Boris Brovinsky

MOTORCYCLES FROM KOPER

An overview of the development of the Slovenian motorcycle industry

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AN OVERVIEW OF THE DEVELOPMENT OF THE SLOVENIAN MOTORCYCLE INDUSTRY

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The Origins of Tomos

Until the outbreak of the Second World War, nearly all industry in the Primorska (Littoral) region was concentrated within the industrial centres of Trieste, Monfalcone and Gorizia, providing employment to the inhabitants of the region. Following the end of hostilities, the long and apparently intractable problems over the borderline between Italy and Yugoslavia effectively cut the population of the neighbouring Karst region off from the industrial heartland. Many factory workers finding themselves on the wrong side of the border lost their jobs, and the rural population lost the principal market for the sale of their crops. In order to create new employment opportunities, the Karst region secured the gradual establishment of new factories in the textile, wood-processing and electronic industries, and there were also favourable conditions for metal processing. Mr Danilo Petrinja, then President of the Sežana District People's Committee (a political body within the Socialist system of the time), recalls[1] that when they discussed the possibilities of developing industry in the Karst region, the production of motorcycles was proposed by Mr Silvo Hrast, Director of the Iskra company of Kranj (and which subsequently relocated part of its business to Sežana). An investment plan for a motorcycle factory was subsequently prepared by Mr Franc Pečar, Director of Litostroj (Ljubljana) and on 16th July 1954 the Sežana District

[1] *TOMOS*, Tomos Koper Workers Journal, No. 12, November 1984, p 2.

People's Committee (DPC) announced the decision to establish a new motorcycle factory in Sežana[2].

The first, temporary assembly plant in the second half of 1950's (TMS photo collection).

In a subsequent announcement dated 27th July 1954, the title **TOMOS** – an acronym of the full title **TO**varna **MO**tornih koles **S**ežana [Motorycle Factory Sežana][3,4] - appeared for the first time. However, when the London Memorandum signed on 5th October 1954 provided the final answer over the line of the Italo-Yugoslav border, and as a consequence, the destiny of what had been known as 'Zone B of the Free Territory of Trieste', the Slovenian government decided to build the motorcycle plant in Koper and not Sežana. Koper was rapidly developing into another industrial centre in this part of the littoral region and needed new commercial facilities to provide employment for the local population on the coast and immediate Karst hinterland, many of whom had previously worked in neighbouring Trieste which was now across the Italian border.

[2] *20 Years of Tomos*, Chapter 'Construction and Development', published by Tomos Motor Vehicle Factory, Koper 1974.

[3] Idem

[4] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No. 8, p 1.

Following a compromise between the Sežana and Koper DPCs, it was agreed that the main factory would be built in Koper, but a smaller plant would remain in Sežana[5] and an announcement was made on 15th November 1954 to this effect[6]. Within this agreement, Franc Pečar anticipated the future production of mopeds in the Koper factory. It was not until the merger of Mizarsko Podjetje of Senožeče and Tomos on 1st July 1969[7] that the production of automotive parts transferred to the region.

The first, temporary assembly plant in the second half of 1950's (TMS photo collection).

Initially, Tomos product range included the following mopeds:

- Tomos - Puch VS50 (Colibri),

- Scooters: Tomos - Puch RL125, SR and SR-A 150 (Galeb),

- Motorcycles: Tomos - Puch 250 SG, 250 SGS and SV 175.

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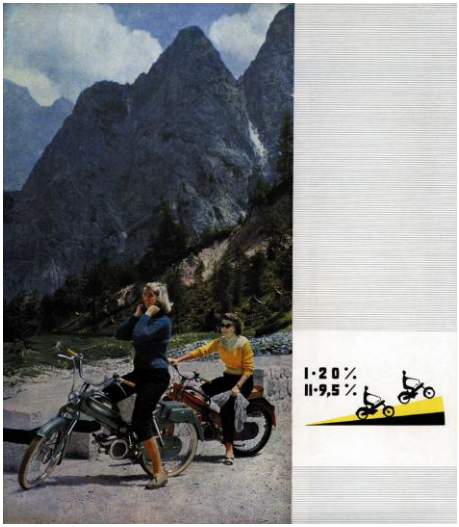
[5] *TOMOS*, Tomos Koper Workers Journal, No. 12, November 1984, p 2.

[6] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No. 8, p 1.

[7] *20 Years of Tomos*, Chapter 'Manufacture of Tomos Citroen cars, including the popular *spaček* (2CV)', published by Tomos Motor Vehicle Factory, Koper 1974.

In the early 1960's, Tomos had around 2,000 employees from Koper and its hinterland. In 1957, the company acquired its own bus fleet for transporting workers. A year later, they offered their personnel favourable loans to purchase Colibris (TMS photo collection).

At the time, views on the feasibility of motorcycle production in the region were divided. The idea of a new factory met with some resistance. Many argued that the population's purchasing power was still too low to buy large quantities of motorcycles. However, a rapid boom in motor vehicle ownership over the following years proved the decision to be correct.



In their first brochures and advertising campaigns the company pointed out the characteristics of Puch's (and their own) motorcycles.

Even before the foundation of the new factory, its representatives discussed collaborating with motorcycle manufacturers in Italy, Germany and Austria. A contract with Steyr-Daimler-Puch was duly

signed by Franc Pečar, the first director of Tomos. The selection of a suitable licence partner was influenced by several factors. The first was that Tomos was not bound to strict cash payments but only by the quantities of motorcycles and components purchased from their Austrian partner[8]. Another reason in favour of the Graz-based company was probably the fact that Puch motorcycles were economical and robust, being designed for the badly maintained roads (with steep gradients) then common in Austria. In addition, Steyr-Daimler-Puch also exported its motorcycles to some very demanding markets, such as the United States of America[9]. It has also been claimed that Puch offered Tomos such favourable licence conditions because the Austrian company doubted that Tomos would ever become a successful independent business[10].

More than 100 motorcycles are loaded on a truck destined to supply the Yugoslav and European markets (TMS photo collection).

The Yugoslav President Josip Broz Tito who officially inaugurated the new Tomos plant often brought foreign statesmen to Koper (TMS photo collection).

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[8] Document: *Vereinbarung, abgeschlossen zwischen der firma STEYR-DAIMLER-PUCH A.G., Graz und der Firma TOMOS, tovarna motornih koles, Koper*; Graz, 1st October 1954. Copy held at the Technical Museum of Slovenia, Motorcycle collection.

[9] Dr. Hans Seper, *100 Jahre Steyr - Daimler - Puch AG, Blatter fur Technikgeschichte, Technisches Museum fur Industrie und Gewerbe in Wien, 26*. Heft 1964, p.70 -71.

[10] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, June, special edition, p. 4.

In the final days of 1954, the first provisional facilities were arranged for the new company in Koper. Offices were established within the building of the wine exporter Vinakoper. Expert personnel came from all over Slovenia, but mainly from Litostroj and TAM of Maribor. Living apartments were provided in a newly built block of flats and houses constructed on the coastline from Hrvatini to Portorož. The number of employees constantly grew and one of the new factory's priorities was to provide housing. In the late 1950's the company actually allocated a substantial portion of its profits towards workers housing, building a canteen and the acquisition of a bus to transport the employees to work. By the end of 1958 the number of employees had increased from 5 (at the end of 1954) to 928. When production was started in a new plant, the number of personnel had increased again, to 1618, by the end of 1959[11]. From that point on, Tomos was continually trying to recruit new personnel as their workforce turnover was surprisingly high. In 1964 the number of employees exceeded 2000 and by 1970 more than 3000. However, records indicate that by September 1974, when the number of employees stood at 3078, the factory has lost more than twice that number (6552), corroborating the findings that there was a substantial worker turnover[12].

At the beginning, temporary production lines and workshops were set up within the former Slavica trading company buildings in Koper. Production commenced on site in 1955; the first vehicle assembled was a Puch **SG 250** motorcycle[13,14] and in that year the company

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[11] *20 Years of Tomos*, chapter: 'Tomos provided employment for people from different places within our broader country', published by Tomos Motor Vehicle Factory, Koper 1974.

[12] Idem

[13] *20 Years of Tomos*, chapter 'Construction and Development', published by Tomos Motor Vehicle Factory, Koper 1974.

[14] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No. 8, p 2.

manufactured a total of 137 of these, together with 124 **RL 125** scooters and 100 mopeds. The following year, when the product range had expanded to include the **SV 175** motorcycle, production of mopeds was outstripping all other products, with 1721 units assembled, alongside 615 motorcycles (of which 147 were the SV 175s) and 532 scooters[15]. From this year on, the ratio in favour of mopeds constantly increased. This mirrored what was happening across all European markets, where the demand for heavier motorcycles decreased whereas the demand for cheaper scooters and mopeds was on a constant increase. Taking note of this new market situation, Tomos modified its product range and doubled the planned annual production of mopeds. Although the manufacture of motorcycles and scooters continued, the idea of having their own in-house research and development department was abandoned. They also wanted to complete its product range by introducing delivery tricycles with a loading capacity between 350-500kg. Puch however, were not making such vehicles and so Tomos considered looking for another licence partner, a situation also aggravated by other problems within their existing partnership.

Puch components were acquired through the services of Autocommerce, which was Puch's official representative in Yugoslavia. However, one of the problematic supply issues surrounding this arrangement was that foreign currency assets could only be acquired using the foreign currency reserves of the National Bank of Yugoslavia, but these were not sufficient to meet the rapidly increasing demand. Tomos searched for solutions to the problem, including making compensation transactions (the so-called "import for export") being actively promoted by the National Bank. In order to import all the components they needed in 1956, for example, the company was exporting, amongst other things, poplar

[15] Based on data from the Overview of Production 1955-1962 (Production data provided by Tomos). Data differs from that published in *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No. 9, p 2.

wood, wine, resin, tar and alumina![16] Tomos was also not satisfied with the attitude of its license partner due to the fact that Puch allegedly demanded advanced payments, whilst their shipments out were sometimes deficient. In 1956 their relations became so aggravated that Tomos intended to terminate the contract. In searching of a new partner they contacted the Czech motorcycle manufacturer Jawa, but they eventually abandoned the idea of a new partner and repaired relations with Puch. With production underway in Koper, the need for new and bespoke factory buildings was pressing. It was originally planned that the new factory would be completed in 1957, but the funds for its construction were delayed. The Federal Executive Council (the executive body of Yugoslavia) which initially approved these funds, cooled in their support for the project and only after further discussions did they reach agreement to extend the construction period to 1959. The factory was officially inaugurated on 14th June 1959 by the President of Yugoslavia, Josip Broz Tito. During its initial trial operation in 1959, they had to master new production technologies using machinery and equipment that anticipated the manufacture of heavier motorcycles and which posed new problems that needed to be overcome. However, Tomos was now effectively a new and fully-fledged company, and as such, was constituted in the first half of 1960 and a workers' council was elected. The company was entered in the Companies Register on 1st July 1960, and production could commence.

Assembly of Colibri mopeds, c1960. On the right, at the back, are Herkul tricycles (TMS photo collection).

[16] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No. 9, p. 1.

2

Exhibits from the Road Vehicles Department of TMS The development of Tomos

A contract with Steyr-Daimler-Puch dating from 1954 shows that the factory's product range originally included the **MS 50** moped, the **RL 125** scooter and the **250 SG** and **250 SGS** motorcycles[17]. In 1956 the range was completed with the introduction of the **SV 175** motorcycle[18]. The **RL 125** was later replaced with the better performing **SR** and **SRA 150** models. The latter was also fitted with an electric starter. Tomos chose the Italian motorcycle manufacturer Moto Guzzi as licence partner for the production of delivery tricycles. In 1956 they started to assemble a tricycle model called **Herkul** (Hercules) that was aimed particularly at farmers who needed an affordable vehicle for the transport of their products and crops. They were manufactured until 1961 in two versions: with or without a

[17] Document: *Vereinbarung, abgeschlossen zwischen der firma STEYR-DAIMLER-PUCH A.G., Graz und der Firma TOMOS, tovarna motornih koles, Koper;* Graz, 1st October 1954. Copy held at the Technical Museum of Slovenia, Motorcycle collection.

[18] Overview of production 1955-1962, data on units of production provided by Tomos.

cabin, and with an open or closed cargo space[19]. During this period, a total of 310 units were assembled[20] and one of them is stored in a depot of the Technical Museum of Slovenia.

Their own market research findings seemed to prove that the demand for heavier motorcycles in Europe was on the decrease, and accordingly they adapted their range of products and oriented production exclusively towards vehicles with two-stroke engines with a capacity of 50cm3. Some other products – the most significant being cars and chainsaws – were however assembled on the basis of co-operative agreements with foreign partners.

Tomos motorcycles were also used by the police (TMS photo collection).

Tomos assembled cars based on a contract with the French company Citroën signed on 21st July 1959. The first cars constructed were **2CV's** and these were already rolling off the production lines at Koper by 1961[21]. In addition to these economy cars (the **2CV** and the later **Ami**), one of the most advanced cars of the age – the **DS** – was

[19] According to the factory brochure for Herkul 192 cargo tricycle - load capacity 500 kg. Brochure held at the Technical Museum of Slovenia, Motorcycle collection, Tomos.

[20] Overview of production 1955-1962, data on units of production provided by Tomos.

[21] *20 Years of Tomos*, Chapter; Manufacture of Tomos Citroen cars, including the popular *spaček* (2CV), published by Tomos Motor Vehicle Factory, Koper 1974.

also assembled in Koper. The **DS** was marketed as a top-range company car. The extent of cooperation between Tomos and Citroën constantly increased, and by 1972 both partners founded a company for the production of cars in Yugoslavia, called Cimos. This effectively ended car production at the Tomos factory. Although Tomos only ever assembled cars, mention should be made of the only attempt by the company to develop a component, in-house. In the early 1960's, Erik Mihevc, who later became the head of motorcycle development, designed a combined spring and hydraulic shock-absorber that could automatically adjust ride height whilst simultaneously maintaining a level in relation to the weight of the load being carried[22]. This was an innovative concept that had never been previously installed in cars. According to the inventor the shock-absorber was trial tested on a **2CV** but was never installed in production vehicles. The Technical Museum of Slovenia has one example of a Tomos assembled car in the form of an **Ami 6** dating from 1976.

Chainsaws were also a significant product worthy of consideration. In the second half of the 1980's they were one of the most important of the company's products if judged by the number of units assembled[23]. They were assembled under contract with the Swedish company Husqvarna between 1977 and 1989[24]. During this time, the Koper factory mastered the production of some chainsaw components, but didn't invest enough time and energy towards properly developing these products.

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[22] File and drawing of a combined spring and hydraulic shock absorber by Erik Mihevc, TMS archive, Tomos technical documentation.

[23] Overview of production 1955-1962, data on units of production provided by Tomos.

[24] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1977, No. 14, p1.

Stationary engines

The first prototype of a stationary engine was manufactured in 1956, and as the model **UMO 05** entered mass-production in 1958[25]. That same year, an improved and more powerful version of the engine was developed, the **UMO 06**, with a cylinder volume of 60 cm3 and 2.2hp output. This was followed in 1959 by a prototype of a stationary engine with the capacity of 150 cm3 based on the engine fitted to the Puch scooter[26]. However, production of this scooter with the larger engine capacity was soon abandoned and consequently the stationary engine version never entered production.

The most commonly used Tomos product were water pumps driven by an UMO stationary engine (TMS photo collection).

An interesting development idea worthy of note was the attempt to design a 'universal engine' that could be used both in vehicles – the intention had been to design a scooter with an engine capacity up to 100cm3 – and which could also serve as a stationary or outboard motor. This was developed as a collaboration between the vehicle and stationary engine research teams. The idea of it entering mass production was abandoned however, and instead their design energies were concentrated on developing a new engine for stationary use (1962). This became the successful **UMO 06NL**, with

[25] Overview of production 1955-1962, data on units of production provided by Tomos.

[26] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, June, special edition, p 4.

an output of 2kW (2.8hp). In different versions, this engine powered pumps, drills, rotor cultivators, ski lifts, generators and other such machinery manufactured by the company's subcontractors.

Tomos only ever attempted to develop four-stroke engines for stationary use. In 1977, the Tomos Institute tested a single-cylinder four-stroke engine, the **UMO 50** with a capacity of 500cm3 that was intended for agricultural machinery and generators[27]. Small four-stroke stationary engines were eventually launched on to the market in the form of the **UMO 4T 18/22**, and these were the fruit of cooperation with the Italian company ACME. Together with their two-stroke stationary engines that were designed in-house, they remained in the product range right up the threshold of the new millennium. Of the products based on stationary engines, the Technical Museum of Slovenia stores the portable ski lift **SV3** and motor pumps **MP 1**, **MP 300/25** and **SMP2.** The last one is a self-priming pump, which means that contrary to normal centrifugal pumps, it doesn't need to fill with water when starting, which is very inconvenient. The designers solved this issue by adding a funnel and a self-closing valve. This solution was patented locally and abroad.

