

Wire rope installation guide

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Important safety information

READ THIS BEFORE INSTALLATION

The practices outlined in this installation guide are general procedures for wire rope installation. Techniques, codes and materials are constantly being updated. The installer is responsible for knowing and following any and all applicable codes. Also see *The Elevator Industry Field Employees' Safety Handbook*, edited by the NEII Safety Committee and published by Elevator World.

Working in the hoistway and handling wire rope can be dangerous. Therefore:

ALWAYS FOLLOW SAFE WORKING PRACTICES. Make sure landing doors are locked or barricaded. Use lock-out tags to prevent accidental switching on of power.

ALWAYS WEAR PROTECTIVE CLOTHING. Use helmets, goggles and gloves - wire rope ends are sharp and can 'fishhook' into unexposed skin. Use anti-fall harnesses as required.

IT IS STRONGLY RECOMMENDED THAT THE SHEAVES BE CAREFULLY CHECKED AND REGROOVED OR REPLACED AS NECESSARY PRIOR TO ROPE REPLACEMENT. The diameter of the new ropes is greater than that of the old ropes and failure to bring the sheave grooves into the specified tolerances can lead to vibration, metal shavings and other problems.

Some information for this manual was taken with permission from the "Installation Manual - Basic Field Practices for Installation of Elevators and Escalators" by Kermit Kraus and published by Elevator World.

Ordering hoist rope

Quantity, dimensions and stranding

While the information on the next three pages may be provided on the existing wire rope tag, it should be noted that the tag information may not always be accurate.

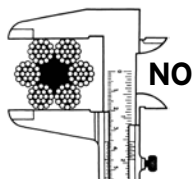
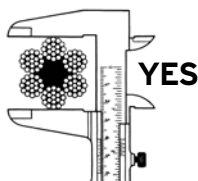
1 **Count the *number* of ropes.**

2 **Determine the *length* of each rope.**

This can often be found on the installation layout.

3 **Determine the *diameter* of the ropes.**

The crosshead data plate on top of the car should show the diameter or the diameter may be stamped on the existing shackles. If not, use a caliper and measure across the crown of the wires.



4 **Determine the *stranding* and *construction* of the rope.**

Stranding is the number of strands per rope and the number of wires per strand (an 8-strand rope with 19 wires per strand has 8 x 19 stranding). Determine whether the rope has 6 or 8 strands by looking at the shackles where the stranding is easier to see.

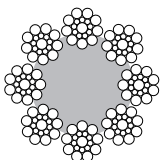
A 6-strand hoist rope is usually 6 x 25 Filler Wire construction with Right Regular lay. If there is not a crosshead data plate and the building is over 50 years old, the ropes used are usually 6 x 25 Filler Wire with Right Regular lay.

An 8-strand hoist rope is usually 8 x 19 Seale.

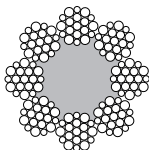
Ordering hoist rope

Constructions

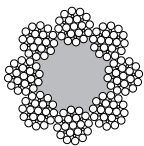
In North America, the most common rope constructions for re-roping are:



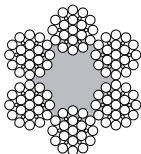
8 x 19 Seale
sisal core
(hoist/compensation/governor)



8 x 19 Warrington
sisal core
(governor)



8 x 25 filler wire
(compensation/governor)



6 x 25 filler wire
(hoist/compensation/governor)

Ordering hoist rope

Lay, grade and breaking load

5 Determine the lay of the rope.

Compare a Right Regular lay to a Right Lang lay rope:

Right Regular



Right Lang



Note that the orientation of the individual wires is parallel to the centerline in a Right Regular lay rope.

Right Regular lay is assumed if the lay is not indicated on your order.

6 Determine the grade or tensile strength of the rope.

Hoist ropes are Traction or Extra High Strength Traction (traction rope can be used for hoist, governor and compensation applications). Extra High Strength Traction rope is sometimes needed for high-rise/high-speed hoisting conditions. Grade is sometimes expressed as tensile strength in Newtons/square millimeters (N/mm^2) or pounds/square inch (psi).

