

CABLEGUARD™ ELASTOMERIC WRAP

INSTALLATION MANUAL

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The D.S. Brown Company
300 East Cherry Street
North Baltimore, OH 45872
Phone: (419) 257-3561
Fax: (419) 257-2200
www.dsbrown.com
Email: sales@dsbrown.com

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Cableguard™ Elastomeric Wrap Installation Manual

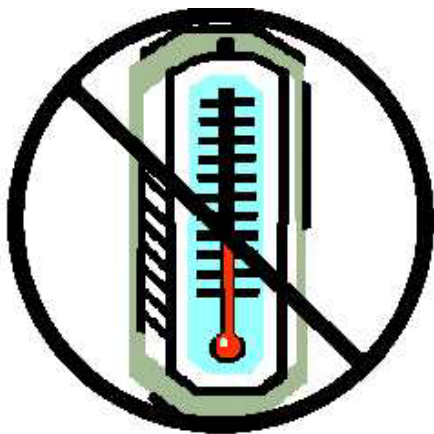
Description

The D.S. Brown Company's Cableguard™ Elastomeric Wrap System is designed to provide corrosion protection for bridge cables. After the wrap is applied it is heated with an electric blanket, which fuses the overlapped seams, and shrinks the wrap to the underlying cable. The heating blanket used for shrinking and bonding D.S. Brown's Cableguard™ Elastomeric Wrap is electrically operated. It is controlled by an operator's panel located in close proximity to the blanket, which allows the operator to match the temperature and timing with ambient conditions.

Handling

When you receive the Cableguard™ wrap it will be packaged in plastic bags. The Cableguard™ wrap is formulated to begin curing when it comes in contact with sunlight and moisture so it is important that the material be stored in a cool, dry, dark area.

 **Note:** *Cableguard™ should not be installed in the rain or in temperatures below 5 °C (40 °F). For proper installation in colder temperatures, please contact DS Brown.*



Installation on Suspension Bridges

Installing the Wrap

1. After adjusting the Skewmaster™ for the correct overlap, begin installing the wrap by hand from the upper cable band (Figure 1) in a counter-clockwise direction as you look up the cable. Tape the loose tail of a roll of Cableguard™ to the cable so the end is facing down in the 3 o'clock position. Wrap around the cable parallel to the cable band until the wrap laps over itself. After a complete wrap is made, begin moving the wrap up the cable while wrapping. While wrapping, apply tension on the roll, and work to maintain correct overlap of 50% after about three or four wraps. If you are installing 150mm (6") wide material, there should be approximately 75mm (3") between the seams (Figure 2). After wrapping about 500 mm (20") from the cable band the wrap can be cut at the 9 o'clock position. Before cutting the wrap, apply tape to the trailing edge to hold it in place.

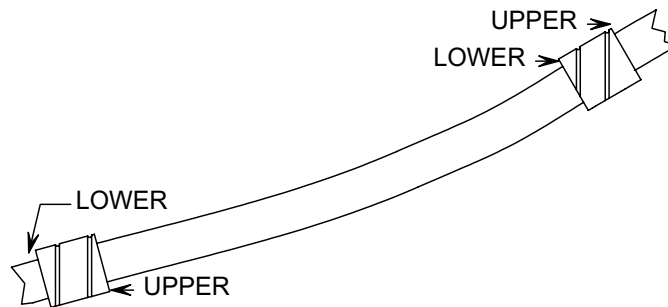


Figure 1 Cable Section Showing Top and Bottom Cable Bands On a Suspension Bridge

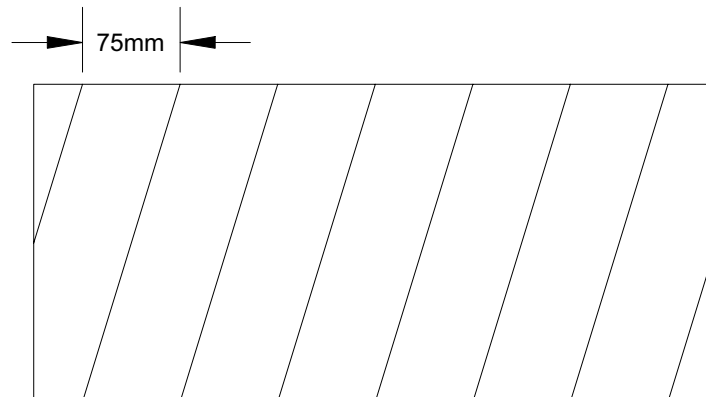


Figure 2 Cableguard Overlap

Installation on Suspension Bridges

Splices

When coming to the end of a roll a splice will need to be made in the wrap using the following procedure:

1. Maintaining tension on the wrap that is in place, unwind the remaining wrap. Cut the wrap so that the splice will occur 90° to the top of the cable. Tape the loose end in place using duct tape.
2. Begin wrapping with the new roll making a 50mm (2") overlap. The lap should be made so that the exposed end faces down (Figure 3A).
3. After making approximately 3 wraps with the new roll, remove the duct tape that held the splice together.

