# SECTION 6 MAINTENANCE STANDARD

# SECTION 6 MAINTENANCE STANDARD

## GROUP 1 OPERATIONAL PERFORMANCE TEST

### 1. PURPOSE

Performance tests are used to check:

#### 1) OPERATIONAL PERFORMANCE OF A NEW MACHINE

Whenever a new machine is delivered in parts and reassembled at a customer's site, it must be tested to confirm that the operational performance of the machine meets Hyundai spec.

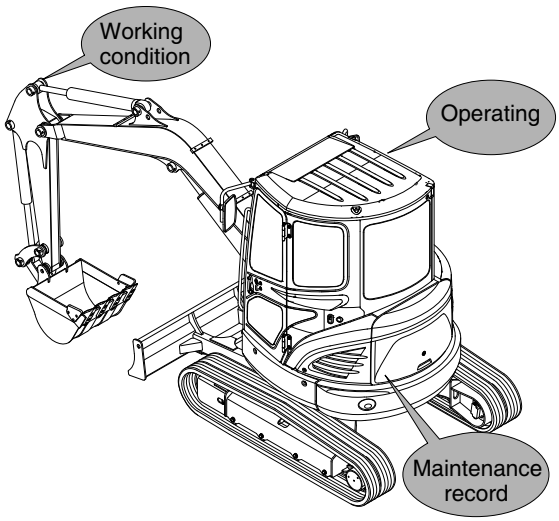
#### 2) OPERATIONAL PERFORMANCE OF A WORKING MACHINE

With the passage of time, the machine's operational performance deteriorates, so that the machine needs to be serviced periodically to restore it to its original performance level.

Before servicing the machine, conduct performance tests to check the extent of deterioration, and to decide what kind of service needs to be done (by referring to the "Service Limits" in this manual).

#### 3) OPERATIONAL PERFORMANCE OF A REPAIRED MACHINE

After the machine is repaired or serviced, it must be tested to confirm that its operational performance was restored by the repair and/or service work done.

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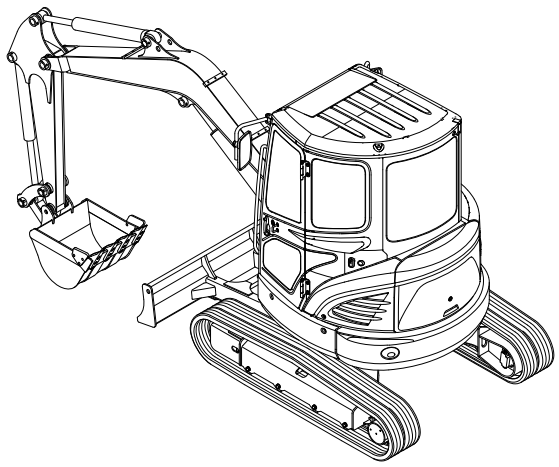
## 2. TERMINOLOGY

### 1) STANDARD

Specifications applied to the brand-new machine, components and parts.



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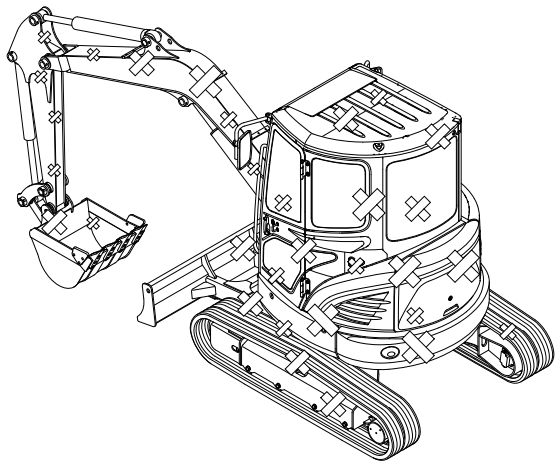
### 2) SERVICE LIMIT

The lowest acceptable performance level. When the performance level of the machine falls below this level, the machine must be removed from work and repaired. Necessary parts and components must be replaced.



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## 3. OPERATION FOR PERFORMANCE TESTS

1) Observe the following rules in order to carry out performance tests accurately and safely.

**(1) The machine**

Repair any defects and damage found, such as oil or water leaks, loose bolts, cracks and so on, before starting to test.

**(2) Test area**

① Select a hard, flat surface.

② Secure enough space to allow the machine to run straight more than 20m, and to make a full swing with the front attachment extended.

③ If required, rope off the test area and provide signboards to keep unauthorized personnel away.

**(3) Precautions**

① Before starting to test, agree upon the signals to be employed for communication among coworkers. Once the test is started, be sure to communicate with each other using these signals, and to follow them without fail.

② Operate the machine carefully and always give first priority to safety.

③ While testing, always take care to avoid accidents due to landslides or contact with high voltage power lines. Always confirm that there is sufficient space for full swings.

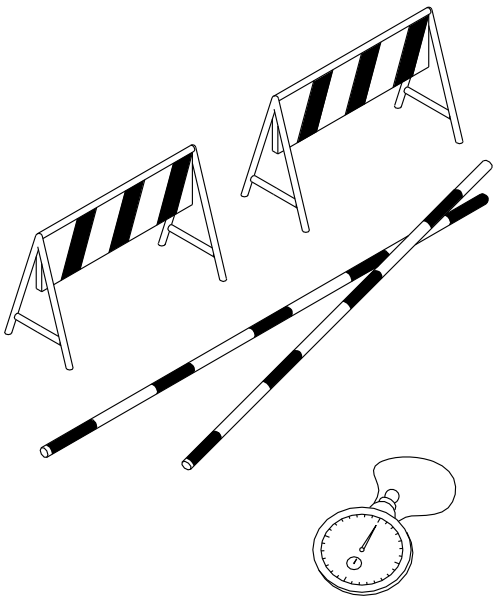
④ Avoid polluting the machine and the ground with leaking oil. Use oil pans to catch escaping oil. Pay special attention to this when removing hydraulic pipings.

**(4) Make precise measurements**

① Accurately calibrate test instruments in advance to obtain correct data.

② Carry out tests under the exact test conditions prescribed for each test item.

③ Repeat the same test and confirm that the test data obtained can be procured repeatedly. Use mean values of measurements if necessary.



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## 2) ENGINE SPEED

(1) Measure the engine speed at the maximum RPM.

※ **The engine speed must meet standard RPM; if not, all other operational performance data will be unreliable. It is essential to perform this test first.**

### (2) Preparation and measurement

① Warm up the machine, until the engine coolant temperature reaches 50°C or more, and the hydraulic oil is 50±5°C.

② Set the accel dial switch at the maximum position.

③ Measure the engine RPM.

### (3) Evaluation

The measured speeds should meet the following specifications.

Unit : rpm

| Model | Engine speed | Standard | | Remarks |
|---|---|---|---|---|
| | | Common | Europe | |
| HX35A Z | Low idle | 1300±50 | 1300±50 | |
| | High idle | 2300±50 | 2000±50 | |

### 3) TRAVEL SPEED

(1) Measure the time required for the excavator to travel a 20 m test track.

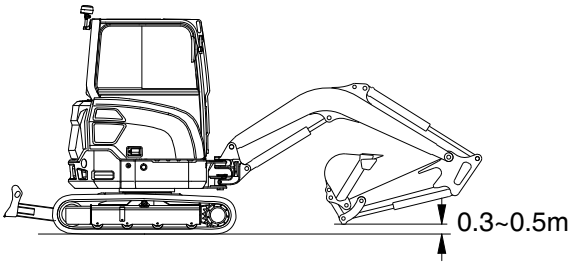
#### (2) Preparation

① Adjust the tension of both tracks to be equal.

② Prepare a flat and solid test track 20 m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5°C.

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#### (3) Measurement

① Measure both the low and high speeds of the machine.

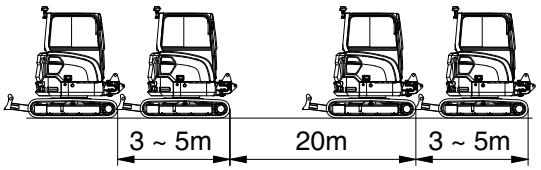
② Before starting either the low or high speed tests, adjust the travel mode switch to the speed to be tested.

③ Start traveling the machine in the acceleration zone with the travel levers at full stroke.

④ Measure the time required to travel 20 m.

⑤ After measuring the forward travel speed, turn the upperstructure 180 ° and measure the reverse travel speed.

⑥ Repeat steps ④ and ⑤ three times in each direction and calculate the average values.

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#### (4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds / 20 m

| Model | Travel speed | Standard | | Remarks |
|---|---|---|---|---|
| | | Common | Europe | |
| HX35A Z | 1 Speed | 29.2 | 30.6 | |
| | 2 Speed | 16.3 | 17.1 | |

## 4) TRACK REVOLUTION SPEED

(1) Measure the track revolution cycle time with the track raised off ground.

