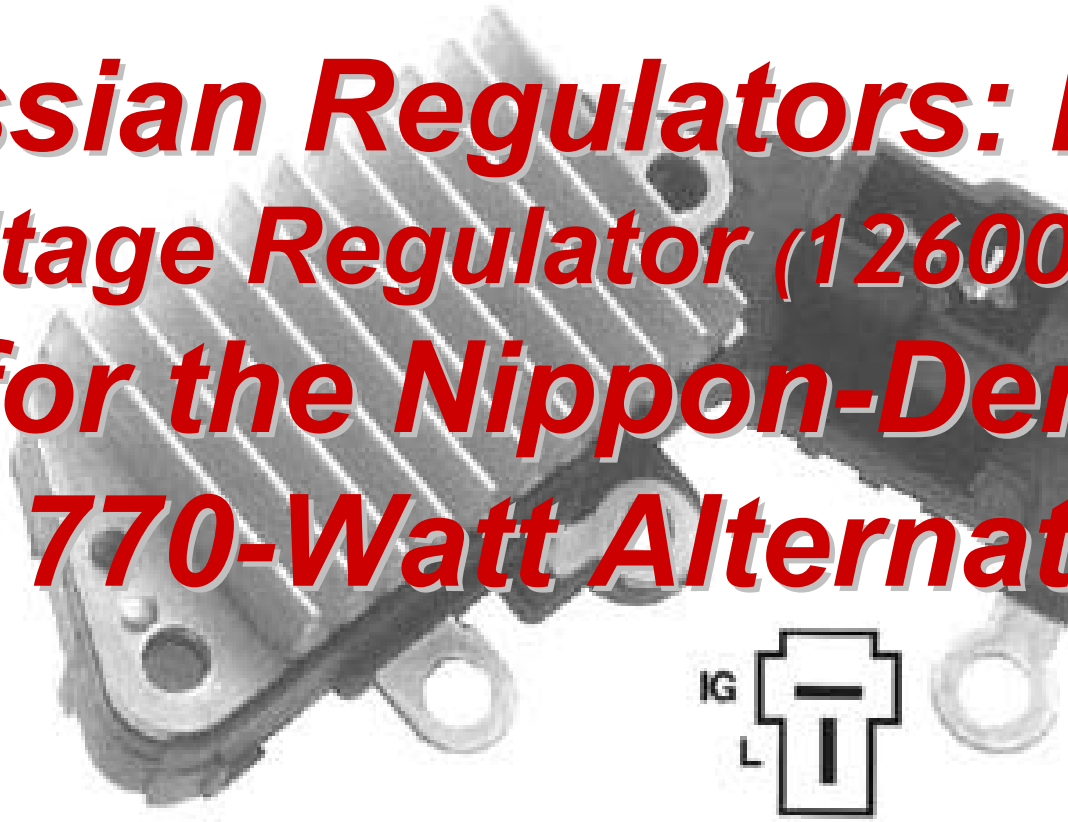
Russian Regulators: Part VI

Voltage Regulator (126000-0600) for the Nippon-Denso 770-Watt Alternator



Ernie Franke
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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
  - Replaced the 14.377 (35-Amp) Alternator in Jan. 2004
  - Retro-fittable 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

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 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-11A (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-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:

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 <u>same</u> part.
2. Cannot use Alternator with discharged battery or without battery.

Regulators are paired with specific generators/alternators.

Ural (Урал) - Dnepr (Днепр) Generator/Alternator Time-Line (01/10)

