SECTION H — ELECTRICITY

H02 GENERATION, CONVERSION, OR DISTRIBUTION OF ELECTRIC POWER

H02B BOARDS, SUBSTATIONS, OR SWITCHING ARRANGEMENTS FOR THE SUPPLY OR DISTRIBUTION OF ELECTRIC POWER (basic electric elements, their assembly, including the mounting in enclosures or on bases, or the mounting of covers thereon, see the subclasses for such elements, e.g. transformers H01F, switches, fuses H01H, line connectors H01R; installation of electric cables or lines, or of combined optical and electric cables or lines, or other conductors for supply or distribution H02G)

Note(s)

This subclass covers boards, switchyards, switchgear or their installation, or the association of switching devices with each other or with other devices, e.g. transformers, fuses, meters or distribution boards; such associations constitute substations or distribution points.

Subclass index

1/00 Frameworks, boards, panels, desks, casings; Details of substations or switching arrangements [5]

1/01 • Frameworks **[5]**

1/015 • Boards, panels, desks; Parts thereof or accessories therefor **[5]**

1/03 • • for energy meters **[5]**

1/04 • • Mounting thereon of switches or of other devices in general, the switch or device having, or being without, casing

1/044 • • • Mounting through openings **[5]**

1/048 • • • • Snap mounting **[5]**

1/052 • • • Mounting on rails **[5]**

1/056 • • • Mounting on plugboards **[5]**

1/06 • • having associated enclosures, e.g. for preventing access to live parts (shutters or guards for contacts H02B 1/14)

1/14 • Shutters or guards for preventing access to contacts (shielding of isolating-contacts in withdrawable switchgear H02B 11/24)

1/16 • Earthing arrangements (earthing arrangements for substations H02B 5/01, for switchgear H02B 11/28, H02B 13/075; earth plates, pins, or other contacts H01R 4/66) **[5]**

1/18 • Disposition or arrangement of fuses (for switchgear having a withdrawable carriage H02B 11/26) **[5]**

1/20 • Bus-bar or other wiring layouts, e.g. in cubicles, in switchyards (installations of bus-bars H02G 5/00)

1/21 • • Bus-bar arrangements for rack-mounted devices with withdrawable units **[5]**

1/22 • • Layouts for duplicate bus-bar selection

1/24 • Circuit arrangements for boards or switchyards (devices for displaying diagrams H02B 15/00; service supply H02J 11/00)

Note(s)

In groups H02B 1/26-H02B 1/56, in the absence of an indication to the contrary, classification is made in the last appropriate place.

1/26 • Casings; Parts thereof or accessories therefor (adapted for a single switch H01H; enclosures for cables, lines or bus-bars H02G; distribution, connection or junction boxes H02G 3/08; casings in general H05K) **[5]**

1/28 • • dustproof, splashproof, drip-proof, waterproof or flameproof **[5]**

1/30 • • Cabinet-type casings; Parts thereof or accessories therefor **[5]**

1/32 • • • Mounting of devices therein **[5]**

1/34 • • • • Racks **[5]**

1/36 • • • • • with withdrawable units **[5]**

1/38 • • • Hinged covers or doors **[5]**

1/40 • • Wall-mounted casings; Parts thereof or accessories therefor **[5]**

1/42 • • • Mounting of devices therein **[5]**

1/44 • • • Hinged covers or doors **[5]**

1/46 • • Boxes; Parts thereof or accessories therefor **[5]**

1/48 • • • Mounting of devices therein **[5]**

1/50 • • Pedestal- or pad-mounted casings; Parts thereof or accessories therefor **[5]**

1/52 • • Mobile units, e.g. for work sites **[5]**

1/54 • Anti-seismic devices or installations (for buildings in general E04B 1/98) **[5]**

1/56 • Cooling; Ventilation **[5]**

3/00 Apparatus specially adapted for the manufacture, assembly, or maintenance of boards or switchgear

5/00 Non-enclosed substations; Substations with enclosed and non-enclosed equipment

5/01 • Earthing arrangements, e.g. earthing rods **[5]**
5/02 • mounted on pole, e.g. pole transformer substation
5/06 • gas-insulated **[5]**

7/00 Enclosed substations, e.g. compact substations [5]
7/01 • gas-insulated **[5]**
7/06 • Distribution substations, e.g. for urban network (H02B 7/01 takes precedence) **[5]**
7/08 • • Underground substations

11/00 Switchgear having carriage withdrawable for isolation
11/02 • Details
11/04 • • Isolating-contacts, e.g. mountings, shieldings (shutters or guards for isolating contacts H02B 1/14, H02B 11/24; switch contacts H01H; line connectors in general H01R) **[5]**
11/06 • • Means for duplicate bus-bar selection (layouts for duplicate bus-bar selection H02B 1/22)
11/08 • • Oil-tank lowering means associated with withdrawal mechanism
11/10 • • Indicating electrical condition of gear; Arrangement of test sockets
11/12 • with isolation by horizontal withdrawal
11/127 • • Withdrawal mechanism **[5]**
11/133 • • • with interlock (interlock for switches in general H01H) **[5]**
11/167 • • truck type (H02B 11/127 takes precedence) **[5]**
11/173 • • drawer type (H02B 11/127 takes precedence) **[5]**
11/18 • with isolation by vertical withdrawal
11/20 • • having an enclosure
11/22 • • • wherein front of enclosure moves with carriage upon horizontal withdrawal subsequent to isolation
11/24 • Shutters or guards **[5]**
11/26 • Arrangement of fuses, resistors, voltage arresters or the like **[5]**
11/28 • Earthing arrangements **[5]**

13/00 Arrangement of switchgear in which switches are enclosed in, or structurally associated with, a casing, e.g. cubicle (in association with main transformer H02B 5/00, H02B 7/00; switchgear having carriage withdrawable for isolation H02B 11/00) **[5]**
13/01 • with resin casing **[5]**
13/02 • with metal casing
13/025 • • Safety arrangements, e.g. in case of excessive pressure or fire due to electrical defect (for buildings in general E04B 1/94; devices for opening or closing safety wings E05F 1/00; emergency protective circuit arrangements for distribution gear, e.g. bus-bar systems, or for switching devices H02H 7/22) **[5]**
13/035 • • Gas-insulated switchgear **[5]**
13/045 • • • Details of casing, e.g. gas tightness (gas reservoirs for switches H01H 33/56) **[5]**
13/055 • • • Features relating to the gas (selection of fluids for switches H01H 33/22) **[5]**
13/065 • • • Means for detecting or reacting to mechanical or electrical defects (for switches H01H 9/50, H01H 33/26, H01H 33/53) **[5]**
13/075 • • • Earthing arrangements **[5]**
13/08 • with stone, brick, or concrete casing

15/00 Supervisory desks or panels for centralised control or display (desks in general A47B)
15/02 • with mimic diagrams
15/04 • • consisting of building blocks

99/00 Subject matter not provided for in other groups of this subclass [2009.01]

H02G INSTALLATION OF ELECTRIC CABLES OR LINES, OR OF COMBINED OPTICAL AND ELECTRIC CABLES OR LINES (insulated conductors or cables with arrangements for facilitating mounting or securing H01B 7/40; distribution points incorporating switches H02B; guiding telephone cords H04M 1/15; cable ducts or mountings for telephone or telegraph exchange installations H04Q 1/06)

Note(s)

1. This subclass covers installation of communication cables or lines, including those comprising a combination of optical and electrical conductors, or of lightning conductors as well as installation of power cables or lines.
2. This subclass does not cover installation of purely optical cables, which is covered by group G02B 6/46.
3. In this subclass, the following expression is used with the meaning indicated:
   • "electric cable" includes cables comprising optical conductors, e.g. fibres, in combination with electrical conductors.

Subclass index

1/00 Methods or apparatus specially adapted for installing, maintaining, repairing, or dismantling electric cables or lines
1/02 • for overhead lines or cables
1/04 • • for mounting or stretching (wire stretchers in general B25B 25/00)
1/06 • for laying cables, e.g. laying apparatus on vehicle (combined with trench digging or back-filling machines or dredgers E02F 5/00)
1/08 • • through tubing or conduit, e.g. rod or draw wire for pushing or pulling
1/10 • • in or under water

1/12 • for removing insulation or armouring from cables, e.g. from the end thereof (pliers in general B25B; cutters in general B26B; insulated conductors or cables with arrangements for facilitating removal of insulation H01B 7/38)
1/14 • for joining or terminating cables (joining electric conductors H01R 43/00)
1/16 • for repairing insulation or armouring of cables

3/00 Installations of electric cables or lines or protective tubing therefor in or on buildings, equivalent structures or vehicles (installations of bus-bars H02G 5/00; overhead installations H02G 7/00; installations in or on the ground H02G 9/00; channels or vertical ducts for receiving utility lines E04F 17/08; wiring of electric apparatus in general H05K)
3/02 • Details
3/03 • • Cooling **[2]**
3/04 • • Protective tubing or conduits, e.g. cable ladders, cable troughs (pipes or tubing in general F16L)
3/06 • • Joints for connecting lengths of protective tubing to each other or to casings, e.g. to distribution box; Ensuring electrical continuity in the joint
3/08 • • Distribution boxes; Connection or junction boxes (cable terminations H02G 15/02)
3/10 • • • for surface mounting on a wall
3/12 • • • for flush mounting
3/14 • • • Fastening of cover or lid to box
3/16 • • • structurally associated with support for line-connecting terminals within the box (terminals H01R 9/00)
3/18 • • • providing line outlets
3/20 • • • • Ceiling roses
3/22 • Installations of cables or lines through walls, floors, or ceilings, e.g. into buildings (devices for use where pipes or cables pass through walls or partitions F16L 5/00; lead-in or lead-through insulators H01B 17/26; insulating tubes or sleeves H01B 17/58)
3/30 • Installations of cables or lines on walls, floors or ceilings (supports for pipes, cables or protective tubing F16L 3/00; hose-clips F16L 33/02) **[7]**
3/32 • • using mounting clamps **[7]**
3/34 • • using separate protective tubing **[7]**
3/36 • Installations of cables or lines in walls, floors or ceilings (H02G 3/22 takes precedence) **[7]**
3/38 • • the cables or lines being installed in preestablished conduits or ducts **[7]**
3/40 • • • using separate protective tubing in the conduits or ducts **[7]**

5/00 Installations of bus-bars
5/02 • Open installations
5/04 • Partially-enclosed installations, e.g. in ducts and adapted for sliding or rolling current collection (non-rotary current collectors H01R 41/00)
5/06 • Totally-enclosed installations, e.g. in metal casings
5/08 • • Connection boxes therefor
5/10 • Cooling **[2]**

7/00 Overhead installations of electric lines or cables (installations of bus-bars H02G 5/00; trolley wires or contact lines for electric railways B60M; fastening conductors to insulators H01B 17/00, e.g. H01B 17/06, H01B 17/16, H01B 17/22; protection against abnormal electric conditions H01H; hook contacts for temporary connections to overhead lines H01R 11/14)
7/02 • Devices for adjusting or maintaining mechanical tension, e.g. take-up device
7/04 • Arrangements or devices for relieving mechanical tension
7/05 • Suspension arrangements or devices for electric cables or lines **[3]**
7/06 • • Suspensions for lines or cables along a separate supporting wire, e.g. S-hook **[3]**
7/08 • • • Members clamped to the supporting wire or to the line or cable **[3]**
7/10 • • • Flexible members or lashings wrapped around both the supporting wire and the line or cable **[3]**
7/12 • Devices for maintaining distance between parallel conductors, e.g. spacer
7/14 • Arrangements or devices for damping mechanical oscillations of lines, e.g. for reducing production of sound
7/16 • Devices for removing snow or ice from lines or cables (from insulators H01B 17/52)
7/18 • Devices affording mechanical protection in the event of breakage of a line or cable, e.g. net for catching broken lines
7/20 • Spatial arrangements or dispositions of lines or cables on poles, posts, or towers (construction of poles, posts, or towers E04H 12/22)
7/22 • Arrangements of earthing wires suspended between mastheads

