

Chainsaw Skills and Safety



**PACIFIC NORTHWEST AGRICULTURAL
SAFETY AND HEALTH CENTER**
farming • fishing • forestry



**OCCUPATIONAL SAFETY AND HEALTH
CONTINUING EDUCATION**
ENVIRONMENTAL & OCCUPATIONAL
HEALTH SCIENCES



WASHINGTON STATE UNIVERSITY
EXTENSION

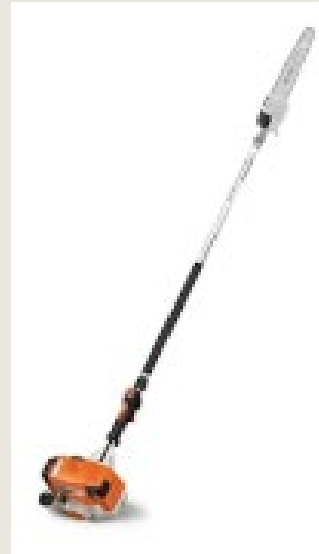


Equipment



What tools do you use?

What tips do you have for the group?

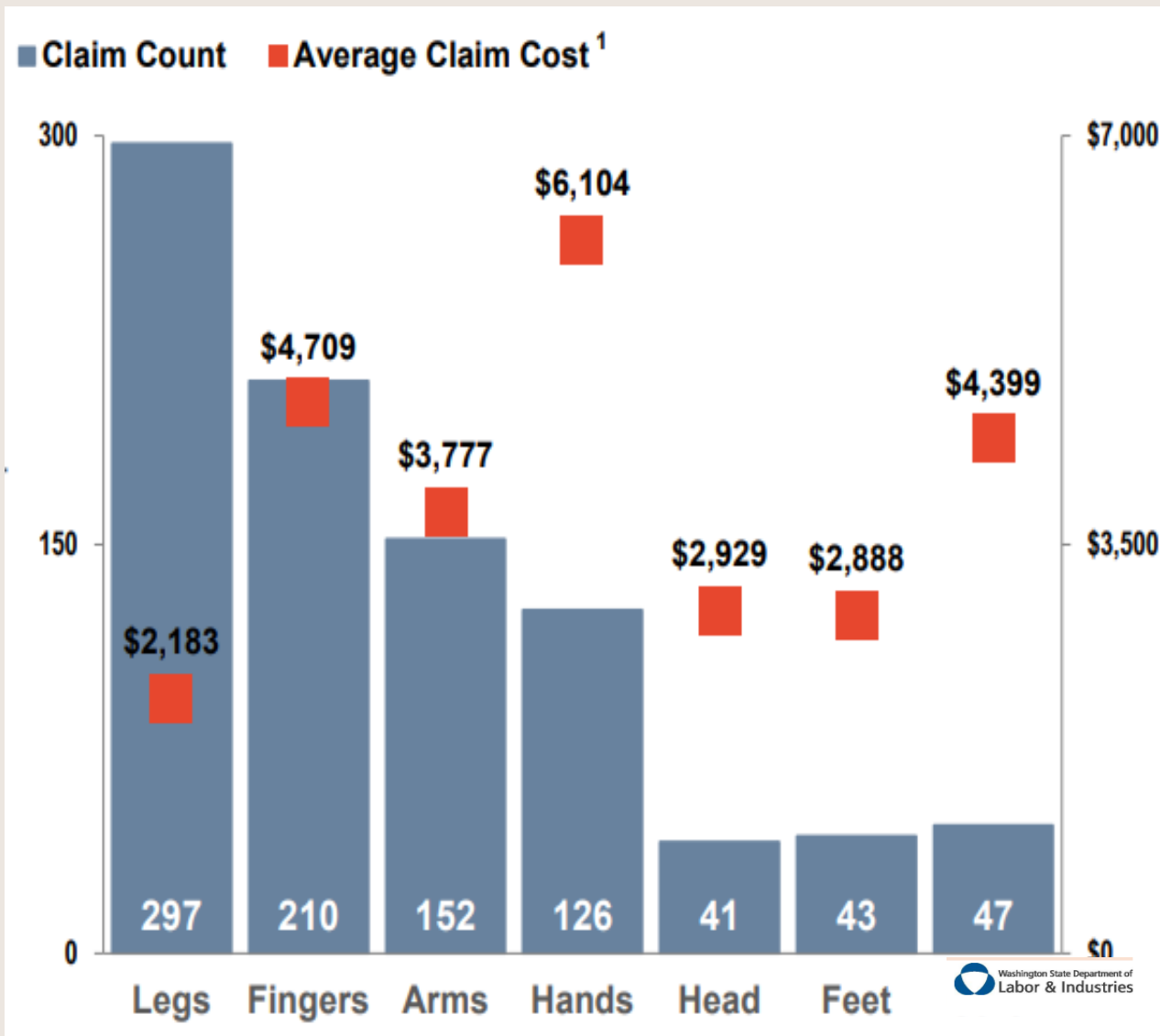


Chainsaw Skills and Safety

Learning Objectives

- Understand, Why Do Accidents Happen?
- Know your Safety Features
- Reactive Forces
- Safety Apparel
- Think Safety
- Proper Maintenance

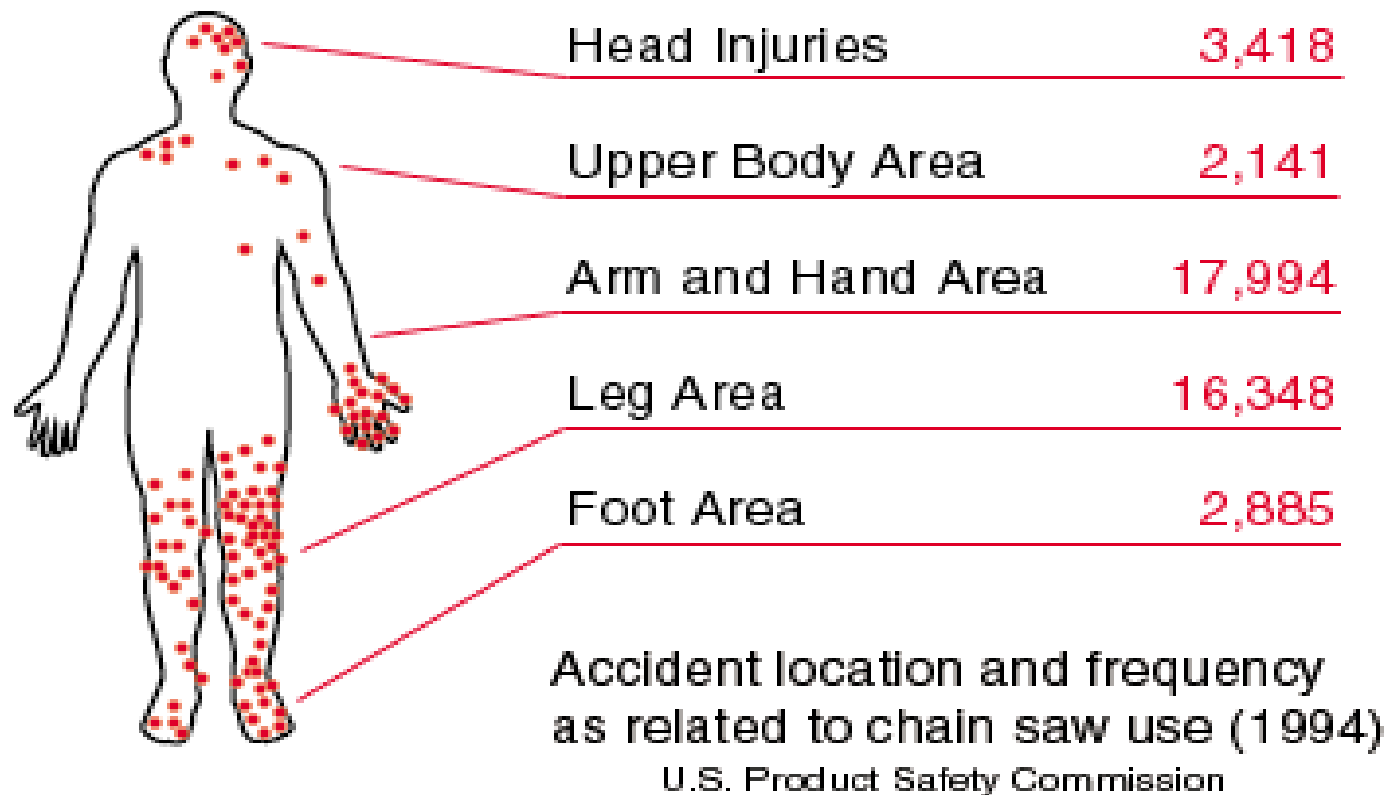
SAFETY CHALLENGES



What do you feel are the 'root' causes of chainsaw accidents in forestry?

