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1.------IND- 2019 0286 CZ- EN- ------ 20190628 --- --- PROJET

Executive summary for the EC (not part of this legislation)

'Gas flow sensors with a nozzle' may be placed on the market and put into use in the Czech Republic as specified measuring instruments pursuant to Act No 505/1990 on metrology, as amended. Pursuant to the Act, specified measuring instruments are instruments which are included in the list of the types of specified measuring instruments (Implementing Decree No 345/2002) and, at the same time, intended (by the manufacturer/importer) for measurements of relevance in the protection of public interests in the fields of *consumer protection, contractual relations, imposition of sanctions, fees, tariffs and taxes, health protection, environmental protection, occupational safety or the protection of other public interests protected by separate legislation*. This means that their purpose is similar to that used for defining specified products – measuring instruments and non-automatic weighing instruments – under Directives 2014/31/EU and 2014/32/EU. The requirements of this regulation do not apply to measuring instruments placed on the market in the Czech Republic for purposes other than the above purposes defined by Act No 505/1990 on metrology.

The subject matter of this notified regulation is to lay down the metrological and technical requirements for specified measuring instruments of this type. This regulation also lays down the tests for the purposes of type-approval and verification of specified measuring instruments of this type.

(End of executive summary)

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P U B L I C D E C R E E

As the authority with substantive and territorial jurisdiction for stipulating metrological and technical requirements for specified measuring instruments and stipulating test methods for type-approval and verification of legally specified instruments pursuant to § 14(1) of Act No 505/1990, on metrology, as amended (hereinafter the 'Metrology Act'), and in accordance with the provisions of § 172 et seq. of Act No 500/2004, the Code of Administrative Procedure (hereinafter the 'CAP'), the Czech Metrology Institute (hereinafter the 'CMI') commenced ex officio proceedings on 15 April2016 pursuant to § 46 of the CAP, and, based on supporting documents, issues the following:

I.

DRAFT MEASURE OF A GENERAL NATURE

number:0111-OOP-C090-18

laying down metrological and technical requirements for specified measuring instruments, including testing methods for the type-approval and verification of those instruments:

'gas flow sensors with a nozzle'

The specified metrological requirements are on a level comparable with the relevant requirements of the European standards and apply to the basic design of gas flow sensors with a nozzle.

1 Basic definitions

For the purposes of this general measure, terms and definitions pursuant to VIM and VIML[1] as well as the terms and definitions stated below apply:

1.1
Measurement system for measuring the flow quantity of gas:
An assembly of one or more measuring devices (measuring device components), frequently including additional equipment, arranged and adapted to provide information on the qualitative and quantitative characteristics of a gas.

1.2
'gas flow sensor with a nozzle'
a gas flow sensor based on the principle of measuring differential pressure before a nozzle and inside its throat, inserted in a defined manner into pipes with specified geometric parameters.

1.3
ISA 1932 nozzle
a primary element comprising a convergent section consisting of a confuser with a rounded profile, and a cylindrical throat

1.4
Venturi nozzle
a primary element comprising a convergent inlet, which is a standardised ISA 1932 nozzle connected to a cylindrical section (the 'throat') and an expanding conical section (the 'diffuser')

1.5
pressure tap (in wall):
an annular or circular cavity drilled in the wall of a pipe using such a method that the edge of the cavity fits with the interior surface of the pipe.

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[1] TNI 01 0115 International Vocabulary of Metrology – Basic and General Concepts and Associated Terms (VIM) and International Vocabulary of Terms in Legal Metrology (VIML) are part of the technical harmonisation compendium 'Terminology in the Area of Metrology', which is publicly accessible at www.unmz.cz

1.6
static pressure of the gas flowing through the pipe:
pressure that can be measured by connecting a pressure gauge to the pressure tap in the wall

1.7
differential pressure:
the difference between (static) pressures measured in pressure taps in the wall, one being in front of the nozzle and the other in the throat of a nozzle inserted in a straight pipe through which gas flows, taking into account all the differences in the amount tapped in front of the nozzle and in its throat

1.8
ratio of diameters β
the ratio of the diameter of the aperture in the nozzle throat to the internal diameter of the pipe in front of the nozzle

1.9
Reynolds pipe number Re_D
a dimensionless parameter expressing the ratio between the inertial forces and the frictional forces in the pipe in front of the nozzle

1.10
flow coefficient C
a coefficient defined for a flow of incompressible liquid; it indicates the ratio of the actual flow through the nozzle to the theoretical flow

1.11
expansion coefficient
a coefficient characterising the degree of compressibility of the liquid in question

2 Metrological requirements

Metrological requirements decisive for the placement of gas flow sensors with a nozzle on the market are applied during verification.

