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Application Guidelines

Gas Clamp-On Ultrasonic Flowmeters

January 26, 2023

Application Guidelines - Gas Clamp-On

Overview

Technology	Title	Subtitle	Details
Both	General Requirements		Overview of fluid, pressure, and general recommendations
	Air Applications		Minimum Pressure, Technology, and Transducer Frequency
	Hydrocarbon Gas Applications		Minimum Pressure, Technology, and Transducer Frequency
TT	Air Limits	Small Size Pipe	Pipe size, wall thickness, minimum pressure, and velocity maximum limit based on traverses
		Medium Size Pipe	Pipe size, wall thickness, minimum pressure, and velocity maximum limit based on traverses
		Large Size Pipe	Pipe size, wall thickness, minimum pressure, and velocity maximum limit based on traverses
	Hydrocarbon Limits	Small Size Pipe	Pipe size, wall thickness, minimum pressure, and velocity maximum limit based on traverses
		Medium Size Pipe	Pipe size, wall thickness, minimum pressure, and velocity maximum limit based on traverses
		Large Size Pipe	Pipe size, wall thickness, minimum pressure, and velocity maximum limit based on traverses
		Small Size Thick Pipe	Pipe size, wall thickness, minimum pressure, and velocity maximum limit based on traverses
		Large Size Thick Pipe	Pipe size, wall thickness, minimum pressure, and velocity maximum limit based on traverses
	Transducer Selection		Transducer model based on pipe size, wall thickness, and maximum temperature
	Installation Equipment		Clamping fixture and dampening material based on pipe size and max temperature
CT	Application Limits		Minimum and maximum velocity based on pipe size
	Transducers Selection		Transducer model based on pipe size and maximum temperature
	Installation Equipment		Clamping fixture and dampening material based on pipe size and max temperature

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General Requirements

Pressure

Fluid	GC868	CTF878 (or GC868 plastic pipes)
Air, N2, O2 and Argon	60 psi-g/5 bar	0 psi-g/1 bar
Hydrocarbon (HC) gases	150 psi-g/11 bar	15 psi-g/2 bar
Other gases	0.37 lbm/ft3, 5.9 kg/m3	0.08 lbm/ft3, 1.2 kg/m3

- Minimum pressure doubles for Duplex steel pipes
- Avoid high CO2 content and Nitrous Oxide applications
- No steam at this time.

Temperature

- -4 to 150 °F, -20 to 65 °C for DMP-1
- Maximum 200 °F, 93 °C for DMP-4
- Maximum 450 °F, 232 °C for DMP-3 with pipe dampening jacket, PDJ

Pipe Specifications

- ANSI ¾ to 36-inch, DIN 20 to 900 mm
- Homogeneous plastics and metal construction, fiberglass and FRP requires a test
- Minimum straight run of 20D upstream and 10D downstream of elbows, valves, probes, etc.

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Air Applications – Minimum Pressure, Transducer, Technology

Pipe Size (in/mm)	0-59 psi-g 0-5.1 bar-a	60-199 psi-g 5.2-14.8 bar-a	200-299 psi-g 14.8-21.6 bar-a	>300 psi >21.7 bar
¾ (20)	N/A	1.0 MHz	1.0 MHz	1.0 MHz
1 (25)	N/A	1.0 MHz	1.0 MHz	1.0 MHz
2 (50)	0.5 MHz	1.0 MHz	1.0 MHz	1.0 MHz
3 (80)	0.5 MHz	0.5 MHz	0.5 MHz	0.5 MHz
4 (100)	0.5 MHz	0.5 MHz	0.5 MHz	0.5 MHz
6 (150)	0.5 MHz	0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz
8 (200)	0.5 MHz	0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz
10 (250)	0.5 MHz	0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz
12 (300)	0.5 MHz	0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz

Pipe Size (in/mm)	0-89 psi-g 0-7.2 bar-a	90-269 psi-g 7.2-19.7 bar-a	>270 psi-g >19.7 bar-a
14 (350)	0.2/0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz
16 (400)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
18 (450)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
20 (500)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
24 (600)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
26 (650)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
28 (700)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
30 (750)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
36 (900)	0.2 MHz	0.2 MHz	0.2/0.5 MHz

RED = Not Available
YELLOW = Correlation Tag Only
Green = Correlation Tag or Transit Time

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Hydrocarbon Gas Applications – Min. Pressure, Transducer, Technology