Source: Work-Related Chainsaw Injuries, 2005-2014

Accident Location & Frequency Related to Chain Saw Use



**Notice how most injuries occur on the lower left leg and the left arm.
Be sure to protect those areas well.**

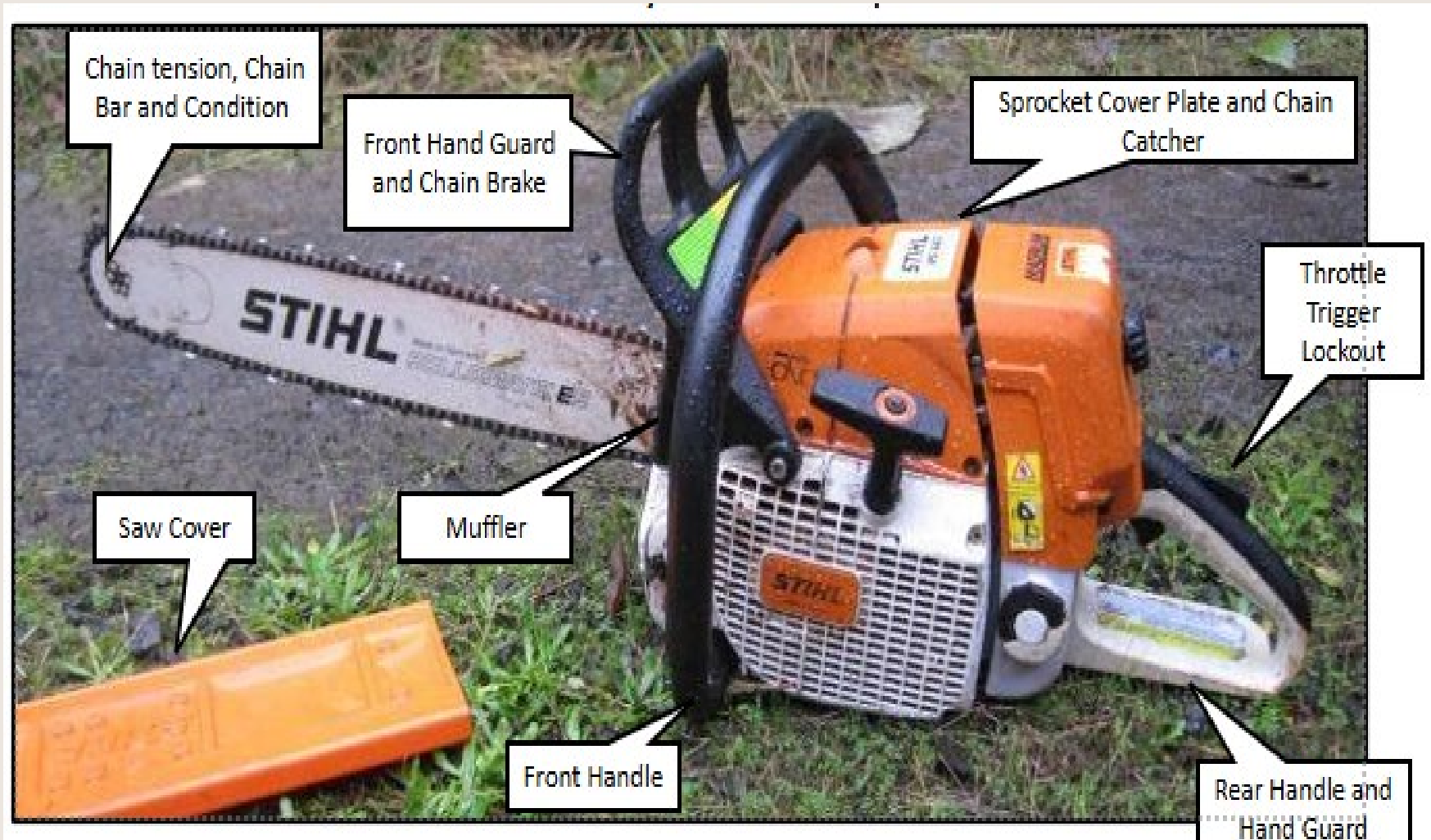
Why Do Accidents Happen?

- Inexperience
- Fatigue
- Not wearing proper safety apparel
- Improper tool for the job
- Improper equipment maintenance



ACTIVITY

Chainsaw Key Features



Safety Features



Throttle- Interlock



Master Control

Become Familiar With the Controls

Master Control Lever™

- A single lever operating the choke, throttle lock and on-off switch

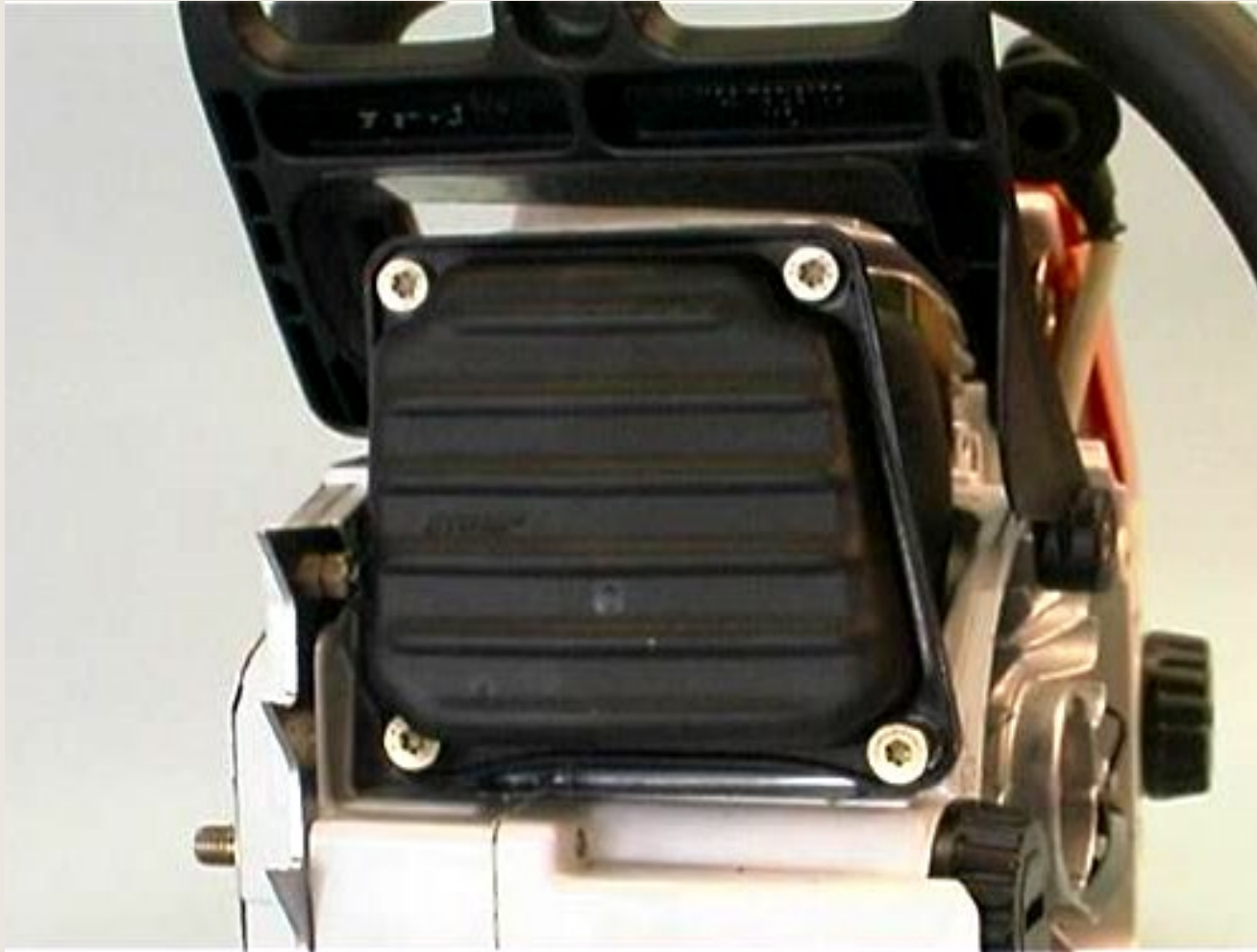


Remote Choke

- Some models have a separate manually operated choke lever



Safety Features



Forest Service Approved Muffler

Starting Features

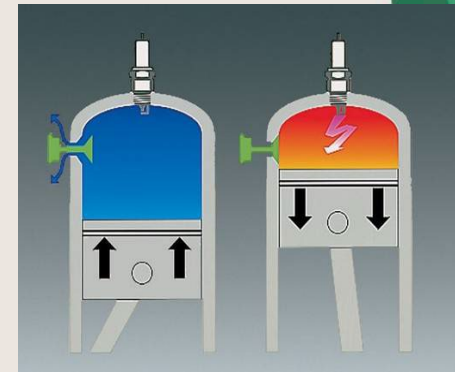
The ElastoStart™ starter handle has a built in shock absorber element as a comfort feature



Saws equipped with the Easy2Start™ can be started with less effort at a lower cranking speed

Options Available on Different Models

- **Decompression Valve:** for larger displacement engines the deco valve bleeds off some of the compression when the starter is activated to make starting easier
- The first time the engine fires it will automatically close the valve



First Time Start-Up: Purge Primer

- The purpose of the purge primer is to prefill the carburetor with fuel before attempting to start the engine.
- Push the bulb until it is full of fuel.
- Fuel is circulated from the fuel to the carburetor. Excess fuel is cycled back to the fuel tank.
- The engine cannot be flooded by over-pumping the primer.
- Once the bulb is full, engage the choke and the unit is ready to start.



ANTI-VIBRATION SOLUTIONS

Hand-arm vibration syndrome (HAVS) is caused by exposure to vibrating hand tools.



