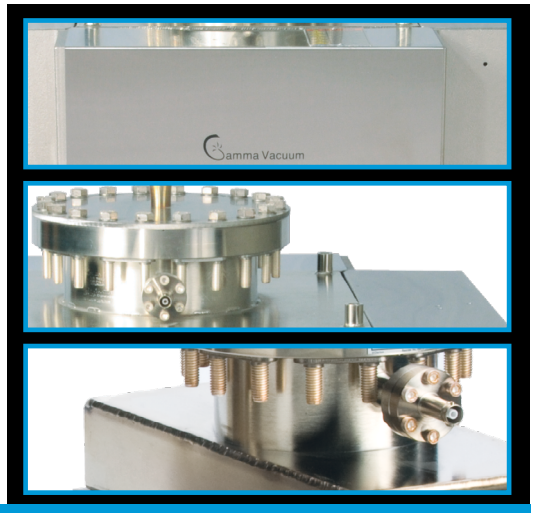
UHV PUMPS

ULTIMATE VACUUM SOLUTIONS

GAMMA ION PUMPS

PERFORMANCE YOU CAN RELY ON



Ion pumps create high vacuum and ultra-high vacuum (UHV) environments in a variety of applications, ranging from portable mass spectrometers to large scale particle accelerators.

Features and Benefits

Ion pumps are used in a wide variety of high and ultra-high vacuum (UHV) environments. They can reach the lowest possible vacuum for an economical cost. In addition, ion pumps have some technical advantages over other technologies:

- Vibration-free operation.
- Low operational cost.
- Bakeability.
- Low maintenance.
- Pressure indication.
- Permanent gas capture.
- Radiation tolerance.
- Long operational life.
- Non-contaminating technology.

Pump Range

Small ion pumps
- Mini – 75S.

Low profile ion pumps
- 100L – 1200LX.

Tall profile ion pumps
- 150TV – 600TV.

Gamma Ion pump characteristics

Lifetime

All Gamma Vacuum ion pumps are designed to operate for 45,000 – 50,000 hours at $1x10^{-6}$ mbar. Lifetime increases linearly with decreased pressure. At $1x10^{-9}$, for example, an ion pump can last for many years.

Ultimate Pressure

Ion pumps are capable of reaching pressures below $1x10^{-10}$ mbar. Ultimate pressure of an ion pump is dictated by overall system conditions and materials.

Vacuum Processing

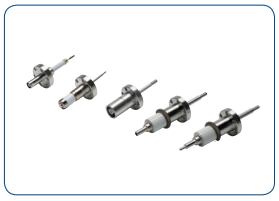
Ion pumps are shipped under vacuum at pressures less than $1x10^{-10}$ mbar. Certificates of conformance are provided and record all leak check points and pump characteristic values. RGA scans can be provided upon request.

Port Configurations

Each ion pump can be configured with a variety of pumping port options. Additional ports are available in most designs on the top, bottom, or side and can accommodate TSP or non-evaporable getter (NEG) modules.

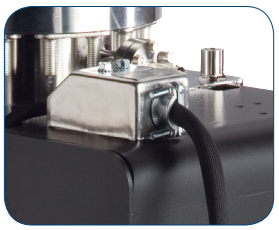
Feedthroughs

Gamma Vacuum has standardized on the commercially available 10kV SHV feedhrough since 1996. For legacy purposes, alternate feedthroughs are available.



Heaters

Integrated heaters can be added to ion pumps for economical and efficient baking.



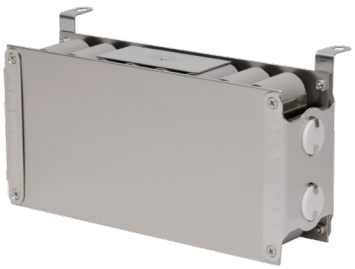
Cables

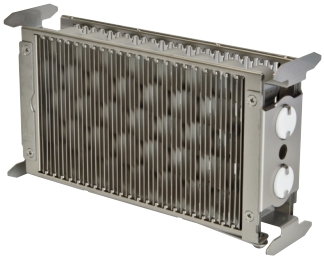
In addition to incorporating the SAFECONN interlock system, high voltage cables are made of flexible silicone materials that are bakeable and have high radiation tolerance.

