



***Russian Regulators: Part V***

***(Я212А11Е / YA212A11E / 36.3702)***

***for the***

***Russian 14.3771 35-Amp Alternator***

***Ernie Franke***

***eafranke@tampabay.rr.com***

# **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  - Later Superseded by the More-Reliable Nippon-Denso 55-Amp Alternator with Built-In Regulator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) (12/09)

eafranke@tampabay.rr.com

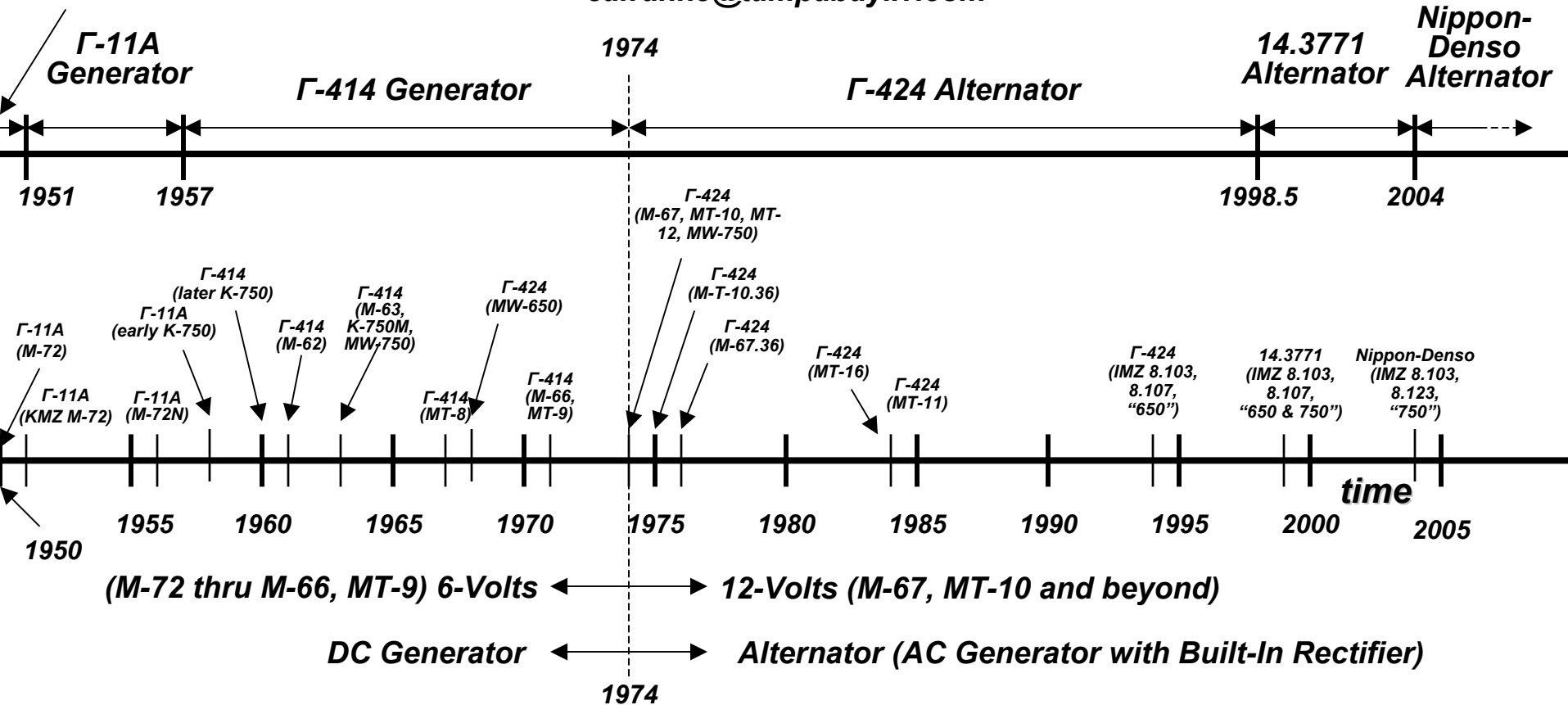
Generator/ Alternator	Type	Vintage	Nominal Voltage	Current	Nominal Power	Regulator	Motorcycles	
							Ural(IMZ)	Dnepr (KMZ)
<b>Г-11</b> (G-11) (P/N: 72181)	<b>DC</b> Generator	<b>1941-</b> <b>1951</b>	<b>6-Volt</b> (7-Volt)	<b>7-Amp</b>	<b>45-Watts</b>	<b>PP-1</b> <b>PP-31 (1950)</b>	<b>M-72</b>	<b>Not Used</b>
<b>Г-11А</b> (G-11A) (P/N: 72181-A)	<b>DC</b> Generator	<b>1952-</b> <b>1957</b>	<b>6-Volt</b> (7-Volt)	<b>7-Amp</b>	<b>45-Watts</b>	<b>PP-31 (1950)</b> <b>PP-31A (1956)</b>	<b>M-72, M-72M,</b> <b>M-61</b>	<b>M-72, M-72N,</b> <b>early K-750</b>
<b>Г-414</b> (G-414) (P/N: 750181)	<b>DC</b> Generator	<b>1957-</b> <b>1974</b>	<b>6-Volt</b> (7-Volt)	<b>10-Amp</b>	<b>65-Watts</b>	<b>PP-31A (1956)</b> <b>PP-302 (1963)</b> <b>PP-302A</b>	<b>M-62, M-63,</b> <b>M-66</b>	<b>K-650, later K-750,</b> <b>K-750M, MW-750,</b> <b>MW-750M, MT-8,</b> <b>MT-9, MT-12</b>
