FUEL SAVING
OPERATION GUIDE

Quality Parts and Service support that you can rely on

Komatsu
Driven by your success
CONTENTS

Introduction .................................................................................................................. 3

MACHINE OPERATION FOR FUEL SAVINGS ......................................................... 4

1.1 HYDRAULIC EXCAVATOR .................................................................................. 6
   1. IDLING ............................................................................................................ 7
   2. DIGGING ....................................................................................................... 8
   3. DIGGING & LOADING .................................................................................. 9, 10
   4. LOADING ..................................................................................................... 11
   5. TRAVELING .................................................................................................. 12

1.2 WHEEL LOADER ................................................................................................. 14
   1. IDLING ............................................................................................................ 15
   2. DIGGING ....................................................................................................... 16, 17
   3. LOADING ..................................................................................................... 18
   4. TRAVELING .................................................................................................. 19

1.3 DUMP TRUCK .................................................................................................... 20
   1. IDLING ............................................................................................................ 21
   2. DRIVING ....................................................................................................... 22, 23
   3. TRAVELING .................................................................................................. 24, 25
   4. DUMPING .................................................................................................... 26
   5. POWER SELECTION .................................................................................... 27
# MAINTENANCE FOR FUEL SAVINGS

1. Basics of Maintenance Work

2. Engine
   - (1) Air cleaner
   - (2) Fuel injection timing
   - (3) Valve clearance
   - (4) Injection nozzle

3. Fuel System

4. Undercarriage (Hydraulic Excavator)

5. Tires (Wheel Loader & Dump Truck)

6. Oil Maintenance
   - (1) Oil viscosity
   - (2) Oil replacement interval

7. Management for Fuel Savings (Dump Truck)
Introduction

Global warming due to increasing concentrations of greenhouse gases in the atmosphere has become a major issue in recent years. Also, fuel consumption is a major concern for Komatsu’s customers from an economical point of view. In response, Komatsu has been focusing on decreasing exhaust emissions as one of its top priorities in product development, and conducted research on machine work methods in order to reduce exhaust emissions through improved fuel efficiency.

This guide provides the essential knowledge and know-how about the operation for saving fuel or better fuel efficiency. Please review your machine operation once again, and practice fuel-saving-operation according to these guidelines. Satisfaction will definitely be a positive result.

Fuel management is in your hands now!

The fuel efficiency statistics displayed herein may vary depending on the actual work site, machine condition and operator skill.
MACHINE OPERATION FOR FUEL SAVINGS
1.1 HYDRAULIC EXCAVATOR
1. IDLING

ADVICE

- Stop the engine as much as possible.
- Do not leave the engine idling during waiting times or breaks.

Avoid unnecessary engine idling.

KEY POINT

While it is necessary to keep an engine idling for 5 minutes right after startup and right before shutting down, unnecessary engine idling consumes fuel for no reason.

TEST DATA

<table>
<thead>
<tr>
<th>When idling</th>
<th>0.76 L / H</th>
</tr>
</thead>
<tbody>
<tr>
<td>When idling in auto deceleration mode</td>
<td>3.30 L / H</td>
</tr>
</tbody>
</table>

Conditions: 1 hour engine idling reduction per day and 25 work days per month
This fuel consumption amount will further increase if a machine is idling in the auto deceleration*1 mode, i.e., it consumes approx. 3.3 liters an hour.

REMARKS

*1 Auto Decel Idling:
Auto deceleration is a function built into Komatsu hydraulic excavators (above 10-ton class).
It serves to automatically reduce the engine revolution to the medium speed when the control lever is left in the neutral position for 4 seconds such as when the machine is waiting for a dump truck, thereby lowering fuel consumption and noise.
(Example)
Engine Revolution (PC200-7)
: When idling 980 – 1080 rpm
: When idling in auto deceleration mode 1300 – 1500 rpm
2. DIGGING

ADVICE

- Avoid relieving hydraulic pressure as much as possible.
- Aim at smooth digging by lessening the load.

KEY POINT

When a load from a single dig is too big, the work equipment will not work even though the control lever is kept engaged, as hydraulic pressure is relieved.

