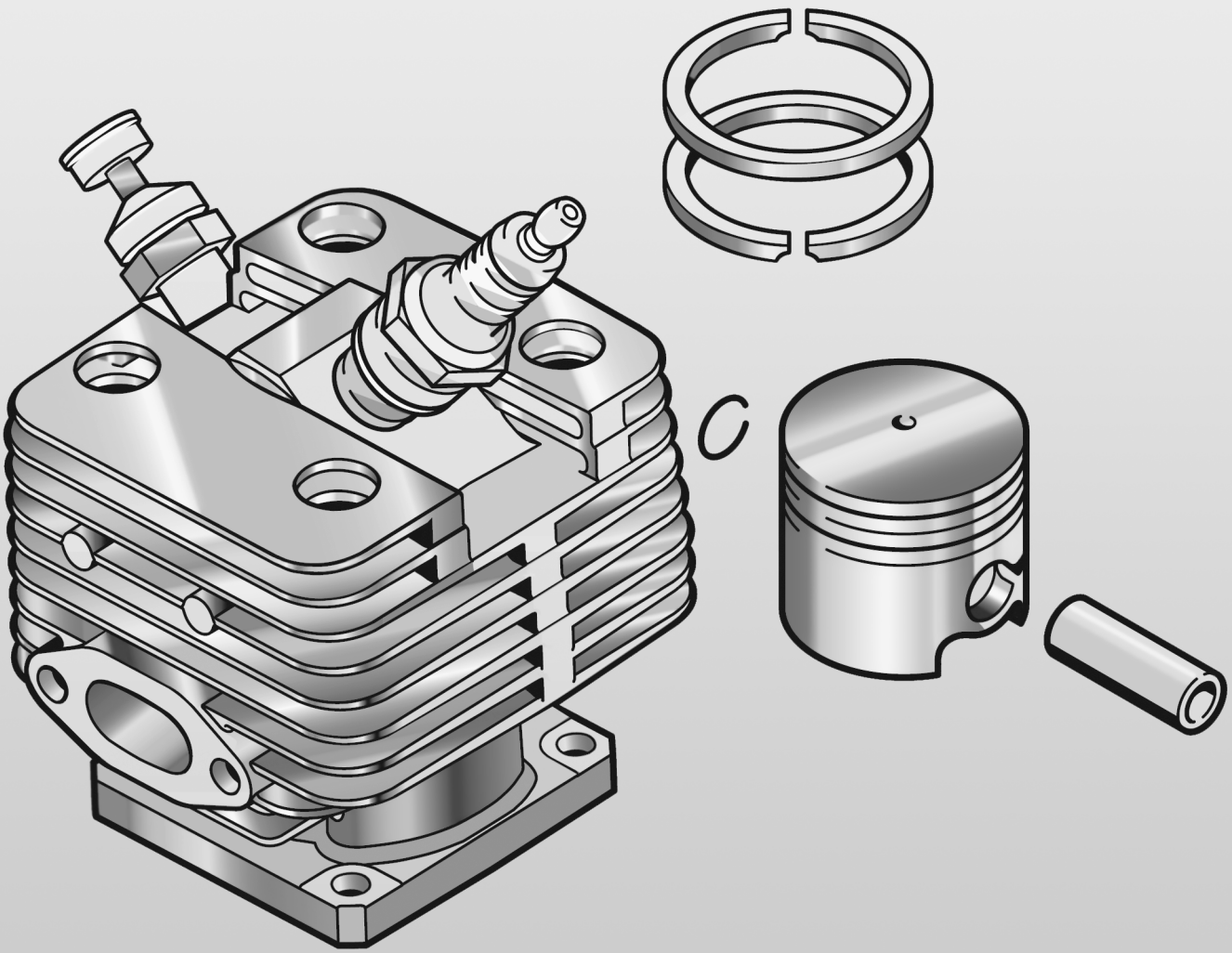
STIHL®

Fault Analysis

2004-02



Fault Analysis

Assessment of Damage

STIHL®

1. Piston

1.1 Location: Running surface of piston

Condition: Scores over entire running surface

Causes: Incorrect fuel mixture
- No engine oil in fuel
- Too little oil in fuel mix
- Fuel old or of unsuitable quality

Fig.: Exhaust side

Fig.: Inlet side

1.2 Location: Piston head

Condition: Burnt out

Causes: Preignition as a result of
- Spark plug with too low a heat range
- Fuel with too low an octane rating (< 90 RON)

1.3 **Location:** Exhaust side of piston

Condition: Scores over entire running surface

Causes: Inlet mixture too lean
- Fuel feed interrupted
- Impulse hose dirty or leaking
- Crank drive leaking

Results in over-revving and insufficient lubrication.

1.4 **Location:** Exhaust side of piston

Condition: Scores over entire running surface

Causes: Thermal overload due to inadequate cooling
- Fan housing very dirty
- Cylinder fins heavily loaded with dirt

Results in overheating or seizure at front right next to muffler.

1.5 **Location:** Exhaust side of piston

Condition: Scores and oil carbon residue over entire running surface

Causes: Unsuitable engine oil or over-rich carb setting causes excessive build up of carbon on piston head. Oil carbon can burn off as a result of an increase in combustion chamber temperature brought about by:
- Making carb setting leaner
- Mixture becoming leaner due to air entering through a leak
- Changing fuel mixture (e.g. to unleaded gasoline or synthetic engine oil)

1.6 Location: Exhaust side of piston

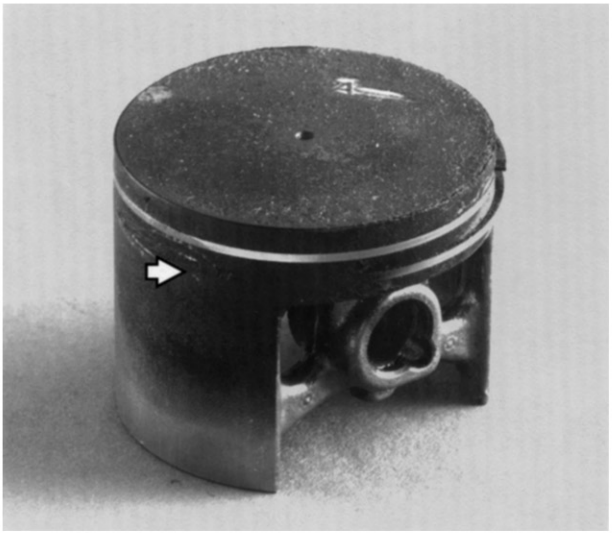
Condition: Worn running surface

Causes: Dirt particles and oil carbon in exhaust port have got between piston skirt and cylinder.

1.7 Location: Area of piston rings

Condition: Carbonization

Causes: Unsuitable engine oil has been used which sticks between piston rings and piston and restricts movement of rings.



1.8 Location: Interior of piston

Condition: Deposits

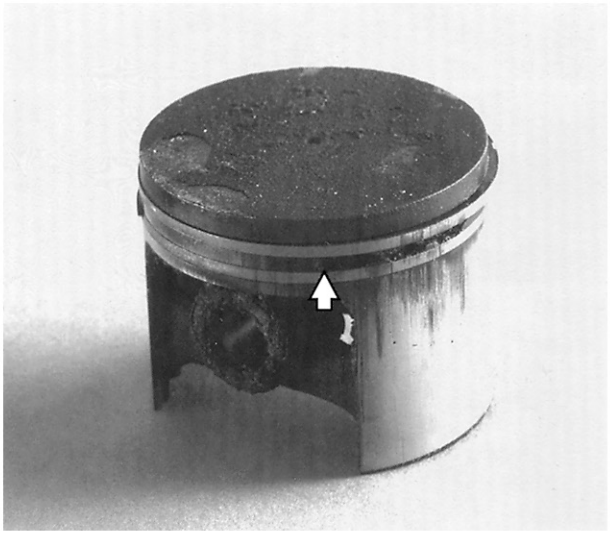
Causes: Chain lubricant seeps into crankcase or combustion chamber through a leaking joint and accumulates on piston and other parts of engine.