Anti Vibration Chainsaw



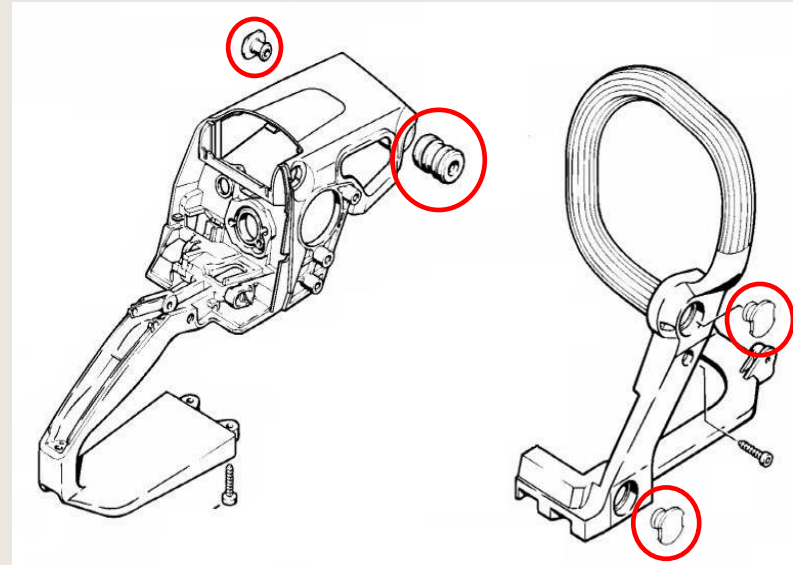
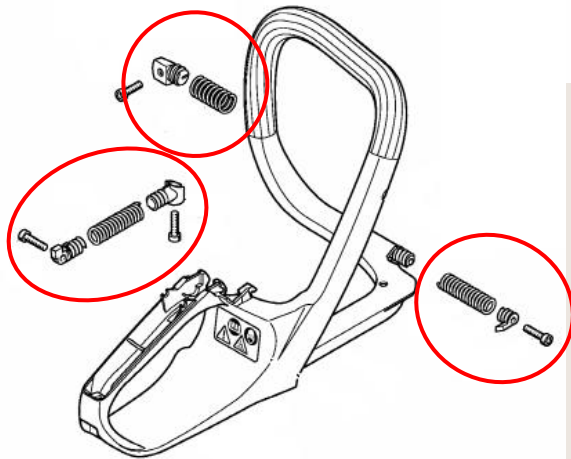
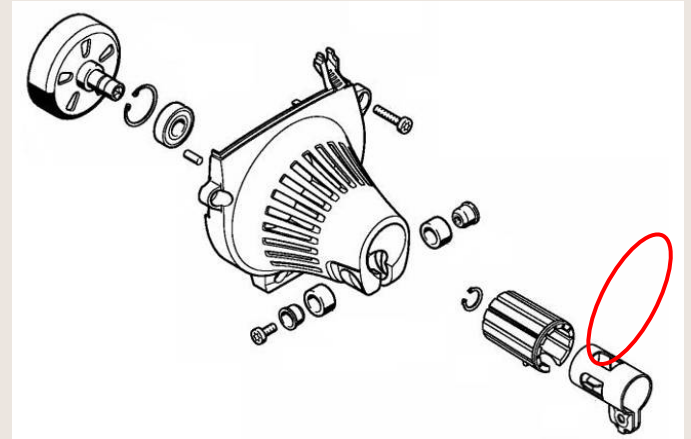
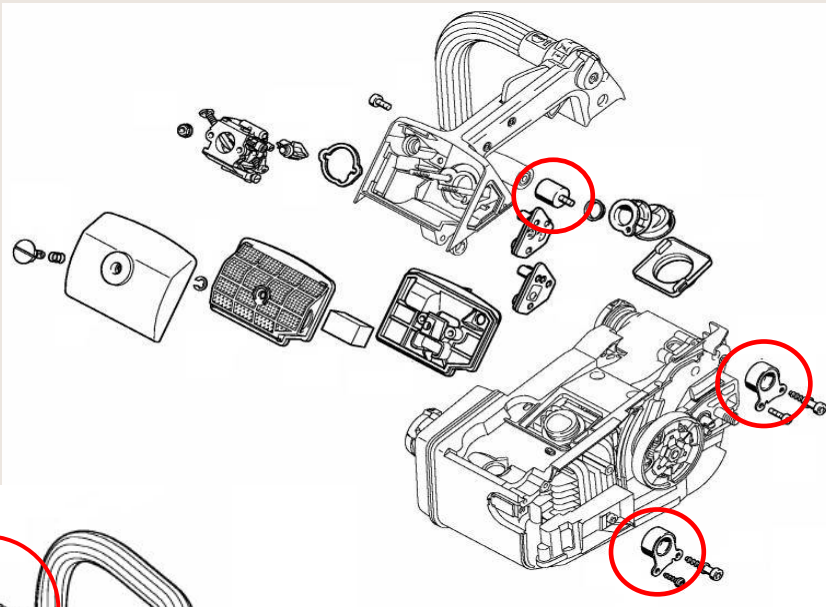
ANTI-VIBRATION

An anti-vibration system is a standard feature on most modern chainsaws. But that hasn't always been the case. In fact, STIHL was the first company to introduce the technology over 50 years ago.

LEARN MORE >

Anti-Vibration System

Inspect for missing parts, torn AV elements, and that springs and retainers are in place



Safety Features

Inertia-Activated Chain Brake



Second Chain Braking System (STIHL Quickstop®)

Some models also engage the chain brake when the operator's right hand completely releases the rear handle, stopping the chain within about one second



Reactive Forces

- Kick-back
- bar tip contacts object
- Push back
- top of saw chain binds in cut
- Pull in
- bottom of saw chain binds in cut



Understanding Chainsaw Reaction Forces



image credit: Patrick Hiesl, Clemson University.

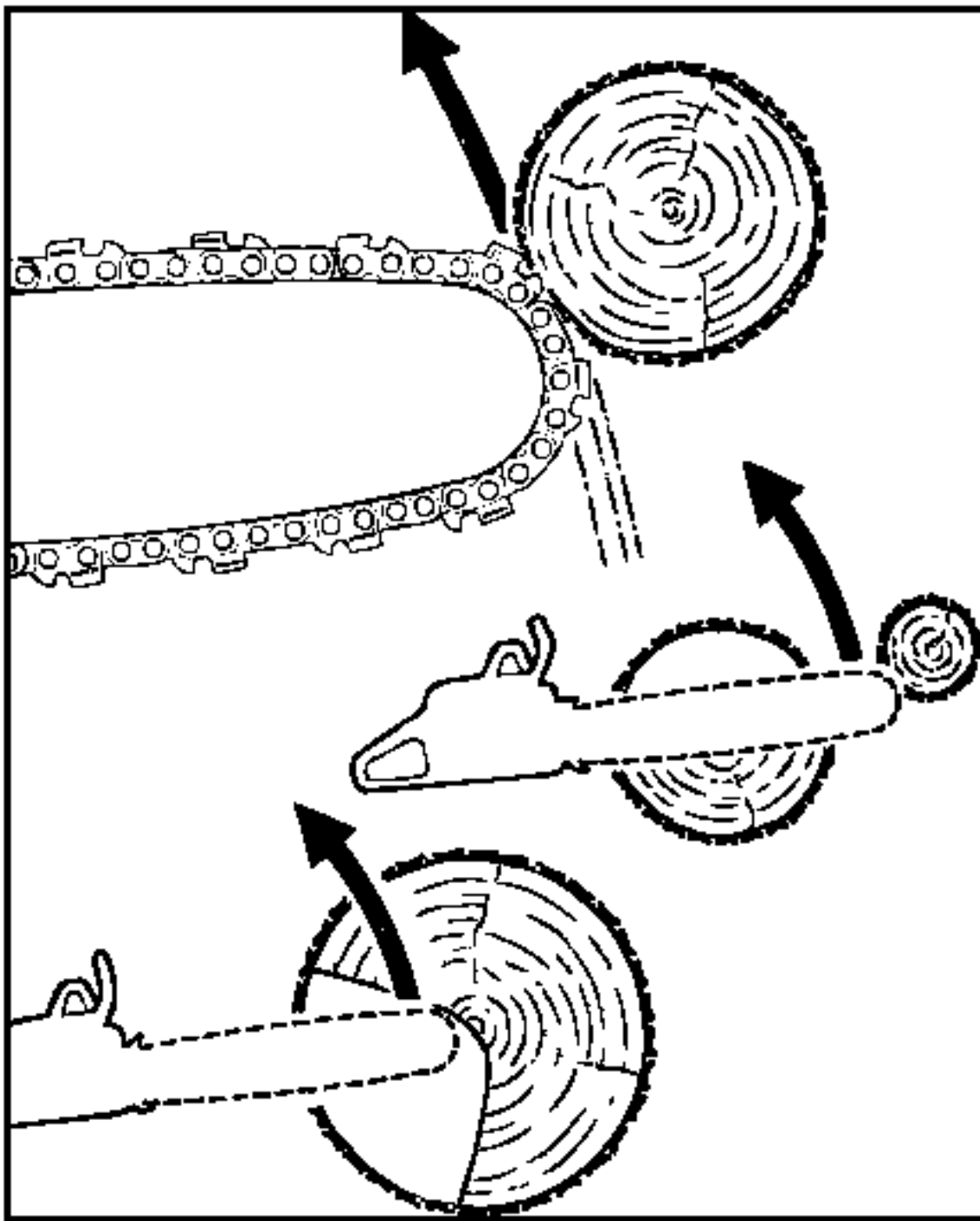
Chain saw reaction forces transfer the power of rotating chain away from the action of cutting wood and back to the saw and the operator, causing your saw move rapidly and unpredictably, losing the control of it or to lose your balance

Kickback is the most serious reaction force



Image credit: Patrick Hiesl, Clemson University.

