MASSEY FERGUSON

MF 1800

Series Small Square Baler

Model: 1840

SERVICE MANUAL

FROM MASSEY FERGUSON

Massey Ferguson®

1840
Small Square Baler

SERVICE MANUAL
4283517M1

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NOTES

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GENERAL INFORMATION

INTRODUCTION

The operation and maintenance instructions included in this Service Manual are assembled from a large amount of field testing and other data. The information was written for typical conditions. Make adjustments as necessary for specific conditions.

Right-hand and left-hand, as used in this Service Manual, is determined by facing the direction the baler will travel when in use.

UNITS OF MEASUREMENT

Measurements are given in metric units of measurement followed by the equivalent in U.S. units. Hardware sizes are given in millimeters for metric hardware and inches for U.S. hardware.

REPLACEMENT PARTS

To receive efficient service, always remember to give your Massey Ferguson® Dealer the following information:

- Correct part description, or part number.
- Model number of your baler.
- Serial number of your baler.

SERIAL NUMBER PLATE LOCATION

FIG. 1: Each baler has a serial number plate (1) with the model and serial number. The serial number plate is located on the left-hand side of the front shield.

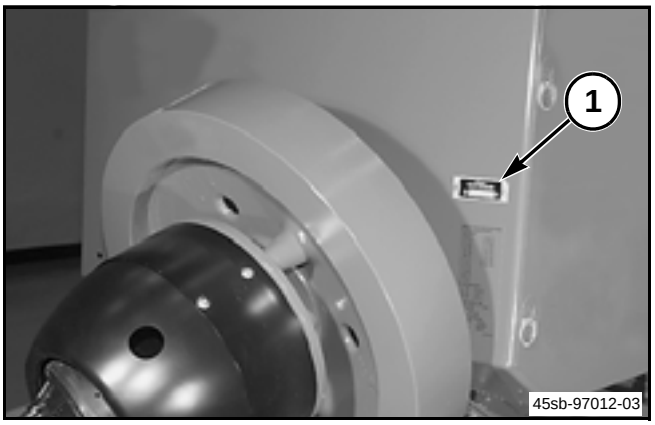


FIG. 1

MACHINE IDENTIFICATION

Model and Serial Numbers

NOTE: Any time your baler needs service, or parts, give your Massey Ferguson® Dealer the model and serial numbers.

Machine model No. _____

Machine serial No. _____

Date received: _____

COMPONENT IDENTIFICATION

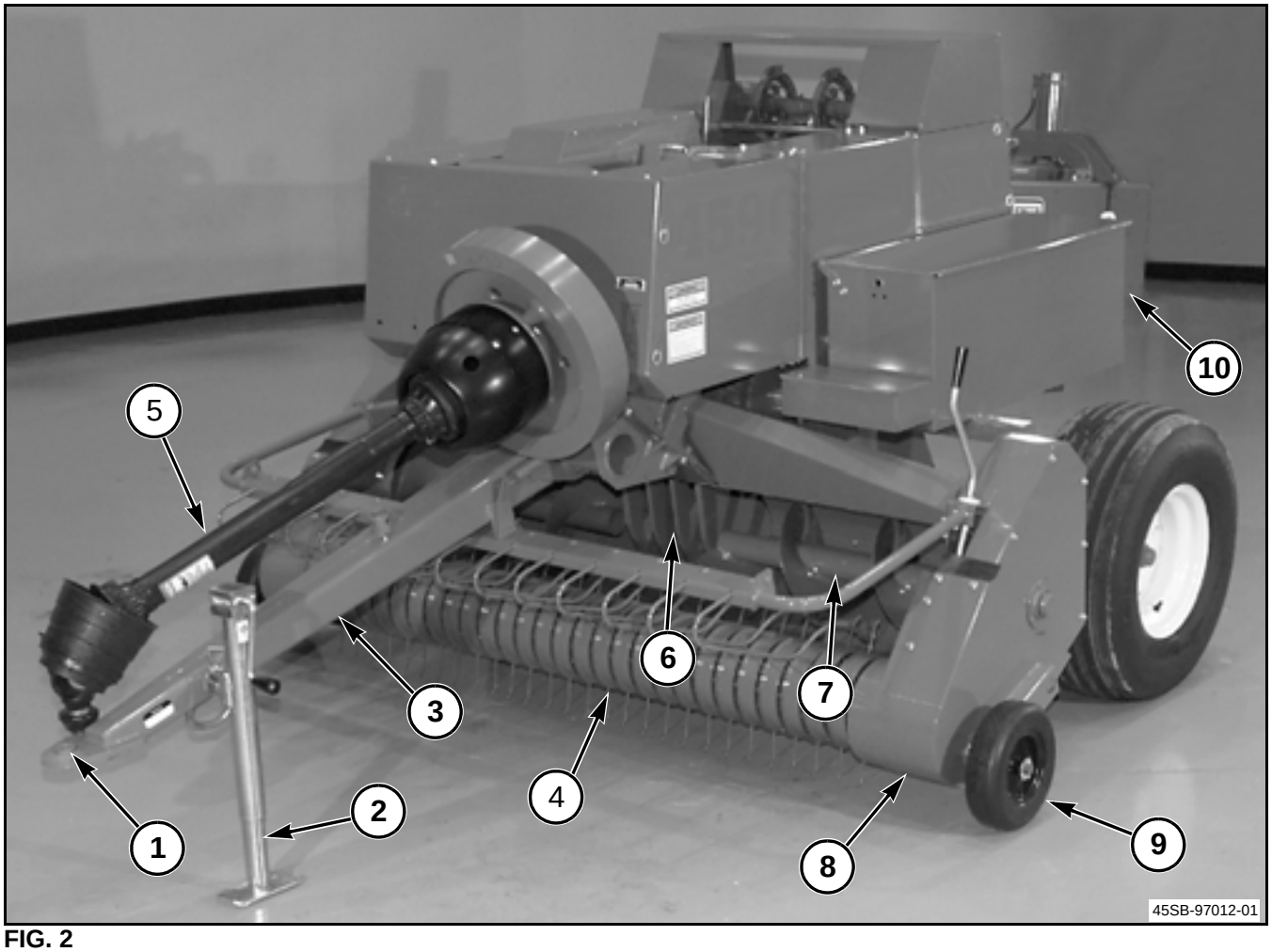


FIG. 2

FIG. 2: Front view

(1) Hitch
(2) Jack
(3) Tongue
(4) Pickup assembly
(5) IDL (Implement Driveline)
(6) Charge chamber
(7) Auger (one on each side)
(8) Left-hand auger drive chain cover
(9) Gauge wheel (one on each side)
(10) Bale chamber

DRIVE TRAIN

FIG. 3: The baler is driven by the tractor PTO system. The baler requires a standard 540 rev/min tractor PTO. The baler uses a four U-joint drive shaft between the tractor and the baler. The tractor power goes from the rear U-joint (1) of the drive shaft to the overrunning clutch (2).

The overrunning clutch permits the baler flywheel (3) to freewheel when the PTO is disengaged or the tractor engine speed is reduced. This permits the operator to change gears on the tractor without waiting for the flywheel to come to a complete stop.

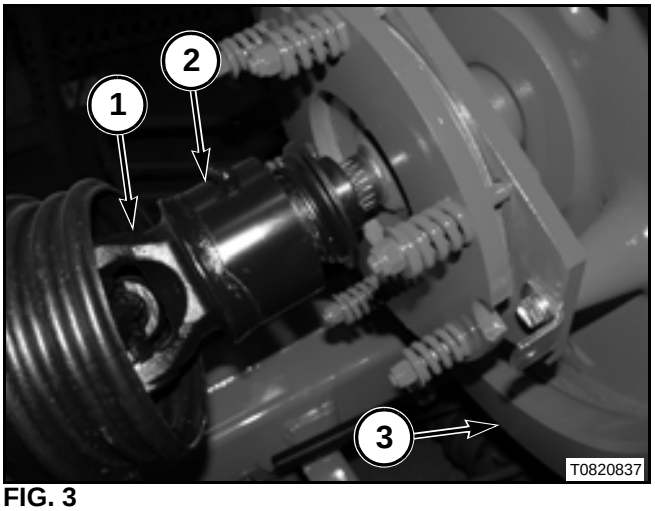


FIG. 3

FIG. 4: From the overrunning clutch, the power goes through a slip clutch (4), and the flywheel and flywheel shearbolt (5). The flywheel shearbolt drives the gearbox, which in turn operates the other baler mechanisms. The flywheel shearbolt also protects the other components.