*1 When hydraulic pressure is relieved, the bucket does not scoop sand and earth, i.e., no work can be done, nonetheless fuel is still consumed.

TEST DATA

<table>
<thead>
<tr>
<th>&lt;20-ton class Hydraulic Excavator (PC200-7)&gt;</th>
<th>&lt;Annual fuel savings&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>When hydraulic pressure is relieved 28 L / H</td>
<td>840 L / Year</td>
</tr>
</tbody>
</table>

Conditions: 6 min. Hydraulic pressure relief reduction per day and 25 work days per month.

REMARKS

*1 Hydraulic Pressure Relief:
It means that the relief valve to the tank circuit is open. Under this condition, work equipment force will not increase, but stay the same.
HYDRAULIC EXCAVATOR

3. DIGGING & LOADING

ADVICE

- Reduce engine speed.
- Use E Mode*1.

KEY POINT

In the same operation, lower engine speed, requires less consumption. Lower engine speed reduces productivity as well, but compensates with improved fuel efficiency.

TEST DATA

<20-ton class Hydraulic Excavator>

(Conditions)
1. Loading a dump truck parked on the same ground level (height).
2. Digging downward
3. Loading a dump truck using 90° swing angles
4. Sand and earth to be dug out

<table>
<thead>
<tr>
<th>Items</th>
<th>Mode</th>
<th>Throttle</th>
<th>Index</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>Full</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% less</td>
<td>109%</td>
<td>+9%</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Full</td>
<td>111%</td>
<td>+11%</td>
</tr>
<tr>
<td>Fuel Consumption (L / H)</td>
<td>A</td>
<td>Full</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% less</td>
<td>88%</td>
<td>-12%</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Full</td>
<td>77%</td>
<td>-23%</td>
</tr>
<tr>
<td>Production (Ton / H)</td>
<td>A</td>
<td>Full</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% less</td>
<td>93%</td>
<td>-7%</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Full</td>
<td>88%</td>
<td>-12%</td>
</tr>
<tr>
<td>Fuel Efficiency *2 (Ton / L)</td>
<td>A</td>
<td>Full</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% less</td>
<td>104%</td>
<td>+4%</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Full</td>
<td>114%</td>
<td>+14%</td>
</tr>
</tbody>
</table>

Fuel efficiency can vary depending on the kind of sand and earth to be dug out.

REMARKS

*1. E Mode (Eco Mode):
This is a function built into Komatsu’s 20-ton class hydraulic excavators. In this mode, the engine power is used at approx. 85% of the full throttle. (It is effective for reducing fuel costs and noise.)

*2. Fuel Efficiency (tons per liter):
Production per Fuel Consumption
3. DIGGING & LOADING

ADVICE

- **Raise excavation position.**
- **Conduct two-tiered excavation.**

**KEY POINT**

The bench height should be the same height or slightly higher than the dump truck body. Excavating the upper side of the slope first and then working on the exposed lower portion shortens cycle time compared with slope toe excavation.

**TEST DATA**

*<20-ton class Hydraulic Excavator>*

(Conditions)
1. Loading a dump truck parked on a lower ground level.
2. Digging downward
3. Loading a dump truck using 90° swing angles
4. Sand and earth to be dug out

<table>
<thead>
<tr>
<th>Items</th>
<th>Operation Type</th>
<th>Index</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle Time</td>
<td>Slope Toe</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Two-tiered slope</td>
<td>88%</td>
<td>-12%</td>
</tr>
<tr>
<td>Fuel Consumption (L/H)</td>
<td>Slope Toe</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Two-tiered slope</td>
<td>98%</td>
<td>-2%</td>
</tr>
<tr>
<td>Production (Ton/H)</td>
<td>Slope Toe</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Two-tiered slope</td>
<td>106%</td>
<td>+6%</td>
</tr>
<tr>
<td>Fuel Efficiency *1 (Ton/L)</td>
<td>Slope Toe</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Two-tiered slope</td>
<td>108%</td>
<td>+8%</td>
</tr>
</tbody>
</table>

Fuel efficiency varies depending on the kind of sand and earth to be dug out.

**REMARKS**

*1. Fuel Efficiency (tons per liter): Production per Fuel Consumption*
4. LOADING

ADVICE

- Reduce swing angle.
- Be closer to a dump truck.

