Ural (Урал) - Днепр (Днепр)
Russian Motorcycle Evolution
Part II: Engine Evolution

(See Also Part III: Alternator and Generator Evolution, Part IV: Ignition System Evolution, and Part V: Carburetor Evolution)

Ernie Franke
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11 / 2017
Sorting thru Ural / Dnepr Engine Types

• All Heavy-Class "Dnepr" and "Ural" Engines Have Same Structural Schemes
  – Two-Cylinder, Four-Stroke, Carburetor, Air-Cooled
  – Opposed Cylinders in Horizontal Plane (Boxer Engine)
    • Provides High Balancing for Crank-and-Rod Mechanism
    • Good Air-Cooling of Engine

• Ural / Dnepr Engines Separate into Seven Different Types
  – 1: M-72 / K-750 Side Valve (SV) Engine
    • Derivative of BMW R71
    • Original M-72 SV 750cc Engine
    • Connecting Rods Mounted on Roller Bearings, Cast Iron Cylinders
    • Intake and Exhaust Valves Are Smaller in Diameter
    • Low-pressure Lubrication System with Full-Flow, Paper Oil Filter
    • Oil Pump Rotated by Camshaft
    • Gases from Crankcase Pushed Directly to the Atmosphere thru Breather
    • First Over-Head Valve (OHV) Design, 650cc Displacement, 32 Horsepower
    • First Introduced with K-650 / MT-8, Later Upgraded with MT9 Engine
    • Replaced Manual Breaker Distributor PM-05 with PM-302 Automatic Ignition
    • Cast Ductile Iron Crankshaft with Removable Connecting Rods and Replaceable Bearing Inserts
    • Forced Lubrication System with Centrifugal Oil Cleaner
    • Engine Reliability, Durability and Repair
      – Replaced Roller Bearings Connecting Rod Journal Bearings (Bi-metallic Liners) and Use of Solid Cast Iron Crankshaft
      – Bimetallic Cylinder (Aluminum and Iron Sleeve) Substantially Reduced Wear Compared to Previous One-Piece, Cast-Iron Piston to Ensure Performance during Long Rides in Heavy Traffic
4: MT10-36 OHV Engine: Dnepr MB-650M, MT-10.36 Motorcycles
  - Modified MT801: Increased Capability to 36 HP (26.5 kW)
  - Increased Intake Valve Diameter from 37 to 40 mm
  - New Camshaft Profile
  - Increased Compression Ratio from 7.0:1 to 7.5:1 (A-72 and A-76 Petrol)
  - Export Engine to Run on High-Octane A-93 with Compression Ratio of 8.5:1
  - Increased Max Performance to 5600 - 5800 rpm
  - Modified Form of Deepening a Valve at Bottom of Piston
  - Since November 1978, Produced Piston Sphere Radius Head 72.5m

5: MT10-32 OHV Engine: Dnepr MT-11, MT-16 Motorcycles
  - Modified MT10-36 for Higher Torque at Lower Speeds, Lower Power: 32HP
  - Maximum Speed Lowered by 700 rpm
  - Modified Camshaft with New Profile

  - Significant Differences from MT10-32 Engine
  - One-Piece Crankshaft Construction and Removed Only by Means of Special Devices

7: Ural 750 cc OHV Engine: Ural Patrol, Gear-Up
  - Use of Valve Covers, Cylinder Heads, Carburetors, Generators/Alternators and Ignition to Verify Engine Types

We will spend a fair amount of time merely identifying Russian engines, which comes in hardy for identifying models and years.
• **Ural 650cc Engine**  
  – IMZ-8.112-01001-50  
   • Engine w/o gearbox, w/o carburetor, w/o generator, w/o ignition system, w/o airfilter box, for electric starter

