Ignition Systems for Russian Motorcycles
Part IV-2: PM-11 and PM-302 Breaker

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PM-11 and PM-302A Breaker Systems

The PM-302 ignition system is not dependent on the supply voltage (6-V or 12-V). They differ only in ignition coils B-201 (6-Volt) and B-204 (12-Volt). The higher current in a 6-volt ignition system led to increased contact breaker pitting, compared with a 12-Volt system.

The basic ignition system is simple. The breaker points are normally closed, allowing the magnetic field to build in the ignition coil. When the cam shaft rises, opening the breaker points, the collapsing magnetic field induces a high-voltage in the secondary winding of the coil.
Simple Diagram of Ignition System with Mechanical Breaker (Contact)

1. Battery
2. Ignition Switch
3. Ignition Coil
4. Primary Winding
5. Hi-Voltage Secondary Winding
6. Distributor Cam
7. Condenser (Capacitor)
8. Breaker Points
9. Spark Plug (Candle)

This evolutionary stage shows the absence of the distributor, but the presence of the breaker points (contacts) – PM-302.
### Table I: IMZ (ИМЗ) - Ural (Урал) Model/Year vs. Electrical System

<table>
<thead>
<tr>
<th>Model</th>
<th>Year</th>
<th>Engine Size</th>
<th>Voltage</th>
<th>Generator/Alternator</th>
<th>Regulator</th>
<th>Ignition Coil</th>
<th>Breaker/Distributor</th>
<th>Battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-72</td>
<td>1941-56</td>
<td>750cc</td>
<td>6-Volt</td>
<td>G-11, G-11A (1952)</td>
<td>PP-1, PP-31 (1950)</td>
<td>KM-01, B2B, IG-4085B (1950)</td>
<td>PM-05</td>
<td>3MT-7 (7A-hr) or 3MT-14 (14A-hr)</td>
</tr>
<tr>
<td>M-72M</td>
<td>1956-61</td>
<td>750cc</td>
<td>6-Volt</td>
<td>G-11A (1952)</td>
<td>PP-31A</td>
<td>KM-01</td>
<td>PM-05</td>
<td>None</td>
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<td>Varta YB18L</td>
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<td></td>
<td></td>
<td>6MTS-18, Interstate FAYTX-20HL</td>
</tr>
</tbody>
</table>

Notes:
1. M-64 (1961) and M-65 (1965) were prototypes.
3. M-73 (1976) was an M-72 (750cc) with engageable sidecar wheel.
4. M-75 (1943) was experimental model with 500cc engine (6-Volt) on M-72 frame. M-76 (1947) was experimental (820cc).
5. Г-424 alternator (150 Watts) has external relay/regulator (PP-302 or PP-330). 14.3771 and Nippon Denso alternators have internal regulators.
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</tr>
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<tbody>
<tr>
<td>M-72</td>
<td>1951-56</td>
<td>750cc</td>
<td>6-Volt</td>
<td>G-11A (1952)</td>
<td>PP-31 (1950)</td>
<td>KM-01, B-2B</td>
<td>PM-05</td>
<td>3MT-7 (7A-hr) or 3MT-14 (14A-hr)</td>
</tr>
<tr>
<td>M-72N (H)</td>
<td>1957-59</td>
<td>750cc</td>
<td>6-Volt</td>
<td>G-11A (1952)</td>
<td>PP-31A (1956)</td>
<td>KM-01</td>
<td>PM-05</td>
<td>3MT-7, -10, -14</td>
</tr>
<tr>
<td>K-750</td>
<td>1956-63</td>
<td>750cc</td>
<td>6-Volt</td>
<td>G-11A (1952)</td>
<td>PP-31A (1956)</td>
<td>IG-4085</td>
<td>PM-05, PM-11A</td>
<td>3MT-12 or -14</td>
</tr>
</tbody>
</table>

Notes:
1. MT-14 (1977) was a prototype.
2. MB-650 is military version of MT-16 and MB-750 is a military version of the MT-12.
4. MT-11 and MT-16 remained in production until 1991 when they were re-named the Dnipro-11 (Dnepr-11) and Dnipro-16 (Dnepr-16).
5. Model #’s: H = N, MW = MB = MV
7. Г-424 alternator (150 Watts) has external relay/regulator (PP-302 or PP-330). 14.3771(350 Watts) alternator has internal regulator.
The introduction of the PM-301/PM-302 breaker system eliminated any need for a distributor and provided automatic spark advance/retard. The centrifugal breaker points automatically adjusted to engine rpm’s. The output of the ignition coil was connected directly to each of the spark plugs.
Both plugs fire simultaneously on the left and right cylinders, one spark being formed when the compression stroke finishes in one cylinder and the other (needlessly) during the exhaust stroke.
The PM-302 ushered in the era of automatic spark advance with the introduction of the centrifugal advance/retard, consisting of breaker points, condenser, advance weights and springs, and earned the nick-name “the mixing bowl of doom.”
PM-302A Breaker with Automatic Spark Advance

To Adjust Gap: Undo screw fastening the automatic park timer. Slacken stop screw (1) and turn eccentric screw (6) in either direction. Set breaker gap to 0.4-0.6mm (0.016-0.024”). Tighten stop screw. Recheck gap.

