

ECLA**EUROPEAN CLASSIFICATION****F15B**

SYSTEMS ACTING BY MEANS OF FLUIDS IN GENERAL; FLUID-PRESSURE ACTUATORS, e.g. SERVO-MOTORS; DETAILS OF FLUID-PRESSURE SYSTEMS, NOT OTHERWISE PROVIDED FOR ([N: hydraulically or pneumatically operated lifting devices for soil-working machines [A01B63/10](#); hydraulic drawing presses [B21D](#); hydraulic or pneumatic manipulators [B25J](#); hydraulic or pneumatic tipping devices for vehicles [B60P1/00](#); hydraulic or pneumatic remote control for railway signals [B61L7/04](#); hydraulic or pneumatic mine supports [E21D15/44](#); motors, turbines, compressors, blowers, pumps [F01](#) to [F04](#); [N: fluid signal amplifiers, relays [F15C](#)]; fluid dynamics [F15D](#); fluid clutches or brakes [F16D](#); fluid springs [F16F](#); fluid gearing [F16H](#); pistons, cylinders packing [F16J](#); valves, taps, cocks, actuating-floats [F16K](#); safety valves with auxiliary fluid operation of the main valve [F16K17/10](#); fluid-operating means for valves [F16K31/12](#); pipes, pipe joints [F16L](#); lubricating [F16N](#))

Note

In this subclass, the following terms are used with the meaning stated:

- "Telemotor" means a system or device in which a substantially constant amount of fluid is trapped between an input member and an output member to act as a fluid link;
- "Servomotor" means a fluid-pressure actuator, e.g. a piston and cylinder, directly controlled by a valve or other device which is responsive to operation of an initial controlling member; "Servomotor" does not cover a telemotor. The initial controlling member may be adjacent to the servomotor or at a distance, and may be, for example a hand lever.

F15B1/00

Installations or systems with accumulators; Supply reservoir or sump assemblies

F15B1/02

- . Installations or systems with accumulators ([N: energy recuperation means [F15B21/14](#)]; devices damping pulsations or vibrations for fluids for use in, or connection with, pipes or pipe systems [F16L55/04](#))

F15B1/02B

- . . [N: used for damping] [N0310]

F15B1/02C

- . . [N: used as an emergency power source, e.g. in case of pump failure] [N0310]

F15B1/02D

- . . [N: used as a supplementary power source, e.g. to store energy in idle periods to balance pump load] [N0310]

F15B1/02E

- . . [N: used for thermal compensation, e.g. to collect expanded fluid and to return it to the system as the system fluid cools down] [N0310]

F15B1/027

- . . having accumulator charging devices (control of fluid pressure in general [G05D16/00](#))

F15B1/027B

- . . . [N: with two or more pilot valves, e.g. for independent setting of the cut-in and cut-out pressures] [N0310]

[N: **WARNING**

[N0310]Not complete, see [F15B1/027](#)

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F15B1/033

- . . . with electrical control means

F15B1/04

- . . Accumulators (connection of valves to inflatable elastic bodies [B60C29/00](#))

F15B1/04B	. . . [N: Dead weight accumulators] [N0310]
F15B1/08	. . . using a gas cushion; Gas charging devices; Indicators or floats therefor
F15B1/08B	. . . . [N: the accumulator having a fusible plug] [N0310]
F15B1/08C	. . . . [N: the gas cushion being entirely enclosed by the separating means, e.g. foam or gas-filled balls] [N0310]
F15B1/10	. . . . with flexible separating means
F15B1/10B	. . . . . [N: the separating means being bellows] [N0310]
F15B1/10C	. . . . . [N: characterised by the way housing components are assembled] [N0310]
F15B1/12	. . . . . attached at their periphery (F15B1/16 takes precedence)
F15B1/12B	. . . . . . [N: characterised by the attachment means (F15B1/14 takes precedence)] [N0310]
F15B1/14	. . . . . . by means of a rigid annular supporting member
F15B1/16	. . . . . . in the form of a tube
F15B1/16B	. . . . . . . [N: in the form of a bladder]
F15B1/18	. . . . . . Anti-extrusion means
F15B1/20	. . . . . . . fixed to the separating means
F15B1/22	. . . . . Liquid port constructions
F15B1/24	. . . . . with rigid separating means, e.g. pistons
F15B1/26	. Supply reservoir or sump assemblies
F15B1/26B	. . [N: with pressurised main reservoir (systems with accumulators F15B1/02)] [N0310]
F15B3/00	Intensifiers or fluid-pressure converters, e.g. pressure exchangers; Conveying pressure from one fluid system to another, without contact between the fluids [N: (fluid-driven pumps F04B9/08)]
F15B5/00	Transducers converting variations of physical quantities, e.g. expressed by variations in positions of members, into fluid-pressure variations or vice-versa; Varying fluid pressure as a function of variations of a plurality of fluid pressures or variations of other quantities (F15B9/00 takes precedence; for measuring or controlling G01, G05)
F15B5/00B	. [N: characterised by variation of the pressure in a nozzle or the like, e.g. nozzle-flapper system]
F15B5/00C	. [N: with electrical means, e.g. electropneumatic transducer (5/00B takes precedence)]
Guide heading:	<u>Fluid-pressure actuator systems (systems peculiar to the control of a particular machine or apparatus covered in a single other class, see the class for such machine or apparatus)</u>
	Note This heading relates to moving members into one or more definite positions by means of fluid pressure. Pump, motor and control features so far as not peculiar to this purpose are classified in the relevant classes.
F15B7/00	Systems in which the movement produced is definitely related to the output of a

