

## SECTION G — PHYSICS

## G01 MEASURING; TESTING

## G01L MEASURING FORCE, STRESS, TORQUE, WORK, MECHANICAL POWER, MECHANICAL EFFICIENCY, OR FLUID PRESSURE (weighing G01G) [4]

**Note(s)**

Attention is drawn to the Notes following the title of class G01.

**Subclass index**

## MEASURING FORCE, STRESS, TORQUE, WORK, MECHANICAL POWER, MECHANICAL EFFICIENCY

General methods; apparatus adapted to special purposes.....1/00, 3/00, 5/00

## MEASURING FLUID PRESSURE

Methods of measuring.....7/00, 9/00, 11/00

Measurements of differential or multiple pressure values.....13/00, 15/00

Details of apparatus or accessories.....19/00

## SPECIAL ADAPTATIONS OF MEASURING APPARATUS

Measurements of pressure of inflated bodies.....17/00

Vacuum gauges.....21/00

## INDICATORS OF FAST CHANGES, PARTICULARLY IN THE OPERATION OF FLUID-PRESSURE

ENGINES.....23/00

TESTING OR CALIBRATING.....25/00, 27/00

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|------|---|------|---|
| 1/00 | <b>Measuring force or stress, in general</b> (measuring force due to impact G01L 5/00) [1, 4, 2006.01]  | 1/24 | • by measuring variations of optical properties of material when it is stressed, e.g. by photoelastic stress analysis [1, 2006.01]  |
| 1/02 | • by hydraulic or pneumatic means [1, 2006.01]  | 1/25 | • using wave or particle radiation, e.g. X-rays, neutrons (G01L 1/24 takes precedence) [4, 2006.01]   |
| 1/04 | • by measuring elastic deformation of gauges, e.g. of springs [1, 2006.01]  | 1/26 | • Auxiliary measures taken, or devices used, in connection with the measurement of force, e.g. for preventing influence of transverse components of force, for preventing overload [1, 2006.01] |
| 1/06 | • by measuring the permanent deformation of gauges, e.g. of compressed bodies [1, 2006.01]  | 3/00 | <b>Measuring torque, work, mechanical power, or mechanical efficiency, in general</b> [1, 2006.01]  |
| 1/08 | • by the use of counterbalancing forces [1, 2006.01]  | 3/02 | • Rotary-transmission dynamometers [1, 2006.01]   |
| 1/10 | • by measuring variations of frequency of stressed vibrating elements, e.g. of stressed strings (using resistance strain gauges G01L 1/22) [1, 2006.01]   | 3/04 | • • wherein the torque-transmitting element comprises a torsionally-flexible shaft [1, 2006.01]   |
| 1/12 | • by measuring variations in the magnetic properties of materials resulting from the application of stress [1, 2006.01]   | 3/06 | • • • involving mechanical means for indicating [1, 2006.01]  |
| 1/14 | • by measuring variations in capacitance or inductance of electrical elements, e.g. by measuring variations of frequency of electrical oscillators [1, 2006.01]   | 3/08 | • • • involving optical means for indicating [1, 2006.01]   |
| 1/16 | • using properties of piezoelectric devices [1, 2006.01]  | 3/10 | • • • involving electric or magnetic means for indicating [1, 2006.01]  |
| 1/18 | • using properties of piezo-resistive materials, i.e. materials of which the ohmic resistance varies according to changes in magnitude or direction of force applied to the material [1, 2006.01]   | 3/12 | • • • • involving photoelectric means [1, 2006.01]  |
| 1/20 | • by measuring variations in ohmic resistance of solid materials or of electrically-conductive fluids (of piezo-resistive materials G01L 1/18); by making use of electrokinetic cells, i.e. liquid-containing cells wherein an electrical potential is produced or varied upon the application of stress [1, 2006.01] | 3/14 | • • wherein the torque-transmitting element is other than a torsionally-flexible shaft [1, 2006.01]   |
| 1/22 | • • using resistance strain gauges [1, 2006.01]   | 3/16 | • Rotary-absorption dynamometers, e.g. of brake type [1, 2006.01]   |
|      |   | 3/18 | • • mechanically actuated [1, 2006.01]  |
|      |   | 3/20 | • • fluid actuated [1, 2006.01]   |
|      |   | 3/22 | • • electrically or magnetically actuated [1, 2006.01]  |