9/00 Installations of electric cables or lines in or on the ground or water (cathodic protection C23F 13/02; detection of buried cables G01V)
9/02 • laid directly in or on the ground, river-bed or sea-bottom; Coverings therefor, e.g. tile
9/04 • in surface ducts; Ducts or covers therefor
9/06 • in underground tubes or conduits; Tubes or conduits therefor
9/08 • in tunnels
9/10 • in cable chambers, e.g. in manhole, in handhole (building aspects of cable chambers section E, e.g. E04H 5/06)
9/12 • supported on or from floats, e.g. in water (floating cables H01B 7/12)

11/00 Arrangements of electric cables or lines between relatively-movable parts (current collectors H01R)
11/02 • using take-up reel or drum

13/00 Installations of lightning conductors; Fastening thereof to supporting structure (indicating, counting or recording lightning strokes G01; lightning arrestors H01C 7/12, H01C 8/04, H01G 9/18, H01T; earth plates, pins or other contacts H01R)

15/00 Cable fittings
15/007 • Devices for relieving mechanical stress **[3]**
15/013 • Sealing means for cable inlets (inlets for cables filled with, or surrounded by, gas or oil H02G 15/32) **[3]**
15/02 • Cable terminations (for gas- or oil-filled cables H02G 15/22)
15/04 • • Cable-end sealings
15/06 • • Cable terminating boxes, frames, or other structures (terminal blocks H01R 9/00)
15/064 • • • with devices for relieving electrical stress **[3]**
15/068 • • • • connected to the cable shield only (H02G 15/072 takes precedence) **[3]**
15/072 • • • • of the condenser type **[3]**
15/076 • • • for multi-conductor cables **[3]**

15/08 • Cable junctions (for gas or oil filled cables H02G 15/24; disconnectable junctions, electrical connections H01R)
15/10 • • protected by boxes, e.g. by distribution, connection or junction boxes (terminal blocks H01R 9/00)
15/103 • • • with devices for relieving electrical stress **[3]**
15/105 • • • • connected to the cable shield only (H02G 15/107 takes precedence) **[3]**
15/107 • • • • of the condenser type **[3]**
15/113 • • • Boxes split longitudinally in main cable direction **[3]**
15/115 • • • Boxes split perpendicularly to main cable direction **[3]**
15/117 • • • for multiconductor cables **[3]**
15/12 • • • for incorporating transformers, loading coils or amplifiers
15/14 • • • • specially adapted for submarine cables
15/16 • • • structurally associated with support for line-connecting terminals within the box
15/18 • • protected by sleeves, e.g. for communication cable (two-part covers H02G 15/10)
15/184 • • • with devices for relieving electrical stress **[3]**
15/188 • • • • connected to cable shield only **[3]**
15/192 • • • with support means for ends of the sleeves **[3]**
15/196 • • • having lapped insulation **[3]**
15/20 • Cable fittings for cables filled with or surrounded by gas or oil (H02G 15/34 takes precedence) **[3]**
15/22 • • Cable terminations
15/23 • • • Cable-end sealings **[3]**
15/24 • • Cable junctions
15/25 • • • Stop junctions **[3]**
15/26 • • Expansion vessels; Locking heads; Auxiliary pipe-lines
15/28 • • structurally associated with devices for indicating the presence or location of non-electric faults (combined with electric protective means H02H)
15/30 • • with devices for relieving electrical stress **[3]**
15/32 • • Cable inlets **[3]**
15/34 • Cable fittings for cryogenic cables **[3]**

H02H **EMERGENCY PROTECTIVE CIRCUIT ARRANGEMENTS** (indicating or signalling undesired working conditions G01R, e.g. G01R 31/00, G08B; locating faults along lines G01R 31/08; emergency protective devices H01H)

Note(s)

This subclass covers only circuit arrangements for the automatic protection of electric lines or electric machines or apparatus in the event of an undesired change from normal working conditions.

Subclass index

1/00 **Details of emergency protective circuit arrangements**
1/04 • Arrangements for preventing response to transient abnormal conditions, e.g. to lightning
1/06 • Arrangements for supplying operative power **[3]**

3/00 **Emergency protective circuit arrangements for automatic disconnection directly responsive to an undesired change from normal electric working condition, with or without subsequent reconnection** (specially adapted for specific types of electric machines or apparatus or for sectionalised protection of cable or line systems H02H 7/00; systems for change-over to standby supply H02J 9/00)
3/02 • Details
3/027 • • with automatic disconnection after a predetermined time (H02H 3/033, H02H 3/06 take precedence) **[3]**
3/033 • • with several disconnections in a preferential order (H02H 3/06 takes precedence) **[3]**
3/04 • • with warning or supervision in addition to disconnection, e.g. for indicating that protective apparatus has functioned
3/05 • • with means for increasing reliability, e.g. redundancy arrangements **[3]**
3/06 • • with automatic reconnection
3/07 • • • and with permanent disconnection after a predetermined number of reconnection cycles **[3]**
3/08 • responsive to excess current (responsive to abnormal temperature caused by excess current H02H 5/04)
3/087 • • for dc applications **[3]**
3/093 • • with timing means **[3]**
3/10 • • additionally responsive to some other abnormal electrical conditions
3/12 • responsive to underload or no-load
3/13 • • for multiphase applications, e.g. phase interruption **[3]**
3/14 • responsive to occurrence of voltage on parts normally at earth potential
3/16 • responsive to fault current to earth, frame or mass (with balanced or differential arrangement H02H 3/26)
3/17 • • by means of an auxiliary voltage injected into the installation to be protected **[3]**
3/18 • responsive to reversal of direct current
3/20 • responsive to excess voltage
3/22 • • of short duration, e.g. lightning
3/24 • responsive to undervoltage or no-voltage
3/247 • • having timing means **[3]**

3/253 • • for multiphase applications, e.g. phase interruption **[3]**
3/26 • responsive to difference between voltages or between currents; responsive to phase angle between voltages or between currents
3/28 • • involving comparison of the voltage or current values at two spaced portions of a single system, e.g. at opposite ends of one line, at input and output of apparatus
3/30 • • • using pilot wires or other signalling channel
3/32 • • involving comparison of the voltage or current values at corresponding points in different conductors of a single system, e.g. of currents in go and return conductors
3/33 • • • using summation current transformers (H02H 3/347 takes precedence) **[3]**
3/34 • • • of a three-phase system
3/347 • • • • using summation current transformers **[3]**
3/353 • • • • involving comparison of phase voltages **[3]**
3/36 • • involving comparison of the voltage or current values at corresponding points of different systems, e.g. of parallel feeder systems
3/38 • responsive to both voltage and current; responsive to phase angle between voltage and current
3/40 • responsive to ratio of voltage and current
3/42 • responsive to product of voltage and current
3/44 • responsive to the rate of change of electrical quantities **[3]**
3/46 • responsive to frequency deviations **[3]**
3/48 • responsive to loss of synchronism **[3]**
3/50 • responsive to the appearance of abnormal wave forms, e.g. ac in dc installations **[3]**
3/52 • • responsive to the appearance of harmonics **[3]**

5/00 Emergency protective circuit arrangements for automatic disconnection directly responsive to an undesired change from normal non-electric working conditions with or without subsequent reconnection (using simulators of the apparatus being protected H02H 6/00; specially adapted for specific types of electric machines or apparatus or for sectionalised protection of cable or line systems H02H 7/00) **[3]**

5/04 • responsive to abnormal temperature
5/06 • • in oil-filled electric apparatus
5/08 • responsive to abnormal fluid pressure, liquid level or liquid displacement, e.g. Buchholz relays
5/10 • responsive to mechanical injury, e.g. rupture of line, breakage of earth connection
5/12 • responsive to undesired approach to, or touching of, live parts by living beings

6/00 Emergency protective circuit arrangements responsive to undesired changes from normal non-electric working conditions using simulators of the apparatus being protected, e.g. using thermal images [3]

7/00 Emergency protective circuit arrangements specially adapted for specific types of electric machines or apparatus or for sectionalised protection of cable or line systems, and effecting automatic switching in the event of an undesired change from normal working conditions (structural association of protective devices with specific machines or apparatus and their protection without automatic disconnection, see the relevant subclass for the machine or apparatus)

7/04 • for transformers
7/045 • • Differential protection of transformers **[3]**
7/05 • • for capacitive voltage transformers, e.g. against resonant conditions **[3]**
7/055 • • for tapped transformers or tap-changing means thereof **[3]**
7/06 • for dynamo-electric generators; for synchronous capacitors
7/08 • for dynamo-electric motors
7/085 • • against excessive load
7/09 • • against over-voltage; against reduction of voltage; against phase interruption
7/093 • • against increase beyond, or decrease below, a predetermined level of rotational speed (centrifugal switches H01H 35/10)
7/097 • • against wrong direction of rotation
7/10 • for converters; for rectifiers
7/12 • • for static converters or rectifiers
7/122 • • • for inverters, i.e. dc/ac converters **[2]**
7/125 • • • for rectifiers **[2]**
7/127 • • • • having auxiliary control electrode to which blocking control voltages or currents are applied in case of emergency **[2]**
7/16 • for capacitors (for synchronous capacitors H02H 7/06)
7/18 • for batteries; for accumulators
7/20 • for electronic equipment (for converters H02H 7/10; for electric measuring instruments G01R 1/36; for dc voltage or current semiconductor regulators G05F 1/569; for amplifiers H03F 1/52; for electronic switching circuits H03K 17/08)
7/22 • for distribution gear, e.g. bus-bar systems; for switching devices
7/24 • for spark-gap arresters
7/26 • Sectionalised protection of cable or line systems, e.g. for disconnecting a section on which a short-circuit, earth fault, or arc discharge has occurred (locating faults in cables G01R 31/08)
7/28 • • for meshed systems
7/30 • • Staggered disconnection **[3]**

9/00 Emergency protective circuit arrangements for limiting excess current or voltage without disconnection (structural association of protective devices with specific machines or apparatus, see the relevant subclass for the machine or apparatus)

9/02 • responsive to excess current
9/04 • responsive to excess voltage (lightning arrestors H01C 7/12, H01C 8/04, H01G 9/18, H01T)
9/06 • • using spark-gap arresters
9/08 • Limitation or suppression of earth fault currents, e.g. Petersen coil **[3]**

11/00 Emergency protective circuit arrangements for preventing the switching-on in case an undesired electric working condition might result

99/00 Subject matter not provided for in other groups of this subclass [2009.01]

H02J CIRCUIT ARRANGEMENTS OR SYSTEMS FOR SUPPLYING OR DISTRIBUTING ELECTRIC POWER; SYSTEMS FOR STORING ELECTRIC ENERGY (power supply circuits for apparatus for measuring X-radiation, gamma radiation, corpuscular radiation or cosmic radiation G01T 1/175; electric power supply circuits specially adapted for use in electronic time-pieces with no moving parts G04G 19/00; for digital computers G06F 1/18; for discharge tubes H01J 37/248; circuits or apparatus for the conversion of electric power, arrangements for control or regulation of such circuits or apparatus H02M; interrelated control of several motors, control of a prime-mover/generator combination H02P; control of high-frequency power H03L; additional use of power line or power network for transmission of information H04B)

Note(s)

1. This subclass covers:
   - ac or dc mains or distribution networks;
   - circuit arrangements for battery supplies, including charging or control thereof, or co-ordinated supply from two or more sources of any kind;
   - systems for supplying or distributing electric power by electromagnetic waves.
2. This subclass does not cover:
   - control of a single motor, generator or dynamo-electric converter, of the types covered by subclass H01F or H02K, which is covered by subclass H02P;
   - control of a single motor or generator, of the types covered by subclass H02N, which is covered by that subclass.

