2017.05.16

MSG MS012 COM

TESTER FOR DIAGNOSTICS OF VOLTAGE REGULATORS

USER MANUAL

QUALITY WARRANTY INNOVATION SERVICE TRAINING UNIQUENESS

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1. DESCRIPTION

Tester MSG MS012 COM is used for diagnostics of voltage regulators. It simulates installation of voltage regulator on faultless alternator in order to test its operation under different loads and modes, under various rotor resistance parameters.

The tester demonstrates how a voltage regulator will operate on the alternator with a certain rotor resistance. The tester detects if it is possible to install a voltage regulator on the alternator.

A voltage regulator is tested under load, as on the real alternator.

MS012 COM Tester contains the possibility to test all existing types/models of voltage regulators. New types/models of voltage regulators can easily be added by updating software through USB-port.

Operation of the tester is conducted by three encoders and a sensor on colored 4.3” TFT display. MS012 COM Tester is easy and user-friendly in operation. Total testing of a voltage regulator lasts no longer than 1-2 minutes.

2. TECHNICAL CHARACTERISTICS

Fig. 1. MS012 COM Voltage regulator tester - front view

Fig. 2. MS012 COM Voltage regulator tester - back view

Supply voltage, V	180-264 90-132
Supply frequency, Hz	50/60
Supply type	Single-phase
Maximum consuming power, W	500
Dimensions, mm	260*250*90
Weight, kg	4
Software update	Yes
Testing of voltage regulators	
Voltage, V	12/24
Resistance of simulated rotor winding, Ohm	1,8-22
Frequency of stator winding (simulation of engine rotations), rpm	0-6000
Load simulation, %	0-100
Generation voltage adjustment (voltage regulators with external control)	Yes
Tested parameters	- Stabilising voltage - Current through rotor winding - COM voltage regulators: protocol, speed of exchange, regulator type, errors - Control lamp - FR (load on voltage regulator)
Voltage meter accuracy, V	0,1
Ampere meter accuracy, A	0,1
Short circuit protection	Yes
Short circuit sound alert	Yes
Connection terminals	COM, P-D, DFM, D+, RLO, C, SIG

3. CONTROL UNITS

3.1 Control Panel

Fig. 3. MS012 COM Voltage regulator tester – front panel

MS012 COM Voltage regulator tester is performed in black metallic case with front panel of stainless steel.

Slot to connect the tester to 220V socket (optional 110V) and safety fuse (2A) are located on the back panel **(Fig. 2)**.

LCD display, adjustment knobs, power switch and terminals for voltage regulators on the front panel.

USB B type port used for software update of MS012 COM Tester is located on the left side panel **(Fig. 4)**.

Fig. 4. Left side panel - USB port location

The tester has short circuit protection. Sound alert turns on in case of short circuit.
In the testing mode parameters of the tester can be set to detect failures in a voltage regulator.

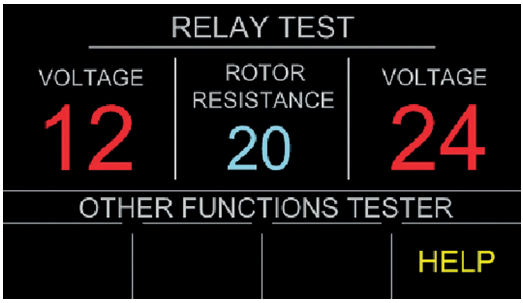


Fig. 5. MS012 COM Voltage regulator tester – Main menu

Button used to activate the testing mode of 12V voltage regulators, which is located on the sensor display. Menu of terminals for a voltage regulator appears on pressing the button **(Fig. 6)**.

Button used to activate the testing mode for 24V voltage regulators, which is located on the sensor display. Pressing the button leads to the testing mode of 24V voltage regulators.

Button used to enter HELP menu **(Fig. 7)**.

Button of selection of rotor resistance to test a voltage regulator. In order to change resistance, use the adjustment knob **EL LOAD**.