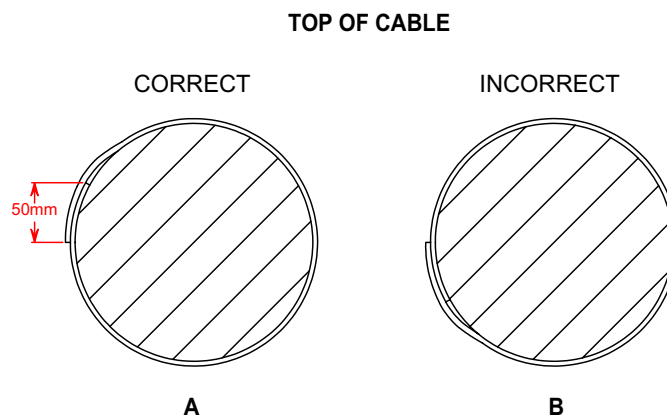


Figure 3 Splice Overlap

Installation on Suspension Bridges

Heating the Wrap

1. Connect the controller to a power source matching the blanket's voltage and current ratings. The power source must be effectively grounded. (National Electrical Code NFPA 70-250).

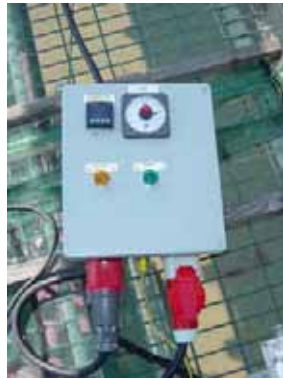


Figure 4 Blanket Control Panel



Warning: Do not connect the control box directly to a power source. You must provide a fusible disconnect at the power source rated for the blanket current and voltage that will provide over current /short circuit protection.

Warning: Connecting the blanket and controller to the improper voltage can cause serious damage. Have a qualified electrician verify that the supply voltage matches the blanket voltage.



Note: Blanket life is approximately 1,000 heating cycles.

Note: See chart in Appendix A-1 for cable sizing.

Note: See chart in Appendix A-2 for generator sizing.

Note: It is **important** for the wrap to be heated the same day it is installed. If the wrap is not heated the same day it can affect its ability to bond.


2. Attach the blanket to the section to be heated and latch toggle straps to apply tension. The male power plug from the blanket plugs into the female plug on the controller.

3. Plug one thermocouple coming from the blanket into the controller. The blanket temperature is regulated from the thermocouple plugged in.

Installation on Suspension Bridges

4. Plug the blanket controller into an appropriate voltage source, and turn the "Power" switch to the on position.

Use the up down arrows to set the initial temperature to 127°C (260°F) on the controller. Verify thermocouple operation by reading the "process" temperature. On initial startup, prior to applying power, it should read ambient temperature.

 **Note:** *On initial startup always verify proper thermocouple operation by reading ambient temperature on the controller. If ambient temperature is not displayed, switch to another thermocouple.*

5. With the blanket in place and controller power on, turn the "Blanket" switch on. When the "Blanket" switch is turned on, power is applied to the blanket. On the first cycle since the "On- Off" switch has been turned on, it can take 10 minutes or more depending on ambient conditions for the blanket to come up to temperature.

The timer and temperature settings should be adjusted to obtain an optimum material bond without overheating. It is preferable to heat the Cableguard™ material for a longer time at a lower temperature than to try and turn the temperature up too high to achieve faster times. The higher temperatures do not allow the material to have any "soak" time, which allows the heat to penetrate the material completely. The temperature controller has been limited to 150°C (300°F).



Warning: *The blanket should never be operated above 300°F. Operating above this temperature will damage the wrap.*

6. The timer is provided for the operators use. It indicates when the current cycle is done with an audible alarm. Power to the blanket remains on all the time, with the operator turning the timer on using the timer start button. The start button is red and is located in the middle of the timer. Start the timer when the blanket reaches a initial temperature of 94°C (200°F). Set the timer for 6 minutes. When the timer has 3 minutes left, rotate the blanket approximately 1/4 turn and finish the cycle. (Rotating the blanket in this manner allows for the heating of the wrap in the gap where the blanket comes together) When the timer times out, move the blanket to the next unheated area, and repeat the process.

