

Micro-flow Valve Type 3510

Pneumatic Control Valves Type 3510/3271 and Type 3510/3277

Electric Control Valve Type 3510/5821



Application

Compact control valves for fine control and metering of fractional flows in pilot plants, R&D and industrial applications such as sampling, injection of additives, catalysts or ph-balancing solutions.

Nominal sizes 1/4" to 1/2" (6 to 15 mm)

Pressure ratings ANSI Class 150, 300, 600 and 2500

Temperatures from -328 °F to 842 °F (-200 °C to 450 °C)

The control valves consist of a body, pre-calibrated exchangeable trim set, bonnet or extension with or without bellows, yoke and a pneumatic actuator with optional control accessories. Alternatively, the valves may be combined with electric actuators.

Features

- Globe or angle pattern, forged body and bonnet
- C_v values 2.0 to 0.000012 (K_{vs} 1.6 to 0.00001)
- Rangeability to 50:1
- Equal percentage or linear characteristic
- Leakage Class III to V (0.1% to 0.001% of C_v)
- All stainless steel construction (alternatively exotic materials)
- Field-retrofitable insulating extensions or metal bellows seals
- Same plugs utilized for all modular bonnets/extensions
- Only 4 diameters of seats apply to entire C_v (K_{vs}) range
- Complete selection of actuators, positioners and accessories

Standard version

Globe pattern or angle pattern body

- Nominal sizes 1/4", 3/8", 1/2"
- Body material AISI 316 Ti (WN 1.4571)
- Temperature range 15 °F to 430 °F (-10 °C to 220 °C)
- Threaded connection NPT-Female, ANSI Class 600, 2500
- Flanged connection 1/2" RF, ANSI Class 150, 300, 600

Options

- **Extension bonnet module** · For extreme temperatures -328 °F to 842 °F (-200 °C to 450 °C)
- **Metal bellows seal module** · For complete seal between process and atmosphere
- **End connections** · Welding ends or other flange types/sizes
- **Materials** · Valve body, bonnet and/or internals of Hastelloy C, Monel and others
- **Jacket** · For heating/cooling the valve body and/or extension

Actuator combinations

Type 3510/3271 · With Type 3271 Pneumatic Actuator

· For operation without a positioner (see T 8310)

Type 3510/3277 (Fig. 1) · With Type 3277 Pneumatic Actuator

· For integral positioner/Accessory mounting (see T 8311)

Type 3510/5821 (Fig. 3) · With Type 5821 Electric Actuator

· With optional positioner (see T 5822)