volumetric pump; Telemotors [N: (for control in motor vehicles [B60K](#); in ships [B63H25/00](#); in aircraft [B64C13/00](#); combinations of telemotor and servomotor systems [F15B17/00](#))]

- F15B7/00B . [N: with multiple inputs (input units [F15B7/08](#), e.g. for dual control)] [N0310]
- F15B7/00C . [N: with multiple outputs] [N0310]
- F15B7/00D . [N: with rotary or crank input (input units [F15B7/08](#))] [N0310]
- F15B7/00D2 . . [N: Rotary pump input] [N0310]
- F15B7/00E . [N: with rotary output] [N0310]
- F15B7/02 . Systems with continuously-operating input and output apparatus
- F15B7/04 . in which the ratio between pump stroke and motor stroke varies with the resistance against the motor (in brake-actuating systems for motor vehicles [B60T](#))
- F15B7/06 . Details ([F15B15/00](#) takes precedence)
- F15B7/08 . . Input units; Master units
- F15B7/10 . . Compensation of the liquid content in a system ([F15B7/08](#) takes precedence; pressure-maintaining arrangements for brake master cylinders [B60T11/228](#))
- F15B9/00** **Servomotors with follow-up action, [e.g. obtained by feed-back control], i.e. in which the position of the actuated member conforms with that of the controlling member** [N: ([F15B11/10](#) takes precedence)]
- F15B9/02 . with servomotors of the reciprocable or oscillatable type
- F15B9/03 . . with electrical control means [N: ([F15B9/07](#), [F15B9/09](#), [F15B9/17](#) take precedence)]
- F15B9/04 . . controlled by varying the output of a pump with variable capacity
- F15B9/06 . . controlled by means using a fluid jet
- F15B9/07 . . . with electrical control means
- F15B9/08 . . controlled by valves affecting the fluid feed or the fluid outlet of the servomotor ([F15B9/06](#) takes precedence)
- F15B9/09 . . . with electrical control means
- F15B9/10 . . . in which the controlling element and the servomotor each controls a separate member, these members influencing different fluid passages or the same passage
- F15B9/12 . . . in which both the controlling element and the servomotor control the same member influencing a fluid passage and are connected to that member by means of a differential gearing
- F15B9/14 . with rotaty servomotors
- F15B9/16 . Systems essentially having two or more interacting servomotors, [N: e.g. multi-stage ([F15B18/00](#), [F15B20/00](#) take precedence; servo-operated pilot valves for the following stage [F15B13/042](#))]
- F15B9/17 . . with electrical control means

Guide heading: [\[N0912\]](#)