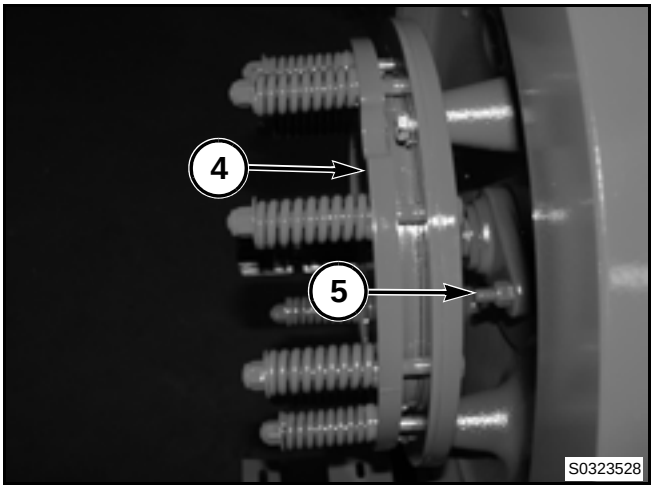


FIG. 4

FIG. 5: The crank arm on the right-hand side of the gearbox drives the plunger (1).

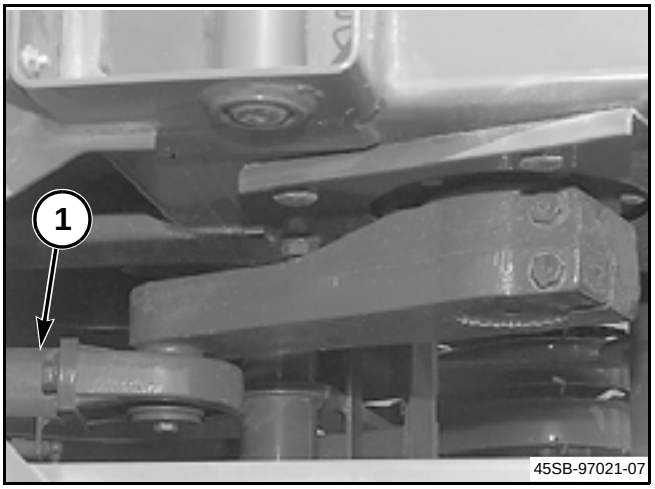


FIG. 5

FIG. 6: The sprocket (1) on the left-hand side of the gearbox drives the chain (2). The sprocket is protected by a shearbolt (3).

The chain drives the stuffer double sprocket (4) and the pickup drive shaft sprocket (5). The stuffer double sprocket drives a No. 50 chain (6). The pickup assembly is protected by a slip clutch.

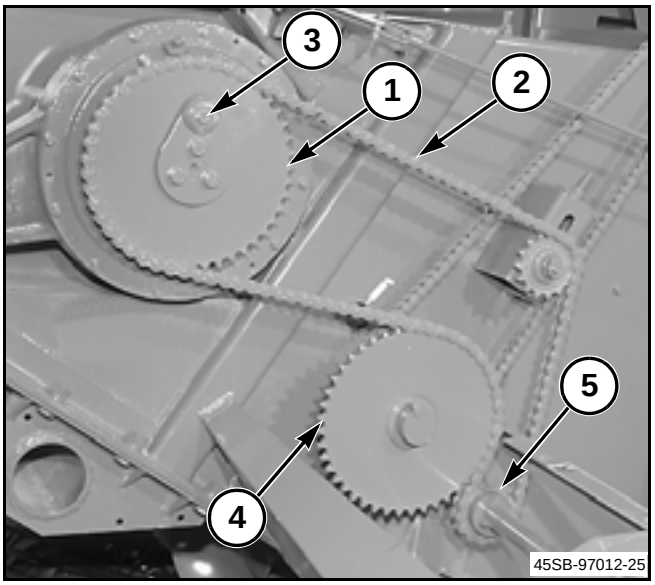


FIG. 6

FIG. 7: The No. 50 chain (1) drives the knotters (2), and the needles (3). These components are protected by a shearbolt (4).

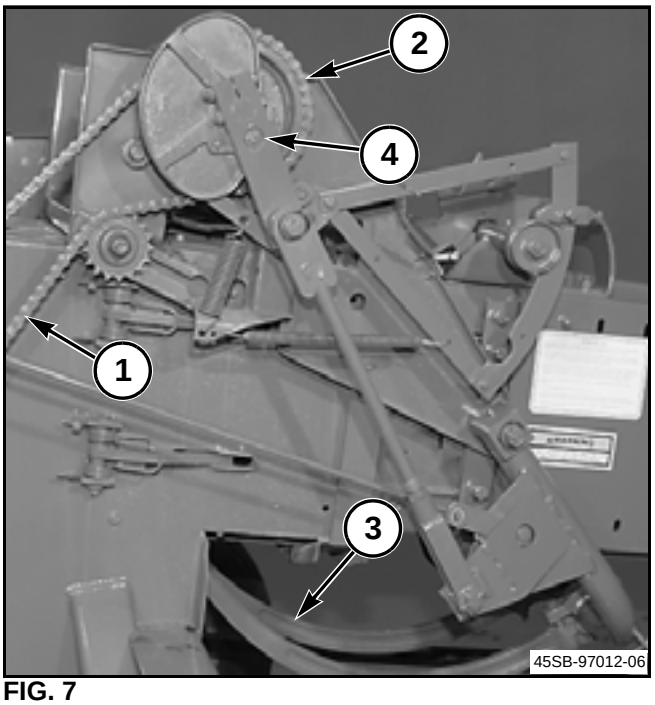


FIG. 7

SLIP CLUTCHES

Slip clutches are used at two locations to protect the baler's components against damage from overloads. The slip clutches use two fibrous clutch discs between steel pressure plates. Spring tension on the plates keeps the required torque.

The slip clutch on the front of the flywheel protects the tractor PTO from stresses caused by sudden overloads. The slip clutch on the pickup assembly drive protects the baler from slugs of hay that can jam the bale chamber or hard objects that can cause damage. The slip clutches must be checked and adjusted.

PICKUP AND FEEDING

FIG. 8: Continuous flow, straight through feeding is possible with the wide, low profile pickup assembly (1). Hay from the windrow is picked up by the closely located tines (2) of the pickup assembly and moved by an auger (3) into a charge chamber (4). The in line charge chamber feeds the baling chamber from the bottom.

This baler makes bales that are the same shape and the same condition in light, or heavy, windrows. As the flakes are formed, the stuffer fingers sweep the flakes into the bale chamber with each return stroke of the plunger. With the PTO operating at 540 rpm, the plunger makes 100 strokes per minute to compress the hay in the baling chamber.

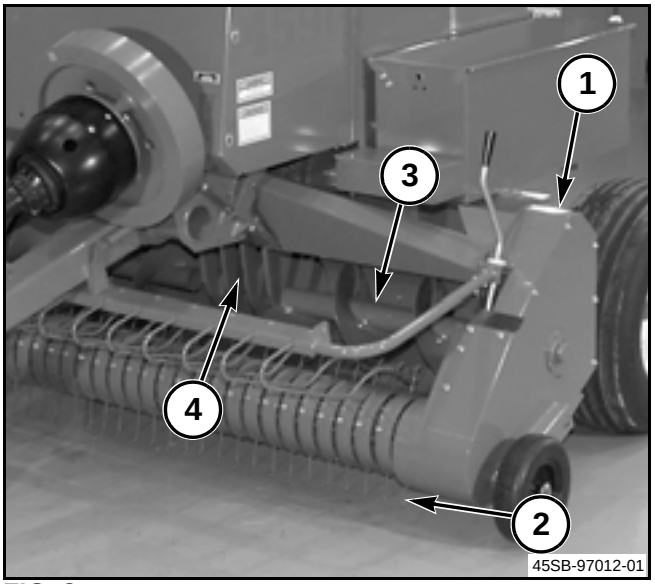


FIG. 8

FIG. 9: The pickup height adjustment strap (1) controls the height of the tines above the ground. Set tine height according to instructions in the Adjustments Section.

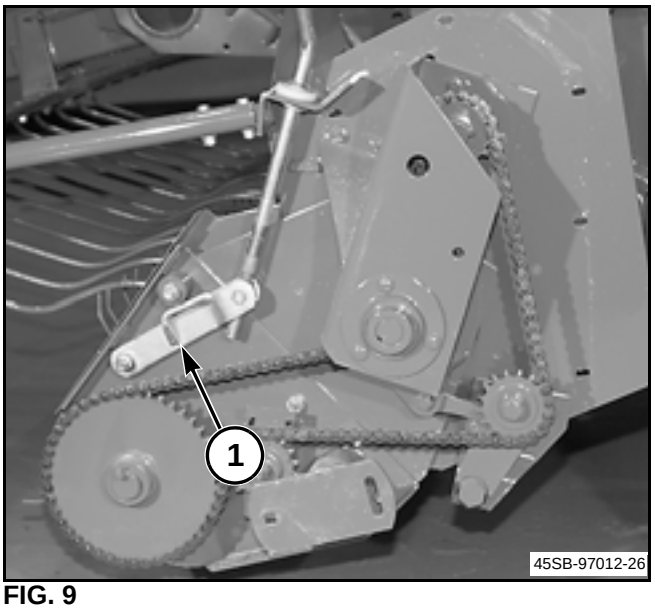


FIG. 9

SHEARBOLTS

Location

The shearbolts are used in three different locations to protect the components.