- 3/24 • Devices for determining the value of power, e.g. by measuring and simultaneously multiplying the values of torque and revolutions per unit of time, by multiplying the values of tractive or propulsive force and velocity [1, 2006.01]
- 3/26 • Devices for measuring efficiency, i.e. the ratio of power output to power input [1, 2006.01]
- 5/00 Apparatus for, or methods of, measuring force, work, mechanical power, or torque, specially adapted for specific purposes [1, 2006.01]**
- 5/03 • for measuring release force of ski safety bindings [1, 2006.01]
- 5/04 • for measuring tension in flexible members, e.g. ropes, cables, wires, threads, belts or bands [1, 2006.01]
- 5/06 • • using mechanical means [1, 2006.01]
- 5/08 • • using fluid means [1, 2006.01]
- 5/10 • • using electrical means [1, 2006.01, 2020.01]
- 5/101 • • • using sensors inserted into the flexible member [2020.01]
- 5/102 • • • using sensors located at a non-interrupted part of the flexible member [2020.01]
- 5/103 • • • using sensors fixed at one end of the flexible member [2020.01]
- 5/105 • • • using electro-optical means [2020.01]
- 5/106 • • • for measuring a reaction force applied on a cantilever beam [2020.01]
- 5/107 • • • for measuring a reaction force applied on an element disposed between two supports, e.g. on a plurality of rollers or gliders [2020.01]
- 5/108 • • • for measuring a reaction force applied on a single support, e.g. a glider [2020.01]
- 5/12 • for measuring axial thrust in a rotary shaft, e.g. of propulsion plants [1, 2006.01]
- 5/13 • for measuring the tractive or propulsive power of vehicles [1, 2006.01]
- 5/14 • for measuring the force of explosions; for measuring the energy of projectiles [1, 2006.01]
- 5/16 • for measuring several components of force [1, 2006.01, 2020.01]
- 5/161 • • using variations in ohmic resistance [2020.01]
- 5/162 • • • of piezoresistors [2020.01]
- 5/1623 • • • of pressure sensitive conductors (using piezoresistors G01L 5/162) [2020.01]
- 5/1627 • • • of strain gauges (using piezoresistors G01L 5/162) [2020.01]
- 5/163 • • • of potentiometers [2020.01]
- 5/164 • • using variations in inductance [2020.01]
- 5/165 • • using variations in capacitance [2020.01]
- 5/166 • • using photoelectric means [2020.01]
- 5/167 • • using piezoelectric means [2020.01]
- 5/168 • • using counterbalancing forces [2020.01]
- 5/169 • • using magnetic means [2020.01]
- 5/171 • • using fluid means [2020.01]
- 5/173 • • using acoustic means [2020.01]
- 5/18 • for measuring ratios of force [1, 2006.01]
- 5/20 • for measuring wheel side-thrust [1, 2006.01]
- 5/22 • for measuring the force applied to control members, e.g. control members of vehicles, triggers [1, 2006.01]
- 5/24 • for determining value of torque or twisting moment for tightening a nut or other member which is similarly stressed [1, 2006.01]
- 5/26 • for determining the characteristic of torque in relation to revolutions per unit of time [1, 2006.01]
- 5/28 • for testing brakes [1, 2006.01]