7 Determine the breaking load.

This is found on the crosshead data plate. For example, if a breaking load of 14,500 lbs • 6450 kg is indicated for 1/2 in • 12.7 mm diameter 8 x 19 ropes, refer to the information in your Draka catalog or call your Draka representative for the correct grade (in this case, traction grade).

Ordering governor and/or compensation rope

The ordering procedure for compensation and governor ropes is similar to hoist ropes EXCEPT you may have to rely on the rope tag to a greater degree because there is no crosshead data plate for compensation or governor ropes.

1 Measure the diameter of the ropes.

Use a caliper, micrometer or Go/No Go gauge.

2 Confirm the stranding of the ropes.

The shackles are the best place to look. Almost all compensation and governor ropes have 8 strands, though they can be Seale, Warrington or Filler Wire construction.

3 Determine the grade or tensile strength of the ropes.

Look at the rope tag to determine breaking strength, then use the Draka catalog or call your Draka representative for the correct rope grade. Governor and compensation ropes are either Iron or Traction grade and NEVER Extra High Strength Traction.

4 Confirm the rope lay.

The lay of governor and compensation ropes is always Right Regular and never Right Lang. If your tag shows Lang lay, take extra care to visually confirm it using the pictures on page 5.

NOTE: In almost all cases, Whisper-Flex® and Steadi-Flex® compensation cables are a faster and less expensive way to provide compensation. HOWEVER, Whisper-Flex and Steadi-Flex cannot be used if the car speed exceeds 700 ft/min • 3.56 m/sec. Hang lengths vary with the compensation cable. Contact your Draka sales representative for more information.

Other factors

Information worth noting

Rope tags

All new rope comes with a metal tag listing such information as diameter, breaking strength, grade, construction classification, manufacturer and lubrication procedures. Note that the installer is responsible for filling in information such as the month/year of installation, month/year of first shortening and name of organization who installed the ropes.

Wire rope cores

Vegetable fiber is the most common core used in elevator ropes in North America. However, in some high-rise/high-speed, most MRL and certain hydraulic applications, the use of steel-reinforced or full-steel core (IWRC) ropes is becoming more common.

Preforming

Preformed rope is the industry standard and provides longer operational life while being easier to handle. All ropes sold by Draka in North America are preformed.

Galvanizing

Bright (uncoated) is the industry standard and comes without any coating on the rope other than lubrication. For protection from weather and corrosion (i.e. exterior or mine elevators), the use of a galvanized coating is often recommended.

Compacted strands

For applications with reverse bends (such as basement machines), the use of compacted strand wire rope has been shown to increase rope life.

Handling wire rope

Moving, storing and unreeling

Moving the reel

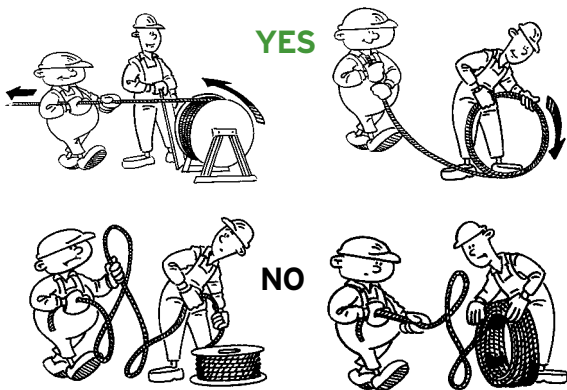
Reels are best transported on the job site by rolling on a clean flat surface or by lifting from a pipe in the reel center hole.

Storage

Wire rope should be stored indoors, off the ground and covered to protect it from moisture, dirt, dust, sunlight, etc.

Unreeling

Wire rope must be unreeled or uncoiled as shown. If unreeling, a helper can use a board as a brake to control the spin. Do not pull wire rope sideways off the reel.



Excessive handling is not good for wire rope. Avoid winding wire rope directly from a reel onto a smaller drum. The rope will not 'relax' and may result in wild and 'cranky' behavior.

