Ural (Урал) - Dnepr (Днепр)
Russian Motorcycle Evolution
Part III: Alternator and Generator Evolution
(See Also Part II: Engine Evolution, Part III: Alternator and Generator Evolution, Part IV: Ignition System Evolution, and Part V: Carburetor Evolution)

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## Generators/Alternators for Ural (Урал) and Dnepr (Днепр)

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<td>770-Watts</td>
<td>IMZ 8.103, 8.103X, 8.123, 8.123X “750” Series Not Used</td>
</tr>
</tbody>
</table>

**Notes:**
1. Nomenclature: The Cyrillic letter “Г” transliterates (Russian-to-Latin) to “G,” “L” or “T.” Thus we see Г-414, G-414, L-414 or T-414, all for the same part.
2. Must never use Г-424 Alternator with discharged battery or without battery.
3. MB-750 = MW-750, MB-750M = MW-750M
4. The frame (case) of the Г-11/Г-11A generator is positive (positive-ground).
5. Г-414 Generator: P/N: 750181 6-Volt (negative ground), whereas P/N: 750181-A (positive-ground) for fitting Г-11A’s into early K-750’s.
Alternators have progressed in output voltage and power; from the Г-11 (G-11) generator of 6-Volts / 45-Watts in 1941, the Г-11А in 1952, the Г-414 6V / 65 W in 1957, the Г-424 of 12V / 150W in 1974, the 14.3771 of 12V / 500W in 1998.5, to the present-day Nippon-Denso alternator of 12-V / 770W.
Recent Ural Starter/Generator/Alternator Time-line

**Engine Size**
- *650 cc*
  - Factory Electric-Start (E-Start) Option & Retrofit introduced by CSMI
  - New Transmission Case (Flywheel Starter Added, New Wiring Harness) (IMZ-8.1037-18016-12)
- *750 cc Engine*
  - New Engine Design (Alternator on top / Flywheel Starter placed on bottom)

**Gen/Alt**
- *14 Amp Russian Г-424 Alternator (150 W)*
- *18 Amp Hitachi Starter/Generator (300 W)*
- *35 Amp Russian Alternator: 14.3771 (Hand Grenade) (500 W, black-plastic rear cap)*
- *55 Amp Nippon Denso Alternator (770 W, metal rear cap)* (Longer by 20 mm)

**Start Relays (RY-115)**
- *No points-ignition Urals Approved for U.S. sales*
  - 1 Relay
  - Two Relays

**Ignition Type**
- *Type I*
- *Type II*
- *Type III Ignition*
- *Type IV* (Type IV with electronics moved into airstream)
- *Type V* (Ducati)

**Voltage Regulator**
- *33.3720200 Solid-State*
- *Regulator Internal to Alternator*

**Year**
- 1994 '95 '96 '97 '98 '99 '00 '01 '02 '03 '04 '05 '06 '07
- '98.5

**Voltage Regulator**
- *Regulator Internal to Alternator*

**Other Notes**
- Roughly Wattage = 14 Volts X Amps
- Voltage Regulator internal to Alternator
- New Transmission Case (Flywheel Starter Added, New Wiring Harness) (IMZ-8.1037-18016-12)
- New Engine Design (Alternator on top / Flywheel Starter placed on bottom)

**Ural imported to U.S. by CSMI (Classic Motorcycles and Sidecars, Inc.)**
Generator vs. Alternator

• Generators
  – Magnetic Field formed by Stator (fixed magnetic field)
  – Windings of Wire (armature) Spin inside Magnetic Field
  – Generates DC on Rotor using Split Commutator
  – Brushes Carry Large Output Current

• Alternators
  – Magnetic Field formed by Rotor (rotating magnetic field)
  – Generates AC on Stator and Rectifies to Produce DC
  – Brushes Carry Steady Low-Current to Rotating Magnetic Field
  – Large Output Current from 3-Ø Stator (fixed) Winding
  – Smaller Rotor May Be Rotated at Higher RPM’s

• Comparison of Generators versus Alternators
  – Generators Don’t Tend to Charge at Low RPM’s (idle)
  – Alternators Are Lighter and More-Compact
  – Alternator Not Designed to Charge a Dead Battery
    • Doing so May Burn It Up!
  – Generators Require Cleaning of the Commutator Every 5-kms

