



Pacific Crest Trail Association



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Association

Chain Saw Specific Training

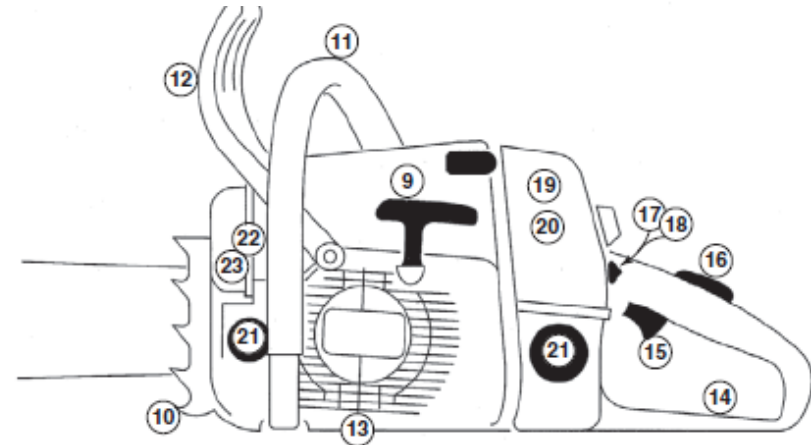
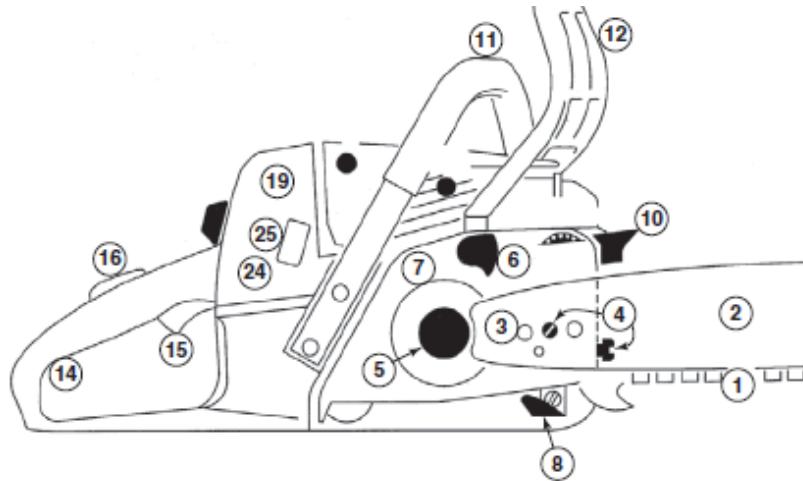
For Trainee Saw Operators and Saw
Operators

April 2017





Parts of a Chain Saw



- 1 Saw chain
- 2 Guide bar
- 3 Bar studs
- 4 Front and side chain tensioners
- 5 Chain sprocket
- 6 Chain brake
- 7 Clutch
- 8 Chain catcher

- 9 Starter grip
- 10 Bumper spikes (dogs)
- 11 Handlebar
- 12 Hand guard
- 13 Gunning marks
- 14 Throttle handle
- 15 Throttle trigger
- 16 Throttle interlock
- 17 On/off switch

- 18 Choke
- 19 Air filter cover
- 20 Air filter
- 21 Oil and fuel caps
- 22 Muffler
- 23 Spark arrester
- 24 Spark plug
- 25 Carburetor adjustments

From Chain Safety Manual, permission by Stihl, Inc.

From 0667-28805-MTDC



Chain Saw Safety Components

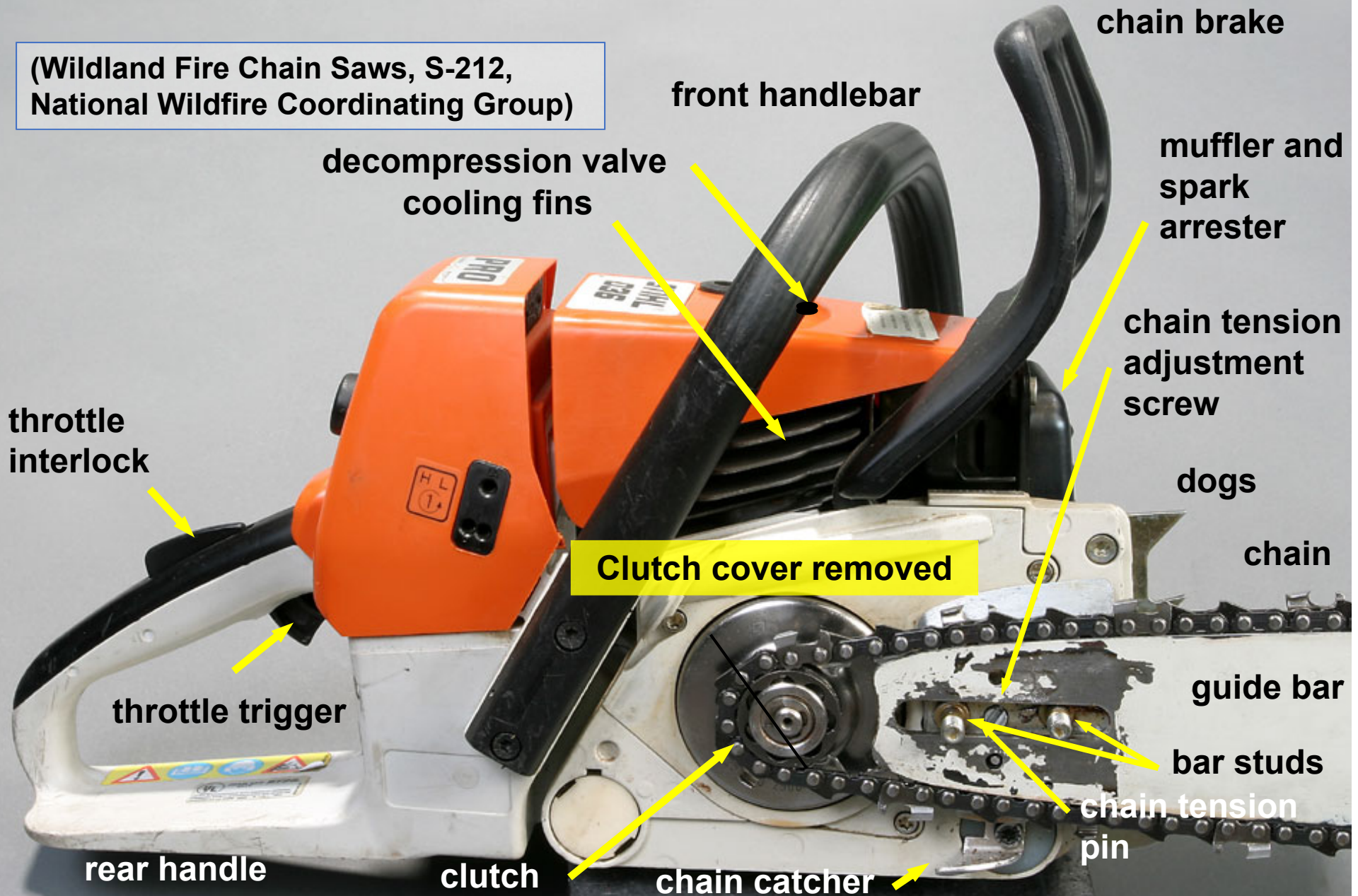
- Chain brake
- Chain catcher
- Bumper spikes, aka dogs
- Bar cover (protection from chain and dogs)
- Throttle Interlock
- Muffler, with Spark Arrestor

Note: Saw Safety & Maintenance Components color coded
Stihl – Black Husqvarna - Gray



Parts of the Chain Saw

(Wildland Fire Chain Saws, S-212,
National Wildfire Coordinating Group)



