The Flyman’s Reference Guide to Stage Ropes

RECOMMENDED WORKING LOADS

Recommended working loads are determined by taking the average tensile strength of new rope under laboratory conditions, and dividing by a factor to determine the maximum working load that should be applied to the rope. Rope manufacturers state that it is impossible to make blanket recommendations as to working loads. There are many variables to consider such as, the amount of risk to life and property, rope size, rope condition, type of knots used, elevated temperatures, extended periods under load, and dynamic load. It is now an industry standard that all stage rigging hardware and equipment have a minimum safety factor of 8:1. This factor should be increased when rope is to be used for safety lines, climbing ropes, life lines, or other critical applications when loads are suspended over people.

INSPECTING ROPE

The following inspection guidelines are suggested guidelines. There is no universal agreement on what constitutes the criteria for removing rope from service. In the theatre industry any suspect rope should be removed from service and discarded.

- 1) Cut Strands
- 2) Abrasion on inside radius of eye
- 3) Burn or melting visible
- 4) Rope suspected of being loaded
- 5) Reduced diameter by 5% over new
- 6) Exposure to excessive temperature as specified for type of fiber

The recommended working loads shown in this table were taken from an averaging of published tensile strengths, then divided by a factor of 8. The actual tensile strengths may vary from one manufacturer to another. It is recommended that the user obtain from the manufacturer certification of tensile strength. Most manufacturers will readily provide this. If they don’t, buy their rope.

SPECIFICATIONS

3/4” Dia. Ropes

<table>
<thead>
<tr>
<th>Fiber</th>
<th>Color</th>
<th>Breaking Strength</th>
<th>25% Service</th>
<th>Safety Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manila</td>
<td>100% hemp</td>
<td>5900 lbs</td>
<td>9900 lbs</td>
<td>12:1</td>
</tr>
<tr>
<td>Nylex</td>
<td>hemp</td>
<td>4800 lbs</td>
<td>10400 lbs</td>
<td>14:1</td>
</tr>
<tr>
<td>Polyester</td>
<td>white</td>
<td>3600 lbs</td>
<td>9000 lbs</td>
<td>25:1</td>
</tr>
<tr>
<td>Polypropylene</td>
<td>Natural</td>
<td>3150 lbs</td>
<td>7950 lbs</td>
<td>25:1</td>
</tr>
<tr>
<td>Polyurethane</td>
<td>5000 lbs</td>
<td>12500 lbs</td>
<td>25:1</td>
<td></td>
</tr>
</tbody>
</table>

EFFECTS OF KNOTS

- **EYE SPLESC Y**
  - 90°
- **FISHERMAN’S BEND (ANCHOR BEND)**
  - 70°
- **CLOVE HITCH**
  - 75%

DRUM FILL

- **TWO HALF HITCHES**
  - 69%
- **BOWLINE (INSIDE)**
  - 65%
- **SQUARE TO OVERHAND**
  - 45%

PRACTICAL USE AND CARE

Avoid overloading: Do not exceed recommended working loads.

Avoid abrasion: Both inner and outer fibers contribute equally to the rope’s strength. If the rope is worn on the outside it is naturally weakened. Use canvas or rubber chafe pads to protect rope where abrasion may occur.

Avoid sudden strain: Rope strong enough for a load under a steady pull, may break if the same load is pulled quickly or jerked. The same holds true for rope subjected to shock. This can easily occur when someone slams on a rope lock while a set is in motion.

Avoid kinks: Rope that is continuously twisted in one direction will develop kinks. Kinks pulled through a restricted space (like headlock sheaves and keepers) can cause the rope serious damage. If you suspect twists, remove one end of the purchase line and throw twists out of line.

Avoid sharp angles: Sharp bends greatly affect rope strength. Sharp angles are weak spots and should be avoided. Padding will help, but be careful!

Reverse ends: Prolonged use at certain points on a rope will, in time, reduce the effectiveness of those points.

Avoid chemicals: Natural fiber ropes are severely damaged by exposure to chemicals. Most synthetic fibers are resistant to chemicals. Be safe, avoid chemicals even with synthetic ropes.

Maintain clean rope: Dirt is abrasive. If you allow dirt to get into your rope it will accelerate the abrasion of the rope fibers. Dirty ropes can be washed.

Avoid excessive heat: Heat can reduce the strength of rope. If the heat is excessive the rope must be discarded.

Avoid improper storage: Synthetic fiber ropes can be stored wet or dry. Manila will not be damaged from dust. Ultraviolet light with all rope.

COMPARISON OF ROPE FIBERS

<table>
<thead>
<tr>
<th>Fiber Type</th>
<th>Nylon</th>
<th>Polyester</th>
<th>Polypropylene</th>
<th>Polyurethane</th>
<th>Manila</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock Load Ability</td>
<td>Very High</td>
<td>Moderate</td>
<td>High</td>
<td>Low</td>
<td>Very Low</td>
</tr>
<tr>
<td>Approximate Break @ 25°F</td>
<td>20-34%</td>
<td>15-20%</td>
<td>15-20%</td>
<td>10-15%</td>
<td>10-15%</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Melting Point</td>
<td>40°F</td>
<td>50°F</td>
<td>30°F</td>
<td>275°F</td>
<td>Does Not Melt</td>
</tr>
<tr>
<td>Aversion Resistance</td>
<td>High</td>
<td>Very High</td>
<td>Low</td>
<td>Very Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Resistance to Sunlight</td>
<td>Good</td>
<td>Excellent</td>
<td>Poor</td>
<td>Fair</td>
<td>Good</td>
</tr>
<tr>
<td>Resistance to Rot</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Poor</td>
<td>Good</td>
</tr>
<tr>
<td>Resistance to Acids</td>
<td>Poor</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Resistance to Alkalis</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Resistance to Oil &amp; Gas</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Resistance to Electrical Conductivity</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Poor</td>
</tr>
<tr>
<td>Flexing Endurance</td>
<td>Very High</td>
<td>High</td>
<td>Moderate</td>
<td>Very Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

COMPARISON OF ROPE CONSTRUCTION

- **Double Braided**
- **Twisted**

- **Spliceable**
  - Yes
  - Excellent
  - Good

- **Flexibility**
  - Good
  - Poor

- **Rotates Under Load**
  - No
  - Yes

- **Mechanical Eflation**
  - Low
  - High

- **Cot Per Size**
  - High
  - Low

- **Abrasion Resistance**
  - Good
  - Poor

- **Flame Resistance**
  - Low
  - High

**FLAME RESISTANCE**

- Nylon, Polyurethane, and Polypropylene ropes are used extensively in theatre and are flame resistant. Non-flammable ropes are used when high fire safety is necessary.

**FLEET ANGLE**

- **13.5 X (ROPE DIAMETER)**

TREATING ROPE ENDS

- **Splicing**
- **Braiding**
- **Ending**

SPOT LINES

- **Right-Hand**
- **Left-Hand**

TRIMMERS

- **Splicing**
- **Braiding**
- **Ending**

- Use standard splices on all connections where rope is subjected to pulling, bending, or the rope is not under constant tension. Use hand splices on double braided and inflexible rope to prevent future bending, kinking, or abrasion. Use hand splices on inflexible rope to prevent rope from being pinched or pinched. These are not permanent splices and should be well made, well made, and well made.

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