15-5010 Testing alternator with regulator in vehicle

Operation no. of operation texts and work units or standard texts and flat rates:

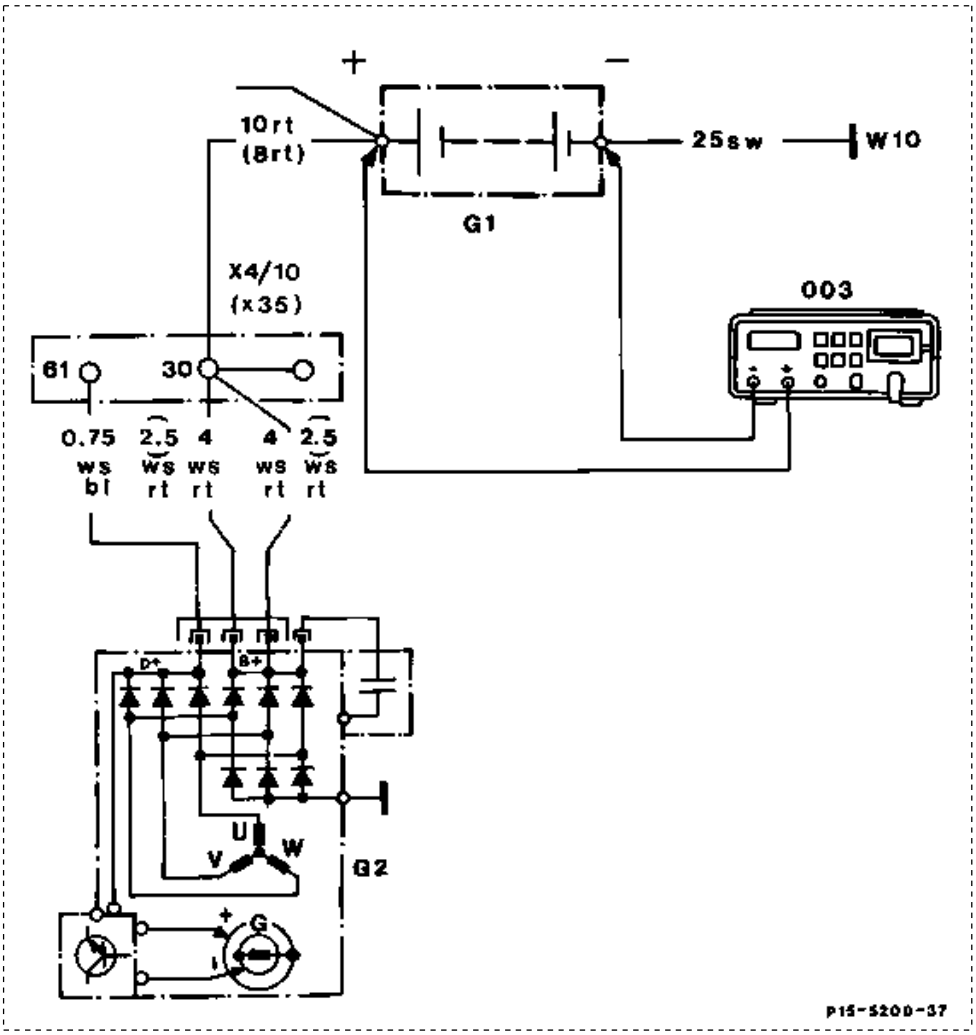
A. Preconditions for test

Electric cables at battery and alternator and also ground cable between engine and body ..... check whether tight and in proper condition.
Poly V-belt tension ..... check (13-342).
Battery electrolyte density ..... measure, specification ≥ 1.24 kg/dm^3.
Charge indicator lamp ..... check operation (see table).

Ignition/glow start switch in position	Charge indicator
0	OFF
1	OFF
2	ON

B. Testing regulating voltage, engines 102, 103, 104, 111, 601, 602, 603, 605, 606

Preceding work:
Section A. Preconditions for test



Connection diagram

G1	Battery	X4/10	Terminal block terminal 30/terminal 61 battery (3-pin)
G2	Alternator		
W10	Battery ground	003	Multimeter

Multimeter (003) ..... connect, disconnect.

Engine ..... start, stop.

Operation of charge indicator lamp when idling and at increasing engine speed (up to 3000/min) ..... check. Indicator lamp must go out.