2.1 Operating conditions

The operating conditions are specified by the manufacturer in consideration of the range of anticipated ambient temperatures during operation and in consideration of the range of temperatures of the gas being measured. If there are significant temperature differences between the ambient temperature and the temperature of the flowing gas, then the gas flow sensor must be thermally insulated by suitable means.

- ISA 1932 nozzle: for $0.30 \leq \beta < 0.44$:$7\text{x}10^4 \leq Re_D \leq 10^7$
  for $0.44 \leq \beta \leq 0.80$:$2\text{x}10^4 \leq Re_D \leq 10^7$
- Venturi nozzle: for $0.316 \leq \beta \leq 0.775$:$1.5\text{x}10^5 \leq Re_D \leq 2\text{x}10^6$

2.2 Limits of use

Gas flow sensors with an ISA 1932 nozzle may only be used for:

- internal pipe diameter D:50 mm to 500 mm
- ratio of diameters β (d/D):0.30 to 0.80
- the roughness of the inside surface of the nozzle and pipe must comply with stipulated requirements

Gas flow sensors with a Venturi nozzle may only be used for:

- internal pipe diameter *D*:65 mm to 500 mm
- minimum throat aperture diameter *d*:50 mm
- ratio of diameters β (d/D):0.316 to 0.775
- the roughness of the inside surface of the nozzle and pipe must comply with stipulated requirements

2.3 Relative uncertainty of the nozzle flow coefficient

The following relative uncertainties for the flow coefficient *C* apply to individual nozzle types during compliance with all technical requirements and installation requirements within the limits of undesired increases in the relative uncertainty of the flow coefficient by additional uncertainty:

- ISA 1932 nozzle: for $\beta \leq 0.6$:0.8 %
for $\beta > 0.6$:$(2\beta - 0.4)$ %
- Venturi nozzle: for $0.316 \leq \beta \leq 0.775$:$(1.2 + 1.5\beta^4)$ %

If a straight length of pipe with additional uncertainty is used, then this uncertainty must be added to the uncertainty of the flow coefficient. The use of a straight length of pipe with additional uncertainty is limited to either only the section before the nozzle, or only the section after the nozzle.

Compliance with technical requirements is determined during the verification of the individual parts of the gas flow sensor, and compliance with installation requirements is determined within the scope of verification of the evaluation unit for the measurement of gas flow quantity.

2.4 Relative uncertainty of the expansion coefficient

The following relative uncertainties for the expansion coefficient ε apply to individual nozzle types during compliance with all stipulated technical requirements:

- ISA 1932 nozzle:$2\frac{\Delta p}{p_1}$%
- Venturi nozzle:$(4 + 100\beta^8)\frac{\Delta p}{p_1}$%

where Δp is the differential pressure and p_1 the absolute static gas pressure in front of the nozzle.

Compliance with technical requirements is ascertained during the verification of the individual parts of the gas flow sensor.

3 Technical requirements

Technical requirements decisive for the placement of gas flow sensors with a nozzle on the market are applied during verification.

3.1 Design

The basic design of a gas flow sensor with a nozzle includes the following parts:

- a nozzle (ISA 1932, long radius nozzle or a Venturi nozzle);
- pressure taps;
- a stabilising straight length of pipe before the nozzle with total minimum length of 10*D*, or a shorter length if measuring system installation requirements allow;
- a stabilising straight length of pipe after the nozzle of minimum length 2*D* from the front side of the nozzle.

The design and installation of the nozzle must ensure that the orifice plate is not subject to plastic or elastic deformation during operation under the pressure of the flowing gas, or that said deformation is within specified limits.