1.9 Location: Piston land

Condition: Broken

Causes: Abnormally high pressure on piston ring is transmitted to piston land

- Preignition /pinking (octane rating of fuel < 90 RON) results in increase in pressure and overheating

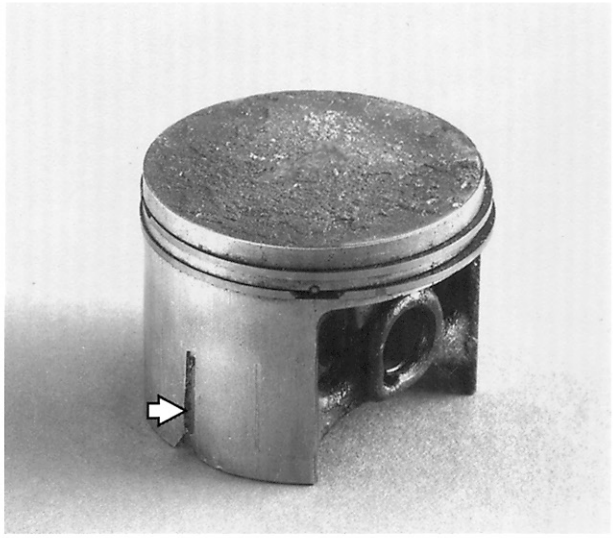


1.10 Location: Inlet side of piston

Condition: Slit in piston skirt

Causes: Large foreign body has entered engine

- through inlet port
- Parts of crank drive (bearing, washer, cage)

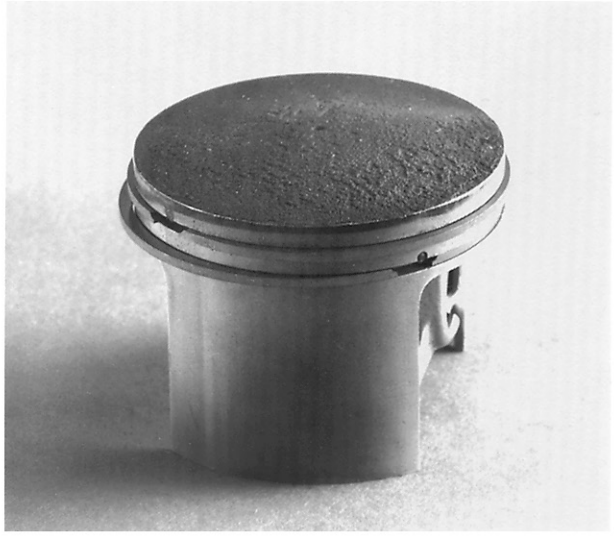


1.11 Location: Inlet side of piston skirt

Condition: Dull running surface

Causes: Abrasive dust causes excessive wear on piston skirt and rings

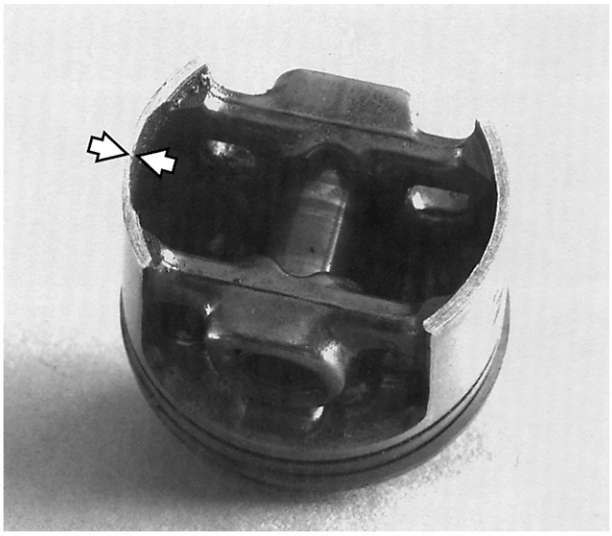
Remedy: Check condition and type of air filter.



1.12 Location: Inlet side of piston

Condition: Abnormal wear

Causes: Dust particles have entered engine through inlet port
- Faulty air filter
- Poor filter maintenance
- Unsuitable air filter



1.13 Location: Inlet side of piston

Condition: Piston ring broken

Causes: Ring severely weakened by wear

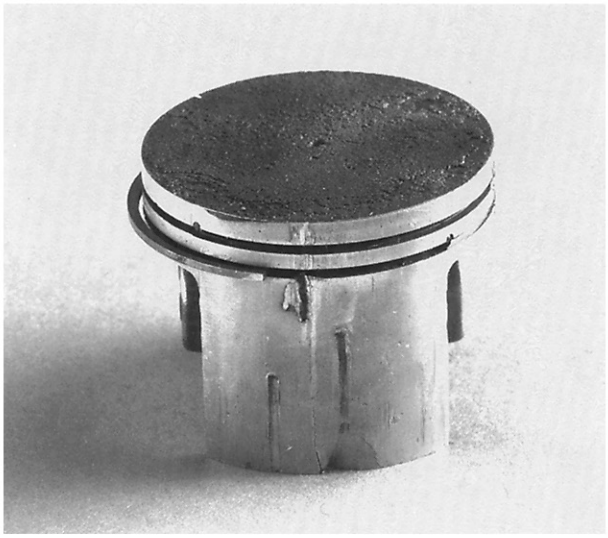
Conse-quences: Lack of control causes ring to break

1.14 Location: Piston rings

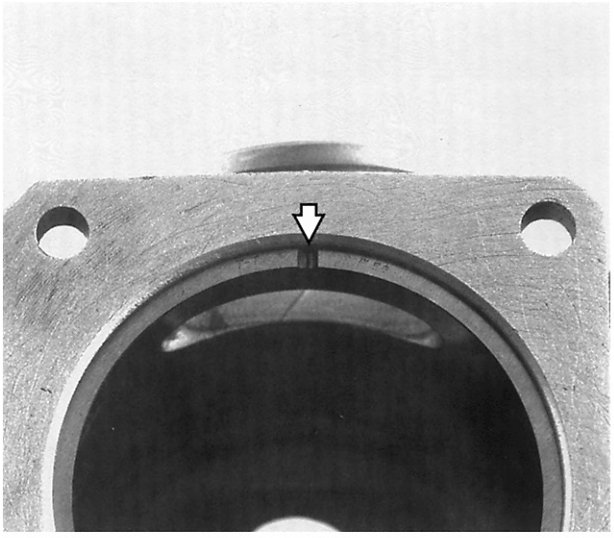
Condition: Ring broken

Causes: Excessive piston ring wear means that ring is no longer properly controlled in groove

Conse-quences: Pieces of broken ring damage running surface



1.15 Location: Piston ring
Check in new condition
Gap on new ring is 0.2 - 0.4 mm



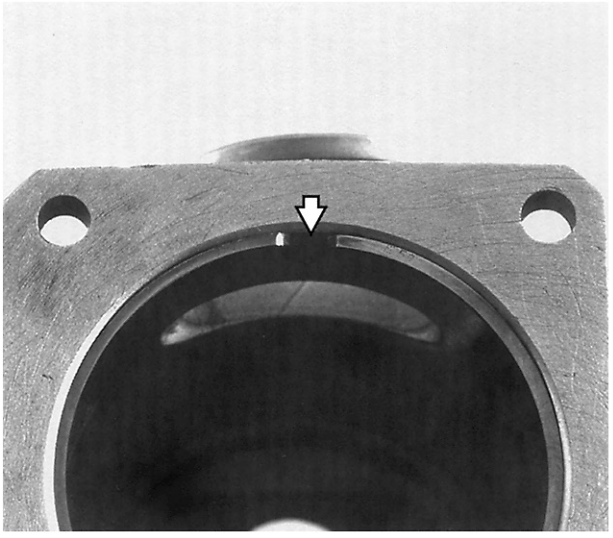
1.16 Location: Piston ring

Condition: Worn

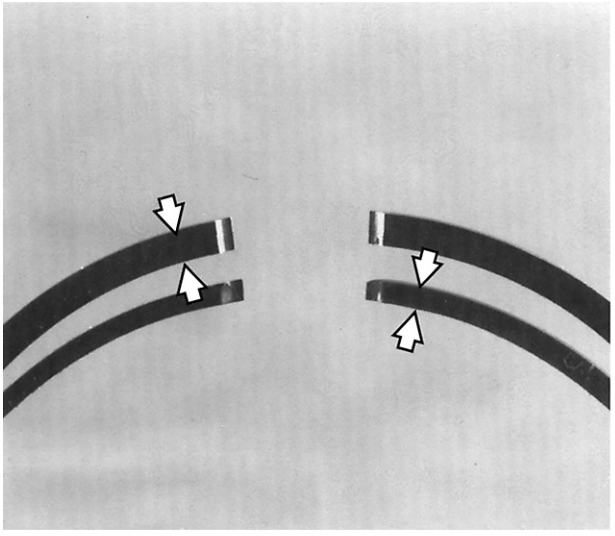
Causes: Long engine running life or effects of dust causes piston rings to wear

Conse-quences: Ring gap becomes much wider, noticeable loss of compression pressure