Art courtesy Gustav Wolf Steel Wire and Steel Wire Ropes

Handling wire rope

Inspection and seizing

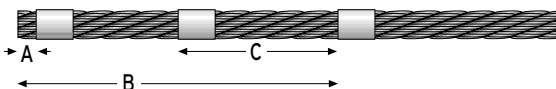
Constantly inspect the rope

Care must be taken to unroll wire rope when paying it off the reel. Kinking and dragging ropes over sharp edges must be avoided. The installer should continually inspect wire rope during installation to identify any areas which may have been damaged in shipment or while in storage on the job site.

Seizing rope ends

Rope ends should always be seized to prevent untwisting of the strands. Untwisted rope ends will weaken the rope and can cause rope failure.

Prior to cutting the rope, the ends **must** be seized in three places with cable bands.



Spacing of seizings (in • mm)

Rope diameter	A	B	C
3/8	1/4 • 6.4	4 • 102	2 • 51
1/2	1/4 • 6.4	4 • 102	2 • 51
5/8	1/4 • 6.4	5 • 127	2 1/2 • 64
3/4	1/4 • 6.4	6 • 152	3 • 76
7/8	1/4 • 6.4	6 1/2 • 165	3 1/4 • 83
1	1/4 • 6.4	7 • 178	3 1/2 • 89

Installing new hoist rope

Overhead 1:1 roping

Overhead 1:1 roping, with its simple path from cab to counterweight, is the most common elevator hoist rope configuration (see pages 20 and 21 for others).

Position the car

If the car was not erected at the top landing, raise it up to there with a hoist. Lock it into position by setting the safety.

Position the counterweight

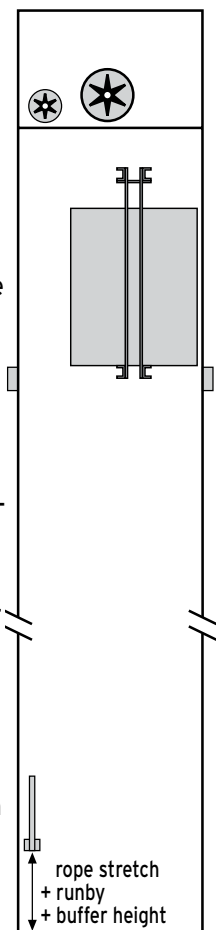
Place the counterweight in the pit and use proper support to hold it above the floor by this formula:

Rope stretch + runby + buffer height

Contact the rope maker to get the amount of stretch for your ropes. The runby (a gap of 6 in • 152 mm*) is the space between the bottom of the counterweight and the top of the buffer.

For example: your rope has a stretch of 3/4 of 1% (.0075) of its length under load. If the rise is 100 ft, then it will stretch 100 ft. x .0075 or .75 ft or 9 in • 229 mm. Add in buffer height (ex. 18 in • 457 mm) plus the runby. The counterweight should be braced with wooden supports 9 + 6 + 18 in. or 33 in • 838 mm above the pit floor.

*Runby dimensions may vary due to local code. Local code always takes precedence.



Installing new hoist rope

Pull new rope into position

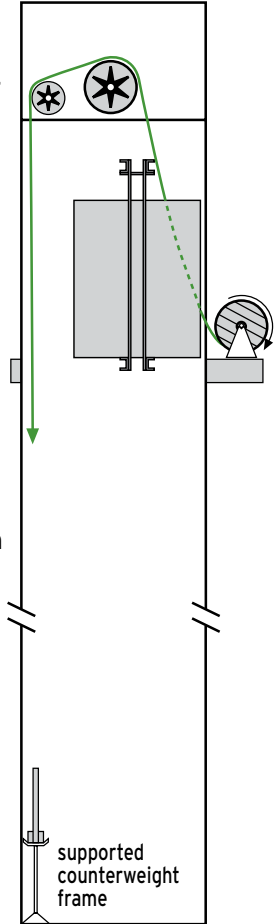
Pull the rope

Rope, either from a reel or a coil, is fed from the top landing to the top of the car. Unreel it as shown on page 8. Do not allow the rope to kink or reverse bend.

The rope is then fed into the machine room and through the first sheave groove.

The rope is then run down to a helper at the counterweight. It's sometimes helpful to attach a weight to the rope end using a temporary loop secured with a rope clip.

