



Ignition Systems
for
Russian Motorcycles
(Part I: Introduction)

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Ignition Systems for Russian Motorcycles

(Plotting the Migratory Course)

- We have seen different distributor/breakers ranging from the PM-05, manually controlled from a spark-advance lever on the left handlebar, to the automatic breaker PM-302, providing automatic change of ignition timing depending on engine speed. Modern, contact-less, electronic ignition migrated through Types I to Type V before arriving at the robust Ducati and Power Arc ignition systems. We have also seen a migration in ignition coils, starting with the KM-01 in the original M-72, and terminating with the distributor-less, compact units used in the electronic ignition systems.**
- Enclosed is a series of briefings where we tried to pull together a lot of information to make sense of this migration path.**
- Interestingly enough, one can almost identify the model and year of the Ural or Dnepr by the original electrical components. One notices that components (regulator, distributors/breakers, ignition coils and 6/12-Volt batteries) are usually paired together. Often one component may migrate faster than another component in the ignition system. This brought about a few mid-model changes.**
- I hope this information helps sort-out the ignition systems of heavy Russian motorcycles and I look forward to receiving helpful suggestions for further clarification and sources of more information.**

Outline of Ignition Study

- ***Association and Evolution of Ignition Components (Part I)***
- ***Manual Spark Advance (Part II): PM-05***
- ***Automatic Spark Advance (Part III): PM-302***
- ***Contact-Less (Electronic) Breaker Points (Part IV):
Type I -to- Type V, Ducati and Power Arc***
- ***Ignition (Induction) Coils (Part V)***
- ***Setting Timing on Manual, Automatic and Electronic Ignition Systems (Part VI)***

This study traces the evolution of the ignition system in the Russian motorcycle. We see automation (automatic spark advance/retard), low maintenance (contact-less breaker points) and optimization (ignition coil).

Russian Ignition Systems

- **Breaker/Distributors**
 - **Contact Systems**
 - **Part II: PM-05: Manual Spark Advance /Retard**
 - **Part III: PM-11/PM-302 Breakers: Automatic Spark Advance**
 - **Contact-Less (Electronic) Systems**
 - **Part IV:**
 - **Type I -to- Type V Ignition Systems**
 - **Ducati Ignition System**
 - **Power Arc Ignition System**
 - **Part V: Ignition Coils**
 - **KM-01 Coil** ↔ **PM-05 Breaker/ Distributor**
 - **IG-4048 Coil** ↔ **PM-05 Breaker/ Distributor**
 - **B11 Coil** ↔ **PM-05 Breaker/ Distributor**
 - **B2B Coil** ↔ **PM-05 Breaker/ Distributor**
 - **B201 Coil** ↔ **PM-11 or PM-302 Breaker**
 - **B204 Coil** ↔ **PM-302/302A Breaker**
 - **Setting the Timing (Part IV)**
 - **Static Timing**
 - **Dynamic (Timing Light) Timing**

Within each ignition system, each breaker/distributor is associated (paired) with a distinctive, corresponding ignition coil.

Table I: IMZ (ИМЗ) - Ural (Урал) Model/Year vs. Electrical System (01/11)

