

SECTION B — PERFORMING OPERATIONS; TRANSPORTING

B60 VEHICLES IN GENERAL

B60L PROPULSION OF ELECTRICALLY-PROPELLED VEHICLES (arrangements or mounting of electrical propulsion units or of plural diverse prime-movers for mutual or common propulsion in vehicles B60K 1/00, B60K 6/20; arrangements or mounting of electrical gearing in vehicles B60K 17/12, B60K 17/14; preventing wheel slip by reducing power in rail vehicles B61C 15/08; dynamo-electric machines H02K; control or regulation of electric motors H02P); **SUPPLYING ELECTRIC POWER FOR AUXILIARY EQUIPMENT OF ELECTRICALLY-PROPELLED VEHICLES** (electric coupling devices combined with mechanical couplings of vehicles B60D 1/64; electric heating for vehicles B60H 1/00); **ELECTRODYNAMIC BRAKE SYSTEMS FOR VEHICLES IN GENERAL** (control or regulation of electric motors H02P); **MAGNETIC SUSPENSION OR LEVITATION FOR VEHICLES; MONITORING OPERATING VARIABLES OF ELECTRICALLY-PROPELLED VEHICLES; ELECTRIC SAFETY DEVICES FOR ELECTRICALLY-PROPELLED VEHICLES** [4]

Subclass index

ELECTRIC PROPULSION

External power supply.....	8/00, 9/00
Internal power supply.....	50/00
Charging.....	53/00
Vehicle-to-grid arrangements.....	55/00
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For monorail vehicles, suspension vehicles or rack railways; Magnetic suspension or levitation for vehicles.....	13/00
Control.....	15/00

CURRENT-COLLECTORS.....5/00

ELECTRIC SUPPLY TO AUXILIARY EQUIPMENT.....1/00

SAFETY ARRANGEMENTS.....3/00

ELECTRODYNAMIC BRAKING.....7/00

1/00 Supplying electric power to auxiliary equipment of electrically-propelled vehicles (arrangement of signalling or lighting devices, the mounting or supporting thereof or circuits therefor, for vehicles in general B60Q) [1, 6, 2006.01]

- 1/02 • to electric heating circuits [1, 2006.01]
- 1/04 • • fed by the power supply line [1, 2006.01]
- 1/06 • • • using only one supply [1, 2006.01]
- 1/08 • • • • Methods or devices for control or regulation [1, 2006.01]
- 1/10 • • • • with provision for using different supplies [1, 2006.01]
- 1/12 • • • • Methods or devices for control or regulation [1, 2006.01]
- 1/14 • to electric lighting circuits [1, 2006.01]
- 1/16 • • fed by the power supply line [1, 2006.01]

3/00 Electric devices on electrically-propelled vehicles for safety purposes; Monitoring operating variables, e.g. speed, deceleration or energy consumption (methods or circuit arrangements for monitoring or controlling batteries or fuel cells B60L 58/00) [1, 2006.01, 2019.01]

- 3/02 • Dead-man's devices [1, 2006.01]
- 3/04 • Cutting-off the power supply under fault conditions [1, 2006.01]
- 3/06 • Limiting the traction current under mechanical-overload conditions [1, 2006.01]
- 3/08 • Means for preventing excessive speed of the vehicle [1, 2006.01]

3/10 • Indicating wheel slip [1, 2006.01]

3/12 • Recording operating variables [1, 2006.01]

5/00 Current-collectors for power supply lines of electrically-propelled vehicles [1, 2006.01]