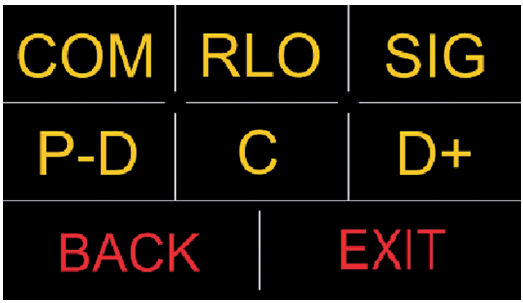


Fig. 6. MS012 COM Voltage regulator tester – voltage regulator terminals menu

COM	Button to activate voltage regulator testing mode with COM (LIN, BSS) terminal **(Fig. 10)**.
RLO	Button to activate voltage regulator testing mode with RLO terminal **(Fig. 12)**.
SIG	Button to activate voltage regulator testing mode with SIG terminal **(Fig. 13)**.
P-D	Button to activate voltage regulator testing mode with P-D terminals **(Fig. 14)**.
C	Button to activate voltage regulator testing mode with C terminal C **(Fig. 15)**.
D+	Button to activate voltage regulator testing mode with D+, L, IL, 61 terminals **(Fig. 16)**.
BACK	Button to return to the previous menu **(Fig. 5)**.
EXIT	Button to return to the main menu **(Fig. 5)**.

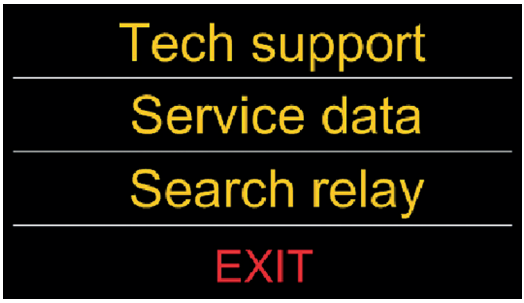


Fig. 7. MS012 COM Voltage regulator tester - Help menu

- **Tech support:** manufacturer contact details menu.
- **Service data:** service data of the tester.
- **Search relay:** button is inactive (prospective development).
- **EXIT:** return to the main men **(Fig. 5)**.

3.2 Buttons and Adjustment Knobs

Fig. 8. MS012 COM Voltage regulator tester – adjustment knobs and on/off switch

MS012 COM Voltage regulator tester on/off switch.

- **EL LOAD:** the adjustment knob with two functions: required resistance of simulated rotor can be set in the main menu, in voltage regulator testing mode (12V/24V), the load on the simulated alternator and on a tested voltage regulator, respectively, can be changed from 0% to 100%.
- **STATOR:** the adjustment knob to change frequency of stator winding from 0 to 6000 in voltage regulator testing mode (12V/24V). The frequency appear on the display as car engine rotation frequency.
- **VOLTAGE:** the adjustment knob to set required current voltage generated by a voltage regulator in voltage regulator testing mode (12V/24V). Used with terminal modes: COM (LIN, BSS); RLO; C; SIG; P-D.

3.3 Terminals

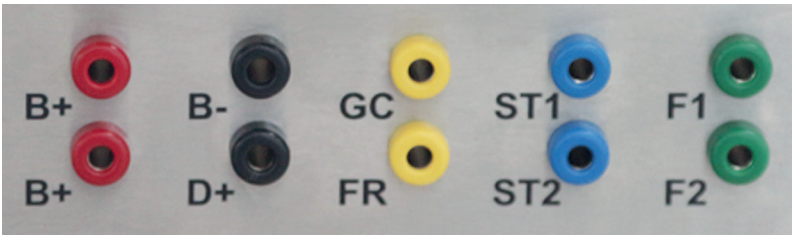


Fig. 9. Voltage regulator tester MS012 COM – terminals

- **B+:** voltage regulator plus (30 or 15 terminal).
- **B-:** voltage regulator minus (earth).
- **D+:** voltage regulator control lamp terminal, used to connect voltage regulator outputs: D+; L; IL; 61.
- **ST1; ST2:** terminals for stator windings of the simulated alternator to connect voltage regulators stator outputs.
- **GC:** terminal to connect voltage regulator terminals: COM (LIN, BSS); SIG; RLO; P-D; C.
- **F1; F2:** terminals for rotor of the simulated alternator, used to connect voltage regulator brushes or the corresponding voltage regulator outputs.