- F15B11/00** **Servomotor systems without provision for follow-up action; [N: Circuits therefor] ([F15B3/00](#) takes precedence) [C9912]**
- F15B11/00B . [N: Systems with load-holding valves (**locking valve details [F15B13/01](#)**)] [N9912]
 - F15B11/00C . [N: Hydraulic "Wheatstone bridge" circuits, i.e. with four nodes, P-A-T-B, and on-off or proportional valves in each link][N0310]
 - F15B11/02 . Systems essentially incorporating special features for controlling the speed or actuating force of an output member
 - F15B11/02B . . [N: in which a rapid approach stroke is followed by a slower, high-force working stroke (**[F15B11/032B](#) takes precedence**)] [N0310]
 - F15B11/024 . . by means of differential connection of the servomotor lines, e.g. regenerative circuits [N: (**interconnecting valve details [F15B13/02C](#)**)] [N9501] [C9912]
 - F15B11/028 . . for controlling the actuating force (**[F15B11/024](#) takes precedence**) [N9501]
 - F15B11/032 . . . by means of fluid-pressure converters (**fluid-pressure converters per se [F15B3/00](#)**) [N9501]
 - F15B11/032B [N: the fluid-pressure converter increasing the working force after an approach stroke] [N9912]
 - F15B11/036 . . . by means of servomotors having a plurality of working chambers (**servomotors per se [F15B15/00](#)**) [N9501]
 - F15B11/036B [N: Tandem constructions] [N9501]
 - F15B11/04 . . for controlling the speed (**[F15B11/024](#) takes precedence**) [C9501]
 - F15B11/04B . . . [N: during starting or stopping (**[F15B11/048](#) takes precedence**)] [N0310]
 - F15B11/04C . . . [N: in one direction only, with no control in the reverse direction, e.g. check valve in parallel with a throttle valve][N0310]
 - F15B11/042 . . . by regulating means in feed line, [N: i.e. "meter in"] (**[F15B11/046](#), [F15B11/05](#) take precedence**) [N9501] [C9912]
 - F15B11/042B [N: by controlling pump output or bypass, other than to maintain constant speed (**adjusting pump output or bypass to maintain constant speed [F15B11/05B](#)**)] [N9912]
 - F15B11/042C [N: by controlling the number of pumps or parallel valves switched on] [N0310]
 - F15B11/044 . . . by regulating means in return line, [N: i.e. "meter out"] (**[F15B11/046](#), [F15B11/05](#) take precedence**) [N9501] [C9912]
 - F15B11/044B [N: with counterbalance valves, e.g. to prevent overrunning or for braking] [N9912]
 - F15B11/046 . . . depending on the position of the working member [N9501]
 - F15B11/048 with deceleration control [N9501]
 - F15B11/05 . . . specially adapted to maintain constant speed, e.g. pressure-compensated, load-responsive [N: (**[F15B11/16B](#) takes precedence**); counterbalance valves [F15B11/044B](#); valves for load sensing [F15B13/04C](#)] [C9912]
 - F15B11/05B [N: by adjusting the pump output or bypass (**pump control [F04B49/00](#)**)] [N9912]
 - F15B11/06 . involving features specific to the use of a compressible medium, e.g. air, steam

- F15B11/064 . . with devices for saving the compressible medium
- F15B11/068 . . with valves for gradually putting pneumatic systems under pressure
- F15B11/072 . . Combined pneumatic-hydraulic systems ([F15B11/032 takes precedence](#)) [C9912]
- F15B11/072B . . . [N: with the driving energy being derived from a pneumatic system, a subsequent hydraulic system displacing or controlling the output element]
- F15B11/076 . . . with pneumatic drive or displacement and speed control or stopping by hydraulic braking

- F15B11/08 . with only one servomotor
- F15B11/10 . . in which the servomotor position is a function of the pressure [N: also pressure regulators as operating means for such systems, the device itself may be a position indicating system]
- F15B11/12 . . providing distinct intermediate positions; with step-by-step action [N: with a number of pistons in a single cylinder step-by-step action obtained by combining two or more servomotors [F15B11/18](#); (for restricting the stroke [F15B15/24](#))] [C9912]
- F15B11/12B . . . [N: providing distinct intermediate positions ([F15B11/13 takes precedence](#))] [N9912]
- F15B11/12B2 [N: by means of actuators with multiple stops] [N9912]
- F15B11/12B4 [N: by means of actuators with fluid-operated stops] [N9912]
- F15B11/12B6 [N: by means of digital actuators, i.e. actuators in which the total stroke is the sum of individual strokes] [N9912]
- F15B11/12B8 [N: by means of actuators of the standard type with special circuit controlling means ([F15B11/12B6 takes precedence](#))] [N9912]
- F15B11/12D . . . [N: with step-by-step action] [N9912]
- F15B11/12D8 [N: by means of actuators of the standard type with special circuit controlling means] [N9912]
- F15B11/13 . . . using [N: separate dosing] chambers of predetermined volume [N9501] [C9912]
- F15B11/15 . . with special provision for automatic return [N: (fluid gearing with oscillating input or output [F16H43/00](#))]