Installation on Suspension Bridges

7. A mark should be placed on the Cableguard™ material at the unheated end with a pen. This will locate how far the blanket needs to be moved on the next cycle. After approximately 6 minutes of heating time, as indicated by the timer on the control box, unstrap the blanket and move it ahead to the next marked position. The blanket is under power the entire time. The timer will cycle off, and can be started again for a new timing cycle when the blanket is moved to its next location. The timer operates only an audible alarm, and is provided for the convenience of the operator.



Figure 5 *Moving the Blanket*

8. Verify that 6 minutes has been long enough to bond the material. If the material is not bonded, increase the time or temperature accordingly.
9. When approximately 2 blanket lengths remain to be heated, measure the distance from the end of the blanket to the Cable Band. If it is less than two times the blanket length minus 150mm (6"), skip to the end section, heat it first, then back up one blanket length to finish heating. This allows the section that would otherwise have been heated twice, cool before being heated again. Example: the blanket is 750mm (30") long, you have about 2 more heats to finish to the Cable Band. You measure 1,150mm (45") of unheated material. Two times the blanket length is 1,500mm (60") minus 150mm (6")=1350mm (54"). Move the blanket to the very end, heat and then move back up 750mm (30").
10. After the wrap has been heated, it needs to cool without being disturbed. This usually takes 10 to 15 minutes.

Optional

11. Locate the low point at the center of the bridge. A 25mm (1") diameter hole needs to be cut in the Cableguard material at the low point of the suspension bridge on the bottom side of the cable. This will allow any water that may have entered the cable to escape at the lowest point.

Installation on Suspension Bridges

Cable Band Preparation

On a suspension bridge there is an upper and lower part to each saddle. They are identified in Figure 6 below.

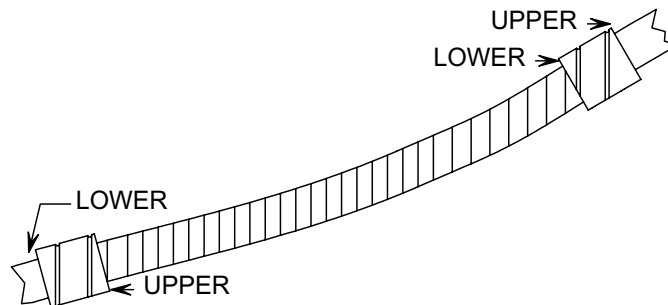



Figure 6 Cable Section Showing Upper and Lower Cable Bands On a Suspension Bridge

Lower Cable Band Preparation


1. The Lower Cable Band area is prepared by cutting the Neoprene Sealing Wedge to length and wrapping it around the cable close to the Cable Band. The wedge should fit snugly around the cable. The wedge is installed after the Cableguard™ Wrap has been installed.



Figure 7 Wedge Installation

 **Note:** *It is important to install the lower wedge with the joint 90° to the top of the cable. (See Figure 8A)*

2. The wedge ends are held together using DS Brown Part 1521 super glue. Apply a small amount of glue to the cut edge, hold the parts together for approximately 20 seconds and release. Next a 9.5mm (3/8") stainless steel band is installed in the groove on the wedge, (Figure 9) and snugged into place around the banding clip. Slide the clamp on the strap and bend the end under at the ear side of clamp (Figure 10). Do not tighten the banding clip at this time.

