

**CPC****COOPERATIVE PATENT CLASSIFICATION****B01D**

**SEPARATION** (separating solids from solids by wet methods [B03B](#), [B03D](#); by pneumatic jigs or tables [B03B](#); by other dry methods [B07](#); magnetic or electrostatic separation of solid materials from solid materials or fluids, separation by high-voltage electric fields [B03C](#); centrifuges, vortex apparatus [B04](#); presses per se for squeezing-out liquid from liquid-containing material [B30B 9/02](#); treatment of water [C02F](#), e.g. softening by ion-exchange [C02F 1/42](#); {arrangements of air intake cleaners in gas turbine plants [F02C 7/05](#)} ; arrangements or mounting of filters in air-conditioning, air-humidification or ventilation [F24F 13/28](#))

**NOTE**

1. This subclass covers:
  - evaporation, distillation, crystallisation, filtration, dust precipitation, gas cleaning, absorption, adsorption;
  - similar processes which are not concerned with, or limited to, separation (except in the case of absorption or adsorption).
2. In this subclass the terms or expressions are used with the meaning indicated:
  - "filtration" and analogous terms include straining solids from fluids;
  - "filter medium" is a porous material or porous arrangement of material used to filter solids from fluids;
  - "filtering element" is a section of filter medium in addition to parts to which the medium is demountably or permanently fixed, including other sections of medium, end caps, peripheral frames or edge strips, but excluding housings;
  - "filter housing" is the fluid-constraining impervious vessel, whether open or closed, which contains, or is adapted to contain, one or more filtering elements or filter media;
  - "filter chamber" is the space within a housing, where filtering elements or filter media are located. Partitions may divide a single housing into a plurality of chambers;
  - "filtering apparatus" consists of filtering elements combined with housings, cleaning arrangements, motor or the like parts, which are characteristic of the particular type of apparatus. Ancillary devices such as pumps or valves are considered part of a filtering apparatus when inside the apparatus. Ancillary devices performing similar or different unit operation such as comminutors, mixers or non-filtering separators, whether or not inside the apparatus, are not considered part of a filtering apparatus. The term does not extend to apparatus, e.g. washing machines, of which the filter forms only a part.
3. For apparatus used in drying or evaporation, [F26](#) takes precedence over [B01D](#).
4. Group [B01D 59/00](#) takes precedence over the other groups of this subclass and over other subclasses in class [B01](#)

**WARNING**

1. The following IPC groups are not used in the CPC scheme. Subject matter covered by these groups is classified in the following groups:



## B01D

(continued)

<a href="#">B01D 19/0454</a>	covered by	<a href="#">B01D 9/00</a>
<a href="#">B01D 15/04</a>	covered by	<a href="#">B01J 39/00</a>
to <a href="#">B01J 49/02</a>		
<a href="#">B01D 17/022</a>	covered by	<a href="#">B01D 17/0202</a>
<a href="#">B01D 17/025</a>	covered by	<a href="#">B01D 17/0208</a>
<a href="#">B01D 17/028</a>	covered by	<a href="#">B01D 17/0211</a>
<a href="#">B01D 17/032</a>	covered by	<a href="#">B01D 17/0214</a>
<a href="#">B01D 17/035</a>	covered by	<a href="#">B01D 17/0205</a>
<a href="#">B01D 17/038</a>	covered by	<a href="#">B01D 17/0217</a>
<a href="#">B01D 17/05</a>	covered by	<a href="#">B01D 17/047</a>
<a href="#">B01D 17/09</a>	covered by	<a href="#">B01D 17/005</a>
<a href="#">B01D 17/12</a>	covered by	<a href="#">B01D 17/00</a>
<a href="#">B01D 25/133</a>	covered by	<a href="#">B01D 25/285</a>
<a href="#">B01D 25/168</a>	covered by	<a href="#">B01D 25/285</a>
<a href="#">B01D 25/21</a>	covered by	<a href="#">B01D 25/164</a>
<a href="#">B01D 29/075</a>	covered by	<a href="#">B01D 29/62,</a>
<a href="#">B01D 29/76</a>		
<a href="#">B01D 29/37</a>	covered by	<a href="#">B01D 29/336,</a>
<a href="#">B01D 29/356</a>		
<a href="#">B01D 33/052</a>	covered by	<a href="#">B01D 33/64</a>
<a href="#">B01D 35/01</a>	covered by	<a href="#">B01D 36/001</a>
<a href="#">B01D 61/26</a>	covered by	<a href="#">A61M 1/1656</a>
<a href="#">B01D 61/34</a>	covered by	<a href="#">A61M 1/16</a>

2. 5. The group [B01D 24/00](#) was introduced in March 1989. This group includes subject matter of [B01D 23/00](#), [B01D 25/06](#), [B01D 25/10](#), [B01D 29/0027](#), [B01D 33/0032](#) and [B01D 33/0054](#).
3. 6. Documents from the backlog of the group [B01D 23/00](#), and the subgroups [B01D 25/06](#), [B01D 25/10](#), [B01D 29/0027](#), [B01D 33/0032](#) and [B01D 33/0054](#) are in the process of being revised and also systematically transferred to [B01D 24/00](#).
4. 7. The groups [B01D 29/01](#) to [B01D 29/43](#) and [B01D 29/50](#) to [B01D 29/965](#) were introduced in March 1989; these subgroups include the subject matter of the subgroups of groups [B01D 29/0002](#), which are from this date no longer use for the classification of new documents.
5. 8. The documents from the backlog of the subgroups of group [B01D 29/0002](#) are in the process of being systematically transferred to the other subgroups of group [B01D 29/00](#).
6. 11. The documents from the backlog of the subgroups of group [B01D 33/0003](#) are in the process of being systematically transferred to the other subgroups of group [B01D 33/00](#).
7. 9. Groups [B01D 25/16](#), [B01D 25/18](#) and [B01D 25/20](#) are no longer used for the classification of new. Patent documents are continuously being reclassified to groups [B01D 29/44](#), [B01D 29/46](#) and [B01D 29/48](#).
8. 10. The groups [B01D 25/04](#), [B01D 25/08](#), [B01D 25/121](#), [B01D 25/122](#), [B01D 25/124](#), [B01D 25/125](#), [B01D 25/14](#), are no longer used for classification of new documents from December 1, 2011 onwards. The backlog of



## B01D

(continued)

those groups are being continuously reclassified to groups [B01D 25/00](#), [B01D 29/00](#) and subgroups.

## B01D 1/00

**Evaporating** ({evaporation in general, e.g. of liquids for gas phase reactions [B01B 1/005](#) ; removal of incrustation [B08B](#); preparation of starch [C08B 30/00](#); sugar industry [C13](#); prevention of incrustation [C23F](#); drying solid materials or objects by evaporating liquids therefrom [F26](#))}

- B01D 1/0005 . {Evaporating devices suitable for floating on water}
- B01D 1/0011 . {Heating features}
- B01D 1/0017 .. {Use of electrical or wave energy ([B01D 1/0029](#) takes precedence)}
- B01D 1/0023 ... {Induction heating}
- B01D 1/0029 .. {Use of radiation}
- B01D 1/0035 ... {Solar energy (for treatment of water [C02F 1/14](#))}
- B01D 1/0041 .. {Use of fluids}
- B01D 1/0047 ... {in a closed circuit ([B01D 3/007](#) takes precedence)}
- B01D 1/0052 ... {Use of a liquid transfer medium or intermediate fluid, e.g. bain-marie}
- B01D 1/0058 .. {Use of waste energy from other processes or sources, e.g. combustion gas (for water treatment [C02F 1/16](#))}
- B01D 1/0064 . {Feeding of liquid into an evaporator}
- B01D 1/007 .. {the liquid feed being split up in at least two streams before entering the evaporator}
- B01D 1/0076 .. {Maintaining the liquid in the evaporator at a constant level}
- B01D 1/0082 . {Regulation; Control}
- B01D 1/0088 . {Cascade evaporators}
- B01D 1/0094 . {with forced circulation}
- B01D 1/02 . Evaporators with heating coils
- B01D 1/04 . Evaporators with horizontal tubes
- B01D 1/06 . Evaporators with vertical tubes
- B01D 1/065 .. {by film evaporating}
- B01D 1/08 .. with short tubes ([B01D 1/12](#) {[B01D 1/065](#)} take precedence)
- B01D 1/10 .. with long tubes, e.g. Kestner evaporators ([B01D 1/12](#) {[B01D 1/065](#)} take precedence)
- B01D 1/12 .. and forced circulation
- B01D 1/14 . with heated gases or vapours {or liquids} in contact with the liquid
- B01D 1/16 . by spraying ([B01D 1/22](#) takes precedence)
- B01D 1/18 .. to obtain dry solids ([B01D 1/24](#) takes precedence)
- B01D 1/20 .. Sprayers (in general [B05B](#))
- B01D 1/22 . by bringing a thin layer of the liquid into contact with a heated surface {([B01D 1/065](#) takes precedence)}
- B01D 1/221 .. {Composite plate evaporators}
- B01D 1/222 .. {In rotating vessels; vessels with movable parts}
- B01D 1/223 ... {containing a rotor}



B01D 1/225	....	{with blades or scrapers}
B01D 1/226	.....	{in the form of a screw or with helical blade members}
B01D 1/227	....	{with brushes}
B01D 1/228	...	{horizontally placed cylindrical container or drum ( <a href="#">B01D 1/223</a> takes precedence)}
B01D 1/24	..	to obtain dry solids
B01D 1/26	.	Multiple-effect evaporating
B01D 1/28	.	with vapour compression
B01D 1/2803	..	{Special features relating to the vapour to be compressed}
B01D 1/2806	...	{The vapour is divided in at least two streams and only a part of the vapour is compressed}
B01D 1/2809	....	{At least two streams are compressed}
B01D 1/2812	...	{The vapour is coming from different sources}
B01D 1/2815	....	{At least one source is a compressor}
B01D 1/2818	...	{Cleaning of the vapour before compression, e.g. demisters, washing of the vapour}
B01D 1/2821	...	{B2+B2B}
B01D 1/2825	...	{B2+B4}
B01D 1/2828	...	{B2+B4B}
B01D 1/2831	...	{B2B+B4}
B01D 1/2834	...	{B2B+B4B}
B01D 1/2837	...	{B4+B4B}
B01D 1/284	..	{Special features relating to the compressed vapour}
B01D 1/2843	...	{The compressed vapour is divided in at least two streams}
B01D 1/2846	...	{The compressed vapour is not directed to the same apparatus from which the vapour was taken off}
B01D 1/285	...	{In combination with vapour from an other source}
B01D 1/2853	.....	{At least one of the other sources is a compressor, ejector}
B01D 1/2856	...	{The compressed vapour is used for heating a reboiler or a heat exchanger outside an evaporator}
B01D 1/2859	...	{D2+D4}

**NOTE**

Documents are only classified in [B01D 1/2843](#) when at least one stream is directed to the same apparatus from which the vapour was taken off

B01D 1/2862	...	{D2+D4+D6}
B01D 1/2865	...	{D2+D4+D6B}
B01D 1/2868	...	{D2+D6}
B01D 1/2871	...	{D2+D6B}
B01D 1/2875	...	{D4+D6}
B01D 1/2878	...	{D4+D6B}



- B01D 1/2881 . . {Compression specifications (e.g. pressure, temperature, processes)}
- B01D 1/2884 . . {Multiple effect compression ([B01D 1/2815](#), [B01D 1/2828](#), [B01D 1/2834](#) and [B01D 1/2837](#) take precedence)}
- B01D 1/2887 . . {The compressor is integrated in the evaporation apparatus}
- B01D 1/289 . . {Compressor features (e.g. constructions, details, cooling, lubrication, driving systems)}
- B01D 1/2893 . . . {Driving systems}
- B01D 1/2896 . . {Control, regulation}
- B01D 1/30 . Accessories for evaporators; {Constructional details thereof}
- B01D 1/305 . . {Demister (vapour-liquid separation)}
  
- B01D 3/00** **Distillation or related exchange processes in which liquids are contacted with gaseous media, e.g. stripping** ({evaporation in general, e.g. of liquids for gas phase reactions [B01B 1/005](#) ; gas chromatography [B01D 15/08](#); destructive distillation [C10B](#); preparation of alcoholic beverages by distillation [C12G 3/12](#))
- B01D 3/001 . {Processes specially adapted for distillation or rectification of fermented solutions}
- B01D 3/002 . . {by continuous methods}
- B01D 3/003 . . {Rectification of spirit}
- B01D 3/004 . . . {by continuous methods}
- B01D 3/005 . . . . {Combined distillation and rectification}
- B01D 3/006 . {by vibration}
- B01D 3/007 . {Energy recuperation; Heat pumps}
- B01D 3/008 . {Liquid distribution}
- B01D 3/009 . {in combination with chemical reactions}
- B01D 3/02 . in boilers or stills
- B01D 3/04 . pipe stills
- B01D 3/06 . Flash distillation
- B01D 3/065 . . {Multiple-effect flash distillation (more than two traps)}
- B01D 3/08 . in rotating vessels; Atomisation on rotating discs ({[B01D 1/222](#) , [B01D 3/10](#) take precedence)}
- B01D 3/085 . . {using a rotary evaporator}
- B01D 3/10 . Vacuum distillation ([B01D 3/12](#) takes precedence)
- B01D 3/101 . . {Recirculation of the fluid used as fluid working medium in a vacuum creating device}
- B01D 3/103 . . {by using a barometric column}
- B01D 3/105 . . {with the use of an ejector for creating the vacuum, the ejector being placed between evaporator or distillation devices}
- B01D 3/106 . . {with the use of a pump for creating vacuum and for removing the distillate}
- B01D 3/108 . . {using a vacuum lock for removing the concentrate during distillation}
- B01D 3/12 . Molecular distillation
- B01D 3/14 . Fractional distillation {or use of a fractionation or rectification column}
- B01D 3/141 . . {where at least one distillation column contains at least one dividing wall}
- B01D 3/143 . . {by two or more of a fractionation, separation or rectification step}



- B01D 3/145 . . . {One step being separation by permeation}
- B01D 3/146 . . . {Multiple effect distillation}
- B01D 3/148 . . . {in combination with at least one evaporator}
- B01D 3/16 .. Fractionating columns in which vapour bubbles through liquid ([packing elements B01J 19/30](#), [B01J 19/32](#))
- B01D 3/163 . . . {Plates with valves}
- B01D 3/166 . . . {Heating and/or cooling of plates}
- B01D 3/18 . . . with horizontal bubble plates
- B01D 3/20 . . . . Bubble caps; Risers for vapour; Discharge pipes for liquid
- B01D 3/205 . . . . . {Bubble caps}
- B01D 3/22 . . . with horizontal sieve plates or grids; Construction of sieve plates or grids
- B01D 3/225 . . . . {Dual-flow sieve trays}
- B01D 3/24 . . . with sloping plates or elements mounted stepwise
- B01D 3/26 .. Fractionating columns in which vapour and liquid flow past each other, or in which the fluid is sprayed into the vapour, or in which a two-phase mixture is passed in one direction
- B01D 3/28 . . . Fractionating columns with surface contact and vertical guides, e.g. film action
- B01D 3/30 .. Fractionating columns with movable parts or in which centrifugal movement is caused
- B01D 3/32 .. Other features of fractionating columns; {Constructional details of fractionating columns not provided for in groups [B01D 3/16](#) to [B01D 3/30](#)}
- B01D 3/322 . . . {Reboiler specifications}
- B01D 3/324 . . . {Tray constructions}
- B01D 3/326 . . . . {Tray supports}
- B01D 3/328 . . . . {Sealing between the column and the trays}
- B01D 3/34 . with one or more auxiliary substances
- B01D 3/343 .. {the substance being a gas}
- B01D 3/346 . . . {the gas being used for removing vapours, e.g. transport gas}
- B01D 3/36 .. Azeotropic distillation
- B01D 3/38 .. Steam distillation
- B01D 3/40 .. Extractive distillation
- B01D 3/42 . Regulation; Control
- B01D 3/4205 .. {Reflux ratio control splitter}
- B01D 3/4211 .. {of columns}
- B01D 3/4216 . . . {Head stream}
- B01D 3/4222 . . . {Head- and side stream}
- B01D 3/4227 . . . {Head- and bottom stream}
- B01D 3/4233 . . . {Head- and feed stream}
- B01D 3/4238 . . . {Head-, side- and bottom stream}
- B01D 3/4244 . . . {Head-, side- and feed stream}
- B01D 3/425 . . . {Head-, bottom- and feed stream}



B01D 3/4255	...	{Head-, side-, bottom- and feed stream}
B01D 3/4261	...	{Side stream}
B01D 3/4266	...	{Side- and bottom stream}
B01D 3/4272	...	{Side- and feed stream}
B01D 3/4277	...	{Side-, bottom- and feed stream}
B01D 3/4283	...	{Bottom stream}
B01D 3/4288	...	{Bottom- and feed stream}
B01D 3/4294	...	{Feed stream}

**B01D 5/00****Condensation of vapours; Recovering volatile solvents by condensation**(B01D 8/00 takes precedence; condensers F28B)

B01D 5/0003	.	{by using heat-exchange surfaces for indirect contact between gases or vapours and the cooling medium}
B01D 5/0006	..	{Coils or serpentines}
B01D 5/0009	..	{Horizontal tubes}
B01D 5/0012	..	{Vertical tubes}
B01D 5/0015	..	{Plates}
B01D 5/0018	..	{Dome shaped <u>(B01D 5/0066 takes precedence)</u> }
B01D 5/0021	..	{Vortex}
B01D 5/0024	..	{Rotating vessels or vessels containing movable parts}
B01D 5/0027	.	{by direct contact between vapours or gases and the cooling medium}
B01D 5/003	..	{within column(s)}
B01D 5/0033	.	{Other features}
B01D 5/0036	..	{Multiple-effect condensation; Fractional condensation}
B01D 5/0039	..	{Recuperation of heat, e.g. use of heat pump(s), compression}
B01D 5/0042	..	{Thermo-electric condensing; using Peltier-effect}
B01D 5/0045	..	{Vacuum condensation}
B01D 5/0048	..	{Barometric condensation}
B01D 5/0051	..	{Regulation processes; Control systems e.g. valves}
B01D 5/0054	..	{General arrangements, e.g. flow sheets}
B01D 5/0057	.	{in combination with other processes}
B01D 5/006	..	{with evaporation or distillation}
B01D 5/0063	...	{Reflux condensation}
B01D 5/0066	...	{Dome shaped condensation}
B01D 5/0069	..	{with degasification or deaeration}
B01D 5/0072	..	{with filtration}
B01D 5/0075	..	{with heat exchanging <u>(B01D 5/0039 takes precedence)</u> }
B01D 5/0078	.	{characterised by auxiliary systems or arrangements}
B01D 5/0081	..	{Feeding the steam or the vapours}
B01D 5/0084	..	{Feeding or collecting the cooling medium <u>(B01D 5/0087 takes precedence)</u> }
B01D 5/0087	..	{Recirculating of the cooling medium}



B01D 5/009	. . {Collecting, removing and/or treatment of the condensate}
B01D 5/0093	. . {Removing and treatment of non condensable gases}
B01D 5/0096	. . {Cleaning (cleaning in general <a href="#">B08B</a> )}
<b>B01D 7/00</b>	<b>Sublimation</b> ( <a href="#">B01D 8/00</a> takes precedence; freeze-drying <a href="#">F26</a> )
B01D 7/02	. Crystallisation directly from the vapour phase (into single crystals <a href="#">C30B 23/00</a> )
<b>B01D 8/00</b>	<b>Cold traps; Cold baffles</b> (pumps for evacuating by condensing or freezing <a href="#">F04B 37/08</a> )
<b>B01D 9/00</b>	<b>Crystallisation</b> (crystallisation directly from the vapour phase <a href="#">B01D 7/02</a> ; making single crystals <a href="#">C30B</a> ; {crystallisation as part of the Bayer process also classified in <a href="#">C01F 7/14</a> })
B01D 9/0004	. {cooling by heat exchange (by evaporation of components of the mixture to be separated <a href="#">B01D 9/0013</a> ; refrigeration machines <a href="#">F25B</a> )}
B01D 9/0009	. . {by direct heat exchange with added cooling fluid}
B01D 9/0013	. . {by indirect heat exchange}
B01D 9/0018	. {Evaporation of components of the mixture to be separated}
B01D 9/0022	. . {by reducing pressure}
B01D 9/0027	. . {by means of conveying fluid, e.g. spray-crystallisation (spray-drying <a href="#">F26B</a> )}
B01D 9/0031	. . {by heating ( <a href="#">B01D 9/0022</a> , <a href="#">B01D 9/0027</a> take precedence)}
B01D 9/0036	. {Crystallisation on to a bed of product crystals; Seeding}
B01D 9/004	. {Fractional crystallisation; Fractionating or rectifying columns}
B01D 9/0045	. . {Washing of crystals, e.g. in wash columns}
B01D 9/005	. {Selection of auxiliary, e.g. for control of crystallisation nuclei, of crystal growth, of adherence to walls; Arrangements for introduction thereof}
B01D 9/0054	. . {Use of anti-solvent}
B01D 9/0059	. {General arrangements of crystallisation plant, e.g. flow sheets}
B01D 9/0063	. {Control or regulation (control per se <a href="#">G05</a> )}
B01D 9/0068	. {Prevention of crystallisation}
B01D 9/0072	. {Crystallisation in microfluidic devices}
B01D 9/0077	. {Screening for crystallisation conditions or for crystal forms}
B01D 9/0081	. {Use of vibrations, e.g. ultrasound}
B01D 2009/0086	. {Processes or apparatus therefor}
B01D 2009/009	. . {Separation of organic compounds by selective or extractive crystallisation with the aid of auxiliary substances forming complex or molecular compounds, e.g. with ureum, thiouream or metal salts}
B01D 2009/0095	. . . {with the aid of other complex forming substances than ureum, thiouream or metal salts}
B01D 9/02	. from solutions {not used}
B01D 9/04	. . concentrating solutions by removing frozen solvent therefrom
<b>B01D 11/00</b>	<b>Solvent extraction</b>
B01D 2011/002	. {Counter-current extraction}



- B01D 2011/005 . {Co-current extraction}
- B01D 2011/007 . {Extraction using a solvent in the gas phase}
- B01D 11/02 . of solids

**NOTE**

Combinations of characteristics of individual groups, e.g. [B01D 11/0226](#) and [B01D 11/028](#) are expressed as [B01D 11/0226](#) + [B01D 11/028](#)

- B01D 11/0203 .. {with a supercritical fluid}
- B01D 11/0207 .. {Control systems}
- B01D 11/0211 .. {in combination with an electric or magnetic field}
- B01D 11/0215 .. {Solid material in other stationary receptacles}
- B01D 11/0219 ... {Fixed bed of solid material}
- B01D 11/0223 ... {Moving bed of solid material ([see also B01D 11/0261](#))}
- B01D 11/0226 .... {with the general transport direction of the solids parallel to the rotation axis of the conveyer, e.g. worm}
- B01D 11/023 .... {using moving bands, trays fixed on moving transport chains}
- B01D 11/0234 .... {using other slow rotating arms or elements, whereby the general transport direction of the solids is not parallel to the rotation axis, e.g. perpendicular ([B01D 11/0238](#) takes precedence)}
- B01D 11/0238 .... {on fixed or rotating flat surfaces, e.g. tables combined with rotating elements or on rotating flat surfaces}
- B01D 11/0242 .... {in towers, e.g. comprising contacting elements}
- B01D 11/0246 ..... {comprising rotating means}
- B01D 11/0249 ..... {comprising jet means}
- B01D 11/0253 ... {Fluidised bed of solid materials}
- B01D 11/0257 .... {using mixing mechanisms, e.g. stirrers, jets ([B01D 11/0242](#) takes precedence)}
- B01D 11/0261 .. {comprising vibrating mechanisms, e.g. mechanical, acoustical}
- B01D 11/0265 ... {Applying ultrasound}
- B01D 11/0269 .. {Solid material in other moving receptacles ([B01D 11/0238](#) takes precedence)}
- B01D 11/0273 ... {in rotating drums}
- B01D 11/0276 .... {with the general transport direction of the solids parallel to the rotation axis of the conveyer, e.g. spirals}
- B01D 11/028 .. {Flow sheets}
- B01D 11/0284 ... {Multistage extraction}
- B01D 11/0288 .. {Applications, solvents}
- B01D 11/0292 .. {Treatment of the solvent}
- B01D 11/0296 ... {Condensation of solvent vapours ([condensation in general B01D 5/00](#))}
- B01D 11/04 . of solutions which are liquid
- B01D 11/0403 .. {with a supercritical fluid}
- B01D 11/0407 ... {the supercritical fluid acting as solvent for the solute}



- B01D 11/0411 . . . {the supercritical fluid acting as solvent for the solvent and as anti-solvent for the solute, e.g. formation of particles from solutions}
- B01D 11/0415 . . {in combination with membranes}
- B01D 11/0419 . . {in combination with an electric or magnetic field or with vibrations}
- B01D 11/0423 . . . {Applying ultrasound}
- B01D 11/0426 . . {Counter-current multistage extraction towers in a vertical or sloping position}
- B01D 11/043 . . . {with stationary contacting elements, sieve plates or loose contacting elements}
- B01D 11/0434 . . . {comprising rotating mechanisms, e.g. mixers, rotational oscillating motion, mixing pumps}
- B01D 11/0438 . . . {comprising vibrating mechanisms, electromagnetic radiations}
- B01D 11/0442 . . . {Mixers with gas-agitation}
- B01D 11/0446 . . {Juxtaposition of mixers-settlers}
- B01D 11/0449 . . . {with stationary contacting elements}
- B01D 11/0453 . . . {with narrow passages limited by plates, walls, e.g. helically coiled tubes [\(B01D 11/0461 takes precedence\)](#)}
- B01D 11/0457 . . . {comprising rotating mechanisms, e.g. mixers, mixing pumps}
- B01D 11/0461 . . . {mixing by counter-current streams provoked by centrifugal force}
- B01D 11/0465 . . . {comprising vibrating mechanisms, radiations}
- B01D 11/0469 . . . {with gas agitation}
- B01D 11/0473 . . . {Jet mixers, venturi mixers}
- B01D 11/0476 . . {Moving receptacles, e.g. rotating receptacles}
- B01D 11/048 . . . {Mixing by counter-current streams provoked by centrifugal force, in rotating coils or in other rotating spaces}
- B01D 11/0484 . . {Controlling means}
- B01D 11/0488 . . {Flow sheets}
- B01D 11/0492 . . {Applications, solvents used}
- B01D 11/0496 . . {by extraction in microfluidic devices}