KEY POINT

When loading dump trucks, reducing the swing angle can accelerate the cycle time, boost hourly productivity and raise fuel efficiency\(^*1\).

TEST DATA

<20-ton class Hydraulic Excavator>

<table>
<thead>
<tr>
<th>Items</th>
<th>Swing Angle</th>
<th>Index</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle Time</td>
<td>90°</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>30°</td>
<td>96%</td>
<td>-4%</td>
</tr>
<tr>
<td>Fuel Consumption (L/H)</td>
<td>90°</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>30°</td>
<td>101%</td>
<td>+1%</td>
</tr>
<tr>
<td>Production (Ton/H)</td>
<td>90°</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>30°</td>
<td>104%</td>
<td>+4%</td>
</tr>
<tr>
<td>Fuel Efficiency (^*1) (Ton/L)</td>
<td>90°</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>30°</td>
<td>103%</td>
<td>+3%</td>
</tr>
</tbody>
</table>

REMARKS

*1. Fuel Efficiency (tons per liter): Production per Fuel Consumption
5. TRAVELING

ADVICE

● Travel at lower speeds.

KEY POINT

Higher travel speeds mean higher engine revolutions, expending more fuel. Conversely, lowering the engine speed improves traveling fuel efficiency*1.

TEST DATA

<20-ton class Hydraulic Excavator>

<table>
<thead>
<tr>
<th>Items</th>
<th>Engine Throttle</th>
<th>Index</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Travel Speed (M)</td>
<td>Full</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>10% less</td>
<td>81%</td>
<td>-9%</td>
</tr>
<tr>
<td></td>
<td>15% less</td>
<td>71%</td>
<td>-29%</td>
</tr>
<tr>
<td>Fuel Consumption (L/H)</td>
<td>Full</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>10% less</td>
<td>75%</td>
<td>-25%</td>
</tr>
<tr>
<td></td>
<td>15% less</td>
<td>67%</td>
<td>-33%</td>
</tr>
<tr>
<td>Fuel Efficiency (M/H)</td>
<td>Full</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>10% less</td>
<td>108%</td>
<td>+8%</td>
</tr>
<tr>
<td></td>
<td>15% less</td>
<td>106%</td>
<td>+6%</td>
</tr>
</tbody>
</table>

REMARKS

*1. Fuel Efficiency = Travel Distance / Amount of Fuel Consumed
1. 2 WHEEL LOADER
1. IDLING

ADVICE

- Stop the engine as much as possible.
- Do not leave the engine idling during waiting times or breaks.

Avoid unnecessary engine idling.

KEY POINT

While it is necessary to keep an engine idling for 5 minutes right after startup and right before shutting down, unnecessary engine idling consumes fuel for no reason.

TEST DATA

<table>
<thead>
<tr>
<th>&lt;3.4m³ bucket size class Wheel Loader&gt;</th>
<th>&lt; Annual fuel savings &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idling fuel consumption</td>
<td>4.20 L / H</td>
</tr>
</tbody>
</table>

Conditions: 1 hour engine idling reduction per day and 25 work days per month
2. DIGGING

ADVICE

- Avoid relieving hydraulic pressure and torque converter stall.

KEY POINT

When sand and earth to be dug out imposes too big of a load, the work equipment will not move even though the control lever is kept engaged, as the torque converter stalls and hydraulic pressure is relieved.

More fuel is consumed in a combination of relieving hydraulic pressure*1 and torque converter stall*2 than in the use of V shape loading.

TEST DATA

<table>
<thead>
<tr>
<th>&lt;3.4m³ bucket size class Wheel Loader&gt;</th>
<th>&lt;Annual fuel savings&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>30° V shape loading</td>
<td>28 L / H</td>
</tr>
<tr>
<td>Relieving hydraulic pressure relief and torque converter stall</td>
<td>43 L / H</td>
</tr>
<tr>
<td></td>
<td>6450 L / Year</td>
</tr>
</tbody>
</table>

Conditions: 30 minutes hydraulic pressure relief reduction per day and 25 work days per month

REMARKS

*1. Hydraulic pressure relief:
   It means that the relief valve to the tank circuit is open. Hydraulic pressure will not rise while the valve is open.
*2. Torque converter stall:
   This term refers to the condition of torque converter when a machine stops while the engine is still running due to some external force.
2. DIGGING

ADVICE

● Avoid tire slippage.