4. TESTING MODES DISPLAY DATA OUTPUT OF VOLTAGE REGULATORS

4.1 Display Data Output When Testing a Voltage Regulator With COM Terminal

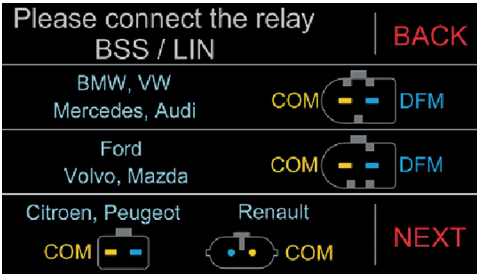


Fig. 10. Graphical symbol of COM terminal location in most common terminals of voltage regulators

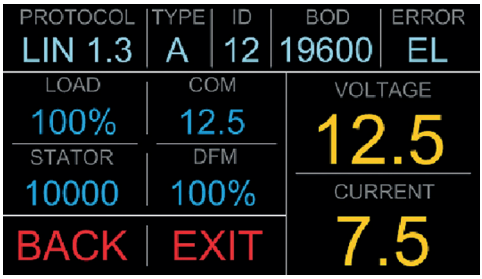


Fig. 11. Display data output when testing a voltage regulator with terminal COM

- **PROTOCOL:** protocol of a voltage regulator. Protocol titles, appearing on the display: BSS, LIN 1.3, LIN 2.0.
- **TYPE:** type of a voltage regulator, it can be A and B type. Voltage regulators of BSS protocol operation can only be A type.
- **ID:** voltage regulator identification number. Possible values: from 1 to 254. Electronic control module of a car detects the presence of the alternator by this identification number. In case of inconsistency, faultless alternator launches emergency mode or does not start at all. In this case a message of failure appears on the display.
- **BOD:** speed of voltage regulator data transfer. LIN protocol voltage regulators operate with speeds: 19200 (High), 9600 (Average), 2400 (Low). BSS protocol voltage regulators operate with speed: 2400 (Low).
- **ERROR:** voltage regulator operation errors. The following symbols are used: EL – electric error (voltage does not correspond to the required voltage indicators of a voltage regulator; probably, internal operating transistor is out of service); ME – mechanic error (stator winding is not connected); TM – thermal error (overheat of voltage regulator exceeds 150°C).
- **LOAD:** load on a voltage regulator. It indicates simulated load on a voltage regulator. Load is set manually with the adjustment knob **EL LOAD**. On increasing the load, the current in brushes of a voltage regulator increases as well.
- **STATOR:** simulated frequency of engine rotation where the alternator with a tested voltage regulator is installed. Frequency is set manually with the adjustment knob **STATOR** from 0 to 6000 rpm.
- **COM:** set voltage on a voltage regulator. It is set manually with the adjustment knob **VOLTAGE** with possible values from 10,6 V to 16 V.
- **DFM:** load control on the alternator with indicators from 0% to 100%. All data is read in digital format in accordance with the corresponding protocol.
- **VOLTAGE:** stabilizing voltage of a voltage regulator.
- **CURRENT:** current in voltage regulator brushes.
- **BACK:** return to the previous menu **(Fig. 6)**.
- **EXIT:** return to the main menu **(Fig. 5)**.

4.2 Display Data Output When Testing a Voltage Regulator With RLO Terminal

Fig. 12. Display data output when testing a voltage regulator with terminal RLO

- **V:** stabilizing voltage of a voltage regulator.
- **A:** current in voltage regulator brushes.
- **:** control lamp (control lamp simulation on car control panel).
- **LOAD:** load on a voltage regulator. It indicates simulated load on a voltage regulator. Load is set manually with the adjustment knob **EL LOAD**.
- **STATOR:** simulated frequency of engine rotation where the alternator with a tested voltage regulator is installed. Frequency is set manually with the adjustment knob STATOR from 0 to 6000 rpm.
- **RLO:** set voltage on a voltage regulator. It is set manually with the adjustment knob **VOLTAGE**.
- **DFM:** load control on the alternator with indicators from 0% to 100%. All data is read from FR output of a voltage regulator.
- **BACK:** return to the previous menu **(Fig. 6)**.
- **EXIT:** return to the main menu **(Fig. 5)**.

4.3 Display Data Output When Testing Voltage Regulator With SIG Terminal

- **V:** stabilizing voltage of a voltage regulator.
- **A:** current in voltage regulator brushes.
- **LOAD:** load on a voltage regulator. Indicates simulated load on a voltage regulator. Load is set manually with the adjustment knob **EL LOAD**.
- **STATOR:** simulated frequency of engine rotation where the alternator with a tested voltage regulator is installed. Frequency is set manually with the adjustment knob **STATOR** from 0 to 6000 rpm.