During the Kickback, the movement is unpredictable, extremely fast and may cause serious injury or death



Kickback!!!

Kickback occurs when the moving saw chain near the upper quadrant of the bar nose contacts a solid object or is pinched

The greater the force of the kickback reaction, the more difficult it becomes for the operator to control the saw

Chainsaw

Preventing Kickback Injuries

- Inspect and maintain equipment.
- Use chainsaw guard
- Use proper-sized saw and bar and the proper chain for the size and species.
- Examine the material to assess its physics.
- Find a stable position to control the saw.
- Maintain a solid grip (not squeezing) on the front and rear handles at all times.
- Always be aware of where the tip of the bar is.
- Do not pinch chain while cutting
- Take breaks, don't rush through a task, and communicate.

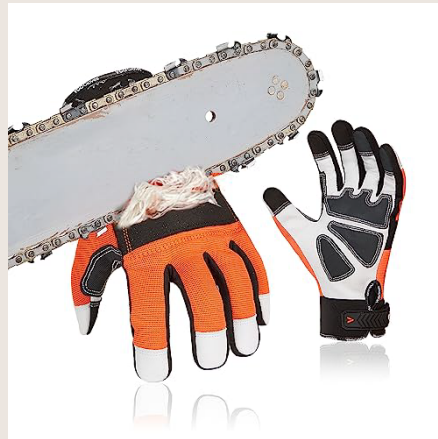
Safety Apparel

OSHA requires that operators of chain saws must wear:

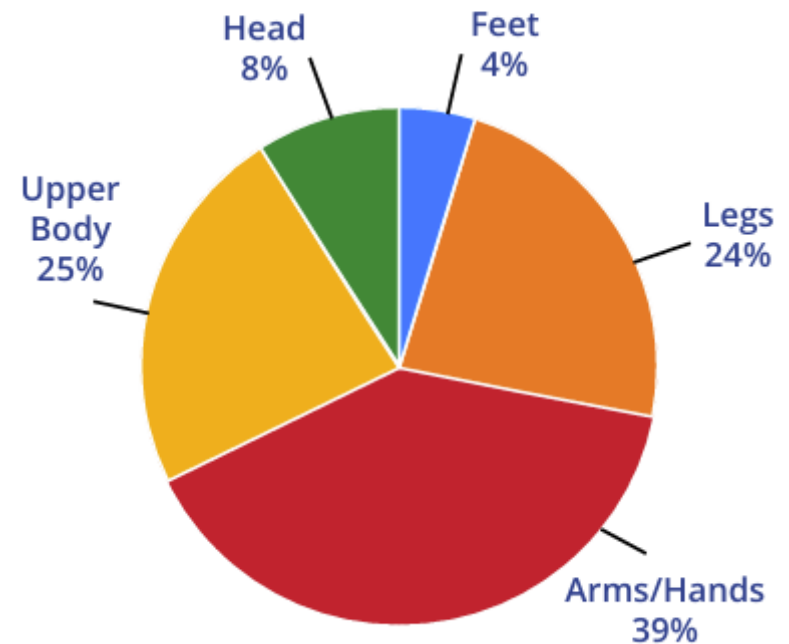
- Hard hat
- Hearing protection
- Eye protection
- Cut resistant leg protection
- Cut resistant boots
- Hand protection

Chainsaw

CUT PROTECTION



Claims Data (WA)
Associated with Chainsaw Use



Cut Resistant Clothing

- Avertic ballistic nylon
- Slows chain
- 6 or 9 layer
- Upper and lower body protection
- Maintenance
- Not body armor



The Electric Chainsaw Controversy

- Chaps manufacturers often do not approve for use with electric saws.
- Yet, Chaps are still good protection for electric chainsaws!



Source: @UprootedTreeCompoany



<https://youtube.com/shorts/ax4NEcwVCCk?si=hl3c72AIsXwFmKjL>

Hard Hat & Hearing Protection

Head Protection

- Replace if damaged or after 3 – 5 yrs
- Replace if plastic is faded
- Replace liner if damaged

Hearing Protection

- Most common work injury
- Damage is not repairable
- Use hearing protection to reduce below 80 dBa
- Must be comfortable & maintained



Approved Eye Protection

- Chip protection required for chain saw use.
- Safety glasses ANSI rating Z87
- Faceshield in addition to glasses is the best practice



Approved Work Boots

- Cut resistant
- 8" leather boots
- Rubber boots must have protective layer
- Stihl has protective layer



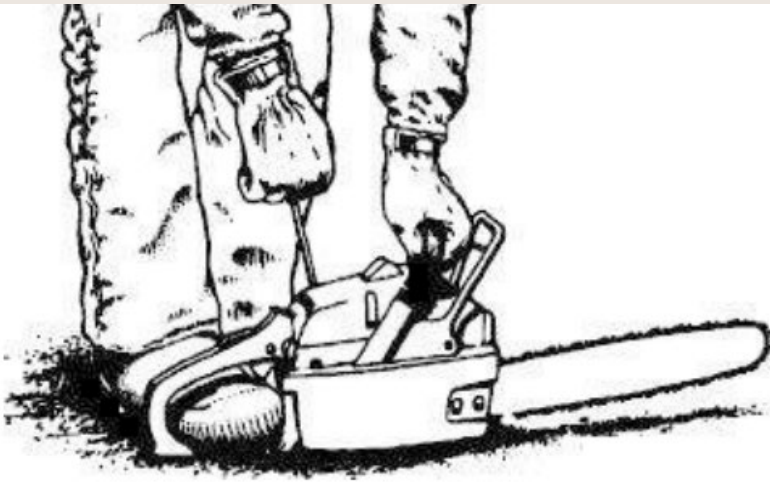
Approved Gloves

- Must be full fingered
- Mittens w/protection left hand



Chainsaw Safety Review

Before starting the saw



- Check chain, bolts, brake, clutch cover, handles, ignition.
- Sharpen chain teeth.
- Add fuel 10 feet from anything that could ignite it.

Running the saw

- Start saw away from fueling area.
- Firm grip and footing.
- Don't cut between your legs.
- Look up before cutting.
- Prevent kickback.
- Shut off or apply chain brake when carrying.
- Work at a safe distance from other workers.
- Communicate with and watch out for co-workers.
- Take breaks.
- Supervise inexperienced workers.

Source: Northwest Forest Worker Center

Adjust the chain tension



Visible sag in the chain indicates that it is too loose

<https://www.firewood-for-life.com/chainsaw-chain-tension.htm>

Adjust the chain tension



A chain like this will not bite into the wood and it will prematurely wear out your drive sprocket or the tip of your bar.

<https://www.firewood-for-life.com/chainsaw-chain-tension.html>

Properly Tensioned Chain

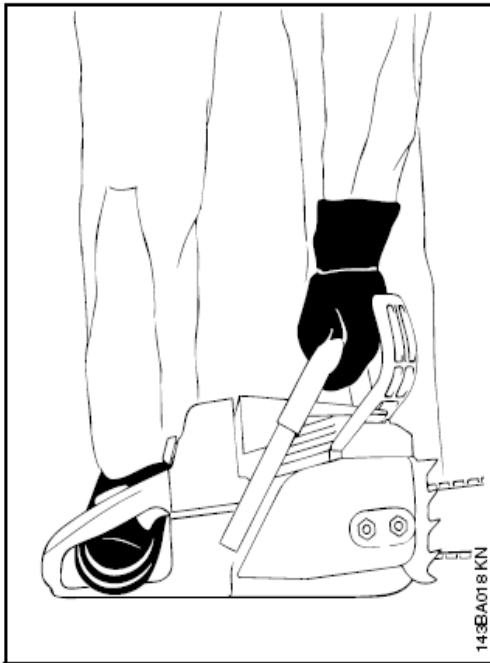


The chain separates itself from the bar; it should “give” about $\frac{1}{4}$ -inch from the bar without much effort. Once released, it easily retracts and stays firmly positioned on the bar.

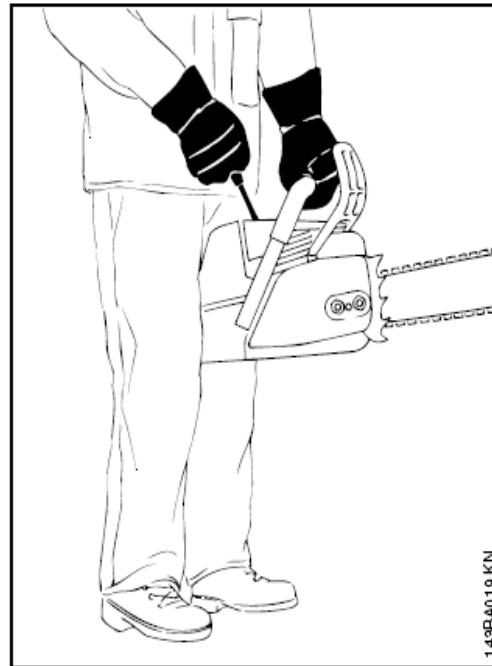
<https://www.firewood-for-life.com/chainsaw-chain-tension.html>

Safely Starting a Chain Saw

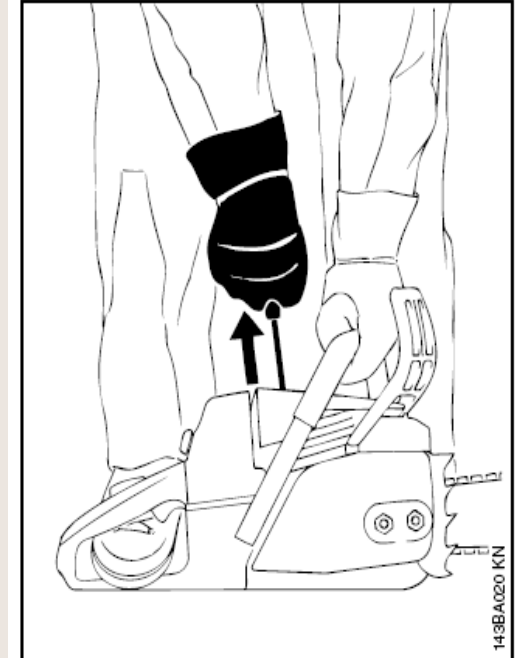
Never Drop Start a Chain Saw!