Outboard engines

The first outboard engine they manufactured was also based around the Puch **MS 50** moped engine. In 1958, the company manufactured three units and mass production started two years later[28]. The adapted upper part of a **Colibri** fuel tank served as the casing of the first mass-produced outboard engines. As with the stationary engines, Tomos also increased the engine capacity to 60cm3 because they were not subject to any legal provision as to the volume restrictions. The first generation of mass-produced outboard engines the **Lamo 05K** followed by the **Lamo 06K** were manufactured by

[27] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1977, No.1-2, p14.

[28] Idem.

1964. Some were also exported to the Western European market. In 1965, the **Lamo 06K** was replaced by a new model (**Lamo 06N**), a prototype of which was made in 1963. It had a new engine with the possibility of left and right direction of rotation (due to the requirements of stationary engines). It was also visually different from its predecessor because it was protected against water at the bottom; the aluminium casing was covered by an angular engine cover made of plastic and the fuel tank was separated from the engine. During this period, Tomos established contacts with the Swedish company Electrolux who evaluated outboard engines from various European manufacturers with the intention of selecting one to be sold in the European market through their distribution network.

The popular Colibri (on the left) provided the Lamo outboard engine, which was one of the first in-house products, with both the engine and upper part of the fuel tank (TMS photo collection, Tomos).

Electrolux chose the Lamo series, which was launched on the market as an Electrolux design, but produced in Yugoslavia. After two years, the partners terminated their collaboration, and Tomos sold the engine through its own sales network. This outboard engine got its final shape in 1969 as the **Tomos 4**[29]. It was fitted with a new hydro-

[29] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No. 5, p1.

dynamically designed steering system (developed in 1967), a new steering lever (the inventor Romeo Miloševič received the international jury's Grand Prix at the exhibition of patents and technical inventions within the 89th International Vienna Fair) and other minor improvements. The "four" placed Tomos among the most successful outboard engine manufacturers worldwide[30] and in 1983 it was allegedly the largest in Europe[31]. By 1971, Tomos was exporting as much as 80% of its outboard motor production[32].

In 1969 Tomos presented a new generation of products, including the Tomos 4 outboard engine and Colibri T 14 V motorcycle. With its different versions, the Tomos 4 became one of the most popular outboard engines in Europe. The engine for vehicles of the 'new generation' was first mounted in Colibri T 14 V motorcycles. Modernised over the years, this engine was the basis for all versions of Tomos gearbox engines used right up to the present day (TMS photo collection)

The **Tomos 4** served as the basis for a number of outboard motor

[30] This corroborates the popularity of Tomos inboard engines in Europe, as well as the test results shown in foreign magazines, for example *TEST, Die Zeitschrift für den Verbraucher*, April 1972.

[31] Study *Long-term Developmental Orientation of Tomos Koper*, Koper, June 1983, p 28.

[32] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No. 5, p 1.

variants. The first developed in 1973-74 was the **4-e** with an electronic starter, and the lower performance **Tomos 3** with a protective cover and an in-built fuel tank (another version was launched in 1977 as the **Tomos 3.5**)[33]. Next in the range of small outboard engines was the **Tomos 4.5** (1977) which had, contrary to the "four", an overrunning clutch (a Tomos patent) and the last in this range of products, the **Tomos 4.8** of the 1980's, was fitted with a built-in reverse gear.

In the late 1960's, when the **Tomos 4** was already established on domestic as well as foreign markets, the company developed a new model with enhanced performance. In 1970, a prototype with an engine capacity of 250cm3 was tested. Although its development was completed by 1972 the production of the **Tomos 18** only commenced in 1974[34]. The company also produced the **Tomos 10**, which had a performance limiter integrated into the design, and this was of particular interest in countries where regulations restricted engine output for vessels driven without a licence. As with the **Tomos 4**, both enhanced performance engines combined several innovations and registered patents. The development of better performance outboard motors didn't stop with the models **10** and **18**. Due to the expansion of water sports and the requirement of the Yugoslav army for more powerful engines, the company management decided to engage in the development of a range of higher performance outboard engines. Between 1977 and 1981, the company was developing an engine with the working title of **T 40** with an output of 29.5kW (40hp). The steering system was designed to allow the development of even better performance engines. Some **T 40** prototypes were produced for civil use (with an electric starter) and for military use (with a manual starter). The latter version successfully passed the necessary military testing, but was

[33] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1984, No. 8, p 3.

[34] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1984, No. 8, p 3.

never mass-produced. Two **T 40** prototypes have been preserved; a military version is held by the Technical Museum of Slovenia and a civil variant is kept by Tomos.

Tomos 4 outboard motors were one of the most successful of their products of all time, receiving several international awards and prizes[35]. Tomos didn't register its models and design patents until the second half of the 1960's, which unfortunately allowed foreign manufacturers to extensively copy them. Such is the case, allegedly, with their solution for the additional water cooling of the engine shaft and the exhaust system which was copied by the majority of other manufacturers of air-cooled outboard engines[36]. Tomos terminated the production of outboard engines in 1998. Some models and their components are kept at the Technical Museum of Slovenia. In addition to the aforementioned **T 40**, these also include the predecessor of the popular "four," the **Lamo 06K**; a cross-section of a **T4**, two exhibits demonstrating patented versions of a rotating throttle, a cross-section of the **T 4.5** engine demonstrating their patent of the over-riding clutch, and a **T 10/18** engine without a cover.

Moped and motorcycle development

The primary products of Tomos were motorcycles and mopeds, accounting for a total of 52 percent of their entire production until 1997[37]. A moped[38] is defined as a type of light motorcycle designed

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[35]- The highest award at the 6th Biennial of Industrial Design in Ljubljana (for T10 and T18)

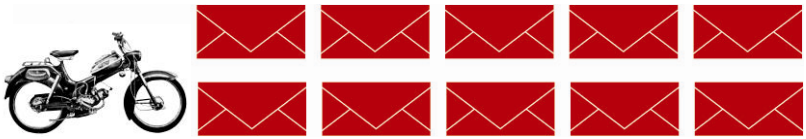
- International award for the quality of T4 outboard engine, Madrid 1972.

- Grand Prix of the international jury at the Patent and Technical Innovation Exhibition within the 89th Vienna Fair, 1968 for a twist grip on an outboard engine.

[36] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, June, special edition, p 4.

[37] Overview of production 1955-1962, data on units of production provided by Tomos.

to provide economical and relatively safe transport with minimal licensing requirements. Mopeds were once all equipped with bicycle-like pedals (the source of the term, motor + pedal) and so the term would perhaps be better suited to a bicycle with an auxiliary motor. However the term moped has been increasingly applied to all motorcycles with an engine capacity up to 50cm3 and regardless of whether they are started by pedals or a kickstarter[39].



In 1957, the price of the Colibri 03 moped in Slovenia amounted to approximately 10 average monthly wages.

Tomos in-house development in the field of mopeds commenced with a number of versions of the Puch MS 50 under the common name of Colibri, which were also intended for foreign markets (TMS photo collection).

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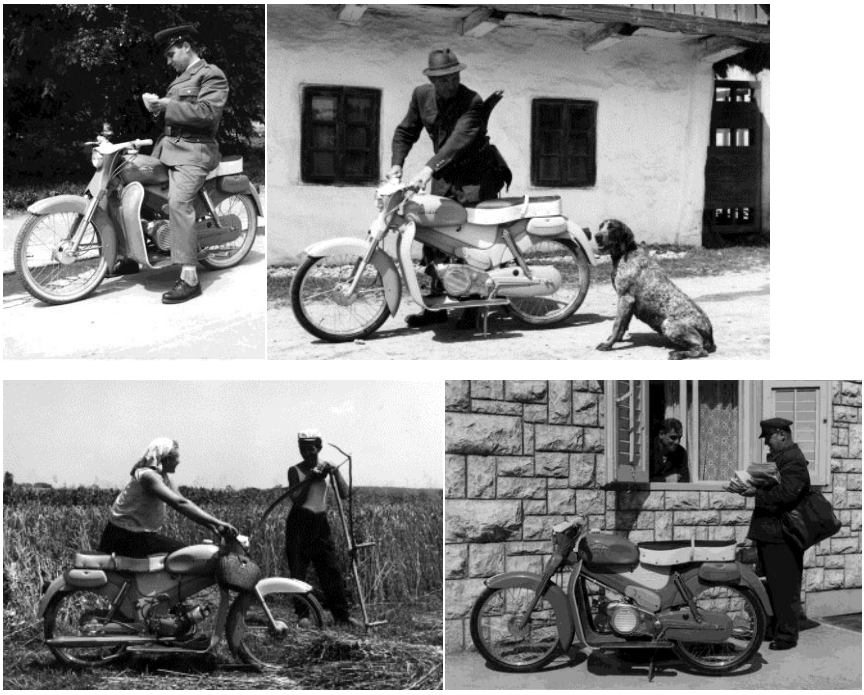
[38] *Dictionary of Standard Slovenian,* Franc Ramovš Institute of the Slovenian Language of the Slovenian Academy of Sciences and Arts, DZS, Ljubljana, 1994.

[39] This was addressed by engineer Dobroslav Purešević in a brochure entitled *Moped* published by Tehnička Knjiga, Belgrade, 1960, p 7-9.

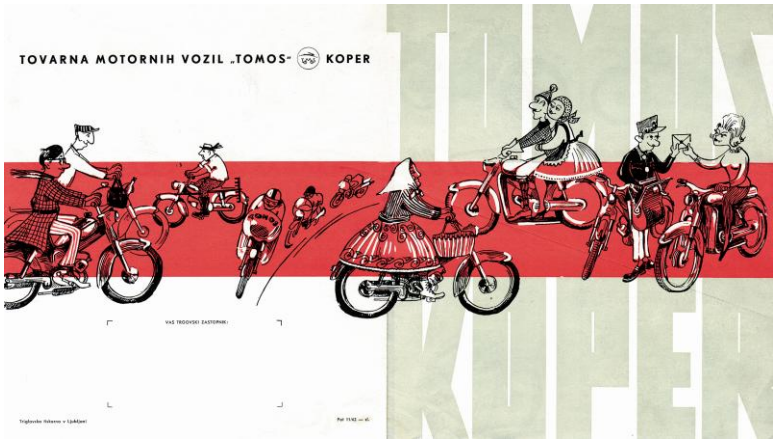
In the Tomos catalogue from the second half of the 1950s, two **Colibri** models are referred to as mopeds; the **VS 50** is fitted with pedals, whereas the **VS 50K** has a kickstarter. A similar case is the **Colibri T 14V** launched in 1969 which was classified, compliant with the then Road Traffic Safety Act, as a motorcycle[40], but in the catalogue was referred to as a moped. In order to avoid confusion, all two-wheeled vehicles from the period before 1968 with an engine capacity of 50 cm3 or less, and regardless of whether they are pedal- or kick-started will be referred to as mopeds. From 1968 onwards we shall refer to all such vehicles in accordance with the provisions of the road traffic safety act of 1968, which includes motorcycles, cycles with auxiliary motors or cycles with motors.



The Colibri T 12 became the most popular and versatile motorcycle of the 1960's (TMS photo collection).

[40] See note 54.

Tomos commenced development of their own in-house designed mopeds in the late 1950's with the production of numerous models of the **Puch MS 50**, collectively referred to as the **Colibri**[41]. The first **Colibri** was the **VS 50**[42] which over the following years saw variations numbered from 1 to 13 according to the differing accessories fitted. Some versions were intended for foreign markets and adapted to the regulations of the import countries. In 1959, they manufactured over 17,000 such models and signed a contract for the first significant export to Sweden (1,750 units)[43].



Tomos advertising brochures clearly showing the market they were aiming at in the early 1960's (TMS photo collection).

This period also saw the creation of the first racing model, also based on the **Puch MS 50,** and this did well in races at home and abroad. The most successful of these many models was the **Colibri T12**, first shown at the Belgrade Engineering Fair in 1961. It became the most

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[41] Based on contributions in Tomos internal journals (*TOMOS* 1972, No. 10, p 3) the company's mopeds were allegedly called Colibri in 1959. However, according to the bill submitted to the Technical Museum of Slovenia along with the moped VS50K by its former owner dating 12th June 1957 (Tomos, inventory folder 1998), Colibri were also called mopeds from the contract period with Puch.

[42] Based on the brochure and bill from 1957 held by the Technical Museum of Slovenia, Tomos, inventory folder, 1998.

[43] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No 10, p 3.

popular moped in the country during the 1960's. In 1966, Tomos manufactured 31,950 **T12's** which accounted for 70.2% of total moped production by the company and 66% of the total production of motorcycles and mopeds in the whole of Yugoslavia[44]. Although these mopeds can be considered the company's own product after 1959, they still used a lot of imported components supplied by their former licence partner, and other manufacturers. It is interesting that these imported components even included such technically simple parts to manufacture as the fuel tank and the seat. These parts were eventually developed and manufactured by Tomos, but only as late as 1964[45].

In the mid-60's, Tomos struggled to meet the demand from the domestic market. Generally mopeds were purchased by those on low to average wages, with wealthier individuals being more interested in cars. A moped allowed people who lived in rural areas with poorly developed public transport to reach employment some distance from their place of residence. A moped was also the most suitable motor vehicle to drive along local or narrow access roads and along forest roads in both low and highland areas. As a result, mopeds were used to run everyday errands by farmers, foresters, postmen, hunters and many others. People who had bought a moped as their first vehicle usually still retained it, even after buying a car to use as an additional means of transport. Those who bought a car in the first place also found the moped useful as an alternate means of transport, as did the urban population, and these users often went for lighter and more agile cycles with auxiliary motors (the **Automatic** family). Fitted with a luggage carrier or a basket they were more suitable for daily shopping and a ride in a city centre. The

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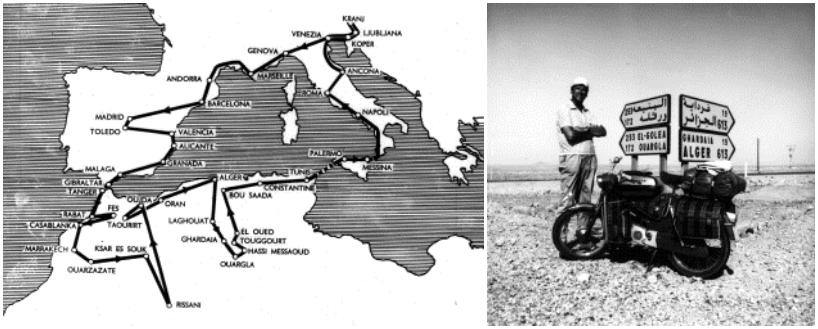
[44] Koštan Šime, *Usporedna analiza razvoja Jugoslovenske industrije za preradu metala, Drumska motorna vozila*, Foreign Trade Institute, Belgrade 1967, p 24.

[45] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1964, No. 22, p 4.

Technical Museum of Slovenia doesn't have a **Colibri T12** in original condition, but it holds some other mopeds of this category manufactured in the late 1950's. The most important include an example of the **VS 50K** (1957) donated to the museum by its first owner Mr Viktor Bančič in 1998, and a **Colibri 12** donated in 1986 by Tomos. This example was slightly modified by the company in 1961 and lent to the adventurer Stane Tavčar, who drove it on a 12,000km journey across the countries of the Middle East and South Africa. The company not only extensively tested the reliability and durability of its product in race competitions, but also gained valuable information by offering them to adventurous individuals who travelled the countries of Europe, Africa, Asia, North and South America. In addition to Stane Tavčar, two other notable Slovene travellers, Tomo Križnar (South America) and Tone Fornezzi (Iceland) and others, hit the road on Tomos mopeds. Stane Tavčar's moped journey to the Middle East in 1961 wasn't his last one. In 1969 he went to the Sahara and for this journey Tomos modified their latest model, the **Colibri T14V**. The trip took him across Italy, France, Spain, Morocco, Algeria, Tunisia, by ship to Sicily and then through Sicily and the Apennine peninsula back to Koper in a 14,400 km journey, and the **T 14V** passed the challenge with flying colours, later presented to the museum in 1986.



The journey by Stane Tavčar through North Africa was a challenging test for the new Tomos motorcycle (TMS photo collection).