 **Note:** *It is important to make sure the banding goes under the clip (Figure 10).*

Installation on Suspension Bridges

Lower Cable Band Preparation

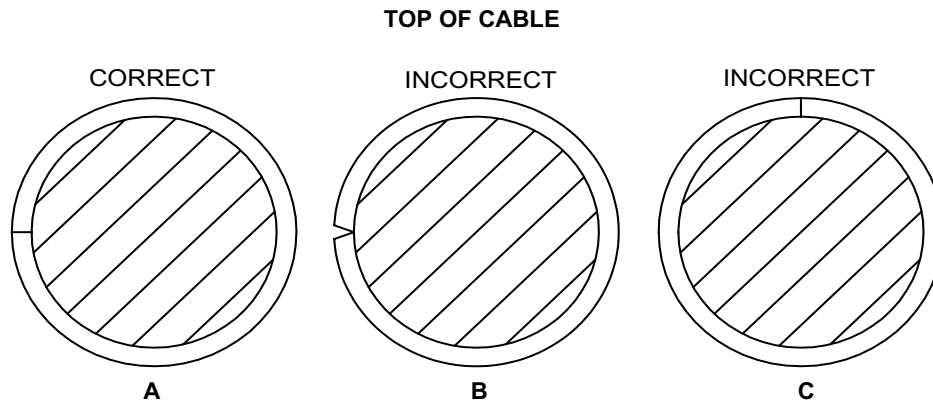


Figure 8 Lower Neoprene Sealing Wedge Installation

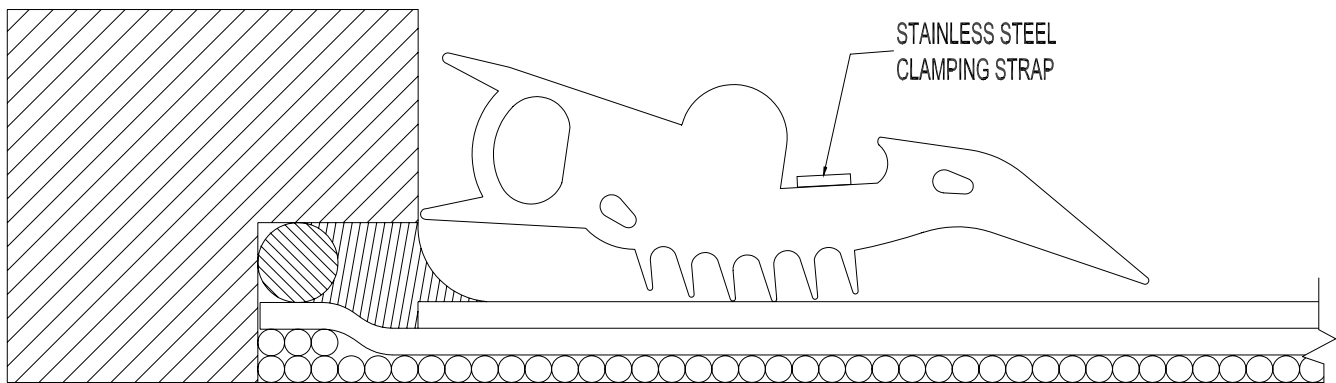


Figure 9 Stainless Steel Band Installation

3. Move the wedge to within 50mm (2") of the Cable Band. Apply a 6mm (¼") bead of caulk around the Cable Band where the wedge will contact it. Slide the wedge until it is in intimate contact with the Cable Band. Using the band-tightening tool, tighten the band and cinch it with the banding clip by folding the retention ears over the band (Figure 10). It may be necessary to use a hammer to move the wedge tight to the Cable Band.

Installation on Suspension Bridges

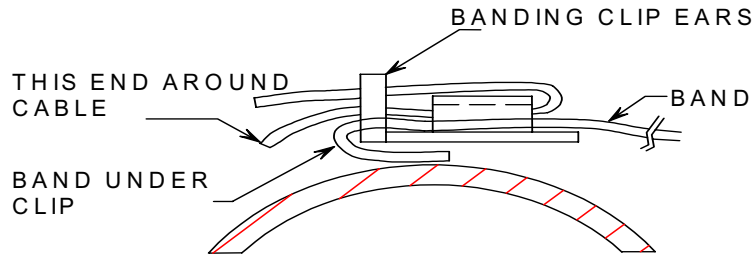



Figure 10 Banding Clip Installation

Upper Cable Band Preparation

1. The Upper Cable Band area is prepared by cutting the sealing wedge to length and wrapping it around the cable so it fits snugly around the cable with a 12mm (1/2") gap at the bottom.

 **Note:** *It is important to install the wedge with the 12mm (1/2") open joint on the **bottom side** of the cable. Figure 11(A) shows what a correctly installed lower sealing wedge will look like in section.*

