ELECTRIC MOTIVE POWER

SINGLE-PHASE A.C. ELECTRIC LOCOMOTIVE

PHASE CONVERTER TYPE ELECTRIC LOCOMOTIVES

PHASE AND FREQUENCY CONVERTER TYPE ELECTRIC LOCOMOTIVES

WARD-LEONARD TYPE ELECTRIC LOCOMOTIVES

RECTIFIER TYPE ELECTRIC LOCOMOTIVES

ELECTRIC RAILCARS AND ELECTRIC TRAINSETS (EMU-S)

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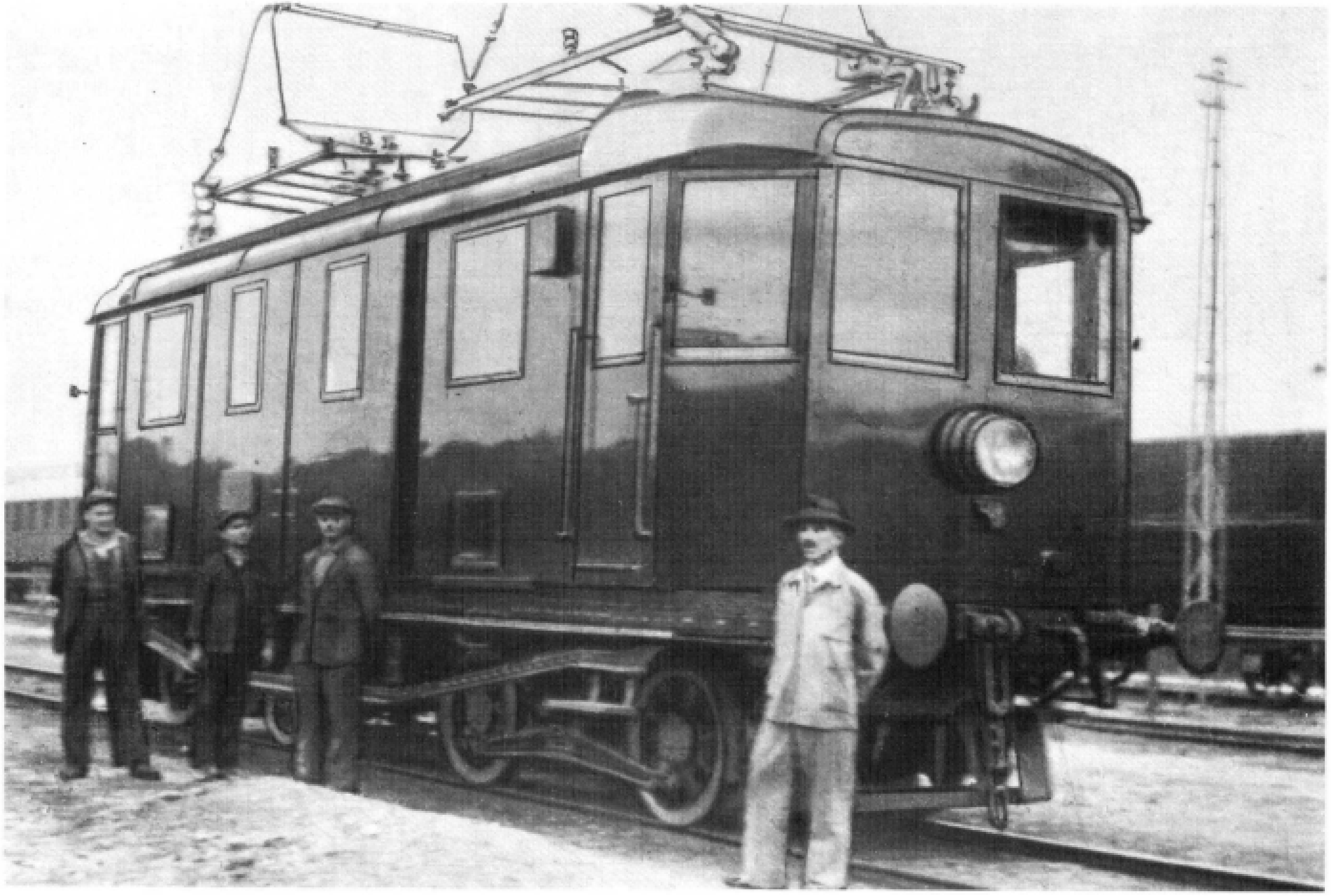
Class V51

Main Data

Current supply	10 kV, 15-3/4 c/s A.C.*	
Continuous output	354	kW
Wheel arrangement (British coding)	B–B	
Axle arrangement (German coding)	B'–B'	
Wheel dia	0.830	m
Bogie wheel base	2.000	m
Pivot pitch	4.640	m
Total wheel base	6.640	m
Length over buffers	10.340	m
Maximum height**	4.650	m
Maximum width	2.906	m
Running order weight	45.5	t
Top speed	40	k.p.h.

* later: 12 kV, 16-2/3 c/s A.C.

** with dropped current collector



The Vác-Budapest-Gödöllő local Railway maintained by MÁV was the first electrified standard gauge Railway in Hungary. On the lines inaugurated in 1911 the goods traffic was worked with Class V51 locomotives. The Supplement of the licence of this Railways prescribed that the locomotives be capable to haul a 160 t trainload on a gradient of 1.5 per cent at a speed of 30 k.p.h. The vehicle part of these locomotives was built by the Bohemian Ringhoffer-Werke AG. (i.e. Ringhoffer Works Corporation) in Smichov near Prague, while their electric part had been manufactured by the Magyar Siemens-Schuckert Művek, Budapest- Pozsony (i.e. Hungarian Siemens-Schuckert Works, Budapest- Pozsony) company. (Pozsony is called now Bratislava.) The locomotive was equipped with single-phase A.C. traction motors rated to 177 kW each accomodated in the bogies. A jackshaft was driven by the traction motor having keyed cranks on both shaft ends. The wheels of the locomotive were driven from the jackshaft cranks by means of link-type coupling rods. A total of 4 units had been manufactured in 1911.

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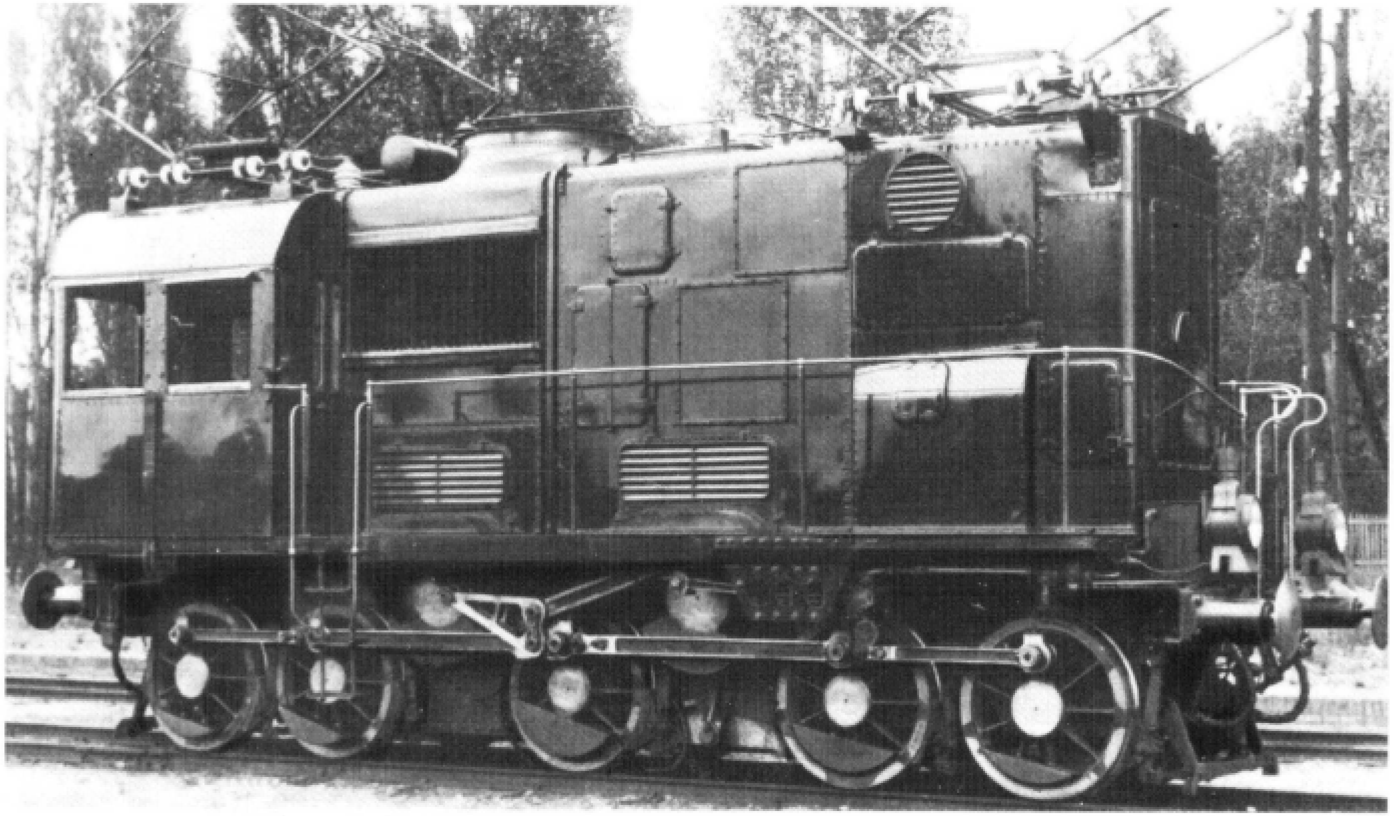
PHASE CONVERTER
TYPE ELECTRIC LOCOMOTIVE



