Russian Voltage Regulators
(Реле-регулятор напряжения)

Part XXVIII-5: 12-Volt
YA212A11E / 36.3702)
for the
14.3771 Alternator

Ernie Franke
eafranke@tampabay.rr.com
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12-Volt Regulator (Я212А11Е / YA212A11E / 36.3702) for the Russian 14.3771 35-Amp Alternator

**Background**
- Voltage Regulators Paired with Specific Generators/Alternators
- Time-Line for Generators/Alternators/Regulators
- Comparison of Alternator Performance: Г-424 vs. 14.3771
- Specs for the 14.3771 Alternator
- Alternator Application in Ural Wiring

**What is it?**
- Internal (Built-In) Voltage Regulator for the Ural 14.3771 35-Amp Alternator
- Completely Solid-State
- Years of Application: 1998.5-to-2004
- Replaced the Г-424 (14-Amp) Alternator in ‘98.5 with its PP-330 Mechanical Regulator or the 33.3072 Electronic Regulator
- Later Superseded by the More-Reliable Nippon-Denso 55-Amp Alternator with Built-In Regulator

**How Does It Work?**
- Regulates Alternator Output Voltage to 14-Volts
- Provides Constant Voltage Regardless of Rotor Speed
- Supplies Exciter Current to Vary Magnetic Field in Rotor

**Circuit Description and Operation**

**Replacement**
- Widely Used in Lada (Russian) Vehicles
- Replacement (with brushes) Purchased On-Line

The YA212A11E built-in, solid-state voltage regulator was a step forward in maintenance-free operation. Unfortunately it was married to the 14.3771 alternator, which suffered from a bad-reliability reputation.
## Types of Generators/Alternators for Ural (Урал) and Dnepr (Днепр)

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<tr>
<th>Generator/Alternator</th>
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<th>Current</th>
<th>Nominal Power</th>
<th>Regulator</th>
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<td>PP-1 PP-31 (1950)</td>
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<tr>
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<tr>
<td>Nippon Denso (P/N: IMZ-8.1037-18092)</td>
<td>Alternator (Built-in Rectifier &amp; Regulator)</td>
<td>2004-present</td>
<td>12-Volt (14-Volt)</td>
<td>55-Amp</td>
<td>770-Watts</td>
<td>Internal to Alternator (126000-0600)</td>
<td>IMZ 8.103, 8.103X, 8.123, 8.123X “750” Series</td>
</tr>
</tbody>
</table>

### Notes:
1. **Nomenclature:** The Cyrillic letter “Г” transliterates (Russian-to-Latin) to “G” or “L” or “T.” Thus we see Г-414 or G-414 or L-414 or T-414, all for the same part.
2. Cannot use Alternator with discharged battery or without battery.
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 of 6-Volts/65-Watt in 1957, the Г-424 of 12-Volts/150-Watts in 1974, the 14.3771 of 12-Volts/500-Watts in 1998.5, to the present-day Nippon-Denso alternator of 12-Volts/770-Watts.
Recent Ural Starter/Generator/Alternator Time-line

**Engine Size**
- 650 cc
- 750 cc Engine

**Start Relays (RY-115)**
- One Relay
- Two Relays

**Ignition Type**
- Type I
- Type II
- Type III Ignition
- Type IV
- Type V
- Ducati

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

**Gen/Alt**
- Kick-Start Only
- 14 Amp Russian Γ-424 Alternator (150 W)
- 18 Amp Hitachi Starter/Generator (300 W)
- Electric-Start (E-Start) Option & Retrofit introduced by CSMI
- Factory Electric-Start (E-Start) Offered (Starter/Alternator at Timing Gear)
- Voltage Regulator internal to Alternator

- New Transmission Case (Flywheel Starter Added, New Wiring Harness) (IMZ-8.1037-18016-12)
- New Wiring Harness (9238000)

**Year**
- 1994
- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007

**Roughly Wattage = 14 Volts X Amps**
- 35 Amp
  - Russian Alternator: 14.3771
    - (Hand Grenade) (500 W, black-plastic rear cap)
- 55 Amp
  - Nippon Denso Alternator (770 W, metal rear cap)
    - (Increased length by 20 mm)

**Voltage Regulator**
- Internal to Alternator

**Factory Electric-Start (E-Start)**
- Option & Retro-fit introduced by CSMI

**Start Relays**
- One Relay
- Two Relays

**No points-ignition Ural Urals Approved for U.S. sale**

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

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

**1998.5**
The higher-output capability of the 14.3771 alternator was needed to provide a migratory path for electric-start, in an urban (slow-speed & traffic lights) driving environment.
The previous Г-424 alternator provided rated current (11-Amps) at 2,000 rpm of the crankshaft. Thus for urban driving (low-speed & traffic lights), the alternator was insufficient to supply the necessary current for charging after an electric-start, while powering the headlights and running lights. The new 14.3771 alternator supplies the same current at idle (900-1,000 rpm). At 2,000 rpm the available current jumps to over 25-Amps.
14.3771 Russian 12-Volt Alternator (AT3-1)

- 12-Volt / 35-Ampere / 500-Watt Alternator (a.k.a. 350-Watt Alternator)
- 3-Ø (three-phase) 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 (Not for Minimum Noise)
  - 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 (Я212А11Е / YA212A11Е)

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 Application (12/09)

36.3702 Regulator (Я212А11Е / YA212A11E)

- Ignition Switch
- Instrument Panel & Indicator Lights
- Parallel Resistor (in case lamp blows)
- RPM Indicator Signal (not used on Ural)
- Positive Terminal

 YA212A11E Built-In Regulator

- Red “Alternator Fault” Indicator Lamp
- (not used on Ural)