<b>Г-424</b> (G-424) (P/N: 3701000)	<b>Alternator</b> ( <b>Built-in</b> <b>Rectifier</b> )	<b>1974-</b> <b>1998</b>	<b>12-Volt</b> (14-Volt)	<b>11-Amp</b> (aka 14-A)	<b>150-Watts</b>	<b>PP-330</b> <b>33.3702 (1992)</b>	<b>M-67, M67.36,</b> <b>IMZ 8.103 Series</b>	<b>MW-650, MW-650M,</b> <b>MT-10, MT-10.36,</b> <b>MT-11, MT-16</b>
<b>Hitachi</b> (Limited Appearance)	<b>Alternator/</b> <b>Starter</b>	<b>1998-</b> <b>1998.5</b>	<b>12-Volt</b> (14-Volt)	<b>18-Amp</b>	<b>300-Watts</b>	<b>Internal to</b> <b>Alternator??</b>	<b>IMZ 8.103 and</b> <b>8.107</b> <b>"650" Series</b>	<b>Not Used</b>
<b>14.3771</b> (P/N: 14.3771- 010)	<b>Alternator</b> ( <b>Built-in</b> <b>Rectifier &amp;</b> <b>Regulator</b> )	<b>1998.5</b> <b>-</b> <b>2004</b>	<b>12-Volt</b> (14-Volt)	<b>35-Amp</b>	<b>500-Watts</b> (aka 350-W)	<b>Internal to</b> <b>Alternator</b> (YA212A11E)	<b>IMZ 8.103, 8.103X,</b> <b>8.123, 8.123X</b> <b>"650 &amp; 750" Series</b>	<b>Not Used</b>
<b>Nippon</b> <b>Denso</b> (P/N: IMZ-8.1037- 18092)	<b>Alternator</b> ( <b>Built-in</b> <b>Rectifier &amp;</b> <b>Regulator</b> )	<b>2004-</b> <b>present</b>	<b>12-Volt</b> (14-Volt)	<b>55-Amp</b>	<b>770-Watts</b>	<b>Internal to</b> <b>Alternator</b> (126000-0600)	<b>IMZ 8.103, 8.103X,</b> <b>8.123, 8.123X</b> <b>"750" Series</b>	<b>Not Used</b>