Pipe Size (in/mm)	15-199 psi-g 1-14.8 bar-a	200-249 psi-g 14.8-18.2 bar-a	250-399 psi-g 18.3-28.5 bar-a	> 400 psi > 28.6 bar
2 (50)	0.5 MHz	0.5 MHz	0.5 MHz	0.5 MHz
3 (80)	0.5 MHz	0.5 MHz	0.5 MHz	0.5 MHz
4 (100)	0.5 MHz	0.5 MHz	0.5 MHz	0.5 MHz
6 (150)	0.5 MHz	0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz
8 (200)	0.5 MHz	0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz
10 (250)	0.5 MHz	0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz
12 (300)	0.5 MHz	0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz
14 (350)	0.2/0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz	0.2/0.5 MHz

Pipe Size (in/mm)	15-299 psi-g 1-21.7 bar-a	300-799 psi-g 21.7-56.1 bar-a	> 800 psi-g > 56.2 bar-a
16 (400)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
18 (450)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
20 (500)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
24 (600)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
26 (650)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
28 (700)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
30 (750)	0.2 MHz	0.2 MHz	0.2/0.5 MHz
36 (900)	0.2 MHz	0.2 MHz	0.2/0.5 MHz

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Small Size Pipe Air Limits – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Min. Pressure psi-g (bar-a)	Single-Traverse ft/s (m/s)	Double-Traverse ft/s (m/s)	Triple-Traverse ft/s (m/s)	Five-Traverse ft/s (m/s)
¾ (20)	≤0.11 (2.8)	60 (5.1)	N/A	N/A	90 (27.4)	90 (27.4)
1 (25)	≤0.13 (3.3)	60 (5.1)	N/A	N/A	90 (27.4)	90 (27.4)
1½ (40)	≤0.15 (3.8)	60 (5.1)	N/A	N/A	90 (27.4)	57 (17.4)
2 (50)	≤0.16 (4.1)	60 (5.1)	90 (27.4)	N/A	75 (22.9)	45 (13.7)
3 (80)	≤0.22 (5.6)	60 (5.1)	120 (36.6)	N/A	69 (21.0)	N/A
4 (100)	≤0.24 (6.1)	60 (5.1)	120 (36.6)	96 (29.3)	72 (22.0)	N/A
	≤0.34 (8.6)	180 (13.4)				
	≤0.68 (17.3)	300 (21.7)				
6 (150)	≤0.28 (7.2)	60 (5.1)	90 (27.4)	72 (22.0)	54 (16.5)	N/A
	≤0.43 (10.9)	180 (13.4)				
	≤0.86 (21.8)	300 (21.7)				

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Medium Size Pipe Air Limits – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Min. Pressure psi-g (bar-a)	Single-Traverse ft/s (m/s)	Double-Traverse ft/s (m/s)	Triple-Traverse ft/s (m/s)
8 (200)	≤0.32 (8.2)	60 (5.1)	80 (24.4)	64 (19.5)	48 (14.6)
	≤0.50 (12.7)	180 (13.4)			
	≤0.88 (25.4)	300 (21.7)			
10 (250)	≤0.37 (9.4)	60 (5.1)	70 (21.3)	56 (17.1)	42 (12.8)
	≤0.50 (12.7)	180 (13.4)			
	≤1.00 (25.4)	300 (21.7)			
12 (300)	≤0.38 (9.7)	60 (5.1)	55 (16.8)	44 (13.4)	33 (10.1)
	≤0.50 (12.7)	180 (13.4)			
	≤1.00 (25.4)	300 (21.7)			
14 (350)	≤0.38 (9.7)	90 (7.2)	87 (26.5)	70 (21.3)	N/A
	≤0.50 (12.7)	270 (19.6)			
16 (400)	≤0.38 (9.7)	90 (7.2)	76 (23.2)	61 (18.9)	N/A
	≤0.50 (12.7)	270 (19.6)			

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Large Size Pipe Air Limits – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Min. Pressure psi-g (bar-a)	Single-Traverse ft/s (m/s)	Double-Traverse ft/s (m/s)
18 (450)	≤0.38 (9.7)	90 (7.2)	67 (20.4)	54 (16.5)
	≤0.50 (12.7)	270 (19.6)		
20 (500)	≤0.38 (9.7)	90 (7.2)	60 (18.3)	48 (14.6)
	≤0.50 (12.7)	270 (19.6)		
24 (600)	≤0.38 (9.7)	90 (7.2)	49 (14.9)	39 (11.9)
	≤0.50 (12.7)	270 (19.6)		
28 (700)	≤0.38 (9.7)	90 (7.2)	39 (11.9)	31 (9.5)
	≤0.50 (12.7)	270 (19.6)		
30 (750)	≤0.38 (9.7)	90 (7.2)	36 (11.0)	28 (8.5)
	≤0.50 (12.7)	270 (19.6)		
36 (900)	≤0.38 (9.7)	90 (7.2)	30 (9.1)	24 (7.3)
	≤0.50 (12.7)	270 (19.6)		