Subclass index

1/00 Circuit arrangements for dc mains or dc distribution networks

1/02 • Arrangements for reducing harmonics or ripples (in converters H02M 1/14)
1/04 • Constant-current supply systems
1/06 • Two-wire systems
1/08 • Three-wire systems; Systems having more than three wires
1/10 • Parallel operation of dc sources (involving batteries H02J 7/34)
1/12 • • Parallel operation of dc generators with converters, e.g. with mercury-arc rectifier
1/14 • Balancing the load in a network (by batteries H02J 7/34)
1/16 • • using dynamo-electric machines coupled to flywheels

3/00 Circuit arrangements for ac mains or ac distribution networks

3/01 • Arrangements for reducing harmonics or ripples (in converters H02M 1/12) **[3]**
3/02 • using a single network for simultaneous distribution of power at different frequencies; using a single network for simultaneous distribution of ac power and of dc power
3/04 • for connecting networks of the same frequency but supplied from different sources
3/06 • • Controlling transfer of power between connected networks; Controlling sharing of load between connected networks
3/08 • • Synchronising of networks
3/10 • Constant-current supply systems
3/12 • for adjusting voltage in ac networks by changing a characteristic of the network load
3/14 • • by switching loads on to, or off from, network, e.g. progressively balanced loading
3/16 • • by adjustment of reactive power
3/18 • Arrangements for adjusting, eliminating, or compensating reactive power in networks (for adjustment of voltage H02J 3/12; use of Petersen coils H02H 9/08)
3/20 • • in long overhead lines
3/22 • • in cables
3/24 • Arrangements for preventing or reducing oscillations of power in networks (by control effected upon a single generator H02P 9/00)
3/26 • Arrangements for eliminating or reducing asymmetry in polyphase networks
3/28 • Arrangements for balancing the load in a network by storage of energy
3/30 • • using dynamo-electric machines coupled to flywheels
3/32 • • using batteries with converting means
3/34 • Arrangements for transfer of electric power between networks of substantially different frequency (frequency converters H02M)
3/36 • Arrangements for transfer of electric power between ac networks via a high-tension dc link
3/38 • Arrangements for parallelly feeding a single network by two or more generators, converters, or transformers
3/40 • • Synchronising a generator for connection to a network or to another generator

3/42 • • • with automatic parallel connection when synchronism is achieved
3/44 • • • with means for ensuring correct phase sequence
3/46 • • Controlling the sharing of output between the generators, converters, or transformers
3/48 • • • Controlling the sharing of the in-phase component
3/50 • • • Controlling the sharing of the out-of-phase component

4/00 Circuit arrangements for mains or distribution networks not specified as ac or dc [2]

5/00 Circuit arrangements for transfer of electric power between ac networks and dc networks (H02J 3/36 takes precedence)

7/00 Circuit arrangements for charging or depolarising batteries or for supplying loads from batteries

7/02 • for charging batteries from ac mains by converters
7/04 • • Regulation of the charging current or voltage
7/06 • • • using discharge tubes or semiconductor devices
7/08 • • • • using discharge tubes only
7/10 • • • • using semiconductor devices only
7/12 • • • using magnetic devices having controllable degree of saturation, i.e. transductors
7/14 • for charging batteries from dynamo-electric generators driven at varying speed, e.g. on vehicle
7/16 • • Regulation of the charging current or voltage by variation of field
7/18 • • • due to variation of ohmic resistance in field circuit, using resistance switching in or out of circuit step by step
7/20 • • • due to variation of continuously-variable ohmic resistor
7/22 • • • due to variation of make-to-break ratio of intermittently-operating contacts, e.g. using Tirrill regulator
7/24 • • • using discharge tubes or semiconductor devices
7/26 • • • using magnetic devices with controllable degree of saturation
7/28 • • • using magnetic devices with controllable degree of saturation in combination with controlled discharge tube or controlled semiconductor device
7/30 • • • using armature-reaction-excited machines
7/32 • for charging batteries from a charging set comprising a non-electric prime mover
7/34 • Parallel operation in networks using both storage and other dc sources, e.g. providing buffering (H02J 7/14 takes precedence) **[4]**
7/35 • • with light sensitive cells **[4]**
7/36 • Arrangements using end-cell switching

9/00 Circuit arrangements for emergency or stand-by power supply, e.g. for emergency lighting (with provision for charging standby battery H02J 7/00)

9/02 • in which an auxiliary distribution system and its associated lamps are brought into service
9/04 • in which the distribution system is disconnected from the normal source and connected to a standby source
9/06 • • with automatic change-over
9/08 • • • requiring starting of a prime-mover

11/00 Circuit arrangements for providing service supply to auxiliaries of stations in which electric power is generated, distributed, or converted (emergency or standby arrangements H02J 9/00)

13/00 Circuit arrangements for providing remote indication of network conditions, e.g. an instantaneous record of the open or closed condition of each circuitbreaker in the network; Circuit arrangements for providing remote control of switching means in a power distribution network, e.g. switching in and out of current consumers by using a pulse code signal carried by the network

15/00 Systems for storing electric energy (mechanical systems therefor F01-F04; in chemical form H01M) **[2]**

17/00 Systems for supplying or distributing electric power by electromagnetic waves [3]

H02K DYNAMO-ELECTRIC MACHINES (measuring instruments G01; dynamo-electric relays H01H 53/00; conversion of dc or ac input power into surge output power H02M 9/00; loudspeakers, microphones, gramophone pick-ups or like acoustic electromechanical transducers H04R)

Note(s)

1. This subclass covers the structural adaptation of the machines for the purposes of their control.
2. This subclass does not cover starting, regulating, electronically commutating, braking, or otherwise controlling motors, generators or dynamo-electric converters, in general, which are covered by subclass H02P.
3. Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "micro-structural devices" and "micro-structural systems".

Subclass index

1/00 **Details of the magnetic circuit** (magnetic circuits or magnets in general, magnetic circuits for transformers for power supply H01F; magnetic circuits for relays H01H 50/16)

1/02 • characterised by the magnetic material

1/04 • characterised by the material used for insulating the magnetic circuit or parts thereof (insulation of windings H02K 3/30)

1/06 • characterised by the shape, form, or construction

1/08 • • Salient poles

1/10 • • • Commutating poles

1/12 • • Stationary parts of the magnetic circuit

1/14 • • • Stator cores with salient poles

1/16 • • • Stator cores with slots for windings

1/17 • • • Stator cores with permanent magnets **[5]**

1/18 • • • Means for mounting or fastening magnetic stationary parts on to, or to, the stator structures

1/20 • • • with channels or ducts for flow of cooling medium

1/22 • • Rotating parts of magnetic circuit

1/24 • • • Rotor cores with salient poles

1/26 • • • Rotor cores with slots for windings

1/27 • • • Rotor cores with permanent magnets **[5]**

1/28 • • • Means for mounting or fastening rotating magnetic parts on to, or to, the rotor structures

1/30 • • • • using intermediate part or parts, e.g. spider

1/32 • • • with channels or ducts for flow of cooling medium

1/34 • • Reciprocating, oscillating, or vibrating part of magnetic circuit

3/00 **Details of windings** (coils in general H01F 5/00)

3/02 • Windings characterised by the conductor material (conductors in general H01B 1/00, H01B 5/00)

3/04 • Windings characterised by the conductor shape, form, or construction, e.g. with bar conductor

3/12 • • arranged in slots

3/14 • • • with transposed conductors, e.g. twisted conductor

3/16 • • • for damping, commutating, or other auxiliary purposes

3/18 • • Windings for salient poles

3/20 • • • for damping, commutating, or other auxiliary purposes

3/22 • • consisting of hollow conductors

3/24 • • with channels or ducts between the conductors for flow of cooling medium

3/26 • • consisting of printed conductors

3/28 • • Layout of windings or of connections between windings (windings for pole-changing H02K 17/06, H02K 17/14, H02K 19/12, H02K 19/32)

3/30 • Windings characterised by the insulating material (insulating bodies in general H01B 3/00, H01B 17/00)

3/32 • Windings characterised by the shape, form, or construction of the insulation

3/34 • • between conductors or between conductor and core, e.g. slot insulation **[3]**

3/38 • • around winding heads, equalising connectors, or connections thereto

3/40 • • for high voltage, e.g. affording protection against corona

3/42 • Means for preventing or reducing eddy-current losses in the winding heads, e.g. by shielding **[2]**

3/44 • Protection against moisture or chemical attack; Windings specially adapted for operation in liquid or gas

3/46 • Fastening of windings on stator or rotor structure

3/47 • • Air-gap windings, i.e. iron-free windings **[3]**

3/48 • • in slots

3/487 • • • Slot-closing devices **[3]**

3/493 • • • • where the devices are magnetic **[3]**

3/50 • • Fastening of winding heads, equalising connectors, or connections thereto

3/51 • • • applicable to rotors only **[3]**

3/52 • • Fastening salient pole windings or connections thereto

5/00 **Casings; Enclosures; Supports** (casings for electric apparatus in general H05K 5/00)

5/02 • Casings or enclosures characterised by the material thereof

5/04 • Casings or enclosures characterised by the shape, form, or construction thereof

5/06 • • Cast metal casings

5/08 • • Insulating casings

5/10 • • affording protection from ingress, e.g. of water, of fingers

5/12 • • specially adapted for operating in liquid or gas (combined with cooling arrangements H02K 9/00)

5/124 • • • Sealing of the shaft **[3]**

5/128 • • • using air-gap sleeve or air-gap disc **[3]**

5/132 • • • Submersible electric motor (H02K 5/128 takes precedence; pumping installations or systems for submerged use F04D 13/08) **[3]**

5/136 • • • explosion-proof **[3]**

5/14 • • Means for supporting or protecting brushes or brush holders **[3]**

5/15 • • Mounting arrangements for bearing-shields or end plates **[3]**
5/16 • • Means for supporting bearings, e.g. insulating support, means for fitting the bearing in the bearing-shield (magnetic bearings H02K 7/09)
5/167 • • • using sliding-contact or spherical cap bearings **[3]**
5/173 • • • using ball bearings or bearings with rolling contact **[3]**
5/18 • • with ribs or fins for improving heat transfer
5/20 • • with channels or ducts for flow of cooling medium
5/22 • • Other additional parts of casings, e.g. shaped to form connection or terminal box
5/24 • specially adapted for suppression or reduction of noise or vibration
5/26 • Means for adjusting the casing relative to its support