Parts of the Chain Saw

safety information

air filter cover

gunning mark

on/off switch and choke

throttle interlock

oil tank

flywheel/fan

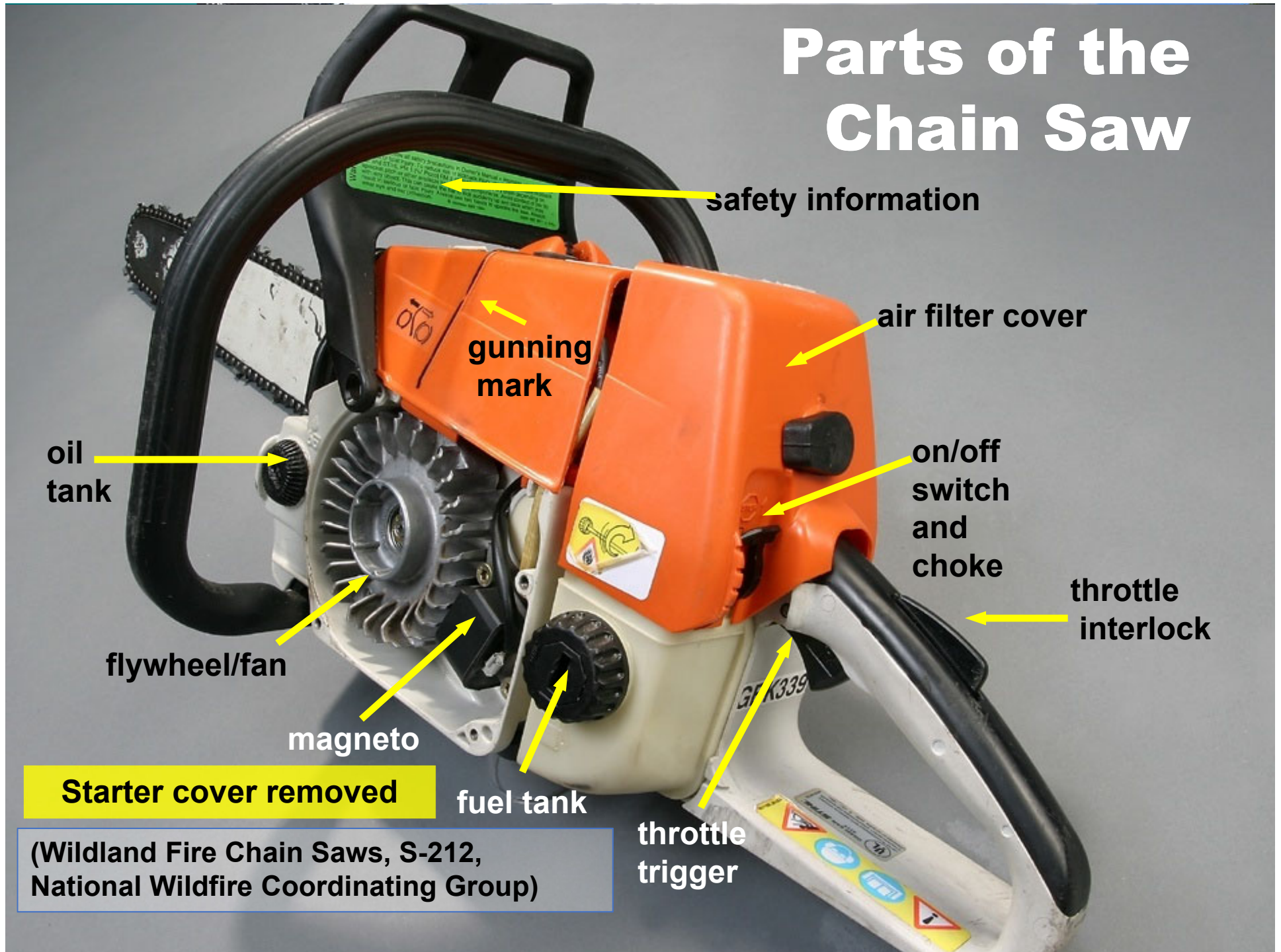
magneto

fuel tank

throttle trigger

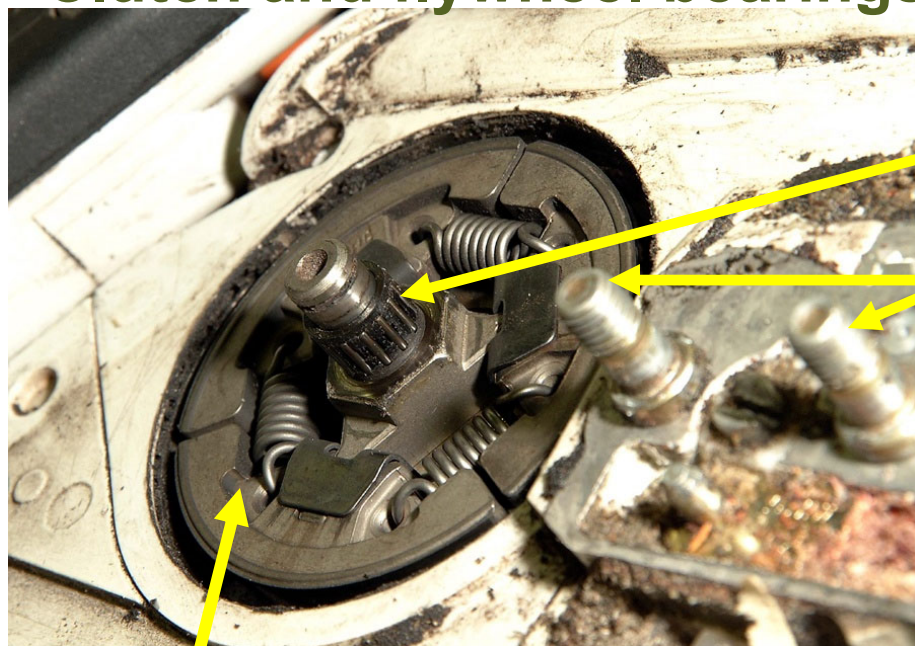
Starter cover removed

(Wildland Fire Chain Saws, S-212,
National Wildfire Coordinating Group)





Clutch and flywheel bearings



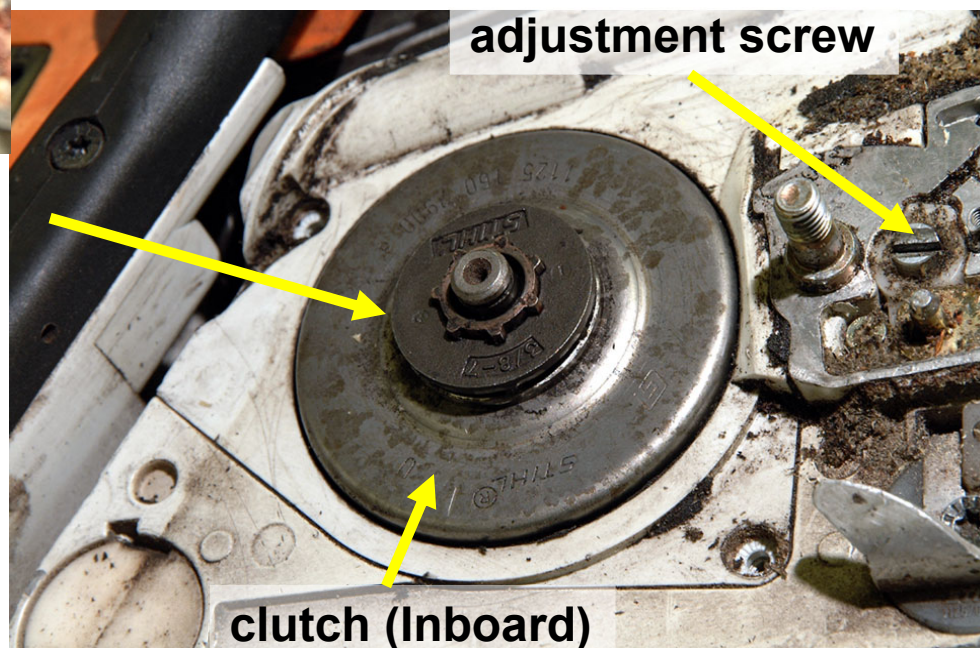
needle
bearings

bar studs

clutch assembly
(clutch cup
removed)

drive sprocket
(rim sprocket shown
– sprocket pitch must
match chain pitch)