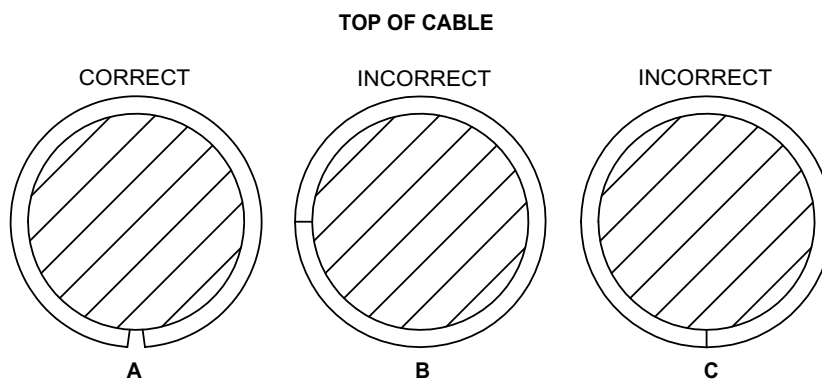


Figure 11 Upper Cable Band Neoprene Sealing Wedge Installation

2. The wedge ends are assembled using two 4.7mm (3/16") plastic barbs inserted into the holes in the end of the wedge. When the wedge is installed there should be a 12mm (1/2") gap between wedge ends as shown in Figure 11(A). Next a 9.5mm (3/8") stainless steel band is installed in the groove on the wedge, (Figure 9) and snugged into place around the banding clip. Slide the clamp on the strap and bend the end under at ear side of clamp (Figure 10). Do not tighten the banding clip at this time.

Installation on Suspension Bridges



Figure 12 *Wedge Gap and Plastic Barbs*

3. Move the wedge to within 50mm (2") of the Cable Band. Apply a 6mm (1/4") bead of caulk around the Cable Band where the wedge will contact it. Do not apply caulk to the bottom of the Cable Band where the 12mm (1/2") gap is. Slide the wedge until it is in intimate contact with the Cable Band. Using the band-tightening tool, tighten the band and cinch it with the banding clip by folding the retention ears over the band. It may be necessary to use a hammer to move the wedge tight to the Cable Band.



Figure 13 *Applying Caulk*



Figure 14 *Sliding Wedge Into Place*



Figure 15 *Band Tightening Tool*



Figure 16 *Band Retention Clip*

Installation on Suspension Bridges

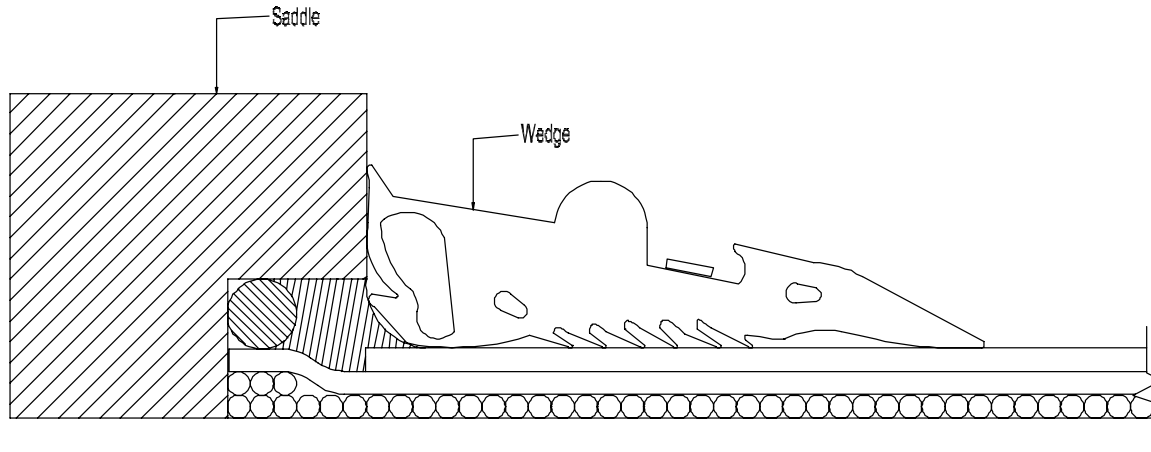


Figure 17 *Compressed Wedge Installation*

4. The finish strip is installed next, over the wedge. Prior to installing the finish strip, wipe the area where the strip will be applied with xylene or toluene. This procedure is the same for both upper and lower Cable Band locations. Wrap un-reinforced Cableguard™ material around the cable, and cut it to a single wrap length, leaving an extra 50 to 75mm (2 to 3 inches). The 50mm overlap should be made so that the exposed end faces down (Figure 11A). It is then heated to itself using a heat gun and roller (Figure 19).

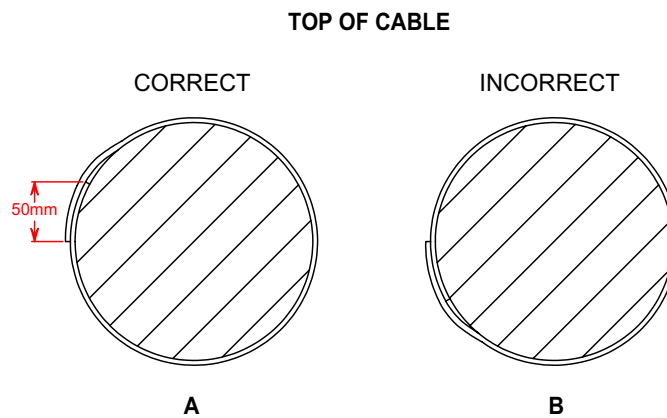


Figure 18 *Finish Strip Installation and Splice Overlap*

5. After forming a snug loop around the cable with the finish strip, it is pulled back over itself and moved close to the wedge (Figure 21). The finish strip is then snapped over the wedge (Figure 22), and a final 9mm (3/8") stainless strap is installed behind the indicating bump on the wedge (Figure 23).