• **Ural 750cc Engine**  
  – IMZ-8.128-01001-50  
   • Engine w/o gearbox, w/o carburetor, w/o generator, w/o ignition system, w/o electric starter, w/o airfilter box
Starting with the M-72, a copy of the German R71, heavy Russian motorcycle production has steadily advanced under IMZ (Ural) and KMZ (Dnepr).
Dnepr dropped out of heavy Russian motorcycle production in 2005, after an outstanding program of military and civilian models.
<table>
<thead>
<tr>
<th><strong>Ural (Урал) Model</strong></th>
<th><strong>Production</strong></th>
<th><strong>Engine (ccm³)</strong></th>
<th><strong>HP / kW</strong></th>
<th><strong>RPM for Max HP</strong></th>
<th><strong>Compression Ratio</strong></th>
<th><strong>Torque (Nm)</strong></th>
<th><strong>RPM for Torque</strong></th>
<th><strong>Engine Type</strong></th>
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<td>746 SV</td>
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<th><strong>Днепр (Днепр) Model</strong></th>
<th><strong>Production</strong></th>
<th><strong>Engine (ccm³)</strong></th>
<th><strong>HP / kW</strong></th>
<th><strong>RPM for Max HP</strong></th>
<th><strong>Compression Ratio</strong></th>
<th><strong>Torque (Nm)</strong></th>
<th><strong>RPM for Torque</strong></th>
<th><strong>Engine Type</strong></th>
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<td>M-72</td>
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<td>22 / 16</td>
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<td>6.0+0.1/-0.3</td>
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<td>MT-12 (Днепр-12)</td>
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<td>МТ10-32</td>
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Model Identification (www.uralmotorbikes.info/model_identification.htm)

• Side Valve (SV) Distinguished by Flat-Sided Cylinder Head with Two Pieces; Barrel and Cylinder Head
• Overhead Valve (OHV) Distinguished by Wider Engine with Three Pieces; Barrel, Cylinder Head and Rocker Cover

• Ural OHV Engines Come in Two Sizes: 650cc and 750cc
  – Earlier 650cc Engines Have Cast Iron Barrel Bolted Directly to Crankcase with Studs on Barrel to Mount the Aluminum Head, with Oval Rocker Cover with Push-Fit Down-Pipes
  – Later 750cc Engines Have Aluminum Barrel Mounted to Aluminum Head with Shaped Rocker Cover with Push-Fit Down-Pipes Studs Pass-Thru Barrel and Head
  – Dnepr 650cc OHV Engines Have Aluminum Barrel Mounted to Aluminum Head with Rectangular Rocker Cover, with Mounting Studs Visible thru Barrel Fins the exhaust has a screw on mounting fin fitting

Apart from the external differences, Dneprs run shell bearings and Urals use roller bearings.
IMZ/Ural M-72 (1941-1950) and M-72M (1956-1960) with M-72 Engine
In 1956 the M-72 was given a minor redesign and issued as the M-72N.
M-72 Side-Valve (SV) Engine (1941)

Part # Prefix: 7201
M-72 750cc Engine

Original M-72 Engine, made in China
Vendor ID: S3873
List Price: €1,649.00
(www.ural-zentrale.de)

Timing Housing Cover
M-72 Engine

Top-View

Side-View
The M-72 engine produced 22 horsepower (16 kW) and a torque of 3.9 kg-m.
Side-Valve (SV) Engine 750cc

Removal of the cylinder head clearly shows the side valves (SV).
K-750 Engine

Dnepr Engine OHV 650cc

Engine, 650ccm with 12V alternator, no carburetor (Dnepr)
Military
List Price: 999.00EUR Used 169km
(www.ural-hamburg.de)
KMZ/Dnepr K-750M

1964 KMZ/Dnepr K-750M
KMZ/Dnepr MB-750 with K-750M Engine
Performance Curve for K-750 Engine

K-750 (Solid Line)
1. Power (kW)
2. Fuel Consumption per hour
3. Torque
4. Specific Fuel Consumption
5. Cylinder Head Temperature (CHT)

M-72 (Dashed Lines)
6. Power (kW)
7. Fuel Consumption per hour
8. Torque
9. Specific Fuel Consumption
10. Cylinder Head Temperature (CHT)
Dnepr K-750 SV 750cc Engine


