



Product description

The flow sensor **SS 25.60** is a mass flow sensor (thermal anemometer), designed for use in oxygen. Due to a careful cleaning during production and packaging of the sensor according to the standard IEC/TR 60877:1999, the sensor can be used in gas mixtures with an oxygen percentage of at least 21 % or in pure oxygen.

Application examples

- Consumption measurement
- Process control
- Burner control
- Welding and cutting technology

Danger warning



Danger warning: **RISK of FIRE and EXPLOSION**

Read and observe the following information!

It is explicitly pointed out that the customer, when opening the packaging assumes full responsibility for the cleanliness of the sensor and its accessories according to the standard IEC/TR 60877:1999.

Product advantages

- High temperature gradient permissible
- Electronic temperature compensation active in the whole range of operating temperatures
- Very high turn down ratio of up to 1 : 1000
- Easy, cost-saving mounting
- Pressure-proofed up to 16 bar
- Digital output for connection to supply meter or energy management systems
- Signaling of sensor state (flow velocity in 6 stages or fault) via 4 double LED's
- Optionally with integrated field bus interface

Information concerning the handling

The general rule applies that a soiling of sensor parts that come into contact with oxygen must be absolutely avoided:

- The installation site must be carefully cleaned before mounting the sensor.
- Make sure to use only clean tools and material for the installation.
- Before opening the packaging film, remove the dirt such as dust from the film, if necessary.
- If possible, open the packaging film and take out the sensor directly at the installation site.
- Otherwise open the packaging film at an appropriate and clean workplace and store the sensor in an appropriate, cleaned and dust and humidity tight container.
- Do not touch the oxygen contacting sensor parts with bare hands.
- Use clean and non-fluffy gloves or cloths or similar to handle the sensor.

SCHMIDT® Flow Sensor SS 25.60



Product model types

SS 20.60



Standard sensor with analog + digital output

- Measuring ranges: up to 200 m/s
- Signal outputs: 1 analog, 1 digital

SS 20.60 FB



Field bus sensor with bus interface integrated in the electronic housing

- Measuring ranges: up to 160 m/s
- Signal outputs: 1 analog, 1 digital
- Field bus: **PROFIBUS DP (V0)** or **DeviceNet**
- Additional functions: calculation of volume flow, monitoring of threshold value

Design Remote Sensor

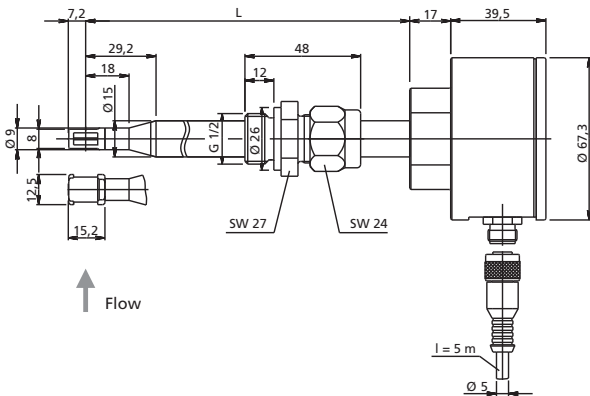


The above mentioned models can be delivered, as shown in the picture, as so-called **compact sensors** or as **remote sensors**.

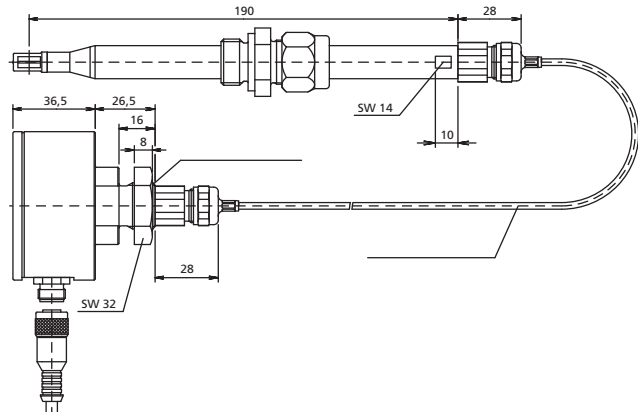
The remote sensor differs in the following characteristics:

- 3 m cable between sensor and electronics, firmly fixed on both sides
- Temperature of the medium up to 60 °C
- Only for operation under atmospheric pressure