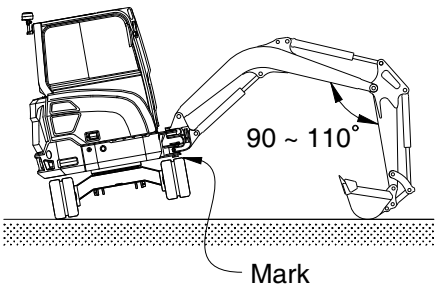
### (2) Preparation

① Adjust the tension of both side tracks to be equal.

② On the track to be measured, mark one shoe with chalk.

③ Swing the upperstructure 90° and lower the bucket to raise the track off ground. Keep the boom-arm angle between 90 to 110° as shown. Place blocks under machine frame.

④ Keep the hydraulic oil temperature at 50±5°C.

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### (3) Measurement

① Select the following switch positions.

· Travel mode switch : 1 or 2 speed

② Operate the travel control lever of the raised track in full forward and reverse.

③ Rotate 1 turn, then measure time taken for next 3 revolutions.

④ Raise the other side of machine and repeat the procedure.

⑤ Repeat steps ③ and ④ three times and calculate the average values.

### (4) Evaluation

The revolution cycle time of each track should meet the following specifications.

Unit : Seconds / 3 revolutions

| Model | Travel speed | Standard | | Remarks |
|---|---|---|---|---|
| | | Common | Europe | |
| HX35A Z | 1 Speed | 19.6±1.5 | 20.5±1.5 | |
| | 2 Speed | 10.9±1.5 | 11.4±1.5 | |

## 5) TRAVEL DEVIATION

(1) Measure the deviation by the tracks from a 20m straight line.

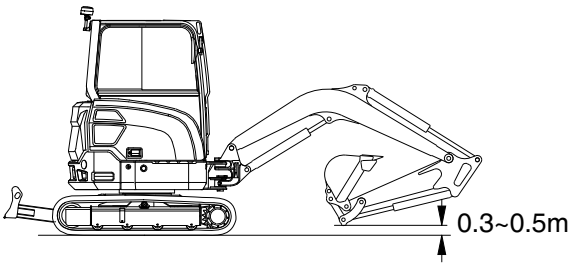
### (2) Preparation

① Adjust the tension of both tracks to be equal.

② Provide a flat, solid test yard 20 m in length, with extra length of 3 to 5 m on both ends for machine acceleration and deceleration.

③ Hold the bucket 0.3 to 0.5 m above the ground with the arm and bucket rolled in.

④ Keep the hydraulic oil temperature at 50±5°C.

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### (3) Measurement

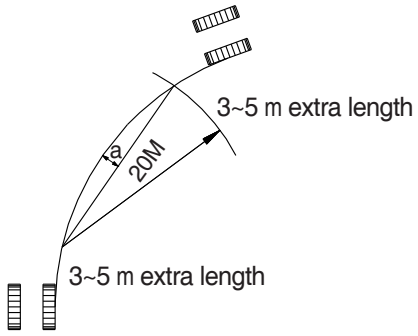
① Measure the amount of mistracking at high and low travel speeds.

② Start traveling the machine in the acceleration zone with the travel levers at full stroke.

③ Measure the distance between a straight 20m line and the track made by the machine. (Dimension a)

④ After measuring the tracking in forward travel, turn the upperstructure 180°and measure that in reverse travel.

⑤ Repeat steps ③ and ④ three times and calculate the average values.

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### (4) Evaluation

Mistrack should be within the following specifications.

Unit : mm / 20 m

| Model | Standard | Maximum allowable | Remarks |
|---|---|---|---|
| HX35A Z | 200 below | 240 | |

### 6) SWING SPEED

(1) Measure the time required to swing three complete turns.

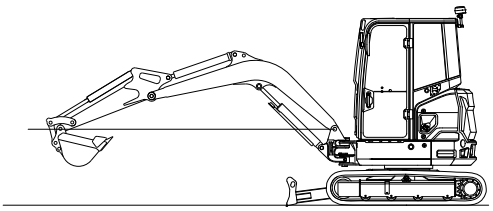
#### (2) Preparation

① Check the lubrication of the swing gear and swing bearing.

② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.

③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.

④ Keep the hydraulic oil temperature at 50±5°C.



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#### (3) Measurement

① Operate swing control lever fully.

② Swing 1 turn and measure time taken to swing next 2 revolutions.

③ Repeat steps ① and ② three time and calculate the average values.

#### (4) Evaluation

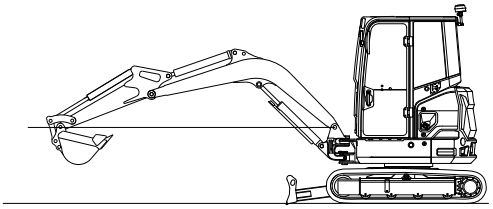
The time required for 2 swings should meet the following specifications.

Unit : Seconds / 2 revolutions

| Model | Standard | | Remarks |
|---|---|---|---|
| | Common | Europe | |
| HX35A Z | 12.8±0.4 | 14.6±0.4 | |

## 7) SWING FUNCTION DRIFT CHECK

(1) Measure the swing drift on the bearing outer circumference when stopping after a 360° full speed swing.



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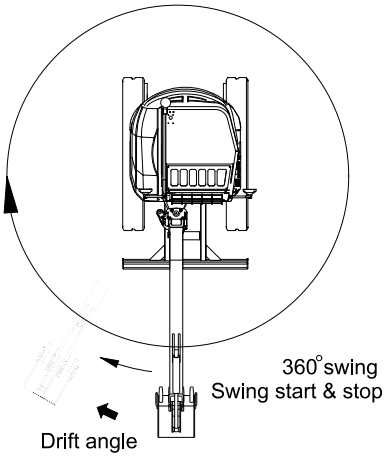
### (2) Preparation

① Check the lubrication of the swing gear and swing bearing.
② Place the machine on flat, solid ground with ample space for swinging. Do not conduct this test on slopes.
③ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin. The bucket must be empty.
④ Make two chalk marks: one on the swing bearing and one directly below it on the track frame.
⑤ Swing the upperstructure 360°.
⑥ Keep the hydraulic oil temperature at 50±5°C.

### (3) Measurement

① Operate the swing control lever fully and return it to the neutral position when the mark on the upperstructure aligns with that on track frame after swinging 360 °
② Measure the distance between the two marks.
③ Align the marks again, swing 360 °, then test the opposite direction.
④ Repeat steps ② and ③ three times each and calculate the average values.

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### (4) Evaluation

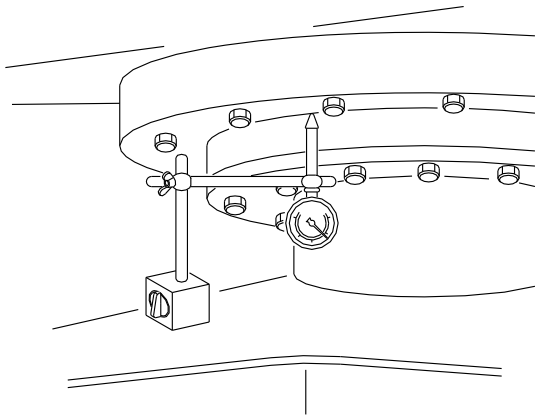
The measured drift angle should be within the following specifications.

Unit : Degree

| Model | Standard | Maximum allowable | Remarks |
|---|---|---|---|
| HX35A Z | 40 below | 50 | |

## 8) SWING BEARING PLAY

(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.



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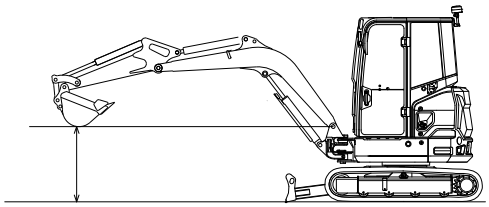
### (2) Preparation

① Check swing bearing mounting cap screws for loosening.
② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.
③ Install a dial gauge on the track frame as shown, using a magnetic base.
④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.
⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.
⑥ Bucket should be empty.

### (3) Measurement

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin.
Record the dial gauge reading (h1).
② Lower the bucket to the ground and use it to raise the front idler 50 ㎝.
Record the dial gauge reading (h2).
③ Calculate bearing play (H) from this data (h1 and h2) as follows.
H=h2-h1

**Measurement : h1**



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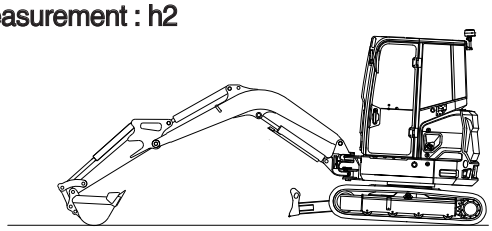
**Measurement : h2**



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### (4) Evaluation

The measured drift should be within the following specifications.

Unit : mm

| Model | Standard | Maximum allowable | Remarks |
|---|---|---|---|
| HX35A Z | 0.5 ~ 1.2 | 2.4 | |

## 9) HYDRAULIC CYLINDER CYCLE TIME

(1) Measure the cycle time of the boom, standard arm, and standard bucket cylinders.

