

## 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

**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**

|  |              |
|--|--------------|
| BOARDS, OR DETAILS OF SUBSTATIONS OR SWITCHING ARRANGEMENTS..... | 1/00         |
| SUBSTATIONS.....   | 5/00, 7/00   |
| SWITCHGEAR.....  | 11/00, 13/00 |
| SUPERVISORY DESKS OR PANELS.....                                 | 15/00        |
| MANUFACTURE.....   | 3/00         |

**1/00 Frameworks, boards, panels, desks, casings; Details of substations or switching arrangements [1, 5, 2006.01]**

- 1/01 • Frameworks [5, 2006.01]
- 1/015 • Boards, panels, desks; Parts thereof or accessories therefor [5, 2006.01]
- 1/03 • • for energy meters [5, 2006.01]
- 1/04 • • Mounting thereon of switches or of other devices in general, the switch or device having, or being without, casing [1, 2006.01]
- 1/044 • • • Mounting through openings [5, 2006.01]
- 1/048 • • • • Snap mounting [5, 2006.01]
- 1/052 • • • Mounting on rails [5, 2006.01]
- 1/056 • • • Mounting on plugboards [5, 2006.01]
- 1/06 • • having associated enclosures, e.g. for preventing access to live parts [1, 2006.01]
- 1/14 • Shutters or guards for preventing access to contacts (shielding of isolating-contacts in withdrawable switchgear H02B 11/24) [1, 2006.01]
- 1/16 • Earthing arrangements (earthing arrangements for substations H02B 5/01; earthing arrangements for switchgear H02B 11/28, H02B 13/075) [1, 5, 2006.01]
- 1/18 • Disposition or arrangement of fuses (for switchgear having a withdrawable carriage H02B 11/26) [1, 5, 2006.01]
- 1/20 • Bus-bar or other wiring layouts, e.g. in cubicles, in switchyards (installations of bus-bars H02G 5/00) [1, 2006.01]
- 1/21 • • Bus-bar arrangements for rack-mounted devices with withdrawable units [5, 2006.01]
- 1/22 • • Layouts for duplicate bus-bar selection [1, 2006.01]
- 1/24 • Circuit arrangements for boards or switchyards [1, 2006.01]

**Note(s) [5]**

In groups H02B 1/26-H02B 1/56, the last place priority rule is applied, i.e. at each hierarchical level, 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 [5, 2006.01]
- 1/28 • • dustproof, splashproof, drip-proof, waterproof or flameproof [5, 2006.01]
- 1/30 • • Cabinet-type casings; Parts thereof or accessories therefor [5, 2006.01]
- 1/32 • • • Mounting of devices therein [5, 2006.01]
- 1/34 • • • • Racks [5, 2006.01]
- 1/36 • • • • • with withdrawable units [5, 2006.01]
- 1/38 • • • Hinged covers or doors [5, 2006.01]
- 1/40 • • Wall-mounted casings; Parts thereof or accessories therefor [5, 2006.01]
- 1/42 • • • Mounting of devices therein [5, 2006.01]
- 1/44 • • • Hinged covers or doors [5, 2006.01]
- 1/46 • • Boxes; Parts thereof or accessories therefor [5, 2006.01]
- 1/48 • • • Mounting of devices therein [5, 2006.01]
- 1/50 • • Pedestal- or pad-mounted casings; Parts thereof or accessories therefor [5, 2006.01]
- 1/52 • • Mobile units, e.g. for work sites [5, 2006.01]
- 1/54 • Anti-seismic devices or installations [5, 2006.01]
- 1/56 • Cooling; Ventilation [5, 2006.01]
- 3/00 **Apparatus specially adapted for the manufacture, assembly, or maintenance of boards or switchgear [1, 2006.01]**
- 5/00 **Non-enclosed substations; Substations with enclosed and non-enclosed equipment [1, 2006.01]**
- 5/01 • Earthing arrangements, e.g. earthing rods [5, 2006.01]

## H02B

|              |   |              |  |
|--------------|---|--------------|--|
| 5/02         | • mounted on pole, e.g. pole transformer substation [1, 2006.01]                                | 11/22        | • • • wherein front of enclosure moves with carriage upon horizontal withdrawal subsequent to isolation [1, 2006.01]   |
| 5/06         | • gas-insulated [5, 2006.01]  | 11/24        | • Shutters or guards [5, 2006.01]  |
| <b>7/00</b>  | <b>Enclosed substations, e.g. compact substations [1, 5, 2006.01]</b>                           | 11/26        | • Arrangement of fuses, resistors, voltage arresters or the like [5, 2006.01]  |
| 7/01         | • gas-insulated [5, 2006.01]  | 11/28        | • Earthing arrangements [5, 2006.01]   |
| 7/06         | • Distribution substations, e.g. for urban network (H02B 7/01 takes precedence) [1, 5, 2006.01] | <b>13/00</b> | <b>Arrangement of switchgear in which switches are enclosed in, or structurally associated with, a casing, e.g. cubicle</b> (switchgear having carriage withdrawable for isolation H02B 11/00) [1, 5, 2006.01] |
| 7/08         | • • Underground substations [1, 2006.01]  | 13/01        | • with resin casing [5, 2006.01]   |
| <b>11/00</b> | <b>Switchgear having carriage withdrawable for isolation [1, 2006.01]</b>                       | 13/02        | • with metal casing [1, 2006.01]   |
| 11/02        | • Details [1, 2006.01]  | 13/025       | • • Safety arrangements, e.g. in case of excessive pressure or fire due to electrical defect [5, 2006.01]  |
| 11/04        | • • Isolating-contacts, e.g. mountings or shieldings [1, 5, 2006.01]                            | 13/035       | • • Gas-insulated switchgear [5, 2006.01]  |
| 11/06        | • • Means for duplicate bus-bar selection [1, 2006.01]  | 13/045       | • • • Details of casing, e.g. gas tightness [5, 2006.01]   |
| 11/08        | • • Oil-tank lowering means associated with withdrawal mechanism [1, 2006.01]                   | 13/055       | • • • Features relating to the gas [5, 2006.01]  |
| 11/10        | • • Indicating electrical condition of gear; Arrangement of test sockets [1, 2006.01]           | 13/065       | • • • Means for detecting or reacting to mechanical or electrical defects [5, 2006.01]   |
| 11/12        | • with isolation by horizontal withdrawal [1, 2006.01]  | 13/075       | • • • Earthing arrangements [5, 2006.01]   |
| 11/127       | • • Withdrawal mechanism [5, 2006.01]   | 13/08        | • with stone, brick, or concrete casing [1, 2006.01]   |
| 11/133       | • • • with interlock [5, 2006.01]   | <b>15/00</b> | <b>Supervisory desks or panels for centralised control or display [1, 2006.01]</b>   |
| 11/167       | • • truck type (H02B 11/127 takes precedence) [5, 2006.01]                                      | 15/02        | • with mimic diagrams [1, 2006.01]   |
| 11/173       | • • drawer type (H02B 11/127 takes precedence) [5, 2006.01]                                     | 15/04        | • • consisting of building blocks [1, 2006.01]   |
| 11/18        | • with isolation by vertical withdrawal [1, 2006.01]  | <b>99/00</b> | <b>Subject matter not provided for in other groups of this subclass [2009.01]</b>  |
| 11/20        | • • having an enclosure [1, 2006.01]  |              |  |

## H02G INSTALLATION OF ELECTRIC CABLES OR LINES, OR OF COMBINED OPTICAL AND ELECTRIC CABLES OR LINES

### Note(s) [6]

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

#### PRINCIPAL TYPES OF INSTALLATIONS

Inside; overhead; underground or underwater.....3/00, 7/00, 9/00

#### SPECIAL INSTALLATIONS

Of bus-bars; of lightning conductors; of movable parts.....5/00, 13/00, 11/00

CABLE FITTINGS.....15/00

INSTALLING, MAINTAINING, REPAIRING.....1/00

|             |  |             |  |
|-------------|--|-------------|--|
| <b>1/00</b> | <b>Methods or apparatus specially adapted for installing, maintaining, repairing, or dismantling electric cables or lines [1, 2006.01]</b> | 1/12        | • for removing insulation or armoring from cables, e.g. from the end thereof [1, 2006.01]  |
| 1/02        | • for overhead lines or cables [1, 2006.01]  | 1/14        | • for joining or terminating cables [1, 2006.01]   |
| 1/04        | • • for mounting or stretching [1, 2006.01]  | 1/16        | • for repairing insulation or armoring of cables [1, 2006.01]  |
| 1/06        | • for laying cables, e.g. laying apparatus on vehicle [1, 2006.01]   | <b>3/00</b> | <b>Installations of electric cables or lines or protective tubing therefor in or on buildings, equivalent structures or vehicles</b> (installations of bus-bars H02G 5/00; overhead installations H02G 7/00; installations in or on the ground H02G 9/00) [1, 2006.01] |
| 1/08        | • • through tubing or conduit, e.g. rod or draw wire for pushing or pulling [1, 2006.01]   |             |  |
| 1/10        | • • in or under water [1, 2006.01]   |             |  |

- 3/02 • Details [1, 2006.01]
- 3/03 • • Cooling [2, 2006.01]
- 3/04 • • Protective tubing or conduits, e.g. cable ladders or cable troughs [1, 2006.01]
- 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 [1, 2006.01]
- 3/08 • • Distribution boxes; Connection or junction boxes [1, 2006.01]
- 3/10 • • • for surface mounting on a wall [1, 2006.01]
- 3/12 • • • for flush mounting [1, 2006.01]
- 3/14 • • • Fastening of cover or lid to box [1, 2006.01]
- 3/16 • • • structurally associated with support for line-connecting terminals within the box [1, 2006.01]
- 3/18 • • • providing line outlets [1, 2006.01]
- 3/20 • • • • Ceiling roses [1, 2006.01]
- 3/22 • Installations of cables or lines through walls, floors or ceilings, e.g. into buildings [1, 2006.01]
- 3/30 • Installations of cables or lines on walls, floors or ceilings [7, 2006.01]
- 3/32 • • using mounting clamps [7, 2006.01]
- 3/34 • • using separate protective tubing [7, 2006.01]
- 3/36 • Installations of cables or lines in walls, floors or ceilings [7, 2006.01]
- 3/38 • • the cables or lines being installed in preestablished conduits or ducts [7, 2006.01]
- 3/40 • • • using separate protective tubing in the conduits or ducts [7, 2006.01]
- 5/00 Installations of bus-bars [1, 2006.01]**
- 5/02 • Open installations [1, 2006.01]
- 5/04 • Partially-enclosed installations, e.g. in ducts and adapted for sliding or rolling current collection [1, 2006.01]
- 5/06 • Totally-enclosed installations, e.g. in metal casings [1, 2006.01]
- 5/08 • • Connection boxes therefor [1, 2006.01]
- 5/10 • Cooling [2, 2006.01]
- 7/00 Overhead installations of electric lines or cables (installations of bus-bars H02G 5/00) [1, 2006.01]**
- 7/02 • Devices for adjusting or maintaining mechanical tension, e.g. take-up device [1, 2006.01]
- 7/04 • Arrangements or devices for relieving mechanical tension [1, 2006.01]
- 7/05 • Suspension arrangements or devices for electric cables or lines [3, 2006.01]
- 7/06 • • Suspensions for lines or cables along a separate supporting wire, e.g. S-hook [1, 3, 2006.01]
- 7/08 • • • Members clamped to the supporting wire or to the line or cable [1, 3, 2006.01]
- 7/10 • • • Flexible members or lashings wrapped around both the supporting wire and the line or cable [1, 3, 2006.01]
- 7/12 • Devices for maintaining distance between parallel conductors, e.g. spacer [1, 2006.01]
- 7/14 • Arrangements or devices for damping mechanical oscillations of lines, e.g. for reducing production of sound [1, 2006.01]
- 7/16 • Devices for removing snow or ice from lines or cables [1, 2006.01]
- 7/18 • Devices affording mechanical protection in the event of breakage of a line or cable, e.g. net for catching broken lines [1, 2006.01]
- 7/20 • Spatial arrangements or dispositions of lines or cables on poles, posts or towers [1, 2006.01]
- 7/22 • Arrangements of earthing wires suspended between mastheads [1, 2006.01]
- 9/00 Installations of electric cables or lines in or on the ground or water [1, 2006.01]**
- 9/02 • laid directly in or on the ground, river-bed or sea-bottom; Coverings therefor, e.g. tile [1, 2006.01]
- 9/04 • in surface ducts; Ducts or covers therefor [1, 2006.01]
- 9/06 • in underground tubes or conduits; Tubes or conduits therefor [1, 2006.01]
- 9/08 • in tunnels [1, 2006.01]
- 9/10 • in cable chambers, e.g. in manhole or in handhole [1, 2006.01]
- 9/12 • supported on or from floating structures, e.g. in water [1, 2006.01]
- 11/00 Arrangements of electric cables or lines between relatively-movable parts [1, 2006.01]**
- 11/02 • using take-up reel or drum [1, 2006.01]
- 13/00 Installations of lightning conductors; Fastening thereof to supporting structure [1, 2006.01]**
- 15/00 Cable fittings [1, 2006.01]**
- 15/007 • Devices for relieving mechanical stress [3, 2006.01]
- 15/013 • Sealing means for cable inlets (inlets for cables filled with, or surrounded by, gas or oil H02G 15/32) [3, 2006.01]
- 15/02 • Cable terminations (for gas- or oil-filled cables H02G 15/22) [1, 2006.01]
- 15/04 • • Cable-end sealings [1, 2006.01]
- 15/06 • • Cable terminating boxes, frames or other structures [1, 2006.01]
- 15/064 • • • with devices for relieving electrical stress [3, 2006.01]
- 15/068 • • • • connected to the cable shield only (H02G 15/072 takes precedence) [3, 2006.01]
- 15/072 • • • • of the condenser type [3, 2006.01]
- 15/076 • • • for multi-conductor cables [3, 2006.01]
- 15/08 • Cable junctions (for gas or oil filled cables H02G 15/24) [1, 2006.01]
- 15/10 • • protected by boxes, e.g. by distribution, connection or junction boxes [1, 2006.01]
- 15/103 • • • with devices for relieving electrical stress [3, 2006.01]
- 15/105 • • • • connected to the cable shield only (H02G 15/107 takes precedence) [3, 2006.01]
- 15/107 • • • • of the condenser type [3, 2006.01]
- 15/113 • • • Boxes split longitudinally in main cable direction [3, 2006.01]
- 15/115 • • • Boxes split perpendicularly to main cable direction [3, 2006.01]
- 15/117 • • • for multiconductor cables [3, 2006.01]
- 15/12 • • • for incorporating transformers, loading coils or amplifiers [1, 2006.01]
- 15/14 • • • • specially adapted for submarine cables [1, 2006.01]
- 15/16 • • • structurally associated with support for line-connecting terminals within the box [1, 2006.01]
- 15/18 • • protected by sleeves, e.g. for communication cable (two-part covers H02G 15/10) [1, 2006.01]

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- 15/184 • • • with devices for relieving electrical stress [3, 2006.01]
- 15/188 • • • • connected to cable shield only [3, 2006.01]
- 15/192 • • • with support means for ends of the sleeves [3, 2006.01]
- 15/196 • • • having lapped insulation [3, 2006.01]
- 15/20 • Cable fittings for cables filled with or surrounded by gas or oil (H02G 15/34 takes precedence) [1, 3, 2006.01]
- 15/22 • • Cable terminations [1, 2006.01]
- 15/23 • • • Cable-end sealings [3, 2006.01]
- 15/24 • • Cable junctions [1, 2006.01]
- 15/25 • • • Stop junctions [3, 2006.01]
- 15/26 • • Expansion vessels; Locking heads; Auxiliary pipe-lines [1, 2006.01]
- 15/28 • • structurally associated with devices for indicating the presence or location of non-electric faults [1, 2006.01]
- 15/30 • • with devices for relieving electrical stress [3, 2006.01]
- 15/32 • • Cable inlets [3, 2006.01]
- 15/34 • Cable fittings for cryogenic cables [3, 2006.01]