Sprocket and Clutch Cover



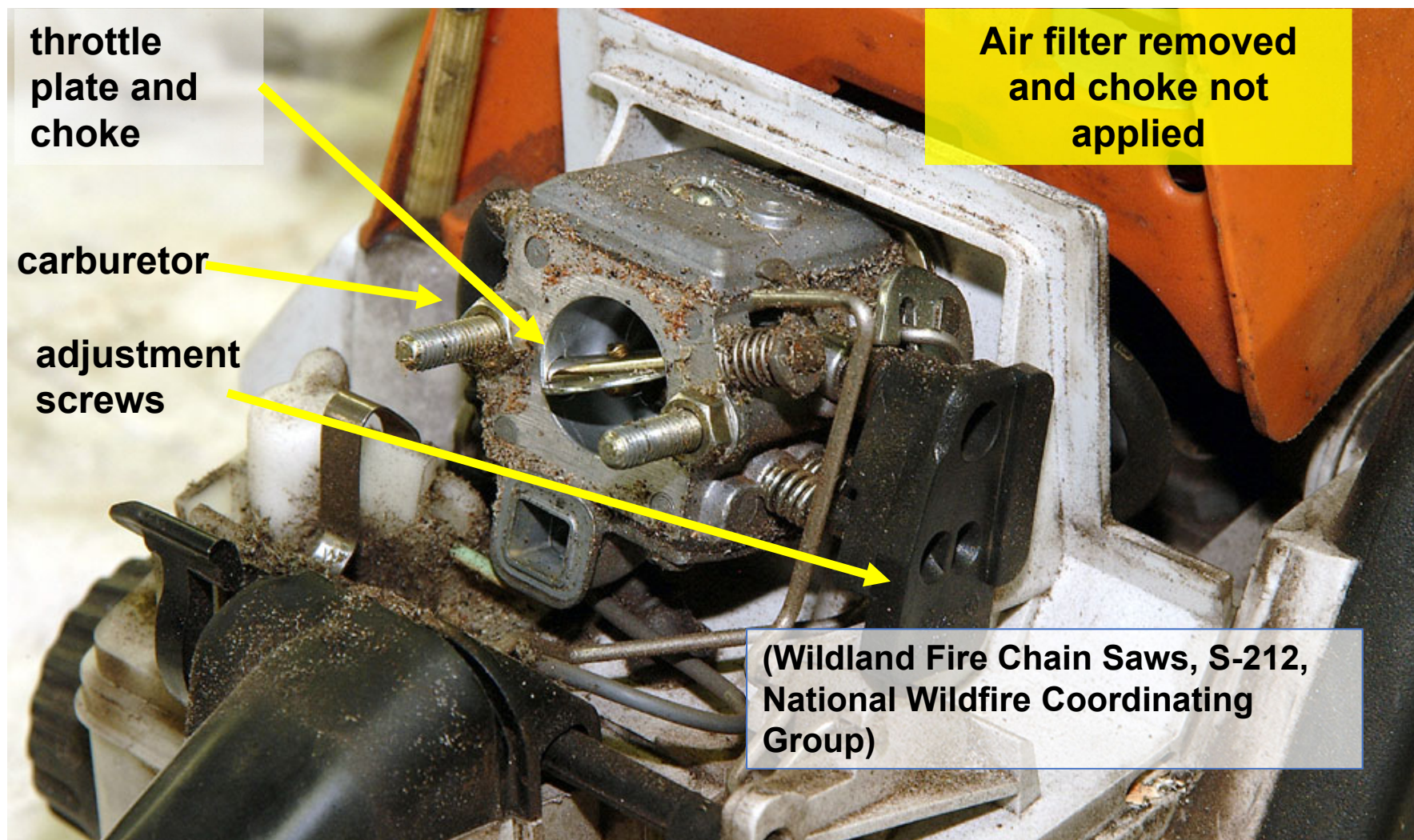
chain tension
adjustment screw

clutch (Inboard)

(Wildland Fire Chain Saws, S-212,
National Wildfire Coordinating Group)

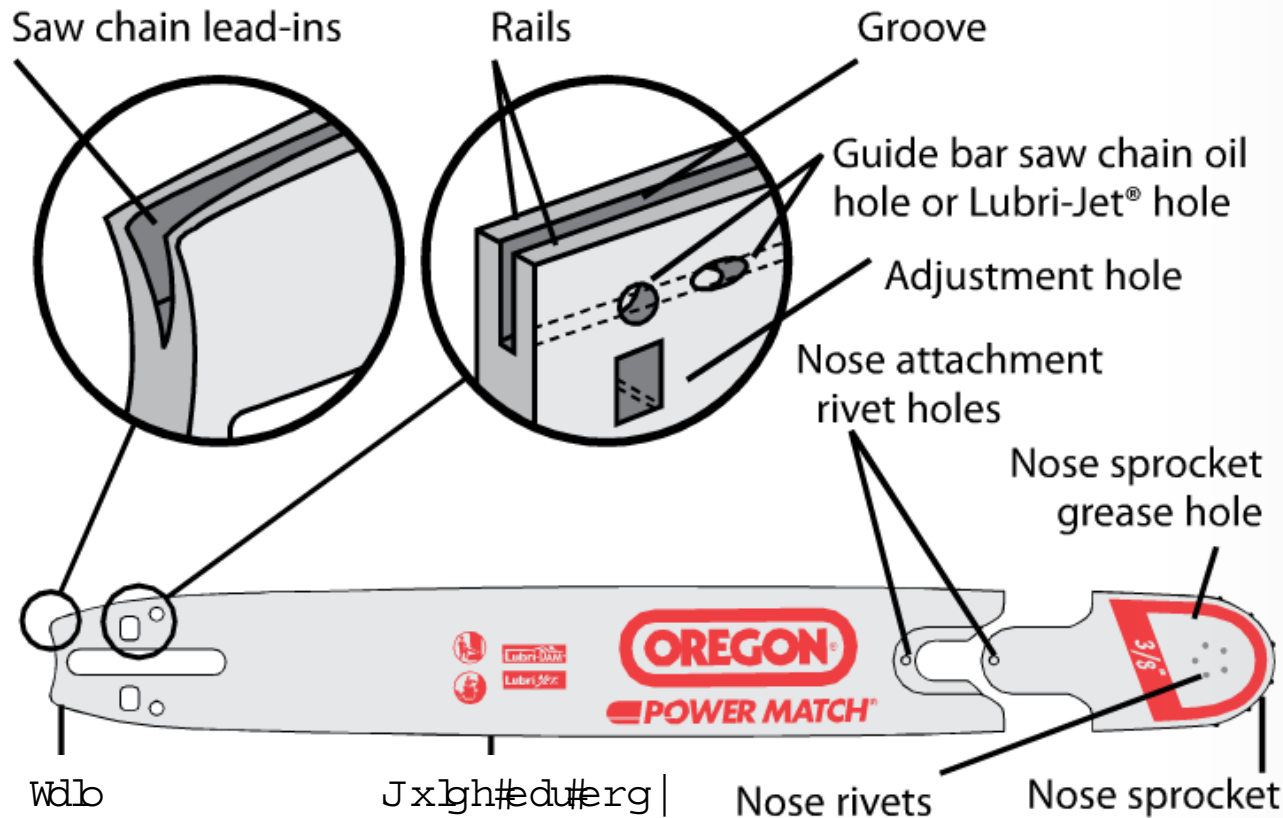


Carburetor





Chain Saw Bar Terms



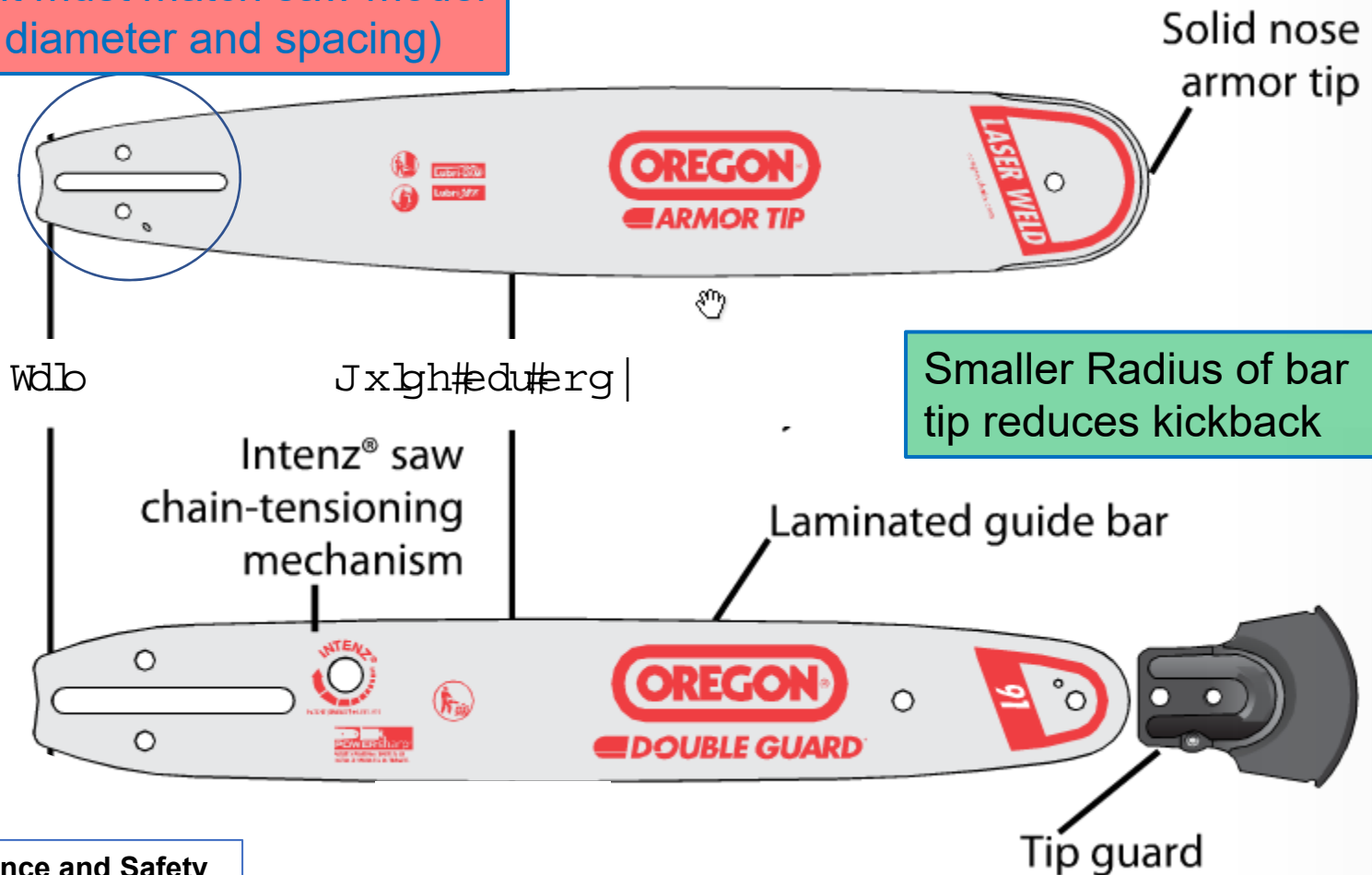
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Manual, Blount, Inc