## Notes:

- 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.**
- Cannot use Alternator with discharged battery or without battery.**

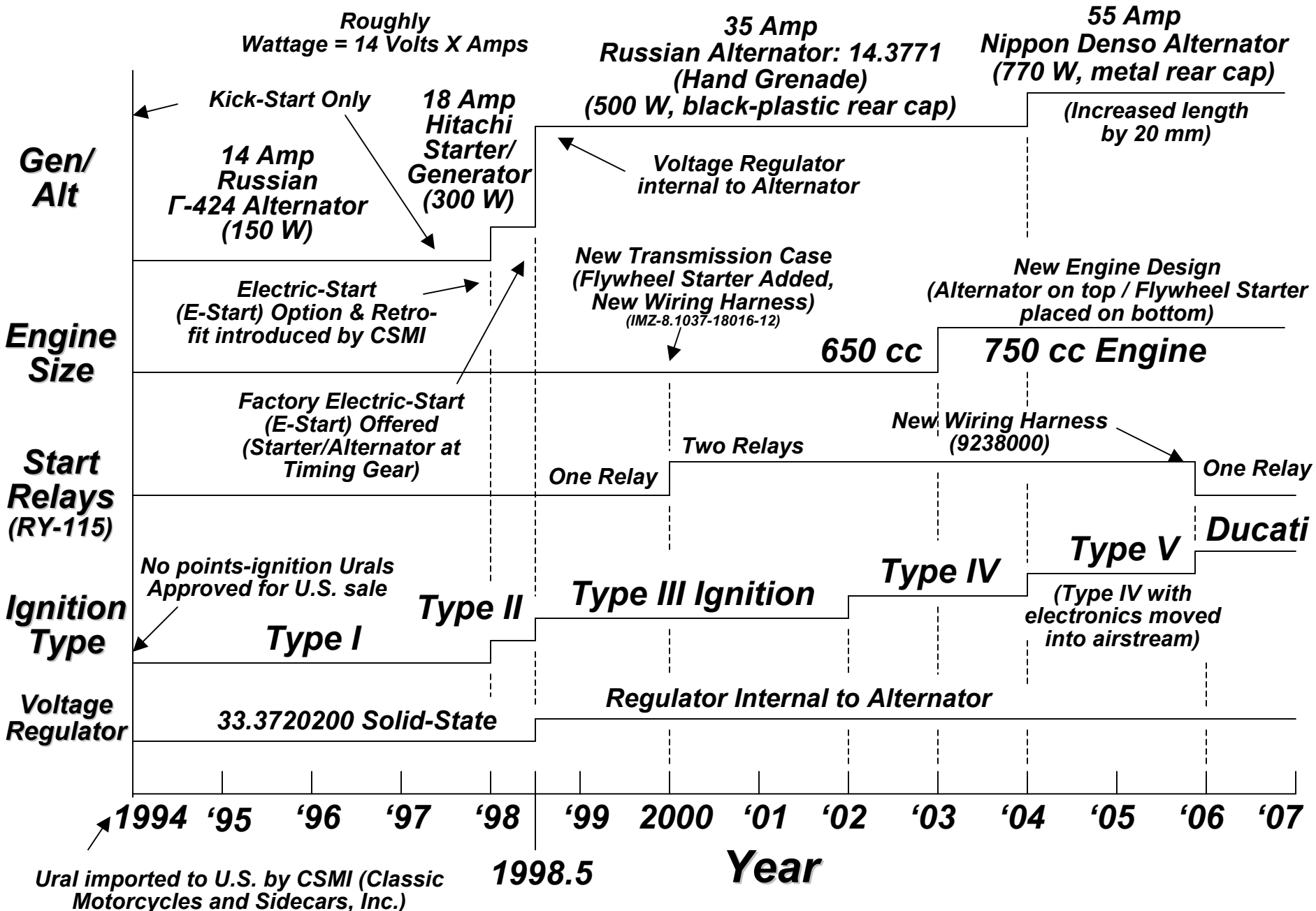
# Ural (Урал) - Днепр (Днепр) Generator/Alternator Time-Line (12/09)

