SELA 1208-06

KUC

PROCEDURE MANUAL

EDITION 12

November 2006

KOMATSU

FOREWORD

We updated KUC Procedure Manual by adding undercarriage related data of following machines which were model changed and introduced in the market recently to meet with Tier 3 (emission control) regulation.

Added Model	S/N
D85EX-15EO	11001 up
D85PX-15EO	1201 up
D155AX-6	80001 up
D275AX-5EO	30001 up
D375A-5EO	50001 up
D475A-5EO	30001 up
PC200/200LC-8	300001 up
PC210/210LC-8	60001 up
PC220/220LC-8	70001 up
PC230/230LC-8	20001 up
PC300/300LC-7EO	50001 up
PC350/350LC-7EO	30001 up
PC400/400LC-7EO	60001 up
PC450/450LC-7EO	30001 up
PC600/600LC-8	30001 up
PC650/650LC-8	50001 up
PC800/800LC-8	50001 up
PC850-8	10001 up
PC1250/1250LC-8	30001 up
PC2000-8	

Hoping the revised KUC Procedure Manual will support your sales promotion activities for Komatsu genuine undercarriage.

CONTENTS

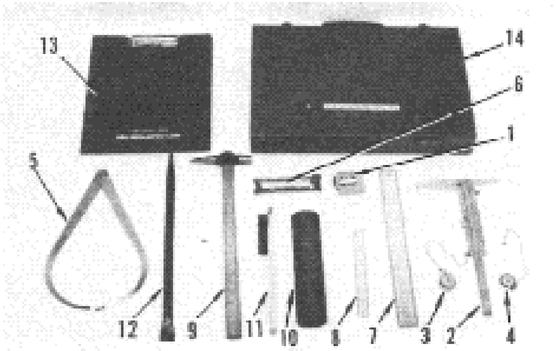
I. General Information

1. Wear Measurement & Total Potential Hour

1-1. Track Measuring Tool

The following instruments and tools are required to make inspections and measurements.

1) KUC Measurement Kit



Parts Number
791-502-1005

Other Tools:
To remove mud, the following auxiliary tools are also required:
a. 1-m Pinch bar
b. Scoop

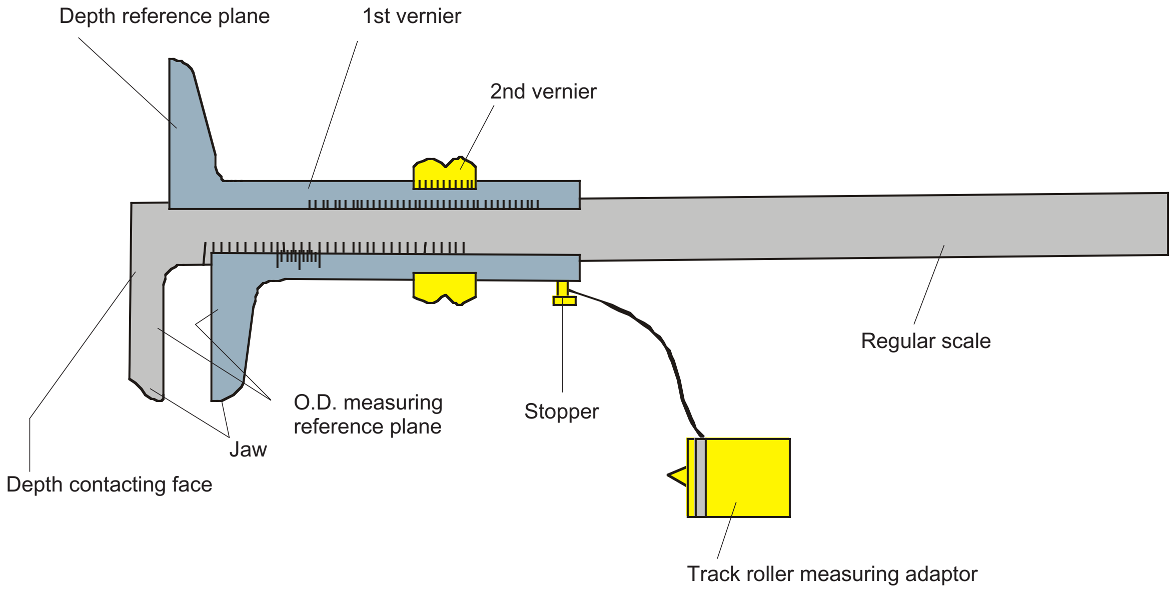
Inspection & Measurement Tool List

Index No.	Part No.	Instrument	Remark	
			Inspection & Measurement	Purpose
1	790-301-1410	Steel Measure	D	
2	791-502-1011	Muti-scale	A, C, F, H, I, J, K, L, M	
3	791-502-1021	Adapter	I	
4	791-502-1030	Adapter	I	
5	791-502-1061	Outer Calipers	G	
6	791-502-1071	Thickness Gauge	E	
7	791-502-1080	Scale	A,L	
8	791-502-1090	Scale	A,L	
9	791-502-1210	Test hammer	B	
10	791-502-1220	Pin	D,E	
11	791-502-1230	Wire Brush		For removing mud
12	791-502-1240	Pinch Bar		For removing mud
13	791-502-1260	Binder		For filing sheets
14	791-502-1291	Case		For carrying measuring instruments

Remark Index	Inspection Parts Name	Inspection & Measurement
A	Shoe	Grouser Height
B		Loose Shoe Bolt
C	Link	Link Height
D		Link Pitch
E		Gap on Link Face
F		Outer Diameter of Bushing
G	Carrier Roller	Outer Diameter of Roller
H		Flange Width
I	Track Roller	Outer Diameter of Roller
J		Flange Width
K	Front Idler	Tread Depth
L		Tread Width
M		Tread Radius
N	Sprocket	Tooth Width

(1) How to Use a Multi-scale

1. Names of parts of a multi-scale and adaptor.



2. How to read the multi-scale.

(1) Regular scale and 1st vernier

The scale can be read to an accuracy of 1/20 mm. Learn how to read the multi-scale by the following example.

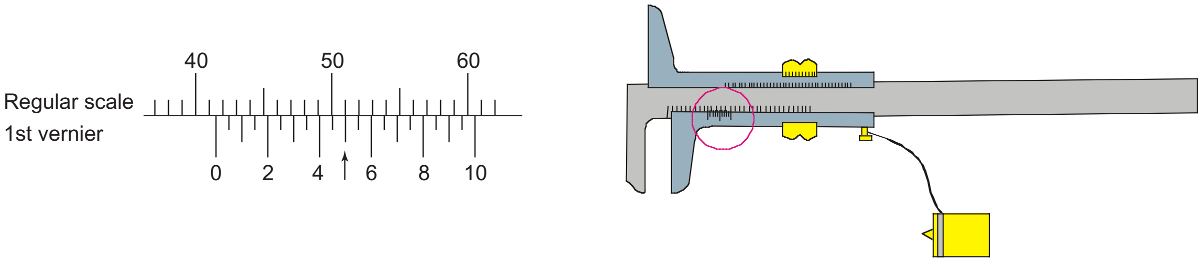


Fig. 1

1 Read the “0” position of the 1st vernier on the regular scale. In Fig. 1, the “0” position is located between the 41-mm and 42-mm scale divisions.

2 Find out where the scale of the 1st vernier coincides with that of the regular scale. In Fig. 1, the scale of the 1st vernier concides with a division between the 4- and 6- divisions of the regular scale. Then, it can be seen that a division between the 41-mm and 42-mm divisions is 0.5.

3 Consequently, the measured value is 41 + 0.5 = 41.5 mm.

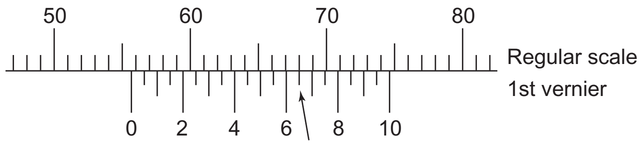


Fig. 2

1 The “0” division of the 1st vernier is located between the 55-mm and 56-mm divisions on the regular scale.

2 The scale of the 1st vernier coincides with the 6.5-division of the regular scale. That is, the regular scale reading is 0.65 mm.

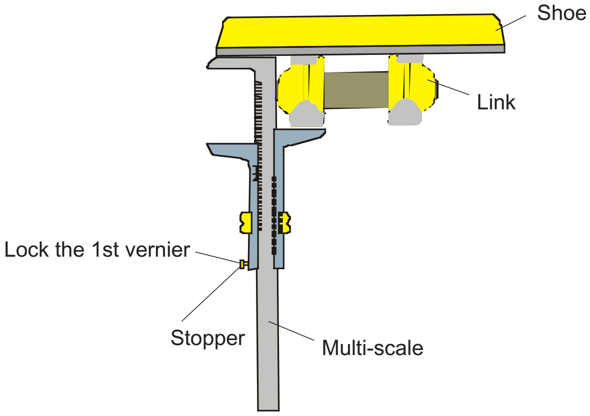
3 Consequently, the measured value is 55.65 mm.

When the multi-scale is used as a depth gauge to measure the depth, the scale can be read in the same manner as described above.

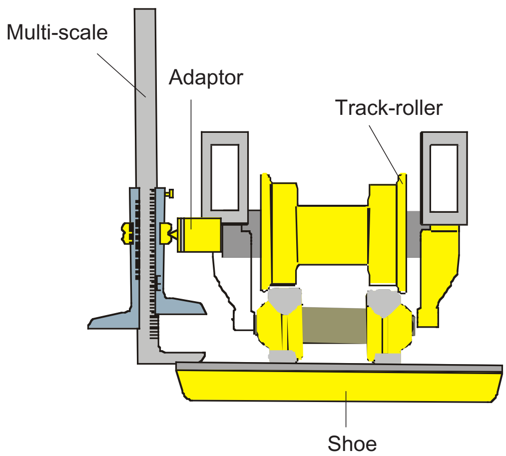
(2) 1st and 2nd verniers

[How to use the multi-scale to measure the track roller O.D.]

1 First measure the link tread height by attaching the depth contacting face to the link and fix the 1st vernier with a stopper.



2 Then, set an adaptor on the bolt used for lubricating track roller with oil and align the tip of the 2nd vernier with the adaptor.



3 Readings of the 1st and 2nd vernier in this case form a value of the track roller O.D.

NOTE: The 1st and 2nd verniers give a twofold reading. That is, the actual track roller outside diameter can be read directly.

The scale of the 2nd vernier can give a reading with a 1/5 mm-accuracy.
See the following example

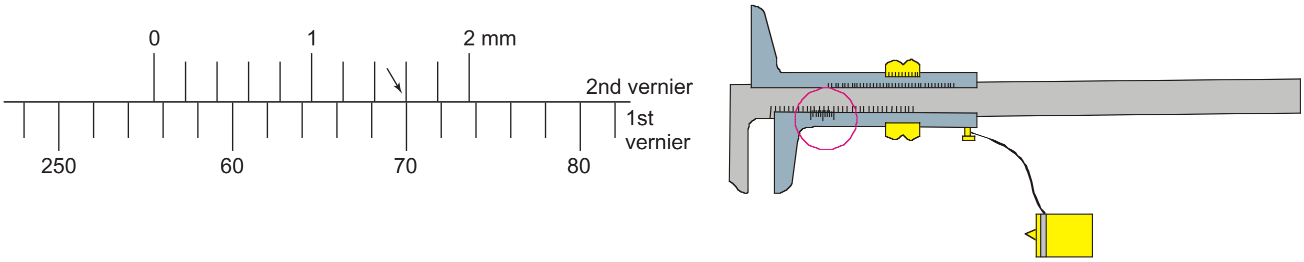


Fig. 3

1 Find out where the "0" position of the 2nd vernier is on the 1st vernier. In Fig. 3, the "0" position is located between the 254-mm and 256-mm scale divisions.
2 Then, find where the scale of the 2nd vernier coincides with that of the 1st vernier. In Fig. 3, both vernier scales coincide with each other in a division of 1.6. Thus, it can be seen that the division of 1.6 mm is between the 254-mm and 256-mm divisions of the 1st vernier.
3 Consequently, the track roller O.D. is 254 + 1.6 = 255.6 mm.

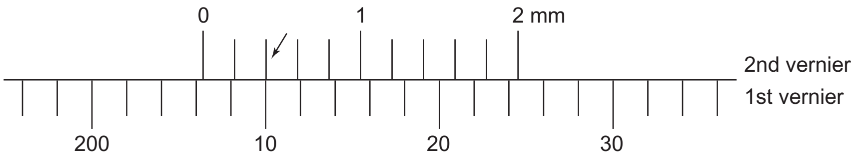


Fig. 4

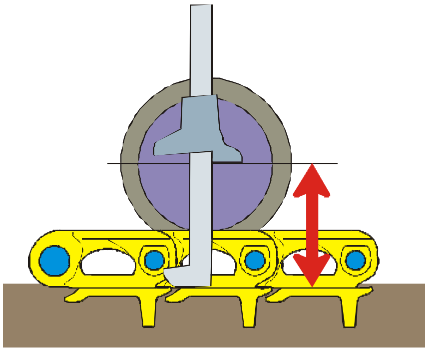
1 The "0" division of the 2nd vernier is located between the 206-mm and 208-mm divisions of the 1st vernier.
2 Both vernier scales coincide with each other in the 0.4-division of the 2nd vernier.
3 Consequently, the measured value is 206.4 mm.

3. Precautions for use of the multi-scale.

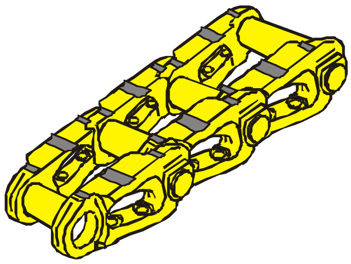
(1) Measurement of the link height

The link height should be measured at the mid-point of the link. Keep the multi-scale upright to the shoe with the depth contacting face pressed onto the shoe. Next, slide the 1st vernier until it comes into contact with the link, then, read the 1st vernier. Do not make a measurement on a bent shoe. If the right angularity cannot be insured, the measurement will not be correct.

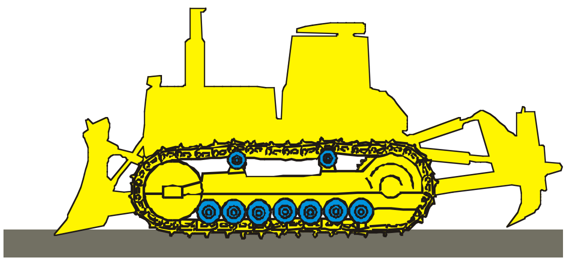
(2) Measurement of the track roller O.D.



As shown above, locate the center of the track roller to be measured at the mid-point of the link wherever practicable and measure the O.D. Force the depth contacting face onto the shoe tightly with the multi-scale kept upright to the shoe. Then, slide the 2nd vernier along the 1st vernier fixed with a stopper until the 2nd vernier is aligned with the adapter. At this time, check the shoe for bending. Do not measure a bent shoe. The measurement should be carried out at the mid-point of link, because the link wears out as shown below and different measured values are obtained at various points of measurement on the link.

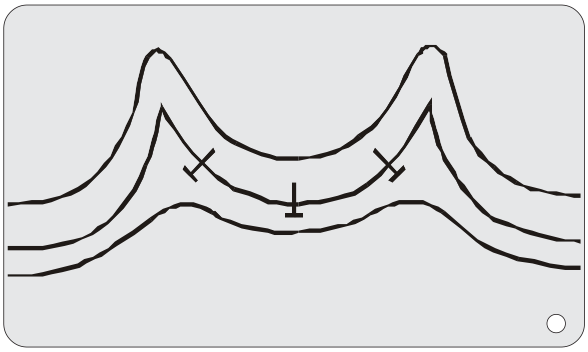


Park the machine on a mound so that the track rollers come into close contact with links and then make the measurement. If they are not in a close contact with each other, errors will likely occur in the measured values.



(2) Sprocket Wear Gauge

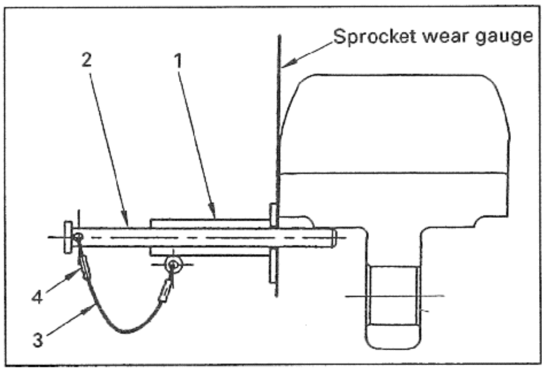
- **Wear gauge**



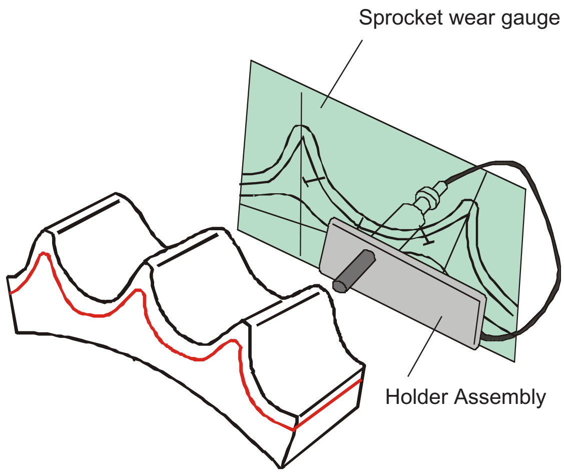
Purpose: To check abrasion on the face of sprocket teeth.

- **Wear gauge with holder assembly**

799-501-1100 HOLDER ASSEMBLY (FOR SPROCKET WEAR GAUGE)



Applicable model: D85P-21, D375A-2, D475A-2



The above type gauges have been developed for some models.
Refer to SERVICE TOOL GUIDE for details.

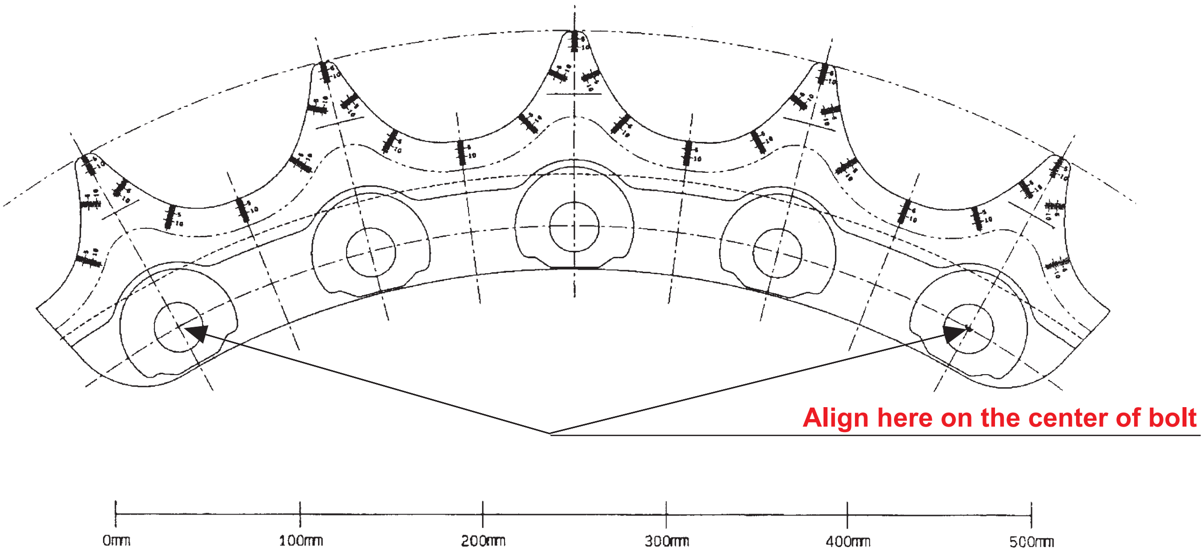
The wear gauge used to be available as SERVICE Tool for old models. But it is not available anymore for new models.

● **Current system**

Sprocket Wear Gauge is not supplied as service tool for new model

1. Komatsu provides a sketch of sprocket profile in Shop Manual for each model.
2. You take a photocopy on transparency film (for OHP) by enlarging into actual size. (A scale factor indicated in a sketch)
3. Use the transparency film as sprocket weargauge

   (See a sample sketch below)



* The above drawing is reduced to 35%. Enlarge it to 287% to return it to the full scale and make it copy on an OHP sheet.

2) Ultrasonic Tool

The ultrasonic measurement tool enables to shorten the measurement time for bushing, track rollers, etc.

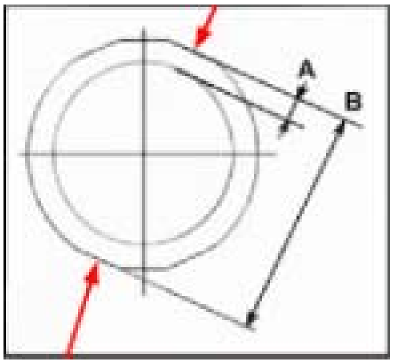
(1) Part Number

799-A50-1000
(Komatsu America supplies)

(2) Feature

1) Removing extra dirt is not necessary.
   For measuring, just remove as much dirt as about 20 mm the diameter of the measuring probe.
2) The tool enables you to easily measure wear of the turned track bushing.
   The external shape of the turned track bushing is warped, and you cannot measure its wear correctly with calipers, etc.
   The ultrasonic measurement tool measures the thickness (A size) of the bushing directly and calculates the wear amount, while calipers cannot correctly measure the wear amount after turned due to the influence of the wear amount (B size) before turn of track bushing.

Wear after turned of track bushing



Wear before turn of track bushing

3) The tool enables you to easily measure the tread of a track roller.
   When you try to measure it with traditional calipers, the calipers hit the guard, etc. and that prevents you from measuring it. But the ultrasonic measurement tool enables you to measure it simply by bringing the probe to it.

(3) Cautions in Measuring with The Ultrasonic Measurement Tool

In measuring idler tread (the inside surface is not finished) and link height, measured values vary with the position to which the probe is placed. So, you have to measure them carefully.

(4) How to Use

4.1 Preparatory work

1) Connection of probe
   Connect a probe to the tool.

2) Zero point adjustment
   Turn the tool ON and apply the couplant to the probe.
   Place the probe on the test disk on top of the tool.
   When Prb0 is displayed, the adjustment is satisfactory.

3) Inputting data of the machine to be measured
   - Turn on the power of the tool, press the FILE button, and select CREATE.
   - Select KOMATSU template and input model name, serial number, service meter, measurement date, and track type.
   - Using the Up and Down arrows to scroll through alphabet/numbers and the Left & Right arrows to change character position, ENTER the information as prompted.

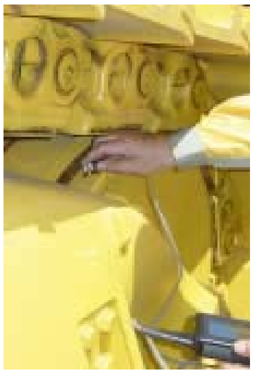
4.2 Measuring each Component (see note). Follow prompts for each measurement.

1) Measuring link bushing thickness
   Put couplant on end of probe.
   Place the probe on the link bushing and measure the thickness of the bushing.

2) Measuring link height
   Put couplant on end of probe.
   Place the probe on the link and measure the height of the link.

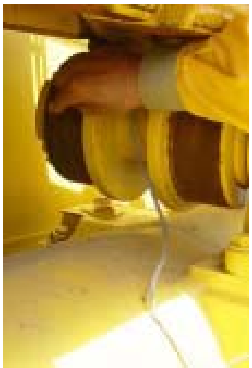
3) Measuring shoe grouser height
   Put couplant on end of probe.
   Place the probe on the shoe grouser and measure the height of the grouser.

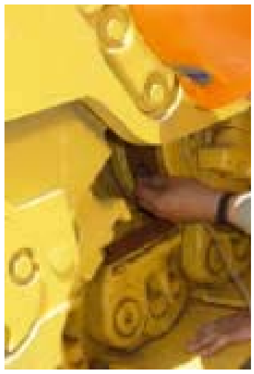
4) Measuring idler tread
   Put couplant on end of probe.
   Place the probe on the idler tread and measure the thickness of the tread.



5) Measuring carrier roller tread
Put couplant on end of probe.
Place the probe on the carrier roller tread and measure the thickness of the tread.

6) Measuring track roller tread
Put couplant on end of probe.
Place the probe on the track roller tread and measure the thickness of the tread.





Note: Refer to “Ultrasonic Measuring Point Table” on KUC procedure manual for where to take ultrasonic measurements.

Warning: Ultrasonic Measurements are based on the velocity of sound through various materials. Before taking any undercarriage measurements, verify that the velocity is set to 5900 meters/sec.

Additional couplant is available: Part Number 799-A50-1130 4 oz. bottle.

(5) Others

Since link pitch cannot be measured with the ultrasonic measurement tool, the manual measurement from the scale can be entered into the ultrasonic measurement tool.

3) Measurement Kit by KSA

This measurement tool kit is a manual measuring tool, but it has unique tools in it.

Fog example ...
- i Small depth gauge for measuring idler tread
- ii Small caliper for measuring Bushing O.D.

(1) Part Number

CK40-25
(Komatsu South Africa supplies)

Fig. 1

(2) Components

This tool is composed of three layers, and there are two kinds of outside calipers on the upper layer as shown in Fig. 1, there are three kinds of scales, two kinds of depth gauges and one kind of outside caliper on the middle layer as shown in Fig. 2, and there are one kind of vernier caliper and brushes on the lower layer as shown in Fig. 3.

Fig. 2

Fig. 3

Component parts:

No.	PART NUMBER	DESCRIPTION	Q'ty	SIZE
1	P40-25	CASE	1	400 x 250 x 100 mm
2	PDG-34	DEPTH GAUGE ALUMINIUM	1	340 mm
3	PDG-12	DEPTH GAUGE ALUMINIUM	1	120 mm
4	POC10-1	OUTSIDE CALIPER	1	100 mm
5	POC15-1	OUTSIDE CALIPER	1	150 mm
6	POC30-1	OUTSIDE CALIPER	1	300 mm
7	PV200-1	VERNIER CALIPER	1	200 mm
8	PST300-1	TAPE MEASURE	1	3 Meter
9	PSR300-1	STEEL RULE	1	300 mm
10	PSR100-1	STEEL RULE	1	100 mm
11	PWB-1	WIRE BRUSH 1		
12	PS50-1	SCRAPER	1	50 mm

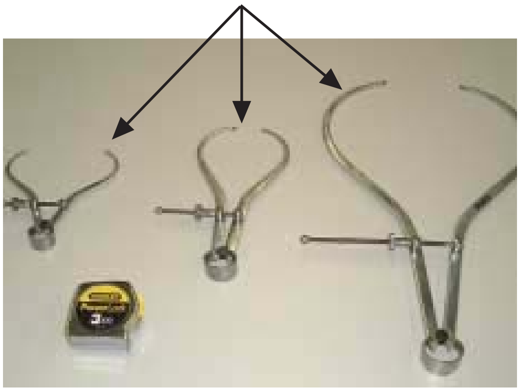
Note: You can order components individually.

(3) Feature

1) Three kinds of calipers are available suitably for parts to be measured.

2) The calipers are fitted with screw and enables you to measure accurately because it prevent positions from changing at the measuring time. In addition, the caliper tips are shaped, enabling to measure easily.

Shape for easy measurement and caliper with screw



3) The depth gauges enable you to measure link heights and grouser heights accurately.

Depth gauge

(4) How to Use

4.1 Measurement of wear of idler tread

1) Use the depth gauges to measure wear.

2) Read the scales to determine the depths measured with the depth gauges.

4.2 Measurement of Link Height

1) Use the depth gauges to measure link height.
2) Read the scales to determine the depths measured with the depth gauges.

4.3 Outer Shape of Bushing

Use the outside calipers to measure outside shape.

4.4 Measurement of Grouser Height

Use the depth gauges to measure grouser height.

4.5 Measurement of Carrier Roller Tread

Use the vernier caliper to measure carrier roller tread.

4.6 Measurement of Track Roller Tread

Use the vernier caliper to measure tread diameter.

4.7 Measurement of Link Pitch

Use the scales to measure link pitch.

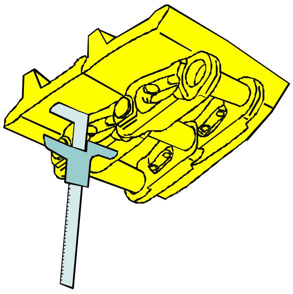
1-2. Measuring Technique

The Komatsu undercarriage measurement tool kit allows you to quickly and accurately measure all undercarriage components.
As a professional alternative, Komatsu ultrasonic measurement tool is available. This tool measures part thickness by sending high frequency sound waves through the component to be measured.

1) Link Height

Track links may be measured by either the multi-scale or ultrasonic measurement tool.

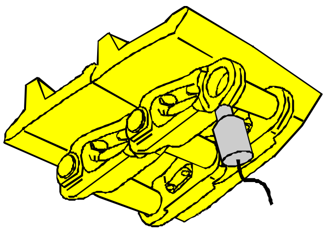
(1) By Manual Tool



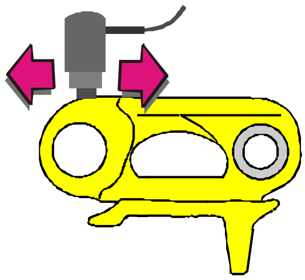
The multi-scale measures link height from the track shoe to the track tread. The ultrasonic measurement tool measures the distance from the link tread surface to the bushing bore.

Obtain an average value by measuring more than 3 places on both right and left sides.
Check for cracked links.
Cracks can be overlooked when the link is filled with mud.
(Clean with a wire brush)
Measure the tread at the place of the greatest wear.
Some rock, swamp, triple-grouser shoes have steps on the link-shoe contacting surfaces. These steps must not be added to the link height.

(2) By Ultrasonic

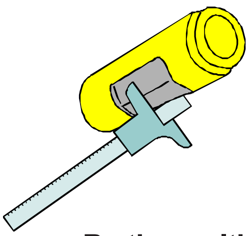


The reference value represents the length of the bushing press fitting part. The minimum length shall be ready by moving the probe on the center line of the bushing press fitting part and the read value shall be regarded as a measured one.

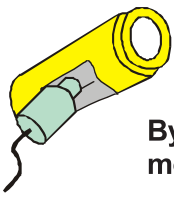


2) Bushing O.D.

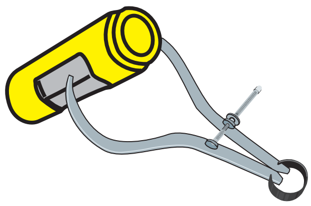
The track link bushing is the most important component to measure in the undercarriage. The bushing may be measured by the multi-scale, by ultrasonic measurement tool or by the outside caliper. The multi-scale measures the diameter of the bushing. The ultrasonic measurement tool measures the bushing wall thickness. The outside caliper measures the diameter of the bushing.



By the multi-scale



By the ultrasonic measurement tool

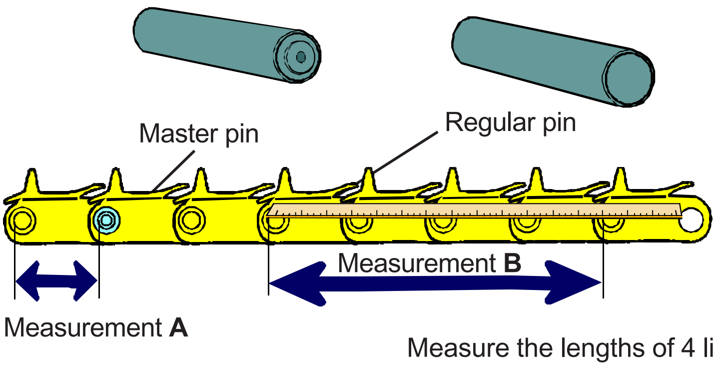


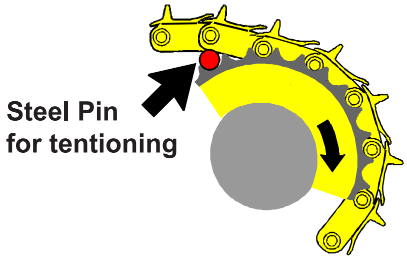
By the outside caliper

3) Link Pitch

Grease Sealed Track

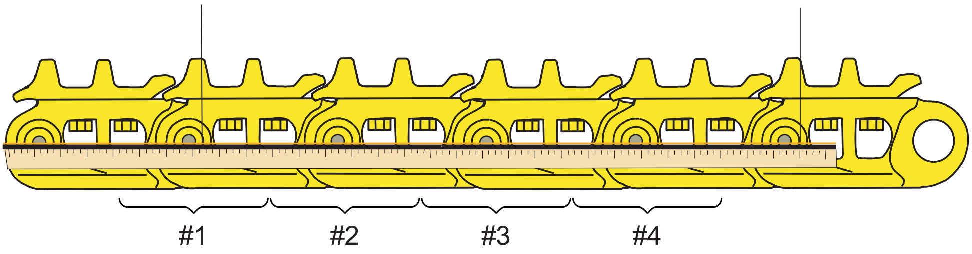
Measurements shall always be made by first applying tension to the track by engagement of pin with sprocket.





Measure the lengths of 4 links, at a point more than 2 links from the master pin.
(Measurement A) ..... for master pin
(Measurement B) ..... for regulation pin
Check for excessive wear on the boss of the link.
Ask how many times the pin-bushing were replaced by new ones.

Sealed and Lubricated Track



Measurement Technique

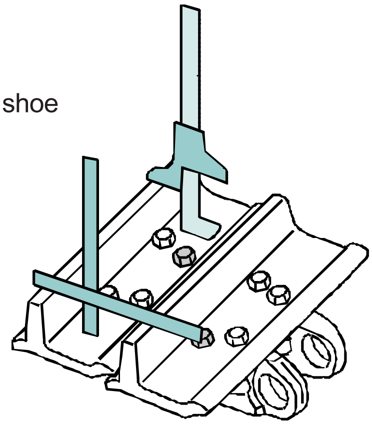
Sealed Track internal wear is measured by determining the pitch extended length over four adjacent sections with a tape measure calibrated in 0.02" (0.5 mm) increments.
The track and tape must be stretched tight and straight to obtain an accurate measurement. The calibrated side of the tape should be located along an imaginary line which connects the pin centers. The reading should be made from one side of a pin to the same side of the fifth pin away (which includes 4 track sections). The hook on the 0" (0 mm) end of the tape should not be used and the mark at an even increment of inches or centimeter should be placed at the 5th pin leaving the end of the tape free to measure the fractional part of the total length (see diagram above.) This measurement should be taken at least 3 sections away from one-piece type master link joints and should be repeated at least twice over different sections of the track on both sides of the machine. This measurement can be used directly to find percent worn in the charts.

4) Shoe Grouser

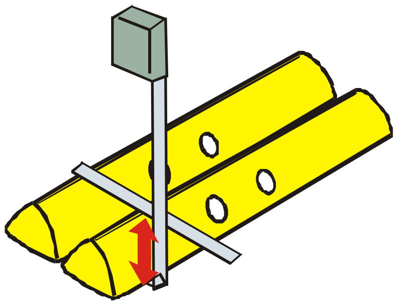
Grouser wear is the only measurable wear on the track shoe. Track shoe may be measured by the multi-scale, by the straight scales or by the ultrasonic measurement tool.
The scales measure the height from the shoe plate to the tip of the grouser.
The ultrasonic measurement tool measures the distance from the tip of the grouser to the bottom of the shoe plate.

(1) Grouser height by the multi-scale

Grouser height may be measured by the multi-scale, convex rule or steel scale.
Remove all mud stuck on the shoe.
Obtain an average by measuring 2 or 3 places on both right and left sides.
Measure swamp shoe at about 100 mm from either end of the shoe.



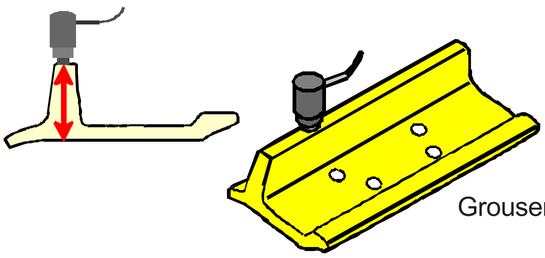
Grouser type shoe



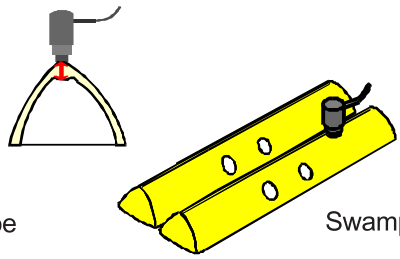
Swamp shoe

(2) Grouser height by the ultrasonic measurement tool

Grouser height may be measured by the ultrasonic measurement tool.
Measure the grouser height at the points 1/4 of the shoe width distant from the shoe ends.

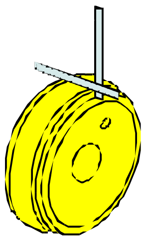


Grouser type shoe

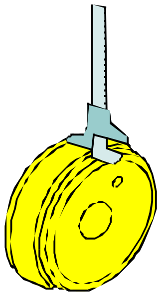


Swamp shoe

5) Idler



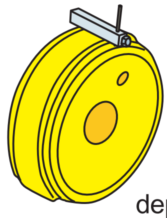
straight scales



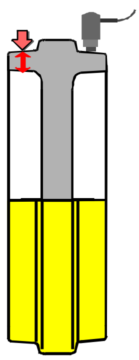
multi-scale

(1) By manual

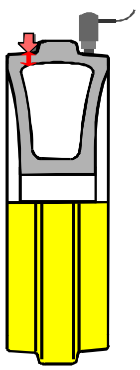
Idler tread wear may be measured by the multi-scale, by the depth gauge or by the straight scales. The both scales measure the height from the idler center flange to tread surface.



depth gauge



Type A

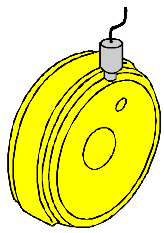


Type B

(2) By ultrasonic

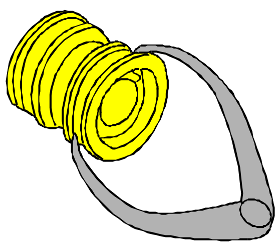
Measure the tread thickness at the center of the tread width. (Type-A)

Measure the tread thickness at the flange-side end of the tread width, both on the inner side tread and outer side tread, to adopt the thinner reading as the measurement value. (Type-B)

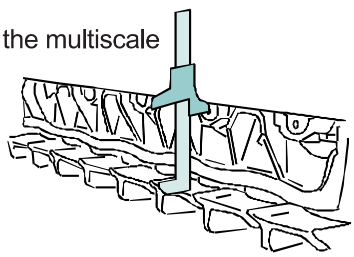


6) Track Roller

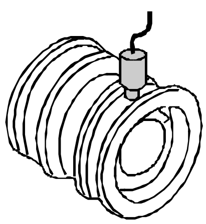
By the outside calipers



By the multiscale



By the ultrasonic measurement tool



(1) By manual

Track roller wear is the most difficult to measure in the undercarriage. Track roller guard or other conditions prevent measurement of all rollers. Track roller tread wear may be measured by using the outside calipers, the multi-scale or the ultrasonic measurement tool.

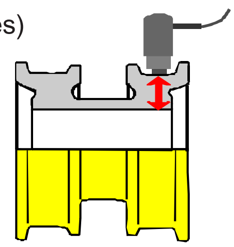
The outside calipers measure tread diameter and give a direct reading. The multi-scale measures height from the track shoe to the center of the track roller circle. The calculated result gives an indirect reading. The ultrasonic measurement tool measures the distance from the tread surface to the inside diameter of the roller.

(2) By ultrasonic

Tread thickness may be measured by the ultrasonic tool.

Measure the tread thickness at a point slightly shifting toward the center of the part from the center of the tread width.

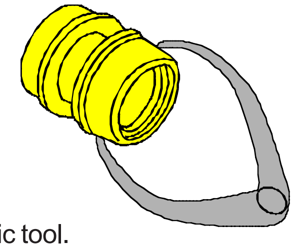
(Common with single flange and double flange types)



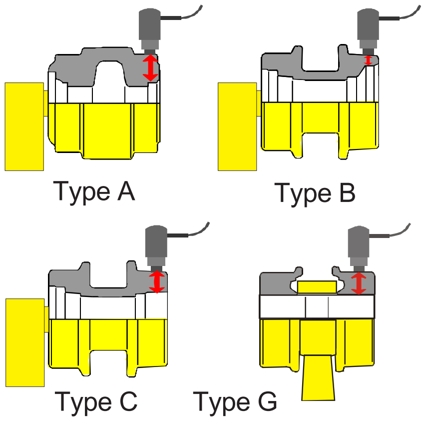
7) Carrier Roller

(1) By manual

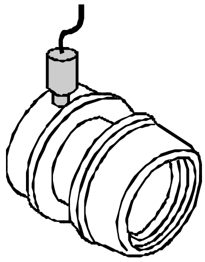
Carrier roller tread wear may be measured by the outside calipers. The outside calipers measures tread diameter and gives a direct reading.



(2) By ultrasonic

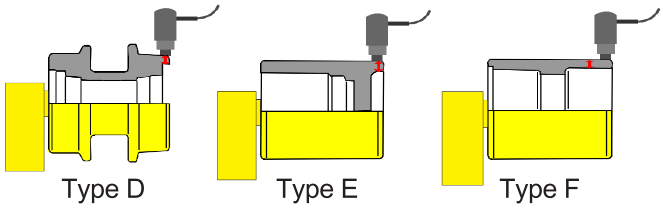


Tread thickness may be measured by the ultrasonic tool.



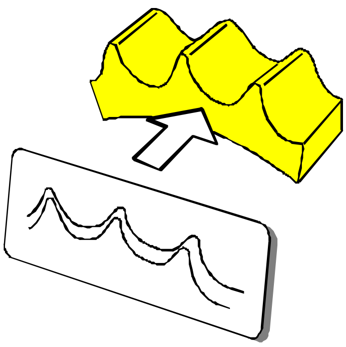
Type A, B
Measure the tread thickness at a point near the outer end of the tread on the opposite side of the support, avoiding the bolt hole.

Type C, G
Measure the tread thickness at the point slightly outward from the center of the tread on the opposite side of the support.
When the measuring point deviates too far out, the tread thickness becomes thinner than the normal section and compare the measurement value with the reference value to make sure measurement is being made at the right position.



Type D, E, F
Measure the tread thickness at a point near the outer end on the tread on the opposite side of the support.
See Measuring point table.

8) Sprocket Teeth



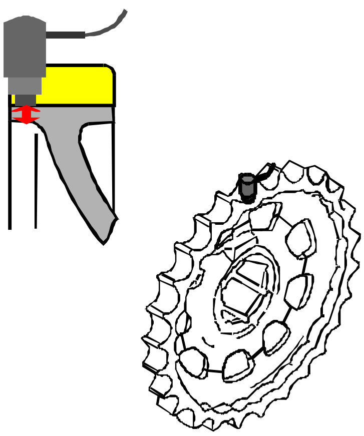
Sprocket wear may be measured by the sprocket wear gauge or ultrasonic measurement tool.

(1) By manual

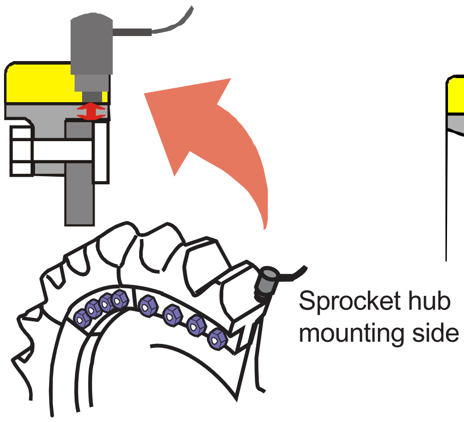
The gauge determines the sprocket tooth percent worn.
When applying the wear gauge, fit the upper and lower portions at the standard line, and cover the two sprocket teeth with the gauge so that the quantity of the right and left teeth becomes equal.
Where a sprocket is not of a segment type, the standard line cannot clearly be determined. Therefore, the amount of wear should be estimated from the viewpoint of balance of the entire profile.

(2) By ultrasonic

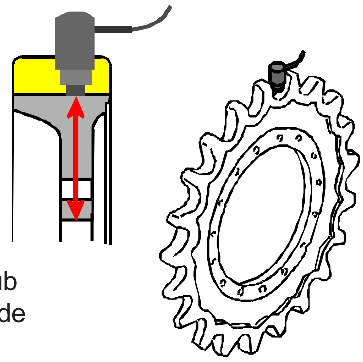
Type A



Type B



Type C



See Measuring point table.

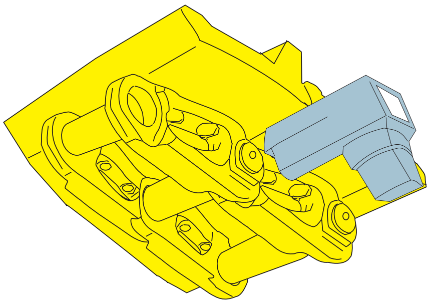
9) Other Check Point

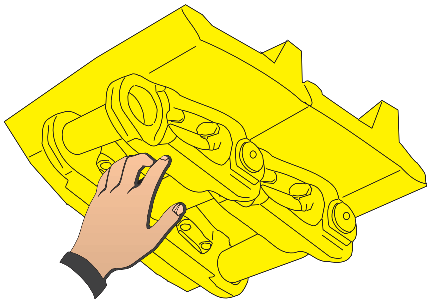
(1) Hot Pin Check for SALT (Sealed and Lubricated Track)

Check the pins temperature by thermometer or hand quickly after stop the machine which operates over 30 minutes.

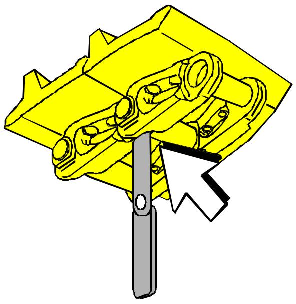
1. HOT: Pretty hot. It can't touch continuously. (More than 50°C)
2. WARM: Like tepid water, but it is hotter than Link. (About 35°C)
3. Cold: A normal temperature which is same as Link. (About 25°C)

- Warm and hot pin indicates loss of lubrication oil.





(2) Gap of Link Face

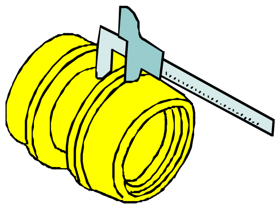


Gap of linked faces may be measured by the thickness gauge.
Carefully check gaps, particularly on a machine operated at high speed, carry all and scraper-towing tractor.
Measure the gap between the outer and inner link after scraping off the dirt.
Measure with the track tightened.

(3) Roller Flange Wear

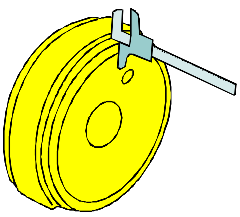
1. Carrier roller

Carrier roller flange wear may be measured by the multi-scale.
The multi-scale measures the thickness of the flange.