**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

#### EMERGENCY PROTECTIVE CIRCUIT ARRANGEMENTS

For automatic disconnection or switching responsive to variation of conditions:

electric; sensed non-electric; simulated non-electric.....3/00, 5/00, 6/00  
adapted for specific machines or for sectionalised protection of cables or lines.....7/00

For limiting excess current or voltage.....9/00

For preventing switching-on in case of undesired conditions.....11/00

DETAILS.....1/00

- 
- 1/00 Details of emergency protective circuit arrangements [1, 2006.01]**
  - 1/04 • Arrangements for preventing response to transient abnormal conditions, e.g. to lightning [1, 2006.01]
  - 1/06 • Arrangements for supplying operative power [3, 2006.01]
  - 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) [1, 2006.01]
  - 3/02 • Details [1, 2006.01]
  - 3/027 • • with automatic disconnection after a predetermined time (H02H 3/033, H02H 3/06 take precedence) [3, 2006.01]
  - 3/033 • • with several disconnections in a preferential order (H02H 3/06 takes precedence) [3, 2006.01]
  - 3/04 • • with warning or supervision in addition to disconnection, e.g. for indicating that protective apparatus has functioned [1, 2006.01]
  - 3/05 • • with means for increasing reliability, e.g. redundancy arrangements [3, 2006.01]
  - 3/06 • • with automatic reconnection [1, 2006.01]
  - 3/07 • • • and with permanent disconnection after a predetermined number of reconnection cycles [3, 2006.01]
  - 3/08 • responsive to excess current (responsive to abnormal temperature caused by excess current H02H 5/04) [1, 2006.01]
  - 3/087 • • for DC applications [3, 2006.01]
  - 3/093 • • with timing means [3, 2006.01]
  - 3/10 • • additionally responsive to some other abnormal electrical conditions [1, 2006.01]
  - 3/12 • responsive to underload or no-load [1, 2006.01]
  - 3/13 • • for multiphase applications, e.g. phase interruption [3, 2006.01]
  - 3/14 • responsive to occurrence of voltage on parts normally at earth potential [1, 2006.01]
  - 3/16 • responsive to fault current to earth, frame or mass (with balanced or differential arrangement H02H 3/26) [1, 2006.01]
  - 3/17 • • by means of an auxiliary voltage injected into the installation to be protected [3, 2006.01]
  - 3/18 • responsive to reversal of direct current [1, 2006.01]
  - 3/20 • responsive to excess voltage [1, 2006.01]
  - 3/22 • • of short duration, e.g. lightning [1, 2006.01]
  - 3/24 • responsive to undervoltage or no-voltage [1, 2006.01]
  - 3/247 • • having timing means [3, 2006.01]
  - 3/253 • • for multiphase applications, e.g. phase interruption [3, 2006.01]
  - 3/26 • responsive to difference between voltages or between currents; responsive to phase angle between voltages or between currents [1, 2006.01]
  - 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 [1, 2006.01]
  - 3/30 • • • using pilot wires or other signalling channel [1, 2006.01]
  - 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 [1, 2006.01]

- 3/33 • • • using summation current transformers (H02H 3/347 takes precedence) [3, 2006.01]
- 3/34 • • • of a three-phase system [1, 2006.01]
- 3/347 • • • • using summation current transformers [3, 2006.01]
- 3/353 • • • • involving comparison of phase voltages [3, 2006.01]
- 3/36 • • involving comparison of the voltage or current values at corresponding points of different systems, e.g. of parallel feeder systems [1, 2006.01]
- 3/38 • responsive to both voltage and current; responsive to phase angle between voltage and current [1, 2006.01]
- 3/40 • responsive to ratio of voltage and current [1, 2006.01]
- 3/42 • responsive to product of voltage and current [1, 2006.01]
- 3/44 • responsive to the rate of change of electrical quantities [3, 2006.01]
- 3/46 • responsive to frequency deviations [3, 2006.01]
- 3/48 • responsive to loss of synchronism [3, 2006.01]
- 3/50 • responsive to the appearance of abnormal wave forms, e.g. AC in DC installations [3, 2006.01]
- 3/52 • • responsive to the appearance of harmonics [3, 2006.01]
  
- 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) [1, 3, 2006.01]
- 5/04 • responsive to abnormal temperature [1, 2006.01]
- 5/06 • • in oil-filled electric apparatus [1, 2006.01]
- 5/08 • responsive to abnormal fluid pressure, liquid level or liquid displacement, e.g. Buchholz relays [1, 2006.01]
- 5/10 • responsive to mechanical injury, e.g. rupture of line, breakage of earth connection [1, 2006.01]
- 5/12 • responsive to undesired approach to, or touching of, live parts by living beings [1, 2006.01]
  
- 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, 2006.01]
  
- 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** [1, 2006.01]
- 7/04 • for transformers [1, 2006.01]
- 7/045 • • Differential protection of transformers [3, 2006.01]
- 7/05 • • for capacitive voltage transformers, e.g. against resonant conditions [3, 2006.01]
- 7/055 • • for tapped transformers or tap-changing means thereof [3, 2006.01]
- 7/06 • for dynamo-electric generators; for synchronous capacitors [1, 2006.01]
- 7/08 • for dynamo-electric motors [1, 2006.01]
- 7/085 • • against excessive load [1, 2006.01]
- 7/09 • • against over-voltage; against reduction of voltage; against phase interruption [1, 2006.01]
- 7/093 • • against increase beyond, or decrease below, a predetermined level of rotational speed (centrifugal switches H01H 35/10) [1, 2006.01]
- 7/097 • • against wrong direction of rotation [1, 2006.01]
- 7/10 • for converters; for rectifiers [1, 2006.01]
- 7/12 • • for static converters or rectifiers [1, 2006.01]
- 7/122 • • • for inverters, i.e. DC/AC converters [2, 2006.01]
- 7/125 • • • for rectifiers [2, 2006.01]
- 7/127 • • • • having auxiliary control electrode to which blocking control voltages or currents are applied in case of emergency [2, 2006.01]
- 7/16 • for capacitors (for synchronous capacitors H02H 7/06) [1, 2006.01]
- 7/18 • for batteries; for accumulators [1, 2006.01]
- 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) [1, 2006.01]
- 7/22 • for distribution gear, e.g. bus-bar systems; for switching devices [1, 2006.01]
- 7/24 • for spark-gap arresters [1, 2006.01]
- 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) [1, 2006.01]
- 7/28 • • for meshed systems [1, 2006.01]
- 7/30 • • Staggered disconnection [3, 2006.01]
  
- 9/00 **Emergency protective circuit arrangements for limiting excess current or voltage without disconnection** [1, 2006.01]
- 9/02 • responsive to excess current [1, 2006.01]
- 9/04 • responsive to excess voltage (lightning arrestors H01C 7/12, H01C 8/04, H01G 9/18, H01T) [1, 2006.01]
- 9/06 • • using spark-gap arresters [1, 2006.01]
- 9/08 • Limitation or suppression of earth fault currents, e.g. Petersen coil [3, 2006.01]
  
- 11/00 **Emergency protective circuit arrangements for preventing the switching-on in case an undesired electric working condition might result** [1, 2006.01]
  
- 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

### 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;
  - circuit arrangements or systems for wireless supply or distribution of electric power.
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

#### CIRCUIT ARRANGEMENTS

For distribution networks:

direct current; alternative current..... 1/00, 3/00  
 combined; not specified..... 5/00, 4/00

For batteries..... 7/00

For emergency or stand-by power supply..... 9/00

For power supply to auxiliaries of stations..... 11/00

For providing remote indication of network conditions..... 13/00

SYSTEMS FOR STORING ELECTRICAL ENERGY..... 15/00

CIRCUIT ARRANGEMENTS OR SYSTEMS FOR WIRELESS SUPPLY OR DISTRIBUTION OF

ELECTRIC POWER..... 50/00

|  |   |
|--|---|
| <p><b>1/00</b> <b>Circuit arrangements for dc mains or dc distribution networks [1, 2006.01]</b></p> <p>1/02 • Arrangements for reducing harmonics or ripples [1, 2006.01]</p> <p>1/04 • Constant-current supply systems [1, 2006.01]</p> <p>1/06 • Two-wire systems [1, 2006.01]</p> <p>1/08 • Three-wire systems; Systems having more than three wires [1, 2006.01]</p> <p>1/10 • Parallel operation of dc sources [1, 2006.01]</p> <p>1/12 • • Parallel operation of dc generators with converters, e.g. with mercury-arc rectifier [1, 2006.01]</p> <p>1/14 • Balancing the load in a network [1, 2006.01]</p> <p>1/16 • • using dynamo-electric machines coupled to flywheels [1, 2006.01]</p> <p><b>3/00</b> <b>Circuit arrangements for ac mains or ac distribution networks [1, 2006.01]</b></p> <p>3/01 • Arrangements for reducing harmonics or ripples [3, 2006.01]</p> <p>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 [1, 2006.01]</p> <p>3/04 • for connecting networks of the same frequency but supplied from different sources [1, 2006.01]</p> <p>3/06 • • Controlling transfer of power between connected networks; Controlling sharing of load between connected networks [1, 2006.01]</p> <p>3/08 • • Synchronising of networks [1, 2006.01]</p> <p>3/10 • Constant-current supply systems [1, 2006.01]</p> <p>3/12 • for adjusting voltage in ac networks by changing a characteristic of the network load [1, 2006.01]</p> <p>3/14 • • by switching loads on to, or off from, network, e.g. progressively balanced loading [1, 2006.01]</p> <p>3/16 • • by adjustment of reactive power [1, 2006.01]</p> | <p>3/18 • Arrangements for adjusting, eliminating or compensating reactive power in networks (for adjustment of voltage H02J 3/16) [1, 2006.01]</p> <p>3/20 • • in long overhead lines [1, 2006.01]</p> <p>3/22 • • in cables [1, 2006.01]</p> <p>3/24 • Arrangements for preventing or reducing oscillations of power in networks (by control effected upon a single generator H02P 9/00) [1, 2006.01]</p> <p>3/26 • Arrangements for eliminating or reducing asymmetry in polyphase networks [1, 2006.01]</p> <p>3/28 • Arrangements for balancing the load in a network by storage of energy [1, 2006.01]</p> <p>3/30 • • using dynamo-electric machines coupled to flywheels [1, 2006.01]</p> <p>3/32 • • using batteries with converting means [1, 2006.01]</p> <p>3/34 • Arrangements for transfer of electric power between networks of substantially different frequency [1, 2006.01]</p> <p>3/36 • Arrangements for transfer of electric power between ac networks <i>via</i> a high-tension dc link [1, 2006.01]</p> <p>3/38 • Arrangements for parallelly feeding a single network by two or more generators, converters or transformers [1, 2006.01]</p> <p>3/40 • • Synchronising a generator for connection to a network or to another generator [1, 2006.01]</p> <p>3/42 • • • with automatic parallel connection when synchronism is achieved [1, 2006.01]</p> <p>3/44 • • • with means for ensuring correct phase sequence [1, 2006.01]</p> <p>3/46 • • Controlling the sharing of output between the generators, converters, or transformers [1, 2006.01]</p> <p>3/48 • • • Controlling the sharing of the in-phase component [1, 2006.01]</p> <p>3/50 • • • Controlling the sharing of the out-of-phase component [1, 2006.01]</p> |
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| 4/00 | <b>Circuit arrangements for mains or distribution networks not specified as ac or dc [2, 2006.01]</b>   | 9/04  | • in which the distribution system is disconnected from the normal source and connected to a standby source [1, 2006.01]   |
| 5/00 | <b>Circuit arrangements for transfer of electric power between ac networks and dc networks (H02J 3/36 takes precedence) [1, 2006.01, 2016.01]</b>                 | 9/06  | • • with automatic change-over [1, 2006.01]  |
|      |   | 9/08  | • • • requiring starting of a prime-mover [1, 2006.01]   |
| 7/00 | <b>Circuit arrangements for charging or depolarising batteries or for supplying loads from batteries [1, 2006.01]</b>   | 11/00 | <b>Circuit arrangements for providing service supply to auxiliaries of stations in which electric power is generated, distributed or converted [1, 2006.01]</b>  |
| 7/02 | • for charging batteries from AC mains by converters [1, 2006.01, 2016.01]  | 13/00 | <b>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 [1, 2006.01]</b> |
| 7/04 | • • Regulation of the charging current or voltage [1, 2006.01]  |       |  |
| 7/06 | • • • using discharge tubes or semiconductor devices [1, 2006.01]   |       |  |
| 7/08 | • • • • using discharge tubes only [1, 2006.01]   |       |  |
| 7/10 | • • • • using semiconductor devices only [1, 2006.01]   |       |  |
| 7/12 | • • • using magnetic devices having controllable degree of saturation, i.e. transducers [1, 2006.01]  | 15/00 | <b>Systems for storing electric energy (mechanical systems therefor F01-F04; in chemical form H01M) [2, 2006.01]</b>   |
| 7/14 | • for charging batteries from dynamo-electric generators driven at varying speed, e.g. on vehicle [1, 2006.01]  | 50/00 | <b>Circuit arrangements or systems for wireless supply or distribution of electric power [2016.01]</b>   |
| 7/16 | • • Regulation of the charging current or voltage by variation of field [1, 2006.01]  |       | <b>Note(s) [2016.01]</b>   |
| 7/18 | • • • due to variation of ohmic resistance in field circuit, using resistance switching in or out of circuit step by step [1, 2006.01]                            |       | In this main group, the specific types of wireless technology used for the power transmission are covered in groups H02J 50/05-H02J 50/30, while aspects relevant to the circuit arrangements or systems thereof are covered in groups H02J 50/40-H02J 50/90.  |
| 7/20 | • • • due to variation of continuously-variable ohmic resistor [1, 2006.01]   | 50/05 | • using capacitive coupling [2016.01]  |
| 7/22 | • • • due to variation of make-to-break ratio of intermittently-operating contacts, e.g. using Tirrill regulator [1, 2006.01]                                     | 50/10 | • using inductive coupling [2016.01]   |
| 7/24 | • • • using discharge tubes or semiconductor devices [1, 2006.01]   | 50/12 | • • of the resonant type [2016.01]   |
| 7/26 | • • • using magnetic devices with controllable degree of saturation [1, 2006.01]  | 50/15 | • using ultrasonic waves [2016.01]   |
| 7/28 | • • • using magnetic devices with controllable degree of saturation in combination with controlled discharge tube or controlled semiconductor device [1, 2006.01] | 50/20 | • using microwaves or radio frequency waves [2016.01]  |
| 7/30 | • • • using armature-reaction-excited machines [1, 2006.01]   | 50/23 | • • characterised by the type of transmitting antennas, e.g. directional array antennas or Yagi antennas [2016.01]   |
| 7/32 | • for charging batteries from a charging set comprising a non-electric prime mover [1, 2006.01]   | 50/27 | • • characterised by the type of receiving antennas, e.g. rectennas [2016.01]  |
| 7/34 | • Parallel operation in networks using both storage and other DC sources, e.g. providing buffering (H02J 7/14 takes precedence) [1, 4, 2006.01]                   | 50/30 | • using light, e.g. lasers [2016.01]   |
| 7/35 | • • with light sensitive cells [4, 2006.01]   | 50/40 | • using two or more transmitting or receiving devices (H02J 50/50 takes precedence) [2016.01]  |
| 7/36 | • Arrangements using end-cell switching [1, 2006.01]  | 50/50 | • using additional energy repeaters between transmitting devices and receiving devices [2016.01]   |
| 9/00 | <b>Circuit arrangements for emergency or stand-by power supply, e.g. for emergency lighting [1, 2006.01]</b>  | 50/60 | • responsive to the presence of foreign objects, e.g. detection of living beings [2016.01]   |
| 9/02 | • in which an auxiliary distribution system and its associated lamps are brought into service [1, 2006.01]  | 50/70 | • involving the reduction of electric, magnetic or electromagnetic leakage fields [2016.01]  |
|      |   | 50/80 | • involving the exchange of data, concerning supply or distribution of electric power, between transmitting devices and receiving devices [2016.01]  |
|      |   | 50/90 | • involving detection or optimisation of position, e.g. alignment [2016.01]  |
| H02K | <b>DYNAMO-ELECTRIC MACHINES (dynamo-electric relays H01H 53/00; conversion of DC or AC input power into surge output power H02M 9/00)</b>                         |       |  |

**Note(s) [7]**

1. This subclass covers the structural adaptation of dynamo-electric machines for the purpose of their control.

H02K

2. This subclass does not cover starting, regulating, electronically commutating, braking, or otherwise controlling motors, generators or dynamo-electric converters, in general, which is covered by subclass H02P.
3. Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "microstructural devices" and "microstructural systems".