3.2 ISA 1932 nozzle

Part of the nozzle inside the pipe is circular and concentric with the pipe axis. The nozzle comprises a confuser with a rounded profile and a cylindrical throat. The profile of an ISA 1932 nozzle comprises:

- a straight inlet section A, perpendicular to the axis;
- a convergent section (confuser) defined by two arcs of length B and C;
- a cylindrical throat E;
- mount F (used to protect edge G from physical damage).

3.2.1 Straight inlet section A

The straight inlet section is limited by the circumference of a circle concentric with the rotational axis of diameter 1.5d and the inner circumference of the pipe of diameter D.

If $d = 2D/3$, the radial width of this straight section is zero.
If $d > 2D/3$, the front section of the nozzle does not have a straight inlet section inside the pipe.

The surface of the front straight inlet section must have a roughness parameter $Ra \leq 10^{-4}\, d$.

3.2.2 Convergent section of the nozzle (confuser)

Arc B is tangential to the straight inlet section A if $d < 2D/3$, and its radius R_1 equals $0.2d \pm 0.02d$ for $\beta < 0.5$ and $0.2d \pm 0.006d$ for $\beta \geq 0.5$.Its centre is $0.2d$ from the inlet plane and $0.75d$ from the axis.

Arc C is tangential to arc B and throat E. Its radius R_2 equals $d/3 \pm 0.033d$ for $\beta < 0.5$ and $d/3 \pm 0.01d$ for $\beta \geq 0.5$.Its centre is at a distance $d/2 + d/3 = 5d/6$ from the axis and a distance of $0.3041d$ from the straight inlet section A.

The convergent inlet profile must comply with specific geometric requirements. Two diameters of the convergent inlet in the same plane perpendicular to the axis must not differ from each other by more than 0.1 % of their mean value.

3.2.3 Nozzle throat E

The throat E has diameter d and length $b_n = 0.3d$, where the nozzle opening diameter d must comply with requirements specified in Article 2.2.

3.2.3.1 Throat diameter

The diameter of the throat opening d is the mean value of at least four diameter measurements distributed along axial planes and at approximately the same angles to each other.

3.2.3.2 Throat cylindricity

The nozzle throat must be cylindrical, and no diameter in any cross-section measured in the cylindrical section of the throat may differ by more than 0.05 % of the mean diameter.

3.2.3.3 Throat exit edge G

The throat exit edge G must be sharp.

3.2.3.4 Throat surface roughness

The inner surface of the nozzle throat must have a roughness parameter $Ra \leq 10^{-4}\, d$.

3.2.4 Mount F

The mount F must have a diameter c_n equal to at least 1.06*d* and a length less than or equal to 0.03*d*.Ratio of the height of the mount $(c_n - d)/2$ to its axial length must not be greater than 1.2.

3.2.5 Nozzle length

The total length of the nozzle without mount F equals 0.6041*d* for $0.3 \leq \beta \leq 2/3$ and $\left(0{,}4041 + \sqrt{\frac{0{,}75}{\beta} - \frac{0{,}25}{\beta^2} - 0{,}5225}\right) d$ for $2/3 < \beta \leq 0.8$.

3.2.6 The back side of the nozzle

The thickness of the nozzle walls H (the straight inlet section) must not exceed 0.1*D*.No other requirements are specified for the back side of the nozzle.

3.2.7 Nozzle material

An ISA 1932 nozzle may be made of any kind of material with a known longitudinal expansion coefficient under the condition that it will continuously meet all of the relevant requirements of this regulation under operating conditions.

3.2.8 Differential pressure taps for the ISA 1932 nozzle

Fillet pressure taps (spot taps or annular slots) must be used in front of the nozzle. Both tap types can be located either in the pipe or in its flanges or in the chamber rings.

The chosen pressure taps downstream of the nozzle should preferably be the fillet type, unless the other relevant requirements of notified standards specify otherwise for this measure of a general nature.

The diameter of the pressure taps must be less than 0.13 *D* and less than 13 mm. The pressure taps must be circular and cylindrical over a length of at least 2.5 times the inner diameter of the tap (measured from the inner wall of the pipe).The axis of the pressure tap must intersect the pipe axis at an angle of 90° ± 3°.