2. Front idler

Idler flange wear may be measured by the multi-scale or by the ultrasonic measurement tool. The multi-scale measures the tread width.

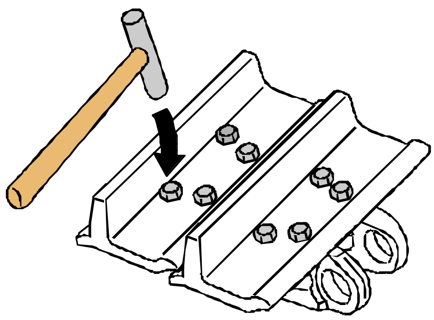


Tread width by the multi-scale

Tread width may be measured by the multi-scale.
Measure from the end of roundness.

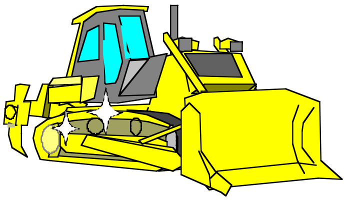
(4) Shoe Bolt Loose

Shoe bolt loose may be measured by tapping with the test hammer.
A shoe bolt may be loose even though there is no mud stuck on it.
(A visual check should be made.)



10) Ultrasonic Measuring Point Table

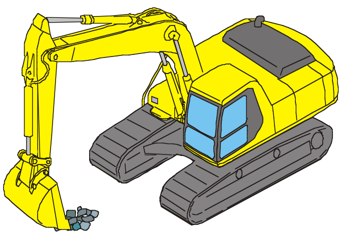
Bulldozer



Model	C. Roller	Idler	Sprocket
	measurement type		
D21-6	A	A	A
D21-7	A	A	A
D31-18	A	A	A
D31-20	A	A	A
D31-21	A	A	B
D37-2	A	A	A
D37-5	A	A	A
D37-21	A	A	B
D39-21	B	A	B
D41-5	C	B	A
D41-6	B	A	A
D53-17/-18	C	B	B
D58-1	C	B	B
D61-12	C	A	B
D61-15	C	A	B
D63-1	C	B	B
D65-8/-11	C	B	B
D65-12	C	B	B
D65-15	C	B	B
D68-1	C	B	B
D75S-5	C	B	B
D81-1	C	B	B
D85A, E-18	C	B	B
D85-15, 15EO	C	B	B
D85P-18	C	B	B
D85A, E-21	C	B	B
D85P-21	C	B	B
D135A-1	C	B	B
D135A-2	C	B	B
D155A-2	C	B	B
D155A-3	C	B	B
D155A-6	C	B	B
D155AX-6	C	B	B
D275-2	C	B	B
D275-5, 5EO	C	B	B
D355-3	C	B	B
D355-5	C	B	B
D375-1	C	B	B
D375-2	C	B	B
D375-3	C	B	B
D375-5, 5EO	C	B	B

Model	C. Roller	Idler	Sprocket
	measurement type		
D475-1	C	B	B
D475-2	C	B	B
D475-3	C	B	B
D475-5, 5EO	C	B	B
D575-2	C	B	B
D575-3	C	B	B

Hydraulic excavator



	measurement type		
Model	C. Roller	Idler	Sprocket
PC60-6	E	A	C
PC60L-6	E	A	C
PC60-7	E	A	C
PC70-6	E	A	C
PC70-7	E	A	C
PC78US-6	E	A	C
PC78UU-6	E	A	C
PC80-3	E	A	C
PC90-1	E	A	C
PC100-5	E	A	C
PC100L-5	C	B	C
PC100-6	E	A	C
PC100L-6	C	B	C
PC120-5	E	A	C
PC120-6	E	A	C
PC128UU-1	E	A	C
PC130-5	E	A	C
PC130-6	E	A	C
PC150-5	C	A	C
PC158US-2	C	A	C
PC200-5	C	A	B
PC210-5	C	A	B
PC220-5	C	A	B
PC200/LC-6	C	A	B
PC200/LC-7	C	B	B
PC200/LC-8	C	B	B
PC220/LC-6	C	A	B
PC220/LC-7	C	B	B
PC220/LC-8	C	B	B
PC228-3	C	A	B
PC230/LC-6	C	A	B
PC300-5	C	B	B
PC300/LC-6	C	B	B
PC300/LC-7, 7EO	C	B	B
PC310/LC-5	C	B	B
PC350/LC-6	C	B	B
PC400/LC-5	C	B	B
PC400/LC-6	C	B	B
PC400/LC-7, 7EO	C	B	B
PC450/LC-6	C	B	B
PC600/LC-6	C	B	B

	measurement type		
Model	C. Roller	Idler	Sprocket
PC600/LC-7	C	B	B
PC600/LC-8	C	B	B
PC650/LC-5	C	B	B
PC650/LC-6	C	B	B
PC650SE-5	C	B	B
PC710-5	C	B	B
PC750-6	C	B	B
PC750-7	C	B	B
PC800-6/7	G	B	B
PC800-8	G	B	B
PC1000/LC-1	C	B	B
PC1100/LC-6	G	B	B
PC1250-7	G	B	B
PC1250-8	G	B	B
PC1600-1	C	B	B
PC1800-6	C	B	B

1-3. Calculation of Hour Left

1) Basic Idea

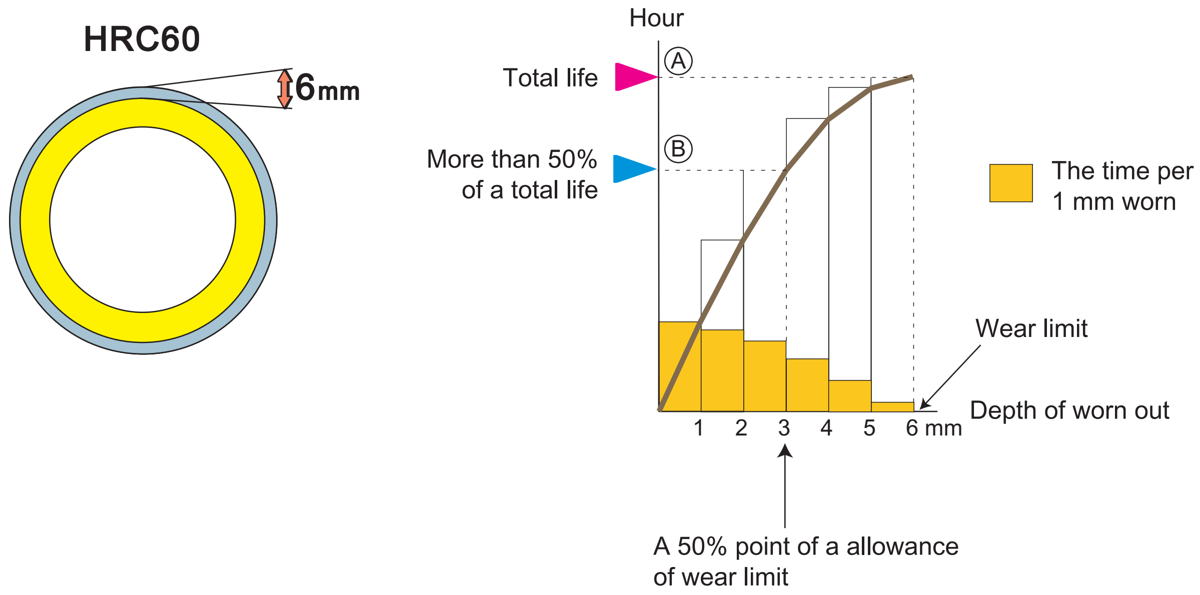
(1) The purpose of UC wear measurement is as follows.

① To calculate the remaining service life (hours) based on the dimension.

② To estimate the replacement timing of UC parts based on the remaining service life.

(2) As for all of UC parts, the wear portion is heat-treated, and the surface has the higher hardness. But as the portion is inner, the hardness is lower.

(3) The wear progression is influenced by the hardness, and the hardness is higher, the wear is less.



(4) For example, as for the bushing outer-diameter, the relation between the wear progression and the hardness is explained as follows.

① A surface is the hardest in the area of allowance of worn out. At the surface area it takes longer time to be worn 1 mm of depth. And the wear progresses slowly at the beginning.

② But when the wear progresses to the deeper portion, the hardness is lowered. Therefore, the wear progresses faster.

③ Ⓐ is the hours of the life potential. It is called Total Life. To be 50% of the wear allowance (3 mm), it takes more hours than 50% of the wear life. (Point Ⓑ)

→ A wear does not go on in the relation with hours in propotion.

(5) As above-explained, because the relation between the wear amount and the service life is not linear, the total life cannot be calculated by the simple comparative calculation due to the wear ratio between the present service meter and the dimension.

(6) Komatsu guesses by the experience that the relation between the wear amount and the life becomes the curve of the quadratic function $Y = aX^k$. The shape of curve (the k value of $Y\text{-}aX^k$) is varied by the relation between the heat-treatment depth and the wear limit (the tolerance margin of 100% Wear) of the UC part. (Usually, Wear Limit of UC part is designed that it is bigger than the heat-treatment depth.)

(7) Based on the above relation, after the wear dimension measurement of the UC part, the life is calculated by the measured value, at this time, Komatsu prepares the following three methods.
   *① The method that “Percent Worn Chart” and “Hours Left Chart” are used.
   *② The method that “Wear Life %” is calculated by using “KUC Program (Software)”, and based on this, “Total Potential Hour” is calculated.
   *③ The method that “Wear Life %” is calculated by using “Wear Life % Table, and based on this, “Total Potential Hour” is calculated.

(8) The concept of the life calculation is the above ①, but currently, Percent Worn Chart is not prepared. Accordingly, use ② or ③. Basically, use ② KUC Program. But when the personal computer is not prepared, or when the approximate life is desired after the undercarriage wear is measured at the jobsite, the method ③ Wear Life % Table is convenient. For each detail, refer to the following item.

2) 3-Ways for Calculating of Hours Left

(1) Percent Worn Chart & Hours Left Chart

- This is the way that while checking the table, the calculation is done manually.
- The way is as follows.

Conditions:

1. Service meter reading: 1600 hours.
2. Wear value of idler tread step: 31.3 mm

Step 1. Using the PERCENT WORN CHART on the right, convert the wear value of the idler step to a percentage.
* Wear rate = 70%

Step 2. Using the HOURS LEFT CHART below, draw a line up from 1600 hours (Service meter reading) on the horizontal axis, and find point A where it intersects the horizontal line drawn from 70% (wear rate) on the vertical axis.

Step 3. Draw a curve parallel to the nearest curve to point A up to the right and find point B where it intersects the horizontal line from the 100% wear rate.

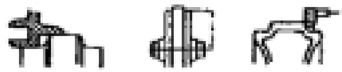
Step 4. Draw a perpendicular line from point B down to intersect the horizontal axis (operating hours) at point C. This point C (2100 hours) indicates the service limit for repair and rebuilding.

Step 5. Subtract the present service meter reading (1600 hours) from the reading at point C (2100 hours) to obtain the estimated hours left until repair and rebuilding (D).
* D = 2100 - 1600 = 500 hours

D375A-2 **#16001 - #16999**

IDLER Tread Step Tread Radius Thickness

195-30-53110 Type B



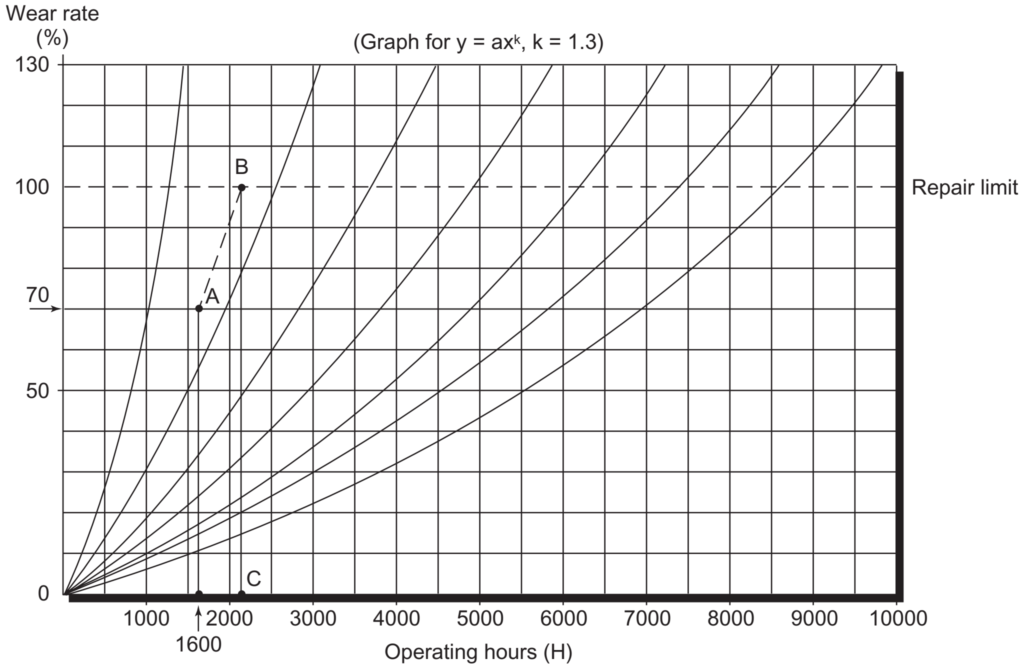
Multi-scale / Idler wear gauge / Ultrasonic

Measure Wear value → 31.3

Multi-scale mm	Multi-scale Inches	% Worn	Idler wear gauge mm	Idler wear gauge Inches	Ultrasonic mm	Ultrasonic Inches
22.5	0.89	0	457.5	18.01	30.0	1.18
23.8	0.94	10	456.3	17.96	28.8	1.13
25.0	0.98	20	455.0	17.91	27.5	1.08
26.3	1.03	30	453.8	17.88	28.3	1.03
27.5	1.08	40	452.5	17.81	25.0	0.98
28.8	1.13	50	451.3	17.77	23.8	0.94
30.0	1.18	60	450.0	17.72	22.5	0.89
30.6	1.21	65	449.4	17.69	21.9	0.86
31.3	1.23	70	448.8	17.67	21.3	0.84
31.9	1.25	75	448.1	17.64	20.6	0.81
32.5	1.28	80	447.5	17.62	20.0	0.79
33.1	1.30	85	446.9	17.59	19.4	0.76
33.8	1.33	90	446.3	17.57	18.8	0.74
34.4	1.35	95	445.6	17.54	18.1	0.71
35.0	1.38	100	445.0	17.52	17.5	0.69
35.6	1.40	105	444.4	17.50	16.9	0.66
36.3	1.43	110	443.8	17.47	16.3	0.64
36.9	1.45	115	443.1	17.45	15.6	0.62
37.5	1.48	120	442.5	17.42	15.0	0.59
37.5	1.48	120	442.5	17.42	15.0	0.59
38.8	1.53	130	441.3	17.37	13.8	0.54
40.0	1.57	140	440.0	17.32	12.5	0.49
41.3	1.62	150	438.8	17.27	11.3	0.44

Note:
1. Always use the PERCENT WORN CHART that is applicable for the model and Serial No.
2. Obtain the wear rate from the measured wear value using the PERCENT WORN CHART, or calculate it with the following formula.

$$\text{Wear rate} = \frac{\text{Standard value - measured wear value}}{\text{Standard value ñ repair limit}}$$



- However, since the KUC Program has been introduced, "Percent Worn Chart" is not maintained. Therefore, as for the new models, both "Percent Worn Chart" and "Hours Left Chart" are not prepared.

(2) KUC Program Software is Used.

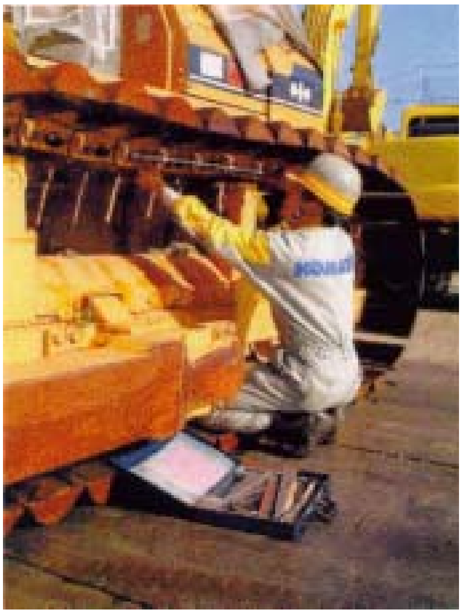
- This method is alternative for the method that Total Potential Hour is obtained by using the both "Percent Worn Chart" and "Hours Left Chart".
- After setting the operation and the usage conditions of the undercarriage in Program, when the measured dimension is input, "Wear Life %" (The current rate of the use life when Total Potential Hour is 100%.) is automatically calculated by Program.
- After that, based on the calculated "Wear Life %", "Total Potential Hour" and "Remaining Life (Total Potential Hour - Current SMR) are manually calculated.
- "Total Potential Hour" is the hour that the UC part reaches from "New" to "100% Wear Limit", and is calculated by the following formula.
  Total Potential Hour = Current SMR / Wear Life %

FEATURE OF THE PROGRAM

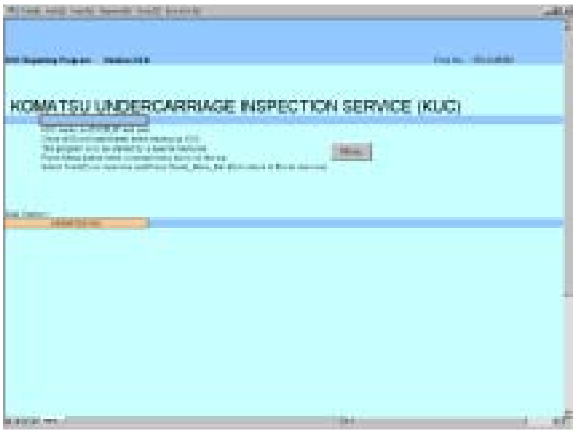
The program

- **Can be processed by only clicking its menu bar,**
- **Has all standard value and wear criteria,**
- **Automatically calculate wear life percent with formula "$y=aX^k$",**
- **Automatically calculate second wear life after bushing turn basing on the first measurement.**
- **Create colored report rapidly,**
- **Create wear percent graphs automatically**

for not only standard measurement but also ultrasonic measurement.



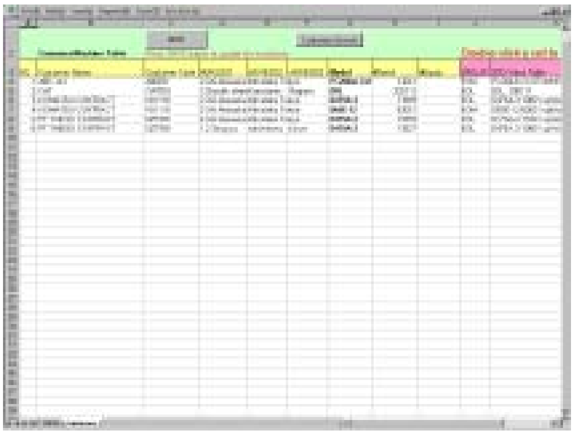
SUMMARY OF THE PROGRAM



Program Main Menu

There are four (4) functions which are

1. **Create New Inspection Report**
2. **Edit Library**
3. **View of Library, Standard value & machine database**
4. **Chart (graph) and Summary report**

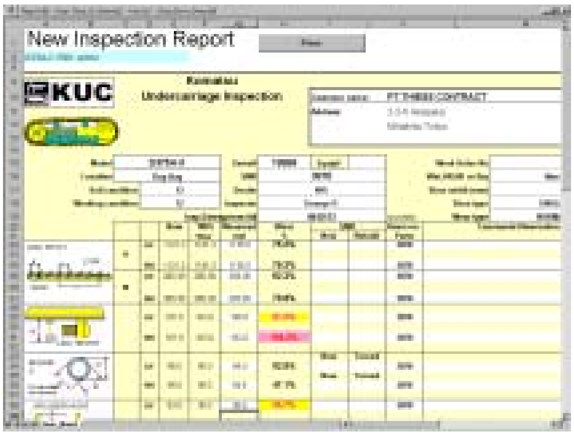


Create New Report-1

Base information and measurement data are only required for Input!

Register the customer name and machine information so that it will be loaded on the Inspection report automatically.

Once the base information are registered, only input measured value is required.



Create New Report-2

Input measured value in the report form so wear life percent are automatically calculated.

And it can be displayed in three (3) different colors, which are

Black (under 80%),

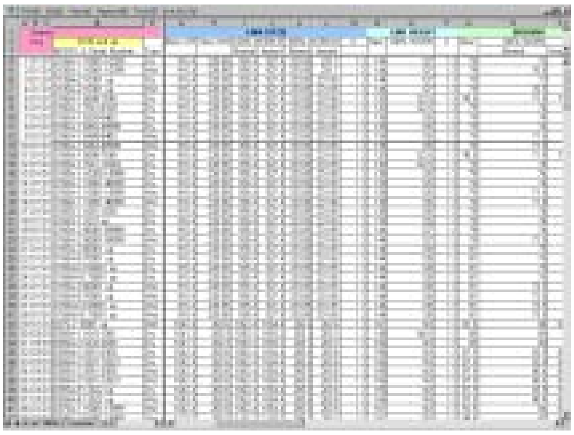
Pink (over 80% to 99%) and

Red (over 100%)

Edit Library

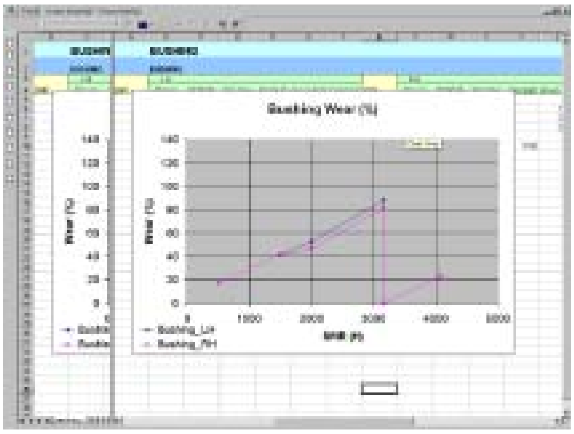
Any mistake of data input can be corrected by using the edit function.

The inspection report need to be corrected can be searched by clicking only menu button, and it is required to input correct data and save.



View function

All saved inspection report, standard value at 0% wear and wear criteria at 100% wear and database which are Customer and machine information can be referred simply.



Create wear trend graph

It can be done by only clicking sheet button for specifying area and undercarriage component to create graph.

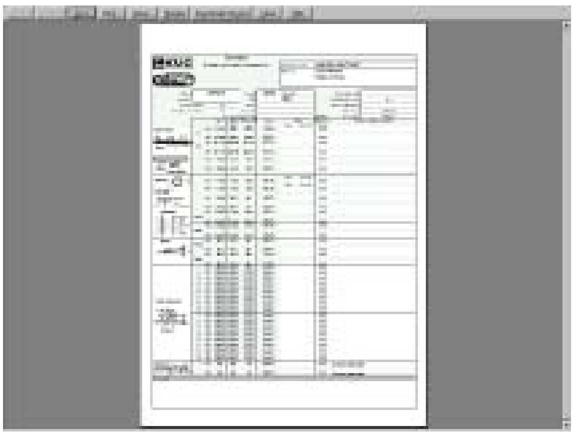
The graph can be modified as required under Excel program.

Summary report for fleet machines

It is quite useful to let customer grasp each machines wear condition.

Summary report for models

It is quite useful to understand wear condition per model to schedule proper undercarriage parts stock in advance.



Printing Reports

Inspection report, Summary report for fleet customer and Summary report for models are able to print by clicking menu button only as same as graph creation.

- Precautions when using KUC Program

•① By using this Program, both Manual measurement value (the measurement value by Caliper, etc) and Ultrasonic measurement value can be processed. But both exclusive displays should be started, and it is careful that both measurement values cannot be processed by the same display.

•② As for K-bogie which are adopted on D275A-5, D375A-5 and D475A-5, Wear Criteria are different in S/F and D/F of T/Roller. But in the current KUC Program, only Wear Criteria of S/F can be indicated. When Wear Life % of D/F is required, this is calculated by using “Wear Life % Table”.

•③ Until now, Program and the updated Wear Criteria are designed so that they are downloaded from WebCARE, but it is careful that after January in 2005, the system is changed so that they are downloaded from Global Extranet.

(3) Wear Life % Table

This Table is the table that “Wear Life %” can be directly read from the measurement value by using KUC Program. The sample is as follows.

D155 A-2 S/N 50001up
D155 AX-3 S/N 60001up

<u>Bushing O.D.</u> for *SALT*

【Manual】			
Mesurement		Wear Life%	
mm	inch	NORMAL	IMPACT
81.0	3.22	0.0	0.0
80.5	3.20	24.3	28.9
80.0	3.18	34.3	40.8
79.5	3.16	42.0	50.0
79.0	3.14	48.5	57.7
78.5	3.12	54.2	64.5
78.0	3.10	59.4	70.7
77.5	3.08	64.2	76.4
77.0	3.06	68.6	81.6
76.5	3.04	72.8	86.6
76.0	3.02	76.7	91.3
75.5	3.00	80.4	95.7
75.0	2.98	84.0	100.0
74.5	2.96	87.4	104.1
74.0	2.94	90.7	108.0
73.5	2.92	93.9	111.8
73.0	2.90	97.0	115.5
72.5	2.88	100.0	119.0
72.0	2.86	102.9	122.5
71.5	2.84	105.7	125.8
71.0	2.82	108.5	129.1
70.5	2.80	111.1	132.3
70.0	2.78	113.8	135.4
69.5	2.76	116.3	138.4
69.0	2.74	118.8	141.4
68.5	2.72	121.3	144.3
68.0	2.70	123.7	147.2
67.5	2.68	126.0	150.0
67.0	2.66	128.3	152.8
66.5	2.64	130.6	155.5

【Ultrasonic】			
Mesurement		Wear Life%	
mm	inch	NORMAL	IMPACT
15.8	0.63	0.0	0.0
15.0	0.60	30.7	36.5
14.5	0.58	39.1	46.5
14.0	0.56	46.0	54.8
13.5	0.54	52.0	61.9
13.0	0.52	57.4	68.3
12.5	0.50	62.3	74.2
12.0	0.48	66.9	79.6
11.5	0.46	71.1	84.7
11.0	0.44	75.1	89.4
10.5	0.42	79.0	94.0
10.0	0.40	82.6	98.3
9.8	0.39	84.0	100.0
9.0	0.36	89.4	106.5
8.5	0.34	92.7	110.3
8.0	0.32	95.8	114.0
7.3	0.29	100.0	119.0
7.0	0.28	101.7	121.1
6.5	0.26	104.6	124.5
6.0	0.24	107.4	127.8
5.5	0.22	110.1	131.0
5.0	0.20	112.7	134.2
4.5	0.18	115.3	137.2
4.0	0.16	117.8	140.2
3.5	0.14	120.3	143.2
3.0	0.12	122.7	146.1
2.5	0.10	125.1	148.9
2.0	0.08	127.4	151.7
1.5	0.06	129.7	154.4
1.0	0.04	132.0	157.1

- Because the read value is “Wear Life %”, same as KUC Program, “Total Potential Hour” can be calculated by the following formula.
  Total Potential Hour = Current SMR/Wear Life %
- “Wear Life % Table” was respectively delivered by UC Sales Promotion Material “UCFN04-014 (Bulldozer)” and “UCFN05-001 (Excavator)”.
- When their tables are printed out, they can be conveniently used at the field. Therefore, use them.

1-4. Study on Point of Sales

1) As already described, the purpose for the measurement of UC part wear dimension is as follows.
   (1) Based on the measurement value, the remaining hour of UC part is calculated.
   (2) By matching to the replacement time or the maintenance time, the part is timely prepared and offered to the customer for receiving the part order.

2) For calculating Remaining Hour, “Total Potential Hour” is calculated by three previously-described methods. But the following precautions are required.
   (1) When the Wear Life %, which was obtained by KUC Program and Wear Life % Table, is less than 30%, the value of Total Potential Hour, which was calculated by depending on it, is not accurate. Accordingly, it is better to use as the reference for assuming the next measurement time.
   (2) When “Wear Life %” is about 50%, the assumption is accurate.
   (3) In the case that the rough life of undercarriage is obtained by the experience at the jobsite, the following is recommendable. When Wear Life % is about 50%, shortly at the middle point, the wear of undercarriage is measured, and Total Life is assumed. After that, when Wear Life % is assumed at approx. 90%, the wear is measured again, and the replacement time is specified.

3) As previously described, Total Potential Hour, which is obtained by KUC Program or Wear Life % Table is the hour reaching to 100% Wear Limit. Accordingly, depending on the use method of “Use by rebuilding” or “Run to destruction”, actual Total Potential Hour, shortly how long the part is used, is required to change as follows. Usually, the use is depending on the customer favorite, budget, etc. Therefore, by preparing various options, explain and negotiate with customers.
   (1) Using by rebuilding: Calculated Total Potential Hour is used as it is.
   (2) Run to destruction: Total Potential Hour x 1.3 is used.

4) Accordingly, the concept of Remaining Hour is changed as follows.
   (1) When the UC part is used by rebuilding.
   Remaining Hour = Calculated Total Potential Hour - Current SMR
   (2) When the UC part is used by “Run to destruction”.
   Remaining Hour = Calculated Total Potential Hour x 1.3 - Current SMR

5) From the calculated Remaining Hour, Point of Sales is assumed by the following procedures.
   (1) By the Hour Meter, which the machine worked from Delivery Date to the present measurement time, the monthly mean operation hours is obtained.
   (2) The Remaining Hour is divided by the monthly mean operation hours, and the period, which reaches the UC part replacement or the maintenance from the wear measurement.
   (3) This period is applied to the calendar, and the time is specified. This time is the Point of Sales.

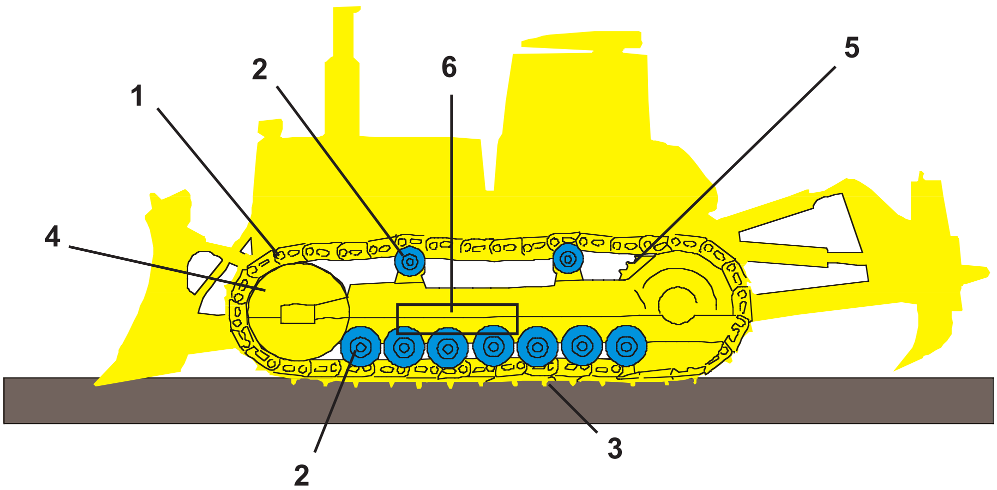
6) When the Point of Sales is identified, the next preparation is progressed elaborately and the sure order receiving is endeavored.
   (1) The Quotation for the customer is prepared and produced.
   (2) The stock of the required parts is ensured and the order of the Non-Stock parts is prepared.
   (3) The next visit to the customer is arranged.

2. Undercarriage Component

2-1. Structure & Function

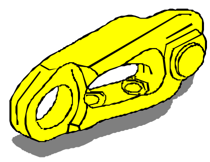
1) Overview

The tracks which bear and spread the weight of the machine on the ground convert the driving power transmitted from the sprockets into tractional force. The track group includes a pair of right and left track frames, front idlers (1), carrier rollers (2) and track rollers (3) are mounted. The track looped around each track frame is driven by the sprocket wheel and its rolling is guided by the front idler, carrier roller and track rollers. The track roller guard (6) attached on the bottom surface of each track frame prevents the track from slipping off due to intrusion stones.



(1) Track links

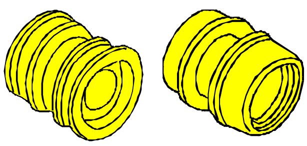
The hardness of the track link tread and side-surface improves durability and increases strength against impact load. Dust seals are equipped to prevent sand and soil from entering the gap between track links and bushing. Lubricated track link assemblies are also available.

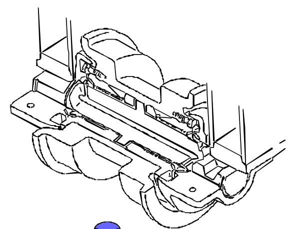


(2) Rollers

Track rollers

Track rollers are arranged under each track frame, they distribute the machine weight evenly onto the tracks on which the track rollers rotate.

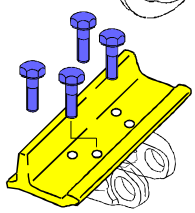




Carrier rollers

Carrier rollers are arranged above each track frame, this act to support the upper half of the track loop in the proper rolling condition, preventing the track from dangling by its own weight.

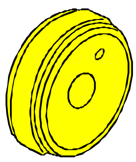
(3) Track shoes

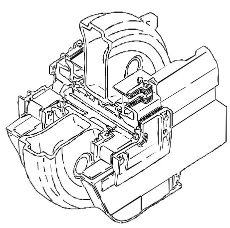


Various track shoes are available to meet any working condition. The grouser hardness strengthens the track shoes against wear and impact load. Excellent ground penetration guarantees a large drawbar pull.

(4) Idlers

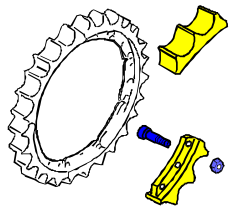
The front idler mounted at the front-end of each track frame. The idler maintain smooth rolling of the track.





(5) Sprocket teeth

The sprocket teeth are hardened through a unique heat treatment method for added strength. Deep hardening enhances durability and increases strength against impact load.



(6) Recoil spring

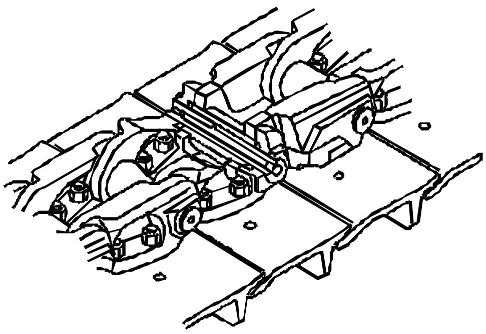
Keep the track tension properly.

2) Shoe Assy

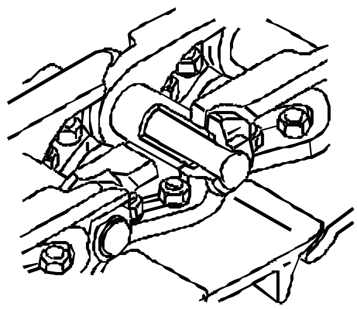
(1) General

a) Grease Sealed vs S.A.L.T. (Sealed and Lubricated Track)

Well, let us see what type of stress is delivered on a track by the nature of job specification, A bulldozer is required to have more traction force than dozer-shovels or hydraulic excavators that work with bucket. There are two types of track links. One is oil sealed and lubricated type and the other is grease sealed type. In both types, the clearance between bushing and pin is lubricated. But Oil sealed type last much longer than Grease sealed type.



Sealed and lubricated type track

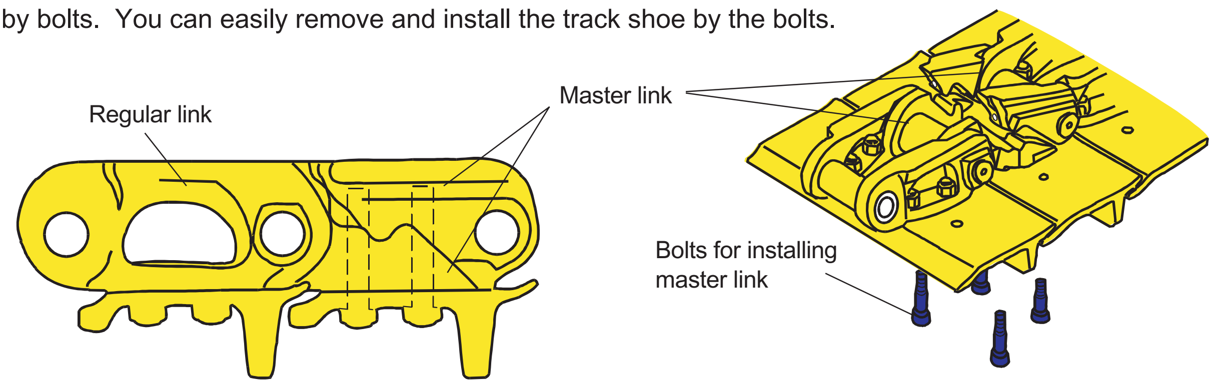


Grease sealed type track

b) Master Pin vs Master Link

Master Link Type

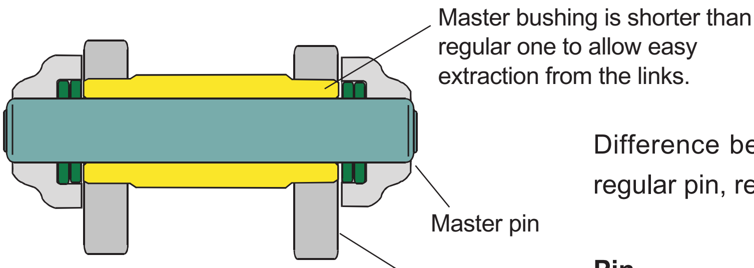
Master Link Type is whereby the link is divided into sections and secured by bolts. You can easily remove and install the track shoe by the bolts.



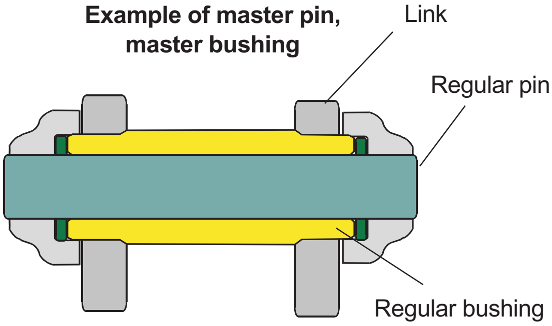
Example of master link

Master Pin Type

Master Pin Type shares the same link shape with portions of other links but the shape is different from that of the pin and bushing. You need to pull the pin for replacement.



Example of master pin, master bushing



Example of regular pin, regular bushing

Difference between master pin, master bushing and regular pin, regular bushing.

Pin

Master pin has the same diameter as regular pin. The end of the regular pin are flat but the surfaces of the master pin are chamfered for easy identification.

Bushing

Master bushing has the same diameter and tightening limit as the regular bushing but is slightly shorter. This is for easier replacement purpose.

c) HD Link & AR Link

There are HD track link and AR track link on D39-21 ~ D65-15. If you use proper tack link on your machine to meet job-site condition, you can extend UC life and reduce operation cost.
Here is a detailed explanation on both tack link.

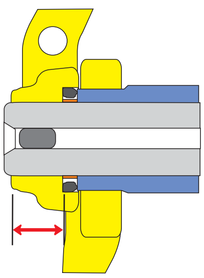
HD track Link

The Heavy Duty (HD) track link is reinforced versions of the STD track link to have more durability and life. Generally speaking HD track link has a bigger diameter of pin and bushing and higher link height than STD track link.

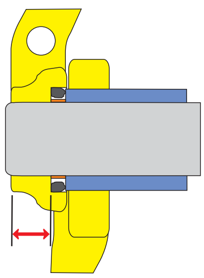
The outlook is different between HD track link (or HD base AR link) and STD track link as shown below.

Example: D41-6 case

HD Link adopt longer pin press fit area, larger bushing and higher link height so that more durable than STD Link.



Link height: 106



Link height: 98

The HD track link is available on D41-6 and D65-12. On after miner changed machine (see below). The HD track link has been applied from factory. But even before miner changed machine, you can install the HD track link with some modification. (Please refer to P&S News “BB99001” and “BT01015”)

D41-6 m/c machine: S/N B30001 and up
B65-12 m/c machine: S/N 65001 and up

<u>NOTE: On D39-21 and D61-12, the idea of HD track link has been applied on STD track link since the beginning</u>

Because of the advantage of HD track link against STD track link, we recommend that you use the HD track link on harsh load works sites such as rocky ground work sites and forestry work sites.

AR Track Link (Optional parts)

Abrasion Resistant (AR) track link has a special heat treatment bushing (Through hard, See below in detail) to achieve longer wear life of bushing than normal bushing on STD and HD track link. The AR track link exhibits advantage in sandy soil work sites where normally the bushing wear very rapidly.

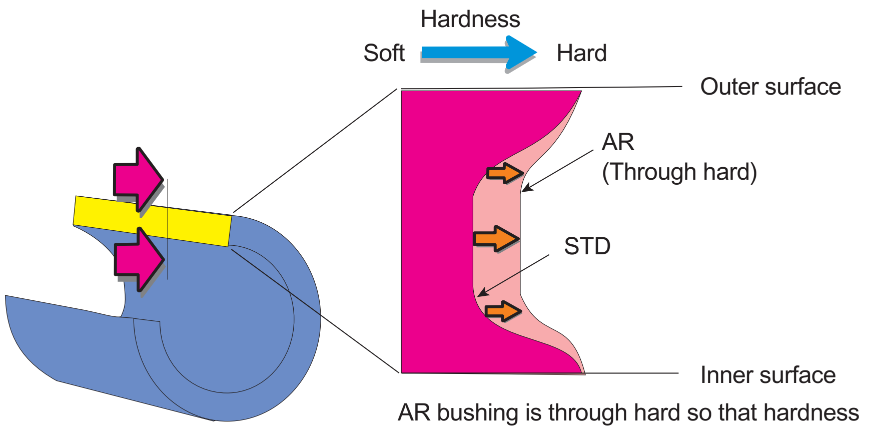
Cautions

1) The AR track link is abrasion resistant track link for usage on lighter load work sites and it is not all mighty track link.
2) Since the bushing hardness of AR track link is high in deep by special heat treatment, the bushing may break if AR track link is used on other work sites than sandy soil condition. It is recommended to use STD or HD track link on other works sites.
3) Do not use AR track link on the rocky terrain like as river bed. Reduce the speed when getting over an obstacle even on the sand soil.

AR link is available on following models as an optional parts

D39-21	D65-12 (STD-AR and HD-AR)
D41-6 (STD-AR and HD-AR)	D65-15
D61-12	

"Hardness distribution of bushing for AR track link"

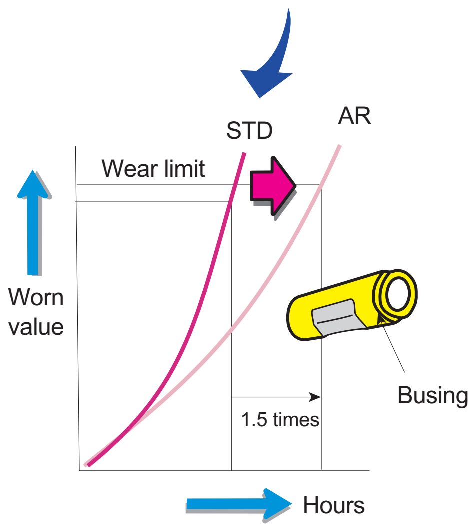


AR bushing is through hard so that hardness and wear limit could be increased.

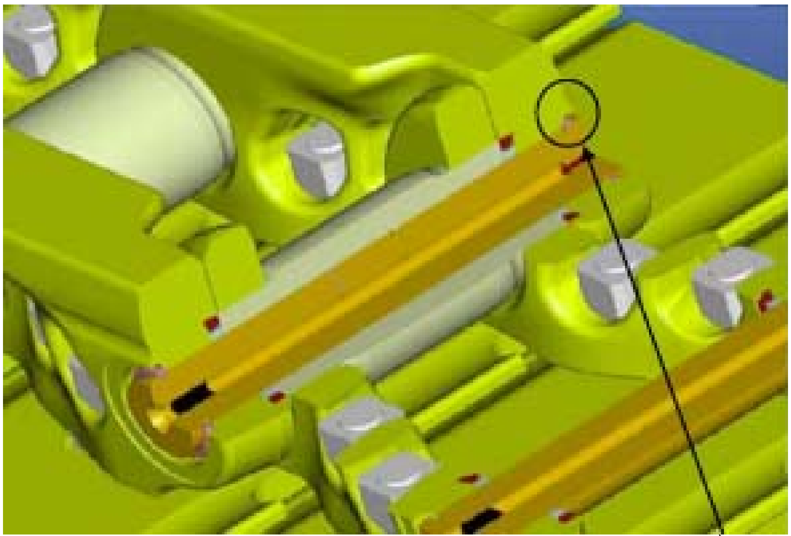
"Wear progress on bushing"

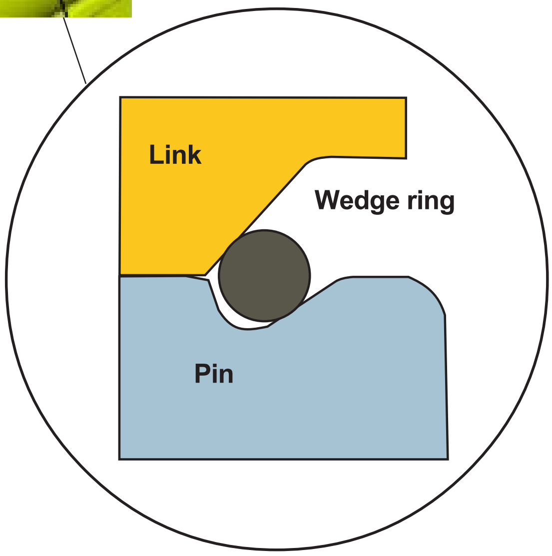
Because of the hardness distribution change on bushing for AR track link as shown the above, long wear life could be achieved.

AR track link has 1.5 times wear life to STD track link.