In late 1950's when the license agreement with Puch was about to end, Europeans were starting to prefer the look and style of scooters. In Yugoslavia, a Zagreb-based motorcycle factory started production of a so-called 'moped-scooter', the **Švrćo 50** in 1960. Tomos offered

in reply the **Colibri Scooter** (a full Puch licenced product). Its design – with an open engine, chain drive and classic rear suspension – made it look more like a motorcycle, and only the smaller tyres (470mm diameter) and the legshield gave it any scooter-like characteristics. This was probably why Colibri Scooters did not become very popular in the Yugoslav market, as 'regular' scooters fitted with a legshield offered the driver more comfort and protection. It is not commonly known that at around 1961, Tomos was engaged in the development of a new scooter. This not only had the classic looks, but an advanced specification, being fitted with a variable belt transmission (CVT), an electric starter and either metal or plastic legshields and was to be offered in two versions (engine capacity 50 or 100cm3).

Colibri scooters (on the left) were manufactured by Tomos for a relatively short time. The Colibri range from that period (on the right) with its many versions became ever more numerous. Its successor from the end of the century could be considered the APN range of cycles with motors (TMS photo collection).

The majority of manufacturers today fit their scooters with similar transmissions, but at the time this was more the exception than the rule. This could have become not only the first 'regular' Tomos scooter but also the first vehicle of the company's own design. Unfortunately it never made it into mass production. According to the company, this failure to go into production can be attributed to the fact that the prototype came too late to break into the already

established market[46]. Other factors however should be considered, such as a relatively long period required to master the production of a completely new product at a time when the company also had to handle the mass production of an established license product. They also encountered numerous production problems, in particular in regard to the standard of tools and materials required, and then on top of this, the company made the decision to shift its focus away from heavier motorcycles and consequently there was a need to acquire completely new machinery. Finally, new technological solutions were also being introduced, such as hard chrome plating of aluminium cylinders, and as a result, the company was probably being over-stretched[47].

The little scooter was not their only attempt to develop a vehicle of their own design in the first half of the 1960's. Simultaneously, the company worked on a bicycle design with an auxiliary motor, which was planned to be the first such product in their range. The prototype **Mobi 1** was developed around a design by the French manufacturer Velosolex. The motor was mounted above the front wheel and power was delivered via a small ceramic roller by direct friction against the tyre. The company also planned a version of the **Mobi** with two rollers. However Tomos decided they were coming too late into the market with this vehicle and so, it too, was never mass-produced[48]. It should be pointed out that the **Velosolex** was one of the most popular powered bicycles of all time; they were manufactured in France between 1946 and 1988, in Hungary from 1988 to 2002 and they are still produced in China. It is estimated

[46] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, June, special edition, p 4.

[47] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, No. 10, p 3.

[48] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, June, special edition, p 4.

that more than 8 million units had been sold by 1999[49]. Thanks to the bicycle manufacturer Partizan in Subotica, who imported and assembled them from 1967[50], the **Velosolex** can be considered a domestic product in Yugoslavia during the 1960's and 70's. The **Mobi 1** prototype was however followed by the **Mobi 2** prototype in 1965. Its classic design, with a rear wheel powered via a centrifugal clutch and a chain, resembled the later and more well-known **Automatic**. But like its predecessor, the **Mobi 2** was never mass-produced because the company wasn't yet able to fully master the production of such a product[51].

With the **Mobi 2** the company abandoned for the time being the idea of developing a cycle with an auxiliary motor and focused on a successor to the popular **T 12**. Due to the difficulties and almost overwhelming challenges involved in the introduction of a completely new product (new technology, documentation, new tooling, etc.), the designers based their development work very much on the use of already applied, if slightly adapted, solutions using, where possible, components from the existing moped models (such as frames and fuel tank, etc.). In the design of this 'new generation' moped, most of their attention was given to the engine and transmission, which were developed anew. The new engine allowed various versions: with capacity from 1 to 6hp, direct or forced cooling, the choice of 3 to 5 gears (for the race version, there were 6). A special feature of the new transmission was the in-house solution of a foot-operated gear stick and reverse mechanism. This was developed by Erik Mihevc, Head of the Vehicle Development Department, and was presented by Tomos at an exhibition of patents

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[49] Based on Velosolex Technical information, http://www.velosolex.co.uk/technica.htm, last accessed 24.2.1999 and Solex Club of Canada and North America, http://www.freeyelow.com /members3/solexclub/index.html (last accessed 24.2.1999).

[50] Koštan Šime, *Usporedna analiza razvoja Jugoslovenske industrije za preradu metala, Drumska motorna vozila*, Foreign Trade Institute, Belgrade 1967, p 24.

[51] Idem.

and technical innovations at the 89th International Vienna Fair. This mechanism and the twist grip on the outboard motor's gas tank (the invention of Romeo Miloševič, head of the Engine and Generator Development Department) were both awarded the Grand Prix by the exhibition's international jury.

Although the company started detailed work in 1966 mass production only commenced in 1969[52]. Due to the inherited design of the frame, fuel tank, seat and legshield, the **Colibri 14 V** looked very much like its predecessor, the **T 12**. In addition to a new engine, the more attentive observer could however spot new front forks with a headlight, new wheels, a new design of front mudguard and a modified chain guard. The **Colibri 14 V** was followed by various versions and then a model with a better engine and direct cooling, the **T 15**. In the 1970's, both families of the new generation (**Colibri T 14 and T 15**) were also fitted with new tubular frames that finally visually interrupted the link back to the licensed **MS 50.**

Colibri T 14 (at the front) did not achieve the popularity of its predecessor, the Colibri T 12 (at the rear) (TMS photo collection).

It took the company some years to master the production of the new Colibri range although they were familiar with certain processes to a

[52] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1969, No. 73, p.4.

Avto, 1969, No. 4, p 10.

greater or lesser degree. During this period, moped production was still focused on the **Colibri T 12.** The launch of the new **Colibri 14 V** didn't yield anticipated sales results. The old **T 12** was still in great demand from customers because it was sold at a price that hadn't changed since February 1965. This was considerably lower than that of the new model. The procedure to gain approval for a higher price via the Federal Price Administration was time consuming, and it was not until 1971 that the **T 12** finally saw a price increase!

In the 1960's, the engine output of mopeds came close to that of motorcycles. Mopeds from the mid-1950's hardly came close to delivering 1.18kW (1.6hp) and had a maximum speed of around 50km/h, but their speed in the mid-1960's had increased to 80km/h. Tomos followed this trend with several improvements and new products. This was most probably one of the reasons that the Traffic Safety on Public Roads Act from 1965 put mopeds and motorcycles into the same category, and anticipated the adoption of new rules governing their registration. According to the Rules on Registration of Motor Vehicles and Trailers adopted in 1967[53], moped drivers could only drive their Colibris with their current driving licences until the end of 1967. Starting from 1968, they had to replace them with category A driving licences and register their vehicles. Only mopeds classified by law under 'cycles with auxiliary motors' were exempt from registration.[54,55] This new law gave a slight benefit to owners by licensing them to travel abroad, but brought great advantages to the State, in the form of compulsory insurance and

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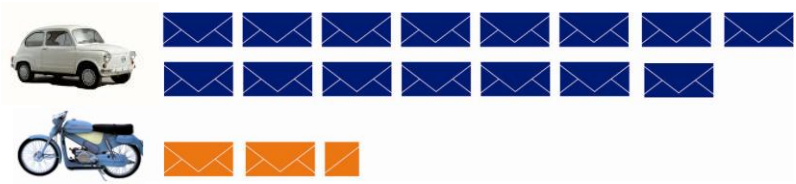
[53] *Official Gazette of the Socialist Republic of Yugoslavia*, 1967, No. 20.

[54] Pursuant to Article 10, Item 13 of the Traffic Safety on Public Roads Act (*Official Gazette of SFRY*, 1965, No. 14), a cycle with auxiliary motor was defined as a vehicle which has, in terms of manufacture and ability to move by human power, all the characteristics of a bicycle and is fitted with a motor whose capacity doesn't exceed 50cm3.

[55] Manual, *On Traffic Regulations* published in 1969 by AMZS Roadside Assistance, provides on pages 17 -18 a definition of a cycle with auxiliary motor emphasizing three basic characteristics: it is fitted with pedals to start and support the engine operation, engine capacity of up to 50cm3 and it can't develop over 40km/h on a straight road.

better control. However, the new regulations adversely affected those Tomos customers who were in the majority; i.e. farmers and low-paid workers. Due to the high cost of the driving test as well as the distances to the urban centres where the test could be taken, they now thought twice before acquiring a moped. According to the data on Tomos production, this new ruling did not significantly affect their production in the short term[56], but it did have an impact on their future development and production policy by promoting the development of cycles with auxiliary motors that didn't have to be registered. The increasing demand for Colibris that marked the first half of 1960's slowed down in the second half of the decade. This can be attributed to the new regulations as well as less favourable credit conditions and other economic measures that increased the price of products.



Comparison of the price of a Colibri T 12 moped and the Zastava 750 car according to the net wage in Slovenia in 1965/66.

Tomos temporarily abandoned the idea of their own in-house development of cycles with an auxiliary motor for the various reasons previously outlined, and instead decided to acquire engines and main components from other manufacturers and assemble them in their plant. In 1967 they signed a mutual supply contract with the Dutch motorcycle manufacturer Laura[57], with frames supplied by the

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[56] Based on the Overview of production 1963-69 and 1970-77 (data on the production of units provided by Tomos company), the annual production of mopeds from the motorcycle category still increased after 1966 (when it numbered 45,500 units). In 1969 it exceeded 50,000 units for the first time and started to decline only after 1970. From 1971 onwards, data on the units of production also included the new types of AO-S and AO-N which didn't require a driving licence.

[57] *20 Years of Tomos*, chapter 'Construction and Development', published by Tomos Motor Vehicle Factory, Koper, 1974.

Italian company Piraci. Tomos manufactured Laura cycles with auxiliary motors under the name of **Automatic**. They were produced in 23" and 20" frame sizes. This apparently favourable contract with Laura turned out to be quite the opposite. The demand for this type of vehicle in the domestic market was now enormous and the acquisition of components abroad was proving a considerable foreign exchange burden, whilst orders from the Dutch partner were falling, allegedly due to inaccurately specified quantities in the contract[58]. To compound their problems, the market niche for powered cycles was successfully being met by the Ljubljana-based bicycle manufacturer Rog, who launched the popular **Pony Express** fitted with exactly the same motor. With front and rear suspension and drum brakes, the **Automatic** was technically superior to all other competitors in the Yugoslav market (notably Rog's **Pony Express** and the **Velosolex** by Partizan) but it was also more expensive. Over the ensuing years the demand for these powered cycles increased and Rog became ever-more oriented towards this market niche. In 1969 Rog modernised their **Pony Express** by fitting it with Puch motors. The following year Tomos doubled the production of their **Automatic** (27,720 units) and Rog was also satisfied with increased sales of the **Pony Express** because demand was remaining high. Following an agreement with the Italian manufacturer Piaggio known for their Vespa scooters, Tomos catalogues from 1970-71 featured under the name **Tomos Automatic C** a popular Italian model, the **Piaggio Ciao,** however this was never seen on the local market.

Comparison of the price of an Automatic and the Zastava 750 according to average net wage in Slovenia in 1969.

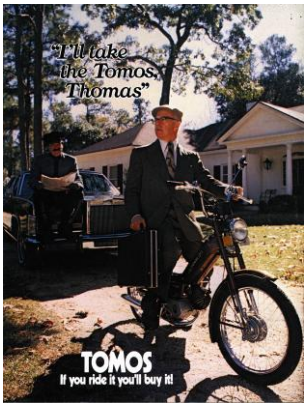
[58] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1973, No. 3-4, p 3.

The Tomos Automatic allowed anyone from 14 years of age onwards to be independent from public transport, facilitating excursions at the weekends, much to their colleagues' envy (TMS photo collection).

The company didn't manage to seize the market opportunities available, largely due to a development setback that arose as a direct consequence of an unfavourable contract with Laura[59]. In 1970, the technical documentation was finally prepared for the **A3**, which was a new version of the **Automatic** that had been designed in-house by Klement Vuga. Simple modifications to the engine allowed versions to be offered with one or two gears via an automatic transmission, as well as offering adaptation to the requirements and regulations of certain foreign markets. The **A3** saw the introduction of a new two-speed automatic gearbox with two centrifugal clutches that was designed by Tomos. Power was transmitted from the shaft via one of two pairs of sprockets (for first or second gear). The first clutch was engaged when the engine rpm increased upon starting the engine (first gear) whilst the second allowed the activation of second gear when the speed increased to between 15 and 25 km/h, depending on the version. The modern styling of the **A3** included a completely new frame manufactured from welded sheet metal, and which required a

[59] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1972, June, special edition, p 4.

series of new tools and technological equipment. As a consequence, the company decided to initially offer only a single-speed engine and temporarily assemble this around an adapted tubular frame from the older **Automatic** model. The result was the **Automatic 1** to be eventually followed by the **A3** in 1973 when a new production line with an automatic frame welding system was commissioned[60]. The **A3** was still included in the company's range at the start of the new millennium. The new **Colibri** launched in the late 1980's was supposed to be the successor to the **A3,** but eventually became its contemporary, such was the longevity of the older design. Some modernised versions of the **A3** were produced, including the **Targa LX** (based on the **Tomos TT Bullet**, which first appeared in 1986 for the USA market) and actually hide their origins very well.



Tomos also penetrated the USA market with the Automatic A3 (TMS photo collection).

Some modernised Automatic A3 versions, such as the Tomos TT Bullet produced for the USA market in 1986, hide their origins very well (TMS photo collection).

The increasing market demand for motor-assisted cycles and the change in regulations that saw 50cm3 motorcycles requiring a category A driving licence, lead the company to make a wise decision to adapt the latter vehicles so that they could be classed as 'cycles with motors'. The result was a new type of moped, the **A-OS** (fitted

[60] *20 Years of Tomos*, chapter: Construction and Development, published by Tomos Motor Vehicle Factory, Koper, 1974.

with the old Puch-design engine) and the **A-ON** (fitted with a new generation Tomos engine). This enabled the company to clear out the entire stock of **Colibri T14's** that had been in the warehouse for over six months[61]. The new **A-ON**, **A-OS** mopeds and their eventual successors (the **APN** range) again attracted customers from remote and upland areas that needed a more powerful moped than an **Automatic** but one that did not require the category A driving licence. Due to improved living standards in the early 1970's, the number of younger customers aged between 14 -20 increased and the **Automatic** as well as the **A-OS**, **A-ON** and **APN** ranges became particularly popular amongst this age group. They often re-tuned them in their garages to increase their power, which was not difficult given the universal design of the engine. Tomos also produced special versions of these mopeds aimed particularly towards the youth market, fitted with many accessories that served more fashionable rather than useful purposes. A good example is the **APN 4 Hippie** fitted with a high-rise handlebar, a seat with a backrest, plastic side panniers and a lot of chrome!

Young people in the 1970's became ever more important buyers of mopeds and motorcycles and special versions. Tomos APN 4 h (Hippie) or Tomos 15 SLH were aimed at this market (TMS photo collection).

These new mopeds increasingly became the principal products within the motorcycle range, however the company did still continue

[61] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1971, No. 6, p1.

to develop motorcycles with a smaller engine capacity. Considering the number of prototypes and new products launched in the late 60's and early 70's, the developments in this area were intensive. The 'new generation' engine provided a good basis for further development and extension of the motorcycle range. Tomos entered the market in the 1970's with three models fitted with Puch licensed engines (**Colibri T-03, T-12, T-13)** and the **Colibri 14V** fitted with their own design engine[62]). According to the company price list dated 20th January 1970, the **Colibri 14V** was already fitted with a better performance engine; at the presentation of this machine in 1969, the engine capacity was then rated at 2kW (2.7hp) with a top speed of 65km/h[63] whereas the 1970 model's capacity was 2.6kW (3.5hp) and the maximum speed 68km/h. In order to achieve this, the compression ratio was increased within the forced air-cooled engine (by a cooling fan mounted on a magnetic flywheel) and the carburettor was modified by means of a larger suction mouth and nozzle. The percentage of Puch-based engines used in the product range gradually decreased after 1970, and according to the 1973 catalogue, all the company's motorcycles and cycles with auxiliary motors (except the **Automatic NT** fitted with an Anker Laura engine) had the new generation engines. The successor to the **Colibri 14V** tested in 1971[64] had a new fuel tank that not only followed new fashion trends but also employed a new manufacturing method that enabled simpler, faster and more cost-efficient welding[65]. Tool boxes that previously hung on the rear fender were removed and these tools found a new place between the frame, seat

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[62] Tomos motor vehicle company Koper, Price list, data of 20th February 1970.

[63] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1969, No. 73, p 4.

Avto, 1969, No. 4, p 10.