**B01D 12/00** **Displacing liquid, e.g. from wet solids or from dispersions of liquids or from solids in liquids, by means of another liquid**

**WARNING**

Attention is drawn to WARNING (6) following the subclass title

**B01D 15/00** **Separating processes involving the treatment of liquids with solid sorbents** (using liquid sorbents [B01D 11/00](#); ion exchange processes or materials, sorbent materials in general [B01J](#), e.g. sorbents for chromatography [B01J 20/281](#); for investigating or analysing materials [G01N 30/00](#)); **Apparatus therefor**

- B01D 15/02 . with moving adsorbents
- B01D 15/08 . Selective adsorption, e.g. chromatography

**NOTE**



## B01D 15/08

(continued)

In order that group [B01D 15/08](#) may provide a basis for a complete search with respect to chromatography in general, all subject matter of general interest is classified in this group even if it is classified primarily in the application-oriented groups, for example dairy products [A23C 9/148](#), treatment of blood, e.g. [A61M 1/36](#), optically active organic compounds [C07B 57/00](#) or peptides [C07K 1/16](#)

- B01D 15/10      ..      characterised by constructional or operational features
- B01D 15/12      ...      relating to the preparation of the feed
- B01D 15/125      ....      {Pre-filtration}
- B01D 15/14      ...      relating to the introduction of the feed to the apparatus
- B01D 15/16      ...      relating to the conditioning of the fluid carrier
- B01D 15/161      ....      {Temperature conditioning}
- B01D 15/163      ....      {Pressure or speed conditioning}
- B01D 15/165      .....      {Flash chromatography}
- B01D 15/166      ....      {Fluid composition conditioning, e.g. gradient}
- B01D 15/168      .....      {pH gradient, chromatofocusing, i.e. separation according to the isoelectric point pI}
- B01D 15/18      ...      relating to flow patterns
- B01D 15/1807      ....      {using counter-currents, e.g. fluidised beds}
- B01D 15/1814      ....      {recycling of the fraction to be distributed}
- B01D 15/1821      .....      {Simulated moving beds}
- B01D 15/1828      .....      {characterized by process features}
- B01D 15/1835      .....      {Flushing}
- B01D 15/1842      .....      {characterized by apparatus features}
- B01D 15/185      .....      {characterized by the components to be separated}
- B01D 15/1857      .....      {Reactive simulated moving beds}
- B01D 15/1864      ....      {using two or more columns}
- B01D 15/1871      .....      {placed in series}
- B01D 15/1878      .....      {for multi-dimensional chromatography}
- B01D 15/1885      .....      {placed in parallel}
- B01D 15/1892      ....      {the sorbent material moving as a whole, e.g. continuous annular chromatography, true moving beds}
- B01D 15/20      ...      relating to the conditioning of the sorbent material
- B01D 15/203      ....      {Equilibration or regeneration}
- B01D 15/206      ....      {Packing or coating}
- B01D 15/22      ...      relating to the construction of the column
- B01D 15/24      ...      relating to the treatment of the fractions to be distributed
- B01D 15/242      ....      {Intermediate storage of effluents}
- B01D 15/245      ....      {Adding materials to the effluents}
- B01D 15/247      ....      {Fraction collectors}
- B01D 15/26      ..      characterised by the separation mechanism



B01D 15/265	...	{Adsorption chromatography}
B01D 15/30	...	Partition chromatography
B01D 15/305	....	{Hydrophilic interaction chromatography [HILIC]}
B01D 15/32	...	Bonded phase chromatography
B01D 15/322	....	{Normal bonded phase}
B01D 15/325	....	{Reversed phase}
B01D 15/327	.....	{with hydrophobic interaction}
B01D 15/34	...	Size selective separation, e.g. size exclusion chromatography, gel filtration, permeation
B01D 15/345	....	{Perfusive chromatography}
B01D 15/36	...	involving ionic interaction
B01D 15/361	....	{Ion-exchange}
B01D 15/362	.....	{Cation-exchange}
B01D 15/363	.....	{Anion-exchange}
B01D 15/364	.....	{Amphoteric or zwitterionic ion-exchanger}
B01D 15/365	....	{Ion-exclusion}
B01D 15/366	....	{Ion-pair, e.g. ion-pair reversed phase}
B01D 15/367	....	{Ion-suppression}
B01D 15/368	....	{Cation- pi interaction}
B01D 15/38	...	involving specific interaction not covered by one or more of groups <a href="#">B01D 15/265</a> to <a href="#">B01D 15/36</a>
B01D 15/3804	....	{Affinity chromatography}
B01D 15/3809	.....	{of the antigen-antibody type, e.g. protein A, G, L chromatography}
B01D 15/3814	.....	{of the substrate or co-factor - enzyme type}
B01D 15/3819	.....	{of the nucleic acid-nucleic acid binding protein type}
B01D 15/3823	.....	{of other types, e.g. avidin, streptavidin, biotin}
B01D 15/3828	.....	{Ligand exchange chromatography, e.g. complexation, chelation or metal interaction chromatography}
B01D 15/3833	....	{Chiral chromatography}
B01D 2015/3838	....	{Ligand exchange chromatography, e.g. complexation chromatography, chelation chromatography, metal interaction chromatography}
B01D 15/3842	....	{Micellar chromatography}
B01D 15/3847	....	{Multimodal interactions}
B01D 15/3852	....	{using imprinted phases or molecular recognition; using imprinted phases}
B01D 15/3857	....	{Reaction chromatography}
B01D 15/3861	....	{using an external stimulus}
B01D 15/3866	.....	{using ultra-sound}
B01D 15/3871	.....	{using light}
B01D 15/3876	.....	{modifying the temperature}
B01D 15/388	.....	{modifying the pH}
B01D 15/3885	.....	{Using electrical or magnetic means}



B01D 2015/389	....	{using ultra-sound}
B01D 2015/3895	....	{using light}
B01D 15/40	...	using supercritical fluid as mobile phase or eluent
B01D 15/42	..	characterised by the development mode, e.g. by displacement or by elution
B01D 15/422	...	{Displacement mode}
B01D 15/424	...	{Elution mode}
B01D 15/426	....	{Specific type of solvent}
B01D 15/428	...	{Frontal mode}

**B01D 17/00****Separation of liquids, not provided for elsewhere, e.g. by thermal diffusion**

(devices for separating or removing fatty or oily substances or similar floating material from water, waste water, or sewage [C02F 1/40](#); cleaning or keeping clear the surface of open water from oil or like materials [E02B 15/04](#); arrangements for separating lubricants from refrigerants [F25B 43/02](#))

**NOTE**

in this group, documents are classified and arranged according to a combination system limited to the symbols of the group and subgroups of [B01D 17/00](#). In this system each combination is indicated, also of subgroups depending from the same group, e.g. [B01D 17/041](#) + [B01D 17/042](#)

B01D 17/005	.	{by thermal diffusion}
B01D 17/02	.	Separation of non-miscible liquids
B01D 17/0202	..	{by ab- or adsorption}
B01D 17/0205	..	{by gas bubbles or moving solids}
B01D 17/0208	..	{by sedimentation}
B01D 17/0211	...	{with baffles}
B01D 17/0214	...	{with removal of one of the phases}
B01D 17/0217	..	{by centrifugal force}
B01D 17/04	..	Breaking emulsions
B01D 17/041	...	{with moving devices}
B01D 17/042	...	{by changing the temperature}
B01D 17/044	...	{by changing the pressure}
B01D 17/045	...	{with coalescers}
B01D 17/047	...	{with separation aids}
B01D 17/048	...	{by changing the state of aggregation}
B01D 17/06	.	Separation of liquids from each other by electricity
B01D 17/08	.	Thickening liquid suspensions by filtration
B01D 17/085	..	{with membranes}
B01D 17/10	..	with stationary filtering elements



B01D 17/12

- Auxiliary equipment particularly adapted for use with liquid-separating apparatus, e.g. control circuits

**WARNING**

This group is not complete pending reclassification; see also group [B01D 17/00](#)

**B01D 19/00****Degasification of liquids**

B01D 19/0005

- {with one or more auxiliary substances}

B01D 19/001

- .. {by bubbling steam through the liquid ([B01D 19/0042](#), [B01D 19/0047](#) and [B01D 19/0052](#) take precedence)}

B01D 19/0015

- ... {in contact columns containing plates, grids or other filling elements}

B01D 19/0021

- {by bringing the liquid in a thin layer}

B01D 19/0026

- .. {in rotating vessels or in vessels containing movable parts}

B01D 19/0031

- {by filtration}

B01D 19/0036

- {Flash degasification ([the other groups take precedence](#))}

B01D 19/0042

- {modifying the liquid flow ([B01D 19/0021](#) takes precedence)}

B01D 19/0047

- .. {Atomizing, spraying, trickling}

B01D 19/0052

- .. {in rotating vessels, vessels containing movable parts or in which centrifugal movement is caused ([B01D 19/0026](#) takes precedence)}

B01D 19/0057

- ... {the centrifugal movement being caused by a vortex, e.g. using a cyclone, or by a tangential inlet}

B01D 19/0063

- {Regulation, control including valves and floats ([for construction and details of valves F16K](#))}

B01D 19/0068

- {General arrangements, e.g. flowsheets ([B01D 19/0063](#) takes precedence)}

B01D 19/0073

- {by a method not covered by groups [B01D 19/0005](#) to [B01D 19/0042](#)}

B01D 19/0078

- .. {by vibration}

B01D 19/0084

- .. {using an electric current}

B01D 19/0089

- .. {using a magnetic field ([magnetic separation in general B03C 1/00](#))}

B01D 19/0094

- .. {by using a vortex, cavitation}

B01D 19/02

- Foam dispersion or prevention ([during boiling B01B 1/02](#); [during fermentation C12](#))

B01D 19/04

- .. by addition of chemical substances

**NOTE**

1. Antifoam compositions containing a specific compound as the main substance are only classified in the, for this specific compound, corresponding [B01D 19/0404](#) subgroup (e.g. polysiloxanes receive the classification [B01D 19/0409](#)); when the specific compound(s) is (are) not the main substance, then the attributed classification for this compound(s) is a combination of [B01D 19/0404](#) + the corresponding [B01D 19/0404](#) subgroup(s), (e.g. hydrocarbons containing silica are classified in [B01D 19/0404](#) + [B01D 19/0409](#)).

If the main substance is a mixture containing more than one specific compound, then the attributed classification is a combination of the corresponding [B01D 19/0404](#) subgroup of the specific compounds, (e.g.



B01D 19/04

(continued)

benzene sulfonate and an amide are classified in [B01D 19/0413](#) + [B01D 9/02](#) ).

2. In groups [B01D 19/0404](#) to [B01D 19/0495](#), in the absence of an indication to the contrary, an invention is classified in the last appropriate place].

B01D 19/0404	...	{characterised by the nature of the chemical substance}
B01D 19/0409	....	{compounds containing Si-atoms}
B01D 19/0413	....	{compounds containing N-atoms}
B01D 19/0418	....	{compounds containing P-atoms}
B01D 19/0422	....	{compounds containing S-atoms}
B01D 19/0427	....	{compounds containing halogen-atoms}
B01D 19/0431	....	{containing aromatic rings}
B01D 19/0436	.....	{with substituted groups}
B01D 19/044	.....	{which contain Si-atoms}
B01D 19/0445	.....	{which contain N-atoms}
B01D 19/045	.....	{which contain P-atoms}
B01D 19/0454	.....	{which contain S-atoms}
B01D 19/0459	.....	{which contain halogen-atoms}
B01D 19/0463	....	{containing rings other than aromatic rings}
B01D 19/0468	.....	{with substituted groups}
B01D 19/0472	.....	{which contain Si-atoms}
B01D 19/0477	.....	{which contain N-atoms}
B01D 19/0481	.....	{which contain P-atoms}
B01D 19/0486	.....	{which contain S-atoms}
B01D 19/049	.....	{which contain halogen-atoms}
B01D 19/0495	....	{containing hetero rings}

**B01D 21/00****Separation of suspended solid particles from liquids by sedimentation**

{separation of ores or the like by sedimentation [B03B 5/48](#) to [B03B 5/60](#)} ; differential sedimentation [B03D 3/00](#); {purification of water, waste water, sewage or sludge [C02F](#), e.g.} devices for separating or removing fatty or oily substances or similar floating material from water, waste water or sewage [C02F 1/40](#))

**WARNING**

The following groups are not complete: [B01D 21/0006](#), see also [B01D 21/00](#)[B01D 21/0018](#), see also [B01D 21/00](#)[B01D 21/0054](#), see also [B01D 21/00](#)[B01D 21/0057](#), see also [B01D 21/00](#)[B01D 21/003](#), see also [B01D 21/00](#)[B01D 21/0036](#), see also [B01D 21/00](#)[B01D 21/0087](#), see also [B01D 21/00](#)[B01D 21/2416](#), see also [B01D 21/2405](#)[B01D 21/2422](#), see also [B01D 21/2405](#)[B01D 21/2427](#), see also [B01D 21/24](#)[B01D 21/2433](#), see also [B01D 21/24](#)[B01D 21/262](#), see also [B01D 21/26](#)[B01D 21/265](#), see also [B01D 21/26](#)[B01D 21/267](#), see also [B01D 21/26](#)[B01D 21/28](#), see also [B01D 21/28](#)[B01D 21/302](#), see also [B01D 21/30](#)[B01D21/30B](#), see also [B01D 21/30](#) ]



- B01D 21/0003 . {Making of sedimentation devices, structural details thereof, e.g. prefabricated parts}
- B01D 21/0006 . {Settling tanks provided with means for cleaning and maintenance}
- B01D 21/0009 . {Settling tanks making use of electricity or magnetism (electric ultra filters [B01D 61/425](#); filters making use of electricity or magnetism [B01D 35/06](#); magnetic or electrostatic separation [B03C](#))}
- B01D 21/0012 . {Settling tanks making use of filters, e.g. by floating layers of particulate material}
- B01D 21/0015 . {Controlling the inclination of settling devices}
- B01D 21/0018 . {provided with a pump mounted in or on a settling tank}
- B01D 21/0021 . . {provided with a jet pump}
- B01D 21/0024 . {Inlets or outlets provided with regulating devices, e.g. valves, flaps ([B01D 21/24](#) takes precedence)}
- B01D 21/0027 . {Floating sedimentation devices}
- B01D 21/003 . {Sedimentation tanks provided with a plurality of compartments separated by a partition wall ([B01D 21/0039](#) takes precedence)}
- B01D 21/0033 . . {Vertical, perforated partition walls ([B01D 21/2422](#) takes precedence)}
- B01D 21/0036 . . {Horizontal partition walls}
- B01D 21/0039 . {Settling tanks provided with contact surfaces, e.g. baffles, particles}
- B01D 21/0042 . . {Baffles or guide plates}
- B01D 21/0045 . . {Plurality of essentially parallel plates}
- B01D 21/0048 . . {Plurality of plates inclined in alternating directions}
- B01D 21/0051 . . {Plurality of tube like channels}
- B01D 21/0054 . . {Plates in form of a coil}
- B01D 21/0057 . . {with counter-current flow direction of liquid and solid particles}
- B01D 21/006 . . {with co-current flow direction of liquid and solid particles}
- B01D 21/0063 . . {with cross-flow flow direction of liquid and solid particles}
- B01D 21/0066 . . {with a meandering flow pattern of liquid or solid particles}
- B01D 21/0069 . . {Making of contact surfaces, structural details, materials therefor}
- B01D 21/0072 . . . {Means for adjusting, moving or controlling the position or inclination of the contact surfaces e.g. for optimising the particle-liquid separation, for removing the settled particles, for preventing fouling}
- B01D 21/0075 . . . {Contact surfaces having surface features}
- B01D 2021/0078 . {Settling tanks provided with contact surfaces, e.g. baffles, particles}
- B01D 2021/0081 . {Settling tanks provided with vibrators}
- B01D 21/0084 . {Enhancing liquid-particle separation using the flotation principle ([flotation in general B03D 1/00](#))}
- B01D 21/0087 . {Settling tanks provided with means for ensuring a special flow pattern, e.g. even inflow or outflow ([B01D 21/2411](#) takes precedence)}
- B01D 21/009 . {Heating or cooling mechanisms specially adapted for settling tanks}
- B01D 21/0093 . {Mechanisms for taking out of action one or more units of a multi-unit settling mechanism}
- B01D 21/0096 . {Safety mechanisms specially adapted for settling tanks ([B01D 21/22](#) takes precedence)}



- B01D 21/01 . using flocculating agents (for purifying water [C02F 1/52](#); for liquid radioactive waste [G21F 9/10](#))
- B01D 21/02 . Settling tanks {with single outlets for the separated liquid}
- B01D 21/04 . . with moving scrapers
- B01D 21/06 . . . with rotating scrapers
- B01D 21/08 . . provided with flocculating compartments
- B01D 21/10 . Settling tanks with multiple outlets for the separated liquids
- B01D 21/12 . . with moving scrapers
- B01D 21/14 . . . with rotating scrapers
- B01D 21/16 . . provided with flocculating compartments
- B01D 21/18 . Construction of the scrapers or the driving mechanisms for settling tanks
- B01D 21/183 . . {with multiple scraping mechanisms}
- B01D 21/186 . . {with two or more scrapers fixed at different heights on a central rotating shaft}
- B01D 21/20 . . Driving mechanisms
- B01D 21/22 . . Safety mechanisms
- B01D 21/24 . Feed or discharge mechanisms for settling tanks
- B01D 21/2405 . . {Feed mechanisms for settling tanks}
- B01D 21/2411 . . . {having a tangential inlet}
- B01D 21/2416 . . . {Liquid distributors with a plurality of feed points}
- B01D 21/2422 . . . . {Vertically arranged feed points}
- B01D 21/2427 . . {The feed or discharge opening located at a distant position from the side walls}
- B01D 21/2433 . . {Discharge mechanisms for floating particles}
- B01D 21/2438 . . . {provided with scrapers on the liquid surface for removing floating particles}
- B01D 21/2444 . . {Discharge mechanisms for the classified liquid}
- B01D 21/245 . . {Discharge mechanisms for the sediments}
- B01D 21/2455 . . . {Conveyer belts}
- B01D 21/2461 . . . {Positive-displacement pumps; Screw feeders; Trough conveyers}
- B01D 21/2466 . . . {Mammoth pumps, e.g. air lift pumps}
- B01D 21/2472 . . . {Means for fluidising the sediments, e.g. by jets or mechanical agitators}
- B01D 21/2477 . . . {Centrifugal pumps}
- B01D 21/2483 . . . {Means or provisions for manually removing the sediments}
- B01D 21/2488 . . {bringing about a partial recirculation of the liquid, e.g. for introducing chemical aids}
- B01D 21/2494 . . {provided with means for the removal of gas, e.g. noxious gas, air}
- B01D 21/26 . Separation of sediment aided by centrifugal force {or centripetal force} (centrifuges [B04B](#); cyclones [B04C](#))
- B01D 21/262 . . {by using a centrifuge}
- B01D 21/265 . . {by using a vortex inducer or vortex guide, e.g. coil ([B01D 21/0054](#) takes precedence)}
- B01D 21/267 . . {by using a cyclone}



- B01D 21/28 . Mechanical auxiliary equipment for acceleration of sedimentation, e.g. by vibrators or the like
- B01D 21/283 . . {Settling tanks provided with vibrators}
- B01D 21/286 . . {Means for gentle agitation for enhancing flocculation}
- B01D 21/30 . Control equipment

### **WARNING**

Groups [B01D 21/302](#) to [B01D 21/34](#) are not complete, see also [B01D 21/30](#)

- B01D 21/302 . . {Active control mechanisms with external energy e.g. with solenoid valve}
- B01D 21/305 . . {Control of chemical properties of a component, e.g. control of pH}
- B01D 21/307 . . {Passive control mechanisms without external energy, e.g. using a float}
- B01D 21/32 . . Density control of clear liquid or sediment, e.g. optical control; {Control of physical properties}
- B01D 21/34 . . Regulation of feed distribution; Regulation of liquid level; {Control of process parameters}

**Filtration; Filtering material, regeneration thereof** ({aquarium filters [A01K 63/04](#); filters for cigars and cigarettes [A24D 3/00](#); filters for coffee or tea-making machines [A47J 31/06](#); filters for frying fat [A47J 37/12](#); filters for suction cleaners [A47L 9/10](#) ; blood or infusion liquid filters [A61M 5/165](#); {liquid-liquid separation, e.g. for filtering elements made hydrophilic or hydrophobic, [B01D 12/00](#), [B01D 17/00](#), [B01D 43/00](#); filtering material and its regeneration, as well as filtering aids, [B01D 39/00](#); gas or air filters in general [B01D 46/00](#); filtration devices for laboratory use [B01L](#); "dewatering" ore or coal slurry [B03B 5/48](#); magnetic filters [B03C 1/00](#) ; screens or sieves per se [B07B 1/00](#); {filters for lubricating and cooling systems in turning, boring or milling machines [B23Q 11/10](#); filters for cooling systems in grinding machines [B24B 55/00](#) ; extrusion filters [B29C 47/68](#); {filter presses [B30B 9/02](#); purification of process water, drinking water and waste water [C02F](#); filters for alcoholic beverages [C12H 1/00](#) ; filtering spinning solution or melt [D01D 1/10](#); {filters for washing machines [D06F 39/10](#); filters or strainers for papermaking [D21D](#); filters in water collecting systems [E03B 3/18](#), [E03B 7/07](#); subsoil filters for boreholes [E21B 43/02](#); air filters for internal-combustion engines [F02M 35/02](#); filters for pumps [F04B 39/16](#), [F04D 29/70](#); filters in pipe systems [F16L 55/24](#) ; filtration of lubricants [F16N 39/06](#); {filters for volume measuring apparatus [G01F 15/12](#)})

- B01D 23/00 Gravity filters (with moving filtering elements [B01D 33/0035](#))**
- B01D 23/005 . {making filtering elements, not provided for elsewhere (see also [B01D 25/001](#), [B01D 27/005](#), [B01D 29/0093](#))}
- B01D 23/02 . with fixed filter bodies
- B01D 23/04 . . with filter bags filtering from the inside
- B01D 23/06 . . with rigid tubular bodies
- B01D 23/08 . . with saucer-shaped filtering elements
- B01D 23/10 . with loose filter material
- B01D 23/12 . . with filtering material supported on louvred sides
- B01D 23/14 . . carbon filters
- B01D 23/16 . . Sand or gravel filters {(filterbed-basin filters, small bed filters, e.g. in closed housing [B01D 23/10](#))}
- B01D 23/18 . . Bottoms of filter beds



- B01D 23/20 . Feed or discharge devices (nozzles B05B)
- B01D 23/205 . . {Special adaptation of spray heads therefor}
- B01D 23/24 . Regeneration of the filter material in the filter
- B01D 23/26 . integrally combined with devices for controlling the filtration {(shutting-off elements, changing over from one element to another B01D 35/12, B01D 35/14; control of filtration processes B01D 37/04)}
- B01D 23/28 . Filter funnels; Holders therefor (funnels in general B67C; {funnels for laboratory use B01L; coffee or tea strainers or apparatus A47J 31/00 - A47J 31/06})

**B01D 24/00** **Filters comprising loose filtering material, i.e. filtering material without any binder between the individual particles or fibres thereof (B01D 27/02 takes precedence)**

### **WARNING**

See WARNING after subclass title, particularly items (7), (8) and (14)

- B01D 24/001 . {Making filter elements (not provided for elsewhere)(see also B01D 25/001, B01D 27/005, B01D 29/012, B01D 29/111, B01D 33/0093)}
- B01D 24/002 . {with multiple filtering elements in parallel connection}
- B01D 24/004 . . {arranged concentrically or coaxially}
- B01D 24/005 . . {Filters being divided into a plurality of cells or compartments (B01D 24/004 takes precedence)}
- B01D 24/007 . {with multiple filtering elements in series connection}
- B01D 24/008 . . {arranged concentrically or coaxially}
- B01D 24/02 . with the filter bed stationary during the filtration
- B01D 24/04 . . the filtering material being clamped between pervious fixed walls (B01D 24/10, B01D 24/20 take precedence)
- B01D 24/042 . . . {the filtering material being held in a flexible porous bag}
- B01D 24/045 . . . {with at least one flat vertical wall}
- B01D 24/047 . . . . {with vertical tubes distributing the liquid to be filtered or for collecting filtrate}
- B01D 24/06 . . . the pervious walls comprising a series of louvres or slots
- B01D 24/08 . . . the filtering material being supported by at least two pervious coaxial walls
- B01D 24/10 . . the filtering material being held in a closed container
- B01D 24/105 . . . {downward filtration without specifications about the filter material supporting means}
- B01D 24/12 . . . Downward filtration, the filtering material being supported by pervious surfaces (B01D 24/18 takes precedence)
- B01D 2024/125 . . . . {spray heads specially adapted therefor}
- B01D 24/14 . . . Downward filtration, the container having distribution or collection headers or pervious conduits (B01D 24/18 takes precedence)
- B01D 2024/145 . . . . {spray heads specially adapted therefor}
- B01D 24/16 . . . Upward filtration (B01D 24/18 takes precedence)
- B01D 2024/162 . . . . {spray heads specially adapted therefor}
- B01D 24/165 . . . . {the filtering material being supported by pervious surfaces}