Regulating voltage ..... check. Run engine at 3000/min. Drain on battery only from positive-operation electrical components (e. g. ignition). Read off regulating voltage after running engine for 2 minutes. **Specification** 13.0 - 14.5 volts.

Regulating voltage > 14.5 volts ..... 1. Replace regulator.

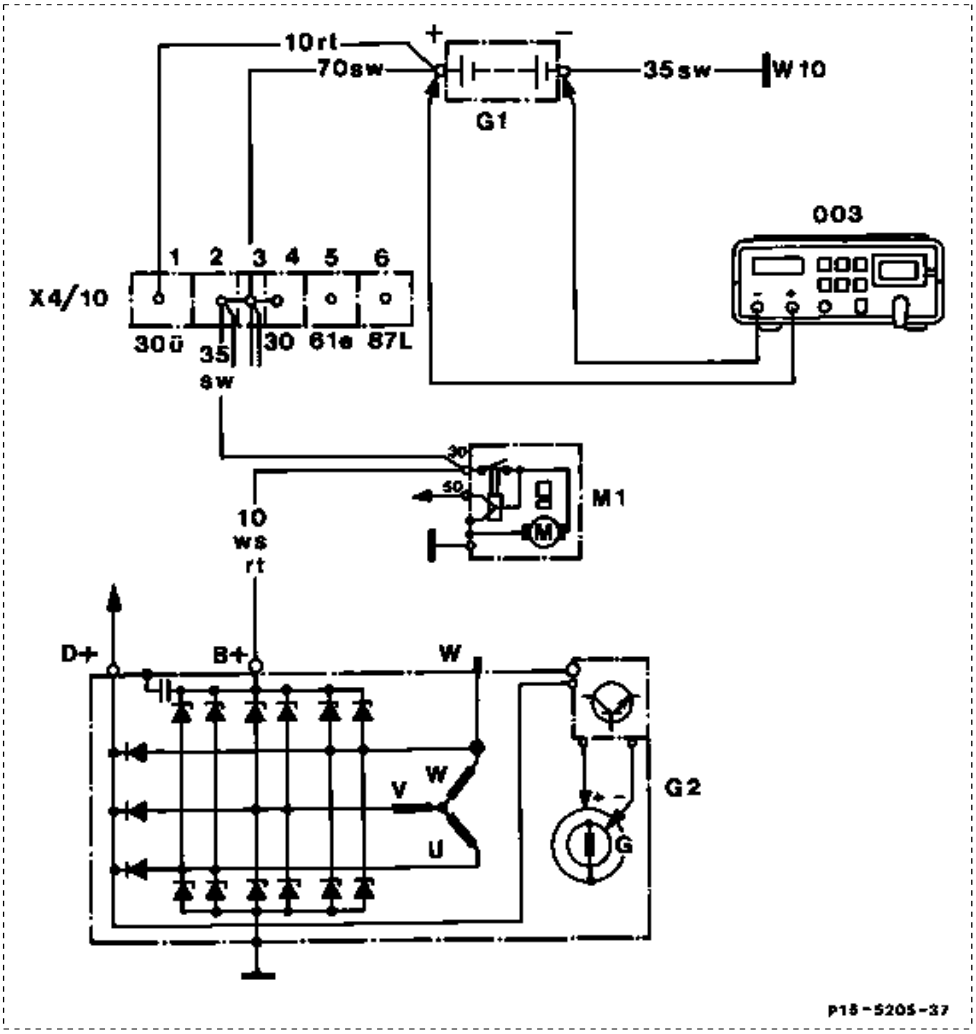
2. Replace alternator if regulator in order.

Regulating voltage < 13.0 volts ..... 1. Rectify contact resistance at electrical connections of charging system.