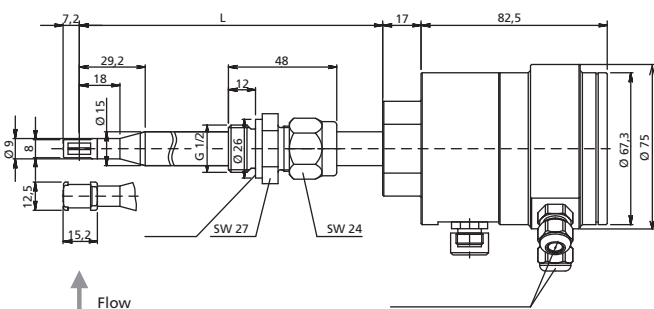
Dimensions Compact Sensor



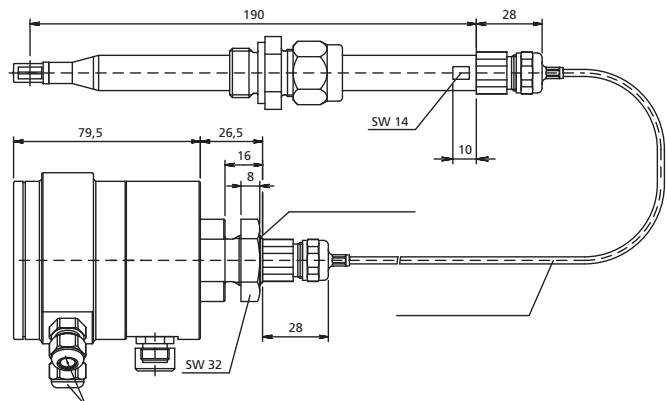
Dimensions Remote Sensor



Dimensions Compact Sensor SS 25.60 FB



Dimensions Remote Sensor SS 25.60 FB



All dimensions in mm (if not otherwise noted)

| Technical data | | Electrical connection standard sensor | |
|----------------------------|--|---------------------------------------|--|
| Measuring quantity | standard flow velocity w_N normalized to $\vartheta_N = 20\text{ °C}$ and $p_N = 1013.25\text{ hPa}$ | Electrical connection | plug-in connector M12, 4-pin including connection cable with plug, 4 x 0.34 mm ² , pigtail with wire end sleeve |
| Measuring fluid | air or nitrogen other gases on request | Cable length (standard) | 5 m |
| Measuring range (w_N) | 0 ... 200 m/s / 656.2 ft/s 0 ... 160 m/s / 524.9 ft/s 0 ... 120 m/s / 393.7 ft/s 0 ... 60 m/s / 196.9 ft/s 0 ... 40 m/s / 131.2 ft/s 0 ... 20 m/s / 65.6 ft/s 0 ... 10 m/s / 32.8 ft/s 0 ... 2.5 m/s / 8.2 ft/s | Cable length (adm.) | 5 m |
| Lower range limit | 0.2 m/s 0.66 ft/s | • Voltage output | 15 m |
| Lower detection limit | 0.1 m/s 0.33 ft/s | • Current output | 100 m |
| Measuring inaccuracy | ± (3 % of measurement value + 0.4 % of measuring range) | • Digital output | 100 m |
| Repeatability | ± 0.5 % of measurement value | Analog output | selectable when ordering |
| Response time (t_{90}) | 3 s (0 to 5 m/s transient) | • Type voltage | 0 ... 10 V |
| Operating temperature | | • Type current | 0 / 4 ¹⁾ ... 20 mA |
| - Compact sensor | -20 ... +60 °C | Load resistance (adm.) | |
| - Remote sensor | -20 ... +60 °C | • Voltage output | ≥ 10 kΩ |
| - Electronics | 0 ... +60 °C | • Current output | ≤ 400 Ω |
| Storage temperature | -20 ... +85 °C | Digital output | pulse output high level: ≥ $U_B - 3\text{ V}$ low level: < 0.7 V load resistance: ≥ 2 kΩ |
| Humidity range | 0 ... 95 % RF | Digital output frequency | 0 ... 100 Hz 0 ... 40 Hz 0 ... 20 Hz 0 ... 16 Hz 0 ... 10 Hz (selectable when ordering) |
| Pressure range | | Digital pulse duration | min. 1 / (2 x f_{max}) |
| - Atmospheric | 700 ... 1300 hPa | Other features | |
| - Overpressure | 0 ... 16 bar (only compact sensor) | Housing | aluminium anodised |
| Temperature gradient | 8 K/min @ $w_N = 5\text{ m/s}$ | Probe tube | stainless steel 1.4571 |
| Recovery time constant | 6 s at temperature jump $\Delta\vartheta_{air} = 40\text{ K}$, $w_N = 5\text{ m/s}$ | Sensor head | thermoplast PPO/PA |
| Temperature dependence | compensated within the operating temperature range | Sensor element | platinum resistor element, glass passivated |
| Pressure dependence | independent of medium pressure within pressure range | Mounting | tube throughpassage, stainless steel 1.4571, pressure-proofed, probe tube adjustable, mounting thread G 1/2 x 12 |
| Zero offset compensation | pressure dependent adaptation of characteristic line | Mounting tolerance | ± 5° relative to flow direction |
| Supply voltage U_B | 24 V DC ± 20 % | Installation position | as desired, for vertical downdraft flow lower range limit approx. 2m/s |
| Current consumption | | Dimensions | |
| • Standard | 75 mA typ. @ $w_N = 0\text{ m/s}$ 140 mA typ. @ $w_N = 200\text{ m/s}$ | • Standard housing | 67.3 mm x 56.5 mm (Ø x H) |
| • Fieldbus | 250 mA typ. @ $w_N = 160\text{ m/s}$ | • Housing field bus | 67.3 mm x 103.5 mm (Ø x H) |
| Switch-on current | | • Sensor head | 8 mm x 15.2 mm x 12.5 mm (W x H x D) |
| • Standard | 160 mA for max. 5 s | • Probe tube | 15 mm (Ø) |
| • Fieldbus | 270 mA for max. 5 s | Mounting length (L) | |
| Stabilization time | approx. 10 s after switch-on | • Compact probe | 120 / 180 / 250 / 400 mm optionally |
| | | • Remote probe | 190 mm, remote from housing, with 3 m connection cable firmly fixed |
| | | Weight | 450 g max. (without cable) 800 g (SS 25.60 FB) |
| | | Protection type | IP 65 (housing) IP 67 (sensor head + tube) |