B01D 24/167	.... {the container having distribution or collection headers or pervious conduits}
B01D 24/18	... Combined upward and downward filtration
B01D 24/183	.... {the filtering material being supported by pervious surfaces}
B01D 24/186	.... {the container having distribution or collection headers or pervious conduits}
B01D 24/20	.. the filtering material being provided in an open container
B01D 24/205	... {Downward filtration without specifications about the filter material supporting means}
B01D 24/22	... Downward filtration, the filter material being supported by pervious surfaces
B01D 24/24	... Downward filtration, the container having distribution or collection headers or pervious conduits
B01D 24/26	... Upward filtration
B01D 24/263	.... {the filtering material being supported by pervious surfaces}
B01D 24/266	.... {the container having distribution or collection headers or pervious conduits}
B01D 24/28	. with the filter bed moving during the filtration (with the filter bed fluidised <a href="#">B01D 24/36</a> )
B01D 24/30	.. Translation
B01D 24/305	... {Vibrations}
B01D 24/32	.. Rotation
B01D 24/34	. with the filtering material and its pervious support moving (tipping buckets, trays or like sections <a href="#">B01D 33/327</a> )
B01D 24/36	. with the filter bed fluidised during the filtration (with the filter bed being stationary <a href="#">B01D 24/02</a> )
B01D 24/38	. Feed or discharge devices
B01D 24/383	.. {using multiple way valves}
B01D 24/386	.. {internal recirculation}
B01D 24/40	.. for feeding
B01D 24/402	... {containing fixed liquid displacement elements or cores}
B01D 24/405	... {Special treatment of the feed stream before contacting the filtering material, e.g. cutting ( <a href="#">B01D 35/24</a> , <a href="#">B01D 37/02</a> , <a href="#">B01D 37/03</a> take precedence)}
B01D 24/407	... {provoking a tangential stream}
B01D 24/42	.. for discharging filtrate
B01D 24/425	... {containing fixed liquid displacement elements or cores}
B01D 24/44	.. for discharging filter cake, e.g. chutes
B01D 24/46	. Regenerating the filtering material in the filter ( <a href="#">B01D 24/44</a> takes precedence)
B01D 24/4605	.. {by scrapers, brushes, nozzles or the like placed on the cake-side of the stationary filtering material and only contacting the external layer ( <a href="#">B01D 24/4631</a> takes precedence)}
B01D 24/461	... {by scrapers}
B01D 24/4615	... {by brushes}
B01D 24/4621	... {by nozzles acting on the cake side of the filter material, or by fluids acting in co-current direction with the feed stream}
B01D 24/4626	.. {Construction of spray heads specially adapted for regeneration of the filter material or for filtrate discharging}



- B01D 24/4631 . . {Counter-current flushing, e.g. by air}
- B01D 24/4636 . . . {with backwash shoes; with nozzles}
- B01D 24/4642 . . . {with valves, e.g. rotating valves}
- B01D 24/4647 . . . . {with a rectilinear movement of the closing means}
- B01D 24/4652 . . . {by using gasbumps}
- B01D 24/4657 . . . {by using membranes}
- B01D 24/4663 . . . {by using pistons}
- B01D 24/4668 . . {by moving the filtering element ([B01D 24/4605](#) and [B01D 24/4631](#) take precedence)}
- B01D 24/4673 . . . {using rotary devices or vibration mechanisms, e.g. stirrers}
- B01D 24/4678 . . . {using free vortex flow}
- B01D 24/4684 . . . {using spray devices}
- B01D 24/4689 . . . {Displacement of the filtering material to a compartment of the filtering device for regeneration}
- B01D 24/4694 . . {containing filter material retaining means (e.g. screens, balls) placed on the surface of the filter material}
- B01D 24/48 . integrally combined with devices for controlling the filtration
- B01D 24/4807 . . {Handling the filter cake for purposes other than regenerating}
- B01D 24/4815 . . . {for washing}
- B01D 24/4823 . . . {for drying}
- B01D 24/483 . . . . {by compression}
- B01D 24/4838 . . . . {by gases or by heating}
- B01D 24/4846 . . . {Retarding cake deposition on the filter during the filtration period, e.g. using stirrers ([B01D 24/407](#) takes precedence)}
- B01D 24/4853 . . {by clearness or turbidity measuring}
- B01D 24/4861 . . {by flow measuring}
- B01D 24/4869 . . {by level measuring}
- B01D 24/4876 . . {in which the filtering elements are moved between filtering operations; particular measures for removing or replacing the filtering elements ([B01D 24/46](#), [B01D 24/4807](#) take precedence)}
- B01D 24/4884 . . {by pressure measuring}
- B01D 24/4892 . . {by temperature measuring}

**B01D 25/00** **Filters formed by clamping together several filtering elements or parts of such elements** ([disc filters B01D 29/39](#))

**WARNING**

See WARNING after subclass title, particularly items (7), (8), (12), (13) and (14)

- B01D 25/001 . {Making filtering elements (not provided for elsewhere; see also [B01D 24/001](#), [B01D 27/005](#), [B01D 29/012](#), [B01D 29/111](#), [B01D 33/0093](#))}
- B01D 25/002 . {Clamping devices ([B01D 25/12](#) and subgroups take precedence)}
- B01D 25/003 . {integrally combined with devices for controlling the filtration}



- B01D 25/004 . . {by clearness or turbidity measuring}
- B01D 25/005 . . {by flow measuring}
- B01D 25/006 . . {by level measuring}
- B01D 25/007 . . {by pressure measuring}
- B01D 25/008 . . {by temperature measuring}
- B01D 25/02 . in which the elements are pre-formed independent filtering units, e.g. modular systems
- B01D 25/04 . with screens or sheets, e.g. cloths, paper ([B01D 25/12](#) takes precedence)
- B01D 25/06 . with loose, granular or fibrous filtering material
- B01D 25/08 . with rigid self-supporting filtering elements
- B01D 25/10 . in which the suspended particles form the filtering medium
- B01D 25/12 . Filter presses, i.e. of the plate and frame type {(filter presses in which the liquid is removed by pressing-out solid matter [B30B](#))}
- B01D 25/121 . . {with bandshaped filtering elements intermittently entrained between the press plates, the lateral sides of the elements being clamped between two successive plates or between a plate and a successive frame during the filtration period, e.g. zigzag endless filter belts}
- B01D 25/122 . . {Construction of the plates}
- B01D 25/124 . . {Pressing-out operation after filtration, e.g. of the cake (presses in general [B30](#))}
- B01D 25/125 . . {Opening and/or closing and/or pressure applying devices or means}
- B01D 25/127 . . with one or more movable filter bands arranged to be clamped between the press plates or between a plate and a frame during filtration, e.g. zigzag endless filter bands ([B01D 25/172](#), [B01D 25/176](#), [B01D 25/19](#) take precedence)
- B01D 25/1275 . . . {the plates or the frames being placed in a non-vertical position}
- B01D 25/14 . . Clamping means {clamping of filter cloth or similar securing means}
- B01D 25/16 . Edge filtering elements, i.e. using contiguous impervious surfaces
- B01D 25/164 . . Chamber-plate presses, i.e. the sides of the filtering elements being clamped between two successive filtering plates ([B01D 25/127](#), [B01D 25/172](#), [B01D 25/176](#), [B01D 25/19](#) take precedence)
- B01D 25/1645 . . . {the plates being placed in a non-vertical position}
- B01D 25/172 . . Plate spreading means (removal of filter cakes [B01D 25/32](#))
- B01D 25/176 . . attaching the filter element to the filter press plates, e.g. around the central feed hole in the plates
- B01D 25/18 . . of flat, stacked bodies
- B01D 25/19 . . Clamping means for closing the filter press, e.g. hydraulic jacks
- B01D 25/20 . . of spirally or helically wound bodies
- B01D 25/21 . . Plate and frame presses ([B01D 25/172](#), [B01D 25/176](#), [B01D 25/19](#) take precedence)
- B01D 25/215 . . . {Construction of the filter plates, frames}
- B01D 25/22 . Cell-type filters
- B01D 25/24 . . Cell-type roll filters
- B01D 25/26 . . Cell-type stack filters
- B01D 25/28 . Leaching or washing filter cakes in the filter {handling the filter cake for purposes other than regenerating}



- B01D 25/281 .. {specially for chamber filter presses}
- B01D 25/282 .. {for drying}
- B01D 25/284 ... {by gases or by heating}
- B01D 25/285 ... {by compression using inflatable membranes}
- B01D 25/287 ... {by compression using pistons}
- B01D 25/288 .. {Retarding cake deposition on the filter during the filtration period, e.g. using stirrers}
- B01D 25/30 . Feeding devices; {Discharge devices}
- B01D 25/302 .. {specially adapted for chamber filter presses}
- B01D 25/305 .. {for discharging filtrate}
- B01D 25/307 .. {with internal recirculation through the filtering element ([B01D 37/02](#) takes precedence)}
- B01D 25/32 . Removal of the filter cakes
- B01D 25/322 .. {specially for chamber filter presses}
- B01D 25/325 .. {counter-current flushing, e.g. by air bumps}
- B01D 25/327 ... {with backwash shoes, with nozzles}
- B01D 25/34 .. by moving, {e.g. rotating,} the filter elements {([B01D 25/172](#), [B01D 25/19](#) take precedence)}
- B01D 25/343 ... {Particular measures for replacing or isolating one or more filtering elements; Transport systems for the filtering apparatus ([B01D 25/28](#), [B01D 25/32](#), [B01D 25/346](#), [B01D 25/36](#) take precedence)}
- B01D 25/346 ... {by vibration}
- B01D 25/36 ... by centrifugal force
- B01D 25/38 .. by moving parts, e.g. scrapers, contacting stationary filter elements {sprayers}
- B01D 25/383 ... {Brushes}
- B01D 25/386 ... {Nozzles}

## **B01D 27/00 Cartridge filters of the throw-away type**

### **WARNING**

See WARNING after subclass title, particularly item (14)

- B01D 27/005 . {Making filter elements (not provided for elsewhere)}(see also [B01D 24/001](#), [B01D 25/001](#), [B01D 29/012](#), [B01D 29/111](#), [B01D 33/0093](#))}
- B01D 27/02 . with cartridges made from a mass of loose {granular or fibrous} material
- B01D 27/04 . with cartridges made of a piece of unitary material, e.g. filter paper
- B01D 27/06 .. with corrugated, folded or wound material
- B01D 27/07 ... having a coaxial stream through the filtering element
- B01D 27/08 . Construction of the casing
- B01D 27/10 . Safety devices, e.g. by-passes
- B01D 27/101 .. {Filter condition indicators}
- B01D 27/103 .. {Bypass or safety valves}
- B01D 27/105 .. {Bidirectional working filters}



- B01D 27/106 .. {Anti-leakage or anti-return valves}
- B01D 27/108 .. {Flow control valves; Damping or calibrated passages}
- B01D 27/14 . having more than one filtering element
- B01D 27/142 .. {connected in parallel}
- B01D 27/144 ... {arranged concentrically or coaxially}
- B01D 27/146 .. {connected in series}
- B01D 27/148 ... {arranged concentrically or coaxially}

**B01D 29/00** **Other filters with filtering elements stationary during filtration, e.g. pressure or suction filters, or filtering elements therefor** {(B01D 24/00, B01D 25/00 and B01D 27/00 take precedence)}

#### **WARNING**

See WARNING after subclass title, particularly items (7), (8), (9), (10) ,(12) and (14)

- B01D 29/0002 . {Aspects of other filters with filtering elements stationary during filtration, or of filtering elements thereof}
- B01D 29/0004 .. {Filters with flat filtering elements}
- B01D 29/0006 ... {Making filtering elements}
- B01D 29/0009 ... {with curved filtering elements}
- B01D 29/0011 ... {ring shaped}
- B01D 29/0013 .. {Filters in which the filtering elements are moved between filtering operations; Means specially adapted for removing the filtering elements or introducing new ones; Transport systems specially adapted for the filtering elements}
- B01D 29/0015 ... {Filtering bands}
- B01D 29/0018 .. {Filters with screens or sheets, e.g. cloth, paper}
- B01D 29/002 ... {with rigid, self-supporting filtering elements, e.g. of ceramic material}
- B01D 29/0022 ... {Filters with corrugated, folded, or wound sheets}
- B01D 29/0025 .... {allowing a coaxial stream through the filtering element (for cartridge filters B01D 27/06)}
- B01D 29/0027 .. {Filters with loose, granular, or fibrous filtering material}
- B01D 29/0029 .. {Bag, cage, hose, tube, sleeve, or like filters}
- B01D 29/0031 ... {Pressing-out operation after filtration, e.g. by means of membranes (filter presses per se B01D 25/12)}
- B01D 29/0034 ... {Filters having flexible filtering material}
- B01D 29/0036 .... {which is supported}
- B01D 29/0038 ..... {on solid frames with surface grooves and the like}
- B01D 29/004 ..... {to take up a concertina shape during filtration}
- B01D 29/0043 ... {having rigid self-supporting filtering material (B01D 29/0068 takes precedence)}
- B01D 29/0045 .... {Edge filtering elements}
- B01D 29/0047 ... {with multiple filtering units}
- B01D 29/005 .... {connected in parallel (B01D 29/0056 takes precedence)}



- B01D 29/0052 . . . . {connected in series ([B01D 29/0059](#) takes precedence)}
- B01D 29/0054 . . . . {arranged concentrically or coaxially}
- B01D 29/0056 . . . . . {connected in parallel}
- B01D 29/0059 . . . . . {connected in series}
- B01D 29/0061 . . . {which are vibrated}
- B01D 29/0063 . . . {which are open-ended}
- B01D 29/0065 . . . {Filter candles}
- B01D 29/0068 . . {Filters with hollow discs side-by-side on or around one or more tubes (with elements moving during filtration [B01D 33/0048](#), [B01D 33/0051](#))}
- B01D 29/007 . . . {having filtrate discharge tubes fixed non-perpendicularly to the filtering surfaces}
- B01D 29/0072 . . Filters integrally combined with devices for controlling the filtration (for shutting-off elements or changing over from one element to another [B01D 35/12](#), [B01D 35/14](#); controlling filtration processes [B01D 37/04](#))
- B01D 29/0075 . . {Regeneration of the filtering material in the filter (for two separate filter elements placed in different units [B01D 35/12](#))}
- B01D 29/0077 . . . {by scrapers, brushes, nozzles or the like placed on the cake-side of the filters ([B01D 29/0084](#) takes precedence)}
- B01D 29/0079 . . . {Counter-current flushing, e.g. by air bumps}
- B01D 29/0081 . . . . {with backwash shoes; with nozzles}
- B01D 29/0084 . . . {by moving the filter element ([B01D 29/0088](#) takes precedence)}
- B01D 29/0086 . . . . {by vibration}
- B01D 29/0088 . . . {by centrifugal force}
- B01D 29/009 . . {Filters having feed or discharge devices}
- B01D 29/0093 . {Making filtering elements (not provided for elsewhere)(see also [B01D 23/005](#), [B01D 25/001](#), [B01D 27/005](#))}
- B01D 29/0095 . {Flat filtering elements ([B01D 25/12](#), [B01D 25/26](#), [B01D 29/0015](#), [B01D 29/0068](#) take precedence)}
- B01D 29/0097 . {Curved filtering elements, e.g. concave filtering elements}
- B01D 29/01 . . with flat filtering elements ([B01D 29/39](#) takes precedence)

**NOTE**

If the construction of the filtering element itself is of minor importance the document is classified in the subgroups [B01D 29/01](#), [B01D 29/014](#), [B01D 29/016](#) or [B01D 29/018](#); otherwise in the subgroups [B01D 29/03](#) to [B01D 29/07](#)

- B01D 29/012 . . {Making filtering elements (making bag, cage, hose, tube, sleeve or like filtering elements [B01D 29/111](#))}
- B01D 29/014 . . {with curved filtering elements (construction [B01D 29/035](#), [B01D 29/071](#))}
- B01D 29/016 . . {with corrugated, folded or wound filtering elements}
- B01D 29/018 . . {ring shaped}
- B01D 29/03 . . self-supporting
- B01D 29/031 . . . {with corrugated, folded filtering elements}
- B01D 2029/033 . . . {bar screens}



- B01D 29/035 . . . {with curved filtering elements}
- B01D 29/036 . . . {ring shaped}
- B01D 29/038 . . . . {with corrugated, folded filtering elements}
- B01D 29/05 . . supported
- B01D 29/055 . . . {ring shaped}
- B01D 29/07 . . . with corrugated, folded or wound filtering sheets
- B01D 29/071 . . . . {with curved filtering elements ([B01D 29/072](#), [B01D 29/073](#) take precedence)}
- B01D 29/072 . . . . {ring shaped}
- B01D 29/073 . . . . {with wound filtering sheets}
- B01D 2029/075 . {Located in a closed housing and comprising scrapers or agitators on the cake side of the filtering elements, e.g. Nutsche- or Rosenmund-type filters for performing multiple step operations}
- B01D 29/085 . Funnel filters; Holders therefor
- B01D 29/09 . with filtering bands, e.g. movable between filtering operations {([B01D 25/121](#) takes precedence)}
- B01D 29/093 . . {combined with means to fasten the opposite edges of the filtering band together, e.g. Zipper}
- B01D 29/096 . . {Construction of filtering bands or supporting belts, e.g. devices for centering, mounting or sealing the filtering bands or the supporting belts}
- B01D 29/11 . with bag, cage, hose, tube, sleeve or like filtering elements

#### **NOTE**

If the construction of the filtering element itself is of minor importance the document is classified in the subgroups [B01D 29/11](#), [B01D 29/114](#) and [B01D 29/117](#), otherwise in the subgroups [B01D 29/13](#) to [B01D 29/356](#)

- B01D 29/111 . . {Making filtering elements}
- B01D 29/112 . . {Ring shaped filters wherein both opposite axial sides are opened and the axial length is shorter than the diameter, e.g. as used in hydraulic transmission systems}
- B01D 29/114 . . {arranged for inward flow filtration ([B01D 29/15](#), [B01D 29/33](#) take precedence)}
- B01D 29/115 . . . {open-ended, the arrival of the mixture to be filtered and the discharge of the concentrated mixture are situated on both opposite sides of the filtering element}
- B01D 29/117 . . {arranged for outward flow filtration ([B01D 29/23](#), [B01D 29/35](#) take precedence)}
- B01D 29/118 . . . {open-ended}
- B01D 29/13 . . Supported filter elements
- B01D 29/15 . . . arranged for inward flow filtration
- B01D 29/17 . . . . open-ended {the arrival of the mixture to be filtered and the discharge of the concentrated mixture are situated on both opposite sides of the filtering element}
- B01D 29/19 . . . . on solid frames with surface grooves or the like
- B01D 29/21 . . . . with corrugated, folded or wound sheets
- B01D 29/213 . . . . . {having a concertina shape}



B01D 29/216	.....	{with wound sheets}
B01D 29/23	...	arranged for outward flow filtration
B01D 29/232	....	{with corrugated, folded or wound sheets}
B01D 29/235	.....	{having a concertina shape}
B01D 29/237	.....	{with wound sheets}
B01D 29/25	....	open-ended {the arrival of the mixture to be filtered and the discharge of the concentrated mixture are situated on both opposite sides of the filtering element}
B01D 29/27	....	Filter bags
B01D 29/31	..	Self-supporting filtering elements
B01D 29/33	...	arranged for inward flow filtration
B01D 29/333	....	{with corrugated, folded filtering elements}
B01D 29/336	....	{open-ended, the arrival of the mixture to be filtered and the discharge of the concentrated mixture are situated on both opposite sides of the filtering element}
B01D 29/35	...	arranged for outward flow filtration
B01D 29/353	....	{with corrugated, folded filtering elements}
B01D 29/356	....	{open-ended, the arrival of the mixture to be filtered and the discharge of the concentrated mixture are situated on both opposite sides of the filtering element}
B01D 29/39	.	with hollow discs side by side on, or around, one or more tubes, e.g. of the leaf type
B01D 29/395	..	{mounted axially on the tube}
B01D 29/41	..	mounted transversely on the tube
B01D 29/413	...	{divided in sectors}
B01D 29/416	...	{Filtering tables}
B01D 29/43	..	mounted otherwise than transversely on the tube {mounted otherwise than axially on the tube}
B01D 29/44	.	Edge filtering elements, i.e. using contiguous impervious surfaces
B01D 29/445	..	{Bar screens}
B01D 29/46	..	of flat, stacked bodies
B01D 29/48	..	of spirally or helically wound bodies
B01D 29/50	.	with multiple filtering elements, characterised by their mutual disposition ( <a href="#">B01D 29/39 takes precedence</a> )
B01D 29/52	..	in parallel connexion
B01D 29/54	...	arranged concentrically or coaxially
B01D 29/56	..	in series connexion
B01D 29/58	...	arranged concentrically or coaxially
B01D 29/60	.	integrally combined with devices for controlling the filtration
B01D 29/601	..	{by clearness or turbidity measuring}
B01D 29/603	..	{by flow measuring}
B01D 29/605	..	{by level measuring}
B01D 29/606	..	{by pressure measuring}



- B01D 29/608 .. {by temperature measuring}
- B01D 29/62 . Regenerating the filter material in the filter (devices for taking out of action one or more units of multi-unit filters, e.g. for regeneration, [B01D 35/12](#))
- B01D 29/64 .. by scrapers, brushes, {nozzles}, or the like, acting on the cake side of the filtering element
  - B01D 29/6407 ... {brushes}
    - B01D 29/6415 .... {with a rotary movement with respect to the filtering element}
    - B01D 29/6423 .... {with a translational movement with respect to the filtering element}
    - B01D 29/643 .... {with a combination of movements with respect to the filtering elements}
  - B01D 29/6438 ... {nozzles}
    - B01D 29/6446 .... {with a rotary movement with respect to the filtering element}
    - B01D 29/6453 .... {with a translational movement with respect to the filtering element}
    - B01D 29/6461 .... {with a combination of movements with respect to the filtering elements}
  - B01D 29/6469 ... {scrapers}
    - B01D 29/6476 .... {with a rotary movement with respect to the filtering element}
    - B01D 29/6484 .... {with a translatory movement with respect to the filtering element}
    - B01D 29/6492 .... {with a combination of movements with respect to the filtering elements}
- B01D 29/66 .. by flushing, e.g. counter-current air-bumps
  - B01D 29/661 ... {by using gas-bumps}
  - B01D 29/663 ... {by using membranes}
  - B01D 29/665 ... {by using pistons}
  - B01D 29/666 ... {by a stirrer placed on the filtrate side of the filtering element}
  - B01D 29/668 ... {with valves, e.g. rotating valves for coaxially placed filtering elements}

**NOTE**

the subgroup covers only counter-current flushing

- B01D 29/68 ... with backwash arms, shoes or nozzles
  - B01D 29/682 .... {with a rotary movement with respect to the filtering element}
  - B01D 29/684 .... {with a translatory movement with respect to the filtering element}
  - B01D 29/686 .... {with a combination of movements with respect to the filtering elements}
  - B01D 29/688 .... {with backwash arms or shoes acting on the cake side}
- B01D 29/70 .. by forces created by movement of the filter element
  - B01D 29/705 ... {by compression of compressible filter medium, e.g. foam}
  - B01D 29/72 ... involving vibrations
  - B01D 29/74 ... involving centrifugal force
- B01D 29/76 . Handling the filter cake in the filter for purposes other than for regenerating ([B01D 29/94](#) takes precedence)
- B01D 29/78 .. for washing
- B01D 29/80 .. for drying
- B01D 29/82 ... by compression



- B01D 29/822 . . . . {using membranes}
- B01D 29/824 . . . . {using pistons}
- B01D 29/826 . . . . {using rollers}
- B01D 29/828 . . . . {using screws ([B01D 29/6476](#) takes precedence)}
- B01D 29/84 . . . by gases or by heating
- B01D 29/843 . . . . {by direct contact with a fluid}
- B01D 29/846 . . . . {by indirect heat-exchange}
- B01D 29/86 . . Retarding cake deposition on the filter during the filtration period, e.g. using stirrers  
{([B01D 29/908](#) takes precedence)}
- B01D 29/865 . . . {by vibration of the liquid}
- B01D 29/88 . . having feed or discharge devices
- B01D 29/885 . . {with internal recirculation through the filtering element ([B01D 37/02](#) takes precedence)}
- B01D 29/90 . . for feeding
- B01D 29/902 . . . {containing fixed liquid displacement elements or cores}
- B01D 29/904 . . . {directing the mixture to be filtered on the filtering element in a manner to clean the filter continuously ([B01D 29/115](#), [B01D 29/118](#), [B01D 29/17](#), [B01D 29/25](#), [B01D 29/336](#), [B01D 29/356](#), [B01D 29/902](#), [B01D 29/908](#) take precedence)}
- B01D 29/906 . . . {Special treatment of the feed stream before contacting the filtering element, e.g. cutting ([B01D 35/24](#), [B01D 37/02](#), [B01D 37/03](#) take precedence)}
- B01D 29/908 . . . {provoking a tangential stream}
- B01D 29/92 . . for discharging filtrate
- B01D 29/925 . . . {containing liquid displacement elements or cores}
- B01D 29/94 . . for discharging the filter cake, e.g. chutes
- B01D 29/945 . . . {for continuously discharging concentrated liquid}
- B01D 29/96 . . in which the filtering elements are moved between filtering operations; Particular measures for removing or replacing the filtering elements; Transport systems for filters ([B01D 29/09](#), [B01D 29/70](#) take precedence)
- B01D 29/965 . . {Device for changing the inclination of the filtering element}

**B01D 33/00** **Filters with filtering elements which move during the filtering operation** (filters comprising loose filtering material moving or fluidised during filtration [B01D 24/28](#) to [B01D 24/36](#); centrifuges [B04B](#))

#### **WARNING**

See WARNING after subclass title, particularly items (7), (8), (11) and (14)

- B01D 33/0003 . {Aspects of filters with filtering elements which move during the filtering operation}
- B01D 33/0006 . . {with rotating filtering surfaces ([rotating brush filters B01D 35/10](#))}
- B01D 33/0009 . . . {with cylindrical filtering surfaces, e.g. hollow drums, rotating drum filters for paper making [D21B](#)}
- B01D 33/0012 . . . . {Drums provided with cells each independently connected with pressure distributor}
- B01D 33/0016 . . . . {Drums with a single compartment}