2. Perform diode test as per section F.

C. Testing regulating voltage engine 119.974

Preceding work:
Section A. Preconditions for test



Connection diagram

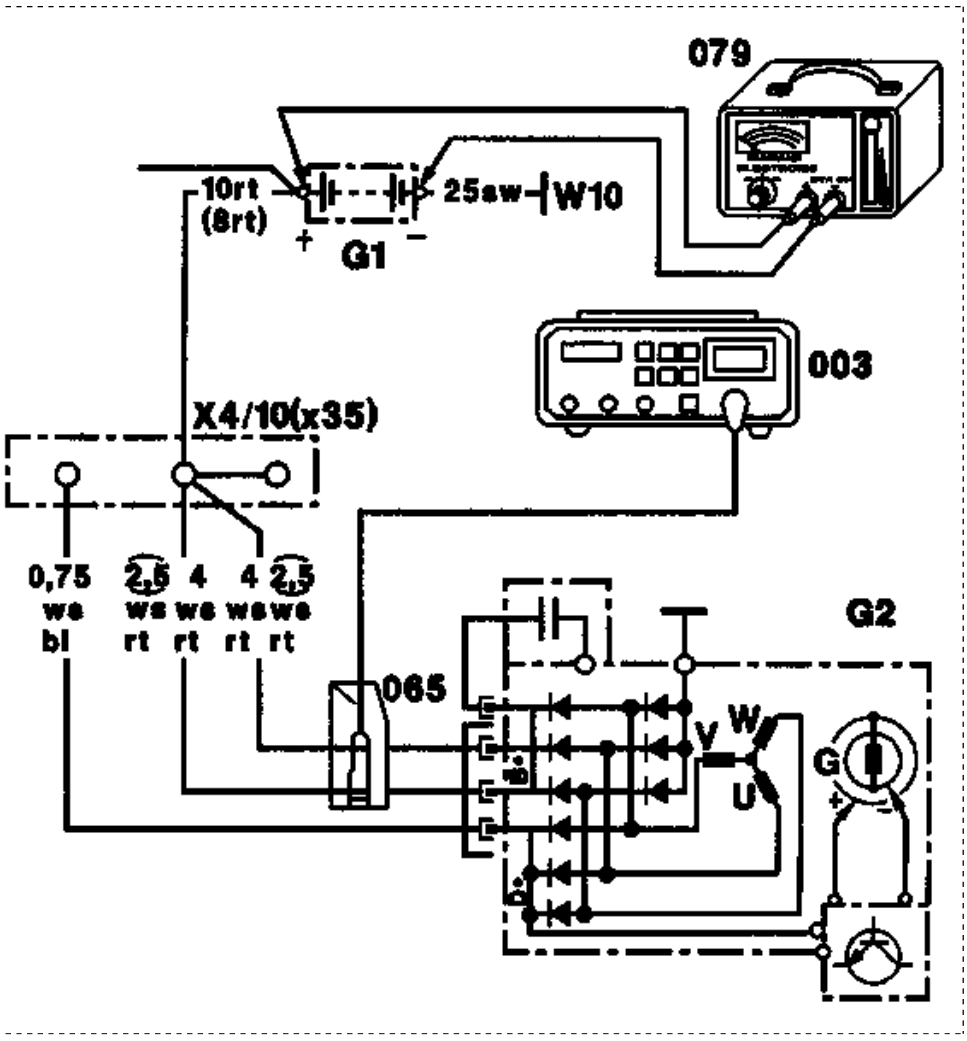
G1	Battery	X4/10	Terminal block terminal 30/30Ü, 61e/87L (6-pin)
G2	Alternator	003	Multimeter
M1	Starter		
W10	Battery ground		

Multimeter (003)	connect, disconnect.
Engine	start, stop.
Function of charge indicator lamp at idle and increasing engine speed (up to 3000 rpm)	check. Charge indicator lamp should go out.
Regulating voltage	check. Run engine at 3000/min. Drain on battery only from positive-operation electrical components (e. g. ignition). Read off regulating voltage after running engine for 2 minutes. **Specification** 13.0 - 14.5 volts.

Regulating voltage >14.5 volts	1. Replace regulator. 2. Replace alternator if regulator in order.
Regulating voltage <13.0 volts	1. Rectify contact resistance at electrical connections of charging system. 2. Perform diode test as per section F.

D. Testing charging current, engines 102, 103, 104, 111, 601, 602, 603, 605, 606

Preceding work:
Section A. Preconditions for test
Section B. Testing regulating voltage



Connection diagram

G1	Battery	003	Multimeter
G2	Alternator	065	DC clamp
W10	Battery ground	079	Load resistor
X4/10	Terminal block terminal 30/terminal 61 battery (3-pin)		

Multimeter (003)	connect, disconnect.
Load resistor (079)	connect, disconnect.
Engine	start, stop.
Charging current	test. Run engine up to appropriate speed (see table). Apply drain on battery with load resistor until max. charging current is reached. The regulating voltage must not drop below 12.7 volts when this is done. Specification not reached. Perform diode test as per section F.