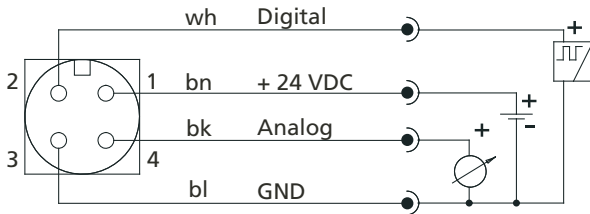
¹⁾ Output with error indication according to NAMUR NE43
(error signaling current 2 mA)

²⁾ Tube throughpassage and safety chain are included in delivery of compact sensors. Remote sensors will solely be delivered with tube throughpassage.

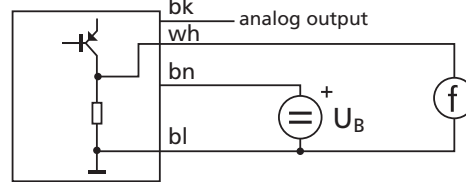
SCHMIDT® Flow Sensor SS 25.60



Pin assignment SS 25.60 and SS 25.60 FB



Digital output



View on sensor plug pins.

Color assignment of connection cable 300 722:
wh = white, bn = brown, bk = black, bl = blue

Minus pole of supply voltage (GND) is also reference potential for analog signal.

LED display

The standard version of SS 25.60 (not version FB) has a 4-fold double LED status display. The following states are indicated:

| No. | state | LED 1 | LED 2 | LED 3 | LED 4 |
|-----|--------------------------------|-------|-------|-------|-------|
| 1 | operational & flow < 5 % | ● | ○ | ○ | ○ |
| 2 | operational > 5 % | ● | ○ | ○ | ○ |
| 3 | operational > 20 % | ● | ● | ○ | ○ |
| 4 | operational > 50 % | ● | ● | ● | ○ |
| 5 | operational > 80 % | ● | ● | ● | ● |
| 6 | operational > 100 % = Overflow | ● | ● | ● | ● |
| 7 | sensor element defective | ◐ | ◐ | ◐ | ◐ |

| No. | state | LED 1 | LED 2 | LED 3 | LED 4 |
|-----|-------------------------------------|-------|-------|-------|-------|
| 8 | supply voltage too low | ◐ | ◐ | ○ | ○ |
| 9 | supply voltage too high | ○ | ○ | ◐ | ◐ |
| 10 | temperature of electronics too high | ◐ | ○ | ○ | ◐ |
| 11 | temperature of electronics too low | ○ | ◐ | ◐ | ○ |