**Subclass index**

MOTORS OR GENERATORS

Continuously rotating

- AC machines: asynchronous; synchronous; with mechanical commutators.....17/00, 19/00, 21/00, 27/00
- DC machines or universal AC/DC motors: with mechanical commutators; with interrupters.....23/00, 25/00
- with non-mechanical commutating devices.....29/00
- Acyclic machines; oscillating machines; motors rotating step by step.....31/00, 33/00, 35/00, 37/00
- Generators producing a non-sinusoidal waveform.....39/00
- Machines with more than one rotor or stator.....16/00

SPECIAL DYNAMO-ELECTRIC APPARATUS

- Machines for transmitting angular displacements; torque motors.....24/00, 26/00
- Machines involving dynamo-electric interaction with a plasma or a flow of conductive liquid or of fluid-borne conductive or magnetic particles.....44/00
- Systems for propulsing a rigid body along a path.....41/00
- Converters.....47/00
- Dynamo-electric clutches or brakes; dynamo-electric gears.....49/00, 51/00
- Alleged perpetua mobilia.....53/00
- Machines operating at cryogenic temperatures.....55/00

DETAILS

- Magnetic circuits; windings; casings.....1/00, 3/00, 5/00
- Arrangements structurally associated with the machine for handling mechanical energy; cooling; measuring or protective devices; current collection or commutation.....7/00, 9/00, 11/00, 13/00

MANUFACTURE.....15/00

SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....99/00

|  |  |
|--|--|
| <p>1/00 <b>Details of the magnetic circuit</b> (magnetic circuits for relays H01H 50/16) [1, 2006.01]</p> <p>1/02 • characterised by the magnetic material [1, 2006.01]</p> <p>1/04 • characterised by the material used for insulating the magnetic circuit or parts thereof [1, 2006.01]</p> <p>1/06 • characterised by the shape, form or construction [1, 2006.01]</p> <p>1/08 • • Salient poles [1, 2006.01]</p> <p>1/10 • • • Commutating poles [1, 2006.01]</p> <p>1/12 • • Stationary parts of the magnetic circuit [1, 2006.01]</p> <p>1/14 • • • Stator cores with salient poles [1, 2006.01]</p> <p>1/16 • • • Stator cores with slots for windings [1, 2006.01]</p> <p>1/17 • • • Stator cores with permanent magnets [5, 2006.01]</p> <p>1/18 • • • Means for mounting or fastening magnetic stationary parts on to, or to, the stator structures [1, 2006.01]</p> <p>1/20 • • • with channels or ducts for flow of cooling medium [1, 2006.01]</p> <p>1/22 • • Rotating parts of the magnetic circuit [1, 2006.01]</p> <p>1/24 • • • Rotor cores with salient poles [1, 2006.01]</p> <p>1/26 • • • Rotor cores with slots for windings [1, 2006.01]</p> <p>1/27 • • • Rotor cores with permanent magnets [5, 2006.01, 2022.01]</p> <p>1/2706 • • • • Inner rotors [2022.01]</p> <p>1/2713 • • • • the magnetisation axis of the magnets being axial, e.g. claw-pole type [2022.01]</p> <p>1/272 • • • • the magnetisation axis of the magnets being perpendicular to the rotor axis [2022.01]</p> <p>1/2726 • • • • the rotor consisting of a single magnet or two or more axially juxtaposed single magnets [2022.01]</p> | <p>1/2733 • • • • • • Annular magnets [2022.01]</p> <p>1/274 • • • • • • the rotor consisting of two or more circumferentially positioned magnets [2022.01]</p> <p>1/2746 • • • • • • the rotor consisting of magnets arranged with the same polarity, e.g. consequent pole type [2022.01]</p> <p>1/2753 • • • • • • the rotor consisting of magnets or groups of magnets arranged with alternating polarity [2022.01]</p> <p>1/276 • • • • • • Magnets embedded in the magnetic core, e.g. interior permanent magnets [IPM] [2022.01]</p> <p>1/278 • • • • • • Surface mounted magnets; Inset magnets [2022.01]</p> <p>1/2781 • • • • • • Magnets shaped to vary the mechanical air gap between the magnets and the stator [2022.01]</p> <p>1/2783 • • • • • • with magnets arranged in Halbach arrays [2022.01]</p> <p>1/2786 • • • • Outer rotors [2022.01]</p> <p>1/2787 • • • • the magnetisation axis of the magnets being perpendicular to the rotor axis [2022.01]</p> <p>1/2788 • • • • the rotor consisting of a single magnet or two or more axially juxtaposed single magnets [2022.01]</p> <p>1/2789 • • • • the rotor consisting of two or more circumferentially positioned magnets [2022.01]</p> <p>1/279 • • • • • • Magnets embedded in the magnetic core [2022.01]</p> <p>1/2791 • • • • • • Surface mounted magnets; Inset magnets [2022.01]</p> |
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- 1/27915 • • • • • Magnets shaped to vary the mechanical air gap between the magnets and the stator [2022.01]
- 1/2792 • • • • • with magnets arranged in Halbach arrays [2022.01]
- 1/2793 • • • • Rotors axially facing stators [2022.01]
- 1/2795 • • • • • the rotor consisting of two or more circumferentially positioned magnets [2022.01]
- 1/2796 • • • • • where both axial sides of the rotor face a stator [2022.01]
- 1/2798 • • • • • where both axial sides of the stator face a rotor [2022.01]
- 1/28 • • • Means for mounting or fastening rotating magnetic parts on to, or to, the rotor structures [1, 2006.01]
- 1/30 • • • • using intermediate parts, e.g. spiders [1, 2006.01]
- 1/32 • • • with channels or ducts for flow of cooling medium [1, 2006.01]
- 1/34 • • Reciprocating, oscillating or vibrating parts of the magnetic circuit [1, 2006.01]
- 3/00 Details of windings [1, 2006.01]**
- 3/02 • Windings characterised by the conductor material [1, 2006.01]
- 3/04 • Windings characterised by the conductor shape, form or construction, e.g. with bar conductors [1, 2006.01]
- 3/12 • • arranged in slots [1, 2006.01]
- 3/14 • • • with transposed conductors, e.g. twisted conductors [1, 2006.01]
- 3/16 • • • for auxiliary purposes, e.g. damping or commutating [1, 2006.01]
- 3/18 • • Windings for salient poles [1, 2006.01]
- 3/20 • • • for auxiliary purposes, e.g. damping or commutating [1, 2006.01]
- 3/22 • • consisting of hollow conductors [1, 2006.01]
- 3/24 • • with channels or ducts for cooling medium between the conductors [1, 2006.01]
- 3/26 • • consisting of printed conductors [1, 2006.01]
- 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) [1, 2006.01]
- 3/30 • Windings characterised by the insulating material [1, 2006.01]
- 3/32 • Windings characterised by the shape, form or construction of the insulation [1, 2006.01]
- 3/34 • • between conductors or between conductor and core, e.g. slot insulation [1, 3, 2006.01]
- 3/38 • • around winding heads, equalising connectors, or connections thereto [1, 2006.01]
- 3/40 • • for high voltage, e.g. affording protection against corona discharges [1, 2006.01]
- 3/42 • Means for preventing or reducing eddy-current losses in the winding heads, e.g. by shielding [1, 2, 2006.01]
- 3/44 • Protection against moisture or chemical attack; Windings specially adapted for operation in liquid or gas [1, 2006.01]
- 3/46 • Fastening of windings on the stator or rotor structure [1, 2006.01]
- 3/47 • • Air-gap windings, i.e. iron-free windings [3, 2006.01]
- 3/48 • • in slots [1, 2006.01]
- 3/487 • • • Slot-closing devices [3, 2006.01]
- 3/493 • • • • magnetic [3, 2006.01]
- 3/50 • • Fastening of winding heads, equalising connectors, or connections thereto [1, 2006.01]
- 3/51 • • • applicable to rotors only [3, 2006.01]
- 3/52 • • Fastening salient pole windings or connections thereto [1, 2006.01]
- 5/00 Casings; Enclosures; Supports [1, 2006.01]**
- 5/02 • Casings or enclosures characterised by the material thereof [1, 2006.01]
- 5/04 • Casings or enclosures characterised by the shape, form or construction thereof [1, 2006.01]
- 5/06 • • Cast metal casings [1, 2006.01]
- 5/08 • • Insulating casings [1, 2006.01]
- 5/10 • • with arrangements for protection from ingress, e.g. of water or fingers [1, 2006.01]
- 5/12 • • specially adapted for operating in liquid or gas (combined with cooling arrangements H02K 9/00) [1, 2006.01]
- 5/124 • • • Sealing of shafts [3, 2006.01]
- 5/128 • • • using air-gap sleeves or air-gap discs [3, 2006.01]
- 5/132 • • • Submersible electric motors (H02K 5/128 takes precedence) [3, 2006.01]
- 5/136 • • • explosion-proof [3, 2006.01]
- 5/14 • • Means for supporting or protecting brushes or brush holders [1, 3, 2006.01]
- 5/15 • • Mounting arrangements for bearing-shields or end plates [3, 2006.01]
- 5/16 • • Means for supporting bearings, e.g. insulating supports or means for fitting bearings in the bearing-shields (magnetic bearings H02K 7/09) [1, 2006.01]
- 5/167 • • • using sliding-contact or spherical cap bearings [3, 2006.01]
- 5/173 • • • using bearings with rolling contact, e.g. ball bearings [3, 2006.01]
- 5/18 • • with ribs or fins for improving heat transfer [1, 2006.01]
- 5/20 • • with channels or ducts for flow of cooling medium [1, 2006.01]
- 5/22 • • Auxiliary parts of casings not covered by groups H02K 5/06-H02K 5/20, e.g. shaped to form connection boxes or terminal boxes [1, 2006.01]
- 5/24 • specially adapted for suppression or reduction of noise or vibrations [1, 2006.01]
- 5/26 • Means for adjusting casings relative to their supports [1, 2006.01]
- 7/00 Arrangements for handling mechanical energy structurally associated with dynamo-electric machines, e.g. structural association with mechanical driving motors or auxiliary dynamo-electric machines [1, 2006.01]**
- 7/02 • Additional mass for increasing inertia, e.g. flywheels [1, 2006.01]
- 7/04 • Balancing means [1, 2006.01]
- 7/06 • Means for converting reciprocating motion into rotary motion or *vice versa* [1, 2006.01]
- 7/065 • • Electromechanical oscillators; Vibrating magnetic drives [3, 2006.01]
- 7/07 • • using pawls and ratchet wheels [3, 2006.01]
- 7/075 • • using crankshafts or eccentrics [3, 2006.01]
- 7/08 • Structural association with bearings [1, 2006.01]
- 7/09 • • with magnetic bearings [3, 2006.01]
- 7/10 • Structural association with clutches, brakes, gears, pulleys or mechanical starters [1, 2006.01]
- 7/102 • • with friction brakes [1, 2006.01]

## H02K

- 7/104 • • with eddy-current brakes [1, 2006.01]
- 7/106 • • with dynamo-electric brakes [1, 2006.01]
- 7/108 • • with friction clutches [1, 2006.01]
- 7/11 • • with dynamo-electric clutches [1, 2006.01]
- 7/112 • • with friction clutches in combination with brakes [1, 2006.01]
- 7/114 • • with dynamo-electric clutches in combination with brakes [1, 2006.01]
- 7/116 • • with gears [1, 2006.01]
- 7/118 • • with starting devices [1, 2006.01]
- 7/12 • • with auxiliary limited movement of stators, rotors or core parts, e.g. rotors axially movable for the purpose of clutching or braking [1, 2006.01]
- 7/14 • Structural association with mechanical loads, e.g. with hand-held machine tools or fans (with fan or impeller for cooling the machine H02K 9/06) [1, 2006.01]
- 7/16 • • for operation above the critical speed of vibration of the rotating parts [1, 2006.01]
- 7/18 • Structural association of electric generators with mechanical driving motors, e.g. with turbines [1, 2006.01]
- 7/20 • Structural association with auxiliary dynamo-electric machines, e.g. with electric starter motors or exciters [1, 2006.01]
- 9/00 Arrangements 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) [1, 2006.01]
- 9/02 • by ambient air flowing through the machine [1, 2006.01]
- 9/04 • • having means for generating a flow of cooling medium [1, 2006.01]
- 9/06 • • • with fans or impellers driven by the machine shaft [1, 2006.01]
- 9/08 • by gaseous cooling medium circulating wholly within the machine casing (H02K 9/10 takes precedence) [1, 2006.01]
- 9/10 • by gaseous cooling medium flowing in closed circuit, a part of which is external to the machine casing [1, 2006.01]
- 9/12 • • wherein the cooling medium circulates freely within the casing [1, 2006.01]
- 9/14 • wherein gaseous cooling medium circulates between the machine casing and a surrounding mantle [1, 2006.01]
- 9/16 • • wherein the cooling medium circulates through ducts or tubes within the casing [1, 2006.01]
- 9/18 • • wherein the external part of the closed circuit comprises a heat exchanger structurally associated with the machine casing [1, 2006.01]
- 9/19 • for machines with closed casing and closed-circuit cooling using a liquid cooling medium, e.g. oil [1, 2006.01]
- 9/193 • • with provision for replenishing the cooling medium; with means for preventing leakage of the cooling medium [1, 2006.01]
- 9/197 • • in which the rotor or stator space is fluid-tight, e.g. to provide for different cooling media for rotor and stator [1, 2006.01]
- 9/20 • • wherein the cooling medium vaporises within the machine casing [1, 2006.01]
- 9/22 • by solid heat conducting material embedded in, or arranged in contact with, the stator or rotor, e.g. heat bridges [1, 2006.01]
- 9/24 • Protection against failure of cooling arrangements, e.g. due to loss of cooling medium or due to interruption of the circulation of cooling medium [1, 2006.01]
- 9/26 • Structural association of machines with devices for cleaning or drying cooling medium, e.g. with filters [1, 2006.01]
- 9/28 • Cooling of commutators, slip-rings or brushes, e.g. by ventilating [1, 2006.01]
- 11/00 Structural association of dynamo-electric machines with electric components or with devices for shielding, monitoring or protection** (casings, enclosures or supports H02K 5/00) [1, 2006.01, 2016.01]
- 11/01 • for shielding from electromagnetic fields (means for preventing or reducing eddy-current losses in the winding heads by shielding H02K 3/42) [2016.01]
- 11/02 • for suppression of electromagnetic interference [6, 2006.01, 2016.01]
- 11/026 • • Suppressors associated with brushes, brush holders or their supports [2016.01]
- 11/028 • • Suppressors associated with the rotor [2016.01]
- 11/04 • for rectification [6, 2006.01, 2016.01]
- 11/042 • • Rectifiers associated with rotating parts, e.g. rotor cores or rotary shafts [2016.01]
- 11/049 • • Rectifiers associated with stationary parts, e.g. stator cores [2016.01]
- 11/05 • • • Rectifiers associated with casings, enclosures or brackets [2016.01]
- 11/20 • for measuring, monitoring, testing, protecting or switching (rectifiers H02K 11/04; power electronics H02K 11/33) [2016.01]
- 11/21 • • Devices for sensing speed or position, or actuated thereby (specially adapted for machines having non-mechanical commutating devices H02K 29/06, H02K 29/14) [2016.01]
- 11/215 • • • Magnetic effect devices, e.g. Hall-effect or magneto-resistive elements [2016.01]
- 11/22 • • • Optical devices [2016.01]
- 11/225 • • • Detecting coils [2016.01]
- 11/23 • • • Mechanically-actuated centrifugal switches [2016.01]
- 11/24 • • Devices for sensing torque, or actuated thereby (H02K 11/27 takes precedence) [2016.01]
- 11/25 • • Devices for sensing temperature, or actuated thereby [2016.01]
- 11/26 • • Devices for sensing voltage, or actuated thereby, e.g. overvoltage protection devices [2016.01]
- 11/27 • • Devices for sensing current, or actuated thereby (overcurrent protection responsive to temperature of the machines or parts thereof, e.g. windings, H02K 11/25) [2016.01]
- 11/28 • • Manual switches [2016.01]
- 11/30 • Structural association with control circuits or drive circuits [2016.01]
- 11/33 • • Drive circuits, e.g. power electronics (H02K 11/38 takes precedence) [2016.01]
- 11/35 • • Devices for recording or transmitting machine parameters, e.g. memory chips or radio transmitters for diagnosis [2016.01]
- 11/38 • • Control circuits or drive circuits associated with geared commutator motors of the worm-and-wheel type [2016.01]
- 11/40 • Structural association with grounding devices [2016.01]

