Ignition Systems for Russian Motorcycles

Part IV-1: PM-05 Breaker/Distributor

(Also See Part IV-6: Handlebar Control (Advance / Retard, Dimmer, and Signal Horn) Switch)

Ernie Franke

eafranke@tampabay.rr.com

02 / 2018
Ignition System of Early Urals and Dneprs

1. Spark Plug (Candle)
2. Center Contact of Distributor Rotor
3. Ignition Coil (KM-01 or IG-4085B)
4. High-Voltage Secondary Winding
5. Low-Voltage Primary Winding
6. Manual Control of Spark Advance/Retard
7. Contact Breaker Arm
8. Rotary Cam
9. Ground Contact with Locking Screw
10. Condenser (Capacitor)
11. Battery
12. Distributor (PM-05)
13. Ignition Switch

Ignition System Diagram:
- Spark Gap: 0.5-0.6mm
- Breaker Gap: 0.4-0.6mm
- Capacitor Helps to Keep Points from Pitting
- 6-Volts Path to Ground
- 6-Volts Interrupted

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.
<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>
</tr>
<tr>
<td>M-72K</td>
<td>1954-60</td>
<td>750cc</td>
<td>6-Volt</td>
<td>&quot;Magneto&quot;</td>
<td>PP-30, PP-31A (1956)</td>
<td>B11, KM-01</td>
<td>PM-05</td>
<td>None</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 an 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.
7. PP-1, PP-30, PP-31 reverse-relay/voltage regulator for generator Г-11/-11A systems were replaced with PP-302/-302A voltage regulator for Г-414, and finally P-330 for the Г-424 alternator.
### Table II: KMZ (КМЗ) - Dnepr (Днепр) 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>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></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 PM-05 breaker/distributor was introduced to heavy Russian bikes on Ural’s M-72. The distributor cap is fastened by a special spring. High-voltage travels from the middle contact to the spark plugs (candles).
Ignition Distributor PM-05 (6-Volt) for M-72 and K-750 (Part # 72172)
The vast majority of SV 750 cm$^3$ engines have the manual spark-advance PM-05, where the angle is varied from late ($0^\circ$-$4^\circ$) to early ($28^\circ$-$32^\circ$) before TDC.
PM05 Breaker/Distributor was used on early versions of Dnepr’s M-72, K-650, K-750, MT-12, and MB-750.
PM-05 Distributor Cover (Cap) and Rotor

(www.ural-hamburg.de)
The PM-05 breaker/distributor, with manual ignition advance, consists of a body with a cap, breaker points riding on a cam, and two screws to allow rotation around an angle, which can be set for timing. The movable contact can be moved to regulate the gap, with the help of the eccentric adjusting screw.
The PM05 is controlled by the ignition lever on the left handlebar, while the later PM-302 centrifugal regulator, provided an automatic change of ignition timing depending on engine speed.
Why Advance/Retard Ignition Timing?

• "Timing Advance" refers to the number of degrees Before Top Dead Center (BTDC) that the spark will ignite the air-fuel mixture in the combustion chamber during the compression stroke.
• Retarded timing can be defined as changing the timing so that fuel ignition happens later than the manufacturer's specified time.
• Timing advance is required because it takes time to burn the air-fuel mixture. Igniting the mixture before the piston reaches Top Dead Center (TDC) will allow the mixture to fully burn soon after the piston reaches TDC.
• As the engine speed increases, the time available to burn the mixture decreases, but the burning itself proceeds at the same speed. It needs to be started increasingly earlier to complete (advanced) in time.
• In a classic ignition system with breaker points, the basic timing can be set statically using a test light or dynamically using a timing light.

Ignition timing is the process of setting the time when a spark will occur during the compression stroke relative to piston position and crankshaft angular velocity.
Use of Handlebar Timing Lever (CossackPower (b-Cozz))

- On the Open Road: Full Advance
- Going Up a Steep Hill: Retard a Bit
- Show-Off (slow thumpy idle when stopped): Full or Almost Retard
- If Bike Stalls (like a kill switch) when Pulled to Full Retard:
  – Probably Due to Cable Stretch
  – Retarding Too Far
- Never Ride on Full Retard
- When Spark Advance Is Increased (point when the ignition spark occurs, BTDC of the compression stroke) we Get More Power, but Also More Heat
  - There is a point after which we get lots more heat and very little extra power. (STOP before we get to this point!)
- With Engine at Normal Operating Temperature and Idling, Advance Timing Slowly (Engine Will Speed Up)
- Move Timing Back and Forth, Advancing and Retarding to Get Highest Engine Idling Speed
- Back It Off (retard) a Bit
  – Engine Speed Slows Down Just a Little (Still idling, don't touch the throttle)
- Take Short Ride to Make Sure Engine Does Not “Ping” under Load
- Check Color of Spark Plugs to Make Sure Not Running Too Hot

The manual control of spark advance is controlled by a handlebar lever connected to a PM-05 breaker/distributor.
Application of PM-05 Breaker/Distributor (Ural (Урал) later M-52, M-61 and M-72M, M-72K)