### (2) Preparation

① To measure the cycle time of the boom cylinders:
With the arm rolled out and the empty bucket rolled out, lower the bucket to the ground, as shown.

② To measure the cycle time of the arm cylinder.
With the empty bucket rolled in, position the arm so that it is vertical to the ground. Lower the boom until the bucket is 0.5 m above the ground.

③ To measure the cycle time of the bucket cylinder.
The empty bucket should be positioned at midstroke between roll-in and roll-out, so that the sideplate edges are vertical to the ground.

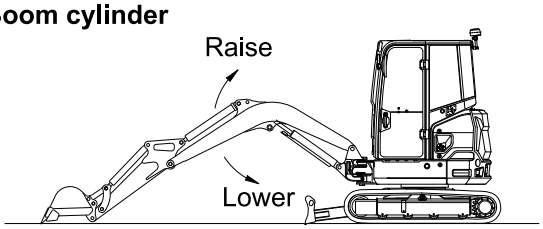
④ Keep the hydraulic oil temperature at 50±5°C.

### (3) Measurement

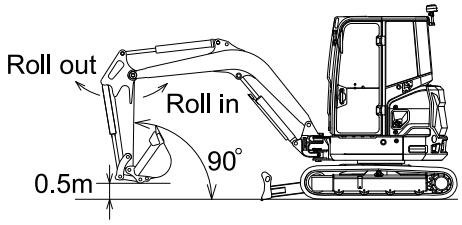
① To measure cylinder cycle times.

- **Boom cylinders**
  Measure the time it takes to raise the boom, and the time it takes to lower the boom. To do so, position the boom at one stroke end then move the control lever to the other stroke end as quickly as possible.
- **Arm cylinder**
  Measure the time it takes to roll in the arm, and the time it takes to roll out the arm. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

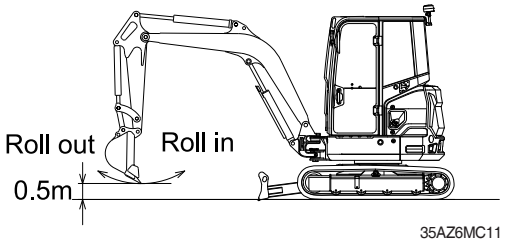
**Boom cylinder**




**Arm cylinder**




**Bucket cylinder**

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- **Bucket cylinders**

  Measure the time it takes to roll in the bucket, and the time it takes to roll out the bucket. To do so, position the bucket at one stroke end, then move the control lever to the other stroke end as quickly as possible.

- Repeat each measurement 3 times and calculate the average values.

### (4) Evaluation

The average measured time should meet the following specifications.

Unit : Seconds

| Model | Function | Standard | | Remarks |
|---|---|---|---|---|
| | | Common | Europe | |
| HX35A Z | Boom raise | 2.3±0.4 | 2.4±0.4 | |
| | Boom lower | 2.0±0.4 | 2.0±0.4 | |
| | Arm in | 2.7±0.4 | 2.8±0.4 | |
| | Arm out | 2.1±0.3 | 2.2±0.3 | |
| | Bucket load | 3.1±0.4 | 3.4±0.4 | |
| | Bucket dump | 2.0±0.3 | 2.3±0.3 | |
| | Boom swing (LH) | 5.8±0.3 | 6.6±0.4 | |
| | Boom swing (RH) | 5.2±0.3 | 5.8±0.4 | |
| | Dozer up (raise) | 2.2±0.3 | 2.4±0.3 | |
| | Dozer down (lower) | 2.9±0.3 | 3.4±0.4 | |

## 10) DIG FUNCTION DRIFT CHECK

(1) Measure dig function drift, which can be caused by oil leakage in the control valve and boom, standard arm, and standard bucket cylinders, with the loaded bucket.
When testing the dig function drift just after cylinder replacement, slowly operate each cylinder to its stroke end to purge air.

### (2) Preparation

① Load bucket fully. Instead of loading the bucket, weight (W) of the following specification can be used.

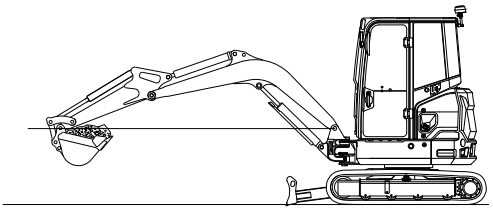
· $W = M^3 \times 1.5$
Where :
$M^3$ = Bucket heaped capacity($m^3$)
1.5 = Soil specific gravity

② Position the arm cylinder with the rod 20 to 30㎜ extended from the fully retracted position.

③ Position the bucket cylinder with the rod 20 to 30㎜ retracted from the fully extended position.

④ With the arm rolled out and bucket rolled in, hold the bucket so that the height of the bucket pin is the same as the boom foot pin.

⑤ Keep the hydraulic oil temperature at 50±5°C.



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### (3) Measurement

① Stop the engine.

② Five minutes after the engine has been stopped, measure the changes in the positions of the boom, arm and bucket cylinders.

③ Repeat step ② three times and calculate the average values.

### (4) Evaluation

The measured drift should be within the following specifications.

Unit : mm / 5 min

| Model | Drift to be measured | Standard | Remarks |
|---|---|---|---|
| HX35A Z | Boom cylinder | 10 below | |
| | Arm cylinder | 20 below | |
| | Bucket cylinder | 20 below | |
| | Dozer cylinder | 30 below | |

## 11) CONTROL LEVER OPERATING FORCE

(1) Use a spring scale to measure the maximum resistance of each control lever at the middle of the grip.

### (2) Preparation

① Keep the hydraulic oil temperature at 50±5°C.

### (3) Measurement

① Start the engine.

② Operate each boom, arm, bucket and swing lever at full stroke and measure the maximum operating force for each.

③ Lower the bucket to the ground to raise one track off the ground. Operate the travel lever at full stroke and measure the maximum operating force required. When finished, lower the track and then jack-up the other track.

④ Repeat steps ② and ③ three times and calculate the average values.

### (4) Evaluation

The measured operating force should be within the following specifications.

Unit : kgf

| Model | Kind of lever | Standard | Maximum allowable | Remarks |
|---|---|---|---|---|
| HX35A Z | Boom lever | 1.4 or below | 1.9 | |
| | Arm lever | 1.4 or below | 1.9 | |
| | Bucket lever | 1.4 or below | 1.9 | |
| | Swing lever | 1.4 or below | 1.9 | |
| | Travel lever | 2.0 or below | 2.5 | |

## 12) CONTROL LEVER STROKE

(1) Measure each lever stroke at the lever top using a ruler.

※ **When the lever has play, take a half of this value and add it to the measured stroke.**

**(2) Preparation**

Keep the hydraulic oil temperature at 50±5°C.

**(3) Measurement**

① Stop the engine.

② Measure each lever stroke at the lever top from neutral to the stroke end using a ruler.

③ Repeat step ② three times and calculate the average values.

**(4) Evaluation**

The measured drift should be within the following specifications.

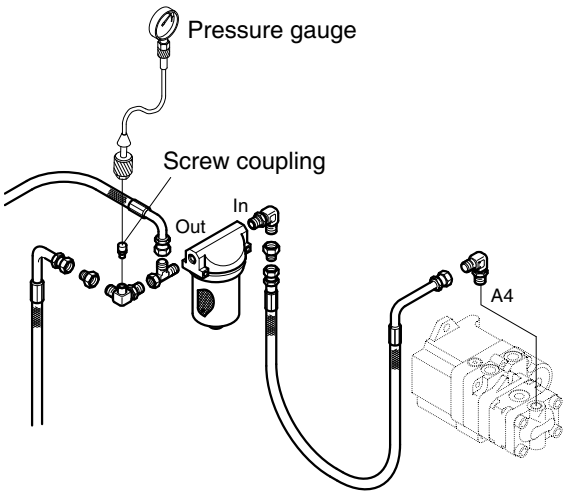
Unit : mm

| Model | Kind of lever | Standard | Maximum allowable | Remarks |
|---|---|---|---|---|
| HX35A Z | Boom lever | 87±10 | 109 | |
| | Arm lever | 87±10 | 109 | |
| | Bucket lever | 87±10 | 109 | |
| | Swing lever | 87±10 | 109 | |
| | Travel lever | 86±10 | 105 | |

## 13) PILOT PRIMARY PRESSURE

### (1) Preparation

① Stop the engine.
② Push the pressure release button to bleed air.
③ Loosen the cap of screw coupling at the fitting near pilot filter and connect pressure gauge.
④ Start the engine and check for oil leakage from the port.
⑤ Keep the hydraulic oil temperature at 50±5°C.

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### (2) Measurement

① Measure the primary pilot pressure in the H mode.