- **SIG:** set voltage on a voltage regulator through terminal SIG. It is set manually with the adjustment knob **VOLTAGE**.
- **DFM:** load control on the alternator. Possible values: from 0% to 100%. All data is read from FR output of a voltage regulator.
- **BACK:** return to the previous menu **(Fig. 6)**.
- **EXIT:** return to the main menu **(Fig. 5)**.

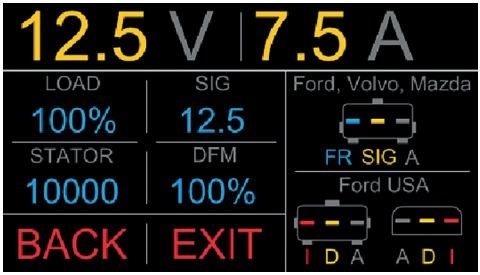


Fig. 13. Display data output when testing a voltage regulator with SIG terminal

4.4 Display Data Output When Testing Voltage Regulator With P-D Terminals

- **V:** stabilizing voltage of a voltage regulator.
- **A:** current in voltage regulator brushes.
- **LOAD:** load on a voltage regulator. It indicates simulated load on a voltage regulator. Load is set manually with the adjustment knob **EL LOAD**.
- **STATOR:** simulated frequency of engine rotation where the alternator with a tested voltage regulator is installed. Frequency is set manually with the adjustment knob **STATOR** from 0 to 6000 rpm.

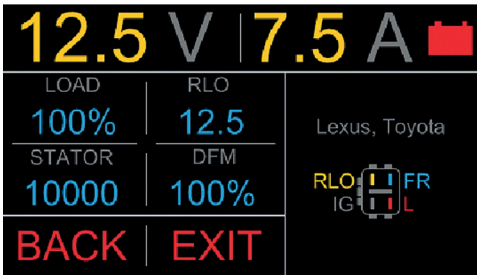


Fig. 14 Display data output when testing a voltage regulator with P-D terminal

- **D:** set voltage on a voltage regulator. It is set manually with the adjustment knob **VOLTAGE**.
- **P:** engine rotation frequency indicator. Through this terminal the control module detects rotor rotation and if the belt is safe. Only in this case the command signal to output D is sent.
- **BACK:** return to the previous menu **(Fig. 6)**.
- **EXIT:** return to the main menu **(Fig. 5)**.

4.5 Data output on display when testing voltage regulator with terminal C

- **V:** stabilizing voltage of a voltage regulator.
- **A:** current in voltage regulator brushes.
- **:** control lamp (control lamp simulation on car control panel).
- **LOAD:** load on a voltage regulator. It indicates simulated load on a voltage regulator. Load is set manually with the adjustment knob **EL LOAD**.
- **STATOR:** simulated frequency of engine rotation where the alternator with a tested voltage regulator is installed. Frequency is set manually with the adjustment knob **STATOR** from 0 to 6000 rpm.
- **C:** set voltage on a voltage regulator. It is set manually with the adjustment knob **VOLTAGE**.
- **DFM:** control indicator of load on the alternator. Possible values: from 0% to 100%. All data is read from FR output of a voltage regulator.
- **BACK:** return to the previous menu **(Fig. 6)**.
- **EXIT:** return to the main menu **(Fig. 5)**.

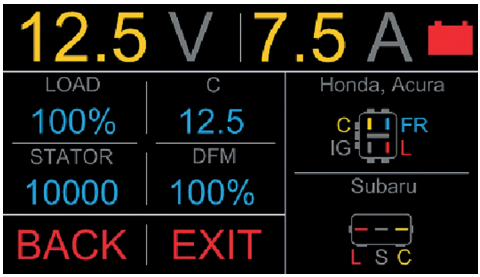


Fig. 15. Display data output when testing a voltage regulator with terminal C

4.6 Display Data Output When Testing Voltage Regulator With D+, L, IL, 61 Terminals

- **VOLTAGE:** stabilizing voltage of a voltage regulator.
- **CURRENT:** current in voltage regulator brushes.
- **LOAD:** load on a voltage regulator. It indicates simulated load on a voltage regulator. Load is set manually with the adjustment knob **EL LOAD**.
- : control lamp (control lamp simulation on car control panel).