Chain Saw Bar Terms

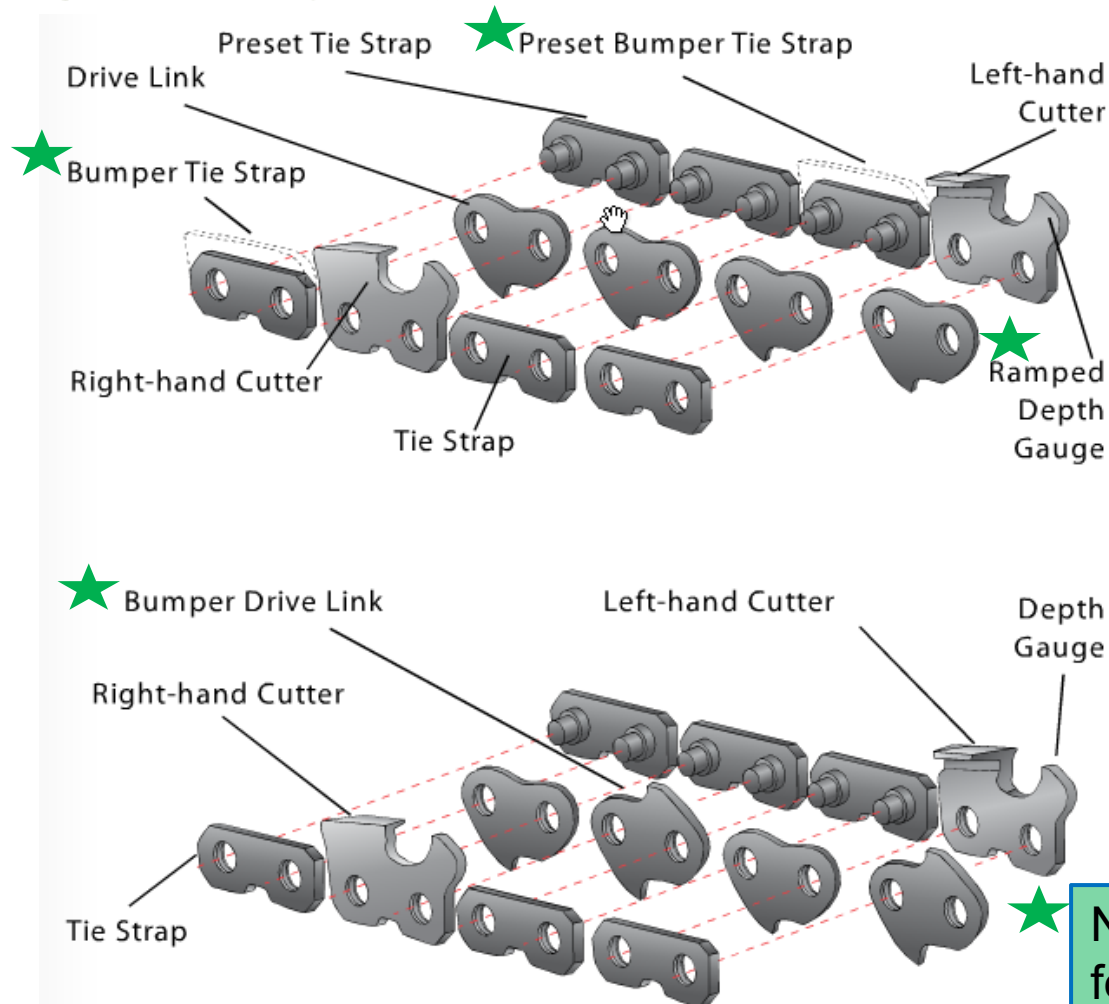
Bar mount must match saw model
(bar stud diameter and spacing)



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Saw Chain



Tie Straps and Cutters held together with rivets

Note: These parts of a chain are features that can reduce kickback



Kickback

What is Kickback?

Kickback is the violent backward and/or upward motion of the chain saw guide bar occurring when the saw chain near the nose or tip of the guide bar contacts any object, such as another log or branch, or when the wood closes in and pinches the saw chain in the cut.

Avoiding Kickback Injury

Kickback Awareness

1. Be alert at all times to guard against a possible kickback reaction. Always be aware of the position of your guide bar's nose.
2. Different models of saw chain are available for most cutting tasks. Use the saw chain, suitable for your type of cutting, with the lowest kickback potential.
3. Narrow-nose guide bars such as our Double Guard® guide bars are recommended for maximum kickback safety.



Bar Reaction
when Kickback
Occurs

Potential kickback situation

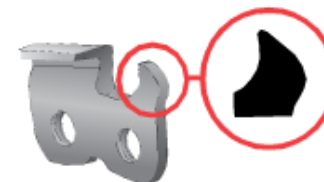


Low Kickback Saw Chain

Bumper
Drive Links



Ramped
Depth Gauge



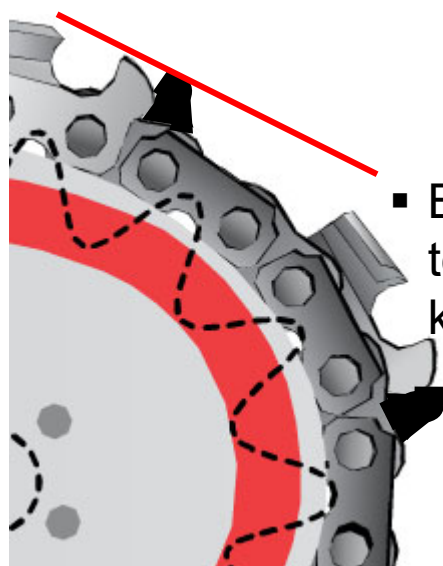
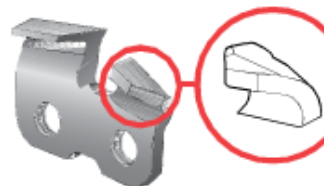
Bumper
Tie Straps



Low Profile
Ramped
Depth Gauge



Wide-Track
Vanguard™
Depth Gauge



- Bumpers increase raker height as tooth passes thru bar tip, reducing kickback potential
- Most low kickback chains do not allow for boring into wood

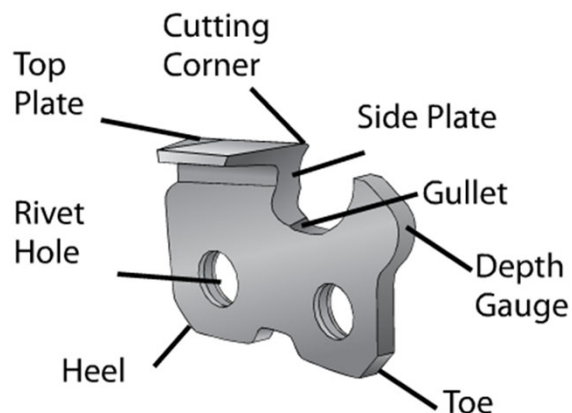
These parts of a chain are features that can reduce kick back of the chain

Low kickback chain often designated by a green drive link or green label on box

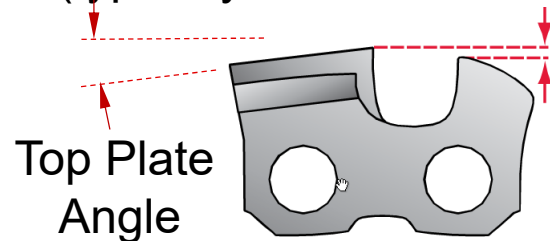


Chain Saw Cutter

Parts of a Cutter



Raker Depth
(typically 0.025" or 0.030")

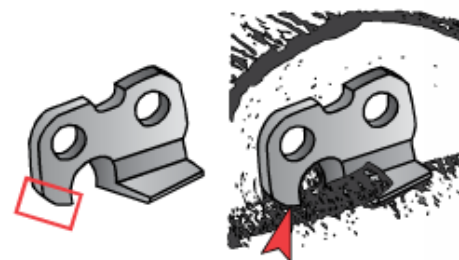


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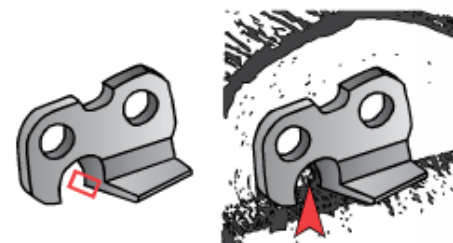
How a Cutter Works

Understanding how cutters work can help you see why proper saw chain maintenance is so important.