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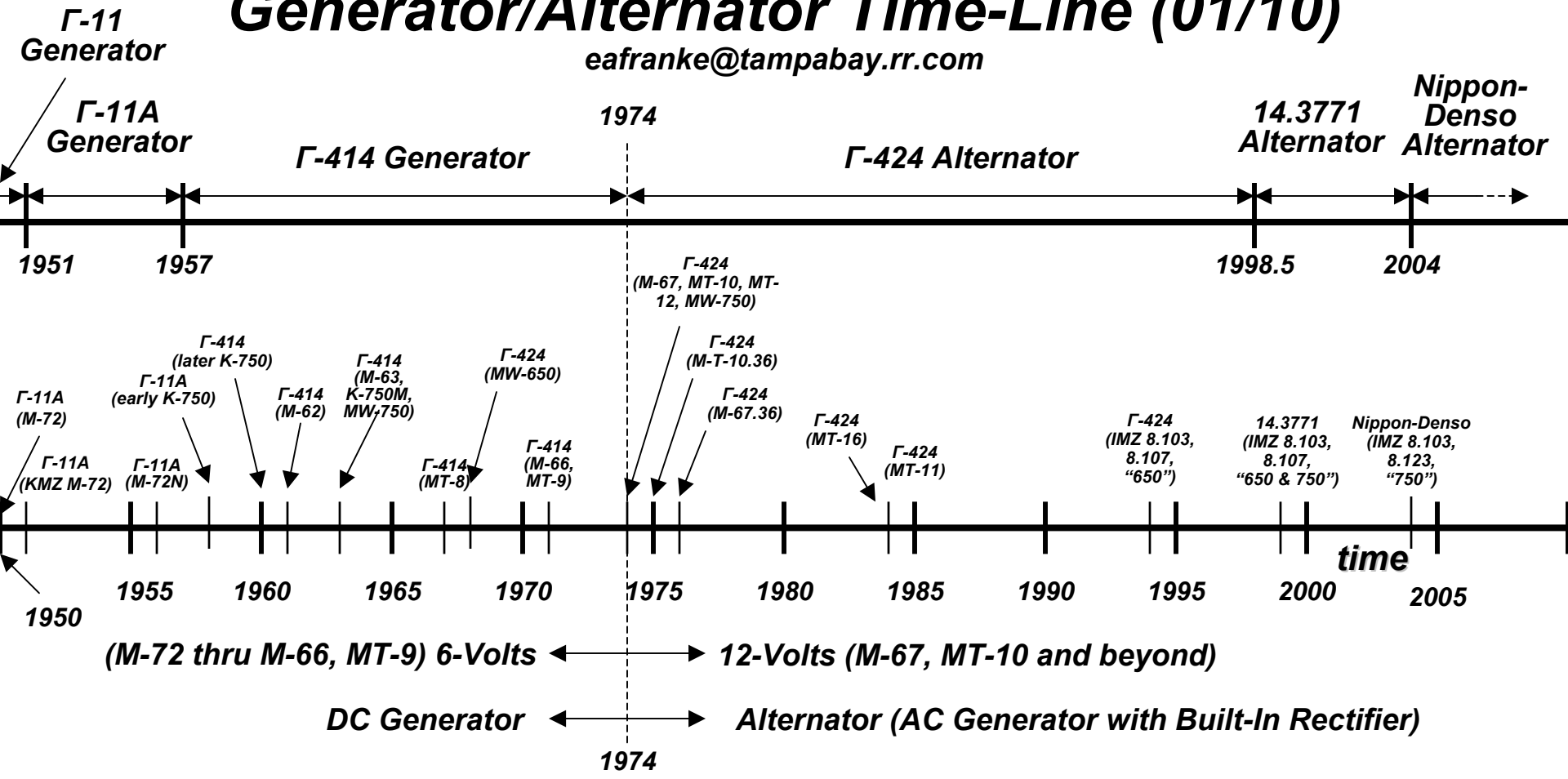
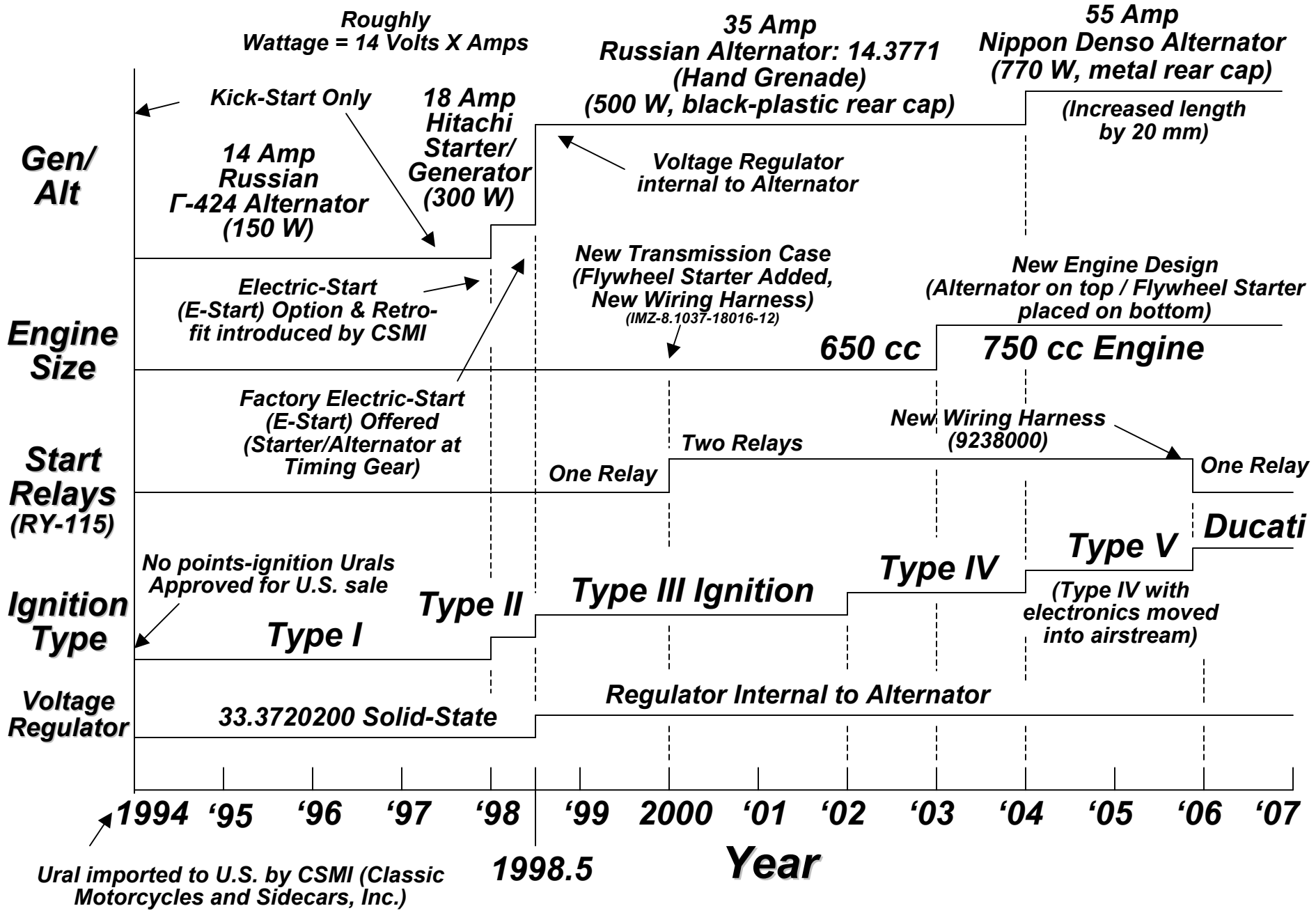


Alternators have progressed in output voltage and power, from the Г-11 (G-11) generator of 6-Volts/45-Watts in 1941, Г-11А in 1952, Г-414 of 6V/65W in 1957, Г-424 of 12V/150W in 1974, 14.3771 of 12V/500W in 1998.5, to the present-day Nippon-Denso alternator of 12-V/770W.

