



***Russian Regulators: Part IV
Solid-State (33.3702) Regulator
for the
Г-424 11-Amp Alternator (rev. 2)***

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12-Volt Solid-State (Electronic) Regulator (33.3072) for the Г-424 11-Amp Alternator

- **Background**
 - Voltage Regulators Paired with Specific Generators/Alternators
 - Time-Line for Generators/Alternators/Regulators
 - Specs for the Г-424 Alternator
 - Г-424 Alternator Performance
 - Alternator / Regulator Application in Ural and Dnepr Wiring
- **What is the 33.3072 Regulator?**
 - External Voltage Regulator for the Г-424 11-Amp Alternator
 - Completely Solid-State (Electronic, Transistorized)
 - Years of Application: 1992-to-1998
 - Replaced PP-330 Relay-Type (Mechanical) Regulator
 - Superseded by 35-Amp Alternator (14.3771) with Built-In Regulator
- **How Does It Work?**
 - Supplies Exciter Current to Vary Magnetic Field in Rotor Coil
 - Provides Constant Voltage Regardless of Rotor Speed
 - Regulates Alternator Output Voltage to 14-Volts
- **Replacement**
 - Widely Used in Lada (Russian) Vehicles
 - Replacements Purchased On-Line

The electronic regulator (33.3072) was a welcome substitute for the vibration-sensitive PP-330 (electro-magnetic) mechanical regulator used in the Г-424 11-Amp Alternator.

Types of Generators/Alternators for Ural (Урал) and Dnepr (Днепр) (01/10)

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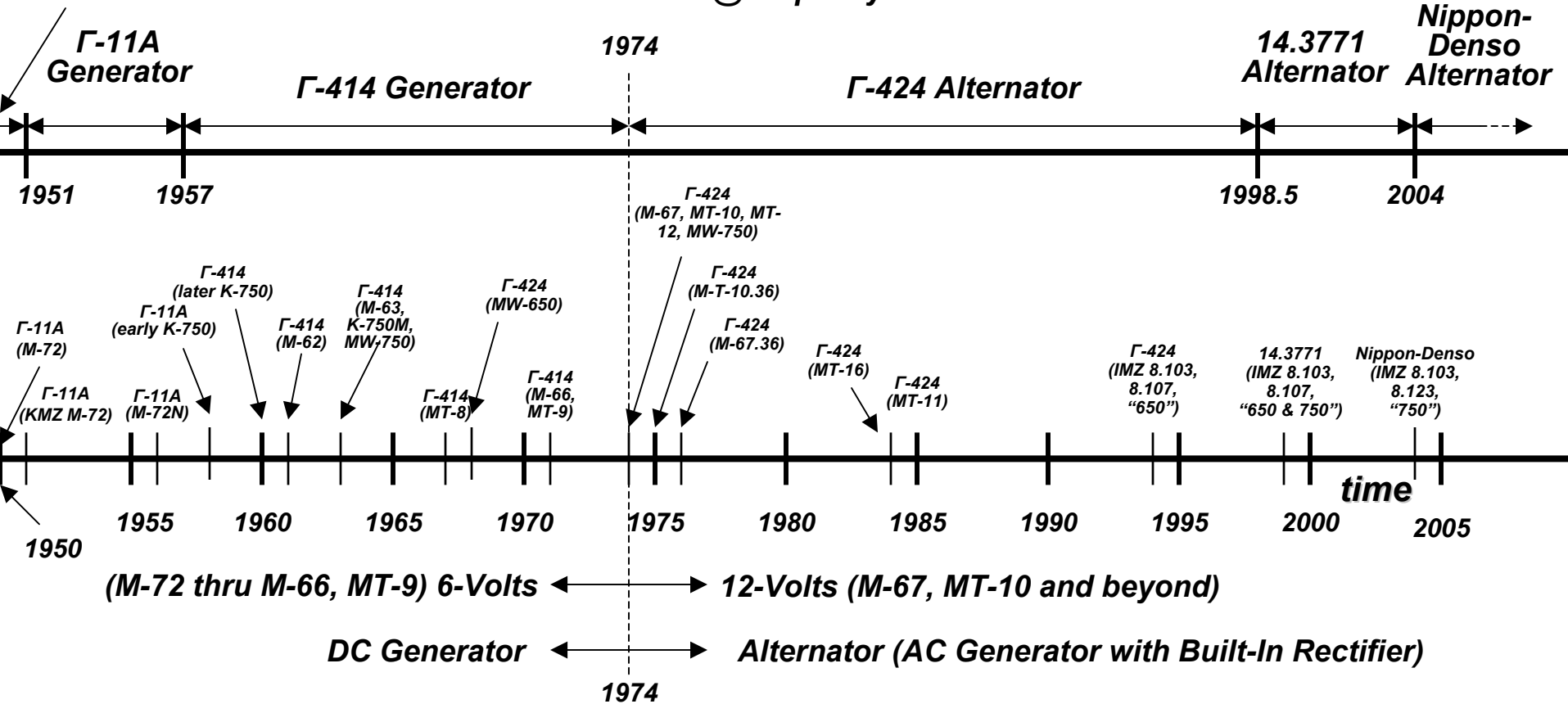
Generator/ Alternator	Type	Vintage	Nominal Voltage	Current	Nominal Power	Regulator	Motorcycles	
							Ural(IMZ)	Dnepr (KMZ)
Г-11 (G-11) (P/N: 72181)	DC Generator	1941- 1951	6-Volt (7-Volt)	7-Amp	45-Watts	PP-1 PP-31 (1950)	M-72	Not Used
Г-11А (G-11A) (P/N: 72181-A)	DC Generator	1952- 1957	6-Volt (7-Volt)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