- 5/02 • with ice-removing device [1, 2006.01]
- 5/04 • using rollers or sliding shoes in contact with trolley wire (B60L 5/40 takes precedence) [1, 2006.01]
- 5/06 • • Structure of the rollers or their carrying means [1, 2006.01]
- 5/08 • • Structure of the sliding shoes or their carrying means [1, 2006.01]
- 5/10 • • Devices preventing the collector from jumping off [1, 2006.01]
- 5/12 • • Structural features of poles or their bases [1, 2006.01]
- 5/14 • • • Devices for automatic lowering of a jumped-off collector [1, 2006.01]
- 5/16 • • • Devices for lifting and resetting the collector (B60L 5/34 takes precedence) [1, 2006.01]
- 5/18 • using bow-type collectors in contact with trolley wire [1, 2006.01]
- 5/19 • • using arrangements for effecting collector movement transverse to the direction of vehicle motion [3, 2006.01]
- 5/20 • • Details of contact bow [1, 2006.01]
- 5/22 • • Supporting means for the contact bow [1, 2006.01]
- 5/24 • • • Pantographs [1, 2006.01]

- 5/26 • • • Half-pantographs, e.g. using counter-rocking beams [1, 2006.01]
- 5/28 • • • Devices for lifting and resetting the collector [1, 2006.01]
- 5/30 • • • • using springs [1, 2006.01]
- 5/32 • • • • using fluid pressure [1, 2006.01]
- 5/34 • with devices to enable one vehicle to pass another one using the same power supply line [1, 2006.01]
- 5/36 • with means for collecting current simultaneously from more than one conductor, e.g. from more than one phase [1, 2006.01]
- 5/38 • for collecting current from conductor rails (B60L 5/40 takes precedence) [1, 2006.01]
- 5/39 • • from third rail [3, 2006.01]
- 5/40 • for collecting current from lines in slotted conduits [1, 2006.01]
- 5/42 • for collecting current from individual contact pieces connected to the power supply line [1, 2006.01]
- 7/00 Electrodynamic brake systems for vehicles in general [1, 4, 2006.01]**
- 7/02 • Dynamic electric resistor braking (B60L 7/22 takes precedence) [1, 2006.01]
- 7/04 • • for vehicles propelled by DC motors [1, 2006.01]
- 7/06 • • for vehicles propelled by AC motors [1, 2006.01]
- 7/08 • • Controlling the braking effect (B60L 7/04, B60L 7/06 take precedence) [1, 2006.01]
- 7/10 • Dynamic electric regenerative braking (B60L 7/22 takes precedence) [1, 2006.01]
- 7/12 • • for vehicles propelled by DC motors [1, 2006.01]
- 7/14 • • for vehicles propelled by AC motors [1, 2006.01]
- 7/16 • • for vehicles comprising converters between the power source and the motor [1, 2006.01]
- 7/18 • • Controlling the braking effect (B60L 7/12, B60L 7/14, B60L 7/16 take precedence) [1, 2006.01]
- 7/20 • Braking by supplying regenerated power to the prime mover of vehicles comprising engine-driven generators [1, 2006.01]
- 7/22 • Dynamic electric resistor braking, combined with dynamic electric regenerative braking [1, 2006.01]
- 7/24 • with additional mechanical or electromagnetic braking [1, 2006.01]
- 7/26 • • Controlling the braking effect [1, 2006.01]
- 7/28 • Eddy-current braking [1, 2006.01]
- 8/00 Electric propulsion with power supply from forces of nature, e.g. sun or wind [5, 2006.01]**
- 9/00 Electric propulsion with power supply external to the vehicle (electric propulsion for monorail vehicles, suspension vehicles or rack railways B60L 13/00; in combination with batteries or fuel cells within the vehicle B60L 50/53) [1, 5, 6, 2006.01, 2019.01]**
- 9/02 • using DC motors [1, 2006.01]
- 9/04 • • fed from DC supply lines [1, 2006.01]
- 9/06 • • • with conversion by metadyne [1, 2006.01]
- 9/08 • • fed from AC supply lines [1, 2006.01]
- 9/10 • • • with rotary converters [1, 2006.01]
- 9/12 • • • with static converters [1, 2006.01]
- 9/14 • • fed from different kinds of power supply lines [1, 2006.01]
- 9/16 • using AC induction motors [1, 2006.01]
- 9/18 • • fed from DC supply lines [1, 2006.01]
- 9/20 • • • single-phase motors [1, 2006.01]
- 9/22 • • • polyphase motors [1, 2006.01]
- 9/24 • • fed from AC supply lines [1, 2006.01]