- Foot Brake-Light Switch
- Generator (Г-11А)
- Battery (3MT-6 or 3MT-7)
- Regulator
- Ignition Coil (B2B)
- Horn
- Breaker/Distributor (PM-05)
- Turn Signal
- Manual Spark-Advance Cable
- Hi/Lo Beam Switch
- Manual Spark Advance
- Horn Button
- Flasher Unit

14
Application of PM-05 Breaker/Distributor
(Dnepr (Днепр) К-750, К-750M and MT-12)

- Manual Spark-Advance Cable
- Generator (Г-414)
- Battery (3MT-6 or 3MT-7)
- Foot Brake-Light Switch
- Flasher Unit
- Turn Signal
- Hi/Lo Beam Switch
- Manual Spark Advance
- Ignition Coil (B2B)
- Horn Button
- Breaker/Distributor (PM-05)
Dnepr wiring

Dnepr (Днепр) M-72

Horn Button

Horn

Generator (G-11A)

Regulator (PP-31)

Ignition Coil (KM-01)

Breaker/Distributor (PM-05)

Light

Lights

Battery Positive Ground

Plane Dnepr
1 - generator: Г-11
2 - relay-regulator: PP-1
3 - rechargeable battery
4 - valve
5 - breaker/distributor: PM-05
6 - ignition coil: KM-01
7 - spark plugs (candles)
8 - signal
9 - lamp
10 - driving lamp and low light
11 - the parking light bulb
12 - tail light
13 - tail light sidecar
14 - front light sidecar
15 - control lamp
16 - ignition switch
17 - key
18 - fuse
19 - switch beam and dipped beam
20 - lever switch near and far light
21 - horn button signal
22 - Ignition control stick
23 - fuse lamps
24, 25 and 26 - high voltage wires
27, 28, 29 and 30 - bundle of low voltage wires
31 and 32 wire lanterns sidecar
Ural (Урал) M-72 with Voltage Regulator PP-31
(1950+)

1 - generator: Г-11А
2 - relay-regulator: PP-31
3 - rechargeable battery
4 - valve
5 - breaker: PM-05
6 - ignition coil: B2B
7 - spark plugs (candles)
8 - horn
9 - lamp
10 - driving lamp and low light
11 - the parking light bulb
12 - tail light
13 - tail light sidecar
14 - front light sidecar
15 - control lamp
16 - central switch
17 - key
18 - fuse
19 - switch beam and dipped beam
20 - lever switch near and far light
21 - button signal
22 - Ignition control stick
23 - fuse lamps
24, 25 and 26 - high voltage wires
27, 28, 29 and 30 - bundle of low voltage wires
31 and 32 wire lanterns stroller

Manual Spark Advance

Hi/Lo Beam Switch

Spark Plug (candle)

Breaker/Distributor (PM-05)

Horn Button

Ignition Coil (B2B)

Generator (Г-11А)

Positive-Ground

Battery

Regulator (PP-31)

19
1941 Днепр (Днепр) M-72, К-750, К-750M and MT-12
with PM-05 Distributor/Breaker Points

Distributor/Breaker (PM-05)

Generator (Г-11)

Ignition Coil (КМ-01)

Regulator (РР-1)

Battery

Hi/Lo Beam Switch

Horn Button

1. Headlamp/Dash
2. High and low beam
3. Parking light
4. Fuse
5. Key
6. Dimmer switch
7. 
8. Generator charge indicator
9. Mechanical dimmer switch lever
10. Primary switch
11. Horn button
12. Speedometer bulb
13. 
14. Condenser
15. Spark plugs A8Y
16. Points and distributor
17. Front sidecar fender light
18. Ignition coil
19. DC Generator
20. Battery
21. Horn
22. Regulator
23. Connector
24. Stoplight switch
25. Rear sidecar fender light
26. Rear light

20

Note: Wire colors are not likely correct nor consistent with factory wiring. Schematic may have errors as well.
Early Ural (Урал) М-72 (1942)

G-11 Generator
PP-1 Regulator
KM-01 Coil
PM-05 Breaker/Distributor
3MT-7 Battery

Breaker/Distributor (PM-05)
Manual Spark Advance
Hi/Lo Beam Switch
Generator (Γ-11)
Regulator (PP-1)
Positive Ground
Battery

Ignition Coil (KM-01)
Ural (Урал) М-72

with Г-11А generator and PP-31 regulator

Manual Spark Advance

Hi/Lo Beam Switch

Horn Button

Distributor/Breaker (PM-05)

Regulator (PP-31)

Battery

1. Headlight
2. Parking light bulb
3. High and Low beam bulb
4. High beam/low beam electrical switch
5. Central switch
6. Fuse
7. Indicator light
8. Front light of the sidecar
9. Sidecar lights fuse
10. Ignition key
11. Ignition setting lever with actuator cable
12. High beam/low beam mechanical actuator with cable
13. Signal button
14. Distributor
15. Spark plugs
16. Ignition coil
17. Points
18. Horn
19. Generator
20. Sidecar taillight
21. Relay automatic controller РР-1
22. Battery
23. Taillight