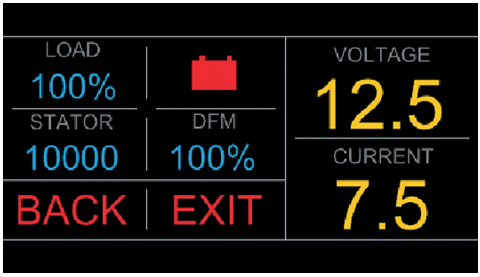


Fig. 16. Display data output when testing a voltage regulator with D+,L, IL, 61 terminals

- **STATOR:** simulated frequency of engine rotation where the alternator with a tested voltage regulator is installed. Frequency is set manually with the adjustment knob **STATOR** from 0 to 6000 rpm.
- **DFM:** control indicator of load on the alternator. Possible values: from 0% to 100%. All data is read from FR output of a voltage regulator.
- **BACK:** return to the previous menu **(Fig. 6)**.
- **EXIT:** return to the main menu **(Fig. 5)**.

5. STEP-BY-STEP INSTRUCTION

Voltage regulator testing starts from identifying which operating terminal and voltage regulator outputs are used, which outputs of the tester must be connected to a voltage regulator.

There are voltage regulators with stator connection (**ST1** and **ST2** outputs of the tester), or connection through additional diodes, known as “Trio” (**B+** output of the tester).

Learn the connection to the real alternator for correct connection of a voltage regulator to the tester. If it is impossible, use **APPENDIX 1** of actual User Manual.

When the correct way of connection to the tester is identified, it is recommended to measure alternator rotor resistance with an ohmmeter, where a voltage regulator was previously installed for more accurate testing.

Set resistance of simulated rotor winding, using the adjustment knob **EL LOAD**. Indicators appear on the display of the main menu **(Fig. 5)**.

After resistance is set, enter the testing mode for 12V or 24V voltage regulators of by pressing the relevant button **(Fig. 5)**. Select the corresponding control terminal for a voltage regulator **(Fig. 6)**.

Connect a voltage regulator in following sequence: **B+/B-**/voltage regulator control terminal **(COM, RLO, SIG, P-D, C, D+)**/**F1** and **F2**/**ST1** and/or **ST2**, or **B** (in case when a voltage regulator is connected to additional diodes).

Voltage and current indicators of a voltage regulator appear on the display.

Voltage regulator operability can be determined by stabilizing voltage indicators and by changes in current consumption under different loads.

COM terminal voltage regulators are considered to be faultless if stabilizing voltage corresponds to the set voltage and when no error messages appear on the display.

Voltage regulators with **P-D**, **SIG**, **RLO**, C terminals are considered to be faultless if stabilizing voltage changes according to the set voltage.

Non-adjustable voltage regulators (**D+**, **L** and others) are considered to be faultless if stabilizing voltage ranges from 13.8 to 14.8 V for 12 V voltage regulators, from 27.6 to 29.6 V for 24 V voltage regulators and current changes in direct proportion to the set load.

6. TEST CERTIFICATE

Tester MSG MS012 COM for voltage regulators meets technical requirements of Directive 2014/30/EU - Electromagnetic Compatibility (EMC) EN Directive 2014/35/EU - Low voltage (LVD) Directive 2006/42/EC - Machinery (MD) and is qualified for exploitation.

APPENDIX 1

Connection of Terminals to Alternators

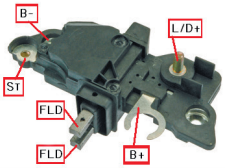
Indicial notation	Functional purpose	Terminal
B+	Battery (+)	B+
30		
A	(Ignition) Input for switch starting	
IG		
15		
AS	Alternator Sense	
BVS	Battery Voltage Sense	
S	(Sense) Input for voltage comparison at control point	
B-	Battery (-)	B-
31		
E	Earth, battery (-)	
D+	Used for connection to an indicator lamp that transfers initial driving voltage, and indicates alternator operability	L/D+
I	Indicator	
IL	Illumination	
L	(Lamp) Output for alternator operability indicator lamp	
61		
FR	(Field Report) Output for load control on an alternator by engine management block	FR
DFM	Digital Field Monitor	
M	Monitor	
LI	(Load Indicator) Same as FR, but with universal signal (Drive) Input of voltage regulator control with P-D terminals Mitsubishi	
D	(Drive) Input of voltage regulator control with terminal P-D Mitsubishi (Mazda) and Hitachi (Kia Sephia 1997-2000)	GC
D	(Digital) Input of code voltage installation on American Ford, same as SIG	GC
RC	(Regulator Control) same as SIG	
SIG	(Signal) Input of code voltage installation	