KEY POINT

The tires of a wheel loader tend to slip when it grinds to a halt while digging and the engine is revved to still move it forward. When the tires slip, the bucket can no longer dig into sand and earth and scoop. Prolonged tire slippage consumes fuel for no reason.

(1) If the bucket is pressed hard against the ground during the digging work, the front wheels lift off the ground (consequently, the load on the front wheels diminishes), which in turn makes it easier for them to slip. Before digging into sand and earth, hold the bucket slightly off the ground.

(2) When the tires show signs of slipping, release the accelerator pedal slightly and press on the accelerator pedal gradually to raise the engine revolution up to a level right before slipping, thereby digging into the ground and scooping sand and earth.

(3) If the tires begin to slip, release the accelerator pedal once and step on it again gradually to dig and scoop as explained above.
3. LOADING

ADVICE

- Shorten the loading distance.
- Minimize the loading V-angle.

**KEY POINT**

Optimum: Distance 0.8L
Angle 30°

**TEST DATA**

<table>
<thead>
<tr>
<th>Items</th>
<th>Distance</th>
<th>Index</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle Time</td>
<td>0.8L</td>
<td>92%</td>
<td>-8%</td>
</tr>
<tr>
<td></td>
<td>1.0L</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>1.5L</td>
<td>112%</td>
<td>+12%</td>
</tr>
<tr>
<td>Fuel Consumption (L/H)</td>
<td>0.8L</td>
<td>101%</td>
<td>+1%</td>
</tr>
<tr>
<td></td>
<td>1.0L</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>1.5L</td>
<td>101%</td>
<td>+1%</td>
</tr>
<tr>
<td>Production (Ton/H)</td>
<td>0.8L</td>
<td>117%</td>
<td>+17%</td>
</tr>
<tr>
<td></td>
<td>1.0L</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>1.5L</td>
<td>93%</td>
<td>-7%</td>
</tr>
<tr>
<td>Fuel Efficiency *1 (Ton/L)</td>
<td>0.8L</td>
<td>116%</td>
<td>+16%</td>
</tr>
<tr>
<td></td>
<td>1.0L</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>1.5L</td>
<td>92%</td>
<td>-8%</td>
</tr>
</tbody>
</table>

Conditions:
1. 30° V shape loading
2. Forward and reverse travel distance classified into three stages (L = machine overall length)

**REMARKS**

*1. Fuel Efficiency (tons per liter): Production per Fuel Consumption
4. TRAVELING

ADVICE

● Travel at lower speeds.

KEY POINT

Higher travel speeds mean higher engine revolutions, expending more fuel. Conversely, lowering the engine speed improves traveling fuel efficiency*1.

TEST DATA

<table>
<thead>
<tr>
<th>Items</th>
<th>Max Travel Speed</th>
<th>Index</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L/H)</td>
<td>21km/h</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>17km/h</td>
<td>79%</td>
<td>-21%</td>
</tr>
<tr>
<td></td>
<td>14km/h</td>
<td>65%</td>
<td>-35%</td>
</tr>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Ton/H)</td>
<td>21km/h</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>17km/h</td>
<td>91%</td>
<td>-9%</td>
</tr>
<tr>
<td></td>
<td>14km/h</td>
<td>81%</td>
<td>-19%</td>
</tr>
<tr>
<td>Fuel Efficiency*1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Ton/L)</td>
<td>21km/h</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>17km/h</td>
<td>116%</td>
<td>+16%</td>
</tr>
<tr>
<td></td>
<td>14km/h</td>
<td>124%</td>
<td>+24%</td>
</tr>
</tbody>
</table>

Conditions:
1. Load & Carry operation.
2. Bucket filled with sand and earth
3. Travel distance of 95 m

REMARKS

*1. Fuel Efficiency (tons per liter):
Production per Fuel Consumption
1.3 DUMP TRUCK
1. IDLING

ADVICE

- Stop the engine as much as possible.
- Do not leave the engine idling during waiting times or breaks.