B01D 33/0019	.....	{arranged for outward flow filtration}
B01D 33/0022	....	{combined with filtering bands or the like}
B01D 33/0025	.....	{with endless filtering bands}
B01D 33/0029	.....	{with multiple filtering bands with or without one or more non filtering bands}
B01D 33/0032	....	{with loose, granular, or fibrous filtering material}
B01D 33/0035	....	{Gravity filters}
B01D 33/0038	.....	{with external feed}
B01D 33/0041	...	{with plane surfaces}
B01D 33/0045	....	{with rotary tables}
B01D 33/0048	....	{with hollow discs transversely mounted on a hollow shaft}
B01D 33/0051	....	{with hollow frames axially mounted on a hollow shaft}
B01D 33/0054	....	{with loose, granular, or fibrous filtering material}
B01D 33/0058	...	{with filtering surfaces travelling along conveyers (tipping bucket type <a href="#">B01D 35/08</a> ; brush filters <a href="#">B01D 35/10</a> )}
B01D 33/0061	..	{Accessories and components}
B01D 33/0064	...	{Devices for handling the filter cake, e.g. washing, discharging}
B01D 33/0067	....	{with scrapers, brushes, nozzles or the like placed on the cake-side of the filter ( <a href="#">B01D 33/0074</a> takes precedence)}
B01D 33/007	....	{counter-current flushing}
B01D 33/0074	.....	{with backwash shoes, with nozzles}
B01D 33/0077	....	{by moving the filter element}
B01D 33/008	.....	{by vibration}
B01D 33/0083	.....	{by centrifugal force}
B01D 33/0087	...	{Feed or discharge devices for liquids}
B01D 33/009	...	{Pressure distribution systems (pressure distribution systems for filters with tipping buckets or trays <a href="#">B01D 35/08</a> )}
B01D 33/0093	.	{Making filter elements (not provided for elsewhere)(see also <a href="#">B01D 24/001</a> , <a href="#">B01D 25/001</a> , <a href="#">B01D 27/005</a> , <a href="#">B01D 29/012</a> , <a href="#">B01D 29/111</a> )}
B01D 33/0096	..	{moving rectilinearly (filters <a href="#">B01D 35/10</a> )}
B01D 33/01	.	with translationally moving filtering elements, e.g. pistons ( <a href="#">B01D 33/04</a> to <a href="#">B01D 33/327</a> take precedence)
B01D 33/0108	..	{with bag, cage, hose, tube, sleeve or the like filtering elements}
B01D 33/0116	...	{arranged for inward flow filtration}
B01D 33/0125	....	{open ended}
B01D 33/0133	...	{arranged for outward flow filtration}
B01D 33/0141	....	{open ended}
B01D 33/015	..	{with flat filtering elements}
B01D 33/0158	...	{self-supporting}
B01D 33/0166	....	{Bar screens}
B01D 33/0175	....	{with curved filtering elements}
B01D 33/0183	...	{supported}



- B01D 33/0191 . . . . {with corrugated, folded or wound filtering sheets}
- B01D 33/03 . . with vibrating filter elements
- B01D 33/0307 . . . {with bag, cage, hose, tube, sleeve or the like filtering elements}
- B01D 33/0315 . . . . {arranged for inward flow filtration}
- B01D 33/0323 . . . . . {open ended}
- B01D 33/033 . . . . {arranged for outward flow filtration}
- B01D 33/0338 . . . . . {open ended}
- B01D 33/0346 . . . {with flat filtering elements}
- B01D 33/0353 . . . . {self-supporting}
- B01D 33/0361 . . . . . {Bar screens}
- B01D 33/0369 . . . . . {with curved filtering elements}
- B01D 33/0376 . . . . {supported}
- B01D 33/0384 . . . . . {with corrugated, folded or wound filtering sheets}
- B01D 33/0392 . . . . . {with curved filtering elements}
- B01D 33/04 . with filtering bands or the like supported on cylinders which are impervious for filtering
- B01D 33/042 . . {whereby the filtration and squeezing-out take place between at least two filtering bands}
- B01D 33/044 . with filtering bands or the like supported on cylinders which are pervious for filtering
- B01D 33/048 . . with endless filtering bands
- B01D 2033/052 . . . {combined with a compression device}
- B01D 33/056 . Construction of filtering bands or supporting belts, e.g. devices for centering, mounting or sealing the filtering bands or the supporting belts
- B01D 33/0565 . . {combined with means to fasten the opposite edges of the filtering band together, e.g. Zipper}
- B01D 33/06 . with rotary cylindrical filtering surfaces, e.g. hollow drums ([B01D 33/044](#) takes precedence; {rotating drums for paper-making [D21B](#)})
- B01D 33/067 . . Construction of the filtering drums, e.g. mounting or sealing arrangements
- B01D 2033/07 . . {arranged for inward flow filtration}
- B01D 33/073 . . arranged for inward flow filtration
- B01D 33/09 . . . with surface cells independently connected to pressure distributors
- B01D 33/11 . . arranged for outward flow filtration
- B01D 33/13 . . . with surface cells independently connected to pressure distributors
- B01D 33/15 . with rotary plane filtering surfaces
- B01D 33/155 . . {the filtering surface being parallel to the rotation axis}
- B01D 33/17 . . with rotary filtering tables ([tables divided into separately tiltable buckets, trays or like sections \[B01D 33/327\]\(#\)](#))
- B01D 33/19 . . . the table surface being divided in successively tilted sectors or cells, e.g. for discharging the filter cake
- B01D 33/21 . . with hollow filtering discs transversely mounted on a hollow rotary shaft
- B01D 33/215 . . . {the filtering discs being fixed inwardly on a rotating construction}
- B01D 33/23 . . . Construction of discs or component sectors thereof
- B01D 33/25 . . with hollow frames axially mounted on a hollow rotary shaft



- B01D 33/27 . with rotary filtering surfaces, which are neither cylindrical nor planar, e.g. helical surfaces
- B01D 33/275 .. {using contiguous impervious surfaces}
- B01D 33/29 . the movement of the filter elements being a combination of movements ([B01D 33/19 takes precedence](#))
- B01D 33/31 .. Planetary movement
- B01D 33/327 .. Tipping buckets, trays or like sections
- B01D 33/333 . with individual filtering elements moving along a closed path ([tipping buckets, trays or like sections B01D 33/327](#))
- B01D 33/35 . with multiple filtering elements characterised by their mutual disposition ([B01D 33/042](#) , [B01D 33/21 take precedence](#))
- B01D 33/37 .. in parallel connexion
- B01D 33/39 ... concentrically or coaxially
- B01D 33/41 .. in series connexion
- B01D 33/42 ... concentrically or coaxially
- B01D 33/44 . Regenerating the filter material in the filter ([devices for taking out of action one or more units of multi-unit filters, e.g. for regeneration, B01D 35/12](#))
- B01D 33/46 .. by scrapers, brushes {nozzles} or the like acting on the cake-side of the filtering element {([B01D 33/503 takes precedence](#))}
- B01D 33/461 ... {brushes}
- B01D 33/463 ... {nozzles}
- B01D 33/465 ... {take-off rollers}
- B01D 33/466 ... {scrapers}
- B01D 33/468 ... {wires, strands, strings or the like}
- B01D 33/48 .. by flushing, e.g. counter-current air-bumps

**NOTE**

the subgroup covers only counter-current flushing

- B01D 33/50 ... with backwash arms, shoes or nozzles
- B01D 33/503 .... {the backwash arms, shoes acting on the cake side}
- B01D 33/506 .... {with a stirrer placed on the filtrate side}
- B01D 33/52 .. by forces created by movement of the filter element
- B01D 33/54 ... involving vibrations
- B01D 33/56 ... involving centrifugal force
- B01D 33/58 . Handling the filter cake in the filter for purposes other than for regenerating ([B01D 33/76 takes precedence](#)) {the filter cake remaining on the filtering element}
- B01D 33/60 .. for washing
- B01D 33/62 .. for drying
- B01D 33/64 ... by compression
- B01D 33/642 .... {by pressure belts}
- B01D 33/644 .... {by pressure plates, membranes}
- B01D 33/646 .... {by pressure rollers}



- B01D 33/648 . . . . {by screws}
- B01D 33/66 . . . by gases or by heating
- B01D 33/663 . . . . {by direct contact with a fluid}
- B01D 33/666 . . . . {by indirect heat-exchange}
- B01D 33/68 . . Retarding cake deposition on the filter during the filtration period, e.g. using stirrers
- B01D 33/70 . . having feed or discharge devices ([B01D 33/82](#) takes precedence)
- B01D 33/705 . . {with internal recirculation through the filter}
- B01D 33/72 . . for feeding
- B01D 33/722 . . . {containing fixed liquid displacement elements or cores}
- B01D 33/725 . . . {Special treatment of the feed stream before contacting the filtering element, e.g. cutting ([B01D 35/24](#), [B01D 37/02](#), [B01D 37/03](#) take precedence)}
- B01D 33/727 . . . {provoking a tangential stream}
- B01D 33/74 . . for discharging filtrate
- B01D 33/742 . . . {containing fixed liquid displacement elements or cores}
- B01D 33/745 . . . {Construction of suction casings, pans, or the like}
- B01D 33/747 . . . . {moving during the filtration period}
- B01D 33/76 . . for discharging the filter cake, e.g. chutes
- B01D 33/763 . . . {for continuously discharging concentrated liquid}
- B01D 33/766 . . . {Devices for breaking the filter cake, e.g. cutting}
- B01D 33/80 . . Accessories
- B01D 33/801 . . {Driving means, shaft packing systems or the like}
- B01D 33/802 . . {Device for changing the inclination of the filtering element}
- B01D 33/803 . . {in which the filtering elements are moved between filtering operations ([B01D 33/52](#) takes precedence); Particular measures for removing or replacing the filtering elements; Transport systems for filters}
- B01D 33/804 . . {integrally combined with devices for controlling the filtration}
- B01D 33/805 . . . {by clearness or turbidity measuring}
- B01D 33/806 . . . {by flow measuring}
- B01D 33/807 . . . {by level measuring}
- B01D 33/808 . . . {by pressure measuring}
- B01D 33/809 . . . {by temperature measuring}
- B01D 33/82 . . Means for pressure distribution

## **B01D 35/00 Other filtering devices; Auxiliary devices for filtration; Filter housing constructions**

### **WARNING**

See WARNING after subclass title, particularly item (14)

- B01D 35/005 . . {Filters specially adapted for use in internal-combustion engine lubrication or fuel systems, not of special interest for [B01D 23/00](#) - [B01D 33/00](#) (internal-combustion engine lubricating systems [F02M](#); lubrication in general [F16N](#))}



- B01D 35/02
  - . Filters adapted for location in special places, e.g. pipe-lines, pumps, stop-cocks, ([B01D 35/05](#) takes precedence; {water pipe system filters [E03B 3/18](#), [E03B 7/07](#); dirt catchers in sewers [E03F](#); filters or strainers for pipe-lines in general [B08B](#), [E03F](#); object or dirt catching devices in sinks or the like [E03C 1/26](#); suction strainers or filters for pumps [F04B 53/005](#), [F04D 29/70](#)})
- B01D 35/023
  - .. {Filler pipe filters}
- B01D 35/027
  - .. rigidly mounted in or on tanks or reservoirs ([B01D 35/04](#) takes precedence)
- B01D 35/0273
  - ... {Filtering elements with a horizontal or inclined rotation or symmetry axis submerged in tanks or reservoirs}
- B01D 35/0276
  - ... {Filtering elements with a vertical rotation or symmetry axis mounted on tanks or reservoirs}
- B01D 35/04
  - .. Plug, tap, or cock filters {filtering elements mounted in or on a faucet}
- B01D 35/043
  - ... {Reversible faucet filters}
- B01D 35/046
  - ... {the filtering element being mounted in the faucet plug}
- B01D 35/05
  - . Floating filters
- B01D 35/06
  - . Filters making use of electricity or magnetism (ultrafiltration, microfiltration [B01D 61/14](#); electrodialysis, electro-osmosis [B01D 61/42](#); devices comprising filters and magnetic separators [B03C 1/30](#))
- B01D 35/08
  - . Filters with tipping buckets or trays
- B01D 35/10
  - . Brush filters {Rotary brush filters}
- B01D 35/12
  - . Devices for taking out of action one or more units of multi- unit filters, e.g. for regeneration
- B01D 35/14
  - . Safety devices specially adapted for filtration ([preventing or minimising fires or explosions A62C](#)); Devices for indicating clogging ([incorporated in a throw-away filter B01D 27/10](#))
- B01D 35/143
  - .. Filter condition indicators
- B01D 35/1435
  - ... {with alarm means}
- B01D 35/147
  - .. Bypass or safety valves
- B01D 35/1475
  - ... {Pressure relief valves or pressure control valves}
- B01D 35/15
  - .. Bidirectional working filters
- B01D 35/153
  - .. Anti-leakage or anti-return valves
- B01D 35/157
  - .. Flow control valves: Damping or calibrated passages
- B01D 35/1573
  - ... {Flow control valves}
- B01D 35/1576
  - ... {Calibrated passages}
- B01D 35/16
  - . Cleaning-out devices {e.g. for removing the cake from the filter casing or for evacuating the last remnants of liquid}
- B01D 35/18
  - . Heating or cooling the filters
- B01D 35/185
  - .. {comprising a vaporizing unit}
- B01D 35/20
  - . Vibrating the filters ([regenerating filter material by vibrations in filters with stationary filtering elements B01D 29/72](#); [discharging the filter cake by vibrations in filters with moving filtering elements B01D 33/54](#), [B01D 33/76](#))
- B01D 35/22
  - . Directing the mixture to be filtered on to the filters in a manner to clean the filters ({[B01D 29/904](#) takes precedence})
- B01D 35/24
  - . Providing loose granular material to scratch the filters clean



- B01D 35/26 . Filters with built-in pumps {filters provided with a pump mounted in or on the casing (aquarium pumps or filters [A01K 63/04](#))}
- B01D 35/28 . Strainers not provided for elsewhere
- B01D 35/30 . Filter housing constructions
- B01D 35/301 .. {Constructions of two or more housings ([B01D 35/12](#) takes precedence)}
- B01D 35/303 ... {the housings being modular, e.g. standardised}
- B01D 35/305 .. {with features related to crash tests or crash safety measures}
- B01D 35/306 .. {Filter mounting adapter}
- B01D 35/308 .. {Made of at least two different materials, e.g. metal and plastic}
- B01D 35/31 .. including arrangements for environmental protection, e.g. pressure resisting features
- B01D 35/32 ... against radiation
- B01D 35/34 .. open-topped ([B01D 35/31](#) takes precedence)

## **B01D 36/00 Filter circuits or combinations of filters with other separating devices**

### **WARNING**

See WARNING after subclass title, particularly item (14)

- B01D 36/001 . {Filters in combination with devices for the removal of gas, air purge systems.}
- B01D 36/003 . {Filters in combination with devices for the removal of liquids ([B01D 35/185](#) takes precedence)}
- B01D 36/005 .. {Liquid level sensing means, e.g. for water in gasoil-filters}
- B01D 36/006 .. {Purge means}
- B01D 36/008 .. {Means to filter or treat the separated liquid}
- B01D 36/02 . Combinations of filters of different kinds ([B01D 29/50](#), [B01D 33/35](#) take precedence)
- B01D 36/04 . Combinations of filters with settling tanks
- B01D 36/045 .. {Combination of filters with centrifugal separation devices}

## **B01D 37/00 Processes of filtration (processes specially adapted for filtering gases [B01D 46/00](#))**

### **WARNING**

See WARNING after subclass title, particularly item (14)

- B01D 37/02 . Precoating the filter medium; Addition of filter aids to the liquid being filtered {(devices for feeding reagents [C02F 1/685](#) and sub-groups; filter aids)}
- B01D 37/025 .. {additives incorporated in the filter}
- B01D 37/03 . using flocculating agents
- B01D 37/04 . Controlling the filtration

### **NOTE**

1. If the construction of the filtering element is of minor importance, the documents are classified in this group only



B01D 37/04  
(continued)

2. Filters integrally combined with devices for controlling the filtration are also classified in the relevant groups for these aspects, e.g. [B01D 24/48](#), [B01D 29/60](#), [B01D 33/804](#)

- B01D 37/041 .. {by clearness or turbidity measuring}
- B01D 37/043 .. {by flow measuring}
- B01D 37/045 .. {by level measuring}
- B01D 37/046 .. {by pressure measuring}
- B01D 37/048 .. {by temperature measuring}

## B01D 39/00

### Filtering material for liquid or gaseous fluids

- B01D 39/02 . Loose filtering material, e.g. loose fibres
- B01D 39/04 .. Organic material, e.g. cellulose, cotton
- B01D 39/06 .. Inorganic material, e.g. asbestos fibres, glass beads or fibres
- B01D 39/08 . Filter cloth, i.e. woven, knitted or interlaced material ([metallic B01D 39/10](#))

### **WARNING**

Groups [B01D 39/083](#) and [B01D 39/086](#) are incomplete pending a reorganisation, see also [B01D 39/08](#)

- B01D 39/083 .. {of organic material}
- B01D 39/086 .. {of inorganic material}
- B01D 39/10 . Filter screens essentially made of metal
- B01D 39/12 .. of wire gauze; of knitted wire; of expanded metal
- B01D 39/14 . Other self-supporting filtering material; {Other filtering material ([non-woven fabrics in general D04H 3/00](#))}
- B01D 39/16 .. of organic material, e.g. synthetic fibres
- B01D 39/1607 ... {the material being fibrous ([B01D 39/18](#) takes precedence)}
- B01D 39/1615 .... {of natural origin}
- B01D 39/1623 .... {of synthetic origin}
- B01D 39/163 ..... {sintered or bonded}
- B01D 39/1638 ... {the material being particulate}
- B01D 39/1646 .... {of natural origin, e.g. cork or peat}
- B01D 39/1653 .... {of synthetic origin}
- B01D 39/1661 ..... {sintered or bonded}
- B01D 39/1669 ... {Cellular material}
- B01D 39/1676 .... {of synthetic origin}
- B01D 39/1684 ... {Wound filtering material}

### **WARNING**

This group is no longer used for classification of new documents as from December 1, 2011. The backlog of this group is being continuously reclassified to [B01D 39/16](#) and [B01D 2239/0695](#)



B01D 39/1692	...	{Other shaped material, e.g. perforated or porous sheets}
B01D 39/18	...	the material being cellulose or derivatives thereof ({cork or peat <a href="#">B01D 39/1646</a> }; making filter paper <a href="#">D21F 11/14</a> )
B01D 39/20	..	of inorganic material, e.g. asbestos paper, metallic filtering material of non-woven wires (porous ceramic material { <a href="#">C04B 38/00</a> }; sintering metals <a href="#">C22C 1/04</a> ; {making porous sintered metal bodies <a href="#">B22F 3/10</a> , honeycomb filters <a href="#">B01D 46/2418</a> , materials used for filtering exhaust gases of an internal combustion engine <a href="#">F01N 3/022</a> , ceramic honeycomb structures <a href="#">C04B 38/0006</a> })
B01D 39/2003	...	{Glass or glassy material}
B01D 39/2006	....	{the material being particulate}
B01D 39/201	.....	{sintered or bonded by inorganic agents}
B01D 39/2013	.....	{otherwise bonded, e.g. by resins}
B01D 39/2017	....	{the material being filamentary or fibrous}
B01D 39/202	.....	{sintered or bonded by inorganic agents}
B01D 39/2024	.....	{otherwise bonded, e.g. by resins}
B01D 39/2027	...	{Metallic material}
B01D 39/2031	....	{the material being particulate}
B01D 39/2034	.....	{sintered or bonded by inorganic agents}
B01D 39/2037	.....	{otherwise bonded}
B01D 39/2041	....	{the material being filamentary or fibrous}
B01D 39/2044	.....	{sintered or bonded by inorganic agents}
B01D 39/2048	.....	{otherwise bonded}
B01D 39/2051	....	{Metallic foam}
B01D 39/2055	...	{Carbonaceous material (solid sorbent compositions comprising free carbon <a href="#">B01J 20/20</a> )}

**WARNING**

Groups [B01D 39/2058](#) to [B01D 39/2065](#) are not complete, see also [B01D 39/20](#)

B01D 39/2058	....	{the material being particulate}
B01D 39/2062	.....	{Bonded, e.g. activated carbon blocks}
B01D 39/2065	....	{the material being fibrous}
B01D 39/2068	...	{Other inorganic materials, e.g. ceramics}
B01D 39/2072	....	{the material being particulate or granular}
B01D 39/2075	.....	{sintered or bonded by inorganic agents}
B01D 39/2079	.....	{otherwise bonded, e.g. by resins}
B01D 39/2082	....	{the material being filamentary or fibrous}
B01D 39/2086	.....	{sintered or bonded by inorganic agents}
B01D 39/2089	.....	{otherwise bonded, e.g. by resins}
B01D 39/2093	....	{Ceramic foam}



B01D 39/2096 . . . {Wound materials}

### **WARNING**

This group is no longer used for classification of new documents as from December 1, 2011. The backlog of this group is being continuously reclassified to [B01D 39/20](#) and [B01D 2239/0695](#)

**B01D 41/00**      **Regeneration of the filtering material or filter elements outside the filter for liquid or gaseous fluids**

B01D 41/02      . of loose filtering material

B01D 41/04      . of rigid self-supporting filtering material

**B01D 43/00**      **Separating particles from liquids, or liquids from solids, otherwise than by sedimentation or filtration** (flotation processes [B03D 1/00](#); drying solid materials or objects [F26B](#))

**Separating dispersed particles from gases or vapours** (suction cleaner filters [A47L 9/10](#); filters for breathing-protection purposes [A62B 23/00](#); filtering air for vehicles [B60H 3/06](#); separating pneumatically-conveyed materials from propelling gas [B65G 53/60](#); exhaust or silencing apparatus for machines or engines having means for removing solid constituents of exhaust [F01N 3/02](#); air cleaners for the intakes of gas-turbine or jet-propulsion plants [F02C 7/05](#), of combustion engines [F02M 35/024](#), of compressors [F04B 39/16](#); filtering in air-conditioning [F24F 3/16](#))

**B01D 45/00**      **Separating dispersed particles from gases or vapours by gravity, inertia, or centrifugal forces**

B01D 45/02      . by utilising gravity

B01D 45/04      . by utilising inertia ([B01D 45/12](#) takes precedence)

B01D 45/06      . . by reversal of direction of flow

B01D 45/08      . . by impingement against baffle separators

B01D 45/10      . . . which are wetted

B01D 45/12      . by centrifugal forces ([centrifuges B04B](#); [cyclones B04C](#))

B01D 45/14      . . generated by rotating vanes, discs, drums or brushes

B01D 45/16      . . generated by the winding course of the gas stream, {the centrifugal forces being generated solely or partly by mechanical means, e.g. fixed swirl vanes}

B01D 45/18      . Cleaning-out devices

**B01D 46/00**      **Filters {i.e. particle separators} or filtering processes specially modified for separating dispersed particles from gases or vapours** (filtering elements [B01D 23/00](#) to [B01D 35/00](#); filtering material [B01D 39/00](#); their regeneration outside the filters [B01D 41/00](#))

B01D 46/0001      . {Making filtering elements}

B01D 46/0002      . {Casings; Housings; Frame constructions}

B01D 46/0004      . . {Details of removable closures, lids, caps or filter heads}

B01D 46/0005      . . {Mounting of filtering elements within casings, housings or frames ([B01D 46/2422](#) takes precedence)}

B01D 46/0006      . . . {Filter elements or cartridges installed in a drawer-like manner}



- B01D 46/0008 . . . {Two or more filter elements not fluidly connected positioned in the same housing}
- B01D 46/0009 . . . {Tray-like arrangements of filters in a vessel}
- B01D 46/001 . . {Means for connecting filter housings to supports}
- B01D 46/0012 . . {In-line filters}
- B01D 46/0013 . . {Modules}
- B01D 46/0015 . . {Throw-away type filters}
- B01D 46/0016 . . {Folded frame or housing constructions}
- B01D 46/0017 . . {Filter elements installed in a branch of a pipe, e.g. with an y-shaped tubular housing}
- B01D 46/0019 . {with multiple filtering elements, characterised by their mutual disposition}
- B01D 46/002 . . {connected in parallel}
- B01D 46/0021 . . . {arranged concentrically or coaxially}
- B01D 46/0023 . . {connected in series}
- B01D 46/0024 . . . {arranged concentrically or coaxially}
- B01D 46/0026 . . . {Protecting screens at filter inlet or outlet}
- B01D 46/0027 . {with additional separating or treating functions}
- B01D 46/0028 . . {provided with antibacterial or antifungal means}
- B01D 46/003 . . {including coalescing means for the separation of liquid}
- B01D 46/0031 . . . {with collecting, draining means}
- B01D 46/0032 . . {using electrostatic forces to remove particles, e.g. electret filters}
- B01D 46/0034 . . {using magnetic forces to remove particles}
- B01D 46/0035 . . {by wetting, e.g. using surfaces covered with oil}
- B01D 46/0036 . . {by adsorption or absorption}
- B01D 46/0038 . . {with means for influencing the odor, e.g. deodorizing substances}
- B01D 46/0039 . {with flow guiding by feed or discharge devices}
- B01D 46/0041 . . {for feeding}
- B01D 46/0042 . . . {Use of the inlet flow in order to clean the filter surface}
- B01D 46/0043 . . . {containing fixed gas displacement elements or cores}
- B01D 46/0045 . . . {by using vanes}
- B01D 46/0046 . . . {provoking a tangential stream ([B01D 46/0045](#) takes precedence)}
- B01D 46/0047 . . {for discharging the filtered gas}
- B01D 46/0049 . . . {containing fixed gas displacement elements or cores}
- B01D 46/005 . . {Crossflow filtration, i.e. having an inlet and two outlets}
- B01D 46/0052 . {with filtering elements moving during filtering operation ([B01D 46/22](#), [B01D 46/32](#) take precedence)}
- B01D 46/0053 . . {with vibrating filtering elements}
- B01D 46/0054 . . {with translational movement}
- B01D 46/0056 . . {with rotational movement}
- B01D 46/0057 . {Regenerating the filter material in the filter ([B01D 46/04](#), [B01D 46/48](#) take precedence)}