- F15B11/16 . with two or more servomotors [N: (for soil-shifting machines [E02F9/22](#))]
- F15B11/16B . . [N: with sensing of servomotor demand or load] [N9912]
- F15B11/16B2 . . . [N: for giving priority to particular servomotors or users (priority valve details [F15B13/02D](#); for power steering [B62D5/07](#))] [N9912]
- F15B11/16B4 . . . [N: for sharing the pump output equally amongst users or groups of users, e.g. using anti-saturation, pressure compensation] [N9912]
- F15B11/16B6 . . . [N: for adjusting the pump output or bypass in response to demand] [N9912]
- F15B11/16B8 . . . [N: Controlling a pilot pressure in response to the load, i.e. supply to at least one user is regulated by adjusting either the system pilot pressure or one or more of the individual pilot command pressures] [N0310]
- F15B11/16B10 . . . [N: using pilot pressure to sense the demand] [N0310]
- F15B11/16B12 . . . [N: with an isolator valve (duplicating valve), i.e. at least one load sense (LS) pressure is derived from a work port load sense pressure but is not a work port pressure itself] [N0310]
- F15B11/17 . . using two or more pumps
- F15B11/18 . . used in combination for obtaining stepwise operation of a single controlled member
- F15B11/18B . . . [N: Linear stepwise operation] [N9912]
- F15B11/18C . . . [N: Rotary stepwise operation] [N9912]

- F15B11/20 . . . controlling several interacting or sequentially-operating members (fluid distribution or supply devices for the control of two or more servomotors [F15B13/06](#))
- F15B11/20B . . . [N: the position of the actuator controlling the fluid flow to the subsequent actuator (telescopic booms [B66C23/70](#))] [N0310]
- F15B11/22 . . . Synchronisation of the movement of two or more servomotors
- F15B13/00** **Details of servomotor systems** ([N: [F15B1/04](#), [F15B1/06](#), [F15B3/00](#), [F15B7/08](#), [F15B11/02](#), [F15B11/10](#), [F15B15/00](#) take precedence; Valves for servomotor systems] [C9912])
- F15B13/01 . . . Locking-valves or other detent, [N: i.e. load-holding], devices (associated with the actuator [F15B15/26](#); [N: systems with load-holding valves [F15B11/00B](#)]) [C9912]
- F15B13/01B . . . [N: using an enclosed pilot flow valve] [N9912]
- F15B13/02 . . . Fluid distribution or supply devices characterised by their adaptation to the control of servomotors ([N: [F15B11/15](#) takes precedence]; multiple-way valves [F16K11/00](#))
 [N: **WARNING** [N0909]
 Subgroups [F15B13/02E](#) to [F15B13/02K](#) are not complete, see [F15B13/02](#)]
- F15B13/02C . . . [N: Valves for interconnecting the fluid chambers of an actuator (regenerative circuits [F15B11/024](#))] [C9912]
- F15B13/02D . . . [N: Flow-dividers; Priority valves (circuits for giving priority to particular servomotors [F15B11/16B2](#); priority valves for power steering [B62D5/07](#))] [C9912]
- F15B13/02E . . . [N: Excess flow valves, e.g. for locking cylinders in case of hose burst] [N0909]
- F15B13/02F . . . [N: Pressure relief valves] [N0909]
- F15B13/02G . . . [N: Pressure reducing valves] [N0909]
- F15B13/02H . . . [N: Pressure compensating valves] [N0909]
- F15B13/02I . . . [N: Check valves] [N0909]
- F15B13/02J . . . [N: Shuttle valves] [N0909]
- F15B13/02K . . . [N: Counterbalance valves] [N0909]
- F15B13/04 . . . for use with a single servomotor
- F15B13/04B [N: Valve members; Fluid interconnections therefor] [N9912]
- F15B13/04B2 [N: for linearly sliding valves, e.g. spool valves] [N9912]
- F15B13/04B2B [N: a secondary valve member sliding within the main spool, e.g. for regeneration flow ([F15B13/04C2B](#) takes precedence)] [N0310]
- F15B13/04B4 [N: for seat valves, i.e. poppet valves] [N9912]
- F15B13/04B6 [N: for rotary valves] [N9912]
- F15B13/04B8 [N: Means for damping the valve member movement] [N9912]
- F15B13/04C [N: with means or adapted for load sensing (fluid systems with load sensing [F15B11/05](#), [F15B11/16B](#))] [N9912]
- F15B13/04C2 [N: Load sensing elements; Internal fluid connections therefor; Anti-saturation or pressure-compensation valves] [N9912]
- F15B13/04C2B [N: Load sensing elements sliding within a hollow main valve spool] [N9912]
- F15B13/042 operated by fluid pressure [N: ([F15B13/04B](#), [F15B13/04C](#) take precedence)] [C9912]
- F15B13/042F [N: with manually-operated pilot valves, e.g. joysticks (arrangements of