Result: Ring breaks



1.17 Location: Piston rings
Comparison - NEW / OLD
Width of ring can be measured to establish wear



1.18 Location: Piston

Condition: Scores in running surface

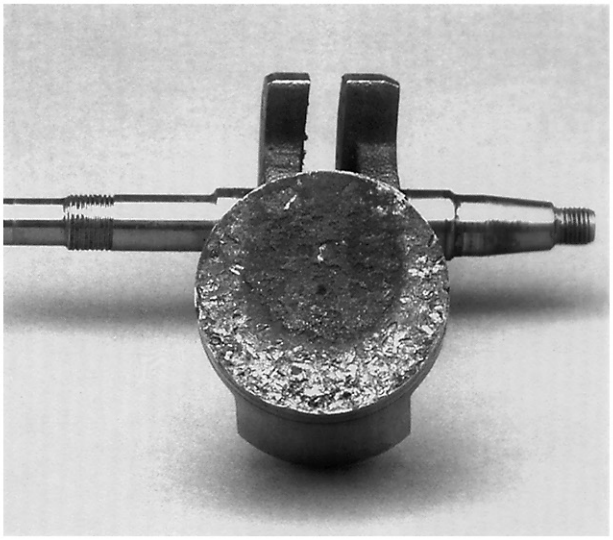
Causes: Minute particles of faulty
- Main bearings
- Big-end bearing
- Small-end bearing

have got between cylinder wall and piston skirt

1.19 Location: Piston head

Condition: Indentations caused by impact with foreign bodies

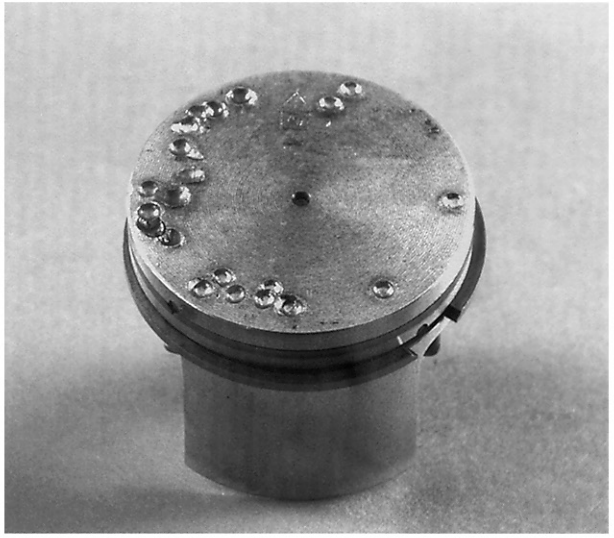
Causes: Large particles of bearing have entered combustion chamber through transfer ports



1.20 Location: Piston head

Condition: Indentations caused by impact with foreign bodies

Causes: Loose balls of main bearings have entered combustion chamber through transfer ports



1.21 Location: Piston lands

Condition: Ring retaining pin has loosened

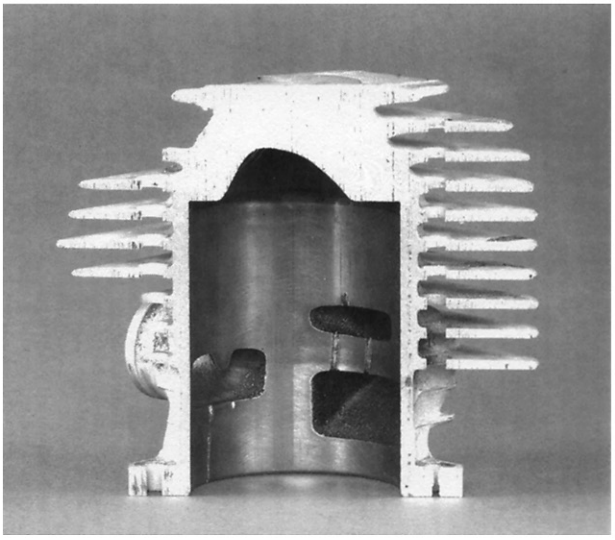
Causes: Retaining pin not pressed in correctly

2. Cylinder

2.1 **Location:** Cylinder wall

Condition: Severe scores

Causes: Foreign body has got between piston and cylinder wall (in this case it was a piston pin snap ring which had not been fitted properly)



2.2 **Location:** Exhaust port

Condition: Carbon deposits

Causes: Using unsuitable engine oil

Conse-quences: Interruption of oil film results in traces of friction on piston.

2.3 **Location:** Exhaust port

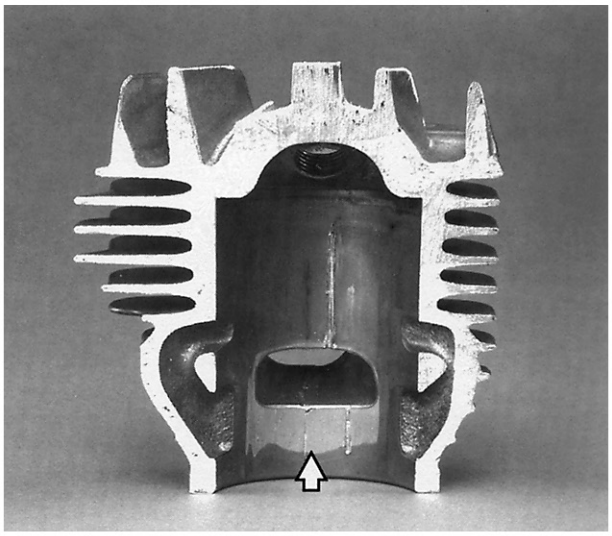
Condition: Wear on edges of port

Causes: Broken piston ring has spread the piston ring groove and damaged the edge of the cylinder port

2.4 **Location:** Inlet side of cylinder wall

Condition: Severe wear

Causes: Long engine running life and effects of dust



2.5 **Location:** Cylinder running surface

Condition: No coating

Causes: Cylinder has been re-bored after a mild piston seizure.

Note: Ni or Cr coated cylinders must not be re-bored

3. Crankshaft

3.1 **Location:** Crankshaft (inside crankcase)

Condition: Deposits

Causes: Chain lubricant seeps into crankcase through a leak
- Faulty crankcase gasket
- Defective oil/shaft seal

3.2 **Location:** Big-end bearing

Condition: Bearing failure

Causes: Bearing components can be overloaded or worn and fail as a result of excessively high engine speeds or an abnormal buildup of dirt

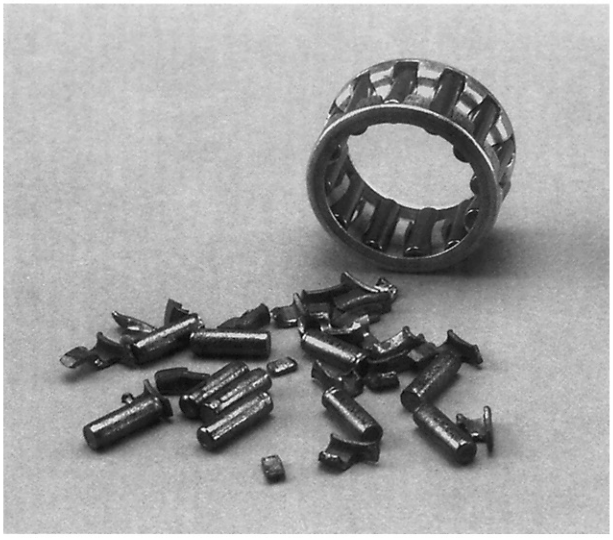


Fig.: Comparison of NEW and FAULY bearing

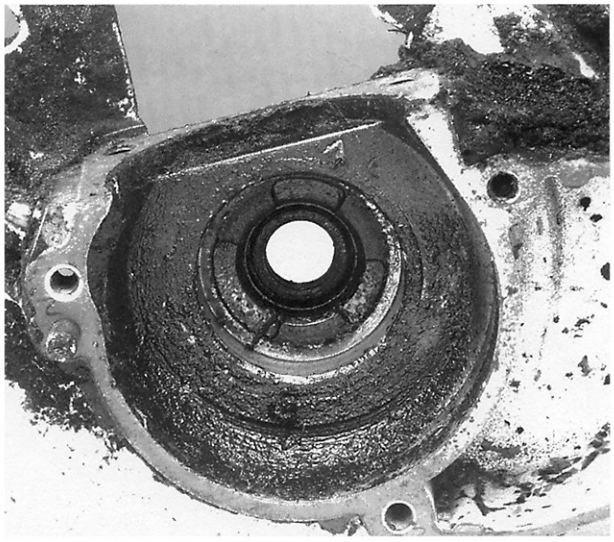
Conse-quences: Pieces of big-end bearing can damage cylinder bore and piston.