Class V50

Main Data

Current supply	16 kV, 50 c/s A.C.	
Continuous output	2x590	kW
Wheel arrangement (British coding)	0-10-0	
Axle arrangement	(German coding) E	
Wheel dia	1.070	m
Total wheel base	6.508	m
Length over buffers	9.640	m
Maximum height*	4.650	m
Maximum width	2.934	m
Running order weight	74.5	t
Top speed	67	k.p.h.

* with dropped current collector

In the years after the World War I MÁV began to deal with mainline electrification again. In 1922 a decision was found that „the Kandó-type locomotive selected for the purposes of general electrification should be tried well in the practice on the line section between Budapest-Nyugati pályaudvar (i.e. West Railway Station of Budapest) and Dunakeszi-Alag in the service of the State Railways". One of the most distinguished engineers of Railway technology, Kálmán KANDÓ chose the simple and highly reliable 3-phase asynchronous electric motor as traction motor for the test locomotive for realizing his theory. Additionally, as a new type of rotating electric machines he constructed the so-called synchronous phase converter incorporating a 16 kV single phase synchronous motor, a 3-phase 1000 V synchronous generator as well as a transformer in a sole machine. The coupling rod driven test locomotive of Kandó was finished in 1923. The electric parts of the locomotive were manufactured by Ganz whereby the vehicle part had been built by MÁVAG. Kandó's concept of development had been verified by the one year test runs with special respect to the phase converter. The shortcomings occured during the test runs were eliminated along the reconstruction of the locomotive. (The drawing illustrates the original locomotive, while the picture shows the modified version of the locomotive.)

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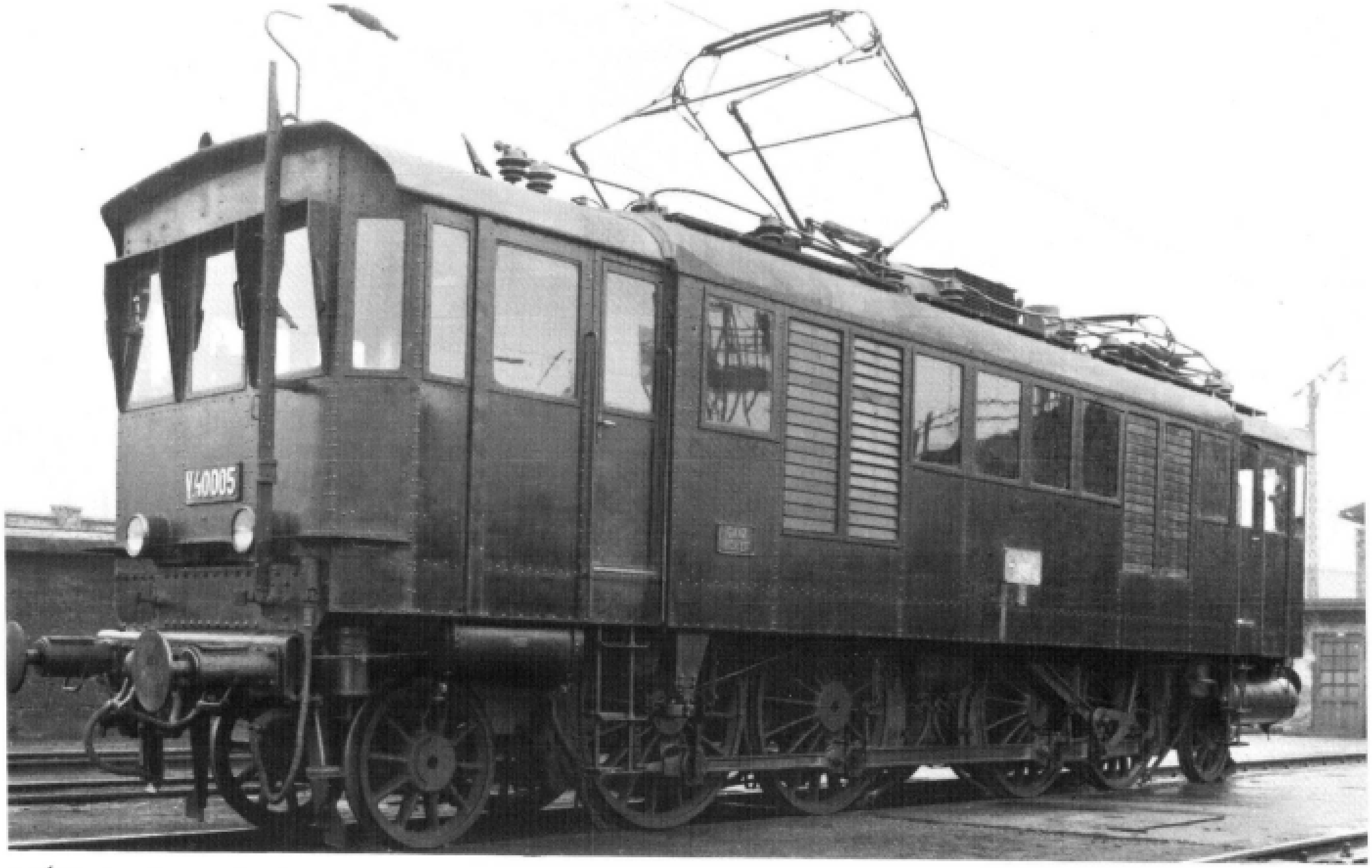
PHASE CONVERTER
TYPE ELECTRIC LOCOMOTIVE

Class V40

Main Data

Current supply	16 kV, 50 c/s A.C.
Continuous output	1620 kW
Wheel arrangement	
(British coding)	2-8-2
Axle arrangement	
(German coding)	1'–D–1'
Wheel dia driving/running	1.660/1.040 m
Total wheel base	10.260 m
Length over buffers	13.830 m
Maximum height*	4.650 m
Maximum width	3.150 m
Running order weight	94 t
Adhesion weight	66.2 t
Top speed	100 k.p.h.