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)

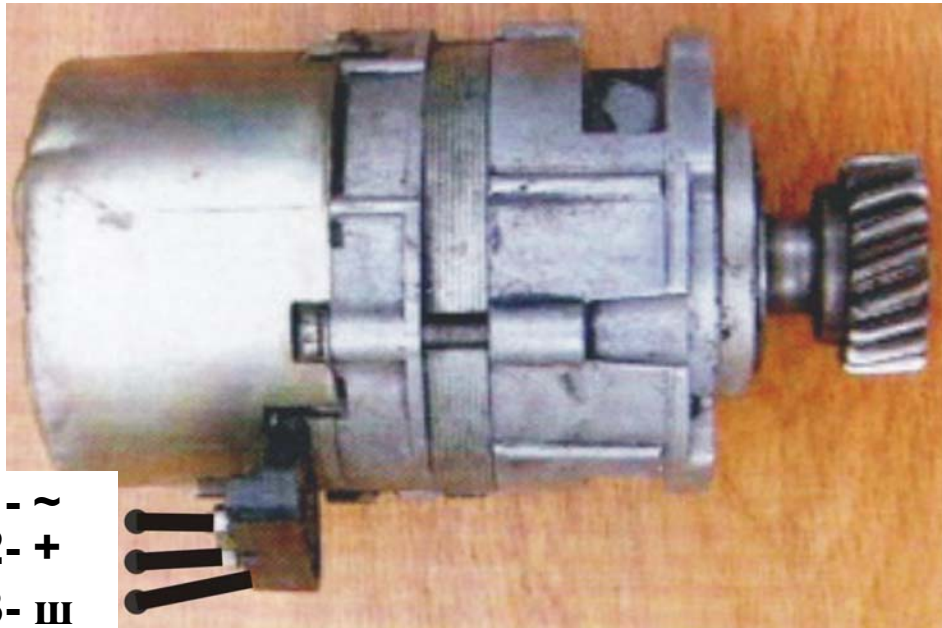
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Alternators have progressed in output voltage and power, from the Γ -11 (G-11) generator of 6-Volts/45-Watts in 1941, the Γ -11A in 1952, the Γ -414 of 6-Volts/65-Watt in 1957, the Γ -424 of 12-Volts/150-Watts in 1974, the 14.3771 of 12-Volts/500-Watts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

Alternator Specification: Г-424 (G-424) (1974-1998)

- **12-Volt / 11-Ampere / 150-Watt Alternator (a.k.a. 14-Amp)**
- **“Full-Time” (Continuous) Current Rating: 11-Amperes**
- **Alternator Г-424 Used on;**
 - **Ural: M-67, M-67.36, IMZ 8.103 “650cc” Series**
 - **Dnepr: MW-650, MW-650M, MT-10, MT-10.36, MT-11, MT-14, MT-16**
- **Used with Mechanical (PP-330) & Solid-State (33.3702) Regulators**
- **3-Ø (three-phase), 12-Pole Stator Winding for Smooth Output Voltage**
- **Built-in Full-Wave Rectifier (MSF-2A)**



