Russian Voltage Regulators (Реле-регулятор напряжения)

Part XXVIII-6: Voltage Regulator for the Nippon-Denso Alternator

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12-Volt Regulator (N-D Part # 126000-0600) for the Nippon-Denso 55-Amp Alternator

- **Background**
  - Voltage Regulators Paired with Specific Generators/Alternators
  - Time-Line for Generators/Alternators/Regulators
  - Performance Specs for the Nippon-Denso (N-D) Alternator
  - Alternator Application in Ural Wiring

- **What is it?**
  - Internal (Built-In) Voltage Regulator for the Ural Nippon-Denso (N-D) Alternator
  - Completely Solid-State
  - Years of Application: 2004-to-Present
  - Retro-fitable to 14.377 (35-Amp) and Г-424 (11-Amp) Applications

- **How Does It Work?**
  - Regulates Alternator Output Voltage to 14.5-Volts
  - Provides Constant Voltage Regardless of Rotor Speed
  - Supplies Exciter Current to Vary Magnetic Field of Rotor

- **Circuit Description and Operation**

- **Replacement**
  - Widely Used in Nippon-Denso (Denso), Daihatsu, Kubota and Suzuki Alternators
  - Replacement Parts Readily Purchased On-Line

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The Nippon-Denso 126000-0600 built-in, solid-state voltage regulator is a widely-used, reliable unit.
### Types of Generators/Alternators for Ural (Урал) and Днепр (Днепр)

<table>
<thead>
<tr>
<th>Generator/Alternator</th>
<th>Type</th>
<th>Vintage</th>
<th>Nominal Voltage</th>
<th>Current</th>
<th>Nominal Power</th>
<th>Regulator</th>
<th>Motorcycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Г-11 (G-11)</td>
<td>DC Generator</td>
<td>1941-1951</td>
<td>6-Volt (7-Volt)</td>
<td>7-Amp</td>
<td>45-Watts</td>
<td>PP-1 PP-31 (1950)</td>
<td>Ural(IMZ) M-72</td>
</tr>
<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

- **Gen/Alt**: Kick-Start Only, 14 Amp Russian Г-424 Alternator (150 W)
- **Engine Size**: 650 cc
- **Start Relays (RY-115)**: Electric-Start (E-Start) Option & Retro-fit introduced by CSMI
- **Ignition Type**: Type I
- **Voltage Regulator**: 33.3720200 Solid-State
- **Year**: 1994 '95 '96 '97 '98 '99 2000 '01 '02 '03 '04 '05 '06 '07

**1998.5**

- **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**

- **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)

- **Type I**: No points-ignition Urals Approved for U.S. sale
- **Type II**: Factory Electric-Start (E-Start) Offered (Starter/Alternator at Timing Gear)
- **Type III Ignition**: New Wiring Harness (9238000)
- **Type IV**: Type IV with electronics moved into airstream
- **Type V**: Ducati

- **Voltage Regulator Internal to Alternator**

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

**Ural imported to U.S. by CSMI (Classic Motorcycles and Sidecars, Inc.)**
Nippon-Denso 12-Volt Alternator

• 14-Volt / 55-Ampere / 770-Watt Alternator (actually rated at 43-Amp)
• 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
• P/N for Alternator-Only (minus cushion adaptor): 100211-1680
• Current Rating for 100211-1680 Alternator:

<table>
<thead>
<tr>
<th>Engine (Crankshaft) Speed</th>
<th>Alternator (Rotor) Speed</th>
<th>Output Current</th>
<th>Motorcycle Speed (mph / kmph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>340-to-450 rpm</td>
<td>450-to-600 rpm</td>
<td>“Fault” Light Extinguishes</td>
<td>Idle</td>
</tr>
<tr>
<td>2,025 rpm</td>
<td>2,700 rpm</td>
<td>30-Amp</td>
<td>22 mph / 35 kmph</td>
</tr>
<tr>
<td>2,250 rpm</td>
<td>3,000 rpm</td>
<td>34-Amp</td>
<td>24 mph / 38 kmph</td>
</tr>
<tr>
<td>3,000 rpm</td>
<td>4,000 rpm</td>
<td>40-Amp</td>
<td>32 mph / 51 kmph</td>
</tr>
<tr>
<td>3,750 rpm</td>
<td>5,000 rpm</td>
<td>43-Amp</td>
<td>40 mph / 64 kmph</td>
</tr>
<tr>
<td>5,250 rpm</td>
<td>7,000 rpm</td>
<td>46-Amp</td>
<td>56 mph / 90 kmph</td>
</tr>
<tr>
<td>-</td>
<td>&gt;7,000 rpm</td>
<td>Not Much Increase above 50-Amp</td>
<td>&gt;56 mph / 90 kmph</td>
</tr>
</tbody>
</table>