Avoid unnecessary engine idling.

KEY POINT

While it is necessary to keep an engine idling for 5 minutes right after the startup and right before shutting down, unnecessary engine idling consumes fuel for no reason.

TEST DATA

<table>
<thead>
<tr>
<th>When idling</th>
<th>8 L / H</th>
</tr>
</thead>
</table>

<90-ton class Dump truck>  
<Annual fuel saving>  

2400 L / Year

Conditions: 1 hour engine idling reduction per day and 25 work days per month
2. DRIVING

ADVICE

• Drive with coasting.

KEY POINT

No fuel is consumed by releasing the acceleration pedal and applying the engine brake while driving.

(1) Normal driving  Fig. 1

- Fuel is consumed as the accelerator pedal is depressed.
- The retarder brake begins to work.
- Fuel Cutoff
- Initial Speed 30 km/h
- Fuel is consumed until dump truck stops.

(2) Coasting  Fig. 2

- Beginning of Coasting
- No fuel is injected for this portion of running.
- Fuel Cutoff
- Initial Speed 30 km/h
- Stop Point
- A driving technique enabling a coasting distance created by the initial speed that can help save fuel.

When a dump truck is going down a slope, the driver is required to select an appropriate safety speed, taking into account the initial running speed and slope inclination.

Never coast on a downslope.

TEST DATA

<90-ton class Dump Truck with load>  <Condition of hauling road: 100 m of startup running and 120 m of coasting>

<table>
<thead>
<tr>
<th>Items</th>
<th>Index of Fuel Consumption ( L / H )</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Driving (Fig.1)</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td>Coasting (Fig.2)</td>
<td>62%</td>
<td>-38%</td>
</tr>
</tbody>
</table>
2. DRIVING

ADVICE

- Drive at a constant speed.
- Do not accelerate and decelerate frequently.

KEY POINT

(1) Driving at constant speed  Fig. 1

Driving at a constant speed to minimize variations in running speed less fuel consumption.

(2) Frequent acceleration and deceleration  Fig. 2

Repeated acceleration and deceleration reduces fuel efficiency.

TEST DATA

<90-ton class Dump Truck with load>

<table>
<thead>
<tr>
<th>Driving type</th>
<th>Index of Fuel Consumption (L/H)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent acceleration and deceleration (Fig.1)</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td>Constant Speed (Fig.2)</td>
<td>87%</td>
<td>-13%</td>
</tr>
</tbody>
</table>

Conditions: Alternating speeding up and slowing down twice between 20 km/h and 30 km/h in a 300 m distance
3. TRAVELING

ADVICE

● Travel at lower speeds.

**Recommended**  
慢速 (Slow)

**Not Recommended**  
快速 (Fast)

KEY POINT

Higher travel speeds mean higher engine revolutions, expending more fuel. Conversely, lowering the engine speed improves traveling fuel efficiency.

It takes more time when a dump truck is running at a lower speed, but the time saved could easily be wasted for reason if waiting at its destination for loading or dumping.

TEST DATA

<90-ton class Dump Truck with load>

<table>
<thead>
<tr>
<th>Items</th>
<th>Index of Fuel Consumption (L/H)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>40km/h</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td>30km/h</td>
<td>84%</td>
<td>-16%</td>
</tr>
</tbody>
</table>

Conditions: Running for a 100 m distance at a speed of 30 km/h and 40 km/h, respectively
3. TRAVELING

ADVICE

● **Switch off the exhaust brake when coasting on a flat road assuring safety. (If equipped)**

KEY POINT

<table>
<thead>
<tr>
<th>Exhaust Switch</th>
<th>Switch Condition</th>
<th>Switch Lamp</th>
<th>Condition for Activation</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Pressed in</td>
<td>Light up</td>
<td>Activated when the foot is released from the accelerator pedal</td>
</tr>
<tr>
<td>ON</td>
<td>Pressed out</td>
<td>Go off</td>
<td>Activated together with the service brake or retarder brake</td>
</tr>
</tbody>
</table>

REMARKS

Exhaust Brake

The exhaust brake works by applying resistance to the exhaust from the engine. It is activated when the torque converter is in the lockup* condition.