Gamma Ion pump elements

Gamma ion pump elements are “tuned” for specific pumping applications. Surfaces are chemically processed to remove potential surface contaminants and provide maximum adhesion for extended lifetime. Ceramics are optimally shielded to reduce exposure to sputtered material.

- Gamma CV (Conventional) – two titanium cathodes for high pumping speed of reactive gases.
- Gamma DI (Differential) – a titanium and tantalum cathode for maintained pumping speeds of reactive gases and long term stability of noble gases.
- Gamma TR – classic triode element for higher pressure operation



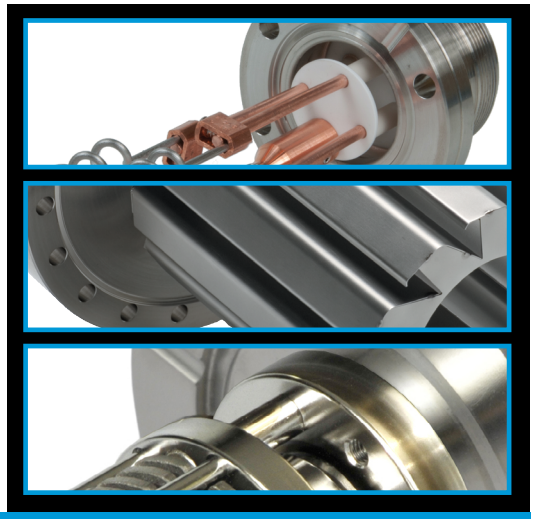


Gamma Ion pumps

SPECIFICATIONS					Element Options			Internal
	SPEED (l/s)	INLET FLANGE(S)	DIMENSIONS mm (inch) (H x L x W, max)	WEIGHT kg (lbs)	CV	DI	TR	TSP/NEG Option
SMALL ION PUMPS								
MINI	0.2	DN 16 (1.33”)	38 x 38 x 51 (1.5 x 1.5 x 2.0)	0.35 (0.8)		✓		
3S	2-3	DN 16 (1.33”)	45 x 45 x 108 (1.8 x 1.8 x 4.3)	0.35 (0.8)	✓	✓		
5S	4-5	DN 35 (2.75”)	81 x 85 x 106 (3.2 x 3.3 x 4.1)	2.3 (5)	✓	✓		
10S	8-10	DN 35 (2.75”)	81 x 85 x 106 (3.2 x 3.3 x 4.2)	2.3 (5)	✓	✓		
25S	15-20	DN 35 (2.75”)	202 x 125 x 130 (8.0 x 4.9 x 5.1)	9 (20)	✓	✓	✓	✓
45S	30-40	DN 35 (2.75”) DN 63 (4.5”)	209 x 251 x 130 (8.2 x 9.9 x 5.1)	16 (34)	✓	✓	✓	✓
75S	40-75	DN 35 (2.75”) DN 63 (4.5”) DN 100 (6”)	277 x 242 x 130 (10.9 x 9.5 x 5.1)	19 (42)	✓	✓	✓	✓
LOW PROFILE ION PUMPS								
100L	80-100	DN 100 (6”)	325 x 325 x 128 (13 x 13 x 5)	29 (62)	✓	✓	✓	✓
200L	160-200	DN 150 (8”)	325 x 413 x 233 (13 x 16 x 9)	49 (108)	✓	✓	✓	✓
300L	240-300	DN 150 (8”)	325 x 413 x 337 (13 x 16 x 13)	66 (145)	✓	✓	✓	✓
400L	320-400	DN 150 (8”)	325 x 413 x 413 (13 x 16 x 16)	72 (159)	✓	✓	✓	✓
400LX	320-400	DN 150 (8”)	508 x 413 x 233 (20 x 16 x 9)	115 (253)	✓	✓	✓	✓
600L	480-600	DN 150 (8”)	325 x 513 x 513 (13 x 20 x 20)	103 (226)	✓	✓	✓	✓
600LX	480-600	DN 150 (8”)	508 x 413 x 336 (20 x 16 x 13)	115 (253)	✓	✓	✓	✓
800LX	640-800	DN 150 (8”)	508 x 413 x 413 (20 x 16 x 16)	124 (273)	✓	✓	✓	✓
1200LX	960-1200	DN 150 (8”) DN 200 (10”)	537 x 513 x 513 (21 x 20 x 20)	206 (452)	✓	✓	✓	✓
TALL PROFILE ION PUMPS								
150TV	120-150	DN 100 (6”)	338 x 247 x 231 (14 x 10 x 9)	32 (70)	✓	✓	✓	✓
300TV	240-300	DN 150 (8”)	345 x 450 x 231 (14 x 18 x 9)	65 (143)	✓	✓	✓	✓
600TV	480-600	DN 150 (8”)	525 x 450 x 305 (21 x 18 x 12)	109 (243)	✓	✓	✓	✓