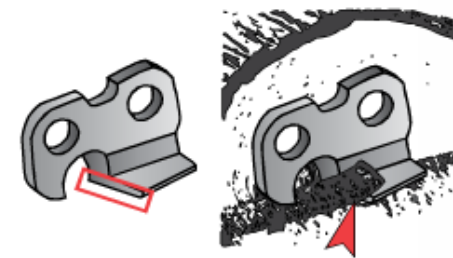
1. The depth gauge rides on the wood and controls the depth at which the working corner bites in.



2. The working corner and side plate sever the wood fibers across the grain. This is the hardest part of the work.



3. The top plate cutting angle chisels out the severed wood fibers, lifting them up and out of the kerf.





Chain Saw Cutter

CUTTER MAINTENANCE TERMS

DEPTH-GAUGE
SETTING



TOP-PLATE
FILING ANGLE



TOP-PLATE
CUTTING ANGLE



SIDE-PLATE ANGLE



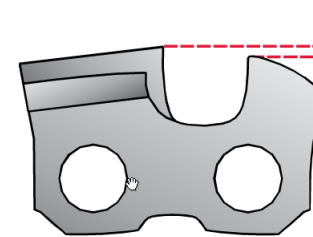
FILE-GUIDE ANGLES



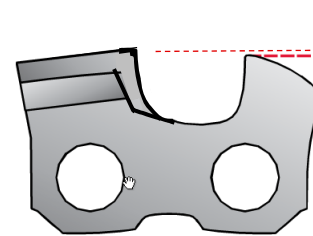
- Correct raker height is key for cutting performance and safety
- Tall raker will not cut wood
- Short raker has higher kickback potential due to aggressive cut

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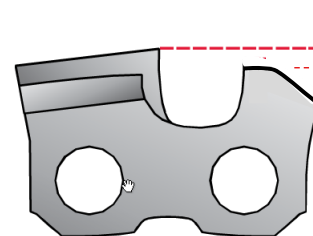
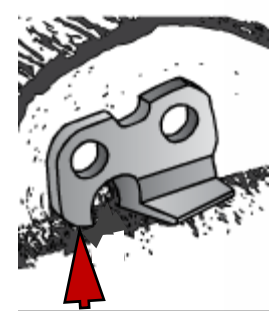
Depth Gauge



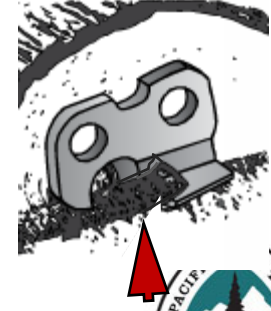
Correct Depth Gauge



Tall Raker


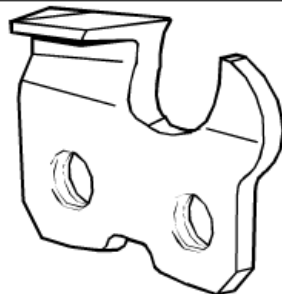


Short Raker





Types of Saw Chain

Semi-Chisel	
7	
Chisel	
7	

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- More Durable in dirty conditions
- Becoming less common to find
- Available in Square Ground and Round Ground
- Round ground easier to file in the field with round file
- Square ground cuts faster, but harder to file



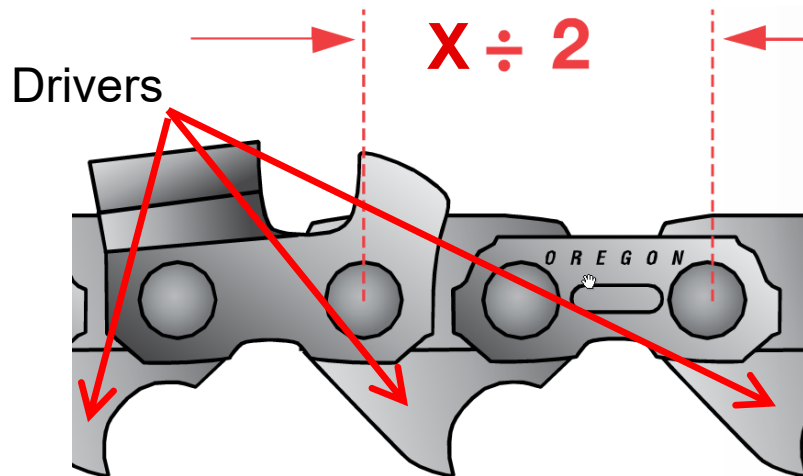


Types of Saw Chain

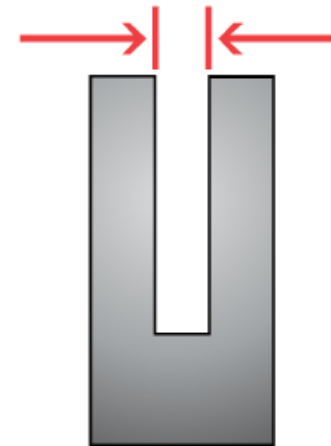
Pitch

Pitch = (Distance of Drivers) / 2
Standard Pitches: 0.325" & 3/8"

Chain length determined by
number of drivers



Gauge



Width of groove in Bar
Standard Gauges:
0.050" (1.3 mm), 0.058"
(1.5 mm) & 0.063" (1.6 mm)

Oregon Maintenance and Safety Manual,
Blount, Inc





Types of Saw Chain

Saw Chain Cutter Sequence Terms

Standard



Semi-Skip



Skip



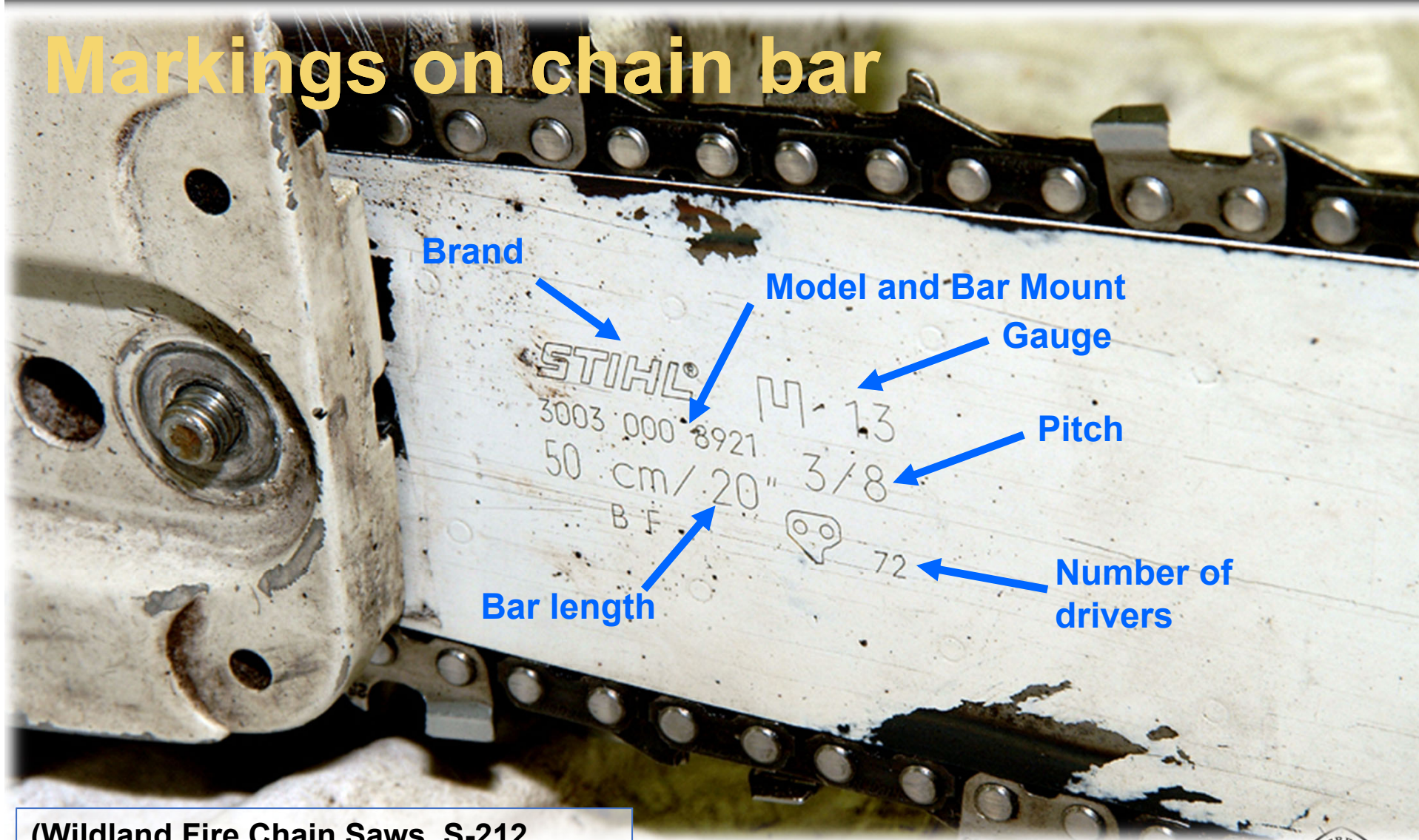
- **Standard Chain (or Full Comp)** recommended up to 24" bars
- **Skip chains** recommended for 28" bars and longer, especially when cutting softer wood (more room for chips)