- 13/00 Structural associations of current collectors with motors or generators, e.g. brush mounting plates or 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 [1, 2006.01]**
- 13/02 • Connections between slip-rings and windings [1, 2006.01]
- 13/04 • Connections between commutator segments and windings [1, 2006.01]
- 13/06 • • Resistive connections, e.g. by high-resistance chokes or by transistors [1, 2006.01]
- 13/08 • • Segments formed by extensions of the winding [1, 2006.01]
- 13/10 • Arrangements of brushes or commutators specially adapted for improving commutation [1, 2006.01]
- 13/12 • Arrangements for producing an axial reciprocation of the rotor and its associated current collector part, e.g. for polishing commutator surfaces [1, 2006.01]
- 13/14 • Circuit arrangements for improvement of commutation, e.g. by use of unidirectionally conductive elements [1, 2006.01]
- 15/00 Processes or apparatus specially adapted for manufacturing, assembling, maintaining or repairing of dynamo-electric machines [1, 2006.01, 2025.01]**
- 15/02 • of stator or rotor bodies [1, 2006.01, 2025.01]
- 15/021 • • Magnetic cores [2025.01]
- 15/022 • • • with salient poles [2025.01]
- 15/0225 • • • • with claw-shaped poles [2025.01]
- 15/023 • • • Cage rotors [2025.01]
- 15/025 • • • characterised by skewed structures in cores [2025.01]
- 15/026 • • • Wound cores [2025.01]
- 15/027 • • • Punching the cores [2025.01]
- 15/0273 • • • Laminating the cores [2025.01]
- 15/0275 • • • Annealing the cores [2025.01]
- 15/0278 • • • Welding the cores [2025.01]
- 15/028 • • Fastening stator or rotor bodies to casings, supports, shafts or hubs [2025.01]
- 15/03 • • having permanent magnets [5, 2006.01, 2025.01]
- 15/035 • • • on the rotor [2025.01]
- 15/038 • • • Polarising or magnetising the permanent magnets [2025.01]
- 15/04 • of windings prior to their mounting into the machines (insulating windings H02K 15/10, H02K 15/12) [1, 2006.01, 2025.01]
- 15/0407 • • Manufacturing of windings by etching, printing or stamping the complete coils [2025.01]
- 15/0414 • • the windings consisting of separate elements, e.g. bars, segments or half coils [2025.01]
- 15/0421 • • • and consisting of single conductors, e.g. hairpins [2025.01]
- 15/0428 • • • • Processes or apparatus for simultaneously twisting two or more hairpins [2025.01]
- 15/043 • • winding flat conductive wires or sheets [2025.01]
- 15/044 • • winding non-flat conductive wires, e.g. cables or cords [2025.01]
- 15/046 • • • Concentrated windings [2025.01]
- 15/047 • • • Distributed windings [2025.01]
- 15/048 • • • of the wave winding type [2025.01]
- 15/06 • Embedding prefabricated windings in the machines [1, 2006.01, 2025.01]
- 15/061 • • Air-gap windings [2025.01]
- 15/062 • • Windings in slots; Salient pole windings [2025.01]
- 15/064 • • • Windings consisting of separate segments [2025.01]
- 15/0643 • • • • Hairpin windings [2025.01]
- 15/0646 • • • • Bar windings consisting of pre-assembled multiple conductors, e.g. Roebel bars [2025.01]
- 15/065 • • • Windings consisting of complete sections, e.g. coils or waves [2025.01]
- 15/066 • • • • inserted perpendicularly to the axis of the slots or inter-polar channels [2025.01]
- 15/067 • • • • inserted in parallel to the axis of the slots or inter-polar channels [2025.01]
- 15/068 • • • • • Strippers; Embedding windings by strippers [2025.01]
- 15/08 • Forming windings by laying conductors into or around core parts [1, 2006.01]
- 15/085 • • by laying conductors into slotted stators [1, 2006.01]
- 15/09 • • by laying conductors into slotted rotors [1, 2006.01]
- 15/095 • • by laying conductors around salient poles [1, 2006.01]
- 15/10 • Applying solid insulation to windings, stators or rotors, e.g. applying insulating tapes [1, 2006.01, 2025.01]
- 15/104 • • Insulating between conductors [2025.01]
- 15/106 • • Insulating between conductors and cores [2025.01]
- 15/108 • • • with slot liners [2025.01]
- 15/12 • Impregnating, moulding insulation, heating or drying of windings, stators, rotors or machines [1, 2006.01, 2025.01]
- 15/121 • • of cores [2025.01]
- 15/122 • • of windings [2025.01]
- 15/123 • • of casings or enclosures [2025.01]
- 15/125 • • Heating or drying of machines in operational state, e.g. standstill heating [2025.01]
- 15/13 • Applying slot closure means in the cores; Manufacture of slot closure means [2025.01]
- 15/14 • Casings; Enclosures; Supports [1, 2006.01, 2025.01]
- 15/142 • • by moulding [2025.01]
- 15/144 • • of shafts, bearings or supports therefor [2025.01]
- 15/146 • • of brush holders [2025.01]
- 15/148 • • Insulating casings or enclosures (H02K 15/123 takes precedence) [2025.01]
- 15/16 • Centring rotors within the stators [1, 2006.01, 2025.01]
- 15/165 • • Balancing the rotors [2025.01]
- 15/20 • Shaping or compacting conductors or winding heads after the installation of the winding in the cores or machines; Applying fastening means on winding heads [2025.01]
- 15/22 • • Shaping or compacting conductors in slots or around salient poles (H02K 15/28 takes precedence) [2025.01]
- 15/24 • • Shaping or compacting winding heads (H02K 15/0428, H02K 15/28, H02K 15/36 take precedence) [2025.01]
- 15/26 • • • Applying fastening means on winding heads [2025.01]
- 15/28 • • using electrodynamic forces [2025.01]
- 15/30 • Manufacture of winding connections [2025.01]
- 15/32 • • Manufacture of terminal arrangements; Connecting the terminals to external circuits [2025.01]

## H02K

- 15/33 • • *Connecting winding sections; Forming leads; Connecting leads to terminals [2025.01]*
- 15/34 • • • *Connecting the neutral point [2025.01]*
- 15/35 • • • *Form-wound windings [2025.01]*
- 15/36 • • • • *Processes or apparatus for simultaneously twisting two or more open ends of hairpins after their insertion into the machine (for simultaneously twisting two or more hairpins prior to mounting into the machine H02K 15/0428) [2025.01]*
- 15/38 • • • • *Manufacturing or repairing cooling fluid boxes, e.g. ensuring both electrical and fluid connection of terminals of fluid cooled windings [2025.01]*
- 15/40 • *Assembling dynamo-electric machines (H02K 15/16 takes precedence) [2025.01]*
- 15/50 • *Disassembling, repairing or modifying dynamo-electric machines (repairing of cooling fluid boxes H02K 15/38) [2025.01]*
- 15/60 • *Hoisting or moving dynamo-electric machines [2025.01]*
- 15/70 • *Cleaning dynamo-electric machines [2025.01]*
- 15/80 • *Manufacturing lines specially adapted for dynamo-electrical machines, e.g. feeding or unloading [2025.01]*
- 15/90 • *Positioning or clamping dynamo-electric machines, e.g. jigs [2025.01]*
- 15/95 • *Installation of current collectors, e.g. commutators, slip-rings or brushes [2025.01]*
- 16/00 Machines with more than one rotor or stator [2, 2006.01]**
- 16/02 • *Machines with one stator and two rotors [2, 2006.01]*
- 16/04 • *Machines with one rotor and two stators [2, 2006.01]*
- Note(s) [2]**
- Group H02K 16/00 takes precedence over groups H02K 17/00-H02K 53/00.
- 17/00 Asynchronous induction motors; Asynchronous induction generators [1, 2006.01]**
- 17/02 • *Asynchronous induction motors [1, 2006.01]*
- 17/04 • • *for single phase current [1, 2006.01]*
- 17/06 • • • *having windings arranged for permitting pole-changing [1, 2006.01]*
- 17/08 • • • *Motors with auxiliary phase obtained by externally fed auxiliary windings, e.g. capacitor motors [1, 2006.01]*
- 17/10 • • • *Motors with auxiliary phase obtained by split-pole carrying short-circuited windings [1, 2006.01]*
- 17/12 • • *for multi-phase current [1, 2006.01]*
- 17/14 • • • *having windings arranged for permitting pole-changing [1, 2006.01]*
- 17/16 • • *having rotors with internally short-circuited windings, e.g. cage rotors [1, 2006.01]*
- 17/18 • • • *having double-cage or multiple-cage rotors [1, 2006.01]*
- 17/20 • • • *having deep-bar rotors [1, 2006.01]*
- 17/22 • • *having rotors with windings connected to slip-rings [1, 2006.01]*
- 17/24 • • • *in which both stator and rotor are fed with AC [1, 2006.01]*
- 17/26 • • *having rotors or stators designed to permit synchronous operation [1, 2006.01]*
- 17/28 • • *having compensating winding for improving phase angle [1, 2006.01]*
- 17/30 • • *Structural association of asynchronous induction motors with auxiliary electric devices influencing the characteristics of the motor or controlling the motor, e.g. with impedances or switches [1, 2006.01]*
- 17/32 • • *Structural association of asynchronous induction motors with auxiliary mechanical devices, e.g. with clutches or brakes [1, 2006.01]*
- 17/34 • • *Cascade arrangement of an asynchronous motor with another dynamo-electric motor or converter [1, 2006.01]*
- 17/36 • • • *with another asynchronous induction motor [1, 2006.01]*
- 17/38 • • • *with a commutator machine [1, 2006.01]*
- 17/40 • • • *with a rotary AC/DC converter [1, 2006.01]*
- 17/42 • *Asynchronous induction generators (H02K 17/02 takes precedence) [1, 4, 2006.01]*
- 17/44 • • *Structural association with exciting machines [1, 2006.01]*
- 19/00 Synchronous motors or generators (having permanent magnets H02K 21/00) [1, 2006.01]**
- 19/02 • *Synchronous motors [1, 2006.01]*
- 19/04 • • *for single-phase current [1, 2006.01]*
- 19/06 • • • *Motors having windings on the stator and a variable-reluctance soft-iron rotor without windings, e.g. inductor motors [1, 2006.01]*
- 19/08 • • • *Motors having windings on the stator and a smooth rotor without windings of material with large hysteresis, e.g. hysteresis motors [1, 2006.01]*
- 19/10 • • *for multi-phase current [1, 2006.01]*
- 19/12 • • • *characterised by the arrangement of exciting windings, e.g. for self-excitation, compounding or pole-changing [1, 2006.01]*
- 19/14 • • *having additional short-circuited windings for starting as asynchronous motors [1, 2006.01]*
- 19/16 • *Synchronous generators [1, 2006.01]*
- 19/18 • • *having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar generators [1, 2006.01]*
- 19/20 • • • *with variable-reluctance soft-iron rotors without winding [1, 2006.01]*
- 19/22 • • *having windings each turn of which co-operates alternately with poles of opposite polarity, e.g. heteropolar generators [1, 2006.01]*
- 19/24 • • • *with variable-reluctance soft-iron rotors without winding [1, 2006.01]*
- 19/26 • • *characterised by the arrangement of exciting windings [1, 2006.01]*
- 19/28 • • • *for self-excitation [1, 2006.01]*
- 19/30 • • • *for compounding [1, 2006.01]*
- 19/32 • • • *for pole-changing [1, 2006.01]*
- 19/34 • • *Generators with two or more outputs [1, 2006.01]*
- 19/36 • • *Structural association of synchronous generators with auxiliary electric devices influencing the characteristic of the generator or controlling the generator, e.g. with impedances or switches [1, 2006.01]*
- 19/38 • • *Structural association of synchronous generators with exciting machines [1, 2006.01]*
- 21/00 Synchronous motors having permanent magnets; Synchronous generators having permanent magnets [1, 2006.01]**
- 21/02 • *Details [1, 2006.01]*