COMBINED TITANIUM SUBLIMATION PUMPING (TSP) AND NON-EVAPORABLE GETTER (NEG)

PERFORMANCE YOU CAN RELY ON



Titanium Sublimation Pumps (TSPs) are often used in combination with ion pumps or independently to remove reactive gases from the vacuum environment. Combined with an ion pump, the TSP allows for low ultimate pressures in a shorter amount of time. All TSP components are bakeable to 400 ˚C.

NEG's are reactive metals that have been pressed onto solid substrates or sintered into discs. The amount of material used controls the speed and capacity of the NEG pump, but typically ranges from 50 to 3,500 ls^{-1} of hydrogen. As NEG's become saturated with gases, they can be reactivated without venting to atmosphere. Their prime advantage is their ability to pump for extended periods without the need for power.

TSP filament cartridge

The filament cartridge is mounted on a 2-3/4" CFF (DN 35). The feedthrough supports three titanium-molybdenum filaments and a return path for ground isolation. Each filament contains 1.5 grams of usable titanium and averages 20 hours of operation.

Liquid Cryoshroud

The liquid cryoshroud consists of a double walled, type 304L stainless steel cylinder with two liquid nitrogen feedthroughs (.375 inch diameter) with flare type fittings. It provides 1578 cm^2 (245 $inch^2$) of liquid nitrogen cooled surface area that provides pumping speeds up to 12,000 l/s for hydrogen (see table). The shroud is mounted on an 8 inch CFF (NW 150).

Ambient Sputter Shield

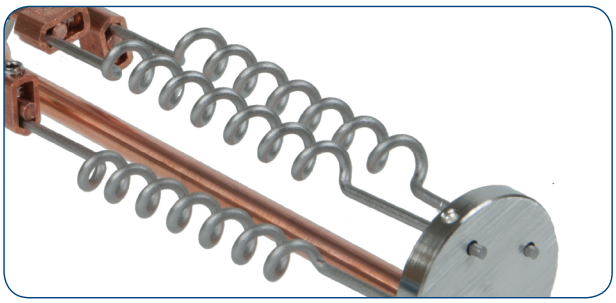
The ambient sputter shield economically maximizes surface area when cooling is not practical or possible. It provides 827cm^2 (128 $inch^2$) of ambient temperature surface area that provides pumping speeds up to 2200 l/s for hydrogen (see table). The shield is mounted on an 8" CFF (NW 150) or a 6 inch CFF (NW 100).

NEG catridge

NEG's are ideal for pump down, stay down applications and can be used to boost the performance of an ion pump or as a standalone pump. They are ideal for UHV applications due to their compact size and high H_2 pumping speed. They are not suitable for applications that cycle up to atmospheric pressure regularly as this will saturate the surface and they can only be reactivated a finite number of times.

DIGITEL™ TSP/NEG controller

The TSP/NEG controller has an easy-to-read touchscreen LCD display that displays all manual or programmed firing paramenters. Manual operation is as simple as pressing one button. Programming is just as easy by viewing all programming options on one screen. The TSP/NEG controller can operate up to 8 TSP filaments or 2 NEG pumps.



Ease of use

The TSP/NEG and MPCe controllers are each fully controlled with an intuitive touch panel LCD.

Filaments

Each titanium-molybdenum filament contains 1.5 grams of usable titanium and averages 20 hours of operation.

Connectivity

TSP/NEG cables have MS style connectors that are bakeable and radiation resistant.

Safety

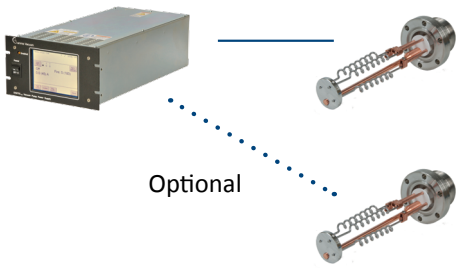
High currents travel over distances up to 10 meters through bakeable and radiation-resistant insulated and strain relief cabling.