### (3) Evaluation

The average measured pressure should meet the following specifications:

Unit : kgf / cm²

| Model | Standard | Remarks |
|---|---|---|
| HX35A Z | 40±5 | |

## 14) FOR TRAVEL SPEED SELECTING PRESSURE

### (1) Preparation

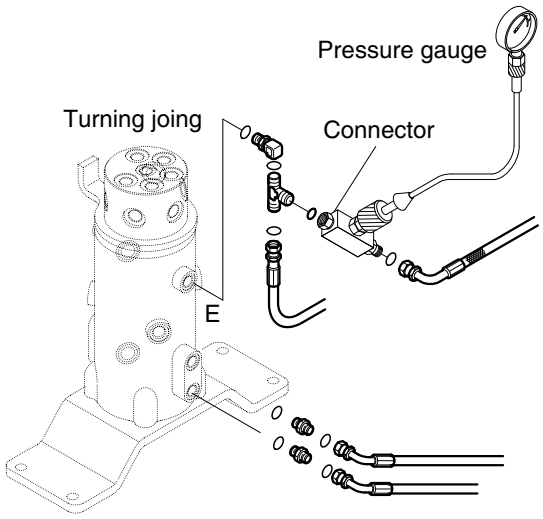
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the speed selecting pressure:
Install a connector and pressure gauge assembly to turning joint E port as shown.

④ Start the engine and check for on leakage from the adapter.

⑤ Keep the hydraulic oil temperature at 50±5°C.

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### (2) Measurement

① Select the following switch positions.
Travel mode switch : 1 speed
2 speed

② Measure the travel speed selecting pressure in the Hi or Lo mode.

③ Lower the bucket to the ground to raise the track off the ground. Operate the travel lever at full stroke and measure the fast speed pressure.

④ Repeat steps ② and ③ three times and calculate the average values.

### (3) Evaluation

The average measured pressure should be within the following specifications.

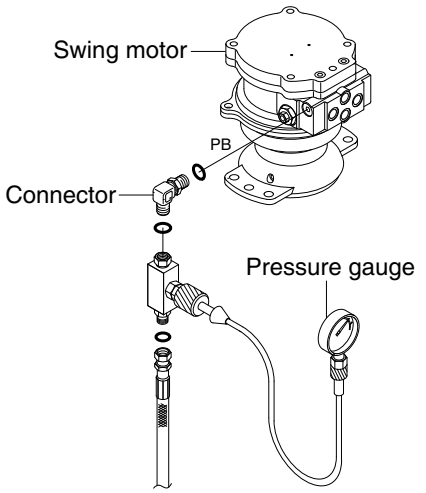
Unit : kgf / cm²

| Model | Travel speed mode | Standard | Maximum allowable | Remarks |
|---|---|---|---|---|
| HX35A Z | 1 Speed | 0 | - | |
| | 2 Speed | 40±5 | - | |

## 15) SWING PARKING BRAKE RELEASING PRESSURE

### (1) Preparation

① Stop the engine.
② Push the pressure release button to bleed air.
③ Install a connector and pressure gauge assembly to swing motor PP port, as shown.
④ Start the engine and check for oil leakage from the adapter.
⑤ Keep the hydraulic oil temperature at 50±5°C.




R35Z76MC16

### (2) Measurement

① Operate the swing function or arm roll in function and measure the swing brake control pressure with the brake disengaged. Release the control lever to return to neutral and measure the control pressure when the brake is applied.
② Repeat three times and calculate the average values.

### (3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm$^2$

| Model | Engine speed | Standard | Remarks |
|---|---|---|---|
| HX35A Z | Brake disengaged | 40±5 | |
| | Brake applied | 0 | |

## 16) MAIN PUMP DELIVERY PRESSURE

### (1) Preparation

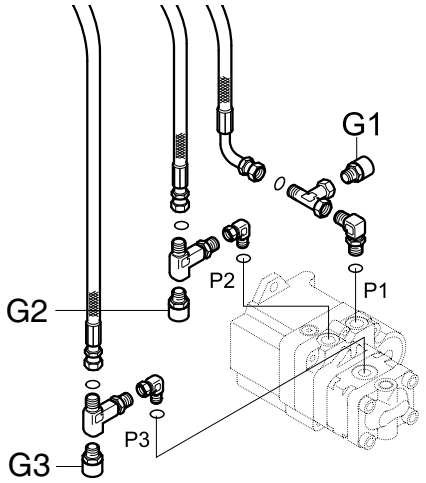
① Stop the engine.

② Push the pressure release button to bleed air.

③ To measure the main pump pressure. Loosen the cap of screw coupling and connect pressure gauge to the main pump gauge port (G1, G2, G3) as shown.

④ Start the engine and check for oil leakage from the port.

⑤ Keep the hydraulic oil temperature at 50±5°C.




35AZ6MC37

### (2) Measurement

① Measure the main pump delivery pressure at high idle.

### (3) Evaluation

The average measured pressure should meet the following specifications.

Unit : kgf / cm²

| Model | Engine speed | Standard | Allowable limits | Remarks |
|---|---|---|---|---|
| HX35A Z | High idle | 20±5 | - | |

## 17) SYSTEM PRESSURE REGULATOR RELIEF SETTING

### (1) Preparation

① Stop the engine.

② Push the pressure release button to bleed air.

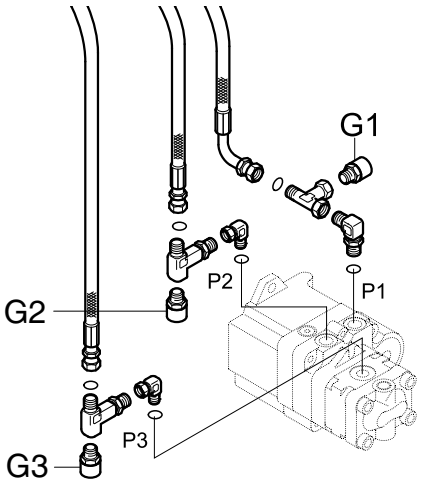
③ To measure the system relief pressure. Loosen the cap of screw coupling and connect pressure gauge to the main pump gauge port (G1, G2, G3) as

④ shown.

Start the engine and check for oil

⑤ leakage from the port.

Keep the hydraulic oil temperature at 50±5°C.




35AZ6MC37

### (2) Measurement

① Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.

② In the swing function, place bucket against an immovable object and measure the relief pressure.

③ In the travel function, lock undercarriage with an immovable object and measure the relief pressure.

### (3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm²

| Model | Function to be tested | Standard |
|---|---|---|
| HX35A Z | Boom, Arm, Bucket | 230±10 |
| | Travel | 230±10 |
| | Swing | 210±10 |

# GROUP 2 MAJOR COMPONENT

## 1. MAIN PUMP

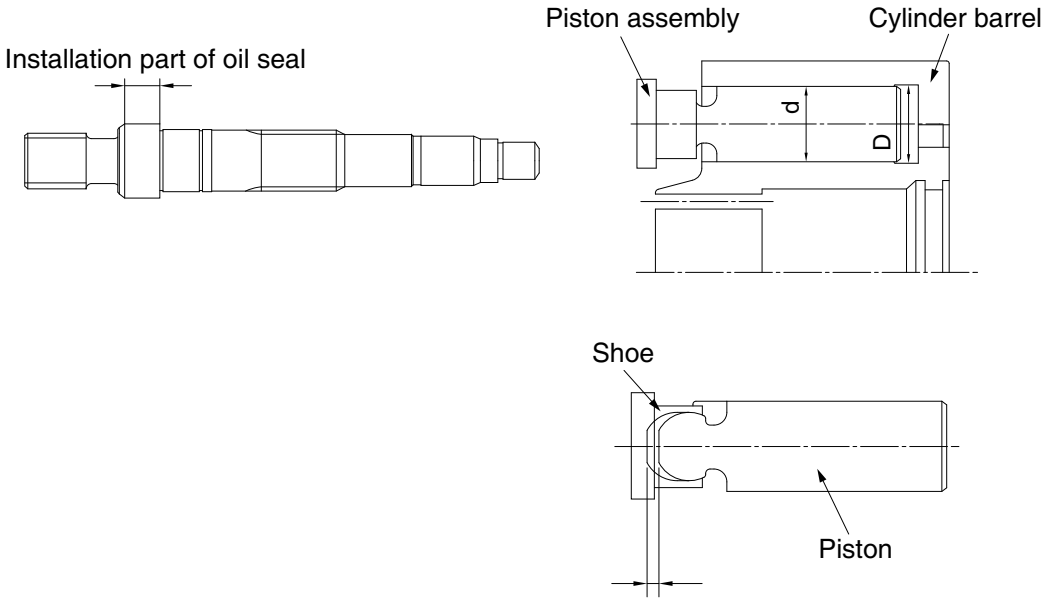
Before inspection, wash the parts well and dry them completely.

Inspect the principal parts with care and replace them with new parts when any abnormal wear exceeding the allowable limit or damage considered harmful is found.

Replace the seal also when any remarkable deformation and damage are found.

