

# DIN EN ISO 5167-4:2023-08 (E)

## Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 4: Venturi tubes (ISO 5167-4:2022)

| Contents   | Page     |
|--|----------|
| European foreword .....  | 4        |
| Foreword.....  | 5        |
| Introduction.....  | 6        |
| <b>1 Scope.....</b>  | <b>7</b> |
| <b>2 Normative references.....</b>   | <b>7</b> |
| <b>3 Terms and definitions.....</b>  | <b>8</b> |
| <b>4 Principles of the method of measurement and computation.....</b>                                  | <b>8</b> |
| <b>5 Classical Venturi tubes.....</b>  | <b>8</b> |
| 5.1 Field of application.....  | 8        |
| 5.1.1 General.....   | 8        |
| 5.1.2 Classical Venturi tube with an “as cast” convergent section.....                                 | 9        |
| 5.1.3 Classical Venturi tube with a machined convergent section.....                                   | 9        |
| 5.1.4 Classical Venturi tube with a fabricated convergent section.....                                 | 9        |
| 5.2 General shape.....   | 9        |
| 5.2.1 General.....   | 9        |
| 5.2.2 Entrance cylinder.....   | 9        |
| 5.2.3 Convergent section.....  | 10       |
| 5.2.4 Throat.....  | 10       |
| 5.2.5 Divergent section.....   | 11       |
| 5.2.6 Truncated Venturi tube.....  | 11       |
| 5.2.7 Roughness.....   | 11       |
| 5.2.8 Classical Venturi tube with an “as cast” convergent section.....                                 | 11       |
| 5.2.9 Classical Venturi tube with a machined convergent section.....                                   | 12       |
| 5.2.10 Classical Venturi tube with a fabricated convergent section.....                                | 12       |
| 5.3 Material and manufacture.....  | 13       |
| 5.4 Pressure tappings.....   | 13       |
| 5.5 Discharge coefficient, $C$ .....   | 14       |
| 5.5.1 Limits of use.....   | 14       |
| 5.5.2 Discharge coefficient of the classical Venturi tube with an “as cast”<br>convergent section..... | 14       |
| 5.5.3 Discharge coefficient of the classical Venturi tube with a machined<br>convergent section.....   | 15       |
| 5.5.4 Discharge coefficient of the classical Venturi tube with a fabricated<br>convergent section..... | 15       |
| 5.6 Expansibility [expansion] factor, $\epsilon$ .....   | 15       |
| 5.7 Uncertainty of the discharge coefficient, $C$ .....  | 15       |
| 5.7.1 Classical Venturi tube with an “as cast” convergent section.....                                 | 15       |
| 5.7.2 Classical Venturi tube with a machined convergent section.....                                   | 15       |
| 5.7.3 Classical Venturi tube with a fabricated convergent section.....                                 | 16       |
| 5.8 Uncertainty of the expansibility [expansion] factor, $\epsilon$ .....                              | 16       |
| 5.9 Pressure loss.....   | 16       |
| 5.9.1 Definition of the pressure loss.....   | 16       |
| 5.9.2 Relative pressure loss.....  | 16       |

|          |  |           |
|----------|--|-----------|
| <b>6</b> | <b>Installation requirements</b> .....   | <b>17</b> |
| 6.1      | General.....   | 17        |
| 6.2      | Minimum upstream and downstream straight lengths for installation between various fittings and the Venturi tube..... | 18        |
| 6.3      | Flow conditioners.....   | 22        |
| 6.4      | Additional specific installation requirements for classical Venturi tubes.....                                       | 22        |
| 6.4.1    | Circularity and cylindricity of the pipe and alignment of the classical Venturi tube.....                            | 22        |
| 6.4.2    | Roughness of the upstream pipe.....  | 23        |
| <b>7</b> | <b>Flow calibration of Venturi tubes</b> .....   | <b>23</b> |
| 7.1      | General.....   | 23        |
| 7.2      | Test facility.....   | 23        |
| 7.3      | Meter installation.....  | 24        |
| 7.4      | Design of the test programme.....  | 24        |
| 7.5      | Reporting the calibration results.....   | 24        |
| 7.6      | Uncertainty analysis of the calibration.....   | 24        |
| 7.6.1    | General.....   | 24        |
| 7.6.2    | Uncertainty of the test facility.....  | 24        |
| 7.6.3    | Uncertainty of the Venturi tube.....   | 25        |
|          | <b>Annex A (informative) Table of expansibility [expansion] factor</b> .....   | <b>26</b> |
|          | <b>Annex B (informative) Classical Venturi tubes used outside the scope of ISO 5167-4</b> .....                      | <b>27</b> |
|          | <b>Annex C (informative) Pressure loss in a classical Venturi tube</b> .....   | <b>30</b> |
|          | <b>Bibliography</b> .....  | <b>32</b> |