Thus we see that the older units (Γ-11/11A and Γ-414) were DC generators, while modern units (Γ-424, 14.3771 and the Nippon-Denso) are all alternators (AC generators with rectifiers).
Flashing the Field of the Generator

- Generator Can Reverse Polarity if You Have a Completely Dead Battery or If You Remove the Battery from the Frame
- Flashing the Field Sets the Polarity of the Generator to Match the Battery
- Flashing the Field Can Be Done at the Generator or at the Regulator

**To Flash the Field on a Negative Ground System**
- Disconnect the Wires to the Regulator
- Connect a Ground from the Frame to the Field (Ш)
- Spark the Armature Terminal (Я) from the Battery +

**To Flash the Field at the Regulator**
- Use a 8” Jumper Wire (16 Gauge or Larger)
- Momentarily (No Longer than 2 seconds) Touch the Jumper Wire between the Terminal Marked D+ or 61 and the Terminal Marked B+
  - There May Be a Brief Spark (This Is Normal)
- Caution: Do Not Touch the Jumper Wire to Terminals F or DF or to Ground
- Start Vehicle and Check Charging System for Proper Operation
Г-11 and Г-11A (G-11 & G-11A) 6-Volt Generator (1941-1957)

- 6-Volt / 7-Ampere / 45-Watt Generator
- Positive-Ground Case
- Used on:
  - Ural (IMZ): M-72, M-72M, M-61
  - Dnepr (KMZ): M-72, M-72N, early K-750
- Used in Conjunction with PP-1, PP-30, PP-31 and PP-31A Regulators
1. Pinion Drive
2. Armature
3. Armature Winding
4. Pole Extension or Shoe
5. Rotor
6. Carbon Brush
7. Commutator
8. Case
The rotor is eccentrically located to allow a controlled meshing of the gears by minor rotation and clamping of the case.
Г-11А mounted on an М-72

Mounting Straps
The Г-11A generator is driven off a gear mounted on the timing cam.
М-72М Side-View Showing Г-11А Generator
М-72М Top-View Showing Г-11А Generator

(Кроме сетчатого воздухоочистителя на двигателях М-72 устанавливается также контактно-масляный воздухоочиститель.)

Г-11А Generator
Г-414 (G-414) 6-Volt Generator (1957-1974)

- 6-Volt / 10-Ampere / 65-Watt Generator
- Rotor Speed: 1,350 rpm (6.5-V, 0-A), 1,950 rpm (10-A)
- Used on:
  - Ural: M-62, M-63, M-66
  - Dnepr: K-650, later K-750, K-750M, MB-750, MB-750M, MT-8, MT-9 & MT-12
- Negative-Ground Case
- Works in Conjunction with PP-302 Regulator
Generator (Г-414) Specifications

- Rated Voltage: 6-Volts
- Full output current: 10-Amperes
- Direction of Armature Rotation (viewed from the drive side): Right-Hand
- Rotational Speed of Armature, Ensuring a Voltage of 6.5 V, at Ambient of 20ºC
  - at zero load: 1350 rpm
  - at full load (10 A): 1950 rpm
- Idle current (with the generator operating as a motor): 6-Amps
- Polarity of the frame (ground): minus
- Generator Winding Data
  - Field Coil
    - Wire: copper, enamelled, grade size: 0.74 mm
    - Winding: CCW
    - Number of turns: 300
    - Number of layers: 24
    - Insulation, half-overlapping, one layer of tafieta tape: 0.25 x 15 mm
    - Output terminals Markings: “Я” and “Ш”
  - Generator Armature
    - Wire: copper
    - Insulation: two layers of high strength enamel, size: 1.16 mm
    - Number of turns in the section: 5
    - Number of wires in the slot: 20
    - Number of sections: 2
    - Number of slots: 14
    - Number of commutator sheets: 28
    - Slot pitch: 1-7
    - Commutator Sheet Pitch: 1-2

The Г-414 is a d.c. shunt excitation generator.
Г-414 6-Volt Generator

- Polarity: Negative Ground
- Direction of Rotation (drive side): Right-Hand (clockwise)
- Weight: 3.8 kg
Later alternators, with more-compact rotors, are able to generate current at higher geared speeds, to allow charging even at idle. They are also able to handle higher power in the stator windings, without the limitations and wear of the brushes.
Г-414 (G-414) Generator