7/00 Arrangements for handling mechanical energy structurally associated with the machine, e.g. structural association with mechanical driving motor or auxiliary dynamo-electric machine
7/02 • Additional mass for increasing inertia, e.g. flywheel
7/04 • Balancing means
7/06 • Means for converting reciprocating into rotary motion or vice versa
7/065 • • Electromechanical oscillators; Vibrating magnetic drives (in time-pieces G04C 5/00) **[3]**
7/07 • • using pawl and ratchet wheel **[3]**
7/075 • • using crankshaft or eccentric **[3]**
7/08 • Structural association with bearings (support in machine casing H02K 5/16)
7/09 • • with magnetic bearings **[3]**
7/10 • Structural association with clutches, brakes, gears, pulleys, mechanical starters
7/102 • • with friction brakes
7/104 • • with eddy-current brakes
7/106 • • with dynamo-electric brakes
7/108 • • with friction clutches
7/11 • • with dynamo-electric clutches
7/112 • • with friction clutches and brakes
7/114 • • with dynamo-electric clutches and brakes
7/116 • • with gears
7/118 • • with starting device
7/12 • • with auxiliary limited movement of stator, rotor, or core parts, e.g. rotor axially movable for the purpose of clutching or braking
7/14 • Structural association with mechanical load, e.g. hand-held machine tool, fan (with fan or impeller for cooling the machine H02K 9/06; for suction cleaners A47L)
7/16 • • for operation above critical speed of vibration of rotating parts
7/18 • Structural association of electric generator with mechanical driving motor, e.g. turbine (if the driving-motor aspect predominates, see the relevant place of section F, e.g. F03B 13/00)
7/20 • Structural association with auxiliary dynamo-electric machine, e.g. with electric starter motor, with exciter

9/00 Systems for cooling or ventilating (channels or ducts in parts of the magnetic circuit H02K 1/20, H02K 1/32; channels or ducts in or between conductors H02K 3/22, H02K 3/24)
9/02 • by ambient air flowing through the machine
9/04 • • having means for generating flow of cooling medium, e.g. having fan
9/06 • • • with fan or impeller driven by the machine shaft
9/08 • by gaseous cooling medium circulating wholly within the machine casing (H02K 9/10 takes precedence)
9/10 • by gaseous cooling medium flowing in closed circuit, a part of which is external to the machine casing
9/12 • • wherein the cooling medium circulates freely within the casing
9/14 • wherein gaseous cooling medium circulates between the machine casing and a surrounding mantle
9/16 • • wherein the cooling medium circulates through ducts or tubes within the casing
9/18 • • wherein the external part of the closed circuit comprises a heat exchanger structurally associated with the machine casing
9/19 • for machines with closed casing and with closed-circuit cooling using a liquid cooling medium, e.g. oil
9/193 • • with provision for replenishing the cooling medium; with means for preventing leakage of the cooling medium
9/197 • • in which the rotor or stator space is fluid-tight, e.g. to provide for different cooling media for rotor and stator
9/20 • • wherein the cooling medium vaporises within the machine casing
9/22 • by solid heat conducting material embedded in, or arranged in contact with, stator or rotor, e.g. heat bridge
9/24 • Protection against failure of cooling arrangements, e.g. due to loss of cooling medium, due to interruption of the circulation of cooling medium (circuit arrangements affording such protection H02H 7/00)
9/26 • Structural association with machine of devices for cleaning or drying cooling medium, e.g. of filter
9/28 • Cooling of commutators, slip-rings, or brushes, e.g. by ventilating (current collectors in general H01R 39/00)

11/00 Structural association with measuring or protective devices or electric components, e.g. with resistor, with switch, with suppressor for radio interference
11/02 • for suppression of radio interference **[6]**
11/04 • for rectification **[6]**

13/00 Structural associations of current collectors with motors or generators, e.g. brush mounting plates, connections to windings (supporting or protecting brushes or brush holders in motor casings or enclosures H02K 5/14)**; Disposition of current collectors in motors or generators; Arrangements for improving commutation**
13/02 • Connections of slip-rings with the winding
13/04 • Connections of commutator segments with the winding
13/06 • • Resistive connections between winding and commutator segments, e.g. by high-resistance choke, by transistor
13/08 • • Segments formed by extensions of winding
13/10 • Special arrangements of brushes or commutators for the purpose of improving commutation
13/12 • Means for producing an axial reciprocation of the rotor and its associated current collector part, e.g. for polishing commutator surface
13/14 • Circuit arrangements for improvement of commutation, e.g. by use of unidirectionally conductive element

15/00 **Methods or apparatus specially adapted for manufacturing, assembling, maintaining, or repairing dynamo-electric machines** (manufacture of current collectors in general H01R 43/00)
15/02 • of stator or rotor bodies
15/03 • • having permanent magnets **[5]**
15/04 • of windings, prior to mounting into the machine (insulating windings H02K 15/10, H02K 15/12; coil manufacture in general H01F 41/02)
15/06 • Embedding prefabricated windings in the machine
15/08 • Forming windings by laying conductors into or around core part
15/085 • • by laying conductors into slotted stators
15/09 • • by laying conductors into slotted rotors
15/095 • • by laying conductors around salient poles
15/10 • Applying solid insulation to the windings, the stator, or the rotor
15/12 • Impregnating, heating or drying of windings, stators, rotors, or machines
15/14 • Casings; Enclosures; Supports
15/16 • Centering the rotor within the stator; Balancing the rotor (balancing in general G01M)

16/00 **Machines with more than one rotor or stator [2]**
16/02 • Machines with one stator and two rotors **[2]**
16/04 • Machines with one rotor and two stators **[2]**

Note(s)

Group H02K 16/00 takes precedence over groups H02K 17/00-H02K 53/00.

17/00 **Asynchronous induction motors; Asynchronous induction generators**
17/02 • Asynchronous induction motors
17/04 • • for single phase current
17/06 • • • having windings arranged for permitting pole-changing
17/08 • • • Motors with auxiliary phase obtained by externally fed auxiliary winding, e.g. capacitor motor
17/10 • • • Motors with auxiliary phase obtained by split-pole carrying short-circuited winding
17/12 • • for multi-phase current
17/14 • • • having windings arranged for permitting pole-changing
17/16 • • having rotor with internally short-circuited windings, e.g. cage rotor
17/18 • • • having double- or multiple-cage rotor
17/20 • • • having deep-bar rotor
17/22 • • having rotor with windings connected to slip-rings
17/24 • • • in which both stator and rotor are fed with ac
17/26 • • having rotor or stator designed to permit synchronous operation
17/28 • • having compensating winding for improving phase angle
17/30 • • Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the motor, e.g. with impedance, with switch (control arrangements external to the motor H02P)
17/32 • • Structural association with auxiliary mechanical devices, e.g. clutch, brake (control arrangements external to the motor H02P)
17/34 • • Cascade arrangement of an asynchronous motor with another dynamo-electric motor or converter (control of cascade arrangements H02P)
17/36 • • • with another asynchronous induction motor
17/38 • • • with a commutator machine
17/40 • • • with a rotary ac/dc converter (cascade ac/dc converters H02K 47/06)
17/42 • Asynchronous induction generators (H02K 17/02 takes precedence) **[4]**
17/44 • • Structural association with exciting machine

19/00 **Synchronous motors or generators** (having permanent magnet H02K 21/00)
19/02 • Synchronous motors
19/04 • • for single-phase current
19/06 • • • Motors having windings on the stator and a variable-reluctance soft-iron rotor without windings, e.g. inductor motor
19/08 • • • Motors having windings on the stator and a smooth rotor of material with large hysteresis without windings, e.g. hysteresis motor
19/10 • • for multi-phase current
19/12 • • • characterised by the arrangement of exciting windings, e.g. for self-excitation, for compounding, for pole-changing
19/14 • • having additional short-circuited winding for starting as an asynchronous motor
19/16 • Synchronous generators
19/18 • • having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar generator
19/20 • • • with variable-reluctance soft-iron rotor without winding
19/22 • • having windings each turn of which co-operates alternately with poles of opposite polarity, e.g. heteropolar generator
19/24 • • • with variable-reluctance soft-iron rotor without winding
19/26 • • characterised by the arrangement of exciting winding
19/28 • • • for self-excitation
19/30 • • • for compounding
19/32 • • • for pole-changing
19/34 • • Generators with two or more outputs
19/36 • • Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the generator, e.g. with impedance, with switch (control arrangements external to the generator H02P)
19/38 • • Structural association with exciting machine

21/00 **Synchronous motors having permanent magnet; Synchronous generators having permanent magnet** (stator cores with permanent magnets H02K 1/17; rotor cores with permanent magnets H02K 1/27)
21/02 • Details
21/04 • • Windings on magnet for additional excitation
21/10 • • Rotating armatures
21/12 • with stationary armature and rotating magnet
21/14 • • magnet rotating within armature
21/16 • • • having an annular armature core with salient poles (with homopolar co-operation H02K 21/20)
21/18 • • • having horse-shoe armature core (with homopolar co-operation H02K 21/20)
21/20 • • • having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar machine
21/22 • • magnet rotating around armature, e.g. flywheel magneto

21/24 • • magnet axially facing armature, e.g. hub-type cycle dynamo
21/26 • with rotating armature and stationary magnet
21/28 • • armature rotating within magnet
21/30 • • • having an annular armature core with salient poles (with homopolar co-operation H02K 21/36)
21/32 • • • having a horse-shoe magnet (with homopolar co-operation H02K 21/36)
21/34 • • • having bell-shaped or bar-shaped magnet, e.g. for cycle lighting (with homopolar co-operation H02K 21/36)
21/36 • • • with homopolar co-operation
21/38 • with rotating flux distributor, and armature and magnet both stationary
21/40 • • flux distributor rotating around magnet and within armature
21/42 • • flux distributor rotating around armature and within magnet
21/44 • • armature windings wound upon magnet
21/46 • Motors having additional short-circuited winding for starting as an asynchronous motor
21/48 • Generators with two or more outputs

23/00 Dc commutator motors or generators having mechanical commutator; Universal ac/dc commutator motors

23/02 • characterised by the exciting arrangement
23/04 • • having permanent magnet excitation
23/06 • • having shunt connection of excitation windings
23/08 • • having series connection of excitation windings
23/10 • • having compound connection of excitation windings
23/12 • • having excitation produced by a current source independent of the armature circuit
23/14 • • having high-speed excitation or de-excitation, e.g. by neutralising the remanent excitation field
23/16 • • having angularly adjustable excitation field, e.g. by pole reversing, by pole switching
23/18 • • having displaceable main or auxiliary brushes
23/20 • • having additional brushes spaced intermediately of the main brushes on the commutator, e.g. cross-field machine, metadyne, amplidyne, other armature-reaction excited machine
23/22 • • having compensating or damping winding
23/24 • • having commutating-pole winding
23/26 • characterised by the armature winding
23/28 • • having open winding, i.e. not closed within armature
23/30 • • having lap winding; having loop winding
23/32 • • having wave winding; having undulating winding
23/34 • • having mixed windings
23/36 • • having more than one winding; having more than one commutator; having more than one stator
23/38 • • having winding or connection for improving commutation, e.g. equipotential connection
23/40 • characterised by the arrangement of the magnet circuit
23/42 • • having split poles, i.e. zones for varying reluctance by gaps in poles or by poles with different spacing of the air gap
23/44 • • having movable or turnable iron parts
23/46 • • having stationary shunts, i.e. magnetic cross flux
23/48 • • having adjustable armature
23/50 • Generators with two or more outputs
23/52 • Motors acting also as generators, e.g. starting motor used as generator for ignition or lighting
23/54 • Disc armature motors or generators
23/56 • Motors or generators having the iron core separated from armature winding
23/58 • Motors or generators having no iron core
23/60 • Motors or generators having a rotating armature and a rotating excitation field
23/62 • Motors or generators with stationary armature and rotating excitation field
23/64 • Motors specially adapted for running on dc or ac by choice
23/66 • Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the machine, e.g. with impedance, with switch (control arrangements external to the machine H02P)
23/68 • Structural association with auxiliary mechanical devices, e.g. with clutch, with brake (control arrangements external to the machine H02P)

24/00 Machines adapted for the instantaneous transmission or reception of the angular displacement of rotating parts, e.g. synchro, selsyn

25/00 Dc interrupter motors or generators

26/00 Machines adapted to function as torque motors, i.e. to exert a torque when stalled