Digitel™ FLEXIBILITY

The DIGITEL™ line is flexible enough to control a wide variety of ion pump and TSP configurations. The LPCe and MPCe can operate up to four ion pumps simultaneously or independent operation of one or two ion pumps respectively. The MPCe is capable of controlling one or two TSP/NEG cartridges independently from the Remote TSP/NEG controller or internal TSP (ITSP).

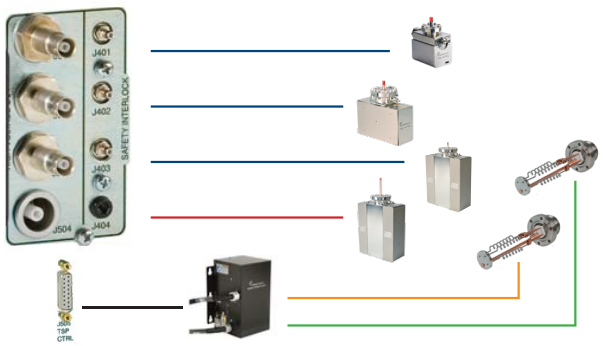
Example Configuration 1

Single or dual TSP operation from the TSP/NEG Controller.



Example Configuration 2

Three parallel diode ion pumps, one triode ion pump, and dual TSP/NEG operation from the MPCe.



TSP/NEG Controller Specifications

The TSP/NEG controller has an easy-to-read touchscreen LCD display that displays all manual or programmed firing paramenters. Manual operation is as simple as pressing one button. Programming is just as easy by viewing all programming options on one screen. The TSP/NEG controller can operate up to 8 TSP filaments or 2 NEG pumps.

SPECIFICATIONS		DIGITEL TSP/NEG	REMOTE TSP/NEG
Input Power	Voltage	90-130 or 200-240 V	90-130 or 200-240 V
	Frequency	48-62 Hz	48-62 Hz
Output Power	Independent Outputs	1	1
	Open Circuit Voltage	+17 vac	+17 vac
	Current (maximum)	55 A	55 A
	Watts (maximum)	800 (max)	800 (max)
	Resolution	0.1 A	0.1 A
high current connections		1-2 MS Style, Configurable	1-2 MS Style, Configurable
Display	Type	1/4 VGA touchscreen LCD	1/4 VGA touchscreen LCD via MPCe
	Readouts	Current, on-time, and programmable options	Current, on-time, and programmable options via MPCe
Analogue outputs	Voltage	linear configurable	linear configurable
	Current/Pressure	linear or logarithmic, configurable	linear or logarithmic, configurable
Control modes		Manual, programmed, or remote	Manual, programmed, or remote
communications		Local/Remote/Full	Local/Remote/Full via MPCe
		Ethernet	Ethernet via MPCe
		Serial: 232, 422, 485	Serial: 232, 422, 485 via MPCe
conformity to norms		EN 55011 Class A, IEC 801-2	EN 55011 Class A, IEC 801-2
		EN 801-3, IEC 801-4, EN 61010-1	EN 801-3, IEC 801-4, EN 61010-1
weight, kg (lbs)		16.8 (37)	13.1 (29)
size		3U high. 1/2 rack wide	293 x 219 x 130 mm (min)
		438 mm (17.2”) deep	(12 x 9 x 5”)
			293 x 219 x 150 mm (max)
			(12 x 9 x 6“)
Additional features		TSP Enable	TSP Enable via MPCe

Technical Data

	Units	N50	H_2 N100	H_2 N200	CO N300	CO N400
Flange			DN40 (2.75°) CFF			
Total mass	kg (lbs)	0.48 (1.05)	0.54 (1.19)	0.75 (1.65)	0.8 (1.79)	0.85 (1.88)
Alloy composition			Zr (70%), V (24.5%), Fe (5.4%)			
Getter mass	g	31.5	58	108	144	180
Pumping Speed	ls*					
H_2		55	106	208	312	412
CO (25°C)		27	51	94	125	156
Getter surface	cm^2	187	348	642	856	1070
Sorpition capacity	Torr - l					
H_2		630	1170	2160	2880	3600
CO (25°C)		0.1	0.2	0.4	0.6	0.8
CO total		284	526	972	1296	1620
Insertion length	mm	48	61	89	110	130
Diameter	mm			34		