Other technical requirements for pressure tap design are specified by requirements of notified standards relevant to this measure of a general tenure.

3.3 Venturi nozzle

A Venturi nozzle comprises a convergent section with a rounded profile, a cylindrical throat, and a divergent section (of the diffuser).The profile of this nozzle is axially symmetrical and can be characterised as follows:

- a straight inlet section A, perpendicular to the axis;
- a convergent section (confuser) defined by two arcs of length B and C;
- a cylindrical throat consisting of sections E and F;
- a divergent section (diffuser).

3.3.1 Straight inlet section A

The front side of a Venturi nozzle is identical to an ISA 1932 nozzle. The straight inlet section is limited by the circumference of a circle of diameter 1.5*d* centred on the axis of rotation, and the inner circumference of the pipe of diameter *D*.

If $d = 2D/3$, the radial width of this straight section is zero.

If $dd > 2D/3$, the front section of the nozzle does not have a straight inlet section inside the pipe.

The surface of the front straight inlet section must have a roughness parameter $Ra \leq 10^{-4}\, d$.

3.3.2 Convergent section of the nozzle (confuser)

Arc B is tangential to the straight inlet part A, if $d < 2D/3$, and its radius R_1 equals $0.2d \pm 0.02d$ for $\beta < 0.5$ and $0.2d \pm 0.006d$ for $\beta \geq 0.5$.Its centre is $0.2d$ from the inlet plane and $0.75d$ from the axis.

Arc C is tangential to arc B and throat E. Its radius R_2 equals $d/3 \pm 0.033d$ for $\beta < 0.5$ and $d/3 \pm 0.01d$ for $\beta \geq 0.5$.Its centre is at a distance $d/2 + d/3 = 5d/6$ from the axis and a distance $0.3041d$ from the straight inlet section A.

The convergent inlet profile must comply with specific geometric requirements. Two diameters of the convergent inlet in the same plane perpendicular to the axis must not differ from each other by more than 0.1 % of their mean value.

3.3.3 Nozzle throat

The nozzle throat comprises section E of length $0.3d$ and section F of length $0.4d$ to $0.45d$.The diameter of the nozzle aperture d must meet the requirements specified in Article 2.2.

3.3.3.1 Throat diameter

The diameter of the throat opening d is the mean value of at least four diameter measurements distributed along axial planes and at approximately the same angles to each other.

3.3.3.2 Throat cylindricity

The nozzle throat must be cylindrical, and no diameter in any cross-section measured in the cylindrical section of the throat may differ by more than 0.05 % of the mean diameter.

3.3.3.3 Nozzle inner surface roughness

The inner surface of a Venturi nozzle must have a roughness parameter $Ra \leq 10^{-4}\, d$.

3.3.4 Divergent section of the nozzle (diffuser)

The divergent section of the nozzle must be connected with the cylindrical section of the throat F past the pressure tap without the rounded section; nevertheless the transition must be free of manufacturing defects and burrs. The apex angle of the divergent section (diffuser) must be less than or equal to 30°.

A Venturi nozzle is called 'shortened' if the outlet diameter of the divergent section is less than the inner diameter of the pipe D,, and 'unshortened' if the inlet diameter is equal to the inner diameter of the pipe D.

3.3.5 Nozzle material

A Venturi nozzle may be made of any kind of material with a known longitudinal expansion coefficient under the condition that it will continuously meet all of the relevant requirements of this regulation under operating conditions.

3.3.6 Differential pressure taps for a Venturi nozzle

Fillet pressure taps (spot taps or annular slots) must be used in front of the nozzle. Both tap types can be located either in the pipe or in its flanges or in the chamber rings.

Pressure taps in the throat must contain at least four separate pressure taps inserted in the ring chamber, a circular tap or three T tap configurations. Annular or dashed slits may not be used. The axes of the pressure taps must intersect the axis of the Venturi nozzle, must be at identical angles to each other, and

must be located in a plane perpendicular to the axis of the Venturi nozzle on the imaginary border between sections E and F of the cylindrical throat. The mean of point pressure taps in the throat of a Venturi nozzle must be less than or equal to 0.04*d*, as well as being between 2 mm and 10 mm.