27/00 Ac commutator motors or generators having mechanical commutator (universal ac/dc motors H02K 23/64)

27/02 • characterised by the armature winding
27/04 • having single-phase operation in series or shunt connection
27/06 • • with a single or multiple short-circuited commutator, e.g. repulsion motor
27/08 • • with multiple-fed armature
27/10 • • with switching devices for different modes of operation, e.g. repulsion-induction motor
27/12 • having multi-phase operation
27/14 • • in series connection
27/16 • • in shunt connection with stator feeding
27/18 • • in shunt connection with rotor feeding
27/20 • Structural association with a speed regulating device
27/22 • having means for improving commutation, e.g. auxiliary fields, double windings, double brushes
27/24 • having two or more commutators
27/26 • having disc armature
27/28 • Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the machine (control arrangements external to the machine H02P)
27/30 • Structural association with auxiliary mechanical devices, e.g. clutch, brake (control arrangements external to the machine H02P)

29/00 Motors or generators having non-mechanical commutating devices, e.g. discharge tubes, semiconductor devices

29/03 • with a magnetic circuit specially adapted for avoiding torque ripples or self-starting problems **[6]**
29/06 • with position sensing devices (H02K 29/03 takes precedence) **[4, 6]**
29/08 • • using magnetic effect devices, e.g. Hall-plates, magneto-resistors (H02K 29/12 takes precedence) **[4]**
29/10 • • using light effect devices **[4]**

29/12 • • using detecting coils **[4]**
29/14 • with speed sensing devices (H02K 29/03 takes precedence) **[4, 6]**

31/00 Acyclic motors or generators, i.e. dc machines having a drum or disc armature with continuous current collectors
31/02 • with solid-contact collectors
31/04 • with at least one liquid-contact collector

33/00 Motors with reciprocating, oscillating, or vibrating magnet, armature, or coil system (arrangements for handling mechanical energy structurally associated with motors H02K 7/00, e.g. H02K 7/06)
33/02 • with armature moved one way by energisation of a single coil system and returned by mechanical force, e.g. by spring
33/04 • • wherein the frequency of operation is determined by the frequency of uninterrupted ac energisation
33/06 • • • with polarised armature
33/08 • • • with dc energisation superimposed on ac energisation
33/10 • • wherein the alternate energisation and de-energisation of the single coil system is effected or controlled by movement of the armature
33/12 • with armature moving in alternate directions by alternate energisation of two coil systems
33/14 • • wherein the alternate energisation and de-energisation of the two coil systems are effected or controlled by movement of the armature
33/16 • with polarised armature moving in alternate directions by reversal or energisation of a single coil system
33/18 • with coil system moving upon intermittent or reversed energisation thereof by interaction with a fixed field system, e.g. permanent magnet

35/00 Generators with reciprocating, oscillating, or vibrating coil system, magnet, armature, or other part of the magnetic circuit (arrangements for handling mechanical energy structurally associated with generators H02K 7/00, e.g. H02K 7/06)
35/02 • with moving magnet and stationary coil system
35/04 • with moving coil system and stationary magnet
35/06 • with moving flux distributor, and both coil system and magnet stationary

37/00 Motors with rotor rotating step by step and without interrupter or commutator driven by the rotor, e.g. stepping motors
37/02 • variable reluctance type **[4]**
37/04 • • Rotor situated within stator **[4]**
37/06 • • Rotor situated around stator **[4]**
37/08 • • Rotor axially facing stator **[4]**
37/10 • permanent magnet type (H02K 37/02 takes precedence) **[4]**
37/12 • • with stationary armature and rotating magnet **[4]**
37/14 • • • Magnet rotating within armature **[4]**
37/16 • • • • having horseshoe armature core **[4]**
37/18 • • • • homopolar type **[4]**
37/20 • • with rotating flux distributor, the armature and magnet both being stationary **[4]**
37/22 • Damping units **[4]**
37/24 • Structural association with auxiliary mechanical devices **[4]**

39/00 Generators specially adapted for producing a desired non-sinusoidal waveform

41/00 Propulsion systems in which a rigid body is moved along a path due to dynamo-electric interaction between the body and a magnetic field travelling along the path
41/02 • Linear motors; Sectional motors **[3]**
41/025 • • Asynchronous motors **[3]**
41/03 • • Synchronous motors; Motors moving step by step; Reluctance motors (H02K 41/035 takes precedence) **[3]**
41/035 • • Dc motors; Unipolar motors **[3]**
41/06 • Rolling motors, i.e. having the rotor axis parallel to the stator axis and following a circular path as the rotor rolls around the inside or outside of the stator

44/00 Machines in which the dynamo-electric interaction between a plasma or flow of conductive liquid or of fluid-borne conductive or magnetic particles and a coil system or magnetic field converts energy of mass flow into electrical energy or vice versa [3]
44/02 • Electrodynamic pumps **[3]**
44/04 • • Conduction pumps **[3]**
44/06 • • Induction pumps **[3]**
44/08 • Magnetohydrodynamic (MHD) generators **[3]**
44/10 • • Constructional details of electrodes **[3]**
44/12 • • Constructional details of fluid channel **[3]**
44/14 • • • Circular or screw-shaped channel **[3]**
44/16 • • Constructional details of the magnetic circuit **[3]**
44/18 • • for generating ac power **[3]**
44/20 • • • by changing the polarity of the magnetic field **[3]**
44/22 • • • by changing the conductivity of the fluid **[3]**
44/24 • • • by reversing the direction of fluid **[3]**
44/26 • • • by creating a travelling magnetic field **[3]**
44/28 • Association of MHD generators with conventional generators (nuclear power plants including a MHD generator G21D 7/02) **[3]**

47/00 Dynamo-electric converters
47/02 • Ac/dc converters or vice versa
47/04 • • Motor/generators
47/06 • • Cascade converters
47/08 • • Single-armature converters
47/10 • • • with booster machine on the ac side
47/12 • Dc/dc converters
47/14 • • Motor/generators
47/16 • • Single-armature converters, e.g. metadyne
47/18 • Ac/ac converters
47/20 • • Motor/generators
47/22 • • Single-armature frequency converters with or without phase-number conversion
47/24 • • • having windings for different numbers of poles
47/26 • • • operating as under- or over-synchronously running asynchronous induction machines, e.g. cascade arrangement of asynchronous and synchronous machines
47/28 • • • operating as commutator machines with added slip-rings
47/30 • • Single-armature phase-number converters without frequency conversion

49/00 Dynamo-electric clutches; Dynamo-electric brakes (electrically or magnetically actuated clutches or brakes F16D 27/00, F16D 29/00, F16D 65/34, F16D 65/36; magnetic-particle clutches F16D 37/02; adapted for use as dynamometers G01L)
49/02 • of the asynchronous induction type

49/04 • • of the eddy-current hysteresis type
49/06 • of the synchronous type
49/08 • of the collector armature type
49/10 • of the permanent-magnet type
49/12 • of the acyclic type

51/00 Dynamo-electric gears, i.e. dynamo-electric means for transmitting mechanical power from a driving shaft to a driven shaft and comprising structurally interrelated motor and generator parts

53/00 Alleged dynamo-electric perpetua mobilia

55/00 Dynamo-electric machines having windings operating at cryogenic temperatures [3]

55/02 • of the synchronous type **[3]**
55/04 • • with rotating field windings **[3]**
55/06 • of the homopolar type **[3]**

57/00 Dynamo-electric machines not provided for in groups H02K 17/00-H02K 55/00 [3]

H02M APPARATUS FOR CONVERSION BETWEEN AC AND AC, BETWEEN AC AND DC, OR BETWEEN DC AND DC, AND FOR USE WITH MAINS OR SIMILAR POWER SUPPLY SYSTEMS; CONVERSION OF DC OR AC INPUT POWER INTO SURGE OUTPUT POWER; CONTROL OR REGULATION THEREOF (conversion of current or voltage specially adapted for use in electronic time-pieces with no moving parts G04G 19/02; systems for regulating electric or magnetic variables in general, e.g. using transformers, reactors or choke coils, combination of such systems with static converters G05F; for digital computers G06F 1/00; transformers H01F; connection or control of one converter with regard to conjoint operation with a similar or other source of supply H02J; dynamo-electric converters H02K 47/00; controlling transformers, reactors or choke coils, control or regulation of electric motors, generators or dynamo-electric converters H02P; pulse generators H03K) **[4, 5]**

Note(s)

1. This subclass covers only circuits or apparatus for the conversion of electric power, or arrangements for control or regulation of such circuits or apparatus.
2. This subclass does not cover the individual electro-technical devices employed when converting electric power. Such devices are covered by the relevant subclasses, e.g. inductors, transformers H01F, capacitors, electrolytic rectifiers H01G, mercury-vapour rectifying or other discharge tubes H01J, semiconductor devices H01L, impedance networks or resonant circuits not primarily concerned with the transfer of electric power H03H.
3. In this subclass, the following term is used with the meaning indicated:
   • "conversion", in respect of an electric variable, e.g. voltage or current, means the change of one or more of the parameters of the variable, e.g. amplitude, frequency, phase, polarity.

Subclass index

1/00 Details of apparatus for conversion [1, 2007.01]

1/02 • Circuits specially adapted for the generation of grid-control or igniter-control voltages for discharge tubes incorporated in static converters
1/04 • • for tubes with grid control
1/06 • Circuits specially adapted for rendering non-conductive gas discharge tubes or equivalent semiconductor devices, e.g. thyratrons, thyristors **[2]**
1/08 • Circuits specially adapted for the generation of control voltages for semiconductor devices incorporated in static converters
1/084 • • using a control circuit common to several phases of a multi-phase system **[4]**
1/088 • • for the simultaneous control of series or parallel connected semiconductor devices **[4]**
1/092 • • • the control signals being transmitted optically **[4]**
1/096 • • • the power supply of the control circuit being connected in parallel to the main switching element (H02M 1/092 takes precedence) **[4]**
1/10 • Arrangements incorporating converting means for enabling loads to be operated at will from different kinds of power supplies, e.g. from ac or dc
1/12 • Arrangements for reducing harmonics from ac input or output
1/14 • Arrangements for reducing ripples from dc input or output
1/15 • • using active elements **[4]**
1/16 • Means for providing current step on switching, e.g. with saturable reactor
1/20 • Contact mechanisms of dynamic converters
1/22 • • incorporating collectors and brushes
1/24 • • incorporating rolling or tumbling contacts
1/26 • • incorporating cam-operated contacts
1/28 • • incorporating electromagnetically-operated vibrating contacts
1/30 • • incorporating liquid contacts
1/32 • Means for protecting converters other than by automatic disconnection (emergency protective circuit arrangements specially adapted for converters with automatic disconnection H02H 7/10) **[2007.01]**
1/34 • • Snubber circuits **[2007.01]**
1/36 • Means for starting or stopping converters **[2007.01]**
1/38 • Means for preventing simultaneous conduction of switches **[2007.01]**

1/40 • Means for preventing magnetic saturation **[2007.01]**
1/42 • Circuits or arrangements for compensating for oradjusting power factor in converters or inverters **[2007.01]**
1/44 • Circuits or arrangements for compensating for electromagnetic interference in converters or inverters **[2007.01]**