[64] Tomos Colibri 14: Colibri 15, *Avto Magazin*, 1971, No. 22, p 40.

[65] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1979, No. 5, p 8.

and fuel tank. Almost at the same time the company launched the **Colibri 15** whose performance (engine capacity 3.9 kW/5.3hp and maximum speed 80km/h) was closer to that of standard motorcycles. The engine was based on the **Colibri 14** and had a direct cooling system, although the new and larger cooling ribs made it look somewhat different from the original. The **15** had stronger forks and shock absorbers as well as larger diameter brake drums. Whereas the **14** was four-speed, the **15** was fitted with a five-speed transmission. The 1973 catalogue listed the following features: **Colibri 14 TL** had an engine capacity of 3.21kW (4.2hp) and a maximum speed of 72km/h; **Colibri 15 SL** had an engine capacity of 4.4kW (6hp) and a maximum speed of 85km/h. Both **Colibri** variants had frames constructed from welded steel sheet. The hand-welded frame was the only component of the new motorcycles that was still based on the licensed Puch MS 50. In 1971, the Tomos Institute developed a new motorcycle with a tubular frame that would be cheaper to manufacture[66]. Its design would allow adaptation to all of the existing product range. With the exception of the **Cross 50 Junior** which already had a tubular frame but of a somewhat different design, all their motorcycles aimed at road usage were first fitted with such frames from 1974.[67,68] The **T14** and **T15** vehicles when fitted with tubular frames had a letter C in their name (for example 14 TL**C** or 15 SL**C**). In 1974 the company also announced the **15 Sprint**[69]**.** The most important innovation over the **T15** version, was the electronic high voltage thyristor ignition, however the new tubular frame and accessories (including imported Marzocchi front forks, improved rear shock absorber, better brakes, new instruments, fuel tank and direction indicators) made it look

[66] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1971, No. 6, p 5.

[67] Brochure of Tomos product range POT 1/74.

[68] *Avto Magazin*, 1974, No. 22, p 26-27.

[69] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory ,1974, No. 9-10, p 8, 12.

even more like a heavier motorcycle. Some **Sprint** versions manufactured for foreign markets were also fitted with front disc brakes.

Colibri successors, such as the T 15 SL (above) or the APN 4 (middle) were fitted with frames of the Puch MS 50 design until the early 1980's. At this time Tomos started to introduce tubular frames, as on the T 15 SLC (below) or Sprint models (TMS photo collection).

All of the above demonstrates a huge leap forward in engine capacity during the early 1970's. This is also borne out by a comparison between the Tomos-Puch **Galeb SR 150** scooter (engine capacity

147cm3) manufactured between 1955-1960 and the **15 SL** from over a decade later. They both deliver 4.4 kW (6hp) of power and offer a maximum speed of 85km/h. Even more illustrative of the development of the Tomos 50cm3 engine is the specific power output (horsepower per litre); the specific power of the **15 SL** or **Sprint** engine was 122hp.

The highest performance mass-produced Tomos motorcycles with an engine capacity of 50cm3 were from the **T15** range. When it comes to engine capacity these machines were only just behind the **Cross 50 Junior,** which was primarily intended for motocross competitions, although it was also accessorized for road use. The designer was Janez Imperl, who was also responsible for their racing motorcycles. The frame design illustrates an interesting example of the use of knowledge and experience acquired in racing competitions being applied to mass-produced motorcycles. Imperl re-designed the frame of the **Cross 50 Junior** and subsequently similar frames were adopted by their racing motorcycles from the mid-1970's onwards. The road and motocross racing competitions undoubtedly proved to be the harshest test for the frame which was – after being further tested and enhanced – used in the production of the **AT**, **ATX** and **BT** motorcycle range of the 1980's.

The engine of the **Cross 50 Junior** is an even better illustration of the advancement of their 50cm3 capacity engines. It is based around the engine of the new generation models, with an output of 5.5kW (7.5hp) at 7500 rpm and with the same bore and stroke. Tomos achieved this through a modification of the timing (the opening and closing of channels) and a larger main nozzle on the carburettor. The output of the successor to the **Junior**, the **Cross 50 Senior,** was 7.8kW (10.6hp) at 9800 rpm, though it should be noted that the **Senior** was exclusively a competition bike. The gearbox of the **Cross 50 Junior** was also slightly modified. According to the factory data, its maximum speed was about 80km/h and the steepest gradient it could tackle was 80%. By replacing the sprockets, the user could adapt it for off-road or road driving, where, with the proper

combination of sprockets, they could achieve a maximum speed of 110km/h. In the mass-produced examples, the **Cross 50 Junior** had a special feature: a fuel tank and a seat made of reinforced polyester that formed a single unit (Tomos used reinforced polyester in the manufacture of racing motorcycle frames in 1965 and for aerodynamic fairings even earlier). The first **Cross 50 Junior** motorcycles were made in small quantities from 1973, but mass production only commenced in 1976[70].

To complete the development overview of Tomos mass-produced motorcycles, mention should be made of their best performing in-house model, the **Tomos 90 Electronic,** which is interesting from another perspective. The design of its engine allowed the combination of two units in a pair, resulting in a two-cylinder engine of a larger capacity. In 1975, when the company announced the **90 Electronic**[71] at the Zagreb Fair, a motorcycle based around the same design but fitted with a two-cylinder engine built in a modular fashion with a capacity of 175cm3 was in the final stages of testing. The **Electronic's** engine was developed from the much-tested 50cm3 engine of the new generation dating from the late 1960s. By increasing bore and stroke they obtained a 90cm3 engine that, together with a larger carburettor, reached an output of 6.6kW (9hp) at 7500 rpm. The more powerful engine was mounted in an adapted tubular frame of a design similar to that of the **Sprint**. Both motorcycles looked very much alike. Unlike the **Sprint**, the **Electronic** had larger tyres (17") and an ignition switch. Despite a higher maximum speed of 104km/h, the **Electronic** was fitted with the same brakes as the **Sprint**. The production of both motorcycles ceased in 1979[72].

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[70] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1976, No. 12, p 1.

[71] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1975, No. 4-5, p 6.

[72] Based on inventories of production orders.

In the 1980's, Tomos produced the model CTX 80 with a larger than 50cm3 engine capacity (1988-1993). Other than the Tomos 90 Electronic, the CTX 80 was the only Tomos mass-produced motorcycle of this type designed in-house (TMS photo collection).

In the motorcycle range of 50cm3 or greater engine capacity, Tomos also manufactured the **CTX 80** (between 1988 and 1993). The **Tomos 90 Electronic** and **CTX 80** were the only mass-produced motorcycles of this category.

Tomos' own designed and manufactured engines were mounted on motorcycles from a number of European manufacturers. This is a photo of a Finnish motorcycle produced by Solifer (TMS photo collection).

3

Tomos and motorcycle road racing

In over 100 years of history, motorcycle racing has proved to be one of the best opportunities for the promotion of the quality and performance of a machine. During races, manufacturers test new and more advanced technical solutions and designs under the most extreme conditions, and the experience gained is often usefully applied to their mass-produced models.

The Colibri was a pioneer in road racing competitions in the power class of up to 50cm3. Vili Romih won the first race of said power class held in Portorož in 1959 on the machine seen here (TMS photo collection).

In the late 1950's, Tomos helped pave the way for 50cm^3 capacity motorcycles to achieve success in the world of motor sport, with

their racing machines winning several international competitions. Thanks to their victories in international road races at the transition into the 1960's, this previously unknown motorcycle manufacturer was soon a familiar name in Europe, and worldwide. Numerous innovative solutions seen on their own racing machines, soon gained respect for the marque. Tomos participated in road racing from 1959 onwards – when the 50cm3 capacity racing motorcycles participated in solely national level competitions, whilst the various manufacturers tried to persuade the International Motorcycle Association to accept this category into the race calendar for the European and World Championships. This happened in 1962, and continued until 1983, when the International Motorcycle Association cancelled this category in the World Championships. During this period, Tomos developed a series of racing machines of which most could be considered unique specimens. For this reason it is impossible to list all variations of their road racing motorcycles, but we can classify them roughly into about 10 generations that will be introduced further in the text.

Colibri special, and D5 – the first international winners

In 1959, Tomos developed from the production Colibri (a license-built Puch MS 50) their first racing motorcycle, which that very same year won international races held in Portorož. It clearly differed from the production Colibri in having lower handlebars, an oblong fuel tank, a sport seat, and a specially adapted exhaust. It was fitted with manual three-stage gears, with the gear handle mounted directly on the changing shaft. Although there wasn't a visible difference between the serial production and racing engine, the alterations to this aspect contributed the most to its success in the races. The highest engine output was 3.7kW (5hp), twice that of the production Colibri. The maximum speed on the level was 95km/h.

Encouraged by this first success in the field of motorsport the experts at Tomos engaged in a planned development of racing motorcycles. In September 1960, the Tomos team participated for the first time in a race abroad, and decided to test its new 50cm3

machine on the last race of the Moto-Cup series in Hockenheim (Germany). The winner, beating 32 competitors and five other marques, was Heinrich Rosenbusch with a Tomos Colibri Special[73], which was a great surprise. Rosenbusch also set a track record for this category of 113.1km/h. Due to its number of gears, the 'winner' at Hockenheim was called the D5, and it represented the second generation of Tomos racing motorcycles. The most visible changes to the engine were a special carburettor, battery ignition and an open cylinder or motor head that was needed because of the special non-forced cooling, which was not the case with the Colibri and other competition 50 cm3 racing mopeds. In less than a year, as the race at Hockenheim counted as an international cup according to the International Motorcycle Federation (FIM), the improved Tomos D5 won yet again – only this time ridden by the Slovene, Miro Zelnik.

The winner of the Hockenheim European cup road racing competition in the power class up to 50cm3 was the Slovene Miro Zelnik on a Tomos racing motorbike (TMS photo collection).

[73] The so-called "Tomos Specials" were the most effective racing motorbikes, in contrast to the serial production machines, and were usually produced in very small numbers and intended only as factory racers. These racing bikes (except the serial ones) did not have any official names, but the Tomos race team, for internal requirements, named them either according to their number of gears (for example, D5, D6, etc.), or after the public presentation after a specific race season (GP 75, etc.).

Tomos D7 set to storm the World Championship title

In 1962 the FIM officially accepted motorcycles with an engine capacity up to 50cm3 into the calendar of world road racing championships. The Tomos team had prepared for this season with a new competitive machine that right from the start was considered one of the favourites. It had no component parts from the licensed Puch MS 50. The most important components of the new racing motorcycle, such as the frame and engine, were fully developed in-house by Tomos. The new frame was longer and tubular, making it lighter and more rigid. In terms of design, the engine was an original among the rivals. Looking from atop it was designed asymmetrically, as the left side of the motor shaft was very short. In a special housing there was a small oil pump, that oiled the bearings. It was fuelled with petrol. The piston had no rings, which offered more possibilities in the designing of open channels, although they also only lasted for 3-4 races. The engine was air-cooled. It offered around 7kW (10hp) power, which was at that time at the absolute top end of the smallest racing machines.

The D 7 was made to win the company their first World Championship title but in the first race in Barcelona in 1962 its major downfall – the transmission – cost it a high ranking. Whilst on the flat parts of the racing track the Tomos was faster than its rivals (Kreidler, Honda, Suzuki), difficulties with the transmission stopped their rider Parlotti from being ranked better than ninth. At the following World Championship race in Clermont, Rajko Piciga with the Tomos D 7 also crossed the finish line ninth. Although after solving the transmission issues it was felt the D 7 could still be competitive, Tomos decided to withdraw it from the World Championships.

In 1969 and 1970, the Italian Gilberto Parlotti won the Italian title in his power class with a Tomos (photo Rajko Krašna, TMS photo collection).

The production D 5 to popularise motor sport

Because of the great interest in 50cm3 racing motorcycles both at home and abroad, Tomos decided to launch into mass production a somewhat 'simplified' second generation racing motorcycle, the D 5. In 1962, they produced the first trial series and slightly upgraded it again in 1964. The production racing bike, the D 5S was based on an adapted Puch MS 50. In 1965, despite improvements and occasional good performances in races, it still wasn't fully competitive with the machines from Kreidler, Suzuki or Honda. Its major advantage however was its reliability, which was a result of tried and tested technical solutions and component parts initially used for the production Colibri (Puch MS 50). This advantage was best shown in the race for the Netherlands National Championship in 1965, where the German-built Kreidler was considered a favourite. The engines of the Kreidler motorcycles several times seized up, and two of them even burnt out during the race, and so Tomos, in addition to winning the Netherlands championship, was also placed second and fifth. The series production of racing motorcycles contributed enormously to the popularity of motorbike racing in Yugoslavia, with Tomos consecutively winning national championship titles in the category up to 50 cm3 between 1962 and 1974.

D 9 – the lightest among the smallest of racing motorcycles

In 1965[74] Tomos developed a new racing motorbike for a comeback into the world's top racing competitions. This was called the D 9 because of the number of gears. Due to a very light frame (made of reinforced polyester) as well as other technical solutions, such as light mechanical disc brakes with an inner grasp (Tomos patent), the motorcycle weighed only 38kg. The Tomos designers wanted to compensate for a modest engine output (8.1KW (11hp) at 14,000 rpm, air-cooled engine) with a lower weight. The D 9 was also the first Tomos racing motorcycle fuelled through the carburettor with the help of a rotating disc of a design like that other competitors had used for years.

The first races quickly showed that the engine overheated and would require the replacement of air-cooling with a water-cooling system. In 1967, the designer of Tomos racing motorcycles, Janez Imperl made some improvements to the D 9[75] engine and many of its weaknesses were eliminated. Unfortunately any further improvement plans were stopped by new rules introduced by FIM. The international motorcycling association set the lowest permissible weight of motorcycles at 60kg and the maximum number of gears at six. In line with the decision of the international motorcycling association, Tomos developed for the 1969 season a whole new racing motorcycle intended to be mass-produced and set to replace the series production D 5S. It was named the D 6 after the number of gears. With a remodelled frame of Puch design, and a

[74] The production year is found in the publication *25 years of Tomos*, which was published in 1979 by the advertising department of Tomos, and also in the development study of Tomos race motorcycles written by Josip Vlahović M.Sc. It is most likely that they made only the first prototype that year, which was later improved (it is also mentioned in the article: *10 years of successful work by Janez Imperl* in the TOMOS Journal, 1965, No. 34). The racer Janko Štefe presented it to the European public in 1967 at Hockenheim (TOMOS Journal, 1967, No. 56).

[75] Avto, 1976, No. 10, p 36.

Tomos "new generation" engine this was to become one of the most successful of the company's racing machines of all time.

The model D 6 Special was designed for factory racing, whereas the D 6 Serial was intended for clubs and private individuals. Its design included some tried and tested solutions, such as a metal sheet frame (Puch design), a new engine adapted from the mass production 'new generation' version, petrol suction into the cylinder, drum brakes, etc. The engine was fitted with one cylinder, piston, head and exhaust pipe of a special design and had a power output of 7.7kW (10hp) at 10,000 rpm. In 1968, the Tomos team raced it at the Yugoslavian National Championships and the following year at the World Championship. At the start of the season, the D 6 was among the best, but eventually lagged behind its rivals. After two races, Gilberto Parlotti held third place in the World Championship but before the Grand Prix of Czechoslovakia in July he dropped down to sixth place.

In 1970, the Tomos team participated in five races that counted towards the World Motorcycle Championship in the category of up to 50cm3. In the first race at the NÜRBURGRING (Germany) Parlotti was third and at the second in Assen (Netherlands) he was sixth. The Tomos machines had engine issues that affected their performance over the rest of the season. Nevertheless, Parlotti won two consecutive races for the Italian National title (1969 and 1970). In 1970, Tomos also won the National Championship titles in road racing in Sweden and Finland. Despite occasional international success, Tomos didn't have a sufficiently competitive racing machine that could get to the very top of the World Championships, although they had an excellent racer in Parlotti. They hoped their new D 6 they were working on at the time would reclaim their position among the world's best.

The new D 6 with the reinforced polyester frame

Unlike its predecessor, the new D 6 (GP 71 for the season 1971/72) was fitted with a new, narrow streamlined frame made of reinforced

polyester which also included a fuel tank (like the D 9 from 1965). The capacity of the water-cooled engine was 10.3kW (14hp) at 14,000 rpm[76] (according to some data even 11.4 kW (15.5hp) at 15,500 rpm[77]). With a thinner frame and shorter steering hidden behind the aerodynamic fairing, the racing machine had a smaller frontal area by a margin of 18.7% and consequently, lower air resistance. Despite all these improvements the new D 6 did not fulfil expectations. It participated in the race in Austria, where Parlotti had an engine defect.