4. Crankcase

4.1 **Location:** Crankcase

Condition: Inside of crankcase dirty

Causes:
- Unsuitable fuel mixture
- Chain lubricant enters crankcase through faulty gasket or oil/shaft seal



5. Carburetor

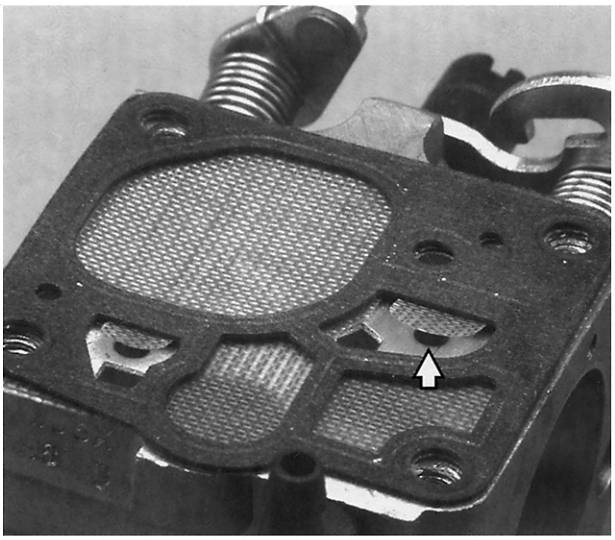
5.1 **Location:** Fuel pump

Condition: Valve tabs in pump diaphragm do not locate properly. Pump ports are no longer sealed properly.

Causes: Valve tabs can deform after long period of service or as a result of using unsuitable fuel.

Conse-quences: Reduced pump output makes mixture too lean

- Engine running problems
- Starting difficulties
- Damage to piston



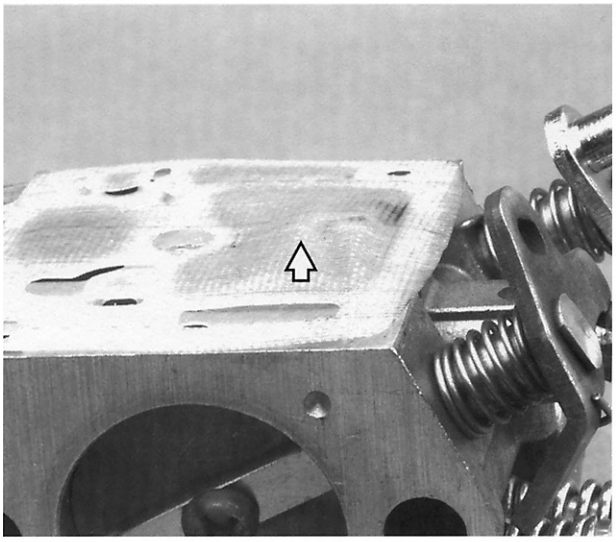
5.2 **Location:** Fuel pump

Condition: Diaphragm surface in area of pump deformed

Causes: Gases in impulse port combined with aggressive fuel constituents, or age

Conse-quences: Stroke too short - resulting in reduced pump output

- Over-lean mixture
- Engine running problems
- Starting difficulties
- Damage to piston



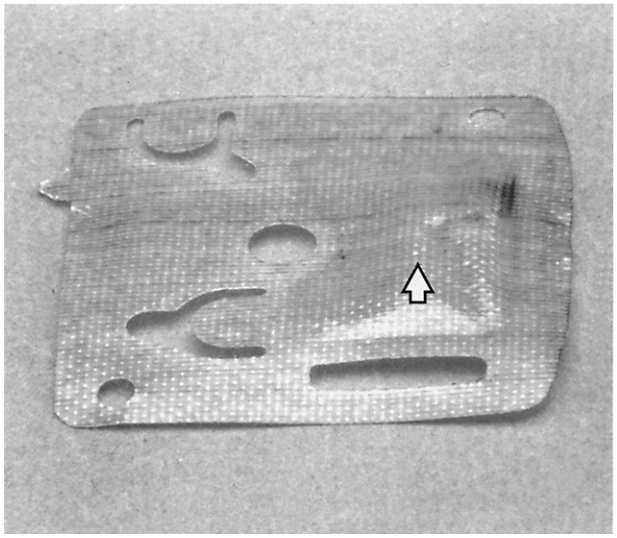


Fig.: Diaphragm removed from carburetor

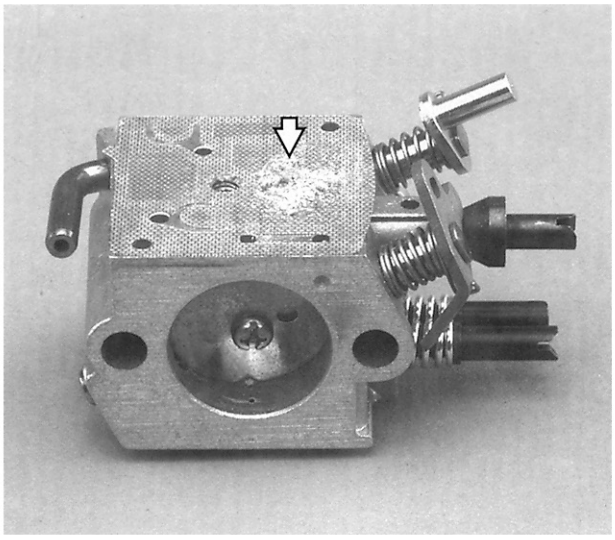
5.3 Location: Fuel pump

Condition: Impulse side of pump chamber is blocked

Causes: Dirt has got in through impulse port

Conse-quences: Stroke too short - resulting in reduced pump output

- Over-lean mixture
- Engine running problems
- Starting difficulties
- Damage to piston



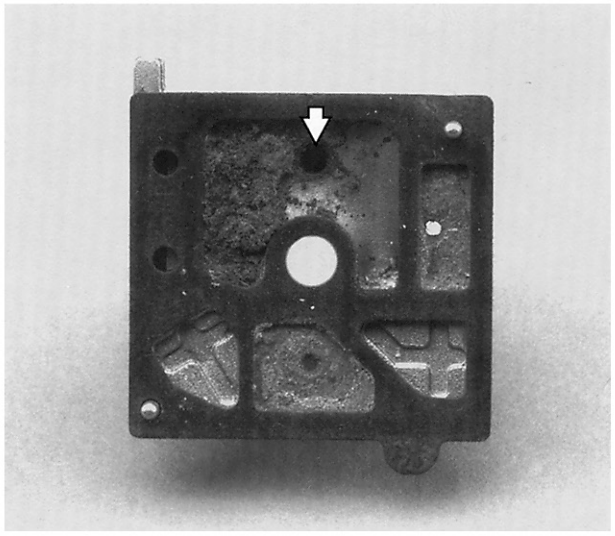


Fig.: Pump end cover

5.4 **Location:** Fuel filter (strainer)

Condition: Dirty

Causes: Dirt particles enter carburetor through damaged fuel pickup body or fuel hose

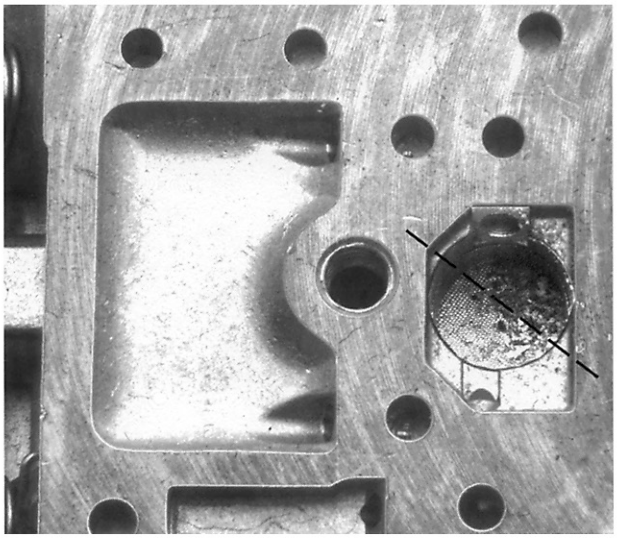


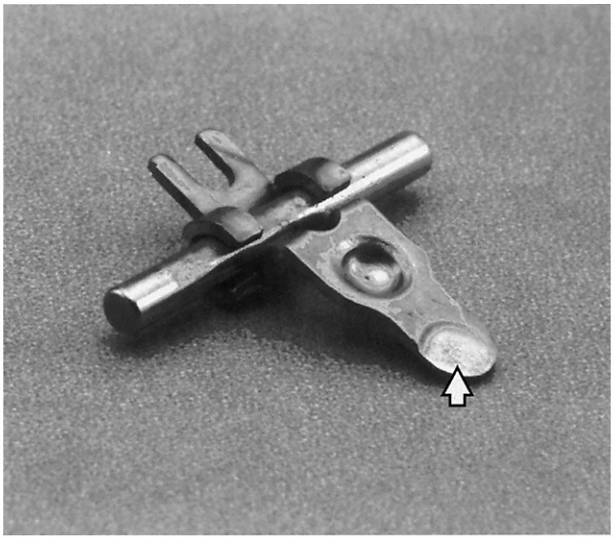
Fig.: Comparison CLEAN / DIRTY

5.5 **Location:** Inlet control lever

Condition: Contact surface worn

Causes: Mechanical abrasion due to
- dirt particles in fuel
- severe engine vibrations