* with dropped current collector



MÁV placed an order in 1931 with the Ganz works to deliver the Class V40 Kandó-Type phase-convertor locomotives to haul her fast trains and stopping trains on the mainline between Budapest and Hegyeshalom (near the river Danube at the Austrian border). The Kandó-system made possible at first all over the World the railway electrification supported by the country-wide industrial network on a simple manner by using transformers rather than rotating converter machines on the railway sub-stations. The 16 kV single phase 50 c/s alternating current collected from the overhead wire was transformed by the rotating phase convertor built in the locomotive to an 1 kV 3-phase alternating current and was directed straightly to the traction motor. The pole number of the sliding ring type single traction motor could be switched-over. By the repeated switching-overs the motor pole number the speed of the locomotive could be set to 25, 50, 75 or 100 k.p.h., respectively. The vehicle part of the Class V40 locomotives was manufactured by MÁVAG. The four coupled axles were driven from the traction motor crank by means of Kandó-type coupling bars characterized by the so-called Kandó-type triangle. Based on the experiences of the test runs the Class V40 locomotives proved well to haul not only passenger but goods trains, too. A total of 29 units were manufactured of this Class of locomotive in the interval between 1932 and 1941.

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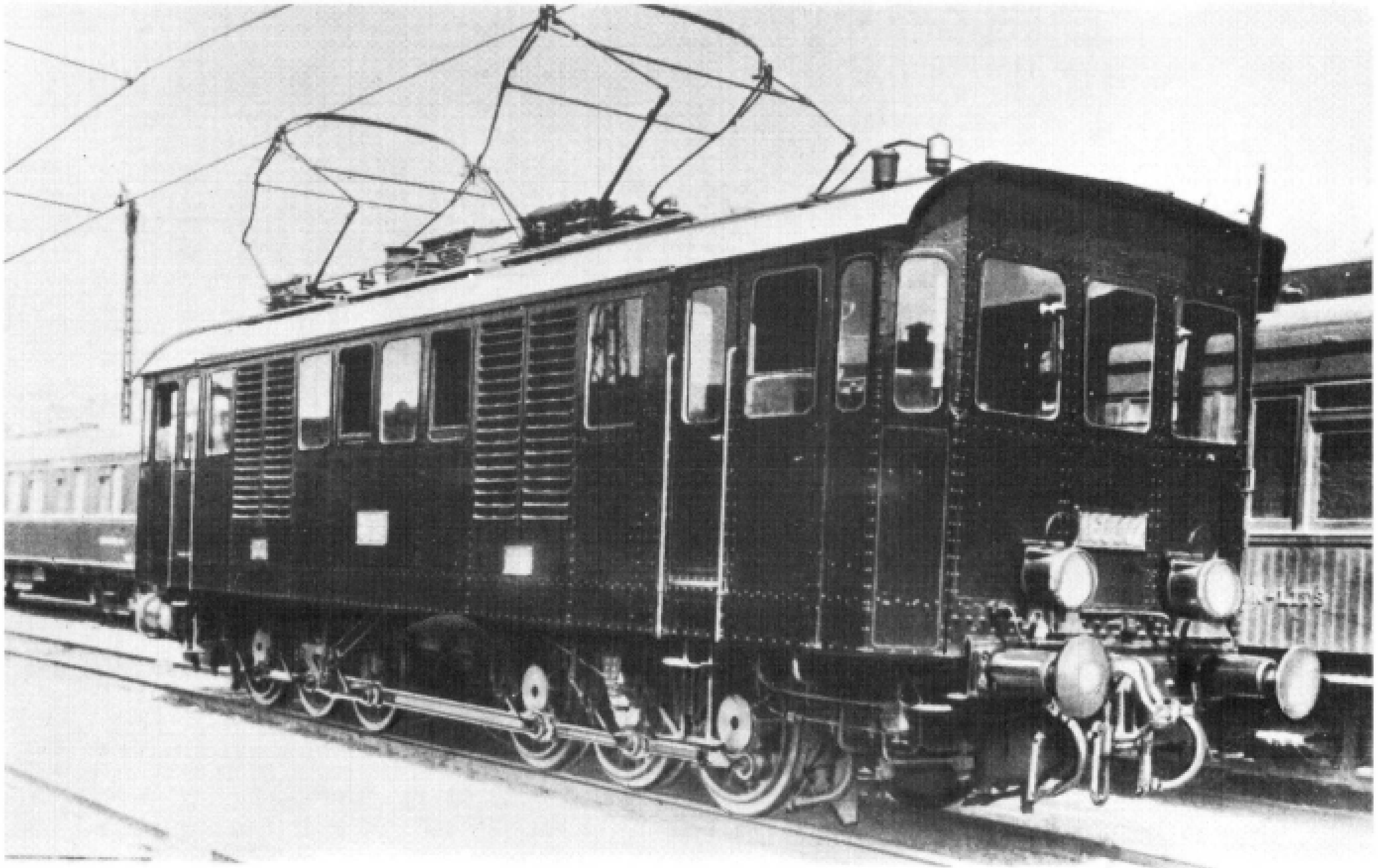
PHASE CONVERTER TYPE ELECTRIC LOCOMOTIVE

Class V60

Main Data

Current supply	16 kV, 50 c/s A.C.	
Continuous output	1620	kW
Wheel arrangement		
(British coding)	0-12-0	
Axle arrangement		
(German coding)	F	
Wheel dia	1.150	m
Total wheel base	7.840	m
Length over buffers	13.570	m
Maximum height*	4.650	m
Maximum width	3.116	m
Running order weight	93.8	t
Top speed	68	k.p.h.

* with dropped current collector



MÁV placed the order in 1931 with Ganz works to deliver the Class V60 locomotives to maintain the heavy goods trains on the mainline Budapest-Hegyeshalom. The electric equipment of these locomotives was identical with that of the Class V40 locomotives. The difference between of the two Class of locomotives was in the vehicle part built by MÁVAG, namely in the main frame, in the running gear and in the transmision gear. The running gear construction of the Class V60 locomotive was characterized by being all wheels coupled and driven by means of side coupling rods. The locomotive proved well in the heavy goods train service and worked regularly trainloads of 1000 to 1400 tonnes. A total of 3 units had been built in the years between 1932 and 1938 only because the Class V40 locomotives proved to be suitable to haul goods trains, too.

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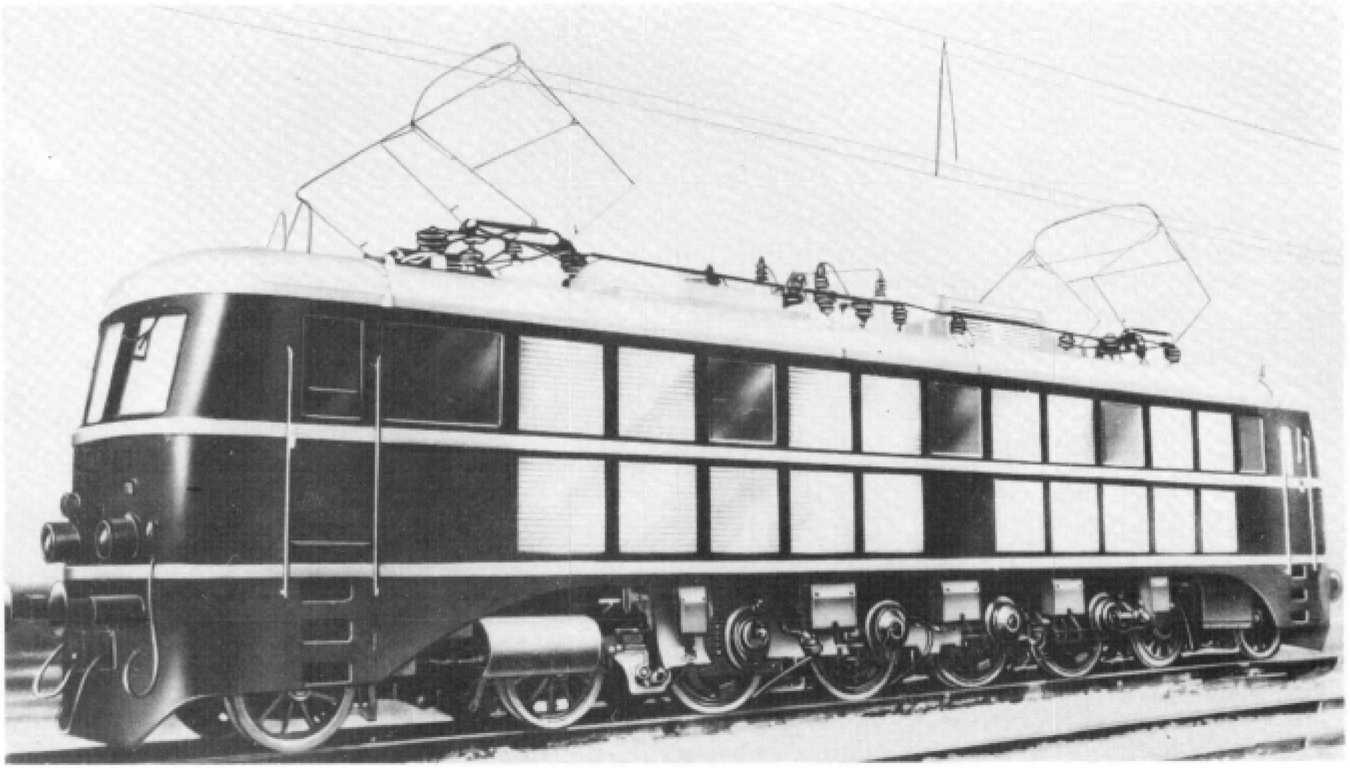
PHASE AND FREQUENCY CONVERTER TYPE ELECTRIC LOCOMOTIVE