FIG. 10: The flywheel shearbolt (1) connects the flywheel to the other parts of the drive train. When the flywheel shearbolt breaks, the flywheel cannot drive the baler.

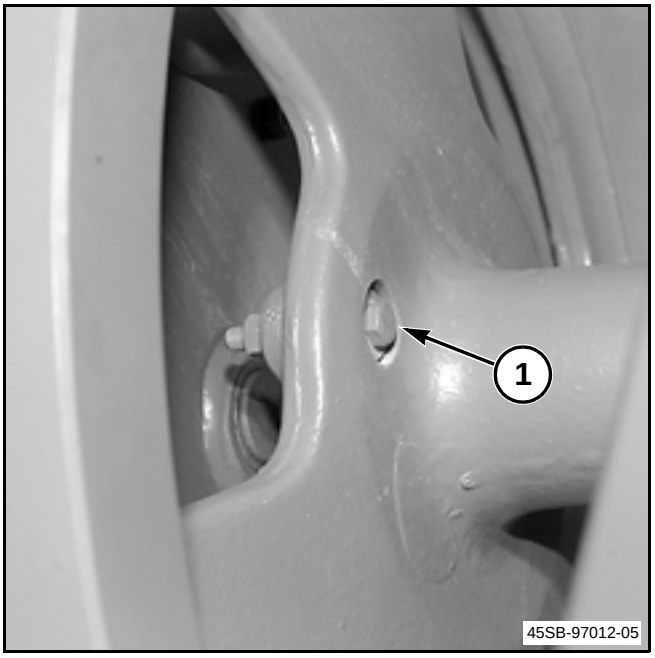


FIG. 10

FIG. 11: The twine knotter (or wire twister) and needles are protected by a shearbolt (1) through the needle arm and reset cam.

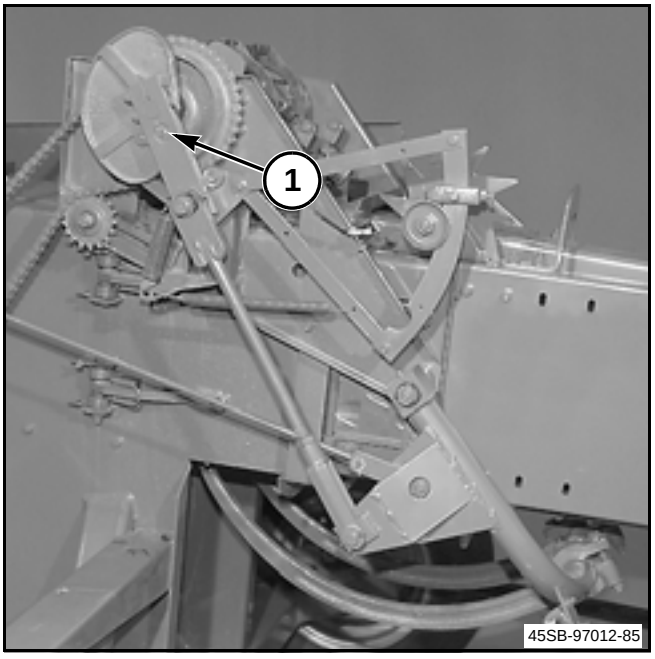


FIG. 11

FIG. 12: The stuffer / pickup drive shearbolt (1) drives the stuffer fingers and the pickup assembly.

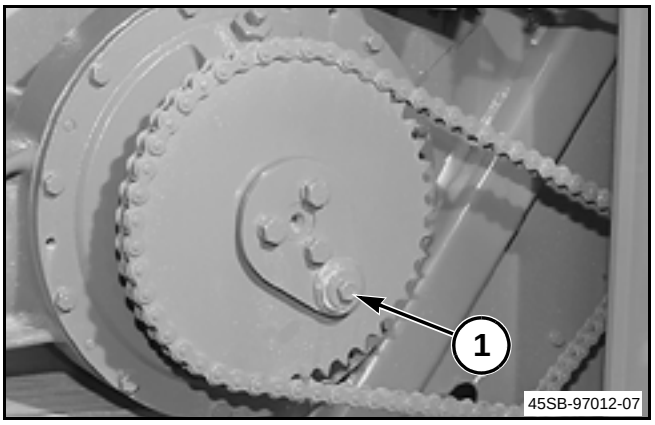


FIG. 12

Replacement

Stop the tractor and baler immediately when a shearbolt breaks. Determine what caused the shearbolt to shear.

If the flywheel shearbolt breaks and is replaced on a tying cycle, DO NOT rotate the flywheel in the reverse direction. Rotating the baler flywheel in the counterclockwise direction (facing the direction of baler travel) will reverse the baler. This can cause damage to the knotter trip arm when the knotter trip arm contacts the clutch dog.

NOTE: If the flywheel shearbolt breaks, check the stuffer and the knotter shearbolts too.

The knotter drive clutch, when engaged, is of a lock up type and will reverse the knotters if the baler is reversed. Trip the knotter trip arm to permit the clutch dog to pass the knotter trip arm without interference.

Always replace broken bolts with the correct bolt as called for in the manual. Do not replace the bolt with a higher strength bolt than specified. This can result in damage to the baler.

Always make sure all shearbolts are tight. Do not tighten shearbolts too much. Refer to the manual when replacing the shearbolts.

ROLLER CHAINS

Inspection of Drive Chains and Sprockets

Experience will determine how frequently drive chains will need to be inspected and serviced. Make a regular schedule and follow the schedule.

With new chains and sprockets some adjustment of the chain tension can be looked for during the first run-in period.

Inspect the chains and sprockets for the following:

1. Wear of the chain link side plates.
2. Wear on the sides of the sprocket teeth.
3. Alignment of the sprockets, idlers, and shafts.
4. Chain elongation.
5. Wear on the working faces of the sprocket teeth.

Check for interference between the drive and other parts of the equipment. If there is any interference, correct immediately. Interference can cause not normal and damaging wear on the chain and interference part. If the edges of the chain link plates hit against a rigid part, the link plate will become weak because of strain and a chain failure can result.

Check for and remove any deposit of debris or foreign material from between the chain and sprockets. A small amount of material in the sprocket roll seat can cause tensile loads large enough to break the chain if forced through the drive.

Inspect the chain for cracks, broken, or distorted parts. If any of these conditions are found, replace the complete chain. Even if the parts of the chain look in good condition, the complete chain has been damaged and must be replaced.

Drive Chain Adjustment and Tightening

Proper adjustment and tightening is necessary for long drive chain service life.

Over tightening causes the drive chains to elongate and puts additional loading on the sprockets, shafts, and bearings.

Loose drive chains will climb on the sprocket teeth and cause excessive wear.

FIG. 13: To check drive chain tension, turn the drive sprocket in a direction that is opposite to the normal direction of rotation (to remove all the slack from the idler sprocket strand of the chain). Measure the slack at the middle point of the longest drive strand as shown.

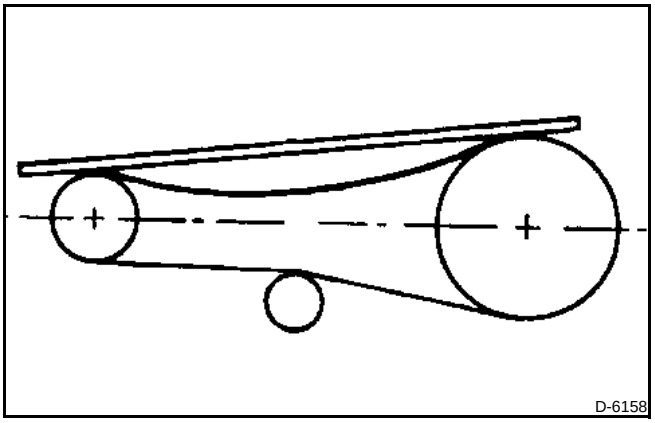


FIG. 13

As a general rule:

- Horizontal and inclined drive chains must be adjusted to have approximately 20 mm of slack per meter of distance between the center of the driver and driven shaft (0.25 inches of slack per foot of distance between the center of the driver and driven shaft) or approximately 2% of the distance between the center of the driver and the driven shaft.
- Vertical drive chains that see shock loads or changes of rotation must be adjusted to have approximately 10 mm of slack per meter of distance between the center of the driver and the center of the driven shaft (0.125 inches of slack per foot of distance between the center of both the driver and the driven shaft) or approximately 1% of the distance between the center of the driver and the center of the driven shaft.

