

# DIN EN ISO 5167-3:2023-08 (E)

## Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 3: Nozzles and Venturi nozzles (ISO 5167-3:2022)

---

<b>Contents</b>		<b>Page</b>
<b>European foreword</b> .....		<b>4</b>
<b>Foreword</b> .....		<b>5</b>
<b>Introduction</b> .....		<b>6</b>
<b>1</b>	<b>Scope</b> .....	<b>7</b>
<b>2</b>	<b>Normative references</b> .....	<b>7</b>
<b>3</b>	<b>Terms and definitions</b> .....	<b>8</b>
<b>4</b>	<b>Principles of the method of measurement and computation</b> .....	<b>8</b>
<b>5</b>	<b>Nozzles and Venturi nozzles</b> .....	<b>9</b>
5.1	ISA 1932 nozzle .....	9
5.1.1	General shape .....	9
5.1.2	Nozzle profile .....	9
5.1.3	Downstream face .....	11
5.1.4	Material and manufacture .....	11
5.1.5	Pressure tappings .....	11
5.1.6	Coefficients of ISA 1932 nozzles .....	13
5.1.7	Uncertainties .....	14
5.1.8	Pressure loss, $\Delta p$ .....	14
5.2	Long radius nozzles .....	15
5.2.1	General .....	15
5.2.2	Profile of high-ratio nozzle .....	15
5.2.3	Profile of low-ratio nozzle .....	17
5.2.4	Material and manufacture .....	18
5.2.5	Pressure tappings .....	18
5.2.6	Coefficients of long radius nozzles .....	18
5.2.7	Uncertainties .....	19
5.2.8	Pressure loss, $\Delta p$ .....	19
5.3	Throat-tapped nozzles .....	19
5.3.1	General .....	19
5.3.2	Profile of throat-tapped nozzle .....	20
5.3.3	Material and manufacturing .....	21
5.3.4	Pressure tappings .....	21
5.3.5	Coefficients .....	22
5.3.6	Uncertainties .....	22
5.3.7	Calibration and extrapolation .....	23
5.3.8	Pressure Loss .....	23
5.4	Venturi nozzles .....	24
5.4.1	General shape .....	24
5.4.2	Material and manufacture .....	26
5.4.3	Pressure tappings .....	26
5.4.4	Coefficients .....	27
5.4.5	Uncertainties .....	28
5.4.6	Pressure loss .....	28
<b>6</b>	<b>Installation requirements</b> .....	<b>29</b>
6.1	General .....	29
6.2	Minimum upstream and downstream straight lengths for installation between various fittings and the primary device .....	29

6.3	Flow conditioners .....	35
6.4	Circularity and cylindricality of the pipe .....	35
6.5	Location of primary device and carrier rings.....	36
6.6	Method of fixing and gaskets.....	37
<b>7</b>	<b>Flow calibration of nozzles .....</b>	<b>37</b>
7.1	General.....	37
7.2	Test facility.....	38
7.3	Meter installation.....	38
7.4	Design of the test programme .....	38
7.5	Reporting the calibration results .....	38
7.6	Uncertainty analysis of the calibration .....	38
	7.6.1 General .....	38
	7.6.2 Uncertainty of the test facility .....	39
	7.6.3 Uncertainty of the nozzle.....	39
<b>Annex A (informative) Tables of discharge coefficients and expansibility [expansion] factors.....</b>		<b>40</b>
<b>Annex B (informative) Akashi type (Mitsubishi type) flow conditioner .....</b>		<b>47</b>
<b>Bibliography.....</b>		<b>48</b>