B01D 46/0058	..	{Devices for taking out of action one or more units of multi-unit filters}
B01D 46/006	..	{Chemical processes for the removal of the retained particles, e.g. by burning of processes}
B01D 46/0061	...	{making use of catalysts}
B01D 46/0063	...	{by heating only}
B01D 46/0064	..	{by means of acting on the cake side and moving with respect to the filtering elements}
B01D 46/0065	...	{by scrapers, brushes, nozzles or the like}
B01D 46/0067	..	{by acting counter-currently on the filtering surface (e.g. flushing)}
B01D 46/0068	...	{with pressurised gas, e.g. pulsed air}
B01D 46/0069	....	{Using pressurized gas at supersonic velocities}
B01D 46/0071	...	{with backwash arms, shoes or nozzles}
B01D 46/0072	..	{by forces created by movement of the filter element}
B01D 46/0073	...	{involving centrifugal forces}
B01D 46/0075	...	{involving vibrations or shaking}
B01D 46/0076	....	{involving sonic or ultrasonic waves}
B01D 46/0078	..	{by electrical means, e.g. for the generation of electrostatic forces in order to reject particles}
B01D 46/0079	..	{by other means not moving with respect to the filtering elements, e.g. fixed nozzles on the cake side}
B01D 46/008	..	{Replacing filter elements}
B01D 46/0082	..	{Washing the filter inside the filter housing}
B01D 46/0083	..	{Cleaning the filter surface by interrupting suction so that the filter cake falls by gravity}
B01D 46/0084	.	{provided with safety means}
B01D 46/0086	..	{Filter condition indicators}
B01D 46/0087	..	{Bypass or safety valves}
B01D 46/0089	..	{Anti-return means}
B01D 46/009	..	{Identification of filter type or position thereof, e.g. by transponders or bar codes}
B01D 46/0091	..	{Including arrangements for environmental or personal protection}
B01D 46/0093	...	{against fire or explosion}
B01D 46/0094	...	{against radiation}
B01D 46/0095	..	{Means acting upon failure of the filtering system, e.g. in case of damage of the filter elements; Failsafes}
B01D 46/0097	..	{Special means for preventing bypass around the filter, i.e. in addition to usual seals}
B01D 46/0098	..	{Protecting coverages on the filter which is removed before the filter is used, protection of filter, packaging}
B01D 46/02	.	Particle separators, e.g. dust precipitators, having hollow filters made of flexible material
B01D 46/023	..	{Pockets filters, i.e. multiple bag filters mounted on a common frame}
B01D 46/026	..	{Means for maintaining a space between filters, e.g. avoiding contact between adjacent filters}



B01D 46/04	..	Cleaning filters
B01D 46/06	..	with means keeping the working surfaces flat
B01D 46/08	...	the working surfaces forming a star shape
B01D 46/10	.	Particle separators, e.g. dust precipitators, using filter plates, sheets, or pads having plane surfaces, {i.e. axial filtering}
B01D 46/103	..	{Curved filtering elements}
B01D 46/106	..	{Ring-shaped filtering elements}
B01D 46/12	..	in multiple arrangements
B01D 46/125	...	{V-type arrangements}
B01D 46/14	..	arranged in a star shape
B01D 46/16	..	arranged on non-filtering conveyers {or supports}
B01D 46/18	.	Particle separators, e.g. dust precipitators, using filtering belts
B01D 46/185	..	{Construction of filtering belts or supporting belts including devices for centering, mounting or sealing thereof}
B01D 46/20	..	the belts combined with drums
B01D 46/22	..	the belts travelling during filtering
B01D 46/24	.	Particle separators, e.g. dust precipitators, using rigid hollow filter bodies
B01D 46/2403	..	{characterised by the physical shape or structure of the filtering element}
B01D 46/2407	...	{Filter candles}
B01D 46/2411	...	{Filter cartridges}
B01D 46/2414	....	{End caps including additional functions or special forms}
B01D 46/2418	...	{Honeycomb filters (used for filtering exhaust gases of an internal combustion engine <a href="#">F01N 3/022</a> ; ceramic honeycomb structures per se <a href="#">C04B 38/0006</a> )}
B01D 46/2422	....	{Mounting of the body within a housing}
B01D 46/2425	....	{characterized by parameters related to the physical properties of the honeycomb structure material, e.g. modulus of rupture, porosity}
B01D 46/2429	.....	{of the honeycomb walls or cells}
B01D 2046/2433	.....	{Porosity}
B01D 2046/2437	.....	{Pore diameter}
B01D 46/244	.....	{of the plugs}
B01D 46/2444	.....	{of the outer peripheral sealing}
B01D 46/2448	.....	{of the adhesive layers, i.e. joints between segments}
B01D 46/2451	....	{characterized by the geometrical structure, shape, pattern or configuration or parameters related to the geometry of the structure, e.g. thickness, cell density}
B01D 46/2455	.....	{of the whole honeycomb or segments, e.g. elliptic body, octagonal segment, centre of gravity}
B01D 46/2459	.....	{of the plugs, e.g. projections, gaps, length}
B01D 46/2462	.....	{the outer peripheral sealing, e.g. undulations, thickness}
B01D 46/2466	.....	{of the adhesive layers, i.e. joints between segments, e.g. undulations, thickness}
B01D 46/247	.....	{of the cells, e.g. diamonds, hexagonal configuration, cell density}



B01D 46/2474	.....	{of the walls along the length of the honeycomb, e.g. inclination from inlet to outlet, length, thickness}
B01D 2046/2477	.....	{Triangular shapes or configurations}
B01D 2046/2481	.....	{Quadrangular shapes or configurations, e.g. square, diamond}
B01D 2046/2485	.....	{Octagonal shapes or configurations}
B01D 2046/2488	.....	{Circular shapes or configurations}
B01D 2046/2492	.....	{Other shapes or configurations not covered by groups <a href="#">B01D 46/2474</a> to <a href="#">B01D 2046/2488</a> }
B01D 2046/2496	....	{The honeycomb filter being defined by mathematical equations}
B01D 46/26	..	rotatable
B01D 46/28	.	Particle separators, e.g. dust precipitators, using filter brushes
B01D 46/30	.	Particle separators, e.g. dust precipitators, using loose filtering material
B01D 46/32	..	the material moving during filtering
B01D 46/34	...	not horizontally, e.g. using shoots
B01D 46/36	...	as a substantially horizontal layer, e.g. on rotary tables, drums, conveyer belts
B01D 46/38	...	as fluidised bed
B01D 46/40	.	Particle separators, e.g. dust precipitators, using edge filters, i.e. using contiguous impervious surfaces
B01D 46/403	..	{of helically or spirally wound bodies}
B01D 46/406	..	{of stacked bodies}
B01D 46/42	.	Auxiliary equipment or operation thereof
B01D 46/4209	..	{Prevention of static charge, e.g. by grounding}
B01D 46/4218	..	{Influencing the heat transfer which act passively, e.g. isolations, heat sinks, cooling ribs}
B01D 46/4227	..	{Manipulating filters or filter elements, e.g. handles or extracting tools}
B01D 46/4236	..	{Reducing noise or vibration emissions}
B01D 46/4245	..	{Means for power supply or devices using electrical power in filters or filter elements}
B01D 46/4254	..	{Allowing or improving visual supervision, e.g. lamps, transparent parts, windows}
B01D 46/4263	..	{Means for active heating or cooling}
B01D 46/4272	..	{Special valve constructions adapted to filters or filter elements}
B01D 46/4281	..	{Venturi's or systems showing a venturi effect}
B01D 46/429	..	{Means for wireless communication}
B01D 46/44	..	controlling filtration
B01D 46/442	...	{by measuring the concentration of particles}
B01D 46/444	...	{by flow measuring}
B01D 46/446	...	{by pressure measuring}
B01D 46/448	...	{by temperature measuring}
B01D 46/46	...	automatic
B01D 46/48	..	Removing dust other than cleaning filters {e.g. by using collecting trays}
B01D 46/50	..	Means for discharging electrostatic potential



- B01D 46/52 . Particle separators, e.g. dust precipitators, using filters embodying folded {corrugated or wound sheet} material
- B01D 46/521 .. {using folded, pleated material}
- B01D 46/522 ... {with specific folds, e.g. having different lengths}
- B01D 46/523 ... {with means for maintaining spacing between the pleats or folds}
- B01D 46/525 ... {which comprises flutes}
- B01D 46/526 .... {in stacked arrangement}
- B01D 46/527 .... {in wound arrangement}
- B01D 46/528 .. {using wound sheets (B01D 46/527 takes precedence)}
- B01D 46/54 . Particle separators, e.g. dust precipitators, using ultra-fine filter sheets or diaphragms
- B01D 46/543 .. {using membranes}
- B01D 46/546 .. {using nano- or microfibres}

**B01D 47/00** **Separating dispersed particles from gases, air or vapours by liquid as separating agent** (B01D 45/10 takes precedence; fractionating columns or parts thereof B01D 3/16)

- B01D 47/02 . by passing the gas or air or vapour over or through a liquid bath

**WARNING**

Groups B01D 47/021 to B01D 47/028 are not complete pending reclassification; see also this group

- B01D 47/021 .. {by bubbling the gas through a liquid bath}
- B01D 47/022 .. {by using a liquid curtain (B01D 47/06 takes precedence)}
- B01D 47/024 .. {by impinging the gas to be cleaned essentially in a perpendicular direction onto the liquid surface}
- B01D 47/025 .. {by contacting gas and liquid with a static flow mixer (B01D 47/14 takes precedence)}
- B01D 47/027 .. {by directing the gas to be cleaned essentially tangential to the liquid surface}
- B01D 47/028 .. {by directing the gas through a wetted wire mesh or a perforated plate (B01D 47/14 takes precedence)}
- B01D 47/04 . by passing the gas or air or vapour through foam
- B01D 47/05 . by condensation of the separating agent
- B01D 47/06 . Spray cleaning

**WARNING**

Groups B01D 47/063 and B01D 47/066 are not complete pending reclassification, see also B01D 47/06

- B01D 47/063 .. {with two or more jets impinging against each other}
- B01D 47/066 .. {with nozzles using mechanical vibrations}
- B01D 47/08 .. with rotary nozzles

**WARNING**



B01D 47/08

(continued)

Group [B01D 47/085](#) is not complete pending reclassification, see also [B01D 47/08](#)

B01D 47/085

... {with nozzles which are partly immersed in the washing fluid}

B01D 47/10

. Venturi scrubbers

B01D 47/12

. Washers with plural different washing sections ([B01D 47/14](#) takes precedence)

B01D 47/14

. Packed scrubbers (packing elements [B01J 19/30](#), [B01J 19/32](#))

B01D 47/16

. Apparatus having rotary means, other than rotatable nozzles, for atomising the cleaning liquid

B01D 47/18

. . with horizontally-arranged shafts

**B01D 49/00**

**Separating dispersed particles from gases, air or vapours by other methods**

B01D 49/003

. {by sedimentation}

B01D 49/006

. {by sonic or ultrasonic techniques}

B01D 49/02

. by thermal repulsion

**B01D 50/00**

**Combinations of devices for separating particles from gases or vapours**

B01D 50/002

. {Combinations of devices relating to groups [B01D 45/00](#) and [B01D 46/00](#)}

B01D 50/004

. {Combinations of devices relating to groups [B01D 45/00](#) and [B01D 47/00](#)}

B01D 50/006

. {Combinations of devices relating to groups [B01D 46/00](#) and [B01D 47/00](#)}

B01D 50/008

. {Combinations of devices relating to groups [B01D 45/00](#) and [B01D 46/00](#) and [B01D 47/00](#)}

**B01D 51/00**

**Auxiliary pre-treatment of gases or vapours to be cleaned** (preventing dust fires [A62C](#); pretreatment specially adapted for magnetic or electrostatic separation [B03C](#))

B01D 51/02

. Amassing the particles, e.g. by flocculation {(amassing by electric fields [B03C 3/0175](#))}

B01D 51/04

. . by seeding, e.g. by adding particles

B01D 51/06

. . by varying the pressure of the gas or vapour

B01D 51/08

... by sound or ultrasonics

B01D 51/10

. Conditioning the gas to be cleaned

**B01D 53/00**

**Separation of gases or vapours; Recovering vapours of volatile solvents from gases; Chemical or biological purification of waste gases, e.g. engine exhaust gases, smoke, fumes, flue gases, aerosols, (recovery of volatile solvents by condensation [B01D 5/00](#); sublimation [B01D 7/00](#); cold traps, cold baffles [B01D 8/00](#); working-up undefined gaseous mixtures obtained by cracking hydrocarbon oils [C10G 70/00](#); cleaning coal gas [C10K](#); working-up of natural gas, or synthetic natural gas, [C10L 3/10](#); separation of difficult-to-condense gases or air by liquefaction [F25J](#); for investigating materials [G01N 30/00](#))**

**NOTE**

Group [B01D 53/34](#) takes precedence over groups [B01D 53/02](#) to [B01D 53/32](#)

B01D 53/002

. {by condensation}



- B01D 53/005 . {by heat treatment}
- B01D 53/007 . {by irradiation}
- B01D 53/02 . by adsorption, e.g. preparative gas chromatography {(solid sorbent compositions [B01J 20/00](#), preparation of inorganic compounds or elements [C01](#))}

**NOTE**

In group [B01D 53/02](#) and subgroups it is desirable to add indexing codes relating to adsorbents, components to be removed, main components in the product gas stream or type of gas or vapour treatment chosen from groups [B01D 2253/00](#), [B01D 2256/00](#), [B01D 2257/00](#) or [B01D 2259/00](#)

- B01D 53/025 .. {with wetted adsorbents; Chromatography (analytical chromatography [G01N 30/00](#) - [G01N 30/96](#); for liquids [B01D 15/08](#))}
- B01D 53/04 .. with stationary adsorbents {(B01D 53/025 takes precedence)}
- B01D 53/0407 ... {Constructional details of adsorbing systems}
- B01D 53/0415 .... {Beds in cartridges}
- B01D 53/0423 .... {Beds in columns}
- B01D 53/0431 .... {Beds with radial gas flow}
- B01D 53/0438 .... {Cooling or heating systems}
- B01D 53/0446 .... {Means for feeding or distributing gases}
- B01D 53/0454 ... {Controlling adsorption (controlling temperature swing adsorption [B01D 53/0462](#), controlling pressure swing adsorption [B01D 53/047](#))}

**NOTE**

In groups [B01D 53/0462](#) and [B01D 53/047](#) to [B01D 53/0476](#) it is desirable to add indexing codes chosen from [B01D 2259/40007](#) to [B01D 2259/40081](#) relating to controlling and processing aspects of pressure or temperature swing adsorption

- B01D 53/0462 ... {Temperature swing adsorption}
- B01D 53/047 ... Pressure swing adsorption
- B01D 53/0473 .... {Rapid pressure swing adsorption}
- B01D 53/0476 .... {Vacuum pressure swing adsorption}
- B01D 53/053 .... with storage or buffer vessel
- B01D 53/06 .. with moving adsorbents, e.g. rotating beds {(B01D 53/025 takes precedence)}
- B01D 53/08 ... according to the "moving bed" method
- B01D 53/10 ... with dispersed adsorbents
- B01D 53/12 .... according to the "fluidised technique"
- B01D 53/14 . by absorption
- B01D 53/1406 .. {Multiple stage absorption}
- B01D 53/1412 .. {Controlling the absorption process}
- B01D 53/1418 .. {Recovery of products}
- B01D 53/1425 .. {Regeneration of liquid absorbents}
- B01D 53/1431 .. {Pretreatment by other processes}



- B01D 53/1437 . . . {Pretreatment by adsorption}
- B01D 53/1443 . . . {Pretreatment by diffusion}
- B01D 53/145 . . . {Pretreatment by separation of solid or liquid material}
- B01D 53/1456 . . {Removing acid components}
- B01D 53/1462 . . . {Removing mixtures of hydrogen sulfide and carbon dioxide}
- B01D 53/1468 . . . {Removing hydrogen sulfide}
- B01D 53/1475 . . . {Removing carbon dioxide}
- B01D 53/1481 . . . {Removing sulfur dioxide or sulfur trioxide}
- B01D 53/1487 . . {Removing organic compounds}
- B01D 53/1493 . . {Selection of liquid materials for use as absorbents}

#### **NOTE**

In [B01D 53/1493](#) it is desirable to add indexing codes for compositional aspects of absorbents. The codes are chosen from [B01D 2252/00](#) - [B01D 2252/61](#)

- B01D 53/18 . . Absorbing units; Liquid distributors therefor ([B01D 3/16](#), [B01D 3/26](#), [B01D 3/30](#) take precedence; packing elements [B01J 19/30](#), [B01J 19/32](#))
- B01D 53/185 . . . {Liquid distributors}
- B01D 53/22 . by diffusion (manufacturing semi-permeable membranes [B01D 67/00](#); form, structure or properties of semi-permeable membranes [B01D 69/00](#); material for semi-permeable membranes [B01D 71/00](#))
- B01D 2053/221 . . {Devices}
- B01D 2053/222 . . . {with plates}
- B01D 2053/223 . . . {with hollow tubes}
- B01D 2053/224 . . . . {with hollow fibres}
- B01D 53/225 . . {Multiple stage diffusion}
- B01D 53/226 . . . {in serial connexion}
- B01D 53/227 . . . {in parallel connexion}
- B01D 53/228 . . {characterised by specific membranes}
- B01D 53/229 . . {Integrated processes (Diffusion and at least one other process, e.g. adsorption, absorption)}
- B01D 53/24 . by centrifugal force ([centrifuges B04B](#); [cyclones B04C](#))
- B01D 53/26 . Drying gases or vapours
- B01D 53/261 . . {by adsorption}
- B01D 53/263 . . {by absorption}
- B01D 53/265 . . {by refrigeration (condensation)}
- B01D 53/266 . . {by filtration}
- B01D 53/268 . . {by diffusion}
- B01D 53/28 . . Selection of materials for use as drying agents
- B01D 53/30 . Controlling by gas-analysis apparatus ([regulating non electrical variables in general G05D](#))
- B01D 53/32 . by electrical effects other than those provided for in group [B01D 61/00](#)



B01D 53/323	..	{by electrostatic effects or by high-voltage electric fields}
B01D 53/326	..	{in electrochemical cells}
B01D 53/34	.	Chemical or biological purification of waste gases
B01D 53/343	..	{Heat recovery}
B01D 53/346	..	{Controlling the process}
B01D 53/38	..	Removing components of undefined structure
B01D 53/40	...	Acidic components ( <a href="#">B01D 53/44</a> takes precedence)
B01D 53/42	...	Basic components ( <a href="#">B01D 53/44</a> takes precedence)
B01D 53/44	...	Organic components
B01D 53/46	..	Removing components of defined structure
B01D 53/48	...	Sulfur compounds
B01D 53/485	....	{containing only one sulfur compound other than sulfur oxides or hydrogen sulfide}
B01D 53/50	....	Sulfur oxides ( <a href="#">B01D 53/60</a> takes precedence)
B01D 53/501	.....	{by treating the gases with a solution or a suspension of an alkali or earth-alkali or ammonium compound}
B01D 53/502	.....	{characterised by a specific solution or suspension}
B01D 53/504	.....	{characterised by a specific device}
B01D 53/505	.....	{in a spray drying process}
B01D 53/507	.....	{by treating the gases with other liquids}
B01D 53/508	.....	{by treating the gases with solids}
B01D 53/52	....	Hydrogen sulfide
B01D 53/523	.....	{Mixtures of hydrogen sulfide and sulfur oxides}
B01D 53/526	.....	{Mixtures of hydrogen sulfide and carbon dioxide}
B01D 53/54	...	Nitrogen compounds
B01D 53/56	....	Nitrogen oxides ( <a href="#">B01D 53/60</a> takes precedence)
B01D 53/565	.....	{by treating the gases with solids}
B01D 53/58	....	Ammonia
B01D 53/60	...	Simultaneously removing sulfur oxides and nitrogen oxides
B01D 53/62	...	Carbon oxides
B01D 53/64	...	Heavy metals or compounds thereof, e.g. mercury
B01D 53/66	...	Ozone
B01D 53/68	...	Halogens or halogen compounds
B01D 53/685	....	{by treating the gases with solids}
B01D 53/70	....	Organic halogen compounds
B01D 53/72	...	Organic compounds not provided for in groups <a href="#">B01D 53/48</a> to <a href="#">B01D 53/70</a> , e.g. hydrocarbons
B01D 53/73	..	After-treatment of removed components
B01D 53/74	..	General processes for purification of waste gases; Apparatus or devices specially adapted therefor ( <a href="#">B01D 53/92</a> takes precedence)
B01D 53/75	...	Multi-step processes



B01D 53/76	...	Gas phase processes, e.g. by using aerosols
B01D 53/77	...	Liquid phase processes
B01D 53/78	....	with gas-liquid contact
B01D 53/79	....	Injecting reactants
B01D 53/80	...	Semi-solid phase processes, i.e. by using slurries
B01D 53/81	...	Solid phase processes
B01D 53/82	....	with stationary reactants
B01D 53/83	....	with moving reactants
B01D 53/84	...	Biological processes
B01D 53/85	....	with gas-solid contact
B01D 53/86	...	Catalytic processes
B01D 53/8603	....	{Removing sulfur compounds}
B01D 53/8606	.....	{only one sulfur compound other than sulfur oxides or hydrogen sulfide}
B01D 53/8609	.....	{Sulfur oxides}
B01D 53/8612	.....	{Hydrogen sulfide}
B01D 53/8615	.....	{Mixtures of hydrogen sulfide and sulfur oxides}
B01D 53/8618	.....	{Mixtures of hydrogen sulfide and carbon dioxides}
B01D 53/8621	....	{Removing nitrogen compounds}
B01D 53/8625	.....	{Nitrogen oxides}
B01D 53/8628	.....	{Processes characterised by a specific catalyst}
B01D 53/8631	.....	{Processes characterised by a specific device}
B01D 53/8634	.....	{Ammonia}
B01D 53/8637	....	{Simultaneously removing sulfur oxides and nitrogen oxides}
B01D 53/864	....	{Removing carbon monoxide or hydrocarbons}
B01D 53/8643	....	{Removing mixtures of carbon monoxide or hydrocarbons and nitrogen oxides}
B01D 53/8646	.....	{Simultaneous elimination of the components ( <a href="#">B01D 53/8656</a> takes precedence)}
B01D 53/865	.....	{characterised by a specific catalyst}
B01D 53/8653	.....	{characterised by a specific device}
B01D 53/8656	....	{Successive elimination of the components}
B01D 53/8659	....	{Removing halogens or halogen compounds}
B01D 53/8662	.....	{Organic halogen compounds}
B01D 53/8665	....	{Removing heavy metals or compounds thereof, e.g. mercury}
B01D 53/8668	....	{Removing organic compounds not provided for in <a href="#">B01D 53/8603</a> to <a href="#">B01D 53/8665</a> }
B01D 53/8671	....	{Removing components of defined structure not provided for in <a href="#">B01D 53/8603</a> to <a href="#">B01D 53/8668</a> }
B01D 53/8675	.....	{Ozone}
B01D 53/8678	....	{Removing components of undefined structure}
B01D 53/8681	.....	{Acidic components ( <a href="#">B01D 53/8687</a> takes precedence)}



B01D 53/8684	.....	{Basic components ( <a href="#">B01D 53/8687</a> takes precedence)}
B01D 53/8687	.....	{Organic components}
B01D 53/869	....	{Multiple step processes}
B01D 53/8693	....	{After-treatment of removed components}
B01D 53/8696	....	{Controlling the catalytic process}
B01D 53/88	....	Handling or mounting catalysts
B01D 53/885	.....	{Devices in general for catalytic purification of waste gases}
B01D 53/90	....	Injecting reactants
B01D 53/92	..	of engine exhaust gases ( <a href="#">exhaust {or silencing} apparatus {for internal combustion engines, machines or engines in general}</a> , having means for purifying, <a href="#">{rendering innocuous} or otherwise treating exhaust gases F01N 3/00</a> )
B01D 53/922	...	{Mixtures of carbon monoxide or hydrocarbons and nitrogen oxides}
B01D 53/925	....	{Simultaneous elimination of carbon monoxide or hydrocarbons and nitrogen oxides}
B01D 53/927	....	{Successive elimination of carbon monoxide or hydrocarbons and nitrogen oxides}
B01D 53/94	...	by catalytic processes
B01D 53/9404	....	{Removing only nitrogen compounds}
B01D 53/9409	.....	{Nitrogen oxides}
B01D 53/9413	.....	{Processes characterised by a specific catalyst}

**WARNING**

Groups [B01D 53/9418](#) to [B01D 53/9427](#) are not complete pending a reorganisation. See also [B01D 53/9413](#)

B01D 53/9418	.....	{for removing nitrogen oxides by selective catalytic reduction [SCR] using a reducing agent in a lean exhaust gas}
B01D 53/9422	.....	{for removing nitrogen oxides by NO <sub>x</sub> storage or reduction by cyclic switching between lean and rich exhaust gases (LNT, NSC, NSR)}
B01D 53/9427	.....	{for removing nitrous oxide}
B01D 53/9431	.....	{Processes characterised by a specific device}
B01D 53/9436	....	{Ammonia}
B01D 53/944	....	{Simultaneously removing carbon monoxide, hydrocarbons or carbon making use of oxidation catalysts ( <a href="#">three-way-catalysts [TWC] B01D 53/9445</a> )}
B01D 53/9445	....	{Simultaneously removing carbon monoxide, hydrocarbons or nitrogen oxides making use of three-way catalysts [TWC] or four-way-catalysts [FWC]}

**WARNING**

Groups [B01D 53/945](#) and [B01D 53/9454](#) are not complete pending a reorganisation. See also [B01D 53/9445](#)

B01D 53/945	.....	{characterised by a specific catalyst}
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- B01D 53/9454 . . . . . {characterised by a specific device}
- B01D 53/9459 . . . . . {Removing one or more of nitrogen oxides, carbon monoxide, or hydrocarbons by multiple successive catalytic functions; systems with more than one different function, e.g. zone coated catalysts (layered catalysts with only one function [B01D 53/9413](#), [B01D 53/944](#) or [B01D 53/945](#))}

**WARNING**

Groups [B01D 53/9459](#) to [B01D 53/9477](#) are not complete pending a reorganisation. See also [B01D 53/9459](#)

- B01D 53/9463 . . . . . {with catalysts positioned on one brick}
- B01D 53/9468 . . . . . {in different layers}
- B01D 53/9472 . . . . . {in different zones}
- B01D 53/9477 . . . . . {with catalysts positioned on separate bricks, e.g. exhaust systems}
- B01D 53/9481 . . . . . {Catalyst preceded by an adsorption device without catalytic function for temporary storage of contaminants, e.g. during cold start}