Use a board as a brake on the reel (like in the YES diagram on page 8) to keep the reel from overspinning.



Installing new hoist rope

Use of reeving splices in replacing rope

In rope replacement, an old rope can be used to pull a new rope into position.

Reeving splices temporarily marry rope ends together. Three splices are wound around the ends of the ropes (one is shown in the diagram at right).

When pulled, the old rope guides the new rope over the sheave and to the attachment point at either the counterweight or car.

Reeving splices are designed for specific rope lays and diameters. Make sure you have the correct size. A reeving splice is designed to bear no more than 2,000 lbs • 909 kg of rope, so use the listed weight/ft shown in the Draka catalog to calculate the weight of the rope.

Reeving splices are to be used **ONCE** and then discarded.



Installing new hoist rope

Attaching the wedge socket

Wedge sockets should be attached as shown to both the car and counterweight frame crossheads. The threaded bar should be in place as shown, with enough of the bar below the crosshead to insert the cotter pin.

Prior to cutting the rope, make sure the rope is secure and will not fall down the hoistway. If the rope is set in the sheave groove, that should give enough grip to hold the rope. You may also want to use a rope clamp attached to the rail to hold the rope.

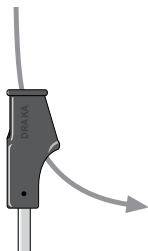
Mark the cut point of the rope, making sure to leave enough slack for installation (2 to 3 ft • 610 to 915 mm), then seize and cut the rope (see page 9).



Installing new hoist rope

Attach the rope at the car

- 1 Run the rope down through the wedge socket body.



- 2 Thread the rope 'dead' end back up through the top of the wedge socket body. Leave a loop of rope just large enough to insert the wedge.



- 3 Insert the wedge into the loop.



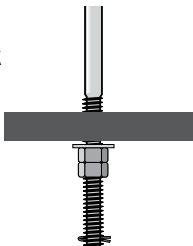
Installing new hoist rope

Attach the rope at the car continued

- 4 Pull down on the rope with one hand to keep it taut. Use a quick pull on the dead end to seat the wedge.



- 5 The washer and nuts can now be tightened. Use the lower nut to lock the upper nut and washer against the crosshead of the counterweight frame. Insert and bend the cotter pin.



- 6 Install two wire rope retaining clips to hold the dead end in place. Retaining clips bear no load - they are used only to keep the rope and wedge in place should there be a momentary loss of tension. Apply no more than 8 ft/lbs • 11 N/m of torque on the bolt and nut.



Installing new hoist rope

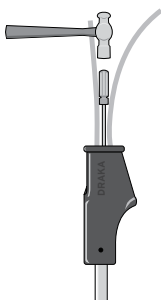
Attach the rope at the counterweight

The counterweight wedge socket should be attached to the counterweight crosshead like the wedge sockets at the car crosshead.

Run the rope down through the counterweight wedge socket body. Repeat the technique shown in steps 1 through 4 on pages 14 and 15.

The rope should be as taut as you can get it using only manual effort. There should be enough threaded wedge socket below the crosshead to tighten the washer and nuts.

If the rope is still slack, the rope may need to be re-seated in the wedge socket. Use a hammer and a drift pin to tap the wedge down until the rope loosens. Repeat steps 2 through 4 on pages 14 and 15 to tighten the rope.



Tensioning hoist rope

Individual rope adjustment

After all ropes are installed and the counterweight loaded, release the car and let the weight of the car and counterweight rest on the ropes. The rope and wedge will rise about 1 in • 2.5 cm to the final “set” under load.

Initial equalization

Use a Quick-Check tension meter to get an idea which ropes are carrying the most tension. Any ropes tighter than the rest can be slackened and equalized using the hammer/drift pin method from page 16.

Repeat on all tight ropes until they all carry tension within a 10% range of each other.

Fine tuning

Equalize final rope tension by adjusting the wedge socket rod nuts. DO NOT let the wedge socket rotate. Rotating the body will let the rope untwist and weaken the rope. Hold the wedge socket body to prevent rotation.