Pumping speeds reference intial speed values at 25° C in exposed configuration

Typical TSP pumping speeds

	AREA (cm^2/$inch^2$)	TEMPERATURE (˚C)	H_2 RATE (L/S/CM2)	H_2 SPEED (L/S)	CO RATE (L/S/CM2)	CO SPEED (L/S)	H_20 RATE (L/S/CM2)	H_20 SPEED (L/S)
LIQUID CRYOSHROUD (8 inch)	709/110	20 ˚C	2.6	1,843	8.2	5,814	7.3	5,176
	1578/245*	-195 ˚C	17	12,053	11	7799	14.6	23,039
AMBIENT SPUTTER SHIELD (8 inch)	827/128	20 ˚C	2.6	2,150	8.2	6,780	7.3	6,037
AMBIENT SPUTTER SHIELD (6 inch)	621/96	20 ˚C	2.6	1,614	8.2	5,092	7.3	4,533

*Applies to H_2O speed only.

DIGITEL™ ION PUMP CONTROLLERS
PERFORMANCE YOU CAN RELY ON

The DIGITEL family of Ion Pump controllers offers the right balance of performance, power and protection.

Digitel™ SPCe

Small Pump Controller

The SPCe is a versatile way to fully operate ion pumps 0.2-75 l/s. An LCD pressure/current/voltage display along with standard serial communications makes the SPCe able to accommodate the needs of basic and advanced users. Nano amp resolution provides gauging capabilities using the appropriate ion pump set-up.

Digitel™ QPCe

The new QPC controller offers adjustable output voltage, nano ampere resolution plus up to four independent power supplies, allowing for high current control of up to four ion pumps independently. It has an easy-to-read colour touchscreen LCD display that simultaneously displays pressure, current, and voltage and includes serial and Ethernet communications as standard.

Digitel™ MPCe (Multiple Pump controller)

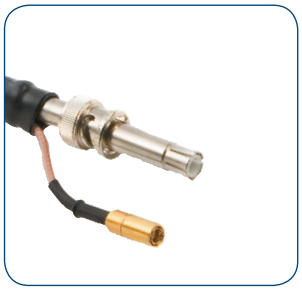
Ion Pump Control

Ion pumps 100 l/s and larger require higher currents for starting and higher pressure operation. The MPCe allows for high current control of two ion pumps independently (or up to four ion pumps in parallel) and has an easy-to-read touchscreen LCD display that simultaneously displays pressure, current, and voltage.

At 3U high and a full rack in width, the MPCe is ideal for operating a wide variety of ion pump configurations on any system.

TSP/NEG Control

A TSP or NEG can be fully operated from the LCD touchscreen of the MPCe. They can be fired manually or automatically based on the pressure of either ion pump the MPCe is monitoring. Timed modes also let the user have full control over exact parameters of operation. A single remote controller can operate up to eight TSP filaments or two NEG pumps.



Ease of Use

Each DIGITEL™ has a highly visible display. The SPCe has an easy-to-read LCD that displays pressure, current and voltage. The LPCe and MPCe are each fully controlled with an intuitive touch panel LCD. Digital resolution down to 1 nA is possible depending on pump size and current requirements.

Operator Safety

The integrated SAFECONN high voltage interlock system eliminates electrical shocks and false positive pressure readings. The controller automatically shuts off high voltage when the cable is disconnected from the ion pump or controller end. The system is isolated and guarantees ground, high voltage, and safety connectivity that prevents accidental arcing.

Communications

Serial communications (RS232, RS422, and RS485) are standard on all DIGITEL™ products. Optional Ethernet protocol for advanced facility and instrumentation communications is available on all units.

Connectivity

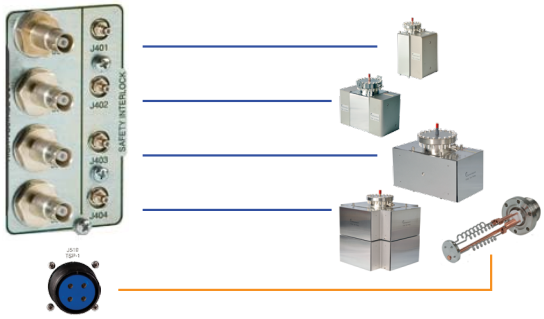
Each DIGITEL™ has programmable analogue and interlock capabilities. This allows for optimal flexibility when integrating with standard or legacy setpoint and analogue monitoring systems.