The pressure taps must be circular and cylindrical over a length of at least 2.5 times the inner diameter of the tap (measured from the inner wall of the Venturi nozzle).

Other technical requirements for pressure tap design are specified by requirements of notified standards relevant to this measure of a general tenure.

3.4 Straight lengths of pipe before and after the nozzle

3.4.1 Design

The minimum straight length of pipe before the nozzle that must be complied with in the specific application is determined based on the ratio of diameters β and according to the type and mutual arrangement of at least two fittings situated in front of the nozzle.

The straight part of the pipe between the first fitting in front of the nozzle and the nozzle itself may be made of one or more pieces, but the part of the pipe up to the length 2*D* in front of the nozzle must always consist of a single section.

The design and execution of the straight lengths of pipe must facilitate the performance of the tests defined in Article 5.2.4 or Article 6.2.4.

3.4.2 Pipe straightness

The straightness of the stabilising minimum straight lengths of pipe is deemed adequate if the surface deviation of the pipe from a straight line running parallel to the axis of the pipe does not exceed 0.4 % of its length before and after the nozzle.

3.4.3 Mean value of the inner diameter of the pipe

The inner diameter *D* of the pipe is the arithmetic mean of at least 12 measured diameter values, i.e. four diameters situated at approximately the same angles to one another at each of at least three cross-sections evenly distributed over a length of 0.5 *D* before the pressure tap at the nozzle inlet. Two of these cross-sections must be situated at distances 0*D* and 0.5*D* from the front pressure tap and one at the plane of the weld in the case of a design using a welded-on throat. If a chamber tapping is used, this value of 0.5*D* shall be measured from the front edge of the chamber ring.

3.4.4 Circularity and cylindricity of the pipe

The internal shape of the pipe must be circular along the entire minimum straight length of pipe.

No inner pipe diameter may differ from the mean value of inner diameter *D* by more than 0.3 % in any plane in the part of the straight length of pipe up to a distance of 2*D* before the nozzle.

The difference between inner pipe diameters of two arbitrary sections of pipe may not exceed 0.3 % of the mean value of inner diameter *D* along the straight section of pipe between 2*D* and 10*D* before the nozzle. At the same time, the overlap of the inner diameters of parts of the pipe connected to one another, caused by a deviation and/or change in diameter *D*, may not exceed 0.3 % of the mean value of the internal diameter *D* at any point along the inner circumference of the pipe.

No inner diameter of a straight length of pipe past the nozzle may differ by more than 3 % from the mean internal diameter *D* of the pipe before the nozzle along a distance of at least 2*D* from the front side of an ISA 1932 nozzle. In the case of a Venturi nozzle, the inner diameter of the connected pipe must not be less than 90 % of the inner diameter of the end of its divergent section (diffuser).

3.4.5 Quality of the inner surface of the pipe

The inner surface of the pipe must be clean and free of any visible defects.

Along at least the minimum straight length in front of the nozzle stipulated by the basic version of the gas flow sensor (see Article 3.1), the inner surface of the pipe must comply with requirements for surface roughness *Ra*.

3.5 Installation requirements

The installation position of the nozzle must be clearly defined by its design, or it must be schematically marked directly on the nozzle.

4 Measuring instrument markings

4.1 General

All inscriptions and markings must be easily visible, legible, and indelible and must be a source of the information needed for the trouble-free implementation of the gas flow meter with a nozzle into the measurement system in relation to its other components.

4.2 Markings

4.2.1 Markings on the nozzle

The following information must be on the nozzle:

a) serial number;
b) the value of the inner diameter of the nozzle throat opening d_{20} in relation to a reference temperature of 20 °C;
c) type-approval mark;
d) suitable markings to identify type and placement of differential pressure taps, if pressure taps are a permanent part of the nozzle's design.

If after the nozzle is installed in the pipe the above information is not visible, the nozzle must have a separate auxiliary label with the given information, which will be part of the apparatus used to secure the nozzle from unauthorised removal or replacement.

