Remanufacturing Research and Development

Submitted by: Komatsu Ltd
Remanufacturing Research and Development

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4) Reman Facility (KRI)
## Main Products

### Crawler Dozers

<table>
<thead>
<tr>
<th>Model</th>
<th>Operating wgt.(ton)</th>
<th>Capacity (HP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D155 - D475</td>
<td>39.5 – 113.2</td>
<td>354 - 890</td>
</tr>
</tbody>
</table>

### Crawler Excavators

<table>
<thead>
<tr>
<th>Model</th>
<th>Operating wgt.(ton)</th>
<th>Capacity (HP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC1000 - PC8000</td>
<td>103.0 – 744.0</td>
<td>611 - 3863</td>
</tr>
</tbody>
</table>

### Dump Trucks

<table>
<thead>
<tr>
<th>Model</th>
<th>Operating wgt.(ton)</th>
<th>Capacity (HP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD465 – 960E</td>
<td>42.8 – 249.5</td>
<td>739 - 3500</td>
</tr>
</tbody>
</table>

### Wheel Loaders

<table>
<thead>
<tr>
<th>Model</th>
<th>Operating wgt.(ton)</th>
<th>Capacity (HP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA500 – WA1200</td>
<td>32.9 – 205.2</td>
<td>353 – 1715</td>
</tr>
</tbody>
</table>

### Motor Graders

<table>
<thead>
<tr>
<th>Model</th>
<th>Operating wgt.(ton)</th>
<th>Capacity (HP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GD825</td>
<td>26.4</td>
<td>280</td>
</tr>
</tbody>
</table>

## Overburden treatment in mining

- **Electric Dump Truck** (wgt. 140.6 ton, 2,000HP)  
- **Excavator** (wgt. 398.0ton, 1,775HP)
Komatsu Reman Operation

1. Concept

Komatsu is helping to create a resource recycling society by promoting the reuse and recycling of used components and by improving the recyclability rate of construction machinery through its Reman Activity.

2. Basic Policy

Komatsu to provide Quality Assurance Responsibility for Reman as a manufacture to maximize Customer Machine Availability and O&O Cost Reduction and create Reliable Relationship with Customer.

1. Quality: Quality & Performance guaranteed to be the same level as for new component
2. Cost: Lower cost for Reman component
3. Delivery: Reduced idle time for machines through sufficient Inventory
4. Efficiency: Centralized by Komatsu Reman Facility can avoid duplicate investment by customer
Reman Potential

Reman Activity has been growing

Lots of Potential in future with machine population increase

Large size machine global population

(Komatsu Global Reman Operation Network)

① Komatsu has Large size Global Reman Operation Facilities in Indonesia & Chile
② Komatsu establish Regional Reman Facilities in Emerging area
   (Difficult Core Trade; China, Russia, India & Brazil)
Remanufacturing Research & Development

Research Center

Development Center

- Dozer
- Excavator
- Dump Trucks
- ICT, Others

- Engines
- Transmissions
- Hydraulic Pumps, Cylinders
- Electronic, Others

Material development

Components development

Production Engineering development

Co-Working for development

Remanufacturing Engineering development

The Shaft of Engine Water Pump

Spec. of the shaft

- Material: SUS
- Surface hardness: HRC30~35
- Surface hardness
  Oil seal contacted-part: HRC40~50

Remanufactured parts the same quality assurance methods
as Komatsu newly developed parts
Durability Test for the layer of Metal spraying

<table>
<thead>
<tr>
<th>Test Equipment</th>
<th>Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Durability Test (Breaking Test)</td>
<td></td>
</tr>
<tr>
<td>(2) Torsion Fatigue Test</td>
<td></td>
</tr>
<tr>
<td>Frequency Number: 10 million times.</td>
<td></td>
</tr>
</tbody>
</table>

Durability Test: Pass
<without any damage such as abrasion or crack on the layer of Metal spraying>

Corrosion Evaluation after Operation Test in Actual Vehicle

<table>
<thead>
<tr>
<th>Appearance after Operation Test in Actual Vehicle</th>
<th>Inspection of the Seal-Contacted part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal contacted part</td>
<td>No corrosion on the surface and in the inner part of Metal Spraying</td>
</tr>
<tr>
<td>Top-coat</td>
<td>Bond-coat</td>
</tr>
<tr>
<td>Bond-coat</td>
<td>Base layer</td>
</tr>
<tr>
<td>Adherent matters</td>
<td></td>
</tr>
</tbody>
</table>

Energy dispersion X-ray Spectroscopic Analysis: EDX

Corrosion Evaluation Test: Pass
<after Operation Test in Actual Vehicle>
Examples of Remanufacturing Engine Parts

- **Cylinder Block** by Metal Spraying
- **Cylinder Head** by Cutting & Grinding
- **Valve, Crank Shaft** by Grinding & Polishing
- **Turbocharger**
- **Fuel Injection Pump**
Examples of Remanufacturing Transmission Parts

- **Clutch Plate by Tempering & Grinding**
- **Tempering**
- **Grinding**
- **Finished Good**

- **T/M Case by Insert Collar**
- **Cross Section of T/M**
- **Hub by Metal Spraying**
- **Wear: Mounting Part**
- **Wear: Bearing Part**

Global Reman Factory - Komatsu Reman Indonesia (KRI)

- **General view**
- **Location**
  - Jakarta, Indonesia
- **Establishment**: Jan., 2007
- **Products**
  - Reman Engines (Large)
  - Reman T/C & T/M (Large)
  - Reman Piston & Pump Motor (Large)
Remanufacturing Process

1. Inspection Upon Receipt
2. Core Cleaning
3. Dis-Assembly
4. Parts Inspection
5. Parts Cleaning
6. Salvaging
7. Assembly
8. Performance Test
9. Painting
10. Finished Goods
11. Shipment

Quality Assurance same as New Component

1. ISO9001-2000 Certification
2. STD Procedure (Check Sheet)
3. 100% In-House Machining & Salvaging
4. Measuring Equipments (Parts evaluation)
5. Component Traceability Control
6. Testing Equipments (Performance)
7. ISO9001
8. Check Sheet
9. Measuring Equipments
10. Component Traceability
   - IC Tag
   - Second Dimension Bar Code

In-house Salvaging: ex Boring machine

Coordinate Measuring Machine
Testing Equipments

ENGINE DYNAMOMETER

HYDRAULIC TEST BENCH

ENGINE DYNAMOMETER CERTIFICATE

Issues !!
Thank you very much