eafranke@tampabay.rr.com



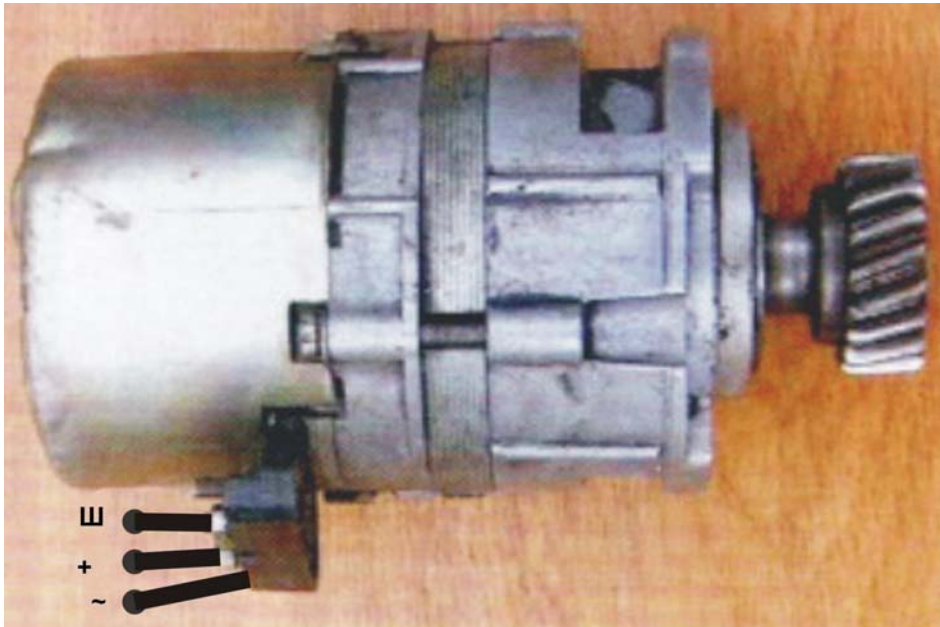
**Alternators have progressed in output voltage and power, From the Г-11 (G-11) generator of 6-Volts/45-Watts in 1941, the Г-11A in 1952, the Г-414 6V/65 W in 1957, the Г-424 of 12V/150W in 1974, the 14.3771 of 12V/500W in 1998.5, to the present-day Nippon-Denso alternator of 12-V/770W.**

# Recent Ural Starter/Generator/Alternator Time-line (12/09)



# **Previous Alternator: Г-424 (G-424) (1974-1998)**

- **12-Volt / 11-Ampere / 150-Watt Alternator**
- **Used on;**
  - **Ural: M-67, M-67.36, IMZ 8.103 Series**
  - **Dnepr: MW-650, MW-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), 12-Pole Construction**
- **Built-in Rectifier (MSF-2A)**