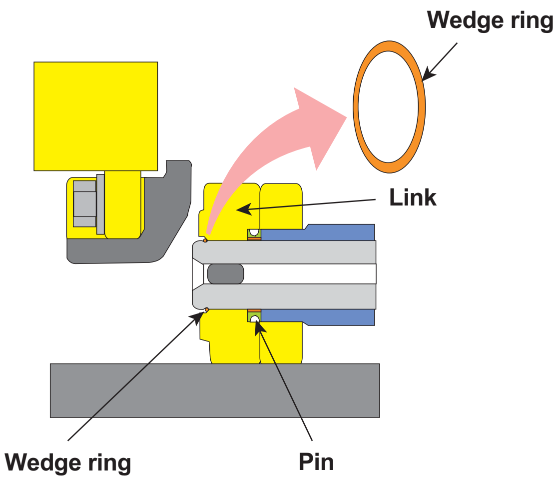


d) Wedge Ring Type UC



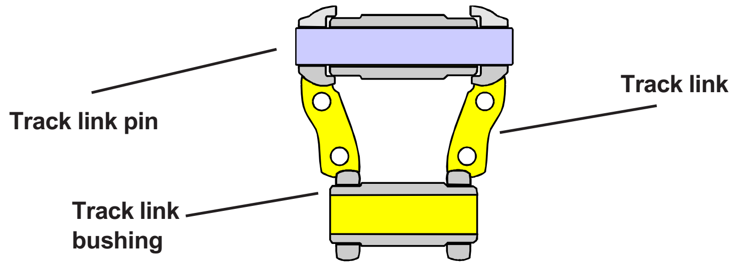


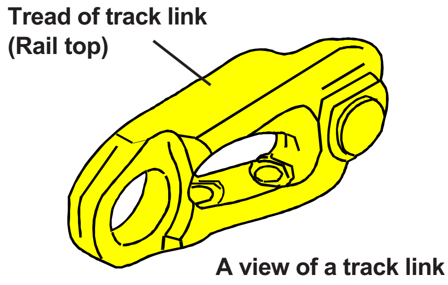
1) Wedge ring was installed at the end of pin. It partially take charge of holding pin so that pin press fitting force can be reduced.
2) Shape of link side face and guard has been changed as shown below. In old track, the pin end contacts with the guard. But in new track, upper portion of link contact with guard prior to the pin contacts with guard. So there is no wear a pin end.
3) Because of changing link side shape, total width of link tread and T/Roller tread got widen as shown below.
   This change will help to extend wear life.
4) Wedge ring type UC has been adopted on D275A-5, D375A-5 and D475A-5.



(2) Link

Track link has complicated style. Required characteristics are long wear life, durability against crack and chipping-off of tread.

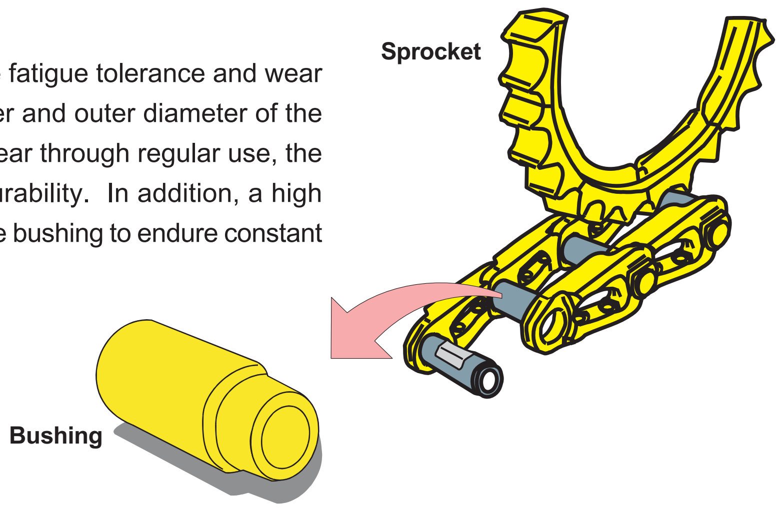




Link tread wears by sand and other abrasives, and receives cyclic stress from track roller. That is why the link is built with tenacious materials not to crack nor wear in a short time. Pin is pressed into one side of link and bushing is pressed into the other side. Fitting part of link with either pin or bushing is contrived not to come off by strong stress, for instance a part of link where bushing is pressed into is designed as thick as possible not to crack.

(3) Bushing

The essential qualities of a bushing are fatigue tolerance and wear resistance. As the surface of both inner and outer diameter of the bushing are subjected to friction and wear through regular use, the bushing is quenched to increase its durability. In addition, a high fatigue strength is designed to enable the bushing to endure constant impact from the sprocket.



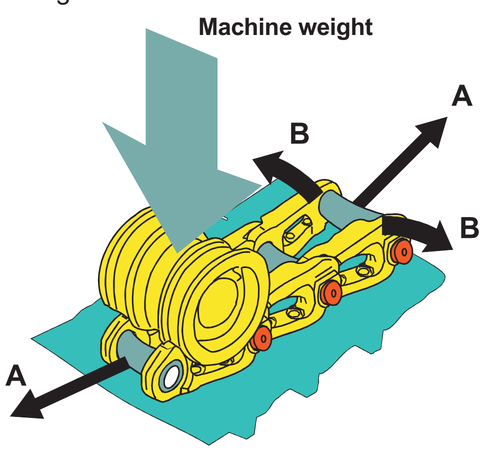
- The exterior surface of the busing is engaged with the sprocket and is subjected to hammering. Soil particles which got in between the sprocket and the busing accelerates wear process.
- Interaction between the interior surface of the busing and the pin also creates wear process. The oil sealed type track link can help to prevent this process. If the tension of link assembly is too tight, the inner wear will be faster.

The exterior surface of the busing wears down more prominently than the inner surface. For Komatsu products, both surfaces are quenched and made tenacious for a long use.

(4) Pin

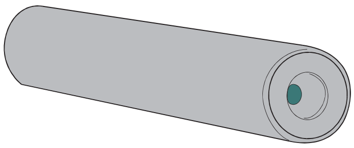
The essential qualities of a pin are endurance to constant stress and wear resistance.

The pin is always subjected to pull strength (A) from track links. It is an important part that joints the links together. In addition, with the presence of track roller and link, it is also subjected to bending force (B) from the machine weight. Hence, the pin is designed to have a high strength against fatigue.



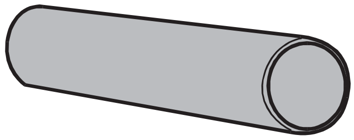
There are 2 types of pins, one being the normal ones (regular pins) and the other being used for replacement of track link (master pins).

For oil sealed type track link

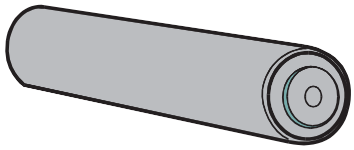


Regular pin

For grease sealed type track link



Regular pin



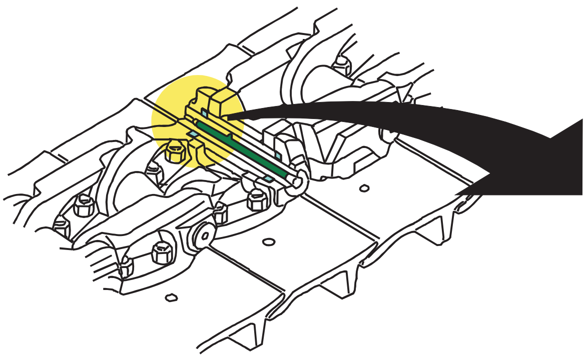
Master pin

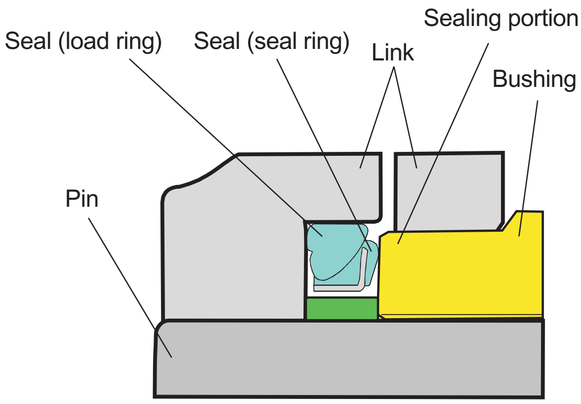
(5) Seal

The life span of the oil lubricated type track link lies in the seal. If the seal is torn or broken, oil leaks and fine sand will enter inside of the bushing and cause wearing of the bushing and pin. Pitch of the track link assembly will also be elongated.

As sand particles often come in contact around the area of the seal, both the seal and the seal surface of the bushing tend to wear out faster than the general seals.

As the seal wears out, the sealing tension also reduces causing the interior of the bushing and pin to wear out faster due to internal oil leaks and intrusion of the sand particles. Seals designed by Komatsu are such that its sealing performance remains as good as new even though wear continues at the sealing portion.



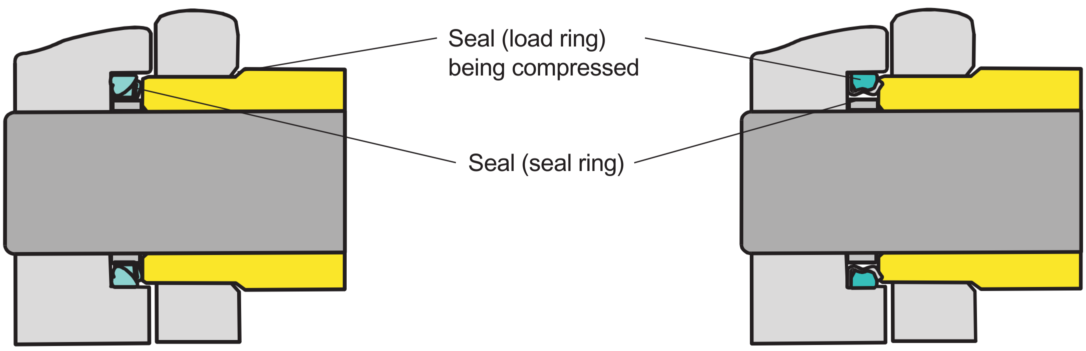


Seal used in oil sealed type track link

Seal for SALT type track link

The oil sealed track link seal consists of a seal ring that seals off sand and internal lubricating oil and a load ring which produces a pressing force against the seal. The load ring is designed to maintain the sealing performance with its elasticity as it is compressed and embedded into the link.

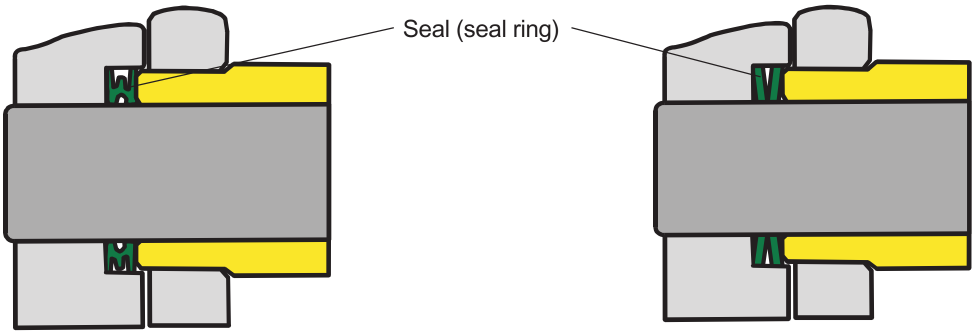
F type **W type**



Seal for grease sealed type track link

As the seal ring in the grease sealed type track link seal is squashed and embedded, it also has a similar function as the load ring in the oil sealed type track link.

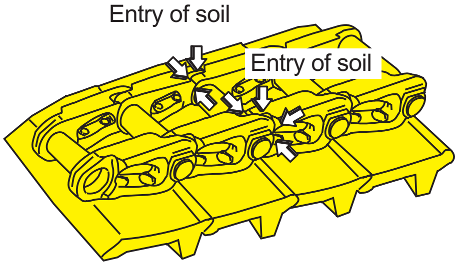
W type **V type**



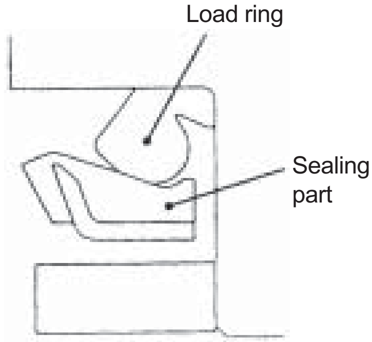
There are other different types of seal

Function of seal

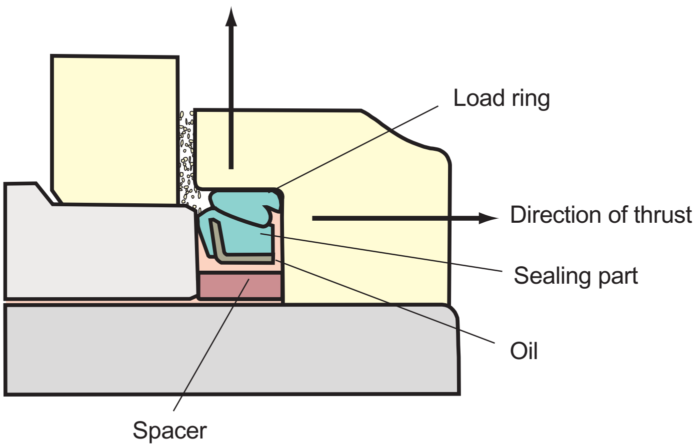
The track parts are always subjected to the effects of soil or water, but in addition to this, the bending and sliding motion creates a condition where it is always easy for soil to enter between the pin and bushing (link connection).
To prevent the entry of soil and water, and to prevent leakage of the oil sealed inside the track, a special seal is used for sealed & lubricated track.



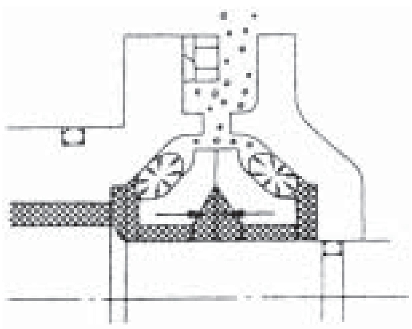
The structure of this seal is similar to that of floating seals used in idlers and rollers of the undercarriage. It consists of a part which seals oil in and keeps dirt and sand out, and a load ring which imposes a thrust to the said part. The load ring is set in place in a crushed condition. Its resilience pushes the sealing portion in the direction of thrust, exerting the proper surface pressure on the sliding surface with the bushing.
The thrust is also given in the radial direction of the link counterbore, preventing oil from leaking from the bores. The spacer is set inside the seal to protect it from overload and keep the deflection of the seal at a proper level while the machine is traveling.



Free conditions of a seal



Installation condition of a seal

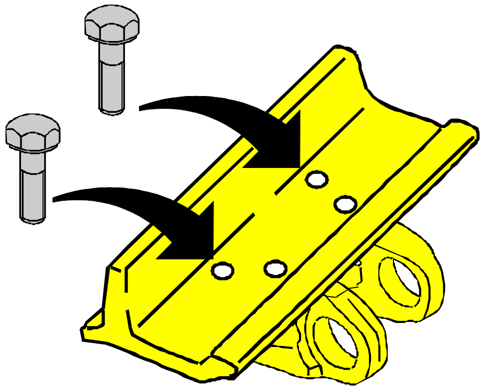


Structure of floating seal

(6) Shoe

Structure and characteristic

Track shoe is fixed on the track link by 4 bolts and 4 nuts in general. Shoe has a varieties which width and type of grouser are different. Track shoe consists of plate part where machine weight is supported and grouser which transfer the traction to the ground. During a operation, shoe receives a complex stress of bend, shock and friction from the ground.
Therefore track shoe is designed to have been hardened through and tenacious not to bend, crack or wear soon.
If the shoe bolt is loosen or came off, track shoe and link will get damaged. Therefore it is required to inspect a shoe bolt periodically to avoid a undercarriage trouble.

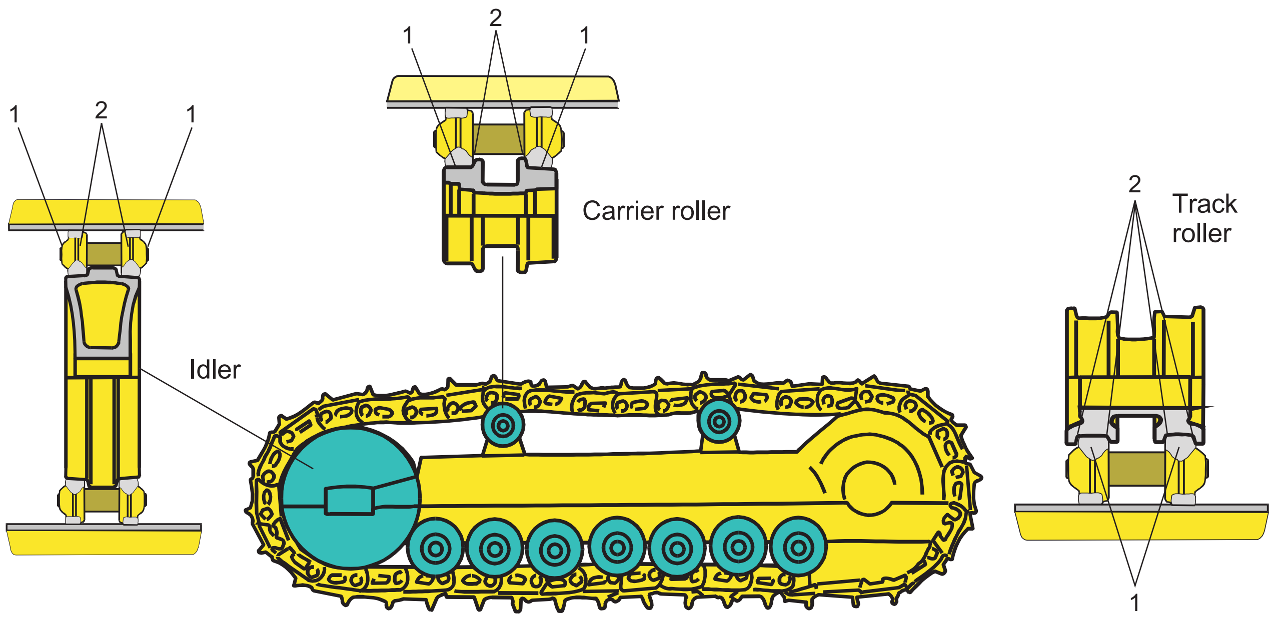


3) Rollers

The following figures show how the idler, track roller and carrier roller work when a bulldozer is dozing. Let us call them "Rollers" for the three items in the explanation below.

Some common phenomenons for the rollers are:

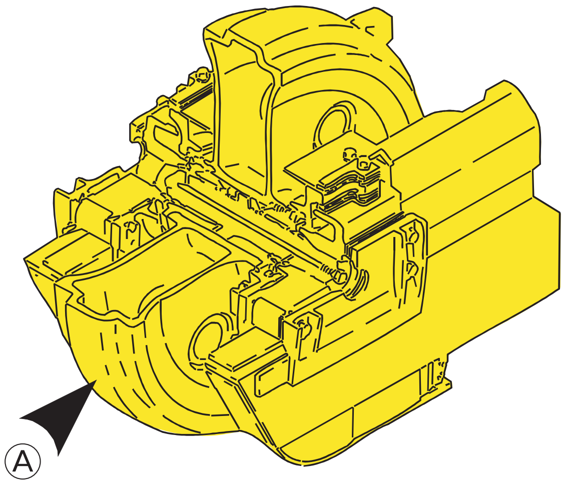
1. Abrasions occur on the surfaces of the rollers and the tread of track links.
2. Flanges of rollers prevent track links from falling out. Abrasions occur also on flanges of rollers due to constant contact with the track link assembly.

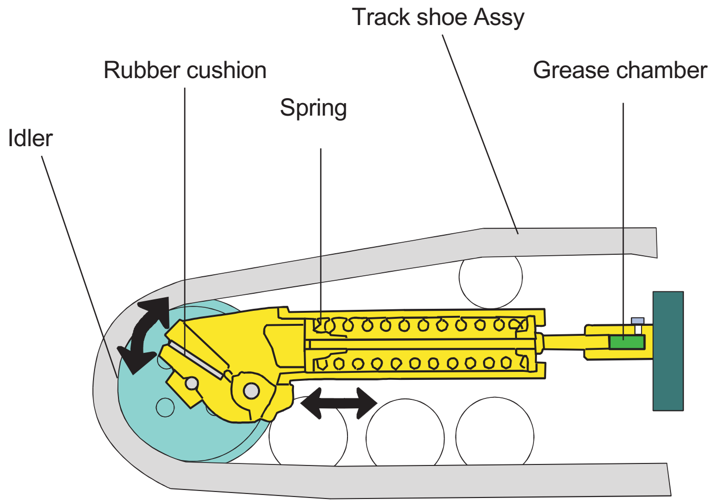


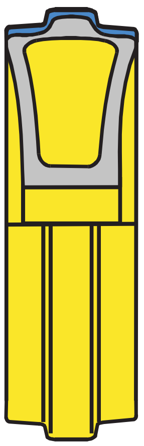
(1) Idler

a) Track Adjuster & Recoil Spring

Idler is installed at the front of the track frame and is used to guide the track link assembly. Inner parts consisting of bushings and shaft, are lubricated with oil.
Idler is equipped with track link tension adjustment mechanism and cushion mechanism.







Ⓐ cross section of an idler when viewed from A

Hardened and wear resistance portion

Flange

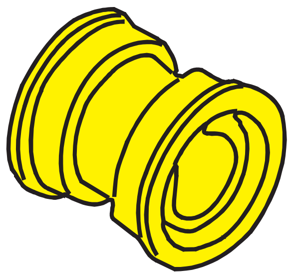
As the tread and flange are prone to wear, these portions are hardened to extend the life.

Idler equipped with rubber cushion minimizes stress and vibration around the track shoe Assy enhancing operators comfort.

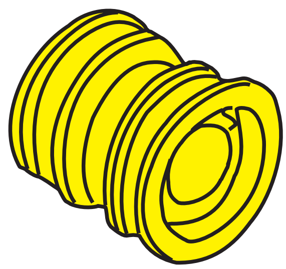
An example of track tension adjustment mechanism and a rubber cushion.

(2) Track Roller

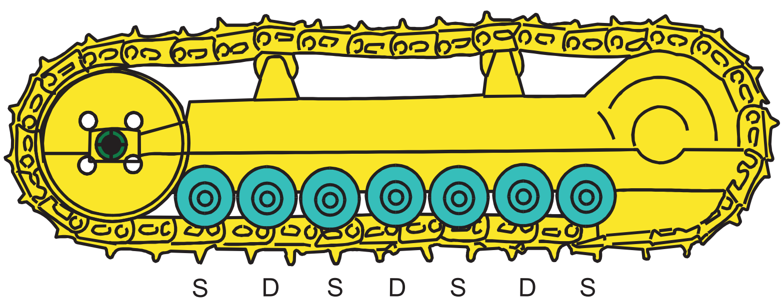
There are single flange type and double flange type rollers which are installed to a track frame. The rollers roll on the track link assembly under heavy load of machine weight. Track rollers are installed, not to warp the link, but to bear the machine weight and distribute evenly over the track shoes. Bushing and roller shaft are lubricated by oil. Track rollers installed near idler and sprocket are single flange rollers. The order of installation of single or double flange rollers are decided depends upon machine size.



Single flange type track roller



Double flange type track roller



Example for D155A model

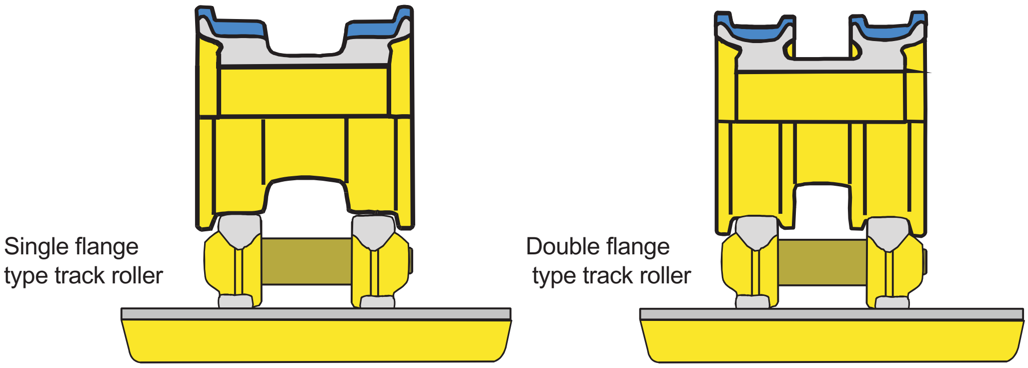
S: Single flange type track roller
D: Double flange type track roller

A crawler type vehicle works on a rough ground. Therefore, single and double flange rollers are positioned to release a lateral trust while the vehicle is working.

Flange of track roller improves straight drivability

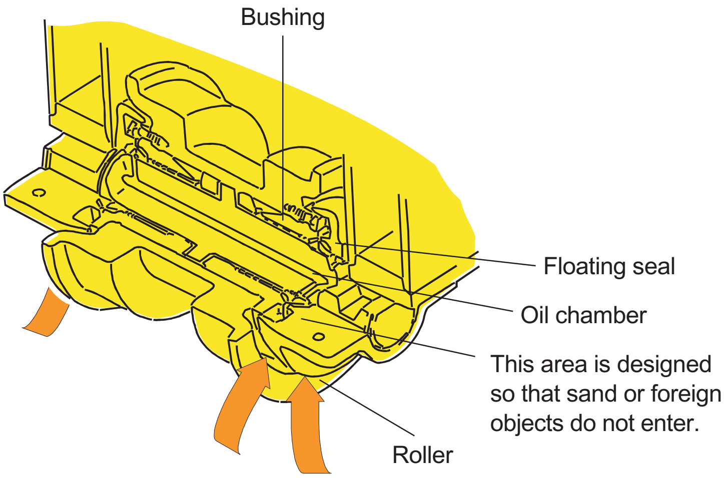
The flange of the track roller guides the track link assy to prevent it from moving in a zigzag manner. The hardness of the flange has to be improved for abrasion resistant because the flange rubs against the side of the track links.

Hardened and wear resistant portion
Flange



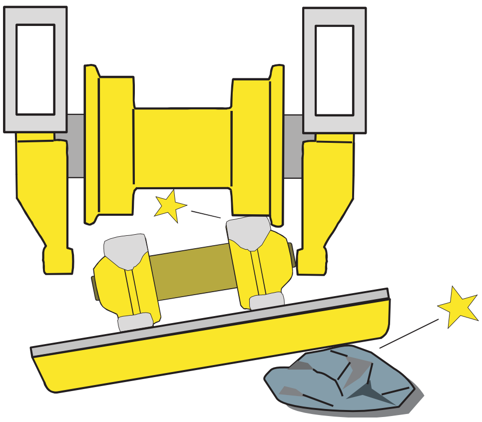
Structure of track roller

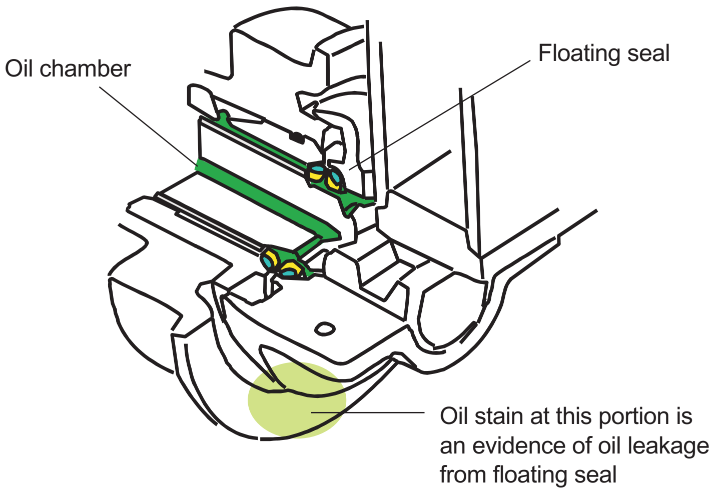
As shown below, oil is filled to minimize friction between the bushing and the shaft.



As the inner parts of a roller are lubricated with oil, floating seal is used to prevent oil leak. Since the sealed area may be filled with mud or sand, erosion takes place. Therefore, this area is designed so that sand or foreign objects do not easily enter the floating seal area.

Moreover, when the track shoe rides on stones, track rollers will be subjected to impulsive loads. Under such a condition, the floating seal is used to absorb distortion of sealing surface and prevent oil leak.



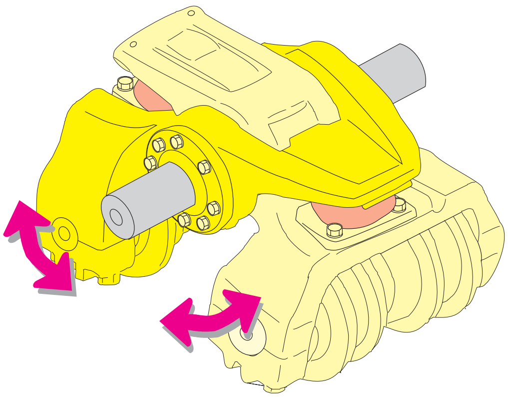


a) X-Bogie vs K-Bogie

Advanced Resilient Equalized Undercarriage (REU)

1) X-bogie

The Komatsu X-bogie resilient equalized undercarriage (REU) performs independent see-saw movements. Tremendous traction can be achieved even on uneven ground, because the shoe always follows the contour of the ground.



A rubber shock absorber is mounted on the X-bogie and decreases vibration and shock. The X-bogie and rubber cushion provide different absorption characteristics, depending on the ground surface. When the machine travels on flat ground, the REU functions as a conventional rigid undercarriage. When the machine travels on uneven ground, the REU maximizes the suspension effect. The Komatsu REU system improves traction, component durability, and operator comfort.

Conventional Undercarriage

There is minimal shoe slippage with the conventional low drive type undercarriage. The shoe slip limit has been substantially raised due to long tracks and large ground contact area. The large traction force thus obtained, in combination with high engine power, results in superb drawbar pull. With the low center of gravity, dynamic stability is excellent.

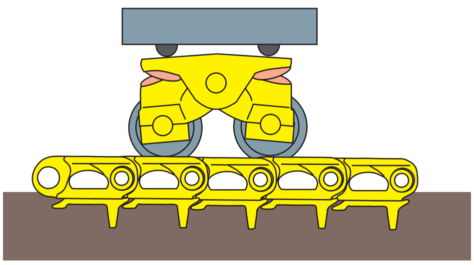
Flexibility

Flexibly grasps ground surface due to Komatsu's unique track roller design for better ground contact. Independent X-bogies and rubber pads (cushions) are incorporated into the track rollers.

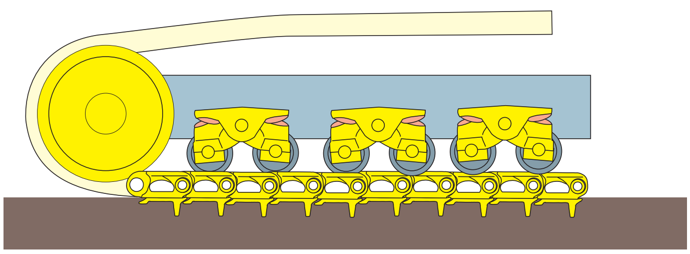
Powerful Drawbar Pull for All Kinds of Terrain

The X-bogie and rubber pad provide different suspension characteristics depending on the ground surface. On flat ground, REU functions as a conventional rigid undercarriage. On uneven terrain, the REU maximizes the suspension effect the shoes always follow the contour of the ground, ensuring a greater actual ground contact for greatly-improved drawbar pull.

On flat ground

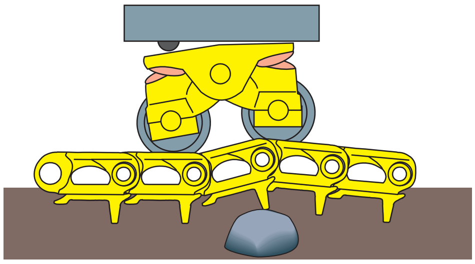


Functions as a conventional rigid undercarriage.

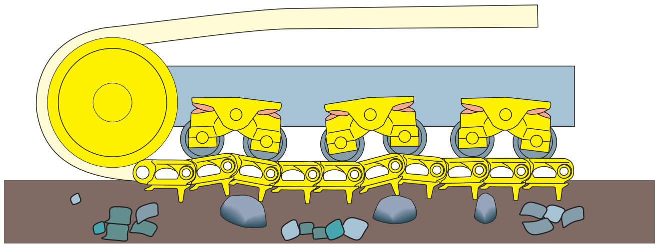


Ensures almost the same traction force as a conventional rigid undercarriage.

On uneven ground

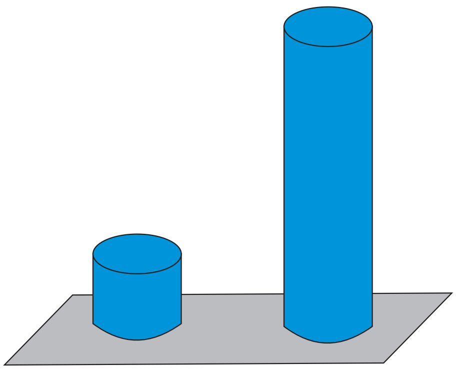


Seesaw movement is performed corresponding to ground surface.



Compared with a rigid type, the actual ground contact area increases and powerful drawbar pull is ensured because the track shoes follow the contour of the ground. Large deformation of the rubber pads contributes to greater suspension effect.

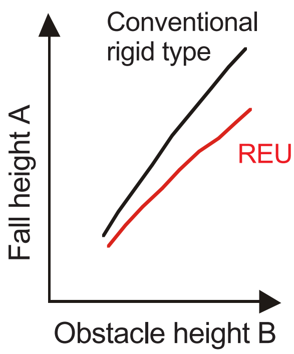
Comfortable Ride on Uneven Ground

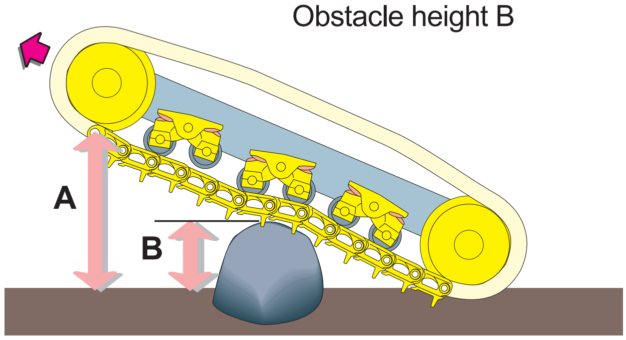


Flat ground travel   Rough terrain travel

On uneven ground, the rubber pad provides four times the suspension effect.

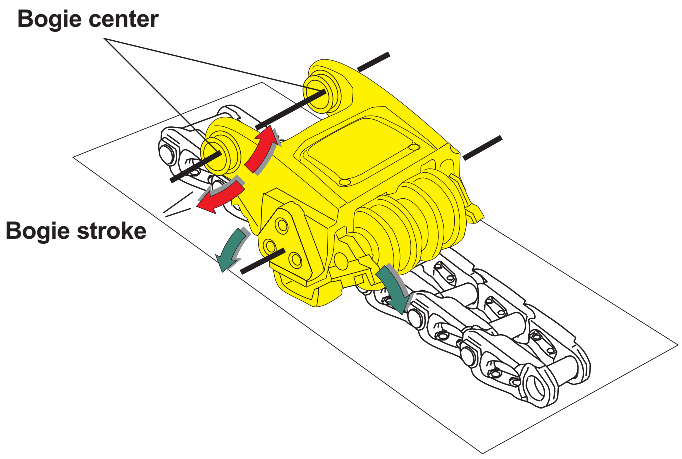
Minimum Shock in Riding Over Obstacles

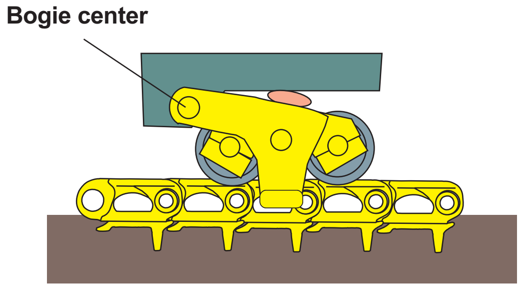


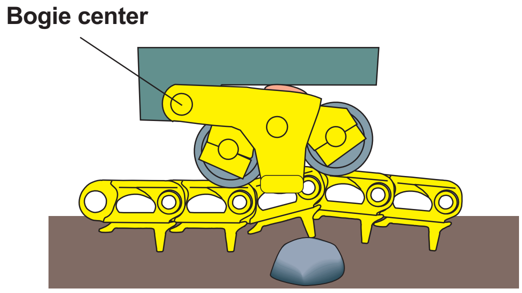


When riding over obstacles, the height of the machine fall is low.

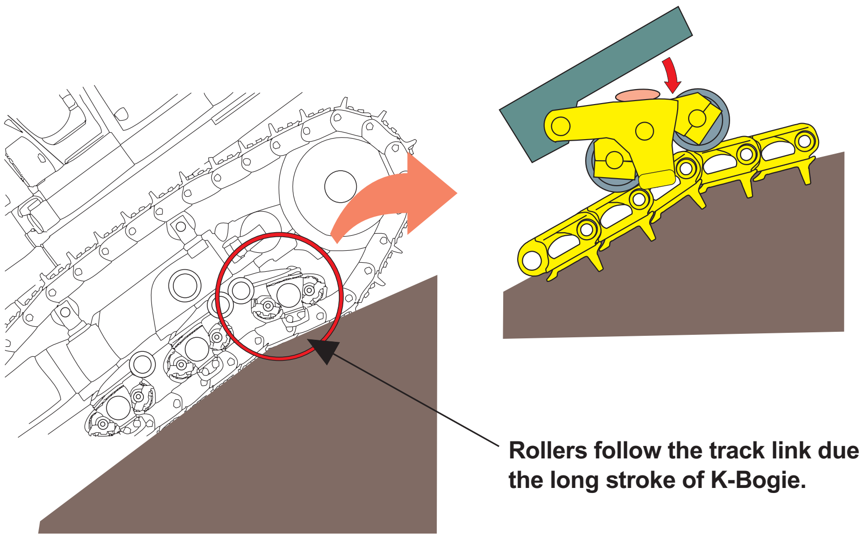
2) K-bogie
Komatsu improved the ability of track roller to track link, and improved riding comfort for operator in addition to reduction in load on undercarriage.
- Greater K-bogie stroke maintains consistent track tension and alignment.
- The design eliminates link pin-boss, providing greater clearance between track link and roller flange.



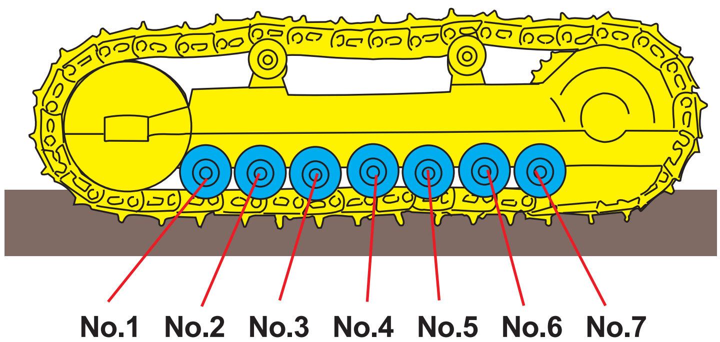




Improved Operator Ride & Comfort



b) T/Roller Sequence



S : Single flange
D : Double flange

Model	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	Remarks
D20, 21-6	S	S	S	S	S	$S_{P, PL}$	S_{PL}		
D20, 21-7, 8	S	S	S	S	S	S_{PL}	S_{PLL}		
D31-16	S	S	S	S	S	S_{PL}	S_{PLL}	S_{PLL}	
D31-17, 18, 20	S	S	S	S	S	$S_{P, PL}$	S_{PLL}	S_{PLL}	
D31EX-21	S	S	S	S	S				
D31EX-21	S	D	S	D	S				OPTION
D31P-21	S	S	S	S	S	S			
D31P-21	S	D	S	S	D	S			OPTION
D37-1, 2, 5	S	S	S	S	S	S_{P}			
D37-21	S	S	S	S	S	S			
D37-21	S	D	S	S	D	S			OPTION
D39-21	S	S	S	S	S	S			
D39-21	S	D	S	S	D	S			OPTION
D40, 41A, E-1	S	D	S	D	S				
D40, 41P-1	S	D	S	S	D	S			
D41A-6	S	S	S	S	S				
D41A-6 (HD)	S	D	S	D	S				OPTION
D41E, P-6	S	S	S	S	S	S_{P}			
D41E-6 (HD)	S	D	S	S	D	S			OPTION
D41P-6 (HD)	S	D	S	D	S	D	S		OPTION
D50, 53-17, 18	S	D	S	D	S	D_{P}	S_{P}		
D58E-1	S	D	S	S	D	S			
D58P-1	S	D	S	D	S	S	D	S	
D61E-12, 15	S	D	S	S	D	S			
D61P-12, 15	S	S	D	S	S	D	S	S	
D63-1	S	D	S	D	S	D	S		
D60, 65A-6, 7	S	D	S	S	D	S			
D60, 65E, P-6, 7	S	D	S	D	S	D	S		
D60, 65A-8, 11	S	D	S	S	D	S			
D60, 65E-8, 11	S	D	S	D	S	D	S		E type only
D65E-12, 15	S	S	D	S	D	S	S		
D65P-12, 15	S	S	D	S	S	D	S	S	
D66-1	S	D	S	S	D	S			
D68-1	S	D	S	D	S	D	S		
D75S-3	S	D	S	D	S	D	S		
D75S-5	S	D	S	D	S	D	S		
D83E-1	S	D	S	D	S	D	S		
D80, 85A-18	S	D	S	S	D	S			
D80, 85P-18	D	S	D	S	S	S	D	S	

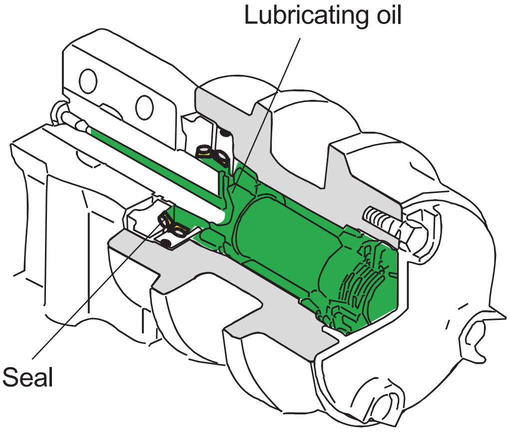
(to be continued)

S: Single flange
D: Double flange

Model	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	Remarks
D85A, E-21	S	D	S	S	S	D	S		
D85P-21	D	S	D	S	S	S	D	S	
D85EX-15, 15EO	S	D	S	S	S	D	S		
D85PX-15, 15EO	S	S	D	S	S	S	D	S	
D85E-SS-2	S	S	D	S	S	D	S	S	
D95-2	S	D	S	D	S	D	S		
D135-1, 2	D	S	D	S	S	D	S		
D150, 155-2	D	D	D	S	D	D	S		
D155A, AX-3, 5	D	S	S	D	D	S			
D155AX-6	S	D	S	D	S	D	S		
D275-2	S	D	D	S	S	D	D	S	
D275-5, EO	S	D	D	D	D	D	S		
D355-3, 5	D	D	D	S	D	D	S		
D375-1	S	D	D	S	S	D	D	S	
D375-2	S	D	D	S	S	D	D	S	
D375-3	S	D	D	S	D	S			
D375-3, 5, 5EO	S	D	S	D	S	D	S		
D375-5EO	S	D	D	D	D	D	D	S	8 roller type
D455-1	D	D	S	D	S	D	S		
D475-1	S	D	D	S	S	D	D	S	
D475-2	S	D	D	S	S	D	D	S	
D475-3SD	S	D	S	D	S	D	S		
D475-3, 5	S	D	D	D	D	D	S		
D475-5EO	S	D	D	D	D	D	D	S	8 roller type
D575-2	D	S	D	S	D	S			
D575-2SD	D	S	D	S	D	S	D	S	
D575-3	D	S	D	S	D	S	D	S	

(3) Carrier Roller

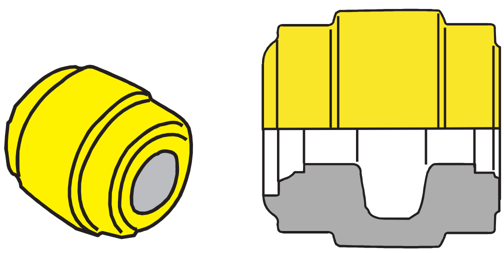
There are mainly two types of carrier rollers, flange type and flat type. The flange type roller is used for medium and large size Bulldozers, and Dozer shovels.
The flat type roller is used for small size Hydraulic Excavators.
Since the carrier rollers support only the shoe assembly, the structure is less complicated compared to the track rollers. However, the accumulation of sand and soil around the carrier rollers will also cause erosion.



Be careful when operating a machine at a high speed. This will cause the track links to hit the carrier rollers strongly and as a result, it will shorten the life of both items.
The bearing and the shaft in the carrier roller are lubricated with oil.

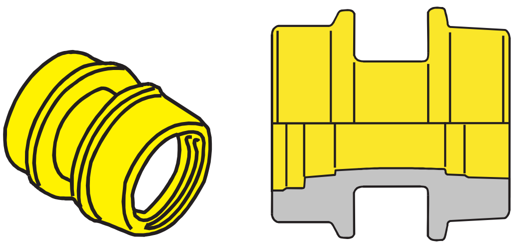
Flange type

There are center flange type and single flange type.



Center flange type

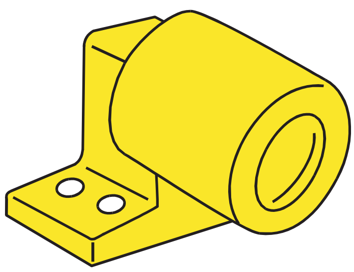
The center flange type is used for Hydraulic Excavators, small size Bulldozers and Dozer shovels.



Single flange type

The single flange type is used mainly for medium and large size Bulldozer, and Dozer shovel.

Flat type

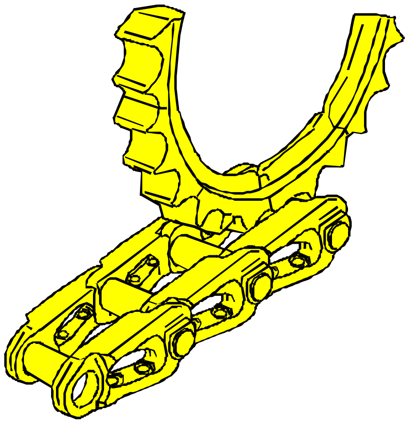


The flat type is used for small size Hydraulic Excavators.

4) Sprocket

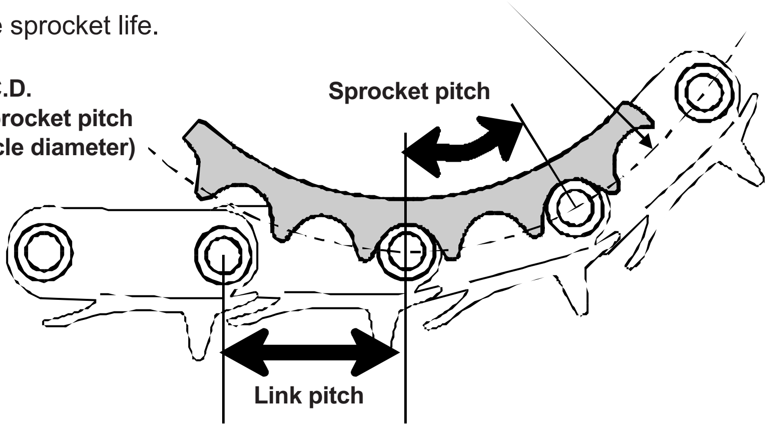
Structure and characteristic

The sprocket engages with bushing of tack link, and drives the vehicle. Abrasion occurs to various parts around the sprocket while it is running. Knowing the place to be worn is not difficult if we understand how power is transferred from sprocket to track link assembly.