Consequences: Poor inlet flow control resulting in problems with engine idling behavior

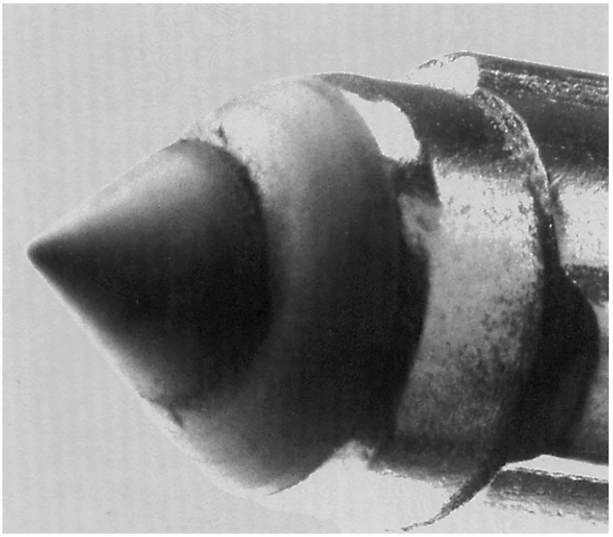


5.6 **Location:** Inlet needle

Condition: Tip worn

Causes: Increased mechanical abrasion owing to dirt particles in fuel

Consequences: Inlet needle seat not properly sealed and allows fuel to flow continuously; over-rich mixture causes engine running problems



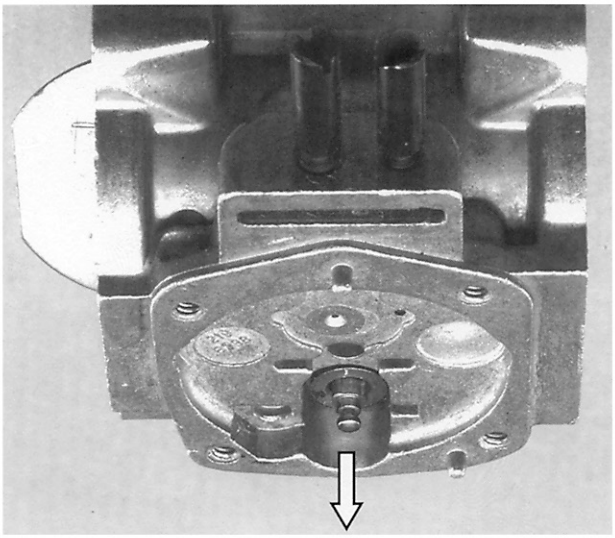
5.7 **Location:** Inlet needle

Condition: Needle stuck

Causes: Dirt particles in fuel or prolonged out-of-service period cause needle to stick

Conse-quences: Engine running problems

Inspection:
1. Remove inlet control lever
2. Turn carb upside down
3. Needle should drop out

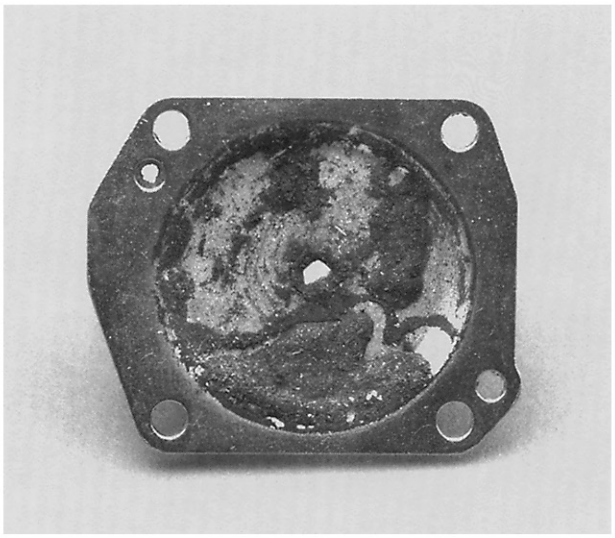


5.8 **Location:** Metering chamber

Condition: Exterior of chamber very dirty

Causes: Dirt has entered through compensation bore in end cover.

Conse-quences: Inlet needle does not close properly and allows fuel to flow continuously
- Engine running problems due to over-rich mixture

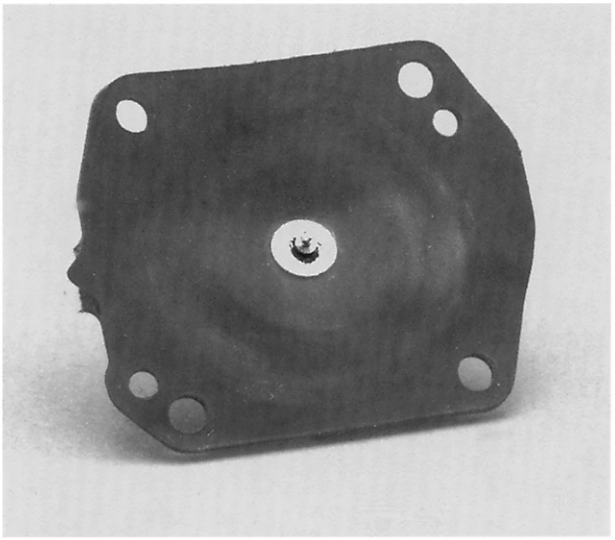


5.9 **Location:** Metering diaphragm

Condition: Deformed

Causes: Aggressive fuel or long period of service

Conse-quences: Deficient metering results in
- Over-lean mixture
- Engine running problems
- Starting difficulties
- Damage to piston

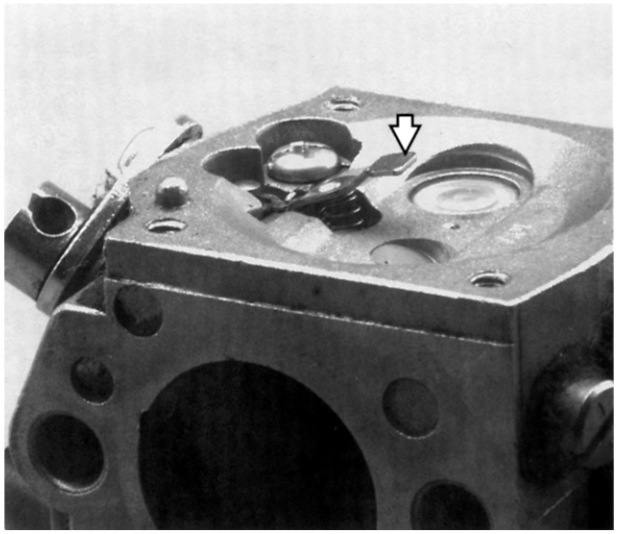


5.10 Location: Inlet control lever

Condition: Position of contact surface is incorrect

Causes: Inlet control lever wrongly adjusted or bent

Consequences: Incorrect fuel flow rate

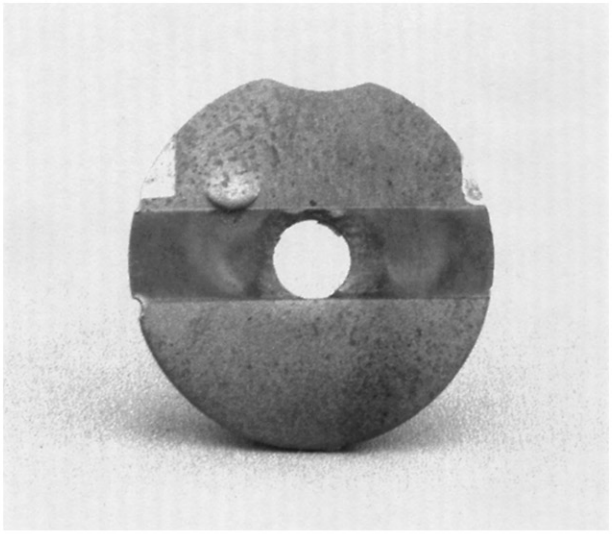


5.11 Location: Choke or throttle shutter

Condition: Worn (looks as if it has been sandblasted)

Causes: High level of dirt particles at clean air side

Consequences:
- Engine running problems
- Loss of power
- Wear on cylinder bore, piston and rings

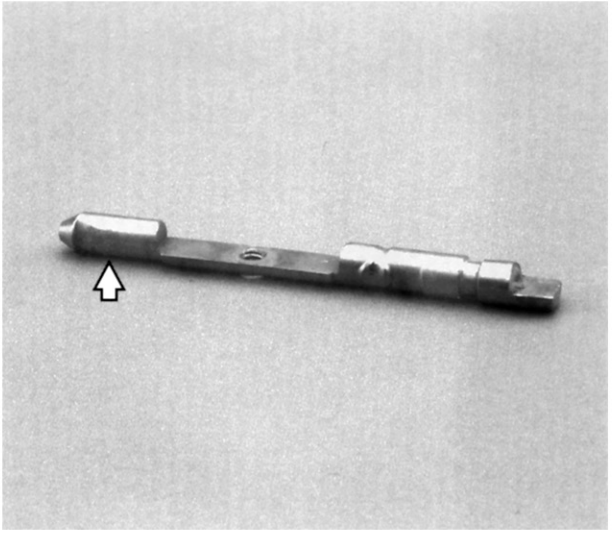


5.12 Location: Choke or throttle shaft

Condition: Severe wear

Causes: High level of dust in air
- Faulty air filter
- Unsuitable air filter
- Poor filter maintenance

Consequences: Supplementary air causes engine running problems. In case of breakage, parts of choke shaft may get into crankcase or combustion chamber.