Dnepr K-750 SV 750cc Engine

List Price: 1,790€ NOS (www.oldtimergarage.eu)
Dnepr K-750 SV 750cc Engine

List Price: 1,353€ NOS (moto-boxer.com)
Dnepr K-750 SV 750cc Engine

Engine, 750cc (K-750)
List Price: $1,300
(www.dnepr-kiev.com)
KMZ/Dnepr K-750 SV 750cc Engine
Smooth Cylinder Head on Early K-750 (bcozz.multiply.com)
The piston head has three grooves: the top two are compression rings, and the bottom is a scraper ring.
Smooth cylinder end-pieces are original only on early K-750 models. They were never used on M-72's.
Dnepr K-750 SV 750cc
List Price: 1,680€
(www.ural-motos.com)
KMZ/Dnepr K-750M Engine

Г-414 Generator

Dnepr MT-12 with K-750M Engine
KMZ/Dnepr MT801 (650cc) Engine

- Developed from K-750 Engine
- Features
  - Developed in 1967
  - Over-Head Valve (OHV) Timing
  - Cast Iron Crankshaft with Detachable Connecting Rod
  - Replaceable Rod Bearing Inserts
  - Installation on K-650/MT-8, MT-9, MT-10 and MB-650
KMZ/Dnepr MT801 (650cc) Engine (Rear View)

Dnepr Valve Cover (Old Style: 5 Cooling Ribs)
The MT801 engine was used in Dnepr’s K-650/MT-8, MT-9, MB-650 and MT-10.
The K-650 / MT-8 used Dnepr’s first Overhead Valve engine.
• MT10-36 Engine: Upgraded MT801 Engine from MT-10 Motorcycle
  – Increased Capacity to 36 Hp (26.5 kW)
  – Achieved by Increasing Diameter of Intake Valve 37 to 40 mm, Using Camshaft with a New Profile and Increasing Compression Ratio to 7.5:1
  – Engine Speed Increased to 5600 - 5800 rpm
  – Modified Form of Deepening Valve at Bottom of Piston
  – Used Carburetor K-301D, Instead of K-301B; Breaker PM302-01 Automatic Ignition
  – Since November 1978, Produced Piston Sphere Radius Head 72.5m
  – Increased Compression Ratio from 7.0:1 to 7.5:1 (A-72 and A-76 Petrol)
  – Export Engine to Run on High-Octane A-93 with Compression Ratio of 8.5:1
  – Distance from Axis of Piston Pin to Outer Surface of 48.2 mm
  – Piston Bore Reshaped under Exhaust Valve
• Used on Dnepr: MB-650M, MT-10.36 Motorcycles
KMZ/Dnepr MT10-36 Engine
KMZ/Dnepr MT10-32 Engine (KMZ-8.15501)

- Based on Previous MT10-36 Engine
  - Higher Torque at Low and Mid-Range Engine Speed
  - Significantly Improved Traction-in-Dynamic Performance in Rural Areas
  - Maximum Power Decreased by 3 kW and Maximum Speed Lower by 700 rpm
  - Engine Improved by Modified Camshaft with New Profile
    - MT10-32 Fully Interchangeable with Engine of Previous Design
    - Can Be installed on Engines MT9, MT10 and MT10-36.
  - Change in Piston Design
    - Previous Engine (10-32) Sphericity of Bottom Set with Ejector Piston
    - 10-36 Has a Flat Bottom
    - Reduced Compression to 7.0:1
    - Increased Size of 10-32 Cylinder by 0.9 mm
  - Upgraded Engine Used K-63T Carburetors
  - Used in Dnepr MT-11 and MT-16 Motorcycles

Dnepr Valve Cover
(New Style: 2 Cooling Ribs)

The MT10-32 engine was used in Dnepr’s MT-11 and MT-16.
The MT10-32 engine was used in Dnepr’s MT-11 and MT-16.
Dnepr MT10-32 (650cc) Engine (MT-11, MT-16)

Vendor ID: 400347677353
List Price: $999.00 USD
(www.ebay.com)
The MT10-32 engine was used in Dnepr’s MT-11 and MT-16.
MT10-36 vs. MT10-32 Engine (uraldnepr.ru)