6. Heat the finishing strip with a heating blanket (Figure 19).

Installation on Suspension Bridges



Figure 19 Heating Finish Strip With a Blanket



Figure 20 Heating Finish Strip



Figure 21 Finish Strip Pulled Back



Figure 22 Finished Strip Snapped Over Wedge



Figure 23 Strap Installed Behind Indicator Bump

6. On the Upper Cable Band finishing strip, cut a 10mm wide by 15mm long slot and align this slot with the wedge gap as shown in Figure 24.



Figure 24 10mm Wide By 15mm Long Slot For the Wedge Gap on the Upper Cable Band



Figure 25 Optional 10mm Hole In the 6 O'clock Position on the Lower Cable Band

7. On the Lower Cable Band finishing strip, an optional 10mm diameter hole 90mm from the cable band in the 6 o'clock position is cut, as shown in Figure 25.

Installation on Suspension Bridges

Walk Surface Application

If the optional anti-slip walk surface is specified, apply it as follows:

1. Clean affected area with xylene or toluene to ensure proper bonding.
2. Mask off the area to maintain a 150mm (6") wide (or other specified width) uniform area on top of the cable (Figure 26).
3. Liberally brush or roll on the base coat (45-1), completely covering the masked walk area (Figure 27).
4. Immediately sprinkle abrasive grit (45-2) on the brushed surface. Lightly press the grit in using a cardboard core from the wrapping operation or other smooth round object to insure maximum embedding of the grit. Allow to dry to touch approximately 10-15 minutes).
5. Liberally brush or roll on top coat (XXXX-1301-CG-5) and insure good coverage of the abrasive grit (Figure 28).
6. Remove masking material. Allow 24 hours of cure time after the top coat is applied, and before walking on the new surface.



Figure 26 Mask Off Walk Surface Area



Figure 27 Brush On Base Coat



Figure 28 Paint Walk Surface

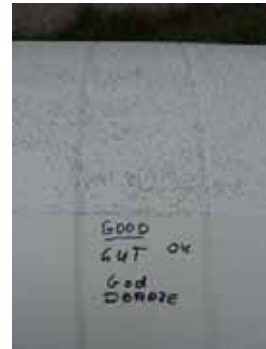


Figure 29 Good Walk Surface

Installation on Cable-Stayed Bridges

Because there is no Cable Band on cable-stayed bridges, installation is straightforward.

1. Begin wrapping as outlined in step 1 of “Installation on Suspension Bridges”, “Installing the Wrap”.
2. Heat the wrap as outlined in the section “Heating the Wrap”. A second blanket may be employed to speed up the heating operation. Contact D.S. Brown for more information.
3. Allow time for the wrap to cool.
4. After a complete section of cable is wrapped, heated and cooled, fold the top end up on itself, and apply a 6mm (1/4”) bead of caulk around the cable where the wrap starts and finishes. Then roll the wrap over the caulk and apply a stainless steel band to seal the area as in step 5 in the section “Installation on Suspension Bridges”, “Upper Cable Band Preparation”. Apply a second stainless steel band to the bottom of the cable, but do not use caulk.

D.S. Brown can also supply transition boots to maintain an impervious seal in areas where cable diameters change dramatically (See Figure 30).



Figure 30 *Transition Boot*

Dual blanket controls are also available through D.S. Brown to control the heating cycle on two blankets simultaneously (See Figure 31).



Figure 31 *Double Timer*

Appendices

Appendix A-1 Maximum Amperage For Length of Conductor

Table 1 Maximum Amperage For Given Length of Conductor and Conductor Size

Length	#12	#10	#8	#6	#4
100'	20	25	35	45	60
200'	20	25	35	45	60
300'	20	25	35	45	60
400'	15	24	35	45	60
500'	12	19	30	45	60

Appendix A-2 Generator Sizing

Table 2 3 Phase Generator Sizing

3 Phase Generator Sizing			
	Generator Output Voltage		
	480	380	240
Generator KW	Maximum Amperes		
10	11	14	22
15	16	21	33
20	22	28	44
25	27	35	55
30	33	41	66
35	38	48	77
40	44	55	87
45	49	62	98
50	55	69	109

Notes:

1. Chart calculated with unity power factor for blanket loads and a 10% allowance for variances
2. Standard blanket voltage supply is 480/277 Y or 380/220 Y 3 phase 4 wire (3 phases, 1 neutral plus ground)
3. Any blanket voltage is available. Contact DS Brown for more information
4. For single phase equipment, contact DS Brown

Appendix B DS Brown Cableguard™ Repair Instructions

There are 3 basic types of damage:

Type 1: Cut

Type 2: Tear or puncture (from physical damage)

Type 3: Burn from overheating the wrap.