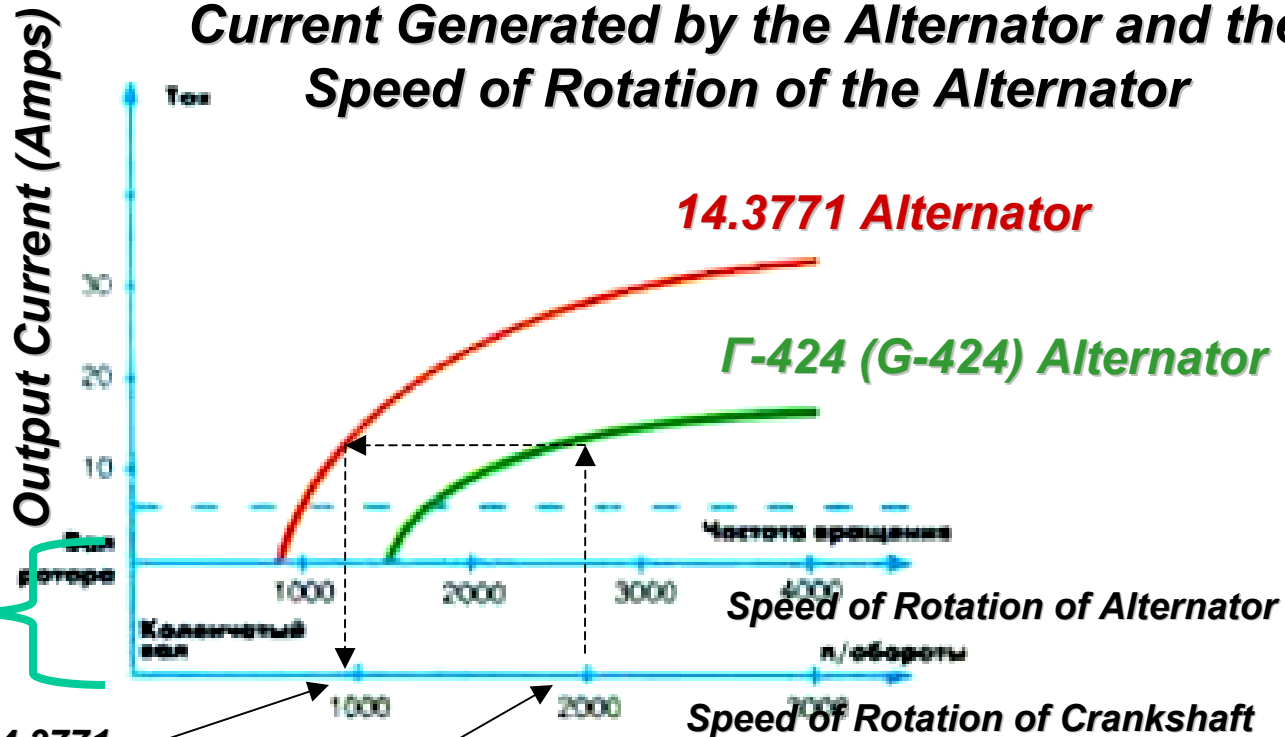


**The higher-output capability of the 14.3771 alternator was needed to provide a migratory path for electric-start, in an urban (slow-speed & traffic lights) driving environment.**

# 14.3771 Russian 35-Amp Alternator

Engine (Crankshaft) Speed	Alternator (Rotor) Speed	Motorcycle Speed (mph/kmph)
Idle (900-to - 1,000 rpm)	1,200 rpm -to-1,333 rpm	10 mph/ 16 kmph
2,500 rpm	3,333 rpm	25 mph/ 40 kmph
3,500 rpm	4,667 rpm	40 mph/ 65 kmph