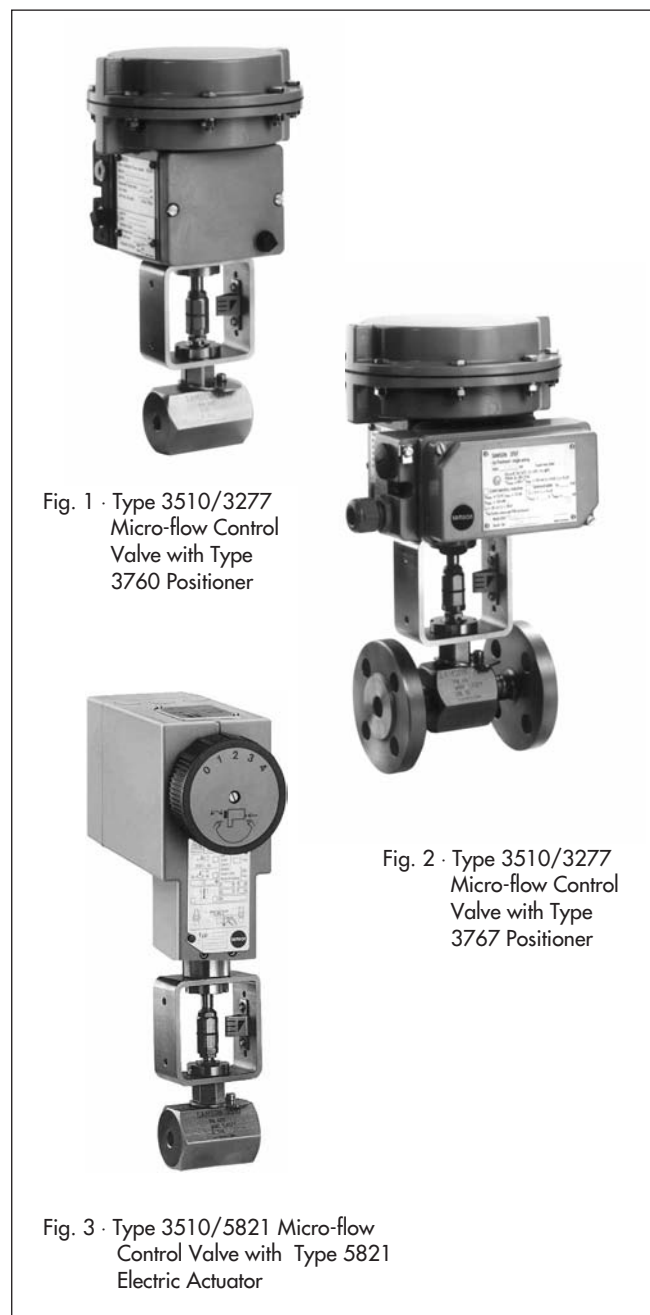


Fig. 1 · Type 3510/3277 Micro-flow Control Valve with Type 3760 Positioner

Fig. 2 · Type 3510/3277 Micro-flow Control Valve with Type 3767 Positioner

Fig. 3 · Type 3510/5821 Micro-flow Control Valve with Type 5821 Electric Actuator

For DIN versions see Technical Data Sheet T 8091 EN

Principle of operation (Figs. 4 and 5)

The process medium flows through the micro-flow valve in the direction indicated by the arrow (micro-flow valve with an angle-pattern body style, see dimensional drawings).

The position of the valve plug (3) determines the cross-sectional area of flow between the seat (2) and the closure member (valve plug).

The plug stem (6) is connected to the actuator stem (8.1) via the stem connector (coupling) and sealed by means of an adjustable stuffing box packing (4). The stem connector enables both the plug stem and the actuator stem to be turned independent of one another.

For applications where external leakage cannot be tolerated at all, a double-walled metal bellows (10) can be used on the valve.

The anti-rotation device (13) prevents loosening of the screw connection between the valve body (1) and the bonnet (5) or the extension piece (9).

Fail-safe action

Depending on how the springs are arranged in the actuator (see Technical Data Sheet T 8310 or T 8311 for details), the valve moves in a pre-determined direction with the absence of air supply.

Actuator stem "extends"

When the forces acting on the actuator diaphragm are reduced or the air supply fails, the spring force moves the actuator stem to the lower extreme position (stem "extends"), causing the valve to fail closed.

Actuator stem "retracts"

When the forces acting on the actuator diaphragm are reduced or the air supply fails, the spring force moves the actuator stem to the upper extreme position (stem "retracts"), causing the valve to fail open.

- 1 Valve body
- 2 Seat
- 3 Plug
- 4 Stuffing box packing
- 5 Valve bonnet
- 5.1 Body seal
- 6 Plug stem
- 7 Stem coupling connector
- 8 Actuator
- 9 Extension bonnet (insulating section)
- 10 Metal bellows
- 13 Anti-rotation device