Caution – Skip Chains are not recommended for brushing with higher kickback potential and harsh operation, due to wide tooth spacing





Markings on chain bar



(Wildland Fire Chain Saws, S-212,
National Wildfire Coordinating Group)





Chainsaw Size

- **Become familiar with the chain saw size**
- **Chainsaw size is usually referenced in engine displacement (usually “cc” or cubic centimeter)**
 - ▶ Larger saws have more power and are heavier
 - ▶ Smaller saws are easier to handle and learn skills
 - ▶ 45 cc – 75 cc saws are typically used for trail work
- **Saw bar length is matched to saw size and power**
 - ▶ Smaller saws use shorter bars (16-20”) and larger saws use longer bars (20-28”).
- **Only operate chainsaws with bars and chains that you have experience and can operate safely**





Filing a Chain Saw

- Square Ground chains can be filed with a double bevel flat file, 3 Corner file, or a Square Grinding Wheel
- Requires specialized equipment and requires advanced filing technique
- Round ground chains can be hand filed in the field using a round file with the diameter specified by the chain manufacturer
- File guides allow for precise control of height of file in the cutter tooth and also filing angle – some include raker files
- Bar mounted file guides allow for more precise hand filing
- Round wheel grinders are also available for high volume chain sharpening

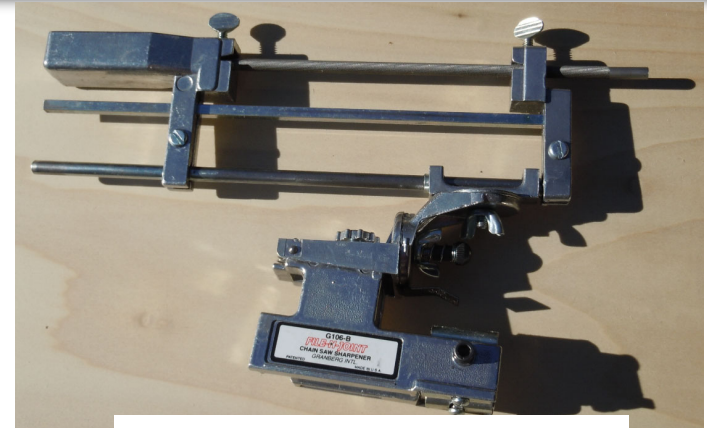




Filing Tools



Round file, raker file, depth gauge, roller guide, file guide, file guide with raker file (single and dual side)



Bar Mount File Guide



Stump Vise



Filing Technique

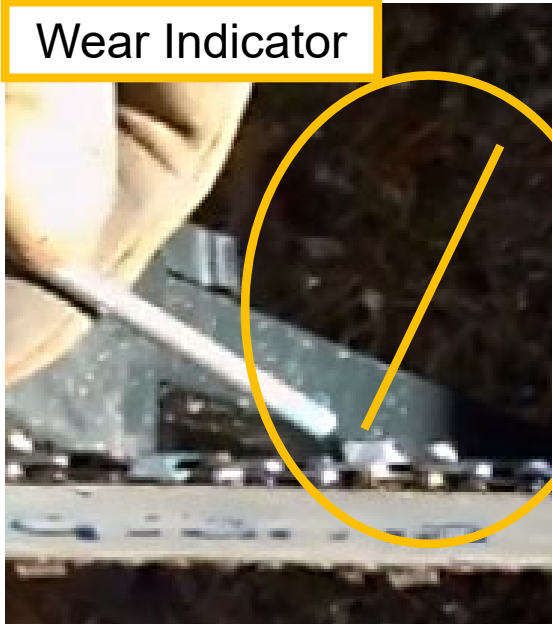
- **MUST match file technique to the chain manufacturer instructions and guidelines:**
 - File Diameter
 - File Angles
 - Raker Depth
 - File Depth
 - Cutter Angle
 - File Guide
- Only file in the direction, from the inside to the outside, and only file cutters on one side, then switch to other side
- File cutters that are accessible, then roll chain forward to reveal unfiled cutters
- Ensure bar is supported when filing – use vise when possible, use keft in log, or control with spare hand
- Increase the tension on the chain to improve control to restrain each too then filing