handles or pedals for cranes [B66C13/54](#); control levers for dredgers and soil shifting machines [E02F9/20A](#); similar mechanical control actuators [G05G9/049](#)] [C0310]

F15B13/042F2	. . . . .	[N: the joysticks being provided with electrical switches or sensors] [N0310]
F15B13/042G	. . . . .	[N: with fluid-operated pilot valves, i.e. multiple stage valves] [N9912]
F15B13/043	. . . . .	with electrically-controlled pilot valves [N: electrically-operated main valves F15B13/044] [C9912]
F15B13/043B	. . . . .	[N: the electrical control resulting in an on-off function]
F15B13/043D	. . . . .	[N: the pilot valves being pressure control valves (F15B13/043E , F15B13/043F , F15B13/043G take precedence)]
F15B13/043E	. . . . .	[N: the pilot valves being sliding valves]
F15B13/043F	. . . . .	[N: the pilot valves being of the steerable jet type] [C9912]
F15B13/043G	. . . . .	[N: the pilot valves being of the nozzle-flapper type] [C9912]
F15B13/044	. . . . .	operated by electrically-controlled means, e.g. solenoids, torque-motors [N: (electrically-controlled pilot valves F15B13/043)] [C9912]
F15B13/044B	. . . . .	[N: with proportional solenoid allowing stable intermediate positions] [N9912]
F15B13/044C	. . . . .	[N: with rotary electric motor] [N9912]
F15B13/044D	. . . . .	[N: with moving coil, e.g. voice coil] [N9912]
F15B13/06	. . . . .	for use with two or more servomotors
F15B13/07	. . . . .	in distinct sequence
F15B13/08	. . . . .	Assemblies of units, each for the control of a single servomotor only [C0710]
F15B13/08B	. . . . .	[N: Modular units] [N0710]
F15B13/08B2	. . . . .	[N: Manifolds] [N0710]
F15B13/08B2B	. . . . .	[N: Laminated constructions] [N0710]
F15B13/08B2D	. . . . .	[N: Monoblock manifolds] [N0710]
F15B13/08B2F	. . . . .	[N: Multiblock manifolds] [N0710]
F15B13/08B4	. . . . .	[N: Attachment or sealing of modular units to each other] [N0710]
F15B13/08B4B	. . . . .	[N: the modular elements being mounted on a common member, e.g. on a rail] [N0710]
F15B13/08B6	. . . . .	[N: characterised by sealing means of the modular units] [N0710]
F15B13/08B8	. . . . .	[N: Modular valves] [N0710]
F15B13/08B8B	. . . . .	[N: Cartridge type valves] [N0710]
F15B13/08B8D	. . . . .	[N: Stacked plate type valves] [N0710]
F15B13/08B8F	. . . . .	[N: Monoblock type valves, e.g. with multiple valve spools in a common housing] [N0710]
F15B13/08B10	. . . . .	[N: Electrical details] [N0710]
F15B13/08B10B	. . . . .	[N: Electrical controllers] [N0710]
F15B13/08B10D	. . . . .	[N: Electric circuit boards] [N0710]
F15B13/08B10F	. . . . .	[N: Electrical connecting means, e.g. plugs, sockets] [N0710]
F15B13/08B10H	. . . . .	[N: Sensing means, e.g. pressure sensors] [N0710]
F15B13/08B10J	. . . . .	[N: Signalling means, e.g. LEDs] [N0710]
F15B13/08B10L	. . . . .	[N: Data bus systems] [N0710]
F15B13/08B12	. . . . .	[N: Channels for fluid] [N0710]