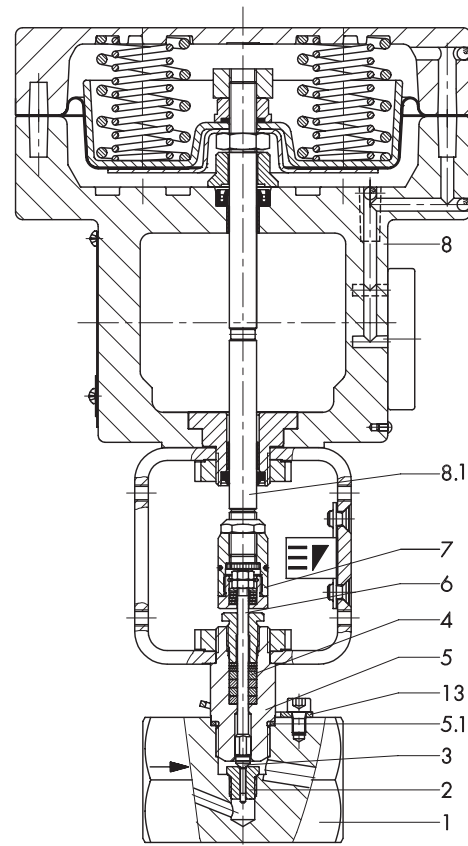


Fig. 4 · Type 3510/3277 Pneumatic Micro-flow Control Valve

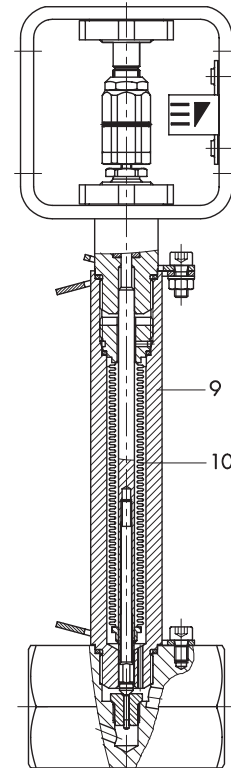


Fig. 5 · Type 3510 Micro-flow Valve with bellows seal bonnet

Table 1 · Technical data

Version ¹⁾		Threaded	Flanged
Nominal valve size		1/4", 3/8", 1/2"	1/2" ²⁾
Pressure-temperature ratings		ANSI Class 600, 2500	ANSI Class 150, 300, 600
Maximum working pressures		According to ASME/ANSI B16.34 – 1988 (Standard class)	
Temperature range	Standard bonnet	15 °F to 390 °F (-10 °C to 200 °C)	
	Extension bonnet or bellows seal	-328 °F to 842 °F (-200 °C to 450 °C)	
End connections		NPT-F internal thread	1/16" RF flanges according to ASME/ANSI B16.5-1988 ³⁾
Face-to-Face dimensions		-	According to ISA-S75.03-1992
Flange face finish		-	130 to 250 µinch (3.2 to 6.3 µm)
Packing design		Adjustable PTFE/graphite composite	
Flow direction (normal)		Up through the seat (flow to open)	
Terms for control valve sizing according to ISA-S75.02 and IEC 534, parts 2-1 and 2-2		$F_L = 0.95, X_T = 0.75$	
Seat bore diameter, rated travel, C_v value		Refer to Table 3	
Seat/plug seal		Metal-to-metal	
Leakage rate according to ANSI/FCI F70-2 and IEC 534-6	C_v 2.0 to 0.02 ⁴⁾	Standard	Class IV $\leq 0.01\%$ of rated C_v value
		Lapped-in	Class V $\approx 0.001\%$ of rated C_v value
	C_v 0.012 to 0.000012 ⁵⁾	Standard	Class III $\leq 0.1\%$ of rated C_v value
		Lapped-in	Class IV $\leq 0.01\%$ of rated C_v value
Characteristic		Equal percentage / linear ⁶⁾ / on-off	
Rangeability		50:1; with $C_v < 0.01$, approx. 15:1	
Weights and dimensions		Refer to Table 6	

¹⁾ Versions with welding ends available upon request

²⁾ 3/4" or 1" flanges available upon request

³⁾ Other flange versions available upon request

⁴⁾ K_{vs} 1.6 to 0.016

⁵⁾ K_{vs} 0.01 to 0.00001

⁶⁾ Available with $C_v \geq 0.012$ ($K_{vs} \geq 0.01$)