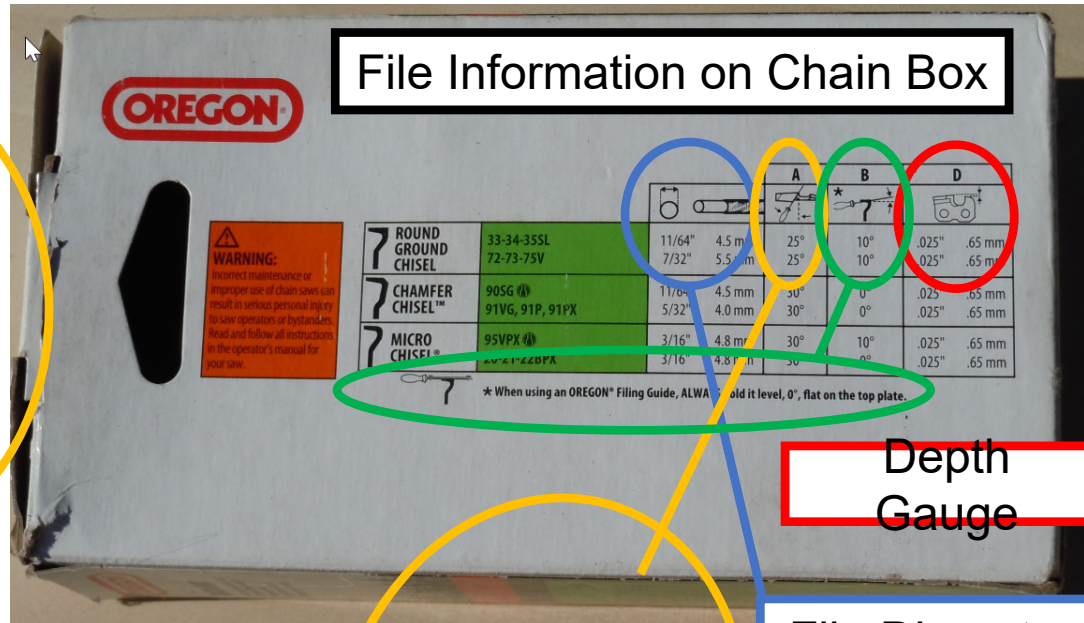


File Instruction

Wear Indicator

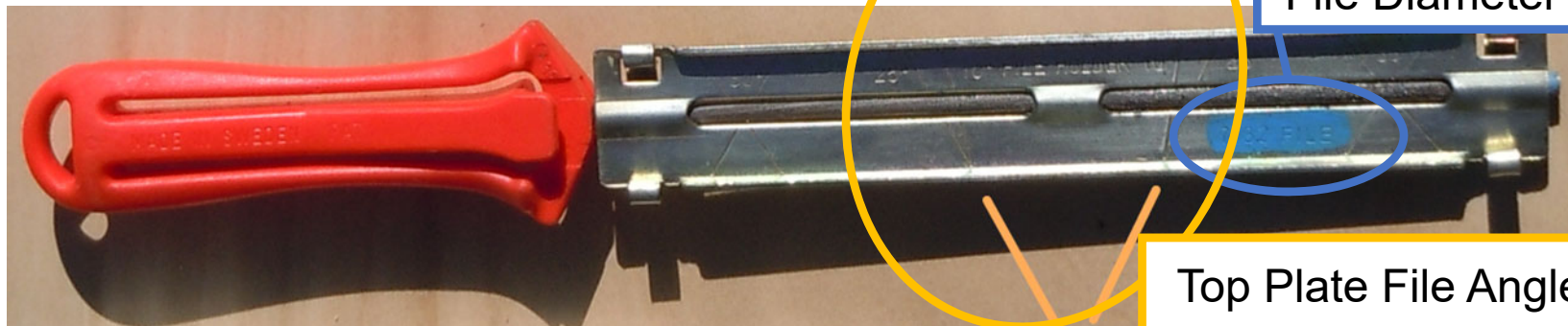


File Information on Chain Box



Depth Gauge

File Diameter



Top Plate File Angle



Filing Technique

- **Always match the angle of the file to the recommended Top-Plate filing angle – use the marked angles in the file guide aligned to the bar, as an aid**
- **Top-Plate file angle is usually 25° or 30°**
- **The Top Plate and Side Plate Cutting Angles are reference, very difficult to measure, and are achieved when following the recommended filing guidelines**
- **When hand filing, the file guide is held 90° to the bar**
- **Throw away chain when filed down to the wear indicators on the cutter**
- **ALWAYS WEAR CUT-RESISTANT GLOVES when filing and handling chain**





Filing Technique

Useful Videos

Stihl Chain Saw Maintenance and Operation – Chapter 3

<https://www.youtube.com/watch?v=qvcCh2XqEPc>

Husqvarna Chain Saw How to Use Videos – Getting Started -6

<http://www.husqvarna.com/us/support/how-to-videos/chain-saw-videos-how-to-use/>





Filing Technique

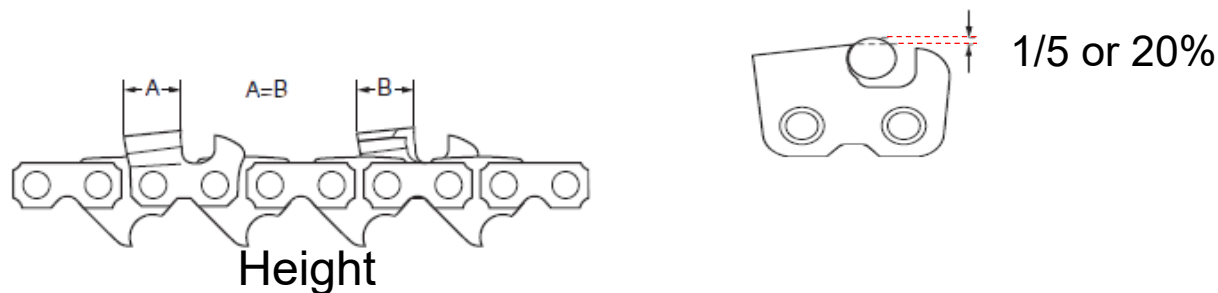
- **Match file technique to type of file guide used:**
 - ▶ Free hand – use slight rotation of file, rotate upwards along the cutter, to help keep the proper file height
 - ▶ Roller Guide – ensure guide sits on tie straps, with correct orientation, so the roller angle matches the top plate angle (high end of guide towards power head). File in direction of arrow on the guide
 - ▶ File Guide – Ensure file guide sits on both top plate and raker (usually at 90° to bar, per instructions)
 - ▶ File Guide w/ Raker File – File only in the proper direction to match side of cutters. Follow instructions. Does not work with Skip Chains.





Filing Technique

- Ensure cutters are filed to the same length with proper file height



- Repair any damaged cutting surfaces during filing
- Check raker depth using depth gauge and file with raker file to required height.



- Use proper Depth Gauge - ensure it rests on all the cutters
- Only file Inside to Outside
- Use raker file with no teeth on edges
- Dress to round off sharp corner of raker

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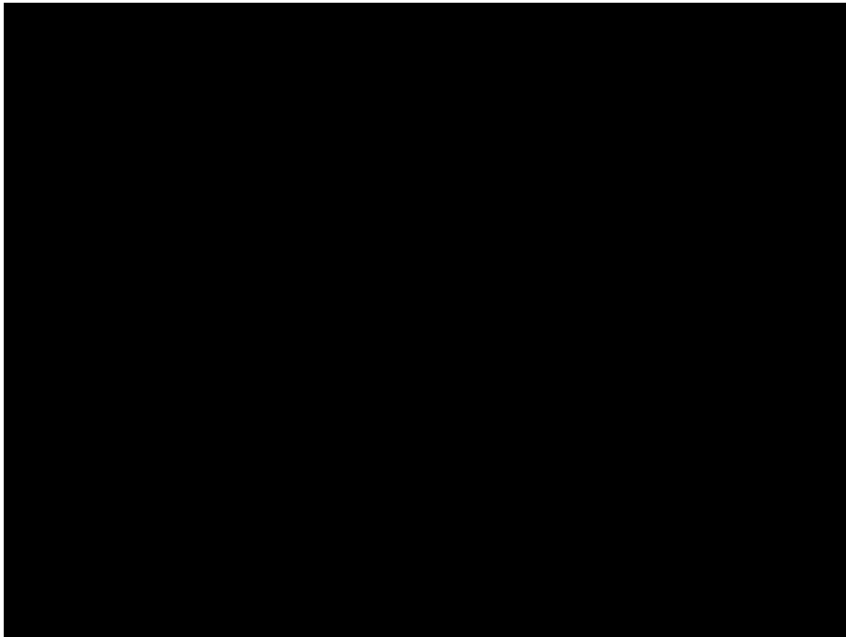
Chain Saw Starting Procedure

- Chain brake **MUST** be on when starting
- **NO DROP STARTING**
- Find the best method that works for you
 - ▶ Ground Start (kneeling or bent over), or Leg Start
- **MUST** have 2 points of control when starting
- Follow starting procedure in manual
 - ▶ Apply Choke, or Half Choke as described in operator manual for cold and warm starting
 - ▶ Use decompression valve (if saw equipped with feature)
 - ▶ Remove Choke, once saw “burps” or partially fires, then continue pulling starter cord until saw starts





Chain Saw Starting Procedure



Starting Between Legs



Starting on the Ground

(Wildland Fire Chain Saws, S-212 Video, National Wildfire Coordinating Group)



Chain Saw Operation

- Left Hand **MUST** wrap around handlebar with thumb locked
 - ▶ Saw should be balanced in left hand so that bar is vertical and cuts straight, not at angle
 - ▶ Watch position of left hand on bar, so it returns to balance point on handlebar
 - ▶ Keep comfortable and firm, but relaxed grip on handlebar
 - ▶ Left hand controls roll of chainsaw
 - ▶ Right hand controls pitch and yaw of chainsaw
- Right Hand **MUST** wrap thumb around rear handle
- Be prepared for reactive forces of saw and for Kickback





Chain Saw Operation

- Stand Perpendicular to the log, with the saw in front of the body to allow room to move saw in and out of log
- Keep out of the plane of the saw, incase of kickback
 - ▶ Can look down the bar to align cuts
- Don't overreach arms – Stand close to log and saw
 - ▶ Arms should be bend slightly
 - ▶ If possible, rest saw handlebar or rear handle on thigh or support forearm on knee to relieve weight of saw
- Don't move feet when transitioning between cuts to ensure the cuts remain aligned
- **MUST** be prepared for kickback and reactive forces





Chain Saw Operation

- **Don't apply throttle with the chain engaged in the wood**
 - ▶ Lift bar so the chain is not contacting the wood to reduce reactive forces (push back/pull in)
- **Balance the throttle to increase the engine speed as the chain engages the wood – use finesse over force**
- **Keep engine speed high 75%-100% throttle when in the wood**
 - ▶ Time the release of the throttle as the saw stops cutting to reduce fuel consumption and reduce wear
 - ▶ Allow inertia of saw motor to finish cut and clear chips
 - ▶ Don't bog down motor – this is a sign of forcing the cut or binding or twisting the saw bar





Chain Saw Operation



(Wildland Fire Chain Saws, S-212 Video, National Wildfire Coordinating Group)