Repair Procedures

Type 1 - Cut < 75mm long

Cuts less than 75mm in length can be repaired with a patch (Figure 32). Cut the patch in a square shape 100mm longer than the cut length (Figure 33). For example, if the cut is 50 mm long, make a patch that is 150mm by 150mm. Use scissors to round the corners of the patch.

Clean the area to be patched, as well as the patch itself with Xylene (Figures 34 and 35). Apply the patch using a heat gun and silicone roller (Figure 36). Ensure that the entire patch is well bonded.



Figure 32 *Cut Less Than 75mm Long*



Figure 33 *Patch 100mm Longer Than the Cut*



Figure 34 *Clean Patch with Xylene*



Figure 35 *Clean Affected Area with Xylene*

Appendix B



Figure 36 *Apply the Patch Using a Heat Gun and Roller*

Cut >75mm long

After cleaning the area and the patch, wrap reinforced Cableguard material over the cut and completely around the cable, overlapping by at least 75mm. Continue wrapping until the patch wrap extends at least 50mm beyond the cut area on each side. If the walk surface is installed, it will be necessary to remove it using solvent prior to repair to allow an area for bonding completely around the wrap. Use the heating blanket to bond the patch using the normal heating procedure.

Type 2 - Tear or Puncture

This type of damage is usually caused by physical contact from equipment or falling debris.

Tears or punctures less than 75mm in length can be repaired with a patch the same way a cut is repaired as noted above.



Figure 37 *Puncture Requiring Cut Procedure*



Figure 38 *Tear*



Figure 39 *Cut 2 Ply Filler Patch to Match Tear*



Figure 40 *Apply Filler Patch With A Heat Gun and Roller*

Appendix B



Figure 41 *Clean Patch With Xylene*



Figure 42 *Clean Affected Area With Xylene*



Figure 43 *Apply Patch Using a Heat Gun and Roller*

Type 3 - Burn

There are three types of burns caused by overheating the wrap:

- a) A burn that has overheated the wrap only on the surface. No repair is necessary.
- b) A burn that has melted the wrap down to the reinforcement mesh not more than halfway through.
- c) A burn that has melted the wrap past the reinforcement mesh.



Figure 44 *Type B Burn*



Figure 45 *Type C Burn*

Appendix B

Type (b) Burn Repair (See Figures 33-36)

To apply a simple patch, the burn must be 100mm narrower than the patch. So a burn that can be covered by 200mm wide wrap would not exceed 100mm in width.

Cut the patch in 100mm longer than the burn length. For example, if the burn is 200 mm long, make a patch that is the wrap width by 300mm. Use scissors to round the corners of the patch.

Clean the area to be patched, as well as the patch itself with Xylene. Apply the patch using a heat gun and silicone roller. Ensure that the entire patch is well bonded. It may be easier to use the heating blanket depending on the size of repair of situation.

Type (c) Burn Repair (See Figures 33-36)

Burn < 75mm wide

If the wrap is burned past the reinforcement, and the burn is less than 75mm in length, it can be repaired with a patch. The patch must be 100mm longer than the burn. So a 100mm burn must be covered by at least a 200mm wide patch.

Cut the patch at least 100mm longer than the burn length, but not more than 175mm. For example, if the burn is 50 mm long, make a square patch that is 150mm by 150mm. Use scissors to round the corners of the patch.

Clean the area to be patched, as well as the patch itself, with Xylene. Apply the patch using a heat gun and silicone roller. Ensure that the entire patch is well bonded. It may be easier to use the heating blanket depending on the situation.

Burn >75mm long

After cleaning the area and the patch, wrap reinforced Cableguard material over the cut and completely around the cable, overlapping by at least 75mm. Continue wrapping until the patch wrap extends at least 50mm beyond the cut area on each side. If the walk surface is installed, it will be necessary to remove it using solvent prior to repair to allow an area for bonding completely around. Use the heating blanket to bond the patch using the normal heating procedure.