Class V44

Main Data

Current supply	16 kV, 50 c/s A.C.	
Continuous output	2940	kW
Wheel arrangement		
(British coding)	4-8-4	
Axle arrangement		
(German coding)	2'–Do–2'	
Wheel dia, driving/trailing	1.40/1.04	m
Bogie wheel base	2.400	m
Pivot pitch	11.670	m
Total wheel base	14.070	m
Length over buffers	17.640	m
Maximum height*	4.650	m
Maximum width	3.100	m
Running order weight	144	t
Adhesion weight	80	t
Top speed	125	k.p.h.

* with dropped current collector

MÁV placed the order in 1939 with the Ganz works to deliver two units of phase- and frequency-converter type electric locomotives equipped with individual axledrives, to haul first of all passenger trains. The vehicle part of this locomotive was built by MÁVAG. The Sècheron-type individual drive eliminated the disadvantages of the coupling rod drives of the earlier Kandó- type locomotives and made possible to increase the speed of this locomotive. Because of the big sizes the accomodation of the earlier Kandó-type traction motors with pole-changing possibilities was insoluble therefore Ganz developed the so- called Ganz-Kandó-Ratkovszky system with phase- and frequency convertor. With this system the pole change-over was performed within an inductive rotating machine, in the so-called cycle converter. The cycle convertor supplied with 3-phase alternating current of step-to-step variable cycling the 3-phase A.C. traction motors, the latters equipped with short-circuited squirrel-cage armatures. These traction motors having high starting torque, simple construction and almost no maintenance need were prominently suitable for railway service and represented the forerunner model of the recent most up-to-date traction motors. The four traction motors supported on the main frame drove the four axles individually by a flexible drive. Not more than 2 units were manufactured of the Class V44 locomotive in the years 1943 and 1944. One of them which wore the nameplate V44,001 performed during her test runs about 16.000 km. For the ravages of the war both locomotives got as badly damaged as it was not worth-while to restore them.

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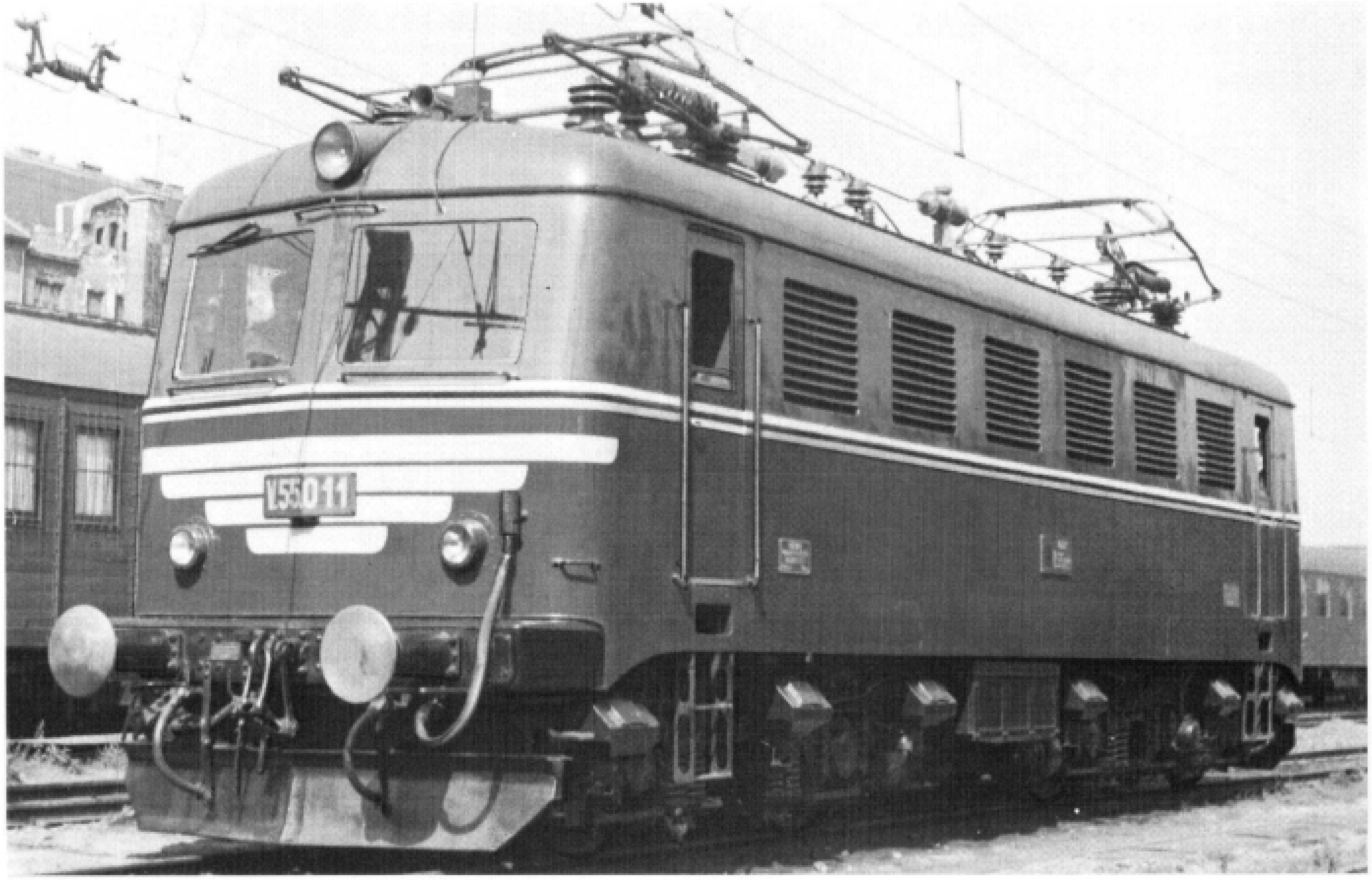
PHASE AND FREQUENCY CONVERTER TYPE ELECTRIC LOCOMOTIVE



Class V55

Main Data

Current supply	16 kV, 50 c/s A.C.	
Continuous output	2354	kW
Wheel arrangement		
(British coding)	Bo–Co	
Axle arrangement		
(German coding)	B'o–C'o	
Wheel dia	1.040	m
Wheel base		
2-axled bogie	2.500	m
3-axled bogie	1.75+1.75	m
Total wheel base	10.350	m
Length over buffers	14.600	m
Maximum height*	4.650	m
Maximum width	3.000	m
Running order weight	92.5	t
Top speed	125	k.p.h.