Relationships between sprocket and link (bushing and pin)

On a new machine, the link pitch (center distance between link pins) is equal to the sprocket pitch (distance between two teeth along the pitch line of sprocket). In many hours of operation, the sprocket pitch will be shortened slightly by the worn tooth surface, whereas the link pitch will be extended by the worn pin O.D. and bushing I.D. In the lapse of time, both pitches will be more unmatched to each other. If the sprocket is used continuously under such a condition, the bushing O.D. and sprocket tooth surface will have to the abnormal wear, shortening the sprocket life.



The sprocket pitch is the center distance between teeth beyond one tooth and every two teeth; the sprocket meshes with a bushing. If a sprocket has an even number of teeth, the same teeth come into mesh with the same bushing at all times. Therefore, the sprocket has normally an odd number of teeth to make different teeth mesh with different bushings every rotation, insuring the even wear of sprocket tooth surface and bushings.

2-2. Wear Limit

1) General View

For the wear portion of all UC parts, the allowable wear margin (100% Wear Limit) is specified. The allowable wear limit is specified by considering the required conditions on the UC parts performance and the strength (especially when rebuilding), and by considering the interference with the other parts at wear. (For details, refer to Chapter 2.) Accordingly, depend on how UC parts are used (rebuilt or run destruction), handling of Wear Limit is different.

In addition, Bushing and Pin of Link engage with Sprocket, and directly receive the bigger load from the ground at the lower portion of Final Drive. The strength of received load depends on the condition of machine operation and the ground condition. Accordingly, in order to keep the strength corresponding to the load condition, based on the ground condition, as for Bushing O.D. and Pitch elongation, the Wear Limit is classified as two types of Impact and Normal. Therefore, in order to do Management, it is necessary that the ground condition is ensured on the jobsite, and the suitable allowable value is selected

(1) Rebuilt vs Run to Destruction

When "Rebuilt" is done

- When rebuilding by turning Bushing, build up by welding Roller tread surface, etc, it is necessary to do it at the time when the wear is within Wear Limit. Especially, as for Bushing, when it is turned after exceeding Wear Limit, it is very probable that Bushing has already been cracked. Therefore, it is careful that this causes the early Oil Leakage after turning.

When use "Run to Destruction"

- When the UC parts are used to the very end and abandoned without turning Bushing, etc, it is usual that the UC parts are continued to use as it is after exceeding Wear Limit. But when exceeding Wear Limit, the structural problems such as the interference with other parts, cracks, breakage, etc occur. Generally, the replacement time is the time when the vibration occurs by the interference, and the part is broken.

(2) Normal Limit vs Impact Limit

Normal Limit

- This is Wear Limit at the time when the machine is operated at the sandy land without rocks, etc, and at the jobsite where the shock is not given to each portion of the undercarriage.

Impact Limit

- This is Wear Limit at the time when the machine is operated at the rocky land, and at the jobsite where the shock is given to each portion of the undercarriage.

Komatsu's Concept when the criteria of **Impact** and **Normal** are specified. (Remarks)

- Only Bulldozer has both criteria of Normal and Impact. As for H/E, it is basically not operated at the rocky land, and its travel is less. Therefore, the criteria is one.
- In addition, Bushing O.D. and the Pitch elongation have both criteria of Normal and Impact, and except them, other UC parts have one criteria.
- As for Grease Sealed Track of Bulldozer, both Bushing O.D. and Pitch elongation have the criteria of Normal and Impact. In the case of Impact, by considering the crack occurrence of Bushing and the pin breakage due to the impact load, Wear Limit is smaller.

- As for SALT of Bulldozer, Bushing O.D. has the criteria of Normal and Impact. As for SALT, because there is no pitch elongation, Pitch elongation has only one criteria. In addition, as for Bushing O.D., because there is no pitch elongation, shortly there is no internal wear, Wear Limit is bigger than that of Grease Sealed Track.

2) Concept on Wear Limit for each UC Parts

(1) Track Link (Tread Wear)

- Wear Limit is specified by considering the rebuilding. Therefore, when the wear is within Wear Limit, after rebuilding by weld-overlaying the tread surface, the strength can be maintained.
- Wear Limit is specified by considering the interference with other parts. Therefore, when the wear exceeds Wear Limit, the interference of following portions may occur.
  - Pin Boss portion and T/Roller Outer Flange
  - Bushing and T/Roller Inner Flange
  - Bushing and C/Roller Flange
  - Bushing and Idler Flange
- From the view point of Life, generally on the wear balance with other parts due to the soil, the following items are considered.
  - Two times life of Bushing O.D. (Bushing is turnable.)

(2) Bushing (O.D. Wear)

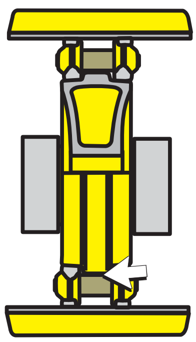
- This is specified by considering the turning use. Therefore, when the wear is within Wear Limit, even the load is applied, the crack does not occur. Accordingly, it is important that Bushing turning is done within Wear Limit.

(3) Pin & Bushing (Inner Wear, Pitch Elongation)

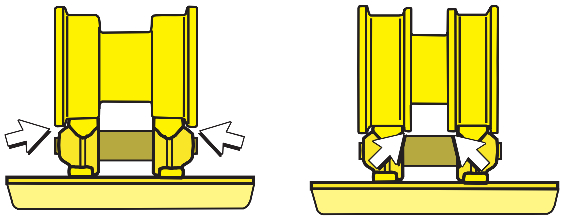
- This is specified by considering the turning use. Therefore, when the wear is within Wear Limit, even the load is applied, the crack and the breakage do not occur on Pin and Bushing. Accordingly, when Bushing is turned, Pin can be also used.
- This is specified by considering Track Sag adjustment. Therefore, when the Pitch elongation occurs, if the wear is within Wear Limit, Track Sag can be absorbed within the range of Idler forward adjustment amount.

(4) Idler (Tread Surface Wear)

- Wear Limit is specified by considering the rebuilding. Therefore, when the wear is within Wear Limit, after building up by welding the tread surface, the strength can be maintained.
- Wear Limit is specified by considering the interference with other parts. Therefore, when the wear exceeds Wear Limit, the interference between Bushing of Link Ass'y and Flange portion may occur.

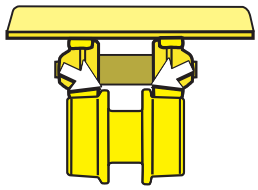


(5) Track Roller



- Wear Limit is specified by considering the rebuilding. Therefore, when the wear is within Wear Limit, after building up by welding the tread surface, the strength can be maintained.
- Wear Limit is specified by considering the interference with other parts. Therefore, when the wear exceeds Wear Limit, the following interference may occur.
  - Outer Flange and Link Pin Boss portion
  - Inner Flange and Link Bushing portion

(6) Carrier Roller



- Wear Limit is specified by considering the rebuilding. Therefore, when the wear is within Wear Limit, after building up by welding the tread surface, the strength can be maintained.
- Wear Limit is specified by considering the interference with other parts. Therefore, when the wear exceeds Wear Limit, the interference between Bushing of Link Ass’y and Flange portion may occur.

(7) Shoe (Grouser Height Wear)

- Wear Limit is specified by considering the rebuilding. Therefore, when the wear is within Wear Limit, the enough strength is maintained, and the bend does not occur. Accordingly, the rebuilding is possible by the lug-weld.
- From the view point of performance, when the grouser wear is within Wear Limit, the performance is specified so that the traction force is obtained on the general soil.

(8) Sprocket Teeth

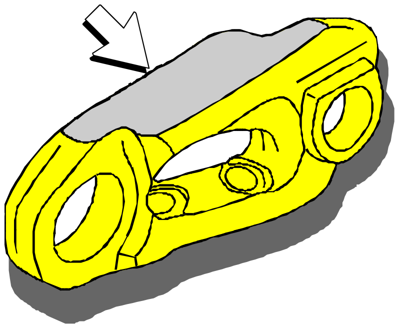
* When the wear is within Wear Limit, if the load is applied, the crack and the breakage do not occur.

2-3. Wear & Problem

1) Link

(1) Wear Pattern

a) Wear of Link Tread

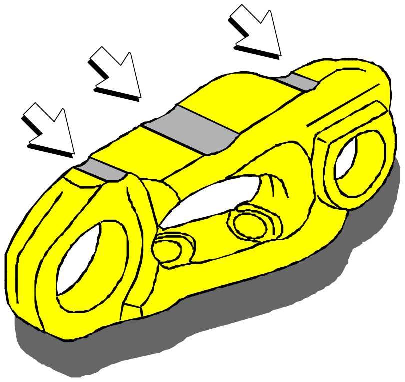


CAUSES: Wear is caused by contact with track rollers which support tractor weight.
This is normal wear.
Abnormal progress of wear will be caused by grinding effect of hard gravely particles or quartz sand intruded between link tread and roller tread.

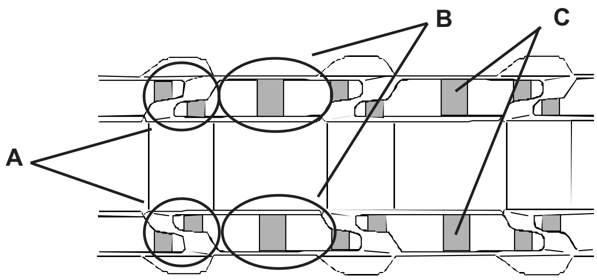
EFFECT: Link height will be decreased, causing interference of roller flange to pin boss.
Excessive progress of wear will make reconditioning difficult.

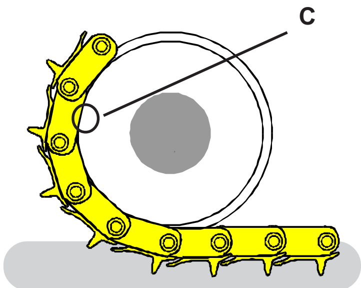
REMEDY: When link tread wear has reached the repair limit, recommend replacement of link otherwise hard facing build-up welding.

b) Uneven Wear of Link Tread



CAUSES 1: **Wear due to difference of surface pressure**
As width of link tread is small at link joints, portion "A" which is subjected to higher surface pressure of track roller than portion "B" will wear faster.



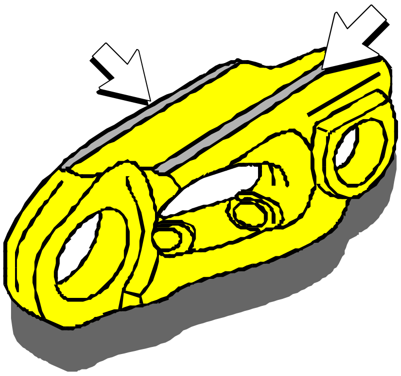


CAUSES 2: **Wear due to contact with front idler**
When track link runs around the front idler, only the middle portion "C" of link comes into contact with idler and, therefore, uneven wear will progress over a long period of operation.

EFFECT: The deeper the worn step, the more difficult even padding will be. Generally the uneven wear appears at the beginning of operation and continue to grow in the period. Then the wear do not progress.
This wear pattern do not affect severe problem to undercarriage. But the unusual (unexpected) wear may affect severe problems.

REMEDY: When wear is reached the repair limit, recommend replacement of link otherwise hard facing build-up welding.

c) Wear of Tread Side Face



CAUSES: Wear is caused by contact of link tread side surface to sprocket teeth side face, front idler flange side face and roller flanges, and this wear is unavoidable to some degree.

If excessively fast progress of wear is noticed, the cause may be assumed due to any of the following unusual operating condition:

1. Where machine is subject to frequent turns including many pivot turns.
2. Where turning of machine to a fixed direction is continued a long time.
3. Where traveling across hillside or side cutting of a hill is continued a longtime.
4. Where track is misaligned.

If any of these unusual conditions exists, link tread side face will be subjected to large part of machine weight through the sprocket teeth side face, front idler side face and roller flanges, so that wear of tread side face progresses quickly.

EFFECT: As width of tread is decreased, surface pressure exerted by track rollers, increases, therefore wear of tread will be accelerated. Life of rollers is reduced. Excessively worn tread is difficult to repair by padding.

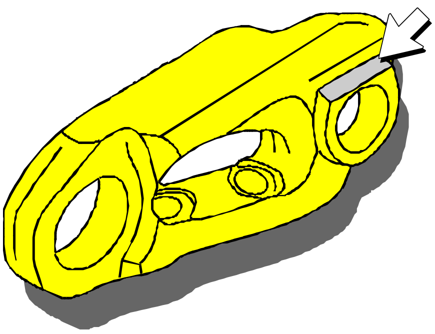
REMEDY: When any possible cause of wear is found out, advise customer to correct the cause. For example,

Adjusting tack alignment.
Replacing with narrower track shoe,
Replacing with sealed and lubricated track.

If wear has progressed until link tread is affected, recommend immediate build-up welding and removal of the cause of wear of tread side face.

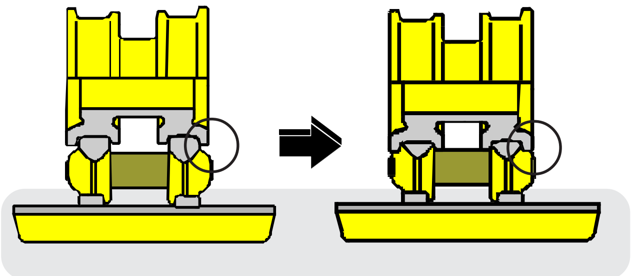
As complex contour of tread side face is impossible to repair by automatic welding, wear must be treated early.

d) Wear of Pin Boss Top Face



CAUSES: Wear is caused by interference of pin boss top face with roller flanges.

With progress of wear on link tread face, wear will occur also on rollers which contact with link tread. Access of roller flange to pin boss top face by the cumulative effect of wear of link and wear of roller will lead to interference between them to cause wear of pin boss top face.



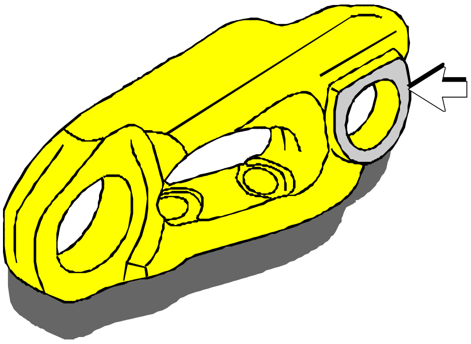
If rail wear progress...

EFFECT: When wear progress excessively:

Repair of link becomes difficult.
Pin bore expands, making pin difficult to hold.
Roller flange will be damaged.

REMEDY: Repair links and rollers before interference between pin boss and roller flange occurs.
(Interference between pin boss and roller flange can be prevented by observing repair limit.)

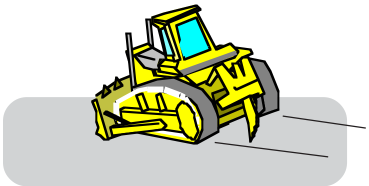
e) Wear of Pin Boss End Face

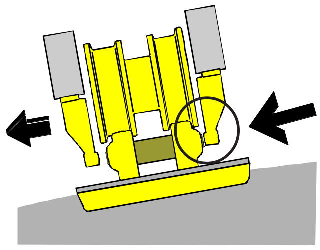


CAUSES: This wear accompanies the interference of track roller guard inside surface with pin boss end face.

CAUSE 1: **Long time travel of machine across hillside**

Under this operating condition, thrust load caused by machine weight will accelerate wear of link side face and roller flange side face. As the result, link pin boss end will be brought in contact with track roller guard.





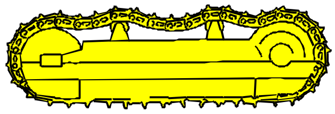
CAUSE 2: **Wear due to interference caused by snaky track**

Wear of link joint surfaces

Earth intruded between link joint surfaces will accelerate progress of wear of mating surfaces with "bending" movement of track links, thus causing snaking movement of track.

Improper track tension

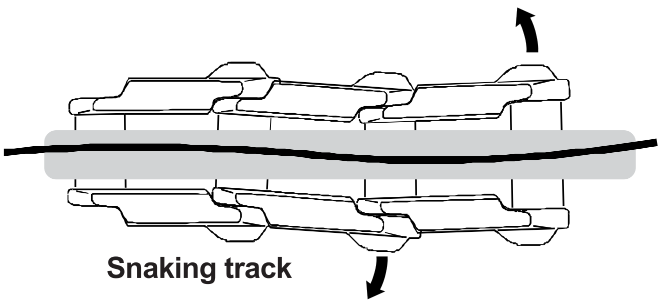
Loose track will cause excessively snaky track.

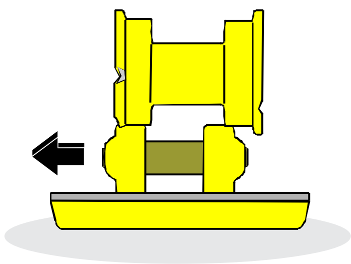


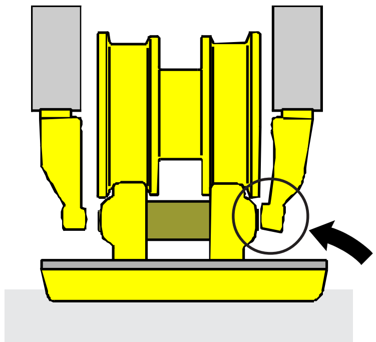
Broken track roller flange

Track roller with nicked flange will fail in its function to guide track links in proper alignment, thus causing excessively snaky track.

When track becomes snaky due to any of above-mentioned causes, interference of pin boss with roller guard will occur and wear of pin boss side face will result.



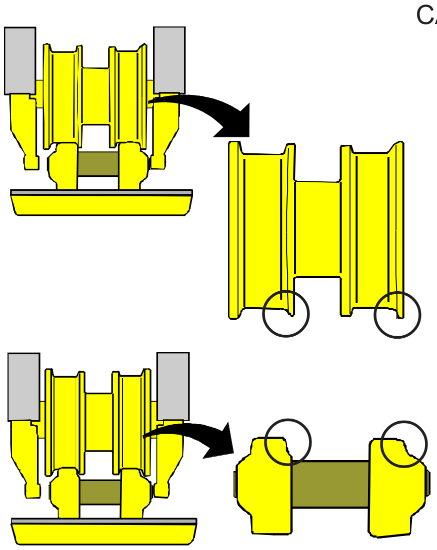




CAUSE 3: **Deformation of track roller guard**

Originally, pin boss side face is spaced from roller guard with a clearance large enough to prevent interference between them even if track is in lightly snaky condition. However, the clearance may be decreased because of deformation of roller guard caused by hit with rocks during machine operation on rocky ground.

When such reduction of clearance once arises, roller guard will easily interfere with link pin boss even when snaky condition of track is light causing wear of pin boss side face.



CAUSE 4: **Worn roller flange side face or link side face**

Long-time operation of bulldozer will cause worn roller flange side face and worn link side face.

The whole wear of these surfaces help the track to becomes snaky. With progress of wear, the amount of wear will exceed standard clearance, thus causing wear of link pin boss side face due to interference of it with roller guard.

EFFECT: When wear progresses excessively:

Track pins will become difficult to remove thus making repair of link impossible, contrarily, pins will easily slip out due to reduction of force-fit in link.

Track roller guard prevents track roller going off from track link rail. Generally pin boss side face and the guard have some rubbing and some wear in operation. But unusual "heavy" wear may damage many parts.

REMEDY: When wear of pin boss side face is noticed, examine the following:

(1) Whether or not possible cause exists in job site conditions.
(2) Whether or not there is any possible cause which makes snaky track.
(3) Whether track roller guard is deformed or not.
(4) Whether progress of wear is found on roller flange side face and link side face or not.

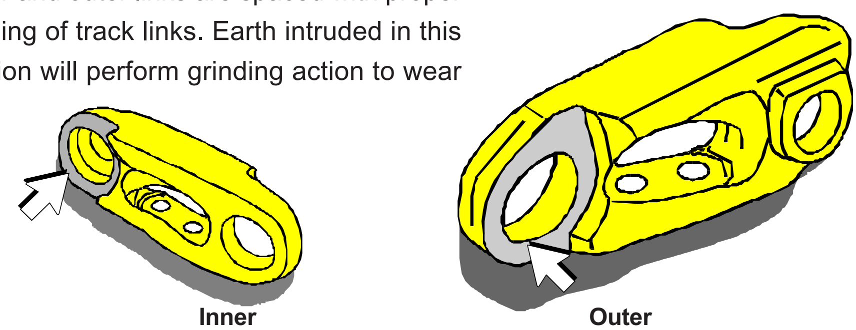
When some cause is detected, advise customer to correct the cause.

For example,

Turning pins and bushings to prevent snaky track.
Applying build-up welding to track roller flanges.
Repair of roller guard.

f) Wear of Link Mating Face

CAUSES: Mating surfaces of inner and outer links are spaced with proper clearance to assure smooth bending of track links. Earth intruded in this clearance during machine operation will perform grinding action to wear the mating surfaces.

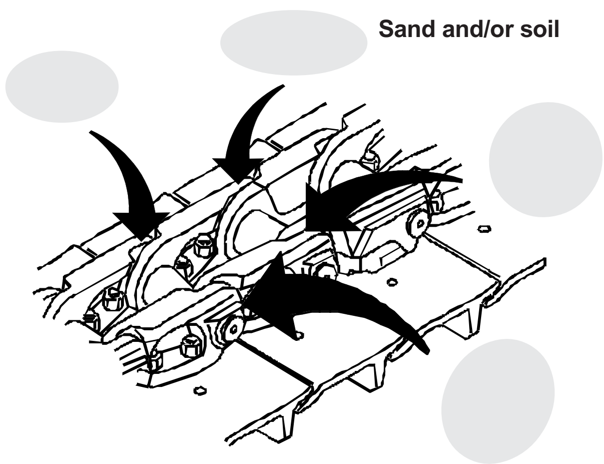


EFFECT:

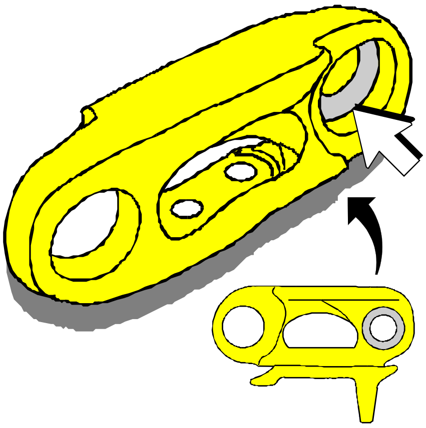
Track becomes snaky, thus causing shortened life of rollers, sprocket wheel and front idler.
Progress of wear of link tread is accelerated.
Excessive wear makes link difficult to repair.

REMEDY:

Turn pins and bushings.
Replace with oil lubricated track.



g) Depth Wear of Counterbore Bottom Surface

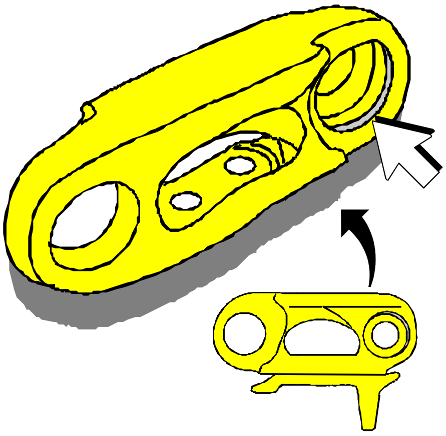


CAUSE: The wear is caused by earth intruded in the clearance between counterbore bottom surface and bushing end face.

EFFECT: Repair of link will become difficult.

REMEDY:
Turn or replace pins and bushings. Be sure to replace dust seal when replacing pins and bushings.
Replace with sealed and lubricated track.

h) Wear of Counterbore Side Surface

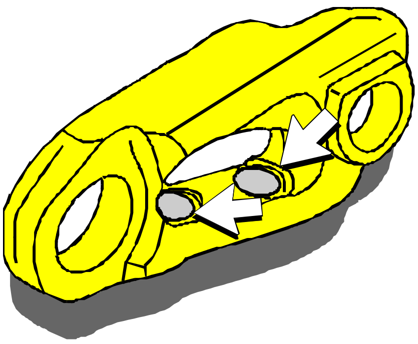


CAUSE: The wear is caused by interference between bushing and counterbore due to elongation of link pitch.
The wear will be progressed by excessively tightened track.

EFFECT: Repair of link will become difficult.
Wear of pins and bushing will be accelerated.

REMEDY:
Turn pins and bushings.
Keep proper track tension.
Replace with sealed and lubricated track.

i) Expanded Shoe Bolt Holes



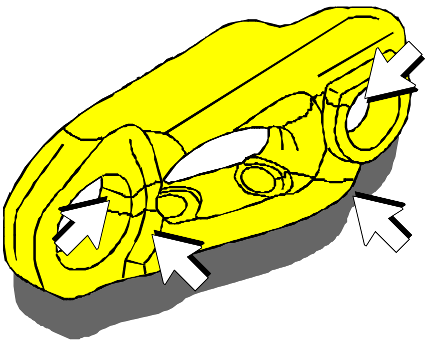
CAUSE: Shoe bolts are insufficiently torqued.
Improperly wide shoe is installed.

EFFECT: Bolts may be broken.
Shoes may get out of place.

REMEDY: Tighten shoe bolts to specified torque.
After 100-hour initial operation with new shoes, check bolts for loosening.
This is essential specially when operating on rocky ground.
Replace with narrower shoes.

(2) Structural Problem

a) Crack on Link



CAUSES: During rocky-ground operation, running on and off large rocks may cause twisted link and cracked link. The following is assumable cause of cracking:

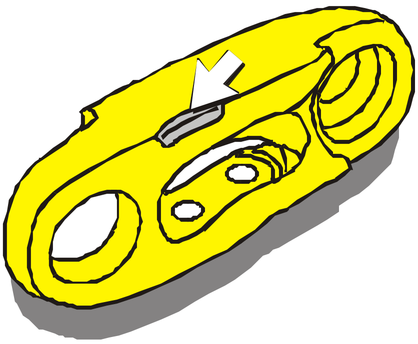
1) Where decreased thickness of shoe plate due to wear fails to prevent shocks from directly affecting the link.
2) Where loose shoe bolts allow shocks to affect directly the link.
3) Where tilted shoe causes excessively twisted link.
4) Where failure of engagement between sprocket teeth and link bushings due to elongated link pitch causes bushing to hit sprocket tooth end and resulting shocks are transmitted to link.

EFFECT: When wear progresses excessively:

- Repair of link becomes difficult.
- Turning of pin and bushing becomes difficult.

REMEDY: Check for loosening of shoe bolts and check for adaptability of track shoe to the ground condition of job site. Recommend customer to replace track link assembly with new one.

b) Broken Link Tread

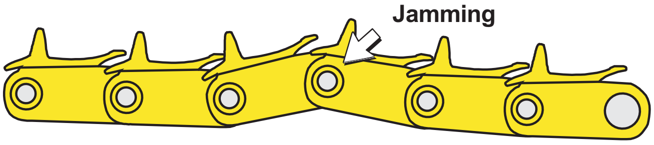


CAUSES: This is occurred by the high surface pressure due to the uneven contact impact load with the roller and the roller flange riding-on load.
Impact load occurs on the hard ground or by the high speed travel.
The uneven contact load and the flange riding-on occur by the uneven ground travel or the wider shoes.
Misalignment or incorrect shoe tension is assumable.

EFFECT: Because the surface of the broken link tread is worn, the breakage occurs or disappears repeatedly. Therefore, it does not matter. The breakage more than 30% of the tread surface may lower the wear service life.

REMEDY: When the larger breakage is found, the part is partially replaced. Otherwise, the part is continued to be used as is.
And, the causes of breakage (refer to CAUSES) should be reduced.

c) Back Jamming of Track Link



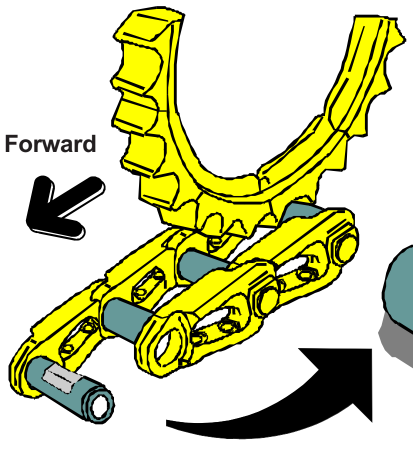
CAUSES: Pin and bushing go to rust. Specifically appears on storage machine or low availability machine. (Excavators etc.)

REMEDY: Travel a machine about 20 minutes a month even in a storage. Remove all sweat from a machine when stored.

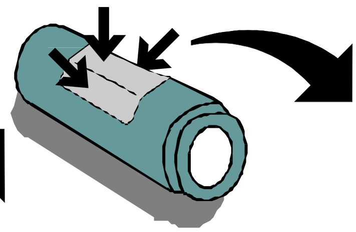
2) Bushing

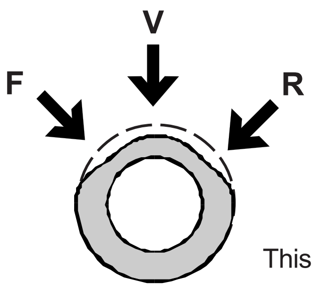
(1) Wear Pattern

a) Wear of Bushing O.D.

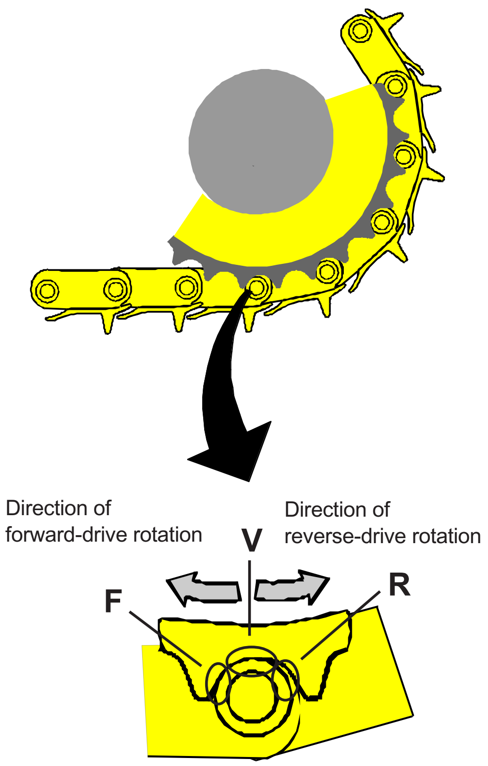


As bushings are brought into engagement with sprocket teeth, wear of bushing O.D. must be investigated in connection with wear of sprocket teeth. The following is the definition of three important terms which must be understood without confusion when wear of bushing O.D. is under discussion.





This is normal wear.



(1) External wear on forward drive side ...F
This wear is caused by sliding motion which occurs between rotatively contacting surfaces when a bushing leaves toothed face of sprocket wheel while it is in forward-drive rotation.

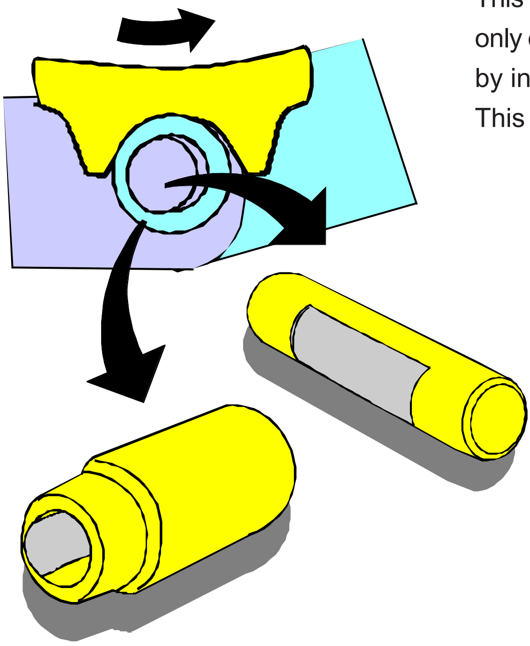
(2) External wear of root ... V
This wear is caused by sliding motion of a bushing which moves along the root of sprocket tooth to fill backlash when a shift of forward-reverse travel is made.

(3) External wear on reverse drive side ... R
This wear is caused by sliding motion which occurs between rotatively contacting surfaces when a bushing comes to mesh with toothed face of sprocket wheel while it is in reverse-drive rotation.

EFFECT: Wall thickness of bushing is decreased, thus making bushing liable to crack or break.

REMEDY: When bushing O.D. is close to its turnable limit, recommend customer to turn pins and bushings. Assumable causes of abnormally quick progress of wear are intrusion of hard rock grits or quartz sand between sprocket teeth and bushing outer diameter, and excessively tight track tension.
Perform soil survey in the job site and checking of track tension, and explain the result of investigation to customer. Also, improper traveling speed of machine can affect largely wear of bushing O.D. If careless operation of a machine is suspected as the cause of abnormal progress of wear of bushing O.D., observe actual operating condition of the machine at job site and advise the operator to operate the machine at proper traveling speed under proper load.

b) Wear of Bushing I.D.

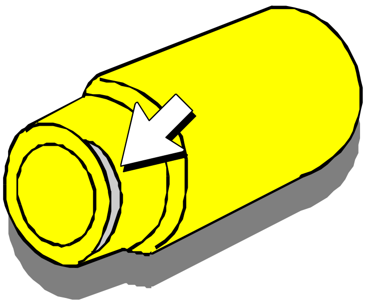


CAUSE:
This wear is caused by contact of bushing I.D. with pin. Wear will progress only on the forward drive side with wear of pin O.D. and will be accelerated by intrusion of earth inside the bushing.
This is normal wear.

EFFECT:
Link pitch will be increases.
Track will become snaky, thus causing wear of link side face and counterbore.

REMEDY:
Turn or replace bushings and pins.
Replace with sealed and lubricated track.

c) Wear of Bushing End O.D.

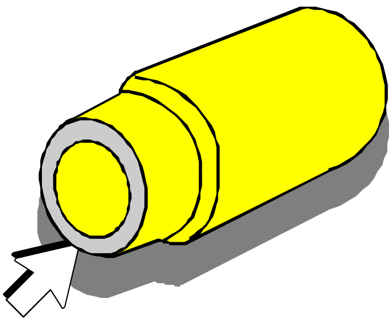


CAUSE: The wear is caused by contact of bushing to link counterbore due to elongation of link pitch.

EFFECT: As wear progress on only one side of link counterbore, repair of link will become difficult.

REMEDY:
Turn or replace bushings.
Replace with sealed and lubricated track.

d) Wear of Bushing End Face



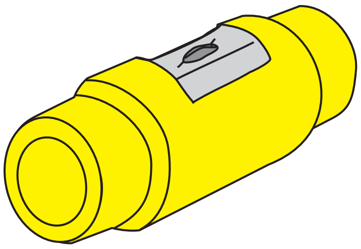
CAUSE: The wear is caused by friction of bushing with link counterbore bottom and is found on the end surface of long bushing not provided with dust seal.

EFFECT: Excessive progress of wear will make track more snaky.

REMEDY:
Replace bushings.
In the sealed type bushings, also replace seal assembly which may be crushed instead of bushing end face being worn.

(2) Structural Problem

a) Bushing Cracks (Through the wall)



CAUSES: Exceeding wear limit for respective degree of impact or other criteria.

ACCELERATORS: Same as "Vertical Position" wear pattern.

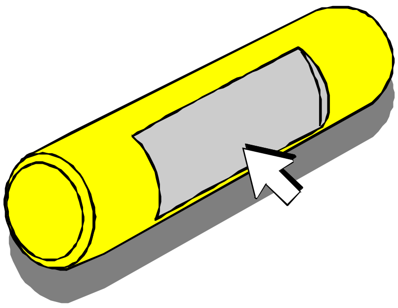
EFFECT: (1) Loss of lubricant and resulting internal wear. (2) Makes bushing non-reusable in wet joint and may not be reusable at all if a piece is broken out of a dry joint.

REMEDIES: Re-evaluate decision to run past wear limit.

3) Pin

(1) Wear Pattern

a) One Side Wear on Pin O.D.

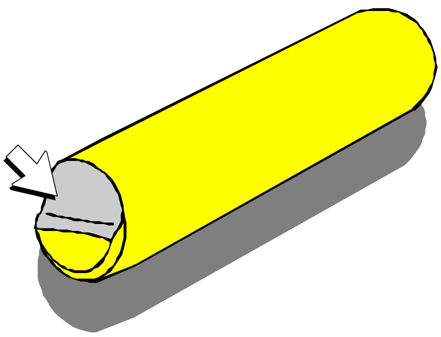


CAUSE: The wear will occur only on forward-drive side of track on ground the wear is caused by contact of pin with bushing and progress of wear will be excessively accelerated by intrusion of earth and rock grits inside the bushing.

EFFECT: Link pitch will be elongated. As this wear causes snaky track, wear of link side face and counterbore will result and wear of roller flange, sprocket wheel and front idler will be accelerated.

REMEDY: Turn or replace pins to correct link pitch.

b) Wear of Pin End Face



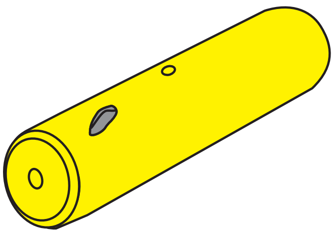
CAUSE: This is an abrasion caused by roller guard in which it appears as if upper half of pin end face is cut off.

EFFECT: Snaky track becomes out of control by roller guard.
Wear of roller flanges is accelerated.

REMEDY: Turn the worn pin to equalize wear of pin end face or replace pin.

(2) Structural Problem

a) Pin Spalling



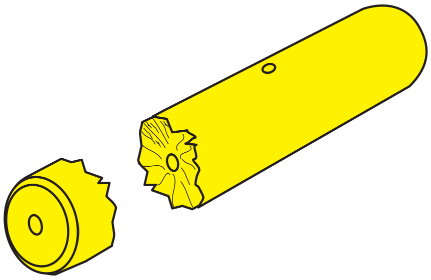
CAUSES: Flexing pin causes cracks to begin in oil reservoir hole and spreads out to surface at a slow fatigue rate.

ACCELERATORS: Same as "Pin Galling."

EFFECTS: Chip or flake of material may become loose from pin surface. Pin should not be reused for wet or dry turn.

REMEDIES: Same as "Pin Galling."

b) **Pin Breakage**



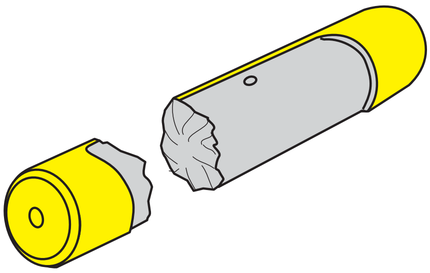
CAUSES: Crack starts on outer surface and spreads through entire pin at a fast rate (not nearly as common as with Sealed Track Pins).

ACCELERATORS: Impact loads combined with other loads caused by tight track, severe packing, too wide shoes and effects of worn rear rollers.

EFFECT: Track separation with little or no warning.

REMEDIES: Eliminate or reduce controllable accelerator variables, particularly too-wide shoes and entry of non-extrudable packing materials (rocks, etc.) into the sprocket bushing contact area.
The following problem is externally visible and while the cause is the same as with Sealed Track the effect is different and should be noted.

c) **Pin Breakage (Impact Load)**



CAUSES: High static or impact loads which cause crack to start at outer surface (usually at pin wear step) and moves through entire pin at a fast rate.
Pin cracking and breaking is less severe with Sealed and Lubricated Track during absence of internal wear. However, it may be more serious once lubricant is lost and internal wear is present due to faster rate of internal wear and loss of pin strength due to reservoir hole.

ACCELERATORS: Horsepower, weight and speed of machine. Impact and terrain conditions. Amount of internal wear that reduces pin diameter. Tight track, too-wide shoe, worn rear rollers and severe packing loads caused by rocks between bushing and sprocket are main controllable variables.

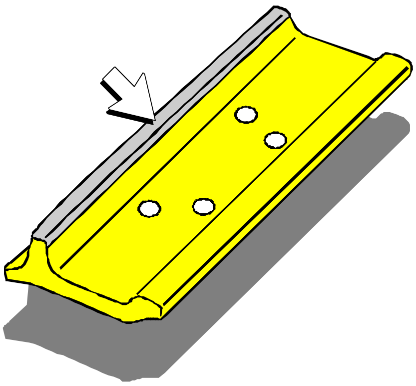
EFFECT: Immediate track separation. Severe damage to other components.

REMEDIES: Eliminate or reduce controllable accelerator variables, particularly rocks which are getting into spaces between sprocket and bushings.

4) Shoe

(1) Wear Pattern

a) **Shoe Grouser Wear**



CAUSE: Wear is caused by friction between grouser and earth which occurs when grouser cuts into earth and kicks earth to produce tractive force.

This is normal wear.
Abnormal progress of wear may be caused by erroneous selection of shoe or by unsuitability for operation of machine.

(Frequent shoe slips due to excessive load or frequent sharp turning of machine will accelerate wear.)

EFFECT:
Lacking of tractive force will lead to power losses.
Reduction of shoe strength may cause (bent cracked link).

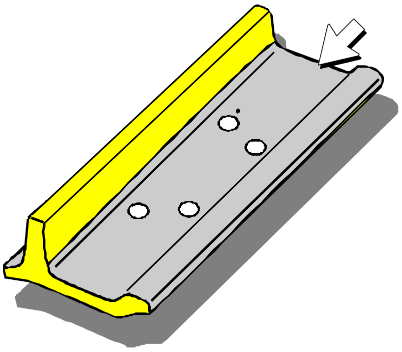
REMEDY:

When grouser height is near to its repair limit, recommend repair by lug-welding otherwise replacement of shoe with new one.

Adoption of lug-welding or shoe replacement should be determined by also taking other faulty conditions after-mentioned into consideration.

Recommend to the customer to select the proper kind of shoe depending on the soil of the individual job site.

b) Shoe Plate Wear



CAUSE: Wear is caused by friction between shoe plate and earth or rock. This normal wear.

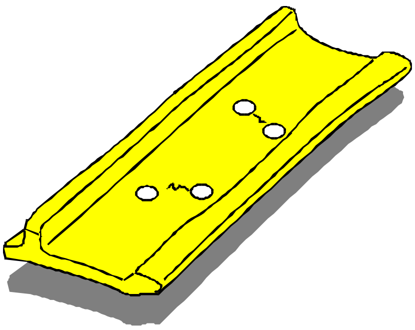
EFFECT: When wear progresses excessively. Reduction of shoe strength will cause bent shoe. Track link may be cracked.

REMEDY:

Recommend to the customer to select the proper kind of shoe depending on the soil of the individual job site.

(2) Structural Problem

a) Shoe Bending



CAUSE: Bend of shoe may be caused by erroneous shoe selection, worn grouser and plate, or running on large stones.

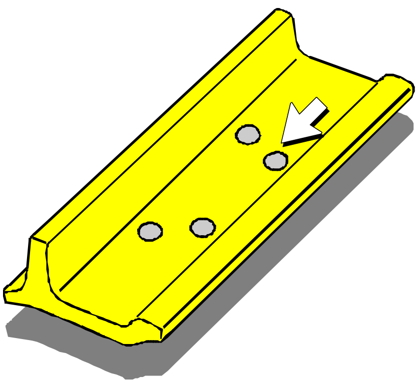
Standard shoe may be bent when operated on job sites of hard ground or of stony ground.

Wide shoe are liable to bend, because wide shoes tends to be affected by bending stress. This tendency will be specially appeared when swamp shoe is used on stony ground.

EFFECT: When wear progresses excessively: Repair of shoe will become difficult. Reduction of shoe strength will cause bent shoe.

REMEDY: Recommend customer to select the proper kind of shoe depending on the soil of the individual job site.

b) Bolt Holes Wallowed Out



CAUSE: Insufficient strength of worn grouser and plate.

Too large width of shoe. Insufficient torquing of shoe bolts.

Loosened shoe bolts due to above-mentioned conditions will cause expansion of shoe bolt holes.

EFFECT:

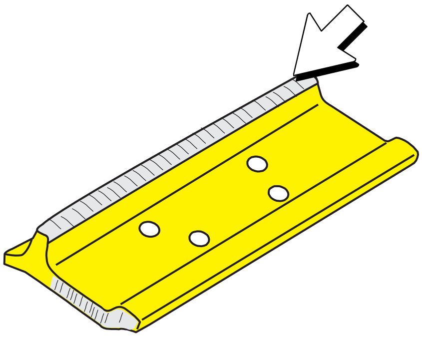
Retightening of bolts will be ineffective to keep bolts tightened long, thus requiring replacement of shoe and link.

Loosen bolts will be broken and lost during operation.

Cracked shoe may result.

REMEDY: Advise customer to inspect for loosening of shoe bolts before daily operation.

c) Hair Cracks



Many hair cracks are seen at a surface of grouser top or plate.

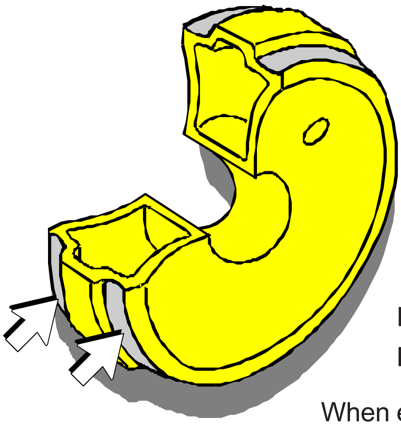
CAUSE: Earth conditions are not abrasiveness. Heat due to frequent shoe slipping.

REMEDY: Avoid shoe slipping.
Avoid overloading to a bucket that causes a machine body to drag. (Excavators only)

5) Idler

(1) Wear Pattern

a) Wear on Thread



CAUSE: Tread of idler, which contacts with link tread while it is rotating on its shaft, is subject to wear caused by metal-to-metal contact and by impact load which will occurs when track runs on a rock and be transmitted to idler through link. Wear of idler tread will progress uniformly under normal condition. Excessive progress of wear may arise when very abrasive hard rock grits or quartz sand intrude between the contacting surfaces.

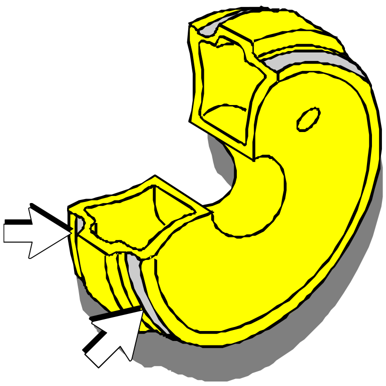
EFFECT: No parts will be affected by wear of front idler tread.