Terminals: Ш and Я

- 12-Volt / 11-Ampere avg. 14-Ampere max. / 150-Watt Alternator
- First Used on Ural M-67 and Dnepr MT-10
- Total Capacity Doubled Improved Lighting
- Maximum Short-Term Overload: 200 W
- Rotor Speed:
  - Begins to Produce Voltage (no load) at Speed of 1000-1100 rpm, corresponding to 750-850 rpm Engine Crankshaft Speed
  - 1,300 rpm (14-V, 0-A), 2,400 rpm (11-A), 5,000 rpm (Max)
- Used on:
  - Ural: M-67, M-67.36, IMZ 8.103 Series
  - Dnepr: MB-650, MB-650M, MT-10, MT-10.36, MT-11, MT-16
- Used in Conjunction with Mechanical PP-330 & Solid-State 33.3702 Regulators
- 3-Ø (three-phase) Generation, 12-Pole Construction
- Built-in Rectifier: MSF-2A (ВБГ-2А)

The higher-output capability of the Г-424 alternator was needed to provide a migratory path for electric-start.
This diagram is handy because the terminals are unlabeled.
The 14-Amp Г-424 alternator has a thin pressed sheet-metal shroud covering the rear half, while the later 35-Amp 14.3771 alternator has a thicker cast aluminum housing.
Structure and Features of the Г-424 Alternator

- Front Cover (1), from Drive Side, Has Adjustable Eccentric Cylindrical Rotor Axis
- Drive-Side Has Rubber Gasket (2) for Environmental Protection
- Internal Bearings Lubricated with Single- and Double-Sided Seals
- Rotor (3) Rotates with Windings Excitation Powered Via Slip Rings
- Three-Phase (4) Stator Winding Connected into a Star with Insulated Neutral
- All Phases Soldered to Head Bolts Fastening Rectifier Unit (8)
- Two Covers, End Shield (6) and Stator Fastened with Three Screws MB
- Brush with Wire Attached to Plate and Holder (7) with Six Captive Screws
- Integrated Semiconductor (8) Rectifier Unit type MSF-2A
- Rectifier Unit (8) Consists of Three Monoblocks, Cast Aluminum Heat Sink Fins
- Axial Fan (9), under Protective Cover (10) on Rotor Shaft (3), Cools Rectifier
- Terminal Block (5) for Connection to Alternator

1 — end shield; 2 — rubber collar; 3 — rotor; 4 — stator; 5 — terminal block; 6 — end shield; 7 — brush holder; 8 — rectifier unit; 9 — axial fan; 10 — guard
Construction of Γ-424 Alternator

- **PP-330 Regulator**
- **Dash “Fault” Indicator**
- **12-Volt Battery**
- **Full-Wave 3Ø Rectifier**
- **Slip-Rings**
- **Rotors** (exciter magnetic field)
- **Stator** (field output winding)
The concentrically-located rotor shaft is made for the newly-designed engine case.
Г-424 Alternator Parts Breakdown

- Pinion Gear
- Rotor
- Brushes
- Stator
- Terminal Block
- Rectifier
- Plastic End-Cap
The 3-Ø (three-phase) winding produces three waves, 120° apart, for a more continuous supply of current.
MT-11 and MT-16 Alternator/Regulator Circuitry

Diagram is useful when unmarked wires are removed from unmarked terminals!

'+ (output) goes to the battery

'W' (field) goes to the regulator

'~' is not used. Used only with the old electromechanical regulators (PP-330).
Г-424 Alternator Parts

- Alternator Consists of Three Main Parts; Stator, Rotor and Covers
  - Stator Pack (8):
    - Sheet Electrical Steel, Thickness 1 mm, with 18 Teeth
    - Three-Phase winding, Wye-Connected
    - Each of 18 Coils: Wound Wire TCPI-2, diameter 1.08 mm
  - 12-Pole Rotor
    - Maximum Excitation Current at 14-Volts: 1.2-Amperes
    - Rotor Shaft (6) and Slip Rings (10)
  - Cast Aluminium Alloy Covers (4 and 11) Enclose;
    - Rectifier Unit: MSF-2A
    - Non-Conductive Holder and Clamps with Three Labels
    - Cover (4) and Gasket Set (5) Protect Cavity from Crankcase Oil
Г-424 (G-424) Alternators
Г-424 Alternator