Recent Ural Starter/Generator/Alternator Time-line (01/10)



Nippon-Denso 12-Volt Alternator (01/10)

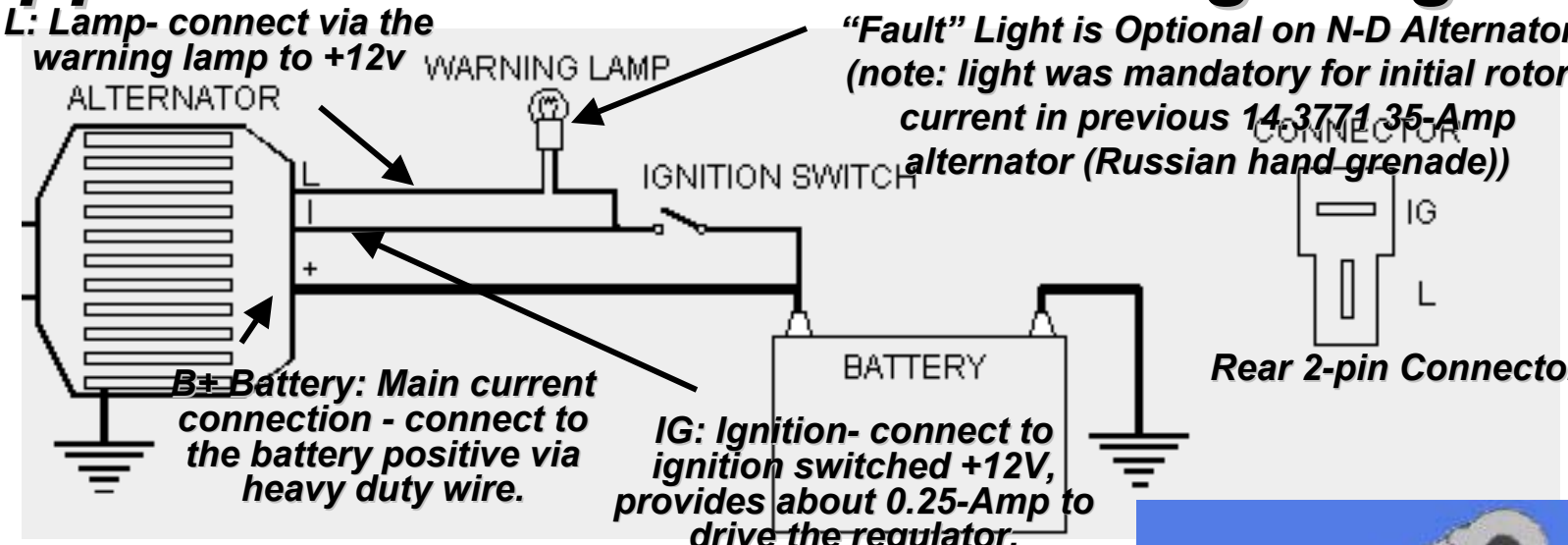
- 14-Volt / 55-Ampere / 770-Watt Alternator (actually rated at 43-Amp)
- Used on;
  - Ural: 8.103, 8.103X, 8.123, 8.123X, "750" Series
  - Dnepr: Not Used (retro-fittable to Г-424 applications)
- Built-In Voltage Regulator
- P/N for Alternator-Only (<u>minus</u> cushion adaptor): 100211-1680
- Current Rating for 100211-1680 Alternator:

100211-1680 Alternator "+"
Cush Adapter and Pinion Gear

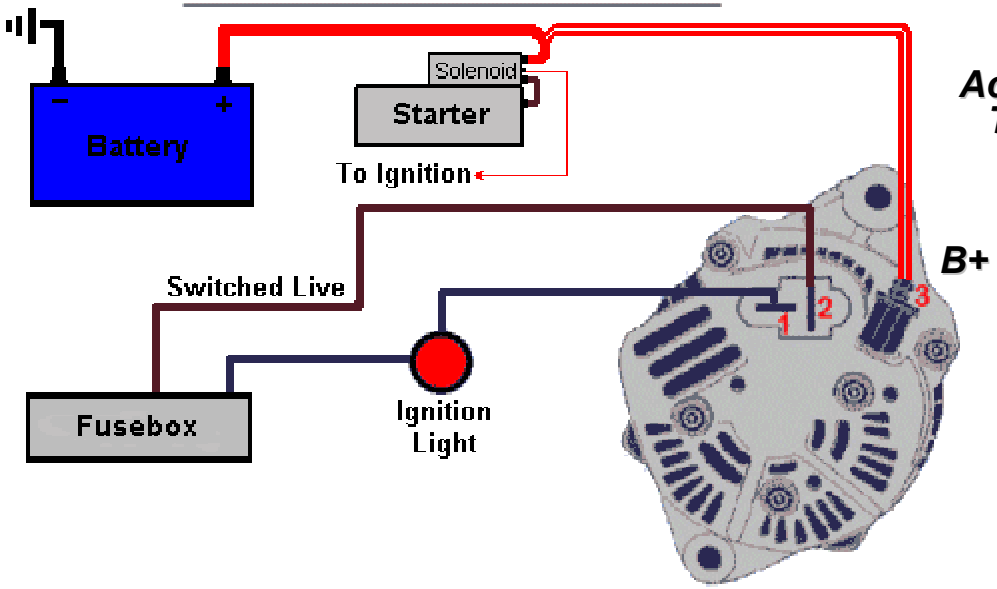
Engine (Crankshaft) Speed	Alternator (Rotor) Speed	Output Current	Motorcycle Speed (mph / kmph)
340-to-450 rpm	450-to-600 rpm	"Fault" Light Extinguishes	Idle
2,025 rpm	2,700 rpm	30-Amp	22 mph / 35 kmph
2,250 rpm	3,000 rpm	34-Amp	24 mph / 38 kmph
3,000 rpm	4,000 rpm	40-Amp	32 mph / 51 kmph
3,750 rpm	5,000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

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).

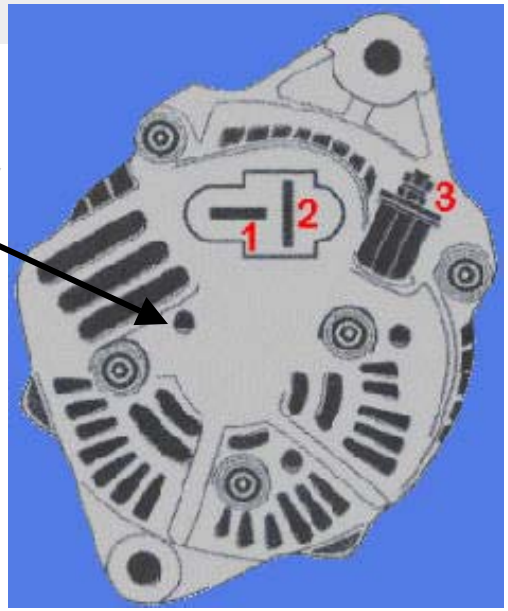
Nippon-Denso Installation Wiring Diagram