* with dropped current collector

MÁV placed the order in 1948 with Ganz Villamossági Részvénytársaság (i.e. Ganz Electric Company) to manufacture the Class V55 locomotives partly for the already electrified lines, partly for the mainlines envisaged for electrification in the next future. The electric equipment of the locomotives intended to haul passenger trains as well as goods trains was principally identical to that of the Class V44 locomotives. The biggest constructional deviations between the two locomotive types could be found in their vehicle part and in the execution of their traction motors. The bogie-type running gear of the Class V55 locomotive required the accomodation of the traction motors into the bogies. A characterizing feature of the MÁVAG-made vehicle part was the asymmetrical running gear, having the locomotive one 2-axled and one 3-axled bogie. Another feature was and at that time it could be considered as a novelty that the locomotive had a self- carrying body composing a compact structural unit with the floor framework and having two driver's cabs, one at each end. A total of 12 units had been manufactured of this locomotive within the period between 1950 and 1957 as the technical development exceeded the Kandó-type locomotives and tended towards the rectifier-type electric transmissions executed with semi- conductors.

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Class V41 and Class V42

Main Data

Current supply	25 kV, 50 c/s A.C.
Continuous output	V41/V42 956/1214 kW
Wheel arrangement	
(British coding)	Bo–Bo
Axle arrangement	
(German coding)	B'o–B'o
Wheel dia	1.040 m
Bogie wheel base	2.200 m
Pivot pitch	6.500 m
Total wheel base	8.700 m
Length over buffers	12.290 m
Maximum height*	4.450 m
Maximum width	3.150 m
Running order weight	V41/V42 73.0/74.0 t
Top speed	80 k.p.h.

* with dropped current collector

The home railway industry developed in the late 1950's a Ward- Leonard system electric locomotive equipped with rotating A.C./D.C. convertors to satisfy the needs of MÁV on electric locomotives, first of all to haul goods trains. It was an intermittent technical solution,because the directions of development of the up-to-date electric locomotive transmissions executed with use of semi-conductor type rectifiers didn't already unfold definitely. The prototype unit of the Class V41 locomotive had been finished in 1958 while the first unit of the Class V42 was commissioned in 1960. One of the most important feature of the identically arranged vehicle parts of the two locomotive types was the centrally arranged driver's desk that can be walked around accomodated in the single driver's cab. The basic difference was between the electric equipment of the two locomotive types the number of the main generators: in the Class V41 locomotive two identical main generators were driven by the synchronous motor (one for each bogie), while in the Class V42 locomotive all the four traction motors were supplied by a single main generator. The electric transmission of the locomotives was manufactured by Ganz Villamossági Művek (i.e. Ganz Electric Works) while their vehicle part had been built by Ganz-MÁVAG. A total of 30 units were manufactured from the Class V41 locomotives within the period of 1959-1962, while the Class V42 was built in a total unit No. of 42 between 1961 and 1964.

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RECTIFIER TYPE
ELECTRIC LOCOMOTIVE

Class V43

Main Data

Current supply	25 kV, 50 c/s A.C.
Continuous output	2220 kW
Wheel arrangement (British coding)	B–B
Axle arrangement (German coding)	B'–B'
Wheel dia	1.180 m
Bogie wheel base	2.300 m
Pivot pitch (theoretical)	9.100 m
Total wheel base	11.400 m
Length over buffers	15.700 m
Maximum height*	4.450 m
Maximum width	3.110 m
Running order weight	80 t
Top speed	130 k.p.h.

* with dropped current collector

In 1964 MÁV began the purchase of the multi-purpose Class V43 electric locomotives equipped with silicon rectifiers suitable equally to haul passenger and goods trains. The first 7 units had been delivered by the licence holder „Arbeitsgemeinschaft für die Bahnelektrifikation mit 50 Hz" (i.e. Co-operative for Railway Electrification with 50 c/s), which co-operative came into existence from some leading Companies of the West-European railway industry, while the further ones were built by the Hungarian licencees, namely by Ganz Villamossági Művek (i.e. Ganz Electric Works, electrical part) and Ganz-MÁVAG (vehicle part). The main transformer of the locomotive has two separate secondary coils. The two traction motors are supplied with ripple direct current from the two main rectifiers. An interesting constructional feature of the locomotive has been the transmission gear: the bogies have a single traction motor only, both axles of the bogie are driven by this motor by means of an integrated gear transmission and hollow-type cardan shafts. A total of 379 units has been manufactured from this locomotive in the interval between 1963 and 1982.

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RECTIFIER TYPE
ELECTRIC LOCOMOTIVE

Class V46

Main Data

Current supply	25 kV, 50 c/s A.C.
Continuous output	820 kW
Wheel arrangement	
(British coding)	Bo–Bo
Axle arrangement	
(German coding)	B'o–B'o
Wheel dia	1.040 m
Bogie wheel base	2.600 m
Pivot pitch (theoretical)	7.000 m
Total wheel base	9.600 m
Length over buffers	14.400 m
Maximum height*	4.550 m
Maximum width	3.116 m
Running order weight	80 t
Top speed	80 k.p.h.

* with dropped current collector

In the early 1980's the share of electric traction was at MÁV almost 60 per cent while in shunting service the participation was approximately 4 % only. The rentability studies showed that there is practical benefit of using of electric locomotives on the electrified network in shunting service, too. The electric shunting locomotives are particularly advantageous in point of view of environmental protection. Based on these arguments MÁV placed an order with Ganz Villamossági Művek (i.e. Ganz Electric Works) to manufacture the prototype of the electric shunting locomotives. The vehicle part of this locomotive was developed and manufactured by Ganz-MÁVAG. The first units of the Class V46 locomotives had been commissioned in 1983.

The two bogies of the locomotive are driven by four traction motors, one for each axle. The traction motors supplied with ripple direct current are connected on series within the bogie while the two bogies are connected in parallel. The traction motors are fed through the two in-series connected, air cooled, half-controlled thyristorized rectifier bridge. The control system of the locomotive is completely electronic. The Class V46 locomotives proved well both in marshalling yard flat shunting as well as in hump yard shunting service. 15 units were manufactured between 1983 and 1990, but their purchase has not been finished as yet.

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RECTIFIER TYPE
ELECTRIC LOCOMOTIVE

Class V63

Main Data

Current supply	25 kV, 50 C/s A.C.
Continuous output	3575 kW
Wheel arrangement (British coding)	Co-Co
Axle arrangement (German coding)	C'o-C'o
Wheel dia	1.250 m
Bogie wheel base	1.95+2.25 m
Pivot pitch	10.440 m
Total wheel base	14.300 m
Length over buffers	19.596 m
Maximum height*	4.550 m
Maximum width	3.040 m
Running order weight	116 t
Top speed	130 k.p.h.

* with dropped current collector

In 1971 Ganz Villamossági Művek (i.e. Ganz Electric Works) was commissioned by MÁV to develop a highperformance electric locomotive which could have a long-term capability to maintain the heavy passenger trains as well as goods trains. In 1974 the Class V63 thyristor-controlled electric locomotive reached the completion where the electric energy of the overhead wire comes through a fix-ratio tranformer and a thyristorized rectifier bridge to the six ripple D.C. traction motors. By use of the thyristors the stepless control of tractive effort and locomotive speed was possible. The maintenance need of this locomotive decreased as the voltage regulator of complicated construction could be deleted. A step-by-step control of the field weakening is performed by the thyristor-controlled excitation of the traction motor poles. The vehicle parts of the locomotives were built by Ganz-MÁVAG. The bogies from the nameplate No. 008 (from 1984) were manufactured under licence from KRUPP Industrie- und Stahlbau Werk Essen (i.e. Krupp Industry and Steel Constructions, Essen Works) of Germany. A total of 56 units of the Class V63 locomotives were put into service in the period between 1974 and 1988.