3/00 Conversion of dc power input into dc power output
3/02 • without intermediate conversion into ac
3/04 • • by static converters
3/06 • • • using resistors or capacitors, e.g. potential divider
3/07 • • • • using capacitors charged and discharged alternately by semiconductor devices with control electrode **[4]**
3/08 • • • using discharge tubes without control electrode or semiconductor devices without control electrode
3/10 • • • using discharge tubes with control electrode or semiconductor devices with control electrode (H02M 3/07 takes precedence) **[4]**
3/125 • • • • using devices of a thyratron or thyristor type requiring extinguishing means **[2]**
3/13 • • • • • using discharge tubes only **[2]**
3/135 • • • • • using semiconductor devices only **[2]**
3/137 • • • • • • with automatic control of output voltage or current, e.g. switching regulators **[4]**
3/139 • • • • • • • with digital control **[4]**
3/142 • • • • • • • including plural semiconductor devices as final control devices for a single load **[4]**
3/145 • • • • using devices of a triode or transistor type requiring continuous application of a control signal **[2]**
3/15 • • • • • using discharge tubes only **[2]**
3/155 • • • • • using semiconductor devices only **[2]**
3/156 • • • • • • with automatic control of output voltage or current, e.g. switching regulators **[4]**
3/157 • • • • • • • with digital control **[4]**
3/158 • • • • • • • including plural semiconductor devices as final control devices for a single load **[4]**
3/16 • • by dynamic converters
3/18 • • • using capacitors or batteries which are alternately charged and discharged, e.g. charged in parallel and discharged in series
3/20 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
3/22 • with intermediate conversion into ac
3/24 • • by static converters
3/26 • • • using discharge tubes without control electrode or semiconductor devices without control electrode to produce the intermediate ac
3/28 • • • using discharge tubes with control electrode or semiconductor devices with control electrode to produce the intermediate ac
3/305 • • • • using devices of a thyratron or thyristor type requiring extinguishing means **[2]**
3/31 • • • • • using discharge tubes only **[2]**
3/315 • • • • • using semiconductor devices only **[2]**
3/325 • • • • using devices of a triode or a transistor type requiring continuous application of a control signal **[2]**
3/33 • • • • • using discharge tubes only **[2]**
3/335 • • • • • using semiconductor devices only **[2]**
3/337 • • • • • • in push-pull configuration **[4]**
3/338 • • • • • • in a self-oscillating arrangement (H02M 3/337 takes precedence) **[4]**
3/34 • • by dynamic converters
3/36 • • • using mechanical parts to select progressively or to vary continuously the input potential
3/38 • • • using mechanical contact-making and -breaking parts to interrupt a single potential
3/40 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers
3/42 • • • • with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general H01H 51/34)
3/44 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters

5/00 Conversion of ac power input into ac power output, e.g. for change of voltage, for change of frequency, for change of number of phases
5/02 • without intermediate conversion into dc
5/04 • • by static converters (controlling transformers, reactors or choke coils, e.g. by tap changing, H02P 13/00) **[4]**
5/06 • • • using impedances
5/08 • • • • using capacitors only
5/10 • • • using transformers
5/12 • • • • for conversion of voltage or current amplitude only
5/14 • • • • for conversion between circuits of different phase number
5/16 • • • • for conversion of frequency
5/18 • • • • for conversion of waveform
5/20 • • • using discharge tubes without control electrode or semiconductor devices without control electrode
5/22 • • • using discharge tubes with control electrode or semiconductor devices with control electrode
5/25 • • • • using devices of a thyratron or thyristor type requiring extinguishing means (H02M 5/27 takes precedence) **[2]**
5/253 • • • • • using discharge tubes only **[2]**
5/257 • • • • • using semiconductor devices only **[2]**
5/27 • • • • • for conversion of frequency **[2]**
5/275 • • • • using devices of a triode or transistor type requiring continuous application of a control signal (H02M 5/297 takes precedence) **[2]**
5/29 • • • • • using discharge tubes only **[2]**
5/293 • • • • • using semiconductor devices only **[2]**
5/297 • • • • • for conversion of frequency **[2]**
5/32 • • by dynamic converters
5/34 • • • using mechanical contact-making and -breaking parts
5/36 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers
5/38 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
5/40 • with intermediate conversion into dc
5/42 • • by static converters
5/44 • • • using discharge tubes or semiconductor devices to convert the intermediate dc into ac
5/443 • • • • using devices of a thyratron or thyristor type requiring extinguishing means **[2]**

5/447 • • • • • using discharge tubes only **[2]**
5/45 • • • • • using semiconductor devices only **[2]**
5/451 • • • • • • with automatic control of output voltage or frequency **[4]**
5/452 • • • • • • with automatic control of output waveform **[4]**
5/453 • • • • using devices of a triode or transistor type requiring continuous application of a control signal **[2]**
5/456 • • • • • using discharge tubes only **[2]**
5/458 • • • • • using semiconductor devices only **[2]**
5/46 • • by dynamic converters
5/48 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters

7/00 Conversion of ac power input into dc power output; Conversion of dc power input into ac power output
7/02 • Conversion of ac power input into dc power output without possibility of reversal
7/04 • • by static converters
7/06 • • • using discharge tubes without control electrode or semiconductor devices without control electrode
7/08 • • • • arranged for operation in parallel
7/10 • • • • arranged for operation in series, e.g. for multiplication of voltage
7/12 • • • using discharge tubes with control electrode or semiconductor devices with control electrode
7/145 • • • • using devices of a thyratron or thyristor type requiring extinguishing means **[2, 4]**
7/15 • • • • • using discharge tubes only **[2]**
7/155 • • • • • using semiconductor devices only **[2]**
7/162 • • • • • • in a bridge configuration **[4]**
7/17 • • • • • • arranged for operation in parallel **[2, 4]**
7/19 • • • • • • arranged for operation in series, e.g. for voltage multiplication **[2, 4]**
7/21 • • • • using devices of a triode or transistor type requiring continuous application of a control signal **[2, 4]**
7/213 • • • • • using discharge tubes only **[2]**
7/217 • • • • • using semiconductor devices only **[2]**
7/219 • • • • • • in a bridge configuration **[4]**
7/23 • • • • • • arranged for operation in parallel **[2, 4]**
7/25 • • • • • • arranged for operation in series, e.g. for multiplication of voltage **[2, 4]**
7/26 • • • using open-spark devices, e.g. Marx rectifier
7/28 • • • using electrolytic rectifiers
7/30 • • by dynamic converters
7/32 • • • using mechanical contact-making and -breaking parts
7/34 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers
7/36 • • • • with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general H01H 51/34)
7/38 • • • using one or more sparking electrodes rotating over counterelectrodes
7/40 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
7/42 • Conversion of dc power input into ac power output without possibility of reversal
7/44 • • by static converters
7/46 • • • using discharge tubes without control electrode or semiconductor devices without control electrode
7/48 • • • using discharge tubes with control electrode or semiconductor devices with control electrode **[1, 2007.01]**
7/483 • • • • Converters with outputs that each can have more than two voltage levels **[2007.01]**
7/487 • • • • • Neutral point clamped inverters **[2007.01]**
7/49 • • • • • Combination of the output voltage waveforms of a plurality of converters **[2007.01]**
7/493 • • • • the static converters being arranged for operation in parallel **[2007.01]**
7/497 • • • • sinusoidal output voltages being obtained by combination of several voltages being out of phase **[2007.01]**
7/501 • • • • sinusoidal output voltages being obtained by the combination of several pulse-voltages having different amplitude and width **[2007.01]**
7/505 • • • • using devices of a thyratron or thyristor type requiring extinguishing means **[2]**
7/51 • • • • • using discharge tubes only **[2]**
7/515 • • • • • using semiconductor devices only **[2, 2007.01]**
7/516 • • • • • • Self-oscillating arrangements **[2007.01]**
7/517 • • • • • • with special starting equipment **[4]**
7/519 • • • • • • in a push-pull configuration (H02M 7/517 takes precedence) **[4]**
7/521 • • • • • • in a bridge configuration **[4]**
7/523 • • • • • • with LC-resonance circuit in the main circuit **[4]**
7/525 • • • • • • with automatic control of output waveform or frequency (H02M 7/517-H02M 7/523 take precedence) **[4]**
7/527 • • • • • • • • by pulse width modulation **[4]**
7/529 • • • • • • • • using digital control **[4]**
7/53 • • • • using devices of a triode or transistor type requiring continuous application of a control signal **[2]**
7/533 • • • • • using discharge tubes only **[2]**
7/537 • • • • • using semiconductor devices only, e.g. single switched pulse inverters **[2]**
7/5375 • • • • • • with special starting equipment **[4]**
7/538 • • • • • • in a push-pull configuration (H02M 7/5375 takes precedence) **[4, 2007.01]**
7/5381 • • • • • • • Parallel type **[2007.01]**
7/5383 • • • • • • in a self-oscillating arrangement (H02M 7/538 takes precedence) **[4, 2007.01]**
7/53838• • • • • • • using a single commutation path **[2007.01]**
7/53846• • • • • • • Control circuits **[2007.01]**
7/53854• • • • • • • • using thyristor type converters **[2007.01]**
7/53862• • • • • • • • using transistor type converters **[2007.01]**
7/5387 • • • • • • in a bridge configuration **[4, 2007.01]**
7/5388 • • • • • • • with asymmetrical configuration of switches **[2007.01]**
7/539 • • • • • • with automatic control of output wave form or frequency (H02M 7/5375-H02M 7/5387 take precedence) **[4]**
7/5395 • • • • • • • by pulse-width modulation **[4]**

7/54 • • by dynamic converters
7/56 • • • using mechanical parts to select progressively, or to vary continuously, the input potential
7/58 • • • using mechanical contact-making and -breaking parts to interrupt a single potential
7/60 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers
7/62 • • • • with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general H01H 51/34)
7/64 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters
7/66 • with possibility of reversal
7/68 • • by static converters
7/70 • • • using discharge tubes without control electrode or semiconductor devices without control electrode
7/72 • • • using discharge tubes with control electrode or semiconductor devices with control electrode
7/75 • • • • using devices of a thyratron or thyristor type requiring extinguishing means (H02M 7/77 takes precedence) **[2]**
7/753 • • • • • using discharge tubes only **[2]**
7/757 • • • • • using semiconductor devices only **[2]**
7/758 • • • • • • with automatic control of output waveform or frequency **[4]**
7/77 • • • • • arranged for operation in parallel **[2]**
7/79 • • • • using devices of a triode or transistor type requiring continuous application of a control signal (H02M 7/81 takes precedence) **[2]**
7/793 • • • • • using discharge tubes only **[2]**
7/797 • • • • • using semiconductor devices only **[2]**
7/81 • • • • • arranged for operation in parallel **[2]**
7/82 • • • using open-spark devices, e.g. Marx rectifier
7/84 • • • using electrolytic rectifiers
7/86 • • by dynamic converters
7/88 • • • using mechanical parts to select progressively or to vary continuously the input potential
7/90 • • • using mechanical contact-making and -breaking parts to interrupt a single potential
7/92 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers
7/94 • • • • wherein the parts are operated by rotating cams or cam-like devices
7/95 • • • • with electromagnetically-operated vibrating contacts, e.g. chopper (self-interrupters in general H01H 51/34)
7/96 • • • • with moving liquid contacts
7/98 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters

9/00 Conversion of dc or ac input power into surge output power [2]
9/02 • with dc input power **[2]**
9/04 • • using capacitative stores **[2]**
9/06 • with ac input power **[2]**

11/00 Power conversion systems not covered by the other groups of this subclass [4]

H02N ELECTRIC MACHINES NOT OTHERWISE PROVIDED FOR

Note(s)

1. This subclass covers:
   - electrostatic generators, motors, clutches, or holding devices;
   - other non-dynamo-electric generators or motors;
   - holding or levitation devices using magnetic attraction or repulsion;
   - arrangements for starting, regulating, braking, or otherwise controlling such machines unless in conjoint operation with a second machine.
2. Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "micro-structural devices" and "micro-structural systems".
3. Specific provision for generators, motors, or other means for converting between electric and other forms of energy also exists in other subclasses, e.g. in subclasses H01L, H01M, H02K, H04R.