Instead of further improving the new D 6, Tomos decided to develop a wholly new racing motorcycle of a similar design, but ergonomically fully adapted to suit Parlotti. The racing machine was very low and in its design a lot of attention was paid to reducing air resistance. The frontal area of 0.303m^2 was nearly 3% less than on the D 6 and the engine capacity[78] was closer to that of the other rival competition bikes. Tragically, Parlotti lost his life in the TT race on the Island of Man and so the GP 71 didn't get chance to try and level with the competition. In addition, despite a new racing motorcycle, the DMS (GP 75), Tomos lost the Yugoslav championship title after thirteen years to the German Kreidler. In 1978 Tomos regained the title with Zoran Kristić.

In the first half of the 1970's, Tomos participated in Yugoslav National Championship races with the D 6 (model 1969/70) until the company developed a new racing machine, the GP 75 or DMS as it was more often called. Its tubular frame design was very similar to

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[76] Data from the publication *25 years of Tomos*, published in 1979 by the advertising department of Tomos.

[77] Data from the publication *25 years of Tomos*, published in 1979 by the advertising department of Tomos, and out of the development study of Tomos race motorcycles of the author Josip Vlahović M.Sc.

[78] Example for the most successful racing motorcycles from 1969, namely: Derbi 50 – 15,5 hp at 14.500 rpm and Kreidler Van Veen 50 –15,5 hp at 14.500 rpm.

that of the Cross 50 Junior. The fuel tank and seat of reinforced polyester were made in one piece. The front brakes were hydraulic discs and it had rear drum brakes. The racing motorcycles were also produced in a small production series featuring engine improvements. The first samples of this racing bike were fitted with a water-cooled engine and classic petrol suction. The engine output was about 10.3kW (14hp) at 13,500 rpm, the maximum speed about 160km/h[79].

The next Tomos "special" was the GP 77 of a similar design. The main difference from its predecessor was the engine, the steering with a rotating disc and some other improvements. Its output was 11.8kW (16hp) at 15,000 rpm, which should have delivered a maximum speed of 170km/h. According to data on racing motorcycles[80] presented to public by Tomos, in comparison with its competitors, the Italian racing machine Morbidelli had a similar capacity as the Tomos, whilst the Kreidler and Butalco machines both surpassed them by 4.4kW (6hp)[81].

Comeback to the world top with GP 78/79

In the second half of 1978, when the most important Yugoslavian motorcycle races for the Grand Prix of Yugoslavia were for the first time held at the new racing track in Grobnik near Rijeka, Tomos presented a new racing motorcycle with (just as with the D 9 and D 6/GP 71 before) a light frame made of reinforced polyester. It was obvious at first sight that with this new GP 78, as it was called, the

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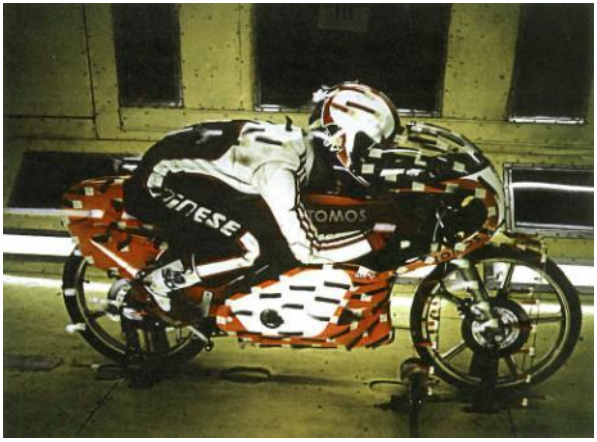
[79] Data from the publication *25 years of Tomos*, published in 1979 by the advertising department of Tomos, and out of the development study of Tomos race motorcycles of the author. Josip Vlahović.M.Sc

[80] Data of capacities was a factory secret; their overestimations or underestimations can be deliberately used by the factories.

[81] The data was from the article published in the journal *SAM: the fastest motorcycles of the world*, SAM, 1977, No. 10, p. 928-930

Tomos designers had paid a lot of attention to the reduction of air resistance. For this purpose they applied an innovative engine cooling system: instead of a large radiator in the centre, they fitted the engine with two smaller radiators at each side. Other important improvements included the front forks and rear shock absorbers, disc brakes made of a light casting and sprayed molybdenum, and rims made of cast magnesium. The new GP 78 didn't cross the finish line at the Grand Prix of Yugoslavia in 1978 due to a defect with the exhaust pipe. In 1979 the aerodynamics were tested in the wind tunnel of the Institute of Faculty of Mechanical Engineering in Belgrade at speeds up to 170 km/h. The results of the research were published by its author, Josip Vlahović M.Sc. in several technical publications[82].



*Testing and optimising the aerodynamics of the Tomos GP 79 in a wind tunnel at the Faculty of Mechanical Engineering in Belgrade (Picture from the collection of Josip Vlahović, researcher and author).*Special attention was paid to the aerodynamics of the wheels and they studied the impact

[82] More about:

- J. Vlahović, D. Janković, I. Umer: Ispitivanje aerodinamičkih karakteristika GP motocikla Tomos, Jugoslovensko društvo za motore i vozila, Nauka i motorna vozila "81", Saopštenja III, 11. – 14. Maj 1981, Kragujevac.

- Mr. Josip Vlahović: Prilog izučavanju aerodinamike motocikla, Jugoslovensko društvo za motore i vozila, Zbornik saopćenja, Nauka i motorna vozila "83", 25 – 28 April 1983, Opatija.

of other accessories that would further improve the overall aerodynamics, (the driver's helmet, front mudguard, spoiler with front forks, the rear part of the seat, etc.) as well considering the engine cooling system. With the aerodynamic design to these particular details they managed to reduce the resistance by up to 22%[83]. Some improvements (such as the back part of the seat) allowed the GP 79 to reach during testing at Grobnik airfield a maximum speed of about 200 km/h,[84] which was above the permissible racing speed.

According to the racer Zdravko Matulja, while testing at the Grobnik sports airfield near Rijeka, the GP 79 achieved 204km/h. This picture is from collection of Zdravko Matulja, who raced and later became European champion on this type of motorcycle.

All the efforts invested in improvements bore fruit in 1982 when Zdravko Matulja won the European championship title in the category of 50cm3. At the time, Tomos officially no longer participated in races but in 1982-83 the company provided Matulja[85] with financial and material support. In 1983 a Tomos racing

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83 J. Vlahović, D. Janković, I. Umer, p. 48.

84 Data from racer Zdravko Matulje, who in 1979 tested this motorcycle.

85 *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1982, No. 8, p 7;

statement of Zdravko Matulja for *Avto magazin* (1983, No.12, p 17)

motorcycle came again very close to the rivals in the same category[86]. The 1983 season was also the last one to include 50cm3 motorcycles[87] in the World Championships.

In the final seasons of road racing competitions in the power class up to 50cm3, Zdravko Matulja was very successful internationally (TMS photo collection).

Although Tomos recorded excellent results in road racing competitions, it should also be pointed out that the company's Cross 50 Junior and Senior machines took part in many motocross competitions in the 1970's and significantly contributed to the popularisation of this sport, in particular amongst the younger generations. Further to this, Tomos also supported speedway racing with serial production models as well as other events as a good way of promoting and popularising the brand.

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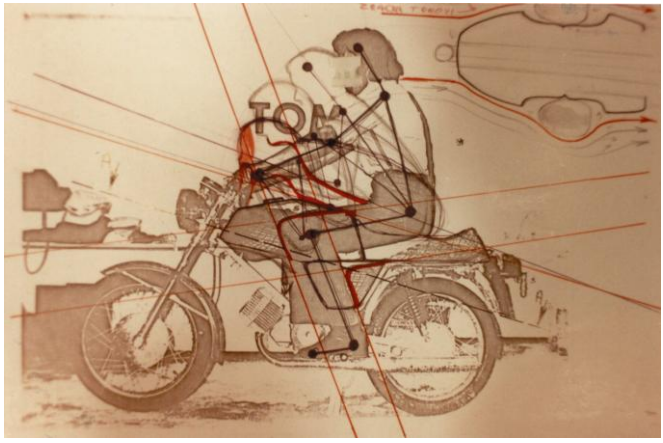
86 This provided the 4th place at the Grand Prix of Yugoslavia, which was counted as a world championship, and the training results at some other races in the same year (Italy, France).

87 In 1984 the international motorcycle association introduced among the races for the world championship instead of the old a new category of motorcycles with cubic capacity up to 80cc.

4

The collection of motorcycle prototypes



Study of the ergonomics of riding position and rider contact surfaces on the T 175 motorcycle from 1974[88] (private archive of author Igor Rosa).

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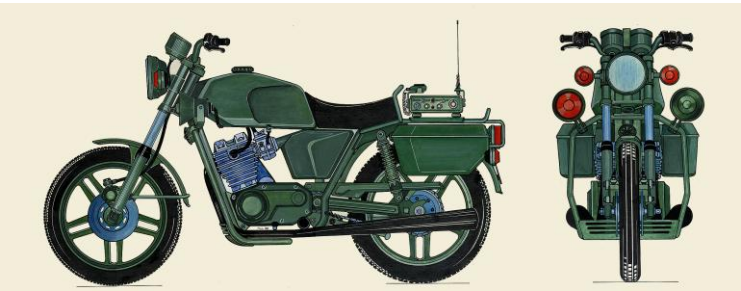
[88] *Author's comment: "It should be noted that the ergonomic study of riding position and the points of contact between driver and the motorcycle ('the drawing') were conducted using a three-dimensional form in clay and illustrated in other drawings, and had a decisive influence both on the design as well as the marketing success of later models that remained in production until today: the ATX 50 (BT 50) in production since 1984-85; the Tomos "Top-tank" (Targa) designed in 1985 (fuel tank, seat) in production since 1986 or the BT 50-N (Austria) designed in 1988 and in production ever since.*

Tomos started its own in-house development in the early years of the company when they created the Department for Product Development, Design and Research (RKR). In 1962, the RKR grew into the Tomos Institute, which took over the development and design of all new products, the production of prototypes, technical measurements, systems and product testing, development technology, patents, documentation and information services as well as other activities required to ensure that the product met market expectations in terms of styling, usage, economy, quality and price.



Drawing of the Tomos 350 Military version, made in 1978 when Tomos 175 motorcycles were already supposed to be on the open market (Drawing by Viktor Jakomin, original held by TMS).

The Tomos Institute produced a great number of patents, original solutions and new products, although several of them for various reasons never passed the prototype stage. In addition to difficulties in terms of technology, further development was sometimes abandoned due to changing market conditions or a deterioration in the economic situation which consequently rendered the design out-dated by the time the situation improved. Certain prototypes and technical solutions were only produced as studies or for research. It is interesting that over 50% of their effort and resources were invested in the development of products that never made it into mass production[89]. In addition to the **Mobi 1** and **Mobi 2** that have already been discussed, the Technical Museum of Slovenia gained custody in 1998 of some other prototypes that were never mass produced. The motorcycle **T175** with an engine capacity of 174cm3

[89] Study (see note 31), p 6.

was developed in the mid-1970's, and probably came the closest to going into mass production. At the same time the **T175** was also the first Tomos motorcycle to be fitted with a twin-cylinder engine. It was developed in two versions: the **T175 Touring** and **T175 Sport**. They had different accessories and engine output: the touring version offering 13.7kW (18.6hp) and the sport version 16.2kW (22hp). What was especially interesting was the engine built in a modular fashion (increasing the engine capacity by adding another cylinder) and with a compound main shaft that would reduce the cost of production. The two-cylinder engine was developed around that of the **T90 Electronic**. The prototype **T175**s were produced in 1975-76 and displayed at the Car Show in Belgrade in 1977[90]. During that period, their introduction into mass production was supposed to be just a matter of time because the technology and most of tools were already prepared. It is now known that the company were also working on a design of a 350cm3 engine. The Yugoslav army was modernizing its vehicle fleet and showed interest in the new model and it was planned to be manufactured both in military and civilian versions which – the same as with the **T175** – anticipated the production of several variants. The main components of the motorcycle, such as frame and engine, were also based on the design of the **T175,** which was then at the prototype stage. The decision to mass-produce a motorcycle with the larger engine capacity was revoked in 1980 (a year after Tomos generated a loss). In line with the recovery programme implemented that same year, the company would discontinue the production of larger capacity motorcycles including the **90 Electronic** because it could not cover the cost price[91]. These motorcycles were to be launched on to the Yugoslav market in cooperation with foreign partners (more about

[90] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1977, No. 9, p 15.

[91] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1980, No. 4, p 1.

the contract with the Czech company Jawa at the end of this chapter). Hence the **T175** that was so eagerly anticipated by the public ended as just a prototype, whilst the **T350** that the public didn't know anything about, stopped on the drafting table. Similar things happened to the range of larger capacity outboard engines.

A variant the Colibri 'new look' with the working title A9 (from 1986) by Tomos designer Igor Rosa (Private collection of Igor Rosa).

At the same time that *Tomos* planned to penetrate the market of larger capacity motorcycles, the company also developed the next generation of cycles with motors. Unfortunately, they also didn't make it to mass production and the prototype of one of them **–** the **A9 –** is now in the custody of the Technical Museum of Slovenia. The successor of the **A3** that bears the name of the first *Tomos* mopeds and motorcycles (Colibri) was only presented a decade later. The final product was designed by the Italian studio Giorgetto Giugiaro. Tomos' own designer Igor Rosa who designed one of the Colibri's predecessors (**A9**) also presented his vision for a new motorcycle.

Prototype bicycle with auxiliary motor developed by Erik Mihevc in the early 1980's. The image shows some interesting technical solutions, especially the arrangement of motor, exhaust, rear spring fork, wheel with a belt over the rim and a variator belt mounted on the lower part of the frame and supported with a central rubber shock absorber at the rear. (Image from collection of Josip Vlahović, who designed the rear suspension.) (TMS photo collection).

The scooter **TI 1** and **A4** prototypes were basically developed as study versions of city motorcycles in order to research and monitor driving characteristics. The objective of the first prototype was an environmental-friendly motorcycle for short city rides where the speed and range of the vehicle weren't a primary concern. It was powered by an electric motor and the electric energy was accumulated in two 12V batteries with a capacity of 35Ah. The **A4** scooter powered by a two-cylinder internal combustion engine would also be intended for short city rides. To provide as smooth and silent engine running as possible, the designers fitted it exclusively with belt drives. They also worked on a study for a two-seat passenger motor-powered tricycle with a cabin, under the name of **Triko**. According to the traffic regulations it would fit in the category of cycles with a motor, while in terms of use it would be a type of city car for two persons. It was powered by an adapted new generation engine (the same as in the APN), with a maximum speed of 50km/h.

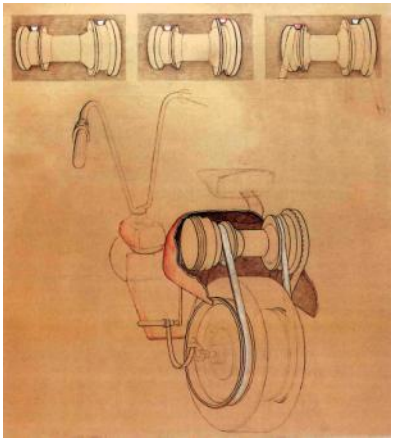


Illustration of V-belt transmission of the A4 scooter prototype designed by Erik Mihevc, whose provision of driving belts to the rear wheel was patented (Original held by TMS, drawing by France Aleksandra).

In addition to this in-house development of motorcycles, it is interesting to note the company's collaboration with other European manufacturers. With the exception of their cooperation with Steyr-Daimler-Puch and the Italian Moto Guzzi which was limited to cargo tricycles Tomos made their first attempt at licensed manufacturing in the early 1970's when heavy motorcycles regained popularity in Europe. The company contacted the London-based motorcycle manufacturer Norton Villiers and the two companies co-presented the **Tomos-Norton TN 750 Fastback** to the Yugoslav market. Following an advertising campaign[92] and its presentation at the Belgrade Car Show in 1970, production was discontinued after just a test series of 3 units in 1970 and 12 units a year later[93]. This was the only attempt to penetrate the larger capacity motorcycle market. That same year they commenced collaboration with the famous Italian scooter manufacturer Piaggio. The company intended to offer delivery tricycles to the Yugoslav market, a small tractor known as the **T-111**[94], the popular **Vespa** scooters[95] plus cycles with auxiliary

[92] Example: *Avto magazine*, No. 9, 1970, p 18.

[93] Overview of production 1970-77, motorcycles, data on units of production provided by Tomos company.