• New Pistons, Cylinders and Camshafts
• Pistons of Old (MT10-36) and New (MT10-32) Designs Fully Interchangeable
  – Cylinders with Size of 108.6 mm Can Be Installed on All Previous Models of Motorcycles with Engine Dnepr MT
  – Suitable for All Dnepr Engines in K-650/MT-8, MT-9, MT-10, MT-10.36
  – Change Pistons in Pairs
  • Pistons Are Selected with the Same Color Index, Which Have the Piston Pin and the Upper End of Connecting Rod, and Similar Masses
• Compression Ratio Decreased from 7.5:1 (MT10-36) to 7.0:1 (MT10-32)
  – Achieved by an Increase of 0.9 mm Height of the Cylinder (Distance between the Surfaces Adjacent to the Block and Cylinder Head)
  – Rest of the Cylinders Is the Same
• Modified Profile Camshaft Lobes, Which Improved Torque characteristic
MT10-36 vs. MT-32 Engine

(uraldnepr.ru)

- Change from MT10-36 (MB-650M and MT10.36) to MT10-32 (MT-11 and MT-16) Engine
- Reduce Fuel Consumption in Rural Area and Lower Demands for Higher Octane Gasoline
  - MT10-36 Did Not Fully Satisfy Riders Who Live in Rural Areas (Most of Russia)
  - Rural Riders Almost Never Use the Maximum Power (36 Hp) of MT10-36 Attainable at Very High Speed (5900 rpm)
  - Torque Insufficient at Low and Medium Speed, Typical for Such Conditions
    - Increased to 50 Nm (5 kg-m) and Changes Little in a Fairly Large Range of Speeds
- Both Engines Produced at Kiev (Dnepr) Motorcycle Plant
- New Engine MT10-32 Replaces MT10-36
  - From mid-1985 to Establish the MT-11 / MT-16
- Result
  - Improved Traction and Dynamic Quality
  - Increased So-Called Coefficient of Adaptability, Which Characterizes Ability of Engine to Keep Engine Speed When Load Increases
  - Easier to Drive on Bad Roads

Power and Torque vs. Speed

MT10-36: Solid Line, MT10-32: Dotted Line

Dnepr Valve Cover (Old Style: 5 Cooling Ribs)
Engine MT10-32 650cc (MT-11, MT-16)

Breather Outlet Tubes

Dnepr Valve Cover
(Old Style: 5 Cooling Ribs)
Engine MT10-32 (650cc) Side View (MT-11, MT-16)


Dnepr Valve Cover (Old Style: 5 Cooling Ribs)
KMZ/Dnepr Engine OHV 650cc (MT-11, MT-16)

Engine, 650cc (MT-11, MT-16)
Part #: KMZ-8.15501
List Price: $1,300
(www.dnepr-kiev.com)

Dnepr Valve Cover
(Old Style: 5 Cooling Ribs)
At the end of 1974 IMZ began to produce the Ural M-67. In 1976, the engine was increased from 32 to 36 Hp, and the motorcycle was named Ural M-67.36. The new higher-power engine was designated the M67-36.
M-63 (Ural-2) and M-66 (Ural-3) Ural 650 Engine

M-63 (Ural-2) and M-66 (Ural-3) Ural 650 Engine

IMZ/Ural M67-36 Engine (650cc) Rear View


Г-424 Alternator

Ural Valve Cover
(Part #: 6201515)

Ural Valve Cover (Part #: 6201515)

γ-424 Alternator
IMZ/Ural M67-36 OHV 650cc Engine

- Significant Differences from MT 10-32 Engine
  - One Piece Construction Crankshaft
    - Removed Only by Means of Special Devices
  - Connecting Rod Inserted Roller Bearing with Cage
  - Cast Iron Cylinders
  - Mounting Cylinders and Their Heads Split. By crankcase cylinders mounted pins.
  - Pushers Have Rectangular Head Guides
  - Rocker Arm Shaft Installed in Special Brackets Attached by bolts to Head
  - Intake and Exhaust Valves Smaller in Diameter
  - Low-Pressure Lubrication System Has Full-Flow Paper Oil Filter
  - Oil Pump Rotated by a Camshaft
  - Gases from Crankcase Pushed Directly to Atmosphere thru Breather