Drive Chain Sprocket and Idler Alignment

FIG. 14: If there is wear on the inside surface of the chain roller link plates, the sprockets are not aligned. Make sure that:

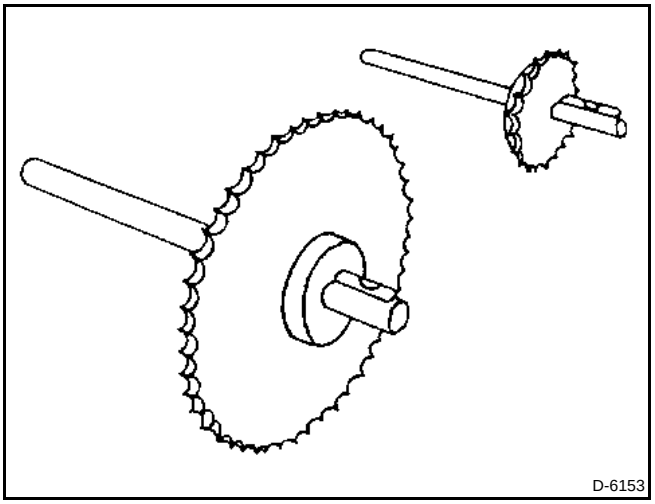


FIG. 14

The shafts (that the driver and driven sprockets are mounted on) are in the same location (level with each other).

Check for tilting or shafts not in alignment by using a bubble level. For proper alignment, the bubble must be in the same position as measured on each shaft.

Rotate the drive and look for excessive movement. If movement is shown inspect the sprocket and shaft. If there is no problem shown, remove and install sprocket. Not correctly mounted sprockets or out of round sprockets are from time to time the root of vibration or more severe problems. A dial indicator can be used to measure the side to side sprocket movement or diameter vibration by holding the dial indicator up to the sprocket sidewall.

IMPORTANT: Always turn off the machine before using the dial indicator. Rotate the drive by hand to make the measurements.

FIG. 15: The shafts (that the driver and driven sprockets are mounted on) are parallel to each other.

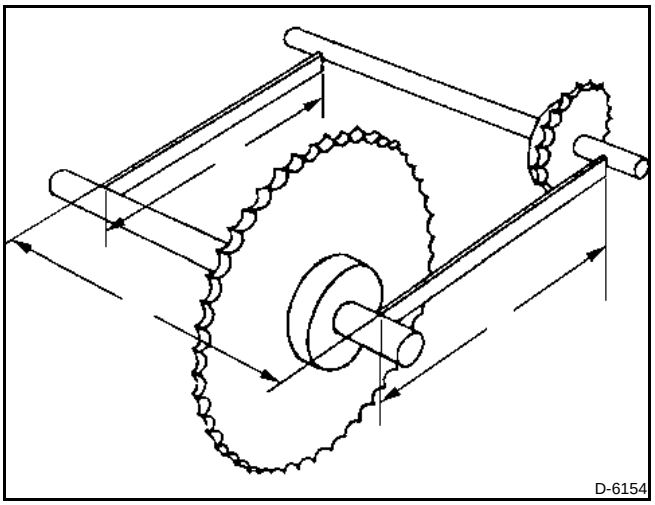


FIG. 15

FIG. 16: The driver and driven sprockets are in line (not offset).

To check the alignment use a long straight edge (1) made of wood, metal, or any rigid material. Line the straight edge along the outside face of both sprockets. If the drive is properly aligned, the straight edge will contact each sprocket evenly. The straight edge must touch the two outer edges of each sprocket for a total of four points of contact.

Shafts not aligned will show up as a gap between the outside face of the sprocket and the straight edge.

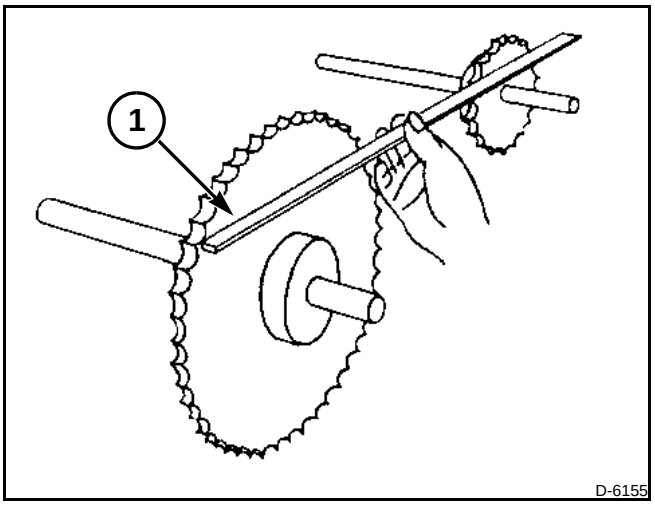


FIG. 16

FIG. 17: The idler and adjusting sprockets are in alignment with the driver and driven sprockets.

Bad alignment, especially with multiple strand chains results in not equal loading across the width of the chain and can cause an early chain failure.

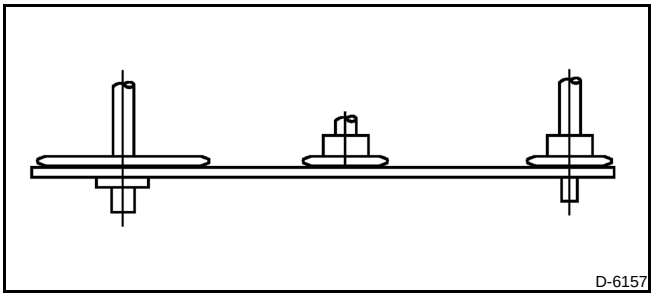


FIG. 17

Drive Chain Elongation and Sprocket Wear

Drive chain wear occurs on the inside of the chain in the load bearing areas between the chain outer link hardened pins and the chain inner link bushing surfaces. This wear causes chain elongation which is referred to as chain stretch.

This wear is not seen on the outside of the chain and cannot be measured with the chain under tension. To measure chain elongation, remove the chain and select a 305 mm (1 ft) section of chain. Push the selected section of chain tightly together and measure the distance between the link pins. Then pull the same selected section of chain and measure the distance between the same link pins. If the movement (elongation) is more than 10 mm per meter (0.125 inches per foot), the chain is worn out and must be replaced.

When wear of this amount or more is seen, the hardened surfaces on the link pins are worn through. The chain is worn out, and making frequent adjustments will be necessary.

Gradual increase in chain slack is the result of normal chain wear. A sudden increase in chain slack indicates one or more of the following problems:

1. Not enough lubrication or failure of the lubricant.
2. Excessive over loading or shock loading of the chain drive.
3. Loose bearing mounting hardware or a failed drive.
4. Loose idler sprockets, chain guide blocks, or failed idler sprocket bearings.

Normal Tooth Wear

FIG. 18: Normal Tooth Wear.

Worn sprockets must not be used with new roller chain.

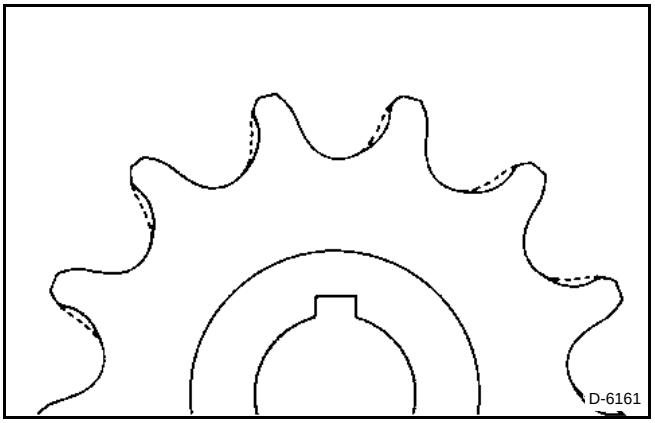


FIG. 18

Not Normal Tooth Wear

FIG. 19: Chain tension that is not correct can cause not normal wear on the outer tips of the sprocket teeth. Not enough chain and sprocket lubrication can cause not normal wear of the sprocket teeth.

Check for roughness or binding when the chain engages or disengages from the sprocket. Inspect the sprocket teeth for reduced tooth section and curved tooth tips.

If these conditions are present, the sprocket teeth are excessively worn and the sprocket must be replaced. Do not run new chain on worn sprockets as this will cause the new chain to wear rapidly.