- Place your saw on the ground. Make sure you have a firm footing – check that chain is not touching any object or the ground.
- ⚠ Bystanders must be well clear of the general work area of the saw.
- Hold the saw firmly on the ground with your left hand on the front handle – your thumb should be under the handle.
- Put your right foot into the rear handle and press down.



- Alternative method of starting:
- Hold the rear handle tightly between your legs, just above the knees.
 - Hold the front handle firmly with your left hand – your thumb should be under the handle.



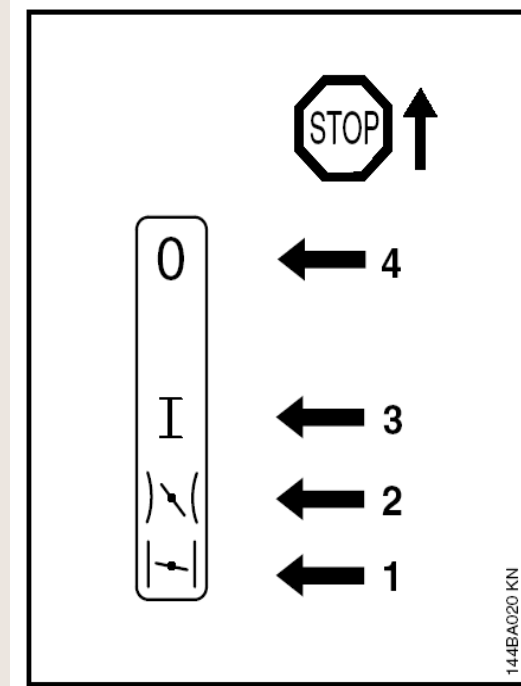
- Pull the starter grip slowly with your right hand until you feel it engage – then give the grip a brisk strong pull and push down the front handle at the same time.
- ⚙ Do not pull out the starter rope to its full length – it might otherwise break.
Do not let the starter grip snap back – guide it slowly into the housing so that the starter rope can rewind properly.

If the engine is new, pull the starter several times to prime the fuel system.

Proper Starting Procedure

Starting a cold engine or after refuelling

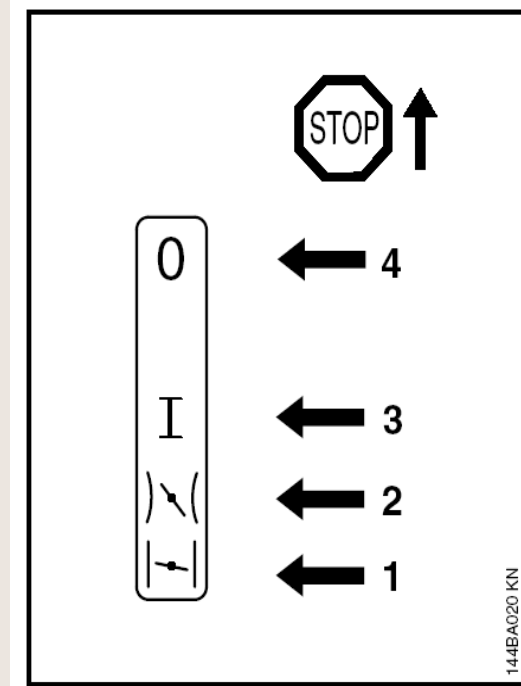
- Engage chain brake
- Squeeze throttle to activate choke, move choke to choke position
- Once engine tried to start (burps) or after 3 – 4 pulls of the rope, move master control from **choke** to half-throttle position
- Pull rope until engine starts then immediately blip the throttle trigger
- This will move master control shaft to the I or idle position.
- Allow the unit to idle for 30 – 40 seconds.
- Then blip the throttle in and out for another 30 – 40 seconds. This allows the saw to warm up properly and the bar oil system to prime.



Proper Starting Procedure

Starting a cold engine or after refuelling

- Failure to blip throttle immediately when the chain brake is engaged and the engine starts at half throttle can cause severe damage to the clutch and oil pump system.
- Never hold the saw at full throttle without a load on the engine for longer than 2 – 3 seconds. Free-wheeling the engine may cause engine damage.



Think Safety!

- Be prepared
- Develop a checklist
- Escape Route
- Know when to walk away
- Be aware of fatigue
- Do not use damaged equipment
- Maintain your tools

Preventive Maintenance

3 Main Benefits of Preventive Maintenance

- Reduced risk of accidents for improperly maintained equipment
- Minimized equipment operating costs
- Reduced down time costs due to equipment failures

Maintenance Priorities

- Air Intake System
- Fuel System
- Engine Cooling System
- Cutting Systems

Oil System Check

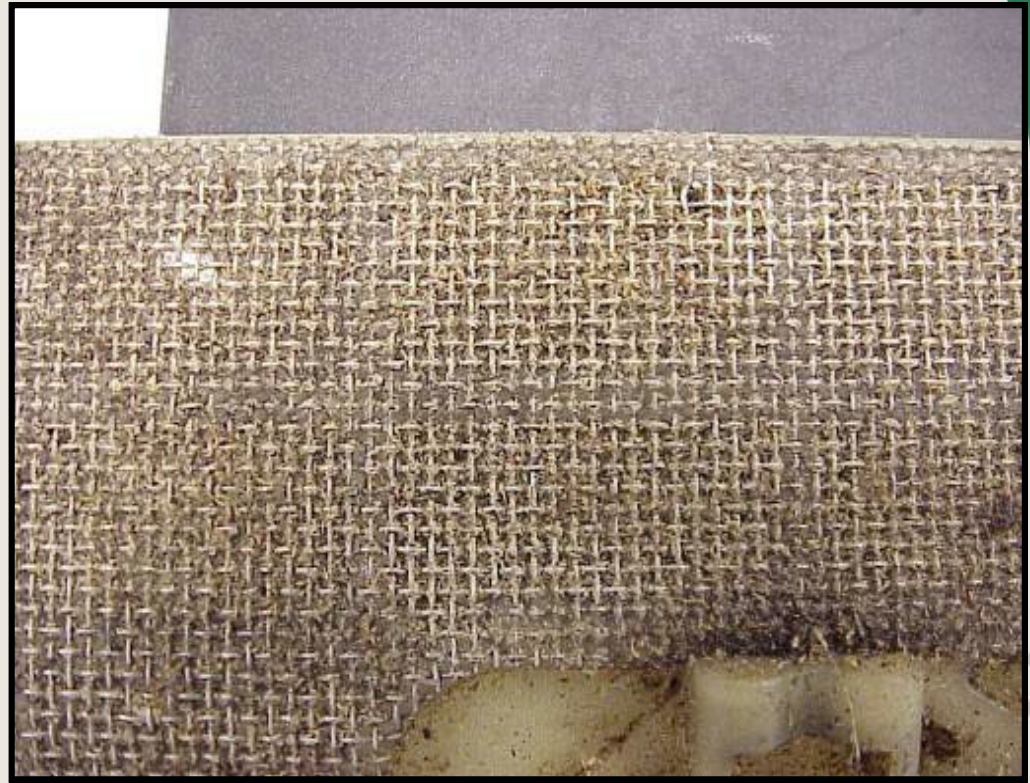
- Carefully hold the tip of the bar over a piece of wood or cardboard
- Run the saw at half throttle for 3-4 seconds to verify oil output



Maintenance Procedures

Air Filter Maintenance

- Carry extra filter
- Change often
- Clean correctly



Maintenance Procedures

Carburetor Adjustment

- **Don't adjust the carburetor**

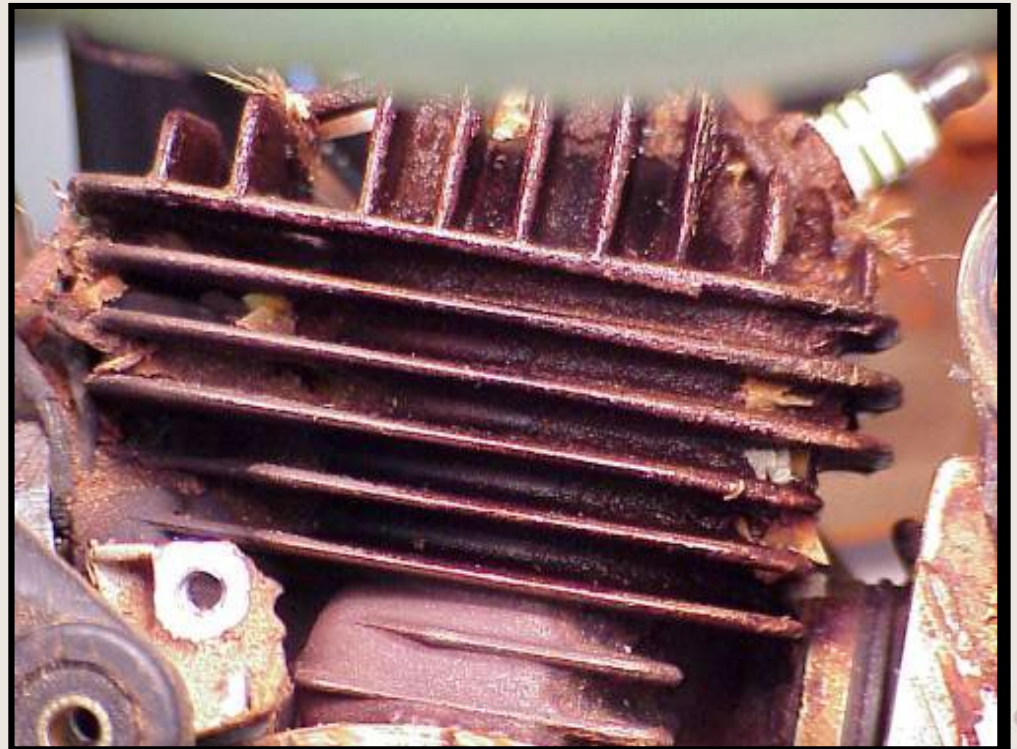
Change in run characteristics shows mechanical problems