- 21/04 • • Windings on magnets for additional excitation [1, 2006.01]
- 21/10 • • Rotating armatures [1, 2006.01]
- 21/12 • with stationary armatures and rotating magnets [1, 2006.01]
- 21/14 • • with magnets rotating within the armatures [1, 2006.01]
- 21/16 • • • having annular armature cores with salient poles (with homopolar co-operation H02K 21/20) [1, 2006.01]
- 21/18 • • • having horse-shoe armature cores (with homopolar co-operation H02K 21/20) [1, 2006.01]
- 21/20 • • • having windings each turn of which co-operates only with poles of one polarity, e.g. homopolar machine [1, 2006.01]
- 21/22 • • with magnets rotating around the armatures, e.g. flywheel magnetos [1, 2006.01]
- 21/24 • • with magnets axially facing the armatures, e.g. hub-type cycle dynamos [1, 2006.01]
- 21/26 • with rotating armatures and stationary magnets [1, 2006.01]
- 21/28 • • with armatures rotating within the magnets [1, 2006.01]
- 21/30 • • • having annular armature cores with salient poles (with homopolar co-operation H02K 21/36) [1, 2006.01]
- 21/32 • • • having horse-shoe magnets (with homopolar co-operation H02K 21/36) [1, 2006.01]
- 21/34 • • • having bell-shaped or bar-shaped magnets, e.g. for cycle lighting (with homopolar co-operation H02K 21/36) [1, 2006.01]
- 21/36 • • • with homopolar co-operation [1, 2006.01]
- 21/38 • with rotating flux distributors, and armatures and magnets both stationary [1, 2006.01]
- 21/40 • • with flux distributors rotating around the magnets and within the armatures [1, 2006.01]
- 21/42 • • with flux distributors rotating around the armatures and within the magnets [1, 2006.01]
- 21/44 • • with armature windings wound upon the magnets [1, 2006.01]
- 21/46 • Motors having additional short-circuited winding for starting as an asynchronous motor [1, 2006.01]
- 21/48 • Generators with two or more outputs [1, 2006.01]
- 23/00 DC commutator motors or generators having mechanical commutator; Universal AC/DC commutator motors [1, 2006.01]**
- 23/02 • characterised by arrangement for exciting [1, 2006.01]
- 23/04 • • having permanent magnet excitation [1, 2006.01]
- 23/06 • • having shunt connection of excitation windings [1, 2006.01]
- 23/08 • • having series connection of excitation windings [1, 2006.01]
- 23/10 • • having compound connection of excitation windings [1, 2006.01]
- 23/12 • • having excitation produced by current sources independent of the armature circuit [1, 2006.01]
- 23/14 • • having high-speed excitation or de-excitation, e.g. by neutralising the remanent excitation field [1, 2006.01]
- 23/16 • • having angularly adjustable excitation field, e.g. by pole reversing or pole switching [1, 2006.01]
- 23/18 • • having displaceable main or auxiliary brushes [1, 2006.01]
- 23/20 • • having additional brushes spaced intermediately of the main brushes on the commutator, e.g. cross-field machines, metadynes, amplidynes or other armature-reaction excited machines [1, 2006.01]
- 23/22 • • having compensating or damping windings [1, 2006.01]
- 23/24 • • having commutating-pole windings [1, 2006.01]
- 23/26 • characterised by the armature windings [1, 2006.01]
- 23/28 • • having open windings, i.e. not closed within the armatures [1, 2006.01]
- 23/30 • • having lap or loop windings [1, 2006.01]
- 23/32 • • having wave or undulating winding [1, 2006.01]
- 23/34 • • having mixed windings [1, 2006.01]
- 23/36 • • having two or more windings; having two or more commutators; having two or more stators [1, 2006.01]
- 23/38 • • having winding or connection for improving commutation, e.g. equipotential connection [1, 2006.01]
- 23/40 • characterised by the arrangement of the magnet circuits [1, 2006.01]
- 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 [1, 2006.01]
- 23/44 • • having movable, e.g. turnable, iron parts [1, 2006.01]
- 23/46 • • having stationary shunts, i.e. magnetic cross flux [1, 2006.01]
- 23/48 • • having adjustable armatures [1, 2006.01]
- 23/50 • Generators with two or more outputs [1, 2006.01]
- 23/52 • Motors acting also as generators, e.g. starting motors used as generators for ignition or lighting [1, 2006.01]
- 23/54 • Disc armature motors or generators [1, 2006.01]
- 23/56 • Motors or generators having iron cores separated from armature winding [1, 2006.01]
- 23/58 • Motors or generators without iron cores [1, 2006.01]
- 23/60 • Motors or generators having rotating armatures and rotating excitation field [1, 2006.01]
- 23/62 • Motors or generators with stationary armatures and rotating excitation field [1, 2006.01]
- 23/64 • Motors specially adapted for running on DC or AC by choice [1, 2006.01]
- 23/66 • Structural association with auxiliary electric devices influencing the characteristic of, or controlling, the machine, e.g. with impedances or switches [1, 2006.01]
- 23/68 • Structural association with auxiliary mechanical devices, e.g. with clutches or brakes [1, 2006.01]
- 24/00 Machines adapted for the instantaneous transmission or reception of the angular displacement of rotating parts, e.g. synchro, selsyn [1, 2006.01]**
- 25/00 DC interrupter motors or generators [1, 2006.01]**
- 26/00 Machines adapted to function as torque motors, i.e. to exert a torque when stalled [1, 2006.01]**
- 27/00 AC commutator motors or generators having mechanical commutator [1, 2006.01]**
- 27/02 • characterised by the armature winding [1, 2006.01]
- 27/04 • having single-phase operation in series or shunt connection [1, 2006.01]
- 27/06 • • with a single or multiple short-circuited commutator, e.g. repulsion motor [1, 2006.01]
- 27/08 • • with multiple-fed armature [1, 2006.01]

- 27/10 • • with switching devices for different modes of operation, e.g. repulsion-induction motor [1, 2006.01]
- 27/12 • having multi-phase operation [1, 2006.01]
- 27/14 • • in series connection [1, 2006.01]
- 27/16 • • in shunt connection with stator feeding [1, 2006.01]
- 27/18 • • in shunt connection with rotor feeding [1, 2006.01]
- 27/20 • Structural association with a speed regulating device [1, 2006.01]
- 27/22 • having means for improving commutation, e.g. auxiliary fields, double windings, double brushes [1, 2006.01]
- 27/24 • having two or more commutators [1, 2006.01]
- 27/26 • having disc armature [1, 2006.01]
- 27/28 • Structural association with auxiliary electric devices influencing the characteristic of the machine or controlling the machine [1, 2006.01]
- 27/30 • Structural association with auxiliary mechanical devices, e.g. with clutches or brakes [1, 2006.01]
- 29/00 Motors or generators having non-mechanical commutating devices, e.g. discharge tubes or semiconductor devices [1, 2006.01]**
- 29/03 • with a magnetic circuit specially adapted for avoiding torque ripples or self-starting problems [6, 2006.01]
- 29/06 • with position sensing devices (H02K 29/03 takes precedence) [4, 6, 2006.01]
- 29/08 • • using magnetic effect devices, e.g. Hall-plates or magneto-resistors (H02K 29/12 takes precedence) [4, 2006.01]
- 29/10 • • using light effect devices [4, 2006.01]
- 29/12 • • using detecting coils [4, 2006.01]
- 29/14 • with speed sensing devices (H02K 29/03 takes precedence) [4, 6, 2006.01]
- 31/00 Acyclic motors or generators, i.e. DC machines having drum or disc armatures with continuous current collectors [1, 2006.01]**
- 31/02 • with solid-contact collectors [1, 2006.01]
- 31/04 • with at least one liquid-contact collector [1, 2006.01]
- 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) [1, 2006.01]**
- 33/02 • with armatures moved one way by energisation of a single coil system and returned by mechanical force, e.g. by springs [1, 2006.01]
- 33/04 • • wherein the frequency of operation is determined by the frequency of uninterrupted AC energisation [1, 2006.01]
- 33/06 • • • with polarised armatures [1, 2006.01]
- 33/08 • • • with DC energisation superimposed on AC energisation [1, 2006.01]
- 33/10 • • wherein the alternate energisation and de-energisation of the single coil system is effected or controlled by movement of the armatures [1, 2006.01]
- 33/12 • with armatures moving in alternate directions by alternate energisation of two coil systems [1, 2006.01]
- 33/14 • • wherein the alternate energisation and de-energisation of the two coil systems are effected or controlled by movement of the armatures [1, 2006.01]
- 33/16 • with polarised armatures moving in alternate directions by reversal or energisation of a single coil system [1, 2006.01]
- 33/18 • with coil systems moving upon intermittent or reversed energisation thereof by interaction with a fixed field system, e.g. permanent magnets [1, 2006.01]
- 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) [1, 2006.01]**
- 35/02 • with moving magnets and stationary coil systems [1, 2006.01]
- 35/04 • with moving coil systems and stationary magnets [1, 2006.01]
- 35/06 • with moving flux distributors, and both coil systems and magnets stationary [1, 2006.01]
- 37/00 Motors with rotor rotating step by step and without interrupter or commutator driven by the rotor, e.g. stepping motors [1, 2006.01]**
- 37/02 • of variable reluctance type [4, 2006.01]
- 37/04 • • with rotors situated within the stators [4, 2006.01]
- 37/06 • • with rotors situated around the stators [4, 2006.01]
- 37/08 • • with rotors axially facing the stators [4, 2006.01]
- 37/10 • of permanent magnet type (H02K 37/02 takes precedence) [4, 2006.01]
- 37/12 • • with stationary armatures and rotating magnets [4, 2006.01]
- 37/14 • • • with magnets rotating within the armatures [4, 2006.01]
- 37/16 • • • • having horseshoe armature cores [4, 2006.01]
- 37/18 • • • • of homopolar type [4, 2006.01]
- 37/20 • • with rotating flux distributors, the armatures and magnets both being stationary [4, 2006.01]
- 37/22 • Damping units [4, 2006.01]
- 37/24 • Structural association with auxiliary mechanical devices [4, 2006.01]
- 39/00 Generators specially adapted for producing a desired non-sinusoidal waveform [1, 2006.01]**
- 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 [1, 2006.01]**
- 41/02 • Linear motors; Sectional motors [1, 3, 2006.01]
- 41/025 • • Asynchronous motors [3, 2006.01]
- 41/03 • • Synchronous motors; Motors moving step by step; Reluctance motors (H02K 41/035 takes precedence) [3, 2006.01]
- 41/035 • • DC motors; Unipolar motors [3, 2006.01]
- 41/06 • Rolling motors, i.e. motors 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 [1, 2006.01]
- 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, 2006.01]**
- 44/02 • Electrodynamic pumps [3, 2006.01]
- 44/04 • • Conduction pumps [3, 2006.01]
- 44/06 • • Induction pumps [3, 2006.01]

- 44/08 • Magnetohydrodynamic [MHD] generators [3, 2006.01]
- 44/10 • • Constructional details of electrodes [3, 2006.01]
- 44/12 • • Constructional details of fluid channels [3, 2006.01]
- 44/14 • • • Circular or screw-shaped channels [3, 2006.01]
- 44/16 • • Constructional details of the magnetic circuits [3, 2006.01]
- 44/18 • • for generating AC power [3, 2006.01]
- 44/20 • • • by changing the polarity of the magnetic field [3, 2006.01]
- 44/22 • • • by changing the conductivity of the fluid [3, 2006.01]
- 44/24 • • • by reversing the direction of fluid [3, 2006.01]
- 44/26 • • • by creating a travelling magnetic field [3, 2006.01]
- 44/28 • Association of MHD generators with conventional generators (nuclear power plants including a MHD generator G21D 7/02) [3, 2006.01]
- 47/00 Dynamo-electric converters [1, 2006.01]**
- 47/02 • AC/DC converters or *vice versa* [1, 2006.01]
- 47/04 • • Motor/generators [1, 2006.01]
- 47/06 • • Cascade converters [1, 2006.01]
- 47/08 • • Single-armature converters [1, 2006.01]
- 47/10 • • • with booster machines on the AC side [1, 2006.01]
- 47/12 • DC/DC converters [1, 2006.01]
- 47/14 • • Motor/generators [1, 2006.01]
- 47/16 • • Single-armature converters, e.g. metadyne [1, 2006.01]
- 47/18 • AC/AC converters [1, 2006.01]
- 47/20 • • Motor/generators [1, 2006.01]
- 47/22 • • Single-armature frequency converters with or without phase-number conversion [1, 2006.01]
- 47/24 • • • having windings for different numbers of poles [1, 2006.01]
- 47/26 • • • operating as under- or over-synchronously running asynchronous induction machines, e.g. cascade arrangement of asynchronous and synchronous machines [1, 2006.01]
- 47/28 • • • operating as commutator machines with added slip-rings [1, 2006.01]
- 47/30 • • Single-armature phase-number converters without frequency conversion [1, 2006.01]
- 49/00 Dynamo-electric clutches; Dynamo-electric brakes [1, 2006.01]**
- 49/02 • of the asynchronous induction type [1, 2006.01]
- 49/04 • • of the eddy-current hysteresis type [1, 2006.01]
- 49/06 • of the synchronous type [1, 2006.01]
- 49/08 • of the collector armature type [1, 2006.01]
- 49/10 • of the permanent-magnet type [1, 2006.01]
- 49/12 • of the acyclic type [1, 2006.01]
- 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 [1, 2006.01]**
- 53/00 Alleged dynamo-electric perpetua mobilia [1, 2006.01]**
- 55/00 Dynamo-electric machines having windings operating at cryogenic temperatures [3, 2006.01]**
- 55/02 • of the synchronous type [3, 2006.01]
- 55/04 • • with rotating field windings [3, 2006.01]
- 55/06 • of the homopolar type [3, 2006.01]
- 99/00 Subject matter not provided for in other groups of this subclass [2014.01]**

**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** (transformers H01F; dynamo-electric converters H02K 47/00; controlling transformers, reactors or choke coils, control or regulation of electric motors, generators or dynamo-electric converters H02P) [4, 5]

**Note(s) [4]**

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, H10, 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**

|                                      |       |
|--------------------------------------|-------|
| DETAILS.....                         | 1/00  |
| TYPES OF CONVERSION                  |       |
| DC to DC.....                        | 3/00  |
| AC to AC.....                        | 5/00  |
| AC to DC and <i>vice versa</i> ..... | 7/00  |
| DC or AC to surge output power.....  | 9/00  |
| other power conversion systems.....  | 11/00 |

- 1/00 Details of apparatus for conversion [1, 2006.01, 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, 2006.01]
- 1/04 • • for tubes with grid control [1, 2006.01]
- 1/06 • Circuits specially adapted for rendering non-conductive gas discharge tubes or equivalent semiconductor devices, e.g. thyratrons, thyristors [1, 2, 2006.01]
- 1/08 • Circuits specially adapted for the generation of control voltages for semiconductor devices incorporated in static converters [1, 2006.01]
- 1/084 • • using a control circuit common to several phases of a multi-phase system [4, 2006.01]
- 1/088 • • for the simultaneous control of series or parallel connected semiconductor devices [4, 2006.01]
- 1/092 • • • the control signals being transmitted optically [4, 2006.01]
- 1/096 • • • the power supply of the control circuit being connected in parallel to the main switching element (H02M 1/092 takes precedence) [4, 2006.01]
- 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, 2006.01]
- 1/12 • Arrangements for reducing harmonics from AC input or output [1, 2006.01]
- 1/14 • Arrangements for reducing ripples from DC input or output [1, 2006.01]
- 1/15 • • using active elements [4, 2006.01]
- 1/16 • Means for providing current step on switching, e.g. with saturable reactor [1, 2006.01]
- 1/20 • Contact mechanisms of dynamic converters [1, 2006.01]
- 1/22 • • incorporating collectors and brushes [1, 2006.01]
- 1/24 • • incorporating rolling or tumbling contacts [1, 2006.01]
- 1/26 • • incorporating cam-operated contacts [1, 2006.01]
- 1/28 • • incorporating electromagnetically-operated vibrating contacts [1, 2006.01]
- 1/30 • • incorporating liquid contacts [1, 2006.01]
- 1/32 • Means for protecting converters other than by automatic disconnection [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 or adjusting 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 [1, 2006.01]**
- 3/02 • without intermediate conversion into AC [1, 2006.01]
- 3/04 • • by static converters [1, 2006.01]
- 3/06 • • • using resistors or capacitors, e.g. potential divider [1, 2006.01]
- 3/07 • • • • using capacitors charged and discharged alternately by semiconductor devices with control electrode [4, 2006.01]
- 3/08 • • • using discharge tubes without control electrode or semiconductor devices without control electrode [1, 2006.01]
- 3/10 • • • using discharge tubes with control electrode or semiconductor devices with control electrode (H02M 3/07 takes precedence) [1, 4, 2006.01]
- 3/125 • • • • using devices of a thyatron or thyristor type requiring extinguishing means [2, 2006.01]
- 3/13 • • • • using discharge tubes only [2, 2006.01]
- 3/135 • • • • using semiconductor devices only [2, 2006.01]
- 3/137 • • • • • with automatic control of output voltage or current, e.g. switching regulators [4, 2006.01]
- 3/139 • • • • • with digital control [4, 2006.01]
- 3/142 • • • • • including plural semiconductor devices as final control devices for a single load [4, 2006.01]
- 3/145 • • • • using devices of a triode or transistor type requiring continuous application of a control signal [2, 2006.01]
- 3/15 • • • • using discharge tubes only [2, 2006.01]
- 3/155 • • • • using semiconductor devices only [2, 2006.01]
- 3/156 • • • • • with automatic control of output voltage or current, e.g. switching regulators [4, 2006.01]
- 3/157 • • • • • with digital control [4, 2006.01]
- 3/158 • • • • • including plural semiconductor devices as final control devices for a single load [4, 2006.01]
- 3/16 • • by dynamic converters [1, 2006.01]
- 3/18 • • • using capacitors or batteries which are alternately charged and discharged, e.g. charged in parallel and discharged in series [1, 2006.01]
- 3/20 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters [1, 2006.01]
- 3/22 • with intermediate conversion into AC [1, 2006.01]
- 3/24 • • by static converters [1, 2006.01]
- 3/26 • • • using discharge tubes without control electrode or semiconductor devices without control electrode to produce the intermediate AC [1, 2006.01]
- 3/28 • • • using discharge tubes with control electrode or semiconductor devices with control electrode to produce the intermediate AC [1, 2006.01]
- 3/305 • • • • using devices of a thyatron or thyristor type requiring extinguishing means [2, 2006.01]
- 3/31 • • • • using discharge tubes only [2, 2006.01]
- 3/315 • • • • using semiconductor devices only [2, 2006.01]
- 3/325 • • • • using devices of a triode or a transistor type requiring continuous application of a control signal [2, 2006.01]
- 3/33 • • • • using discharge tubes only [2, 2006.01]
- 3/335 • • • • using semiconductor devices only [2, 2006.01]
- 3/337 • • • • • in push-pull configuration [4, 2006.01]
- 3/338 • • • • • in a self-oscillating arrangement (H02M 3/337 takes precedence) [4, 2006.01]
- 3/34 • • by dynamic converters [1, 2006.01]
- 3/36 • • • using mechanical parts to select progressively or to vary continuously the input potential [1, 2006.01]