Model	Year	Engine Size	Voltage	Generator/ Alternator	Regulator	Ignition Coil	Breaker/ Distributor	Battery
M-72	1941-56	750cc	6-Volt	G-11, G-11A (1952)	PP-1, PP-31 (1950)	KM-01, B2B, IG-4085B (1950)	PM-05	3MT-7 (7A-hr) or 3MT-14 (14A-hr)
M-72M	1956-61	750cc	6-Volt	G-11A (1952)	PP-31A	KM-01	PM-05	
M-72K	1954-60	750cc	6-Volt	*Magneto*	None	-	PM-05	None
M-61	1961-63	650cc	6-Volt	G-11A (1952)	PP-30, PP-31A (1956)	B11, KM-01	PM-05	3MT-12 (12A-hrs)
M-62	1963-65	650cc	6-Volt	G-414 (1957)	PP-31	B2B (1963)	PM-05	3MT-6 (6A-hrs) or 3MT-12 (12A-hrs)
					PP-302, PP-302A	B201, B201A	PM-302, PM-302A	
M-63 (Ural-2)	1965-80	650cc	6-Volt	G-414 (1957)	PP-302 (1963), PP-302A	B2B (1963)	PM-11A	
						B201, B201A	PM-302, PM-302A	
M-66 (Ural-3)	1971-75	650cc	6-Volt	G-414 (1957)	PP-302 (1963), PP-302A	B201, B201A	PM-302, PM-302A	
M-67	1974-76	650cc	12-Volt	G-424 (1974)	PP-302A, PP-330	B204	PM-302, PM-302A	6MTS-9 (9A-hrs) or 2X 3MT-6 (2X 6A-hrs)
M-67.36	1976-95	650cc	12-Volt	G-424 (1974)	PP-330, 33.3702 (1992)	B204	PM-302, PM-302A	
8.103 and 8.107 Series "650"	1994-98	650cc	12-Volt	G-424 (1974)	PP-330, 33.3702 (1992)	B204	PM-302A (1982)	6MTS-9 or 6CT-18-36A (18-to-36A-hrs)
						BC3 (BZ3) Contact-less Ignition System Type I (1994), II (1997), III (1998)		
8.103, 8.103X, 8.123, 8.123X 650 & 750 Series	1999-2003	750cc	12-Volt	14.3771 (1998)	Internal to Alternator (YA212A11E)	Contact-less Ignition System Type IV (2002)		Varta YB18L
8.103, 8.103X, 8.123, 8.123X "750" Series	2004-present	750cc	12-Volt	Nippon Denso (2004)	Internal to Alternator	Type V (2004) Ducati (2006), Power Arc		6MTS-18, Interstate FAYTX-20HL

Notes:

- M-64 (1961) and M-65 (1965) were prototypes.
- Alternators progress in output voltage and power from Г-11 (G-11) generator of 6-Volts/45-Watts in 1941, Г-11A of 6 V/45 W in 1952, Г-414 6V/65 W in 1957, Г-424 of 12V/150W in 1974, 14.3771 of 12V/350W in 1998.5, to the present-day Nippon-Denso alternator of 12V/770W.
- M-73 (1976) was an M-72 (750cc) with engageable sidecar wheel.
- M-75 (1943) was experimental model with 500cc engine (6-Volt) on M-72 frame. M-76 (1947) was experimental (820cc).
- Г-424 alternator (150 Watts) has external relay/regulator (PP-302 or PP-330). 14.3771 and Nippon Denso alternators have internal regulators.
- 12-Volt ignition coil B2B (manual spark advance) paired with PM-05 distributor, B201/B201A (ignition coil for automatic spark advance) paired with PM-302/PM-302A. B2B and B201 coils for 6-Volts and B204 for 12-Volts.
- PP-1, PP-30, PP-31 reverse-relay/voltage regulator for generator G-11/-11A systems were replaced with PP-302/-302A voltage regulator for G-414, and finally P-330 for the G-424 alternator.
- 33.3702 Solid-State Voltage Regulator replaced the PP-330 in 1992.

Table II: KMZ (KM3) - Dnepr (Днепр) Model/Year vs. Electrical System (01/11)

Model	Year	Engine Size	Voltage	Generator/ Alternator	Regulator	Ignition Coil	Breaker/ Distributor	Battery
M-72	1951-56	750cc	6-Volt	G-11A (1952)	PP-31 (1950)	KM-01, B-2B	PM-05	3MT-7 (7A-hr) or 3MT-14 (14A-hr)
M-72N (H)	1957-59	750cc	6-Volt	G-11A (1952)	PP-31A (1956)	KM-01	PM-05	
K-750	1956-63	750cc	6-Volt	G-11A (1952)	PP-31A (1956)	IG-4085	PM-05, PM-11A	3MT-7, -10, -14
	1963-67			G-414 (1957)	PP-302 (1963)	B2B (1963), B201	PM-302	3MT-12 or -14
K-750M	1963-77	750cc	6-Volt	G-414 (1957)	PP-302 (1963)	B2B (1963)	PM-05	3MT-6
						B201	PM-302	
MT-12 (Dnepr-12)	1974-82 2WD 1982-85 1WD	750cc	6-Volt	G-414 (1957)	PP-302 (1963), PP-302A	B2B (1963)	PM-05	3MT-12
						B201	PM-302	
MB-750	1964-73	750cc	6-Volt	G-414 (1957)	PP-302 (1963)	B2B (1963)	PM-05	3MT-12
						B201	PM-301/PM-302	
MB-750M	1973-77	750cc	6-Volt	G-414 (1957)	PP-302 (1963), 33.3702 (1992)	B2B (1963)	PM-05	3MT-12
						B201	PM-302	
K-650/MT-8	1967-70	650cc	6-Volt	G-414 (1957)	PP-302 (1963), PP-302A	B2B	PM-05, PM-11A	3MT-12
						B201	PM-302	
K-650/MT-9	1971-74	650cc	6-Volt	G-414 (1957)	PP-302 (1963), PP-302A	B2B	PM-05	3MT-6 or 3MT-12
						B201A	PM-302	
MB-650	1968-91	650cc	12-Volt	G-424 (1974)	PP-330	B204	PM-302, PM-302A(1982)	6MTS-9 or 2X 3MT-6
MB-650M1	1985-late 90s	650cc	12-Volt	G-424 (1974)	PP-330	B204	PM-302A	
MT-10	1973-76	650cc	12-Volt	G-424 (1974)	PP-330	B204	PM-302, PM-302A (1982)	
MT-10.36	1976-88	650cc	12-Volt	G-424 (1974)	PP-330	B204	PM-302A (1982)	
MT-11 (Dnepr-11)	1982-late 90s	650cc	12-Volt	G-424 (1974)	PP-330, 33.3702 (1992)	B204	PM-302A (1982)	
MT-16 (Dnepr-16)	1985-late 90s	650cc	12-Volt	G-424 (1974)	PP-30, PP-31, PP-330, 33.3702 (1992)	B201, B204	PM-302, PM-302A (1982)	