- Output Transistor
- Rotor (Rotating Magnetic Field)
- Stator (3-Ø)
- Full-Wave Rectifier (6X 20-Amp Diodes)

- Rectifiers Used to Supply Rotor Current while Running

- Unused Circuitry in Orange (not connected)

- Alternator Exciter (+Fault Terminal)

- Chassis Ground

- Battery

- Carbon Brush

- Rectifiers Used to Supply Rotor Current while Running

- Alternator/Rectifier
How the YA212A11E Voltage Regulator Works

- Alternator Output Voltage Created by Magnetic (exciter) Field Rotating (rotor) within Stationary (three-phase stator) Winding
- Current Supplied thru Carbon Brushes to Rotor Shaft Slip-Rings via the Voltage Regulator
- Stronger Magnetic Field or Higher Rotor Speed Yields Higher Output Voltage
- Regulator Maintains Constant Output Voltage by Modulating the Exciter Rotor Current
- Operation:
  - Turn-On (engine not running): Exciter Winding Energized with Closed Ignition Switch S1 thru two parallel resistor of 100 ohms each and the Red “Fault” lamp.
    - Current flowing in this circuit, does not exceed 0.4-Amp to Provides Pre-Excitation of the Alternator, before Obtaining Necessary Speed of Rotor
    - Fault Indicator Lamp Indicates It is Supplying Current to the Rotor (Exciter)
    - If the engine is not running lamp is not lit, then: defective control lamp “or” defective generator (break in the chain excitation) “or” defective voltage regulator
  - After Engine Starts: With rpm’s, Alternator then Supplies Exciter Current thru Six Diode Rectifiers, thus Extinguishing the Red “Fault Light”
    - If the engine control lamp continues to burn, this may be caused by: Broken Coupling “or” Defective Alternator
  - Normal Run: Regulator’s Output Transistor Provides Variable Ground Path for Rotor Exciter Current to Maintain Constant Output Voltage
- Voltage Settings: 14.0-Volt -to- 14.2-Volt
  - Measure the battery voltage with the engine running
  - With increasing speed, the voltage slowly rises to a maximum of 14.2-V, and may not even exceed the value of further increases in speed
  - If it does, it still does not work the controller - then immediately turn off the engine. Then the built-in regulator is either broken or an error occurs in the wiring

The voltage regulator provides a constant 14-Volt output, regardless of the crankshaft or rotor speed or load current.

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

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**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.

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The red “Alternator Fault” indicator light supplies current to both the Electric Start Relay #1 and the Exciter (rotor) winding of the alternator. If the lamp is burnt-out or the in-line fuse is blown, the electric-start will not work and the battery will not charge.
36.3702 (Я212А11Е / YA212A11E) Voltage Regulator for 14.3771 Alternator

- **Built-In Brushes for Alternator Slip-Rings**
- **Rated at 12-Volts / 5-Amps**
- **Standard Threshold Regulators Must Be within 13.6-14.4 Volts (typ. 14-V)**
- **Since 2002, Output Transistor Used a Powerful Field-Effect Transistor (FET)**
  - Sharply Lowered Power Losses Given Off in the Form of Heat
  - Load and Current High-Speed Characteristics Improved Reliability
- **Used In:**
  - Vehicles (Russian): VAZ (Lada) -2108, -09, -10, -11, -12, -23; VAZ -21214, -15; NIVA, GAZ (Gorky Automobile Plant) - 3102, -29, 3302; & "Ural“ Motorcycle
  - Alternators: 372.3701; 373.3701; 9402.3701-01; 9402.3701; 412.3701-01; 9422.3701; 26.3771; 2502.3771-01; 37.3701 (VAZ-2110, 2112, 2111); 14.3771 (Ural)
  - Available in Russian Auto Shops (hanging on the wall) or Off the Internet
Alternator Testing

• **Measure Voltage at the Battery**
• **Start the Engine**
  – Voltage Should Be Approximately 14-Volts, Regardless of Speed
• **While the Engine is Running**
  – Remove the Positive Cable from the Battery Terminal
  – If Engine Instantly Dies: Alternator is Defective
• **Check for Worn Slip-Ring Brushes**
  – Recommended Checking Every 20,000 km
  – Brushes Should Contact over 80% of Working Surface
  – Brushes Less than (10 mm) Should Be Replaced
  – Slip-Rings May Be re-surfaced: Shiny, Smooth Film is a Good Sign of Normal Wear
• **Check for Broken Wires or Brush Springs**
1) Turn Ignition Switch to Middle “On” position and Observe the Red Charging “Fault” Indicator Light. Is Light Illuminated?
   No: Go to Step 6
   Yes: Proceed to Step 2

2) Start Engine and Observe Red Charging “Fault” Light. Is the Light Still Illuminated?
   No: Normal Operation of Charging System. Normal Operation is 14-Volts
   Yes: Proceed to Step 3

3) Observe Alternator Shaft Turning?
   No: Make Necessary Mechanical Repairs
   Yes: Proceed to Step 4

4) Stop Engine and Remove Alternator. Remove Rear Cover. Remove Voltage Regulator and Brush Assembly. Are Brushes Excessively Worn?
   No: Proceed to Step 5
   Yes: Replace Brushes

5) Carefully Inspect Voltage Regulator for Broken Solder Joints. Appear OK?
   No: Re-solder the Connections and test Alternator (Proceed to Step 1)
   Yes: Replace Voltage Regulator

6) Remove the Small Wire with the Automotive Connector on the End from Rear Alternator Cover. Ground the Connector on the Wire to a Metal Part of Engine using a Short Length of Wire. Did the Red Charging “Fault” Light Illuminate when the Wires’ Connector was Grounded?
   No: Check the red Light and it’s Wiring. Check Fuses.
   Yes: Alternator Unit is Faulty.