### Measuring fluid pressure

- 7/00 Measuring the steady or quasi-steady pressure of a fluid or a fluent solid material by mechanical or fluid pressure-sensitive elements** (transmitting or indicating the displacement of mechanical pressure-sensitive elements by electric or magnetic means G01L 9/00; measuring differences of two or more pressure values G01L 13/00; measuring two or more pressure values simultaneously G01L 15/00) [1, 2006.01]
- 7/02 • in the form of elastically-deformable gauges [1, 2006.01]
- 7/04 • • in the form of flexible, deformable tubes, e.g. Bourdon gauges [1, 2006.01]
- 7/06 • • of the bellows type [1, 2006.01]
- 7/08 • • of the flexible-diaphragm type [1, 2006.01]
- 7/10 • • of the capsule type [1, 2006.01]
- 7/12 • • • with exhausted chamber; Aneroid barometers [1, 2006.01]
- 7/14 • • • • with zero-setting means [1, 2006.01]
- 7/16 • in the form of pistons [1, 2006.01]
- 7/18 • using liquid as the pressure-sensitive medium, e.g. liquid-column gauges [1, 2006.01]
- 7/20 • • involving a closed chamber above the liquid level, the chamber being exhausted or housing low-pressure gas; Liquid barometers [1, 2006.01]
- 7/22 • • involving floats, e.g. floating bells [1, 2006.01]
- 7/24 • • involving balances in the form of rings partly filled with liquid [1, 2006.01]
- 9/00 Measuring steady or quasi-steady pressure of a fluid or a fluent solid material by electric or magnetic pressure-sensitive elements; Transmitting or indicating the displacement of mechanical pressure-sensitive elements, used to measure the steady or quasi-steady pressure of a fluid or fluent solid material, by electric or magnetic means** (measuring differences of two or more pressure values G01L 13/00; measuring two or more pressure values simultaneously G01L 15/00) [1, 2006.01]
- 9/02 • by making use of variations in ohmic resistance, e.g. of potentiometers [1, 2006.01]
- 9/04 • • of resistance strain gauges [1, 2006.01]
- 9/06 • • of piezo-resistive devices [1, 2006.01]
- 9/08 • by making use of piezoelectric devices [1, 2006.01]
- 9/10 • by making use of variations in inductance [1, 2006.01]
- 9/12 • by making use of variations in capacitance [1, 2006.01]
- 9/14 • involving the displacement of magnets, e.g. electromagnets [1, 2006.01]
- 9/16 • by making use of variations in the magnetic properties of material resulting from the application of stress [1, 2006.01]
- 9/18 • by making use of electrokinetic cells, i.e. liquid-containing cells wherein an electric potential is produced or varied upon the application of stress [1, 2006.01]
- 11/00 Measuring steady or quasi-steady pressure of a fluid or a fluent solid material by means not provided for in group G01L 7/00 or G01L 9/00 [1, 2006.01]**
- 11/02 • by optical means [6, 2006.01]
- 11/04 • by acoustic means [6, 2006.01]
- 11/06 • • Ultrasonic means [6, 2006.01]
- 13/00 Devices or apparatus for measuring differences of two or more fluid pressure values [1, 2006.01]**