1- ~
2- +
3- III

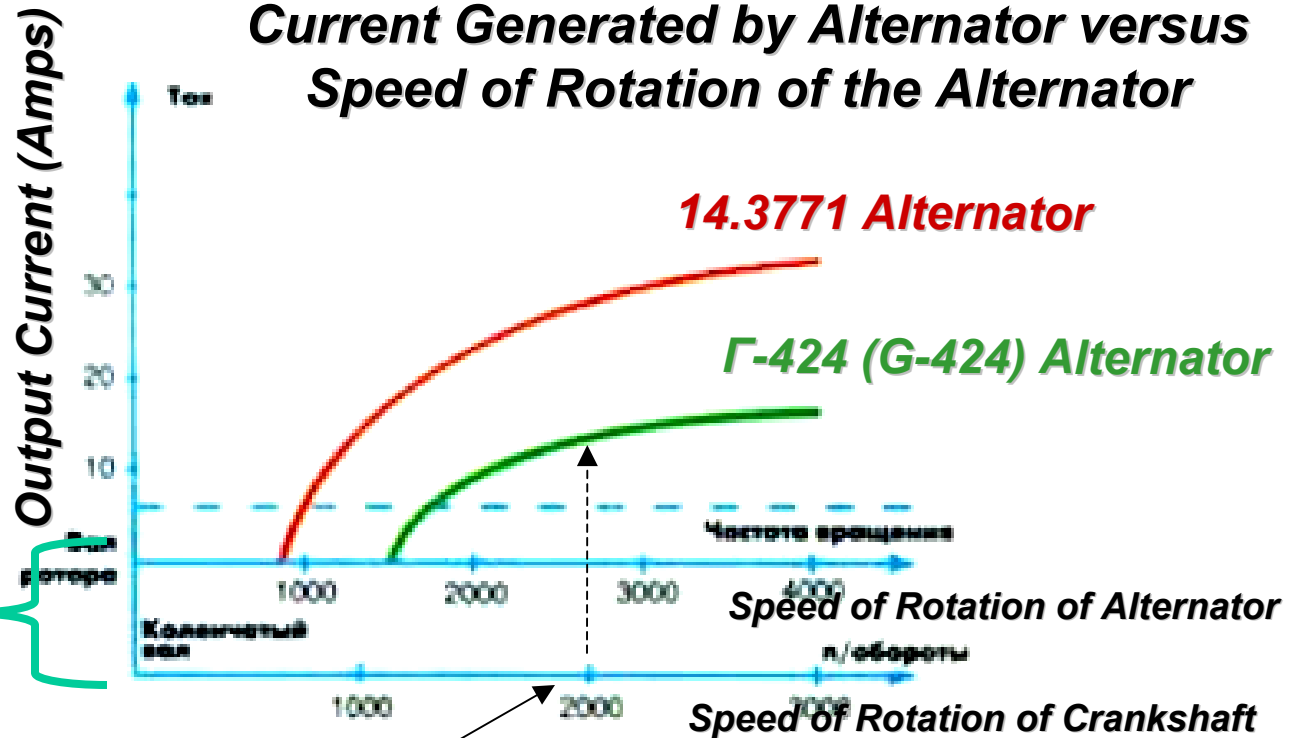


The Г-424 alternator surfaced in 1974 on Ural's M-67 and Dnepr's MT-10, as Russian motorcycles migrated to 12-Volts.

Г-424 Russian 11-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 Alternator versus Speed of Rotation of the Alternator



Г-424 alternator rotor turns 1.33X crankshaft

Crankshaft speed of Г-424 Alternator to produce Rated Current (15-to-20 mph)

Indicator light may blink when motorcycle moves at 20 mph (30 km/h) and at the instance an additional load is connected!

The Г-424 alternator provides rated current (11-Amps) at 2,000 rpm of the crankshaft. Thus for urban driving (low-speed & traffic lights), the alternator was sufficient to supply the necessary charging current (prior to electric-start).