Nippon-Denso’s 100211-1680 alternator is nominally rated at 43-amps @ 5,000-rpm, corresponding to a motorcycle speed of 40-mph (64 km/hr).
**Nippon-Denso Installation Wiring Diagram**

**L:** Lamp - connect via the warning lamp to +12v

**B+ Battery:** Main current connection - connect to the battery positive via heavy duty wire.

**IG:** Ignition - connect to ignition switched +12V, provides about 0.25-Amp to drive the regulator.

“Fault” Light is Optional on N-D Alternator (note: light was mandatory for initial rotor current in previous 14.3771 35-Amp alternator (Russian hand grenade))

**Three connector Alternator**

Grounding the “F” terminal gives “full-field” for testing.
Connections to the ND Voltage Regulator

The voltage regulator is the brain of the charging system, monitoring both battery and stator voltages. Depending on the measured voltages, the regulator will adjust the amount of rotor field current to control alternator output.

Solid-state voltage regulator has only two external connections; L (output to the indicator lamp) and IG (input from the ignition switch).

“L” Terminal provides ground to light the “Fault” warning indicator.
Inside the Nippon-Denso Voltage Regulator

The regulator controls the amount of battery current going to the field winding in the rotor.
Ural 750 Starter / Alternator Circuit (2004-2005)

**Notes:**
1. Two Start Relays (RY-115)
2. In-Line Fuse #1 deleted mid-2005

**Connector Pin**

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>87</td>
<td>87</td>
</tr>
</tbody>
</table>

**Pos +**
black/white

**Neg -**
white/large grey

**12 Volt Battery**

**Starter Solenoid**

**Starter Motor**

**Chassis Ground**

**Fuse Block**

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

**Notes:**
(+12V. when Ignition Switch on “Run”)

**55 Amp Nippon Denso Alternator**

**Headlight Cavity**

**Neutral Switch**
(on transmission)

**Green (Neutral)**
gray (face-side)
(red) (back-side)

**Red (Alternator Fault)**

**Ignition Switch**

6 5 1 2 3

**Ignition Key**

**Brakes**

3 4

**Headlites**

1 2

**Run Lites**

9-pin Connector

**S-pinc**

**Rocker-Arm “Run / Kill” Switch**
“Kill”
“Start”

**Rocker-Arm “Start” Button**

**Momentary “Start” Button**

**Right Handlebar**
Parts for the Nippon-Denso 12-Volt alternator are readily available from Tiedemann Auto-Elektric (Denmark) at www.auto-elektrik.de and Metro Auto Industrial, Pomona, CA at www.metroautoinc.com.
Voltage Regulator for the Ural 100211-1680 Alternator

• 12-Volt Voltage Regulator
• Output Voltage Set Point: 14.5-Volts
• Repair Circuit: VR-H2005-26S; TRI254
• Terminal Markings” IG (ignition) and L (lamp)
• Low/High Speed RPM Charge Point (lamp on/off): 450/ 600 rpm Rotor Speed
• Ambient Operating Temperature (full load): -40°C to +135°C (-40°F to +275°F)
• Alternator Series: IR / IF (internal Regulator / Internal Fan)
• Soft-Start for Field
• Load Control: “Y” and Load Response: 7 sec
• Principal Use: Fork-lift and Industrial
• N-D Alternators Shut Down for:
  – Over-Voltage
  – Shorted “B” Lead
  – High Field Current (over-load)
  – Warning Light Will Illuminate

The questionable 14.3771 alternator was replaced with a Nippon-Denso (N-D) alternator, adding to Ural’s reliability.
Nomenclature for Nippon-Denso (N-D) Alternator