- 3/38 • • • using mechanical contact-making and -breaking parts to interrupt a single potential [1, 2006.01]
- 3/40 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers [1, 2006.01]
- 3/42 • • • • with electromagnetically-operated vibrating contacts, e.g. chopper [1, 2006.01]
- 3/44 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters [1, 2006.01]
- 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 [1, 2006.01]**
- 5/02 • without intermediate conversion into DC [1, 2006.01]
- 5/04 • • by static converters (controlling transformers, reactors or choke coils, e.g. by tap changing, H02P 13/00) [1, 4, 2006.01]
- 5/06 • • • using impedances [1, 2006.01]
- 5/08 • • • • using capacitors only [1, 2006.01]
- 5/10 • • • using transformers [1, 2006.01]
- 5/12 • • • • for conversion of voltage or current amplitude only [1, 2006.01]
- 5/14 • • • • for conversion between circuits of different phase number [1, 2006.01]
- 5/16 • • • • for conversion of frequency [1, 2006.01]
- 5/18 • • • • for conversion of waveform [1, 2006.01]
- 5/20 • • • using discharge tubes without control electrode or semiconductor devices without control electrode [1, 2006.01]
- 5/22 • • • using discharge tubes with control electrode or semiconductor devices with control electrode [1, 2006.01]
- 5/25 • • • • using devices of a thyatron or thyristor type requiring extinguishing means [2, 2006.01]
- 5/253 • • • • • using discharge tubes only [2, 2006.01]
- 5/257 • • • • • using semiconductor devices only [2, 2006.01]
- 5/27 • • • • • for conversion of frequency [2, 2006.01]
- 5/275 • • • • using devices of a triode or transistor type requiring continuous application of a control signal [2, 2006.01]
- 5/29 • • • • • using discharge tubes only [2, 2006.01]
- 5/293 • • • • • using semiconductor devices only [2, 2006.01]
- 5/297 • • • • • for conversion of frequency [2, 2006.01]
- 5/32 • • by dynamic converters [1, 2006.01]
- 5/34 • • • using mechanical contact-making and -breaking parts [1, 2006.01]
- 5/36 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers [1, 2006.01]
- 5/38 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters [1, 2006.01]
- 5/40 • with intermediate conversion into DC [1, 2006.01]
- 5/42 • • by static converters [1, 2006.01]
- 5/44 • • • using discharge tubes or semiconductor devices to convert the intermediate DC into AC [1, 2006.01]
- 5/443 • • • • using devices of a thyatron or thyristor type requiring extinguishing means [2, 2006.01]
- 5/447 • • • • • using discharge tubes only [2, 2006.01]
- 5/45 • • • • • using semiconductor devices only [2, 2006.01]
- 5/451 • • • • • with automatic control of output voltage or frequency [4, 2006.01]
- 5/452 • • • • • with automatic control of output waveform [4, 2006.01]
- 5/453 • • • • using devices of a triode or transistor type requiring continuous application of a control signal [2, 2006.01]
- 5/456 • • • • • using discharge tubes only [2, 2006.01]
- 5/458 • • • • • using semiconductor devices only [2, 2006.01]
- 5/46 • • by dynamic converters [1, 2006.01]
- 5/48 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters [1, 2006.01]
- 7/00 Conversion of AC power input into DC power output; Conversion of DC power input into AC power output [1, 2006.01]**
- 7/02 • Conversion of AC power input into DC power output without possibility of reversal [1, 2006.01]
- 7/04 • • by static converters [1, 2006.01]
- 7/06 • • • using discharge tubes without control electrode or semiconductor devices without control electrode [1, 2006.01]
- 7/08 • • • • arranged for operation in parallel [1, 2006.01]
- 7/10 • • • • arranged for operation in series, e.g. for multiplication of voltage [1, 2006.01]
- 7/12 • • • using discharge tubes with control electrode or semiconductor devices with control electrode [1, 2006.01]
- 7/145 • • • • using devices of a thyatron or thyristor type requiring extinguishing means [2, 4, 2006.01]
- 7/15 • • • • • using discharge tubes only [2, 2006.01]
- 7/155 • • • • • using semiconductor devices only [2, 2006.01]
- 7/162 • • • • • in a bridge configuration [4, 2006.01]
- 7/17 • • • • • arranged for operation in parallel [2, 4, 2006.01]
- 7/19 • • • • • arranged for operation in series, e.g. for voltage multiplication [2, 4, 2006.01]
- 7/21 • • • • using devices of a triode or transistor type requiring continuous application of a control signal [2, 4, 2006.01]
- 7/213 • • • • • using discharge tubes only [2, 2006.01]
- 7/217 • • • • • using semiconductor devices only [2, 2006.01]
- 7/219 • • • • • in a bridge configuration [4, 2006.01]
- 7/23 • • • • • arranged for operation in parallel [2, 4, 2006.01]
- 7/25 • • • • • arranged for operation in series, e.g. for multiplication of voltage [2, 4, 2006.01]
- 7/26 • • • using open-spark devices, e.g. Marx rectifier [1, 2006.01]
- 7/28 • • • using electrolytic rectifiers [1, 2006.01]
- 7/30 • • by dynamic converters [1, 2006.01]
- 7/32 • • • using mechanical contact-making and -breaking parts [1, 2006.01]
- 7/34 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers [1, 2006.01]
- 7/36 • • • • with electromagnetically-operated vibrating contacts, e.g. chopper [1, 2006.01]

- 7/38 • • • using one or more sparking electrodes rotating over counterelectrodes [1, 2006.01]
- 7/40 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters [1, 2006.01]
- 7/42 • Conversion of DC power input into AC power output without possibility of reversal [1, 2006.01]
- 7/44 • • by static converters [1, 2006.01]
- 7/46 • • • using discharge tubes without control electrode or semiconductor devices without control electrode [1, 2006.01]
- 7/48 • • • using discharge tubes with control electrode or semiconductor devices with control electrode [1, 2006.01, 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, 2006.01]
- 7/51 • • • • using discharge tubes only [2, 2006.01]
- 7/515 • • • • using semiconductor devices only [2, 2006.01, 2007.01]
- 7/516 • • • • • Self-oscillating arrangements [2007.01]
- 7/517 • • • • • with special starting equipment [4, 2006.01]
- 7/519 • • • • • in a push-pull configuration (H02M 7/517 takes precedence) [4, 2006.01]
- 7/521 • • • • • in a bridge configuration [4, 2006.01]
- 7/523 • • • • • with LC-resonance circuit in the main circuit [4, 2006.01]
- 7/525 • • • • • with automatic control of output waveform or frequency (H02M 7/517-H02M 7/523 take precedence) [4, 2006.01]
- 7/527 • • • • • • by pulse width modulation [4, 2006.01]
- 7/529 • • • • • • using digital control [4, 2006.01]
- 7/53 • • • • using devices of a triode or transistor type requiring continuous application of a control signal [2, 2006.01]
- 7/533 • • • • • using discharge tubes only [2, 2006.01]
- 7/537 • • • • • using semiconductor devices only, e.g. single switched pulse inverters [2, 2006.01]
- 7/5375 • • • • • with special starting equipment [4, 2006.01]
- 7/538 • • • • • in a push-pull configuration (H02M 7/5375 takes precedence) [4, 2006.01, 2007.01]
- 7/5381 • • • • • • Parallel type [2007.01]
- 7/5383 • • • • • in a self-oscillating arrangement (H02M 7/538 takes precedence) [4, 2006.01, 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, 2006.01, 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, 2006.01]
- 7/5395 • • • • • • by pulse-width modulation [4, 2006.01]
- 7/54 • • by dynamic converters [1, 2006.01]
- 7/56 • • • using mechanical parts to select progressively, or to vary continuously, the input potential [1, 2006.01]
- 7/58 • • • using mechanical contact-making and -breaking parts to interrupt a single potential [1, 2006.01]
- 7/60 • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers [1, 2006.01]
- 7/62 • • • • with electromagnetically-operated vibrating contacts, e.g. chopper [1, 2006.01]
- 7/64 • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters [1, 2006.01]
- 7/66 • with possibility of reversal [1, 2006.01]
- 7/68 • • by static converters [1, 2006.01]
- 7/70 • • • using discharge tubes without control electrode or semiconductor devices without control electrode [1, 2006.01]
- 7/72 • • • using discharge tubes with control electrode or semiconductor devices with control electrode [1, 2006.01]
- 7/75 • • • • using devices of a thyratron or thyristor type requiring extinguishing means [2, 2006.01]
- 7/753 • • • • • using discharge tubes only [2, 2006.01]
- 7/757 • • • • • using semiconductor devices only [2, 2006.01]
- 7/758 • • • • • • with automatic control of output waveform or frequency [4, 2006.01]
- 7/77 • • • • • arranged for operation in parallel [2, 2006.01]
- 7/79 • • • • • using devices of a triode or transistor type requiring continuous application of a control signal [2, 2006.01]
- 7/793 • • • • • using discharge tubes only [2, 2006.01]
- 7/797 • • • • • using semiconductor devices only [2, 2006.01]
- 7/81 • • • • • arranged for operation in parallel [2, 2006.01]
- 7/82 • • • using open-spark devices, e.g. Marx rectifier [1, 2006.01]
- 7/84 • • • using electrolytic rectifiers [1, 2006.01]
- 7/86 • • by dynamic converters [1, 2006.01]
- 7/88 • • • using mechanical parts to select progressively or to vary continuously the input potential [1, 2006.01]
- 7/90 • • • using mechanical contact-making and -breaking parts to interrupt a single potential [1, 2006.01]

- |      |  |       |   |
|------|--|-------|---|
| 7/92 | • • • • wherein the parts are rotating and collectors co-operate with brushes or rollers [1, 2006.01]  | 9/00  | <b>Conversion of DC or AC input power into surge output power [2, 2006.01]</b>                |
| 7/94 | • • • • wherein the parts are operated by rotating cams or cam-like devices [1, 2006.01]   | 9/02  | • with DC input power [2, 2006.01]  |
| 7/95 | • • • • with electromagnetically-operated vibrating contacts, e.g. chopper [1, 2006.01]  | 9/04  | • • using capacitive stores [2, 2006.01]  |
| 7/96 | • • • • with moving liquid contacts [1, 2006.01]   | 9/06  | • with AC input power [2, 2006.01]  |
| 7/98 | • • by combination of static with dynamic converters; by combination of dynamo-electric with other dynamic or static converters [1, 2006.01] | 11/00 | <b>Power conversion systems not covered by the other groups of this subclass [4, 2006.01]</b> |

## H02N ELECTRIC MACHINES NOT OTHERWISE PROVIDED FOR

### Note(s) [7]

- 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.
- Attention is drawn to the Notes following the titles of class B81 and subclass B81B relating to "microstructural devices" and "microstructural systems".
- 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 class H10 and subclasses H01L, H01M, H02K, H04R.

### Subclass index

|   |             |
|---|-------------|
| GENERATORS, MOTORS  |             |
| With electrostatic effect.....  | 1/00        |
| Generators using thermal ionisation and removal of charge; electric motors using thermal effects..... | 3/00, 10/00 |
| Others.....   | 11/00       |
| ELECTRIC MACHINES IN GENERAL USING PIEZOELECTRIC EFFECT, ELECTROSTRICTION OR MAGNETOSTRICTION.....    | 2/00        |
| ELECTROSTATIC CLUTCHES OR HOLDING DEVICES.....  | 13/00       |
| MAGNETIC HOLDING OR LEVITATING DEVICES.....   | 15/00       |
| SUBJECT MATTER NOT PROVIDED FOR IN OTHER GROUPS OF THIS SUBCLASS.....                                 | 99/00       |

- |      |  |       |   |
|------|--|-------|---|
| 1/00 | <b>Electrostatic generators or motors using a solid moving electrostatic charge carrier [1, 2006.01]</b>   | 2/18  | • producing electrical output from mechanical input, e.g. generators (for measurement devices G01) [6, 2006.01]   |
| 1/04 | • Friction generators [1, 2006.01]   | 3/00  | <b>Generators in which thermal or kinetic energy is converted into electrical energy by ionisation of a fluid and removal of the charge therefrom</b> (discharge tubes functioning as thermionic generators H01J 45/00) [1, 3, 2006.01] |
| 1/06 | • Influence generators [1, 2006.01]  | 10/00 | <b>Electric motors using thermal effects [3, 2006.01]</b>   |
| 1/08 | • • with conductive charge carrier, i.e. capacitor machines [1, 2006.01]   | 11/00 | <b>Generators or motors not provided for elsewhere; Alleged <u>perpetua mobilia</u> obtained by electric or magnetic means</b> (by hydrostatic pressure F03B 17/04; by dynamo-electric means H02K 53/00) [1, 2006.01]                   |
| 1/10 | • • with non-conductive charge carrier [1, 2006.01]  | 13/00 | <b>Clutches or holding devices using electrostatic attraction, e.g. using Johnson-Rahbek effect [1, 2006.01]</b>  |
| 1/12 | • • • in the form of a conveyor belt, e.g. van de Graaff machine [1, 2006.01]  |       |   |
| 2/00 | <b>Electric machines in general using piezoelectric effect, electrostriction or magnetostriction</b> (generating mechanical vibrations in general B06B; piezoelectric, electrostrictive or magnetostrictive elements in general H10N 30/00, H10N 35/00) [4, 2006.01] |       |   |
| 2/02 | • producing linear motion, e.g. actuators; Linear positioners [6, 2006.01]   |       |   |
| 2/04 | • • Constructional details [6, 2006.01]  |       |   |
| 2/06 | • • Drive circuits; Control arrangements [6, 2006.01]  |       |   |
| 2/08 | • • using travelling waves, e.g. linear motors [6, 2006.01]  |       |   |
| 2/10 | • producing rotary motion, e.g. rotary motors [6, 2006.01]   |       |   |
| 2/12 | • • Constructional details [6, 2006.01]  |       |   |
| 2/14 | • • Drive circuits; Control arrangements [6, 2006.01]  |       |   |
| 2/16 | • • using travelling waves [6, 2006.01]  |       |   |

**H02N**

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|---|--|---|
| <p><b>15/00 Holding or levitation devices using magnetic attraction or repulsion, not otherwise provided for</b> (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 conveyors 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</p> | <p>15/02</p> <p>15/04</p> <p>99/00</p> | <p>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, 2006.01]</p> <ul style="list-style-type: none"> <li>• by Foucault currents [3, 2006.01]</li> <li>• Repulsion by the Meissner effect (superconductors or hyperconductors in general H10N 60/00) [3, 2006.01]</li> </ul> <p><b>Subject matter not provided for in other groups of this subclass [2006.01]</b></p> |
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**H02P CONTROL OR REGULATION OF ELECTRIC MOTORS, ELECTRIC GENERATORS OR DYNAMO-ELECTRIC CONVERTERS; CONTROLLING TRANSFORMERS, REACTORS OR CHOKE COILS [4]**

**Note(s) [6, 2015.01]**

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, it is desirable to add the indexing codes of groups H02P 101/00 and H02P 103/00.