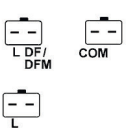
RVC(L)	(Regulated Voltage Control) Similar to SIG, but voltage change ranges from 11.0 V to 15.5 V. Control signal is sent to L terminal	
C	(Communication) Voltage regulator input to control engine operation block. Japanese cars	GC
G		
RLO	(Regulated Load Output) Input to control stabilizing voltage from 11,8 to 15 V (TOYOTA)	
COM	(Communication) General term for physical interface, alternator control and diagnostics. Protocols of use: BSD (Bit Serial Device), BSS (Bit Synchronized Signal) or LIN (Local Interconnect Network)	
LIN	Direct indication on control interface and alternator diagnostics, conducted under LIN protocol (Local Interconnect Network)	
DF	Output of voltage regulator	F1; F2
F		
FLD		
67		
P	Output of one of alternator stator windings. Used for measuring alternator driving voltage	
S		
STA		
Stator		
W	(Wave) Output of one of alternator stator windings for connection of tachometers in diesel engine cars	
N	(Null) Output of average stator winding point. Usually used to regulate alternator operability with mechanically regulated voltage by an indicator lamp	
D	(Dummy) Blank, no connection, mostly in Japanese cars	
N/C	(No connect) No connection	
Options of LRC voltage regulators	(Load Response Control) Function of voltage regulator response delay on load increase on an alternator. Delay duration ranges from 2,5 to 15 seconds. On increasing the load (lights, cooler fan on), a voltage regulator adds driving voltage smoothly ensuring stability of engine drive rotation. Remarkably seen under idle running	

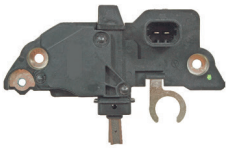
APPENDIX 2

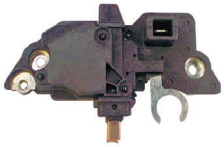
Connection of Voltage Regulators to MS012 COM Voltage Regulator Tester

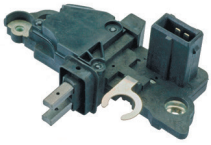
BOSCH

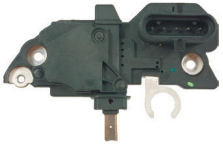


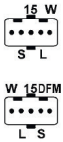


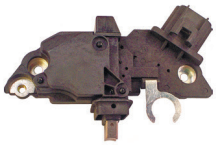


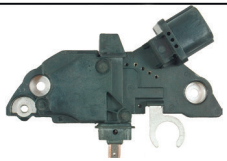


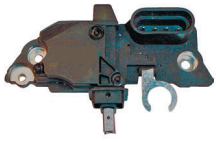


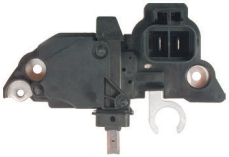


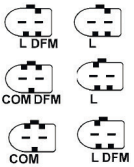


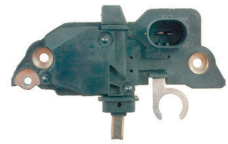












DELCO REMY


FLD
FLD
ST
B-
B+
PLFS


FLD
FLD
ST
B-
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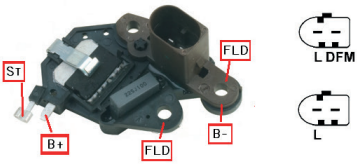
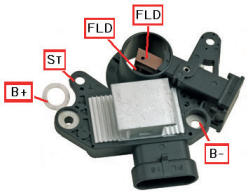