### 1) INSPECTION POINTS WHEN DISASSEMBLED

| Part | Extent of the damage | Inspection standard | Action |
|---|---|---|---|
| Shaft | Excessive wear on the seal surface. | Worn depth : 0.025 mm or more | Replace the shaft. |
| Valve plate | Excessive wear or damages on the sliding surface. | Worn depth : 0.020 mm or more | Replace the cylinder barrel kit. |
| Cylinder barrel | Excessive wear or damages on the sliding surface. | Worn depth : 0.020 mm or more | Replace the cylinder barrel kit. |
| | Clearance between the pistons (D-d) | 0.030 mm or more | Replace the cylinder barrel kit. |
| Piston and shoe | Wear of joint section | Check play ( $\varepsilon$) between the shoe and the piston<br>$\varepsilon$: 0.2 mm or more by hand operation. | Replace the cylinder barrel kit. |
| Seals (O-rings, gasket, etc.) | Damage, excessive rust | - | Replace each part. |




17Z9A6MC01

## 2) TROUBLESHOOTING AND COUNTERMEASURE

| No. | Trouble | Possible cause | Countermeasure |
|---|---|---|---|
| 1 | Overload to engine | · Speed is higher than standard<br>· Setting pressure is higher than specifications<br>· Damage of internal parts of pump | · Readjust it as standard<br>· Readjust it as spec<br>· Repair or replace |
| 2 | Low pump flow or low pressure | · Speed down of engine<br>· Wrong coupling<br>· Damage of internal parts of pump | · Readjust of engine speed<br>· Repair or replace<br>· Repair or replace |
| 3 | Abnormal noise or abnormal vibration (cavitations) | · The level of oil in the tank is low<br>· Air in the oil<br>· Water in the oil<br>· Clog of suction filter<br>· High suction pressure<br>· Damage of piston shoe<br>· Installation condition is no good<br>· Wrong coupling | · Replenish a tank with oil<br>· Check piping<br>Bleed the air in the hydraulic circuit<br>· Replace oil<br>· Clean or replace<br>· Correction<br>· Replace<br>· Correction<br>· Replace |
| 4 | Oil leakage | · Damage of O-ring or packing<br>· Loosened plug<br>· Leaking from oil seal | · Replace<br>· Tight up<br>· Replace<br>Replace of oil seal |

## 2. MAIN CONTROL VALVE

| Part name | Inspection item | Criteria & measure |
|---|---|---|
| Block | · Existence of scratch, rusting or corrosion. | · In case of damage in following section, replace part.<br>- Sliding sections of casing fore and spool, especially land sections applied with holded pressure.<br>- Seal pocket section where spool is inserted.<br>- Seal section of port where O-ring contacts.<br>- Seal section of each relief valve for main, travel, and port.<br>- Other damages that may damage normal functions. |
| Spool | · Existence of scratch, gnawing, rusting or corrosion. | · Replacement when its outside sliding section has scratch (especially on seals-contacting section). |
| | · O-ring seal sections at both ends. | · Replacement when its sliding section has scratch. |
| | · Insert spool in casing hole, rotate and reciprocate it. | · Correction or replacement when O-ring is damaged or when spool does not move smoothly. |
| Poppet | · Damage of poppet or spring | · Correction or replacement when sealing is incomplete. |
| | · Insert poppet into casing and function it. | · Normal when it can function lightly without being caught. |
| Around spring | · Rusting, corrosion, deformation or breaking of spring, spring seat, plug or cover. | · Replacement for significant damage. |
| Around seal for spool | · External oil leakage. | · Correction or replacement. |
| | · Rusting, corrosion or deformation of seal plate. | · Correction or replacement. |
| Main relief valve & port relief valve | · External rusting or damage. | · Replacement. |
| | · Contacting face of valve seat. | · Replacement when damaged. |
| | · Contacting face of poppet. | · Replacement when damaged. |
| | · Abnormal spring. | · Replacement. |
| | · O-rings, back up rings and seals. | · 100% replacement in general. |

## 3. SWING MOTOR

Replace the parts referring to the following table.

### 1) MOTOR

| Part name | Service criteria |
|---|---|
| Piston assembly (2-13) | 1. The sliding parts are scratched deeply or the sliding surface has become rough.<br>2 The clearance between the piston and the cylinder block bore is too large.<br>Upper limit of diameter clearance : 0.04 mm<br>3. The piston shoe ball is loose excessively.<br>Max. clearance (movement) : 0.4 mm |
| Thrust plate (2-4)<br>Retainer holder (2-11)<br>Retainer plate (2-12)<br>Brake piston (2-15)<br>Valve plate (2-24) | 1. The sliding parts are scratched deeply or the sliding surface has become rough. |
| Cylinder block (2-5) | 1. The sliding parts are scratched deeply or the sliding surface has become rough.<br>2. The meshing surface is worn excessively or cut. |
| Disc (2-14) | 1. The disc (friction material) is scratched deeply or peeled.<br>2. The meshing surface is worn excessively or cut. |
| Ball bearings (2-2) (2-22) | 1. The rolling contact surface has been flaked or peeled.<br>2. The rolling contact surface is dented.<br>3. Bearing rotation produces abnormality (abnormal noise, irregular rotation). |
| Spring (2-7) | 1. The spring is broken or deformed excessively. |
| O-rings (2-16), (2-17), (2-20), (2-26), (2-42), (2-44), (2-46) | 1. Damage that is likely to cause oil leak, damage that is likely to deteriorate the sealing or permanent deformation is noticed. |

### 2) REDUCTION GEAR

| Part name | Service criteria |
|---|---|
| Pinion shaft (1-2) | 1. The gear tooth surface is damaged excessively, worn of flaked. |
| Plates (1-3), (1-8) | 1. The plate is damaged or worn excessively. |
| Taper roller bearings (1-5), (1-7) | 1. The roller or the race is damaged excessively, dented or flaked.<br>2. The rotation produces abnormal noise or is not smooth.<br>※ To replace the bearing, replace the body assembly. |
| Oil seal (1-6) | 1. The lip is damaged, deformed or worn excessively.<br>2. The lip is hardened. |
| Housing (1-1)<br>Holders (1-10), (1-18)<br>Drive gear (1-24)<br>Sun gear (1-17) | 1. The gear tooth surface is damaged excessively, worn or flaked.<br>※ To replace the housing, replace the body assembly. |
| Inner races (1-12), (1-20) | 1. The surface of the needle bearings is damaged excessively or worn or flaked. |
| Needle bearings (1-13), (1-21) | 1. The surface of the needle bearings is damaged excessively or worn or flaked. |
| Planetary gears (1-14), (1-22) | 1. The gear tooth surface is excessively damaged, worn of flaked.<br>2. The rolling contact surface in contact with the needle bearing is excessively damaged, worn or flaked. |
| Thrust plates (1-15), (1-23) | 1. The sliding surface is excessively damaged, worn or seized. |

### 3) VALVE

| Part name | Service criteria |
|---|---|
| Piston (2-38-14)<br>Case (2-1) | 1. The sliding surface is damaged deeply or rough.<br>2. The clearance between the piston and the case hole is large.<br>Upper limit of diameter clearance : 0.04 ㎜ |
| Spring (2-40) | 1. The spring is broken or deformed excessively. |
| Plugs (2-38-6), (2-41)<br>Check valve (2-39)<br>O-rings (2-38-8, 9, 10, 11), (2-42)<br>Backup rings (2-38-12, 13) | 1. Damage that is likely to cause oil leak, damage that is likely to deteriorate the sealing or permanent deformation is noticed. |

### 4) OTHERS

| Part name | Service criteria |
|---|---|
| Other plugs and O-rings | Damage that is likely to cause oil leak, damage that is likely to deteriorate the sealing or permanent deformation is noticed. |

## 4. TRAVEL MOTOR

Wash all parts disassembly in treated oil and dry in the compressed air.

Perform maintenance including replacement or corrections in accordance with the following criterion.

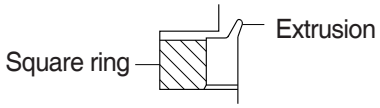
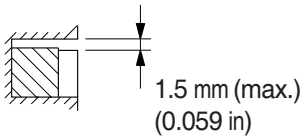
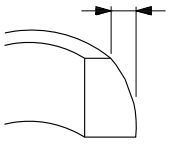
| No. | Part name | Check Points | Criterion (recommended standards for replacement) | Measures |
|---|---|---|---|---|
| 1 | Floating seal (1-2) | Sliding surface | No remarkable flaws, wear, or seizure are noted. | Replacement |
| 2 | Angular bearing (1-3) | Rolling surface | No remarkable flaws, wear, or flaking are noted on balls and race. | Replacement |
| 3 | Housing (1-6) | Gear tooth surface | No remarkable flaws, wear, or flaking are noted on gear tooth surface. (note 1) | Replacement |
| 4 | Planetary gear A (1-18), B (1-9) | Gear tooth surface and rolling surface of inner side | No remarkable flaws, wear, or flaking are noted as same as No.3 | Replacement |
| 5 | Needle bearing (1-10), (1-19) | Rolling surface of needle bearing | No remarkable flaws, wear, or flaking are noted. | Replacement |
| 6 | Inner race (1-11), (1-20) | Rolling surface of inner race | No remarkable flaws, wear, or flaking are noted. | Replacement |
| 7 | Thrust washer (1-12) | Sliding surface | No remarkable flaws, wear, or seizure are noted. | Replacement |
| 8 | Thrust plate (1-13), (1-23) | Sliding surface | No remarkable flaws, wear, or seizure are noted. | Replacement |
| 9 | Sun gear (1-15) | Gear tooth surface | Same as No. 3 | Replacement |
| 10 | Holder (1-17) | Sliding surface of planetary gear A | No remarkable flaws, wear, or seizure are noted. | Replace planetary A and holder. |
| 11 | Drive gear (1-22) | Gear tooth surface | Same as No. 3 | Replacement |
| 13 | O-ring (1-25), (1-29), (28), (29), (39), (31-5), (44), (50-5), (50-6), (50-7), (65), (66), (74) | Surface and hardness | No flaws and deflection are noted. Not hardened. | Recommend that seals be replaced with new ones at time of reassembly, since rubber materials normally deteriorate with age. |
| 14 | Shaft (2) | Sliding surface of oil seal | No remarkable flaws, wear. | Replacement |
| 15 | Ball bearing (3), (27) | Same as No. 2. | Same as No. 2. | Replacement |
| 16 | Oil seal (4) | Surface and hardness of seal lip | No flaw, wear or deflection are noted. Not hardened. | Replacement |