Chain Brake

- **Apply Chain Brake with the back of the Left Hand**
- **Don't use Right hand to apply chain brake**
 - ▶ Get comfortable applying and releasing brake with left hand without having to look at hand
 - ▶ Keep left hand tethered to handlebar, with left thumb
 - ▶ Can use right hand to set brake, only when saw is not running (such as setting brake before starting saw)
- **Apply brake when moving around log or brush, or when distracted during cutting operation**
- **Apply brake when setting saw on the ground**
- **Apply brake when shutting off, so it's ready to start**





Kickback

- Kickback occurs when the upper corner of the bar nose contacts wood
- Commonly occurs when cutting on top side of bar (such as undercutting) or boring
- Can occur when bar is extended beyond the log and strikes other objects on other side of log
 - ▶ Be sure to inspect offside of log and brush out clearance before cutting on log
 - ▶ Be aware of bar and how much is exposed on far side
- Kickback can occur when brushing, with risks of striking hidden objects and overreaching the bar





Chain Saw Operation

● Keep Chain Sharp

- ▶ Monitor as cutting performance decreases
- ▶ Replace dull chain or file in field with proper file guide
- ▶ Using dull chain will increase wear on chain & bar

● Keep air filter clean

- ▶ Frequently remove and tap off excess dirt
- ▶ Clean per instructions in manual (usually wash in soap or detergent and water)
- ▶ Apply choke when removing filter to prevent dirt and saw chips from being ingested into carburetor
- ▶ Check for dirty air filter if saw does not start





Chain Saw Operation

● Maintain proper chain tension

- ▶ Chain will stretch as it warms with use, and lose tension
- ▶ New chains will stretch on initial use – watch closely
- ▶ Loose chains increase wear on bar and chain
 - *Loss of lubricant*
 - *Increased contact wear on bar near drive sprocket*
- ▶ Loose chain tension can result in a thrown chain
 - *Most likely to throw chain when Brushing, Cutting small diameter trees and Spring poles*
 - *Increased risk when kerf closes and catching loose chain*
- ▶ Check tension when refueling





Chain Saw Operation

● Maintain proper chain tension

- ▶ Thrown chain will be caught in chain catcher,
 - *Inspect thrown chain for burrs and tight links*
 - *Remove burrs on drivers of thrown chain with flat file, before reusing chain*
 - *Ensure chain has no tight links, fits properly in bar groove and moves freely around bar nose*
- ▶ Be aware of chain tension when saw cools
 - *Tension will increase and can cause high loading*
 - *Reduce tension when storing saw*





Chain Saw Operation

- **Use scrench to adjust chain tension**
 - ▶ Loosen bar nuts and tighten chain to be snug to bar
 - ▶ Long bars will appear to have less tension on chain
 - ▶ Solid nose bars require less tension
 - ▶ For bars with a drive sprocket nose and cold saw:
 - *Hold bar up with spare hand*
 - *Tighten chain until the middle of chain just contacts bar*
 - *Check tension - pull on chain and it should snap back*
 - *Check tension - chain moves freely without any drag*
 - ▶ Tighten Bar Nuts, while supporting bar
 - ▶ Know the proper tension needed for the saw that you use





Chain Saw Operation

- **Ensure Adequate Bar and Chain Lubrication**
 - ▶ Chain and bar require lubrication with oil
 - ▶ Never operate a saw without bar oil in tank
 - ▶ **ONLY** use designated Bar and Chain Oil with chain saw
 - ▶ Many saws have adjustable oil flow
 - *Match flow to bar length – longer bars require more flow*
 - *Set oil flow to run out of bar oil after running out of fuel*
 - ▶ **Allow oil to flow to chain - Clean bar of debris**
 - *Clean oil passage and Groove in bar*
 - *Use groove cleaning tool (multi-tool or depth gauge)*
 - ▶ **Monitor oil flow - watch for oil splatter off chain**





Chain Saw Operation

● Replacing the Chain

- ▶ Release chain brake, set saw on stable surface, with clutch cover oriented up
- ▶ Loosen bar nuts and turn chain tension adjuster all the way to increase slack in the chain
- ▶ Remove bar nuts (DO NOT LOSE!!) and remove clutch cover
- ▶ Remove chain from bar nose end or drive sprocket (latter only possible with inboard clutch)
- ▶ Remove bar by raising bar to clear chain adjuster and the lift over bar studs (notice what side of bar was facing out)
- ▶ Clean out groove in bar to ensure proper flow of bar oil





Chain Saw Operation

● Installing the Chain

- ▶ Flip saw bar so opposite side is facing out
- ▶ Slide the bar over the bar studs put bar in the rearmost position in the chain tension adjustment pin
- ▶ Put chains over drive sprocket and feed into top groove working toward bar nose and then around bar nose
- ▶ Ensure chain is seated properly in drive sprocket and bar groove and is not backwards (top cutting teeth facing forwards is correct)
- ▶ Install clutch cover and snug up bar nuts to secure cover
- ▶ Set tension on chain and ensure chain moves freely
- ▶ Tighten bar nuts, confirm proper chain tension, set brake





Chain Saw Fuel and Bar Oil

● Bar and Chain Oil

- ▶ Only use approved Bar and Chain Oil
- ▶ Recommended to use Biodegradable Bar and Chain Oil

● Fuel

- ▶ Use of ethanol fuels can cause costly repairs
- ▶ Use Non-Ethanol Premium and add a stabilizer, like Sta-Bil, for storage
- ▶ Store only in full container and store unmixed only
- ▶ Mix with approved Two-Stroke Oil at required ratio, usually 50:1 and only mix when needed
- ▶ Drain fuel tanks at end of season, and run saw dry.
- ▶ Can use Pre-mixed fuel, but is more costly





Fuel Pressurization

- **Pressure in fuel tanks and fuel bottles**
 - ▶ Systems are not vented to relieve pressure
 - ▶ Fuel blend (summer and winter) behave differently, with winter fuels more volatile
 - ▶ Changes in environment (increased elevation and elevated temperatures)
- **Fuel in tanks and fuel bottles can become superheated**
- **Vapor Lock is one symptom, be aware of poor running saw, or poor starting saw, with ½ tank of fuel**
- **Fuel will boil or geyser, when cap pressure is released**
- **High risk of sprayed fuel and highly flammable vapors exist leading to fires due to hot engine or muffler**





Chain Saw ReFueling

- **Pressure in fuel tanks and fuel bottles**
 - ▶ Allow time for saw to cool (at least 5 min) before refueling
 - ▶ Aim opening away from body
 - ▶ Open cap slowly to relieve pressure
 - ▶ Turn cap to unlock, but do not remove cap
 - *Stihl Locking Caps require only ¼ turn to remove*
 - *Allow pressure to vent, before removing cap*
 - *Full thread caps are easier to vent*
- **Do not Overfill fuel tank**
 - ▶ Leave enough room for air pocket and fill cap
- **Do not start saw within 10 feet of area of refueling**
- **Remove any clothing or PPE soaked with fuel**





Chain Saw Operation

● Working with Swampers

- ▶ Saw Crew Leader is responsible to ensure Swampers are briefed about hazards of working around chainsaws
 - *Don't reach in to grab cut pieces with running chainsaw*
 - *Kickback and blood circle – maintain clearance*
 - *Methods to get Sawyer's attention and to direct swampers, when saw is running*
- ▶ Full chainsaw PPE is required for swampers if they are working within 10' of Sawyer
- ▶ Volunteers have full range of experience levels as swampers, but expect inexperience
- ▶ Apply chain brake or shut off chainsaw when swampers are clearing cut brush, limbs or logs





Chain Saw Tools

Required

- **PPE**
- **First aid kit**
- **Communications**
- **Fire extinguisher**
- **Chain saw + bar cover**
- **Fuel + chain oil**
(in approved containers)
- **Bar wrench (Scrench)**
- **Single-bit, straight-handled axe + sheath**
- **Bucking wedges**
- **Pruning saw + sheath**
- **Flagging**





Chain Saw Tools

Recommended

- Extra chain(s) and/or filing kit with file guide and gauge
- Saw maintenance kit (air filter, fuel filter and spark plug)
- Extra bar
- Multi-tool
- Chain saw pack, or padded saw cover
- Loppers, Pruners and/or Clippers
- Small shovel or combi-tool
- Spare bar nuts, & pull cord
- Extra fuel and bar oil





Chain Saw Tools

Project Dependent

- **Pulaski**
- **Peavey, cant hook**
- **Log carrier**
- **Double-bit axe + sheath**
- **Basic rigging: strap, rope, come-along**





Pacific Crest Trail Association

A photograph of a dense forest with tall, thin trees and a rocky ground. In the background, a mountain with snow is visible under a blue sky with clouds.

Questions?