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
3. Alternators progress in output voltage and power from Г-11 (G-11) generator of 6-Volts/45-Watts in 1941, Г-11A of 6 V/45 W in 1952, Г-414 6V/65 W in 1957, Г-424 of 12V/150W in 1974, 14.3771 of 12V/350W in 1998.5, to the present-day Nippon-Denso alternator of 12V/770W.
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
6. 33.3702 Solid-State Voltage Regulator replaced the PP-330 in 1992.
7. Г-424 alternator (150 Watts) has external relay/regulator (PP-302 or PP-330). 14.3771(350 Watts) alternator has internal regulator.
8. 12-Volt ignition coil B2B (manual spark advance) paired with PM-05 distributor, B201/B201A (ignition coil for automatic spark advance) paired with PM-302/PM-302A. B2B and B201 coils for 6-Volts and B204 for 12-Volts.

Figure 1A: 6-Volt Electrical Systems (01/11)

Motorcycle

Generator

Regulator

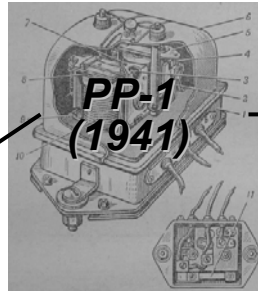
Ignition Coil

Breaker/Distributor

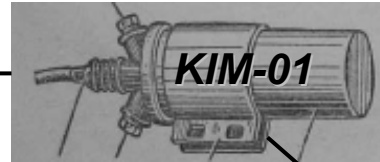
Ural: M-72, M-72M, M-61
Dnepr: M-72, M-72N



**Г-11/11A: 45 W
(1941/1952)**



**PP-1
(1941)**



KIM-01



PP-30



**IG-4085B (1950)
and B11**



**PM-05
(1954)
(with manual
spark advance)**

Ural: M-62, M-63, M-66
Dnepr: K-750, K-750M, MB-750,
MB-750M, K-650,
MT-9, MT-12



**PP-31/PP-31A
(1950/1956)**



B2B

**PM-11A
or
PM-301/PM-302/PM-302A
(with automatic spark
advance)**



**Г-414: 65 W
(1957)**



**PP-302/302A
(1963/197X)**



B201/B201A



Figure 1B: 12-Volt Electrical Systems (01/11)

Motorcycle

Alternator

Regulator

Breaker - Ignition Coil

**Ural: M-67, M-67.36,
IMZ 8.103 Series
Dnepr: MB-650, MT-10,
MT-10.36, MT-11, MT-16**



**Ural: IMZ 8.103 Series
(1999-2003)
Dnepr: None**



**Ural: IMZ 8.103 Series
(2004-present)
Dnepr: None**



(Relay-Regulator)