1. Spring
2. Carrier
3. Weight Pin

1. Stop Screw
2. Contact Leg
3. Breaker Body
4. Breaker’s Lever
5. Lever Pin
6. Eccentric
7. Automatic Spark Timer
8. Weight Pin
9. Bushing
10. Spring
11. Carrier
12. Locking Ring
13. Cam
14. Weight
15. Lubrication Wick
16. Capacitor Holder
17. Condenser (Capacitor)
18. Terminal

Spark-advance is determined by the relationship between rotary speed (centrifugal force) and the tension spring. The correct placement of the two-piece advance unit’s top plate is a rectangular opening at each side of the mounting bolt.
Automatic ignition advance PM-302 Breaker consists of a body with a lid, cam with a centrifugal regulator, breaker contacts, capacitor and a felt pad to lubricate the cam. The breaker is attached to the crankcase with three screws and can be rotated at an angle, through which you can set the desired time of ignition timing. The breaker gap is set using the eccentric adjusting screw.
The PM-11 was the predecessor to the more-popular PM-302/PM-302A. The weights and springs are attached to the points cam. As the cam spins on its shaft, centrifugal force causes weights to move and turn the cam on its shaft, advancing the timing of the spark, thus giving the combustion process more time to occur as the rpm increase. Full advance is usually reached around 3,000 rpm.
PM-11 Distributor with Automatic Advance Timer

Dnepr (Днепр) Later K-750
(with Breaker PM-11A, PP-302 and B201 for Automatic Control of Firing Angle)

12. Breaker Points (PM-302)
Later K-750, MB-750

Breaker Points (PM-302)
K-750M with Automatic Spark Advance

10. Breaker Points (PM-302)
Dnepr (Днепр) Later K-650 (MT-8) with PM-302 Breaker
Dnepr (Днепр) Later K-650 (MT-8) and MT-9 with PP-302 Regulator PM-302 Breaker and B201 Ignition Coil.
Dнепр (Днепр) МТ-9 with Automatic Control of Firing Angle
(B201A Ignition Coil and PM-302 Breaker)
Dnepr (Днепр) MT-9: **Automatic Control of Firing Angle** (B201A Ignition Coil and PM-302 Breaker)

17. Breaker Points (PM-302)
17. Breaker
(PM-302/PM-302A)

- Oil-Pressure Sensor
- Turn Signal
- Ignition Coil (B204)
- Alternator (Г-424)
- Flasher
- Horn Button
- Battery
- Voltage Regulator (PP-31A)
- Foot Brake-Light Switch

Dnepr (Днепр) MT-10
Dnepr (Днепр) MT-10

- Oil-Pressure Sensor (MM-106A)
- Alternator (Г-424)
- Voltage Regulator (PP-330)
- Battery (2X 3MT-6)
- Ignition Coil (B204)
- Horn (C-38)
- Breaker (PM-302/PM-302A)
Application of PM-302A Breaker
(Dнепр (Днепр) MT-10 and MT-10.36)

1. Turn Signal
2. Flasher
3. Master Switch
4. Battery (2X 3MT-6)
5. Horn Button
6. Foot Brake Light Switch
7. Brake
8. Horn
9. Ignition Coil (B204)
10. Neutral Switch
11. Oil Pressure Switch
12. 25. Breaker (PM-302A)
13. Oil Pressure Switch
14. Regulator (33.3702)
15. Neutral Switch
16. 25
7-Oil Pressure Sensor (MM126)
8-Foot Brake-Light Switch (BK854B)
14-Flasher Unit (PC427)
16-Voltage Regulator: 33.3702
19-Battery: 6MTS-9 (12V/9A-hr)
21-Alternator: Τ-424 (150W)
33-Horn (C205B)
35-Ignition Coil (B204)
36-Spark plug (A14B)
37-Breaker (PM-302A (with automatic spark timer))
42-Master Switch (46.3710)
Dnepr (Днепр) Early MT-11 and MT-16 with PP-330 Regulator, later replaced with 33.3072 (solid-state)

