SLOVENSKI STANDARD
SIST EN 334:2000

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Regulatorji tlaka plina za vstopne tlake do 100 bar

Gas pressure regulators for inlet pressures up to 100 bar

Gas-Druckregelgeräte für Eingangsdrücke bis 100 bar

Appareils de régulation de pression de gaz (régulateurs) pour des pressions amont jusqu'a 100 bar

Ta slovenski standard je istoveten z: **EN 334:1999**

ICS:

23.060.40 Tlaļ ni regulatorji Pressure regulators

SIST EN 334:2000 **en**

EUROPEAN STANDARD
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EN 334

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English version

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This European Standard was approved by CEN on 7 August 1998.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 235 "Gas pressure regulators and associated safety shut-off devices for use in gas transmission and distribution", the secretariat of which is held by UNI.

At the time of drafting, it has not been decided whether the pressure regulators within the scope of this European Standard will fall under the Pressure Equipment Directive 97/23/EC and also there was no network of Notified Bodies under the provisions of the directive itself. Therefore it was decided to establish the evaluation of conformity according to the CEN "Guidelines for Technical Committees - Requirements in European Standards concerning the evaluation of conformity 1993-01".

When it is confirmed that pressure regulators within the scope of this European Standard fall under the Pressure Equipment Directive, the Standard will be revised to ensure that it's clauses conform with the essential requirements and conformity assessments of the Directive.

NOTE: Referring to 4.2.2 of this European Standard it should be noted that at the discussion during its elaboration within WG 1, it was pointed out that in some member countries there is legislation limiting the application of some materials listed in table 5.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 1999, and conflicting national standards shall be withdrawn at the latest by November 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies constructional and functional requirements, regulator sizing, testing, documentation and marking of gas pressure regulators:

- for inlet pressures up to 100 bar;

- used at an ambient temperature range from -20 °C to +60 °C.

which operate with fuel gases of the 1st and of the 2nd family in accordance with EN 437 in transmission and distribution networks and also in industrial installations.

"Gas pressure regulators" hereafter will be called "regulators" except in the titles.

This European Standard considers the following classes of regulators:

- class 1: operating temperature range from -10 °C to 60 °C;

- class 2: operating temperature range from -20 °C to 60 °C.

For inlet pressures higher than 100 bar and/or ambient temperatures lower than –20 °C this European Standard may be used as a "guideline".

This European Standard applies to regulators which use the pipeline gas as a source of control energy unassisted by any external power source. These regulators have no continuous discharge of gas into the atmosphere but temporary discharges from safety devices can occur.

The regulators complying with the requirements of this European Standard may be declared as "in conformity with EN 334".

This European Standard does not apply to:

- regulators upstream from/on/in domestic gas-consuming appliances which are installed downstream of domestic gas meters;

- regulators that comply with both of the following characteristics:

  - volumetric flow rate ≤ 100 m^3/h at standard conditions;

  - inlet pressure ≤ 5 bar;

- regulators for which a specific European Standard exists (e.g. EN 88, etc.);

- industrial process control valves in accordance with prEN 1349.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendement or revision. For undated references the latest edition of the publication referred to applies:

EN 437	Test gases - Test pressures - Appliance categories
prEN 1349	Industrial process control valves
EN 10045-1	Metallic materials – Charpy impact test – Part 1: Test method
EN 10204	Metallic products - Types of inspection documents
EN 20898-1	Mechanical properties of fasteners - Part 1: Bolts, screws and studs (ISO 898-1:1988)