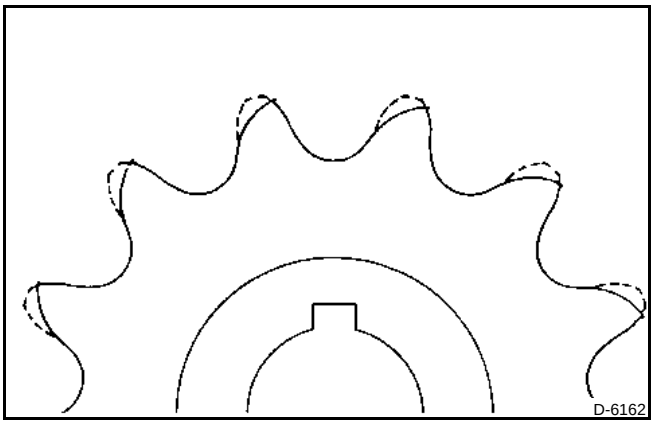


FIG. 19

Worn Chain on New Sprockets

FIG. 20: A worn or elongated drive chain must never be used with new sprockets since the chain no longer fits the sprocket teeth properly. The pitch of the chain is larger than the pitch of the sprocket teeth. A worn or elongated drive chain rides high on the outer tips of the sprocket teeth, causing rapid wear on the outer tips of the sprocket teeth.

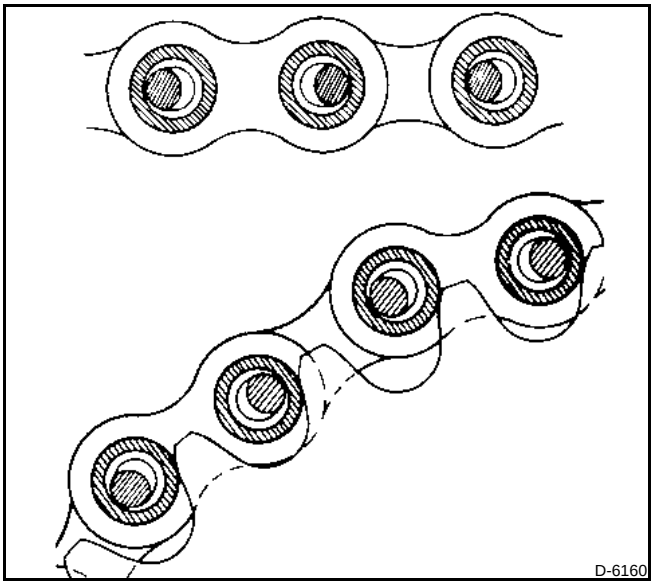


FIG. 20

Drive Chain Service Tips

FIG. 21: To extend drive chain service life follow these rules:

- Chains must be removed from the machine for cleaning and lubrication at the end of every season. In addition, drive chains must be lubricated daily (except when operating in dirty or sandy field conditions).
- Periodically, check the alignment of all sprockets and idlers. A sprocket not in alignment will wear on the sides of the sprocket teeth or on the inside of the chain inner (roller) links.
- To remove a chain, turn the drive until the connecting link is fully engaged on one of the sprockets (to relieve the tension on the connecting link pins), then remove the connecting link pins and lift the chain off the sprockets.

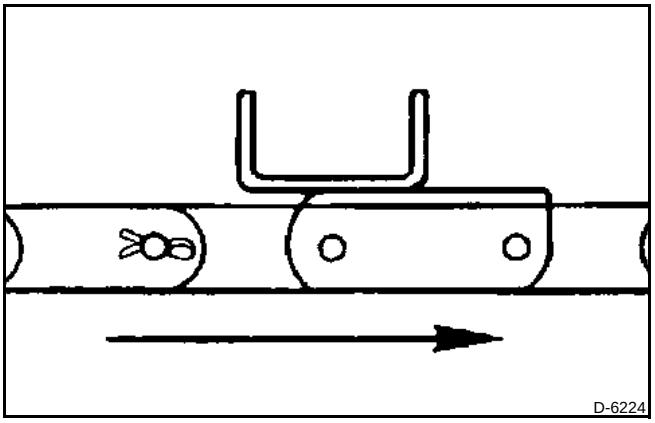


FIG. 21

- Never insert a new link in a chain that has been elongated by wear. The pitch of the new link will be shorter than the pitch of the worn links. The shock each time the new link engages a sprocket will soon destroy the chain.
- Do not install a new chain on worn sprockets. Operation under such conditions will do more damage to a new chain than many hours of normal use.
- Do not install a worn or elongated chain on new sprockets. A worn or elongated chain will ride high on the outer tips of the sprocket teeth causing rapid wear of the new sprockets.
- As a drive chain wears and extends, always remove links to make sure the chain length and tension are correct.

Chain Replacement

Pin Removal

If the chain is of cotter pin type construction, remove the cotter pins.

If the chain is of rivet type construction, grind the pin heads off so the pin ends are flush with the link plate. Drive the pins out of the link plate.

Installation

Check all the adjustments, alignment, and make sure all the setscrews, bolts, and nuts are tight on the chain drive.

Fit the chain around both sprockets and put the free ends together on one sprocket for connection. The sprocket teeth will locate the chain end links. Install the connecting link, connecting link cover plate, and the spring clip or cotter pins. On larger pitch chains or heavy multiple strand chains, lock the sprockets for this operation. When press fit cover plates are used, be careful not to drive the plate on so far as to grip the roller links. Stiff joints can result if this is done.

On drives with long distances, support the chain with a plank or bar as the connection is made.

FIG. 22: When using spring clip connectors, always install the spring clip (1) with the open end of the clip trailing in the direction of chain travel to prevent removal or loss of the spring clip.

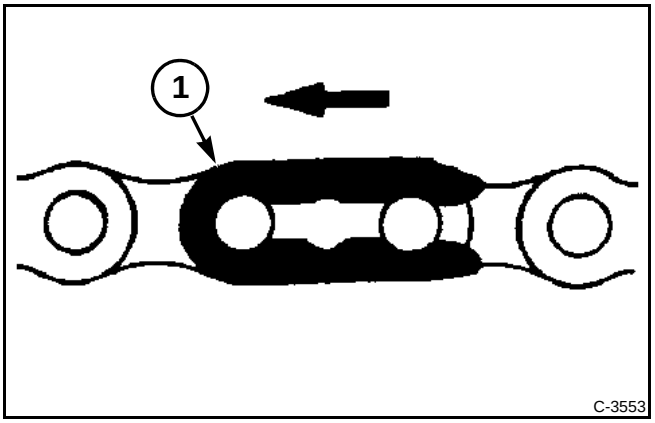


FIG. 22

Cleaning and Lubricating Chains

Roller chain is made of a series of connecting moving metallic bearings, which must be properly lubricated to get the maximum service life out of the chain. Many slow speed drives operate with little or no lubrication beyond the first factory lubrication. But proper lubrication will extend the life of every chain drive. The chain drive requires lubrication for six purposes.

1. To reduce wear of the pin bushing joint.
2. To cushion shock loads
3. To remove heat generated by the drive.
4. To flush away foreign materials.
5. To lubricate the chain sprocket contact surfaces.
6. To retard rust or corrosion.

Lubricate the chains with AGCO chain and cable lubricant or light engine oil at least once every ten hours of operating time. Apply the lubricant when the chain is warm, then let the extra oil drain off before operating the machine.

Once every season, or when the chains show signs of becoming stiff, remove the chains from the machine and service as follows:

- Clean in solvent to remove dirt.
- Permit the chain to soak as long as possible in engine oil, over night if possible.
- Remove the chain from the oil and put the chain in position to permit extra oil to drain off.
- Wipe the chain with a clean cloth.

IMPORTANT: The chain must be permitted to drain completely.

The seal rings form a reservoir of lubrication between the pin and bushing. Lubricating the chain periodically can prevent surface rust. If the chain requires cleaning, use kerosene applied with a cloth. Do not apply kerosene directly or soak the chain in kerosene.

IMPORTANT: The chain must not come in contact with solvents such as gasoline, benzene, acetone, or other corrosive materials as this will damage the O-rings.

Drive Chain Lubrication

Drive chain service life will vary according to the method the chain is lubricated. A properly lubricated chain will last 100 to 200 times longer than the same chain which is poorly lubricated and not kept in good condition.

Lubrication of the chain pins and inner link bushing surfaces which contact each other while the chain is under full load are most important. Lubrication to a smaller degree is also required between the chain rollers and inner link bushing surfaces.

Oil must be applied to the upper edges of the chain link side plates on the slack chain strand before the chain engages a sprocket. Since access of oil to chain pins and bushings is only possible through the clearances between the link side plates when the chain is slack.

If oil is applied only to the chain rollers the oil can not reach the chain link side plate pins and bushings, and can not retard chain wear.

The elongation of roller chains results from wear between the pins and bushings only. Roller wear does not cause or add to the extending of roller chains.

Drive Chain Lubricants

Lubrication specifications are met by the use of a good grade of clean engine oil without detergents.

Detergent oils are not required but oils with anti-foam, anti-rust, or film strength additives can be helpful.

The proper lubricant viscosity for many operating temperatures are shown in the chart below.