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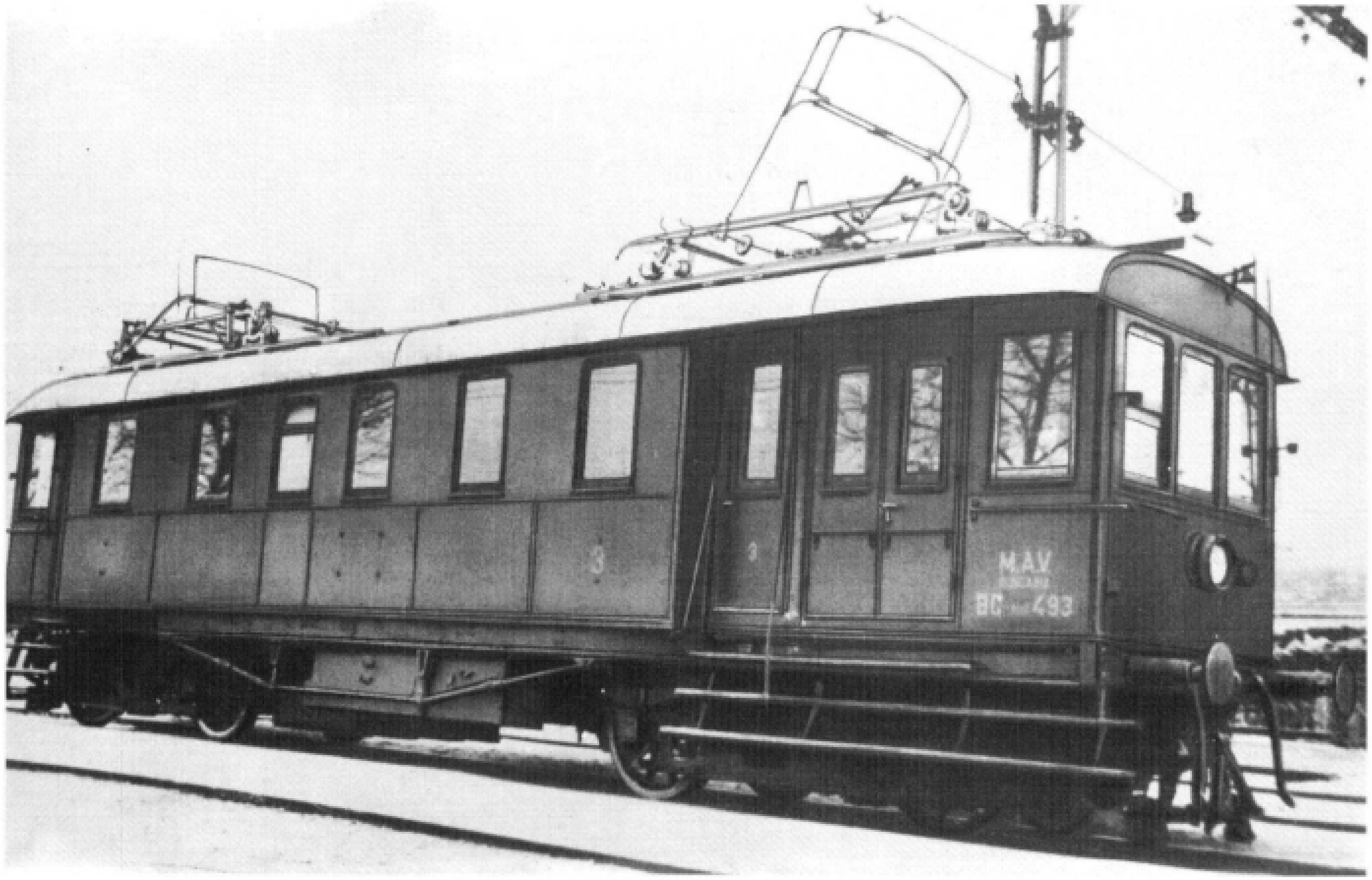

Class ACa

Main Data

Current supply*	10 kV, 15-3/4 c/s A.C.	
Continuous output	220	kW
Wheel arrangement		
(British coding)	A1–1A	
Axle arrangement		
(German coding)	A1'–1A'	
Wheel dia	0.850	m
Bogie wheel base	2.500	m
Pivot pitch	8.000	m
Total wheel base	10.800	m
Length over buffers	14.500	m
Maximum height**	3.770	m
Maximum width	3.050	m
Running order weight	43	t
Top speed	50	k.p.h.
Seats:		
1st class	20	
3rd class	30	

* later: 12 kV, 16-2/3 c/s

** to the roof level

On the electrified local railway of Vác-Budapest-Gödöllő, maintained by MÁV, the passenger traffic was performed with electric ralicars. The vehicle part of the Class ACa railcar was built by the Magyar Waggon- és Gépgyár Rt. (i.e. Hungarian Wagon- and Machine Works Company) of Győr while the electric part was manufactured by the Magyar Siemens-Schuckert Művek Kft. (i.e. Hungarian Siemens-Schuckert Works Ltd) of Budapest and Pozsony (now called Bratislava, the capital of Slovakia). The electric part of this railcar was almost identical with that of the Class V51 locomotives. Both bogies of the railcar were provided with a single A.C. traction motor having an output of 110 kW each. One of the axles of the bogie was driven by means of a gear drive. Two-axled trailers had been manufactured to these railcars. A total of 11 units were puchased of this railcar type in 1911.

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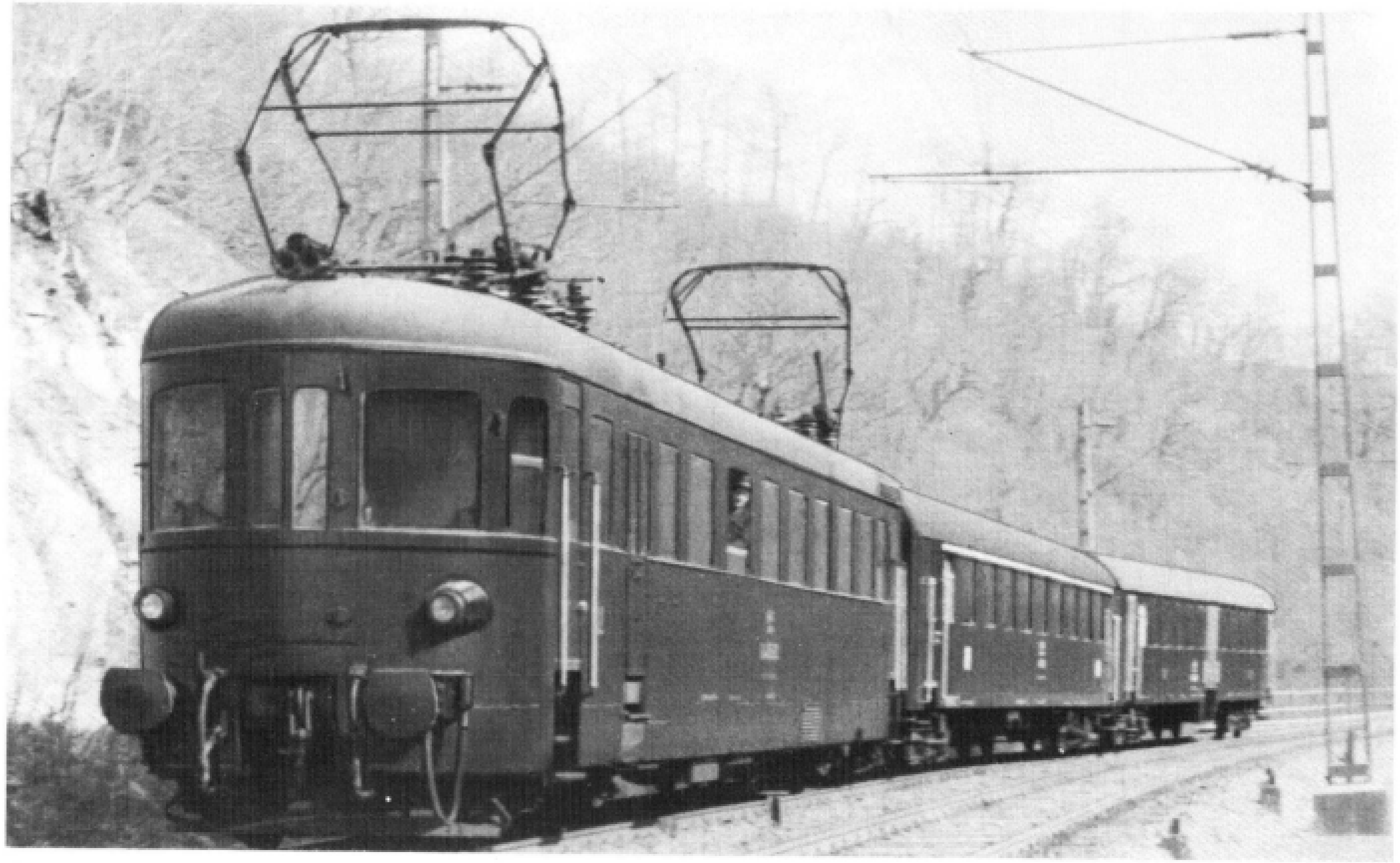
ELECTRIC RAILCAR
OF THE WARD-LEONARD SYSTEM