*Lockup means that engine output is directly transmitted to the transmission, bypassing the torque converter. The function can be turned on and off with a switch inside the operator’s cab.

Table for Operating Exhaust Brake
4. DUMPING

ADVICE

- Make sure to carry out dumping at a lower engine speed!

KEY POINT

In dumping, a lifting speed of the body changes in proportion to the engine revolution. Therefore the faster the body rises, the more fuel the engine consumes.

In the dumping operation, at 80% of the max. engine revolution, fuel can be saved by as much as 45%, as compared with dumping at the max. engine revolution.

TEST DATA

<90-ton class Dump Truck with load>

<table>
<thead>
<tr>
<th>Items</th>
<th>Index of Fuel Consumption ( L / H )</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine at max. revolution</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td>Engine at 80% of max.</td>
<td>55%</td>
<td>-45%</td>
</tr>
</tbody>
</table>
5. POWER SELECTION

ADVICE

**Use Economy Mode for better fuel economy!**

KEY POINT

This is a function Komatsu dump trucks are equipped with, which allows an operator to select either the max. or 85% of engine output.

- **High Power Mode**
  A mode to enable the engine to exert its max. power, thereby maximizing the workload. (Best suited to a jobsite that requires a dump truck to climb up a slope with a load)

- **Economy Mode**
  A mode to limit the engine power to 85% of its max. power, aiming at fuel savings. In addition, the shift-up and shift-down points are set low to keep engine running low. (Best suited to work on a level ground that does not require the max. engine power and focuses on achieving fuel economy)

More time is required for the work to the extent that the engine is throttled down, but this mode also demonstrates a fuel-saving effect on an uphill climb. It will prove very effective in work that focuses on achieving fuel economy.

**TEST DATA**

<table>
<thead>
<tr>
<th>Items</th>
<th>Index of Fuel Consumption ( L / H )</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-Mode</td>
<td>100%</td>
<td>—</td>
</tr>
<tr>
<td>E-Mode</td>
<td>89%</td>
<td>-11%</td>
</tr>
</tbody>
</table>

Conditions: Climbing on an uphill of 10% grade for a 200 m distance
MAINTENANCE FOR FUEL SAVINGS
1. Basics of Maintenance Work

- Always keep your machine in good condition through recommended inspection and maintenance to ensure that machine can run smoothly with good fuel consumption.

Fuel, oils and water used for construction equipment may well be compared to bread and butter, blood, sweat and tears for humans. Machines, cannot do without any of them, and it will cause a serious problem if the wrong one is used.

<Handling of Fuel>

- Do not use fuel that contains water.
- Do not allow dirt and dust to get into fuel.
- Be sure to use a designated fuel.
- Fill up the fuel tank after the day’s work.
- Drain water from the fuel tank before starting the engine.

<Handling of Oils>

- Be sure to replace oils at a specified interval.
- Do not allow dirt and dust to get into oils.
- Do not blend oils of different grades and brands.
- Be sure to fill oils at the specified amount.

<Handling of Cooling Water>

- Do not use undrinkable water for cooling.
- When using antifreeze, follow the instructions for use.
- Be sure to fill water at the specified amount.

<Handling of Filters>

- Replace filters periodically (in a jobsite having rigorous working conditions, replace them at a shorter interval).
- Never reuse filters (cartridge type) even well cleaned.
- Make sure to use Komatsu genuine filters.
2. Engine

(1) Air cleaner

- **Clean or replace the outer element to prevent the filter element from clogging when the dust indicator turns red.**

If the air cleaner is clogged due to less intake air volume, exhaust color becomes darker and the engine power goes down, and fuel consumption increases (by approx. 3%).

![Dust Indicator Cleaning of Outer Element]

1. When this portion turns red, the air cleaner needs to be cleaned.
2. Press down this button after cleaning to turn the red indicator off.

Blow dry compressed air (pressure to be 7 kgf/cm² or less).

Do not reuse the inner element even after cleaning.