Subclass index

1/00 Electrostatic generators or motors using a solid moving electrostatic charge carrier
1/04 • Friction generators
1/06 • Influence generators
1/08 • • with conductive charge carrier, i.e. capacitor machines
1/10 • • with non-conductive charge carrier
1/12 • • • in the form of a conveyer belt, e.g. van de Graaff machine

2/00 **Electric machines in general using piezo-electric effect, electrostriction or magnetostriction** (generating mechanical vibrations in general B06B; piezo-electric, electrostrictive or magnetostrictive elements in general H01L 41/00) **[4]**

2/02 • producing linear motion, e.g. actuators; Linear positioners **[6]**

2/04 • • Constructional details **[6]**

2/06 • • Drive circuits; Control arrangements **[6]**

2/08 • • using travelling waves, e.g. linear motors **[6]**

2/10 • producing rotary motion, e.g. rotary motors **[6]**

2/12 • • Constructional details **[6]**

2/14 • • Drive circuits; Control arrangements **[6]**

2/16 • • using travelling waves **[6]**

2/18 • producing electrical output from mechanical input, e.g. generators (for measurement devices G01) **[6]**

3/00 **Generators in which thermal or kinetic energy is converted into electrical energy by ionisation of a fluid and removal of the charge therefrom** (discharge tubes functioning as thermionic generators H01J 45/00) **[3]**

6/00 **Generators in which light radiation is directly converted into electrical energy** (solar cells or assemblies thereof H01L 25/00, H01L 31/00) **[4]**

10/00 **Electric motors using thermal effects [3]**

11/00 **Generators or motors not provided for elsewhere; Alleged perpetua mobilia obtained by electric or magnetic means** (by hydrostatic pressure F03B 17/04; by dynamo-electric means H02K 53/00)

13/00 **Clutches or holding devices using electrostatic attraction, e.g. using Johnson-Rahbek effect**

15/00 **Holding or levitation devices using magnetic attraction or repulsion, not otherwise provided for** (electric or magnetic devices for holding work on machine tools B23Q 3/15; sliding or levitation devices for railway systems B61B 13/08; material handling devices associated with conveyers incorporating devices with electrostatic or magnetic grippers B65G 47/92; separating thin or filamentary articles from piles using magnetic force B65H 3/16; delivering thin or filamentary articles from magnetic holders by air blast or suction B65H 29/24; bearings using magnetic or electric supporting means F16C 32/04; relieving bearing loads using magnetic means F16C 39/06; magnets H01F 7/00; dynamo-electric clutches or brakes H02K 49/00) **[3]**

15/02 • by Foucault currents **[3]**

15/04 • Repulsion by the Meissner effect (superconductors or hyperconductors in general H01L 39/00) **[3]**

99/00 **Subject matter not provided for in other groups of this subclass [2006.01]**

H02P **CONTROL OR REGULATION OF ELECTRIC MOTORS, GENERATORS, OR DYNAMO-ELECTRIC CONVERTERS; CONTROLLING TRANSFORMERS, REACTORS OR CHOKE COILS** (structure of the starter, brake, or other control devices, see the relevant subclasses, e.g. mechanical brake F16D, mechanical speed regulator G05D, variable resistor H01C, starter switch H01H; systems for regulating electric or magnetic variables using transformers, reactors or choke coils G05F; arrangements structurally associated with motors, generators, dynamo-electric converters, transformers, reactors or choke coils, see the relevant subclasses, e.g. H01F, H02K; connection or control of one generator, transformer, reactor, choke coil, or dynamo-electric converter with regard to conjoint operation with similar or other source of supply H02J; control or regulation of static converters H02M) **[4]**

Note(s)

1. This subclass covers arrangements for starting, regulating, electronically commutating, braking, or otherwise controlling motors, generators, dynamo-electric converters, clutches, brakes, gears, transformers, reactors or choke coils, of the types classified in the relevant subclasses, e.g. H01F, H02K.
2. This subclass does not cover similar arrangements for the apparatus of the types classified in subclass H02N, which arrangements are covered by that subclass.
3. In this subclass, the following terms or expressions are used with the meanings indicated:
   - "control" means influencing a variable in any way, e.g. changing its direction or its value (including changing it to or from zero), maintaining it constant, limiting its range of variation;
   - "regulation" means maintaining a variable at a desired value, or within a desired range of values, by comparison of the actual value with the desired value.

Subclass index

1/00 **Arrangements for starting electric motors or dynamo-electric converters** (starting of synchronous motors with electronic commutators H02P 6/20, H02P 6/22; starting dynamo-electric motors rotating step by step H02P 8/04; vector control H02P 21/00) **[4, 2006.01]**

1/02 • Details

1/04 • • Means for controlling progress of starting sequence in dependence upon time or upon current, speed, or other motor parameter

1/06 • • • Manually-operated multi-position starters

1/08 • • • Manually-operated on/off switch controlling power-operated multi-position switch or impedances for starting a motor

1/10 • • • Manually-operated on/off switch controlling relays or contactors operating sequentially for starting a motor (sequence determined by power-operated multi-position switch H02P 1/08)

1/12 • • • Switching devices centrifugally operated by the motor

1/14 • • • Pressure-sensitive resistors centrifugally operated by the motor

1/16 • for starting dynamo-electric motors or dynamo-electric converters

1/18 • • for starting an individual dc motor

1/20 • • • by progressive reduction of resistance in series with armature winding

1/22 • • • in either direction of rotation

1/24 • • for starting an individual ac commutator motor (starting of ac/dc commutator motors H02P 1/18)

1/26 • • for starting an individual polyphase induction motor

1/28 • • • by progressive increase of voltage applied to primary circuit of motor

1/30 • • • by progressive increase of frequency of supply to primary circuit of motor

1/32 • • • by star/delta switching

1/34 • • • by progressive reduction of impedance in secondary circuit

1/36 • • • • the impedance being a liquid resistance

1/38 • • • by pole-changing

1/40 • • • in either direction of rotation

1/42 • • for starting an individual single-phase induction motor

1/44 • • • by phase-splitting with a capacitor

1/46 • • for starting an individual synchronous motor

1/48 • • • by pole-changing

1/50 • • • by changing over from asynchronous to synchronous operation (H02P 1/48 takes precedence)

1/52 • • • by progressive increase of frequency of supply to motor

1/54 • • for starting two or more dynamo-electric motors

1/56 • • • simultaneously

1/58 • • • sequentially

3/00 **Arrangements for stopping or slowing electric motors, generators, or dynamo-electric converters** (stopping of synchronous motors with electronic commutators H02P 6/24; stopping dynamo-electric motors rotating step by step H02P 8/24; vector control H02P 21/00) **[2, 4, 2006.01]**

3/02 • Details

3/04 • • Means for stopping or slowing by a separate brake, e.g. friction brake, eddy-current brake (brakes F16D, H02K 49/00) **[2]**

3/06 • for stopping or slowing an individual dynamo-electric motor or dynamo-electric converter **[2]**

3/08 • • for stopping or slowing a dc motor **[2]**

3/10 • • • by reversal of supply connections

3/12 • • • by short-circuit or resistive braking

3/14 • • • by regenerative braking

3/16 • • • by combined electrical and mechanical braking

3/18 • • for stopping or slowing an ac motor **[2]**

3/20 • • • by reversal of phase sequence of connections to the motor

3/22 • • • by short-circuit or resistive braking

3/24 • • • by applying dc to the motor

3/26 • • • by combined electrical and mechanical braking

4/00 **Arrangements specially adapted for regulating or controlling the speed or torque of electric motors that can be connected to two or more different voltage or current supplies** (starting H02P 1/00; stopping or slowing H02P 3/00; vector control H02P 21/00) **[2006.01]**

5/00 **Arrangements specially adapted for regulating or controlling the speed or torque of two or more electric motors** (starting H02P 1/00; stopping or slowing H02P 3/00; vector control H02P 21/00) **[1, 2006.01]**

5/46 • for speed regulation of two or more dynamo-electric motors in relation to one another

5/48 • • by comparing mechanical values representing the speeds

5/50 • • by comparing electrical values representing the speeds

5/52 • • additionally providing control of relative angular displacement

5/60 • controlling combinations of dc and ac dynamo-electric motors (H02P 5/46 takes precedence) **[2006.01]**

5/68 • controlling two or more dc dynamo-electric motors (H02P 5/46, H02P 5/60 take precedence) **[2006.01]**

5/685 • • electrically connected in series, i.e. carrying the same current **[2006.01]**

5/69 • • mechanically coupled by gearing **[2006.01]**

5/695 • • • Differential gearing **[2006.01]**

5/74 • controlling two or more ac dynamo-electric motors (H02P 5/46, H02P 5/60 take precedence) **[2006.01]**

5/747 • • mechanically coupled by gearing **[2006.01]**

5/753 • • • Differential gearing **[2006.01]**

6/00 **Arrangements for controlling synchronous motors or other dynamo-electric motors with electronic commutators in dependence on the rotor position; Electronic commutators therefor** (stepping motors H02P 8/00; vector control H02P 21/00) **[3, 4, 6]**

6/04 • Arrangements for controlling or regulating speed or torque of more than one motor **[6]**

6/06 • Arrangements for speed regulation of a single motor wherein the motor speed is measured and compared with a given physical value so as to adjust the motor speed **[6]**

6/08 • Arrangements for controlling the speed or torque of a single motor **[6]**

6/10 • • providing reduced torque ripple; controlling torque ripple **[6]**

6/12 • Monitoring commutation; Providing indication of commutation failure **[6]**

6/14 • Electronic commutators **[6]**

6/16 • • Circuit arrangements for detecting position (structural arrangement of position sensors H02K 29/06) **[6]**

6/18 • • • without separate position detecting element, e.g. using back-emf in windings **[6]**

6/20 • Arrangements for starting (H02P 6/08, H02P 6/22 take precedence) **[6]**

6/22 • Arrangements for starting in a selected direction of rotation **[6]**

6/24 • Arrangements for stopping **[6]**

7/00 **Arrangements for regulating or controlling the speed or torque of electric dc-motors** (starting H02P 1/00; stopping or slowing H02P 3/00; vector control H02P 21/00) **[2, 2006.01]**

7/06 • for regulating or controlling an individual dc dynamo-electric motor by varying field or armature current

7/08 • • by manual control without auxiliary power

7/10 • • • of motor field only

7/12 • • • • Switching field from series to shunt excitation or vice versa

7/14 • • • of voltage applied to the armature with or without control of field

7/18 • • by master control with auxiliary power

7/20 • • • using multi-position switch, e.g. drum, controlling motor circuit by means of relays (H02P 7/24, H02P 7/30 take precedence)

7/22 • • • using multi-position switch, e.g. drum, controlling motor circuit by means of pilot-motor-operated multi-position switch or pilot-motor-operated variable resistance (H02P 7/24, H02P 7/30 take precedence)

7/24 • • • using discharge tubes or semiconductor devices

7/26 • • • • using discharge tubes

7/28 • • • • using semiconductor devices

7/282 • • • • • controlling field supply only **[4]**

7/285 • • • • • controlling armature supply only **[4]**

7/288 • • • • • • using variable impedance **[4]**

7/29 • • • • • • using pulse modulation **[4]**

7/292 • • • • • • using static converters, e.g. ac to dc **[4]**

7/295 • • • • • • • of the kind having one thyristor or the like in series with the power supply and the motor **[4]**

7/298 • • • • • controlling armature and field supply **[4]**

7/30 • • • using magnetic devices with controllable degree of saturation, i.e. transductors