[94] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1970, No. 6-7, p 1.

motors called **Ciao**[96]. Of all these anticipated models, only the delivery tricycles, the **Tomos 550 MP** and **Ape Car 600** were sold in appreciable quantities. In 1980, Tomos signed a contract for collaboration and mutual exchange with the Czech company Jawa. Tomos was supposed to import about 6,000 **Jawa 350** motorcycles and fit them with modern accessories for the Yugoslav market and in exchange export to Czechoslovakia 6,000 motorcycles of the **14 TL** in **15 SLC** series. This collaboration was never realized. In 1988, the company signed a contract with the Italian motorcycle manufacturer Cagiva and became its official distributer in the Yugoslav market.

The Tomos-Norton TN 750 fastback was the company's most powerful motorcycle (TMS photo collection).

[95] Photo of Vespa with Tomos logo held in TMS photo collection.

[96] Brochure of Tomos product range held in TMS TOMOS collection.

5

Conclusion

An overview of the Slovenian motorcycle industry at the threshold of the new millennium illustrates that only *Group Tomos* – which following the bankruptcy in 1989 of *Tomos* became the new owner – is still manufacturing motorcycles that are fully the result of in-house development.

Throughout its history, characterised by intensive R&D, *Tomos* met both successes and failures, rises and falls. In addition to the achievements that form the main subject of the permanent exhibition in the Technical Museum of Slovenia, it should also be noted that *Tomos* was a successful international company. To facilitate the launch of their products, they founded joint-ventures with foreign enterprises, such as Tomos-Nederland (1965), Tomos-Ghana (1971) and Tomos-Gorizia (1980)[97]. In 1974 the company exported its products to 32 countries in Europe, North and South America, Asia, Africa and Australia[98]. In 1984, the total number of countries reached by their products to rose again by 10[99].

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[97] *TOMOS*, Tomos Koper Workers Journal, 1984, No. 12, p 6.

[98] *20 Years of Tomos*, chapter 'Tomos on all the Continents', published by Tomos Motor Vehicle Factory, Koper, 1974.

[99] In addition to the countries listed in the publication *20 Years of Tomos* (see note 82), there are also the countries mentioned in the Tomos journal (see note 81).

The global percentage of Tomos production in 1983 was claimed to be as follows[100]:

- outboard engines: 2% do 2.5%
- stationary engine up to 7.4kW (10hp): 0.6%
- motorcycles of up to 80cm3 capacity: 2.2%
- total motorcycles: 1%
- percentage of other products is negligible.

In 1983, Tomos was ranked between third and fourth place[101] among European manufacturers of motorcycles with the engine capacity up to 80cm3, whilst in regard to marine outboard engine production, it was number one in Europe[102].

According to the study entitled 'Long-term Development Orientation of Tomos Koper' (1983), the company first generated a loss in 1972. This was supposed to be the result of the disproportion between the growth of the selling and purchase price, as well as the result of certain business decisions that proved an excessive financial burden on the company (that year the construction works in Senožeče and Buzet were completed)[103]. The recovery loan offered was mainly spent on settling the liabilities to Citroen. The losses recorded from 1976 could be attributed to the same reasons. The majority of the recovery measures were never implemented however. The number of employees increased but productivity declined and in 1979 the company generated a loss for a third time. Only some short-term recovery measures were implemented, whilst most of reasons for the previous losses were not eliminated. Further to this, a wide product range and relatively small production series would push the company in 1982 in a difficult economic situation for the fourth time

[100] Study (see note 31), p 24.

[101] Study (see note 31), p 28.

[102] Study (see note 31), p 28.

[103] Study (see note 31), p 3, 4.

in its history[104]. Due to insufficient foreign currency resources for the acquisition of materials and components, the company was unable to operate normally. In addition, exports were in decline since 1976 and the company's export capacity was low[105]. In 1982, export sales could only cover one third of the total foreign currency requirements[106]. According to the company, this could be attributed to the fact that the factory and the models being made were technologically out dated[107]. The overly wide product range[108] that was technically and market-wise spread thinly[109] and the small series of products, all added to their problems. By the 1980's Tomos faced overwhelming difficulties, which eventually led to bankruptcy in 1989. In 1991 the company was acquired by their largest creditor, Splošna Banka Koper, and a new holding company GROUP TOMOS was founded, which through its subsidiaries continued the same product range. In 1994 the Swedish company Husqvarna, which established its own factory in Koper, took over the production of the chainsaw range. The tradition of motorcycle manufacture is now maintained by the company PROMO d.o.o.

Alussuise Lonza Group is the majority shareholder of Alusuisse Tomos (former STAMO d.o.o. that manufactured stationary engines) and they mainly produce aluminium components for the European

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[104] Study (see note 31), p 5, 6.

[105] Study, (see note 31), p 5, 8.

[106] Study (see note 31), p 5.

[107] According to the Study (see note 31), page 6, the book value of the equipment written off in 1983 amounted to over 90%.

[108] According to the Study (see note 31), page 6, the company's recovery programme was focused on the extension of the product range rather than a reduction of production costs.

[109] Study (see note 31), p.5.

car industry. Tomos Netherlands assembles and distributes mopeds within the European Union. The main clients for Tomos components are the European motor vehicle industry, and the demand is largely for the smaller stationary engines and chainsaws. In 1999, GROUP TOMOS had 50 after-sales services, with 5 representatives in Slovenia and 12 offices abroad (Netherlands, Italy, Australia, Iran, Croatia and other countries of ex-Yugoslavia). In 1998, the companies forming the TOMOS Group had 650 employees, of which 470 were in PROMO d.o.o. and 35 in Tomos Netherlands. The personnel in Alusuisse Tomos amounted to 140. A review of research and development work undertaken in 1999, was part of the recognition of the company's 45th anniversary, and the 40th anniversary of production within the new plant. A story that started in the second half of the 1950's and then via a number of new solutions, products, prototypes and patents, culminated in 1960s and 1970s[110]. It is fair to say that the crisis in 1979/80 was a milestone in R&D work. In the 1980's the company modernized the total range of motorcycles that could – both in terms of styling as well as performance – compare with world competition. Special attention was paid to reduce noise and pollutants in the engine exhaust, to the driver's position and thought given to modern styling. The first in a new 1980's range was the **APN 6** (successor of the popular APN 4) launched at the Zagreb Fair in 1981. The most important innovation was new in-house designed sheet metal frame that replaced the old Puch one. 1983 saw the **AT 50** motorcycle launched[111]. The design of the frame and engine was based on models from the 1960's (the new generation engine) and the 1970's the frame of the Cross (50 Junior), so considering the time needed to

[110] My argument is supported by the material available at the museum, the contributions in the company journal *TOMOS* and other periodicals, as well as the review of publications in the COBISS database. In order to have a complete picture, the research papers and projects issued by the Tomos Institute in 1980's should also be reviewed.

[111] *TOMOS*, Journal of Labour Collective of Tomos Koper Motorcycle Factory, 1983, No. 9, p 5.

master the production of a new product we can come to the conclusion that both of these motorcycles that were launched in the early 1980's further testify to the fact that Tomos R&D had actually reached its peak in the 60's and 70's.

The 1998 Tomos catalogue[112] includes different versions of the **Automatic 3** (with new names) and the **ATX 50C** (manufactured since 1984, and a version of a cycle with motor from the AT/BT 50 range), two versions of the **APN 6**, a new **Colibri** (manufactured since 1988) and the **TX 50** (a moped for children designed by Toni Rifelj). This catalogue also features motor pumps fitted with two- or four-stroke engines and two outboard motors. The production of the latter ceased in 1999, whilst the **Flexer** now joined the range. Its engine was based on the Automatic's and was adapted in order to fall within the category of cycles with auxiliary motors. The frame took the design of a single-tube (a tube of a larger diameter also incorporated a fuel tank) and anticipated the **A11** prototype of 1982[113].

At the end of the millennium, *Tomos* is ever more oriented towards the manufacture of components for the European motor vehicle industry whilst preserving within its product range 'cycles with motors' that are the result of years of research and design investment. It is impossible to say what the future will bring, but at present scooters not manufactured by *Tomos* seem to gain in popularity. Whether *Tomos* will decide to collaborate again with foreign partners, modernize the existing range or take bold decisions similar

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[112] *Tomos svoboda gibanja* [Tomos Freedom of Movement], 1988 range, 12/1997.

[113] The year is written on a picture of this prototype in the brochure for a solo exhibition of former Tomos designer Igor Rosa held between 19th May and 19th June 1992 in the winter garden of Plečnik House, Ljubljana.

to that made in 1980, will depend on many factors. One of the most important is consumer demand, and the positioning of our local company amidst a flood of famous Italian and Japanese marques. The numerous websites dedicated to *Tomos* are an indication that there is considerable recognition of the brand abroad – which perhaps offers some hope. May this collection, which testifies to the extensive innovation and developmental accomplishments within the Slovene motorcycle industry, be our tribute to the engineers, designers and many others who took the name of *Tomos* all around the world.

Appendix of Tables

TOMOS MOTORCYCLES AND SCOOTERS FROM COOPERATION

	Tomos Puch 250 SG, SGA SGS, SGSA	**Tomos Puch 175 SV SVS**	**Tomos Puch RL 125 Galeb**	**Tomos Puch SR / SRA 150 Galeb**
Year	1957	1957	1957	1958
Engine capacity (cm^3)	248	172	121	147
Bore and stroke (mm)	45 x 78 (two-stroke, single cylinder)	42 x 62 (two-stroke, single cylinder)	52 x 57	57 x 57
Engine output: kW/min^{-1} (KM/min^{-1})	**SG, SGA**: 13.8 KM/5400 **SGS, SGSA:** 16.5 KM/5800	**SV**: 10 KM/5800 **SVS:** 12.3 KM/6200	5.1 KM/5100	6 KM/5500
Cooling	air, circulation	air, circulation	air, forced	air, forced
Transmission	four-speed, foot-operated	four-speed, foot-operated	three-speed, hand-operated	three-speed, hand-operated
Ignition	battery, 6V/45/60W	battery, 6V/40/50W	battery, 6V/30W	battery, 6V/30W
Breaks front / rear	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum
Frame	welded steel-sheet	welded steel-sheet	tubular	tubular
Tyre size	16" x 3.5 "	16" x 3.25 "	12" x 3.25 "	12" x 3.25 "
Fuel consumption (l/100)	**SG, SGA:** 3.1 **SGS, SGSA:** 3.3	**SV:** 2.7 **SVS:** 2.9	2.1	2.4
Steepest gradient (%)	app. 40%	app. 33%	app. 35% (single person)	app. 38% (single person)
Load (kg)	**SG / SGA:** 175/180	170	150	(150)
Weight (kg)	**SG / SGA:** 139 /151 (dry weight)	111 (dry weight)	100 (with fuel)	102 (with fuel)
Dimensions: length x width x height (mm)	1985 x 645 x 920	1925 x 685 x 925	1970 x 700 x 905	1900 x 650 x 940
Maximum speed (km/h)	**SG, SGA:** 105 **SGS, SGSA:** 110	**SV:** 95 **SVS:** 100	75	80
Starting / Accessories	**SG, SGS** – kickstarter **SGA, SGSA** – electric starter, fuel tank 13 l, single seat with load setting (special seat for a passenger - extra charge or dual seat of a Denfeld type), set of tools, air pump, lock (luggage carrier extra)	kickstarter, fuel tank 11.5 l, single seat with load setting (special seat for a passenger - extra charge, set of tools, air pump, lock (luggage carrier extra)	kickstarter, fuel tank 6.7 l, dual seat, leg shield and footrest area, spare tyre and set of tools, air pump, lock, bag hook	SR – kickstarter SRA – electric starter / fuel tank 7 l, dual seat, leg shield and footrest area, spare tyre, set of tools, air pump, lock, bag hook
Notes, modifications compared to the previous model	See above	See above	See above	Compared to RL 125, it offers better engine performance, more efficient brakes, improved design.

	Tomos Norton TN 750 Fastback	**TSR 50**
Year	1970	1997
Engine capacity (cm^3)	745 – four-stroke	49.4
Bore and stroke (mm)	73 x 89 (twin cylinder)	41 x 37.4
Engine output: kW (KM)/min^{-1}	43 kW (58.5 KM) / 6800	2.5 kW (3.4KM) / 6800
Cooling	air, circulation	air, forced
Transmission	4-speed, foot-operated	continuously variable transmission (CVT)
Ignition	condenser, 12V, LUCAS 6CA	electronic
Breaks front/rear	hand-operated, drum / foot-operated, drum	hand-operated, disc / foot-operated, drum
Frame	tubular	tubular
Tyre size	front 19" x 3", rear 19" x 3.5"	10" x 3.5"
Fuel consumption (l/100)	5.7	
Steepest gradient (%)		20
Load (kg)		1 person + 7 kg
Weight (kg)	185 (dry weight)	78 (dry weight)
Dimension length x width x height (mm)	Length & width 2210 x 650	1770 x 660 x 1080
Maximum speed (km/h)	200	50
Starting / Accessories	kickstarter, fuel tank 14.7 l, dual seat, set of tools	electric starter and kickstarter, fuel tank 4.8 l, under-seat storage, instruments
Notes, modifications compared to the previous model		

TOMOS MOTORCYCLES WITH PUCH-DESIGN ENGINES

	Colibri VS 50 **Colibri VS 50 K** **Colibri VS 50 S**	**Colibri 01** **Colibri 02** **Colibri 03** **Colibri 04**	**Colibri Scooter**
Year	1956	1958/59	1960/61
Engine capacity (cm^3)	49	49	49
Bore and stroke (mm)	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	2 KM	2 KM	2.3 KM
Cooling	air, forced	air, forced	air, forced
Transmission	2-speed, hand-operated	2-speed, hand-operated	3-speed, hand-operated
Ignition	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W
Brakes front/rear	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum
Frame	welded steel sheet	welded steel sheet	welded steel sheet
Tyre size	23" x 2.25 "	23" x 2.25 "	12" x 3"
Seat	single, rubber coated, height adjustable	single, rubber coated, height adjustable	banana saddle
Weight (kg)	43 (with fuel)	43 (with fuel)	63
Dimensions length x width x height (mm)	1790 x 625 x 990	1810 x 625 x 990	1680 x 580 (length x width)
Maximum speed (km/h)	50	50	50
Starting / Accessories	pedals / fuel tank 4.6 l, bell, toolbox, air pump	pedals / fuel tank 5.5 l, monochrome, bell, no legshield, no luggage carrier, tool box, air pump	kickstarter / fuel tank 5.5 l, legshield, footpegs, under-seat storage, tool box, air pump
Notes, modifications compared to the previous model	**VS 50 K version:** same as VS 50, except: kickstarter, legshield **VS 50 S version:** same as VS 50 except: elongated fuel tank, long single seat, no tool box	Difference from Colibri 01: **Colibri 02**: two-coloured **Colibri 03**: additionally fitted with horn and luggage carrier (year 1962 maximum speed 55 km/h) **Colibri 04:** two-colour, additionally fitted with horn, legshield and luggage carrier (year 1962 maximum speed 55 km/h)	Difference with Colibri 01: **Colibri 02**: two-coloured **Colibri 03**: additionally fitted with horn and luggage carrier (year 1962 maximum speed 55 km/h) **Colibri 04:** two-coloured, additionally fitted with horn, legshield and luggage carrier (year 1962 maximum speed 55 km/h)

	Colibri 11	**Colibri 12**	**Colibri T 11**	**Colibri T12**
Year	1958/59	1958/59 (1962*)	1963 (1965*)	1962, 1963
Engine capacity (cm^3)	49	49	49	49
Bore and stroke (mm)	38 x 43	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	2 KM	2 KM (2.3 KM*)	2.3 KM (2.5 KM*)	2.3 KM
Cooling	air, forced	air, forced	air, forced	air, forced
Transmission	2-speed, hand-operated	2-speed, hand-operated	3-speed, hand-operated	3-speed, hand-operated
Ignition	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W
Breaks front/rear	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum
Frame	welded steel sheet	welded steel sheet	welded steel sheet	welded steel sheet
Tyre size	23" x 2.25 "	23" x 2.25 "	23" x 2.25 "	23" x 2.25 "
Seat	single, rubber coated, height adjustable	single, rubber coated, height adjustable	banana saddle	banana saddle
Weight (kg)	43 (with fuel)	43 (with fuel)	55 (with fuel)	55 (with fuel)
Dimensions length x width x height (mm)	1810 x 625 x 990	1810 x 625 x 990	1810 x <725 x 1003	1810 x 725 x 1003
Maximum speed (km/h)	50	50 (60)	60	60
Starting / Accessories	kickstarter / fuel tank 5.5 l, horn, monochrome, legshield, no luggage carrier, tool box, air pump	kickstarter / fuel tank 5.5 l, horn, two-coloured, legshield, foot pegs, luggage carrier, tool box, air pump	kickstarter / horizontally fitted fuel tank 8.5 l, profiled handlebar, two-coloured, horn, luggage carrier, tool box, air pump	kickstarter / horizontally fitted fuel tank 8.5 l, profiled handlebar, two-coloured, horn, legshield, footpegs, tool box, air pump
Notes, modifications compared to the previous model			*Compared to previous version, 1965 model has a new fuel tank and a seat (the same as T12 after 1964).	