Legende

- LED off
- LED on: green
- ◐ LED on: orange
- ◑ LED flashes (approx. 2 Hz):

Field bus interface DeviceNet

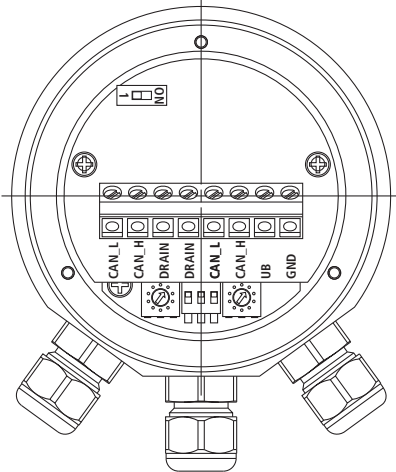
| | |
|-----------------------|---|
| Standardization | ISO / DIS 11 898 DeviceNet specification volume I + II release 2.0 |
| Electrical connection | 8-pin screw-type terminal inside the housing cable feed via 3 cable bushings |
| Terminal resistor | The terminal resistor (120 Ohm, 0.25 W) is disabled on delivery and can be switched in by a single-pole DIP switch. |
| Baud rate | 125 / 250 / 500 kbit/s, default value 125 kbit/s, adjustable via DIP switches or by software |
| Address | 0 .. 63, default value of address 63 (MAC ID 63), can be configured via rotary switch or by software |
| Operating modes | poll mode, Change of State (COS), cyclic |
| Process data | 32 bit; volume flow, alternatively flow velocity selectable |
| Switch thresholds | upper and lower switch threshold adjustable for flow velocity and volume flow |
| Warning flag | signal when exceeding measuring range |
| Alarm flag | signal of a defective sensor |
| Status display | two-color LED indicates status of field bus com- |

Field bus interface PROFIBUS DP

| | |
|-----------------------|---|
| Standardization | PROFIBUS standard EN 50 170 |
| Electrical connection | 8-pin screw-type terminal inside the housing cable feed via 3 cable bushings |
| Terminal resistor | The activated network terminal resistor (390-220- 390 Ohm) is disabled on delivery and can be switched in by a two-pole DIP switch. |
| Baud rate | 9600 Bd – 12 MBd, automatic adjustment by PROFIBUS master |
| Address | 00 ... 99, adjustable via BCD rotary switch |
| Operating modes | "Data Exchange" to PROFIBUS DP-V0 |
| Process data | 32 bit; volume flow, alternatively flow velocity selectable |
| Switch thresholds | upper and lower switch threshold adjustable for flow velocity and volume flow |
| Warning flag | signal when exceeding measuring range |
| Alarm flag | signal of a defective sensor |
| Status display | two-color LED indicates status of field bus communication |

Pin assignment DeviceNet interface

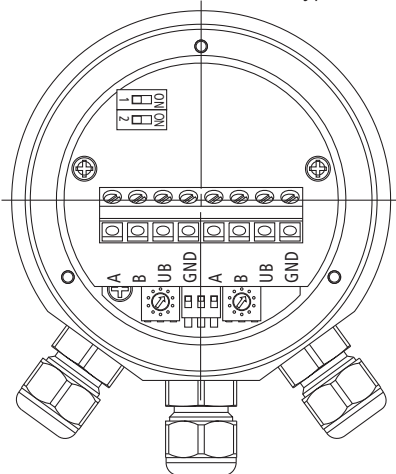
Electrical connections (screw-type terminals)



| Pos. | Cable color | Solder pin/terminal | Explanation |
|------|-------------|-----------------------------|--|
| 1 | blue | CAN_L | CAN negative data line (dominant low) |
| 2 | white | CAN_H | CAN positive data line (dominant high) |
| 3 | without | drain (CAN_SHLD) | shield connections |
| 4 | without | drain (CAN_SHLD) | shield connections |
| 5 | blue | CAN_L | CAN negative data line (dominant low) |
| 6 | white | CAN_H | CAN positive data line (dominant high) |
| 7 | red | U _B (24 V ±20 %) | supply voltage |
| 8 | black | GND | connection to earth |