ST
FLD
B+
B-
FLD
LDFM
L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B-
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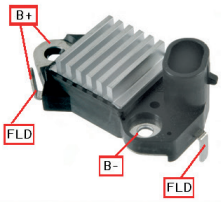
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B-
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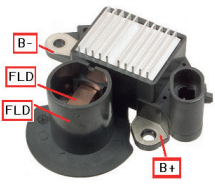
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FLD
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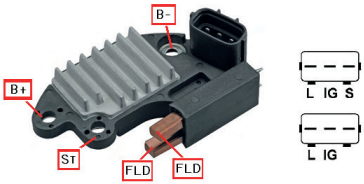
L IG/R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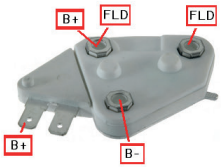
B+
ST
FLD
FLD
L IG S
L IG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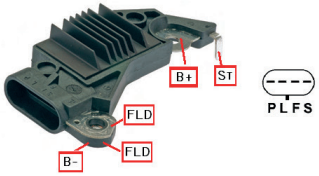
FLD
FLD
B+
B-


B+


B+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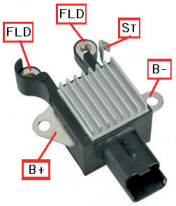
ST
FLD
FLD
B-
PLFS


C
FR
IG
L

DENSO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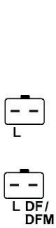
ST
B-
B+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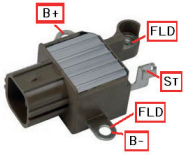
L DF/
DFM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FLD
ST
FLD
B-
C
F
IG
L
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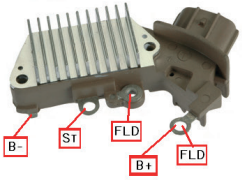
S
FR
IG
L


FR SIG A
LI RC A


L IG S
L IG
L IG C
L IG FR


FR SIG A
LI RC A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ST
FLD
B+
FLD
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L IG M
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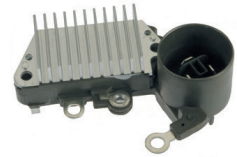
P L F S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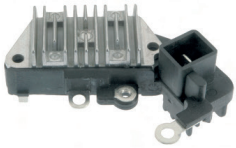
IG
L
IG
C
L
IG
L
F1
F2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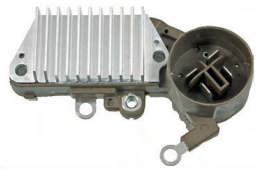
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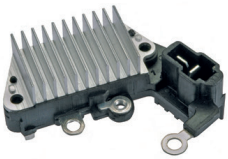
F
B+
E
N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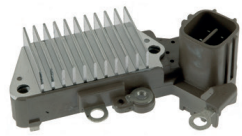
S
L


C
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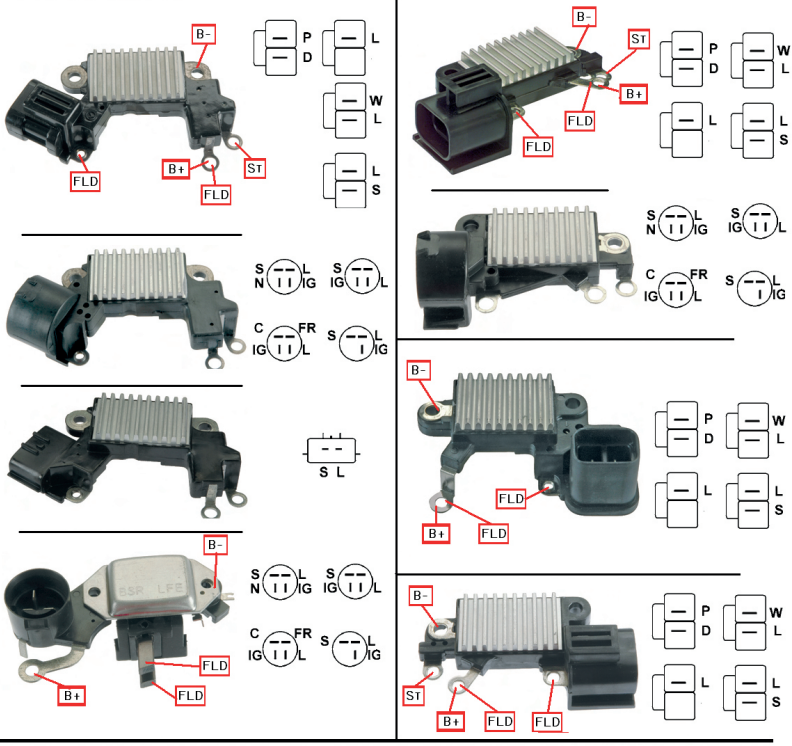
FR
IG
L
C
FR
IG
L