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Small Size Pipe Hydrocarbon Limits – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Min. Pressure psi-g (bar-a)	Single-Traverse ft/s (m/s)	Double-Traverse ft/s (m/s)	Triple-Traverse ft/s (m/s)
2 (50)	≤0.16 (4.1)	200 (14.8)	110 (33.5)	N/A	66 (20.5)
3 (80)	≤0.22 (5.6)	200 (14.8)	120 (36.6)	N/A	72 (22.0)
4 (100)	≤0.24 (6.1)	150 (11.4)	120 (36.6)	96 (29.3)	72 (22.0)
	≤0.34 (8.6)	400 (28.6)			
	≤0.68 (17.3)	800 (56.2)			
6 (150)	≤0.28 (7.2)	150 (11.4)	120 (36.6)	96 (29.3)	72 (22.0)
	≤0.43 (10.9)	400 (28.6)			
	≤0.86 (21.8)	800 (56.2)			
8 (200)	≤0.32 (8.2)	175 (13.1)	100 (30.5)	80 (24.4)	60 (18.3)
	≤0.50 (12.7)	400 (28.6)			
	≤0.88 (22.4)	800 (56.2)			

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Medium Size Pipe Hydrocarbon Limits – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Min. Pressure psi-g (bar-a)	Single-Traverse ft/s (m/s)	Double-Traverse ft/s (m/s)	Triple-Traverse ft/s (m/s)
10 (250)	≤0.37 (9.4)	175 (13.1)	100 (30.5)	80 (24.4)	60 (18.3)
	≤0.50 (12.7)	400 (28.6)			
12 (300)	≤0.38 (9.7)	250 (18.3)	70 (21.3)	56 (17.1)	42 (12.8)
	≤0.50 (12.7)	500 (37.6)			
14 (350)	≤0.38 (9.7)	300 (21.7)	103 (31.4)	77 (23.5)	62 (18.9)
	≤0.50 (12.5)	800 (56.2)			
16 (400)	≤0.38 (9.7)	300 (21.7)	90 (27.4)	72 (22.0)	54 (16.5)
	≤0.50 (12.5)	800 (56.2)			
18 (450)	≤0.38 (9.7)	300 (21.7)	78 (23.8)	62 (18.9)	47 (14.3)
	≤0.50 (12.7)	800 (56.2)			

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Large Size Pipe Hydrocarbon Limits – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Min. Pressure psi-g (bar-a)	Single-Traverse ft/s (m/s)	Double-Traverse ft/s (m/s)	Triple-Traverse ft/s (m/s)
20 (500)	≤0.38 (9.7)	300 (21.7)	70 (21.3)	56 (17.1)	42 (12.8)
	≤0.50 (12.7)	800 (56.2)			
24 (600)	≤0.38 (9.7)	300 (21.7)	56 (17.1)	45 (13.7)	34 (10.4)
	≤0.50 (12.7)	800 (56.2)			
26 (650)	≤0.38 (9.7)	300 (21.7)	52 (15.9)	42 (12.8)	31 (9.5)
	≤0.50 (12.7)	800 (56.2)			
28 (700)	≤0.38 (9.7)	300 (21.7)	47 (14.3)	38 (11.6)	28 (8.5)
	≤0.50 (12.7)	800 (56.2)			
30 (750)	≤0.38 (9.7)	300 (21.7)	35 (10.7)	28 (8.5)	21 (6.4)
	≤0.50 (12.7)	800 (56.2)			
36 (900)	≤0.38 (9.7)	300 (21.7)	29 (8.8)	23 (7.0)	17 (5.2)
	≤0.50 (12.7)	800 (56.2)			

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Small Size Thick Pipe Hydrocarbon Limits – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Min. Pressure psi-g (bar-a)	Single-Traverse ft/s (m/s)	Double-Traverse ft/s (m/s)	Triple-Traverse ft/s (m/s)
2 (50)	0.22 (5.6)	300 (22)	120 (36.6)	N/A	72 (22.0)
	0.44 (11.2)	550 (39)			
3 (80)	0.30 (7.6)	300 (22)	120 (36.6)	N/A	72 (22.0)
	0.60 (15.2)	550 (39)			
4 (100)	1.00 (25.4)	1200 (83)	120 (36.6)	96 (29.3)	72 (22.0)
	1.50 (38.1)	1800 (124)			
6 (150)	1.00 (25.4)	1000 (69)	120 (36.6)	96 (29.3)	72 (22.0)
	3.00 (76.2)	3000 (207)			
8 (200)	1.00 (25.4)	1000 (69)	120 (36.6)	96 (29.3)	72 (22.0)
	3.00 (76.2)	3000 (207)			
10 (250)	1.00 (25.4)	800 (55)	110 (33.5)	88 (26.8)	66 (20.5)
	3.00 (76.2)	2400 (166)			