Ambient Operating Temperatures		**Recommended Lubricant**
degrees F	**degrees C**	**Viscosity**
-20 to 20	- 29 to - 7	SAE 10
20 to 40	- 7 to 4	SAE 20
40 to 100	4 to 38	SAE 30
100 to 120	38 to 49	SAE 40
120 to 140	49 to 60	SAE 50

NOTE: Heavy oils and greases are too stiff to enter the chain joints and must not be used.

With proper lubrication, a separating wedge of lubrication is formed between the pins and bushings in the chain joints much like that formed in journal bearings.

The viscosity of the lubricant changes the lubricants film strength, and capacity to keep the moving parts separate. The highest viscosity oil which will flow between the chain link plates and fill the pin bushing areas will provide the best wear life. This is needed to reduce metal to metal contact. If the lubricant is supplied with enough volume, the lubricant also cools and cushions shock loads.

Good Drive Chain Lubrication

Connector link pins, on removal from a properly lubricated drive chain, will have a high luster polish and will not be changed in color.

Drive chains which are operated without proper lubrication will have a reddish brown oxide in the joints. On removal, the connector link pins will be changed in color, rough, with grooves, or damaged.

When operating in dust containing excessive amounts of damaging particles (sandy field conditions), the chain must not be lubricated on the outside. The oil will pick up damaging particles that form a grinding compound with lubricant (similar to valve lapping compound) which causes early wear of both the sprockets and the drive chain.

Under severe conditions, the chain must be removed every 50 hours of operation cleaned and lubricated, following the procedure shown below:

1. Remove the chain from the sprockets.
2. Wash the chain in cleaning solvent. If the chain is gummed, soak the chain for several hours in the cleaning solvent, and then wash the chain in clean fluid.
3. Using clean and dry compressed air, blow the chain dry or wipe the chain dry with a clean towel or cloth.
4. Inspect the chain for wear and corrosion.
5. Soak the chain in engine oil to lubricate the pins, bushings, and rollers.
6. Position the chain in a vertical position and permit the extra lubricant to drain off.
7. Wipe the chain dry with a clean shop towel or cloth.
8. While the chain is off the sprockets, clean the sprockets with cleaning solvent, and inspect the chain for wear and corrosion.
9. Check the driver, driven, and idler sprocket alignment and make corrections if found necessary.
10. Install the drive chain and properly adjust the chain tension.

CHAIN SPEED CALCULATION FORMULAS

To calculate or find chain speed in ft/min, use the formulas below: = Belt Speed (ft/min)

Driver Sheave Diameter (inches) X 3.1416/12 X Driver Sheave Speed (rpm) = Chain Speed (ft/min)

Driver Sheave Diameter (inches) X 0.2618 X Driver Sheave Speed (rpm) = Chain Speed (ft/min)

GEOMETRICAL FORMULAS

To calculate or find the following geometrical values, use the formulas shown below:

Circumference of a Circle

Diameter of circle X 3.1416 = Circumference of circle

Area of a Circle

(Diameter of circle)^2 X 0.7854 = Area of circle

Volume of a Cylinder

(Diameter of circle)^2 X 0.7854 X Length of cylinder= Volume of cylinder

Volume of a Sphere

(Diameter of circle)^3 X 0.5236 = Volume of sphere

Area of a Triangle

Length of triangle base X Length of triangle height / 2 = Area of triangle

METRIC TO IMPERIAL AND IMPERIAL TO METRIC CONVERSION FACTORS

To change metric measurements into imperial measurements or imperial measurements into metric measurements use the conversion factors shown below:

Measures of Temperature

Degrees Centigrade (Celsius) to Degrees Fahrenheit

(C X 1.8) + 32 = F

Degrees Fahrenheit to Degrees Centigrade (Celsius)

(F - 32) X 0.556 = C

Measures of Power

Kilowatts to Horsepower

Kilowatts X 1.34104 = Horsepower

Horsepower to Kilowatts

Horsepower X 0.7457 = Kilowatts

Measures of Pressure

kilo Pascals to Pound-force per Square Inch

kilo Pascals X 0.14504 = Pound-force per Square Inch

Pound-force per Square Inch to kilo Pascals

Pound-force per Square Inch X 6.8947 = kilo Pascals

Measures of Length

Millimeters to Inches

mm X 0.03938 = Inches

Inches to Millimeters

Inches X 25.4 = mm

Centimeters to Inches

Centimeters X 0.3937 = Inches

Inches to Centimeters

Inches X 2.54 = Centimeters

Meters to Feet

Meters X 3.2808 = Feet

Feet to Meters

Feet X 0.3048 = Meters

Meters to Yards

Meters X 1.09361 = Yards

Yards to Meters

Yards X 0.9144 = Meters

Kilometers to Miles

Kilometers X 0.62137 = Miles

Miles to Kilometers

Miles X 1.6093 = Kilometers

Measures of Area

Square Millimeters to Square Inches

Square Millimeters X 0.00155 = Square Inches

Square Inches to Square Millimeters

Square Inches X 645.16 = Square Millimeters

Square Centimeters to Square Inches

Square Centimeters X 0.1550 = Square Inches

Square Inches to Square Centimeters

Square Inches X 6.4516 = Square Centimeters

Square Meters to Square Feet

Square Meters X 10.7640 = Square Feet

Square Feet to Square Meters

Square Feet X 0.0929 = Square Meters

Square Meters to Square Yards

Square Meters X 1.196 = Square Yards

Square Yards to Square Meters

Square Yards X 0.836 = Square Meters

Square Kilometers to Square Miles

Square Kilometers X 0.38614 = Square Miles

Square Miles to Square Kilometers

Square Miles X 2.5889 = Square Kilometers

Hectares to Acres

Hectares X 2.47104 = Acres

Acres to Hectares

Acres X 0.40469 = Hectares

Measures of Volume (Dry)

Cubic Millimeters to Cubic Inches

Cubic Millimeters X 0.000061 = Cubic Inches

Cubic Inches to Cubic Millimeters

Cubic Inches X 16 387.06 = Cubic Millimeters

Cubic Centimeters to Cubic Inches

Cubic Centimeters X 0.0610 = Cubic Inches

Cubic Inches to Cubic Centimeters

Cubic Inches X 16.387 = Cubic Centimeters

Cubic Meters to Cubic Feet

Cubic Meters X 35.3145 = Cubic Feet

Cubic Feet to Cubic Meters

Cubic Feet X 0.028317 = Cubic Meters

Cubic Meters to Cubic Yards

Cubic Meters X 1.308 = Cubic Yards

Cubic Yards to Cubic Meters

Cubic Yards X 0.7646 = Cubic Meters

Cubic Meters to Bushels

Cubic Meters X 27.4959 = Bushels

Bushels to Cubic Meters

Bushels X 0.03639 = Cubic Meters

Measures of Volume (Liquid)

Milliliters to Fluid Ounces

Milliliters X 0.35195 = Fluid Ounces

Fluid Ounces to Milliliters

Fluid Ounces X 28.413 = Milliliters

Centiliters to Fluid Ounces

Centiliters X 0.35195 = Fluid Ounces

Fluid Ounces to Liters

Fluid Ounces X 0.02841 = Liters

Liters to Imperial Quarts

Liters X 0.880 = Imperial Quarts

Imperial Quarts to Liters

Imperial Quarts X 1.13652 = Liters

Liters to Imperial Gallons

Liters X 0.21997 = Imperial Gallons

Imperial Gallons to Liters

Imperial Gallons X 4.546 = Liters

Liters to U.S. Quarts

Liters X 1.0567 = U.S. Quarts

U.S. Quarts to Liters

U.S. Quarts X 0.946 = Liters

Liters to U.S. Gallons

Liters X 0.2642 = U.S. Gallons

U.S. Gallons to Liters

U.S. Gallons X 3.785 = Liters

Measures of Mass (Weight)

Grams to Ounces

Grams X 0.03527 = Ounces

Ounces to Grams

Ounces X 28.355 = Grams

Kilograms to Pounds

Kilograms X 2.2046 = Pounds

Pounds to Kilograms

Pounds X 0.45359 = Kilograms

Metric Tonnes to Pounds

Metric Tonnes X 2204.628 = Pounds

Pounds to Metric Tonnes

Pounds X 0.000454 = Metric Tonnes

Long Tons to Short Tons

Long Tons X 1.1023 = Short Tons

Short Tons to Long Tons

Short Tons X 0.90718 = Long Tons

Measures of Effort (Torque)