**Subclass index**

|  |              |
|--|--------------|
| ARRANGEMENTS FOR STARTING; FOR SLOWING, STOPPING.....  | 1/00, 3/00   |
| ARRANGEMENTS FOR CONTROLLING ELECTRIC MOTORS THAT CAN BE CONNECTED TO DIFFERENT POWER SUPPLIES.....  | 4/00         |
| ARRANGEMENTS FOR CONTROLLING TWO OR MORE ELECTRIC MOTORS.....  | 5/00         |
| ARRANGEMENTS FOR CONTROLLING SYNCHRONOUS MOTORS OR OTHER DYNAMO-ELECTRIC MOTORS WITH ELECTRONIC COMMUTATORS IN DEPENDENCE ON THE ROTOR POSITION..... | 6/00         |
| ARRANGEMENTS FOR CONTROLLING DC MOTORS.....  | 7/00         |
| ARRANGEMENTS FOR CONTROLLING DYNAMO-ELECTRIC MOTORS ROTATING STEP BY STEP.....   | 8/00         |
| ARRANGEMENTS FOR OBTAINING DESIRED OUTPUT OF GENERATOR.....  | 9/00         |
| ARRANGEMENTS FOR OBTAINING DESIRED OUTPUT OF CONVERTERS: DYNAMO-ELECTRIC; STATIC.....  | 11/00, 13/00 |
| ARRANGEMENTS FOR CONTROLLING BRAKES OR CLUTCHES.....   | 15/00        |
| ARRANGEMENTS FOR CONTROLLING DYNAMO-ELECTRIC GEARS.....  | 17/00        |
| ARRANGEMENTS FOR CONTROLLING ELECTRIC MACHINES BY VECTOR CONTROL.....  | 21/00        |
| ARRANGEMENTS FOR CONTROLLING AC MOTORS BY METHODS OTHER THAN VECTOR CONTROL.....   | 23/00        |
| CHARACTERISED BY THE KIND OF AC MOTORS OR BY STRUCTURAL DETAILS.....   | 25/00        |
| CHARACTERISED BY THE KIND OF SUPPLY VOLTAGE.....   | 27/00        |
| ARRANGEMENTS FOR CONTROLLING APPROPRIATE FOR BOTH AC AND DC MOTORS.....  | 29/00        |
| ARRANGEMENTS FOR CONTROLLING NOT OTHERWISE PROVIDED FOR.....   | 31/00        |

- |  |   |  |
|--|---|--|
| <p><b>1/00 Arrangements for starting electric motors or dynamo-electric converters</b> (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) [1, 4, 2006.01]</p> | <p>1/10</p> <p>1/12</p> <p>1/14</p> <p>1/16</p> <p>1/18</p> <p>1/20</p> <p>1/22</p> <p>1/24</p> | <ul style="list-style-type: none"> <li>• • • Manually-operated on/off switch controlling relays or contactors operating sequentially for starting a motor [1, 2006.01]</li> <li>• • • Switching devices centrifugally operated by the motor [1, 2006.01]</li> <li>• • • Pressure-sensitive resistors centrifugally operated by the motor [1, 2006.01]</li> <li>• for starting dynamo-electric motors or dynamo-electric converters [1, 2006.01]</li> <li>• • for starting an individual DC motor [1, 2006.01]</li> <li>• • • by progressive reduction of resistance in series with armature winding [1, 2006.01]</li> <li>• • • in either direction of rotation [1, 2006.01]</li> <li>• • for starting an individual AC commutator motor (starting of AC/DC commutator motors H02P 1/18) [1, 2006.01]</li> </ul> |
| <p>1/02 • Details [1, 2006.01]</p>   |   |  |
| <p>1/04 • • Means for controlling progress of starting sequence in dependence upon time or upon current, speed, or other motor parameter [1, 2006.01]</p>  |   |  |
| <p>1/06 • • • Manually-operated multi-position starters [1, 2006.01]</p>   |   |  |
| <p>1/08 • • • Manually-operated on/off switch controlling power-operated multi-position switch or impedances for starting a motor [1, 2006.01]</p>   |   |  |

- 1/26 • • for starting an individual polyphase induction motor [1, 2006.01]
- 1/28 • • • by progressive increase of voltage applied to primary circuit of motor [1, 2006.01]
- 1/30 • • • by progressive increase of frequency of supply to primary circuit of motor [1, 2006.01]
- 1/32 • • • by star/delta switching [1, 2006.01]
- 1/34 • • • by progressive reduction of impedance in secondary circuit [1, 2006.01]
- 1/36 • • • • the impedance being a liquid resistance [1, 2006.01]
- 1/38 • • • by pole-changing [1, 2006.01]
- 1/40 • • • in either direction of rotation [1, 2006.01]
- 1/42 • • for starting an individual single-phase induction motor [1, 2006.01]
- 1/44 • • • by phase-splitting with a capacitor [1, 2006.01]
- 1/46 • • for starting an individual synchronous motor [1, 2006.01]
- 1/48 • • • by pole-changing [1, 2006.01]
- 1/50 • • • by changing over from asynchronous to synchronous operation (H02P 1/48 takes precedence) [1, 2006.01]
- 1/52 • • • by progressive increase of frequency of supply to motor [1, 2006.01]
- 1/54 • • for starting two or more dynamo-electric motors [1, 2006.01]
- 1/56 • • • simultaneously [1, 2006.01]
- 1/58 • • • sequentially [1, 2006.01]
- 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) [1, 2, 4, 2006.01]
- 3/02 • Details [1, 2006.01]
- 3/04 • • Means for stopping or slowing by a separate brake, e.g. friction brake or eddy-current brake [1, 2, 2006.01]
- 3/06 • for stopping or slowing an individual dynamo-electric motor or dynamo-electric converter [1, 2, 2006.01]
- 3/08 • • for stopping or slowing a DC motor [1, 2, 2006.01]
- 3/10 • • • by reversal of supply connections [1, 2006.01]
- 3/12 • • • by short-circuit or resistive braking [1, 2006.01]
- 3/14 • • • by regenerative braking [1, 2006.01]
- 3/16 • • • by combined electrical and mechanical braking [1, 2006.01]
- 3/18 • • for stopping or slowing an AC motor [1, 2, 2006.01]
- 3/20 • • • by reversal of phase sequence of connections to the motor [1, 2006.01]
- 3/22 • • • by short-circuit or resistive braking [1, 2006.01]
- 3/24 • • • by applying DC to the motor [1, 2006.01]
- 3/26 • • • by combined electrical and mechanical braking [1, 2006.01]
- 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 electric power supplies** (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** (H02P 6/04, H02P 8/40 take precedence) [1, 2006.01, 2016.01]
- 5/46 • for speed regulation of two or more dynamo-electric motors in relation to one another [1, 2006.01]
- 5/48 • • by comparing mechanical values representing the speeds [1, 2006.01, 2016.01]
- 5/485 • • • using differential movement of the two motors, e.g. using differential gearboxes [2016.01]
- 5/49 • • • by intermittently closing or opening electrical contacts [2016.01]
- 5/50 • • by comparing electrical values representing the speeds [1, 2006.01, 2016.01]
- 5/505 • • • using equalising lines, e.g. rotor and stator lines of first and second motors [2016.01]
- 5/51 • • • Direct ratio control [2016.01]
- 5/52 • • additionally providing control of relative angular displacement [1, 2006.01, 2016.01]
- 5/54 • • • Speed and position comparison between the motors by mechanical means [2016.01]
- 5/56 • • • Speed and position comparison between the motors by electrical means [2016.01]
- 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 using electronic commutation dependent on the rotor position; Electronic commutators therefor** (vector control H02P 21/00) [3, 4, 6, 2006.01, 2016.01]
- Note(s) [2016.01]  
Group H02P 6/26 takes precedence over groups H02P 6/04-H02P 6/24 and H02P 6/28-H02P 6/34.
- 6/04 • Arrangements for controlling or regulating the speed or torque of more than one motor (H02P 6/10 takes precedence) [6, 2006.01, 2016.01]
- 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, 2006.01]
- 6/08 • Arrangements for controlling the speed or torque of a single motor (H02P 6/10, H02P 6/28 take precedence) [6, 2006.01, 2016.01]
- 6/10 • Arrangements for controlling torque ripple, e.g. providing reduced torque ripple [6, 2006.01]
- 6/12 • Monitoring commutation; Providing indication of commutation failure [6, 2006.01]
- 6/14 • Electronic commutators [6, 2006.01, 2016.01]
- 6/15 • • Controlling commutation time [2016.01]
- 6/16 • • Circuit arrangements for detecting position [6, 2006.01, 2016.01]
- 6/17 • • • and for generating speed information [2016.01]
- 6/18 • • • without separate position detecting elements [6, 2006.01, 2016.01]

- 6/182 • • • • using back-emf in windings [2016.01]
- 6/185 • • • • using inductance sensing, e.g. pulse excitation [2016.01]
- 6/20 • Arrangements for starting (H02P 6/08 takes precedence) [6, 2006.01, 2016.01]
- 6/21 • • Open loop start [2016.01]
- 6/22 • • in a selected direction of rotation [6, 2006.01]
- 6/24 • Arrangements for stopping [6, 2006.01]
- 6/26 • Arrangements for controlling single phase motors [2016.01]
- 6/28 • Arrangements for controlling current (H02P 6/10 takes precedence) [2016.01]
- 6/30 • Arrangements for controlling the direction of rotation (H02P 6/22 takes precedence) [2016.01]
- 6/32 • Arrangements for controlling wound field motors, e.g. motors with exciter coils [2016.01]
- 6/34 • Modelling or simulation for control purposes [2016.01]
- 7/00 Arrangements for regulating or controlling the speed or torque of electric DC motors [1, 2, 2006.01, 2016.01]**
- 7/02 • the DC motors being of the linear type [2016.01]
- 7/025 • • the DC motors being of the moving coil type, e.g. voice coil motors [2016.01]
- 7/03 • for controlling the direction of rotation of DC motors [2016.01]
- 7/06 • for regulating or controlling an individual DC dynamo-electric motor by varying field or armature current [1, 2006.01]
- 7/08 • • by manual control without auxiliary power [1, 2006.01]
- 7/10 • • • of motor field only [1, 2006.01]
- 7/12 • • • • Switching field from series to shunt excitation or *vice versa* [1, 2006.01]
- 7/14 • • • of voltage applied to the armature with or without control of field [1, 2006.01]
- 7/18 • • by master control with auxiliary power [1, 2006.01]
- 7/20 • • • using multi-position switch, e.g. drum, controlling motor circuit by means of relays (H02P 7/24, H02P 7/30 take precedence) [1, 2006.01]
- 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) [1, 2006.01]
- 7/24 • • • using discharge tubes or semiconductor devices [1, 2006.01]
- 7/26 • • • • using discharge tubes [1, 2006.01]
- 7/28 • • • • using semiconductor devices [1, 2006.01, 2016.01]
- 7/281 • • • • • the DC motor being operated in four quadrants [2016.01]
- Note(s) [2016.01]**
- Group H02P 7/281 takes precedence over groups H02P 7/282-H02P 7/298.
- 7/282 • • • • • controlling field supply only [4, 2006.01, 2016.01]
- 7/285 • • • • • controlling armature supply only [4, 2006.01, 2016.01]
- 7/288 • • • • • using variable impedance [4, 2006.01, 2016.01]
- 7/29 • • • • • using pulse modulation [4, 2006.01, 2016.01]
- 7/291 • • • • • • with on-off control between two set points, e.g. controlling by hysteresis [2016.01]
- 7/292 • • • • • • using static converters, e.g. AC to DC [4, 2006.01, 2016.01]
- 7/293 • • • • • • using phase control (H02P 7/295 takes precedence) [2016.01]
- 7/295 • • • • • • of the kind having one thyristor or the like in series with the power supply and the motor [4, 2006.01, 2016.01]
- 7/298 • • • • • controlling armature and field supplies [4, 2006.01, 2016.01]
- 7/30 • • • using magnetic devices with controllable degree of saturation, i.e. transducers [1, 2006.01]
- 7/32 • • • using armature-reaction-excited machines, e.g. metadyne, amplidyne, rototrol [1, 2006.01]
- 7/34 • • • using Ward-Leonard arrangements [1, 2006.01, 2016.01]
- 7/343 • • • • in which both generator and motor fields are controlled [2016.01]
- 7/347 • • • • in which only the generator field is controlled [2016.01]
- 8/00 Arrangements for controlling dynamo-electric motors rotating step by step [2, 6, 2006.01]**
- 8/02 • specially adapted for single-phase or bi-pole stepper motors, e.g. watch-motors, clock-motors [6, 2006.01]
- 8/04 • Arrangements for starting [6, 2006.01]
- 8/06 • • in selected direction of rotation [6, 2006.01]
- 8/08 • • Determining position before starting [6, 2006.01]
- 8/10 • • Shaping pulses for starting; Boosting current during starting [6, 2006.01]
- 8/12 • Control or stabilisation of current [6, 2006.01]
- 8/14 • Arrangements for controlling speed or speed and torque (H02P 8/12, H02P 8/22 take precedence) [6, 2006.01]
- 8/16 • • Reducing energy dissipated or supplied [6, 2006.01]
- 8/18 • • Shaping of pulses, e.g. to reduce torque ripple [6, 2006.01]
- 8/20 • • characterised by bidirectional operation [6, 2006.01]
- 8/22 • Control of step size; Intermediate stepping, e.g. microstepping [6, 2006.01]
- 8/24 • Arrangements for stopping (H02P 8/32 take precedence) [6, 2006.01]
- 8/26 • • Memorising final pulse when stopping [6, 2006.01]
- 8/28 • • Disconnecting power source when stopping [6, 2006.01]
- 8/30 • • Holding position when stopped [6, 2006.01]
- 8/32 • Reducing overshoot or oscillation, e.g. damping [6, 2006.01]
- 8/34 • Monitoring operation (H02P 8/36 takes precedence) [6, 2006.01]
- 8/36 • Protection against faults, e.g. against overheating or step-out; Indicating faults [6, 2006.01]
- 8/38 • • the fault being step-out [6, 2006.01]
- 8/40 • Special adaptations for controlling two or more stepping motors [6, 2006.01]
- 8/42 • characterised by non-stepper motors being operated step by step [6, 2006.01]