Note: Positive-Ground
Dnepr (Днепр) Later M-72 (1955) with Г-11A generator and PP-31 regulator

- Generator (G-11A)
- Regulator (PP-31A)
- Ignition Coil (IG-4085B)
- Hi/Lo Beam Switch
- Manual Spark Advance
- Breaker/Distributor PM-05
- Positive Ground
- Battery
- Horn
- Battery
- G-11A Alternator
- PP-31A Regulator
- IG-4085B Coil
- PM-05 Breaker/Distributor
- 3MT-14 Battery
Dnepr (Днепр) Early K-750

Breaker/Distributor (PM-05)
Dnepr (Днепр) Early K-750, K-750M and MT-12
with PM-05 Breaker/Distributor and B2B Ignition Coil

1. Switch indicators P-201
2. The right front indicator lamp on a motorcycle-alone
3. Flasher PC-419
4. Lamp headlight A6-32, 21 or A6-32 +32
5. Parking light bulb headlights
6. Left direction indicators
7. Chopper PM-05
8. Light switch (located in the housing headlights)
9. Cable Shifters ignition
10. Lever light switch
11. Shifters ignition
12. Fuse 15A
13. Central switch (on M-72 & K-750 slightly different notation terminals)
14. Bulb illumination A6-2 scale speedometer
15. Generator
16. Control lamp of the generator A6-0.25
17. Ignition coil KM-01 or B-2B
18. Splitter
19. Indices turning right (sidecar)
20. Front position lamp sidecar
21. Lamp A6-15 stop-signals (only in the lamp, or OP-230 OP-246)
22. Battery 3MT-6 or 3MT-7
23. Right rear indicator lamp on motorcycle-alone
24. Relay-regulator
25. Stop light switch
26. Headlight rear position lamps
27. Horn C-35
Dnepr (Днепр) Early K-750
with PP-31A Regulator, PM-05 Breaker/Distributor and B2B Ignition Coil

G-11A Generator
PP-31A Regulator
B2B Ignition Coil
PM-05 Breaker/Distributor
3MT-7 Battery

Battery

Hi/Lo Beam Switch

Ignition Coil (B2B)

Breaker/Distributor (PM-05)
Dnepr (Днепр) Later K-750
with PP-302 Regulator, PM-05 Breaker/Distributor and B2B Ignition Coil
Dnepr (Днепр) K-750, K-750M and MT-12
Ural (Урал) M-61

- Battery (3MT-6 or 3MT-7)
- Generator (Г-414)
- Ignition Coil (B2B)
- Foot Brake-Light Switch
- Flasher Unit
- Hi/Lo Beam Switch
- Manual Spark Advance
- Breaker/Distributor (PM-05)
- Horn Button
- Turn Signal
- Generator
- Foot Brake-Light Switch
- Flasher Unit
Dnepr (Днепр) K-750M

- Hi/Lo Beam Switch
- G-414 Generator
- PM-302 Regulator
- B2B Coil
- PM-05 Breaker
- 3MT-6 Battery
- Ignition Coil (B2B)
- Generator (Г-414)
- Regulator (РР-302)
- Horn (С-37)
- Breaker/Distributor (PM-05)
Dnepr (Днепр) K-750M

Breaker/Distributor (PM-05)
Dnepr (Днепр) K-750, MB-750

Breaker/Distributor (PM-05)

Рис. 37. Схема электрооборудования.

1 — прерыватель-распределитель; 2 — фара; 3 — замок зажигания; 4 — габаритный фонарь; 5 — аккумуляторная батарея; 6 — реле-регулятор; 7 — генератор;
Dnepr (Днепр) Early K-650
with PM-05 Breaker/Distributor and B2B Ignition Coil

7, 8-Oil Pressure Sensor (MM-106) and Emergency Light
15- Spark Plug (Candle) (A8)
16-Interrupter/Distributor (PM-05)
18-Horn (C37A)
22-Foot Brake-Light Switch (BK854)
23-Regulator (PP-31A)
24- Generator (Г-414)
25-Battery (3MT-12)
27-Horn Button
29-Dimmer Switch
Dnepр (Днепр) МТ-9 with Manual Control of Firing Angle
(B2B Ignition Coil and PM-05 Breaker/Distributor)
Dнепр (Днепр) МТ-9: Manual Control of Firing Angle
(B2B Ignition Coil and PM-05 Breaker/Distributor)
**Dnepr (Днепр) MB-750, MT-12**

**(MB-750 is the Militarized Version of the MT-12)**

- G-414 Generator
- PP-302 Regulator
- B2B Coil
- PM-05 Breaker
- 3MT-12 Battery

**Components:**
- **Battery:**
- **Generator (Г-414):**
- **Voltage Regulator (PP-302):**
- **Ignition Coil (B2B):**
- **Horn:**
- **Distributor/Breaker (PM-05):**