REMEDY:

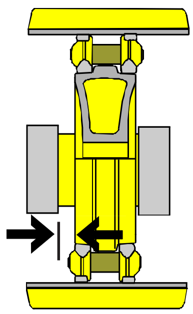
Effect of track tension to wear of rollers

When excessively quick progress of wear is claimed by customer, examination must be made for improper track tension in addition to effect of soil, work conditions and machine operating conditions.
When track tension is too tight, increased resistance between link tread and roller tread will accelerate progress of wear. This will specially affect the front idler and carrier rollers. Adjust track tension rather slack (approx. 5 mm larger in deflection than standard deflection) on clay or muddy ground to prevent deposit of earth on the sprocket tooth root, while adjusting track tension rather tight (approx. 5 mm small in deflection than standard deflection) on rocky ground to prevent biting of rocks.

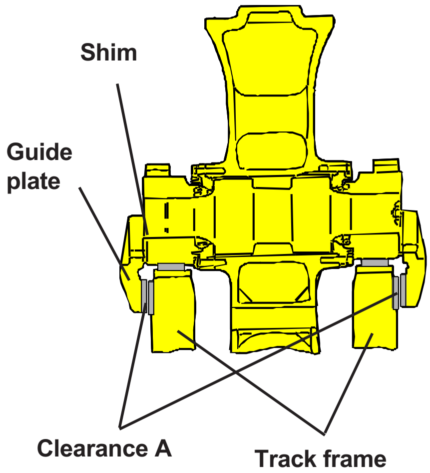
b) Uneven Flange Side Wear



CAUSE: Rollers are assembled on track frame so that their alignment of sprocket wheel center is maintained within tolerance.
As long as rollers are under this normal alignment, they will not cause interference with track links.



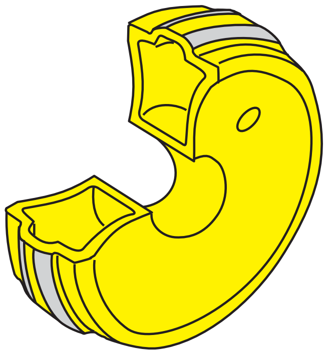
EFFECT:
Wear of link tread side face will occur to shorten link life.
Repair of roller will become difficult.
Oil floating seals will be subjected to excessive thrust load, thus causing leakage of oil.



REMEDY: When tread O.D. and depth (at the severely worn part) are close to repair limit, recommend repair by build-up welding. When wear reaches service limit (beyond repair limit), recommend replacement of rollers.

c) Flange Top Wear

(May be domed)



CAUSES: (1) Sliding contact with any abrasive material packed into idler assembly area. (2) Impact contact and motion with track links which have jumped out of tread area.

ACCELERATORS: Speed, packing, adhesion and abrasiveness of packed material. Tool loose or too snaky track increased chances of track link damage.

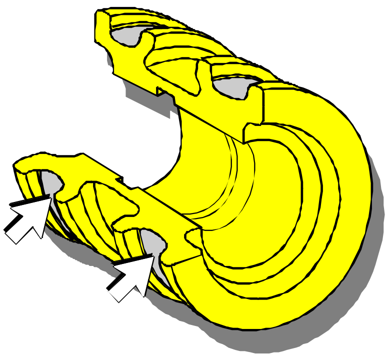
EFFECTS: Reduces wear measurement distance and resulting accuracy. Reduces rebuildability in extreme cases.

REMEDIES: Rebuild if critical. Clean packed material away from area behind the idler. Correct cause of links jumping out of tread and running on center flange if this wear is present in absence of packing.

6) Track Roller

(1) Wear Pattern

a) Wear on Thread



CAUSE: Rollers are subject to wear as track rollers carry weight of tractor while they are rolling on track links and carrier rollers carry weight of track while they are rolling on track links. As center of roller tread is in coincidence with center of link tread under normal condition, wear of roller tread will progress unfirmly even when track is in slightly snaky condition.

EFFECT:

(1) With contact of roller flange to link pin boss, wear of pin boss will progress, thus making repair of link difficult.

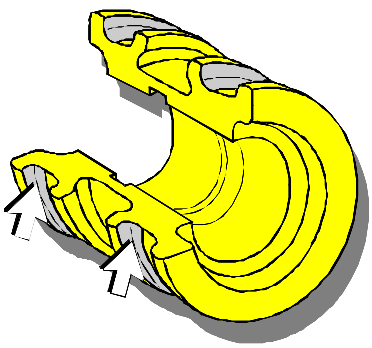
REMEDY: When tread O.D. and tread depth are close to repair limit, recommend repair of tread by build-up welding. When service limit is reached beyond repair limit, recommend replacement of worn rollers.

Necessity of repair or replacement of rollers should be judged under systematic examination of various conditions including the after mentioned problems. Also, advise customer the optimum time of repair or replacement, in connection with wear and remaining life of other parts (track links, etc.).

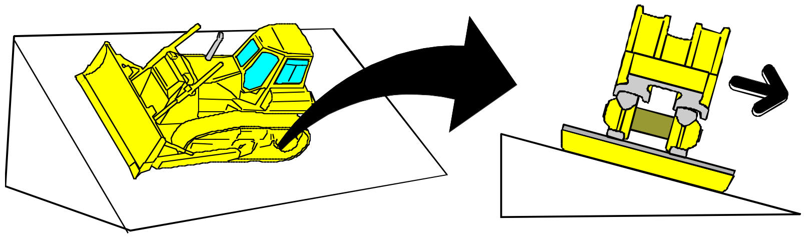
Effect of track tension to wear of rollers

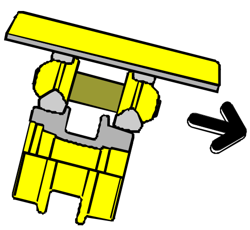
When excessively quick progress of wear is claimed by customer, examination must be made for improper track tension in addition to effect of soil, work conditions and machine operating conditions.

b) Uneven Flange Side Wear



CAUSE: The thrust load is supported by track roller flange side face and link side face. Under this condition, normal contact between the center of track roller tread and the center of link tread center is lost and, after long-time operation, stepwise wear of track roller tread will result.





On the upper half of track, normal contact between the center of carrier roller tread and the center of track link tread is lost and carrier rollers are subjected to stepwise wear.

Therefore, uneven wear of track rollers and that of carrier rollers are opposite to each other when wear is caused by traveling of machine across hill side.

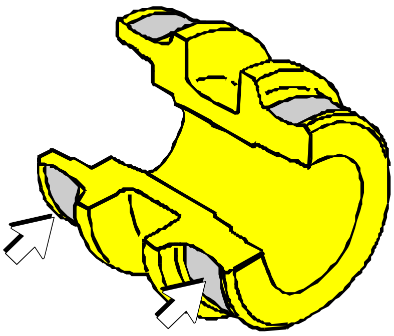
EFFECT:
Wear of link tread side face will occur to shorten link life.
Repair of roller will become difficult.
Roller floating seals will be subjected to excessive thrust load, thus causing leakage of oil.

REMEDY: When tread O.D. and depth (at the severely worn part) are close to repair limit, recommend repair by build-up welding otherwise replace roller with new one.
Necessity of repair or replacement of rollers should be judged under systematic examination of various conditions including the after mentioned problems. Also, advise customer the optimum time of repair or replacement, in connection with wear and remaining life of other parts (track links, etc.)
Stepwise wear is difficult to repair flat by automatic build-up welding and, therefore, it is necessary to repair rollers at early stage of progress of wear.
Such countermeasures include improvement of working steps to prevent the machine from being subject to uneven load and the swapping of right and left rollers to during their life cycle equalize wear of them.

7) Carrier Roller

(1) Wear Pattern

a) Wear on Thread



CAUSE: Rollers are subject to wear as track rollers carry weight of tractor while they are rolling on track links and carrier rollers carry weight of track while they are rolling on track links. As center of roller tread is in coincidence with center of link tread under normal condition, wear of roller tread will progress unfirmly even when track is in slightly snaky condition.

EFFECT:
(1) With contact of roller flange to link pin boss, wear of pin boss will progress, thus making repair of link difficult.

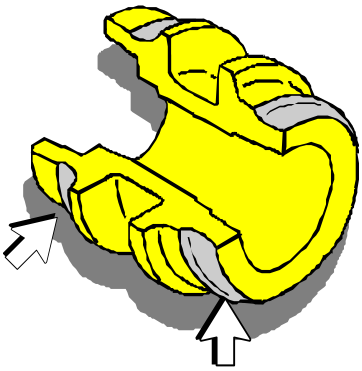
REMEDY: When tread O.D. and tread depth are close to repair limit, recommend repair of tread by build-up welding. When service limit is reached beyond repair limit, recommend replacement of worn rollers.

Necessity of repair or replacement of rollers should be judged under systematic examination of various conditions including the after mentioned problems. Also, advise customer the optimum time of repair or replacement, in connection with wear and remaining life of other parts (track links, etc.).

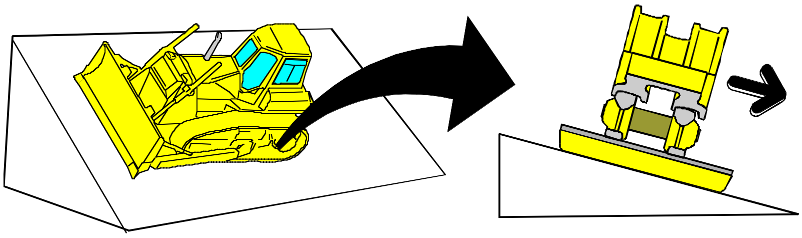
Effect of track tension to wear of rollers

When excessively quick progress of wear is claimed by customer, examination must be made for improper track tension in addition to effect of soil, work conditions and machine operating conditions.

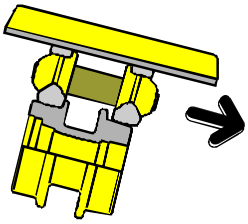
b) Uneven Flange Side Wear



CAUSE: The thrust load is supported by track roller flange side face and link side face. Under this condition, normal contact between the center of track roller tread and the center of link tread center is lost and, after long-time operation, stepwise wear of track roller tread will result.



On the upper half of track, normal contact between the center of carrier roller tread and the center of track link tread is lost and carrier rollers are subjected to stepwise wear.



Therefore, uneven wear of track rollers and that of carrier rollers are opposite to each other when wear is caused by traveling of machine across hill side.

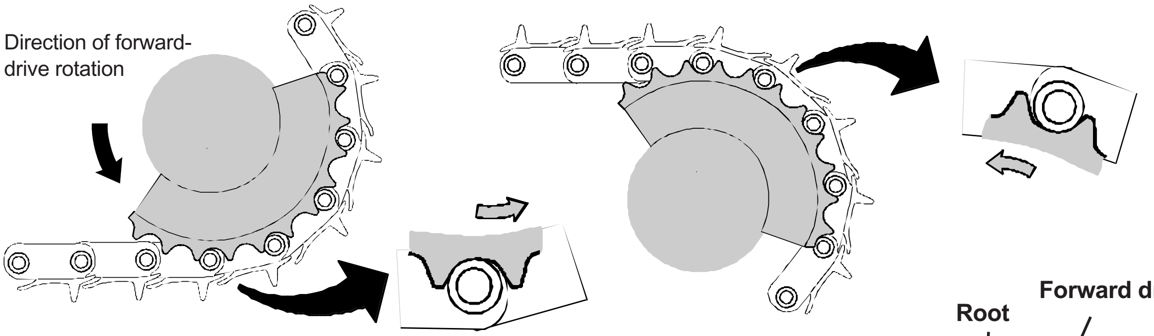
EFFECT:
Wear of link tread side face will occur to shorten link life.
Repair of roller will become difficult.
Roller floating seals will be subjected to excessive thrust load, thus causing leakage of oil.

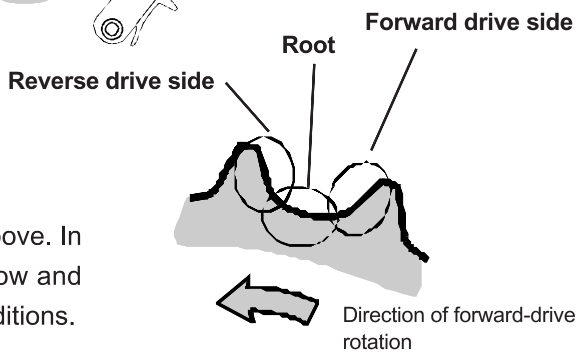
REMEDY: When tread O.D. and depth (at the severely worn part) are close to repair limit, recommend repair by build-up welding otherwise replace roller with new one.
Necessity of repair or replacement of rollers should be judged under systematic examination of various conditions including the after mentioned problems. Also, advise customer the optimum time of repair or replacement, in connection with wear and remaining life of other parts (track links, etc.)
Stepwise wear is difficult to repair flat by automatic build-up welding and, therefore, it is necessary to repair rollers at early stage of progress of wear. Such countermeasures include improvement of working steps to prevent the machine from being subject to uneven load and the swapping of right and left rollers to during their life cycle equalize wear of them.

8) Sprocket Teeth

Progress of wear of sprocket

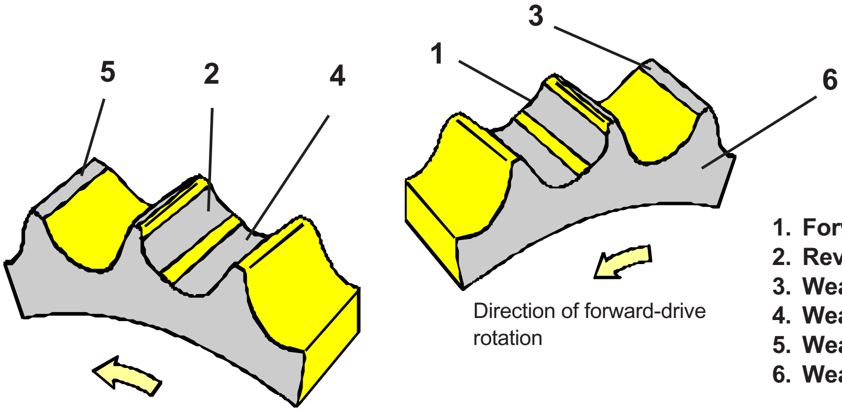
The figure below defines several terms to prevent confusion in the following description.





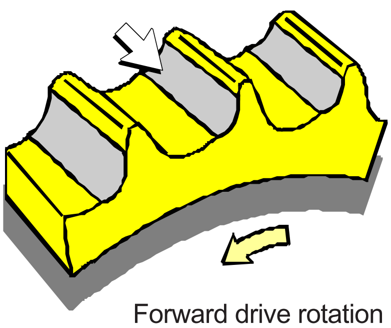
(1) Wear Pattern

Typical wear of sprocket teeth is classified as shown above. In actuality, wear will be more complex as described below and subject to various operating conditions and ground conditions.



1. **Forward drive side wear**
2. **Reverse drive side wear**
3. **Wear of forward drive side tooth top**
4. **Wear of root**
5. **Wear of reverse drive side tooth top**
6. **Wear of side face**

a) Forward Drive Side Wear



Forward drive rotation

CAUSE:

The wear is caused by contact to bushings during forward-drive rotation of sprocket.

Wear will be accelerated with the elongation of link pitch.

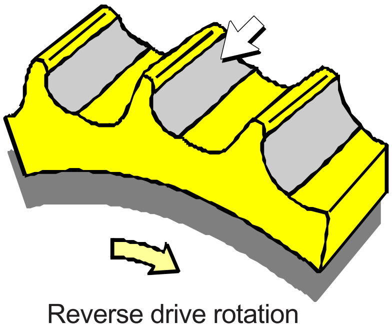
EFFECT: Wear of bushing O.D. will be accelerated.

REMEDY:

Replace sprocket rim or segment teeth.

Right and left sprockets may be alternated if their reverse drive side wear is small.

b) Reverse Drive Side Wear

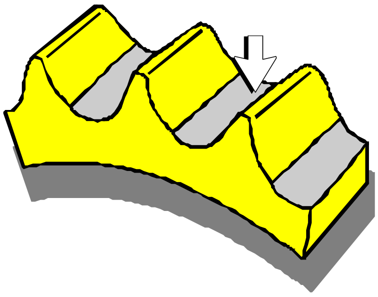


CAUSE:
The wear is caused by contact to bushings during reverse-drive rotation of sprocket.
Wear will be accelerated with elongation of link pitch and by high-speed reverse drive or loaded reverse drive.

EFFECT: Wear of bushing O.D. will be accelerated.

REMEDY:
Replace sprocket rim or segment teeth.
Right and left sprockets may be alternated if their forward-drive side wear is small.

c) Root Wear

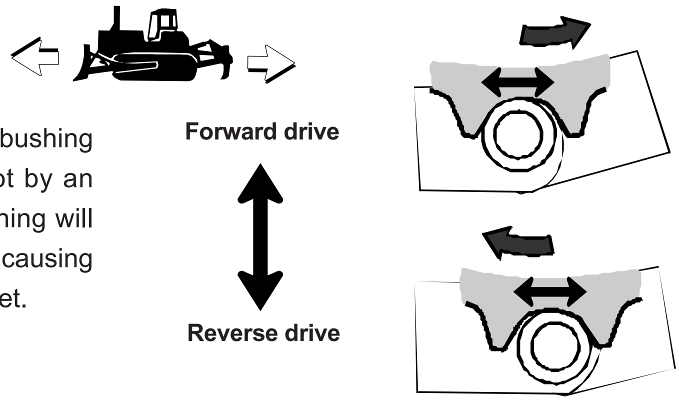


CAUSE:
The wear is caused by sliding of bushing on root of sprocket teeth to follow through backlash when a forward-reverse shift of drive rotation is made.

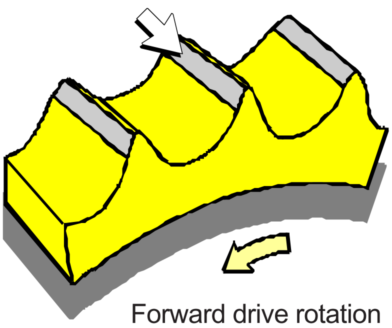
EFFECT:
As pitch of sprocket wheel is decreased, wear of bushings will be accelerated.

REMEDY: Replace sprocket rim or segment teeth.

Note: In the forward-reverse gearshifting, a bushing will slip along the sprocket tooth root by an amount equal to backlash or the bushing will make a sidewise slippage on the root, causing wear between the bushing and sprocket.



d) Tip Wear of Forward Drive Side

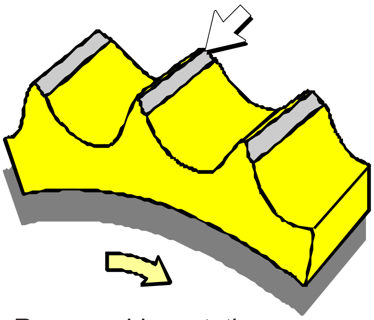


CAUSE: Wear is caused by elongation of link pitch.

EFFECT:
Pitting
This wear may occur in machine with new sprocket teeth, pins and bushings. In this case, however, progress of wear will stop after new parts have worn to match with others during the break-in running period.

REMEDY:
Turn pins and bushings.
Replace sprocket rim or segment teeth.
Right and left sprockets may be alternated if forward-drive side wear of them is small.

e) Tip Wear of Reverse Drive Side



Reverse drive rotation

CAUSE:

Wear is caused by elongation of link pitch.

The wear is caused by forward drive rotation of sprocket wheel while soil is deposited on sprocket root or around bushings. Deposit of soil raises bushings near the reverse drive side tooth top of sprocket teeth, thus causing wear of tooth top.

The same wear will also be caused by loosened track link tension because mud may be deposited in sprocket root.

EFFECT:

Pitting

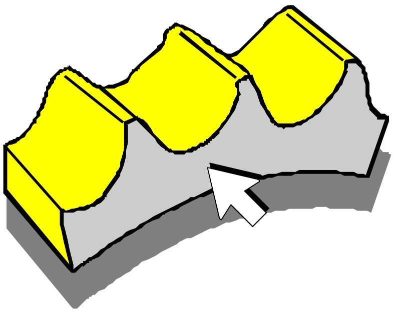
This wear may occur in machine with new sprocket teeth, pins and bushings. In this case, however, progress of wear will stop after new parts have worn to match with others during the break-in running period.

REMEDY:

Remove mud after daily operation.

When this wear is caused by elongation of link pitch, replace pins and bushings. Adjust track tension in the good condition.

f) Wear of Side Face



CAUSE:

This wear is caused by contact with link side face under the following conditions:

Travel of machine across hillside.

EFFECT: Repair of link will become difficult.

REMEDY:

Maintain correct alignment of track.

Keep roller guard in properly maintained condition.

Keep proper track tension

3. Variables that Affect Undercarriage Parts

To extend the life of undercarriage system, not only select suitable track and track shoe, but to operate the machine with more care. The variables that determine the life can be formed into three groups.

- **Controllable variables** include track tension adjustment, shoe width and alignment.
- **Partially controllable variables** is a condition may be influenced by uncontrollable variables but it is compensable by the operator.
- **Uncontrollable variables** include ground condition and life determining factors given by the job.

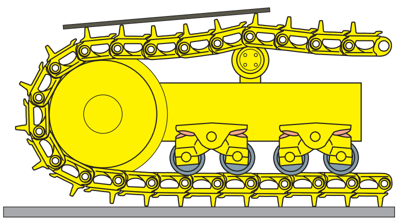
3-1. Controllable Variables

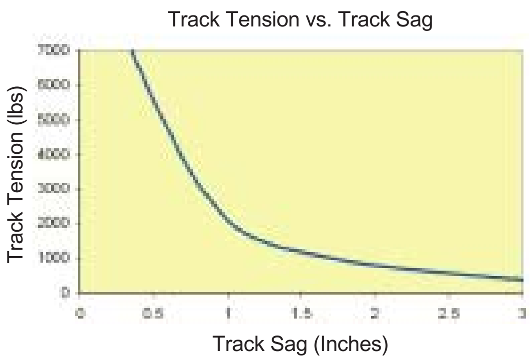
So far we have explored causes of wear, factors that accelerate wear and the ways that wear affects machine performance. To reduce wear and prolong undercarriage life, there are three ways to minimize wear: maintenance, machine outfitting, alignment and method of operation.
These are three major controllable variable group and variables in it.

- Maintenance: Track adjustment
- Machine outfit (Specification): Shoe width, Track guards
- Alignment: Roller frame, Idler mounting

1) Track Adjustment

It is extremely important to maintain proper track tension at all times of operation. Chain tightness is measured by the amount of track sag. Track sag has an inverse relationship with track tension, which means that a large track sag indicates that the track is loose and a small track sag indicates that the track is tight.



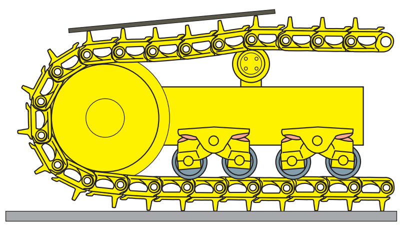


Notice from the graph that if you decrease track sag just a little bit (e.g. from 1.0" to 0.5") it increases tension tremendously (about 3000 lbs). This illustrates the sensitivity of track tension and the importance of keeping it properly adjusted.

Track tension is maintained by a track adjuster that is situated behind the front idler. Adjustments are made by pumping or draining grease through a fitting on the track adjuster.

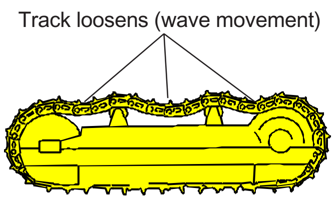
Effects of a Tight Track

- Increased wear on all undercarriage components
- Increased friction causes mechanical loss and reduced drawbar pull
- Hotter temperatures



Effects of a Loose Track

- Track chain side to side
- Upper waviness and whipping
- Popping
- Excessive noise and shaking

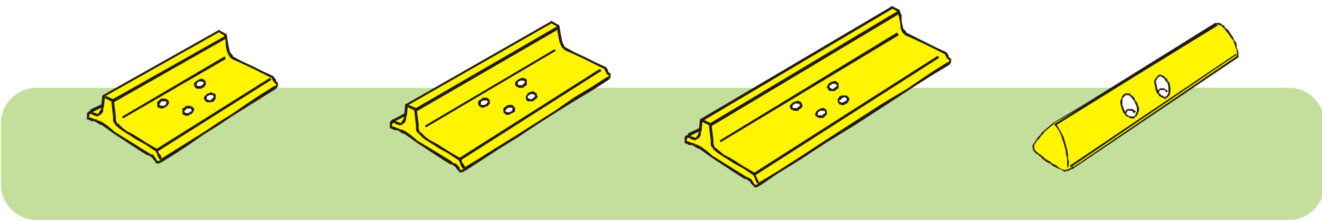


2) Shoe

(1) Shoe Width/Shoe Type

Service life of the undercarriage depends on the selection of the right shoe. There are many different types of shoes. The following chart shows the shoes that Komatsu crawlers are equipped with. Notice that each shoe has advantages, disadvantages and is designed for specific applications.

Narrow shoe Standard shoe Wider shoe Swampy shoe



[Basic factor of shoe which affects performance and life]

	A \ B	Basic factor of Shoe: Shoe Wdth	Shoe Section Thickness	Shoe Hardness	Numbers of Grousers	Height of Grousers
Factors Affecting Machine Production	Floatation	↑	●	●	●	●
	Penatration	●	↘	●	↘	↑
	Maneuving Abillity	↓	●	●	↗	↓
	Robustness		●	●	↘	●
Undercarriage System wear and structual Life Factors	Shoe Wear Life	●	↑	↑		↑
	Shoe Structural Life	↓	↑	↑	↑	↑
	Link–Roller–Idler Wear Life	↓	↘	●	↗	↘
	Pin and Bushing Wear Life		↘	●	●	↘
	Pin and Bushing Structureal Life		↘	●	●	↘

Note:
- ↑ A factor A goes to well when factor B increase
- ↗ A factor A rather increase when factor B increase
- ● No affection to the factor A even factor B increase
- ↘ A factor A rather decrease when factor B increase
- ↓ A factor A goes to bad when factor B increase

1. First find machine productivity factor most important to the user.
2. Find what effect the various shoes selection variables may have.
3. Next, look straight across to find what degree of wear and structural life effects may be expected.
4. Repeat these steps until all productivity and life factors have been considered.

(2) Factors Affecting Machine Production

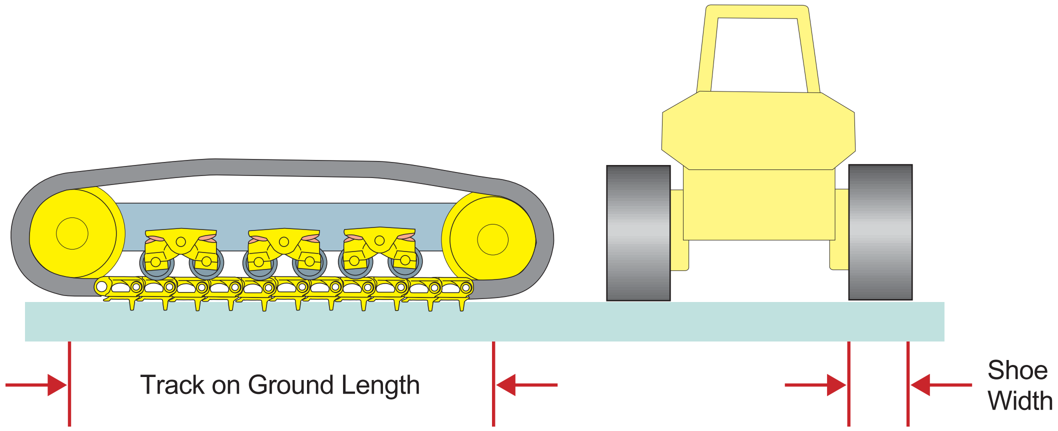
a) Flotation

Ground material is the biggest factor. It is very easy to stay afloat when you are working in hard material, like rock. But it is very difficult to keep the machine from sinking when you are working in a swamp.

Machine weight is also an important factor because the heavier the machine is, the harder it is to keep it afloat.

Shoe width determines the contact area between the tracks and ground. Wider shoes provide more contact area and allow the weight of the machine to be distributed over a larger area, thereby increasing flotation. This concept is called ground pressure.

Ground pressure combines the effects of machine weight with shoe width. It is determined by the following formulas:

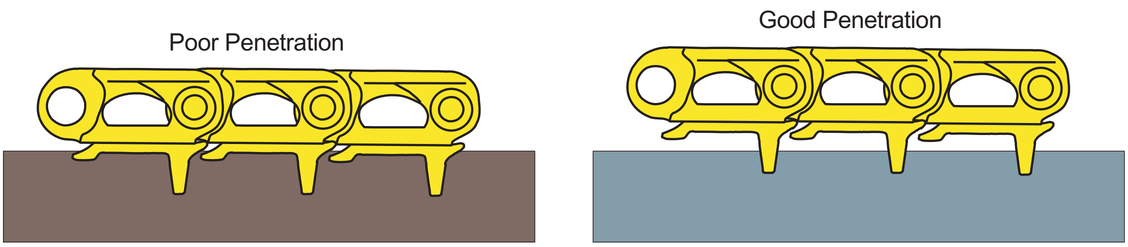


Contact Area = 2 x (Track on Ground Length x Shoe Width)
Ground Pressure = Machine Weight / Contact Area

As a rule of thumb, shoe width must be wide enough to keep the machine afloat, but not wider.

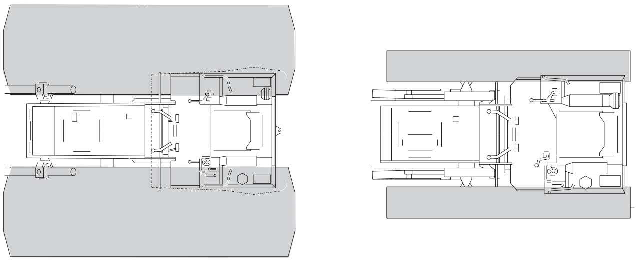
b) Penetration

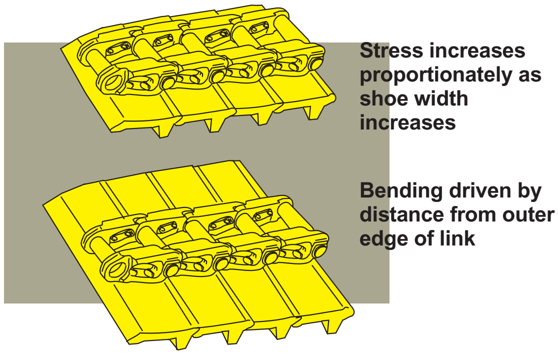
Penetration is the portion of the grouser that digs into the ground during operation. Good penetration means that the whole grouser gets embedded into the ground. Poor penetration means that very little of the grouser gets embedded into the ground. Penetration is directly related to traction, which means that more penetration equals more traction. Traction is the machine's ability to grip the ground and propel itself in a forward or reverse direction. It is important to understand that traction is a function of ground material, machine weight and shoe type, but it is NOT related to shoe width. Therefore, outfitting a machine with wider shoes will not necessarily increase traction.



c) **Maneuvering Ability**

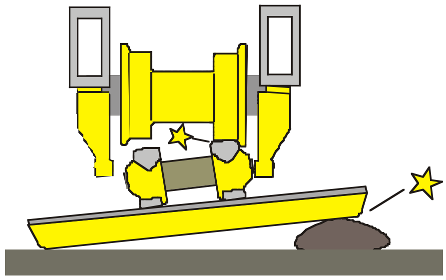
Maneuvering ability is a function of ground material, machine weight, shoe type and shoe width. Wider shoes make it more difficult to maneuver the machine because they stick out further and offer more turning resistance.





d) **Robustness**

Robustness is the ability to withstand wear and impact. Shoes are subjected to a bending moment that increases proportionally with shoe width. A track shoe is like a lever; the longer the lever, the easier it is to break. For this reason, wider shoes are more susceptible to wear and impact. They also increase the effects of impact to all other undercarriage components. Some common problems related to wide shoes are:



- Increased wear on link sides, rollers and flanges
- External/internal bushing wear
- Pin loosening
- Premature seal failure
- Wide shoes also contribute to packing conditions because they can scoop deeper and provide more room for material accumulation.

(3) Undercarriage System Wear & Structural Life Factor

a) Shoe Wear Life

Wider shoes do not improve wear life. The extra wear material provided by wider grousers gives a little extra life. The largest variable affecting shoe wear life is slippage.

b) Shoe Structural Life

Bending stress on the shoe increases proportionately to the distance from the outer edge of the link to the end of the shoe. Cracking, bending and hardware loosening increases as shoe width increases.
Basic Rule of Thumb: Always specify the narrowest shoe possible that will provide adequate flotation and traction without excessive track slippage. See chart on following page.

c) Link Roller Idler Wear Life

Wear rates increase on link rail sides, rollers and idler flanges as shoe width increases because of increased load interference. Increased shoe width can also aggravate link cracking.

d) Pin and Bushing Wear Life

External bushing wear rate on Sealed and Sealed and Lubricated Track and internal wear rate on Sealed Track increases as shoe width increases in a given underfoot condition. This is due to the increased loads, weight and twisting.

e) **Pin and Bushing Structural Life**

Too wide shoes in high impact or steep terrain can cause pins and bushings to loosen in the link bores. This becomes more evident with high single grouser shoes. Loss of pin and bushing retention prevents successful turn and replacement maintenance.

(4) Sealed and Lubricated Track Joint Life

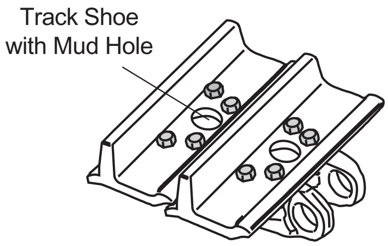
The most costly effect of too wide shoes in high impact conditions and/or steep terrain is the loss of lubricant and seal life resulting in premature dry joints. The wider the shoe, plus the higher the impact, the greater the chance of a pressed track joint “opening up,” allowing loss of lubricant. The loss of lubricant occurs when the bushing slides back and forth along the pin. The clearance between the links created by this “opening up” is called end play. End play is permanent and can only be eliminated by pressing the components tight as at initial assembly or when track press work is performed. For maximum lubricant and seal life the machine should be equipped with the narrowest possible shoes which will provide adequate flotation.

In addition, shoes may have grouser corners cut off to reduce turning resistance and bonding forces without loss of flotation and with little loss of overall wear life.

(5) Shoes for Special Conditions

Some shoes have a mud relief hole, which is drilled in the center of the shoe plate. Its purpose is to prevent packing accumulation by helping the material escape. Every time the sprocket pushes on a bushing it squeezes the material out.

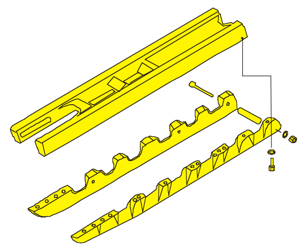
Prior to implementing a mud relief hole it is important to check that the ground material is extrudable. Extrudable materials include clay, soil, snow and ice. Non-extrudable materials include rocks, gravel, branches and brush.



3) Track Guards

The decision to install or not to install roller guards is considerable. Although roller guards provide many benefits there are times when they are best left off the machine.

Roller guards serve two purposes. First, they prevent rocks from impacting and clogging track rollers. Second, they provide additional guidance for the track chain. The problem with roller guards is that they often keep material in instead of keeping it out. This adverse effect often outweighs the benefits. For this reason, roller guards should not be used in high packing conditions.



4) Alignment

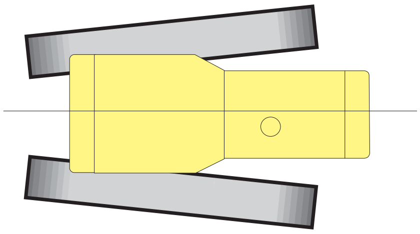
In general, a good way to identify an alignment problem is to look for unbalanced wear patterns. This involves comparing left components with right components, front with rear and inner with outer. The four main kinds of track frame misalignment are toe-in/toe-out, bow, tilt and twist

(1) Track Frame

- Toe-In/Toe-Out
- Track Bow
- Tilt
- Twist

a) Toe-In/Toe-Out

When viewed from the top, either or both of the roller frames is not parallel to the center line of the tractor.



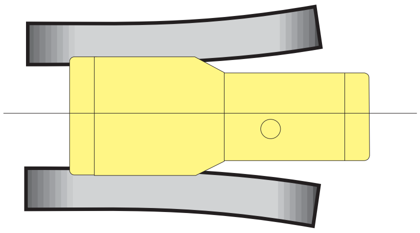
CAUSE: temporarily (during load only) or permanently bent diagonal brace or roller frame

EFFECT: unbalanced wear when comparing inboard versus outboard roller and idler flanges and rail sides — rollers worsen from rear to front

REMEDY: straighten diagonal braces and repair mounting bearings

b) Track Bow

Similar to toe-in and toe-out, but roller frame is bent and curves in or out with respect to tractor.



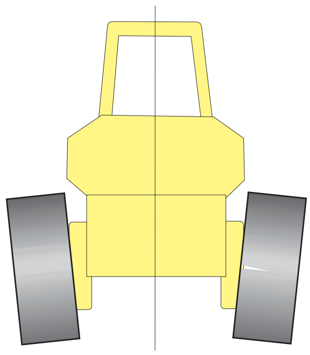
CAUSE: bent roller frame

EFFECT: similar to toe-in and toe-out except rear rollers are not affected

REMEDY: straighten roller frame

c) Tilt

When viewed from front or rear the roller frame tilts toward or away from tractor.



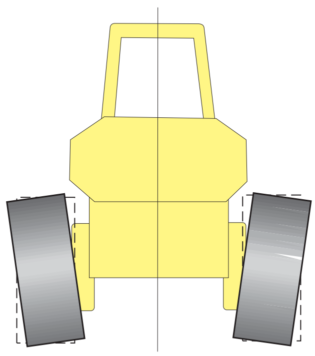
CAUSE: permanently bent diagonal brace, broken mountings or bearings

EFFECT: unbalanced wear when comparing inboard versus outboard roller, idler, link treads and flanges — unbalance from front to rear on rollers

REMEDY: straighten diagonal brace and/or repair mountings

d) Twist

When viewed from the front, the roller frame is twisted, with the front end of the roller frame tilted out.



CAUSE: roller frame twisted around a horizontal axis parallel to the tractor

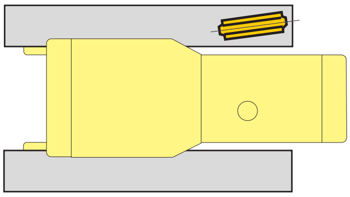
EFFECT: similar to effect of tilt except that rear rollers should not be affected

REMEDY: straighten roller frame

(2) Front Idler

The main kinds of idler misalignment are toe-in/toe-out, shift and twist/tilt

a) Toe-In/Toe-Out

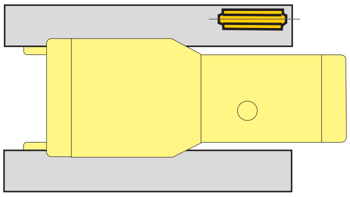


CAUSE: ① Bent idler supports
② Bent idler mounting yoke

EFFECT: Increased wear on link sides, idler flanges and front roller flanges.

REMEDY: Straighten bent components

b) Front Idler Shift

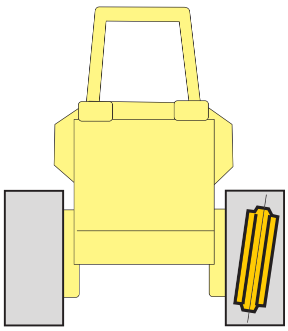


CAUSE: Improper shimming

EFFECT: Increased wear of link sides, idler flanges and roller flanges

REMEDY: Readjust idler support shims. Clearance between track frame and guide plates should be between 0.5 mm and 1.0 mm.

c) Front Idler Twist/Tilt



CAUSE: ① Bent idler supports
② Bent idler mounting yoke
③ Unevenly worn idler wear plates.

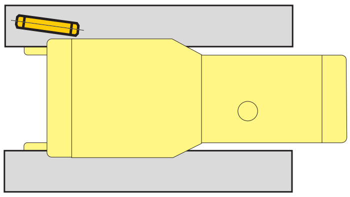
EFFECT: Increased wear on link sides, idler flanges and front roller flanges

REMEDY: Straighten or replace damaged components

(3) Sprocket

The main kinds of sprocket misalignment are toe-in/toe-out, shift and twist

a) Toe-In/Toe-Out

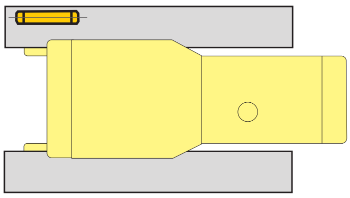


CAUSE: Bent sprocket shaft

EFFECT: Increased wear of link sides and sprocket tooth side wear.

REMEDY: Replace shaft

b) Sprocket Shift



CAUSE: Sprocket mounted incorrectly

EFFECT: Increased sprocket side face wear and link side wear.

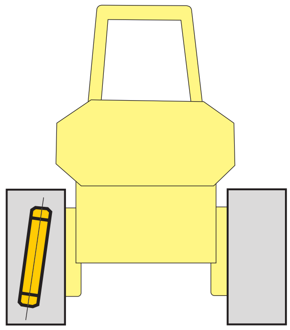
REMEDY: Reposition sprocket mounting

c) **Sprocket Twist**

CAUSE: Bent sprocket shaft

EFFECT: Uneven sprocket wear, rail wear and track roller flanges

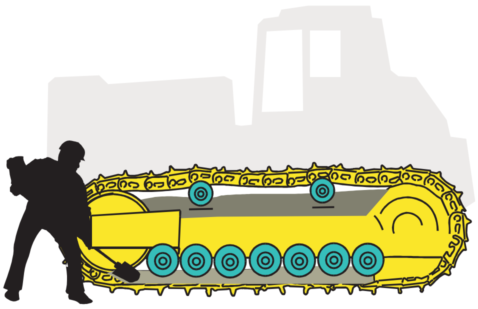
REMEDY: Replace shaft



5) Others

(1) Cleaning

Packing material that accumulates on undercarriage components can become as hard as the components themselves. Regular cleaning can greatly reduce the effects of packing. Use a shovel to clear out the area between the track frame and the upper portion of the chain. Then use water to wash away any remaining material.



(2) Routine Inspection

When it comes to undercarriage life, early detection of wear, misalignment and damage is the key to preventing a serious and costly condition. There are several items that should be checked regularly.

① Keep track of undercarriage wear. Pay special attention to bushing wear and premature link pitch elongation. Also, keep an eye out for any differences between component wear patterns (i.e. left vs. right and front vs. rear). This can often reveal other hidden problems, like misalignment or poor operator habits.

② Watch out for component damage, such as cracks, bends, and breaks. These can lead to interference and malfunction. Most importantly, check rollers for oil leakage. Leakage means that oil is being lost. If this condition is ignored the component will seize and cause quick, excessive wear and damage.

③ Misalignment causes unnecessary wear to all undercarriage components. The most common type of misalignment is idler shift, which can usually be fixed by adjusting idler shims.

④ Loose nuts and bolts cause interference with moving parts, abnormal wear, bolt hole wallowing, bolt breakage, accelerated misalignment and component loss. It is very important to apply proper torque to all bolts. If bolts are not tightened enough then vibration will slowly loosen them until they are free. On the other hand, if bolts are over-tightened their structural integrity will be weakened and they will fail prematurely.

(3) Keeping Good Records

It is important to keep good records of all service-related activity, such as wear measurement, repair and costs of repair. This information can be used to evaluate current wear and reduce future wear through scheduled servicing. An excellent way to accomplish this task is to use CARE software, provided through Komatsu.

3-2. Partially Controllable Variables

METHOD OF OPERATION

Method of operation is another factor that can greatly influence wear. There are several rules that should be observed to minimize wear:

1) Use Slowest Operating Speed

Use slowest operating speed that will get the job done in time. Wear rate is proportional to speed. Therefore, the faster you go, the more wear you will induce. When working in high impact conditions this rule is even more critical and the lowest gears should always be used.

2) Minimize Reverse Travel

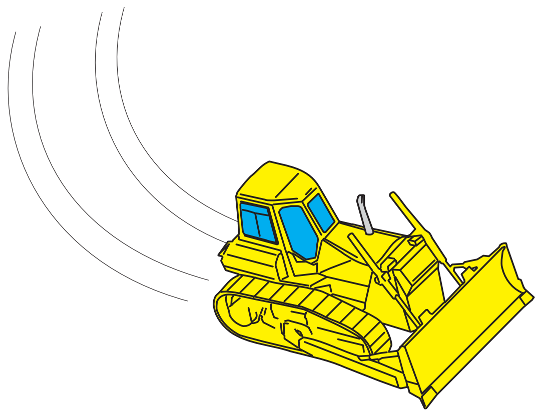
Minimize reverse travel because it causes much more wear to bushings and sprockets than forward travel. This concept is thoroughly explained in Chapter 4 - Basic Wear. Completely avoid reverse travel in high gear or when climbing uphill.

3) Avoid Spinning the Tracks

It is ineffective and subjects the undercarriage to unnecessary wear. It affects grousers the most because they undergo a grinding action.

4) Avoid Favoring One Side

Avoid favoring one side because it causes uneven undercarriage wear. Operators should use symmetrical operating patterns to produce balanced wear. If this is impossible or highly unproductive then left and right rollers should be swapped periodically. Here are some examples of preferred-side operations:

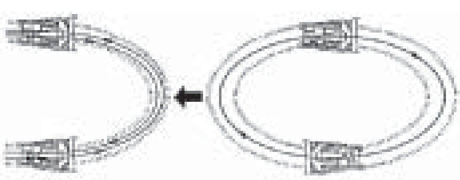


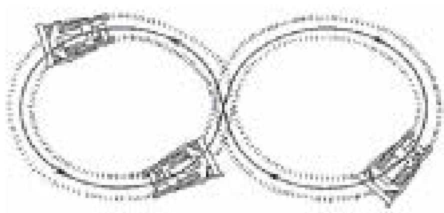
5) Frequent Turning in the Same Direction

Frequent turning in the same direction produces uneven wear on roller flanges and link side faces. Sometimes such maneuvering is made necessary by worksite geometry and job application.
But usually it is caused by poor operator habits

6) Alternatives

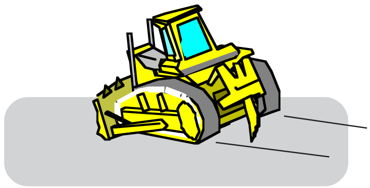
Operators should maneuver the machine so that the operating pattern has an even number of left and right turns. For example, instead of doing an oval pattern, which requires one-sided turning, operators can do a semi-oval pattern, which involves symmetrical turning. Another alternative is to do a figure 8 pattern, however this is not recommended because it is inefficient and redundant.

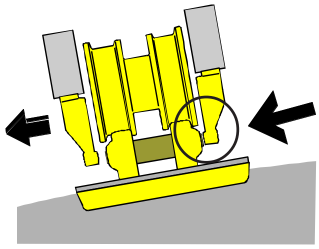




7) Traveling Across a Lateral Slope

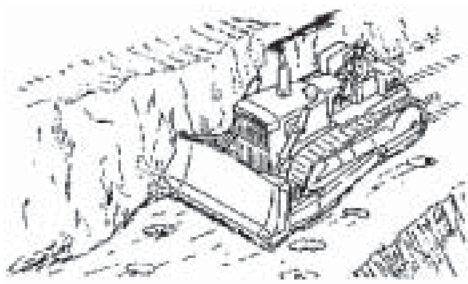
Traveling across a lateral slope produces heavy side-loading on the downhill track. It is best to avoid this kind of operation altogether, but if the job requires it then the operator should change sides for each pass to balance wear on both tracks.