|              |   |              |   |
|--------------|---|--------------|---|
| <b>9/00</b>  | <b>Arrangements for controlling electric generators for the purpose of obtaining a desired output [1, 2006.01]</b>  | <b>13/00</b> | <b>Arrangements for controlling transformers, reactors or choke coils, for the purpose of obtaining a desired output [1, 4, 2006.01]</b>  |
| 9/02         | • Details [1, 2006.01]  | 13/06        | • by tap-changing; by rearranging interconnections of windings [1, 2006.01]   |
| 9/04         | • Control effected upon non-electric prime mover and dependent upon electric output value of the generator [1, 2, 2006.01]  | 13/08        | • by sliding current collector along winding [1, 2006.01]   |
| 9/06         | • Control effected upon clutch or other mechanical power transmission means and dependent upon electric output value of the generator [1, 2, 2006.01]   | 13/10        | • by moving core, coil winding, or shield, e.g. by induction regulator [1, 2006.01]   |
| 9/08         | • Control of generator circuit during starting or stopping of driving means, e.g. for initiating excitation [1, 2, 2006.01]   | 13/12        | • by varying magnetic bias [1, 2006.01]   |
| 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 [1, 2, 2006.01] | <b>15/00</b> | <b>Arrangements for controlling dynamo-electric brakes or clutches (vector control H02P 21/00) [1, 2006.01]</b>   |
| 9/12         | • • for demagnetising; for reducing effects of remanence; for preventing pole reversal [1, 2, 2006.01]  | 15/02        | • Conjoint control of brakes and clutches [3, 2006.01]  |
| 9/14         | • by variation of field (H02P 9/08, H02P 9/10 take precedence) [1, 2, 2006.01]  | <b>17/00</b> | <b>Arrangements for controlling dynamo-electric gears (vector control H02P 21/00) [3, 2006.01]</b>  |
| 9/16         | • • due to variation of ohmic resistance in field circuit, using resistances switched in or out of circuit step by step [1, 2006.01]  | <b>21/00</b> | <b>Arrangements or methods for the control of electric machines by vector control, e.g. by control of field orientation [6, 2006.01, 2016.01]</b>   |
| 9/18         | • • • the switching being caused by a servomotor, measuring instrument, or relay [1, 2006.01]   |              | <b>Note(s) [2006.01, 2016.01]</b>   |
| 9/20         | • • due to variation of continuously-variable ohmic resistance [1, 2006.01]   | 1.           | When classifying in this group, classification should also be made in group H02P 25/00 when the method of control is characterised by the kind of motor being controlled.                       |
| 9/22         | • • • comprising carbon pile resistance [1, 2006.01]  | 2.           | When classifying in this group, classification should also be made in group H02P 27/00 when the method of control is characterised by the kind of supply voltage of the motor being controlled. |
| 9/24         | • • due to variation of make-to-break ratio of intermittently-operating contacts, e.g. using Tirrill regulator [1, 2006.01]   | 21/02        | • specially adapted for optimising the efficiency at low load [2006.01]   |
| 9/26         | • • using discharge tubes or semiconductor devices (H02P 9/34 takes precedence) [1, 2, 2006.01]   | 21/04        | • specially adapted for very low speeds [2006.01]   |
| 9/28         | • • • using discharge tubes [1, 2006.01]  | 21/05        | • specially adapted for damping motor oscillations, e.g. for reducing hunting [2006.01]   |
| 9/30         | • • • using semiconductor devices [1, 2006.01]  | 21/06        | • Rotor flux based control involving the use of rotor position or rotor speed sensors [2006.01, 2016.01]  |
| 9/32         | • • using magnetic devices with controllable degree of saturation (H02P 9/34 takes precedence) [1, 2, 2006.01]  | 21/08        | • • Indirect field-oriented control; Rotor flux feed-forward control [2006.01, 2016.01]   |
| 9/34         | • • using magnetic devices with controllable degree of saturation in combination with controlled discharge tube or controlled semiconductor device [1, 2006.01]   | 21/09        | • • • Field phase angle calculation based on rotor voltage equation by adding slip frequency and speed proportional frequency [2016.01]   |
| 9/36         | • • using armature-reaction-excited machines [1, 2006.01]   | 21/10        | • • Direct field-oriented control; Rotor flux feed-back control [2006.01, 2016.01]  |
| 9/38         | • • Self-excitation by current derived from rectification of both output voltage and output current of generator [1, 2006.01]   | 21/12        | • Stator flux based control involving the use of rotor position or rotor speed sensors [2006.01, 2016.01]   |
| 9/40         | • by variation of reluctance of magnetic circuit of generator [1, 2006.01]  | 21/13        | • Observer control, e.g. using Luenberger observers or Kalman filters [2006.01]   |
| 9/42         | • to obtain desired frequency without varying speed of the generator [1, 2006.01]   | 21/14        | • Estimation or adaptation of machine parameters, e.g. flux, current or voltage [2006.01, 2016.01]  |
| 9/44         | • Control of frequency and voltage in predetermined relation, e.g. constant ratio [1, 2006.01]  | 21/16        | • • Estimation of constants, e.g. the rotor time constant [2016.01]   |
| 9/46         | • Control of asynchronous generator by variation of capacitor [1, 2006.01]  | 21/18        | • • Estimation of position or speed [2016.01]   |
| 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, 2006.01]  | 21/20        | • • Estimation of torque [2016.01]  |
| <b>11/00</b> | <b>Arrangements for controlling dynamo-electric converters [1, 4, 2006.01]</b>  | 21/22        | • Current control, e.g. using a current control loop [2016.01]  |
| 11/04        | • for controlling dynamo-electric converters having a DC output [1, 2006.01]  | 21/24        | • Vector control not involving the use of rotor position or rotor speed sensors [2016.01]   |
| 11/06        | • for controlling dynamo-electric converters having an AC output [1, 2006.01]   | 21/26        | • • Rotor flux based control [2016.01]  |
|              |   | 21/28        | • • Stator flux based control [2016.01]   |
|              |   | 21/30        | • • • Direct torque control [DTC] or field acceleration method [FAM] [2016.01]  |
|              |   | 21/32        | • • Determining the initial rotor position (H02P 21/34 takes precedence) [2016.01]  |
|              |   | 21/34        | • Arrangements for starting [2016.01]   |

- 21/36 • Arrangements for braking or slowing; Four quadrant control [2016.01]
- 23/00 Arrangements or methods for the control of AC motors characterised by a control method other than vector control [2006.01, 2016.01]**
- Note(s) [2006.01]**  
When classifying in this group, subject matter also relating to groups H02P 21/00, H02P 25/00 or H02P 27/00 is further classified in those groups whenever appropriate.
- 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, 2016.01]
- 23/07 • • Polyphase or monophas asynchronous induction motors [2016.01]
- 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 [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]
- 23/16 • Controlling the angular speed of one shaft (H02P 23/18 takes precedence) [2016.01]
- 23/18 • Controlling the angular speed together with angular position or phase [2016.01]
- 23/20 • Controlling the acceleration or deceleration [2016.01]
- 23/22 • Controlling the speed digitally using a reference oscillator, a speed proportional pulse rate feedback and a digital comparator [2016.01]
- 23/24 • Controlling the direction, e.g. clockwise or counterclockwise [2016.01]
- 23/26 • Power factor control [PFC] [2016.01]
- 23/28 • Controlling the motor by varying the switching frequency of switches connected to a DC supply and the motor phases [2016.01]
- 23/30 • Direct torque control [DTC] or field acceleration method [FAM] [2016.01]
- 25/00 Arrangements or methods for the control of AC motors characterised by the kind of AC motor or by structural details [2006.01]**
- Note(s) [2006.01]**  
When classifying in this group, subject matter also relating to groups H02P 21/00, H02P 23/00 or H02P 27/00 is further classified in those groups whenever appropriate.
- 25/02 • characterised by the kind of motor [2006.01, 2016.01]
- 25/022 • • Synchronous motors (H02P 25/064 takes precedence) [2016.01]
- 25/024 • • • controlled by supply frequency [2016.01]
- 25/026 • • • • thereby detecting the rotor position [2016.01]
- 25/028 • • • with four quadrant control [2016.01]
- 25/03 • • • with brushless excitation [2016.01]
- 25/032 • • Reciprocating, oscillating or vibrating motors [2016.01]
- 25/034 • • • Voice coil motors (voice coil motors driven by DC H02P 7/025) [2016.01]
- 25/04 • • Single phase motors, e.g. capacitor motors [2006.01]
- 25/06 • • Linear motors [2006.01, 2016.01]
- 25/062 • • • of the induction type [2016.01]
- 25/064 • • • of the synchronous type [2016.01]
- 25/066 • • • • of the stepping type [2016.01]
- 25/08 • • Reluctance motors [2006.01, 2016.01]
- 25/083 • • • Arrangements for increasing the switching speed from one coil to the next one [2016.01]
- 25/086 • • • Commutation [2016.01]
- 25/089 • • • • Sensorless control (direct torque control H02P 23/30) [2016.01]
- 25/092 • • • Converters specially adapted for controlling reluctance motors [2016.01]
- 25/098 • • • Arrangements for reducing torque ripple [2016.01]
- 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. transducers [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 (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, subject matter also relating to groups H02P 21/00, H02P 23/00 or H02P 25/00 is further classified in those groups whenever appropriate.
- 27/02 • using supply voltage with constant frequency and variable amplitude [2006.01, 2016.01]
- 27/024 • • using AC supply for only the rotor circuit or only the stator circuit [2016.01]
- 27/04 • using variable-frequency supply voltage, e.g. inverter or converter supply voltage [2006.01, 2016.01]
- 27/048 • • using AC supply for only the rotor circuit or only the stator circuit [2016.01]
- 27/05 • • using AC supply for both the rotor and the 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 vector, current vector or voltage vector on a circle or a closed curve, e.g. for 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** (arrangements for starting electric motors H02P 1/00; arrangements for stopping or slowing electric motors H02P 3/00; control of motors that can be connected to two or more different electric power supplies H02P 4/00; regulating or controlling the speed or torque of two or more electric motors H02P 5/00; vector control H02P 21/00) [2006.01, 2016.01]
  - 29/02 • Providing protection against overload without automatic interruption of supply (protection against faults of stepper motors H02P 8/36) [2006.01, 2016.01]
  - 29/024 • • Detecting a fault condition, e.g. short circuit, locked rotor, open circuit or loss of load [2016.01]
  - 29/028 • • • the motor continuing operation despite the fault condition, e.g. eliminating, compensating for or remedying the fault [2016.01]
  - 29/032 • • Preventing damage to the motor, e.g. setting individual current limits for different drive conditions [2016.01]
  - 29/04 • by means of a separate brake [2006.01]
  - 29/10 • for preventing overspeed or under speed [2016.01]
  - 29/20 • for controlling one motor used for different sequential operations [2016.01]
  - 29/40 • Regulating or controlling the amount of current drawn or delivered by the motor for controlling the mechanical load [2016.01]
  - 29/50 • Reduction of harmonics [2016.01]
  - 29/60 • Controlling or determining the temperature of the motor or of the drive (H02P 29/02 takes precedence) [2016.01]
  - 29/62 • • for raising the temperature of the motor [2016.01]
  - 29/64 • • Controlling or determining the temperature of the winding [2016.01]
  - 29/66 • • Controlling or determining the temperature of the rotor [2016.01]
  - 29/68 • • based on the temperature of a drive component or a semiconductor component [2016.01]
  - 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]
- Indexing scheme associated with groups relating to the arrangements for controlling electric generators** [2015.01]
- 101/00 Special adaptation of control arrangements for generators** [2015.01]
  - 101/10 • for water-driven turbines [2015.01]
  - 101/15 • for wind-driven turbines [2015.01]
  - 101/20 • for steam-driven turbines [2015.01]
  - 101/25 • for combustion engines [2015.01]
  - 101/30 • for aircraft [2015.01]
  - 101/35 • for ships [2015.01]
  - 101/40 • for railway vehicles [2015.01]
  - 101/45 • for motor vehicles, e.g. car alternators [2015.01]
  - 103/00 Controlling arrangements characterised by the type of generator** [2015.01]
  - 103/10 • of the asynchronous type [2015.01]
  - 103/20 • of the synchronous type [2015.01]

**H02S GENERATION OF ELECTRIC POWER BY CONVERSION OF INFRARED RADIATION, VISIBLE LIGHT OR ULTRAVIOLET LIGHT, e.g. USING PHOTOVOLTAIC [PV] MODULES** (obtaining electrical energy from radioactive sources G21H 1/12; light sensitive inorganic semiconductor devices H10F; light sensitive organic semiconductor devices H10K 30/00; thermoelectric devices H10N 10/00; pyroelectric devices H10N 15/00) [2014.01]

- 10/00 PV power plants; Combinations of PV energy systems with other systems for the generation of electric power** [2014.01]
- 10/10 • including a supplementary source of electric power, e.g. hybrid diesel-PV energy systems (combinations with gas-turbine plants F02C 6/00) [2014.01]
- 10/12 • • Hybrid wind-PV energy systems [2014.01]
- 10/20 • Systems characterised by their energy storage means (H02S 40/38 takes precedence) [2014.01]
- 10/30 • Thermophotovoltaic systems (photovoltaic cells specially adapted for conversion or sensing of infrared [IR] radiation H10F 10/00; thermoelectric devices H10N 10/00) [2014.01]
- 10/40 • Mobile PV generator systems [2014.01]
- 20/00 Supporting structures for PV modules** [2014.01]
- Note(s)** [2014.01]
- Supporting structures also intended for use with solar heat collectors should also be classified in groups F24S 25/00-F24S 30/00 or F24S 50/20.
- 20/10 • Supporting structures directly fixed to the ground (H02S 20/30 takes precedence) [2014.01]
- 20/20 • Supporting structures directly fixed to an immovable object (H02S 20/30 takes precedence) [2014.01]
- 20/21 • • specially adapted for motorways, e.g. integrated with sound barriers [2014.01]
- 20/22 • • specially adapted for buildings [2014.01]
- 20/23 • • • specially adapted for roof structures [2014.01]
- 20/24 • • • • specially adapted for flat roofs [2014.01]
- 20/25 • • • • Roof tile elements [2014.01]
- 20/26 • • • Building materials integrated with PV modules, e.g. façade elements (H02S 20/25 takes precedence) [2014.01]
- 20/30 • Supporting structures being movable or adjustable, e.g. for angle adjustment [2014.01]
- 20/32 • • specially adapted for solar tracking [2014.01]

## H02S

- 30/00 Structural details of PV modules other than those related to light conversion** (semiconductor device aspects of modules of electrolytic light sensitive devices H01G 9/20, of inorganic PV modules H10F 10/00, H10F 19/00, of organic PV modules H10K 30/00) **[2014.01]**
- 30/10 • Frame structures **[2014.01]**
  - 30/20 • Collapsible or foldable PV modules **[2014.01]**
- 40/00 Components or accessories in combination with PV modules, not provided for in groups H02S 10/00-H02S 30/00 [2014.01]**
- 40/10 • Cleaning arrangements **[2014.01]**
  - 40/12 • • Means for removing snow **[2014.01]**
  - 40/20 • Optical components **[2014.01]**
  - 40/22 • • Light-reflecting or light-concentrating means (directly associated with the PV cell or integrated with the PV cell H10F 77/42) **[2014.01]**
  - 40/30 • Electrical components **[2014.01]**
  - 40/32 • • comprising DC/AC inverter means associated with the PV module itself, e.g. AC modules **[2014.01]**
  - 40/34 • • comprising specially adapted electrical connection means to be structurally associated with the PV module, e.g. junction boxes **[2014.01]**
  - 40/36 • • characterised by special electrical interconnection means between two or more PV modules, e.g. electrical module-to-module connection **[2014.01]**
  - 40/38 • • Energy storage means, e.g. batteries, structurally associated with PV modules **[2014.01]**
  - 40/40 • Thermal components (H02S 10/30 takes precedence) **[2014.01]**
  - 40/42 • • Cooling means **[2014.01]**
  - 40/44 • • Means to utilise heat energy, e.g. hybrid systems producing warm water and electricity at the same time (directly associated with the PV cell or integrated with the PV cell H10F 77/67) **[2014.01]**
- 50/00 Monitoring or testing of PV systems, e.g. load balancing or fault identification [2014.01]**
- 50/10 • Testing of PV devices, e.g. of PV modules or single PV cells (testing of semiconductor devices during manufacturing H01L 21/66) **[2014.01]**
  - 50/15 • • using optical means, e.g. using electroluminescence **[2014.01]**
- 99/00 Subject matter not provided for in other groups of this subclass [2014.01]**