- 9/26 • • • single-phase motors [1, 2006.01]
- 9/28 • • • polyphase motors [1, 2006.01]
- 9/30 • • fed from different kinds of power supply lines [1, 2006.01]
- 9/32 • using AC brush-displacement motors [1, 2006.01]
- 13/00 Electric propulsion for monorail vehicles, suspension vehicles or rack railways; Magnetic suspension or levitation for vehicles [1, 4, 6, 2006.01]**
- 13/03 • Electric propulsion by linear motors [6, 2006.01]
- 13/04 • Magnetic suspension or levitation for vehicles [4, 2006.01]
- 13/06 • • Means to sense or control vehicle position or attitude with respect to railway [4, 2006.01]
- 13/08 • • • for the lateral position [4, 2006.01]
- 13/10 • Combination of electric propulsion and magnetic suspension or levitation [4, 2006.01]
- 15/00 Methods, circuits or devices for controlling the propulsion of electrically-propelled vehicles, e.g. their traction-motor speed, to achieve a desired performance; Adaptation of control equipment on electrically-propelled vehicles for remote actuation from a stationary place, from alternative parts of the vehicle or from alternative vehicles of the same vehicle train [1, 2006.01]**
- 15/02 • characterised by the form of the current used in the control circuit [1, 2006.01]
- 15/04 • • using DC [1, 2006.01]
- 15/06 • • using substantially-sinusoidal AC [1, 2006.01]
- 15/08 • • using pulses [1, 2006.01]
- 15/10 • for automatic control superimposed on human control to limit the acceleration of the vehicle, e.g. to prevent excessive motor current (electric devices for safety purposes B60L 3/00) [1, 2006.01]
- 15/12 • • with circuits controlled by relays or contactors [1, 2006.01]
- 15/14 • • with main controller driven by a servomotor (B60L 15/18 takes precedence) [1, 2006.01]
- 15/16 • • with main controller driven through a ratchet mechanism (B60L 15/18 takes precedence) [1, 2006.01]
- 15/18 • • without contact-making and breaking, e.g. using a transducer [1, 2006.01]
- 15/20 • for control of the vehicle or its driving motor to achieve a desired performance, e.g. speed, torque, programmed variation of speed [1, 2006.01]
- 15/22 • • with sequential operation of interdependent switches, e.g. relays, contactors, programme drum [1, 2006.01]
- 15/24 • • with main controller driven by a servomotor (B60L 15/28 takes precedence) [1, 2006.01]
- 15/26 • • with main controller driven through a ratchet mechanism (B60L 15/28 takes precedence) [1, 2006.01]
- 15/28 • • without contact-making and breaking, e.g. using a transducer [1, 2006.01]
- 15/30 • • with means to change-over to human control [1, 2006.01]
- 15/32 • Control or regulation of multiple-unit electrically-propelled vehicles [1, 2006.01]
- 15/34 • • with human control of a setting device [1, 2006.01]
- 15/36 • • • with automatic control superimposed, e.g. to prevent excessive motor current [1, 2006.01]
- 15/38 • • with automatic control [1, 2006.01]