Three connector Alternator

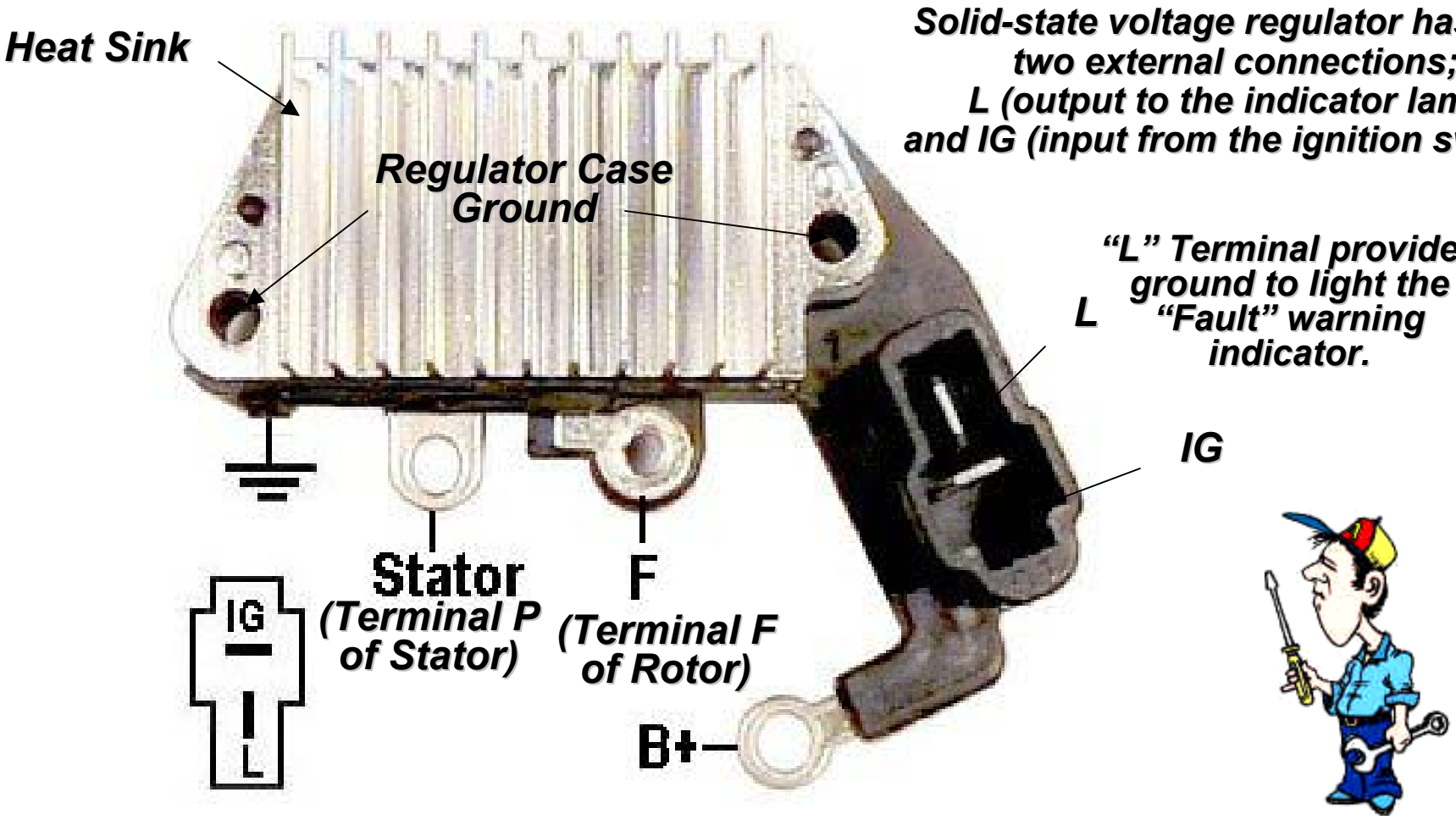


Access Hole for Terminal "F" of Rotor



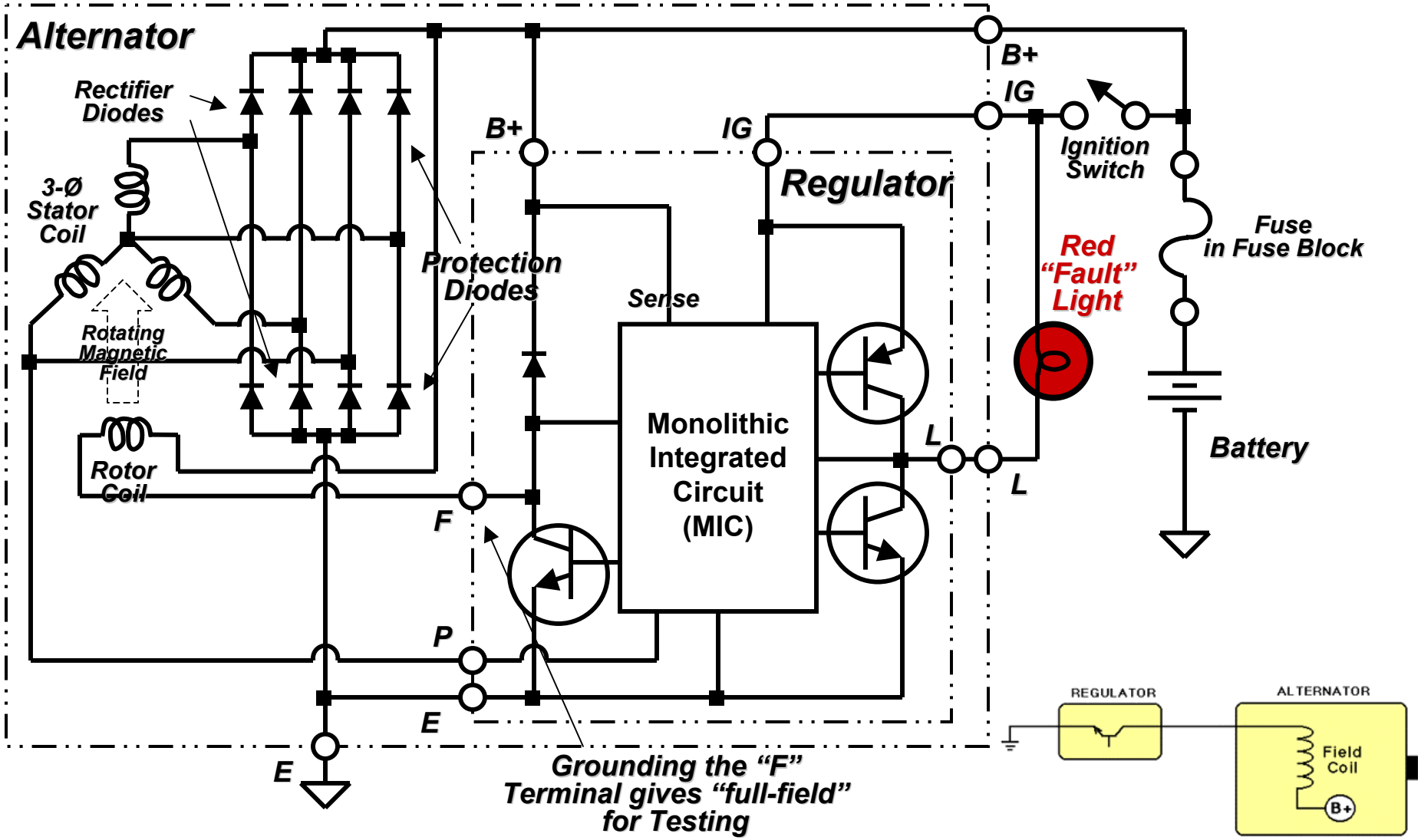
Grounding the "F" terminal gives "full-field" for testing.