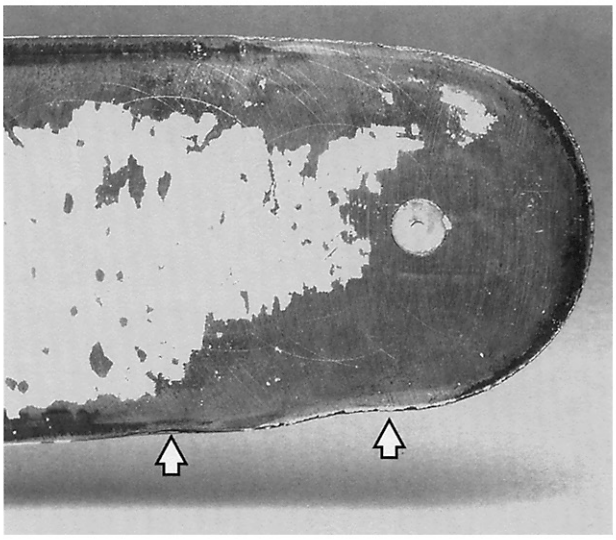


6. Guide Bar

6.1 **Location:** Underside of bar, just behind nose

Condition: Battered bar rails - rippled appearance

Causes: Saw chain run too slack over an extended period has knocked against rails on underside of bar



6.2 **Location:** Duromatic bar nose

Condition: Stellite worn

Causes: Poor lubrication due to inadequate oil flow rate or use of unsuitable chain lubricant, e.g. vegetable oil without additives

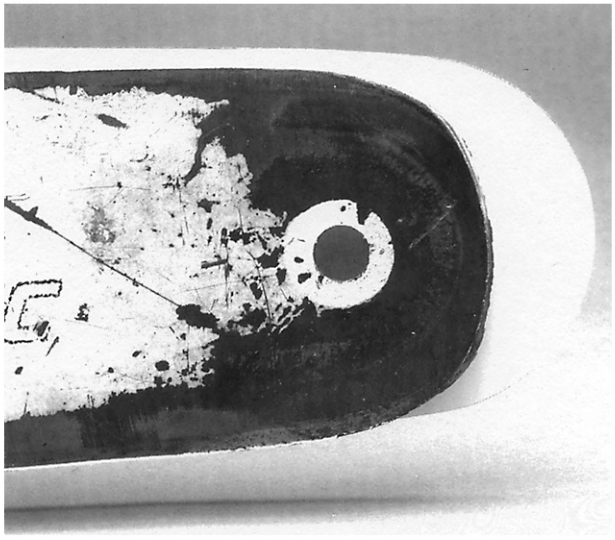
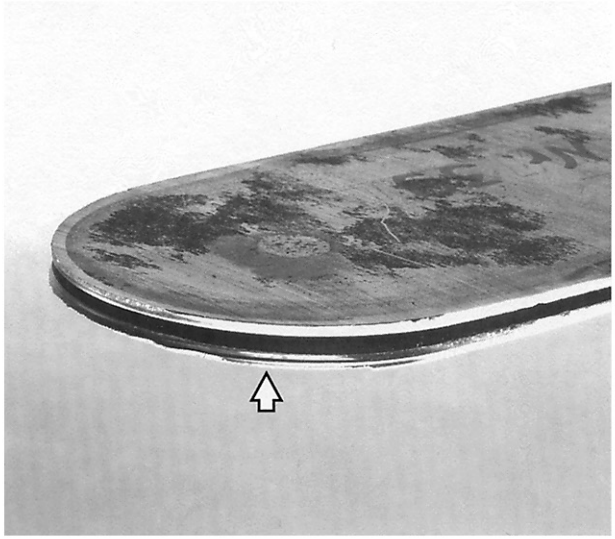


Fig.: Comparison of NEW / OLD bar

6.3 **Location:** Duromatic bar nose

Condition: Splayed groove

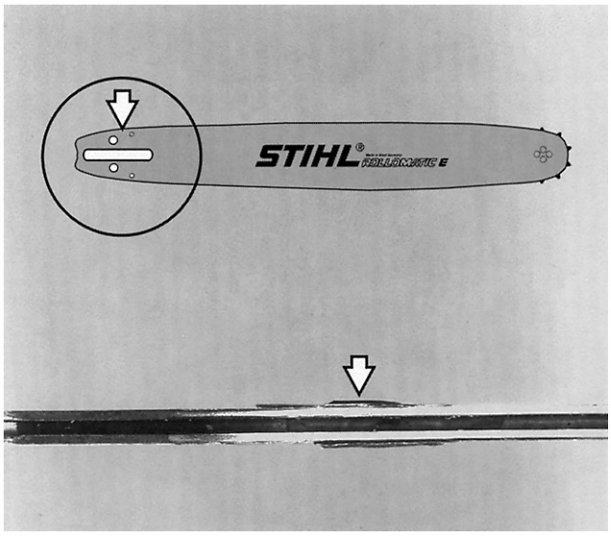
Causes: Groove has been spread by the use of force, e.g. during wedging, or bar has been used as lever



6.4 **Location:** Chain entry area on bar tail

Condition: Wear / severe burrs

Causes: Saw chain run too slack over an extended period has knocked against rails in entry area



6.5 **Location:** Bar rails

Condition: Local overheating

Causes: Bar has been pinched in cut, thus causing bar rails to close

Remedy: Bar remains serviceable if groove is opened up immediately (with groove drift)

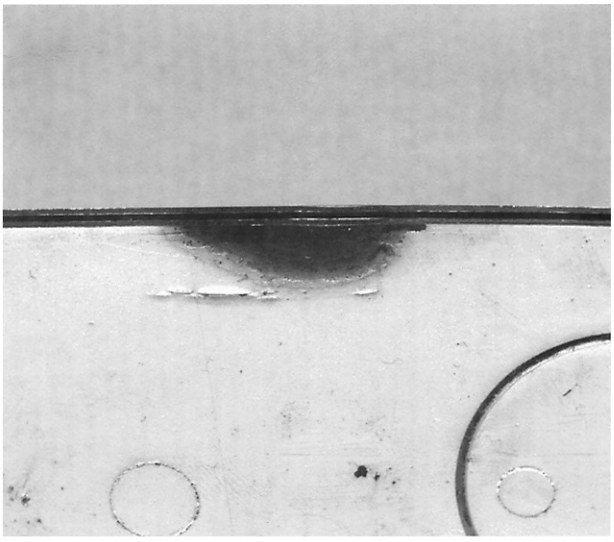
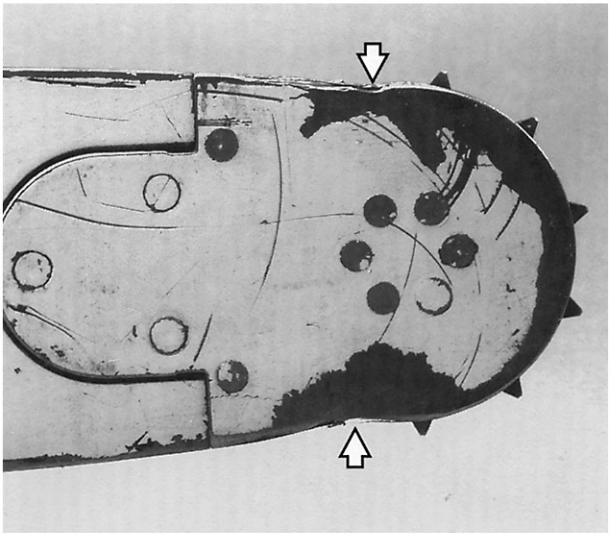