In cases where the nozzle could be installed incorrectly with regards to the direction of gas flow, the nozzle must have a marking clearly indicating flow direction.

4.2.2. Markings on gas flow sensors with a nozzle

The following information must be on gas flow sensors with a nozzle:

a) the name of the manufacturer and type (design variant);
b) serial number and year of manufacture;
c) the value of the internal diameter D_{20} of the pipe in relation to a reference temperature of 20 °C;
d) type-approval mark;
e) nominal size DN/nominal pressure PN;
f) indication of the direction of flow;
g) suitable marking for type identification and placement of differential pressure taps, if pressure taps are a permanent part of the design of straight lengths of pipe;
h) the measured flow range or the maximum flow value.

This information must be positioned on a part of the gas flow sensor that is permanently connected to the straight pipe section 0.5*D* in front of the nozzle (installation chamber, connection flange before the nozzle, straight length of pipe at a maximum length of 2*D* before the nozzle).

The following information must be specified on the connection flange or other location of the straight length of pipe past the nozzle (at most 2*D* past the nozzle):

i) the manufacturer's name;
j) serial number and year of manufacture;
k) type-approval mark;
l) an indication of the direction of flow (if reverse installation is possible).

If in the basic configuration of the gas flow sensor the straight length of pipe before the nozzle is made up of multiple parts of pipe, then all of these parts must bear a type-approval mark. In general, all major separate parts of gas flow sensors with a nozzle must bear a type-approval mark.

4.3 Marking with official marks

Suitable areas for placement of the type-approval mark and official mark(s) must be provided.

It must be possible to safeguard the nozzle against unauthorised removal or replacement.

5 Measuring instrument type-approval

The type-approval process for gas flow sensors with a nozzle includes the following tests and activities:

a) an external inspection;
b) a check of geometric parameters.

5.1 External inspection

The following are checked during the external inspection:

- completeness of the required technical documentation;
- the conformity of the metrological and technical characteristics specified by the manufacturer in the documentation with this regulation's technical and metrological requirements specified in Chapters 2 and 3;
- the nozzle, pressure taps and straight lengths of pipe for any physical damage or traces of corrosion that would preclude further testing; and
- places for indicating the basic geometric parameters of the gas flow sensor with a nozzle and places for placing official marks are determined.

5.2 Check of geometric parameters

5.2.1 Test equipment

Suitable equipment with valid metrological traceability must be used during the check of geometric parameters.

5.2.2 Reference ambient temperature for tests

5.2.2.1 Nozzle

During the test, the ambient temperature must be between 18 and 22 °C and must not change by more than 2 °C.

5.2.2.2 Straight lengths of pipe

Pipe ≤ DN 300: During the test, the ambient temperature must be between 15 and 25 °C and must not change by more than 2 °C.

Pipe > DN 300: During the test, the ambient temperature must be between 10 and 30 °C and must not change by more than 5 °C.

5.2.3 Check of the nozzle's geometric parameters

The internal diameter d_{20} of the nozzle aperture must be established in accordance with the requirement of Article 3.2.3.1 or 3.3.3.1, and must relate to a reference temperature of 20 °C.

5.2.3.1 Check of the geometric parameters of an ISA 1932 nozzle

In the case of ISA 1932 nozzles, the following geometric parameters are also checked:

- surface finish and roughness of the front flat inlet section (see Article 3.2.1);
- the shape of the convergent inlet profile (see Article 3.2.2);
- the length of the nozzle throat (see Article 3.2.3);
- the cylindricity of the nozzle throat (see Article 3.2.3.2);
- the sharpness of the throat inlet edge (see Article 3.2.3.3);
- the roughness of the inner surface of the throat (see Article 3.2.3.4);
- the mount on the outlet side of the throat (see Article 3.2.4);
- the total length of the nozzle (see Article 3.2.5);
- the thickness of the nozzle wall (see Article 3.2.6).