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Large Size Thick Pipe Hydrocarbon Limits – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Min. Pressure psi-g (bar-a)	Single-Traverse ft/s (m/s)	Double-Traverse ft/s (m/s)	Triple-Traverse ft/s (m/s)
12 (300)	1.00 (25.4)	800 (56)	90 (27.4)	67 (20.4)	1.00 (25.4)
	3.00 (76.2)	2400 (166)	120 (36.6)	96 (29.3)	3.00 (76.2)
14 (350)	1.00 (25.4)	1000 (69)	80 (24.4)	64 (19.5)	1.00 (25.4)
	3.00 (76.2)	3000 (208)	120 (36.6)	96 (29.3)	3.00 (76.2)
16 (400)	1.00 (25.4)	1000 (69)	70 (21.3)	56 (17.1)	1.00 (25.4)
	3.00 (76.2)	3000 (208)	98 (29.9)	78 (23.8)	3.00 (76.2)
18 (450)	1.00 (25.4)	1000 (69)	60 (18.3)	48 (14.6)	1.00 (25.4)
	3.00 (76.2)	3000 (208)	80 (24.4)	64 (19.5)	3.00 (76.2)
20 (500)	1.00 (25.4)	1000 (69)	54 (16.5)	43 (13.1)	1.00 (25.4)
	3.00 (76.2)	3000 (208)	70 (21.3)	56 (17.1)	3.00 (76.2)
24 (600)	1.00 (25.4)	1000 (69)	44 (13.4)	35 (10.7)	1.00 (25.4)
	3.00 (76.2)	3000 (208)	54 (16.5)	43 (13.1)	3.00 (76.2)

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Transducer Selection – GC868 or PT878GC

Pipe Size inches (mm)	Wall Thickness inches (mm)	Transducer Model	Frequency (MHz)	Max Temperature °F (°C)
¾ (20) to 2 (50)	All	C-RS-402	1.0	300 (150)
		C-RL-308		450 (232)
2½ (60) to 12 (300)	<0.2 (5.1) and Plastic	C-RS-401	0.5	300 (150)
		C-RL-307		450 (232)
2½ (60) to 12 (300)	0.2 (5.1) to 0.5 (12.7)	C-RV-310	0.5	266 (130)
		C-RL-307		450 (232)
6 (150) to 36 (900)	0.2 (5.1) to 0.5 (12.7) High Pressure	C-RW-312	0.2	266 (130)
		C-RW-318		350 (176)
4 (100) to 24 (600)	>0.5 (12.7) High Pressure	C-RS-401	0.5	300 (150)
		C-RL-307		450 (232)

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Installation Equipment – GC868 or PT878GC

Pipe Size inches (mm)	Clamping Fixture	Dampening Material	Max Temperature, °F (°C)
¾ (20) to 1½ (40)	CFG-V1	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)
2 (50) to 4 (100)	CFG-V4	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)
		PDJ-3TT, PDJ-4TT	450 (232)
5 (130) to 8 (200)	CFG-V8	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)
		PDJ-5TT, PDJ-6TT, PDJ-8TT	450 (232)
10 (250) to 12 (300)	CFG-V12	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)
		PDJ-10TT, PDJ-12TT	450 (232)
Above 12 (300)	CFG-PIS	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)

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Application Limits and Transducers – CTF878

Pipe Size, inches (mm)	Minimum Velocity, ft/s (m/s)	Maximum Velocity, ft/s (m/s)
2 (50) to 2½ (60)	10 (3.1) or 10,000 Reynolds	200 (60)
3 (75) to 3½ (90)	7 (2.1) or 10,000 Reynolds	200 (60)
4 (100) to 5 (130)	5 (1.5) or 10,000 Reynolds	200 (60)
6 (150) to 36 (900)	3.5 (1.1) or 10,000 Reynolds	200 (60)

Pipe Size, inches (mm)	Transducer Model	Frequency (MHz)	Max Temperature, °F (°C)
2 (50) to 14 (350)	C-RS-401	0.5	300 (150)
	C-RL-307		450 (232)
16 (400) to 36 (900)	C-RW-312	0.2	266 (130)
	C-RW-318		350 (176)

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Installation Equipment– CTF878

Pipe Size, inches (mm)	Clamping Fixture	Dampening Material	Max Temperature, °F (°C)
2 (50) to 4 (100)	CFT-V4	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)
		PDJ-3TAG, PDJ-4TAG	450 (232)
5 (130) to 8 (200)	CFT-V8	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)
		PDJ-5TAG, PDJ-6TAG, PDJ-8TAG	450 (232)
10 (250) to 12 (300)	CFT-V12	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)
		PDJ-10TAG, PDJ-12TAG	450 (232)
Above 12 (300)	CFT-PIS	DMP-1	150 (65)
		DMP-3, DMP-4*	200 (93)

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