(2) Fuel injection timing

- **Check the fuel injection timing.**

Good fuel combustion does not take place inside the engine unless fuel is supplied at the appropriate timing in tune with the engine speed. When lower engine power or darker exhaust occur, accompanied by more fuel consumption, check whether or not the fuel injection timing is at the proper setting.
2. Engine

(3) Valve clearance

**Check the valve clearance.**

An engine is equipped with valves that move every time the combustion chamber is closed, the air is drawn in or the exhaust gas is blown out. These valves are activated by a complex mechanical setup. Check the valve clearance every 2000 hours.

- If a valve clearance is too big:
  Enough air cannot be taken in, and fuel can not burn completely (darker exhaust and lower engine power).

- If a valve clearance is too small:
  The combustion chamber does not close tightly, and fuel can not burn (engine output drastically reduced).
2. Engine

(4) Injection nozzle

- **Do not allow dirt and dust to get into fuel tank while filling, and drain water from the fuel tank regularly.**

An injection nozzle is a device to atomize fuel and inject the atomized fuel into a high temperature, high pressure cylinder. If fuel is not well atomized, good combustion cannot be achieved, which causes engine power to lower, exhaust gas to be darker, and fuel consumption to be increased.

A major cause of insufficiently atomized fuel is contamination due to water and dust getting into fuel. So in order to prevent engine failure, do not allow dirt and dust to get into the fuel tank while filling, and drain water from the fuel tank regularly.

![Injection Nozzle Diagram]

**Good and Bad Injection**

- Good Injection
- Bad Injection
- Irregular injection angle
- Defective injection
3. Fuel System

(1) Filter element

- **Replace the fuel filter element periodically.**

A fuel filter element prevents the engine from breaking down and prolongs its service life by providing clean fuel for the engine after removing moisture or dirt and dust contained in fuel. However, major components in the fuel system are lubricated with fuel, and moreover, they are very fine precision parts that are sensitive even to minuscule materials. A trace of them could easily invite seizure, scuffing or rust due to moisture. Therefore, it is necessary to replace the fuel element periodically.

(2) Strainer

- **Clean strainer.**

A strainer is installed on the fuel filler port. Its function is to remove relatively large-sized foreign materials that may enter the fuel tank together with fuel. Do not remove it when pouring fuel. Also, clean it when foreign materials are found upon inspection.
3. Fuel System

(3) Draining water

- **Fill up the fuel tank at end of the day.**
- **Drain water and sediment from the fuel tank during startup inspection.**

When a machine is parked with the fuel tank almost empty, air inside the tank cools off and condenses into droplets of water, which drip into the fuel. Therefore, fill up the fuel tank at the end of the day and drain water and sediment from the fuel tank at the start of the day.
4. Undercarriage
(Hydraulic Excavator)

- **Remove mud.**

If mud has got stuck in the undercarriage, it increases travel resistance, which leads to worse fuel efficiency. Remove mud as often as possible.

- **Adjust track shoe tension.**

If proper track shoe tension is not maintained, it increases travel resistance, which causes higher fuel consumption. For the adjustment method, see the operation and maintenance manual.
5. Tires
(Wheel Loader & Dump Truck)

● Use radial tires.

There are two kinds of tires: a bias tire and a radial tire. Radial tires have less rolling resistance and less fuel consumption than bias tires by 5% to 15%.

Structure of Bias Tire and Radial Tire

Comparison of Rolling Resistance

Example of Comparison of Fuel Consumption for a dump truck

<table>
<thead>
<tr>
<th></th>
<th>Dam Construction Site (one way 6.5 km)</th>
<th>Limestone Quarry (one way approx. 800 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial Tire</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Bias Tire</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
5. Tires
(Wheel Loader & Dump Truck)

- Check tire air pressure during startup inspection when they are still cool so that proper air pressure is maintained at all times.

A tire supports the load with its internal air pressure. Therefore, it can not adequately demonstrate its inherent performance, or has a shorter tirelife, if the internal air pressure is higher or lower than specified. In particular, when the air pressure is lower, tire rims can often incur friction that will cause a problem.
6. Oil Maintenance

(1) Oil viscosity

- **Use an adequate kind of oil that matches the prevailing ambient temperature to prevent engine failure.**

To lubricate various parts of the engine, oil needs to have adequate viscosity. As oil viscosity can largely be affected by ambient temperatures, oil needs to be replaced for another kind that is better suited to the prevailing temperature. When oil viscosity is too high, it not only invites more friction resistance and more fuel consumption, but also causes seizure and rapid wear of parts, which results in bad startability of the engine. Conversely, when oil viscosity is too low, oil will overheat and oil film will be lost, which eventually results in higher oil consumption.