**Internal to
Alternator**



Contact-less



Type I

Type III

Type II

Type IV

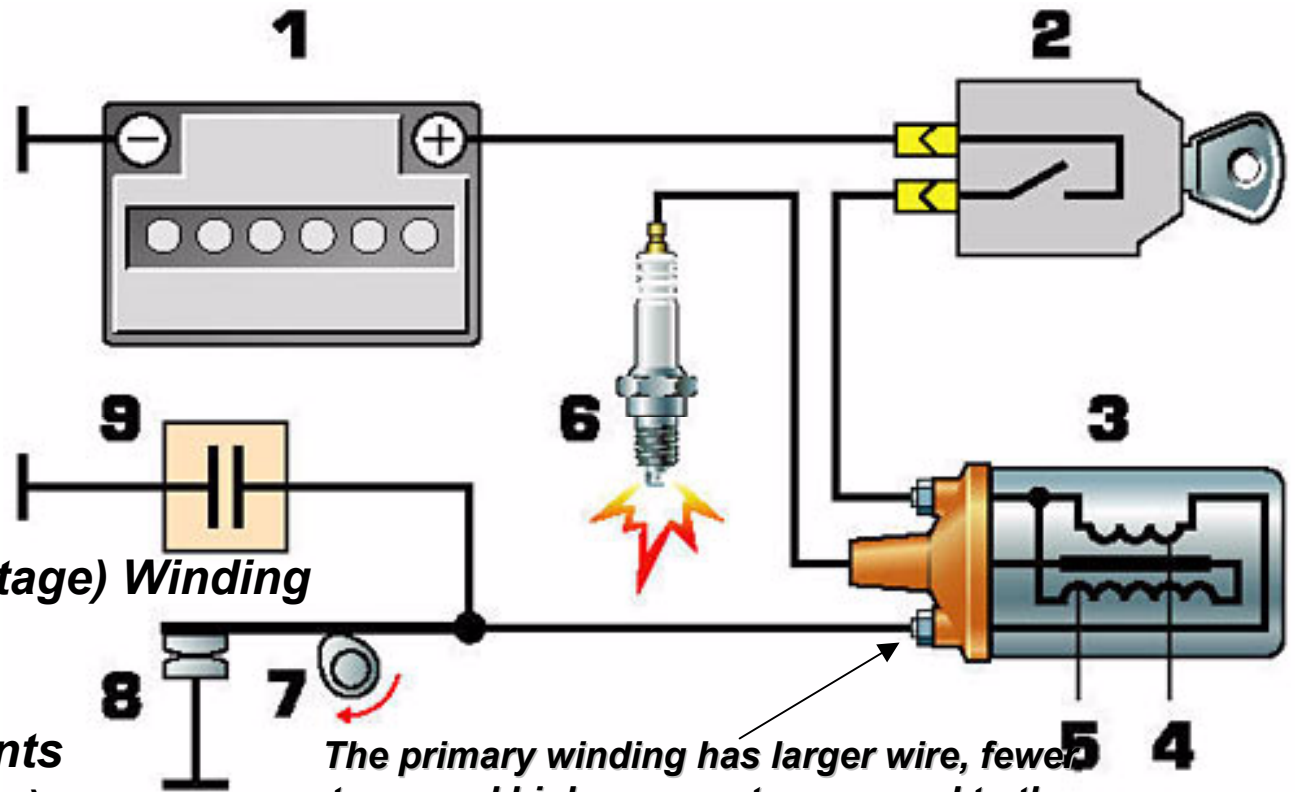
Type V

**Ducati
(2006)**

**Raceway Services
Power Arc**



Basic Ignition System



1. Battery
2. Ignition Switch
3. Ignition Coil
4. Primary Winding
5. Secondary (high-voltage) Winding
6. Spark Plug
7. Rotating Cam
8. Contact Breaker Points
9. Capacitor (condenser)

The primary winding has larger wire, fewer turns and higher current, compared to the multi-turn, finer wire, lower current of the high-voltage secondary winding.