- OHV (Overhead Valve) Engine
- Compression Ratio: 7.0:1, 8.0:1, etc.
- X Stroke Bore - 68mm x 78mm
- Maximum Power: 36 Hp / 26.5 kW
- Maximum Torque: 45 Nm
- Maximum Power Speed: 4600 to 4900 rpm
Differences between Ural M67-36 and Dnepr MT10-36 Engines

- End of 1974 Ural Began Production of M-67
- 1976, Engine Power Increased from 32 to 36 Hp, and Motorcycle Named Dnepr M67-36
- Basic Difference between Interface Connecting Rod to Crankshaft
  - Ural Used Conventional Bearings, Demanding Oil Filtration and Need to Feed at Higher Pressure than Roller Bearing
  - Dnepr Liners Provide Minimal Friction at Work and Also (in theory) Very Durable
- Dnepr and Ural Oil Pumps Differ in Performance, Location and Drive
  - “KMZ“ (Dnepr) Lubrication System More Complex than "IMZ“ (Ural)
  - Dnepr Used Special Gear from Crankshaft
  - Urals Powered from Back of Camshaft Helical Gears and Roller
  - Pumps Are Nearly Identical, Difference in Speed of Rotation
    » Dnepr Pump Installed Pressure-Reducing Valve, Preventing Excessive Pressure Rise
      » Valve Has Ability to Become Clogged, Leading to Abnormal Pressure Drop
      » Oil Pressure Warning Light on Dnepr
  - Dnepr Used Centrifuge Oil Cleaner that Separates Dirt Particles from Oil by Centrifugal Force, but Only Works Well with High Speed Crankshaft
- Crankshaft
  - Ural: Crankshaft Integral, Molded, Connecting Rod Roller Bearings
    - Advantages of Design: Relative Vitality of Lubrication System at Low Oil Pressure
    - Cardboard Oil Filter
      - Reducing Valve In Parallel, Allowing Oil to Bypass Filter if Clogged or Thick Oil
      - Dnepr: One-Piece Crankshaft, Bearings Bottom Heads of Rods - on the Liner (sleeve bearings)
- Cylinders
  - Urals: Aluminum with a Sleeve, and Cast Iron
  - Dnepr: Aluminum, Can Not Press Out
- Cylinder Heads
  - Interchangeable
- Valve Covers
  - Ural: Oval
  - Dnepr: Closer to Rectangular
IMZ/Ural IMZ-8.103.10 Engine (uraldnepr.ru)
### M-62, M-63, M-66, M-67, M67.36 Cylinders & Covers

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<th>Description</th>
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<th>M-66, M-67</th>
<th>M-67.36</th>
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<td>IMZ-8.101-01051</td>
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</table>
Ural 650 Engine for M-61 and M-62

Ural 650 Engine for M-66, M-67, M-67.36, IMZ-8.103

Ural Engine 650 cc
(M-66, M-67, M-67.36, IMZ-8.103)
List Price: 1,480€
(www.ural-motos.com)

No: 284 188

Ural Engine 650 cc
List Price: 1,450€
(www.ural-motos.com)

List Price: 1,480€
(www.ural-motos.com)
IMZ/Ural M-61 with Ural 650 Engine
IMZ/Ural M-62 (Ural-1) with Ural 650 Engine

IMZ/Ural M-63 (Ural-2) with Ural 650 Engine
IMZ/Ural M-66 (Ural-3) with Ural 650 Engine
IMZ/Ural 650 Engine

Ural Engine 650cc
List Price: 25,200 rubles
(www.mazepper.ru)
KMZ/Dnepr MT801 Engine for MT-9, MT-10

Dnepr Valve Cover (5 Cooling Ribs)
MB-650, MT-10.36, MT-11, MT-16 Cylinders and Covers

Dnepr Valve Cover (New Style: 2 Cooling Ribs)
IMZ-8.103 650cc Cylinders and Covers