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Г424-3701006</td>
<td>Casing</td>
<td>1</td>
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<tr>
<td>Г424-3701007</td>
<td>Clamp</td>
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<tr>
<td>Г424-3701008</td>
<td>Fan</td>
<td>1</td>
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<tr>
<td>Г424-3701011</td>
<td>Bushing</td>
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<td>Г424-3701015</td>
<td>Brush Holder</td>
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<td>Г424-3701020</td>
<td>Brush</td>
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<td>Г424-3701030</td>
<td>Brush</td>
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<td>Г424-3701090</td>
<td>Terminal block</td>
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<td>Г424-3701100</td>
<td>Stator with Windings</td>
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<tr>
<td>Г424-3701200</td>
<td>Rotor</td>
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<td>Г424-3701300</td>
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<td>ББГ-2А</td>
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<td>1-22x40-1</td>
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<td>180503K1</td>
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<td>252133</td>
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<tr>
<td>252135</td>
<td>Washer 6Л</td>
<td>4</td>
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</table>
14.3771 12-Volt Alternator

- 14-Volt / 35-Ampere / 500-Watt Alternator
- 3-Ø Windings for More-Continuous Delivery of Current
- Same Dimensions of Previous Alternator (Г-424)
  - Uses Same Pinion Gear from Г-424
  - Adjust for Minimum Trashing of Gears
  - Little or No Back-Lash
- For motorcycles;
  - Ural: 8.103, 8.103X, 8.123, 8.123X, “650 and 750” Series
  - Dnepr: Not Used
- Replacement for the Short-Lived 18-Amp Hitachi
- Developed for Greater Power (needed for Electric-Start option)
- Built-In Voltage Regulator (YA212A11E)

The 14.3771, 12-Volt alternator (affectionately known as the RPOC) developed a bad reputation for exploding and often taking the engine with it, hence the term “Russian hand-grenade.”
14.3771 12-Volt Alternator
14.3771 12-Volt Alternator Application

36.3702 Regulator (Я212А11Е / YA212A11E)

Ignition Switch

Red “Alternator Fault” Indicator Lamp

Parallel Resistor (in case lamp blows)

Built-In Regulator

Rotor (Rotating Magnetic Field)

Stator (3-Ø)

Full-Wave Rectifier

Carbon Brush

Battery

(IMZ-8.103717001-13, 2002 & 2003 Owners Manuals) eafranke@tampabay.rr.com

**Right Handlebar**
- Momentary "Start" Button
- Rocker-Arm "Run / Kill" Switch "Kill"
- Rocker-Arm "Run / Kill" Switch "Run"

**Headlight Cavity**
- Green Switch (Neutral)
- Red Switch (Alternator Fault)

**Ignition Switch**
- 6 5 1 2 3

**Fuse Block**
- 4 3 1 2
- Brakes
- Headlights
- Run Lites

**In-Line Fuse #1**
- 14.3771 35 Amp Russian (Hand Grenade)

**Starter Solenoid**
- Positive Terminal
- Negative Terminal

**Starter Motor**
- 12 Volt Battery

**Chassis Ground**
- Connector Pin

**Notes:**
1. In-Line Fuse #1 (15A) for Turn Signal and Neutral Indicator Lamp.
2. Fuse Block #4 Fuse (5A) for Ignition & Electric Start Relays.

(+12V. When Ignition Switch on "Run")

(0V.: Engine not running, +12V.: Engine running and Alternator working.)
Nippon-Denso 12-Volt Alternator

• 14-Volt / 55-Ampere / 770-Watt Alternator
• Used On:
  – Ural: 8.103, 8.103X, 8.123, 8.123X, “750” Series
  – Dnepr: Not Used (retro-fittable to Г-424 applications)
• Built-In Voltage Regulator

The Nippon-Denso 12-Volt alternator has been installed on all Ural bikes since 2004.
Parts Breakdown of Nippon-Denso Alternator

- Bracket
- Regulator
- Rectifier
- Brush Holder
- Seal Brush Holder
- Stator
- Rotor
- Cover
- Bracket D.E.
- 5
- 22
- 4
- 3
- 28
Nippon Denso Alternator Wiring

- Battery
- Starter
- Solenoid
- Switched Live
- Ignition Light
- Fusebox
- To Ignition
Notice the Addition of Diodes, Allowing the Use of LEDs for Turn-Signals.