Charging current of alternator

Engine	Charging current at 14 volts Amperes	Engine speed (corresponds to alternator speed of 6300/min)	Transmission ratio engine to alternator
102	55	2500	2.54
102 1)	70	2500	2.54
102 3)	80	2500	2.53
102.96/102.98 2)	70	2500	2.54
103	70	2250	2.82
103 3) 4)	80	2250	2.82
104.98	80	2500	2.53
104.94/99	90	2200	2.93
104.94/99 3)	120	2200	2.93
111	70	2200	2.93
111 1)	90	2200	2.93
111 3)	120	2400	2.63
601, 602	55	2500	2.54
601, 602 1)	70	2500	2.54
603.91	55	2200	2.89
603.91 1)	70	2200	2.89
603.96	70	2200	2.89
603.96 3)	80	2200	2.89
605, 606	70	2200	2.89
605, 606 3)	90	2200	2.89

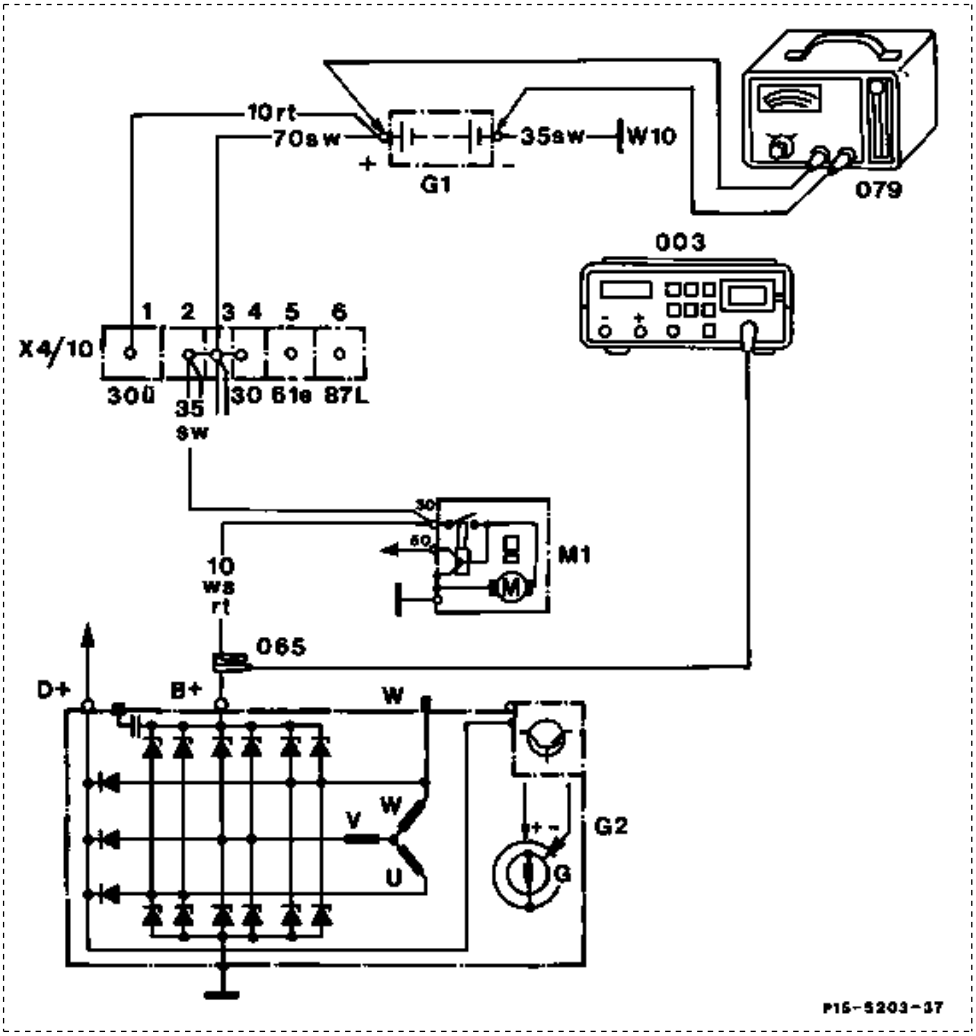
1) With air conditioner/automatic temperature and automatic climate control.
2) Version with catalytic converter as of 08/89.
3) With optional alternator with larger capacity.
4) (AUS), (USA), (J).