Maintenance Procedures

Cooling System

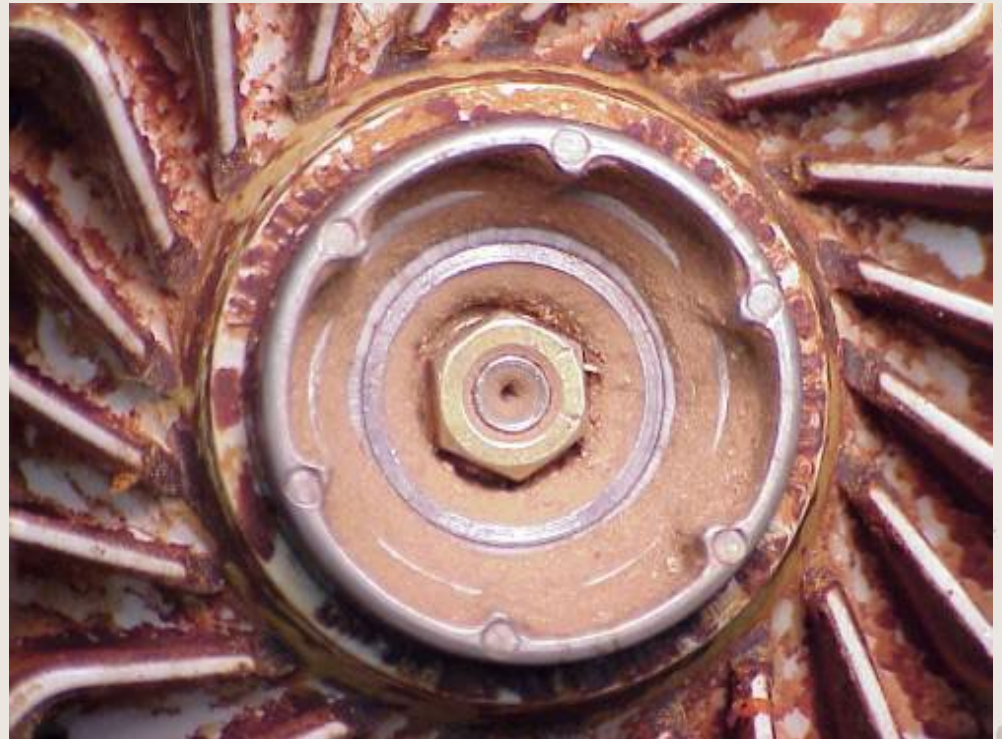
- Starter Housing
- Flywheel
- Cylinder Fins



Maintenance Procedures

Starter Housing

- Starter Rope
- Starter Mechanism



Maintenance Procedures

Fuel Filter

- Inspect weekly
- Replace if discolored



Spark Plug Appearance



Normal color, normal electrode wear due to high run time. Plug has served its useful life.



Heavy carbon build-up and oil fouled. Mix ratio incorrect.



Normal color and wear. Carbon buildup due to high run time. Plug has served its useful life.



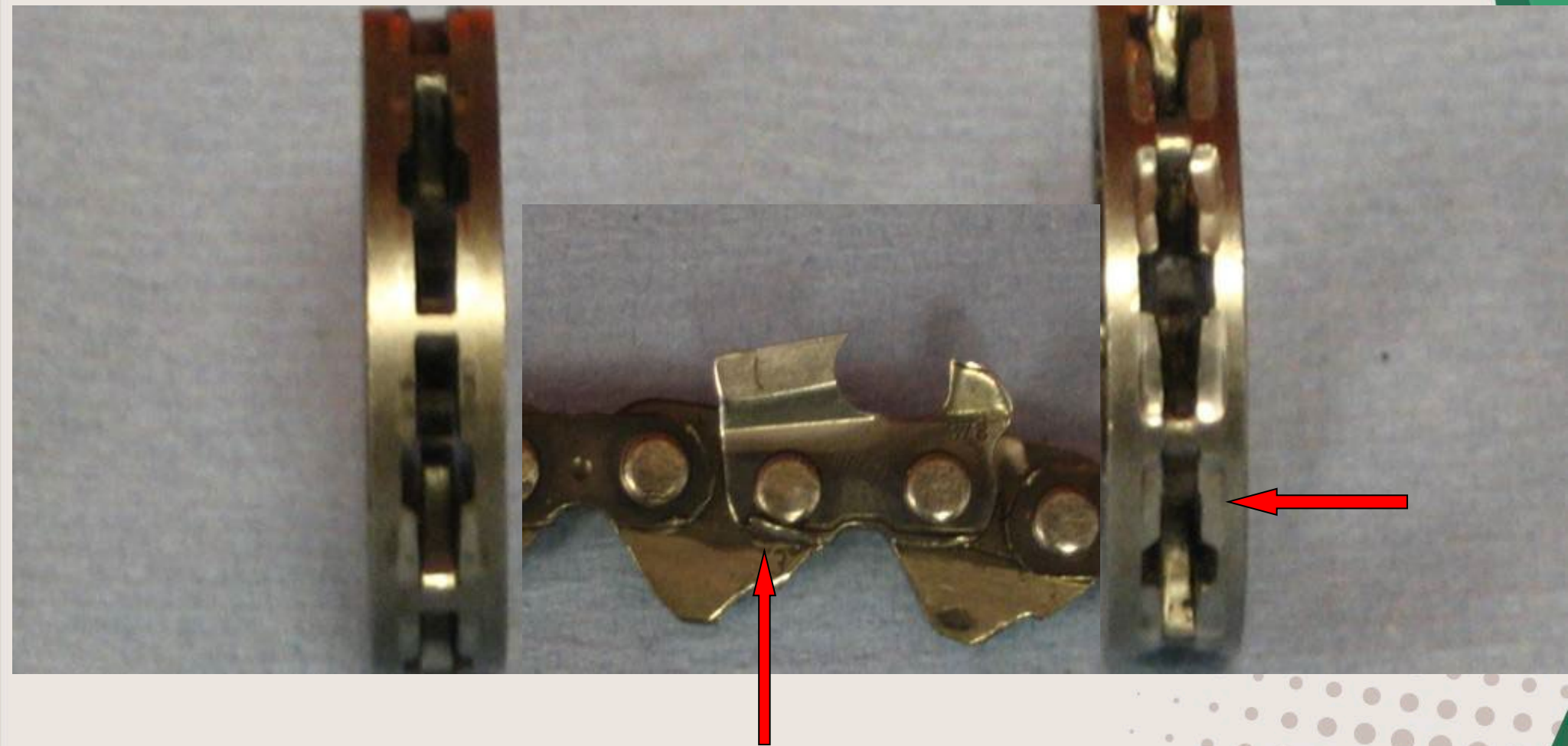
Black, sooty appearance. Caused by rich fuel/air mixture.

Maintenance Procedures

Sprocket Maintenance

- Check sprocket whenever chain is removed
- Replace sprocket every 2-3 chains
- Clutch bearing lubrication
- Lubricate bearing at least once a week
- Inspect clutch shoes, springs and retainers

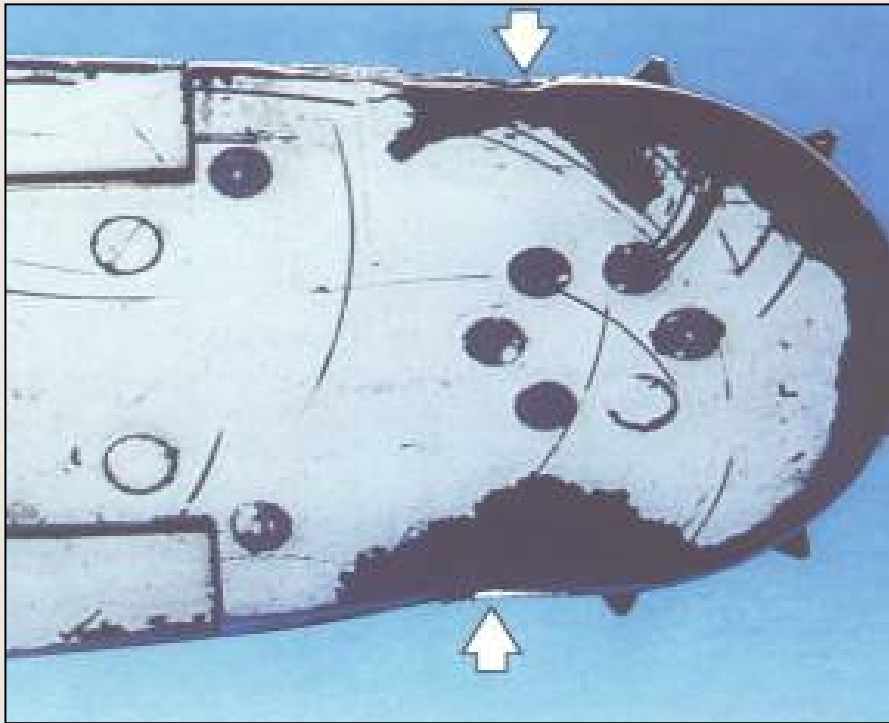
Drive Sprocket Wear



Cutting Attachment

Note type and condition. Inspect for wear or damage.