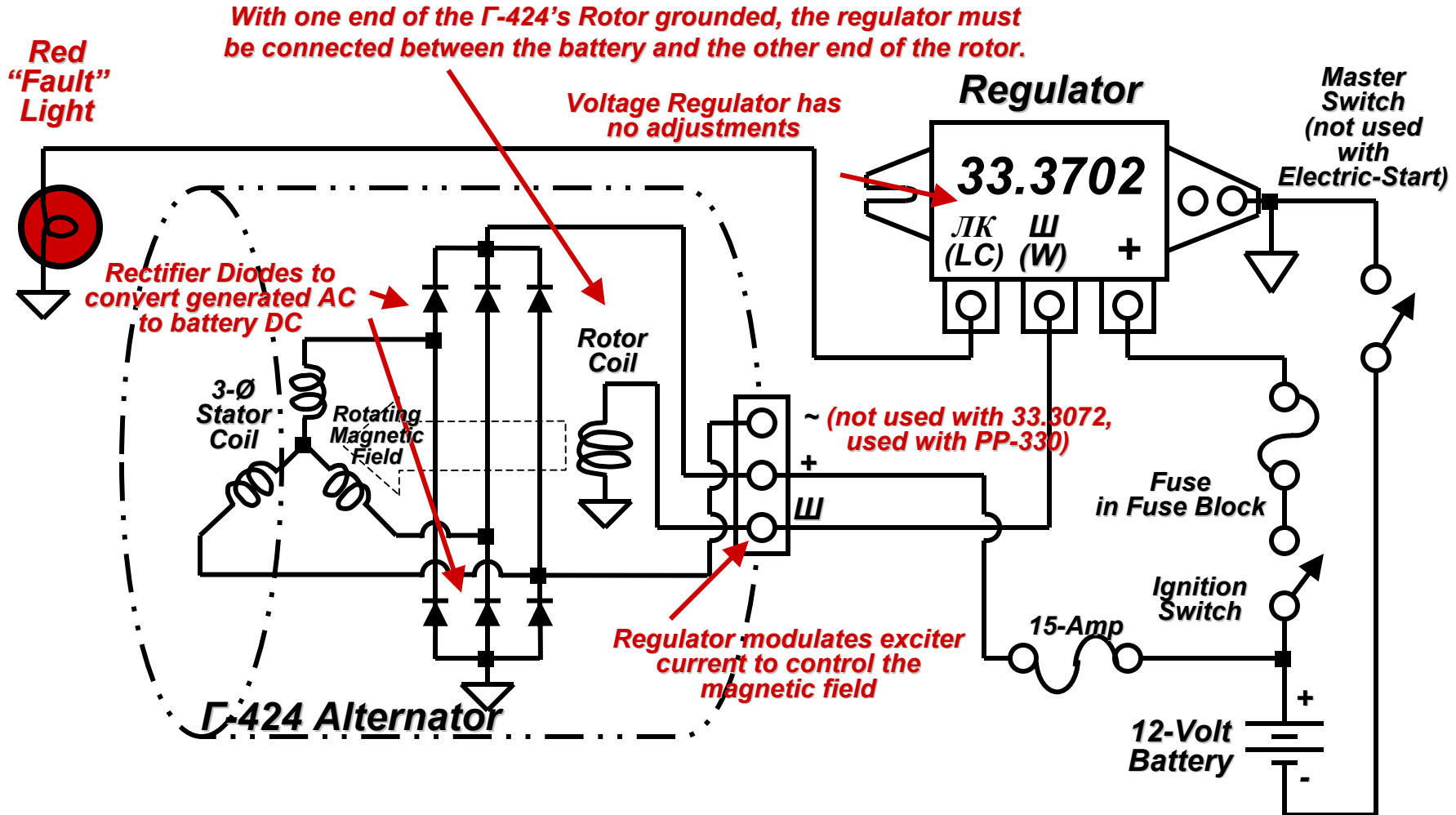
33.3702: Solid-State 12-Volt Regulator for the Г-424 Alternator

- **Rated for 1.5-Amp Current from the Rotor (Exciter) Coil**
- **Used on Ural (Урал, IMZ): 650-cc 8.903, 8.923, 8.103**
- **Used on Dnepr (Днепр, KMZ): MT-10, -10.36, -11, -14, -16**
- **Main Manufacturer: АО КЗАМЭ (AO KZAME, Russia, Kaluga)**
- **6 Transistors**
- **No Adjustment Possible**
- **Board Covered with Thick Layer of Lacquer**