Note 1 : Pitching in this instance refers to a case where pitching occurs in more than 10% of engagement area per tooth surface.

| No. | Part name | Check Points | Criterion (recommended standards for replacement) | Measures |
|---|---|---|---|---|
| 17 | Swash plate (5) | Sliding surface and roughness between piston sub assembly and swash plate | No remarkable flaws (over 0.02 [mm] in thickness), wear, or seizure are noted.<br>0.4a (0.8a) | Correct lapping (#1000) if sliding surface is rough. Replace if proper correction cannot be made. |
| 18 | Cylinder block (7) | Clearance between piston sub assembly and cylinder block. | 0.02 [mm] (0.04 [mm]) | Replace both cylinder block and piston sub assembly concurrently. Correct lapping (#1000) if sliding surface is rough. Replace both cylinder block and piston sub assembly with new, if sliding surfaces cannot be properly corrected. |
| | | Sliding surface and roughness between valve plate and cylinder block. | No remarkable flaws (over 0.02[mm] in thickness), wear, or seizure are noted.<br>0.4a (0.8a) | |
| 19 | Spring (9), (20), (37) (42), (31-3), (50-3), (62), (63) | Breakage or deflection is big. | - | Replacement |
| 20 | Piston sub assembly (15) | Clearance between piston sub assembly and cylinder block. | Same as No. 18. | Same as No. 18. |
| | | Sliding surface and roughness between piston sub assembly and swash plate. | Same as No. 17.<br>0.2a (0.8a) | Same as No. 17. |
| | | Loosen between piston and shoe is big. | 0.15 [mm] (0.4 [mm]) | Replacement |
| 21 | Piston (19) | Clearance between piston sub assembly and flange holder. | Same as No. 18. | Same as No. 18. |
| | | Sliding surface and roughness between piston sub assembly and swash plate. | Same as No. 17. | Same as No. 17. |
| 22 | Valve plate (25) | Sliding surface and roughness between valve plate cylinder block. | Same as No. 18. | Same as. No. 18. |
| | | Thickness; 5 [mm] | 4.8 [mm] | Replacement |
| 23 | Base plate (30) | Sliding surface between plunger and base plate. | No remarkable flaws, wear, or seizure are noted. | Replace both base plate and plunger. |
| | | Sliding surface between spool and base plate. | No remarkable flaws, wear, or seizure are noted. | Replace both base plate and spool. |

| No. | Part name | Check Points | Criterion (recommended standards for replacement) | Measures |
|---|---|---|---|---|
| 24 | Plunger (31-1) | Sliding surface between plunger and base plate. | No remarkable flaws, wear, or seizure are noted. | Replace both base plate and plunger. |
| | | Sliding surface between plunger and check valve. | No remarkable flaws, wear, or seizure are noted. | Replace both check valve and plunger. |
| 25 | Check valve (31-2) | Sliding surface between plunger and check valve. | No remarkable flaws, wear, or seizure are noted. | Replace plunger assy. |
| | | Seat surface between plunger and check valve. | No remarkable flaws, wear, or seizure are noted.<br>Entire surface of seats are rubbing. | Replace both check valve and plunger. |
| 26 | Spool (41) | Sliding surface between plunger and check valve. | Same as No. 23 | Same as No. 23 |
| 27 | Valve body (50-1) | Sliding surface between spool and valve body. | No remarkable flaws, wear, or seizure are noted. | Replace valve assy. |
| 28 | Without parking brake check valve (50-2) | Sliding surface between plunger and check valve. | No remarkable flaws, wear, or seizure are noted. | Replace valve assy. |
| | With parking brake spool (50-2) | Sliding surface between spool and valve body. | No remarkable flaws, wear, or seizure are noted. | Replace valve assy. |

## 5. TURNING JOINT

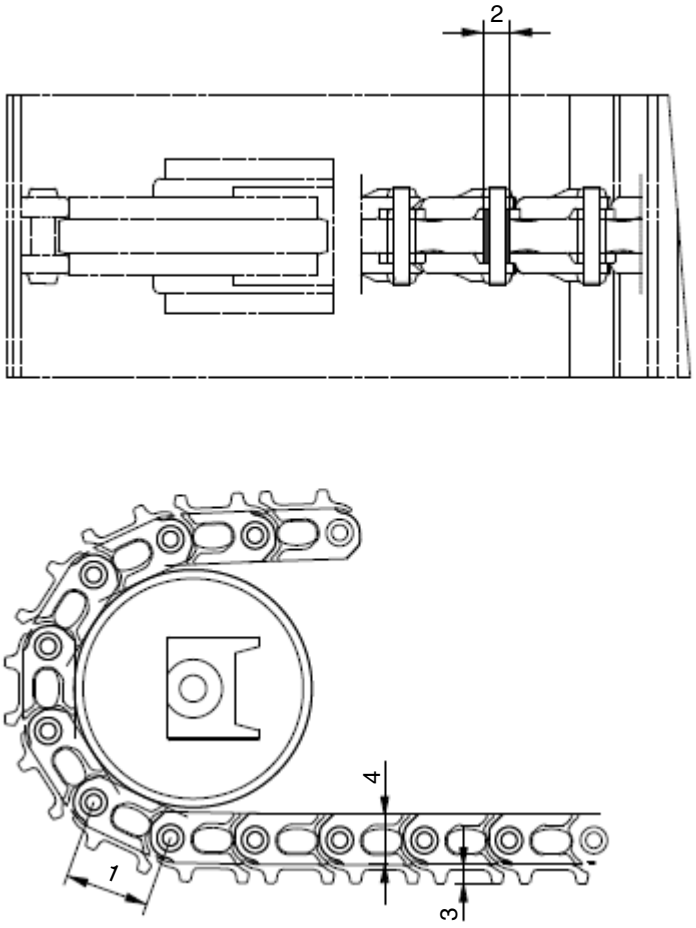
| Parts Name | | Check Points | Measures |
|---|---|---|---|
| Body, Stem | Sliding surface with sealing sections. | Plating worn or peeled due to seizure or contamination. | Replace |
| | Sliding surface between body and stem other than sealing section. | · Worn abnormality or damaged more than 0.1 mm (0.0039 in) in depth due to seizure contamination. | Replace |
| | | · Damaged more than 0.1 mm (0.0039 in) in depth. | Smooth with oilstone. |
| | Sliding surface with thrust plate. | · Worn more than 0.5 mm (0.02 in) or abnormality. | Replace |
| | | · Worn less than 0.5 mm (0.02 in). | Smooth |
| | | · Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in). | Smooth |
| Cover | Sliding surface with thrust plate. | · Worn more than 0.5 mm (0.02 in) or abnormality. | Replace |
| | | · Worn less than 0.5 mm (0.02 in). | Smooth |
| | | · Damage due to seizure or contamination remediable within wear limit (0.5 mm) (0.02 in). | Replace |
| Seal set | - | · Extruded excessively from seal groove square ring.<br>  | Replace |
| | - | · Slipper ring 1.5 mm (0.059 in) narrower than seal groove, or narrower than back ring.<br>  | Replace |
| | - | · Worn more than 0.5 mm (0.02 in) ~ 1.5 mm (MAX.) (0.059 in)<br>  | Replace |

## 6. CYLINDER

| Part name | Inspecting section | Inspection item | Remedy |
|---|---|---|---|
| Piston rod | · Neck of rod pin | · Presence of crack | · Replace |
| | · Weld on rod hub | · Presence of crack | · Replace |
| | · Stepped part to which piston is attached. | · Presence of crack | · Replace |
| | · Threads | · Presence of crack | · Recondition or replace |
| | · Plated surface | · Plating is not worn off to base metal. | · Replace or replate |
| | | · Rust is not present on plating. | · Replace or replate |
| | | · Scratches are not present. | · Recondition, replate or replace |
| | · Rod | · Wear of O.D. | · Recondition, replate or replace |
| | · Bushing at mounting part | · Wear of I.D. | · Replace |
| Cylinder tube | · Weld on bottom | · Presence of crack | · Replace |
| | · Weld on head | · Presence of crack | · Replace |
| | · Weld on hub | · Presence of crack | · Replace |
| | · Tube interior | · Presence of faults | · Replace if oil leak is seen |
| | · Bushing at mounting part | · Wear on inner surface | · Replace |
| Gland | · Bushing | · Flaw on inner surface | · Replace if flaw is deeper than coating |