**WARNING**

Groups [B01D 53/9486](#) and [B01D 53/949](#) are not complete pending a reorganisation. See also [B01D 53/9481](#)

- B01D 53/9486 . . . . . {for storing hydrocarbons}
- B01D 53/949 . . . . . {for storing sulfur oxides}
- B01D 53/9495 . . . . . {Controlling the catalytic process}
- B01D 53/96 . . . . . Regeneration, reactivation or recycling of reactants
- B01D 53/965 . . . . . {including an electrochemical process step}

**B01D 57/00** **Separation, other than separation of solids, not fully covered by a single other group or subclass, e.g. [B03C](#)**

- B01D 57/02 . . . . . by electrophoresis (treatment of water, waste water, sewage or sludge by electrophoresis [C02F 1/469](#); electrophoretic production of compounds or non-metals [C25B 7/00](#); investigating or analysing materials by using electrophoresis [G01N 27/26](#))

**B01D 59/00** **Separation of different isotopes of the same chemical element (preventing occurrence of critical conditions when producing fissile material [G21](#); shielding from radioactivity [G21F](#))**

- B01D 59/02 . . . . . Separation by phase transition
- B01D 59/04 . . . . . by distillation
- B01D 59/06 . . . . . by fractional melting; by zone melting
- B01D 59/08 . . . . . by fractional crystallisation, by precipitation, by zone freezing
- B01D 59/10 . . . . . Separation by diffusion
- B01D 59/12 . . . . . by diffusion through barriers
- B01D 59/14 . . . . . Construction of the barrier
- B01D 59/16 . . . . . by thermal diffusion
- B01D 59/18 . . . . . by separation jets



- B01D 59/20 . Separation by centrifuging
- B01D 59/22 . Separation by extracting
- B01D 59/24 . . by solvent extraction
- B01D 59/26 . . by sorption, i.e. absorption, adsorption, persorption
- B01D 59/28 . Separation by chemical exchange
- B01D 59/30 . . by ion exchange
- B01D 59/32 . . by exchange between fluids
- B01D 59/33 . . . involving dual temperature exchange
- B01D 59/34 . Separation by photochemical methods
- B01D 59/36 . Separation by biological methods
- B01D 59/38 . Separation by electrochemical methods (in general [B01J](#))
- B01D 59/40 . . by electrolysis
- B01D 59/42 . . by electromigration; by electrophoresis
- B01D 59/44 . Separation by mass spectrography (particle spectrometer or separator tubes [H01J 49/00](#))
- B01D 59/46 . . using only electrostatic fields
- B01D 59/48 . . using electrostatic and magnetic fields
- B01D 59/50 . Separation involving two or more processes covered by different groups selected from groups [B01D 59/02](#), [B01D 59/10](#), [B01D 59/20](#), [B01D 59/22](#), [B01D 59/28](#), [B01D 59/34](#), [B01D 59/36](#), [B01D 59/38](#), [B01D 59/44](#)

**Processes of separation using semi-permeable membranes, e.g. dialysis, osmosis, ultrafiltration; Apparatus specially adapted therefor; Semi-permeable membranes or their production** (separation of gases or vapours by diffusion [B01D 53/22](#); treatment of milk by dialysis, reverse osmosis or ultrafiltration [A23C 9/142](#), by electrodialysis [A23C 9/144](#); artificial kidneys [A61M 1/14](#); {manufacture of films of plastics [B29](#), [C08J 5/18](#), of ion-exchange membranes [C08J 5/22](#)} ; treatment of water by dialysis, osmosis or reverse osmosis [C02F 1/44](#), by electrodialysis [C02F 1/469](#); apparatus for enzymology or microbiology with dialysis means [C12M 1/12](#); production or purification of sugar juices, e.g. by osmosis, [C13D3/16](#); extraction of sugar from molasses, e.g. by osmosis, [C13J1/08](#); diaphragms for electrolysis [C25B 13/00](#), [C25C 7/04](#); osmosis as energy source [F03G 7/00](#))

#### **NOTE**

In groups [B01D 61/00](#) to [B01D 71/00](#), in the absence of an indication to the contrary, classification is made in the last appropriate place (in respect of [B01D 71/00](#), see also Note (1) following that group)

#### **WARNING**

Attention is drawn to the WARNING after the subclass title of [A61M](#)

**B01D 61/00** **Processes of separation using semi-permeable membranes, e.g. dialysis, osmosis, ultrafiltration; Apparatus, accessories or auxiliary operations specially adapted therefor**

#### **NOTE**



## B01D 61/00

(continued)

In groups [B01D 61/00](#) to [B01D 61/58](#) it is desirable to add the indexing codes relating to process operations and control chosen from groups [B01D 2311/00](#) to [B01D 2311/2696](#),

to details relating to membrane modules and apparatus indexing codes chosen from [B01D 2313/00](#) to [B01D 2313/90](#),

to details relating to the membrane module operation indexing codes chosen from [B01D 2315/00](#) to [B01D 2315/16](#),

to details relating to the module arrangement within a plant or an apparatus indexing codes chosen from [B01D 2317/00](#) to [B01D 2317/08](#) and

to details relating to the membrane assembly within one housing indexing codes chosen from [B01D 2319/00](#) to [B01D 2319/06](#)

## B01D 61/002

- . {Forward osmosis, direct osmosis (actuators for pressure retarded osmosis [F03G 7/005](#))}

## B01D 61/005

- .. {Osmotic agents, draw solutions}

## B01D 61/007

- . {Separation by stereostructure, steric separation}

## B01D 61/02

- . Reverse osmosis; Hyperfiltration; {Nanofiltration}

## B01D 61/022

- .. {comprising multiple reverse osmosis, hyperfiltration or nanofiltration steps}

## B01D 61/025

- .. {Reverse osmosis; Hyperfiltration ([B01D 61/022](#) takes precedence)}

## B01D 61/027

- .. {Nanofiltration ([B01D 61/022](#) takes precedence)}

## B01D 61/04

- .. Feed pretreatment

## B01D 61/06

- .. Energy recovery

## B01D 61/08

- .. Apparatus therefor

## B01D 61/10

- .. Accessories; Auxiliary operations

## B01D 61/12

- .. Controlling or regulating

## B01D 61/14

- . Ultrafiltration; Microfiltration

## B01D 61/142

- .. {comprising multiple ultrafiltration or microfiltration steps}

## B01D 61/145

- .. {Ultrafiltration ([B01D 61/142](#) takes precedence)}

## B01D 61/147

- .. {Microfiltration ([B01D 61/142](#) takes precedence)}

## B01D 61/16

- .. Feed pretreatment

## B01D 61/18

- .. Apparatus therefor

## B01D 61/20

- .. Accessories; Auxiliary operations

## B01D 61/22

- .. Controlling or regulating

## B01D 61/24

- . Dialysis; {Membrane extraction (dialysate solution flow [A61M 1/1656](#))}

## B01D 61/243

- .. Dialysis

## B01D 61/246

- .. Membrane extraction

## B01D 61/28

- .. Apparatus therefor

## B01D 61/30

- .. Accessories; Auxiliary operations

## B01D 61/32

- .. Controlling or regulating {(Measuring ultrafiltrate during dialysis [A61M 1/16](#))}

## B01D 61/36

- . Pervaporation; Membrane distillation; Liquid permeation

## B01D 61/362

- .. {Pervaporation}

## B01D 61/364

- .. {Membrane distillation}

## B01D 61/366

- .. {Apparatus therefor}



- B01D 61/368 .. {Accessories; Auxiliary operations}
- B01D 61/38 . Liquid-membrane separation
- B01D 61/40 .. using emulsion-type membranes
- B01D 61/42 . Electrodialysis; Electro-osmosis {Electro-ultrafiltration}
- B01D 61/422 .. {Electrodialysis}
- B01D 61/425 .. {Electro-ultrafiltration}
- B01D 61/427 .. {Electro-osmosis}
- B01D 61/44 .. Ion-selective electrodialysis
- B01D 61/445 ... {with bipolar membranes; Water splitting}
- B01D 61/46 ... Apparatus therefor
- B01D 61/48 .... having one or more compartments filled with ion-exchange material {e.g. electrodeionisation}
- B01D 61/485 ..... {Specific features relating to the ion-exchange material}
- B01D 61/50 .... Stacks of the plate-and-frame type
- B01D 61/52 ... Accessories; Auxiliary operations
- B01D 61/54 ... Controlling or regulating
- B01D 61/56 .. Electro-osmotic de-watering
- B01D 61/58 . Multistep processes {(comprising reverse osmosis or hyperfiltration steps [B01D 61/022](#); comprising ultrafiltration or microfiltration steps [B01D 61/142](#))}

**NOTE**

In group [B01D 61/58](#) specific process steps within the multistep process are indexed by codes chosen from [B01D 61/02](#) to [B01D 61/56](#)

**B01D 63/00****Apparatus in general for separation processes using semi-permeable membranes****NOTE**

In groups [B01D 63/00](#) to [B01D 63/16](#) it is desirable to add the indexing codes relating to membrane modules and apparatus chosen from groups [B01D 2313/00](#) to [B01D 2313/90](#),  
to details relating to the membrane module operation indexing codes chosen from [B01D 2315/00](#) to [B01D 2315/16](#),  
to details relating to the module arrangement within a plant or an apparatus indexing codes chosen from [B01D 2317/00](#) to [B01D 2317/08](#) and  
to details relating to the membrane assembly within one housing indexing codes are chosen from [B01D 2319/00](#) to [B01D 2319/06](#)

- B01D 63/005 . {Microfluidic devices comprising semi-permeable hollow fibre membranes}
- B01D 63/02 . Hollow fibre modules
- B01D 63/021 .. {Manufacturing thereof}
- B01D 63/022 ... {Encapsulating hollow fibres}
- B01D 63/023 .... {Materials therefor}
- B01D 63/024 .. {with a single potted end or U-shaped}



- B01D 63/025 .. {Bobbin units}
- B01D 63/026 .. {Wafer type modules or flat-surface type modules}
- B01D 63/027 .. {Twinned or braided type modules}
- B01D 63/028 .. {Microfluidic devices comprising semi-permeable hollow fibre membranes}
- B01D 63/029 .. {Microfluidic devices comprising semi-permeable hollow fibre membranes}
- B01D 63/04 .. comprising multiple hollow fibre assemblies
- B01D 63/043 ... {with separate tube sheets}
- B01D 63/046 ... {in separate housings}
- B01D 63/06 . Tubular membrane modules
- B01D 63/061 .. {Manufacturing thereof}
- B01D 63/062 .. {with membranes on a surface of a support tube}
- B01D 63/063 ... {on the inner surface thereof}
- B01D 63/065 ... {on the outer surface thereof}
- B01D 63/066 .. {with a porous block having membrane coated passages}
- B01D 63/067 .. {with pleated membranes}
- B01D 63/068 .. {with flexible membrane tubes}
- B01D 63/08 . Flat membrane modules
- B01D 63/081 .. {Manufacturing thereof}
- B01D 63/082 .. {comprising a stack of flat membranes, e.g. plate-and-frame devices}
- B01D 63/084 ... {at least one flow duct intersecting the membranes}
- B01D 63/085 .... {specially adapted for two fluids in mass exchange flow}
- B01D 63/087 .. {Single membrane modules}
- B01D 63/088 .. {Microfluidic devices comprising semi-permeable flat membranes}
- B01D 63/10 . Spiral-wound membrane modules
- B01D 63/103 .. {Details relating to membrane envelopes}
- B01D 63/106 .. {Anti-Telescopic-Devices [ATD]}
- B01D 63/12 .. comprising multiple spiral-wound assemblies
- B01D 63/14 . Pleat-type membrane modules
- B01D 63/16 . Rotary, reciprocated or vibrated modules

**B01D 65/00 Accessories or auxiliary operations, in general, for separation processes or apparatus using semi-permeable membranes**

- B01D 65/003 . {Membrane bonding or sealing}
- B01D 65/006 . {Membrane storage}
- B01D 65/02 . Membrane cleaning or sterilisation {; Membrane regeneration}

**NOTE**

In group [B01D 65/02](#) it is desirable to add the indexing codes relating to membrane cleaning, regeneration, sterilization and prevention of membrane fouling chosen from groups [B01D 2321/00](#) to [B01D 2321/28](#)

- B01D 65/022 .. {Membrane sterilisation}



- B01D 65/025 . . {Removal of membrane elements before washing}
- B01D 65/027 . . {Cleaning of other parts of the apparatus than the membrane}
- B01D 65/04 . . with movable bodies, e.g. foam balls

**WARNING**

Group [B01D 65/04](#) is no longer used for classification of new documents as from November 1st, 2007. Documents presently classified in this group are in the process of reclassification

- B01D 65/06 . . with special washing compositions

**WARNING**

Group [B01D 65/06](#) is no longer used for classification of new document as from November 1st, 2007. Documents presently classified in this group are in the process of reclassification

- B01D 65/08 . Prevention of membrane fouling or of concentration polarisation

**NOTE**

In group [B01D 65/08](#) it is desirable to add the indexing codes relating to membrane cleaning, regeneration, sterilization and prevention of membrane fouling chosen from groups [B01D 2321/00](#) to [B01D 2321/28](#)

- B01D 65/10 . Testing of membranes or membrane apparatus; Detecting or repairing leaks

**NOTE**

The documents classified in the groups [B01D 67/00](#) to [B01D 71/00](#) are also searchable in a keyword-based electronic off-line database called "MEMBRANE"

- B01D 65/102 . . {Detection of leaks in membranes}
- B01D 65/104 . . {Detection of leaks in membrane apparatus or modules}
- B01D 65/106 . . {Repairing membrane apparatus or modules}
- B01D 65/108 . . . {Repairing membranes}

**B01D 67/00 Processes specially adapted for manufacturing semi-permeable membranes for separation processes or apparatus**

**NOTE**

In group [B01D 67/00](#) it is desirable to add the indexing codes relating to membrane preparation chosen from groups [B01D 2323/00](#) to [B01D 2323/42](#)

- B01D 67/0002 . {Organic membrane formation}
- B01D 67/0004 . . {by agglomeration of particles, e.g. sintering}
- B01D 67/0006 . . {by chemical reactions (in-situ polymerisation, polycondensation, cross-linking or reaction for manufacturing composite membranes [B01D 69/125](#))}
- B01D 67/0009 . . {by phase separation, sol-gel transition, evaporation or solvent quenching}



B01D 67/0011	...	{Casting solutions therefor}
B01D 67/0013	...	{Casting processes (hollow fibre membrane manufacturing methods <a href="#">B01D 69/08</a> )}
B01D 67/0016	...	{Coagulation}
B01D 67/0018	...	{Thermally induced processes}
B01D 67/002	..	{from melts}
B01D 67/0023	..	{by inducing porosity into non porous precursor membranes}
B01D 67/0025	...	{by mechanical treatment, e.g. pore-stretching}
B01D 67/0027	....	{by stretching}
B01D 67/003	...	{by selective elimination of components, e.g. by leaching}
B01D 67/0032	...	{by elimination of segments of the precursor, e.g. nucleation-track membranes, lithography or laser methods}
B01D 67/0034	....	{by micromachining techniques, e.g. using masking and etching steps, photolithography}
B01D 67/0037	..	{by deposition from the gaseous phase, e.g. CVD, PVD}
B01D 67/0039	.	{Inorganic membrane formation}
B01D 67/0041	..	{by agglomeration of particles in the dry state, e.g. sintering}
B01D 67/0044	..	{by chemical reaction}
B01D 67/0046	..	{by slurry techniques, e.g. die or slip-casting}
B01D 67/0048	..	{by sol-gel transition}
B01D 67/0051	..	{by controlled crystallisation, e.g. hydrothermal growth}
B01D 67/0053	..	{by inducing porosity into non porous precursor membranes}
B01D 67/0055	...	{by mechanical treatment}
B01D 67/0058	...	{by selective elimination of components, e.g. by leaching}
B01D 67/006	...	{by elimination of segments of the precursor, e.g. nucleation-track membranes, lithography or laser methods}
B01D 67/0062	....	{by micromachining techniques, e.g. using masking and etching steps, photolithography}
B01D 67/0065	....	{by anodic oxidation}
B01D 67/0067	..	{by carbonisation or pyrolysis}
B01D 67/0069	..	{by deposition from the liquid phase, e.g. electrochemical deposition ( <a href="#">B01D 67/0046</a> takes precedence)}
B01D 67/0072	..	{by deposition from the gaseous phase, e.g. sputtering, CVD, PVD}
B01D 67/0074	..	{from melts}
B01D 67/0076	..	{Pretreatment of inorganic membrane material prior to membrane formation e.g. coating of metal powder}
B01D 67/0079	.	{Formation of membranes comprising organic and inorganic components}
B01D 67/0081	.	{After-treatment of organic or inorganic membranes}
B01D 67/0083	..	{Thermal after-treatment}
B01D 67/0086	..	{Mechanical after-treatment}
B01D 67/0088	..	{Physical treatment with compounds, e.g. swelling, coating or impregnation (involving chemical reactions <a href="#">B01D 67/0093</a> )}



- B01D 67/009 .. {with wave-energy, particle-radiation or plasma}
- B01D 67/0093 .. {Chemical modification}
- B01D 67/0095 .. {Drying}
- B01D 67/0097 .. {Storing or preservation}

**B01D 69/00**      **Semi-permeable membranes for separation processes or apparatus characterised by their form, structure or properties; Manufacturing processes specially adapted therefor**

**NOTE**

1. In this group, the following term is used with the meaning indicated:
  - "properties" covers those of a mechanical, physical or chemical nature
2. Manufacturing processes, if considered of interest, are also classified in group [B01D 67/00](#)

**WARNING**

The following sub-groups of [B01D 69/00](#) are incomplete. Documents presently classified in the hierarchically higher groups are in the process of reclassification

[B01D 69/043](#)

[B01D 69/046](#)

[B01D 69/081](#)

[B01D 69/082](#)

[B01D 69/084](#)

[B01D 69/085](#)

[B01D 69/087](#)

[B01D 69/088](#)

[B01D 69/105](#)

[B01D 69/141](#)

[B01D 69/144](#)

[B01D 69/145](#)

[B01D 69/147](#)

[B01D 69/148](#)

- B01D 69/02 . characterised by their properties

**NOTE**

In group [B01D 69/02](#) it is desirable to add the indexing codes relating to properties of membranes chosen from groups [B01D 2325/00](#) to [B01D 2325/38](#)

- B01D 69/04 . Tubular membranes
- B01D 69/043 .. {characterised by the tube diameter}
- B01D 69/046 .. {characterised by the cross-sectional shape of the tube}
- B01D 69/06 . Flat membranes
- B01D 69/08 . Hollow fibre membranes (manufacture of hollow fibres [D01D 5/24](#), [D01F 1/08](#))



- B01D 69/081 .. {characterised by the fibre diameter}
- B01D 69/082 .. {characterised by the cross-sectional shape of the fibre}
- B01D 69/084 .. {Undulated fibres}
- B01D 69/085 .. {Details relating to the spinneret}
- B01D 69/087 .. {Details relating to the spinning process}
- B01D 69/088 ... {Co-extrusion; Co-spinning}
- B01D 69/10 . Supported membranes; Membrane supports
- B01D 69/105 .. {Support pretreatment}
- B01D 69/12 . Composite membranes; Ultra-thin membranes
- B01D 69/122 .. {Separate manufacturing of ultra-thin membranes}
- B01D 69/125 .. {In-situ manufacturing by polymerisation, polycondensation, cross-linking, and/or reaction}
- B01D 69/127 ... {using electrical discharge or plasma-polymerisation}
- B01D 69/14 . Dynamic membranes
- B01D 69/141 .. {Heterogeneous membranes, e.g. containing dispersed material; Mixed matrix membranes}
- B01D 69/142 ... {with "carriers"}
- B01D 69/144 .... {containing embedded or bound biomolecules}
- B01D 69/145 ... {containing embedded catalysts}
- B01D 69/147 ... {containing embedded adsorbents}
- B01D 69/148 ... {Organic/inorganic mixed matrix membranes}

**B01D 71/00**      **Semi-permeable membranes for separation processes or apparatus characterised by the material; Manufacturing processes specially adapted therefor**

**NOTE**

1. In this group, if the material is a composition it is classified according to the constituent present in the highest proportion. This constituent is classified according to the last place rule (see Note before group [B01D 61/00](#) ). If there is more than one constituent present in equal highest proportions, then each of these constituents is classified according to the last place rule
2. Manufacturing processes, if considered of interest, are also classified in group [B01D 67/00](#)

- B01D 71/02 . Inorganic material
- B01D 71/021 .. {Carbon}
- B01D 71/022 .. {Metals}
- B01D 71/024 .. {Oxides}
- B01D 71/025 ... {Aluminium oxide}
- B01D 71/027 ... {Silicium oxide}
- B01D 71/028 .. {Molecular sieves, e.g. zeolites, silicalite ([B01D 71/021](#) takes precedence)}
- B01D 71/04 .. Glass



B01D 71/06	. Organic material
B01D 71/08	.. Polysaccharides
B01D 71/10	... Cellulose; Modified cellulose
B01D 71/12	... Cellulose derivatives
B01D 71/14	.... Esters of organic acids
B01D 71/16	..... Cellulose acetate
B01D 71/18	..... Mixed esters, e.g. cellulose acetate-butyrate
B01D 71/20	.... Esters of inorganic acids, e.g. cellulose nitrate
B01D 71/22	.... Cellulose ethers
B01D 71/24	.. Rubbers

**NOTE**

In this group the following term is used with the meaning indicated:

– "rubber" covers:

- natural or conjugated diene rubber;
- rubber in general (for specific rubber, see the group provided for such macromolecular compound)

B01D 71/26	.. Polyalkenes
B01D 71/28	.. Polymers of vinyl aromatic compounds
B01D 71/30	.. Polyalkenyl halides
B01D 71/32	... containing fluorine atoms
B01D 71/34	.... Polyvinylidene fluoride
B01D 71/36	.... Polytetrafluoroethene
B01D 71/38	.. Polyalkenylalcohols; Polyalkenylesters; Polyalkenylethers; Polyalkenylaldehydes; Polyalkenylketones; Polyalkenylacetals; Polyalkenylketals
B01D 71/40	.. Polymers of unsaturated acids or derivatives thereof, e.g. salts, amides, imides, nitriles, anhydrides, esters
B01D 71/42	... Polymers of nitriles, e.g. polyacrylonitrile
B01D 71/44	.. Polymers obtained by reactions only involving carbon-to-carbon unsaturated bonds, not provided for in a single one of groups <a href="#">B01D 71/26</a> to <a href="#">B01D 71/42</a>
B01D 71/46	.. Epoxy resins
B01D 71/48	.. Polyesters
B01D 71/50	.. Polycarbonates
B01D 71/52	.. Polyethers
B01D 71/54	.. Polyureas; Polyurethanes
B01D 71/56	.. Polyamides, e.g. polyester-amides
B01D 71/58	.. Other polymers having nitrogen in the main chain, with or without oxygen or carbon only
B01D 71/60	... Polyamines
B01D 71/62	... Polycondensates having nitrogen-containing heterocyclic rings in the main chain



B01D 71/64	....	Polyimides; Polyamide-imides; Polyester-imides; Polyamide acids or similar polyimide precursors
B01D 71/66	..	Polymers having sulfur in the main chain, with or without nitrogen, oxygen or carbon only
B01D 71/68	...	Polysulfones; Polyethersulfones
B01D 71/70	..	Polymers having silicon in the main chain, with or without sulfur, nitrogen, oxygen or carbon only
B01D 71/72	..	Macromolecular compounds obtained otherwise than by reactions only involving carbon-to-carbon unsaturated bonds, not provided for in a single one of the groups <a href="#">B01D 71/46</a> to <a href="#">B01D 71/70</a>
B01D 71/74	..	Natural macromolecular material or derivatives thereof ( <a href="#">B01D 71/08</a> , <a href="#">B01D 71/24</a> take precedence)
B01D 71/76	..	Macromolecular material not specifically provided for in a single one of groups <a href="#">B01D 71/08</a> to <a href="#">B01D 71/74</a> (rubbers in general <a href="#">B01D 71/24</a> )
B01D 71/78	...	Graft polymers
B01D 71/80	...	Block polymers
B01D 71/82	...	characterised by the presence of specified groups, e.g. introduced by chemical after-treatment

#### **B01D 2101/00**      **Types of filters having loose filtering material**

B01D 2101/005	.	with a binder between the individual particles or fibres
B01D 2101/02	.	Carbon filters
B01D 2101/04	.	Sand or gravel filters

#### **B01D 2201/00**      **Details relating to filtering apparatus**

B01D 2201/02	.	Filtering elements having a conical form
B01D 2201/04	.	Supports for the filtering elements
B01D 2201/0407	..	Perforated supports on both sides of the filtering element
B01D 2201/0415	..	Details of supporting structures
B01D 2201/0423	...	not in the inner side of the cylindrical filtering elements
B01D 2201/043	..	Filter tubes connected to plates
B01D 2201/0438	...	mounted substantially vertically on plates at the lower side of the filter elements
B01D 2201/0446	...	suspended from plates at the upper side of the filter elements
B01D 2201/0453	...	positioned between at least two plates
B01D 2201/0461	..	Springs
B01D 2201/0469	..	Filter tubes connected to collector tubes
B01D 2201/0476	...	mounted substantially vertically on collector tubes at the lower side of the filter elements
B01D 2201/0484	...	suspended from collector tubes at the upper side of the filter elements
B01D 2201/0492	...	positioned between at least two collector tubes
B01D 2201/06	.	Resilient foam as filtering element
B01D 2201/08	.	Regeneration of the filter
B01D 2201/081	..	using nozzles or suction devices