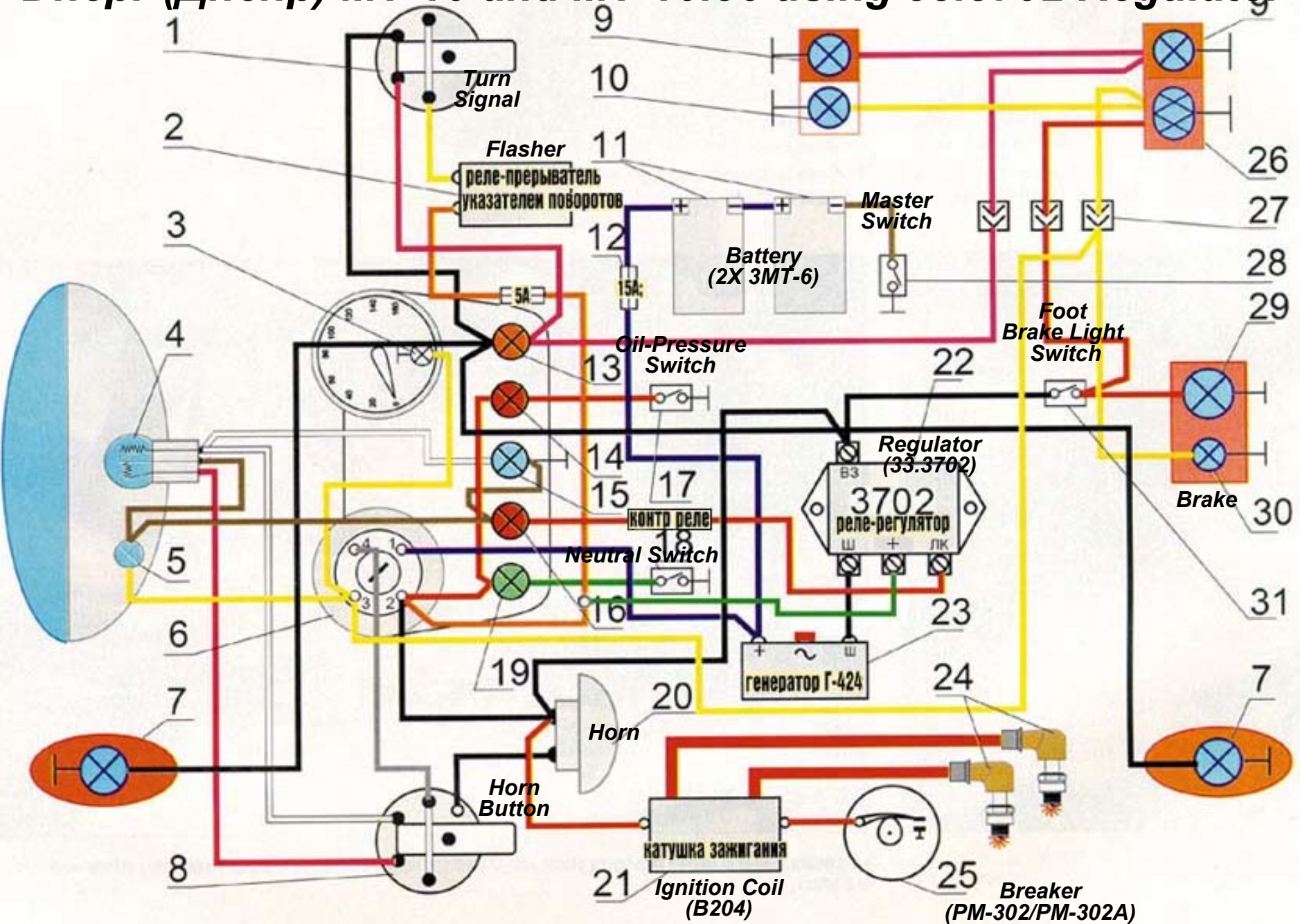
The 33.3702 regulator is readily available from various Ural / Dnepr “parts suppliers” on the Internet.