15/40	• Adaptation of control equipment on vehicle for remote actuation from a stationary place (devices along the route for controlling devices on rail vehicles B61L 3/00; central rail-traffic control systems B61L 27/00) [1, 2006.01]	50/75	• • using propulsion power supplied by both fuel cells and batteries [2019.01]
15/42	• Adaptation of control equipment on vehicle for actuation from alternative parts of the vehicle or from alternative vehicles of the same vehicle train (B60L 15/32 takes precedence) [1, 2006.01]	50/90	• using propulsion power supplied by specific means not covered by groups B60L 50/10-B60L 50/50, e.g. by direct conversion of thermal nuclear energy into electricity [2019.01]
50/00	Electric propulsion with power supplied within the vehicle (with power supply from forces of nature, e.g. sun or wind, B60L 8/00; for monorail vehicles, suspension vehicles or rack railways B60L 13/00) [2019.01]	53/00	Methods of charging batteries, specially adapted for electric vehicles; Charging stations or on-board charging equipment therefor; Exchange of energy storage elements in electric vehicles [2019.01]
50/10	• using propulsion power supplied by engine-driven generators, e.g. generators driven by combustion engines [2019.01]	53/10	• characterised by the energy transfer between the charging station and the vehicle [2019.01]
50/11	• • using DC generators and DC motors [2019.01]	53/12	• • Inductive energy transfer [2019.01]
50/12	• • using AC generators and DC motors [2019.01]	53/122	• • • Circuits or methods for driving the primary coil, i.e. supplying electric power to the coil [2019.01]
50/13	• • using AC generators and AC motors [2019.01]	53/124	• • • Detection or removal of foreign bodies [2019.01]
50/14	• • using DC generators and AC motors [2019.01]	53/126	• • • Methods for pairing a vehicle and a charging station, e.g. establishing a one-to-one relation between a wireless power transmitter and a wireless power receiver [2019.01]
50/15	• • with additional electric power supply (with capacitors charged by engine-driven generators B60L 50/40; with batteries charged by engine-driven generators B60L 50/61) [2019.01]	53/14	• • Conductive energy transfer [2019.01]
50/16	• • with provision for separate direct mechanical propulsion [2019.01]	53/16	• • • Connectors, e.g. plugs or sockets, specially adapted for charging electric vehicles [2019.01]
50/20	• using propulsion power generated by humans or animals [2019.01]	53/18	• • • Cables specially adapted for charging electric vehicles [2019.01]
50/30	• using propulsion power stored mechanically, e.g. in fly-wheels [2019.01]	53/20	• characterised by converters located in the vehicle [2019.01]
50/40	• using propulsion power supplied by capacitors [2019.01]	53/22	• • Constructional details or arrangements of charging converters specially adapted for charging electric vehicles [2019.01]
50/50	• using propulsion power supplied by batteries or fuel cells [2019.01]	53/24	• • Using the vehicle's propulsion converter for charging [2019.01]
50/51	• • characterised by AC-motors [2019.01]	53/30	• Constructional details of charging stations [2019.01]
50/52	• • characterised by DC-motors [2019.01]	53/302	• • Cooling of charging equipment [2019.01]
50/53	• • in combination with an external power supply, e.g. from overhead contact lines [2019.01]	53/31	• • Charging columns specially adapted for electric vehicles [2019.01]
50/60	• • using power supplied by batteries (in combination with fuel cells B60L 50/75) [2019.01]	53/34	• • Plug-like or socket-like devices specially adapted for contactless inductive charging of electric vehicles (positioning means for charging devices using inductive energy transfer B60L 53/38) [2019.01]
50/61	• • • by batteries charged by engine-driven generators, e.g. series hybrid electric vehicles [2019.01]	53/35	• • Means for automatic or assisted adjustment of the relative position of charging devices and vehicles [2019.01]
50/62	• • • charged by low-power generators primarily intended to support the batteries, e.g. range extenders [2019.01]	53/36	• • • by positioning the vehicle [2019.01]
50/64	• • • Constructional details of batteries specially adapted for electric vehicles [2019.01]	53/37	• • • using optical position determination, e.g. using cameras [2019.01]
Note(s) [2019.01] This group <u>covers</u> adaptation of battery structures of electric vehicles, e.g. integration into control or safety systems, crash-resistant casings or vibration-damping means.		53/38	• • • specially adapted for charging by inductive energy transfer [2019.01]
50/70	• • using power supplied by fuel cells (in combination with batteries B60L 50/75) [2019.01]	53/39	• • • with position-responsive activation of primary coils [2019.01]
50/71	• • • Arrangement of fuel cells within vehicles specially adapted for electric vehicles [2019.01]	53/50	• Charging stations characterised by energy-storage or power-generation means [2019.01]
50/72	• • • Constructional details of fuel cells specially adapted for electric vehicles [2019.01]	53/51	• • Photovoltaic means [2019.01]
Note(s) [2019.01] This group <u>covers</u> adaptation of fuel cell structures of electric vehicles, e.g. integration into control or safety systems, crash-resistant casings or vibration-damping means.		53/52	• • Wind-driven generators [2019.01]
		53/53	• • Batteries [2019.01]
		53/54	• • Fuel cells [2019.01]
		53/55	• • Capacitors [2019.01]
		53/56	• • Mechanical storage means, e.g. fly wheels [2019.01]
		53/57	• • Charging stations without connection to power networks [2019.01]
		53/60	• Monitoring or controlling charging stations [2019.01]