**Current Generated by the Alternator and the Speed of Rotation of the Alternator**



**Г-424 alternator rotor turns 1.33X crankshaft**

**Equivalent rpm for 14.3771 to produce rated current of Г-424 Alternator**

**Crankshaft speed of Г-424 Alternator to produce Rated Current**

**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)**

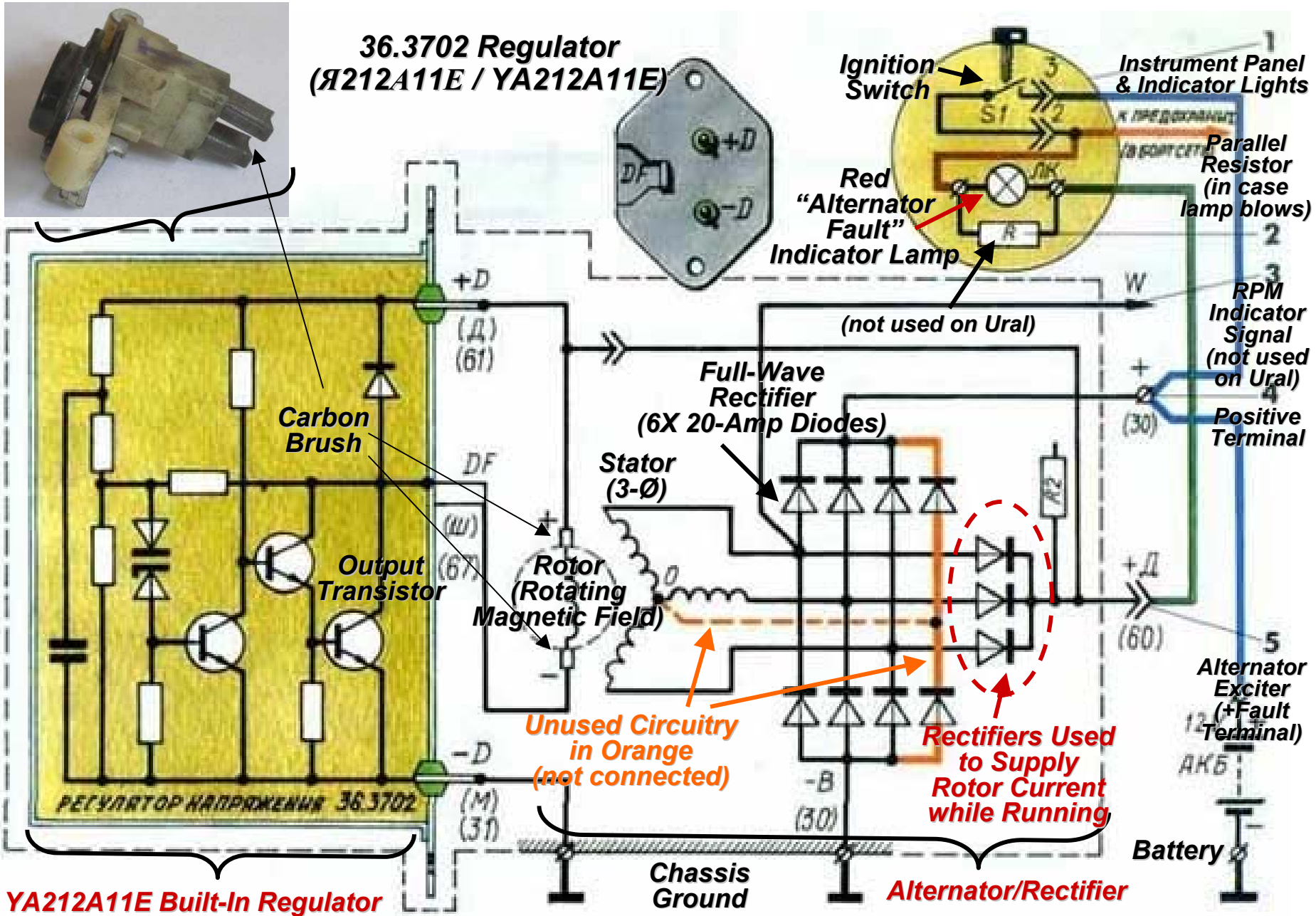
- **12-Volt / 35-Ampere / 500-Watt Alternator (a.k.a. 350-Watt Alternator)**
- **3-Ø (three-phase) Windings for More-Continuous Delivery of Current**
- **Same Dimensions of Previous Alternator (Г-424)**
  - **Uses Same Pinion Gear from Г-424**
  - **Adjust for Minimum Trashing of Gears (Not for Minimum 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 / 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 Application(12/09)