33.3072 Voltage Regulator Application



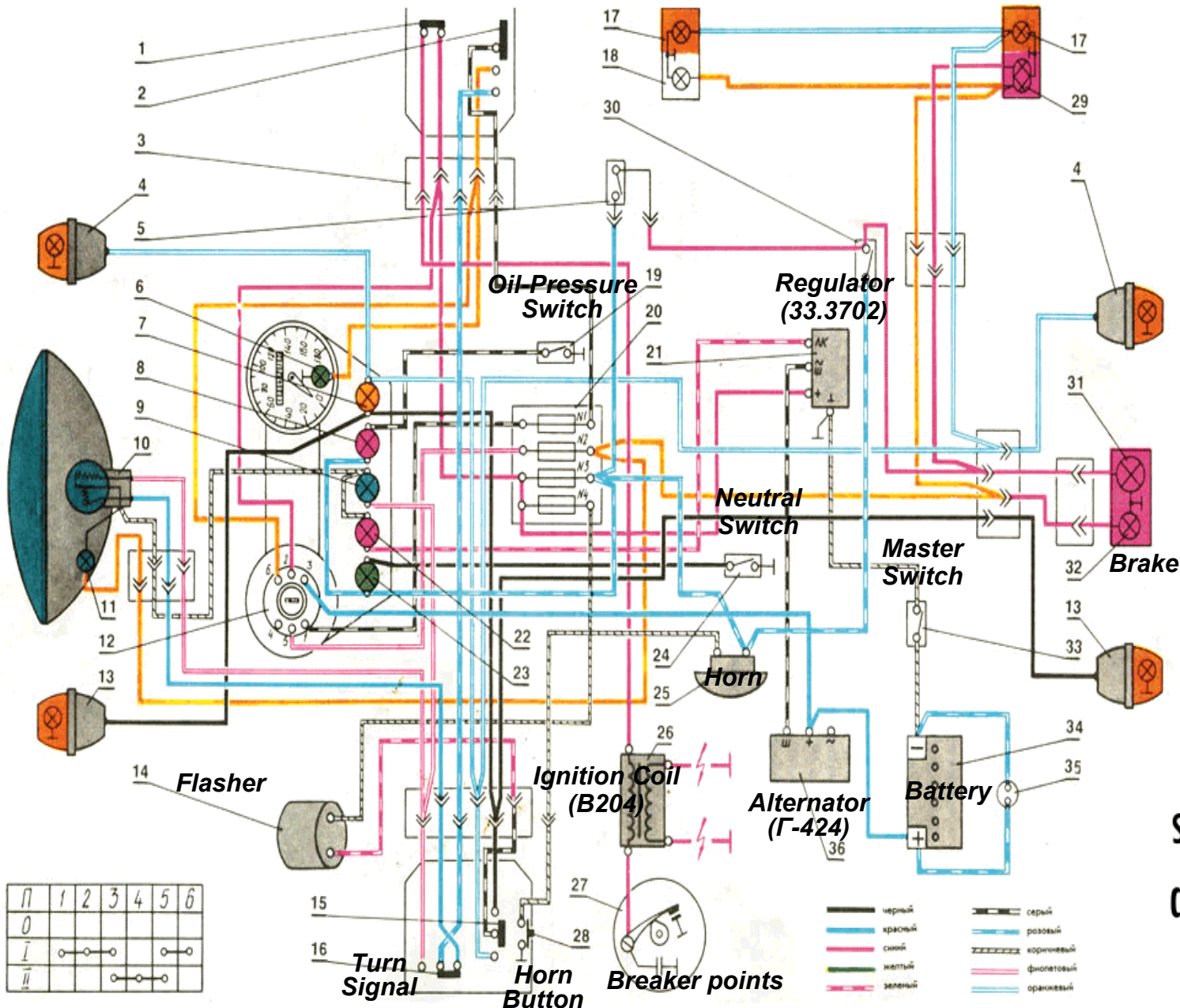
The electronic (33.3072) regulator varies the current in the rotor coil (terminal W) to maintain a constant output voltage at the "+" terminal.

Днепр (Днепр) MT-10 and MT-10.36 using 33.3702 Regulator

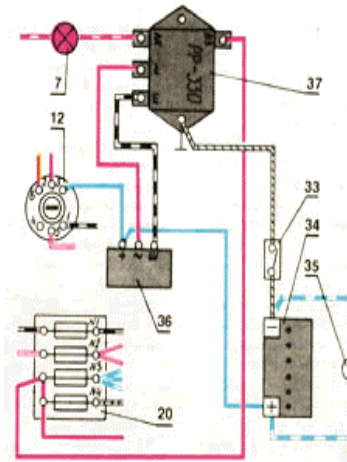


Днепр (Днепр) MT-11, MT-14 and MT-16

(showing replacement of PP-330 Regulator with the Solid-State 33.3702)



Older Models:
PP-330
(Relay-Type)



schemat instalacji
do Dniepra MT-11,
14 i 16

Alternator and Voltage Regulator Testing

Ignition Off

- **Measure DC Voltage between Alternator Terminal and Ground**
- **Voltage Should Be about 12-to-12.5-Volts**
 - **If Less than 12-Volts: Battery Needs to be Charged**
 - **Voltage Below 11-Volts: Indicates Weak or Dead Battery**

Ignition On, Lights On

- **Warning: Do Not Increase Engine Speed if Voltage Rises beyond 16-Volts, as This Will Damage Motorcycle Electrics**
- **If Regulator is Functioning Properly: 13.5- to- 14.5-Volts**

Increase Engine Speed from Idle

- **Voltage Should Rise to about 14-Volts (ideally 14.4-Volts)**
- **If Voltage Remains Normal, 13.5 -to- 14.5-Volts; All Is Well!**
- **If Voltage immediately Heads towards 15-Volts, Alternator is Good, but Regulator is Broken**
- **If Voltage Surpasses 15-Volts with an Increase in Speed and Drops in Voltage when Speed is Decreased, Alternator is Good and Regulator is Broken**
- **If Voltage Does Not Rise with Increased Engine Speed; Alternator is Bad, Regulator Most Likely Good**

Both the alternator and voltage regulator may be checked on the motorcycle. As the engine speed is increased the output voltage should increase slightly, but regulated to less than 15-Volts.

