog:</strong></td>
<td>8 - 20 mm</td>
<td>16 - 28 mm</td>
<td>25 - 40 mm</td>
</tr>
</tbody>
</table>
Advantages against Plastic tubes and tape winding

Compact machine footprint
No cable vibrations
Small storage
Less storage costs
Easy parameter changes possible
Advantages against Plastic tubes and tape winding

- Little wire to wire movement
- Smaller harness diameter
- No fittings required
- Easier installation
- Tamperproof
- 100% occupied
- Flame retardant
  (MVSS 302, SAE J369 und UL 94)
Advantages against Plastic tubes and tape winding

High assembly costs
Pre cut raw materials necessary
approx. 30 % space loss
Vibrations of cables in plastic hoses
water trap
Advantages against Plastic tubes and tape winding

Will not trap particule matter

Seeds, Stones
Dwellings

Rodents, Insects
Advantages against Plastic tubes and tape winding

- Abrasion resistant
- Weatherproof
- Colour/Tracer
- Temperature tolerant
- Chemical exposure
- No tape/ fittings required
- Easy installation
- Tamperproof
- 100% occupied
- Appearance
According to customers’ experiences there are no price difference between braided harnesses and harnesses with plastic hose covers.
For wire harnesses between dia. 8 – 20 mm

User friendly design

Operator panel for left and right handed operators

High efficiency, low maintenance required

Suitable for EY cardboard tubes or Herzog flange bobbin 55 x 130 mm
For wire harnesses between dia. 16 – 28 mm

User friendly design

Operator panel for left and right handed operators

High efficiency, low maintenance required

Suitable for EY cardboard tubes or Herzog flange bobbin 55 x 130 mm
For wire harnesses between dia. 25 – 40 mm

User friendly design

Operator panel for left and right handed operators

High efficiency, low maintenance required

Suitable for cardboard tubes or Herzog flange bobbin 55 x 130 mm
Horizontal braiding machine

Horizontal Braiding machine with Siemens PLC and take-off winch for manufacturing of extra long and heavy harnesses for aviation industry.
Vertical braiding machine with cylindrical take-off disc, turnable pan, laser-pointer, take-off slides, special carriers with easy carrier exchange system for aviation industry.
Hot cutting unit for cutting Polyester fibres.

Enlarged take-off disc for very stiff harness cables.
Easy carrier exchange system to exchange carrier upper parts

- lower down times

- easy carrier change when using different carrier types
Accessories

Turnable pan for easy loading and unloading of the harness when braiding and extra covering to prevent damaging the harness.

Splitted Lexan cover above carriers to avoid harness trees fall into braiding machine.
Accessories

PLC- device for repeatable set-up for aviation industry

Slides for easy take-off and handling of the harnesses
Company Headquarters

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Available yarn types Engineered Yarns

- VN-4400/VN-4000, Standard PVC coated yarn for conventional harness applications.
- VN-4400S/VN-4000S, High performance PVC coated yarns for applications that require improved chemical resistance and temperature tolerance.
- EY-3023, PVDF coated yarn for applications that require improved abrasion resistance with superior heat and chemical resistance.
- EY-1877, TPE coated yarns for applications that require outstanding abrasion resistance with improved heat and chemical resistance.
<table>
<thead>
<tr>
<th></th>
<th>VN-4400</th>
<th>VN-4400S</th>
<th>VN-4000</th>
<th>VN-4000S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>0.028&quot; (0.71 mm)</td>
<td>0.28&quot; (0.71 mm)</td>
<td>0.040&quot; (1.02 mm)</td>
<td>0.040&quot; (1.02 mm)</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>15 lbs (6.80 kg)</td>
<td>15 lbs (6.80 kg)</td>
<td>22 lbs (9.97 kg)</td>
<td>22 lbs (9.97 kg)</td>
</tr>
<tr>
<td>Weight</td>
<td>1000 yds/lbs (2000 m/kg)</td>
<td>1000 yds/lbs (2000 m/kg)</td>
<td>550 yds/lbs (1100 m/kg)</td>
<td>550 yds/lbs (1100 m/kg)</td>
</tr>
</tbody>
</table>
## Engineered Yarns

### Cemical reaction with typical fluids in construction vehicles

<table>
<thead>
<tr>
<th>Fluid</th>
<th>VN-4400</th>
<th>VN-4000</th>
<th>EY-1877</th>
<th>EY-3023</th>
<th>PVC</th>
<th>PVC</th>
<th>TPE55D</th>
<th>PVDF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Acid</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gunk</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Oil</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gasoline</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-Freeze</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washer Fluid</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic Fluid</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brake Fluid</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission Fluid</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Heat Aging 250°F/121.1°C</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

0 = no reaction, 5 = heavy reaction  
(Trial 30 days at room temperature)
Suggested environmental temperatures

**VN-4000/VN-4400:**
-40°C to 107°C  
-40°F to 225°F

**VN-4000S/VN-4400S:**
-54°C to 138°C  
-65°F to 280°F

**EY-3023:**
-54°C to 150°C  
-65°F to 302°F

**EY-1877:**
-45°C to 138°C  
-49°F to 280°F
Coats Thread Germany GmbH

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Wire processing with braiding machine

Nickel-plated copper Per A-A-59551
Silver-plated copper Per A-A-59551
Tin-plated copper Per A-A-59551
Stainless steel Per QQ-W-423
Special aviation execution

Special carriers for

- Nomex
- Copper wires
- Silver plated copper wires
- Nickel plated copper wires
- Aluminum wires
- Carrier fast exchange system
- Bobbins 55 x 130 mm or 42 x 130 mm
Higher bobbin capacity with flange bobbins than cardboard tubes.

Less bobbin changes on winding machine.

Cheaper bulk yarn prices.
Winding technology

- Winding machine with 4 spindles
- Automatic machine stop due to pre select meter counter.
- Automatic stop caused by yarn breakage
Creel for feeding the winding machine

Yarn package is under constant tension.

Yarn package will be braked by pneumatic brake system when winding machine stops.

Yarn is permanently braked and controlled
Comparison between papertube and flange bobbin usage

Standard cardboard tube

141 ccm capacity, cross wound

Advantage: convenient, ready to use product

Disadvantage: more expensive

Low volume, high down times

Flange bobbin Herzog

265 ccm capacity, parallel wound

Advantage: less bobbin changes, higher capacity, cheaper yarn price

Disadvantage: Winding machine necessary, extra production step