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.

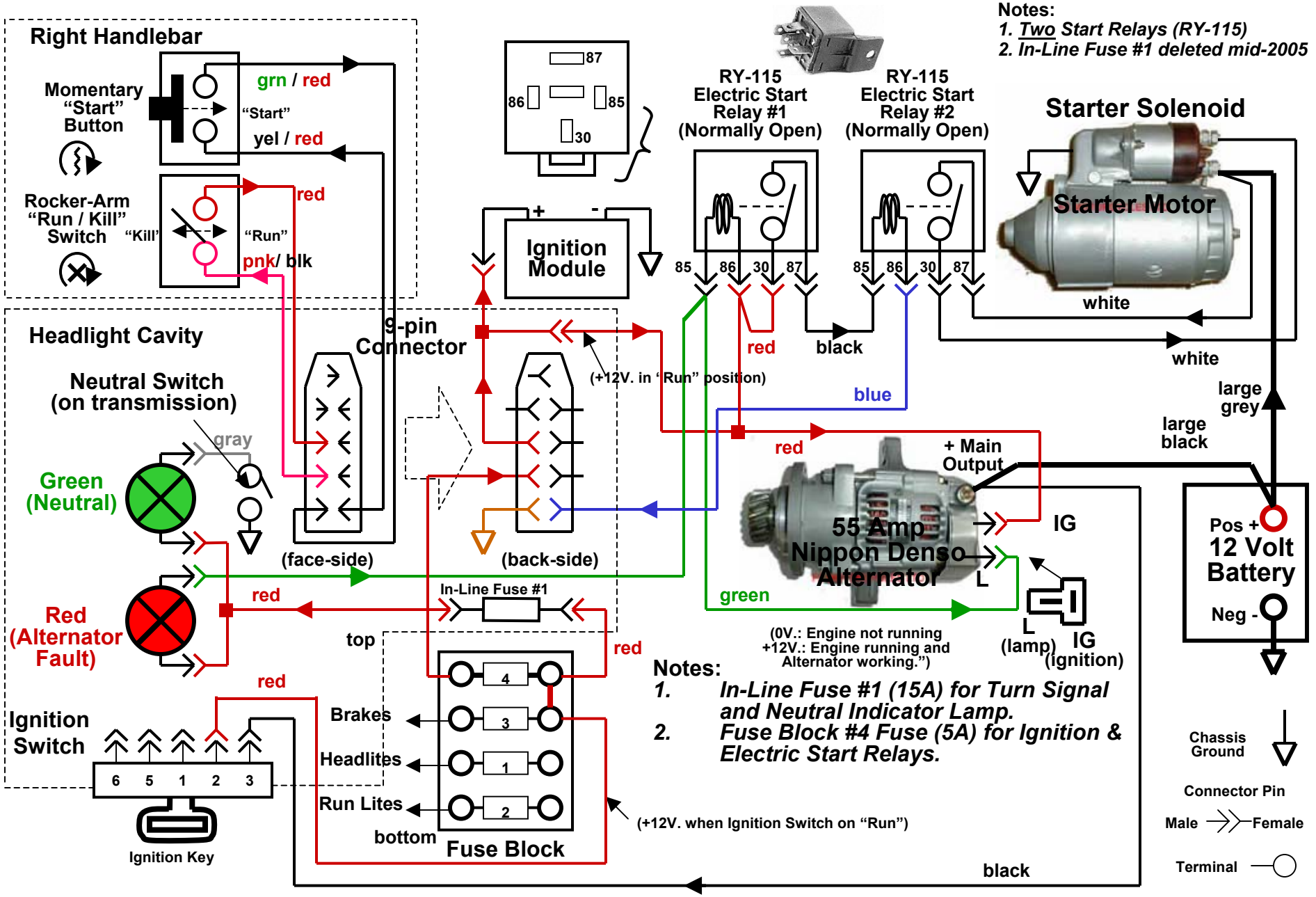
Inside the Nippon-Denso Voltage Regulator



The regulator controls the amount of battery current going to the field winding in the rotor.