Fig.: In this case the bar was used for too long with a pinched groove

6.6 **Location:** Rollomatic S bar nose

Condition: Peened and chipped behind nose

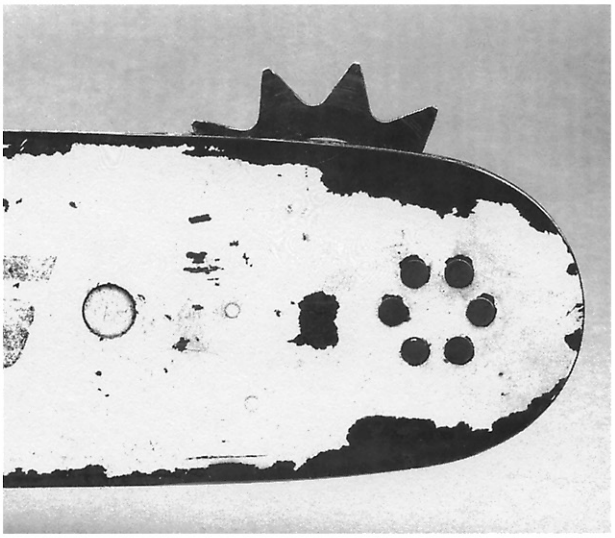
Causes: Loose chain makes heavy impact on rails after leaving nose sprocket



6.7 **Location:** Rollomatic bar nose

Condition: Broken nose sprocket

Causes: Use of force or overloading due to
- Stretched chain
- Wrong chain pitch
- Over-tensioned chain

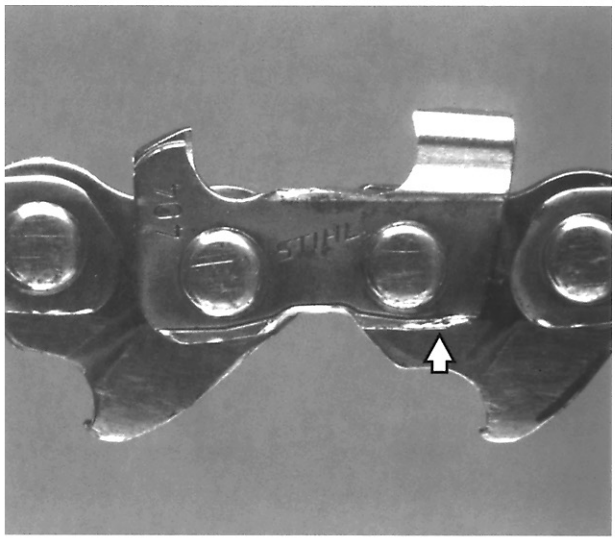


7. Saw Chain

7.1 **Location:** Bottom of cutters

Condition: Wear and burrs

Causes: Excessive loads due to
- High depth gauges
- Dull cutters
- Cutters not properly sharpened
- Inadequate chain lubrication



7.2 **Location:** Cutters, tie straps and drive links

Condition: Wear and burrs

Causes: Worn chain sprocket
- Tips of drive link tangs hit bottom of sprocket
- Tops of sprocket teeth cause abnormal wear in center of cutters and tie straps

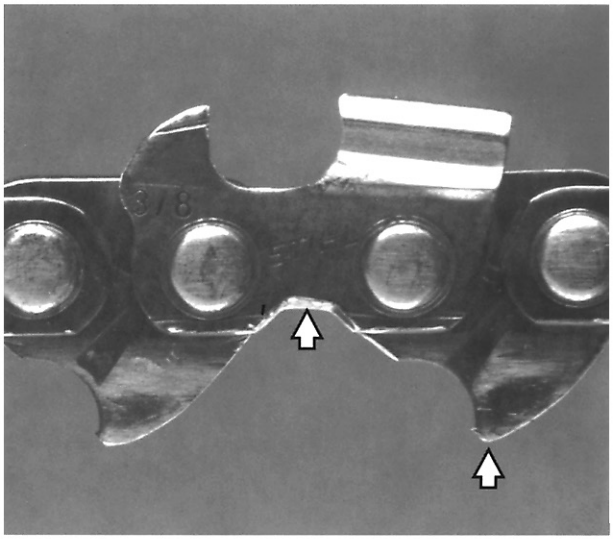


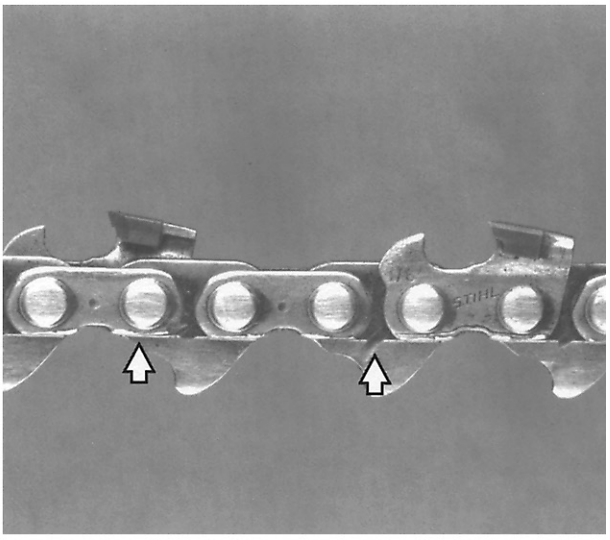
Fig.: Worn spur sprocket

7.3 **Location:** Tie strap and drive link

Condition: Severe wear

Causes:
- Abrasive dirt
- Excessive feed pressure

Fig.: Drive link worn thin, oil channel non-existent in some cases

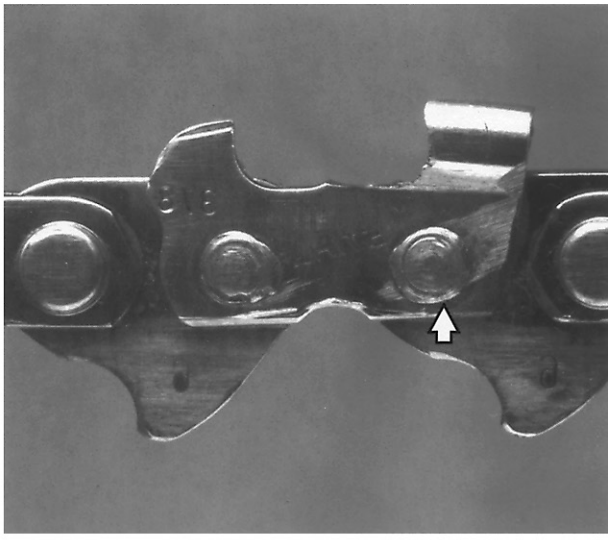


7.4 **Location:** Rivets

Condition: Damaged rivet head

Causes: Riveting not performed properly in workshop

Conse-quences: Broken cutters and tie straps

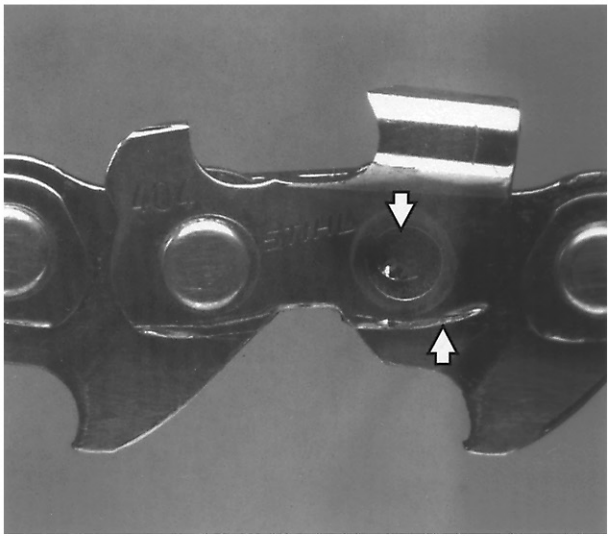


7.5 **Location:** Rivets

Condition: Rivet head broken away

Causes: Severe burrs on bottom of cutters due to
- Insufficient lubrication
- Excessive feed pressure
- Severely worn chain sprocket