750cc
1. IMZ-8.1087-01052 - Cylinder head, LH, with Valves Assy
3. IMZ-8.1087-01051 - Cylinder head, RH, with Valves Assy
9. IMZ-8.103-01515 - Cylinder head cover
Valve Covers

Dnepr MT-11


Ural M-67 (1978)

Valve Covers, 650cc
KMZ/Dnepr MB-650M Engine 650cc

Dnepr Engine
(MB-650M)
Vendor ID: 002.123
List Price: 907.38€
(www.oldtimergarage.eu)
The IMZ-8.XXX (800 series) served as Ural’s basic machine, carried on into the modern 650 solo and sidecar models with various cosmetic and design options.
Ural 750cc Engine

Ural Engine 750cc
List Price: 1,950€
(www.ural-motos.com)

IMZ-8.128-00011-20
(with Gearbox)

IMZ-8.128-01001-20
(without Gearbox)

IMZ-8.128-00011-30
(with Gearbox)
# Ural Gear-Up, Patrol (2010 - 2013)

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engine with gearbox assembly</td>
<td>IMZ-8.128-00011-30</td>
</tr>
<tr>
<td>2</td>
<td>Engine assembly</td>
<td>IMZ-8.128-01001-51</td>
</tr>
<tr>
<td>3</td>
<td>Gearbox assembly</td>
<td>IMZ-8.128-04001</td>
</tr>
<tr>
<td>4</td>
<td>Starter</td>
<td>IMZ-8.1037-18075 no longer produced. IMZ-8.1031807501-01 should be ordered.</td>
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<tr>
<td>5</td>
<td>Screw M10-6gx45</td>
<td>DIN 912 M10x45</td>
</tr>
<tr>
<td>6</td>
<td>Screw M8x25 8.8 ZN</td>
<td>DIN 912 M10x25</td>
</tr>
<tr>
<td>7</td>
<td>Gasket, 1 mm thick shim for starter, if required</td>
<td>IMZ-8.124-18113</td>
</tr>
<tr>
<td>8</td>
<td>Gasket, 2 mm thick shim for starter, if required</td>
<td>IMZ-8.124-18112</td>
</tr>
<tr>
<td>9</td>
<td>Washer M8 ZN</td>
<td>DIN 125 M8</td>
</tr>
<tr>
<td>10</td>
<td>Nut M8-6H</td>
<td>DIN 934 M8</td>
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<tr>
<td>11</td>
<td>Screw M8-6gx75</td>
<td>DIN 912 M8x75</td>
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<tr>
<td>12</td>
<td>Breather pipe</td>
<td>IMZ-8.1037-01454</td>
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<td>13</td>
<td>Clamp 20x32</td>
<td>IMZ-8.128-15008</td>
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<tr>
<td>14</td>
<td>Cover</td>
<td>IMZ-8.1037-18111</td>
</tr>
<tr>
<td>15</td>
<td>Screw M6-6gx12</td>
<td>DIN 7985 M6x12</td>
</tr>
</tbody>
</table>
# Description | Part number
---|---
1 Engine with gearbox assembly | IMZ-8.1040-00011-20
2 Engine assembly | IMZ-8.1040-01001-10
3 Gearbox assembly, specify color | IMZ-8.128-04001-50
4 Starter, specify color | IMZ-8.1037-18075 no longer produced. IMZ-8.1031807501-01 should be ordered.
5 Screw M10-6gx45, strength grade 8.8 | DIN 912 M10x45
6 Screw M8x25 8.8 ZN | DIN 912 M10x25
7 Gasket, 1 mm thick shim for starter, if required | IMZ-8.124-18113
8 Gasket, 2 mm thick shim for starter, if required | IMZ-8.124-18112
9 Washer M8 ZN | DIN 125 M8
10 Nut M8-6H | DIN 934 M8
11 Screw M8-6gx75, strength grade 8.8 | DIN 912 M8x75
12 Breather pipe | IMZ-8.1040-01454
13 Screw M6-6gx12 | DIN 7985 M6x12
14 Cover, specify color | IMZ-8.1037-18111