Fire, Safety & Health
Tech Tips

United States Department of Agriculture
Forest Service
Technology & Development Program
June 2004
5100/6700 0451-2324P–MTDC

Inspecting, Cleaning, Repairing, and Retiring USDA Forest Service Chain Saw Chaps

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Since 1965, the U.S. Department of Agriculture, Forest Service has provided cut-resistant, protective chaps for chain saw operators. Chain saw chaps have prevented thousands of serious injuries. The Missoula Technology and Development Center (MTDC) has tracked chain contact injuries and accidents and has improved the chaps over the past 35 years.

The protective pad in the original style of Forest Service chain saw chaps consisted of four layers of ballistic nylon. This ballistic nylon resisted a chain speed of 1,800 feet per minute without cutting through. In 1981, Forest Service chain saw chaps were redesigned to be stronger and more comfortable. The ballistic nylon was replaced with a Kevlar pad. The level of protection was increased to a chain speed of 2,500 feet per minute without cutting through and the weight of the chaps was reduced by 40 percent.

In 2000, chain saw chaps were redesigned to provide more protection and to increase the coverage area. The new chaps are designed to provide protection to a chain speed of 3,200 feet per minute without cutting through.

Because chain saws are operated in the right hand, the majority of chain contact injuries are on the left leg. The coverage area on the left side of the left leg was increased by about 2½ inches and on the left side of the right leg by about 1½ inches. Because the chaps provide more protection, and cover more area, the weight of each pair of chaps increased by 6 to 8 ounces (depending on the length of chaps required by the user: 32, 36, or 40 inches). Full details on the chaps are included in MTDC specification 6170-4.

How Forest Service Chain Saw Chaps Protect the User

The back-coated nylon shell covering the protective Kevlar pad is resistant to water, oil, and abrasion. The pad consists of a shell of coated nylon duck with five layers of Kevlar inside: woven Kevlar, felted Kevlar, woven Kevlar, woven Kevlar, and felted Kevlar (figure 1).

Figure 1—A chain saw chap has five layers of Kevlar.

Kevlar is a synthetic fiber (aramid) similar to Nomex, but with higher flame resistance (FR) properties. When the chaps are exposed to temperatures higher than 500 °F, the nylon shell may melt, but the Kevlar pad will not.

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The chain saw chaps protect the user by slowing and stopping the chain. Fibers of the protective pad are pulled into the saw's drive sprocket, causing the saw to jam (figure 2).

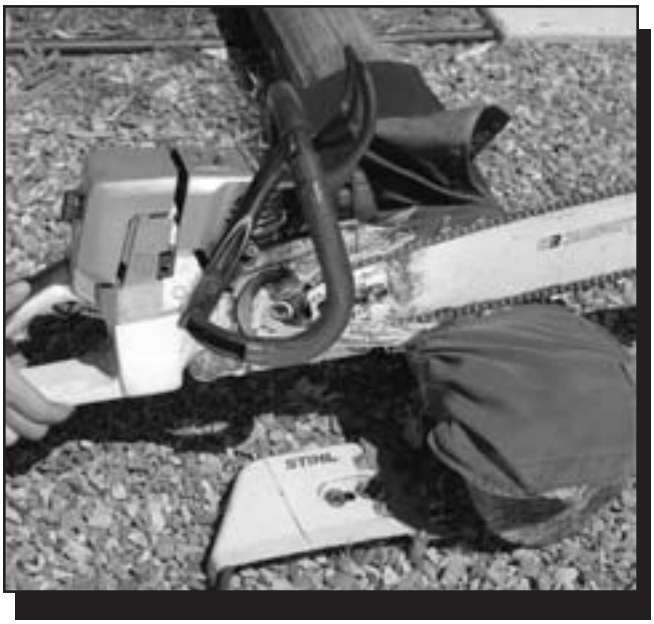

Figure 2—Kevlar fibers jam the chain saw's drive sprocket, stopping the chain saw and preventing injuries.

Chain saw chaps should be adjusted for a snug fit that will keep them positioned correctly on the legs. Chain saw users also need to wear chaps long enough to reach 2 inches below the boot tops. ***PROPER FIT AND CORRECT LENGTH MAXIMIZE PROTECTION!***

Inspection and Retirement

Chain saw chaps need to be inspected frequently and retired when appropriate. Retire chain saw chaps when:

- The outer shell has numerous holes and cuts. Such holes allow bar oil to contaminate the Kevlar pad. The oil acts as an adhesive, reducing the level of protection (figure 3).
- Wood chips and sawdust are evident inside the layers at the bottom of the chaps.
- Improper repairs have been made, such as patch jobs that stitched through the Kevlar pad. Machine or hand stitching the pad prevents the fibers from moving, which lowers the level of cut-through protection (figure 4).

Figure 3—Retire chaps when they have numerous holes and cuts.