- Headlamp
- Hi/Lo beam bulb 45W/40W
- Parking light
- Left front turn signal
- Oil pressure switch
- Dashboard
- Speedometer
- Speedometer light
- Turn signal indicator
- Oil pressure indicator
- High beam indicator
- Generator indicator
- Neutral indicator
- Ignition switch
- Flasher
- Right handlebar controls
- Left handlebar controls
- Front sidcar lamp
- Front left turn signal light
- Front sidcar running light
- Hand brake stop signal switch
- Fuse block
- Neutral switch
- Voltage regulator PP330
- Horn
- Spark plug
- Noise suppressor
- Ignition coil
- Points
- Rear stop light switch
- Generator
- Battery disconnect switch
- Storage battery
- Socket 47K
- Rear sidcar lamp
- Right rear turn signal bulb
- Sidcar position and brake light
- Motorcycle rear lamp
- License plate light
- Motorcycle brake light
- Left rear turn signal
Dнепр (Днепр) МТ-11/16 and МТ-14

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

Older Models:

PP-330 Battery Regulator (33.3702)

Brake Master Switch

Neutral Switch

26. Ignition Coil (B204)

Horn

Alternator (Г-424)

Oil Pressure Switch

Flasher

27. Breaker (PM-302/PM-302A)

schemat instalacji do Dniepra MT-11, 14 i 16
1 - sparkplug, 2 - circuit breaker, 3 - hammer breaker, 4 - anvil breaker, 5 - cam plugs, 6 – condenser, 7 - battery, 8 – headlight, 9 - ignition contact, 10 - ignition key, 11 - ignition coil, 12 – spark gap, 13 - secondary winding, 14 - primary winding
Ural (Урал) M-62, M-63 (Ural-2) and M-66 (Ural-3)

1. Turn Signal
2. Oil Pressure Sensor
3. Battery (3MT-6 or 3MT-12)
4. Ignition Coil (B201)
5. Flasher Unit
6. Horn
7. Hi/Lo Beam Switch
8. Generator (Г-414)
9. Regulator
10. Regulator Brake-Light Switch
11. Battery (PP-302/PP-302A)
12. Foot Brake Light Switch
13. Ignition Coil (B201)
14. Breaker Points (PM-302)
15. 17. Breaker Points (PM-302)
Ural (Урал) M-62, M-63 (Ural-2) and M-66 (Ural-3)

1. Переключатель указателей поворотов П-201
2. Правые указатели поворотов с лампами А6-15 на мотоцикле-одиночке
3. Соединительная колодка
4. Лампа головного света фары А8-32+32
5. Лампа стоячного света фары А6-2
6. Реле-прерыватель указателей поворотов
7. Левые указатели поворотов с лампами А6-15
8. Звуковой сигнал С-37А
9. Переключатель света с кнопкой звукового сигнала П-200
10. Лампа подсвета шкалы спидометра А6-2
11. Предохранители 15А
12. Центральный переключатель
13. Генератор Г-414
14. Контрольная лампа работы генератора А6-0,25
15. Реле-регулятор РР-302А
16. Катушка зажигания Б-201
17. Переключатель ПМ-302
18. Правые указатели поворотов с лампами А6-15 (на коляске)
19. Передний габаритный фонарь на коляске с лампой А6-2
20. Лампы стоп-сигнала А6-15
21. Задние габаритные лампы А6-2
22. Аккумулятор ЗМТ-6
23. Включатель стоп-сигнала
24. Контрольная лампа аварийного давления масла А6-2
25. Датчик давления масла.

Детали поз. 24 и 25 - только на мотоциклах "Днепр", Указателями поворотов оснащены только "Урал" M-66 и "Днепр" МТ-9.

Turn Signal
Flasher Unit
Ignition Coil (B201)
17. Breaker (PM-302)
Hi/Lo Beam Switch
Ural (Урал) M-63 (Ural-2) and M-66 (Ural-3)

- Spark Plug Regulator (PP-302 / PP-302A)
- Battery Generator (Г-414)
- Horn
- Flasher Unit
- Breaker Points (PM-302)
- Ignition Coil (B201)

11. Breaker Points (PM-302)
Ural (Урал) M-62, M-63 (Ural-2) and M-66 (Ural-3)

1. Horn Button
2. Turn Signal
3. Ignition Coil (B201)
4. Battery
5. Regulator (PP-302 / PP-302A)

10. Breaker Points (PM-302)
Ural (Урал) M-66 (Ural-3)

1. Headlamp
2. Turn indicator relay
3. Turn indicator switch
4. Front turn indicator, right-hand
5. Side-car front lamp
6. Side-car tail lamp
7. Tail turn indicator, right-hand
8. Tail turn
9. Stop lamp switch
10. Regulating relay PP-302
11. Generator Γ-414
12. Wire adapter
13. Headlight turn-knob and horn button
14. Horn
15. Front turn indicator, left-hand
16. Ignition coil
17. Distributor with automatic advance timer
18. Spark plug
19. Storage battery
20. Tail turn indicator, left-hand