B01D 2201/082	...	Suction devices placed on the cake side of the filtering element
B01D 2201/083	...	Suction devices placed on the filtrate side of the filtering element, e.g. with variable edge filters
B01D 2201/084	...	Nozzles placed on the filtrate side of the filtering element
B01D 2201/085	..	using another chemical than the liquid to be filtered
B01D 2201/086	..	using fluid streams co-current to the filtration direction
B01D 2201/087	..	using gas bubbles, e.g. air
B01D 2201/088	..	Arrangements for killing micro-organisms
B01D 2201/089	..	using rollers having projections to clear the filter apertures
B01D 2201/10	.	Filtration under gravity in large open drainage basins
B01D 2201/12	.	Pleated filters
B01D 2201/122	..	with pleats of different length
B01D 2201/125	..	with non-parallel pleats
B01D 2201/127	..	with means for keeping the spacing between the pleats
B01D 2201/14	.	Particulate filter materials with a lower density than the liquid mixture to be filtered
B01D 2201/16	.	Valves
B01D 2201/162	..	with snap, latch or clip connecting means
B01D 2201/165	..	Multi-way valves
B01D 2201/167	..	Single-way valves
B01D 2201/18	.	Filters characterised by the openings or pores
B01D 2201/182	..	for depth filtration
B01D 2201/184	..	Special form, dimension of the openings, pores of the filtering elements
B01D 2201/186	...	Pore openings which can be modified
B01D 2201/188	..	Multiple filtering elements having filtering areas of different size
B01D 2201/20	.	Pressure-related systems for filters
B01D 2201/202	..	Systems for applying pressure to filters
B01D 2201/204	..	Systems for applying vacuum to filters
B01D 2201/206	...	by the weight of the liquid in a tube, e.g. siphon, barometric leg
B01D 2201/208	...	by venturi systems
B01D 2201/22	.	Filtering bands with supporting discs
B01D 2201/24	.	Tools used for the removal of filters
B01D 2201/26	.	Transport systems for filtering devices
B01D 2201/265	..	mounted on vehicles
B01D 2201/28	.	Position of the filtering element
B01D 2201/282	..	Filtering elements with a horizontal rotation or symmetry axis
B01D 2201/285	..	Filtering elements with a symmetry axis not parallel to the rotation axis
B01D 2201/287	..	Filtering elements with a vertical or inclined rotation or symmetry axis
B01D 2201/29	.	Filter cartridge constructions
B01D 2201/291	..	End caps
B01D 2201/293	...	Making of end caps



- B01D 2201/295 . . . with projections extending in a radial outward direction, e.g. for use as a guide, spacing means
- B01D 2201/296 . . . Other than having a circular shape
- B01D 2201/298 . . . End caps common to at least two filtering elements
- B01D 2201/30 . Filter housing constructions
- B01D 2201/301 . . Details of removable closures, lids, caps, filter heads
- B01D 2201/302 . . . having inlet or outlet ports
- B01D 2201/303 . . . . not arranged concentrically
- B01D 2201/304 . . . Seals or gaskets
- B01D 2201/305 . . . Snap, latch or clip connecting means
- B01D 2201/306 . . . Closures, lids, caps or filter heads forming one element with the filtering element
- B01D 2201/307 . . Filtering elements contained in an insert body mounted in a filter housing (double casing), e.g. to avoid contamination when removing or replacing the filter element
- B01D 2201/308 . . Use of foils, membranes or other means to protect the filter before its use or for protecting the environment, e.g. during removal of the filter
- B01D 2201/309 . . Housings with transparent parts
- B01D 2201/31 . Other construction details
- B01D 2201/313 . . Means for protecting the filter from the incoming fluid, e.g. shields
- B01D 2201/316 . . Standpipes
- B01D 2201/32 . Flow characteristics of the filter
- B01D 2201/325 . . Outward flow filtration
- B01D 2201/34 . Seals or gaskets for filtering elements ([for removable closures, lids, caps or filter heads B01D 2201/304](#))
- B01D 2201/342 . . Axial sealings
- B01D 2201/345 . . Pressurized seals or gaskets
- B01D 2201/347 . . Radial sealings
- B01D 2201/36 . Filtering elements containing a rotating housing construction
- B01D 2201/38 . Preventing rewetting of the filter cake on the filter media
- B01D 2201/40 . Special measures for connecting different parts of the filter
- B01D 2201/4007 . . Use of cam or ramp systems
- B01D 2201/4015 . . Bayonet connecting means
- B01D 2201/4023 . . Means for connecting filter housings to supports
- B01D 2201/403 . . allowing dilatation, e.g. by heat
- B01D 2201/4038 . . for connecting at least two filtering elements together
- B01D 2201/4046 . . Means for avoiding false mounting of different parts
- B01D 2201/4053 . . . using keys
- B01D 2201/4061 . . . between a cartridge and a filter head or manifold
- B01D 2201/4069 . . Magnetic means
- B01D 2201/4076 . . Anti-rotational means
- B01D 2201/4084 . . Snap or Seeger ring connecting means



- B01D 2201/4092 . . . Treated sections, e.g. screw
- B01D 2201/44 . . Special measures allowing the even or uniform distribution of fluid along the length of a conduit
- B01D 2201/46 . . Several filtrate discharge conduits each connected to one filter element or group of filter elements
- B01D 2201/48 . . Overflow systems
- B01D 2201/50 . . Means for dissipating electrostatic charges
- B01D 2201/52 . . Filter identification means
- B01D 2201/54 . . Computerised or programmable systems
- B01D 2201/56 . . Wireless systems for monitoring the filter
- B01D 2201/58 . . Power supply means for regenerating the filter
  - .. . using the kinetic energy of the fluid circulating in the filtering device
- B01D 2201/586 . . . using regenerative sources, e.g. wind, sun
- B01D 2201/60 . . Shape of non-cylindrical filtering elements
  - .. . Oval
  - .. . Square or rectangular
  - .. . Triangular
- B01D 2201/62 . . Honeycomb-like
- B01D 2201/64 . . Filters having floating elements ([floating filters B01D 35/05](#))
  
- B01D 2202/00      Details concerning evaporation, distillation or condensation**
- B01D 2202/10 . . Use of a micro-device for separation ([micro-reactors B01J 19/00](#))
- B01D 2202/20 . . Use of an ionic liquid in the separation process
  
- B01D 2215/00      Separating processes involving the treatment of liquids with adsorbents**
- B01D 2215/02 . . with moving adsorbents
  - .. . Physically moving or fluidising the adsorbent beads or particles or slurry, excluding the movement of the entire columns
  - .. . Physically moving the adsorbent as a whole, e.g. belts, discs or sheets
  - .. . Simulated moving beds
    - ... . Provisions to deal with recirculated volumes, e.g. in order to regulate flow
    - ... . Reekon with dead volumes between sections
    - ... . Flushing the injection conduits
    - ... . Used at supercritical conditions of temperature or pressure
    - ... . Co-current flow
  - .. . Centrifuge-like arrangements
  
- B01D 2221/00      Applications of separation devices**
- B01D 2221/02 . . Small separation devices for domestic application, e.g. for canteens, industrial kitchen, washing machines
- B01D 2221/04 . . Separation devices for treating liquids from earth drilling, mining ([separation of well effluents E21B 43/34](#), [flotation in general B03D 1/00](#))
- B01D 2221/06 . . Separation devices for industrial food processing or agriculture



- B01D 2221/08 . Mobile separation devices
- B01D 2221/10 . Separation devices for use in medical, pharmaceutical or laboratory applications, e.g. separating amalgam from dental treatment residues ([apparatus for dental treatment A61C 17/04](#))
- B01D 2221/12 . Separation devices for treating rain or storm water ([storm water treatment E03F](#))
- B01D 2221/14 . Separation devices for workshops, car or semiconductor industry, e.g. for separating chips and other machining residues
- B01D 2221/16 . Separation devices for cleaning ambient air, e.g. air along roads or air in cities
  
- B01D 2239/00 Aspects relating to filtering material for liquid or gaseous fluids**
- B01D 2239/02 . Types of fibres, filaments or particles, self-supporting or supported materials
- B01D 2239/0208 .. Single-component fibres
- B01D 2239/0216 .. Bicomponent or multicomponent fibres
- B01D 2239/0225 ... Side-by-side
- B01D 2239/0233 ... Island-in-sea
- B01D 2239/0241 .. comprising electrically conductive fibres or particles
- B01D 2239/025 .. comprising nanofibres ([apparatus incorporating such gas filtering material see B01D 46/546](#))
- B01D 2239/0258 .. comprising nanoparticles
- B01D 2239/0266 .. comprising biodegradable or bio-soluble polymers
- B01D 2239/0275 .. comprising biologically produced plastics, e.g. bioplastics
- B01D 2239/0283 .. comprising filter materials made from waste or recycled materials
- B01D 2239/0291 .. comprising swelling polymers
- B01D 2239/04 . Additives and treatments of the filtering material
- B01D 2239/0407 .. comprising particulate additives, e.g. adsorbents ([apparatus incorporating gas filtering material B01D 46/0036](#))
- B01D 2239/0414 .. Surface modifiers, e.g. comprising ion exchange groups
- B01D 2239/0421 ... Rendering the filter material hydrophilic
- B01D 2239/0428 ... Rendering the filter material hydrophobic
- B01D 2239/0435 .. Electret ([apparatus incorporating such gas filtering material B01D 46/0032](#))
- B01D 2239/0442 .. Antimicrobial, antibacterial, antifungal additives ([apparatus incorporating such gas filtering material B01D 46/0028](#))
- B01D 2239/045 .. Deodorising additives
- B01D 2239/0457 .. Specific fire retardant or heat resistant properties ([apparatus incorporating such gas filtering material B01D 46/0093](#))
- B01D 2239/0464 .. Impregnants
- B01D 2239/0471 .. Surface coating material
- B01D 2239/0478 ... on a layer of the filter
- B01D 2239/0485 ... on particles
- B01D 2239/0492 ... on fibres
- B01D 2239/06 . Filter cloth, e.g. knitted, woven non-woven; self-supported material
- B01D 2239/0604 .. Arrangement of the fibres in the filtering material



B01D 2239/0609	...	Knitted
B01D 2239/0613	...	Woven
B01D 2239/0618	...	Non-woven
B01D 2239/0622	...	Melt-blown
B01D 2239/0627	...	Spun-bonded
B01D 2239/0631	...	Electro-spun
B01D 2239/0636	...	Two or more types of fibres present in the filter material
B01D 2239/064	...	The fibres being mixed
B01D 2239/0645	..	Arrangement of the particles in the filtering material
B01D 2239/065	..	More than one layer present in the filtering material ( <a href="#">apparatus incorporating such gas filtering material B01D 2275/10</a> )
B01D 2239/0654	...	Support layers
B01D 2239/0659	...	The layers being joined by needling
B01D 2239/0663	...	The layers being joined by hydro-entangling
B01D 2239/0668	...	The layers being joined by heat or melt-bonding
B01D 2239/0672	...	The layers being joined by welding
B01D 2239/0677	...	by spot-welding
B01D 2239/0681	...	The layers being joined by gluing
B01D 2239/0686	...	by spot-gluing
B01D 2239/069	..	Special geometry of layers
B01D 2239/0695	...	Wound layers ( <a href="#">apparatus incorporating such gas filtering material B01D 2275/105</a> )

### **WARNING**

This group is not complete, see also [B01D 39/1684](#)

B01D 2239/08	.	Special characteristics of binders
B01D 2239/083	..	Binders between layers of the filter
B01D 2239/086	..	Binders between particles or fibres
B01D 2239/10	.	Filtering material manufacturing
B01D 2239/12	.	Special parameters characterising the filtering material
B01D 2239/1208	..	Porosity ( <a href="#">apparatus incorporating such gas filtering material B01D 2275/30 to B01D 2275/307</a> )
B01D 2239/1216	..	Pore size
B01D 2239/1225	..	Fibre length
B01D 2239/1233	..	Fibre diameter
B01D 2239/1241	..	Particle diameter
B01D 2239/125	..	Size distribution
B01D 2239/1258	..	Permeability
B01D 2239/1266	..	Solidity
B01D 2239/1275	..	Stiffness



- B01D 2239/1283 . . Stability index
- B01D 2239/1291 . . Other parameters

**B01D 2247/00****Details relating to the separation of dispersed particles from gases, air or vapours by liquid as separating agent**

- B01D 2247/02 . Enhancing the particle separation by electrostatic or magnetic effects ([B01D 2247/102 takes precedence](#); [electrostatic or magnetic separation B03C](#))
- B01D 2247/04 . Regenerating the washing fluid ([recovering paint spray booth B05B 15/1266](#))
- B01D 2247/06 . Separation units provided with means for cleaning and maintenance
- B01D 2247/08 . Means for controlling the separation process
- B01D 2247/10 . Means for removing the washing fluid dispersed in the gas or vapours ([separating dispersed particles from gases by gravity, inertia or centrifugal forces B01D 45/00](#))
  - B01D 2247/101 . . using a cyclone
  - B01D 2247/102 . . using electrostatic or magnetic effects
  - B01D 2247/103 . . using fluids, e.g. as a fluid curtain or as large liquid droplets
  - B01D 2247/104 . . using an impeller
  - B01D 2247/105 . . by gas flow reversal
  - B01D 2247/106 . . using an structured demister, e.g. tortuous channels
  - B01D 2247/107 . . using an unstructured demister, e.g. a wire mesh demister
  - B01D 2247/108 . . using vortex inducers
- B01D 2247/12 . Fan arrangements for providing forced draft
- B01D 2247/14 . Fan arrangements for providing induced draft

**B01D 2251/00****Reactants**

- B01D 2251/10 . Oxidants
  - B01D 2251/102 . . Oxygen
  - B01D 2251/104 . . Ozone
  - B01D 2251/106 . . Peroxides
    - B01D 2251/1065 . . . Organic peroxides
  - B01D 2251/108 . . Halogens or halogen compounds ([hydrogen halides B01D 2251/50](#))
  - B01D 2251/11 . . Air
- B01D 2251/20 . Reductants
  - B01D 2251/202 . . Hydrogen
  - B01D 2251/204 . . Carbon monoxide
  - B01D 2251/206 . . Ammonium compounds
    - B01D 2251/2062 . . . Ammonia
    - B01D 2251/2065 . . . Ammonium hydroxide
    - B01D 2251/2067 . . . Urea
  - B01D 2251/208 . . Hydrocarbons
  - B01D 2251/21 . . Organic compounds not provided for in groups [B01D 2251/206](#) or [B01D 2251/208](#)
  - B01D 2251/30 . Alkali metal compounds
    - B01D 2251/302 . . of lithium



B01D 2251/304	..	of sodium
B01D 2251/306	..	of potassium
B01D 2251/40	.	Alkaline earth metal or magnesium compounds
B01D 2251/402	..	of magnesium
B01D 2251/404	..	of calcium
B01D 2251/406	..	of strontium
B01D 2251/408	..	of barium
B01D 2251/50	.	Inorganic acids
B01D 2251/502	..	Hydrochloric acid
B01D 2251/504	..	Nitric acid
B01D 2251/506	..	Sulfuric acid
B01D 2251/508	..	Sulfur dioxide
B01D 2251/51	..	Hydrogen sulfide
B01D 2251/512	..	Phosphoric acid
B01D 2251/60	.	Inorganic bases or salts
B01D 2251/602	..	Oxides
B01D 2251/604	..	Hydroxides
B01D 2251/606	..	Carbonates
B01D 2251/608	..	Sulfates
B01D 2251/61	..	Phosphates
B01D 2251/70	.	Organic acids
B01D 2251/80	.	Organic bases or salts
B01D 2251/90	.	Chelants
B01D 2251/902	..	EDTA
B01D 2251/904	..	NTA
B01D 2251/95	.	Specific microorganisms
<b>B01D 2252/00</b>		<b>Absorbents, i.e. solvents and liquid materials for gas absorption</b>
B01D 2252/10	.	Inorganic absorbents ( <a href="#">chemical reactants B01D 2251/00</a> )
B01D 2252/102	..	Ammonia
B01D 2252/103	..	Water
B01D 2252/1035	...	Sea water
B01D 2252/20	.	Organic absorbents
B01D 2252/202	..	Alcohols or their derivatives
B01D 2252/2021	...	Methanol
B01D 2252/2023	...	Glycols, diols or their derivatives
B01D 2252/2025	....	Ethers or esters of alkylene glycols, e.g. ethylene or propylene carbonate
B01D 2252/2026	....	Polyethylene glycol, ethers or esters thereof, e.g. Selexol
B01D 2252/2028	....	Polypropylene glycol, ethers or esters thereof
B01D 2252/204	..	Amines



B01D 2252/20405	...	Monoamines
B01D 2252/2041	...	Diamines
B01D 2252/20415	...	Tri- or polyamines
B01D 2252/20421	...	Primary amines
B01D 2252/20426	...	Secondary amines
B01D 2252/20431	...	Tertiary amines
B01D 2252/20436	...	Cyclic amines
B01D 2252/20442	....	containing a piperidine-ring
B01D 2252/20447	....	containing a piperazine-ring
B01D 2252/20452	....	containing a morpholine-ring
B01D 2252/20457	....	containing a pyridine-ring
B01D 2252/20463	....	containing a pyrimidine-ring
B01D 2252/20468	....	containing a pyrrolidone-ring
B01D 2252/20473	....	containing an imidazole-ring
B01D 2252/20478	...	Alkanolamines
B01D 2252/20484	....	with one hydroxyl group
B01D 2252/20489	....	with two or more hydroxyl groups
B01D 2252/20494	...	Amino acids, their salts or derivatives
B01D 2252/205	..	Other organic compounds not covered by <a href="#">B01D 2252/00</a> to <a href="#">B01D 2252/20494</a>
B01D 2252/2053	...	Other nitrogen compounds
B01D 2252/2056	...	Sulfur compounds, e.g. Sulfolane, thiols
B01D 2252/30	.	Ionic liquids and zwitter-ions
B01D 2252/40	.	Absorbents explicitly excluding the presence of water
B01D 2252/50	.	Combinations of absorbents
B01D 2252/502	..	having two or more functionalities in the same molecule other than alkanolamine
B01D 2252/504	..	Mixtures of two or more absorbents
B01D 2252/60	.	Additives
B01D 2252/602	..	Activators, promoting agents, catalytic agents or enzymes
B01D 2252/604	..	Stabilisers or agents inhibiting degradation
B01D 2252/606	..	Anticorrosion agents
B01D 2252/608	..	Antifoaming agents
B01D 2252/61	..	Antifouling agents
<b>B01D 2253/00</b>		<b>Adsorbents used in separation treatment of gases and vapours</b>
B01D 2253/10	.	Inorganic adsorbents
B01D 2253/102	..	Carbon
B01D 2253/104	..	Alumina
B01D 2253/106	..	Silica or silicates
B01D 2253/108	...	Zeolites
B01D 2253/1085	....	characterized by a silicon-aluminium ratio



B01D 2253/11	...	Clays
B01D 2253/112	..	Metals or metal compounds not provided for in <a href="#">B01D 2253/104</a> or <a href="#">B01D 2253/106</a>
B01D 2253/1122	...	Metals
B01D 2253/1124	...	Metal oxides
B01D 2253/1126	...	Metal hydrides
B01D 2253/1128	...	Metal sulfides
B01D 2253/116	..	Molecular sieves other than zeolites
B01D 2253/20	.	Organic adsorbents
B01D 2253/202	..	Polymeric adsorbents
B01D 2253/204	..	Metal organic frameworks (MOF's)
B01D 2253/206	..	Ion exchange resins
B01D 2253/25	.	Coated, impregnated or composite adsorbents
B01D 2253/30	.	Physical properties of adsorbents
B01D 2253/302	..	Dimensions
B01D 2253/304	...	Linear dimensions, e.g. particle shape, diameter
B01D 2253/306	...	Surface area, e.g. BET-specific surface
B01D 2253/308	...	Pore size
B01D 2253/31	...	Pore size distribution
B01D 2253/311	...	Porosity, e.g. pore volume
B01D 2253/34	..	Specific shapes
B01D 2253/342	...	Monoliths
B01D 2253/3425	....	Honeycomb shape

**B01D 2255/00****Catalysts**

B01D 2255/10	.	Noble metals or compounds thereof
B01D 2255/102	..	Platinum group metals
B01D 2255/1021	...	Platinum
B01D 2255/1023	...	Palladium
B01D 2255/1025	...	Rhodium
B01D 2255/1026	...	Ruthenium
B01D 2255/1028	...	Iridium
B01D 2255/104	..	Silver
B01D 2255/106	..	Gold
B01D 2255/20	.	Metals or compounds thereof ( <a href="#">noble metals B01D 2255/10</a> )
B01D 2255/202	..	Alkali metals
B01D 2255/2022	...	Potassium
B01D 2255/2025	...	Lithium
B01D 2255/2027	...	Sodium
B01D 2255/204	..	Alkaline earth metals
B01D 2255/2042	...	Barium



B01D 2255/2045	...	Calcium
B01D 2255/2047	...	Magnesium
B01D 2255/206	..	Rare earth metals
B01D 2255/2061	...	Yttrium
B01D 2255/2063	...	Lanthanum
B01D 2255/2065	...	Cerium
B01D 2255/2066	...	Praseodymium
B01D 2255/2068	...	Neodymium
B01D 2255/207	..	Transition metals
B01D 2255/20707	...	Titanium
B01D 2255/20715	...	Zirconium
B01D 2255/20723	...	Vanadium
B01D 2255/2073	...	Manganese
B01D 2255/20738	...	Iron
B01D 2255/20746	...	Cobalt
B01D 2255/20753	...	Nickel
B01D 2255/20761	...	Copper
B01D 2255/20769	...	Molybdenum
B01D 2255/20776	...	Tungsten
B01D 2255/20784	...	Chromium
B01D 2255/20792	...	Zinc
B01D 2255/209	..	Other metals
B01D 2255/2092	...	Aluminium
B01D 2255/2094	...	Tin
B01D 2255/2096	...	Bismuth
B01D 2255/2098	...	Antimony
B01D 2255/30	.	Silica
B01D 2255/40	.	Mixed oxides
B01D 2255/402	..	Perovskites
B01D 2255/405	..	Spinels
B01D 2255/407	..	Zr-Ce mixed oxides
B01D 2255/50	.	Zeolites
B01D 2255/502	..	Beta zeolites
B01D 2255/504	..	ZSM 5 zeolites
B01D 2255/65	.	Catalysts not containing noble metals
B01D 2255/70	.	Non-metallic catalysts, additives or dopants
B01D 2255/702	..	Carbon
B01D 2255/705	..	Ligands for metal-organic catalysts
B01D 2255/707	..	Additives or dopants
B01D 2255/80	.	Type of catalytic reaction



B01D 2255/802	.. Photocatalytic
B01D 2255/804	.. Enzymatic
B01D 2255/806	.. Electrocatalytic
B01D 2255/808	.. Hydrolytic
B01D 2255/90	. Physical characteristics of catalysts
B01D 2255/902	.. Multilayered catalyst
B01D 2255/9022	... Two layers
B01D 2255/9025	... Three layers
B01D 2255/9027	... More than three layers
B01D 2255/903	.. Multi-zoned catalysts
B01D 2255/9032	... Two zones
B01D 2255/9035	... Three zones
B01D 2255/9037	... More than three zones
B01D 2255/904	.. Multiple catalysts
B01D 2255/9045	... in parallel
B01D 2255/905	.. Catalysts having a gradually changing coating
B01D 2255/906	.. Catalyst dispersed in the gas
B01D 2255/908	.. O <sub>2</sub> -storage component incorporated in the catalyst
B01D 2255/909	.. H <sub>2</sub> -storage component incorporated in the catalyst
B01D 2255/91	.. NO <sub>x</sub> -storage component incorporated in the catalyst
B01D 2255/911	.. NH <sub>3</sub> -storage component incorporated in the catalyst
B01D 2255/912	.. HC-storage component incorporated in the catalyst
B01D 2255/915	.. Catalyst supported on particulate filters
B01D 2255/9155	... Wall flow filters
B01D 2255/92	.. Dimensions
B01D 2255/9202	... Linear dimensions
B01D 2255/9205	... Porosity
B01D 2255/9207	... Specific surface
<b>B01D 2256/00</b>	<b>Main component in the product gas stream after treatment</b>
B01D 2256/10	. Nitrogen
B01D 2256/12	. Oxygen
B01D 2256/14	. Ozone
B01D 2256/16	. Hydrogen
B01D 2256/18	. Noble gases
B01D 2256/20	. Carbon monoxide
B01D 2256/22	. Carbon dioxide
B01D 2256/24	. Hydrocarbons
B01D 2256/245	.. Methane
B01D 2256/26	. Halogens or halogen compounds



**B01D 2257/00****Components to be removed**

- B01D 2257/10 . Single element gases other than halogens
- B01D 2257/102 .. Nitrogen
- B01D 2257/104 .. Oxygen
- B01D 2257/106 .. Ozone
- B01D 2257/108 .. Hydrogen
- B01D 2257/11 .. Noble gases
- B01D 2257/20 . Halogens or halogen compounds
- B01D 2257/202 .. Single element halogens
- B01D 2257/2022 ... Bromine
- B01D 2257/2025 ... Chlorine
- B01D 2257/2027 ... Fluorine
- B01D 2257/204 .. Inorganic halogen compounds
- B01D 2257/2042 ... Hydrobromic acid
- B01D 2257/2045 ... Hydrochloric acid
- B01D 2257/2047 ... Hydrofluoric acid
- B01D 2257/206 .. Organic halogen compounds
- B01D 2257/2062 ... Bromine compounds
- B01D 2257/2064 ... Chlorine
- B01D 2257/2066 ... Fluorine
- B01D 2257/2068 ... Iodine
- B01D 2257/30 . Sulfur compounds
- B01D 2257/302 .. Sulfur oxides
- B01D 2257/304 .. Hydrogen sulfide
- B01D 2257/306 .. Organic sulfur compounds, e.g. mercaptans
- B01D 2257/308 .. Carbonoxysulfide COS
- B01D 2257/40 . Nitrogen compounds
- B01D 2257/402 .. Dinitrogen oxide
- B01D 2257/404 .. Nitrogen oxides other than dinitrogen oxide
- B01D 2257/406 .. Ammonia
- B01D 2257/408 .. Cyanides, e.g. hydrogen cyanide (HCH)
- B01D 2257/50 . Carbon oxides
- B01D 2257/502 .. Carbon monoxide
- B01D 2257/504 .. Carbon dioxide
- B01D 2257/55 . Compounds of silicon, phosphorus, germanium or arsenic
- B01D 2257/553 .. Compounds comprising hydrogen, e.g. silanes
- B01D 2257/556 .. Organic compounds
- B01D 2257/60 . Heavy metals or heavy metal compounds
- B01D 2257/602 .. Mercury or mercury compounds