EN 45011	General criteria for certification bodies operating product certification
EN 45014	General criteria for supplier's declaration of conformity
EN 45020	General terms and their definitions concerning standardization and related activities
EN 60534-1	Industrial-process control valves - Part 1: Control valve terminology and general considerations (IEC 534-1:1987)
EN 60534-2-2	Industrial-process control valves - Part 2: Flow capacity - Section 2: Sizing equations for compressible fluid flow under installed conditions (IEC 534-2-2:1980)
EN 60534-2-3	Industrial-process control valves - Part 2: Flow capacity - Section 3: Test procedures (IEC 534-2-3:1983)
EN 60651: 1994	Sound level meters (IEC 651:1979)
EN ISO 6708	Pipework components - Definition and selection of DN (nominal size) (ISO 6708:1995)
EN ISO 9000-1	Quality-management and quality assurance standards - Part 1: Guidelines for selection and use (ISO 9000-1:1994)
EN ISO 9001	Quality systems - Model for quality assurance in design/development, production, installation and servicing (ISO 9001:1994)
EN ISO 9002	Quality systems - Model for quality assurance in production, installation and servicing (ISO 9002:1994)
EN ISO 9003	Quality systems - Model for quality assurance in final inspection and test (ISO 9003:1994)
EN ISO 9004-1	Quality management and quality system elements - Part 1: Guidelines (ISO 9004-1:1994)
ISO 7-1	Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation
ISO 3419	Non-alloy and alloy steel butt-welding fittings
ISO 7005	Metallic flanges
IEC 534-3: 1976	Industrial-process control valves - Part 3: Dimensions - Section 1: Face-to-face dimensions for flanged, two-way, globe-type control valves
IEC 534-3-2: 1984	Industrial-process control valves - Part 3: Dimensions - Section 2: Face-to-face dimensions for flangeless control valves except wafer butterfly valves
ASME B 16.34: 1996	Valves - Flanged, threaded and welding end
ASME VIII div. 1: 1995	Rules for construction of pressure vessels

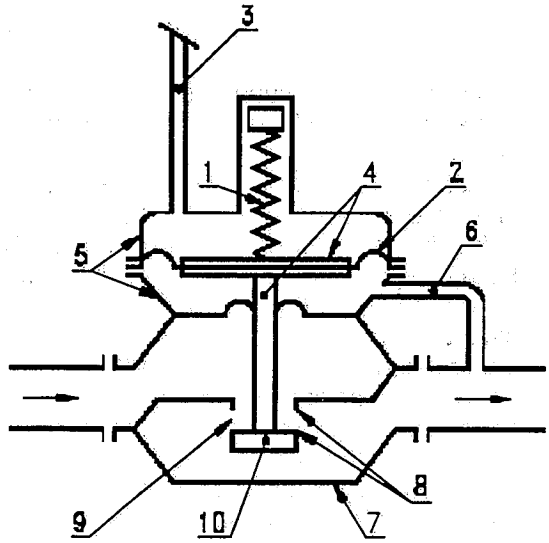
3 Definitions and symbols

For the purposes of this European Standard, the definitions given in EN 60534-1 and the following specific definitions apply.

3.1 Terminology

3.1.1 gas pressure regulator: Device whose function is to maintain the value of the controlled variable (see 3.2.2.1) within its tolerance field irrespective of disturbance variables.

3.1.1.1 direct acting gas pressure regulator: Regulator in which the energy required to move the control member is supplied by the controller (see example in figure 1).

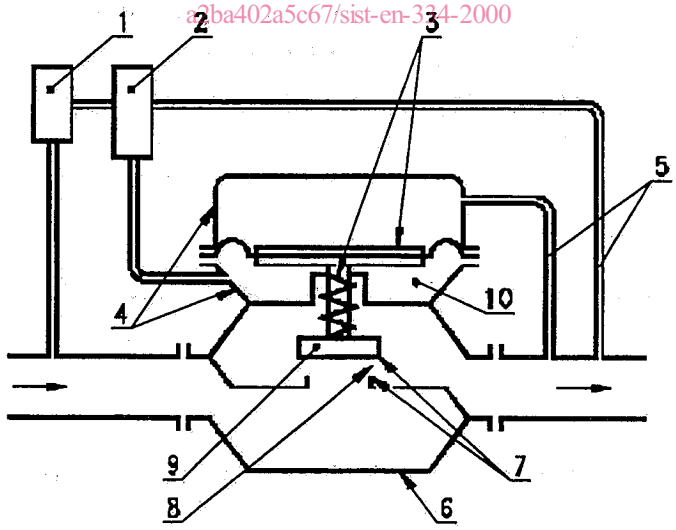


1	Setting element	6	Sensing line
2	Detector element	7	Regulator body
3	Breather/exhaust line	8	Valve seats
4	Actuator	9	Seat ring
5	Casing of actuator	10	Control member