- F15B13/08B14 [N: Channels for electrical components, e.g. for cables or sensors] [N0710]
- F15B13/08B16 [N: Assembly of modular units] [N0710]
- F15B13/08B16B [N: using identical modular elements] [N0710]
- F15B13/08B16D [N: using valves combined with other components] [N0710]
- F15B13/08B16D2 {7 dots} [N: Valves combined with electrical components] [N0710]
- F15B13/08B16D4 {7 dots} [N: Valves combined with fluid components] [N0710]
- F15B13/08B16F [N: using different types or sizes of valves] [N0710]

- F15B13/10 Special arrangements for operating the actuated device [N: with or] without using fluid pressure, e.g. for emergency use [C9912]

- F15B13/12 Special measures for increasing the sensitivity of the system

- F15B13/14 Special measures for giving the operating person a "feeling" of the response of the actuated device

- F15B13/16 Special measures for feedback, [N: e.g. by a follow-up device (servomotors with follow-up action [F15B9/00](#); devices with means or adapted for load sensing [F15B13/04C](#))] [C9912]

Guide heading: [\[N0912\]](#)

F15B15/00 **Fluid-actuated devices for displacing a member from one position to another (motors for continuous movement [F01](#) to [F03](#)); Gearing associated therewith**

- F15B15/02 Mechanical lay-out characterised by the means for converting the movement of the fluid-actuated element into movement of the finally-operated member
- F15B15/04 with oscillating cylinder
- F15B15/06 for mechanically converting rectilinear movement into non- rectilinear movement
- F15B15/06B [N: by unidirectional means]
- F15B15/06C [N: Actuator having both linear and rotary output, i.e. dual action actuator]
- F15B15/06D [N: the motor being of the rack-and-pinion type] [N0909]
- F15B15/06E [N: the motor being of the scotch yoke type] [N0909]
- F15B15/06F N: the motor being of the helical type] [N0909]

- F15B15/08 characterised by the construction of the motor unit (pistons, cylinders, packing [F16J](#))
- F15B15/08B [N: the motor being of the slotted cylinder type (locking mechanisms therefor [F15B15/26D](#))] [C9903]
- F15B15/08C [N: the motor being of the rodless piston type, e.g. with cable, belt or chain (locking mechanisms therefor [F15B15/26D](#))] [C9903]
- F15B15/08C2 [N: with magnetic coupling]
- F15B15/08G [N: the motor using combined actuation, e.g. electric and fluid actuation] [N0909]

- [N: **WARNING** [N0909]
Not complete, see also [F15B15/08](#), [R15B15/20M](#)]
]
- F15B15/10 the motor being of diaphragm type (connection of valves to inflatable elastic bodies

[B60C 29/00](#); diaphragms, bellows [F16J3/00](#); [N: clutches with a fluid-actuated elastic clutching member [F16D25/04](#))]

- F15B15/10B . . . [N: using inflatable bodies that contract when fluid pressure is applied, e.g. pneumatic artificial muscles or McKibben-type actuators] [N1205]
- F15B15/10D . . . [N: the motor being of the pinching-roller type] [N1205]
- F15B15/12 . . . of the oscillating-vane or curved-cylinder type
- F15B15/12B . . . [N: of the curved-cylinder type] [N9903]
- F15B15/14 . . . of the straight-cylinder type
- F15B15/14B . . . [N: in clusters, e.g. multiple cylinders in one block (servomotors having a plurality of working chambers [F15B11/036](#); motors with two or more independently movable working pistons [F15B15/14C](#))] [N0310]
- F15B15/14C . . . [N: with two or more independently movable working pistons (systems [F15B11/12](#), [F15B11/18](#))]
- F15B15/14D . . . [N: with non-rotatable piston]
- F15B15/14D2 [N: of non-circular cross-section] [N9903]
- F15B15/14E . . . [N: Component parts; Constructional details] [N9903]
- F15B15/14E2 [N: Cylinders ([F15B15/14E6](#) takes precedence)] [N9903]
- F15B15/14E4 [N: End caps ([F15B15/14E6](#) takes precedence)] [N9903]
- F15B15/14E6 [N: Cylinder to end cap assemblies] [N9903]
- F15B15/14E6B [N: End cap sealings] [N0909]
- [N: **WARNING** [N0909]
Not complete, see also [F15B15/14E6](#)
]
- F15B15/14E8 [N: Pistons; Piston to piston rod assemblies] [N9903]
- F15B15/14E8B [N: Piston sealings] [N0909]
- [N: **WARNING** [N0909]
Not complete, see also [F15B15/14E8](#)
]
- F15B15/14E10 [N: Piston rods ([F15B15/14E8](#) takes precedence)] [N9903]
- F15B15/14E10B [N: Piston rod sealings] [N0909]
- [N: **WARNING** [N0909]
Not complete, see also [F15B15/14E10](#)
]
- F15B15/14E12 [N: Hollow piston sliding over a stationary rod inside the cylinder (systems for controlling the actuator force [F15B11/036](#))] [N9903]
- F15B15/14E14 [N: Guiding means other than in the end cap ([F15B15/14E12](#) takes precedence)] [N9903]
- F15B15/14E16 [N: Special return means] [N9903]
- F15B15/14E18 [N: Lost-motion means between the piston and the output] [N9903]
- F15B15/14E20 [N: Special measures for cooling or heating] [N9903]
- F15B15/14F [N: Fluid interconnections, e.g. fluid connectors, passages] [N9903]
- F15B15/16 of the telescopic type
- F15B15/16B [N: with synchronisation of sections] [N0310]
- F15B15/17 of differential-piston type