<a href="#">B01D 2257/70</a>	. Organic compounds not provided for in groups <a href="#">B01D 2257/00</a> to <a href="#">B01D 2257/602</a>
<a href="#">B01D 2257/702</a>	.. Hydrocarbons
<a href="#">B01D 2257/7022</a>	... Aliphatic hydrocarbons
<a href="#">B01D 2257/7025</a>	.... Methane
<a href="#">B01D 2257/7027</a>	... Aromatic hydrocarbons
<a href="#">B01D 2257/704</a>	.. Solvents not covered by groups <a href="#">B01D 2257/702</a> to <a href="#">B01D 2257/7027</a>
<a href="#">B01D 2257/706</a>	.. Organometallic compounds
<a href="#">B01D 2257/708</a>	.. Volatile organic compounds V.O.C.'s
<a href="#">B01D 2257/80</a>	. Water
<a href="#">B01D 2257/90</a>	. Odorous compounds not provided for in groups <a href="#">B01D 2257/00</a> to <a href="#">B01D 2257/708</a>
<a href="#">B01D 2257/91</a>	. Bacteria; Micro-organisms
<a href="#">B01D 2257/93</a>	. Toxic compounds not provided for in groups <a href="#">B01D 2257/00</a> to <a href="#">B01D 2257/708</a>

**B01D 2258/00****Sources of waste gases**

<a href="#">B01D 2258/01</a>	. Engine exhaust gases
<a href="#">B01D 2258/012</a>	.. Diesel engines and lean burn gasoline engines
<a href="#">B01D 2258/014</a>	.. Stoichiometric gasoline engines
<a href="#">B01D 2258/016</a>	.. Methanol engines
<a href="#">B01D 2258/018</a>	.. Natural gas engines
<a href="#">B01D 2258/02</a>	. Other waste gases
<a href="#">B01D 2258/0208</a>	.. from fuel cells
<a href="#">B01D 2258/0216</a>	.. from CVD treatment or semi-conductor manufacturing
<a href="#">B01D 2258/0225</a>	.. from chemical or biological warfare
<a href="#">B01D 2258/0233</a>	.. from cement factories
<a href="#">B01D 2258/0241</a>	.. from glass manufacture plants
<a href="#">B01D 2258/025</a>	.. from metallurgy plants
<a href="#">B01D 2258/0258</a>	.. from painting equipments or paint drying installations
<a href="#">B01D 2258/0266</a>	.. from animal farms
<a href="#">B01D 2258/0275</a>	.. from food processing plants or kitchens
<a href="#">B01D 2258/0283</a>	.. Flue gases
<a href="#">B01D 2258/0291</a>	... from waste incineration plants
<a href="#">B01D 2258/05</a>	. Biogas
<a href="#">B01D 2258/06</a>	. Polluted air

**B01D 2259/00****Type of treatment**

<a href="#">B01D 2259/10</a>	. Gas phase, e.g. by using aerosols
<a href="#">B01D 2259/12</a>	. Methods and means for introducing reactants (for catalytic processes <a href="#">B01D 53/90</a> )
<a href="#">B01D 2259/122</a>	.. Gaseous reactants
<a href="#">B01D 2259/124</a>	.. Liquid reactants
<a href="#">B01D 2259/126</a>	.. Semi-solid reactants, e.g. slurries
<a href="#">B01D 2259/128</a>	.. Solid reactants



B01D 2259/40	.	Further details for adsorption processes and devices
B01D 2259/40001	..	Methods relating to additional, e.g. intermediate, treatment of process gas
B01D 2259/40003	..	Methods relating to valve switching
B01D 2259/40005	...	using rotary valves
B01D 2259/40007	..	Controlling pressure or temperature swing adsorption
B01D 2259/40009	...	using sensors or gas analysers
B01D 2259/40011	..	Methods relating to the process cycle in pressure or temperature swing adsorption
B01D 2259/40013	...	Pressurization
B01D 2259/40015	....	with two sub-steps
B01D 2259/40016	....	with three sub-steps
B01D 2259/40018	....	with more than three sub-steps
B01D 2259/4002	...	Production
B01D 2259/40022	....	with two sub-steps
B01D 2259/40024	....	with three sub-steps
B01D 2259/40026	....	with more than three sub-steps
B01D 2259/40028	...	Depressurization
B01D 2259/4003	....	with two sub-steps
B01D 2259/40032	....	with three sub-steps
B01D 2259/40033	....	with more than three sub-steps
B01D 2259/40035	...	Equalization
B01D 2259/40037	....	with two sub-steps
B01D 2259/40039	....	with three sub-steps
B01D 2259/40041	....	with more than three sub-steps
B01D 2259/40043	...	Purging
B01D 2259/40045	....	with two sub-steps
B01D 2259/40047	....	with three sub-steps
B01D 2259/40049	....	with more than three sub-steps
B01D 2259/4005	....	Nature of purge gas
B01D 2259/40052	.....	Recycled product or process gas
B01D 2259/40054	.....	treated before its reuse
B01D 2259/40056	.....	Gases other than recycled product or process gas
B01D 2259/40058	...	Number of sequence steps, including sub-steps, per cycle
B01D 2259/4006	....	Less than four
B01D 2259/40062	....	Four
B01D 2259/40064	....	Five
B01D 2259/40066	....	Six
B01D 2259/40067	....	Seven
B01D 2259/40069	....	Eight
B01D 2259/40071	....	Nine
B01D 2259/40073	....	Ten



B01D 2259/40075	....	More than ten
B01D 2259/40077	...	Direction of flow
B01D 2259/40079	....	Co-current
B01D 2259/40081	....	Counter-current
B01D 2259/40083	..	Regeneration of adsorbents in processes other than pressure or temperature swing adsorption
B01D 2259/40084	...	by exchanging used adsorbents with fresh adsorbents
B01D 2259/40086	...	by using a purge gas ( <a href="#">B01D 2259/4009</a> takes precedence)
B01D 2259/40088	...	by heating
B01D 2259/4009	....	using hot gas
B01D 2259/40092	....	using hot liquid
B01D 2259/40094	....	by applying microwaves
B01D 2259/40096	....	by using electrical resistance heating
B01D 2259/40098	....	with other heating means
B01D 2259/401	..	using a single bed
B01D 2259/402	..	using two beds
B01D 2259/403	..	using three beds
B01D 2259/404	..	using four beds
B01D 2259/406	..	using more than four beds
B01D 2259/4061	...	using five beds
B01D 2259/4062	...	using six beds
B01D 2259/4063	...	using seven beds
B01D 2259/4065	...	using eight beds
B01D 2259/4066	...	using nine beds
B01D 2259/4067	...	using ten beds
B01D 2259/4068	...	using more than ten beds
B01D 2259/41	..	using plural beds of the same adsorbent in series
B01D 2259/414	..	using different types of adsorbents
B01D 2259/4141	...	within a single bed
B01D 2259/4143	....	arranged as a mixture
B01D 2259/4145	....	arranged in series
B01D 2259/4146	.....	Contiguous multilayered adsorbents
B01D 2259/4148	.....	Multiple layers positioned apart from each other
B01D 2259/416	..	involving cryogenic temperature treatment
B01D 2259/418	..	deleted
B01D 2259/45	.	Gas separation or purification devices adapted for specific applications
B01D 2259/4508	..	for cleaning air in buildings
B01D 2259/4516	..	for fuel vapour recovery systems
B01D 2259/4525	..	for storage and dispensing systems
B01D 2259/4533	..	for medical purposes



- B01D 2259/4541 .. for portable use, e.g. gas masks
- B01D 2259/455 .. for transportable use ([portable devices B01D 2259/4541](#))
- B01D 2259/4558 ... for being employed as mobile cleaners for ambient air, i.e. the earth's atmosphere
- B01D 2259/4566 .. for use in transportation means
- B01D 2259/4575 ... in aeroplanes or space ships
- B01D 2259/4583 .. for removing chemical, biological and nuclear warfare agents
- B01D 2259/4591 .. Construction elements containing cleaning material, e.g. catalysts
- B01D 2259/65 . Employing advanced heat integration, e.g. Pinch technology
- B01D 2259/652 .. using side coolers
- B01D 2259/655 .. using heat storage materials
- B01D 2259/657 ... using latent heat, e.g. with phase change materials
- B01D 2259/80 . Employing electric, magnetic, electromagnetic or wave energy, or particle radiation
- B01D 2259/802 .. Visible light
- B01D 2259/804 .. UV light
- B01D 2259/806 .. Microwaves
- B01D 2259/808 .. Laser
- B01D 2259/81 .. X-rays
- B01D 2259/812 .. Electrons
- B01D 2259/814 .. Magnetic fields
- B01D 2259/816 .. Sonic or ultrasonic vibration
- B01D 2259/818 .. Employing electrical discharges or the generation of a plasma
  
- B01D 2265/00** **Casings, housings or mounting for filters specially adapted for separating dispersed particles from gases or vapours**
- B01D 2265/02 . Non permanent measures for connecting different parts of the filter
- B01D 2265/021 .. Anti-rotational means
- B01D 2265/022 .. Bayonet connecting means
- B01D 2265/023 .. making use of magnetic forces
- B01D 2265/024 .. Mounting aids
- B01D 2265/025 ... making use of ramps or cams
- B01D 2265/026 ... with means for avoiding false mounting
- B01D 2265/027 .. Quick closing means for e.g. filter heads, caps, maintenance openings
- B01D 2265/028 .. Snap, latch or clip connecting means
- B01D 2265/029 .. Special screwing connections, threaded sections
- B01D 2265/04 . Permanent measures for connecting different parts of the filter, e.g. welding, glueing or moulding
- B01D 2265/05 .. Special adapters for the connection of filters or parts of filters
- B01D 2265/06 . Details of supporting structures for filtering material, e.g. cores
  
- B01D 2267/00** **Multiple filter elements specially adapted for separating dispersed particles from gases or vapours**



B01D 2267/30	. Same type of filters
B01D 2267/40	. Different types of filters
B01D 2267/60	. Vertical arrangement
B01D 2267/70	. Horizontal arrangement
<b>B01D 2271/00</b>	<b>Sealings for filters specially adapted for separating dispersed particles from gases or vapours</b>
B01D 2271/02	. Gaskets, sealings
B01D 2271/022	.. Axial sealings
B01D 2271/025	.. Making of sealings
B01D 2271/027	.. Radial sealings
<b>B01D 2273/00</b>	<b>Operation of filters specially adapted for separating dispersed particles from gases or vapours</b>
B01D 2273/10	. Allowing a continuous bypass of at least part of the flow, e.g. of secondary air, vents
B01D 2273/12	. Influencing the filter cake during filtration using filter aids
B01D 2273/14	. Filters which are moved between two or more positions, e.g. by turning, pushing
B01D 2273/16	. Means for selecting a filter element of a group of filters for a special purpose other than cleaning a filter
B01D 2273/18	. Testing of filters, filter elements, sealings
B01D 2273/20	. High temperature filtration
B01D 2273/22	. Making use of microwaves, e.g. for measurements
B01D 2273/24	. Making use of acoustic waves, e.g. for measurements
B01D 2273/26	. Making use of optical waves, e.g. for measurements
B01D 2273/28	. Making use of vacuum or underpressure
B01D 2273/30	. Means for generating a circulation of a fluid in a filtration system, e.g. using a pump or a fan
<b>B01D 2275/00</b>	<b>Filter media structures for filters specially adapted for separating dispersed particles from gases or vapours</b>
B01D 2275/10	. Multiple layers
B01D 2275/105	.. Wound layers
B01D 2275/20	. Shape of filtering material
B01D 2275/201	.. Conical shape
B01D 2275/202	.. Disc-shaped filter elements
B01D 2275/203	.. Shapes flexible in their geometry, e.g. bendable, adjustable to a certain size
B01D 2275/204	.. Special shapes of loose filter materials
B01D 2275/205	.. Rectangular shape
B01D 2275/206	.. Special forms, e.g. adapted to a certain housing
B01D 2275/207	.. Triangular shape
B01D 2275/208	.. Oval shape
B01D 2275/30	. Porosity of filtering material



- B01D 2275/302 . . Means for changing the porosity of a filter element, e.g. adjustment of a slit width, compression of a foam material
- B01D 2275/305 . . Porosity decreasing in flow direction
- B01D 2275/307 . . Porosity increasing in flow direction
- B01D 2275/40 . Porous blocks
- B01D 2275/403 . . Flexible blocks
- B01D 2275/406 . . Rigid blocks
- B01D 2275/50 . Stabilised filter material, stabilised by e.g. structuring, calendering

**B01D 2277/00** **Filters specially adapted for separating dispersed particles from gases or vapours characterised by the position of the filter in relation to the gas stream**

- B01D 2277/10 . Parallel
- B01D 2277/20 . Inclined, i.e. forming an angle of between 0° and 90°
- B01D 2277/30 . Transverse, i.e. forming an angle of 90°

**B01D 2279/00** **Filters adapted for separating dispersed particles from gases or vapours specially modified for specific uses**

- B01D 2279/10 . for air bags, e.g. inflators therefor
- B01D 2279/20 . for collecting heterogeneous particles separately
- B01D 2279/30 . for treatment of exhaust gases from IC Engines
- B01D 2279/35 . for venting arrangements
- B01D 2279/40 . for cleaning of environmental air, e.g. by filters installed on vehicles or on streets
- B01D 2279/45 . for electronic devices, e.g. computers, hard-discs, mobile phones
- B01D 2279/50 . for air conditioning ([air-conditioning systems comprising filters F24F 3/1603](#))
- B01D 2279/51 . . in clean rooms, e.g. production facilities for electronic devices, laboratories
- B01D 2279/55 . for cleaning appliances, e.g. suction cleaners ([suction cleaners comprising filters A47L 9/10](#))
- B01D 2279/60 . for the intake of internal combustion engines or turbines ([intake systems for vehicles comprising filters F02M 35/024](#))
- B01D 2279/65 . for the sterilisation of air ([disinfection, sterilisation or deodorization of air A61L 9/00](#))

**B01D 2311/00** **Details relating to membrane separation process operations and control**

**NOTE**

In groups [B01D 2311/02](#) to [B01D 2311/08](#), the nature of specific operations carried out can be indexed by a combination of symbols chosen from [B01D 2311/10](#) to [B01D 2311/2696](#)

- B01D 2311/02 . Specific process operations before starting the membrane separation process
- B01D 2311/04 . Specific process operations in the feed stream; Feed pretreatment
- B01D 2311/06 . Specific process operations in the permeate stream
- B01D 2311/08 . Specific process operations in the concentrate stream
- B01D 2311/10 . Temperature control



B01D 2311/103	.. Heating
B01D 2311/106	.. Cooling
B01D 2311/12	. Addition of chemical agents
B01D 2311/13	. Use of sweep gas
B01D 2311/14	. Pressure control
B01D 2311/16	. Flux control
B01D 2311/165	.. Cross-flow velocity control
B01D 2311/18	. pH control
B01D 2311/20	. Power consumption
B01D 2311/22	. characterised by a specific duration or time
B01D 2311/24	. Quality control
B01D 2311/243	.. Electrical conductivity control
B01D 2311/246	.. Concentration control
B01D 2311/25	. Recirculation, recycling, e.g. recirculation of concentrate into the feed
B01D 2311/26	. Further operations combined with membrane separation precesses
B01D 2311/2603	.. Application of an electric field, different from the potential difference across the membrane
B01D 2311/2607	.. Application of a magnetic field
B01D 2311/2611	.. Irradiation
B01D 2311/2615	... Application of high-frequency electromagnetic fields or microwave irradiation
B01D 2311/2619	... UV-irradiation
B01D 2311/2623	.. Ion-Exchange
B01D 2311/2626	.. Absorption or adsorption
B01D 2311/263	.. Chemical reaction
B01D 2311/2634	... Oxidation
B01D 2311/2638	... Reduction
B01D 2311/2642	.. Aggregation, sedimentation, flocculation, precipitation or coagulation
B01D 2311/2646	.. Decantation
B01D 2311/2649	.. Filtration
B01D 2311/2653	.. Degassing
B01D 2311/2657	... Deaeration
B01D 2311/2661	.. Addition of gas
B01D 2311/2665	... Aeration other than for cleaning purposes
B01D 2311/2669	.. Distillation
B01D 2311/2673	.. Evaporation
B01D 2311/2676	.. Centrifugal separation
B01D 2311/268	.. Water softening
B01D 2311/2684	.. Electrochemical processes
B01D 2311/2688	.. Biological processes
B01D 2311/2692	.. Sterilization



B01D 2311/2696 . . Catalytic reactions

**B01D 2313/00 Details relating to membrane modules or apparatus**

- B01D 2313/02 . Specific tightening or locking mechanisms
- B01D 2313/025 . . Specific membrane holders
- B01D 2313/04 . Specific sealing means
- B01D 2313/06 . External membrane module supporting or fixing means
- B01D 2313/08 . Flow guidance means within the module or the apparatus
- B01D 2313/083 . . Bypass routes
- B01D 2313/086 . . Meandering flow path over the membrane
- B01D 2313/10 . Specific supply elements
- B01D 2313/105 . . Supply manifolds
- B01D 2313/12 . Specific discharge elements
- B01D 2313/125 . . Discharge manifolds
- B01D 2313/13 . Specific connectors
- B01D 2313/14 . Specific spacers
- B01D 2313/143 . . on the feed side
- B01D 2313/146 . . on the permeate side
- B01D 2313/16 . Specific vents
- B01D 2313/18 . Specific valves
- B01D 2313/19 . Specific flow restrictors
- B01D 2313/20 . Specific housing
- B01D 2313/21 . Specific headers, end caps
- B01D 2313/22 . Specific cooling or heating elements
- B01D 2313/23 . Specific membrane protectors, e.g. sleeves or screens
- B01D 2313/24 . Specific pressurizing or depressurizing means
- B01D 2313/243 . . Pumps
- B01D 2313/246 . . Energy recovery means
- B01D 2313/26 . Specific gas distributors or gas intakes
- B01D 2313/28 . Specific concentration chambers
- B01D 2313/30 . Specific dilution or de-ionizing chambers
- B01D 2313/32 . Intermediate chambers
- B01D 2313/34 . Energy carriers
- B01D 2313/345 . . Electrodes
- B01D 2313/36 . Energy sources
- B01D 2313/365 . . Electrical sources
- B01D 2313/38 . Heat exchangers
- B01D 2313/40 . Adsorbents within the flow path
- B01D 2313/42 . Catalysts within the flow path
- B01D 2313/44 . Cartridge types



- B01D 2313/46 . Supply, recovery or discharge mechanisms of washing members
- B01D 2313/48 . Mechanisms for switching between regular separation operations and washing
- B01D 2313/50 . Specific extra reservoirs
- B01D 2313/54 . Modularity of membrane module elements
- B01D 2313/56 . Specific mechanisms for loading the membrane in a module
- B01D 2313/58 . Parts of membrane modules specifically adapted to single use
- B01D 2313/90 . Other integrated auxiliary systems

**B01D 2315/00****Details relating to the membrane module operation**

- B01D 2315/02 . Rotation or turning
- B01D 2315/04 . Reciprocation, oscillation or vibration
- B01D 2315/05 . Moving the membrane in one direction, e.g. displacement, translational movement
- B01D 2315/06 . Submerged-type; Immersion type
- B01D 2315/08 . Fully permeating type; Dead-end filtration
- B01D 2315/10 . Cross-flow filtration
- B01D 2315/12 . Feed-and-bleed systems
- B01D 2315/14 . Batch-systems
- B01D 2315/16 . Diafiltration
- B01D 2315/18 . Time sequence of one or more process steps carried out periodically within one apparatus
- B01D 2315/20 . Operation control schemes defined by a periodically repeated sequence comprising filtration cycles combined with cleaning or gas supply, e.g. aeration

**B01D 2317/00****Membrane module arrangements within a plant or an apparatus ([membrane assemblies within one housing B01D 2319/00](#))**

- B01D 2317/02 . Elements in series
- B01D 2317/022 . . . Reject series
- B01D 2317/025 . . . Permeate series
- B01D 2317/027 . . . Christmas tree arrangements
- B01D 2317/04 . Elements in parallel
- B01D 2317/06 . Use of membrane modules of the same kind
- B01D 2317/08 . Use of membrane modules of different kinds

**B01D 2319/00****Membrane assemblies within one housing ([module or elements arrangements within a plant or an apparatus B01D 2317/00](#))**

- B01D 2319/02 . Elements in series
- B01D 2319/022 . . . Reject series
- B01D 2319/025 . . . Permeate series
- B01D 2319/027 . . . Christmas tree arrangements
- B01D 2319/04 . Elements in parallel
- B01D 2319/06 . Use of membranes of different materials or properties within one module



<b>B01D 2321/00</b>	<b>Details relating to membrane cleaning, regeneration, sterilization or to the prevention of fouling</b>
B01D 2321/02	. Forward flushing
B01D 2321/04	. Backflushing
B01D 2321/06	. Use of osmotic pressure, e.g. direct osmosis
B01D 2321/08	. Use of hot water or water vapor
B01D 2321/10	. Use of feed
B01D 2321/12	. Use of permeate
B01D 2321/14	. Use of concentrate
B01D 2321/16	. Use of chemical agents
B01D 2321/162	.. Use of acids
B01D 2321/164	.. Use of bases
B01D 2321/166	.. Use of enzymatic agents
B01D 2321/168	.. Use of other chemical agents
B01D 2321/18	. Use of gases
B01D 2321/185	.. Aeration
B01D 2321/20	. By influencing the flow
B01D 2321/2008	.. statically
B01D 2321/2016	... Static mixers; Turbulence generators
B01D 2321/2025	... Tangential inlet
B01D 2321/2033	.. dynamically
B01D 2321/2041	... Mixers; Agitators
B01D 2321/205	... Integrated pumps
B01D 2321/2058	... by vibration of the membrane, e.g. with an actuator
B01D 2321/2066	.. Pulsated flow
B01D 2321/2075	... Ultrasonic treatment
B01D 2321/2083	.. By reversing the flow
B01D 2321/2091	.. using movable bodies, e.g. foam balls
B01D 2321/22	. Electrical effects
B01D 2321/223	.. Polarity reversal
B01D 2321/226	.. Interruption of electric currents
B01D 2321/24	. Magnetic effects
B01D 2321/26	. By suction
B01D 2321/28	. By soaking or impregnating
B01D 2321/30	. Mechanical cleaning, e.g. with brushes or scrapers
B01D 2321/32	. By heating or pyrolysis
B01D 2321/34	. by radiation
B01D 2321/343	.. By UV radiation
B01D 2321/346	.. By gamma radiation
B01D 2321/40	. Automatic control of cleaning processes



**B01D 2323/00****Details relating to membrane preparation**

- B01D 2323/02 . Hydrophilization
- B01D 2323/04 . Hydrophobization
- B01D 2323/06 . Specific viscosities of materials involved
- B01D 2323/08 . Specific temperatures applied
- B01D 2323/10 . Specific pressure applied
- B01D 2323/12 . Specific ratios of components used
- B01D 2323/14 . Aging features
- B01D 2323/16 . Use of swelling agents
- B01D 2323/18 . Use of pore-control agents
- B01D 2323/20 . Use of plasticizers
- B01D 2323/21 . Use of fillers
- B01D 2323/22 . Use of non-solvents
- B01D 2323/225 . . . Use of supercritical fluids
- B01D 2323/24 . Use of template or surface directing agents [SDA]
- B01D 2323/26 . Spraying processes
- B01D 2323/28 . Pore treatments
- B01D 2323/283 . . . Reducing the pores
- B01D 2323/286 . . . Closing of pores, e.g. for membrane sealing
- B01D 2323/30 . Cross-linking
- B01D 2323/32 . Use of chain transfer agents or inhibitors
- B01D 2323/34 . Use of radiation
- B01D 2323/345 . . . UV-treatment
- B01D 2323/35 . Use of magnetic or electrical fields
- B01D 2323/36 . Introduction of specific chemical groups
- B01D 2323/38 . Graft polymerization
- B01D 2323/385 . . . involving radiation
- B01D 2323/39 . Electrospinning
- B01D 2323/40 . in-situ membrane formation
- B01D 2323/42 . Details of membrane preparation apparatus
- B01D 2323/44 . Relaxation steps
- B01D 2323/46 . Impregnation
- B01D 2323/48 . Influencing the pH
- B01D 2323/50 . Control of the membrane preparation process

**B01D 2325/00****Details relating to properties of membranes**

- B01D 2325/02 . Details relating to pores or porosity of the membranes
- B01D 2325/021 . . . Characteristic pore shapes
- B01D 2325/022 . . . Asymmetric membranes
- B01D 2325/023 . . . . Dense layer within the membrane



B01D 2325/025	. . Finger pores
B01D 2325/026	. . Sponge structure
B01D 2325/027	. . Nonporous membranes
B01D 2325/028	. . Microfluidic pore structures
B01D 2325/04	. Characteristic thickness
B01D 2325/06	. Surface irregularities
B01D 2325/08	. Patterned membranes
B01D 2325/10	. Catalysts being present on the surface of the membrane or in the pores
B01D 2325/12	. Adsorbents being present on the surface of the membranes or in the pores
B01D 2325/14	. Membrane materials having negatively charged functional groups
B01D 2325/16	. Membrane materials having positively charged functional groups
B01D 2325/18	. Membrane materials having mixed charged functional groups
B01D 2325/20	. Specific permeability or cut-off range
B01D 2325/22	. Thermal or heat-resistance properties
B01D 2325/24	. Mechanical properties, e.g. strength
B01D 2325/26	. Electrical properties
B01D 2325/28	. Degradation or stability over time
B01D 2325/30	. Chemical resistance
B01D 2325/32	. Melting point or glass-transition temperatures
B01D 2325/34	. Molecular weight or degree of polymerization
B01D 2325/36	. Hydrophilic membranes
B01D 2325/38	. Hydrophobic membranes
B01D 2325/40	. Fibre reinforced membranes
B01D 2325/42	. Ion-exchange membranes
B01D 2325/44	. Transmission of light
B01D 2325/46	. Magnetic properties
B01D 2325/48	. Antimicrobial properties