7/32 • • • using armature-reaction-excited machines, e.g. metadyne, amplidyne, rototrol

7/34 • • • using Ward-Leonard arrangements

8/00 **Arrangements for controlling dynamo-electric motors rotating step by step** (vector control H02P 21/00) **[2, 6, 2006.01]**

8/02 • specially adapted for single-phase or bi-pole stepper motors, e.g. watch-motors, clock-motors **[6]**

8/04 • Arrangements for starting **[6]**

8/06 • • in selected direction of rotation **[6]**

8/08 • • Determining position before starting **[6]**

8/10 • • Shaping pulses for starting; Boosting current during starting **[6]**

8/12 • Control or stabilisation of current **[6]**

8/14 • Arrangements for controlling speed or speed and torque (H02P 8/12, H02P 8/22 take precedence) **[6]**

8/16 • • Reducing energy dissipated or supplied **[6]**

8/18 • • Shaping of pulses, e.g. to reduce torque ripple **[6]**

8/20 • • characterised by bidirectional operation **[6]**

8/22 • Control of step size; Intermediate stepping, e.g. micro-stepping **[6]**

8/24 • Arrangements for stopping (H02P 8/32 take precedence) **[6]**

8/26 • • Memorising final pulse when stopping **[6]**

8/28 • • Disconnecting power source when stopping **[6]**

8/30 • • Holding position when stopped **[6]**

8/32 • Reducing overshoot or oscillation, e.g. damping **[6]**

8/34 • Monitoring operation (H02P 8/36 takes precedence) **[6]**

8/36 • Protection against faults, e.g. against overheating, step-out; Indicating faults (emergency protective arrangements with automatic interruption of supply H02H 7/08) **[6]**

8/38 • • the fault being step-out **[6]**

8/40 • Special adaptations for controlling two or more stepping motors **[6]**

8/42 • characterised by non-stepper motors being operated step by step **[6]**

9/00 **Arrangements for controlling electric generators for the purpose of obtaining a desired output** (Ward-Leonard arrangements H02P 7/34; vector control H02P 21/00; feeding a network by two or more generators H02J; for charging batteries H02J 7/14) **[1, 2006.01]**

9/02 • Details

9/04 • Control effected upon non-electric prime mover and dependent upon electric output value of the generator (effecting control of the prime mover in general, see the relevant class for such prime mover) **[2]**

9/06 • Control effected upon clutch or other mechanical power transmission means and dependent upon electric output value of the generator (effecting control of the power transmission means, see the relevant class for such means) **[2]**

9/08 • Control of generator circuit during starting or stopping of driving means, e.g. for initiating excitation **[2]**

9/10 • Control effected upon generator excitation circuit to reduce harmful effects of overloads or transients, e.g. sudden application of load, sudden removal of load, sudden change of load **[2]**

9/12 • • for demagnetising; for reducing effects of remanence; for preventing pole reversal **[2]**

9/14 • by variation of field (H02P 9/08, H02P 9/10 take precedence) **[2]**

9/16 • • due to variation of ohmic resistance in field circuit, using resistances switched in or out of circuit step by step

9/18 • • • the switching being caused by a servomotor, measuring instrument, or relay

9/20 • • due to variation of continuously-variable ohmic resistance

9/22 • • • comprising carbon pile resistance

9/24 • • due to variation of make-to-break ratio of intermittently-operating contacts, e.g. using Tirrill regulator

9/26 • • using discharge tubes or semiconductor devices (H02P 9/34 takes precedence) **[2]**

9/28 • • • using discharge tubes

9/30 • • • using semiconductor devices

9/32 • • using magnetic devices with controllable degree of saturation (H02P 9/34 takes precedence) **[2]**

9/34 • • using magnetic devices with controllable degree of saturation in combination with controlled discharge tube or controlled semiconductor device

9/36 • • using armature-reaction-excited machines

9/38 • • Self-excitation by current derived from rectification of both output voltage and output current of generator

9/40 • by variation of reluctance of magnetic circuit of generator

9/42 • to obtain desired frequency without varying speed of the generator

9/44 • Control of frequency and voltage in predetermined relation, e.g. constant ratio

9/46 • Control of asynchronous generator by variation of capacitor

9/48 • Arrangements for obtaining a constant output value at varying speed of the generator, e.g. on vehicle (H02P 9/04-H02P 9/46 take precedence) **[3]**

11/00 Arrangements for controlling dynamo-electric converters (starting H02P 1/00; stopping or slowing H02P 3/00; vector control H02P 21/00; feeding a network in conjunction with a generator or another converter H02J) **[4, 2006.01]**

11/04 • for controlling dynamo-electric converters having a dc output

11/06 • for controlling dynamo-electric converters having an ac output

13/00 Arrangements for controlling transformers, reactors or choke coils, for the purpose of obtaining a desired output (regulation systems using transformers, reactors or choke coils G05F; transformers H01F; feeding a network in conjunction with a generator or a converter H02J; control or regulation of converters H02M) **[4]**

13/06 • by tap-changing; by rearranging interconnections of windings

13/08 • by sliding current collector along winding

13/10 • by moving core, coil winding, or shield, e.g. by induction regulator

13/12 • by varying magnetic bias

15/00 Arrangements for controlling dynamo-electric brakes or clutches (controlling speed of dynamo-electric motors by means of a separate brake H02P 29/04, vector control H02P 21/00) **[1, 2006.01]**

15/02 • Conjoint control of brakes and clutches **[3]**

17/00 Arrangements for controlling dynamo-electric gears (vector control H02P 21/00) **[3, 2006.01]**

21/00 Arrangements or methods for the control of electric machines by vector control, e.g. by control of field orientation [6, 2006.01]

Note(s) [2006.01]

When classifying in this group, it is desirable to also classify in groups H02P 25/00-H02P 27/00 if the kind of ac-motor, structural details, or the kind of supply voltage are of interest.

21/02 • specially adapted for optimising the efficiency at low load **[2006.01]**

21/04 • specially adapted for very low speeds **[2006.01]**

21/05 • specially adapted for damping motor oscillations, e.g. for reducing hunting **[2006.01]**

21/06 • Rotor flux based control **[2006.01]**

21/08 • • Indirect field-oriented control, e.g. field phase angle calculation based on rotor voltage equation by adding slip frequency and speed proportional frequency **[2006.01]**

21/10 • • Direct field-oriented control **[2006.01]**

21/12 • Stator flux based control **[2006.01]**

21/13 • Observer control, e.g. using Luenberger observers or Kalman filters **[2006.01]**

21/14 • Estimation or adaptation of machine parameters, e.g. rotor time constant, flux, speed, current or voltage **[2006.01]**

23/00 Arrangements or methods for the control of ac-motors characterised by a control method other than vector control (starting H02P 1/00; stopping or slowing H02P 3/00; of two or more motors H02P 5/00; of synchronous motors with electronic commutators H02P 6/00; of dc-motors H02P 7/00; of stepping motors H02P 8/00) **[2006.01]**

Note(s) [2006.01]

When classifying in this group, it is desirable to also classify in groups H02P 25/00-H02P 27/00 if the kind of ac-motor, structural details, or the kind of supply voltage are of interest.

23/02 • specially adapted for optimising the efficiency at low load **[2006.01]**

23/03 • specially adapted for very low speeds **[2006.01]**

23/04 • specially adapted for damping motor oscillations, e.g. for reducing hunting **[2006.01]**

23/06 • Controlling the motor in four quadrants **[2006.01]**

23/08 • Controlling based on slip frequency, e.g. adding slip frequency and speed proportional frequency **[2006.01]**

23/10 • Controlling by adding a dc current (dc current braking H02P 3/24) **[2006.01]**

23/12 • Observer control, e.g. using Luenberger observers or Kalman filters **[2006.01]**

23/14 • Estimation or adaptation of motor parameters, e.g. rotor time constant, flux, speed, current or voltage **[2006.01]**

25/00 Arrangements or methods for the control of ac-motors characterised by the kind of ac-motor or by structural details (starting H02P 1/00; stopping or slowing H02P 3/00; of two or more motors H02P 5/00; of synchronous motors with electronic commutators H02P 6/00; of dc-motors H02P 7/00; of stepping motors H02P 8/00) **[2006.01]**

Note(s) [2006.01]

When classifying in this group, it is desirable to also classify in groups H02P 21/00, H02P 23/00 or H02P 27/00 if the control method or the kind of supply voltage are of interest.

25/02 • characterised by the kind of motor **[2006.01]**

25/04 • • Single phase motors, e.g. capacitor motors **[2006.01]**

25/06 • • Linear motors **[2006.01]**

25/08 • • Reluctance motors **[2006.01]**

25/10 • • Commutator motors, e.g. repulsion motors **[2006.01]**

25/12 • • • with shiftable brushes **[2006.01]**

25/14 • • • Universal motors (H02P 25/12 takes precedence) **[2006.01]**

25/16 • characterised by the circuit arrangement or by the kind of wiring **[2006.01]**

25/18 • • with arrangements for switching the windings, e.g. with mechanical switches or relays **[2006.01]**

25/20 • • • for pole-changing **[2006.01]**

25/22 • • Multiple windings; Windings for more than three phases **[2006.01]**

25/24 • • Variable impedance in stator or rotor circuit **[2006.01]**

25/26 • • • with arrangements for controlling secondary impedance **[2006.01]**

25/28 • • using magnetic devices with controllable degree of saturation, e.g. transductors **[2006.01]**

25/30 • • the motor being controlled by a control effected upon an ac generator supplying it **[2006.01]**

25/32 • • using discharge tubes **[2006.01]**

27/00 Arrangements or methods for the control of ac-motors characterised by the kind of supply voltage (starting H02P 1/00; stopping or slowing H02P 3/00; of two or more motors H02P 5/00; of synchronous motors with electronic commutators H02P 6/00; of dc-motors H02P 7/00; of stepping motors H02P 8/00) **[2006.01]**

Note(s) [2006.01]

When classifying in this group, it is desirable to also classify in groups H02P 21/00, H02P 23/00 or H02P 25/00 if the control method, the kind of the ac-motor or structural details are of interest.

27/02 • using supply voltage with constant frequency and variable amplitude **[2006.01]**

27/04 • using variable-frequency supply voltage, e.g. inverter or converter supply voltage **[2006.01]**

27/05 • • using ac supply for both rotor and stator circuits, the frequency of supply to at least one circuit being variable **[2006.01]**

27/06 • • using dc to ac converters or inverters (H02P 27/05 takes precedence) **[2006.01]**

27/08 • • • with pulse width modulation **[2006.01]**

27/10 • • • • using bang-bang controllers **[2006.01]**

27/12 • • • • pulsing by guiding the flux-, current-, or voltage-vector on a circle or a closed curve, e.g. direct torque control **[2006.01]**

27/14 • • • • with three or more levels of voltage **[2006.01]**

27/16 • • using ac to ac converters without intermediate conversion to dc (H02P 27/05 takes precedence) **[2006.01]**

27/18 • • • varying the frequency by omitting half waves **[2006.01]**

29/00 Arrangements for regulating or controlling electric motors, appropriate for both ac- and dc-motors (starting H02P 1/00; stopping or slowing H02P 3/00; control of motors that can be connected to two or more different voltage or current supplies H02P 4/00; vector control H02P 21/00) **[2006.01]**

29/02 • Providing protection against overload without automatic interruption of supply, e.g. monitoring **[2006.01]**

29/04 • by means of a separate brake **[2006.01]**

31/00 Arrangements for regulating or controlling electric motors not provided for in groups H02P 1/00-H02P 5/00, H02P 7/00 or H02P 21/00-H02P 29/00 [2006.01]