Figure 4—Retire chaps when they have been improperly repaired by stitching through the protective pad.

- Chaps have been improperly cleaned. Using detergents with bleach additives decreases the level of cut-through protection. High-pressure washing destroys the pad.
- The outer shell is caked with oil and dirt deposits that can't be removed with cleaning. Testing shows that chaps with such deposits offer much less protection than relatively clean chaps.
- The first layer of yellow Kevlar has a cut that is more than 1 inch long.

Care and Cleaning

Treat your chain saw chaps as a piece of ***CRITICAL*** safety equipment. Do not use your chaps as a chain stop. Keep them as clean as possible. Correct and timely cleaning reduces general wear and tear and the chaps' flammability.

We recommend cleaning chain saw chaps with a commercially available citrus-based cleaning product called *CitroSqueeze*, which has been tested by DuPont and approved to clean Nomex and Kevlar. *Do not machine wash or machine dry chain saw chaps.*

Hose and brush off chaps to remove dirt and large contaminants. Dilute the CitroSqueeze and follow the manufacturer's instructions. For heavy petroleum contamination, fill a soak tank with 10 to 15 gallons of diluted CitroSqueeze solution. Soak the chaps for at least 4 hours (overnight if possible). After the chaps have soaked, scrub them with a bristle brush, rinse them thoroughly with cold water, and allow them to line dry. Many pairs of chaps can be cleaned in the soak tank.

For light soiling, use CitroSqueeze solution in a spray bottle, containing 1 part CitroSqueeze concentrate to 10 parts water. Spray the solution on the area to be cleaned and scrub with a bristle brush (figure 5). Wait one-half hour. Thoroughly brush the chaps, hose them off with cold water, and allow them to line dry.

Figure 5—Clean lightly soiled chaps with a CitroSqueeze solution and a scrub brush.

Repairs

Clean all chaps before repairing them. Repair cuts and holes in the outer shell as soon as possible to keep sawdust and petroleum products from contaminating the protective Kevlar pad.

We recommend a commercially available product called *Seam Grip* for repairing damage to the chaps' nylon shell. Seam Grip provides a flexible, waterproof, abrasion-resistant patch that will protect the Kevlar pad from contaminants.

To repair holes shorter than one-half inch, apply a dot of Seam Grip over the hole, and allow the Seam Grip to dry.

To repair holes and tears in the nylon shell that are longer than one-half inch:

- Cut a piece of notebook or printer paper that extends about 2 inches beyond the edge of the damage. Slip the paper inside the hole or tear in the nylon shell so that the paper lies on top of the Kevlar pad (figure 6).

Figure 6—Use paper to prevent Seam Grip patching adhesive from adhering to the protective pad.

- Lay the chain saw chaps on a flat, level surface and press the nylon shell onto the piece of paper.
- Squeeze Seam Grip onto the paper and onto the sides of the tear, covering all sides of the tear or hole (figure 7).
- Allow the chaps to dry for at least 12 hours before using them.

Figure 7—Spread Seam Grip over the entire hole.

CitroSqueeze is available from:

CDR Chemical, Inc.
16182 Gothard St., Suite J
Huntington Beach, CA 92647
Phone: 888–270–4237
Web site: http://cdrchemical.com

Solutions Safety Services, Inc.
1516 E. Edinger Ave. Unit A
Santa Ana, CA 92705
Phone: 714–849–5653
Fax: 714–843–6743
Web site: http://www.solutionssafety.com

Seam Grip is available from numerous outdoor retailers. To learn of the retailers close to you, contact:

McNett Corporation
1411 Meador Ave.
Bellingham, WA 98229
Phone: 360–671–2227
Fax: 360–671–4521
Web site: http://www.mcnett.com

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Library Card—Messenger, Lori; Petrilli, Tony. 2004. Inspecting, cleaning, repairing, and retiring USDA Forest Service chain saw chaps. Tech Tip 0451–2324P–MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 4 p.

Describes how to inspect, clean, and repair chaps that protect the user from chain saw injuries. The chaps, developed by the Forest Service's Missoula Technology and Development Center, use five layers of Kevlar to bind the chain saw, stopping the chain, and preventing injuries. Improperly maintained chaps do not provide as much protection as chaps that are maintained according to the instructions. Chaps should be retired (taken out of service) when someone has sewn through the five-layer Kevlar pad or when the chaps have many holes and cuts.

Keywords: clothing, Kevlar, maintenance, personal protective equipment, safety at work

Single copies of this document may be ordered from:
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Electronic copies of MTDC's documents are available on the Internet at:
http://www.fs.fed.us/t-d

Forest Service and Bureau of Land Management employees can search a more complete collection of MTDC's documents, videos, and CDs on their internal computer network at:
http://fsfweb.mtdc.wo.fs.fed.us/search

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