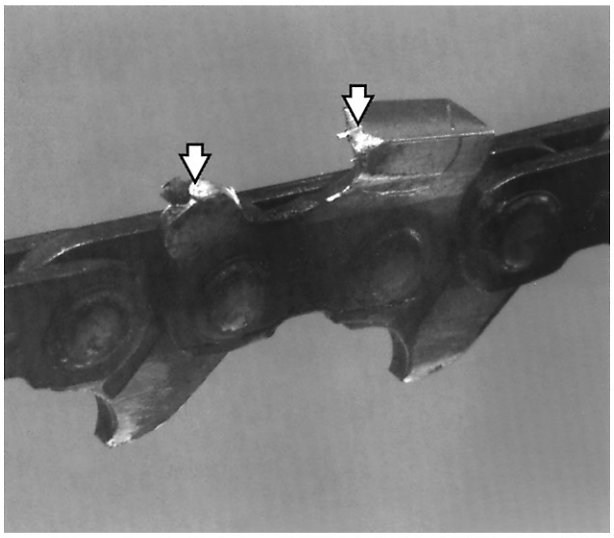
Conse-quences: Chain breakage



7.6 **Location:** Cutters

Condition: Damaged depth gauges and cutting edges

Causes: Contact with solid objects, e.g. stone, metal

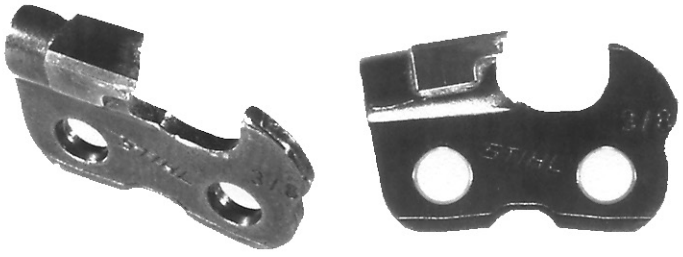


7.1 Rapid-Duro

Cutter in new condition

Normal wear

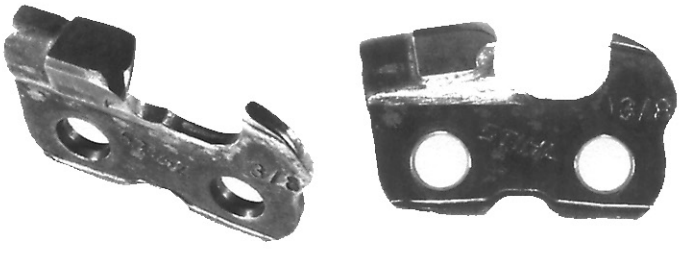
Cutter has to be resharpened



Excessive wear

Cause: Contact with extremely abrasive materials

Conse-quences: Cutter has to be ground back a long way; bottom of cutter badly worn



Cutter in new condition

Cutting edge broken away

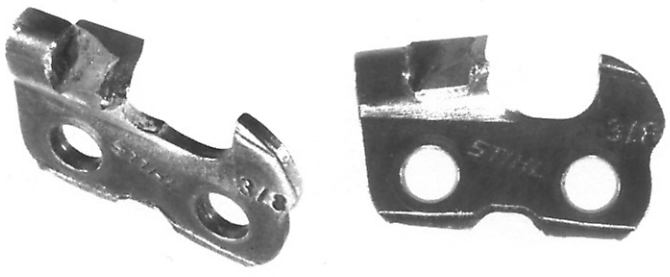
Cause: Light contact with foreign body, e.g. hard stone, steel nail, concrete

Conse-quences: Resharpening may be possible - depending on severity of damage

Top plate edge broken away

Cause: Heavy contact with foreign body while using high feed pressure

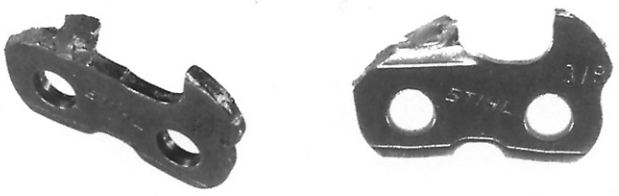
Conse-quences: Resharpening no longer possible; fit new cutter



Carbide tip and back of cutter sheared off

Cause: Extremely heavy contact with foreign body while using excessive feed pressure

Conse-quences: Replace cutter



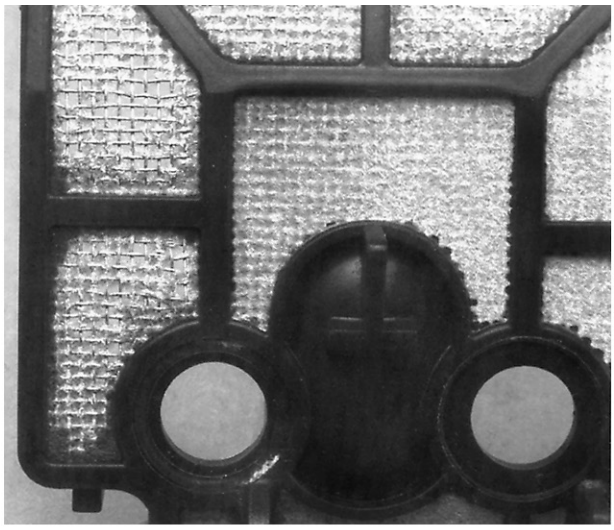
8. Miscellaneous

8.1 **Location:** Air filter (flocked)

Condition: Damaged flocking

Causes: Not cleaned as specified

Conse-quences: Dust and dirt are sucked into clean air zone. Dust particles accelerate engine wear.

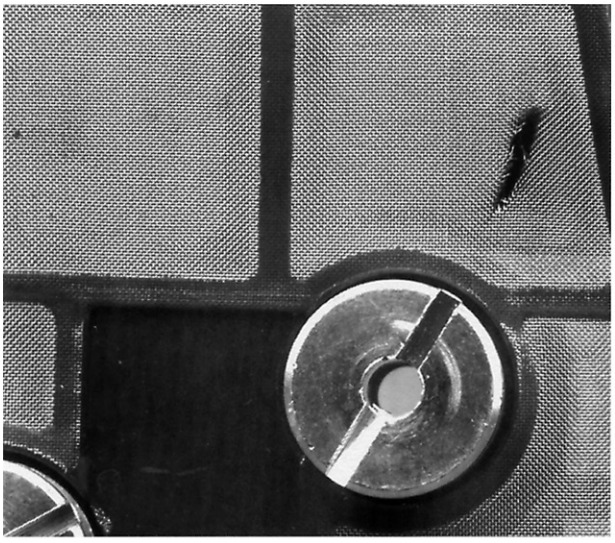


8.2 **Location:** Air filter (wire mesh)

Condition: Fabric torn

Causes: Fabric has been torn by mechanical damage, e.g. combination wrench has slipped while mounting the air filter

Conse-quences: Dust and dirt can be sucked into clean air zone. More rapid engine wear.

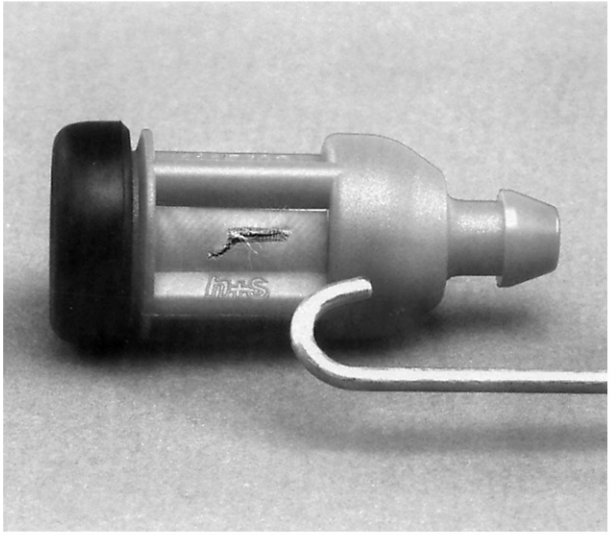


8.3 **Location:** Fuel pickup body

Condition: Filter fabric damaged

Causes: Mechanical damage, e.g. while being removed from tank

Conse-quences: Increased carburetor and engine wear as a result of dirt in fuel



8.4 **Location:** Muffler

Condition: Carbonization

Causes: Unsuitable engine oils have been used

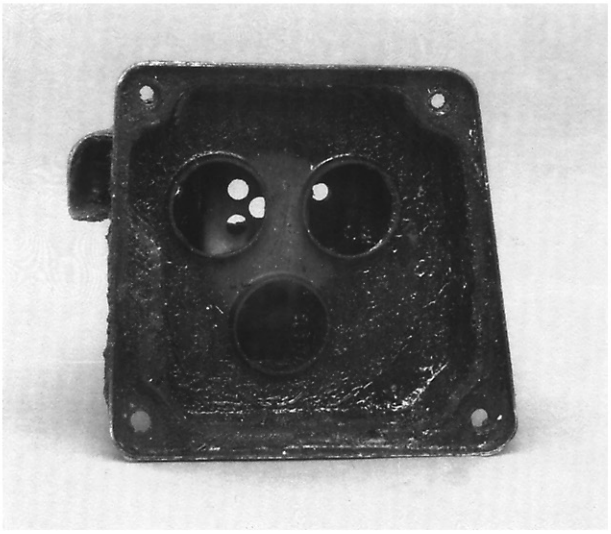


Fig.: In this case Bio chain oil was ingested and burnt

englisch / english

0455 981 0123. M0,5. A12. FST. Printed in Germany