1 + 2 = Controller

Figure 1: Example of a direct acting regulator

3.1.1.2 pilot controlled gas pressure regulator (indirect acting): Regulator in which the energy required to move the control member is supplied by a pilot (see example in figure 2).



1	Fixture	6	Regulator body
2	Pilot	7	Valve seats
3	Actuator	8	Seat ring
4	Casing of actuator	9	Control member
5	Sensing/process line	10	Motorization chamber

Figure 2: Example of a pilot controlled regulator

3.1.1.3 monitor: Second regulator normally installed in series with an active regulator which has the task of maintaining the controlled variable within allowable limits in the event of the failure of the active regulator.

3.1.1.4 series of regulators: Regulators with the same design concept but differing only in size.

3.1.1.5 fail open regulator: Regulator whose control member automatically tends to open when the main diaphragm fails or when the energy required to move the control member fails.

3.1.1.6 fail close regulator: Regulator whose control member automatically tends to close when the main diaphragm fails or when the energy required to move the control member fails.

3.1.1.7 integral strength regulator: Regulator in which the pressure containing parts have a design pressure p_d not less than the allowable pressure p_{zul}.

3.1.1.8 differential strength regulator: Regulator in which some of the pressure containing parts have a design pressure p_d less than the allowable pressure p_{zul}.

3.1.1.9 regulator size; nominal inlet diameter: Nominal size DN of the inlet connection in accordance with EN ISO 6708.

3.1.1.10 nominal outlet diameter: Nominal size DN of the outlet connection in accordance with EN ISO 6708.

3.1.2 main components: The main components of a gas pressure regulator normally include: control member, regulator body, actuator, casing of actuator, controller, pilot (only in pilot controlled regulators). The regulator might include additional units such as: a shut-off device, a monitor, a relief valve and other fixtures. The figures 1 and 2 serve as examples.

3.1.2.1 control member: Movable part of the regulator which is positioned in the flow path to restrict the flow through the regulator. A control member may be a plug, ball, disk, vane, gate, diaphragm, etc.

3.1.2.2 regulator body: Part of the regulator which is the main pressure containing envelope. It provides the fluid flow passageway and the pipe end connections.

3.1.2.3 valve seats: Corresponding sealing surfaces within a regulator which make full contact only when the regulator is in the closed position.

3.1.2.4 seat ring: Part assembled in a component of the regulator to provide a removable soft seat.

3.1.2.5 actuator: Device or mechanism which changes the signal from the controller into a corresponding movement controlling the position of the control member.

3.1.2.6 casing of actuator: Housing of the actuator. There may be two chambers under pressure within it. When the pressure in each chamber is different from atmospheric pressure, the chamber at the higher pressure is termed the "motorization chamber".

3.1.2.7 controller: Device which normally includes:

- a setting element, normally a spring, to obtain the set value of the controlled variable;
- a detector element, normally a diaphragm, for the controlled variable.

3.1.2.8 pilot: Device which includes:

- a setting element to obtain the set value of the controlled variable;
- a detector element for the controlled variable;
- a unit which compares the set value of the controlled variable with its feedback value;
- a system which provides the motorization energy for the actuator.

3.1.2.9 main diaphragm: Diaphragm, the function of which is to detect the feedback of the controlled variable and/or the diaphragm which provides the thrust to move the control member.

3.1.2.10 pressure controlling parts: Parts intended to control or regulate the movement of pressurized fuel gas, such as the control member, the actuator etc..