Inch Ounces to Inch Pounds

Inch Ounces X 0.0625 = Inch Pounds

Inch Pounds to Inch Ounces

Inch Pounds X 16 = Inch Ounces

Inch Pounds to Foot Pounds

Inch Pounds X 0.0834 = Foot Pounds

Foot Pounds to Inch Pounds

Foot Pounds X 12 = Inch Pounds

Inch Ounces to Newton Meters

Inch Ounces X 0.00706 = Newton Meters

Newton Meters to Inch Ounces

Newton Meters X 141.6112 = Inch Ounces

Inch Pounds to Newton Meters

Inch Pounds X 0.1130 = Newton Meters

Newton Meters to Inch Pounds

Newton Meters X 8.8507 = Inch Pounds

Foot Pounds to Newton Meters

Foot Pounds X 1.3556 = Newton Meters

Newton Meters to Foot Pounds

Newton Meters X 0.73756 = Foot Pounds

Reference Tables

Measures of Length

1 Mile = 320 Rods = 1760 Yards = 5280 Feet

1 Rod = 5.5 Yards = 16.5 Feet

Square Measure

1 Square Mile = 640 Acres

1 Acre = 4840 Square Yards = 43 560 Square Feet

1 Square Yard = 9 Square Feet

Cubic Measure

1 Cubic Yard = 27 Cubic Feet

1 Cubic Foot = 1728 Cubic Inches

Dry Measure

1 Bushel (U.S.) = 1.2445 Cubic Feet = 2150.42 Cubic Inches

1 Bushel (Imperial) = 8 Imperial Gallons = 1.2837 Cubic Feet = 2218.19 Cubic Inches

1 Peck = 8 Quarts = 16 Pints

1 Quart = 2 Pints

Liquid Measure

1 Gallon (U.S.) = 0.1337 Cubic Feet = 231 Cubic Inches = 4 Quarts (U.S.)

1 Gallon (Imperial) = 1.2009 U.S. Gallons = 277.42 Cubic Inches

1 Quart = 2 Pints

1 Cubic Foot = 7.48 U.S. Gallons = 6.23 Imperial Gallons

Measures of Weight

1 Gross or Long Ton = 2240 Pounds

1 Net or Short Ton = 2000 Pounds

1 Metric Tonne = 1000 Kilograms = 2204.628 Pounds

1 Pound = 16 Ounces

Measure of Pressure

1 Bar = 14.5 Pound-force per Square Inch = 100 kilo Pascals

1 Atmosphere = 14.7 Pound-force per Square Inch

1 Kilogram per Centimeter = 14.2 Pound-force per Square Inch

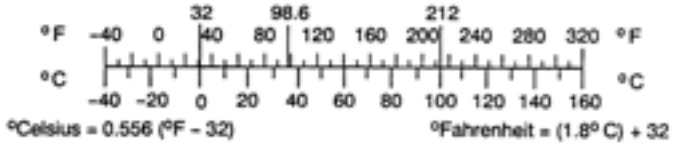
1 Inch of Mercury = 0.4912 Pound-force per Square Inch

1 Pound-force per Square Inch = 6.8947 kilo pascals = 0.145 bar = 2.03 Inches of Mercury

METRIC CONVERSIONS

	MULTIPLY:	BY:		To Get: MULTIPLY	BY:		To Get:
LINEAR	inches	x 25.4	=	millimeters (mm)	x 0.03937	=	inches
	feet	x 0.3048	=	meters (m)	x 3.281	=	feet
	yards	x 0.9144	=	meters (m)	x 1.0936	=	yards
	miles	x 1.6093	=	kilometers (km)	x 0.6214	=	miles
	inches	x 2.54	=	centimeters (cm)	x 0.3937	=	inches
	microinches	x 0.0254	=	micrometers (um)	x 39.37	=	microinches
AREA	inches²	x 645.16	=	millimeters² (mm²)	x 0.00155	=	inches²
	inches²	x 6.4516	=	centimeters² (cm²)	x 0.155	=	inches²
	feet²	x 0.0929	=	meters² (m²)	x 10.764	=	feet²
	yards²	x 0.8361	=	meters² (m²)	x 1.196	=	yards²
	acres	x 0.4047	=	hectometers² (hm²)	x 2.471	=	acres
			=	hectares (ha)			
VOLUME	inches³	x 16387	=	millimeters³ (mm³)	x 0.000061	=	inches³
	inches³	x 16.387	=	centimeters³ (cm³)	x 0.06102	=	inches³
	inches³	x 0.01639	=	liters	x 61.024	=	inches³
	quarts	x 0.94635	=	liters	x 1.0567	=	quarts
	gallons	x 3.7854	=	liters	x 0.2642	=	gallons
	feet³	x 28.317	=	liters	x 0.03531	=	feet³
	feet³	x 0.02832	=	meters³ (m³)	x 35.315	=	feet³
	fluid oz.	x 29.57	=	milliliters (ml)	x 0.03381	=	fluid oz.
	yards³	x 0.7646	=	meters³ (m³)	x 1.3080	=	yards³
	teaspoons	x 4.929	=	milliliters (ml)	x 0.2029	=	teaspoons
	cups	x 0.2366	=	liters	x 4.227	=	cups
	bushel	x 35.239	=	liters	x 0.02838	=	bushels
	bushel	x 0.03524	=	meters³ (m³)	x 28.378	=	bushels
MASS	ounces (av)	x 28.35	=	grams (g)	x 0.03527	=	ounces (av)
	pounds (av)	x 0.4536	=	kilograms (kg)	x 2.2046	=	pounds (av)
	tons (2000 lbs)	x 907.18	=	kilograms (kg)	x 0.001102	=	tons (2000 lbs)
	tons (2000 lbs)	x .90718	=	metric tons(t)	x 1.1023	=	tons(2000 lbs)
	tons (long) (2240 lbs)	x 1016.05	=	kilograms (kg)	x .000984	=	tons (long) (2240 lbs)
FORCE	ounces - f (av)	x 0.278	=	newtons (N)	x 3.597	=	ounces - f (av)
	pounds - f (av)	x 4.488	=	newtons (N)	x 0.2248	=	pounds - f (av)
	kilograms - f	x 9.807	=	newtons (N)	x 0.10197	=	kilograms - f
PRESSURE OR STRESS	pounds/sq.in.	x 6.895	=	kilopascals (kPa)	x 0.145	=	pounds/sq. in.
	pounds/sq.in.	x 0.0689	=	bar	x 14.503	=	pounds/sq. in.
POWER	horsepower	x 0.746	=	kilowatts (kW)	x 1.34	=	horsepower
	ft-lbf/min.	x 0.0226	=	watts (W)	x 44.25	=	ft - lbf/min.
TORQUE	pound - inches	x 0.11298	=	newton-meters (N.m)	x 8.851	=	pound-inches
	pound - feet	x 1.3558	=	newton-meters (N.m)	x 0.7376	=	pound-feet
VELOCITY	miles/hour	x 1.6093	=	kilometers/hour (km/h)	x 0.6214	=	miles/hour
	feet/sec.	x 0.3048	=	meters/sec. (m/s)	x 3.281	=	feet/sec.
	kilometers/hr.	x 0.27778	=	meters/sec. (m/s)	x 3.600	=	kilometers/hr.
	miles/hours	x 0.4470	=	meters/sec. (m/s)	x 2.237	=	miles/hour

TEMPERATURE



METCONV

FRACTIONS, DECIMALS, AND MILLIMETERS CONVERSION CHART

Inches		mm	Inches		mm
Fraction	Decimal		Fraction	Decimal	
-	0.0004	0.01	-	0.3937	10.0
-	0.004	0.1	13/32	0.406	10.319
-	0.01	0.25	-	0.413	10.5
1/64	0.0156	0.397	27/64	0.422	10.716
-	0.0197	0.5	-	0.4331	11
-	0.0295	0.75	7/16	0.438	11.113
1/32	0.03125	0.794	29/64	0.453	11.509
-	0.0394	1.0	15/32	0.469	11.906
3/64	0.0469	1.191	-	0.4724	12.0
-	0.059	1.5	31/64	0.484	12.303
1/16	0.062	1.588	-	0.492	12.5
5/64	0.0781	1.984	1/2	0.5	12.7
-	0.0787	2.0	-	0.5118	13.0
3/32	0.094	2.381	33/64	0.5156	13.097
-	0.0984	2.5	17/32	0.531	13.494
7/64	0.109	2.778	35/64	0.547	13.891
-	0.1181	3.0	-	0.5512	14.0
1/8	0.125	3.175	9/16	0.563	14.288
-	0.1378	3.5	-	0.571	14.5
9/64	0.141	3.572	37/64	0.578	14.684
5/32	0.156	3.969	-	0.5906	15.0
-	0.1575	4.0	19/32	0.594	15.081
11/64	0.172	4.366	39/64	0.609	15.478
-	0.177	4.5	5/8	0.625	15.875
3/16	0.1875	4.763	-	0.6229	16
-	0.1969	5.0	41/64	0.6406	16.272
13/64	0.203	5.159	-	0.6496	16.5
-	0.2165	5.5	21/32	0.656	16.669
7/32	0.219	5.556	-	0.6693	17.0
15/64	0.234	5.953	43/64	0.672	17.066
-	0.2362	6.0	11/16	0.6875	17.463
1/4	0.25	6.35	45/64	0.703	17.859
-	0.2559	6.5	-	0.7087	18.0
17/64	0.2656	6.747	23/32	0.719	18.256