TOMOS MOTORCYCLES WITH PUCH-DESIGN ENGINES




	Colibri T 13	**Colibri T 03**	**Colibri T12**	**Colibri A-OS** (bicycle with an auxiliary motor)
Year	1963 (1965*, 1969*, 1970*)	1963, 1965 (1969*, 1970*)	1965 (1969*, 1970*)	1972
Engine capacity (cm^3)	49	49	49	49
Bore and stroke (mm)	38 x 43	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	2.3 KM (2.5 KM*)	2.3 KM (2.5 KM*)	2.5 KM	1.8 KM
Cooling	air, forced	air, forced	air, forced	air, forced
Transmission	3-speed, hand-operated	3-speed, hand-operated	3-speed, hand-operated	3-speed, hand-operated
Ignition	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W
Breaks front/rear	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum
Frame	welded steel sheet	welded steel sheet	welded steel sheet	welded steel-sheet
Tyre size	23" x 2.25 "	23" x 2.25 "	23" x 2.25 "	23" x 2.25 "
Seat	single, rubber coated, height adjustable	single, rubber coated, height adjustable	banana saddle	single, height-adjustable
Weight (kg)	43 (with fuel)	43 (with fuel)	55 (with fuel)	43
Dimensions length x width x height (mm)	1810 x 625 x 990	1810 x 625 x 990	1810 x 725 x 1003	1810 x 625 x 990
Maximum speed (km/h)	60	60	60	42
Starting / Accessories	kickstarter / fuel tank 5.5 l, two-coloured, horn, legshield, footpegs, luggage carrier, tool box, air pump	pedals / fuel tank 5.5 l, monochrome, horn, luggage carrier, tool box, air pump	kickstarter / horizontally fitted fuel tank 13 l, profiled handlebar, two-coloured, horn, legshield, foot pegs, tool box, air pump	pedals / fuel tank 5.5 l, monochrome, bell, exhaust silencer
Notes, modifications compared to the previous model	* After 1969 the exhaust silencer was replaced with an exhaust pipe.	* After 1969 the exhaust silencer was replaced with the exhaust pipe.	After 1964, the T 12 model had a new fuel tank, legshield and a seat (*after 1969 also new handlebars in three versions, new forks, suspension, headlight).	New Tomos vehicle from category of bicycles with auxiliary motor, powered by a Puch transmission engine.

TOMOS MOPEDS AND LIGHT MOTORCYCLES OF THE SO-CALLED NEW GENERATION





	Colibri 14V	Colibri 14 VN	Colibri 14	Colibri 15 Touring	Colibri 15 Sport
Year	1969	1971	1971 (1972*)	1971	1971
Engine capacity (cm^3)	49	49	49	49	49
Bore and stroke (mm)	38 x 43	38 x 43	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	2 (2.7)	2.6 (3.5)	2.6 (3.5) 3 (4.2)*	3 (4.2)	3.9 (5.3)
Cooling	air, forced	air, forced	air, forced	air, forced	air, circulation
Transmission	4-speed, foot-operated	4-speed, foot-operated	4-speed, foot-operated	5-speed, foot-operated	5-speed, foot-operated
Ignition	Magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W
Breaks front/rear	hand-operated, drum / foot-operated, drum (105 mm)	hand-operated, drum / foot-operated, drum (105 mm)	hand-operated, drum / foot-operated, drum (105 mm)	hand-operated, drum / foot-operated, drum (105 mm)	hand-operated, drum / foot-operated, drum (140/125 mm)
Frame	welded steel-sheet	welded steel-sheet	welded steel-sheet	welded steel-sheet	welded steel-sheet
Tyre size	18" x 2.5"	23" x 2.5"	18" x 2.5"	18" x 2.5"	18" x 2.5"
Seat	dual	dual	dual	dual	dual
Weight (kg)	64 (with fuel)	64 (with fuel)	60 (dry weight)	61 (dry weight)	65 (with fuel)
Dimensions length x width x height (mm)	1850 x 650 x 960	1810 x 660 x 960	1850 x 650 x 1020	1850 x 610 x 960	1850 x 610 x 960
Maximum speed (km/h)	65	68	68 (72)	76	80
Starting /Accessories	kickstarter / fuel tank 13 l, horn, tool box, leg shield, foot rest	kickstarter / fuel tank 13 l, horn, tool box, leg shield, foot rest	kickstarter / fuel tank 11 l, horn, tool box, foot rest for passenger	kickstarter / fuel tank 11 l, horn, tool box, foot rest for passenger	kickstarter / fuel tank 11 l, horn, tool box, foot rest for passenger
Notes; modifications compared to a previous model		Compared to T 14V it has an improved engine.	Compared to T 14VN it has a new fuel tank. Tool box is under the seat (the same as with Colibri 15).	Compared to Colibri 14 it has improved engine, 5 gears; they look similar at first sight.	Compared to Colibri 15 Touring it has improved engine, larger brake drums with air-cooled brakes, new front forks and handlebars, new headlight and partially open chain guard.





	Colibri 14TL	Colibri 14TLS	Colibri 15TL	Colibri 15 SL	Colibri 15 SLH
Year	1973	1973, 1974, 1975, 1976, 1977	1973	1973, 1974, 1975, 1976, 1977	1974
Engine capacity (cm^3)	49	49	49	49	49
Bore and stroke (mm)	38 x 43	38 x 43	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	3 (4.2) / 6500	3 (4.2) / 6500	3 (4.2) / 6500	4.4 (6) / 8200	4.4 (6) / 8200
Cooling	air, forced	air, forced	air, forced	air, circulation	air, circulation
Transmission	4-speed, foot-operated	5-speed, foot-operated	5-speed, foot-operated	5-speed, foot-operated	5-speed, foot-operated
Ignition	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W
Breaks front/rear	hand-operated, drum / foot-operated, drum (105 mm)	hand-operated, drum / foot-operated, drum (105 mm)	hand-operated, drum / foot-operated, drum (105 mm)	hand-operated, drum / foot-operated, drum (140/125 mm)	hand-operated, drum / foot-operated, drum (140/125 mm)
Frame	welded steel-sheet	welded steel-sheet	welded steel-sheet	welded steel-sheet	welded steel-sheet
Tyre size	18" x 2.5"	18" x 2.5"	18" x 2.5"	18" x 2.5"	18" x 2.5"
Seat	dual	dual	dual	dual	dual with a backrest
Weight(kg)	61 (dry weight)	65	61 (dry weight)	65	73
Dimensions length x width x height (mm)	1850 x 650 x 1020	1850 x 650 x 1020	1850 x 610 x 950	1850 x 610 x 960	length 1850
Fuel consumption (l/100)	2.4	2.2	2.4	2.8	2.8
Steepest gradient (%)	25	25		25	25
Load (kg)	160	160		150	150
Maximum speed (km/h)	72	72	78	85	85
Starting / Accessories	kickstarter as with Colibri 14 (1972)	kickstarter as with Colibri 14 TL (1973) / leg shield, foot rest	kickstarter / fuel tank 11 l, horn, tool box	kickstarter / fuel tank 11 l, horn, tool box, foot rest for passenger	kickstarter / the same as with 15 SLH plus semi-rise handlebars with rear-view mirror, plastic luggage panniers over rear wheel, seat with backrest
Notes; modifications compared to a previous model	new commercial code	Compared to Colibri 12, it is five-speed.	new commercial code	Compared to Colibri 15 Sport (1971) it has an improved engine.	Compared to Colibri 15 SL: see above.

TOMOS MOPEDS AND LIGHT MOTORCYCLES OF THE SO-CALLED NEW GENERATION




	Tomos Cross 50 Junior	Tomos 14TLC	Tomos 15 Sprint	Tomos PTT 77
Year	1973 (1978)	1974, 1975, 1976	1975, 1976	1977
Engine capacity (cm^3)	49	49	49	49
Bore and stroke (mm)	38 x 43	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	5.51 kW 7.5 KM / 7500 (7.8 KM)	3 (4.2)	6 (4.4)	3 (4.2)
Cooling	air, circulation	air, forced	air, circulation	air, forced
Transmission	5-speed, foot-operated	4-speed, foot-operated	5-speed, foot-operated	4-speed, foot-operated
Ignition	electronic	magneto, 6V/ 20/15W	electronic 6V/ 25/18W	magneto, 6V/ 20W
Breaks front/rear	hand-operated, drum / foot-operated drum (136 mm)	hand-operated, drum / foot-operated drum (136 mm)	hand-operated, drum / foot-operated drum (136 mm)	hand-operated, drum / foot-operated drum (136 mm)
Frame	tubular	tubular	tubular	welded steel-sheet
Tyre size	front: 19" x 2.5" rear: 18" x 3"	16" x 2.75"	16" x 2.75"	18" x 2.5"
Seat	long single seat	dual	dual	single, height adjustable
Weight (kg)	65 (dry weight)	63	67 (dry weight)	75 (dry weight)
Dimensions length x width x height (mm)	1900 x 820 x 1070	1850 x 650 x 1020	1850 x 610 x 930	1850 x 810 x 980
Fuel consumption (l/100)	3	2.4	2.8	2.2
Steepest gradient (%)	80	25	25	25
Load (kg)	100	160	150	155
Maximum speed (km/h)	80 (with standard sprocket kit)	72	85	65
Starting / Accessories	kickstarter / fuel tank 8 l, the seat and rear mudguard are one piece (reinforced polyester), horn, headlamp, tail light	kickstarter / as with Colibri 14 (1973), plus luggage carrier	kickstarter / fuel tank 11 l, factory fitted accessories same as with 14 TLC plus direction indicators, revolution counter	kickstarter / fuel tank 5.5 l (same as APN), leg shield, foot rest, luggage carrier, panniers
Notes, modifications compared to the original or previous model	Improved engine similar to Colibri (15 SL), otherwise, a fully newly-developed motorcycle.	Compared to Colibri 14 SL it has a tubular frame, front fork and headlight as with Colibri 15 SL.	Compared to Colibri 15 SL it has an improved engine, a new fuel tank, tubular frame of a similar design to 14 SLC, new front forks, rear shock absorbers, headlight.	Compared to Colibri 14 TLS it is customised to the requirements of the postal service. The brakes and front forks are the same as with Colibri 15, the fuel tank is the same as with APN, a reinforced luggage carrier is added.





	Tomos 90 Electronic	Tomos Tricycle	Tomos Cross 50 senior	Tomos 14TL	Tomos 15 SLC
Year	1976, 1977	1976	1978	1980	1981
Engine capacity (cm^3)	90	49	49	49	49
Bore and stroke (mm)	48 x 48	38 x 43	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	6.6 (9) / 7500	1.8 (2.4) / 5000	7.8 (10.6) / 9800	3 (4.2)	4.4 (6)
Cooling	air, circulation	air, forced	air, circulation	air, forced	air, circulation
Transmission	5-speed, foot-operated	4-speed, foot-operated	5-speed, foot-operated	4-speed, foot-operated	5-speed, foot-operated
Ignition	thyristor 6V/ 25/20W	magneto, 6V/ 20/15W	thyristor	magneto, 12V/50W	magneto, 12V/50W
Breaks front/rear	hand-operated, drum / foot-operated, drum (140/125 mm)	drum on both tyres, rear: foot-operated (105 mm)	hand-operated, drum / foot-operated, drum (125/136 mm)	hand-operated, drum / foot-operated, drum (105 mm)	hand-operated, drum / foot-operated, drum (140/125 mm)
Frame	tubular	tubular	tubular	Tubular	tubular
Tyre size	17" x 2.75"	front: 8" x 3.5" rear: 16" x 2.75"	front: 21" x 2.5" rear: 18" x 3.5"	16" x 2.75"	16" x 2.75"
Seat	dual	dual	dual	Dual	dual
Weight (kg)	70 (dry weight)	100	67	62 (dry weight)	65 (dry weight)
Dimensions length x width x height (mm)	1880 x 800 x 980	2350 x 1000 x 1030	1930 x 820 x 1120	1850 x 650 x 1020	1850 x 650 x 1020
Fuel consumption (l/100)	3.7	2.5		2.2	2.2
Steepest gradient (%)	35	32	100	25	25
Load (kg)	160	225	133	160	150
Maximum speed (km/h)	100	40		72	85
Starting / Accessories	kickstarter / fuel tank 11.6 l, factory fitted accessories same as with Tomos Sprint plus direction indicators, revolution counter	kickstarter / luggage carrier 1000 x 1000 mm, load 150kg	kickstarter / fuel tank 8 l, the seat and rear mudguard are from one piece (reinforced polyester)	kickstarter as with Tomos 14 TLC (1975)	kickstarter / fuel tank 11 l, factory fitted accessories same as with 14TL (1980), headlight 130 mm
Notes, modifications compared to the original or previous model	Compared to Tomos Sprint, it has a better performance engine of larger capacity.		Developed from Cross 50 Junior and intended exclusively for competitions.	Compared to Tomos 14 TLC (1975) it has new front forks, smaller headlight, speedometer is mounted to handlebars.	Compared to Tomos 15 Sprint it has front forks, fuel tank and engine that are the same as Tomos 15 SL, the carburettor is above.

TOMOS MOTORCYCLES WITH TRANSMISSION ENGINES AFTER 1981

	Tomos BT 50 (BT 50 S)	**Tomos ATX 50 C**	**Tomos CTX 80**
Year	1985 (1988, 1989)	1988, 1989 (1996, 1998)	1988, 1989
Engine capacity (cm^3)	49	49	80
Bore and stroke (mm)	38 x 43	38 x 43	
Engine output kW/min^{-1} (KM/min^{-1})	4 kW/8000	1.6 kW/5500	5.5 kW/6000
Cooling	air, circulation	air, circulation	air, circulation
Transmission	5-speed, foot-operated	5-speed, foot-operated	5-speed, foot-operated
Breaks front/rear	hand-operated, disc (hydraulic) / foot-operated, drum (220/125 mm)	hand-operated, drum / foot-operated, drum	hand-operated, disc (hydraulic) / foot-operated, drum (220/110 mm)
Frame	tubular frame	tubular frame	tubular frame
Tyre size	front: 2.5 x 17” rear: 2.75 x 17”	front: 2.5 x 18” rear: 2.75 x 18”	front: 2.75 x 18” rear: 3 x 18”
Seat	double	double	double
Weight (kg)	70	70 (75)	74
Dimensions length x width x height (mm)	length 1815	length 1860	length 2010
Fuel consumption (l/100)	2.8	2.1	3.3
Steepest gradient (%)	30	25	35
Load (kg)	150	150	150
Maximum speed (km/h)	80	50	85
Ignition	electronic 12V90W	magneto 12V50W	magneto 12V 80W
Notes, modifications compared to the original or previous model	First examples of the new Tomos motorcycles of the 1980s. Fitted with alloy wheels, direction indicators, revolution counter (BT 50 S has quadrangular instrument panel and seat with a grip for passenger), fuel tank volume 9.5 l.	Development of the BT 50 model, it belongs within the moped category. Unlike the BT 50 it features the so-called *Endure* design, with classic spoked wheels, different mudguards, front forks, brakes, instruments.	CTX 80 is an *Endure* motorcycle with classic spoke wheels, fuel tank volume of 19 l, unlike other Tomos motorcycles it has centrally sprung rear suspension.