Ural 750 Starter / Alternator Circuit (2004-2005) ver. 2.0 (01/10)

(IMZ-8.103717001-13, 2004 & 2005 Owners Manuals) eafranke@tampabay.rr.com



Ural 750 Starter / Alternator Circuit (2006-2007) ver. 2.0 (01/10)

(Electrex, Inc. Rev. E, 2006 GPTT, 2006 & 2007 Owners Manuals) eafranke@tampabay.rr.com

Notes:

1. *Single* Start Relay (RY-115)
2. ND Alternator added 2004
3. In-Line Fuse #1 Deleted mid-2005

Right Handlebar

Momentary "Start" Button

"Start"

grn/red

yel/red

Rocker-Arm "Run / Kill" Switch

"Kill"

"Run"

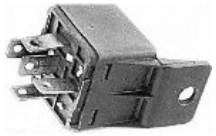
red

pnk/blk

Headlight Cavity

D E F G

10-pin Connector

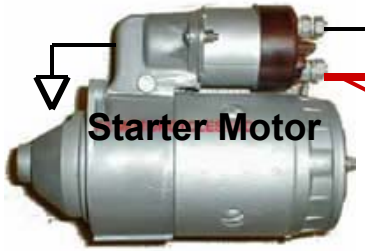


87 86 85 30

RY-115 Electric Start Relay (Normally Open)

85 86 30 87

Starter Solenoid



16 red

16 wht

+ -

Ducati Ignition Module

18 brn/red

18 blu/wht

18 brn/red

8 red

18 pnk

Neutral Switch (on transmission)

(+12V. in "Run" position)

18 brn/red

+ Main Output

12 red

Green (Neutral)

18 blk/red

55 Amp Nippon Denso Alternator

IG

L

Pos + 12 Volt Battery

Neg -

8 blk

Red (Alternator Fault)

18 blk/red

Fuse Block

15A

5A

15A

5A

18 pnk/blk

18 pnk/blk

L (lamp)

IG (ignition)

Ignition Switch

14 blu

14 blu

18 blu

5 6 1 2 3

12 red

Ignition Key

Chassis Ground

Connector Pin

Male Female

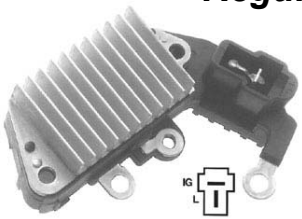
Terminal

Note: # *in front of wire color is AWG wire size.*

Parts for NIPPON-DENSO Ural / Dnepr 12-V / 40-A Alternator

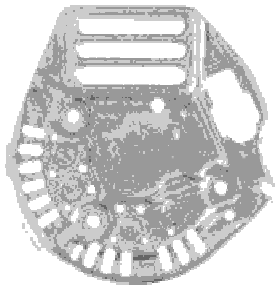
Rectifier

Stator



Regulator

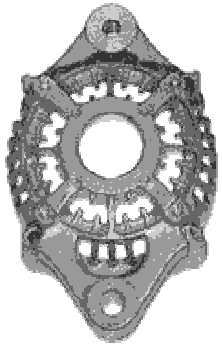
Connector for IG/L



Rear Cover

Brush Box with Brushes

Rotor

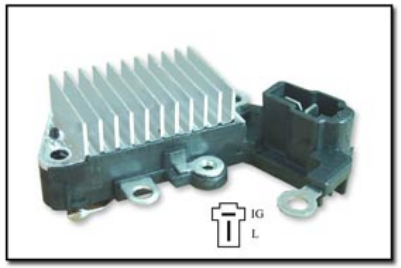


Front Cover

Slip Ring for Rotor Field Current

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.

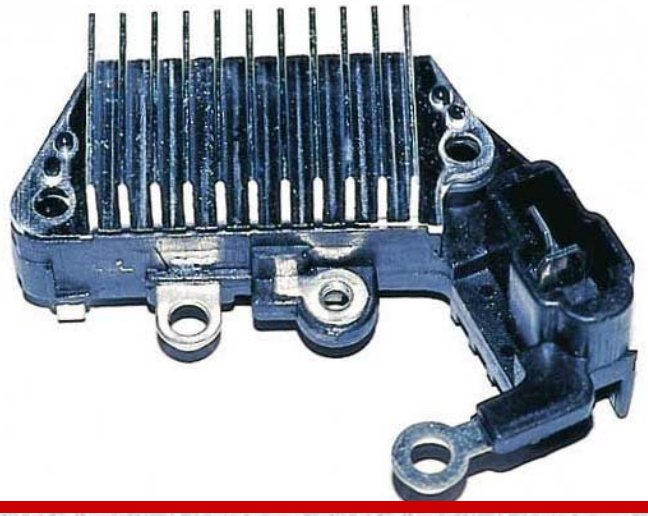
Nomenclature for Nippon-Denso (N-D) Alternator

- *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

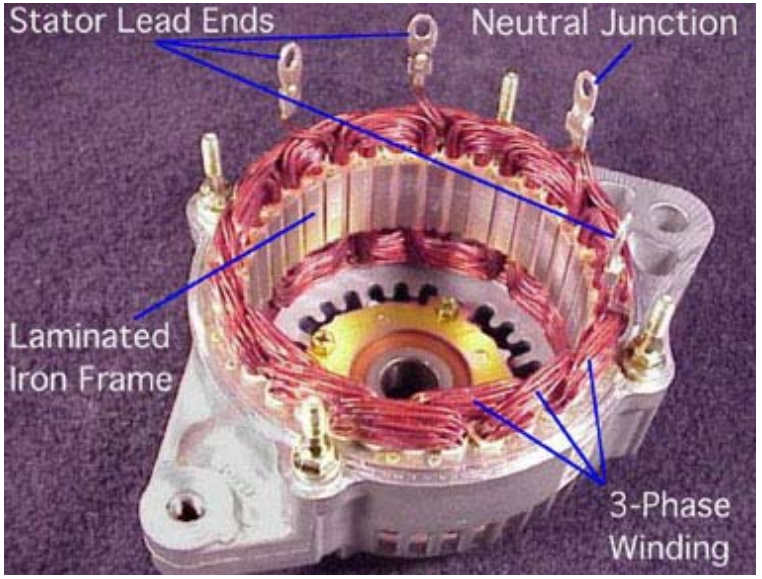
- *Regulator Maintains pre-Determined Charging Voltage Level: 14.5-V*
- *When Charging Voltage Falls below this Point, Regulator Increases Field Current, thus Strengthening the Rotating Magnetic Field, Resulting in Increased Alternator Output*
- *When Charging Voltage Rises above this Point, Regulator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

(Compression and enhancement of Automotive Series, "Understanding the Alternator," developed by Kevin R. Sullivan, Professor of Automotive Technology, http://www.autoshop101.com/trainmodules/alternator/alt101.html)