Appendix C Tool List

- Hammer
- Caulk Gun
- Band Tightening Tool
- Tin Snips
- Tape Measure
- Utility Knife
- Heat Gun
- Roller
- Standard Allen Wrenches
- Standard Wrenches
- Xylene or Toulene

Appendix D Approximate Time Temperature Setting For Heating Blankets

Table 3 *Approximate Time Temperature Setting For Blanket in U.S. Standard Units*

Approximate Time Temperature Setting For Blanket in U.S. Standard Units											
	Temperature °F										
Wind Speed - mph	40	45	50	55	60	65	70	75	80	85	90
	Time in Minutes										
0	5	5	5	5	5	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	5	5	5
10	6	5	5	5	5	5	5	5	5	5	5
15	7	7	6	6	5	5	5	5	5	5	5
20	8	7	7	6	5	5	5	5	5	5	5
25	10	9	8	7	6	6	5	5	5	5	5
30	12	11	10	9	8	7	6	5	5	5	5

Table 4 *Approximate Time Temperature Setting For Blanket in Metric Units*

Approximate Time Temperature Setting For Blanket in Metric Units											
	Temperature °C										
Wind Speed - meters/second	5	7	10	13	15	18	21	24	27	29	32
	Time in Minutes										
0	5	5	5	5	5	5	5	5	5	5	5
3	5	5	5	5	5	5	5	5	5	5	5
5	6	5	5	5	5	5	5	5	5	5	5
7	7	7	6	6	5	5	5	5	5	5	5
9	8	7	7	6	5	5	5	5	5	5	5
11	10	9	8	7	6	6	5	5	5	5	5
13	12	11	10	9	8	7	6	5	5	5	5

Note: Low temperatures combined with high wind (>15 mph, 7 m/s) may require additional insulation or wind block to maintain blanket temperature.

Note: Tables assume blanket temperature of 260-265°F (126-129°C).

Appendix E Skew Master Wheel Adjustment Guide

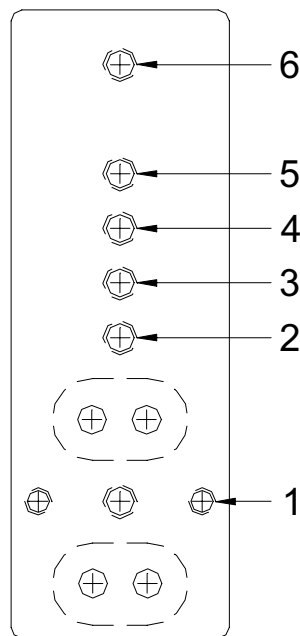
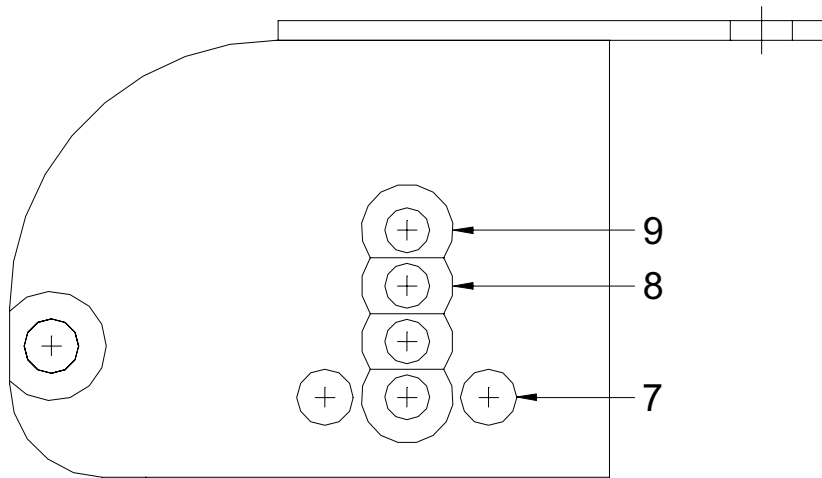


Table 5 Skew Master Wheel Adjustment Settings Based On Cable Size

Skew Master Wheel Adjustment Settings Based On Cable Size				
Machine	Cable Size			
6-12"	6"	8"	10"	12"
14-20"	14"	16"	18"	20"
20-26"	20"	22"	24"	26"
28-36"	28"	30"	32"	36"
36-42"	36"	38"	40"	42"
	6" Wheel	4" Wheel	6" Wheel	4" Wheel
	Match hole 5 to hole 8 Match hole 3 to hole 7		Match hole 1 to hole 7 Match hole 2 to hole 9	