Commercially available testers

Multimeter	e. g.	Sun DMM-5 or Fluke, 23
Load resistor	e. g.	Hermann, Elektronic

E. Testing charging current, engines 119.974/975

Preceding work:
Section A. Preconditions for test
Section C. Testing regulating voltage



Connection diagram

G1	Battery	003	Multimeter
G2	Alternator	065	DC clamp
W10	Battery ground	079	Load resistor
X4/10	Terminal block, terminal 30/30Ü, 61e/87L (6-pin)		

Multimeter (003) ..... connect, disconnect.
Load resistor (079) ..... connect, disconnect.
Engine ..... start, stop.
Charging current ..... test. Run engine up to appropriate speed (see table).
Apply drain on battery with load resistor until the maximum charging current is reached. The regulating voltage must not drop below 12.7 volts when this is done.
Specification not achieved. Perform diode test as per section G.

Charging current of alternator

Engine	Charging current at 14 volts Amperes	Engine speed (corresponds to alternator speed of 6300/min)	Transmission ratio engine to alternator

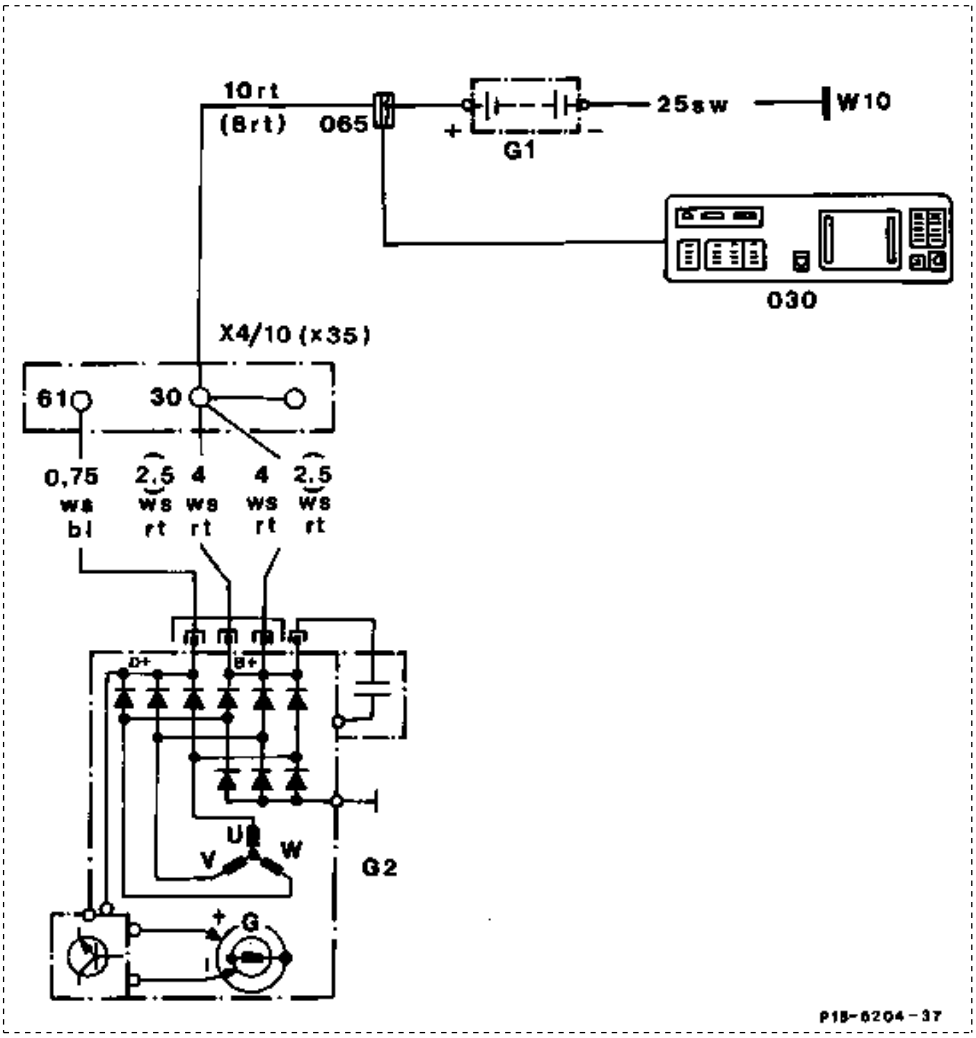
119 [1)]	110	2200	2.91
119 [2)]	110	2000	3.2