Repair of Voltage Regulator and Alternator

- **Faulty 33.3702 Regulator**
 - **Check Terminals of Regulator for Tightness and Corrosion**
- **Fault Alternator**
 - **Check All Terminals: Bad Contacts Almost Always the Cause. Clean with Fine Emery Cloth.**
 - **If Contacts Already Shiny: Remove Block of Carbon Graphite Brushes and Inspect Brushes and Slip-Rings**
- **Inspect Two Copper Slip-Rings**
 - **Rings Should Be Flat, Smooth, Shiny Surface, with Possible Darkening on Brush Tracks**
 - **Clean Tracks: Rub Each Track with Rag or Felt Pad Soaked with Solvent / Acetone**
 - **Warning: Do Not Clean Slip-Rings with Abrasive! Do Not Use Sandpaper or File! Any abrasive Will Make Scratches on Surface of Soft Copper Tracks. Scratches Will Work on Graphite Brushes Like an Emery Wheel.**
- **Check Integrity of Rotor Coil**
 - **Check Rotor Coil Circuit thru Carbon Brushes: Should Be 1-to-5 Ohms**
 - **If Tracks Clean and Ohmmeter Reads High: Coil is Open**
 - **If Rotor Coil Shows Very Little Resistance (less than two ohms): Coil is Short-Circuited**

**A faulty alternator can be repaired,
but if the electronic regulator dies it's best to replace.**

Repair of Alternator (cont.)

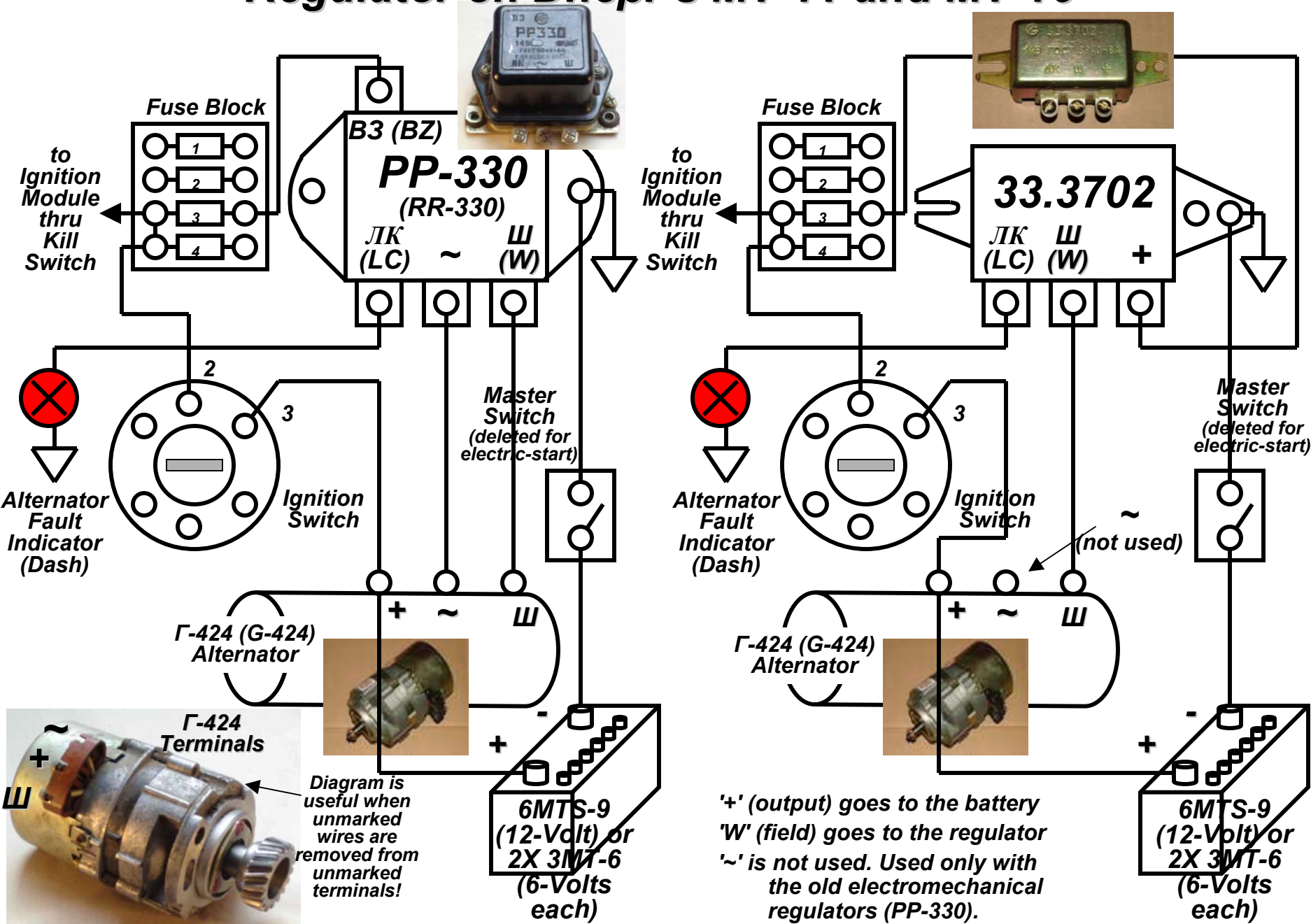
- ***Inspect Graphite Carbon Brushes***
 - ***Measure Brush Length: If Less than 1/16" (4 mm): Replace***
 - ***Without Chips and Breaks***
 - ***Working Surface Must Be Smooth and Polished***
 - ***Smoothly Push Brushes into Spring-Loaded Nests: No Resistance***
- ***Check Resistance of Three-Piece Stator Windings***
 - ***Remove from Terminals and Check Resistance between Each Winding***
 - ***Each Winding Should Be about Same Small Value***