5.2.3.2 Check of the geometric parameters of a Venturi nozzle

In the case of Venturi nozzles, the following geometric parameters are also checked:

- surface finish and roughness of the front flat inlet section (see Article 3.3.1);
- the shape of the convergent inlet profile (see Article 3.3.2);
- the length of the nozzle throat (see Article 3.3.3);
- the cylindricity of the nozzle throat (see Article 3.3.3.2);
- the roughness of the inner surface of the nozzle's throat (see Article 3.3.3.3);
- the finish and apex angle of divergent parts of the nozzle (see Article 3.3.4).

5.2.4 Inspection of the geometric parameters of straight lengths of pipe

The mean internal diameter value D_{20} of the pipe must be established in accordance with the requirement of Article 3.4.3 and must relate to a reference temperature of 20 °C.

The following geometric parameters are checked for straight lengths of pipe:

- the straightness of the pipe (see Article 3.4.2);
- the mean value of the pipe's inner diameter (see Article 3.4.3);
- the circularity and cylindricity of the pipe (see Article 3.4.4);
- the roughness of the pipe's inner surface (see Article 3.4.5).

5.2.5 Check of the geometric parameters of pressure taps

Compliance with requirements for differential pressure taps is determined depending on nozzle type pursuant to Article 3.2.8 (ISA 1932) or 3.3.6 (Venturi nozzle) and the manufacturer's specifications.

6 Initial verification

The following tests and activities are carried out during the initial verification of gas flow sensors with nozzles and parts thereof:

a) visual inspection;
b) test of metrological characteristics;
c) indication of the basic geometric parameters on the relevant parts of a gas flow sensor with a nozzle.

6.1 Visual inspection

The purpose of a visual inspection is to check that:

- the execution of the gas flow sensor with a nozzle matches the approved type;
- the nozzle, pressure taps and straight lengths of pipe are not physically damaged or bear traces of corrosion that would preclude further testing;
- the content and implementation of markings and inscriptions correspond to the information and requirements specified in the type-approval certificate for the measuring instrument.

If the gas flow sensor with a nozzle does not pass the external inspection, it is not tested further.

6.2 Check of geometric parameters

6.2.1 Test equipment

Suitable equipment with valid metrological traceability must be used during the check of geometric parameters.

6.2.2 Reference ambient temperature for tests

The ambient temperature requirements pursuant to Article 5.2.2 apply to the testing.

6.2.3 Check of the nozzle's geometric parameters

The internal diameter d_{20} of the nozzle aperture must be established in accordance with the requirement of Article 3.2.3.1 or 3.3.3.1, and must relate to a reference temperature of 20 °C.

6.2.3.1 Check of the geometric parameters of an ISA 1932 nozzle

During initial verification of ISA 1932 nozzles, the following geometric parameters are also checked:

- surface finish and roughness of the front flat inlet section (see Article 3.2.1);
- the shape of the convergent inlet profile (see Article 3.2.2);
- the length of the nozzle throat (see Article 3.2.3);
- the cylindricity of the nozzle throat (see Article 3.2.3.2);
- the sharpness of the throat inlet edge (see Article 3.2.3.3), if a mere visual check is not accepted;
- the roughness of the inner surface of the throat (see Article 3.2.3.4);
- the mount on the outlet side of the throat (see Article 3.2.4);
- the total length of the nozzle (see Article 3.2.5);
- the thickness of the nozzle wall (see Article 3.2.6).

6.2.3.2 Check of the geometric parameters of a Venturi nozzle

During initial verification of Venturi nozzles, the following geometric parameters are also checked:

- surface finish and roughness of the front flat inlet section (see Article 3.3.1);
- the shape of the convergent inlet profile (see Article 3.3.2);

- the length of the nozzle throat (see Article 3.3.3);
- the cylindricity of the nozzle throat (see Article 3.3.3.2);
- the roughness of the inner surface of the nozzle's throat (see Article 3.3.3.3);
- the finish and apex angle of divergent parts of the nozzle (see Article 3.3.4).

6.2.4 Check of the geometric parameters of the straight lengths of pipe

The mean internal diameter value D_{20} of the pipe must be established in accordance with the requirement of Article 3.4.3 and must relate to a reference temperature of 20 °C.

- the straightness of the pipe (see Article 3.4.2);
- the circularity and cylindricity of the pipe (see Article 3.4.4);
- the roughness of the pipe's inner surface (see Article 3.4.5).