HITACHI



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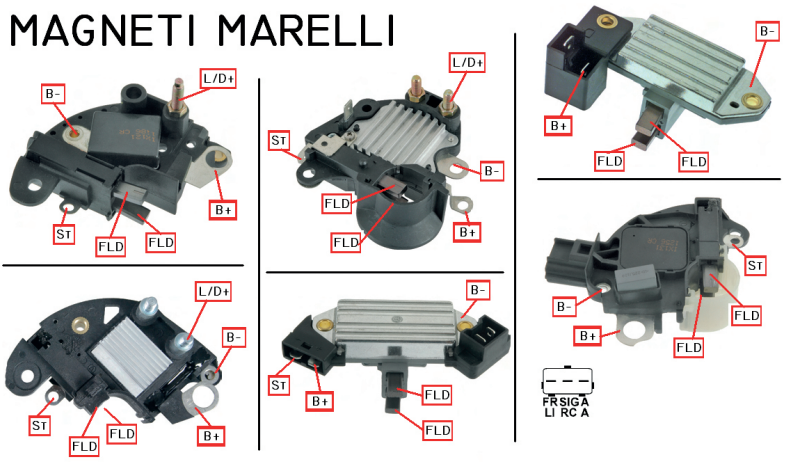

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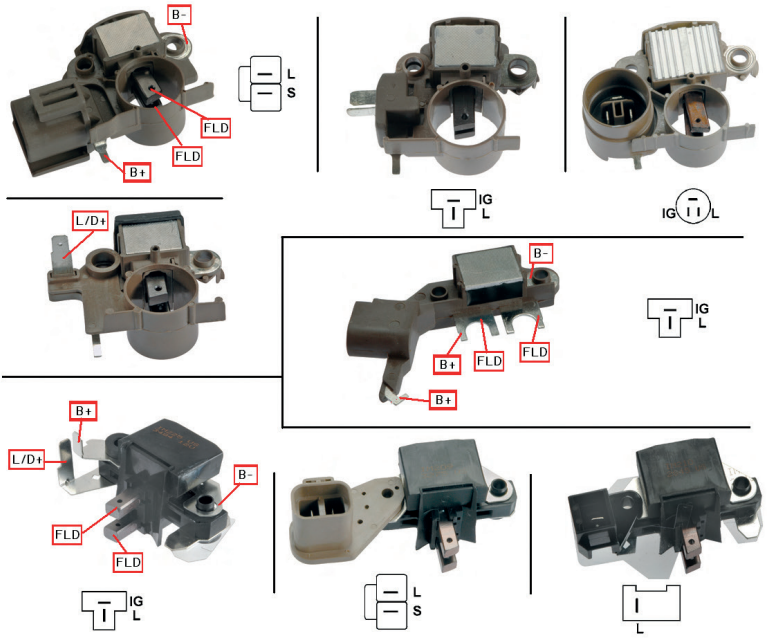
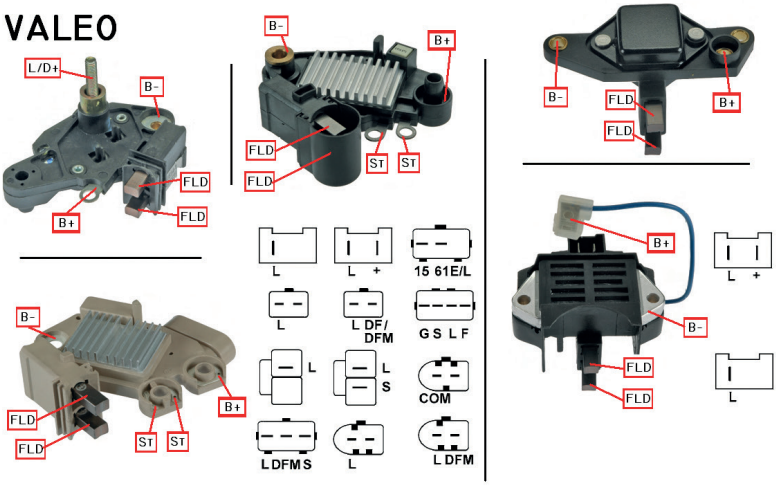


VALEO




MSG
equipment