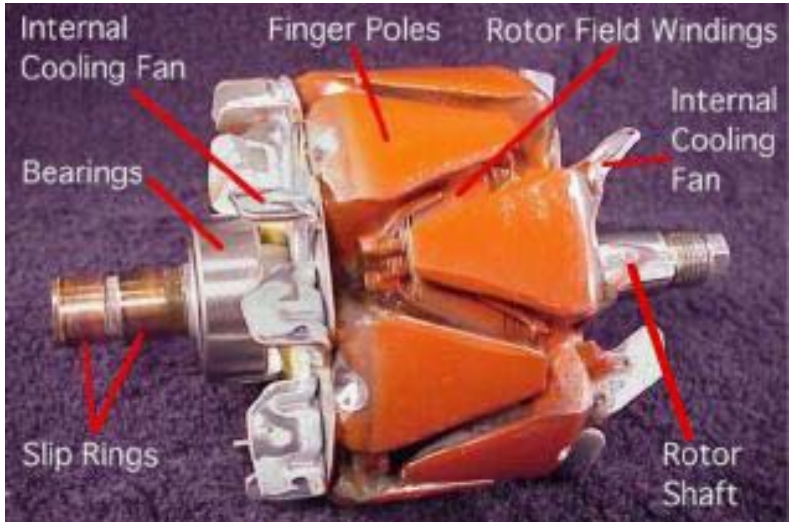
A Peek inside the Alternator

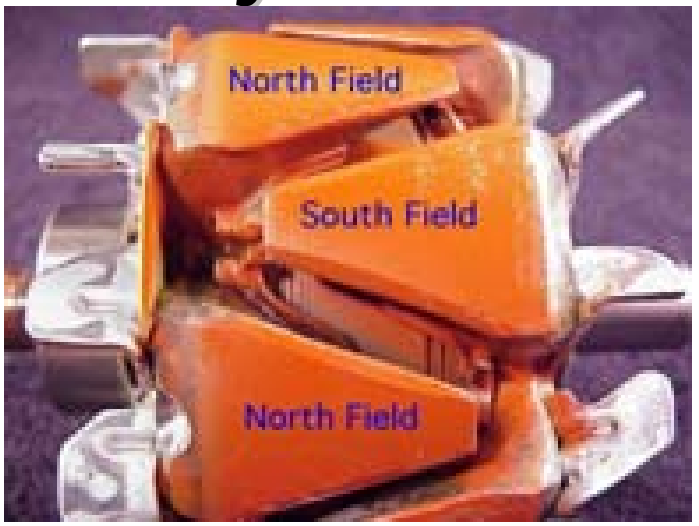


- ***Removing the Rear Case Reveals:***
  - ***Rotor Winding Assembly, which Rotates inside Stator Winding***
  - ***Rotor Generates a Rotating Magnetic Field***
  - ***Stator Winding Develops Voltage***
  - ***Current Begins to Flow from Induced Magnetic Field of the Rotor***
- ***As the Rotor Assembly 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.

Rotor Assembly

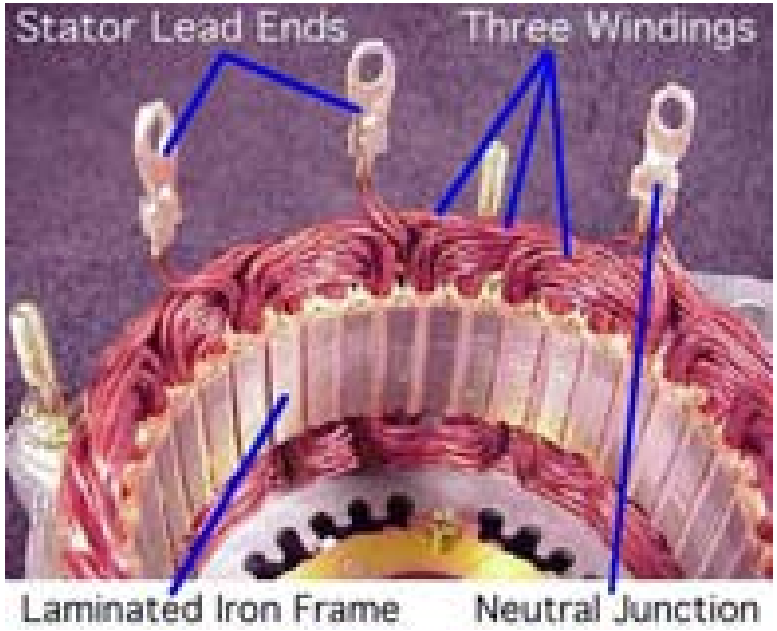


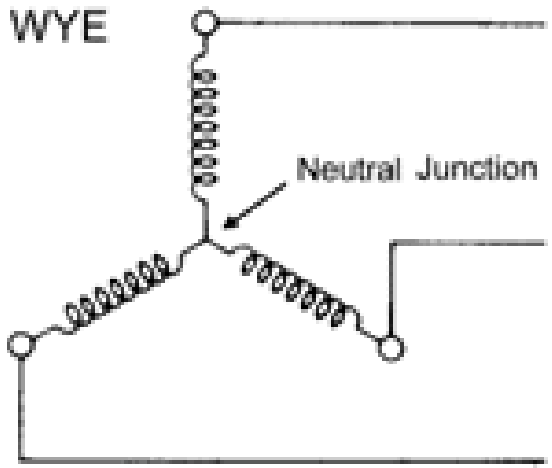


- *Basic Rotor Consists of Iron Core, Coil Winding, Two Slip-Rings, and Two, Inter-leaved, Claw-Shaped Finger Pole-Pieces*
- *Rotor Contains Field Winding Wound over Iron Core*
- *Surrounding the Field Coil are Two Claw-Type Finger-Poles*
- *Each End of Rotor Field Winding Attached to a Slip-Ring*
- *Stationary Brushes Connect Alternator to the Rotor*
- *Magnetic Field Saturates the Iron Finger-Poles*
- *One Finger-Pole becomes a North Pole and Other a South Pole*
- *Rotor Spins Creating Alternating Magnetic Field; North, South, North, South, etc.*

The rotor (exciter) field winding creates the rotating magnetic field that induces voltage into the stator winding.