3.1.2.11 pressure containing parts: Parts whose failure to function as intended would result in a release of the retained fuel gas to the atmosphere. These include bodies, bonnets, the casing of the actuator and blind flanges.

3.1.3 accessories: Parts or minor devices connected to the regulator.

3.1.3.1 sensing and process lines: Lines which connect impulse points to the regulator. Sensing and process lines may be integrated into the regulator or external to the regulator. Those lines with no internal flow are termed "sensing lines"; those with internal flow are termed "process lines".

3.1.3.2 breather line: Connection line between the controller and/or pilot and atmosphere to equalize the pressure on the detector element when it changes its position in normal operating conditions. In the event of a fault in the detector element this line may become an exhaust line.

3.1.3.3 exhaust line: Connection line between the regulator or its fixtures and atmosphere for the safe exhausting of gas in the event of failure of any part.

3.1.3.4 fixtures: Functional devices connected to the main components of the regulator (see 3.1.2).

3.2 Control variables

3.2.1 Reference values

3.2.1.1 pressure

NOTE: All pressures specified in this European Standard are static gauge pressures. They are measured in bar[1].

3.2.1.1.1 inlet pressure, p_e: Gas pressure at the inlet of the regulator.

3.2.1.1.2 outlet pressure, p_a : Gas pressure at the outlet of the regulator.

3.2.1.1.3 differential pressure, Δp : Difference between two values of pressure measured at two different points.

3.2.1.1.4 motorization pressure, p_m: Gas pressure in the motorization chamber.

3.2.1.1.5 pilot feeding pressure, p_{ep}: Gas pressure at the inlet of the pilot.

3.2.1.2 Flow conditions

3.2.1.2.1 standard conditions: Absolute pressure of 1,013 25 bar and temperature of 15 °C (288,15 K ≅ 288 K).

3.2.1.2.2 gas volume: Volume of gas at standard conditions. It is expressed in m^3.

3.2.1.2.3 volumetric flow rate, Q : Volume of gas which flows through the regulator in unit time.
It is expressed in m^3/h at standard conditions.

3.2.1.3 sound pressure level, L_{pA}: Sound pressure frequency weightings A in accordance with EN 60651: 1994.

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[1] 1 bar = 1000 mbar = 10^5 N/m^2 = 10^5 Pa = 10^{-1} MPa.

3.2.2 Variables in the controlling process

3.2.2.1 controlled variable, X : Variable which is monitored by the controlling process. This controlled variable in regulators may be:

- inlet pressure, p_e;
- outlet pressure, p_a;
- differential pressure, Δp.

In this European Standard, only the outlet pressure "p_a" is considered as the controlled variable.

3.2.2.2 disturbance variable, Z : Variables acting from outside on the controlling process. In the case of regulators with the outlet pressure as the controlled variable, the disturbance variables are essentially:

- fluctuations in the inlet pressure, p_e;
- changes in the volumetric flow rate, Q.

3.2.3 Possible values of all variables

3.2.3.1 actual value: Instantaneous value of any variable at any instant. It is specified by the index "i" added to the symbol of the variable.

3.2.3.2 maximum value: The highest value:

- to which any variable can be adjusted or to which it is limited;
- any variable may reach during a series of measurements or during a certain time period.

It is specified by the subscript "max" added to the symbol of the variable.

3.2.3.3 minimum value: The lowest value:

- to which any variable can be adjusted or to which it is limited;
- any variable may reach during a series of measurements or during a certain time period.

It is specified by the index "min" added to the symbol of the variable.

3.2.4 Terms pertinent to the controlled variable

3.2.4.1 set point, p_{as} : Nominal value of the controlled variable.

NOTE: The set point is not directly measurable but determined as shown in figure 5.

3.2.4.2 set range, W_h: Whole range of set points which can be obtained from a regulator by adjustment and/or the replacement of some components (i.e. replacement of the valve seat or adjustment element e.g. spring).