8) Side-Hill Cutting

Side-hill cutting produces uneven wear because it involves loading one track at a time. Where possible, the operator should change sides for each pass.



9) Others

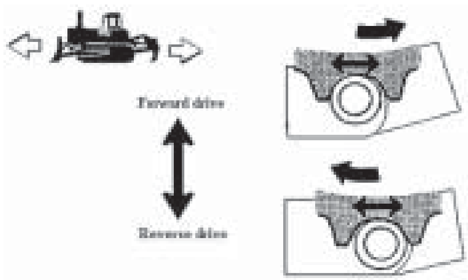
Avoid impact because it produces shock loads that are transmitted to undercarriage components. This causes cracking, bending, breaking and misaligning. If the job involves high impact conditions then operate using lowest gears.

Minimize counter-rotation. It produces heavy side-loading because one track travels forward while the other travels in reverse. However, counter-rotation can be used effectively to minimize preferred-side operations.

Avoid sharp turning, especially when traveling in high gears because it produces a lot of side loading. It is better to make wide, large radius turns.

Park machine properly on a flat, dry surface. Parking a machine on a slope may cause roller seals to become permanently deformed, especially in extremely hot or cold temperatures.

Minimize forward-reverse direction changes because it causes root and radial wear.



3-3. Uncontrollable Variables

There are three groups of factors that affect undercarriage wear. These are earth conditions, terrain and job application.

- Soil and underfoot condition (Earth conditions)
- Terrain condition
- Job application

1) Soil & Underfoot Condition

Earth conditions are abrasiveness, impact, packing, moisture, temperature and chemicals. These conditions cannot be changed, but their adverse effects can be partially controlled by good maintenance

(1) Abrasiveness

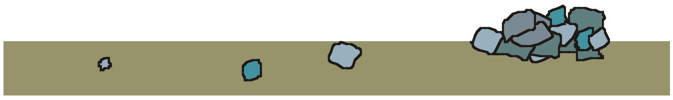
Abrasiveness is a property that describes hardness and sharpness of rock particles in the ground. This property can greatly increase the rate of wear between moving components. Since abrasiveness is difficult to measure quantitatively, it is usually rated qualitatively as being non-abrasive, moderately abrasive or highly abrasive. This property can usually be determined by rubbing some moist material between thumb and fingers.

Non-abrasive material has a low proportion of hard and sharp particles. It feels slick and moldable when moist. *Example:* clay.

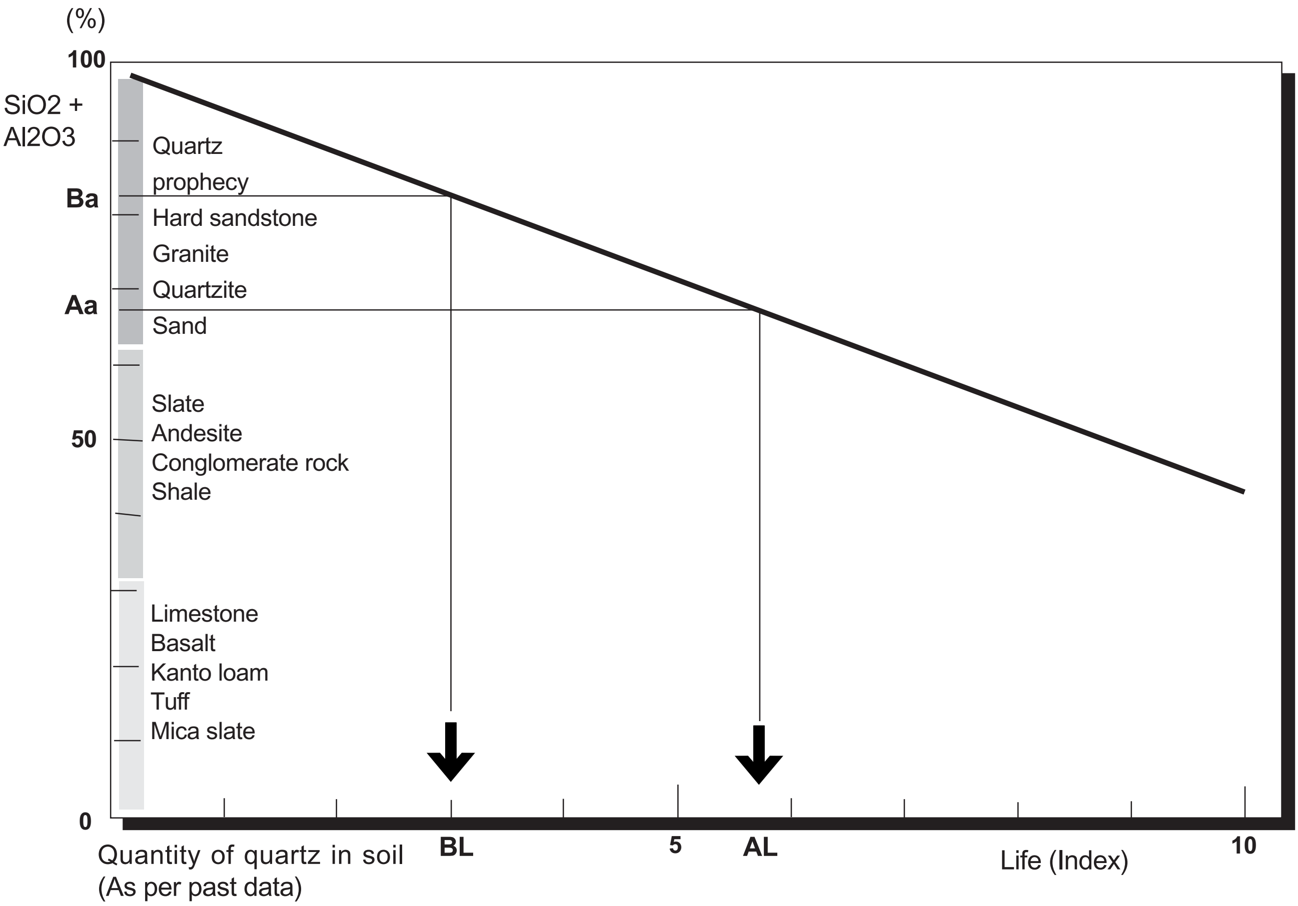
Moderately abrasive material has a moderate proportion of hard and sharp particles. It has a gritty texture when moist. *Example:* loam.

Highly abrasive material has a high proportion of hard and sharp particles. It feels very coarse when moist. *Example:* corral rock, sand.

Relationship between analysis value of soil (contents of SiO2 and Al2O3) and wear life of parts



The life of the undercarriage parts largely depends on how the machine is used and condition of the soil at the job site. All factors related to shortening the life of undercarriage component can not be explained with only the analysis value of the soil. However , we can use the analysis value , as the first step of the analysis of wear and utilize it for sales and service activities.



Remarks

1. The sample of the soil and rock must be about the size of two golf balls.
   If plural types of soil (rock) are mixed together, samples must be taken for each type .
2. The element of soil must be analyzed in mass percentage (See JIS M8214, K0121).

Example of education

A customer who mainly works in district A decided to undertake a job in district B. A Komatsu salesman heard that this customer had said "The undercarriage parts (bushings in particular) of the machines used in district B seem to be worn quickly". Then, the salesman analyzed the soils in districts A and B, and estimated the life of the undercarriage parts to be used in district B, on the basis of the life of the under carriage parts of the customer used in district A.

Estimated life in district B (h) = Estimated life in district A X BL/AL
= 4000 x 3/5.7
= 2100 (h)

Actual life in district A : 4000 h
Aa, Ba : Analysis values of soil in districts A and b
AL, BL : Lives estimated from analysis values in districts A and B (Index)

The above salesman explained the above estimated life to the customer and succeeded in selling the spare parts. Furthermore, since he notified the shortening of the wear life of the parts by the condition of each job site, the customer did not have any complaint on this matter.

(2) Impact

Impact is determined by the percentage of track shoe area that makes contact with the ground. When the ground is soft and level, grousers fully penetrate the soil and the weight of the machine is evenly distributed over the entire area of track. However, when bumpy or hard ground conditions obstruct penetration then the weight of the machine becomes unevenly distributed, producing stress concentrations.

Impact causes structural damage such as bending, breaking, cracking, chipping and spilling. For crawler dozers impact only contributes during travel, but for excavators it also contributes during stationary operation. Earth conditions are described as low, moderate or high impact.

Low impact conditions provide good ground penetration and low exposure to bumps. *Examples:* sand, soft soil.

Moderate impact conditions provide partial ground penetration and moderate exposure to bumps. *Examples:* gravel, hard soil.

High Impact conditions provide poor and uneven ground penetration and constant exposure to tall bumps. *Examples:* frozen ground, concrete, rock quarry, forestry.

(3) Packing

Packing is ground material that sticks to the moving parts of an undercarriage. It affects undercarriage components in six different ways.

a) Serves as a cohesive agent that helps abrasive particles stick to moving components (eg. sand/clay mixture). This greatly increases wear.

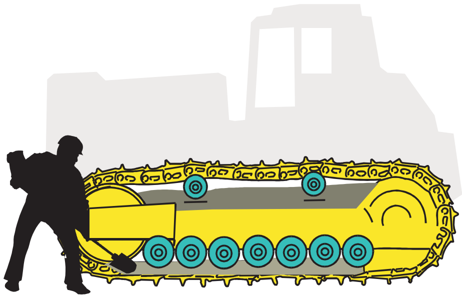
b) Material accumulates on bushings and in sprocket teeth. This produces a mismatch between sprocket pitch and link pitch, which causes increased wear rates due to improper engagement. Reverse drive side tip wear and bushing OD wear are two of the most significant types of wear resulting from this condition. Packing can become so severe that it causes “popping”, which is a loud slapping sound produced when a sprocket tooth arrives too early to grab the next bushing; instead it rides on top of the bushing and slips when the next sprocket tooth makes contact.

c) Increases track tension which causes increased wear on all undercarriage components.

d) Binds rollers, which forces track links to slide across rollers instead of rolling across them. This produces flat spots on rollers and accelerated link tread wear. In freezing conditions this problem is compounded because frozen mud is very cohesive and difficult to remove.

e) May hide a component leakage problem that could otherwise be seen and corrected.

f) Takes away from available engine power by interfering with moving components. This reduces machine performance and fuel economy.



(4) Moisture

Moisture causes considerable damage to undercarriage components. Ground material can have low, moderate or high moisture content. Moisture adversely affects wear in four ways:

a) Combines with packing material to form a cohesive compound that sticks to components. Moist material is moldable so it can easily fill gaps. After the packing material dries new material settles on top and forms a new layer. In this way packing material is able to accumulate.

b) Increases wear by making material more abrasive.

c) Allows material to travel quicker by flowing into moving parts. Moist material can also flow past seals and contaminate sealed components.

d) Causes rust and accelerates the effects of certain chemicals.

On the other hand, moisture also has these advantages:

① Washes away packing material.
② Softens material to make it more extrudable.
③ Dilutes some chemicals.

(5) Temperature

Effects of hot temperature:

① Heat treated metals become weaker and more susceptible to wear
② Seals can melt or become weak and cause leakage.
③ Chemical corrosion is accelerated.

Effects of cold temperature:

① Metals become brittle and have lower resistance to impact.
② Seals become rigid and lose resilience.
③ Moist packing material freezes.
④ Oil becomes viscous and is unable to properly lubricate moving parts.

(6) Chemicals

Salts, acids and other chemicals contaminate lubricants and corrode metals and seals. Surface-hardened metals are more susceptible to corrosion than plain metals.

2) Terrain Condition

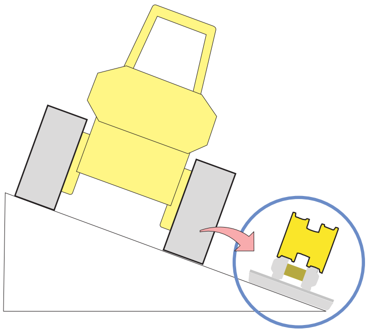
Crawlers do work on almost any kind of terrain. Let's take a look at some common terrains and how they affect undercarriage wear. Keep in mind that the terrain of a worksite, like earth conditions, cannot be changed. But the adverse effects can be partially controlled by proper method of operation

(1) Uphill/Downhill

When working uphill machine weight is shifted to back rollers, causing them to wear faster. The same happens to front rollers when working downhill. Also when working uphill the sprocket has to push harder against the bushings to propel the machine forward. For this reason forward drive side wear is greater. The opposite is true when traveling downhill; the sprocket doesn't have to push as hard so forward drive side wear is less.

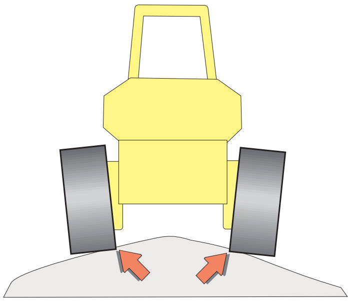
(2) Lateral Slope

When working on a lateral slope machine weight is shifted to the downhill side. This causes premature wear on roller flanges and link side faces, especially on the downhill track.

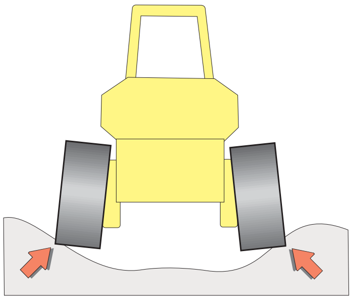


(3) Crown/Depression

When working on a crown or depression the weight of the machine is not evenly distributed by the entire track shoe area. A crown produces high ground pressure on the inner sides and a depression produces high ground pressure on the outer sides. This causes uneven wear, particularly between bushings and sprocket.



Crown

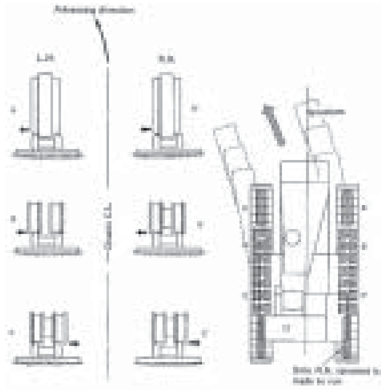


Depression

3) Job Application

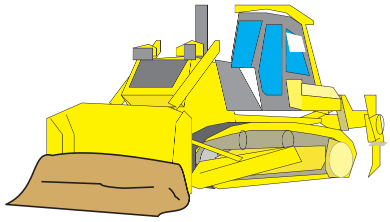
Job application refers to the type of work that the machine is doing. Turning, dozing, grading, ripping, pulling, side-hill cutting, excavating and loading are some of the most common job applications. Here we will briefly discuss how they affect wear. Usually a job application cannot be changed, but it can be partially controlled by choosing the correct machine outfit and employing a good method of operation.

(1) Turning



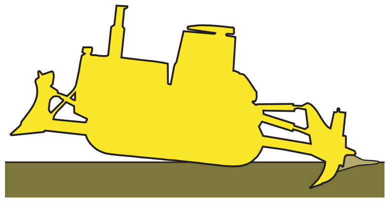
Turning wears flanges more than any other component. The above diagram illustrates the wear pattern that occurs when the machine turns left. Notice that the idler and front rollers (A & B) are pushed left and scrape against right-side link faces. But rear rollers (C) are pushed right and scrape against left-side link faces

(2) Dozing and Grading



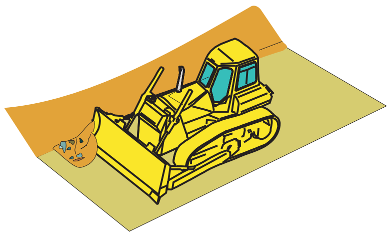
Since these applications require pushing, more load is exerted on the front of the machine. This produces greater wear on front rollers and front idlers.

(3) Pulling, Ripping



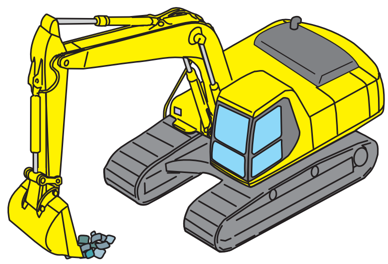
Since these applications require pulling, more load is exerted on the back of the machine. In ripping operations the front of the machine can even raise off the ground. This produces greater wear on back rollers and sprockets.

(4) Side-Hill Cutting



In side-hill cutting operations the blade is loaded on only one side. This produces increased wear on all undercarriage components on the loaded side.

(5) Excavating



Weight of machine is repeatedly shifted from side to side and front to rear. This causes link and bushing fatigue, which weakens their structural integrity.

(6) Loading

Weight of machine is shifted from front to rear. This is because the machine is constantly alternating between digging and carrying. Front and rear rollers are affected the most because they must support the machine.

3-4. Reference

Critical variables that affect undercarriage component life.

Group	Variable	Shoe	Link pitch	Bushing	Sprocket	Track link	Track roller	Idler	Carrier roller
Operation	Machine speed	✔	✔	✔	✔	✔	✔	✔	✔
	Shoe slipping	✔							
	Long distance drawing		✔	✔	✔				
	Traveling on slope					✔	✔		
Maintenance	Track tension		✔	✔	✔	✔	✔	✔	✔
	Packing materials			✔	✔	✔		✔	✔
Ground condition	An element of soil (SiO2)	✔	✔	✔	✔	✔	✔	✔	✔
	Rocky ground (uneven terrain)	✔				✔	✔		
	Soil ground (Splashed soil)		✔	✔	✔				
	Sticky soil ground (Packing materials)					✔	✔	✔	✔

4. Maintenance and Adjustment

4-1. Track Adjustment

The shoe tension remarkably affects the part wear and the strength. Therefore, it should be adjusted properly. For details, refer to the item in “3. Variable that Affect Parts”.
In addition, for the measurement method and the proper value, refer to the Shop Manual of each model.

4-2. Idler Guide Adjustment

Unless the idler adjustment is proper, the idler strength is lowered and the uneven wear of the shoe and the roller occurs. Therefore, adjust it to the proper value.

- D21-D85: Adjust by replacing the shim or the plate.
- D155-D575: Adjust by the build-up welding or the part replacement.

In addition, for the adjustment and the proper value, refer to the Shop Manual of each model.

4-3. Track Roller Rotation

Usually, as for the track roller wear, the end or the front portion wears fast and the center portion wears slowly. Accordingly, in order to prolong the replacing life of whole track rollers, the track roller rotation is carried out. As for the arrangement of the track roller, there are the single-flange and the double-flange. For these information, refer to the arrangement in “2-1. Undercarriage Component, Structure & Function 3) Roller”.
In addition, in order to increase the efficiency of this work, the following are recommended.

1) The replacement work should be done at the time when the bushing is reversed or when the shoe is replaced.
2) The average wear of the track rollers is less than 50%.
3) As the rough standard, the ratio of the maximum and the minimum wear is more than 1.3.

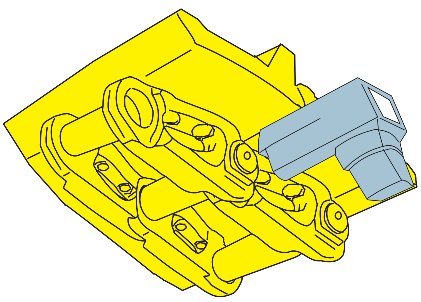
4-4. Field Action against Oil Leakage

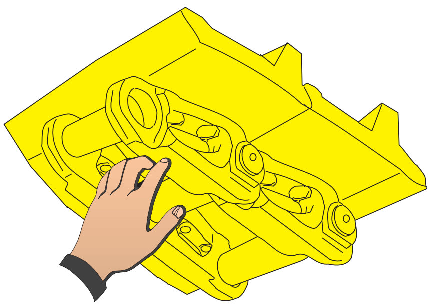
Check the shoe oil leakage as follow.

1) Hot Pin Checking

Check the pins temperature by thermometer or hand quickly after stop the machine which operates over 30 minutes.

1. HOT: Pretty hot. It can’t touch continuously. (More than 50°C)
2. WARM: Like tepid water, but it is hotter than Link. (About 35°C)
3. COLD: A normal temperature which is same as Link. (About 25°C)





2) Method for Dealing with Initial Oil Leakage

- **Check for heat**
  - (a) COLD: No action necessary
  - (b) WARM, HOT — **Check oil**
    - (a) Oil level normal: Check again after 500 hours
    - (b) Oil level low: Add oil
    - (c) Oil dirty: Change oil
    - (d) No oil — **Measure link pitch**
      - (a) Elongation less than 3 mm — **Add oil**
        - (a) No oil leakage: No action necessary
        - (b) Oil leakage: Charge with grease
      - (b) Elongation more than 3 mm: Replace 1 set
    - (e) Dirty or sand in oil — **Measure link pitch**
      - (a) Elongation less than 3 mm: Fill with grease
      - (b) Elongation more than 3 mm: Replace 1 set

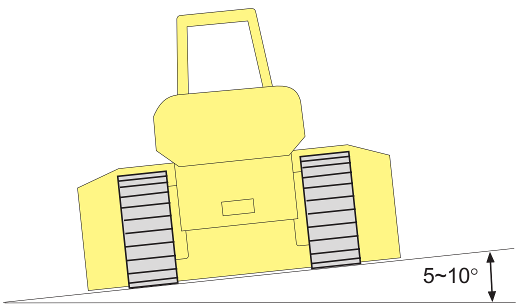
Note: If it is warm or hot for 5 - 10% of the times at the initial stage, remove from the chassis and consider carrying out an overall oil check and repair in the workshop.

3) Procedure

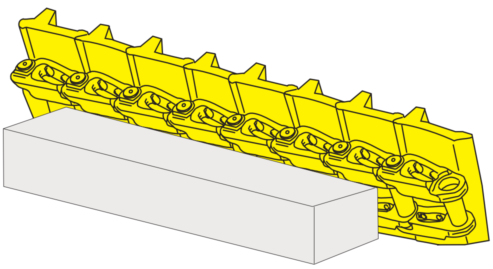
(1) Preparation

a) When the track assembly is attached to the machine. Raise the right side to set the machine at a 5-10 angle.

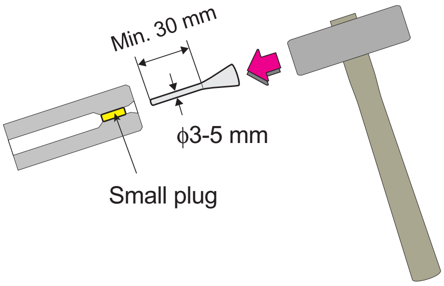
- Change oil at the small plug side.
- The small plug is installed to the right side of the chassis. Therefore, set with the right side of the chassis raise.
- The operation from step 2 is easier to carry out at the following points.
- For the right track: between the outside carrier rollers
- For the left track: at the windon portion of the idler on the inside



b) When the track assembly is removed from the machine. Stand the track assembly as the small plug upper side.

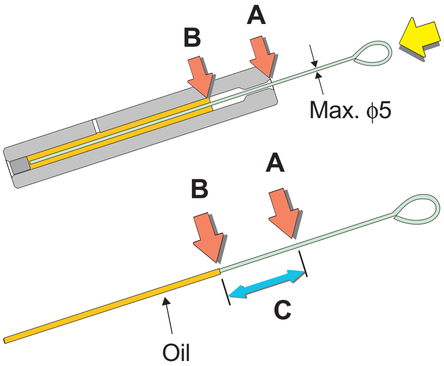


(2) Punch the small plug into pin oil hole with tool.



- The small plug hole is dia. 6.
- Use a suitable bar (dia. 3-5).
- It is convenient to use the special tool to punch the plug.
- Do not remove the large plug with a drill.
  Particles of rubber will be remain in the oil hole and often the plug is not completely installed in.

(3) Check oil quantity and contamination



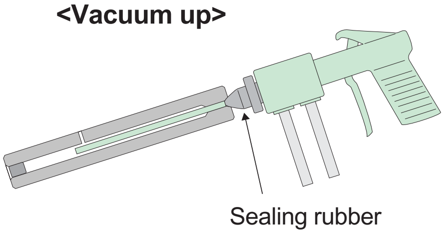
- Take a measure of C.
- Check a contamination by oil on the dipstick.

i) Oil quantity
- C ≦ 50 mm ⇒ Install a plug
- C > 50 mm ⇒ Fill oil

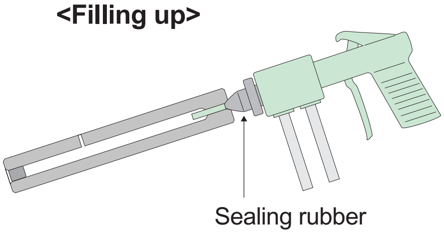
ii) Oil contamination
- Color is dark, but have a fluidity ⇒ Fill oil
- Have an acrid smell of burning ⇒ Filling oil using vacuum pump is recommended
- Earth and sand contaminating ⇒ Have a problem on sealing. Press grease into the oil hole until grease stick out from the joint of the track links.

(4) Filling oil using vacuum pump (when required)

<Vacuum up>

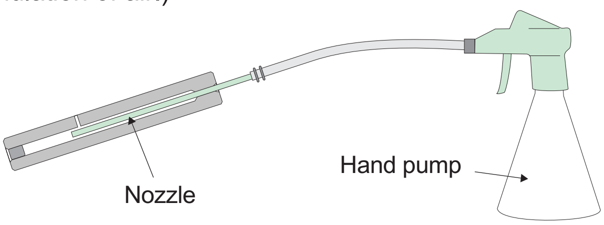


<Filling up>



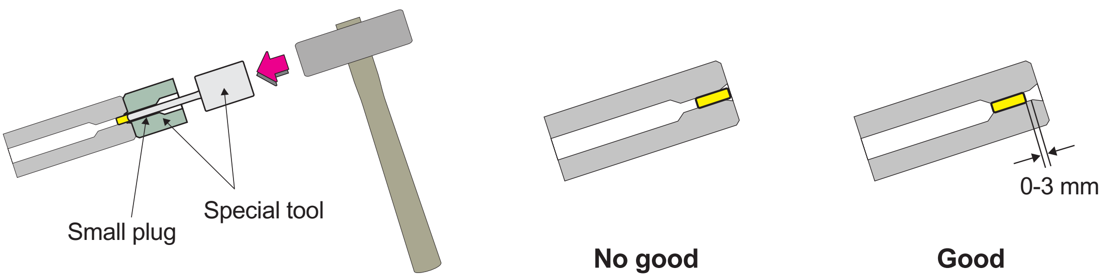
- Use the vacuum pump

Note: A hand pump can be used if the vacuum pump is not available, or the case of filling oil only.
(A nozzle must be inserted deeply to prevent an accumulation of air.)



(5) Install the small plug into the pin oil hole with tool.

- It is convenient to use the special tool to install the plug.
- Install the plug until it is beyond the chamfered portion of the pin. If it is protruding outside the chamfered portion of the pin, it is not installed in properly. (This will cause the plug to come out.)



4-5. Requirement of the Shoe Bolts Tightening

Unless the bolt tightening is proper, the bolt loosening, drop or breakage may occur. Therefore, tighten properly.
As for the shoe bolt tightening, follow the below precautions.
In addition, as for installing and removing the shoe bolt, follow the below precautions.

1. Master Bolt removal

- Do not remove the bolts one by one. As for four bolts, loosen each one by one to two turns and make sure that four bolts turn lightly. After that, remove them.
- When the bolts are turned forcibly in the state that the bolts do not turn lightly, the thread portion of the bolt and the master link may be damaged.

2. Regular Bolt removal

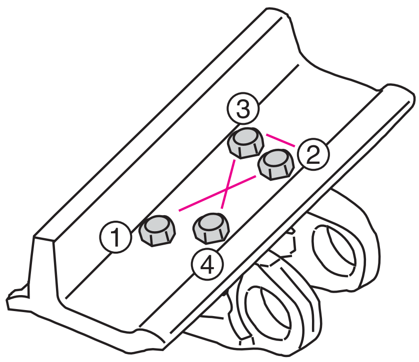
- If the bolt can not be loosened by one turn (If the rotation torque does not become zero), do not turn it forcibly and loosen the retaining bolts.
- If the bolt is turned forcibly in the state that the torque is not zero, the repair work is required.

3. Master bolt installation

- Until the mating surfaces of the master link contact tightly, all of four master bolts should be installed manually.
- In the state that the mating surfaces of the master link do not contact tightly, if the bolts are tightened forcibly, the thread portion of the bolt and the master link may be damaged.

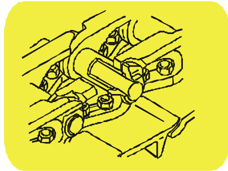
When installing the shoe bolts

(1) Coat the thread of bolts with **Anti-friction compound (LM-P).**
(2) Tighten shoe bolts in order ① - ④
(3) Initial tightening torque and tightening angle:
See shoe bolt torque table. (Next page)
(4) Do not use an impact wrench for the master link mounting bolt.



Shoe Bolt Tightening Torque Table

Bulldozer and Dozer Shovels



kg·m

Model	Item	kg.m	ft-lbs	Additional tightening angle
D20, 21-7/-8	Shoe bolt	6 - 8	44 - 57	90° ± 10°
	Master link bolt			180° ± 10°
D31, 20	Shoe bolt	13 - 17	95 - 122	60° ± 10°
	Master link bolt			180° ± 10°
D31-21	Shoe bolt			60° ± 10°
	Master link bolt			180° ± 10°
D37, 5	Shoe bolt			60° ± 10°
	Master link bolt			180° ± 10°
D37-21	Shoe bolt			60° ± 10°
	Master link bolt			180° ± 10°
D39-21	Shoe bolt	18 - 22	130 - 159	120° ± 10°
	Master link bolt			180° ± 10°
D41A, E, P-6	Shoe bolt			120° ± 10°
	Master link bolt			180° ± 10°
D53-17, 18	Shoe bolt	18 - 22	131 - 159	120° ± 10°
	Master link bolt			180° ± 10°
D61E, P-12/-15	Shoe bolt	50 - 60	362 - 434	120° ± 10°
	Master link bolt	31 - 39	225 - 282	180° ± 10°
D65-12/-15	Shoe bolt	50 - 60	261 - 318	120° ± 10°
	Master link bolt	31 - 39	225 - 282	180° ± 10°
D85-21	Shoe bolt	36 - 44	261 - 318	120° ± 10°
	Master link bolt	31 - 39	225 - 282	$180^{\circ}\,{}^{0}_{-20^{\circ}}$
D85-15, 15EO	Shoe bolt	31 - 39 (Single shoe) 45 - 55 (Swamp shoe)	225 - 282 326 - 397	120° ± 10°
	Master link bolt	31 - 39	225 - 282	$180^{\circ}\,{}^{0}_{-20^{\circ}}$
D155-2	Shoe bolt	40 - 50	290 - 361	120° ± 10°
	Master link bolt			$120^{\circ}\,{}^{+20^{\circ}}_{+0}$
D155A, AX-3 AX-5, AX-6	Shoe bolt	54 - 66	391 - 477	120° ± 10°
	Master link bolt			180° ± 10°
D275-2, -5, 5EO	Shoe bolt	72 - 88	456 - 556	120° ± 10°
	Master link bolt	45 - 55	326 - 397	180° ± 10°
D355-3, 5	Shoe bolt	140 - 170	1013 - 1229	-
	Master link bolt	45 - 55	326 - 397	$120^{\circ}\,{}^{+20^{\circ}}_{+0}$
D375A-3, -5, 5EO	Shoe bolt	126 - 156	911 - 1128	120° ± 10°
	Master link bolt	63 - 77	456 - 567	180° ± 10°
D475A-3/-5, 5EO	Shoe bolt	72 - 88	521 - 636	180° ± 10°
	Master link bolt	90 - 110	651 - 796	
D575A-2, 3	Shoe bolt	190 - 230	1375 - 1663	120° ± 10°
	Master link bolt	180 - 220	1302 - 1591	$120^{\circ}\,{}^{+20^{\circ}}_{+0}$

Note: 1 kgm = 9.807 Nm
1 kgm = 7.233 ft-lbs

Hydraulic Excavator

kg·m

Model	kg.m	ft-lbs	Additional tightening angle
PC60-6, 7			
PC78US-6	10 - 14	73 - 101	90° ± 10°
PC78UU-6			
PC100-6			
PC120-6	18 - 22	131 - 159	90° ± 10°
PC138US-2			
PC200-6, 7, 8			
PC220-6, 7, 8	45 - 55	325 - 398	120° ± 10°
PC228US-3			
PC300-6/-7, 7EO	36 - 44	131 - 159	120° ± 10°
PC400-6/-7, 7EO	36 - 44	261 - 319	120° ± 10°
PC600-6/-7, 8	72 - 88	521 - 636	120° ± 10°
PC750-6/-7, PC800/850-8	72 - 88	521 - 636	120° ± 10°
PC1100-6, PC1250-7/-8	126 - 154	911 - 1114	150° ± 10°
PC1600-1	63 - 77	456 - 556	120° ± 10°
PC1800-6, PC2000-8	63 - 77	456 - 556	120° ± 10°

Note: 1 kgm = 9.807 Nm
1 kgm = 7.233 ft-lbs

5. Reference

5-1. Rebuilding

The replacing time of the undercarriage can be prolonged by the bushing turning or the lug welding of shoe. As for the method, refer to GUIDANCE FOR REUSABLE PARTS “Form No. SEBG4092”.

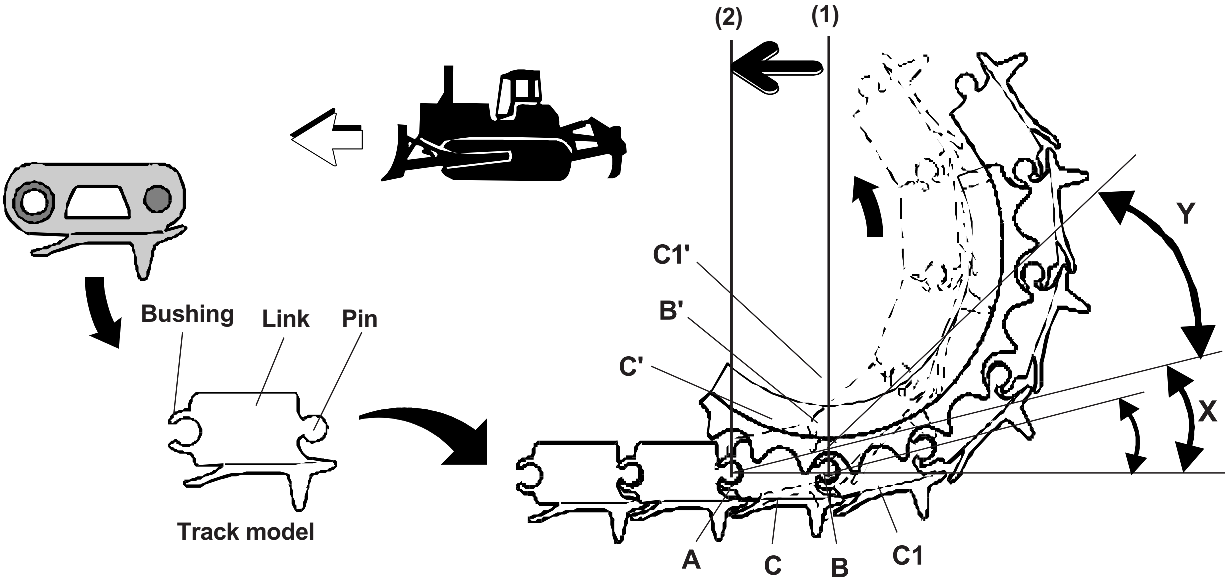
5-2. Wear Mechanism

1) Sprocket Teeth & Bushing O.D.

(1) Reverse and/or forward drive side wear

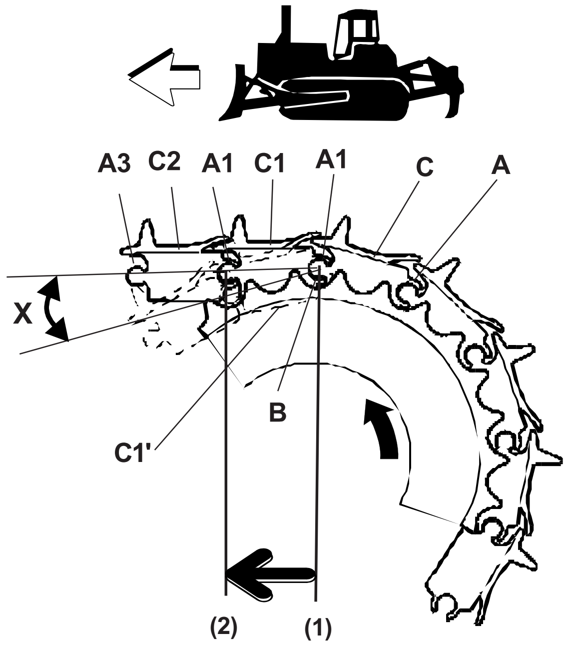
a) Sprocket wear during the engagement

CASE 1: On approach side in forward drive



Where a bushing and sprocket tooth are in mesh with each other in a position B below the sprocket center: if the sprocket center is moved from (1) to (2), the bushing B below the sprocket center will be moved to B' in the sprocket tangential line from the state in mesh with sprocket tooth, causing a link (B) to move to a position (C') by an X-angle.
The link (C1) will also be moved to a position (C1') simultaneously with the sprocket, which will not permit a Y-angular change, since the link is already in mesh with the sprocket.
While the sprocket center is moving from (1) to (2), the link (C) will make a Y-angular change and the bushing A integrated with this link will also make an a-angular change. At the time when the sprocket center has moved to a position (2). The bushing A has already made an a-angular rotation and is going to mesh with the subsequent sprocket tooth. Thus, there will occur no slippage between the bushing A ands rocket tooth and the track rotation is made with contact between the bushing A inner face and pin.

CASE 2: On departure side in forward drive

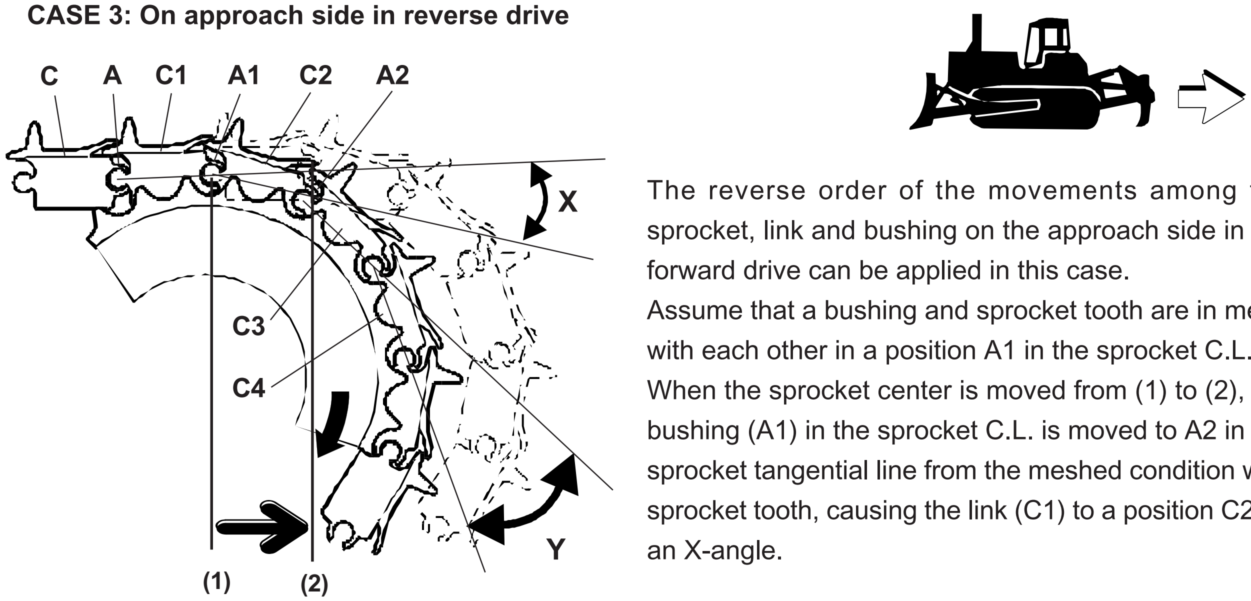


A bushing and a sprocket tooth are in mesh with each other at B in the sprocket C.L., and the bushing is then moved from A to A1, A2 and A3. Where the sprocket center has been moved from (1) to (2), the bushing A1 in the sprocket C.L. will be moved to A2 in the tangential line of sprocket from the meshed condition with a sprocket tooth causing the link (C) to move the position C1.

Where the link (C1) is in mesh with sprocket tooth, the link (C1) is in the dotted line (C1') or in mesh with sprocket by an X-angle. While the sprocket center is moving from (1) to (2), the links (C) and (C1) will come into the same line, indicating that the link to be moved to a position C1' has been moved to a position C1 by an X-angle. Consequently, the bushing (A1) integrated with the link in (C1') will also be moved by an X-angle.

While the sprocket center is moving from (1) to (2), the bushing (A1) will slip by an X-angle in contact with the sprocket.

CASE 3: On approach side in reverse drive



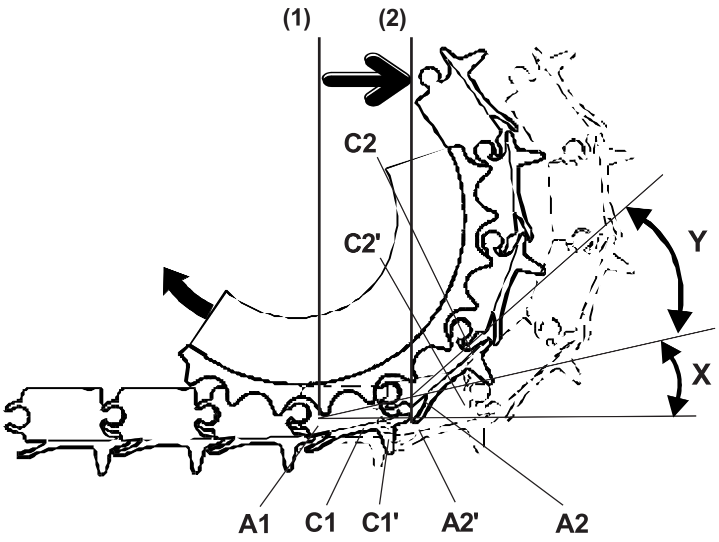
The reverse order of the movements among the sprocket, link and bushing on the approach side in the forward drive can be applied in this case.

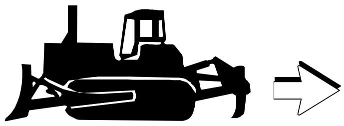
Assume that a bushing and sprocket tooth are in mesh with each other in a position A1 in the sprocket C.L.

When the sprocket center is moved from (1) to (2), the bushing (A1) in the sprocket C.L. is moved to A2 in the sprocket tangential line from the meshed condition with sprocket tooth, causing the link (C1) to a position C2 by an X-angle.

The links (C3) and (C4) are moved in the meshed condition with each other and thus, no change in the Y-angles at C3 and C4 will be made. The link (C) is moved from a position C1, giving no angular change. The sprocket rotation for an X-angular change is made between the pins and bushings at A1 and A2. However, the pin at A and bushing at A1 are integrated with each other, and thus, when the link (C1) is moved to C2, the bushing A1 is also moved to a position A2 simultaneously. Consequently, during the movement from A1 to A2, the bushing and the sprocket tooth face will slip in the meshed condition with each other.

CASE 4: On departure side in reverse drive



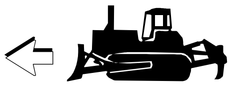


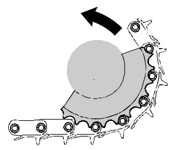
The reverse order of the movements among the sprocket, link and bushing on the approach side in the forward drive can be applied in this case.
When the sprocket center is moved from (1) to (2), the bushing (A2) in mesh with the sprocket tooth is moved to A2' and, the link (C1) is moved to (C1') by an X-angle, since the pin in the bushing A2 is integrated with the link (C1).
The link (C2) is moved to (C2') in mesh with the sprocket without a Y-angular change. Consequently, when the link (C1) is moved to (C1'), the sprocket will be rotated between the bushing inner face and pin at A2.

At this time, the bushing (A1) integrated with the link (C1) will also make a movement by an X-angle, but no slippage will occur between the bushing and sprocket tooth face, because the meshing between the sprocket tooth and bushing is separated as soon as the sprocket center is moved from (1) and (2).
In summarizing the above relationships between the sprocket and links:

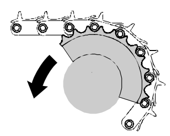
(2) Short Notes

In the forward drive



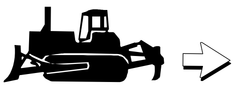


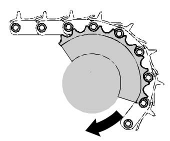
(1) On the approach side (on the sprocket lower side), a bushing rotation is already accomplished before the sprocket tooth comes into mesh with the bushing, giving no sliding wear.



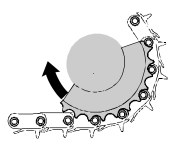
(2) On the departure side (on the sprocket upper side), the bushing is rotated as the link makes an angular change in mesh with the sprocket tooth, giving the sliding wear.

In the reverse drive





(3) On the approaching side (on the sprocket upper side), the link makes an angular change after the sprocket tooth comes into mesh with the bushing, giving the sliding wear between the sprocket tooth and bushing O.D.



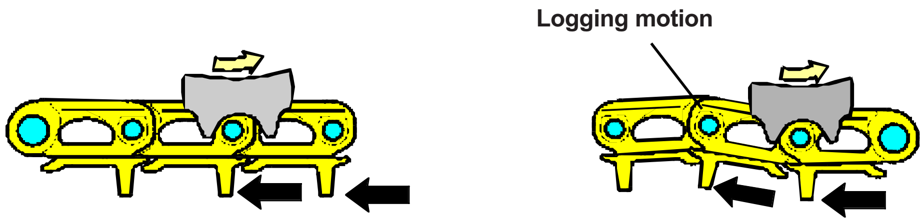
(4) On the departure side (on the sprocket lower side), the link makes an angular change while the sprocket tooth face is being departed from the bushing, causing the bushing to rotate. At this time, the bushing is already departed from the sprocket tooth, giving no sliding wear.

In the note (2) and (3), the track on the departure side in (2) is rather loose in tension and the track on the approaching side is rather tense. Thus, wear on the reverse side in liable to develop faster than that on the forward drive side. Reverse traveling in high gear will accelerate wear on the sprocket teeth and bushings.

(3) What happens if track is installed in the reverse manner ?

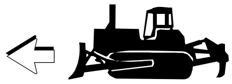
a) If track shoe assembly is installed in the opposite direction, track link tends to slip on a sprocket teeth at the lower part of sprocket. (if it is installed properly, track link slips on a sprocket teeth at the upper part of sprocket). Moreover sand is bitten between bushing and sprocket teeth more which accelerates wear of bushing and sprocket teeth.