- Tap head eyelets worn, spool worn, retainer secure:
- Bar, chain, and sprocket within wear limits:



Maintenance Procedures

Daily Maintenance

- Inspect and clean air filter
- Inspect cutting system, sharpen chain
- Inspect fasteners and tighten
- Clean

Weekly Maintenance

- Inspect fuel filter
- Inspect sprocket
- Inspect fasteners and tighten

Fuel Recommendations

- Use only chainsaw 2-cycle air cooled engine mix oil
- Use at least 89 octane fuel
- Use caution if fuel contains alcohol
 - Increases engine RPM
 - Absorbs water from the atmosphere
 - Acts as a solvent
 - May damage older fuel system components
- Do not use fuel stored over 60 days
 - Fuel Stabilizer
- Mix at 50:1, do not mix richer or leaner

Troubleshooting

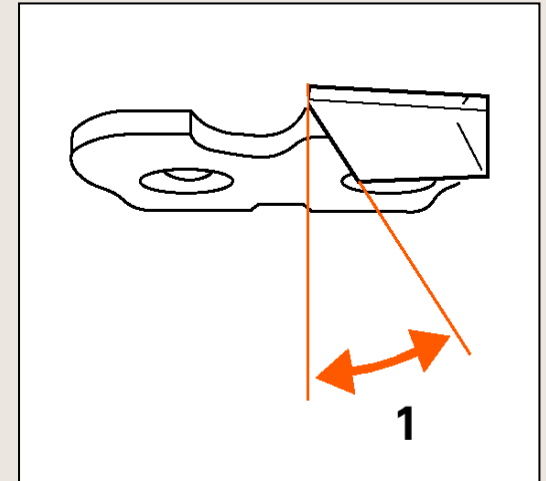
- Check fuel
- Check choke mechanism
- Check spark
- Flooded engine
- Erratic engine operation

How A Cutter Works

TOP PLATE ANGLE

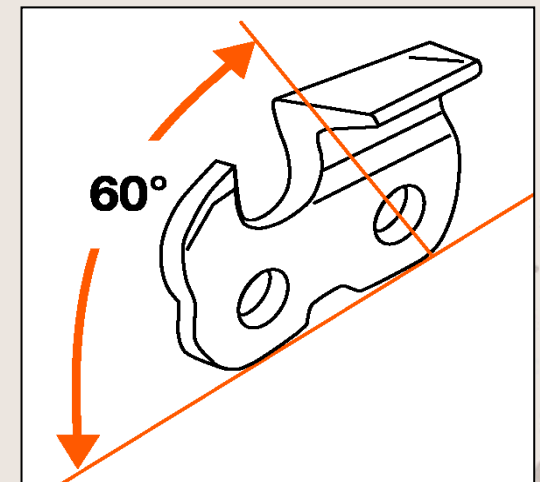
The top horizontal angle controls the kerf or width of cut the cutter makes in the wood.

The greater the angle the wider the kerf.



TOP PLATE CHISEL ANGLE

The top plate chisel angle feeds the cutter into the wood. This splits the cross grain of the wood fibers.



When does the chain need sharpening?

It is time to sharpen the chain when any of the following conditions occurs:

- The chain does not pull itself into the cut, it has to be forced to cut by applying pressure to the powerhead
- When fine sawdust is pulled from the cut instead of coarse, thick chips
- Smoke is seen from the cut even though chain lubrication is in order and chain tension is correct



Results of a sharp chain

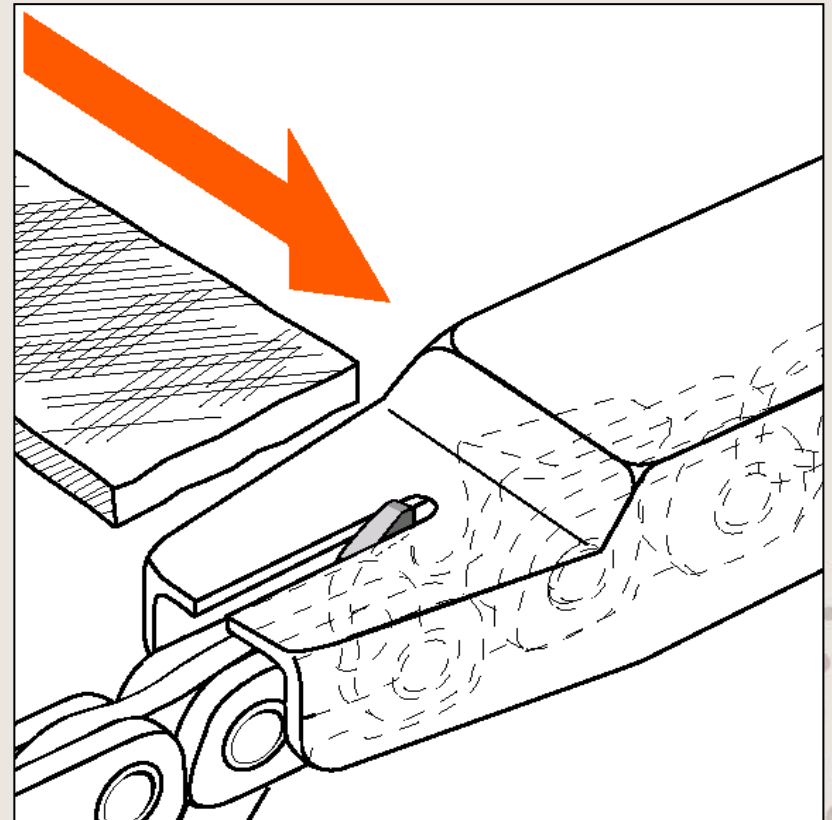
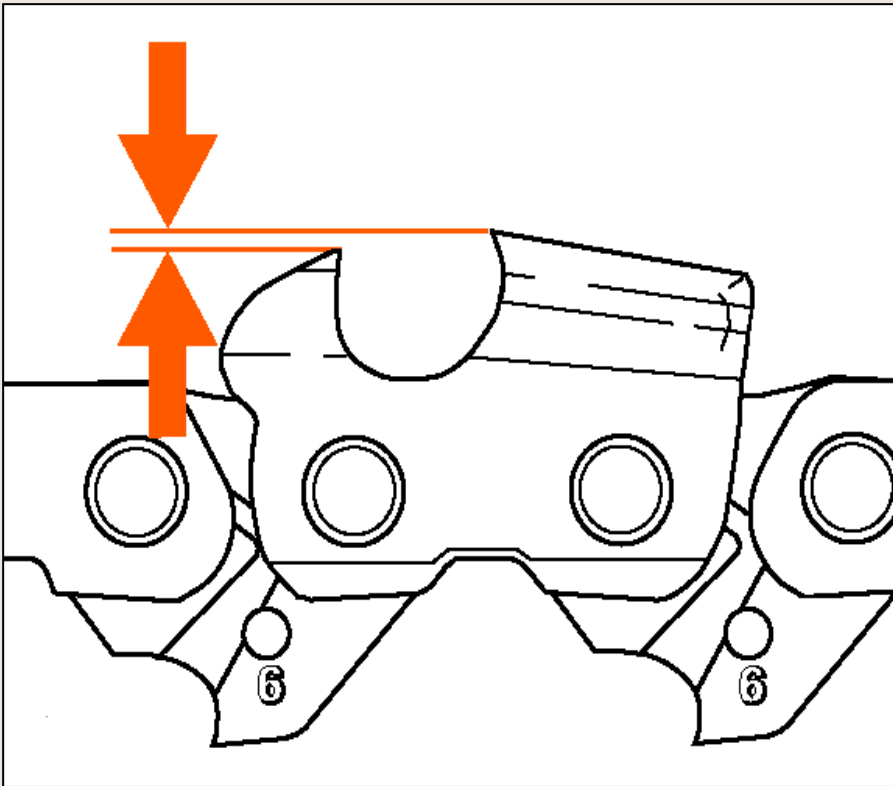
How to File

- Wear gloves and protective glasses
- Always file to the outside of the cutter
- Set the chain tension tighter than normal so the cutter doesn't rock back as it is being filed
- Keep the angle consistent with the top edge of the cutter



Adjusting Depth of Cut

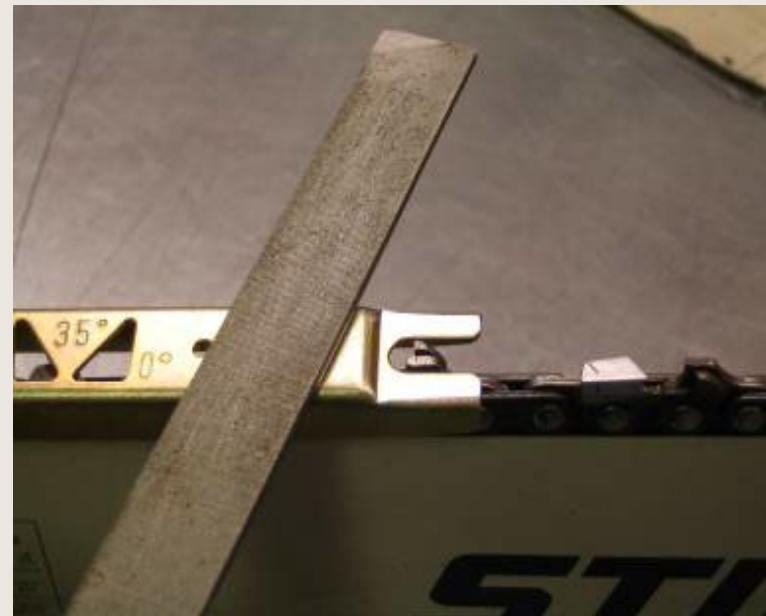
The depth gauge on a saw chain is simialr to a carpenter's plane. The depth gauge determines the thickness of the wood chip.