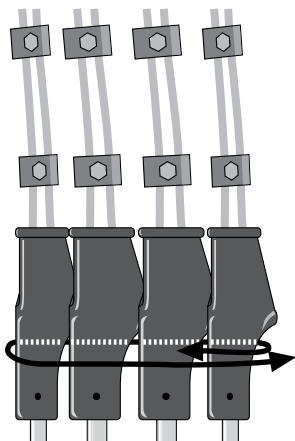
Cut any surplus rope off the car dead end to leave approximately a 12 - 18 in • 305 to 457 mm tail. Install two wire rope retaining clips to hold the dead end in place like step 6 on page 15.

Preventing hoist rope rotation

Tying off the hoist ropes

Once equal tension is established, the ropes need to be tied off or secured so that the wedge sockets do not rotate.

Take a length of wire rope (1/2 in • 12.7 mm diameter is normally adequate, but see local codes for approved diameter) and thread it through the wedge socket bodies.



Use wire rope clips to tie the binding rope ends together.

Installing new governor rope

Use of governor rope wedge sockets

Governor rope does not require the precise tensioning needed by hoist ropes.

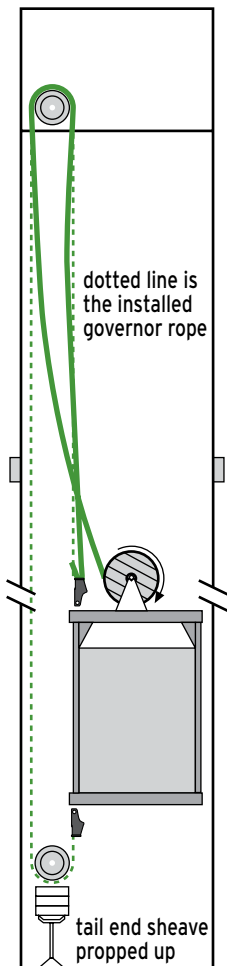
The governor rope reel is placed on top of the car and run over the governor sheave in the machine room.



The rope is attached to a governor rope wedge socket (similar to a hoist rope wedge socket but without the rod) on the crosshead (see pages 14 and 15).

The elevator is slowly lowered and the cable paid out. At the bottom of the hoistway, enough slack is paid out to pass around the tail end sheave and reach the bottom of the car. The tail end sheave should be propped up as high as it can go.

The rope is seized and attached to the car frame with another governor wedge socket.

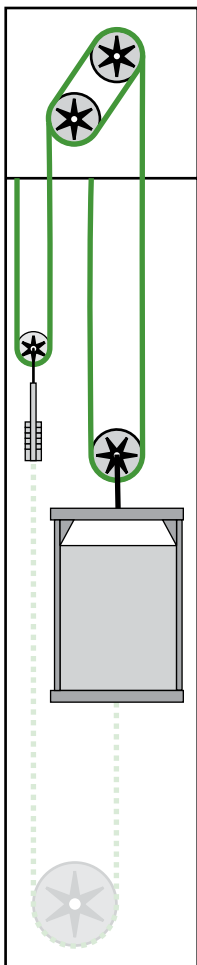


Other hoist rope configurations

Overhead type 2:1

Other roping configurations include the overhead 2:1, which is popular because it permits the use of smaller traction motors.

The same basic principles of hoist rope installation apply with added steps requiring a pull rope attached to the hoist rope end to raise the hoist rope to the attachment points at the top of the hoistway.

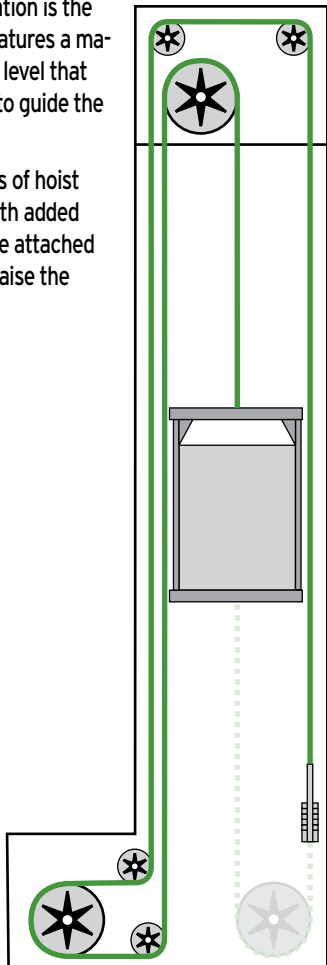


Other hoist rope configurations

Basement type 1:1

Another roping configuration is the basement type 1:1 that features a machine at or below ground level that uses deflecting sheaves to guide the rope into the hoistway.