- **Ural Announced:** Starting January 2004, Motorcycles Equipped with DENSO 100211-1680 (Japan), with Built-In Regulator
- **Consists of N-D 100211-680 Alternator plus Cush Adapter Unit**
- **Alternator Used In:**
  - Line of Toyota Forklift Trucks
  - Ford, Kubota, New Holland Light Tractors
  - Thermo King AG & Industrial
  - Daihatsu Charadl Vehicle
  - Chevrolet Sprint 1.0L (1988-87)
  - Suzuki Samurai 1.3L (1995-86) and Sidekick 1.3L (1989)
- **Alternator (pulley-version, instead of Ural adapter) Used In:**
- **Voltage Regulator OEM#'s:** Nippon-Denso Part# 126000-0600
  - Replaces:
    - Toyota 27700-78301
    - Iseki 281-271-001-0
    - Daihatsu 27700-96301, 27700-87207
    - Victory A8062902
- **Voltage Regulator 27700-96301 Used In:**
  - **Alternators:**
    - Ishikawajima 18504-6220
    - Mitsubishi MD604589
    - Nippon-Denso 100211-1550, -1670, -1680
  - **Vehicles:**
    - Daihatsu
    - Mitsubishi
    - Subaru
    - Suzuki
    - Toyota

Parts for the Nippon-Denso 12-Volt alternator (minus the cushion adapter) are readily available.
Voltage Regulation Process

- Regulator Maintains pre-Determined Charging Voltage Level: 14.5-V
- When Charging Voltage Falls below this Point, Regulator Increases Field Current, thus Strengthening the Rotating Magnetic Field, Resulting in Increased Alternator Output
- When Charging Voltage Rises above this Point, Regulator Decreases Field Current, thus Weakening the Magnetic Field, Resulting in Decreased Alternator Output

The regulator monitors the battery voltage, controlling current flow to the rotor assembly. The rotor produces a magnetic field, which induces voltage into the stator. The rectifier bridge converts AC stator voltage to DC output for use by the motorcycle.

A Peek inside the Alternator

- Removing the Rear Case Reveals:
  - Rotor Winding Assembly, which Rotates inside Stator Winding
  - Rotor Generates a Rotating Magnetic Field
  - Stator Winding Develops Voltage
  - Current Begins to Flow from Induced Magnetic Field of the Rotor
- As the Rotor Assembly Rotates within the Stator Winding:
  - Alternating Magnetic Field from the Spinning Rotor Induces an Alternating Voltage into Stator Winding
  - Strength of the Magnetic Field and Speed of the Rotor Affect the Magnitude of Voltage Induced into Stator

Removal the rear cover of the N-D alternator reveals the rotating magnetic field coil surrounded by the stationary three-phase winding.
The rotor (exciter) field winding creates the rotating magnetic field that induces voltage into the stator winding.
Stator Windings

- Stator Composed of Three Sets of Windings
- Each Winding Placed in Different Position Compared with the Others, Staggered 120° Apart
- Laminated Iron Frame Concentrates the Magnetic Field
- Stator Lead Sends Output Current to Diode Rectifier Bridge
- Neutral Junction in the Wye (Y) Identified by the 6 Strands of Wire

Wye style has four stator leads. One of the leads is called the Neutral Junction, common to all the other leads.

The induced AC voltage in each lead of the stator winding is fed to the diode rectifier assembly to convert to DC.
Diode Rectifier Bridge Assembly

- Two Rectifier Diodes Connected to each Stator Lead
- Six Diodes used to rectify the AC stator voltage to DC Output Voltage
- Full-Wave Rectification: Diodes Redirect both Positive and Negative Polarity AC Voltage to Produce DC Voltage

The Diode Rectifier Bridge is responsible for the rectification of AC voltage to DC voltage.
Two slip rings are located on one end of the rotor assembly. Each end of the rotor field winding is attached to a slip ring, allowing current to flow through the field winding.

Two stationary carbon brushes ride on the two rotating slip rings.

Power for the rotor (exciter) coil is supplied, through the carbon brushes and slip-rings, by the voltage regulator.
Alternator Wiring

• On most ND three pin plug style alternators the pins are marked as "L" / "S" / "IG" The only other connection is usually a large single post terminal marked "B" This is the main wire connected to your battery and is hot at all times.

• The three other Terminals are fairly easy to understand;
  – IG: Ignition wire that issues the "wake up" to energize the circuit when ignition is switched on
  – L: Connected through to the charge warning light on your instrument cluster
  – S: Connected to the battery source and is hot at all times, it may even be connected to the main wire on the large B terminal in the loom but more often to the battery through a fusible link
Part No. IN254
Voltage Set Point: 14.5 V
Regulation: A-Circuit
Mounting: 57.5 mm
Repair Circuit TRI254
L-Terminal does NOT Drive Choke
Terminal Identification: IG-L
FOR USE ON: Forklift and other Industrial Application
DAIHATSU 27 700-87207000, 27 700-96301
NIPPONDENSO 126000-0600, 126000-0760, 126000-1160
(store.alternatorparts.com)

List Price: 316.20 rubles
(genauto.com.ua)