Pin assignment PROFIBUS interface

Electrical connections (screw-type terminals)



| Pos. | Solder | Explanation |
|------|----------------|-----------------------------|
| 1 | A | negative serial data line |
| 2 | B | positive serial data line |
| 3 | U _B | supply voltage (24 V ±20 %) |
| 4 | GND | connection to earth |
| 5 | A | negative serial data line |
| 6 | B | positive serial data line |
| 7 | U _B | supply voltage (24 V ±20 %) |
| 8 | GND | connection to earth |

Process data field bus modules

The process data are transmitted to the bus master via the field bus. According to the adjusted function, you will obtain the flow velocity or the volume flow in a 32-bit representation of integers (only positive values). Optionally, a further byte can be transmitted which is transmitting the limit value, the alarm flags and the warning flags.

| Parameters | Meaning | Value range | Default value |
|---------------|---|-------------------------------------|---------------|
| Flow velocity | measured flow velocity w_N of medium | 0.00 ... 160.00 (16 bit) | 0 |
| Volume flow | volume flow calculated from flow velocity | 0.00 ... 5773265.96 (32 bit) | 0 |
| Lower flag | lower switch threshold L_U not reached | 0: $w_N \geq L_U$ 1: $w_N < L_U$ | 0 |
| Upper flag | upper switch threshold L_O exceeded | 0: $w_N \leq L_O$ 1: $w_N > L_O$ | 0 |
| Warning flag | measuring range M_N exceeded | 0: $w_N \leq M_N$ 1: $w_N > M_N$ | 0 |
| Alarm flag | sensor defective | 0: OK 1: Error | 0 |

Calculation of volume flow in the field bus module

The sensor with field bus interface can convert the measured flow velocity w_N in a standard volume flow V_N , if the correct inside diameter ID has been communicated to the sensor before. The necessary profile factors PF for the conversion are permanently stored in the sensor.

For this the following information is required: bore diameter of measuring tube (profile factor is deposited in the sensor), in order to find out the volume flow rate in m^3/s (conversion factor: CF). In order to convert into other measurements a unit factor is required (unit factor see adjoining scale).

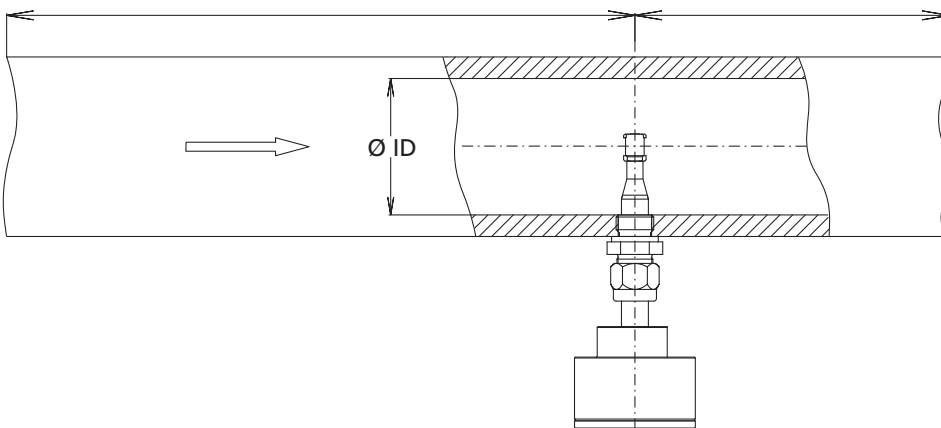
Supported unit factors:

| position | unit factor |
|----------|----------------|
| 1 | [m^3/min] |
| 2 | [m^3/h] |
| 3 | [l/s] |
| 4 | [ft^3/min] |
| 5 | [ft^3/h] |