The same basic principles of hoist rope installation apply with added steps requiring a pull rope attached to the hoist rope end to raise the hoist rope from the pit.



Lubrication

General application notes

Wire rope comes factory-lubricated. Draka strongly recommends an annual lubrication application every spring. Ropes should be field lubricated prior to summer and the increased temperature and humidity it brings. Summertime is when the air conditioners in the machine rooms and offices are operating. Condensation caused by the combination of an air conditioned machine room and a humid hoistway must be kept from entering the rope core.

NOTE: Governor ropes should NEVER be re-lubricated.

Type of lubricant

In North America, Draka recommends the use of DrakaLube™ which reduces wear, protects against corrosion and displaces moisture in the rope core.

Application methods

Automatic lubricators are the most time-efficient way to lubricate ropes. Make sure to manually lubricate the ropes that are over the sheave when the car is at its lowest landing, as the oiler does not touch that section of the ropes. Manual methods, such as paintbrushes or rollers, are also acceptable. Care should be taken not to over-lubricate.

Prior to lubricating, clean all lubrication build-up and dirt from the ropes using an automatic metal-brush cleaner or wire brush. DO NOT use solvents to clean ropes; solvents will break down the rope lubricant and the rope will deteriorate.

See Draka Tech Tip #6 for detailed instructions on lubrication.

Replacement Criteria

From ASME A17.1-2007/CSA B44-07

Replacement criteria for suspension and compensating ropes fall into three categories:

1) Crown wire breaks: The crown wires are those that make contact with the sheave and they will show signs of abrasion. If enough abrasion takes place, the crown wires will break. When using this criterion, an inspector is looking for the number of total crown wire breaks within a rope lay (refer to excerpts below). A rope lay is approximately 6.5 times the diameter of the rope. For example, the rope lay for 3/8 (0.375) in. ropes is 2.44 in., 1/2 (0.500) in. ropes is 3.25 in. and 5/8 (0.625) in. ropes is 4.06 in.

2) Valley breaks: Valley wires are located in the valleys of two adjacent strands and do not make contact with the sheave. Nor do valley wires make contact with other wires of adjacent strands. Valley breaks are attributed to rope fatigue; these valley wires should experience no abrasion (refer to excerpts below).

8.11.2.1.3(cc) Wire suspension and compensating ropes

8.11.2.1.3(cc)(1) Wire suspension and compensating ropes shall be replaced:

(a) if the broken wires are equally distributed among the strands, when the number of broken wires per rope lay in the worst section of the rope exceeds the values shown in column A of Table 8.11.2.1.3(cc)(1); or

(b) if the distribution of the broken wires is unequal, and broken wires predominate in one or two strands, when the number of broken wires per rope lay in the worst section of the rope exceeds the values shown in column B of Table 8.11.2.1.3(cc)(1); or

Replacement Criteria

continued

(c) if four or five wires, side by side, are broken across the crown of any strand, when the number of broken wires per rope lay in the worst section of rope exceeds values shown in column C of Table 8.11.2.1.3(cc)(1); or

(d) if in the judgment of the inspector, any unfavorable condition, such as fretting corrosion (red dust or rouge), excessive wear of individual wires in the strands, unequal tension, poor sheave grooves, etc., exists, the criteria for broken wires will be reduced by 50% of the values indicated in Table 8.11.2.1.3(cc)(1) for any of the three conditions described above; or

(e) if there is more than one valley break per rope lay.