6.2.5 Check of the geometric parameters of the differential pressure taps

During initial verification, compliance with requirements for differential pressure taps is determined depending on nozzle type pursuant to Article 3.2.8 (ISA 1932) or 3.3.6 (Venturi nozzle) and the manufacturer's specifications.

6.2.6 Indication of the basic geometric parameters on the measuring device

The resultant internal diameter value d_{20} of the nozzle throat aperture determined pursuant to Article 6.2.3 must be marked in a legible and indelible manner in a suitable location on the nozzle in accordance with Article 4.2.1.

The resultant internal diameter value D_{20} of the pipe determined pursuant to Article 6.2.4 must be marked in a legible and indelible manner in a suitable location on the gas flow sensor in accordance with Article 4.2.2.

7 Subsequent verification

The procedure for subsequent verification of the nozzle is identical to the procedure for initial verification pursuant to Article 6.2.3.

Subsequent verification of straight lengths of pipe of gas flow sensors with nozzles is not performed.

The user of the measuring device is responsible for long-term compliance with operating conditions, including keeping it in proper condition and keeping the inner surface of the pipe clean. For this purpose, the user of the measuring device performs (or ensures) a visual inspection of the inner surface of the pipe at intervals that take into account operating conditions and the type of gas medium being measured. This inspection must also always be performed prior to the installation of the nozzle.

8 Measuring instrument check

When checking measuring instruments pursuant to § 11a of the Metrology Act at the request of an entity that could be affected by its incorrect measurement, Chapter 6 is followed. The last sentence of Article 6.1 is not used.

9 Notified standards

For the purposes of specifying the metrological and technical requirements for measuring instruments and specifying the testing methods for their type-approval and verification arising from this general measure, the CMI shall notify Czech technical standards, other technical standards or technical documents of international or foreign organisations, or other technical documents containing more

detailed technical requirements (hereinafter referred to as ‘notified standards’).The CMI will publish a list of these notified standards attached to the relevant measures, together with the general measure, in a manner accessible to the public (on www.cmi.cz).

Compliance with notified standards or parts thereof is considered, to the extent and under the conditions stipulated by a general measure, to be compliance with the requirements stipulated by this measure to which these standards or parts thereof apply.

Compliance with notified standards is one way of demonstrating compliance with the requirements. These requirements may also be met by using another technical solution guaranteeing an equivalent or higher level of protection of legitimate interests.

II.

G R O U N D S

The CMI issues, pursuant to § 14(1)(j) of the Metrology Act, for the implementation of § 6(2), § 9(1) and (9) as well as § 11a(3) of the Metrology Act, this measure of a general nature, stipulating metrological and technical requirements for specified measuring devices and test methods for type-approval and for verification of the following specified measuring devices: 'gas flow meters with a nozzle.

Decree No 345/2002 stipulating measuring instruments for mandatory verification and measuring instruments subject to type-approval, as amended, classifies this type of measuring instrument as measuring instruments subject to type-approval and mandatory verification under item 1.3.11(c) in the Annex 'List of Specified Measuring Device Types'.

This legislation (measure of a general nature) will be notified in accordance with Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services.

III.

I N S T R U C T I O N S

In accordance with § 172(l) APC in conjunction with § 39(l) APC, the CMI has stipulated a time limit for comments of 30 days as of the date of posting the draft on the official notice board. Comments submitted after this deadline will not be considered.

The persons concerned are hereby invited to comment on this draft measure of a general nature. With regard to the provisions of § 172(4) APC, comments are to be submitted in writing.

Pursuant to the provisions of § 174(1) APC, in conjunction with the provisions of § 37(1) APC, it must be clearly stated who is submitting the comments, which general measure the comments concern, how the draft contradicts legislation or how the general measure is inaccurate. The comments must also contain the signature of the person making the comments.

The supporting documents for this draft general measure may be consulted at the Czech Metrology Institute, Legal Metrology Department, Okružní 31, 638 00 Brno, after making arrangements by telephone.

This draft general measure shall be posted for 15 days.

Czech Metrology Institute

Director General