How the 33.3702 Voltage Regulator Works

- **Alternator Output Voltage Created by Magnetic (exciter) Field Rotating (rotor) within Stationary (three-phase stator) Winding**
- **Current is Supplied thru Carbon Brushes to Rotor Shaft Slip-Rings via Voltage Regulator**
- **Stronger Magnetic Field or Higher Rotor Speed Yields Higher Output Voltage**
- **Regulator Maintains Constant Output Voltage by Modulating Exciter Rotor Current**
- **Operation:**
 - **Turn-On (engine not running): Exciter Winding Energized with Ignition Switch On**
 - **Current flowing in Rotor Coil, Pre-Excitation of the Alternator, before Obtaining Necessary Speed of Rotor**
 - **Fault Indicator Lamp Indicates Regulator Supplying Current to Rotor (Exciter)**
 - **If Engine Not Running and Lamp Not Lit: Defective Red “Fault” Lamp “or” Defective Alternator “or” Defective Voltage Regulator**
 - **After Engine Starts: With rpm’s, Alternator then Supplies Exciter Current thru Six Diode Rectifiers, Extinguishing the Red “Fault Light”**
 - **If “Fault” Lamp Continues to Light, May Be Caused by Broken Connection “or” Defective Alternator**
 - **Normal Run: Regulator’s Output Transistor Provides Variable Path for Rotor Exciter Current to Maintain Constant Output Voltage**
- **Voltage Settings: 13.5 -to- 14.5-Volts**
 - **Measure Battery Voltage with Engine Running**
 - **With Increasing Speed, Voltage Should Slowly Rise to Maximum of 14.5-V, and Must Not Exceed for Further Increases in Speed**
 - **If Voltage Increases Beyond 15-Volts: Immediately Turn-Off Engine Regulator Is Either Broken or Error in Wiring**

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

Migration from Mechanical (PP-330) to Electronic (33.3702) Regulator on Dnepr's MT-11 and MT-16



Terminal Marking (Replacing PP-330 with 33.3702)

- **3 Unmarked Terminals On I-424 Alternator (11-Amp)**
 - **'+' 12-Volt (output) to the Battery**
 - **'Ш' (field) from Regulator**
 - **'~' not used with 33.3072 Electronic Regulator (used only with older electro-mechanical regulator PP-330)**

Alternator Function	Regulator Designation	PP-330 (RR-330) (Mechanical)	33.3702 (Solid-State)
"+" Battery or Alternator	D+	B3 (BZ)	+
Rotor Excitation (shunt)	DF	Ш (W)	Ш (W)
"-" Ground (mass)	B-	Body of Regulator	Body of Regulator
Mid-Point of Alternator	no	~	Absent
"Fault" Lamp Control	no	ЛК (LC)	ЛК (LC)

Electro-magnetic (mechanical) regulators have traditionally used the terms D+ (battery and alternator), DF (control voltage to rotor) and B- (ground).