Class Cavill

Main Data

Current supply	16 kV,50 c/s A.C.	
Continuous output	440	kW
Wheel arrangement		
(British coding)	Bo–2	
Axle arrangement		
(German coding)	B'o–2'	
Wheel dia	1.040	m
Bogie wheel base	2.900	m
Pivot pitch	15.500	m
Length over buffers	23.150	m
Maximum height*	4.645	m
Maximum width	2.900	m
Running order weight	57	t
Top speed**	90/150	k.p.h.
Seats	56	

* with dropped current collector
** depending on the actual gear ratio



One of the well-known pioneers of the home railway electrification, László Verebély, professor of the Budapest University of Technology, took up a position for the introduction of the electric railcar service on mainlines: „The radical reorganization complying with the nature of the electric traction service involves the considerable improvement of the economy of electrification" he said. Based on an offer of the Ganz works, MÁV placed an order with Ganz to deliver an electric railcar of the continuous periode inverter system. The electric equipment of this railcar reached the completition but the commisioning was kept back by the developments of World War II. In 1949 MÁV placed an order again with Ganz Villamossági Művek (i.e. Ganz Electric Works) to deliver two electric railcars. The prototype railcars of the Ward-Leonard system were commissioned in 1955. The electric part was manufactured by Ganz, called at those times Klement Gottwald Villamossági Gyár (i.e. Klement Gottwald Electric Works) while the vehicle part was built by Dunakeszi Vagongyár (i.e. Wagon Factory of Dunakeszi) today called MÁV Dunakeszi Járműjavító Üzem (i.e. Vehicle Overhaul Shops of MÁV at Dunakeszi). In accordance with the Order Specifications the railcar should haul two four-axled bogie-type coaches on level track at a speed of 90 k.p.h. Various tests had been performed with these prototype railcars only but they never came to service.

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ELECTRIC MULTIPLE UNIT
WITH ASYNCHRONOUS MOTOR
DRIVE SYSTEM

Class BDV

Main Data	Power car	Trailer	Control trailer
Current supply	25 kV, 50 c/s		
Output	1520 kW		
Wheel arrangement (British coding)	B–B	2–2	
Axle arrangement (German coding)	B'–B'	2'–2'	
Wheel dia	0.920 m		
Bogie wheel base	2.600 m		
Pivot pitch	17.200 m	19.000 m	
Length over buffers	24.600 m	26.400 m	
Maximum height*	4.650 m	4.000 m	
Legnagyobb szélesség	2825 mm		
Running order weight	64 t	41 t	
Top speed	120 k.p.h.		
Seats 2nd class	64+2**	96+4**	88+2**
Area of the luggage compartment sq.m	9		

The EMU is composed of a power car, 2 trailers and a control trailer. Her total length is 103.8 m, total seat No 344 + 12** and the running order weight amounts to 193 tonnes.

* with dropped current collector
** additional seats

The electric motorcar units (EMUs) are well-proven means of the passenger transportation on the electrified suburban lines. MÁV placed the order for this task with Ganz-MÁVAG an EMU composed of 4 coaches, the first of them was finished in 1988. The electric part of the EMU was manufactured by Ganz Villamossági Művek (i.e. Ganz Electric Works). There were essential requirements at the construction of the EMU: the high acceleration, the quick change of passengers as well as the possible minimum need for maintenance. The multiple unit consists of an electric railcar, two intermadiate trailers and a control trailer. All of machinery equipment were accomodated in the railcar. The four axles of the two bogies are all driven. The axles of the bogie are coupled by means of a cardan shaft being connected to the axledrives. The asynchronous traction motors are supported below the main frame, two per railcar, and drive the axles of the respective bogie by means of a cardan shaft. Both of the traction motors are supplied by separate rectifiers and current inverters. The railcar is equipped with feedback-type electrodynamic brake, too. The passenger doors of the EMU are remote-controlled, namely individually opened by the passengers in case of centrally- actuated unlock, being unlocked and closed by the railcar driver. Two electric trainsets can be coupled and driven by remote control as an integrated unit. The purchase of this EMU hasn't yet finished. 20 units (i.e. 20 off four-unit trainsets) were manufactured within the period of 1988-1990.

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NUMBERING, MARKING AND CODING SYSTEMS OF LOCOMOTIVES, RAILCARS AND RAILCAR TRAINS

General Features of MÁV Locomotives Numbering System

The current numbering system of locomotives at MÁV is in use from 1910 with slight improvements. The MÁV-locomotives are marked with two number groups. The first number group (having 2 or 3 figures) marks the Class (or type) of the locomotive while the second number group (having 3 or 4 figures) shows the nameplate (serial) numbers of the locomotive.

The first number group of the steam locomotives consists of three figures while that of the Diesel and electric locomotives have two figures. In the originally used numbering system the railcar replacing steam locomotives, the rack-type locomotives as well as the fireless (steam accumulator type) engines were also marked with a first number group having two figures. Correspondingly, the railcar replacing locomotives were marked with Class-numbers 10- 30, the rack locos with 31-50 and the other special engines (for example the fireless locomotives) by 81-99. With all locomotive Classes the number of the driven (coupled) axles was marked by the first figure of the first number group.

Numbering System of MÁV Steam Locomotives

The second and third figures of the first number group of the steam locomotives relate to the axle load of the locomotive furthermore that the locomotive is a tender-type or a tank-type one, see Table 1. With the narrow-gauge steam locomotives, from the first number group one can conclude to the number of the driven (coupled) axles only.

Thus for example the Class 424 locomotive according to the presented numbering system has four coupled axles, a tender and the axle load of the coupled axles is between 12 and 15 tonnes. The nameplate numbers of the steam locomotives consist of three or four figures. Within the given Classes

Table 1.

Class Numbering System os MÁV Steam Locomotives
(first figure group)

1st figure	2nd and 3rd figures	axle load tonnes, kN	supplies stored in	rank of the locomotive
number of coupled axles	01-14	150-200	tender	I. rank (mainline)
	15-19		tank	
	20-41	120-150	tender	
	42-69		tank	
	70-74	-120	tender	II. rank (branch line)
	75-59		tank	
	80-84	any axle load	tender	III. rank (narrow gauge)
	85-99		tank	

the nameplate numbers begin generally with 001 and increase in the delivery sequence of the units, but in some cases the defined number groups of the nameplate numbersrefer to constructional or other deviatoins within the Class.