- 13/02 • using elastically-deformable members or pistons as sensing elements [1, 2006.01]
- 13/04 • using floats or liquids as sensing elements [1, 2006.01]
- 13/06 • using electric or magnetic pressure-sensitive elements [1, 2006.01]
- 15/00 Devices or apparatus for measuring two or more fluid pressure values simultaneously [1, 2006.01]**
- 17/00 Devices or apparatus for measuring tyre pressure or the pressure in other inflated bodies [1, 2006.01]**
- 19/00 Details of, or accessories for, apparatus for measuring steady or quasi-steady pressure of a fluent medium insofar as such details or accessories are not special to particular types of pressure gauges [1, 2006.01]**
- 19/02 • Arrangements for preventing, or for compensating for, effects of inclination or acceleration of the measuring device; Zero-setting means (for aneroid barometers G01L 7/14) [1, 2006.01]
- 19/04 • Means for compensating for effects of changes of temperature [1, 2006.01]
- 19/06 • Means for preventing overload or deleterious influence of the measured medium on the measuring device or *vice versa* [1, 2006.01]
- 19/08 • Means for indicating or recording, e.g. for remote indication [1, 2006.01]
- 19/10 • • mechanical [1, 2006.01]
- 19/12 • • Alarms or signals [1, 2006.01]
- 19/14 • Housings [1, 2006.01]
- 19/16 • Dials; Mounting of dials [1, 2006.01]
- 21/00 Vacuum gauges [1, 2006.01]**
- 21/02 • having a compression chamber in which gas, whose pressure is to be measured, is compressed [1, 2006.01]
- 21/04 • • wherein the chamber is closed by liquid; Vacuum gauges of the McLeod type [1, 2006.01]
- 21/06 • • • actuated by rotating or inverting the measuring device [1, 2006.01]
- 21/08 • by measuring variations in the transmission of acoustic waves through the medium, the pressure of which is to be measured [1, 2006.01]
- 21/10 • by measuring variations in the heat conductivity of the medium, the pressure of which is to be measured [1, 2006.01]
- 21/12 • • measuring changes in electric resistance of measuring members, e.g. of filaments; Vacuum gauges of the Pirani type [1, 2006.01]
- 21/14 • • using thermocouples [1, 2006.01]
- 21/16 • by measuring variation of frictional resistance of gases [1, 2006.01]
- 21/18 • • using a pendulum [1, 2006.01]
- 21/20 • • using members oscillating about a vertical axis [1, 2006.01]
- 21/22 • • using resonance effects of a vibrating body; Vacuum gauges of the Klumb type [1, 2006.01]
- 21/24 • • using rotating members; Vacuum gauges of the Langmuir type [1, 2006.01]
- 21/26 • by making use of radiometer action, i.e. of the pressure caused by the momentum of molecules passing from a hotter to a cooler member; Vacuum gauges of the Knudsen type [1, 2006.01]
- 21/28 • • using torsional rotary measuring members [1, 2006.01]
- 21/30 • by making use of ionisation effects [1, 2006.01]
- 21/32 • • using electric discharge tubes with thermionic cathodes [1, 2006.01]
- 21/34 • • using electric discharge tubes with cold cathodes [1, 2006.01]
- 21/36 • • using radioactive substances [1, 2006.01]
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- 23/00 Devices or apparatus for measuring or indicating or recording rapid changes, such as oscillations, in the pressure of steam, gas, or liquid; Indicators for determining work or energy of steam, internal-combustion, or other fluid-pressure engines from the condition of the working fluid [1, 2006.01]**
- 23/02 • mechanically indicating or recording and involving loaded or return springs [1, 2006.01]
- 23/04 • involving means subjected to known counteracting pressure [1, 2006.01]
- 23/06 • Indicating or recording by optical means [1, 2006.01]
- 23/08 • operated electrically [1, 2006.01]
- 23/10 • • by pressure-sensitive members of the piezoelectric type [1, 2006.01]
- 23/12 • • by changing capacitance or inductance [1, 2006.01]
- 23/14 • • by electromagnetic elements [1, 2006.01]
- 23/16 • • by photoelectric means [1, 2006.01]
- 23/18 • • by resistance strain gauges [1, 2006.01]
- 23/20 • combined with planimeters or integrators [1, 2006.01]
- 23/22 • for detecting or indicating knocks in internal-combustion engines; Units comprising pressure-sensitive members combined with ignitors for firing internal-combustion engines [1, 2006.01]
- 23/24 • for measuring pressure in inlet or exhaust ducts of internal-combustion engines [1, 2006.01]
- 23/26 • Details or accessories [1, 2006.01]
- 23/28 • • Cooling means [1, 2006.01]
- 23/30 • • Means for indicating consecutively positions of pistons or cranks of internal-combustion engines in combination with pressure indicators [1, 2006.01]
- 23/32 • • Apparatus specially adapted for recording pressure changes measured by indicators [1, 2006.01]
- 25/00 Testing or calibrating of apparatus for measuring force, torque, work, mechanical power, or mechanical efficiency [1, 2, 2006.01]**
- 27/00 Testing or calibrating of apparatus for measuring fluid pressure [1, 2, 2006.01]**
- 27/02 • of indicators [1, 2006.01]