3.2.4.3 specific set range, W_a: Whole range of set points which can be obtained in a regulator by adjustment and with no replacement of its components.

3.2.4.4 control deviation, X_w: Difference between the actual value of the controlled variable and the set point.

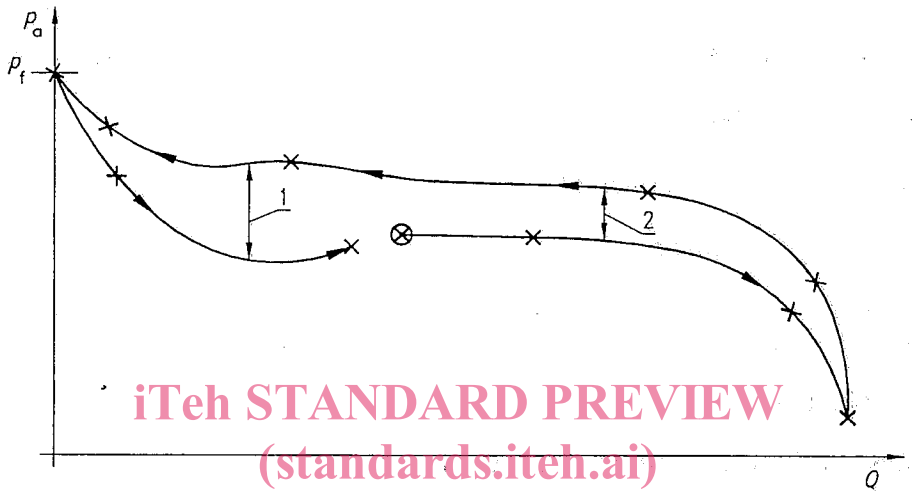
3.2.4.5 regulation change: Control deviation, X_w expressed as a percentage of the set point.

3.3 Operating features in stable conditions

3.3.1 stable conditions: Conditions when the controlled variable settles to a stable value after a disturbance has occurred.

3.3.2 performance curve: Graphic representation of the controlled variable as a function of the volumetric flow rate. This curve is determined by increasing and then decreasing the volumetric flow rate with constant inlet pressure and set point (see figure 3).

3.3.3 hysteresis band: Difference between the two values of outlet pressure for a given volumetric flow rate (see figure 3).



1 Max hysteresis band
2 Hysteresis band
⊗ Start setting
× Measured values

Figure 3: Performance curve (p_{as} constant, p_e constant)

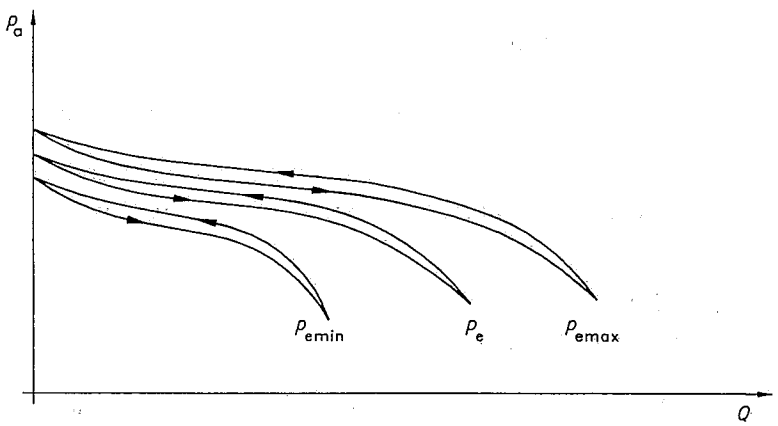


Figure 4: Family of performance curves (p_{as} constant)

3.3.4 family of performance curves: Set of the performance curves for each value of inlet pressure determined for a given set point (see figure 4).

3.3.5 Features pertinent to accuracy

3.3.5.1 accuracy: Average, expressed as a percentage of the set point, of the absolute maximum values of the positive and negative control deviation within the operating range.