Table 2 · Materials

Valve body ¹⁾ and bonnet ²⁾	AISI 316 Ti	WN 1.4571	AISI 316 L	WN 1.4404	Hastelloy C4	WN 2.4610
Seat/plug	Refer to Table 3					
Stuffing box packing	PTFE/Graphite composite					
Gasket	AISI 316 Ti		WN 1.4571		Hastelloy C4	WN 2.4610
Exterior hardware, yoke bracket	AISI 316 Ti		WN 1.4571			
Version with extension bonnet (insulating section or metal bellows module)						
Extension housing	AISI 316 Ti		WN 1.4571		Hastelloy C4	WN 2.4610
Extended plug stem	AISI 316 Ti		WN 1.4571		Hastelloy C4	WN 2.4610
Metal bellows insert	AISI 316 Ti		WN 1.4571		Hastelloy C-276	WN 2.4819
Gasket	AISI 316 Ti		WN 1.4571		Hastelloy C4	WN 2.4610

¹⁾ Other materials on request

²⁾ Wetted parts

Table 3 · C_v and K_{vS} values

Body size	in.	1/4", 3/8", 1/2"					1/2"	
C _v	USGPM	0.000012	0.00012	0.0012	0.012	0.12	–	1.2
		0.000020	0.00020	0.0020	0.020	0.20	–	2.0
		0.000030	0.00030	0.0030	0.030	0.30	–	–
		0.000050	0.00050	0.0050	0.050	–	0.50	–
		0.000075	0.00075	0.0075	0.075	–	–	0.75
Seat Ø, D	in.	0.08"			0.12"	0.16"	0.4"	
Travel	in	0.3"						

Body size	mm	6, 10, 15 mm					15 mm	
K _{vS}	m ³ /h	0.000010	0.00010	0.0010	0.010	0.10	–	1.0
		0.000016	0.00016	0.0016	0.016	0.16	–	1.6
		0.000025	0.00025	0.0025	0.025	0.25	–	–
		0.000040	0.00040	0.0040	0.040	–	0.40	–
		0.000063	0.00063	0.0063	0.063	–	–	0.63
Seat Ø, D	mm	2 mm			3 mm	4 mm	10 mm	
Travel	mm	7.5 mm						

Characteristic	=%	•	•	•	•	•	•	•
	linear	–	–	–	•	•	•	•
End connections	NPT-Female	1/4"	Class 300, 600, 2500					–
		3/8"	Class 300, 600, 2500					Class 600
	1/2"	Class 300, 600, 2500					Class 600	
	RF Flanged	1/2"	Class 150, 300, 600					
Seat/plug material combinations								
AISI 316 Ti/AISI 316 Ti	WN 1.4571/WN 1.4571	–	–	–	•	•	•	•
AISI 440C/AISI 316 Ti	WN 1.4122/WN 1.4571	–	• ¹⁾	•	•	•	•	•
AISI 440C/Stellite	WN 1.4122/Stellite	•	•	•	•	•	•	•
Hastelloy C4/Hastelloy C4	WN 2.4610/WN 2.4610	•	•	•	•	•	•	•

¹⁾ Only with C_v values 0.00030, 0.00050, 0.00075 (K_{vS} values 0.00025, 0.00040, 0.00063)

Table 4 · Permissible differential pressures · with Type 3271 or Type 3277 Pneumatic Actuator, Size 120 cm² (18.5 in²)

Fail-safe action	Actuator stem "extends" ¹⁾				Actuator stem "retracts" ²⁾			
	Without bellows		With bellows		Without bellows		With bellows	
	Cl. 300	Cl. 2500	Cl. 300	Cl. 600	Cl. 300	Cl. 2500	Cl. 300	Cl. 600
Version								

Differential pressures in psi (gauge)									
Actuator bench range	psi	6 to 12	12 to 24			6 to 12			
Required supply pressure	psi	15	27			15	21	19	25
Permissible differential pressures	psi	Δp with p ₂ = 0 psi							
	psi	580	5800	580	1440	580	5800	580	1440

Differential pressures in bar (gauge)									
Actuator bench range	bar	0.4 to 0.8	0.8 to 1.6			0.4 to 0.8			
Required supply pressure	bar	1.0	1.8			1.0	1.4	1.3	1.7
Permissible differential pressures	bar	Δp with p ₂ = 0 bar							
	bar	40	400	40	99	40	400	40	99