17. Breaker points (PM-302) (Automatic Spark Advance)
Ural (Урал) M-67 and M-67.36

1. Horn
2. Foot Brake Switch
3. Hi/Lo Beam Switch
4. Ignition Switch
5. Turn Signal
6. Flasher Unit
7. Alternator (Г-424)
8. 12V Battery (6MTS-9 or 2 X 3MT-6)
9. PP-330 Regulator
10. Alternator (Г-424)
11. Ignition Switch
12. Horn Button
13. Horn
14. Foot Brake-Light Switch
15. Regulator
16. Master Switch
17. Breaker Points (PM-302/PM-302A)
18. Ignition Coil (B204)
19. Battery (6MTS-9 or 2 X 3MT-6)
20. Breaker Points (PM-302/PM-302A)
Ural (Урал) M-67 and M-67.36

1. Right front turn indicator (sidecar not attached)
2. Headlight
3. Hi/Lo headlamp bulb
4. Parking light bulb
5. Left front turn indicator
6. "Day/night" switch, Run/Stop switch
7. Highbeam ON indicator bulb of lamp
8. Speedometer
9. Speedometer light
10. Alternator warning light
11. Ignition switch
12. Light and turn indicator switch, horn button
13. Sidecar front light
14. Sidecar front side and parking light
15. Sidecar front running light
16. Flasher
17. Fuse block
18. Horn
19. Regulator
20. Rear brake light switch
21. Alternator
22. Ignition module
23. Spark plug
24. Ignition switch
25. Points
26. Battery
27. Master Battery Switch*
28. Spark plugs
29. Turn signal
30. Rear right turn indicator (sidecar not attached)
31. Motorcycle rear light
32. Motorcycle brake light
33. Motorcycle tail light
34. Rear left turn indicator

* Deleted on electric start

23. Breaker Points (PM-302/PM-302A)

22. Ignition Coil (B204)
19. Breaker Points (PM-302A)
1. Left indicator lamp
2. Right direction indicator
3. Lamp indicators A12-21-3
4. Regulator
5. The switch controls the lamp Neutral
6. Switch "day-night" with the ignition safety switch
7. Switch signal inhibition handbrake
8. Relay turns
9. Lamp control indicators A12-1
10. Lamp control inclusion of neutral
11. Lamp driving-beam headlights
12. Farah
13. Lamp illuminated
14. Lamp marker light and license plate illumination A12-5
15. Fuse Block
16. Horn
17. Battery
18. Ignition switch
19. Spark Plug
20. Ignition coil
21. Rear
22. Lamp braking signal A12-21-3
23. Lamp marker light and license plate illumination A12-5
24. Rechargeable Battery
25. Switch mass
26. Generator G-424
27. Lamp control of the generator A12-1
28. Lamp marker light and license plate illumination A12-4
29. Lamp control beam headlights A12-1
30. Ignition
31. Switch light and direction indicators, horn button
32. Breaker
33. Sparkplug
34. Spark Plug (PM-302A)
1-select "day-night" with ignition safety switch; 2-side marker light bulb on sidecar A12-8, 3-lamp indicators of A-12-21-3, 4-light front sidecar, 5-Rear sidecar, 6-bulb marker light and a braking signal in a wheelchair A12-212 5, 7-relays, lights, 8-contact (switch controls lamp neutral) 9-switch braking signal handbrake, 10-flashers, 11-driving lamp and low beam headlights A12-45 +40, 12-illumination speedometer A12-1, 13-light control switch neutral A12-1: 14-lamp control indicators A12-1, 15-dashboard; 16-Rear, 17-bulb marker light and license plate illumination A12-5, 18-brake signal A12-21-3, 19-switch braking signal; 20-rechargeable battery; 21-ground switch; 22-generator; 23-ignition coil, 24-horn; 25-fuse box, 26-light beam control A12-1, 27-generator lamp A12-28-headlight; 29-side marker lamp and parking lamp SWERA in A12-4, 30-Index left turn; 31-ignition switch; 32-light switch and indicator lamps; 33-chopper; 34-spark plug; 35-tip of plug; 3-high voltage wire, and A -option to connect two batteries 3MT6.
Early Ural (Урал) 8.103

Breaker Points (PM-302)

Breaker Points (PM-302A)