TOMOS MOTORCYCLES WITH TRANSMISSION ENGINES FROM THE 'NEW GENERATION' APN FAMILY





	Colibri A-ON	**Tomos APN 4** **Tomos APN 4H** **Tomos APN 4K** **Tomos APN 4KS**	**Tomos APN 4 M** **Tomos APN 4 MS**
Year	1972	**APN 4:** 1973, 1975, (1976), **APN 4 H:** 1975 **APN 4 K** in **KS:** 1977	1981
Engine capacity (cm^3)	49	49	49
Bore and stroke (mm)	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	2.25 KM	1.84 kW 2.5 KM/5000	1.84 kW 2.5 KM/5000
Cooling	air, forced	air, forced	air, forced
Transmission	4-speed, foot-operated	4-speed, foot-operated	4-speed, foot-operated
Ignition	magneto, 6V / 17W	magneto, 6V / 17W	magneto, 6V / 21W
Breaks front/rear	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum
Frame	welded steel-sheet	welded steel-sheet	welded steel-sheet
Tyre size	18" x 2.5"	18" x 2.5"	18" x 2.5"
Seat	single, height-adjustable	single, height-adjustable	banana saddle
Weight (kg)	55 (dry weight)	**APN 4:** 55 (dry weight) **APN 4 H:** 62 (dry weight)	**APN 4 M:** 55 (dry weight) **APN 4MS:** 61
Dimensions length x width x height (mm)	1810 x 625 x 990	1810 x 625 x 990	1810 x 625 x 990
Fuel consumption (l/100)	2.2	2.2	2.2
Steepest gradient (%)	25	25	25
Load (kg)	105	105 (150)	150
Maximum speed (km/h)	48	48	48
Starting / Accessories	pedals / fuel tank 5.5 l, monochrome, horn, exhaust	**APN 4** – pedals/ fuel tank 5.5 l **APN 4 H –** pedals / fuel tank 5.5 l, high-rise handlebar, rear-view mirrors, luggage carrier with plastic pannier, single seat with backrest, front mudguard and fuel tank are chromed. **APN 4 K** – kickstarter / fuel tank 5.5 l, monochrome, horn, exhaust **APN 4 KS** – kickstarter / two-colour , leg shield, foot rest and plastic panniers (option)	kickstarter / luggage carrier, **APN 4 MS** has leg shield and foot rest
Notes; modifications compared to a previous model	Compared to Colibri A-OS it is powered by a new Tomos engine, has semi-open chain guard.	Compared to Colibri A-ON, Tomos APN 4 has an improve engine.	Compared to APN 4K it has a long single seat, luggage carrier, new front forks and front headlight.


	Tomos APN 6 **Tomos APN 6S**	**Alpino**
Year	**APN 6** 1986, 1989 **APN 6S** 1987 (1996*)	1988
Engine capacity (cm^3)	49	49
Bore and stroke (mm)	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	1.85 kW 2.5 KM/5000	1.85 kW 2.5 KM/5000
Cooling	air, forced	air, forced
Transmission	4-speed, foot-operated	4-speed, foot-operated
Ignition	magneto, 12V / 50W platinum or electronic	6V / 17W, electronic
Breaks front/rear	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated, drum
Frame	welded steel-sheet	welded steel-sheet
Tyre size	18" x 2.5" **APN 6S**, model 1996, 1998: front 2.25" x 17"; rear 2.75" x 17"	front 2,25" x 17" rear 2.75" x 17"
Seat	long single seat	long single seat
Weight (kg)	55 (dry weight)	55 (dry weight)
Dimensions length x width x height (mm)	length 1820	length 1820
Fuel consumption (l/100)	2.2	2.2
Steepest gradient (%)	25	25
Load (kg)	150	150
Maximum speed (km/h)	48	49
Starting / Accessories	kickstarter / luggage carrier, under-seat tool storage (see notes)	kickstarter / same as APN 6S, speedometer (see notes)
Notes; modifications compared to a previous model	**Tomos APN 6** is the successor of **Tomos APN 4M** featuring new frame, seat, front mudguard and 4 l fuel tank. S version has rear-view mirror, stitched seat, new front forks and rear suspension, improved frame and rear forks, square headlight (model 1996, 5.8-litre fuel tank).	**Alpino** is different from **APN 6S** in having a new design of mudguards and headlight, 4 l fuel tank.

TOMOS VEHICLES FROM THE AUTOMATIC FAMILY




	Automatic **Automatic T, TT, N, NT**	**Automatic 1**	**Automatic 3** **Automatic 3K**
Year (according to the manufacturer's brochures)	**Automatic** 1968, 1969, 1970 **Automatic T, TT**, 1970 **Automatic N** 1971, **NT** 1973, 1975, 1976, 1977	1973	1973, 1974, 1975, 1976, 1977, 1978 **A3K:** 1975, 1976, 1977, 1978
Engine capacity (cm^3)	48	49	49
Bore and stroke (mm)	40 x 38	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	1.8 KM/4500	2 KM/5500	1.5 kW 2 KM/5500
Cooling	air, circulation	air, circulation	air, circulation
Transmission	1-speed	1-speed	2-speed automatic
Ignition	magneto, 6V/17W	magneto, 6V/17W	magneto, 6V/17W
Breaks front/rear	hand-operated, drum / hand-operated, drum	hand-operated, drum / hand-operated, drum	hand-operated, drum / hand-operated (A3K foot-operated), drum
Frame	tubular	tubular	welded steel-sheet
Tyre size	23" x 2" & 20" x 2.25"	20" x 2.25"	20" x 2.25"
Seat	single, height adjustable	single, height adjustable	single, height adjustable
Weight (kg)	43	43	44
Dimensions length x width x height (mm)	length 1720	1645 x 660 x 970–1020	1640 x 620 x 970–1020
Fuel consumption (l/100)	1.5	2	2
Steepest gradient (%)	12	8	20
Load (kg)	110	100	105
Maximum speed (km/h)	40	42	45
Starting / Accessories	pedals / fuel tank 2.5 l, luggage carrier, bell, air pump; **Automatic T** has additional luggage carrier at the front, and **Automatic TT** and **N** in addition to the luggage carrier also has a basket.	pedals / fuel tank 5.4 l at the front, luggage carrier, bell	**A3:** pedals / fuel tank 4 l, luggage carrier, horn **A3K:** kickstarter / additional foot pegs
Notes, modifications compared to the previous model	New model, composed mainly from imported parts (for example Anker Laura engine, Piraci frame). **Automatics N** and **NT** had Tomos front forks, **Automatic NT** also had fuel tank with 5.4 l capacity installed at the front. Height-adjustable handlebars.	Differs from Automatic NT in having a new engine of Tomos manufacture, with adapted frame and foot pegs.	Differences from Automatic 1; the engine is of the same design but with two automatic gears. Frame has a new design incorporating the fuel tank.






	Automatic 3M **Automatic 3MS**	**Automatic 3S** **Automatic 3L** **Automatic 3SL**	**Colibri**
Year (according to the manufacturer's brochures)	**A3M:** 1982 **A3MS:** 1986	1989	1989, 1997
Engine capacity (cm^3)	49	49	49
Bore and stroke (mm)	38 x 43	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	1.5 kW (2 KM)/5500	1.5 kW (2 KM)/5500	1.8 kW (2.4 KM)/5200
Cooling	air, circulation	air, circulation	air, circulation
Transmission	2 automatic	2 automatic	2 automatic
Ignition	magneto, 6V/17W	magneto, 6V/20W or 12V/50W	magneto, 12V/50W or 12V/80W
Breaks front/rear	hand-operated, drum / foot-operated, drum	hand-operated, drum / foot-operated (A3SL hand-operated), drum	hand-operated, drum / hand-operated, drum
Frame	welded steel-sheet	welded steel-sheet	tubular
Tyre size	20" x 2.25"	17" x 2.25"	16" x 2.25"
Seat	banana saddle	banana saddle	banana saddle, longitudinally and height-adjustable
Weight (kg)	44	40-50	57
Dimensions length x width x height (mm)	1640 x 620 (length x width)	1640 x 620 (length x width)	1740 (length)
Fuel consumption (l/100)	2	2	1,8
Steepest gradient (%)	20	20	over 20
Load (kg)	113	113	83
Maximum speed (km/h)	45	48	49
Starting / Accessories	kickstarter / same as with A3K (see notes)	kickstarter / accessories same as with A3MS (see notes)	kickstarter / adjustable luggage rack for baggage mounting, and folding direction indicators, instruments, under-seat storage
Notes, modifications compared to the previous model	Compared to **Automatic 3K** it has fixed handlebars, banana saddle with under-seat tool storage. The export A3MS model has improved front forks, luggage carrier, direction indicators and speedometer.	Compared to **Automatic 3MS**: **- A3S:** new front fork and square headlight - **A3L**: the same as the export A3MS model without direction indicators - **A3SL**: the same as the export A3MS model, alloy wheels, panniers	**Colibri** is a newly designed vehicle meant to become the Automatics successor. It has an improved Automatic engine fixed to the centrally sprung rear suspension.

TOMOS VEHICLES FROM THE AUTOMATIC FAMILY




	Targa (Targa LX, TT Classic) **Sprint** **Standard**	**Flexer**
Year (according to the manufacturer's brochures)	1997/98 TT Classic 1999	1998
Engine capacity (cm^3)	49	49
Bore and stroke (mm)	38 x 43	38 x 43
Engine output kW/min^{-1} (KM/min^{-1})	1.8 kW (2.4 KM)/5200	1 kW (0.7 KM)/3800
Cooling	air, circulation	air, circulation
Transmission	2 automatic	2 automatic
ignition	magneto, 12V/80W	magneto, 12V/80W
Breaks front/rear	hand-operated, drum / hand-operated, drum	hand-operated, drum / hand-operated, drum
Frame	welded steel-sheet	tubular
Tyre size	16" x 2.25"	16" x 2.25"
Seat	banana saddle	single
Weight (kg)	**Sprint, Targa** 51 **Standard** 47	47
Dimensions length x width x height (mm)	1640 (length)	1740
Fuel consumption (l/100)	1.8	2.5
Steepest gradient (%)	20	20
Load (kg)	90	90
Maximum speed (km/h)	49	25
Starting / Accessories	kickstarter **Standard:** (same as with A3S, l 1989) **Targa:** luggage carrier**,** deflector, speedometer, direction indicators, lockable fuel tank cap **Sprint:** tool bag, deflector, speedometer	kickstarter / luggage carrier, horn
Notes, modifications compared to the previous model	Compared to A3S they all have an improved engine (the same as with Colibri), alloy wheels and a new design of footrest area that simultaneously covers the engine. **Targa LX** and **TT Classic** are based on **Targa** (**Automatic 3**) but their design with additional fuel tank, seat and side covers is reminiscent of a motorcycle.	**Flexer** is a newly designed vehicle that according to the Road Traffic Safety Act from 1998 belongs to the category of bicycles with auxiliary motors. Powered by a modified Colibri engine. New tubular frame incorporates a 3.4 l fuel tank.

OVERVIEW OF TOMOS RACING MOTORCYCLES FOR ROAD RACES*



Generation	1	2	3	4	5
Model	**D3**	**D5**	**D7**	**D5S[1]**	**D9**
Version – year of construction	1. – 1959	1. – 1960 2. – 1961	1. – 1962	2nd series – 1962	1. – 1965 2.
No. of produced vehicles	2	1st ver.: 4 2nd ver.: 4	5	100	6
Engine: Output: kW (HP)/min^{-1} (bore and stroke-mm)	3.7 (5)/8000 (38.5 x 43.0)	1st ver.: 5.1 (7) / 12000 2nd ver.: 5.9 (8) / 12000 (38.5 x 43.0)	7 (9.5) /12000 (42.0 x 36.0)	6.2 (8.5) / 12000 (38.0 x 43.0)	8.1 (11) / 14000 (42.0 x 36.0)
Cooling / No. of coolers (water c.)	air	air	air	air	1st ver.: air 2nd ver.: water / 1
Carburettor	Dell'Orto Φ 18,	Dell'Orto Φ 18,	Dell'Orto Φ 22	Dell'Orto Φ 18	Dell'Orto Φ 22 (rotating-disc distribution)
No. of gears	3	5	7	5	9
Ignition	magneto-electric	magneto-electric	battery	magneto-electric	battery
Gross weight (kg)	~ 47	1st ver.: ~ 50 2nd ver.:~ 52	~ 48	~ 50	39 - lean
Maximum speed (km/h)	95	1st ver.: ~ 120 2nd ver.: ~ 130	~ 140	no data	~ 150
Brakes: front / back (diameter in mm)	drum / drum (105/105)	drum / drum (105/105),	drum / drum (140/105),	drum / drum (105/105),	Disc double inner grip mechanic
Frame	serial metal plate	serial remodelled	tube ultra-light version	serial metal plate	fibreglass monocque,
Producer and dim. of pneumatic tyres front; back (″)	Conti 2.00/19	Conti –1st ver.; AVON –2nd ver. 2.00/19	AVON 2.00/19	Conti 2.00/19; 2.25/19	Dunlop 2.00/18
Other data, results	Victory: Portorož »Prix Litoral«.	Victories: 1st ver.: Autumn Cup Hockenheim Germany 2nd ver.: European Cup Hockenheim 1.	Victory: Opatija 1963	Victories: State Champion of The Netherlands in 1964; of Sweden in 1965.	Victories: State champion of Yugoslavia in 1965,1966,1967

* Because each racing motorcycle was a unique specimen it is difficult to classify them into generations and versions. The present table is just one possible rough set of classifications of single versions of Tomos racing motorcycles that enables their clear presentation within the framework of this contribution.

[1] Although from a developmental viewpoint we cannot talk about a new generation of Tomos racing motorcycles, the D5 S is characterised as a new 4th generation machine in this table due to its mass production.

OVERVIEW OF TOMOS RACING MOTORCYCLES FOR ROAD RACES*







Generation	6	7	8	9	10
Model	**D6**	**D6**[1]	**DMS**	**DM GP**[2]	**DM GP**
Version – year of construction	1. – 1967 2. – 1968 3. – 1969	1. – 1971 2. – 1972	1. - 1976 1977	1977	1. - 1978 2. – 1979 3. - 1980
No. of produced vehicles	1st ver.: 12 2nd ver.: 3 3rd ver.: 4	1st ver.: 1 2nd ver.: 1	20	6	1st ver.: 6 2nd ver.: 4 3rd ver.: improved preceding
Engine: Output: kW (HP)/min^{-1} (bore and stroke-mm)	1st ver.: 8.8 (12) /13200 3rd ver.:10.3 (14) /13500 (38.0 x 43.0)	10.3 (14) / 14000 (40.0 x 39.6)	10.3 (14) 13500 (38.0 x 43.0)	11.8 (16) / 14500 (40.0 x 39.7)	1st ver.: 12.2 (16.5) / 15000 2nd and 3rd ver.: 13.2 (18) / 15500 (40.0 x 39.7)
Cooling / No. of coolers (water c.)	1st and 2st ver.: air, 3rd ver.: water / 1	water / 1	water / 1	water / 1	water / 2
Carburettor	1st and 2st ver.: Dell'Orto Φ 22 3rd ver.: Dell'Orto Φ 23	Dell'Orto Φ 25	Dell'Orto Φ 24	Dell'Orto Φ 28 (rotating-disc distribution)	1st ver.: Dell'Orto Φ 28/30 (rotating-disc distribution) 2nd and 3rd ver.: Bing Φ 28/30 (rotating-disc distribution)
No. of gears	6	6	6	6	6
Ignition	1st ver.: magneto-electric 2nd and 3rd ver.: battery	battery	magneto- electric Ducati	electronic battery Krober	electronic battery Krober
Gross weight (kg)	~ 55	~ 55	~ 55	~ 55	~ 55
Maximum speed (km/h)	1st ver.: ~ 150 3rd ver.: ~ 160	~ 165	160		2nd ver.: ~ 175 3rd ver.: ~ 185
Brakes: front / back (diameter in mm)	drum / drum 1st and 2nd ver.: (105/105), 3rd ver.: (140/125),	drum / drum (140/125)	double hydraulic disc / drum (Φ 180 / Φ 125)	double hydraulic disc / drum (Φ 180/ Φ 125)	hydraulic disc / hydraulic disc (Φ 200)
Frame	serial metal plate remodelled	fibreglass monocque	tube	tube	fibreglass monocque
Producer and dim. of pneumatic tyres front; back (˝)	Dunlop 2.00/18	Dunlop 2,00 x 18	Dunlop 2.00 /18; 2.25/18˝	Dunlop 2.00 /18; 2.25/18˝	Michelin 2.00/18; 2.25/18
Other data, results	Results: 1st ver.: State champion of Yugoslavia in 1968–1972 2nd ver.: Nürburgring 6 3rd ver.: State champion of Italy 1969,1970; rankings in the top ten at races for World Championship.	The 2nd version is a new race machine with ergonomically designed frame adapted by Parlotti.	For sale to the factory team.		Aerodynamic shell of the 3rd version was optimised in wind tunnel. More important achievements of the 3rd version: Title of European Champion in 1982.

* Because each racing motorcycle was a unique specimen it is difficult to classify them into generations and versions. The present table is just one possible rough set of classifications of single versions of Tomos racing motorcycles that enables their clear presentation within the framework of this contribution.

[1] Both versions differentiate over their frame, and we could treat them separately as two generations, but in this case we shall treat them as versions, as both are of similar design.
[2] The DM GP from 1977 is, in regard to its design, a development from the DMS. However, because of radical improvements to the engine (its successors had the same), is in this case treated as a new generation.