1) With 8-groove belt drive
2) With 6-groove belt drive

Commercially available testers

Multimeter	e. g.	Sun DMM-5 or Fluke, 23
Load resistor	e. g.	Hermann, Elektronic

F. Testing diodes, engines 102, 103, 104, 111, 601, 602, 603, 605, 606



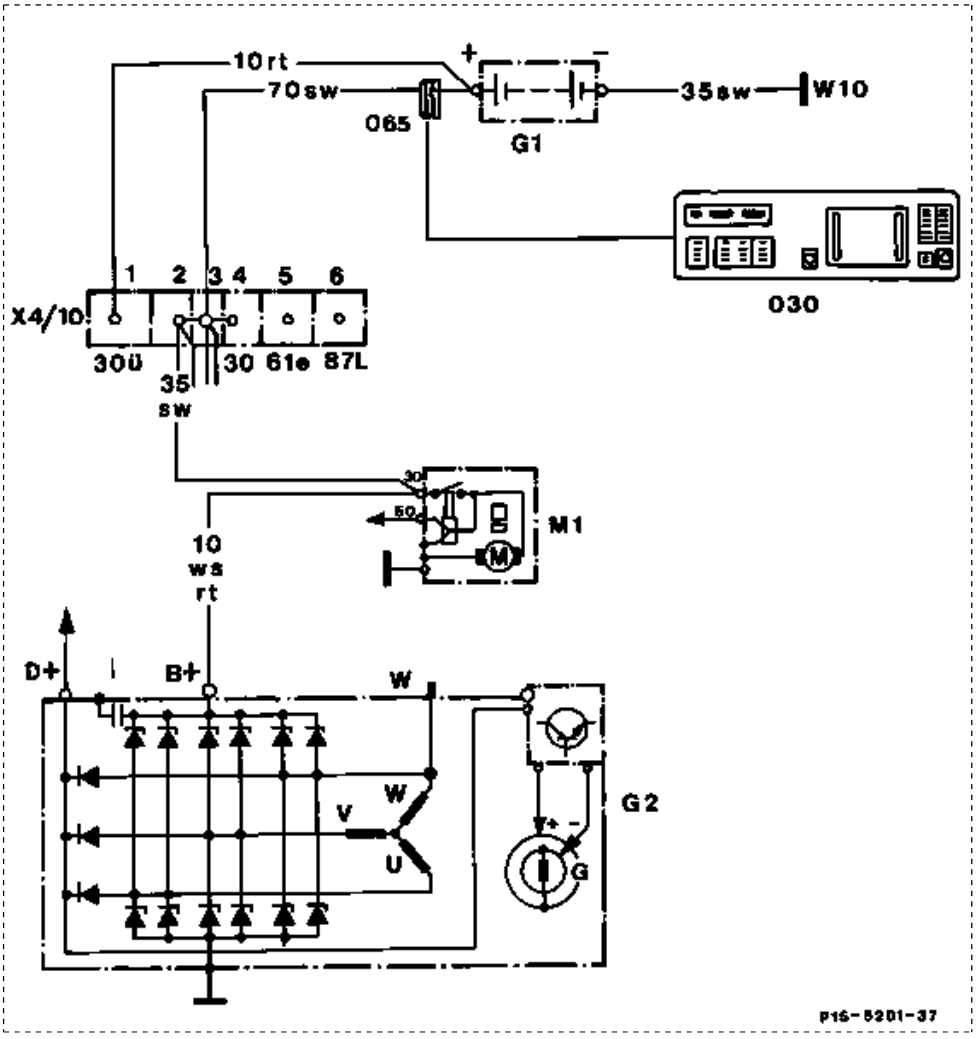
Connection diagram

G1	Battery
G2	Alternator
W10	Battery ground
X4/10	Terminal block terminal 30/terminal 61 battery (3-pin)
030	Engine tester with oscilloscope
065	DC clamp

Note
It is not possible to assess the exciter diode when performing this test.

Engine tester with oscilloscope (030)	connect, disconnect.
Engine	start, stop.
Low beam	switch on, switch off.
Diode harmonics	assess at 3000/min (engine speed) (see section G for diode images).
Diode harmonics in order	replace regulator.
Diode harmonics not in order	replace alternator.