Table 8.11.2.1.3(cc)(1)

Types of Wire Ropes	A	B	C
6x19 class	24-30*	8-12*	12-20*
8x19 class	32-40*	10-16*	16-24*

*The upper limits may be used when inspections are made monthly by a competent person.

8.11.2.1.3(cc)(2) On winding drum machines, the ropes shall be replaced:

(a) if the broken wires are equally distributed among the strands, when the number of broken wires per rope lay in the worst section of rope exceeds 12 to 18; or

(b) if wire breaks predominate in one or two strands, when the number of broken wires per rope lay in the worst section of rope exceeds 6 to 12; or

(c) if there is more than one valley break per rope lay.

3) Diameter reduction: If the ropes reach a specified diameter reduction, they should be replaced even if no crown or valley breaks are present.

Replacement Criteria

continued

8.11.2.1.3(cc)(3) On any type of elevator, the suspension, compensation and governor ropes shall be replaced when their actual diameter is reduced below the value shown in Table 8.11.2.1.3(cc)(3):

Table 8.11.2.1.3(cc)(3)

Nominal Size in.	Maximum Reduced Diameter in. • decimal in.
3/8	11/32 • 0.344
7/16	13/32 • 0.406
1/2	15/32 • 0.469
9/16	17/32 • 0.531
5/8	37/64 • 0.578
11/16	41/64 • 0.641
3/4	45/64 • 0.703
1	15/16 • 0.938

8.6.3.2 Replacement of a single suspension rope

If one rope of a set is worn or damaged and requires replacement, the entire set of ropes shall be replaced, except, where one rope has been damaged during installation or acceptance testing prior to being subjected to elevator service, it shall be permissible to replace a single damaged rope with a new rope, provided that the requirements of 8.6.3.2.1 through 8.6.3.2.6 are met.

8.6.3.2.1 The wire rope data for the replacement rope must correspond to the wire rope data specified in 2.20.2.2(a), (b), (c), (f), and (g) for the other ropes.

8.6.3.2.2 The replacement rope shall be provided with a wire rope data tag conforming to 2.20.2.2.

Replacement Criteria

continued

8.6.3.2.3 The suspension ropes, including the damaged rope, shall not have been shortened since their original installation.

8.6.3.2.4 The diameter of any of the remaining ropes shall not be less than the nominal diameter minus 0.4 mm. (0.015 in.).

8.6.3.2.5 The tension of the new replacement rope shall be checked and adjusted as necessary at semi-monthly intervals over a period of not less than two months after installation. If proper equalization of rope tension cannot be maintained after six months, the entire set of hoist ropes shall be replaced.

8.6.3.2.6 The replacement rope shall be provided with the same type of suspension-rope fastening used with the other ropes.

8.6.3.3 Replacement of ropes other than governor ropes

8.6.3.3.1 Replacement of all ropes, except governor ropes (see 8.6.3.4) shall conform to the following:

(a) Replacement ropes shall be as specified by the original elevator manufacturer or be at least equivalent in strength, weight, and design.

(b) Ropes that have been previously used in another installation shall not be reused.

(c) When replacing suspension, compensating, and car or drum counterweight ropes, all ropes in a set shall be replaced, except as permitted by 8.6.3.2.

(d) The ropes in the set shall be new, all from the same manufacturer, and of the same material, grade, construction, and diameter.

Replacement criteria

continued

(e) Data tags conforming to 2.20.2.2 shall be applied.

(f) Suspension, car, and drum counterweight rope fastenings shall conform to 2.20.9.

8.6.3.4 Replacement of governor or safety rope

8.6.3.4.1 Governor ropes shall be of the same size, material, and construction as the rope specified by the governor manufacturer, except that a rope of the same size but of different material or construction shall be permitted to be installed in conformance with 8.7.2.19.

8.6.3.4.2 The replaced governor ropes shall comply with 2.18.5.

8.6.3.4.3 After a governor rope is replaced, the governor pull-through force shall be checked as specified in 8.11.2.3.2(b).

8.6.3.4.4 A test tag indicating the date when the pull-through test was performed shall be attached.

NOTE: Some in the industry believe that all ropes for an installation must be cut from the same master reel.

ASME/CSA does *not* require that the ropes be from the same master reel.

Notes