- F15B15/18 . Combined units comprising both motor and pump [N: (telemotors [F15B7/00](#))] [C9904]
- F15B15/19 . Pyrotechnical actuators
- F15B15/20 . Other details [N: e.g. assembly with regulating devices]
- F15B15/20B . . [N: Externally-operated valves mounted in or on the actuator] [N9903]
- F15B15/20C . . [N: Control means for piston speed or actuating force without external control, e.g. control valve inside the piston ([F15B11/02](#), [F15B15/22](#) take precedence)] [C9903]
- F15B15/22 . . for accelerating or decelerating the stroke
- F15B15/22A . . . [N: for accelerating the stroke, e.g. by area increase] [N0009]
- F15B15/22B . . . [N: having a piston with a piston extension or piston recess which throttles the main fluid outlet as the piston approaches its end position] [N9903]
- F15B15/22C . . . [N: having a piston with a piston extension or piston recess which completely seals the main fluid outlet as the piston approaches its end position] [N9903]
- F15B15/22D . . . [N: having a piston which closes off fluid outlets in the cylinder bore by its own movement] [N9903]
- F15B15/22E . . . [N: with valve stems operated by contact with the piston end face or with the cylinder wall] [N9903]
- F15B15/22J . . . [N: having elastic elements, e.g. springs, rubber pads] [N0009]
- F15B15/22K . . . [N: having an auxiliary cushioning piston within the main piston or the cylinder end face] [N0009]
- F15B15/22L . . . [N: having shock absorbers mounted outside the actuator housing] [N0009]
- F15B15/24 . . for restricting the stroke
- F15B15/26 . . Locking mechanisms [N: (locking valves not combined with the actuator [F15B13/01](#))]
- F15B15/26B . . . [N: using positive interengagement, e.g. balls and grooves, for locking in the end positions] [N9903]
- F15B15/26C . . . [N: using friction, e.g. brake pads] [N9903]
- F15B15/26C2 [N: Screw mechanisms attached to the piston] [N9903]
- F15B15/26D . . . [N: specially adapted for rodless pistons or slotted cylinders] [N9903]
- F15B15/28 . . Means for indicating the position, e.g. end of stroke
- F15B15/28B . . . [N: Position switches, i.e. means for sensing of discrete positions only, e.g. limit switches] [N9903]
- F15B15/28C . . . [N: Position sensing, i.e. means for continuous measurement of position, e.g. LVDT] [N9903] [C0310]
- [N: **WARNING** [N0909]
Subgroups [F15B15/28C20](#) to [F15B15/28C60](#) are not complete, see [F15B15/28C](#)
]
- F15B15/28C2 [N: by a screw mechanism attached to the piston] [N9903]
- F15B15/28C3 [N: using a cable wrapped on a drum and attached to the piston] [N0310]
- F15B15/28C10 [N: with out using position sensors, e.g. by volume flow measurement or pump speed] [N0310]
- F15B15/28C20 [N: using detection of markings, e.g. markings on the piston rod] [N0909]
- F15B15/28C30 [N: using potentiometers] [N0909]
- F15B15/28C40 [N: using magnetic means] [N0909]

- F15B15/28C50 [N: using electromagnetic radiation, e.g. radar or microwaves] [N0909]
- F15B15/28C50B [N: using optical means, e.g. laser] [N0909]
- F15B15/28C60 [N: using sound, e.g. ultrasound] [N0909]
- F15B15/28D [N: characterised by the attachment means] [N9903]