G. Testing diodes, engines 119.974/975

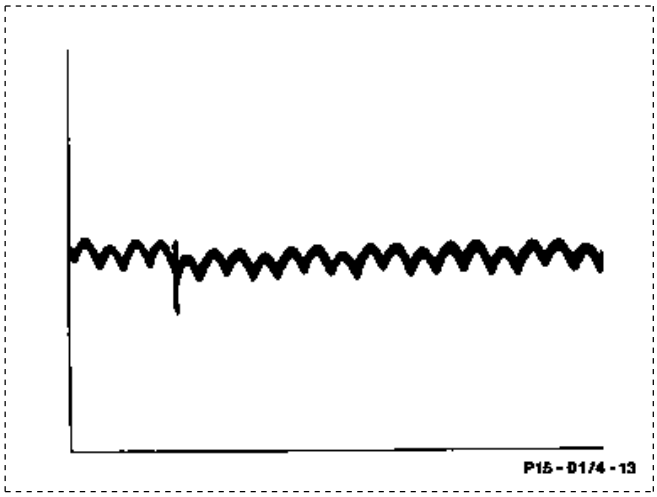


Connection diagram

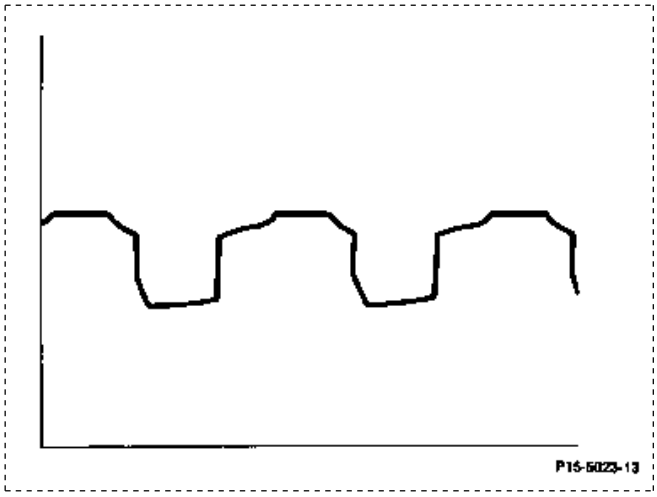
G1	Battery
G2	Alternator
M1	Starter
W10	Battery ground
X4/10	Terminal block, terminal 30/30Ü/ 61e/87L (6-pin)
030	Engine tester with oscilloscope
065	DC clamp

Note
It is not possible to assess the exciter diode when performing this test.

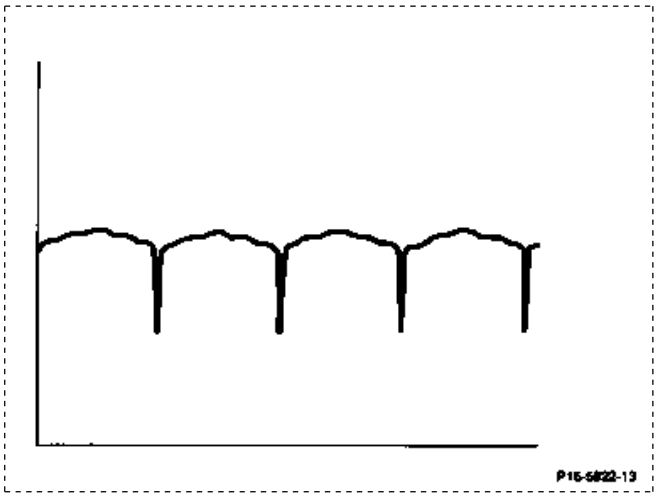
Engine tester with oscilloscope (030)	connect, disconnect.
Engine	start, stop.
Low beam	switch on, switch off.
Diode harmonics	assess at 3000/min (engine speed).
Diode harmonics in order	replace regulator.
Diode harmonics not in order	replace alternator.



Diode harmonics in order (voltage peaks possible but of no significance) (example)



Harmonics if one positive diode is faulty (example)



Harmonics if one negative diode is faulty (example)

Commercially available tester

Engine tester with oscilloscope	e. g.	Hermann, Datascope 980 Bosch, MOT 301/400 Sun, 2110 BEAR, DACE