3.3.5.2 accuracy class, AC: Maximum permissible value of the accuracy.

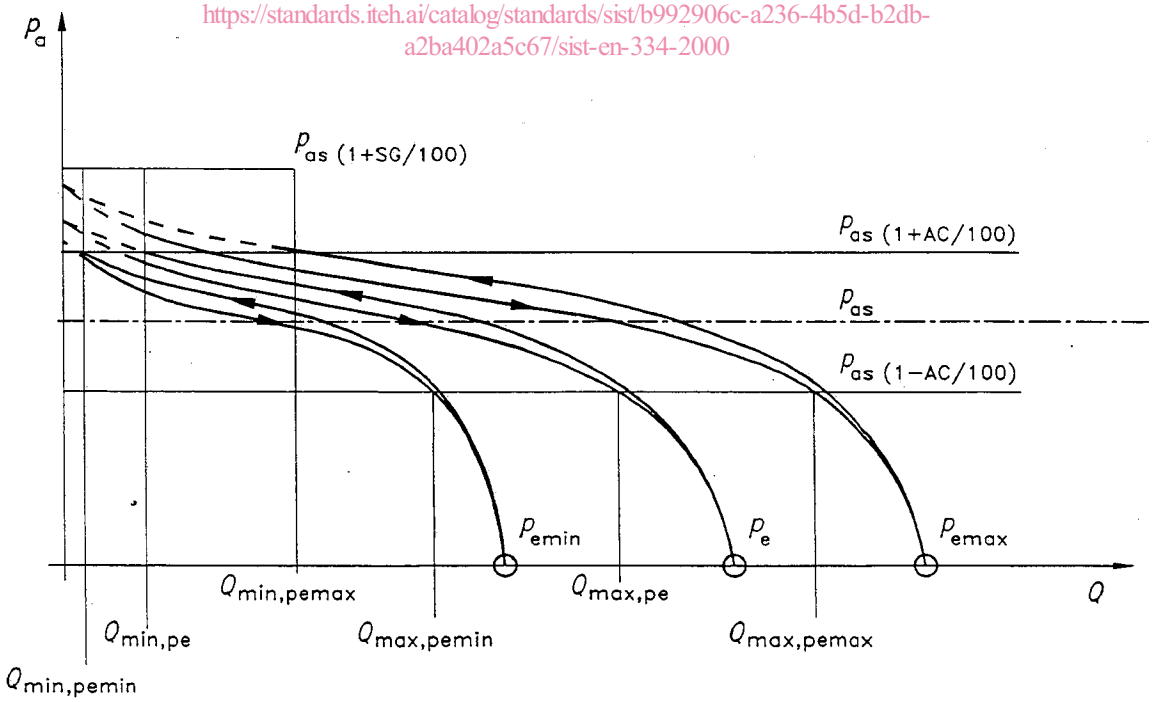
3.3.5.3 inlet pressure range, b_{pe}: Range of the inlet pressure for which the regulator ensures a given accuracy class. The inlet pressure range is characterized by its limit values p_{emax} and p_{emin}.

3.3.5.4 maximum accuracy flow rate: The lowest value of the maximum volumetric flow rate up to which, for a given set point and within the ambient temperature range specified, a given accuracy class is ensured:

- at the lowest inlet pressure (see figure 5) $Q_{max,pemin}$
- at the highest inlet pressure (see figure 5) $Q_{max,pemax}$
- at an intermediate inlet pressure between p_{emax} and p_{emin} (see figure 5) $Q_{max,pe}$.

3.3.6 Features pertinent to lock-up behaviour

3.3.6.1 lock-up time, t_f: Time taken for the control member to move from an open position to the closed position.



○ = Q_{max} with the control member at the limit imposed by the mechanical stop

Figure 5: Family of performance curves indicating maximum accuracy flow rates and minimum flow rates (p_{as} constant, stable conditions)