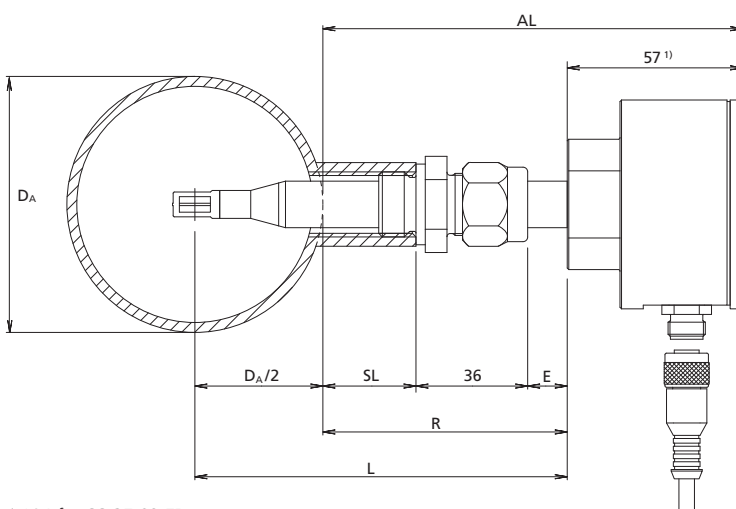
$$CF = \Pi \cdot (ID/2)^2 \cdot PF$$

$$V_n = w_N \cdot UF \cdot CF$$

Mounting instructions



Mounting parameters



D_A = tube outside diameter

SL = welding stud length

E = probe tube setting length

AL = compact sensor projecting length

R = reference length

L = probe tube mounting length

Recommended welding stud length:

min. 10 mm, max. 30 mm

Formula for calculation:

Which probe length is at least necessary?

$$L > D_A/2 + SL + 36 \text{ mm}$$

Where must the immersion mark be placed at the probe tube?

$$E = L - D_A/2 - SL - 36 \text{ mm}$$

How much does the sensor projects out of the tube?

$$AL = L - D_A/2 + 57 \text{ mm}$$

For SS 25.60 FB:

$$AL = L - D_A/2 + 100 \text{ mm}$$

¹⁾ 104 for SS 25.60 FB

All dimensions in mm

Selection table probe length

| Probe length | Recommended for tubes from diameter | Suitable for tubes up to | When installing through ball valve for tubes up to |
|--------------|-------------------------------------|--------------------------|--|
| 120 mm | DN 25 / 1" | DN 65 / 2½" | – |
| 180 mm | DN 50 / 2" | DN 150 / 6" | DN 25 ¹⁾ / 1" |
| 250 mm | DN 100 / 4" | DN 300 / 12" | DN 125 / 5" |
| 400 mm | DN 250 / 10" | DN 800 / 32" | DN 450 / 18" |