Guide heading: [\[N0909\]](#)

F15B17/00 Combinations of telemotor and servomotor systems

- F15B17/02 . in which a telemotor operates the control member of a servomotor

F15B18/00 Parallel arrangements of independent servomotor systems

F15B19/00 Testing; [N: Calibrating; Fault detection or monitoring; Simulation or modelling of] fluid-pressure systems or apparatus not otherwise provided for [C0310]

- F15B19/00B . [N: Calibrating] [N0310]
- F15B19/00C . [N: Fault detection or monitoring] [N0310]
- F15B19/00D . [N: Simulation or modelling] [N0310]

F15B20/00 Safety arrangements; Applications of safety devices (safety devices in general F16P, [N: [F16P3/22](#)]); Emergency measures

- F15B20/00B . [N: Double valve requiring the use of both hands simultaneously] [C9902]
- F15B20/00C . [N: Electrical failure] [N9902]
- F15B20/00D . [N: Fluid pressure supply failure] [N9902]
- F15B20/00E . [N: Leakage; Spillage; Hose burst] [N9902]
- F15B20/00F . [N: Overload] [N9902]
- F15B20/00G . [N: Valve failure ([F15B18/00](#) takes precedence)] [N9902]

F15B21/00 Common features; Fluid-pressure systems, or details thereof, not covered by any preceding group

- F15B21/00B . [N: Servomotor systems with fluidic control]
- F15B21/00C . [N: Systems with different interchangeable components, e.g. using preassembled kits] [N0710]
- F15B21/00D . [N: Filling or draining of fluid systems] [N1208]
- F15B21/00E . [N: Compensation or avoidance of ambient pressure variation (systems with a

pressurised main reservoir [F15B1/26B](#)] [N1208]

- F15B21/00F . [N: Reduction of noise or vibration] [N1208]
- F15B21/02 . Servomotor systems with programme control derived from a store or timing device; Control devices therefor ([N: programme control in washing-machines [D06F33/04](#)]; programme control in general [G05B19/00](#))
- F15B21/04 . Special measures taken in connection with the properties of the fluid, e.g. for venting, compensating for changes of viscosity, cooling, filtering, preventing churning
- F15B21/04B . . [N: Filtering; Removal or measurement of solid or liquid contamination] [N9810]
- F15B21/04C . . [N: Cooling or heating of the fluid; Warming up fluid systems] [N9810]
- F15B21/04D . . [N: Deaeration, venting, bleeding; Removal or measurement of undissolved gas (preventing cavitation [F15B21/04F](#))] [N9810]
- F15B21/04E . . [N: Viscosity or temperature compensation (warming up fluid systems [F15B21/04C](#))] [N9810]
- F15B21/04F . . [N: Preventing foaming, churning or cavitation (supply reservoir or sump assemblies [F15B1/26](#))] [N9810]
- F15B21/04K . . [N: Compressed air preparation units, e.g. comprising air driers or condensers, filters, oilers or lubricators, pressure regulators (for steam traps [F16T](#); for mist lubrication [F16N7/32](#); for air conditioning [F24F](#))] [N0009]
- F15B21/06 . Use of special fluids, e.g. liquid metal; Special adaptations of fluid-pressure systems, or control of elements therefor, to the use of such fluids
- F15B21/06B . . [N: Use of electro- or magnetosensitive fluids, e.g. electrorheological fluid] [N9701] [C9810]
- F15B21/08 . Servomotor systems incorporating electrically operated control means ([F15B21/02](#), [N: [F15B21/06B](#)] take precedence) [C9701]
- F15B21/08B . . [N: with different modes] [N0310]
- F15B21/08C . . [N: using a data bus, e.g. "CANBUS"] [N0310]
- F15B21/08D . . [N: Control strategy, e.g. with block diagram] [N0310]
- F15B21/10 . Delay devices or arrangements ([N: hydraulic braking [F15B11/076](#)]; associated with fluid motors or actuators [F15B15/22](#))
- F15B21/12 . Fluid oscillators or pulse generators (fluid oscillators predominantly used for computing or control purposes [F15C1/22](#), [F15C3/16](#))
- F15B21/12B . . [N: by means of a rotating valve]
- F15B21/14 . Energy recuperation means (for vehicles [B60T1/10](#)); [N: Means for reducing energy consumption (regenerative circuits [F15B11/024](#))] [N9810]