Inches		mm	Inches		mm
Fraction	Decimal		Fraction	Decimal	
-	0.2756	7.0	-	0.7283	18.5
9/32	0.281	7.144	47/64	0.734	18.653
-	0.2953	7.5	-	0.7480	19.0
19/64	0.297	7.541	3/4	0.75	19.05
5/16	0.312	7.938	49/64	0.7656	19.447
-	0.315	8.0	25/32	0.781	19.844
21/64	0.328	8.334	-	0.7874	20.0
-	0.335	8.5	51/64	0.797	20.241
11/32	0.344	8.731	13/16	0.8125	20.638
-	0.3543	9.0	-	0.8268	21.0
23/64	0.359	9.128	53/64	0.828	21.034
-	0.374	9.5	27/32	0.844	21.431
3/8	0.375	9.525	55/64	0.859	21.828
25/64	0.391	9.922	-	0.8661	22.0

Inches		mm	Inches		mm
Fraction	Decimal		Fraction	Decimal	
7/8	0.875	22.225	1-3/4	1.750	44.45
57/64	0.8906	22.622	-	1.7717	45.0
-	0.9055	23.0	1-25/32	1.781	45.244
29/32	0.9062	23.019	-	1.8110	46.0
59/64	0.922	23.416	1-13/16	1.8125	46.038
15/16	0.9375	23.813	1-27/32	1.844	46.831
-	0.9449	24.0	-	1.8504	47.0
61/64	0.953	24.209	1-7/8	1.875	47.625
31/32	0.969	24.606	-	1.8898	48.0
-	0.9843	25.0	1-29/32	1.9062	48.419
63/64	0.9844	25.003	-	1.9291	49.0
1	1.0	25.4	1-15/16	1.9375	49.213
-	1.0236	26.0	-	1.9685	50.0
1-1/32	1.0312	26.194	1-31/32	1.969	50.006
1-1/16	1.062	26.988	2	2.0	50.8
-	1.063	27.0	-	2.0079	51.0
1-3/32	1.094	27.781	2-1/32	2.03125	51.594
-	1.1024	28.0	-	2.0472	52.0
1-1/8	1.125	28.575	2-1/16	2.062	52.388
-	1.1417	29.0	-	2.0866	53.0

Inches		mm	Inches		mm
Fraction	Decimal		Fraction	Decimal	
1-5/32	1.156	29.369	2-3/32	2.094	53.181
-	1.1811	30.0	2-1/8	2.125	53.975
1-3/16	1.1875	30.163	-	2.126	54.0
1-7/32	1.219	30.956	2-5/32	2.156	54.769
-	1.2205	31.0	-	2.165	55.0
1-1/4	1.25	31.75	2-3/16	2.1875	55.563
-	1.2598	32.0	-	2.2047	56.0
1-9/32	1.281	32.544	2-7/32	2.219	56.356
-	1.2292	33.0	-	2.244	57.0
1-5/16	1.312	33.338	2-1/4	2.25	57.150
-	1.3386	34.0	2-9/32	2.281	57.944
1-11/32	1.406	35.719	-	2.2835	58.0
-	1.4173	36.0	2-5/16	2.312	58.738
1-7/16	1.438	36.513	-	2.3228	59.0
-	1.4567	37.0	2-11/32	2.344	59.531
1-15/32	1.469	37.306	-	2.3622	60.0
-	1.4961	38.0	2-3/8	2.375	60.325
1-1/2	1.5	38.1	-	2.4016	61.0
1-17/32	1.531	38.894	2-13/32	2.406	61.119
-	1.5354	39.0	2-7/16	2.438	61.913
1-9/16	1.562	39.688	-	2.4409	62.0
-	1.5748	40.0	2-15/32	2.469	62.706
1-19/32	1.594	40.481	-	2.4803	63.0
-	1.6142	41.0	2-1/2	2.5	63.5
1-5/8	1.625	41.275	-	2.5197	64.0
-	1.6535	42.0	2-17/32	2.531	64.294
1-21/32	1.6562	42.069	-	2.559	65.0
1-11/16	1.6875	42.863	2-9/16	2.562	65.088
-	1.6929	43.0	2-19/32	2.594	65.881
1-23/32	1.719	43.656	-	2.5984	66.0
-	1.7323	44.0	2-5/8	2.625	66.675

Inches		mm	Inches		mm
Fraction	Decimal		Fraction	Decimal	
-	2.638	67.0	3-17/32	3.531	89.694
2-21/32	2.656	67.469	-	3.5433	90.0
-	2.6772	68.0	3-9/16	3.562	90.4877
2-11/16	2.6875	68.263	-	3.5827	91.0
-	2.7165	69.0	3-19/32	3.594	91.281
2-23/32	2.719	69.056	-	3.622	92.0
2-3/4	2.75	69.85	3-5/8	3.625	92.075
-	2.7559	70.0	3-21/32	3.656	92.869
2-25/32	2.781	70.6439	-	3.6614	93.0
-	2.7953	71.0	3-11/16	3.6875	93.663
2-13/16	2.8125	71.4376	-	3.7008	94.0
-	2.8346	72.0	3-23/32	3.719	94.456
2-27/32	2.844	72.2314	-	3.7401	95.0
-	2.8740	73.0	3-3/4	3.75	95.25
2-7/8	2.875	73.025	-	3.7795	96.0
2-29/32	2.9062	73.819	3-25/32	3.781	96.044
-	2.9134	74.0	3-13/16	3.8125	96.838
2-15/16	2.9375	74.613	-	3.8189	97.0
-	2.9527	75.0	3-27/32	3.844	97.631
2-31/32	2.969	75.406	-	3.8583	98.0
-	2.9921	76.0	3-7/8	3.875	98.425
3	3.0	76.2	-	3.8976	99.0
3-1/32	3.0312	76.994	3-29/32	3.9062	99.219
-	3.0315	77.0	-	3.9370	100
3-1/16	3.062	77.788	3-15/16	3.9375	100.013
-	3.0709	78.0	3-31/32	3.969	100.806
3-3/32	3.094	78.581	-	3.9764	101.0
-	3.1102	79.0	4	4.0	101.6
3-1/8	3.125	79.375	4-1/16	4.062	103.188
-	3.1496	80.0	4-1/8	4.125	104.775
3-5/32	3.156	80.169	-	4.1338	105.0
3-3/16	3.1875	80.963	4-3/16	4.1875	106.363
-	3.189	81.0	4-1/4	4.25	107.95
3-7/32	3.219	81.756	4-5/16	4.312	109.538
-	3.2283	82.0	-	4.3307	110
3-1/4	3.25	82.55	4-3/8	4.375	111.125

Inches		mm	Inches		mm
Fraction	Decimal		Fraction	Decimal	
-	3.2677	83.0	4-7/16	4.438	112.713
3-9/32	3.281	83.344	4-1/2	4.5	114.3
-	3.3071	84.0	-	4.5275	115.0
3-5/16	3.312	84.1377	4-9/16	4.562	115.888
3-11/32	3.344	84.9314	4-5/8	4.625	117.475
-	3.3464	85.0	4-11/16	4.6875	119.063
3-3/8	3.375	85.725	-	4.7244	120
-	3.3858	86.0	4-3/4	4.75	120.65
3-13/32	3.406	86.519	4-13/16	4.8125	122.238
-	3.4252	87.0	4-7/8	4.875	123.825
3-7/16	3.438	87.313	-	4.9212	125.0
-	3.4646	88.0	4-15/16	4.9375	125.413
3-15/32	3.469	88.106	5	5.0	127.0
3-1/2	3.5	88.9	-	5.1181	130
-	3.5039	89.0	5-1/4	5.25	133.350

Inches		mm	Inches		mm
Fraction	Decimal		Fraction	Decimal	
5-1/2	5.5	139.7	-	9.8425	250.0
-	5.5118	140.0	10	10.0	254.001
5-3/4	5.75	146.05	-	10.2362	260.0
-	5.9055	150.0	-	10.6299	270.0
6	6.0	152.4	11	11.0	279.401
6-1/4	6.25	158.75	-	11.0236	280.0
-	6.2992	160.0	-	11.4173	290.0
6-1/2	6.5	165.1	-	11.8110	300.0
-	6.6929	170.0	12	12.0	304.801
6-3/4	6.75	171.45	13	13.0	330.201
7	7.0	177.8	-	13.7795	350
-	7.0866	180.0	14	14.0	355.601
-	7.4803	190.0	15	15.0	381.001
7-1/2	7.5	190.5	-	15.7480	400.0
-	7.8740	200.0	16	16.0	406.401
8	8.0	203.2	17	17.0	431.801
-	8.2677	210.0	-	17.7165	450.0
8-1/2	8.5	215.9	18	18.0	457.201