For example, the nameplate numbers of all locomotive Classes having a gauge differing from the standard gauge, i.e. the nameplate numbers of the broad-gauge or narrow-gauge locomotives begin with 5001. Another example: the Class 324 and Class 327 locomotives had originally built with compound machinery but later along with a general updating they were rebuilt to a twin engine. The nameplate numbers of these locomotives begin with 1501 and increase in the sequence of rebuilt. There is another distinction, too, that within the same Class the nameplate number of the locomotives delivered by a foreign factory (as the Class 328 locomotive) or a locomotive originated from another railway company begins with another number group than that of the home manufactured locomotives. If during the delivery of a certain Class some significant constructional modifications were performed this fact was also distincted by the group of the nameplate number. Such as: the Class 375 locomotives having modified valve gear wore a nameplate number beginning with 1001.

The tenders depending on their types are markedby upper case letters of the Roman ABC when they are coupled to a mainline locomotive and on the other hand by lower case letters of the ABC (it means: by a, b, c and so on) at the tenders coupled to the branch-line engines, furthermore by the Class number and nameplate number of the locomotive which they are coupled to. Two examples for this marking system: M324 or 1370).

General Marking System of Steam Locomotives

The marking system developed originally in Germany is generally followed at the Continental European railways and so at MÁV, too.

So the first mark group of the marking system of the steam locomotives informs about the axle arrangement of the locomotive while the second mark group is the information holder of the most important technical features. In the code of the axle arrangement the number of the adjacent running axles are marked by Arabic numerals while the number of coupled axles belonging to the same group are marked by the upper case letters of the Roman ABC (so A means one, B means two, C means three coupled axles and so on). The individual codes are written in the sequence of succession of the axles beginning from the front of the locomotive. If

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the running axle is not embedded in the main frame but in a frame separated from the main frame (for example in a bogie) then a comma will be put behind the figure marking the number of the running axles. Similarly those axles are distincted which can turn relative to the main frame around a theoretical centre of rotation. An example: the code 2'C1 means a locomotive having three coupled axles, two running axles in the front bogie furthermore a rear running axle embedded in the main frame.

Coding system of the Mallet-type locomotives: the codes of the front and rear coupled axle groups are connected by a plus (+). For example: 1C'+C means a Mallet-type locomotive having a running axle and three coupled axle in the front driven bogie as well as three coupled axles embedded in the rear (main) frame. It should be mentioned that the British practice of coding system differs from the Continental (or German) one: we are speaking about „Wheel arrangement" and in the arrangement's code the wheel groups are given by figures, being the individual running or coupled wheel groups separated by dashes. In the USA there was common to code the diverse axle (or wheel) arrangements by a denomination which was sometimes characterizing to the arrangement (for example: „6-wheel switcher" or „double ender") but in most cases were they not (for example: „American" or „Pacific").

The codings of some characteristical steam locomotive axle arrangements are contained by the comparative Table 2.

The markings of the second mark group in the German coding system:

n	locomotive operating with saturated steam
h	locomotive operating with superheated steam
2 or 4	number of steam cylinders
v	compound machinery
t	tank-type locomotive (the existence of a tender will be not marked separately)
tr	tramway locomotive
Z	rack locomotive
E	Engerth-system locomotive

For example, the marking „h2t" means that the locomotive operates with superheated steam, has a two-cylinder simple machinery and is a tank-type one.

Numbering System of MÁV Diesel and Electric Locomotives

The second figure of the Class-marking number group has no particular meaning at the Diesel and electric locomotives. Diesel locomotives have an „M" (at the narrow-gauge diesel locomotives an „Mk") in front of the Class-marking number group. The second number group of the marking, the nameplate number (which consists of 3 or 4 figures) relates to the transmission system and marks the serial number of the locomotive, as follows:

from 001: locomotive with electric transmission,
from 1001: locomotive with mechanical transmission,
from 2001: locomotive with hydraulic transmission.

Recently Diesel locomotives won't be manufactured with mechanical transmission therefore the nameplate number group beginning with 1001 is used for marking the locomotives within the same Class having constructional deviations to each other, too. Such as the Class M47 diesel hydraulic locomotives without train heating equipment are marked with the nameplate number group of 1001 while the units having train heating facilities wear the nameplate numbers beginning with 2001.

Electric locomotives have a „V" in front of the Class-marking number group. The second number group is the nameplate number.

General Coding System of Electric and Diesel Locomotives

The coding of the axle arrangement of electric and Diesel locomotives depends on the layout of their running gear whether they are of rigid frame or bogie type. The axle arrangement coding of the locomotives having rigid frame is equal to that of the steam locomotives. At the bogie-type locomotives a comma will be put behind letter code referring to the axles embedded in the same bogie frame (for example B' – B'). For axle arrangement coding of the bogie-type locomotives please refer to Table 3.

Numbering System of MÁV Railcars and Multiple Units

Railcars are marked with a Class-marking consisting letters and a nameplate number which consists of 3 figures.

The meaning of the letters:

A	1st class passenger compartment
B	2nd class passenger compartment
D	luggage room
a	4-axled
b	5-axled
y	3-axled
mot	Diesel engine powered railcar
Vmot	electric railcar (earlier was marked with: Vill)

The Class-markings of the earlier built railcars being conform to the Class mark of the 3 passenger comfort classes of the coaches:

A 1st-class passenger compartment
B 2nd-class passenger compartment
C 3rd-class passenger compartment

The Class marking of the railcar trains (multiple units) deviates from the system mentioned before namely here dominates the type of the railcar (powered vehicle of the multiple unit). Some examples: Class MD multiple unit: M relates to the Diesel traction as well as D to the luggage compartment in the power car. Class BDV: V relates to the electric traction, B to the 2nd- class passenger compartment of the power car as well as D to the luggage compartment of the (same) power car.

The marking of the trailers and control trailers of the multiple units is identical to that of the power car, supplemented with following letters:

t	control trailer
x	trailer

Table 4 consists the axle arrangement codes for railcars and multiple units.

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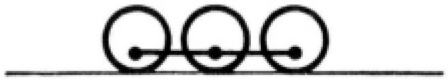
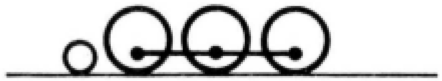
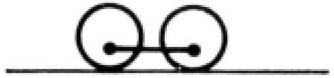
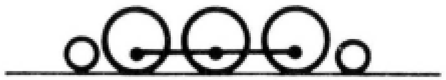
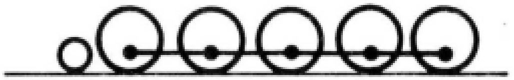
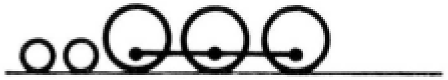
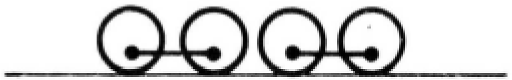
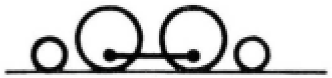
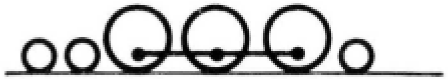
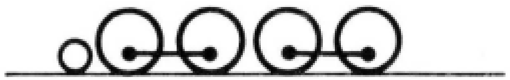
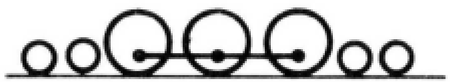
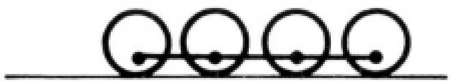
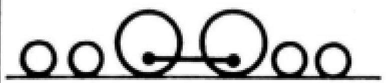
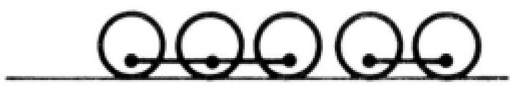
British coding of Steam Locomotive

Tabelle 2.

Axle arrangement		*Axle arrangement*		*Axle arrangement*	
Sketch	Coding	Sketch	Coding	Sketch	Coding
	A1		C		2D
	1A		1C		E
	B		1C1		1E
	1B		2C		B+B
	1B1		2C1		1B+B
	2B		2C2		C+C
	2B1		D		1C+C
	2B2		1D		C+B

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