¹⁾ Valve fully closed at 0 psi (bar) supply pressure

²⁾ Valve fully closed at required supply pressure

Table 5 - Technical data for electric actuators

Electric actuator version		Without fail-safe action		With fail-safe action	
Type		5821-5	5821-6	5822-60	5822-70
Nominal thrust	lbf (kN)	135 (0.6)	67 (0.3)	–	–
Nominal closing force of the safety spring	lbf (kN)	–		94 (0.42)	63 (0.28)
Valve travel	in (mm)	0.3" (7.5 mm)			
Transit time for rated travel	s	90 (60)	40 (30)	90 (60)	40 (30)
Transit time in case of failure	s	–		8	5
Handwheel		With		Without	
Power supply	V ac	24, 110 or 230		24, 110 or 230	
Frequency	Hz	50 to 60		50 or 60	
Power consumption	Motor	4 VA		4 VA	
	Electromagnet	–		5 VA	
Permissible ambient temperature		30 to 120 °F (0 to 50 °C); at point of connection between motor and valve max. 230 °F (110 °C)			
Enclosure protection rating		IP 44 ¹⁾			
Additional electric equipment					
Limit switches		2 contacts, separately adjustable 24 to 250 Vac/3A or 24 Vdc/3A			
Potentiometer		1 potentiometer, 0 to 1000 Ohm			
Electric positioner		Input 4 to 20 mA, version with supply 24 Vac and potentiometer only			
For further details, see Technical Data Sheet		T 5822 E			

¹⁾ Protection rating IP54 on request

Ordering information

Micro-flow Control Valve Type 3510:

Body pattern ...
 Nominal size¹⁾ ... Body material ...
 ANSI Class ... End connections ...
 Seat material ... Plug material ...
 C_v-/K_{vs}-value¹⁾ ... Characteristic ...
 Options/Special version ... Special testing/preparation ...

Actuator:

Type ... Ordering information ⁵⁾ ...
 Fail-safe position ...

Operating conditions ²⁾:

Process fluid ³⁾ ... Flow rate ⁴⁾ ...
 Inlet pressure ... Outlet pressure ⁴⁾ ...
 Temperature ...
 Maximum shutoff Δp for actuator sizing ...
 Air/power supply available for actuator, max./min. ...

Accessories:

Positioner, Switches, Transmitter, Solenoid valve, Filter/regulator,
 Bypass, Volume/pressure amplifier, Lockup relay ...
 Type ... Ordering information ⁵⁾ ...
 Tubing and fittings type/material ...

Other instrumentation:

Controllers, Sensors, Transmitters, Transducers, Converters ...
 Type ... Ordering information ⁵⁾ ...