¹⁾ only if welding stud length = 10 mm

Mounting measurements and measuring ranges for measuring tubes

| Tube diameters + corresponding PF | | | | Mounting measurements | | | | Measuring range of volume flow in m³/h for sensor measuring range | | | |
|-----------------------------------|--------|---------|-------|-----------------------|-------|-------|-------|---|---------|---------|---------|
| DN | Inside | Outside | PF | L | AL | E | R | 60 m/s | 120 m/s | 160 m/s | 200 m/s |
| 25 | 26.0 | 31.2 | 0.796 | 120.00 | 160.9 | 38.4 | 104.4 | 91.3 | 183 | 243 | 304 |
| | 28.5 | 33.7 | 0.796 | 120.00 | 159.7 | 37.2 | 103.2 | 110 | 219 | 292 | 366 |
| | 32.8 | 32.8 | 0.796 | 120.00 | 160.1 | 37.6 | 103.6 | 145 | 291 | 387 | 484 |
| | 36.3 | | 0.770 | 120.00 | 176.5 | 54.0 | 120.0 | 172 | 344 | 459 | 574 |
| 40 | 39.3 | 44.5 | 0.748 | 120.00 | 154.3 | 31.8 | 97.8 | 196 | 392 | 523 | 653 |
| | 43.1 | 48.3 | 0.757 | 120.00 | 152.4 | 29.9 | 95.9 | 239 | 477 | 636 | 795 |
| | 45.8 | 51.0 | 0.763 | 120.00 | 151.0 | 28.5 | 94.5 | 272 | 543 | 724 | 905 |
| 50 | 51.2 | 57.0 | 0.772 | 120.00 | 148.0 | 25.5 | 91.5 | 343 | 687 | 916 | 1.144 |
| | 54.5 | 60.3 | 0.775 | 120.00 | 146.4 | 23.9 | 89.9 | 391 | 781 | 1041 | 1.302 |
| | 57.5 | 63.5 | 0.777 | 120.00 | 144.8 | 22.3 | 88.3 | 436 | 872 | 1162 | 1.453 |
| | 64.2 | 70.0 | 0.782 | 120.00 | 141.5 | 19.0 | 85.0 | 547 | 1094 | 1458 | 1.823 |
| 65 | 70.3 | 76.1 | 0.786 | 120.00 | 138.5 | 16.0 | 82.0 | 659 | 1318 | 1757 | 2.197 |
| | 76.1 | 82.5 | 0.792 | 120.00 | 135.3 | 12.8 | 78.8 | 778 | 1556 | 2075 | 2.594 |
| 80 | 82.5 | 88.9 | 0.797 | 180.00 | 192.1 | 69.6 | 135.6 | 920 | 1841 | 2454 | 3.068 |
| 100 | 100.8 | 108.0 | 0.804 | 180.00 | 182.5 | 60.0 | 126.0 | 1386 | 2772 | 3696 | 4.620 |
| | 107.1 | 114.3 | 0.806 | 180.00 | 179.4 | 56.9 | 122.9 | 1568 | 3137 | 4182 | 5.228 |
| 125 | 125.0 | 133.0 | 0.812 | 180.00 | 170.0 | 47.5 | 113.5 | 2152 | 4305 | 5740 | 7.175 |
| | 131.7 | 139.7 | 0.814 | 180.00 | 166.7 | 44.2 | 110.2 | 2395 | 4790 | 6387 | 7.984 |
| 150 | 150.0 | 159.0 | 0.817 | 180.00 | 157.0 | 34.5 | 100.5 | 3119 | 6237 | 8316 | 10.395 |
| | 159.3 | 168.3 | 0.820 | 180.00 | 152.4 | 29.9 | 95.9 | 3530 | 7060 | 9414 | 11.767 |
| | 182.5 | 193.7 | 0.825 | 180.00 | 139.7 | 17.2 | 83.2 | 4661 | 9323 | 12431 | 15.538 |
| 200 | 206.5 | 219.1 | 0.829 | 250.0 | 197.0 | 74.5 | 140.5 | 5997 | 11,994 | 15,992 | 19.990 |
| 250 | 260.4 | 273.0 | 0.835 | 250.0 | 170.0 | 47.5 | 113.5 | 9602 | 19,205 | 25,606 | 32.018 |
| 300 | 309.7 | 323.9 | 0.840 | 250.0 | 144.6 | 22.1 | 88.1 | 13,668 | 27,336 | 36,448 | 45.560 |
| 350 | 339.6 | 355.6 | 0.842 | 400.0 | 278.7 | 156.2 | 222.2 | 16,474 | 32,947 | 43,930 | 54.912 |
| 400 | 388.8 | 406.4 | 0.845 | 400.0 | 253.3 | 130.8 | 196.8 | 21,670 | 43,339 | 57,786 | 72.232 |
| 450 | 437.0 | 457.0 | 0.847 | 400.0 | 228.0 | 105.5 | 171.5 | 27,440 | 54,881 | 73,174 | 91.468 |
| 500 | 486.0 | 508.0 | 0.850 | 400.0 | 202.5 | 80.0 | 146.0 | 34,059 | 68,119 | 90,825 | 113.531 |
| 550 | 534.0 | 559.0 | 0.852 | 400.0 | 177.0 | 54.5 | 120.5 | 41,216 | 82,432 | 109,909 | 137.387 |
| 600 | 585.0 | 610.0 | 0.854 | 400.0 | 151.5 | 29.0 | 95.0 | 49,581 | 99,162 | 132,215 | 165.269 |

All dimensions in mm

Calculation volume flow

$$\dot{V}_N \left[\frac{m^3}{h} \right] = w_N \left[\frac{m}{s} \right] \cdot PF \cdot \pi \cdot \left(\frac{ID [mm]}{2} \right)^2 \cdot 0,0036$$

\dot{V}_N : standard volume flow
 w_N : standard flow velocity
 PF: profile factor
 ID: tube diameter inside

Unit conversion factors

| | |
|------------|--------------|
| 1 m³/h | 35.315 ft³/h |
| 1 mm | 0.03937 inch |
| 1000 ft³/h | 28.317 m³/h |
| 1 inch | 25.4 mm |