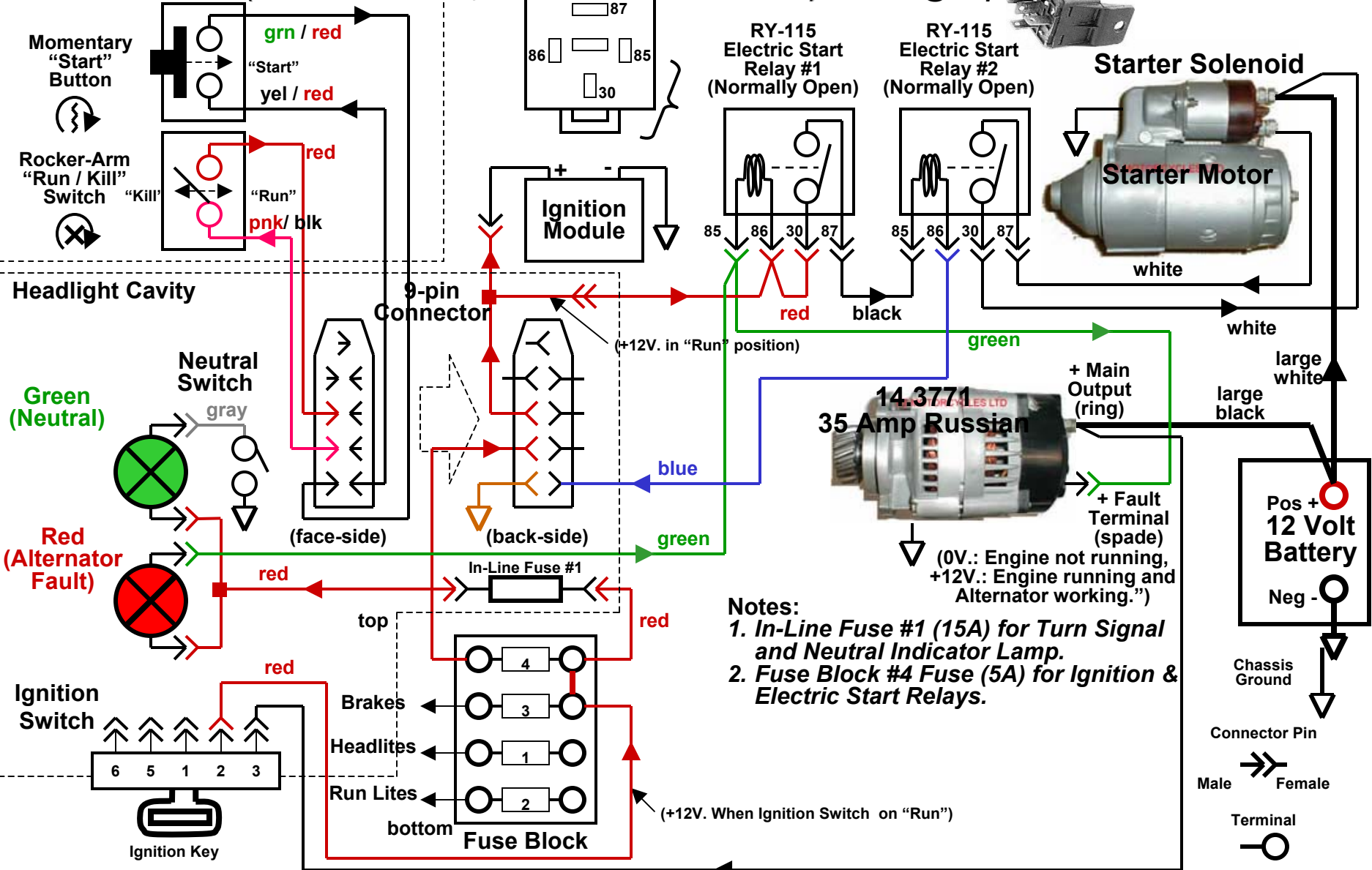
# **How the YA212A11E Voltage Regulator Works**

- **Alternator Output Voltage Created by Rotating (rotor) a Magnetic (exciter) Field within a Stationary (three-phase stator) Winding**
- **Current is 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 Three Auxiliary 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.**

# Ural 650/750 Starter/Alternator Circuit (2002-2003) (12/09)

Right Handlebar (IMZ-8.103717001-13, 2002 & 2003 Owners Manuals) eaf Franke@tampabay.rr.com

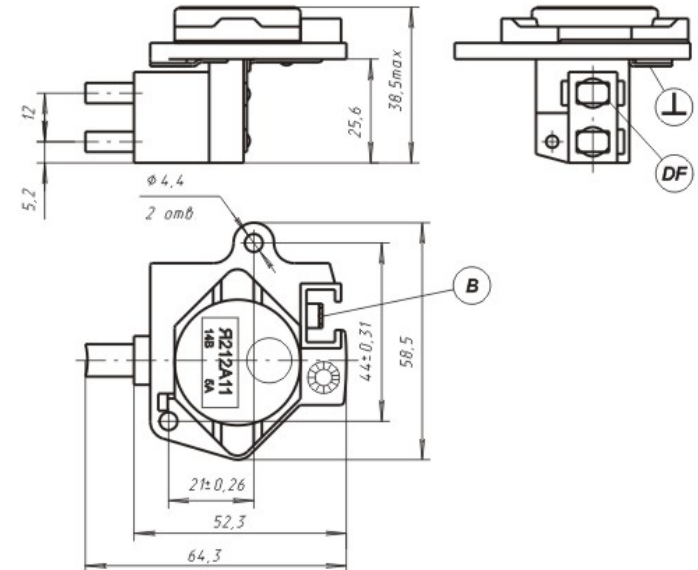


- Notes:**
1. In-Line Fuse #1 (15A) for Turn Signal and Neutral Indicator Lamp.
  2. Fuse Block #4 Fuse (5A) for Ignition & Electric Start Relays.

**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***

# Charging Circuit Trouble-Shooting Guide

(2000 Shop Manual for Ural 650cc)

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.