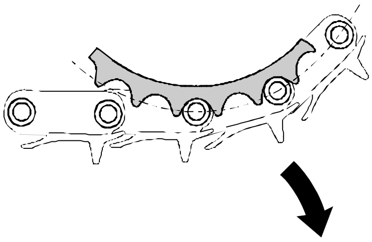
b) Traction force reduces.
Track link starts to kink on the ground (called logging motion), by that extent traction force reduces.



Correct installation of track shoe assembly | **Reverse installation of track shoe assembly**

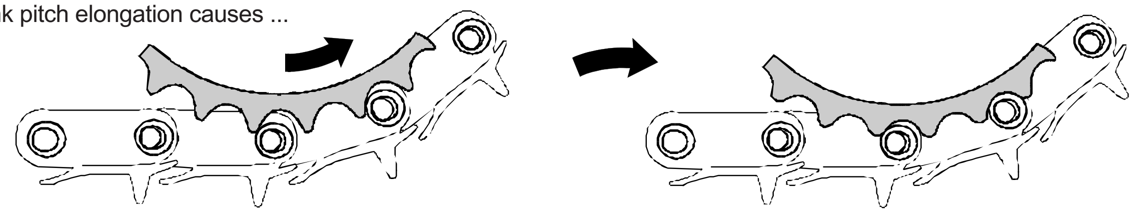
(4) Sprocket teeth tip wear on the forward drive side





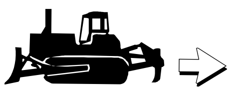
If the link pitch is not matched to the sprocket pitch due to extended link pitch, etc., the sprocket tooth tip will hit a bushing when the sprocket is to come into mesh with the bushing, causing wear to the tooth tip.

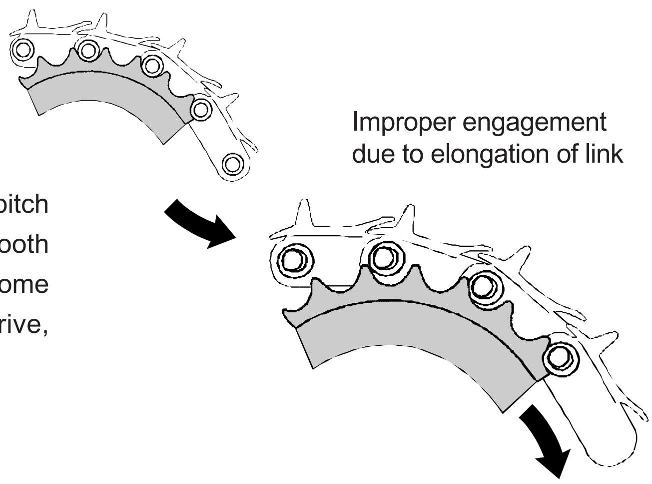
Link pitch elongation causes ...



(5) Sprocket teeth tip wear on the reverse drive side

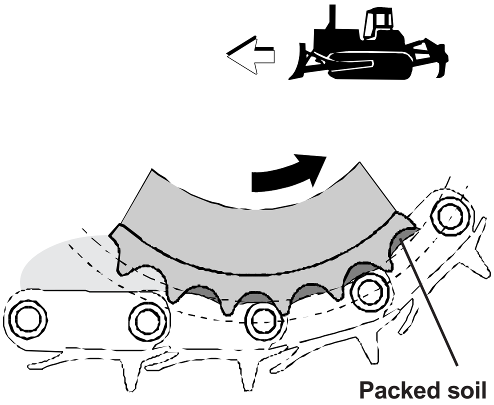
CAUSE A: Where the link pitch is extended.





If the link pitch is unmatched to the sprocket pitch due to the extended link pitch, the sprocket tooth tip will hit a bushing when the sprocket is to come into mesh with the bushing in the reverse drive, causing wear to the tooth tip.

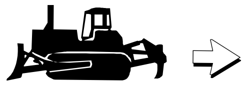
CAUSE B: Where soil has stuck or packed to the sprocket tooth root.



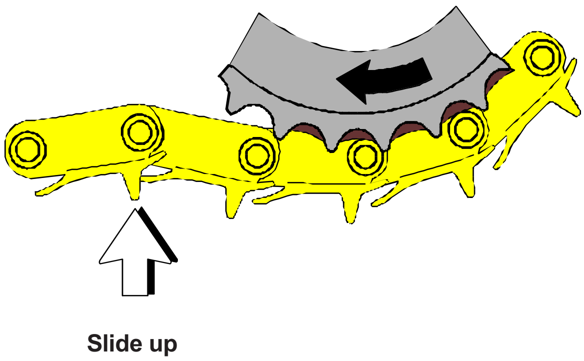
Where a machine is operated in a terrain abundant in moisture content or in clay easy to solidify, the mud is liable to stick to the sprocket tooth lands. Continued operation of the machine with the soil left unmoved from the sprocket teeth will allow the soil to accumulate further on the previous soil, increasing the dia. of the pitch circle of sprocket. In consequence, the larger the pitch circle dia., the larger the sprocket pitch. As a result, the sprocket pitch will be unmatched to the link pitch.

When the sprocket is to come into mesh with a bushing in the forward drive, the sprocket pitch will be unmatched to the link pitch, causing the tooth tips of sprocket on the reverse drive side to hit the bushing surface. Thus the wear occurs between the two.
The above wearing conditions are contrary to the case where the link pitch is extended, and occurs also in a case where rocks are wedged between the sprocket teeth and bushing.

CAUSE C : When the trucks are too loose without tension adjustment

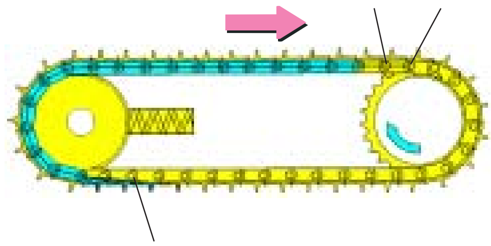


Back-jamming is a cause of reverse drive side tooth tip wear. In reverse, the truck link on the ground, around the idler and to the top side of the sprocket is in tension. The slack is accumulated between the bottom of the sprocket and the rear track roller. If there is too much slack, "back jamming" of the track link between the sprocket and the roller occurs. The bushings slide up the reverse drive side to the tooth tip as they are pushed from the sprocket.
When this occurs, adjust the tracks tension correctly.



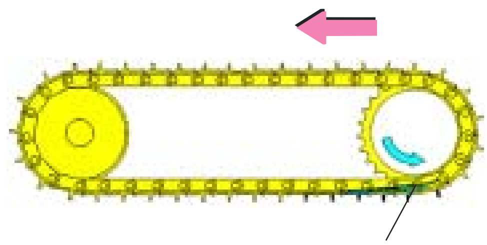
2) Chain Tightness

(1) Reverse Travel



Recall that in reverse drive cycle the majority of torque transfer occurs at the top of the sprocket. This means that the sprocket tooth at position D pulls on the bushing seated in position D. Since the track chain is assembled as one unit, bushing D pulls on the bushing beside it, which is bushing E. Bushing E then pulls on the one beside it, and so on. This chain reaction (pun intended) continues all the way around the idler until it reaches the bushings at position F. These bushings cannot be pulled because they are attached to shoes that are embedded into the ground, and so the chain reaction tapers off. As a result, a large section of chain (from D to F) remains very tight when traveling in reverse.

(2) Forward Travel

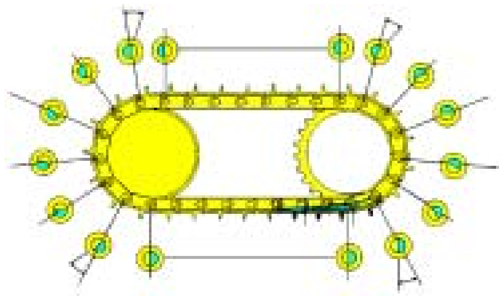


The majority of torque transfer occurs at the bottom of the sprocket. The sprocket tooth at position A pulls on the bushing seated in position A. By the same chain reaction principle, that bushing pulls on the one beside it, and so on. But the reaction does not have far to go before it reaches embedded shoes. In fact, the reaction only lasts a few link segments before tapering off. As a result, increased wear only occurs in a small section of track during forward travel.

3) Pin/Bushing Internal Wear

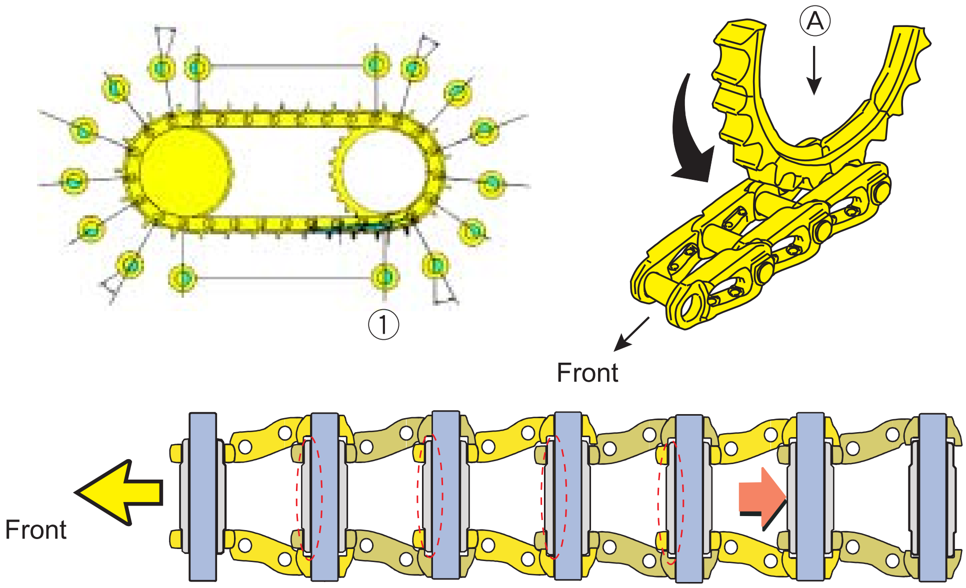
(1) Pin/Bushing Rotation

As the track chain revolves around the sprocket and front idler, the pins and bushings rotate independently of each other. This movement takes place four times per revolution; two times as the chain bends around the sprocket and two times as it bends around the front idler. This movement is the same in both forward and reverse directions, but wear is much greater in reverse. This is because of track chain tightness.

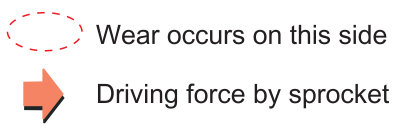


(2) Forward Travel

Recall that in forward travel only a small section of chain is tight and it is only long enough to include the first internal turn (position ① on diagram). Therefore, this is the only internal turn that is critical because the other three are not subjected to heavy loads

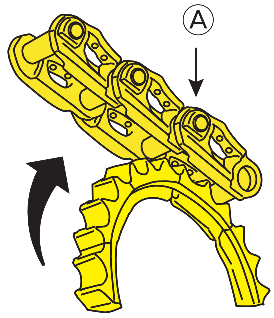


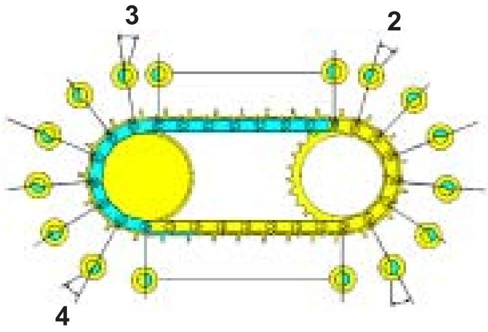
View from A

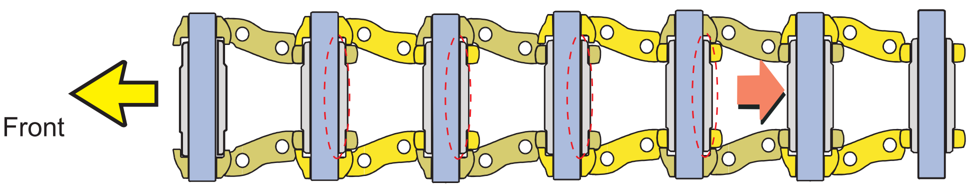


(3) Reverse Travel

However, in reverse travel the chain is tight all the way around the idler and extends far enough to include three internal turns (positions 2, 3 and 4). Therefore, in reverse travel there are three internal turns that are subjected to heavy load.







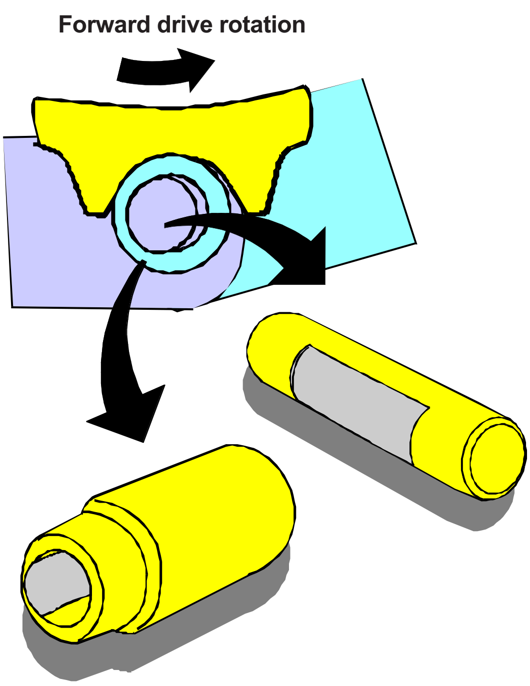
View from A

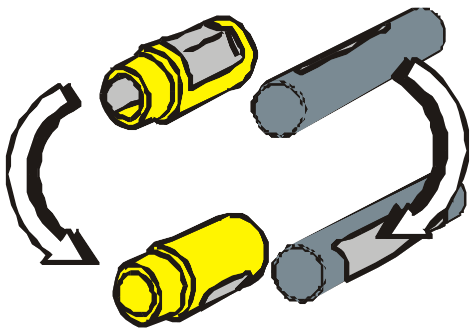
Wear occurs on this side

Driving force by sprocket

(4) Conclusion

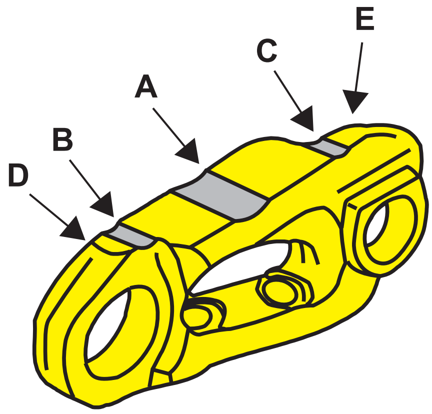
- Because of track chain dynamics, internal wear always affects the one side of the pins and bushings, regardless of travel direction. This means that only one side of the pin OD and bushing ID is worn internally.
- Traveling in reverse causes increased wear on the front idler and all track chain components in that section.
- Traveling in reverse causes so much more wear than forward travel.



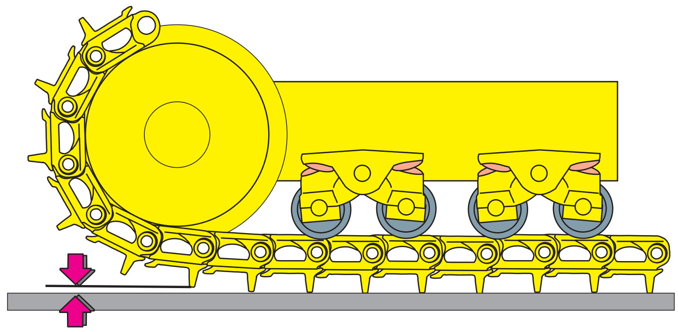


5-3. Operator's Comfort & Vibration

1) As for the link tread surface, the uneven wear occurs under the structural conditions. (For details, refer to 2-3. Wear & Problem 1) Link.)
Basic wear patterns are shown in the below figure. But, depending on the landform and the ground condition of the jobsite, there is the pattern, which D and E do not appear clearly, or A does not appear clearly.
Usually, the uneven wear does not matter, but on the peculiar ground conditions or at the peculiar speed, it may affect the machine vibration.
The vibration can be reduced by replacing deteriorated isolation mounts where necessary, replacing any broken or missing fasteners and by generally keeping the machine in good repair. A change in operating speed or technique, or a change of counterweights or attachments may reduce the effect.



2) In the state that the machine is stopped on the level ground, the clearance is given at the idler lower portion and the sprocket lower portion. But, when the roller wear is remarkably increased, this clearance disappears and the machine may vibrate during traveling.
In this case, by inserting the plate into the bogie portion, the clearance can be obtained.



Clearance

5-4. Distinguishing from the Non-Genuine Parts

1) General View

There are many makers which produce the undercarriage parts. When the customer replaces the undercarriage of his machine, sometime customer use non genuine parts. Accordingly, it is very important that daily friendly relation with customers is maintained, the part replacement time is understood, the offer is timely made, and the part order is obtained.
In addition, during the round, when the machine is found at the field, watch the undercarriage parts. If the parts except the genuine ones are installed, check the following items, talk with the customers and ensure the reason. After that, the countermeasures are examined to sell Komatsu genuine parts.

(1) What is the maker?
(2) What are specifications?
- Grease sealed track or S.A.L.T.?
- Is the track tightening method Master link or Master pin?
- High link or Low link?
- Is Shoe Heavy duty type or Standard type?
- Others

(3) Customers purchasing reason
- Price? (How much is the difference from Komatsu part price?)
- Delivery? (What is the difference from Komatsu?)
- Quality? (Has Komatsu problems?)
- Others (Are there any problems for DB countermeasure? Etc?)

As for distinguishing methods from other makers, refer to the next items.

2) Way for Distinguishing from the Non-Genuine Part

As for the undercarriage parts, any maker's parts are similar shapes. But the maker name can be distinguished by the stamp mark and the shape difference of the following parts.

(1) By Regular Link

- Because the Logo mark is stamped on Link, it is possible to distinguish. Refer to the attached figures.

• **Komatsu**

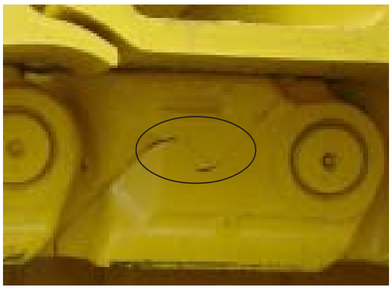
• **Non-Genuine**

• **Non-Genuine**

- As for Komatsu Link, always Komatsu mark is stamped on it. In addition, Part No. or L, R, etc are stamped.

(2) By Master Link

Because the shape of Master Link engaging portion is different by makers, it is possible to distinguish makers. Refer to the attached figures.

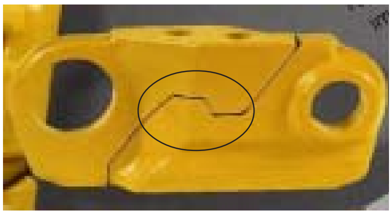


Komatsu original teeth

• **Komatsu**

Many teeth

• **Non-Genuine**



Flat teeth

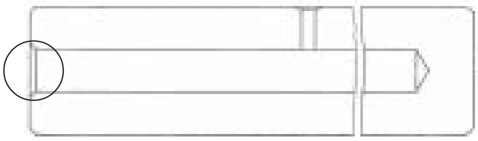
• **Non-Genuine**

(3) Reference Points

- S.A.L.T. and Grease Sealed Track are distinguished by the existence of the plug at the pin end. (There is the plug on S.A.L.T.)
- As for Komatsu S.A.L.T., there are the plug at both pin ends. (Big plug and Small plug.) As for non-Genuine, the plug exists at one end only. Accordingly, Komatsu track, it is necessary to ensure the existence of plug at both ends.
- As for Master Link, it is basically S.A.L.T. track. But, as for non-Genuine, it is careful that Grease Sealed Track may provide with Master Link.

Plug hole on both side

• **Komatsu**



Plug hole on one side

• **Non-Genuine**

II. Undercarriage Management

1. General

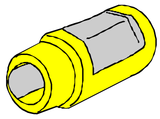
1) The purpose of UC Management is as follows. The wear status of UC parts is known, and corresponding to it, the usage of UC parts is changed, and totally Cost/Hour of the customers is minimized.
   For this, the considering points are as follows.
   (1) Life of Pin and Bushing is matched to Link life. For the sake, whether Bushing is turned run to destruction are judged and treated.
   (2) Life of T/Roller is matched to Link life. For the sake, whether Position Change of T/Roller is done or not are judged and treated.
   (3) Life of Shoe grouser is matched to Link life. For the sake, whether Shoe grouser is reused by lug-welding Grouser or replaced with the new one are judged and treated.
   (4) As for Idler, whether the building up by welding or the replacement are better are judged and treated.
   (5) As for T/Roller, whether the building up by welding or Shell replacement or Ass'y replacement are better is judged and treated.
   (6) When judging whether UC parts are rebuilt, or abandoned, it is necessary to decide totally by considering the comparison of the local man-hour charge with the part price and the rebuilder's level.
   (7) The above-maintenance is done by Minimum Hour and it is necessary that Labor and Machine Down are minimum.
2) Link is the key component on UC Management. For this reason, the treatment which the life of other UC parts comes near Link life is the key point for reducing R & M cost.
3) Namely, at the same time when Link Ass'y maintenance is done, the maintenance of other UC parts should be done. For this reason, Machine Down is less and the efficiency is the best.
4) Usually, as for Link Ass'y, Pin and Bushing are one time turn. And, after the turning, Link Ass'y is used until destruction.
5) When it is used up without the turning, refer to 2-2. Wear Limit.

2. Countermeasure for R & M Cost Reduction

2-1. Precautions when Turning Pin & Bushing

Whether the parts can be reused or not after disassembly, refer to Reusable Guide.

1) Bushing O.D. wear

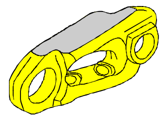


(1) When turning, Bushing O.D. wear should be within Wear Limit (100% Wear).

(2) If the wear exceeds 100%, the crack may already have occurred. Accordingly, if Bushing is turned, oil may leak at the early stage.

(3) After the turning, when it is repaired due to the oil leakage, it is careful that it causes the increased R & M Cost.

2) Link Tread Surface Wear



(1) When Bushing is turned, Link is reused as it is.

(2) Accordingly, at the time when Bushing is turned, it is desired that Link tread surface wear is within 60% of Wear Limit (100% Wear). After the turning, Link is used until the Link tread surface wear is more than 120%, and after that Link is run to destruction.

(3) When turning, if the tread surface wear already exceeds 70%, Life upto the destruction after the turning is decided by Link height wear rather than Bushing O.D.

(4) In that case, it is careful that the expected post-turning life cannot be obtained, and R & M Cost may be increased.

3) Pin Wear

(1) When Bushing is turned, turn Pin to reuse it.

(2) After reusing by turning it, in order to maintain the strength, Pitch elongation should be within Wear Limit.

(3) As for SALT, Pin wear is less, but in order to keep the contact surface same as the state before the turning, similarly turn Pin when Bushing is turned. At that time, it is careful that Pin vertical hole faces to Link tread surface. (When Vertical hole faces oppositely, Pin may be broken.)

(4) When Grease track is turned, the case may be that the one-side wear of Pin has already progressed. (Shortly Pitch elongation has progressed.) But, by turning Pin, Pitch elongation comes near New one.

4) Reusing Seal

(1) Generally, when the service hour exceeds 4000H, Seal Deterioration progresses and the probability of oil leakage from Seal becomes high.

(2) Accordingly, depend on the service hours until Bushing is turned, the judgement criteria for reusing seal should be changed as follows.

(3) When the operating hour is within 2000H;
- Basically Seal is reused.
- Whether Seal is reused or not, confirm to “Reusable Guide”.

(4) When the operating hour is 2000 to 4000H;
- Seal is replaced.

(5) When the operating hour is more than 4000H;
- Seal is basically replaced at the interval of 4000H.

5) Rollers Wear

Rollers are normally used continuously at bushing and pin turn as same as link so the wear life needs to be longer than bushing and pin turn time.
However, it can be scheduled to be replaced even before bushing and pin turn when roller have shorter wear life.

6) Sprocket Wear

(1) When the new Link Ass'y or Link Ass'y with turned Bushing is installed, the new Sprocket Teeth should be installed.

(2) Even if the wear margin is remained on Teeth, Sprocket Teeth should be replaced. When new link is installed. It is careful that if old Teeth are continued to use with new link assy, Bushing O.D. wear progresses due to uneven contact.

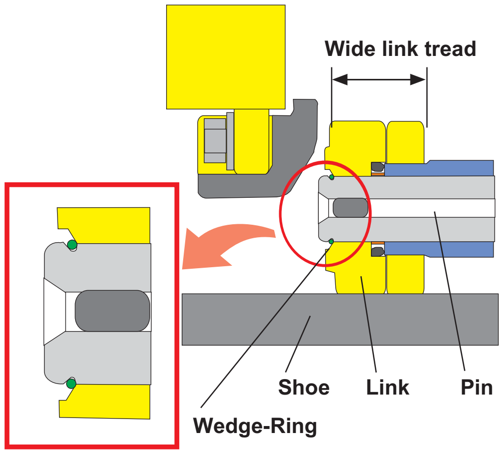
2-2. Contribution to R & M Cost Reduction for K-Bogie and Wedge Ring

1) Features of K-Bogie and Wedge Ring UC

(1) Because Shape of Link and Track Roller Guard is changed, Pin end does not contact with Roller Guard.

(2) Because Pin adopts Wedge ring, Pin is surely retained. Because of it, Pin press-fitting force to Link is reduced. (Total Pin holding force is same as before.)

(3) As for K-Bogie, even when the vehicle is operated on the slope and Link is loosened, T/Roller can be followed. Therefore, the frequency of Link interference with Roller, and Link riding to Roller becomes less.



2) Merit for R & M Cost Reduction

(1) Because Pin end wear does not occurs, especially no slant wear at pin end, when Pin is pressed out for pin bushing turn, Press jig does not contact diagonally. Accordingly, pressing force is surely transmitted, Pin is pressed out easily (Work man-hour is reduced.)

(2) Because Pin press-fitting force is half of the conventional one, Pin is pressed out easily. In addition, because press-fitting force is small, when Pin is removed, Link inner surface scuffing is less. Accordingly, when Link is reused, the cleaning up time of inner surface is less. (Work man-hour is reduced and the part reusable ratio is increased.)

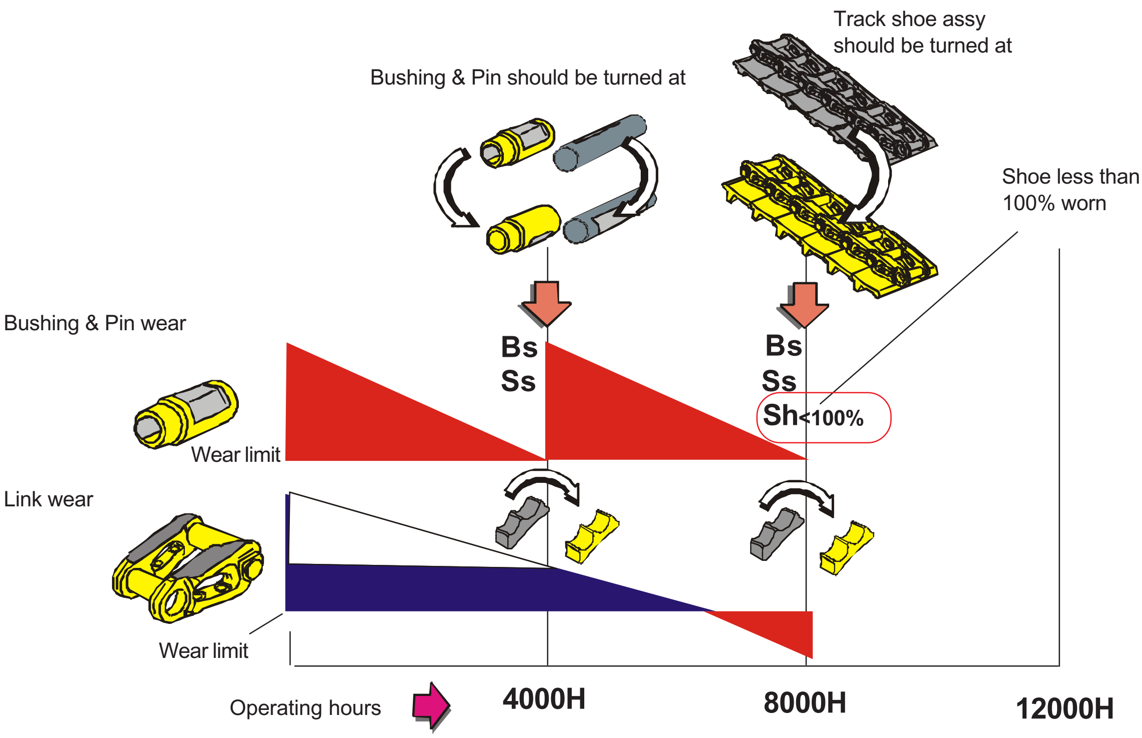
(3) The frequency of Link interference with Roller, and Link riding to Roller becomes less, the damage is reduced. Accordingly, Life is increased. (Operation hours is prolonged.)

2-3. Case Study of Pin and Bushing Turning

Explanation of symbols

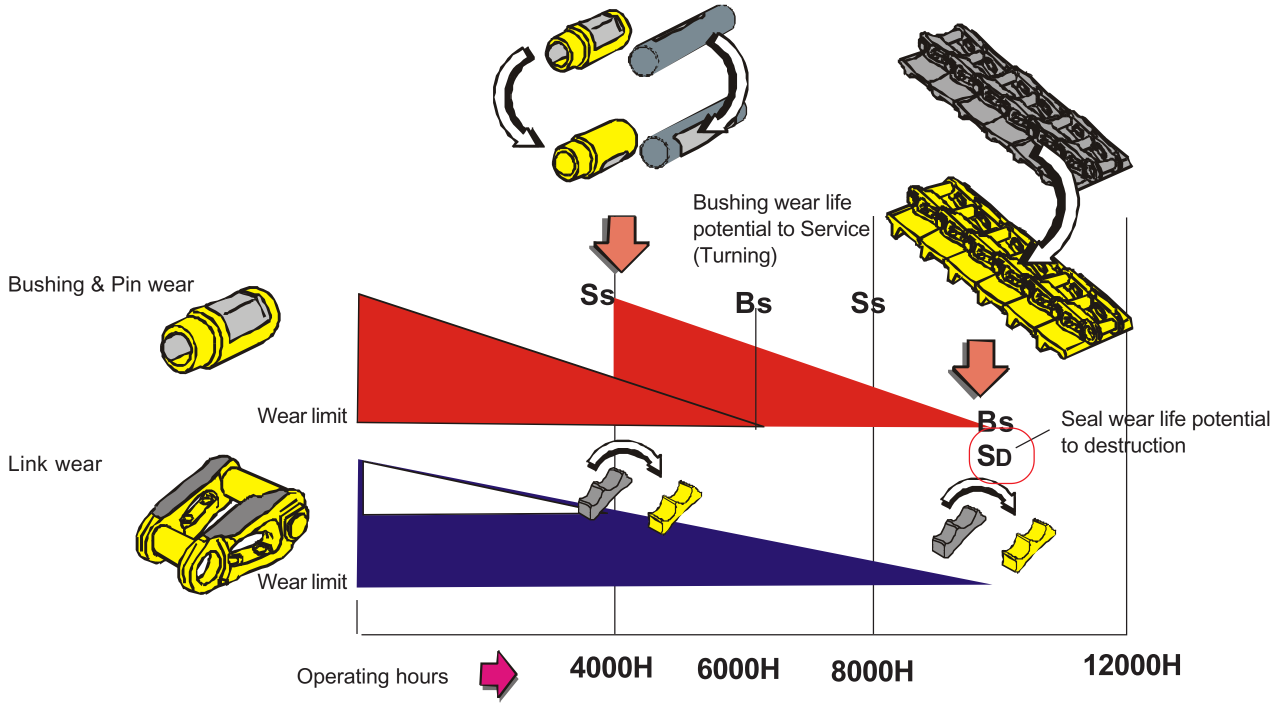
Bs : Bushing wear life potential to Service (Turning)
L<60% : Link less than 60% worn
Sh<100% : Shoe less than 100% worn
Sp(R) : Sprocket teeth wear life potential to replace
Ss : Seal wear life potential to replace
Sd : Seal wear life potential to destruction

Pattern 1. Bushing wear life: 4000 hours below



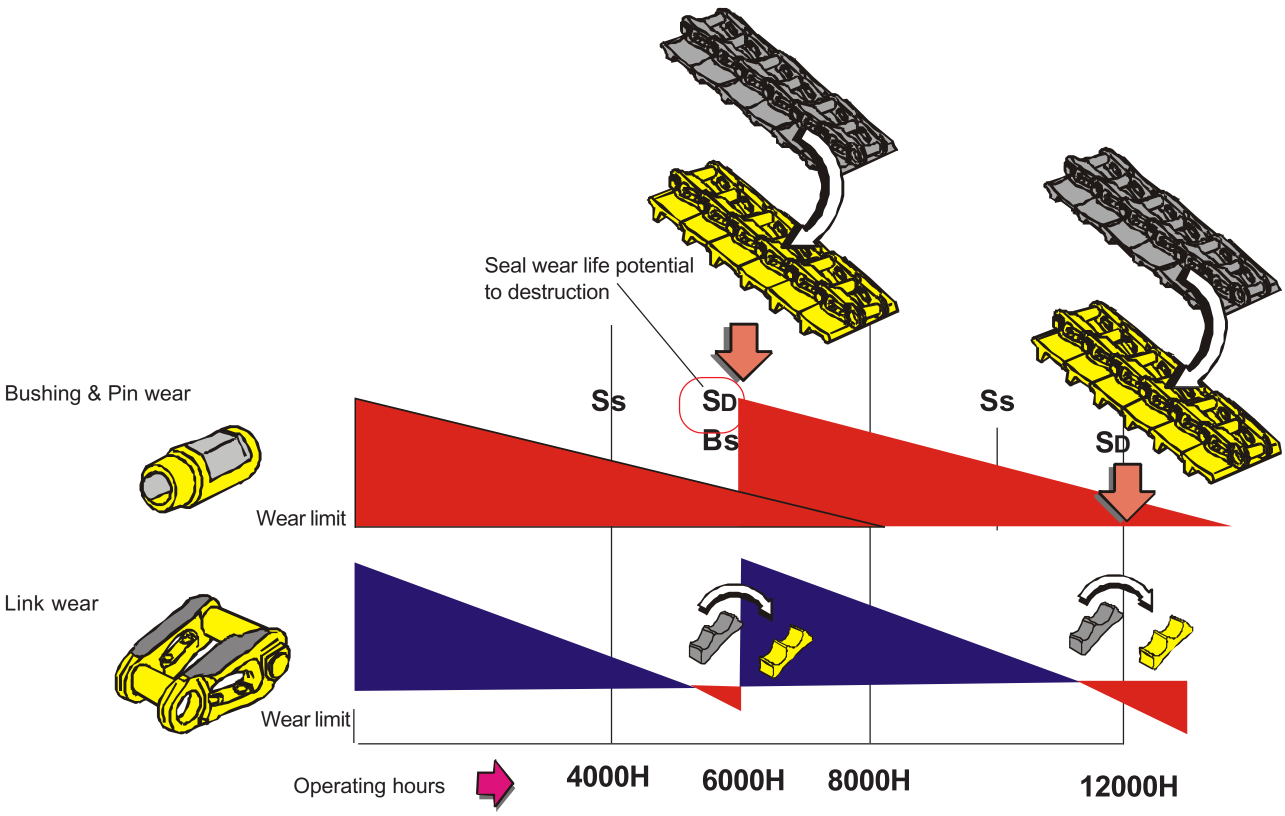
Bushings and Pins should better be turned at 4000 hours when estimated bushing wear life is 4000 hours and Link wear is estimated below 60%. At this time bushing seals and sprocket need to be changed at the same time.

Pattern 2. Bushing wear life: 4000 to 6000 hours



Even if bushing wear life is estimated at 6000 hours, bushings and pins better be turned at 4000 hours which is seal wear life potential to replace, at this time link wear better be 50% and below. After turned bushings and pins with seal replacement, link assembly may be run to destruction at 10000 hours.

Pattern 3. Bushing wear life: 6000 hours and over



This is the cause of run to destruction of shoe assembly.
The link assembly life is determined from amount of link wear even bushing has longer wear life.

R & M comparison (just for reference purpose)

With referring to the sample pattern 1, 2, and 3 described, the R & M cost difference would be as follows. It is not shown actual cost, it just for reference and understanding.

Work	Items	Pattern 1	Pattern 2	Pattern 3	Remarks
		8,000 hours	10,000 hours	12,000 hours	
Shoe assembly removal & installation (1 time)	Parts cost	3,000	3,000	3,000	Sprocket teeth
	Parts cost			40,000	Link assembly
	Labor	800	800	800	
Bushing & Pin turn (1 time)	Parts cost	4,000	4,000		10% of Link assembly
	Labor	1,600	1,600		
Shoe removal & installation (1 time)	Parts cost				
	Labor	240	240	240	
Transport	Cost	200	200	200	
	Total amount	9,840	9,840	44,240	
	Cost per hour	**1.23**	**0.98**	**3.69**	
		(9,840/8,000)	(9,840/10,000)	(44,240/12,000)	

III. Selection Guide

1. Track Selection

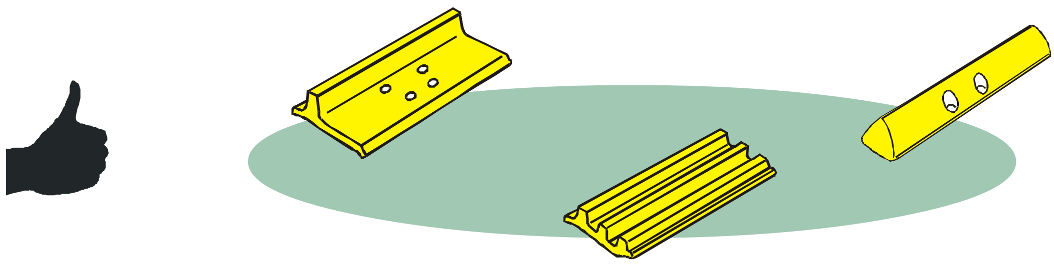
Model	Sealed and Lubricated Track					Grease Sealed Track
	STD	AR	HD	HDAR	Tar sand	STD
D21-7	○					○
D21-8	○					○
D31-20	○					○
D31-21	○					
D37-5	○					○
D37-21	○					
D39-21	○	○				
D41-6	○	○	○	○		
D53-17	○					○
D53-18	○					○
D61-12	○	○				
D61-15	○	○				
D65-12	○	○	○	○		○
D65-15	○	○				
D85-21	○					○
D85-15, 15EO	○					
D155-2	○					○
D155-3	○					○
D155-5, 6	○					○
D275-2	○					
D275-5, 5EO	○					
D355-3	○					○
D355-5	○					○
D375-3	○					
D375-5, 5EO	○					
D475-3	○				○	
D475-5, 5EO	○				○	

2. Shoe Selection

Proper Shoe Selection

Shoe should be selected depending on the user's habits, jobsites condition or the model salesman's recommendation. Sometime, this decision does not reflect machine productivity and the total undercarriage wear and/or life in hours or cost. Connecting machine productivity and undercarriage wear and life performance, it is necessary to analyze the KUC.

For selection, any choice is possible. The proper example is the case based on the low ground pressure (machines with wide shoes) which relatively increases productivity by working in the soft ground.

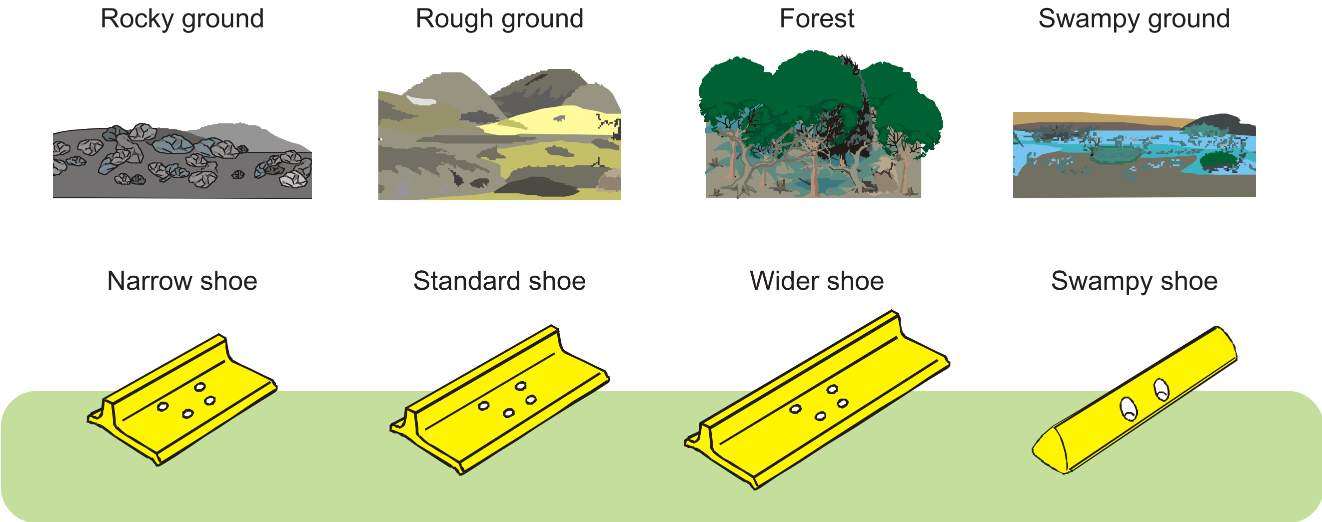


Critical variables that affect undercarriage component life.

Group	Variable	Shoe	Link pitch	Bushing	Sprocket	Track link	Track roller	Idler	Carrier roller
Operation	Machine speed	✔	✔	✔	✔	✔	✔	✔	✔
	Shoe slipping	✔							
	Long distance drawing		✔	✔	✔				
	Traveling on slope					✔	✔		
Maintenance	Track tension		✔	✔	✔	✔	✔	✔	✔
	Packing materials			✔	✔	✔		✔	✔
Ground condition	An element of soil (SiO2)	✔	✔	✔	✔	✔	✔	✔	✔
	Rocky ground (uneven terrain)	✔				✔	✔		
	Soil ground (Splashed soil)		✔	✔	✔				
	Sticky soil ground (Packing materials)					✔	✔	✔	✔

Optimum Shoe Selection Comes from Correct Recognition of Kind of Terrain

Correct shoe selection is not just restricted to the undercarriage. It is one of the most important factors that contributes to high availability and long durability of the structural frames and the machine as a whole. Before starting to operate a machine on a jobsite, check the kind of terrain. Use this information to select the optimum shoes for use on that jobsite.



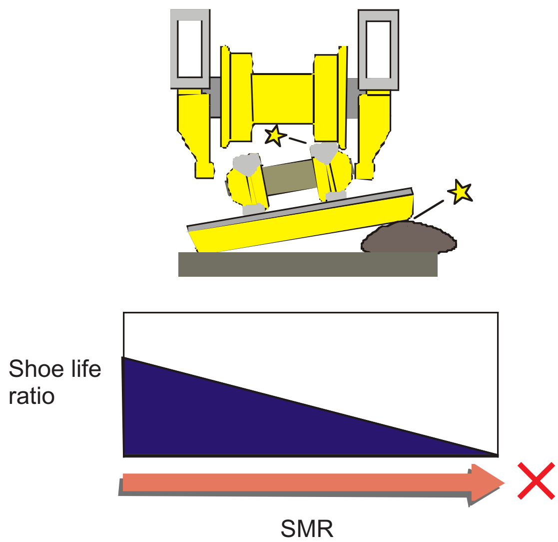
1. **Narrow Shoes on Rough Ground**

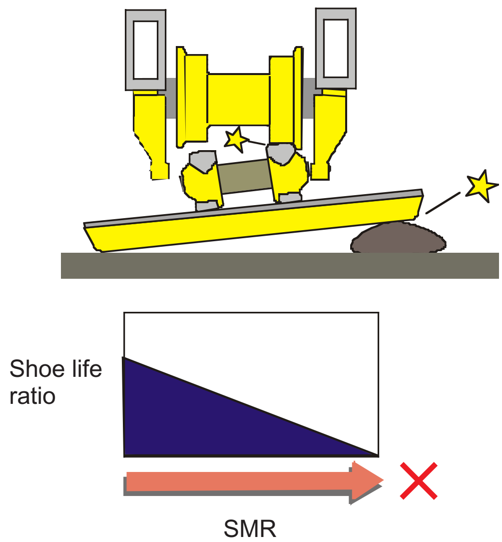
   If a wider shoe than necessary is used, the track will more often ride over rocks and hit obstacles, so the load on the shoe will be increased.

   If the load on the shoe increases, the shoe durability is greatly reduced.

   The load on the shoe is proportional to the distance from the link to the end of the shoe (L in the diagram below), so the wider the shoe is, the greater the load becomes.

   The shoe life is inversely proportional to the 4th power of the shoe load, so on rough ground where the load is always applied to the shoe, if a wide shoe is used, the shoe life will become much shorter than that of a narrow shoe. Load on the shoe can also cause the links to crack, pins to break or come out, and shoe bolts to come loose.

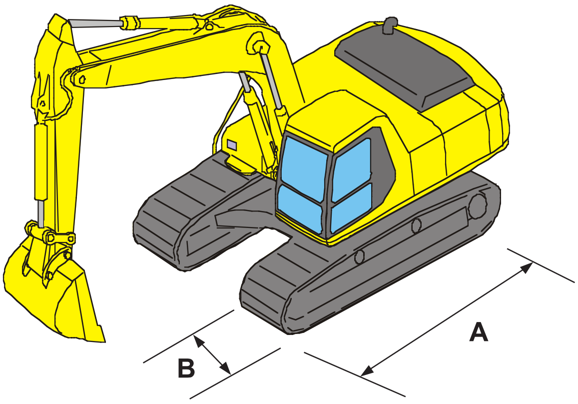




2. Wide Shoes on Soft Ground

Before operating the machines on soft ground, check the ground pressure of the machine.

The ground pressure differs according to the shoe width and it can be calculated using the formula below. The lower the ground pressure, the better the flotation.