## 1. TRACK SHOE

### 1) STEEL SHOE

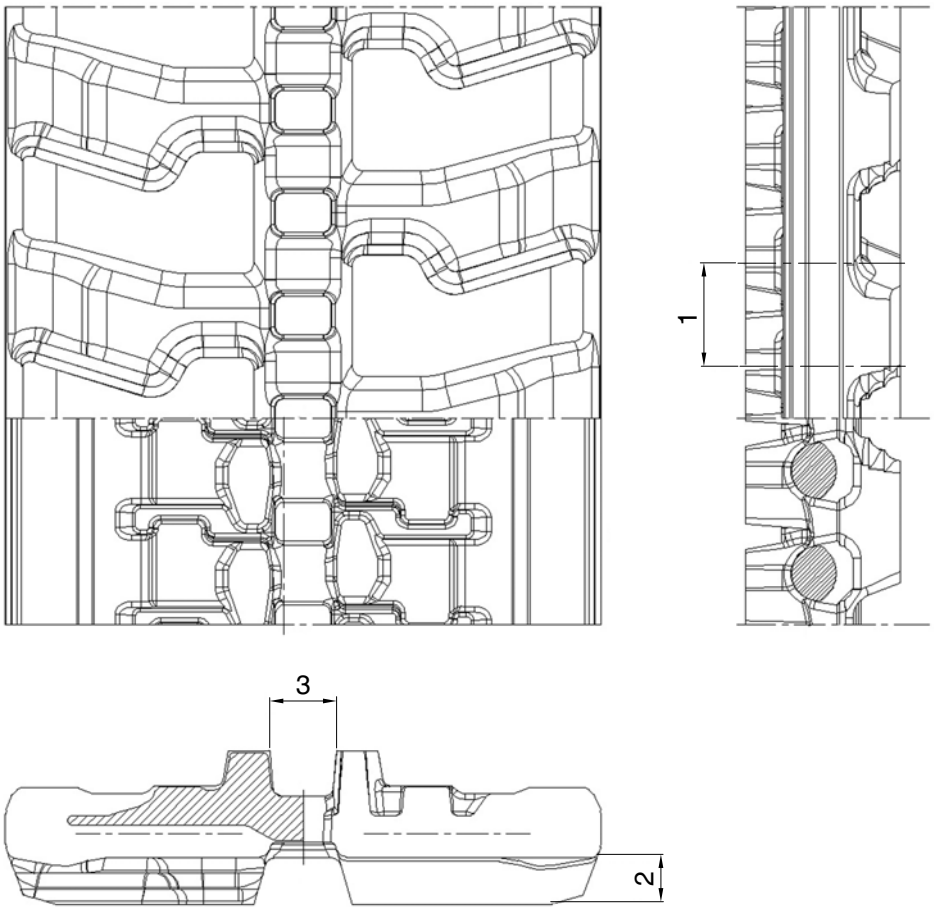



35AZ6MC18

Unit : mm

| No | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| | | Standard size | Repair limit | |
| 1 | Link pitch | 101.6 | 105.0 | Replace bushing and pin and link assembly |
| 2 | Outside diameter of bushing | 32.17 | 28.77 | |
| 3 | Height of grouser | 16.5 | 12.5 | Lug welding, rebuild or replace |
| 4 | Height of link | 65 | 60 | |

## 2) RUBBER SHOE

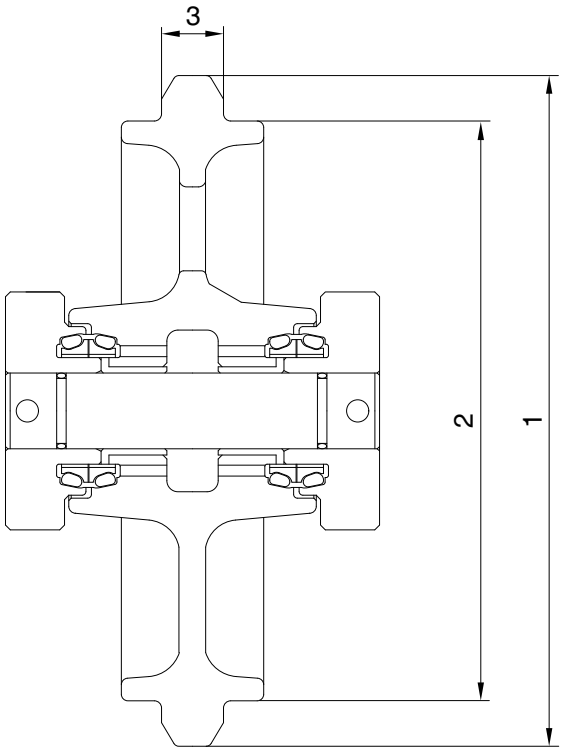



35Z9A6MC17

Unit : mm

| No | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| | | Standard size | Repair limit | |
| 1 | Link pitch | 52.5 | 54.5 | Replace |
| 2 | Height of grouser | 25 | 5 | |
| 3 | Width of link | 33 | 46 | |

## 2. IDLER

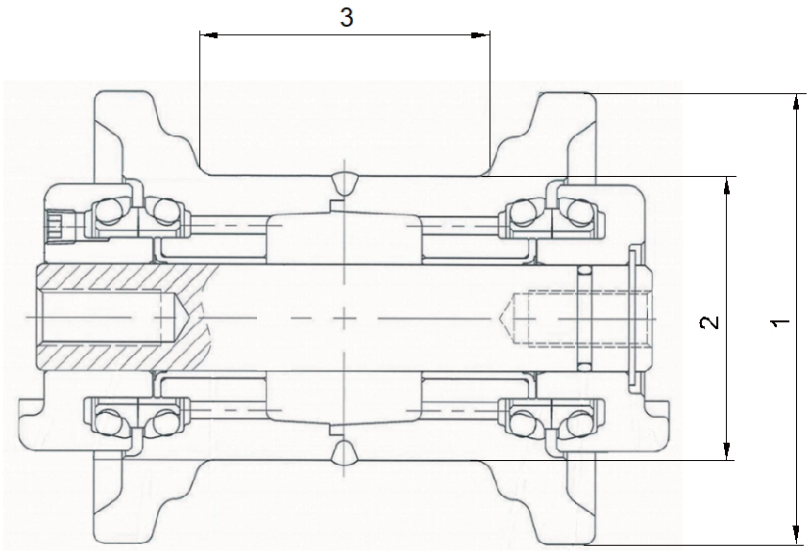



35Z9A6MC18

Unit : mm

| No | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| | | Standard size | Repair limit | |
| 1 | Outside diameter of flange | 331 | - | Rebuild or replace |
| 2 | Outside diameter of thread | 289 | 279 | |
| 3 | Width of flange | 26.2 | 20.2 | |

## 3. TRACK ROLLER

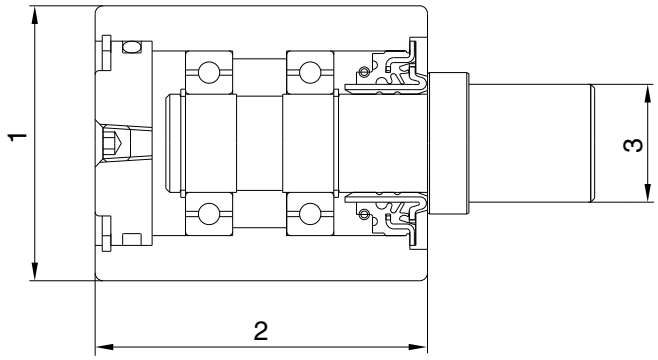



35AZ6MC19

Unit : mm

| No | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| | | Standard size | Repair limit | |
| 1 | Outside diameter of flange | Ø127 | 129 | Rebuild or replace |
| 2 | Outside diameter of thread | Ø80 | 89 | |
| 3 | Width of flange | 81 | 85 | |