Chain Sharpening



- File guide allows correct filing angles
- Depth gauge tool allows correct depth gauge height



Chain Sharpening



- Sharpening Kit includes: round file w/sharpening guide, depth gauge, and depth gauge file.
- Different kits available for different sized saw chain.

3-in-1 File



Guide Bar Maintenance

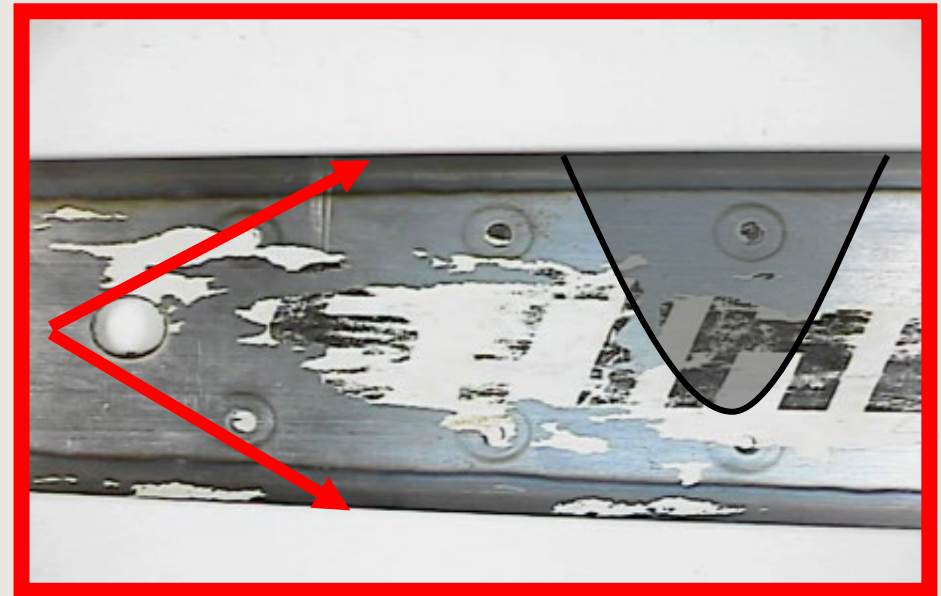


Bar Maintenance

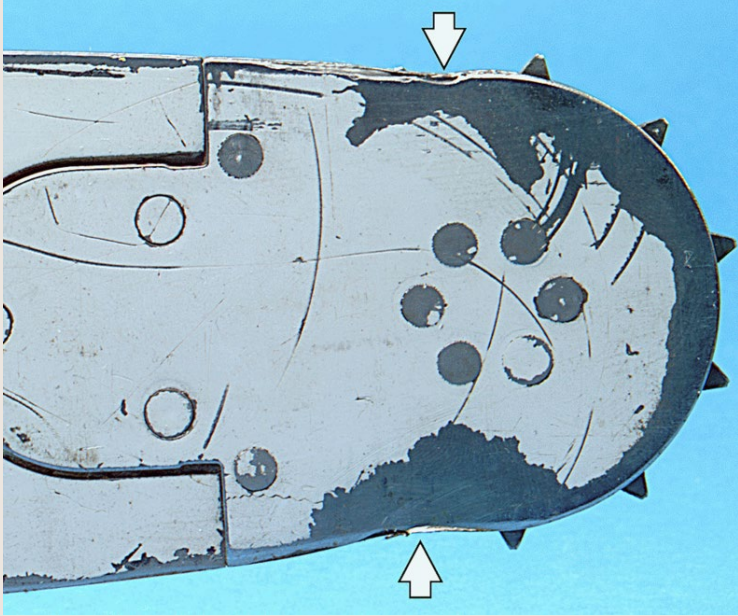
- Clean bar groove and oil delivery holes often
- Rotate the bar

Bar Damage

- Heat Treat
- Bar damage



Guide Bar Maintenance



Wear Areas to Inspect



Chainsaw Maintenance

Regular tasks

- Sharpen chains
- Store chains in oil
- Refill bar chain oil in saw
- Make sure all parts and nuts are tight
- Check that chain brake functions
- Check the interlock
- Replace saw chain at first sign it is dull, damaged, or unable to cut straight

Tools

- Extra bar and saw chains
- Chain file, filing guide and gauges
- In saw shop use electric grinder (manual sharpening is difficult)

Summary

- **Think Safety**
- **Know When To Walk Away**
- **Wear Safety Apparel**
- **Maintain Equipment**

Training & Guides

Videos

- WorkSafeBC, <https://www.youtube.com/@worksafebc>
- Ag Center, How to use a chainsaw (Part 1 and 2)
<https://youtu.be/H9BegDz1Beo?si=hrVS5t-ByWiYpwra>
- Manufacturers video instruction on YouTube

Training Programs

- Wildland Fire Safety Training
<https://www.nwcg.gov/training-courses/wfstar-catalog>
- Associated Oregon Loggers
- Associated Contract Loggers of Idaho
- Washington Contract Loggers Association
- State Forestry Extension Programs

OSHA® QUICK CARD™

Chainsaw Safety

Operating a chainsaw can be hazardous. Potential injuries can be minimized by using proper personal protective equipment and safe operating procedures.

Before Starting a Chainsaw

- Check controls, chain tension, and all bolts and handles to ensure that they are functioning properly and that they are adjusted according to the manufacturer's instructions.
- Make sure that the chain is always sharp and that the oil tank is full.
- Start the saw on the ground or on another firm support. *Don't start in a never-allowed*
- Stand to the side.

OSHA® DATOS RÁPIDOS

Seguridad al usar la sierra de cadena

Operar una sierra de cadena puede ser peligroso. Heridas potenciales pueden ser minimizadas utilizando el equipo de protección de seguridad y procedimientos de operación seguros.

Antes de poner una sierra de cadena en marcha

- Inspeccione los controles, la tensión de la cadena, y todos los tornillos y mangos para asegurarse que estén funcionando apropiadamente y que ellos están siendo ajustados de acuerdo a las instrucciones del fabricante.
- Asegúrese que la cadena esté siempre afilada y que el tanque de aceite esté siempre lleno.
- Ponga la sierra en marcha en el suelo o en otra superficie firme. Nunca la ponga en marcha dejándola caer.
- Ponga la sierra en marcha a un mínimo de 10 pies desde el área donde se echa la gasolina.

Echar gasolina a la sierra de cadena

- Use embudos aprobados para transportar gasolina para la sierra.
- Dispense la gasolina a un mínimo de 10 pies a lo lejos de cualquier fuente de ignición cuando esté haciendo trabajos de construcción. **No fume cuando esté echando gasolina.**
- Use el embudo o la manga flexible cuando esté echando gasolina dentro de la sierra.
- Nunca intente echar gasolina si la sierra está en uso o caliente.

Seguridad de la sierra de cadena

- Quite todo lo sucio, escombros, ramas pequeñas de árboles y piedra del camino de la sierra de cadena. Asegúrese de que no haya clavos, puntas y otros metales en el árbol antes de cortar.
- Apague la sierra o engrane el freno de la cadena cuando lleve la sierra en terreno desigual o irregular.
- Mantenga sus manos en el mango de la sierra y mantenga los pies balanceados cuando esté operando la sierra.
- El equipo de protección personal apropiado debe ser usado cuando esté operando la sierra, el cual incluye protección para las manos, pies, piernas, ojos, cara, oídos y cabeza.
- No se vista con ropa suelta o que le quede grande.
- Tenga cuidado que el tronco o las ramas de los árboles no estén amarradas contra la sierra.
- Tenga cuidado con las ramas que están en tensión, pueden saltar hacia afuera cuando las corte.
- La sierra de cadena que se enciende con gasolina debe ser equipada con un dispositivo protector que minimiza que la sierra de cadena invierta el giro (te patee).
- Tenga precaución con las inversiones de giro (patadas) de la sierra. Para evitar la inversión de giro no corte con la punta. Mantenga el protector de la punta en su lugar.

Para más información:

 **OSHA®** Administración de Seguridad y Salud Ocupacional
Departamento de Trabajo de los EE. UU.
www.osha.gov (800) 321-OSHA (6742)



DISCUSSION

Chainsaw Training Plan

- What training do you provide?
- What task progression would you start a new chainsaw cutter doing?
- What is your mentorship plan?

Knowledge Check



- What should you do before you start using your chainsaw?
- You should not bother to use chaps with electric chainsaws? TRUE or FALSE?
- Give 3 examples of how to prevent kickback?

Acknowledgements

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