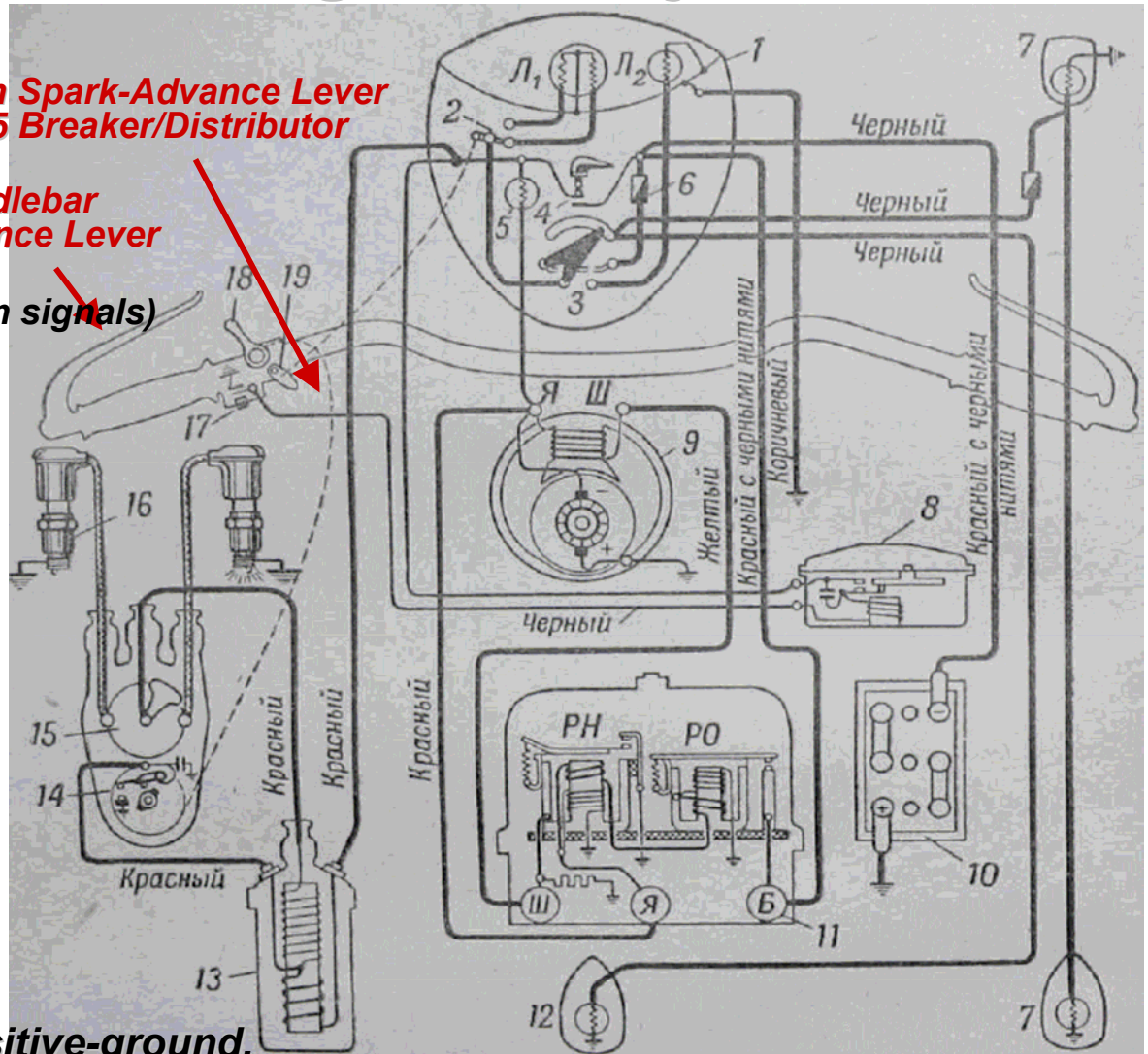
The basic ignition system is simple. The breaker points are normally closed, allowing the magnetic field to build in the ignition coil. When the cam shaft rises, opening the breaker points, the collapsing magnetic field induces a high-voltage in the secondary winding of the coil.

Basic Ural M-72 Ignition System

1. Headlight Cavity
2. Hi/Lo-Beam Switch
3. Central Switch
4. Ignition Switch
5. Charge Light
6. Safety Fuse
7. Sidecar Running Lamps (no turn signals)
8. Signal Horn
9. Generator (Г-11)
10. Battery
11. Relay Regulator (RR-1/PP-1)
12. Rear Bike Lamp
13. Ignition Coil
14. Breaker Points
15. Distributor
16. Spark (Candle) Plug
17. Horn Button Switch
18. Spark-Advance Lever
19. Hi/Lo-Beam Dimmer Lever

Cable from Spark-Advance Lever to PM-05 Breaker/Distributor

Left Handlebar Spark Advance Lever



Note: The early M-72's had positive-ground.

The same elements are shown in this drawing for the M-72, the first heavy Russian motorcycle. The spark advance lever is shown connected (dotted line) to the breaker/distributor.