<table>
<thead>
<tr>
<th>Reservoir</th>
<th>Fluid Type</th>
<th>Ambient Temperature</th>
<th>Recommended Komatsu Fluids</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>-22 -4 14 32 50 68 86 104 122 °F</td>
<td></td>
</tr>
<tr>
<td>Engine Oil Pan</td>
<td>Engine Oil</td>
<td></td>
<td>Komatsu EOS0W30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Komatsu EOS5W40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Komatsu EO10W30-DH</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Komatsu EO15W40-DH</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Komatsu EO30-DH</td>
</tr>
</tbody>
</table>

Refer to the operation and maintenance manual for the detail recommendation of oil usage.
6. Oil Maintenance

(2) Oil replacement interval

- **Replace the engine oil and filter elements periodically in order to minimize engine failure and optimize fuel consumption.**

Engine oil has five functions: lubrication, cleaning, cooling, oil tightness and rust inhibition. As the time of use wears on, these properties become lower or deteriorate. If it is used beyond the specified time of replacement, it will rapidly lose those properties because of generated heat and impurities like oxide, carbon and sludge, as well as reduce the effects of additives. All of these (combined) will result in shortening the life of an engine, not to mention higher consumption of fuel.

Meanwhile, engine oil circulates inside the engine to lubricate each part. It is vital that engine oil remains clean. For this reason, if an oil filter, which catches dirt and impurities in the oil (both getting in from the outside and generated inside), does not work properly, that leads to parts seizure and an even shorter engine life.
Without a log to record operation, fuel-saving driving can help determine whether fuel consumption is high or low. However, in the case of high consumption, it does not help identify the cause.

Even if a dump truck is running along the same hauling road, fuel consumption can vary depending on the operator’s way of driving and various other prevailing conditions like machine maintenance, and road surface. Thus, it becomes necessary to keep a clear record of all factors relating to dump truck operation so that when fuel consumption goes up, the cause for the deterioration can be identified and the proper action can be taken.

An Example of Fuel Management

<table>
<thead>
<tr>
<th>Truck No.</th>
<th>Date of Operation</th>
<th>Weather</th>
<th>Load</th>
<th>Hauled Volume (ton)</th>
<th>Driving Course</th>
<th>Tacho Chart</th>
<th>Operation Hours (H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>505</td>
<td>2001.4.10</td>
<td>Clear</td>
<td>Sand and earth</td>
<td>3640</td>
<td>A</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>505</td>
<td>2001.4.11</td>
<td>Rainy</td>
<td>Sand and earth</td>
<td>2912</td>
<td>A</td>
<td></td>
<td>8</td>
</tr>
</tbody>
</table>

(Continued)

<table>
<thead>
<tr>
<th>Hauling Distance (km)</th>
<th>Fuel Consumed (L)</th>
<th>Driver's Name</th>
<th>Per-hour Fuel Consumption (L/H)</th>
<th>Per-hour Hauled Volume (Ton/H)</th>
<th>Per-ton Fuel Consumption (L/ton)</th>
<th>Per-liter Hauling Distance (km/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>130</td>
<td>Z</td>
<td>16.2</td>
<td>455</td>
<td>0.036</td>
<td>0.31</td>
</tr>
<tr>
<td>32</td>
<td>102</td>
<td>Z</td>
<td>12.7</td>
<td>354</td>
<td>0.035</td>
<td>0.31</td>
</tr>
</tbody>
</table>

- Analyze dump truck operation records using a revolving tacho chart and utilize results of the analysis to train operators for better fuel savings.

Points to be checked

- Is the travel speed too high?
  Check if the travel speed has not exceeded the speed limit, or the operator has not run faster than other operators do.

- Does the travel speed change too often?
  When a travel speed changes too often, so does the engine speed.
FOR MORE INFORMATION:

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New Caledonia: Ph: 24 25 10

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