Stator Windings



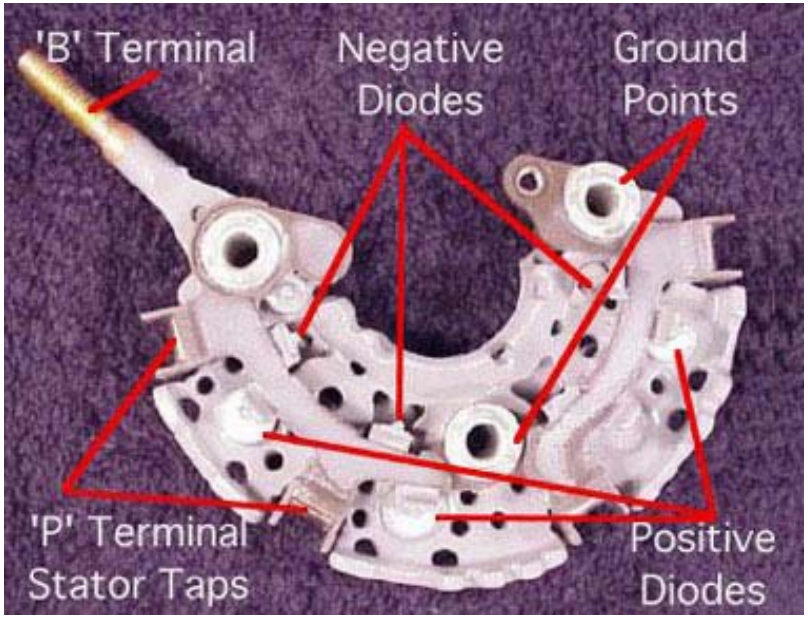


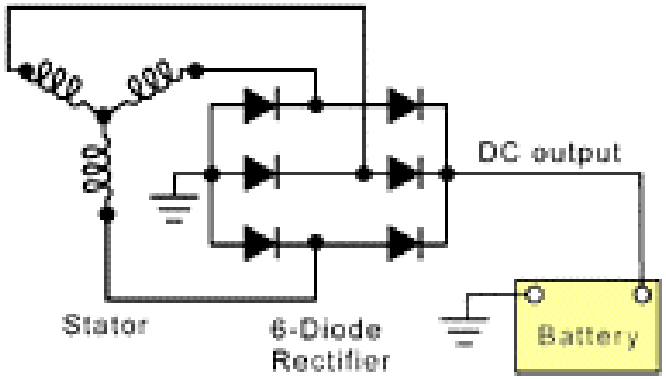
Wye style has four stator leads. One of the leads is called the Neutral Junction, common to all the other leads.

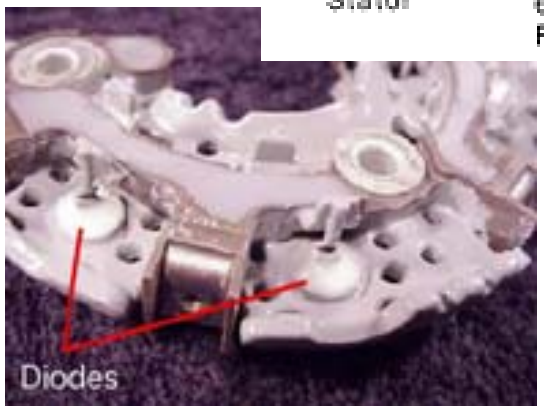
- ***Stator Composed of Three Sets of Windings***
- ***Each Winding Placed in Different Position Compared with the Others, Staggered 120° Apart***
- ***Laminated Iron Frame Concentrates the Magnetic Field***
- ***Stator Lead Sends Output Current to Diode Rectifier Bridge***
- ***Neutral Junction in the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

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



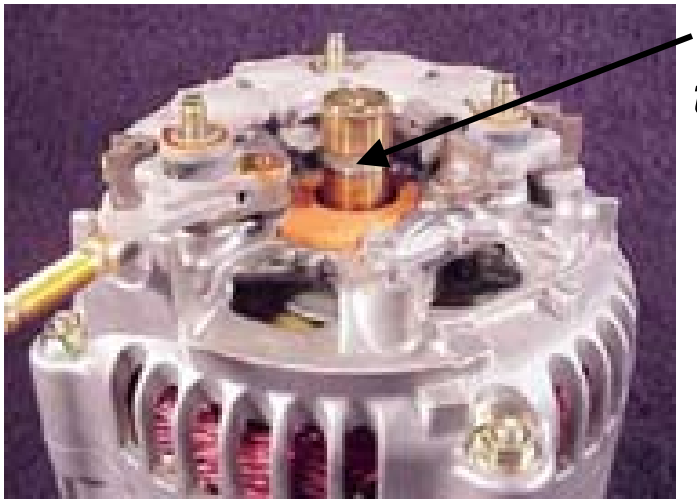




- ***Two Rectifier Diodes Connected to each Stator Lead***
- ***Six Diodes used to rectify the AC stator voltage to DC Output Voltage***
- ***Full-Wave Rectification: Diodes Redirect both Positive and Negative Polarity AC Voltage to Produce DC Voltage***

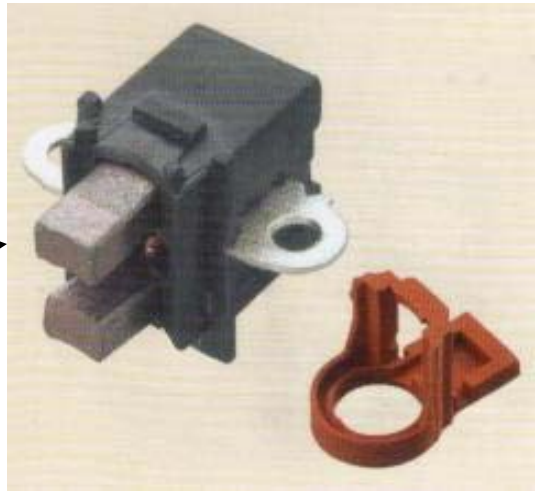
The Diode Rectifier Bridge is responsible for the rectification of AC voltage to DC voltage.

Slip-Rings and Carbon Brushes for Exciter Rotor



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.