## 4. CARRIER ROLLER

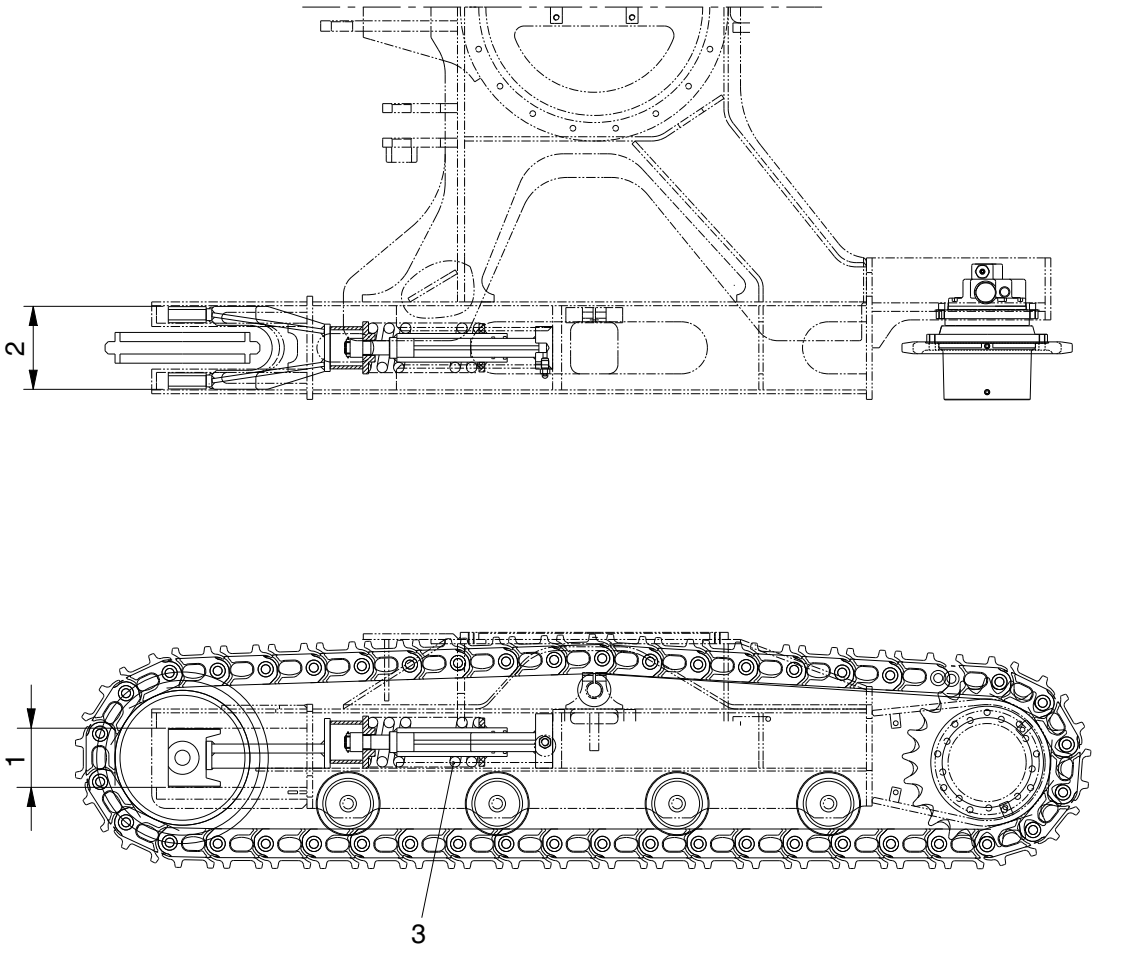



35AZ6MC20

Unit : mm

| No | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| | | Standard size | Repair limit | |
| 1 | Outside diameter of flange | Ø70 | Ø66 | Replace |
| 2 | Width of tread | 86 | - | |
| 3 | Diameter of shaft | Ø30 | - | |

## 5. TENSION CYLINDER (steel and rubber track)



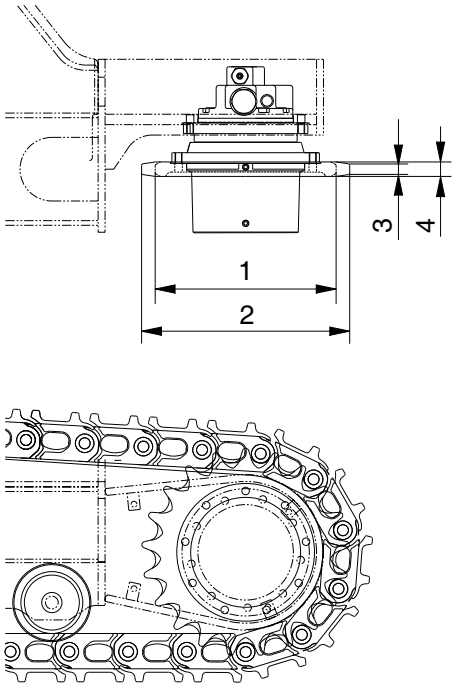

R35Z76MC21

Unit : mm

| No | Check item | Criteria | | | Remedy |
|---|---|---|---|---|---|
| | | | Standard size | Repair limit | |
| 1 | Vertical width of idler guide | Track frame | 125 | 129 | Rebuild |
| | | Idler support | 124 | 128 | Rebuild or replace |
| 2 | Horizontal width of idler guide | Track frame | 178 | 182 | Rebuild |
| | | Idler guide | 174 | 178 | Rebuild or replace |
| 3 | Recoil spring | Standard size | | | Repair limit | | Replace |
| | | Free length | Installed length | Installed load | Free length | Installed load | |
| | | 286.5 | A : 233.5<br>B : 220 | 2,698 kg | - | 2,158 kg | |

A : steel track B : rubber track

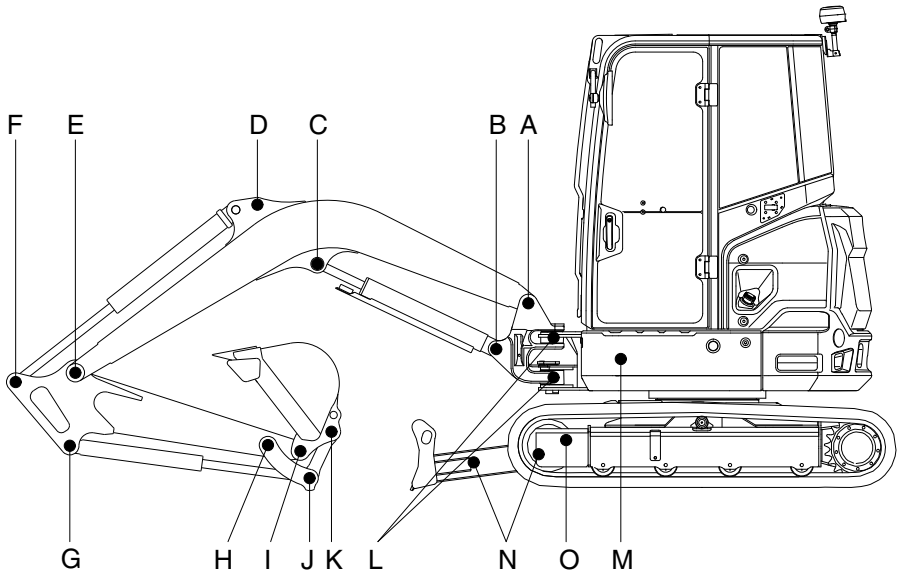
## 6. SPROCKET (steel and rubber track)




R35Z76MC22

| No | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| | | Standard size | Repair limit | |
| 1 | Wear out of sprocket tooth lower side diameter | 313.72 | 304.72 | Repair or Replace |
| 2 | Wear out of sprocket tooth upper side diameter | 359.75 | - | |
| 3 | Wear out of sprocket tooth upper side width | 18 | - | |
| 4 | Wear out of sprocket tooth lower side width | 25 | 17 | |

## 7. WORK EQUIPMENT




35AZ6MC30

Unit : mm

| Mark | Measuring point (Pin and Bushing) | Normal value | Pin | | Bushing | | Remedy & Remark |
|---|---|---|---|---|---|---|---|
| | | | Recomm. service limit | Limit of use | Recomm. service limit | Limit of use | |
| A | Boom Rear | 50 | 49 | 48.5 | 50.5 | 51 | Replace |
| B | Boom Cylinder Head | 45 | 44 | 43.5 | 45.5 | 46 | 〃 |
| C | Boom Cylinder Rod | 45 | 44 | 43.5 | 45.5 | 46 | 〃 |
| D | Arm Cylinder Head | 45 | 44 | 43.5 | 45.5 | 46 | 〃 |
| E | Boom Front | 45 | 44 | 43.5 | 45.5 | 46 | 〃 |
| F | Arm Cylinder Rod | 45 | 44 | 43.5 | 45.5 | 46 | 〃 |
| G | Bucket Cylinder Head | 40 | 39 | 38.5 | 40.5 | 41 | 〃 |
| H | Arm Link | 40 | 39 | 38.5 | 40.5 | 41 | 〃 |
| I | Bucket and Arm Link | 40 | 39 | 38.5 | 40.5 | 41 | 〃 |
| J | Bucket Cylinder Rod | 40 | 39 | 38.5 | 40.5 | 41 | 〃 |
| K | Bucket Link | 40 | 39 | 38.5 | 40.5 | 41 | 〃 |
| L | Boom swing post | 70 | 69 | 68.5 | 70.5 | 71 | 〃 |
| M | Boom swing cylinder | 45 | 44 | 43.5 | 45.5 | 46 | 〃 |
| N | Blade cylinder | 45 | 44 | 43.5 | 45.5 | 46 | 〃 |
| O | Blade and frame link | 40 | 39 | 38.5 | 40.5 | 41 | 〃 |