Ground pressure (kg/cm^2)

$$= \frac{\text{Machine weight (kg)}}{\text{Length of track on ground (cm) x shoe width (cm) x 2}}$$

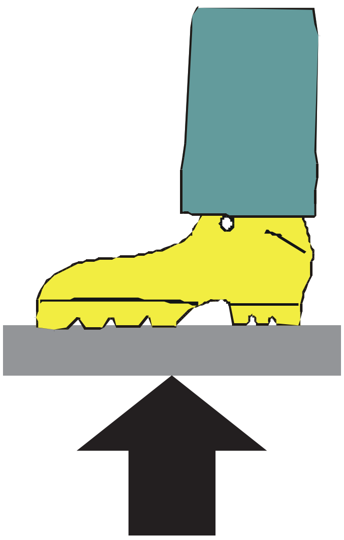
$$= \frac{W}{A \times B \times 2}$$

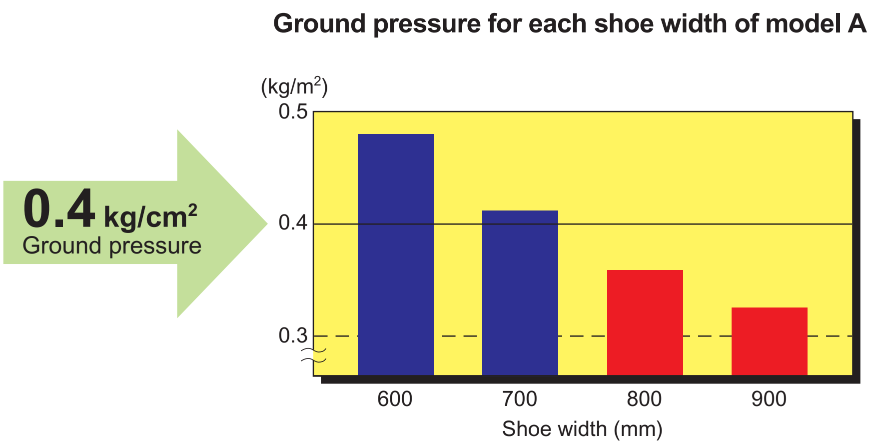
Compare the ground pressure of the machine and the hardness on soft ground to judge the machine trafficability on the jobsite.

The cone index is most widely used to express the hardness on soft ground. But, to estimate the ground hardness, the ground pressure of a man is, used as a handy way of calculating. For example, if a man stands on two feet and doesn't sink, but when he stands on one foot and sinks slightly, it can be taken that a machine with a ground pressure of less than approximately 0.4 kg/cm^2 can travel on that ground. Therefore, model A can travel there with 800 mm shoes or wider without sinking.

However, this is the case for the average ground pressure.

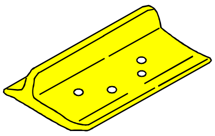
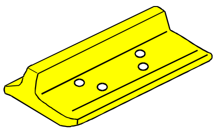
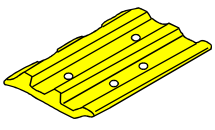
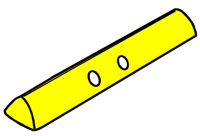
If the center of gravity changes, it may be difficult to guarantee the trafficability.

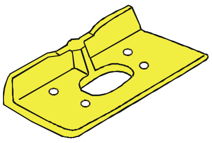
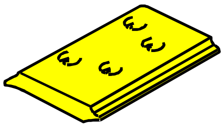
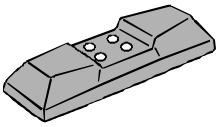
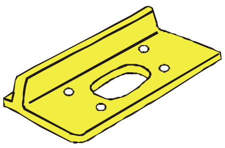




1) Types of Shoe

Applications of different shoes in accordance with soil characteristics and working conditions.

	Type of shoe	Applicable soil and work	Advantage	Disadvantages	Remarks
1	Single grouser shoe 	General soil excluding rocky ground (for bulldozer)	• Because the shape of the grouser is sharp, it easily bites into the ground and provides a large traction force.	• Strength is somewhat reduced on rocky ground, and bending and other damage may occur. • The riding conform is a little inferior to the triple and double grouser shoes. • The road surface is liable to be roughed. • The turning resistance is large.	Is available in various widths to suit the softness of the soil.
2	Heavy duty shoe 	For rocky ground (for bulldozer)	• Compared to a single grouser shoe, the grouser and plate portions of this shoe are thicker and stronger, providing high bending resistance and wear resistance.		
3	• Triple grouser shoe • Double grouser shoe 	Hard ground Suitable for both soft and hard ground (for hydraulic excavator and dozer shovel)	• The three grousers have the same height, hence turning ability is good. • Good riding comfort is obtained as compared with a single grouser shoe. • Rotating resistance is low. • Because three beams are used, resistance to bending is high.	• This shoe does not readily bite into the ground, so the traction force is low.	
4	Swamp shoe 	Swamp areas (for swamp dozer)	• Because the cross-section of this shoe is an arc, the ground contact area is large, and buoyancy is easily obtained. • This shoe is particularly suitable for use in swamp areas and areas with low ground pressure. The ground surface is not damaged when the machine travels over it, so it is suitable for soil compaction and leveling work.	• Unsuitable for ground other than swampy ground. When used off swampy ground, it is liable to bend due to its low strength.	Various widths are available to suit the degree of softness of the swampy ground.

Type of shoe	Applicable soil and work	Advantage	Disadvantages	Remarks
5 Snow shoe 	On snow	• For use on snow • To prevent transverse slip 1. Is provided with rib. 2. Grousers are stepped. • For discharging ice and snow 1. Holes are provided in plate portion. 2. Tail of plate has been eliminated.	• Wear and damage occur rapidly when this shoe is used on general soil and rocky ground.	
6 Flat shoe 	Paved roads Indoor work	• Projections have been eliminated (heads of shoe bolts are recessed), permitting work on paved roads without damaging road surface. • Turning resistance is very low, and tracks are highly wear resistant.	• Because there are no grousers, this shoe does not bite into the ground.	
7 Roadliner (rubber) 	Paved road Indoor work	• The surface of the shoe in contact with the ground is made of rubber, so the machine can travel on paved roads without damaging the road surface. • Prevents noise when machine is traveling.	• Use in the following places will shorten the cutting life of the rubber. (1) Rocky ground (2) Cold areas (below -25°C) (3) Hot areas (above 65°C) • Because there are no grouser, this shoe does not bite into the ground.	
8 Center hole shoe 	Soil which clogs	• There is a hole in the plate to remove any mud or soil. • The sprocket removes any mud or soil collected between the track rails, so clogging of the track is reduced.	• Strength is somewhat reduced on rocky ground, and crack and other damage may occur.	

2) Applicable Shoe on Each Model

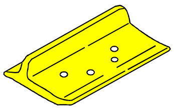
■ Bulldozer

Classification of the applications:

Classification	Applicable terrain	Limitations
A	Rockly terrain, general terrain	These can be used over a wide range of general civil engineering work form crushed rock to preparation of residential land. There is no particular limitation on their use.
B	General or soft terrain	These are used for general earthmoving work where the main work is scraping operations and pushing operations when constructing golf courses, and overburden stripping operations in coal mines. They cannot be used on rocky ground. Be careful to avoid traveling over rocks when carrying out operations on jobsites where there are scattered rocks.
C	Extremely soft terrain (swamps)	These are used on soft ground where B classification shoes would sink. These cannot be used on ground where there are scattered rocks.

Note: Select the proper shoe width for your customers, by taking the limiations described above into consideration, (especially on wide shoes “B” and “C”).
Select the narrowest possible shoes, depending on the flotation and ground pressure of the machines. If the shoe is too wide, the load on the track shoe increases and results in bends in the shoes, cracks in the links, breakage and slipping out of the pins and lossening of the bolts.

Shoe application



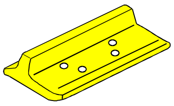
■ Small Model

Model	Shoe type	Shoe width mm (in.)	Classification
D21A-7, 8	Single-grouser	300 (11.8)	A
		340 (13.8)	B
D21P-7, 8	Swamp	510 (20.1)	C
	Single-grouser	510 (20.1)	C
D21PL-7, 8	Swamp	700 (27.6)	C
D31A, E-20	Single-grouser	330 (13.0)	A
		400 (15.7)	B
D31P-20	Single-grouser	400 (15.7)	B
		600 (23.6)	C
	Swamp	600 (23.6)	C
D31EX-21	Single-grouser	400 (15.7)	A
D31PX-21	Single-grouser	400 (15.7)	A
		600 (23.6)	C
	Swamp	600 (23.6)	C
D37E-5	Single-grouser	330 (13.0)	A
		400 (15.7)	B
D37P-5	Single-grouser	400 (15.7)	B
	Swamp	600 (23.6)	C
D37EX-21	Single-grouser	400 (15.7)	A
D37PX-21	Single-grouser	600 (23.6)	B
	Swamp	600 (23.6)	C
D39EX-21	Single-grouser	460 (18.0)	A
		510 (20.1)	C
D39PX-21	Single-grouser	635 (25.0)	B
		700 (27.6)	C
	Swamp	700 (27.6)	C

■ Middle Model

Model	Shoe type	Shoe width mm (in.)	Classification
D41A-6	Single-grouser	406 (16.0)	A
		460 (18.1)	A
D41E-6	Single-grouser	510 (20.1)	A
		560 (22.0)	B
D41P-6	Single-grouser	510 (20.1)	B
		700 (27.6)	C
	Swamp	700 (27.6)	C
D53A-17, 18	Single-grouser	460 (18.1)	A
		510 (20.1)	B
D53P-17, 18	Single-grouser	860 (33.9)	C
	Swamp	860 (33.9)	C
D61EX-12, 15	Single-grouser	600 (23.6)	A
D61PX-12	Single-grouser	600 (23.6)	A
		860 (33.9)	C
	Swamp	860 (33.9)	C
		1100 (43.3)	C
D61PX-15	Single-grouser	860 (33.9)	C
	Swamp	860 (33.9)	C
		1400 (55.1)	C
D65EX-12, 15	Single-grouser	510 (20.1)	A
		560 (22.0)	B
		610 (24.0)	B
		660 (26.0)	C
D65PX-12, 15	Single-grouser	915 (36.0)	C
	Swamp	950 (37.4)	C

Shoe application



■ Large Model

Model	Shoe type	Shoe width mm (in.)	Classifi-cation
D85EX-15, 15EO	Single-grouser	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	C
	Heavy duty	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	C
D85PX-15, 15EO	Single-grouser	910 (35.8)	C
	Swamp	910 (35.8)	C
D85A-21	Single-grouser	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	C
	Heavy duty	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	C
D85E-21	Single-grouser	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	C
	Heavy duty	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	C
D85P-21	Single-grouser	910 (35.8)	C
	Swamp	910 (35.8)	C
D155A-2	Single-grouser	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	B
		710 (28.0)	C
	Heavy duty	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	B
D155A, AX-3	Single-grouser	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	B
		710 (28.0)	C
	Heavy duty	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	B
D155A, AX-5, 6	Single-grouser	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	B
		710 (28.0)	C
	Heavy duty	560 (22.0)	A
		610 (24.0)	B
		660 (26.0)	B

■ Large Model

Model	Shoe type	Shoe width mm (in.)	Classifi-cation
D275A-2	Heavy duty	610 (24.0)	A
		710 (28.0)	B
		760 (29.9)	C
D275A, AX-5, 5EO	Heavy duty	610 (24.0)	A
		710 (28.0)	B
		760 (29.9)	C
D355A-3, 5	Heavy duty	610 (24.0)	A
		710 (28.0)	B
		760 (29.9)	A
D375A-3	Heavy duty	610 (24.0)	A, B
		710 (28.0)	B
		810 (31.9)	C
D375A -5, 5EO	Heavy duty	610 (24.0)	A, B
		710 (28.0)	B
		810 (31.9)	C
D475A-3 D475A-5, 5EO	Heavy duty	710 (28.0)	A
		810 (31.9)	B
		910 (35.8)	C
D475A-3, 5 SUPER DOZER	Heavy duty	810 (31.9)	A, B
		910 (35.8)	D
D575A-2	Heavy duty	760 (29.9)	A
		810 (31.9)	B
		860 (33.9)	B
		910 (35.8)	C
D575A-2 SUPER DOZER	Heavy duty	860 (33.9)	B
		910 (35.8)	C
D575A-3 SUPER DOZER	Heavy duty	860 (33.9)	A, B
		910 (35.8)	B

■ Excavators/Front loaders

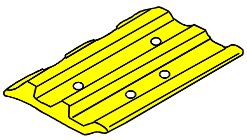
Classification of the applications:

Classification	Applicable terrain	Limitations
A	Rocky terrain, river banks, & general terrain	1. Use low shift for traveling over harsh terrain with various obstacles such as rolling stones and fallen trees.
B	General or soft terrain	1. Not applicable for traveling over harsh terrain with rolling stones and fallen trees. 2. Travel in high shift only on flat ground; use half speed in low shift for going over the obstacles, if they are unavoidable.
C	Extremely soft terrain (swamps)	1. Applicable only when “A” & “B” sink. 2. Not applicable for traveling over harsh terrain with rolling stones and fallen trees. 3. Travel in high shift only on flat terrain; use half speed in low shift for going over the obstacles if they are unavoidable.
D	Paved road	1. Rubber pad shoes must be used mainly in machine operation on paved road surfaces. If used on unpaved surfaces, shoe durability will be badly deteriorated due to rubber cracks, cutouts, etc. The following operations must be avoided. (a) Work on broken concrete, gravel, etc. (b) Work on sharp projections like reinforcing iron rods, glass, etc. (c) Riding on concrete road shoulder, operation on bedrock and in rivers with abundance of stones, pebbles, etc. 2. In operation on roads covered with water, ice, snow, gravel etc. be careful to avoid the shoes slipping, especially in carrying or unloading operation of a machine on or from a truck. 3. In operation at high temperature (65°C or higher) or at low temp. (-25°C or lower), the rubber will be liable to damages because of the changes in the physical properties.

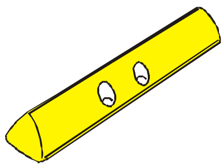
Note: Select the narrowest possible shoes, depending on the flotation and ground pressure of the machines. If the shoe is too wide, the load on the track shoe increases and results in bends in the shoes, cracks in the links, breakage and slipping out of the pins and loosening of the bolts.

■ Shoe type

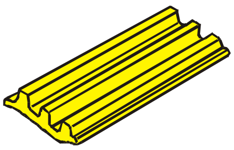
- Double-grouser



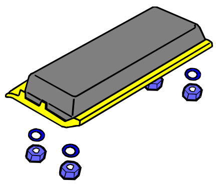
- Swamp



- Triple-grouser



- Rubber pad



Shoe application

■ Small Model

Model	Shoe type	Shoe width mm (in.)	Classifi-cation
PC60-7	Triple-grouser	450 (17.7")	A
		600 (23.6")	B
	Swamp	700 (27.6")	C
PC78US-6	Triple-grouser	450 (17.7")	A
		600 (23.6")	B
PC100-6	Triple-grouser	500 (19.7")	A
		600 (23.6")	B
		700 (27.6")	C
	Swamp	750 (29.5")	C
	Rubber pad	500 (19.7")	D
PC120-6	Triple-grouser	500 (19.7")	A
		600 (23.6")	B
		700 (27.6")	C
		750 (29.5")	C
	Swamp	750 (29.5")	C
	Rubber pad	500 (19.7")	D
PC130-6	Triple-grouser	500 (19.7")	A
	Rubber pad	500 (19.7")	D
PC150-5	Triple-grouser	500 (19.7")	A
		600 (23.6")	B
		700 (27.6")	C
PC150HD-5	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
		900 (35.4")	C
PC150NHD-5	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
PC150SE-5	Triple-grouser	500 (19.7")	A
		700 (27.6")	B
		720 (28.4")	C
	Swamp	800 (31.5")	C
PC158US-2	Triple-grouser	550 (21.6")	A
		700 (27.6")	B
PC180LC-5	Triple-grouser	800 (31.5")	C
		600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
		900 (35.4")	C
PC180LLC-5	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
		900 (35.4")	C
PC180NLC-5	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C

■ Middle Model

Model	Shoe type	Shoe width mm (in.)	Classifi-cation
PC200-6	Triple-grouser	500 (19.7")	A
PC200-7		600 (23.6")	A
PC200-8		700 (27.6")	B
		800 (31.5")	C
	Swamp	860 (33.9")	C
	Rubber pad	600 (23.6")	D
PC210-6	Triple-grouser	500 (19.7")	A
		600 (23.6")	A
PC210-7/8	Triple-grouser	600 (23.6")	A
PC200-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
PC200LC-6	Triple-grouser	600 (23.6")	A
PC200LC-7		700 (27.6")	B
PC200LC-8		800 (31.5")	C
		900 (35.4")	C
	Swamp	860 (33.9")	C
	Rubber pad	600 (23.6")	D
PC200LC-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
		900 (35.4")	C
PC210LC-6	Triple-grouser	600 (23.6")	A
PC210LC-7/8			
PC220-6	Triple-grouser	500 (19.7")	A
PC220-7		*600 (23.6")	A
PC220-8		700 (27.6")	B
		800 (31.5")	C
PC228US	Triple-grouser	600 (23.6")	A
PC228USLC-3		700 (27.6")	B
		800 (31.5")	C
	Swamp	860 (33.9")	C
PC220LC-6	Triple-grouser	600 (23.6")	A
PC220LC-7		700 (27.6")	B
PC220LC-8		800 (31.5")	C
PC230-6	Triple-grouser	600 (23.6")	A
PC230LC-6			
PC250LC-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
PC300-5	Triple-grouser	500 (19.7")	A
		600 (23.6")	A
		700 (27.6")	B
		750 (29.5")	B
		800 (31.5")	C
		850 (33.5")	C

Standard shoe

For North America

■ Middle Model

Model	Shoe type	Shoe width mm (in.)	Classifi-cation
PC300-6 PC300LC-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
PC300-7 PC300LC-7, 7EO	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
PC350-6 PC350LC-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
PC350-7 PC350LC-7, 7EO	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
PC400-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
PC400LC-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
		900 (35.4")	C
PC400-7, 7EO	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
PC400LC-7, 7EO	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
		900 (35.4")	C
PC450-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
		800 (31.5")	C
PC450LC-6	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
PC450-7, 7EO	Triple-grouser	600 (23.6")	A
		700 (27.6")	B
PC450LC-7, 7EO	Triple-grouser	600 (23.6")	A
		700 (27.6")	B

Standard shoe

■ Large Model

Model	Shoe type	Shoe width mm (in.)	Classifi-cation
PC600-6	Triple-grouser	600 (23.6")	A
		750 (29.5")	B
PC600LC-6	Triple-grouser	600 (23.6")	A
		750 (29.5")	B
PC600-8	Triple-grouser	600 (23.6")	A
		750 (29.5")	B
PC600LC-8	Triple-grouser	600 (23.6")	A
		750 (29.5")	B
PC750-6, 7	Double-grouser	610 (24.0")	A
		710 (28.0")	A
		810 (31.9")	B
		910 (35.8")	B
PC800-8	Double-grouser	610 (24.0")	A
		710 (28.0")	A
		810 (31.9")	B
		910 (35.8")	B
PC750SE-6	Double-grouser	610 (24.0")	A
		710 (28.0")	A
		810 (31.9")	B
		910 (35.8")	B
		1010 (39.8")	C
PC750LC-6, 7	Double-grouser	610 (24.0")	A
		710 (28.0")	A
		810 (31.9")	B
		910 (35.8")	B
		1010 (39.8")	C
		1100 (43.7")	C
PC800LC-8	Double-grouser	810 (31.9")	B
		1010 (39.8")	C
		1100 (43.7")	C
PC800-6, 7	Double-grouser	610 (24.0")	A
		710 (28.0")	A
PC850-8	Double-grouser	610 (24.0")	A
		710 (28.0")	A
PC800SE-6	Double-grouser	610 (24.0")	A
		710 (28.0")	A
PC1000-1	Double-grouser	710 (28.0")	A
		910 (35.8")	B
		1010 (39.8")	C
PC1000LC-1	Double-grouser	1010 (39.8")	C
		1210 (47.6")	C
PC1000SE-1	Double-grouser	710 (28.0")	A
PC1100-6	Double-grouser	700 (27.6")	A
		1000 (39.4")	B
PC1100SP-6	Double-grouser	700 (27.6")	A
PC1100LC-6	Double-grouser	1000 (39.4")	B
		1200 (47.2")	C

■ Large Model

Model	Shoe type	Shoe width mm (in.)	Classification
PC1250-7, 8	Double-grouser	700 (27.6")	A
		1000 (39.4")	B
PC1250LC-7,8	Double-grouser	1000 (39.4")	B
		1200 (47.2")	C
PC1600SE-1 PC1800-6	Double-grouser	810 (31.8")	A, B
		1010 (39.8")	C
PC2000-8			

Standard shoe (highlighted)

3) Practical Idea for Shoe Width Selection on D475A

Proper shoe selection to meet with job-site and application is very important to achieve best machine performance and longer undercarriage life. We recommend that you refer to KUC Procedure Manual for proper shoe (type & width) selection, as a general guideline. In addition to that, following is very useful suggestion which we got from Bulldozer Specialist based on his long experience in field. So we introduce it as a sample on D475A together with various photos of job-site and application.

1. STD shoe width for D475A is 710mm. Then 810 mm and 910 mm Shoe are optionally available. In case of D475A Super Dozer, STD shoe width is 810 mm.

2. Consideration points on proper shoe width selection are as follows.
   1) As a general rule, if there are rocks on working ground, STD 710 mm shoe is recommendable. In this case, working with Semi-U Blade is normal combination.
   2) If there is no rock, flat ground condition and long dozing application, 810 mm shoe is recommendable. In this case, working with Full-U Blade is better combination for effective operation.
   3) As a general rule, if machine is equipped with Full U-Blade, working with 810 mm or 910 mm shoe is normal combination. But if there are rocks on job-site, working with STD 710 mm shoe is recommendable even machine is equipped with Full-U Blade.
   4) For downhill or uphill dozing on normal (less rock) ground, gripping force on the ground by shoe is required for effective operation. In such a case, 910 mm shoe is recommendable.
   5) Wider shoe is for soft terrain. We also recommend that you use “shoe with hole” in order to prevent mud or coal from packing.

3. Note for “shoe with hole”
   1) Various shoes with hole are available from Komatsu. Please refer to UC Sales Guide “UCSG06-003” for that. It shows P/N of available shoe with hole on each model.
   2) Even your required size of shoe with hole is currently not available from Komatsu, we can prepare those. So please contact with Komatsu.
   3) Needless to say but we can install shoe with hole on new machine at our assembly line and deliver to you. So please work together closely with your sales people at ordering of the machine.

- **Example of jobsites (pictures)**
  - Job Site “A”
  - Job Site “B”
  - Job Site “C”
  - Job Site “D”
  - Job Site “E”
  - Job Site “F”
  - Job Site “G”
  - Job Site “H”

Job Site "A"

D475A-5 Dual tilt

Full U Blade

Shoe width: 810 mm

- No-Rock
- Flat
- Long Dozing

Job Site "B"

D475A-5 Super dozer 1 unit
D475A-5 Dual tilt 1 unit

Full U Blade

Shoe width: 810 mm

- No-Rock
- Long Dozing

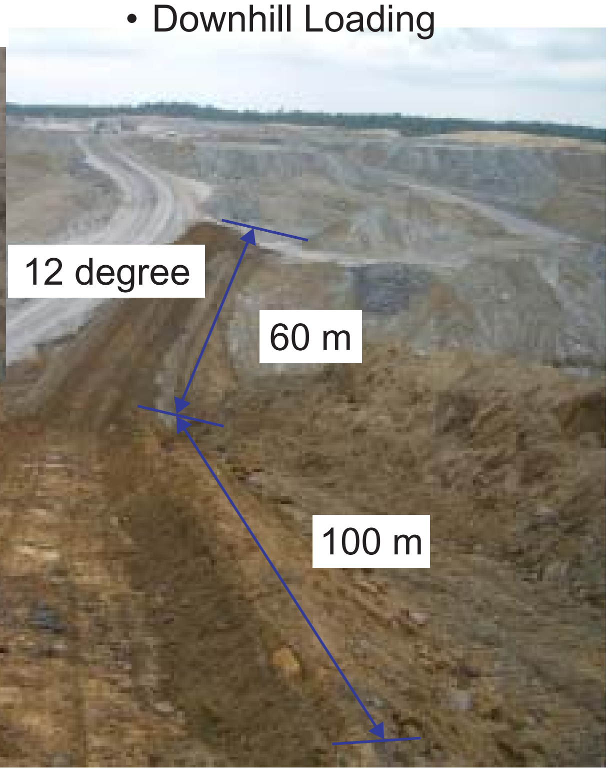
Full U Blade

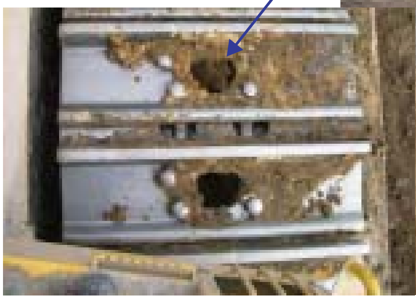
D475A-5 Dual tilt

Full U Blade

Job Site “E”

- No-Rock
- Downhill Loading





Job Site “F”

Job Site “G”

Shoe width: 910 mm

Job Site “H”

- Rocky Area

Shoe width: 710 mm (STD)

Semi U blade: 27.2 m^3

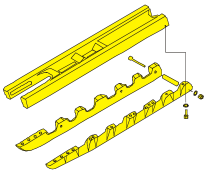
3. Track Roller Guard Selection

■ Bulldozer

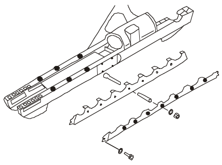
- **Small-middle Class**

Full roller guard

Integral structure full roller guard

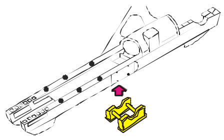


3-part split type full roller guard

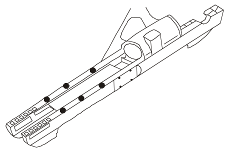


Not full roller guard

Center and end section track guard



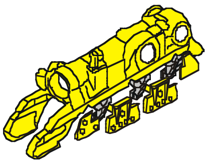
End section track guard



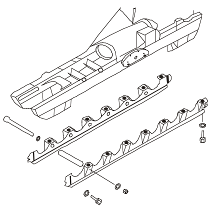
- **Large Class**

Full roller guard

Bogie full roller guard

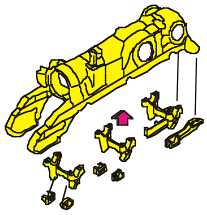


Split type full roller guard

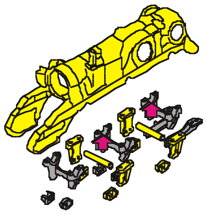


Not full roller guard

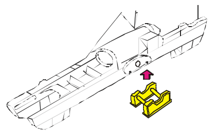
Bogie roller guard



Add-on full roller guard



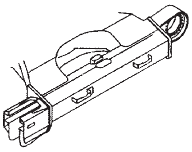
Center end section track guard



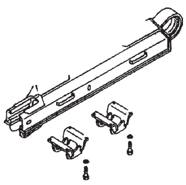
■ Hydraulic Excavator

1. When using hydraulic excavator, it is necessary to make most appropriate choices of the track roller guards fitting to respective working environments. Given below are the criterion for the choices.
2. Although track roller choices have so far been made according to the natural environmental conditions under the SAR (special specifications for specific environmental condition), this chart provides clearer criterion for the choices in consideration of respective functions of different types of track roller guards.

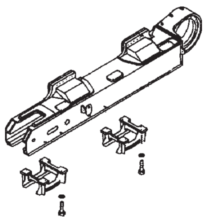
Without roller guard



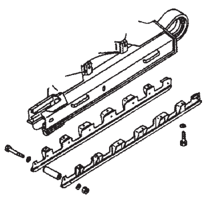
Center roller guard



Center and final roller guard



Full roller guard

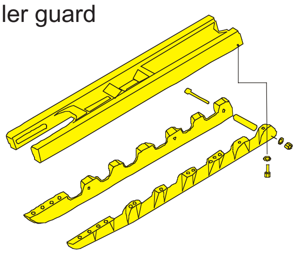
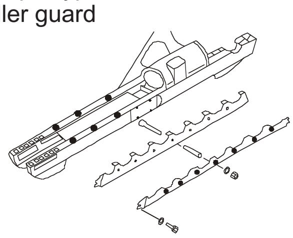


Bulldozer

■ Small-middle Class

1. When using bulldozers, it is necessary to make most appropriate choices of the track roller guards fitting to respective working environments. Given below are the criterion for the choices.
2. Although track roller choices have so far been made according to the natural environmental conditions under the SAR (special specifications for specific environmental condition), this chart provides clearer criterion for the choices in consideration of respective functions of different types of track roller guards.

■ The part is presently available and applicable for use.
(STD : Standard spec.)

Types	Full roller guard									
	Integral structure full roller guard 					3-part split type full roller guard  Local add-on type				
Applicable models	A	E	P	PL	PLL	A	E	P	PL	PLL
D20-7	■		■	■						
D21-7	■		■	■						
D31-20	■	■	■	■		■	■	■	■	■
D37-5	■	■	■			■	■	■		
D39-21	■	■	■			■	■	■		
D41-5, 3						■	■	■		
D41-6						■	■	■		
D50-18								■		
D53-18, 17						STD		■		
D58-1							STD	■		
D60-12								■		
D61-12							■	■		
D65-12							E EX	P PX		

Determination criterion for different working environments

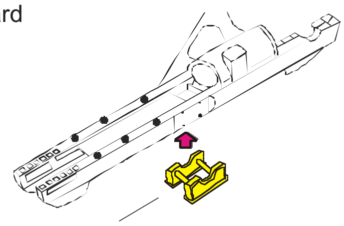
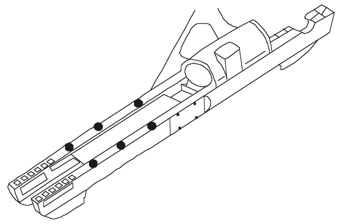
Rocks and soil containing boulders and gravel (A and E)	The part is effective for prevention of catching pebbles.
Sand and sandy soil (A, E and P)	The part is effective for prevention of pitch squeaking.
Claycy soil (P and PL)	Be careful when using this part since the soil sets when dried. (Note 1)
Swamp (PL and PLL)	The part is effective for prevention of snaking of the track. (Prevents side sliding of the track shoes.) (Note 1) The part is effective for prevention of disengagement of the track shoes.
Slopes	The part is effective for prevention of disengagement of the track shoes. (Prevents side-sliding of the track shoes.)

(Note 1) Although soil and sand tend to enter less, once they enter, they may not be easily discharged depending on the type of soil, so make the choice in consideration of past experience with machines having been used in the subject area and of the working environments of the machine.

■ Small-middle Class

1. When using bulldozers, it is necessary to make most appropriate choices of the track roller guards fitting to respective working environments. Given below are the criterion for the choices.
2. Although track roller choices have so far been made according to the natural environmental conditions under the SAR (special specifications for specific environmental condition), this chart provides clearer criterion for the choices in consideration of respective functions of different types of track roller guards.

■ The part is presently available and applicable for use.
(STD : Standard spec.)

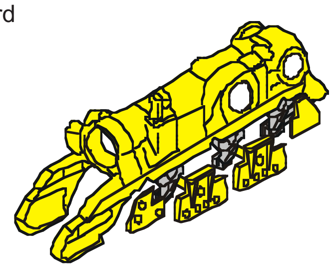
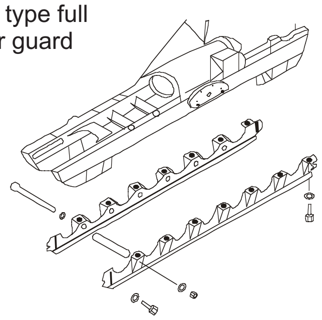
Types	Center and end section track guard  Short length guard for installation at the center section					End section track guard 				
Applicable models	A	E	P	PL	PLL	A	E	P	PL	PLL
D20-7					■	STD		STD	STD	STD
D21-7						STD		STD	STD	
D31-20						STD	STD	STD	STD	STD
D37-5						STD	STD	STD		
D39-21		■	■				STD	STD		
D41-5, 3	■	■	■			STD	STD	STD		
D41-6		STD	STD			STD				
D50-18			STD					■		
D53-18, 17			STD			■		■		
D58-1			STD				■	■		
D60-12			STD							
D61-12			STD P PX				STD			
D65-12		E EX	STD P PX				STD E EX			

Determination criterion for different working environments	Center and end section track guard	End section track guard
Rocks and soil containing boulders and gravel (A and E)	The part is not suitable	The part is not suitable
Sand and sandy soil (A, E and P)	No noticeable difference from use of the end-section only track guard	Although sand and soil tend to enter more, they can be easily discharged and this part is being employed.
Claycy soil (P and PL)	The part is effective for prevention of disengagement or side-sliding of the track shoes	
Swamp (PL and PLL)		
Slopes	The part is not suitable	The part is not suitable

■ Large Class

1. When using bulldozers, it is necessary to make most appropriate choices of the track roller guards fitting to respective working environments. Given below are the criterion for the choices.
2. Although track roller choices have so far been made according to the natural environmental conditions under the SAR (special specifications for specific environmental condition), this chart provides clearer criterion for the choices in consideration of respective functions of different types of track roller guards.

■ The part is presently available and applicable for use.
(STD : Standard spec.)

Types	Full roller guard					
	Bogie full roller guard 			Split type full roller guard 		
Applicable models	A	E	P	A	E	P
D85-21				STD	STD	■
D85-21B						
D155-2				STD		
D155-3	■					
D155-5						
D275-2				STD		
D375-3						
D475-3						
D575-2	■					
D575-2 Super						

Determination criterion for different working environments

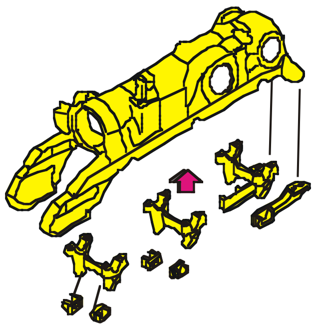
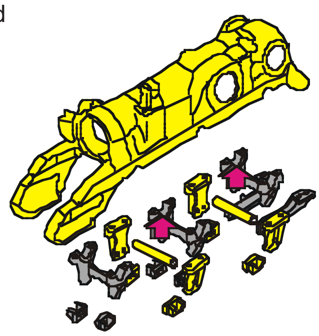
Rocks and soil containing boulders and gravel (A and E)	The part is effective for prevention of catching pebbles.
Sand and sandy soil (A, E and P)	The part is effective for prevention of pitch squeaking.
Clayey soil (A, E and P)	Be careful when using this part since the soil sets when dried. (Note 1)
Slopes	The part is effective for prevention of disengagement of the track shoes. (Prevents side-sliding of the track shoes.)

(Note 1) Although soil and sand tend to enter less, once they enter, they may not be easily discharged depending on the type of soil, so make the choice in consideration of past experience with machines having been used in the subject area and of the working environments of the machine.

■ Large Class

1. When using bulldozers, it is necessary to make most appropriate choices of the track roller guards fitting to respective working environments. Given below are the criterion for the choices.
2. Although track roller choices have so far been made according to the natural environmental conditions under the SAR (special specifications for specific environmental condition), this chart provides clearer criterion for the choices in consideration of respective functions of different types of track roller guards.

(green) The part is presently available and applicable for use.
(STD : Standard spec.)

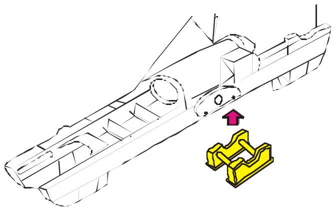
Types		Bogie roller guard 			Add-on full roller guard 		
Applicable models		A	E	P	A	E	P
	D85-21						
	D85-21B						
	D155-2						
	D155-3	STD					
	D155-5	STD			OPTION		
	D275-5	STD			OPTION		
	D375-3, -5	STD			OPTION		
	D475-3	STD					
	D575-2	STD					
	D575-2 Super	STD					

Determination criterion for different working environments		Bogie roller guard	Add-on full roller guard
	Rocks and soil containing boulders and gravel (A and E)	Although sand and soil tend to enter more, they can be easily discharged and this part is being employed.	The part prevents stones from entering between rollers on the rocky soil
	Sand and sandy soil (A, E and P)	The part is effective for prevention of disengagement or side-sliding of the track shoes.	
	Clayey soil (A, E and P)		
	Slopes	The part is not suitable	

■ Large Class

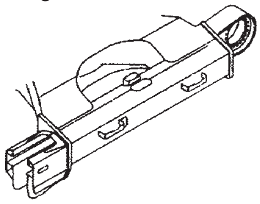
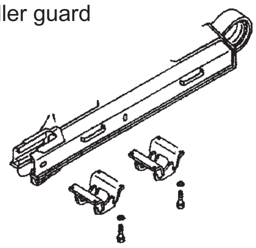
1. When using bulldozers, it is necessary to make most appropriate choices of the track roller guards fitting to respective working environments. Given below are the criterion for the choices.
2. Although track roller choices have so far been made according to the natural environmental conditions under the SAR (special specifications for specific environmental condition), this chart provides clearer criterion for the choices in consideration of respective functions of different types of track roller guards.

The part is presently available and applicable for use.
(STD : Standard spec.)

<table>
<tr><td colspan="2">Type</td><td colspan="3">Center end section
track guard
</td></tr>
<tr><td colspan="2">Applicable models</td><td>A</td><td>E</td><td>P</td></tr>
<tr><td></td><td>D85-21</td><td></td><td></td><td></td></tr>
<tr><td></td><td>D85-21B</td><td>STD</td><td></td><td></td></tr>
<tr><td></td><td>D155-2</td><td></td><td></td><td></td></tr>
<tr><td></td><td>D155-3</td><td></td><td></td><td></td></tr>
<tr><td></td><td>D155-5</td><td></td><td></td><td></td></tr>
<tr><td></td><td>D275-2</td><td></td><td></td><td></td></tr>
<tr><td></td><td>D375-3</td><td></td><td></td><td></td></tr>
<tr><td></td><td>D475-3</td><td></td><td></td><td></td></tr>
<tr><td></td><td>D575-2</td><td></td><td></td><td></td></tr>
<tr><td></td><td>D575-2 Super</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Determination criterion for
different working environments</td></tr>
<tr><td></td><td>Soil containing boulders and gravel (A andm E)</td><td colspan="3">The part is not suitable</td></tr>
<tr><td></td><td>Sand and sandy soil (A, E andm P)</td><td colspan="3" rowspan="2">Although sand and soil tend to enter more, they can be easily discharged and this part is being employed.
The part is effective for prevention of disengagement or side-sliding of the track shoes.</td></tr>
<tr><td></td><td>Clayey soil (A, E and P)</td></tr>
<tr><td></td><td>Slopes</td><td colspan="3">The part is not suitable</td></tr>
</table>

Hydraulic Excavator

The part is presently available and applicable for use.
(STD: Standard spec. OPT: Optional spec.)

Types	Without roller guard 		Center roller guard 	
Appicable models	Std.	Z	Std,	Z
PC60-7	STD		OPT	
PC70-7	STD		OPT	
PC75UU-3	STD			
PC78US-5	STD			
PC78US-6	STD		OPT	
PC78UU-6	STD			
PC100-6	STD		OPT	
PC100L-6			STD	
PC120-6	STD	STD	OPT	OPT
PC128US-2	STD		OPT	
PC128UU-2	STD		OPT	
PC130-6	STD		OPT	
PC138US-2	STD		OPT	
PC150-5			STD	
PC200-6			STD	STD
PC200LC-6			STD	STD
PC210-6			STD	
PC210LC-6			STD	
PC220-6			STD	STD
PC220LC-6			STD	STD
PC230-6			STD	
PC230LC-6			STD	
PC300-6			STD	STD
PC300LC-6			STD	STD
PC350-6			STD	
PC350LC-6			STD	
PC400-6			STD	STD
PC400LC-6			STD	STD
PC450-6			STD	
PC450LC-6			STD	
PC600-6			STD	
PC600LC-6			STD	
PC650-5			STD	
PC650LC-5			STD	
PC650SE-5				

Determination criterion for different working environments

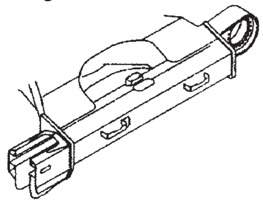
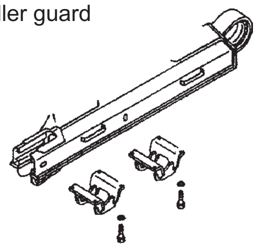
	Without roller guard	Center roller guard
Soil containing boulders and gravel	The part is not suitable.	Although sand and soil tend to enter more, they can be easily discharged and this part is being employed.
Sand and sandy soil	Although sand and soil tend to enter more, they can be easily discharged and this part is being employed.	
Clayey soil		
Slopes	The part is not suitable.	The part is effective for prevention of disen-gagement or side-sliding of the track shoes.

Z: Excel

(to be continued)

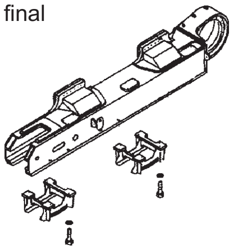
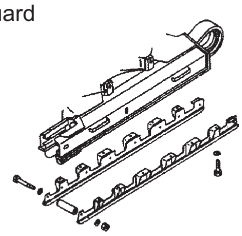
Hydraulic Excavator

The part is presently available and applicable for use.
(STD: Standard spec. OPT: Optional spec.)

Types	Without roller guard 		Center roller guard 	
Appicable models	Std.	Z	Std,	Z
PC710-5				
PC710SE-5				
PC750-6			STD	
PC750LC-6			STD	
PC800-6				
PC1000-1				
PC1000LC-1				
PC1000SE-1				
PC1000SP-1				
PC1100-6			STD	
PC1100LC-6			STD	
PC1600-1				
PC1800-6			STD	
Determination criterion for different working environments				
Soil containing boulders and gravel	The part is not suitable.		Although sand and soil tend to enter more, they can be easily discharged and this part is being employed.	
Sand and sandy soil	Although sand and soil tend to enter more, they can be easily discharged and this part is being employed.			
Clayey soil				
Slopes	The part is not suitable.		The part is effective for prevention of disengagement or side-sliding of the track shoes.	

Z: Excel

The part is presently available and applicable for use.
(STD: Standard spec. OPT: Optional spec.)

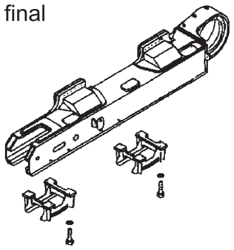
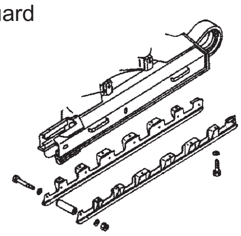
Types	Center and final roller guard 		Full roller guard 	
Appicable models	Std.	Z	Std.	Z
PC100-6				
PC100L-6				
PC120-6				
PC130-6				
PC150-5				
PC200-6			OPT	OPT
PC200LC-6			OPT	OPT
PC210-6			OPT	
PC210LC-6			OPT	
PC220-6			OPT	OPT
PC220LC-6			OPT	OPT
PC230-6			OPT	OPT
PC230LC-6			OPT	OPT
PC300-6			OPT	OPT
PC300LC-6			OPT	OPT
PC350-6			STD	
PC350LC-6			STD	
PC400-6			OPT	OPT
PC400LC-6			OPT	OPT
PC450-6			STD	
PC450LC-6			STD	
PC600-6				
PC600LC-6				
PC650-5				
PC650LC-5				
PC650SE-5				
PC710-5			STD	
PC710SE-5			STD	
PC750-6	OPT		OPT	
PC750LC-6	OPT		OPT	
PC800-6			STD	
Determination criterion for different working environments				
Soil containing boulders and gravel	The part is effective for prevention of snaking of the track. (Prevents side-sliding of the track shoes.) (Note 1) The part is effective for prevention of disengagement of the track shoes.		The part is effective for prevention of catching pebbles.	
Sand and sandy soil			The part is effective for prevention of pitch squeaking.	
Clayey soil			Be careful when using this part since the soil sets when dried. (Note 1)	
Slopes	The part is effective for prevention of disengagement or side-sliding of the track shoes.		The part is effective for prevention of disengagement of the track shoes. (Prevents side-sliding of the track shoes.)	

Z: Excel

(Note 1) Although soil and sand tend to enter less, once they enter, they may not be easily discharged depending on the type of soil, so make the choice in consideration of past experience with machines having been used in the subject area and of the working environments of the machine.

(to be continued)

The part is presently available and applicable for use.
(STD: Standard spec. OPT: Optional spec.)

Types	Center and final roller guard 		Full roller guard 	
Appicable models	Std.	Z	Std.	Z
PC1000-1				
PC1000LC-1				
PC1000SE-1				
PC1000SP-1				
PC1100-6	OPT		OPT	
PC1100LC-6	OPT			
PC1600-1	STD			
PC1800-6	STD		OPT	
Determination criterion for different working environments				
Soil containing boulders and gravel	The part is effective for prevention of snaking of the track. (Prevents side-sliding of the track shoes.) (Note 1) The part is effective for prevention of disengagement of the track shoes.		The part is effective for prevention of catching pebbles.	
Sand and sandy soil			The part is effective for prevention of pitch squeaking.	
Clayey soil			Be careful when using this part since the soil sets when dried. (Note 1)	
Slopes	The part is effective for prevention of disengagement or side-sliding of the track shoes.		The part is effective for prevention of disengagement of the track shoes. (Prevents side-sliding of the track shoes.)	

Z: Excel

(Note 1) Although soil and sand tend to enter less, once they enter, they may not be easily discharged depending on the type of soil, so make the choice in consideration of past experience with machines having been used in the subject area and of the working environments of the machine.

4. Hints for Field Action

1) Wear Criteria on the Soft Ground

Only on the sandy terrain where the impact load is scarcely applied, in order to prolong the wear life, the wear criteria of the bushing and the sprocket are changed into special value.
In addition, in order to minimize the sand entry to the sprocket engaging portion, sometime sand entry prevention cover is effective.

Portion	Contents
Bushing	Increased criteria (Part dimensions are not changed.)
Sprocket	Increased criteria (Part dimensions are not changed.)

Note) If the peculiar wear occurs on the undercarriage, in order to consider the improvement countermeasure, please send the wear dimension information.

2) Soil Packing

Phenomena

If the soil is sticky, the wear of each portion of the undercarriage is accelerated. The soil accumulated on the track frame accelerates the wear on the tread surfaces of the carrier roller and the link. In addition, because the soil drops into the idler portion, the wear of the tread surface on the idler and the link is accelerated. And, because the soil drops into the sprocket, the wear of the sprocket teeth profile and the bushing are accelerated. The soil wound into the track frame accelerates the wear of the tread surface on the track roller and the link.
The remarkable soil clogging into the link portion causes for the shoe jumping.

Action

Remove the soil daily.
As for the prevention of the soil entry, the installation of the covers is recommended. (In case of the vicious soil, this may cause the bad effect.)
In order to reduce the soil clogging into the link portion, it is recommended that the hole at the shoe center for releasing the soil is produced.

3) Skid Guard

Phenomena

Wide shoes may be installed on the hydraulic excavator used by the forestry. When the ends of shoes ride on the stubble or the boulders, the life of each portion of the undercarriage is shortened.
(Shoe bend, shoe bolt breakage, track pin breakage, removal of track pin or bushing, etc)
As the shoe width is wider, the life reduction is larger.

Action

As the method for lessening the life reduction, it is recommended that the skid guard is installed.
Because the load is supported by the whole shoes, the load concentration to the one piece of shoe can be avoided.