- 53/62 • • in response to charging parameters, e.g. current, voltage or electrical charge **[2019.01]**
- 53/63 • • in response to network capacity **[2019.01]**
- 53/64 • • Optimising energy costs, e.g. responding to electricity rates **[2019.01]**
- 53/65 • • involving identification of vehicles or their battery types **[2019.01]**
- 53/66 • • Data transfer between charging stations and vehicles **[2019.01]**
- 53/67 • • Controlling two or more charging stations **[2019.01]**
- 53/68 • • Off-site monitoring or control, e.g. remote control **[2019.01]**
- 53/80 • Exchanging energy storage elements, e.g. removable batteries **[2019.01]**

- 55/00 **Arrangements for supplying energy stored within a vehicle to a power network, i.e. vehicle-to-grid [V2G] arrangements [2019.01]**

- 58/00 **Methods or circuit arrangements for monitoring or controlling batteries or fuel cells, specially adapted for electric vehicles [2019.01]**
- Note(s) [2019.01]**
- This group covers the monitoring of the operating state of batteries or fuel cells in combination with controlling the propulsion in response to the detected variables of the state.
- 58/10 • for monitoring or controlling batteries **[2019.01]**

- 58/12 • • responding to state of charge [SoC] **[2019.01]**
- 58/13 • • • Maintaining the SoC within a determined range **[2019.01]**
- 58/14 • • • Preventing excessive discharging **[2019.01]**
- 58/15 • • • Preventing overcharging **[2019.01]**
- 58/16 • • responding to battery ageing, e.g. to the number of charging cycles or the state of health [SoH] **[2019.01]**
- 58/18 • • of two or more battery modules **[2019.01]**
- 58/19 • • • Switching between serial connection and parallel connection of battery modules **[2019.01]**
- 58/20 • • • having different nominal voltages **[2019.01]**
- 58/21 • • • having the same nominal voltage **[2019.01]**
- 58/22 • • • Balancing the charge of battery modules **[2019.01]**
- 58/24 • • for controlling the temperature of batteries **[2019.01]**
- 58/25 • • • by controlling the electric load **[2019.01]**
- 58/26 • • • by cooling **[2019.01]**
- 58/27 • • • by heating **[2019.01]**
- 58/30 • for monitoring or controlling fuel cells **[2019.01]**
- 58/31 • • for starting of fuel cells **[2019.01]**
- 58/32 • • for controlling the temperature of fuel cells, e.g. by controlling the electric load **[2019.01]**
- 58/33 • • • by cooling **[2019.01]**
- 58/34 • • • by heating **[2019.01]**
- 58/40 • for controlling a combination of batteries and fuel cells **[2019.01]**