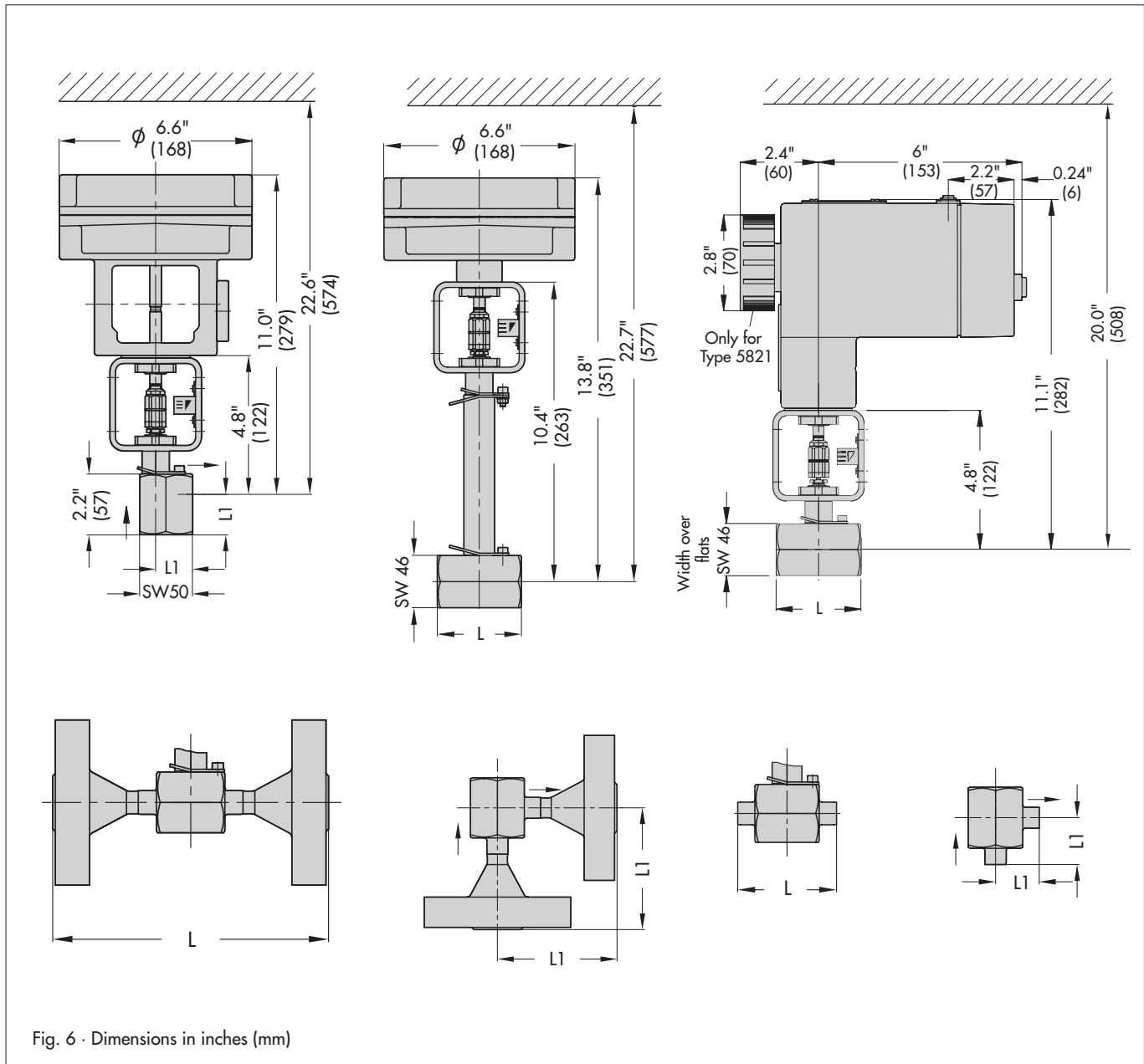
Notes:

- ¹⁾ If Nominal size or C_v-/K_{vs}-value unknown, specify operating conditions
- ²⁾ Specify system of units, pressures: specify in terms of gauge or absolute
 Provide minimum, normal, and maximum values, where applicable.
 Gases, vapors: specify flow rate under standard or operating conditions
- ³⁾ Nonstandard process fluids, specify additionally:
 Density, Specific gravity, or Molecular weight ...
 Liquids: Vapor pressure, Critical pressure, Viscosity ...
 Gases, Vapors: Ratio of specific heats, Compressibility factor
- ⁴⁾ Or, specify required valve flow coefficient C_v, K_{vs} ...
- ⁵⁾ Ordering information per the applicable Technical Data Sheet.

Table 6 · Dimensions and weights

Version	Threaded		Flanged		
Nominal valve size	1/4", 3/8", 1/2"		1/2" Flanges: Raised Face (RF)		
Pressure-temperature rating	ANSI 600, 2500		ANSI 150	ANSI 300	ANSI 600
U.S. customary units					
L	in.	2.91	7.25	7.50	8.00
L1	in.	1.34	2.87	3.00	3.27
Weight	lb	3.5		6.6	
Metric units					
L	mm	74	184	191	203
L1	mm	34	73	76	83
Weight	kg	1.2		3.0	

Note: Dimension and weights for versions with welding ends or other end connections available upon request.



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