DIGITEL™ Flexibility

The DIGITEL™ line is flexible enough to control a wide variety of ion pump and TSP/NEG configurations. The LPCe and MPCe can operate up to four ion pumps simultaneously or independent operation of one or two ion pumps, respectively. The MPCe is capable of controlling one or two TSP/NEG cartridges independently.

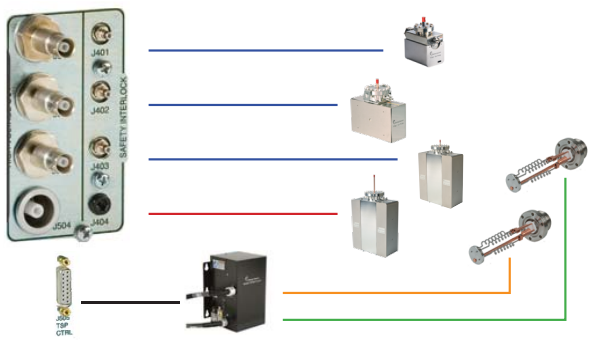
Example Configuration 1

Four diode ion pumps in parallel and single TSP operation.



Example Configuration 2

Three diode ion pumps, in parallel, one triode ion pump and Dual TSP/NEG operation.



DIGITEL ION PUMP CONTROLLERS

SPECIFICATIONS	SPCe	QPC	MPCe
Input Power			
Voltage	90-240 vac or 24 vdc	100-240 volts	90-130 or 200-240 V
Frequency	48-62 Hz	50-60 Hz	48-62 Hz
Output Power			
Independent Outputs	1	1-4	1 or 2
Open Circuit Voltage	3000-7000 vdc (+/- configurable)	+/-3000 or 7000 vdc programmable	+/-5600 or 7000 vdc
Current (maximum)	50 mA	125 mA	100 mA or 500 mA
Watts (maximum)	50	125	1000
Resolution	1 nA	1 nA	0.1 uA
High voltage connections	One 10 kV SHV or Fischer	1-4, 10 kV SHV or Fischer	1-4, 10 kV SHV or Fischer
Display			
Type	LCD	Wide VGA touchscreen Colour LCD	1/4 VGA touchscreen LCD
Readouts	Pressure, current, voltage, and programmable options	Pressure, current, voltage, and programmable options	Pressure, current, voltage, and programmable options
Analogue outputs			
Voltage	linear, configurable	linear, configurable	linear, configurable
Current/Pressure	linear or logarithmic, configurable	linear or logarithmic, configurable	linear or logarithmic, configurable
Setpoints	One relay, one TTL	Four relay, four TTL	Four relay, four TTL
Communications	Local/Remote/Full	Local/Remote/Full	Local/Remote/Full
	Ethernet	Ethernet	Ethernet
	Serial: 232, 422, 485	Serial: 232, 422, 485	Serial: 232, 422, 485
Conformity to norms	EN 55011 Class A, IEC 801-2	EN 55011 Class A, IEC 801-2	EN 55011 Class A, IEC 801-2
	EN 801-3, IEC 801-4, EN 61010-1	EN 801-3, IEC 801-4, EN 61010-1	EN 801-3, IEC 801-4, EN 61010-1
Weight, kg (lbs)	1.5 (3.3)	9.5 (21)	16.8 (37) minimum
			25.4 (56) maximum
Size	2U high, ¼ rack wide	3U high, ½ rack wide	3U high, full rack wide
	313 mm (12.3“) deep	438 mm (17.2“) deep	438 mm (17.2”) deep
Additional features	SAFECONN	SAFECONN	SAFECONN
	AUTOSTART/AUTORUN	AUTOSTART/AUTORUN	AUTOSTART/AUTORUN
	High Voltage Enable		High Voltage Enable
	Fowler-Nordheim Calibration		Remote TSP Control
	High-Pot Capability		
Compatibility (l/s)			
Mini/3S	X	X	
10-75	X	X	X
100-300		X	X
400-1200	*	*	X

*Subject to starting pressure.

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