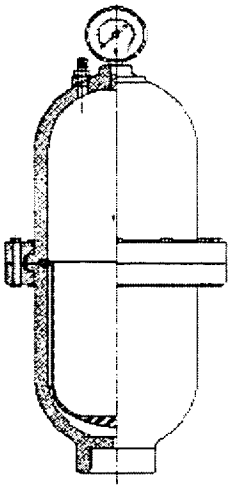
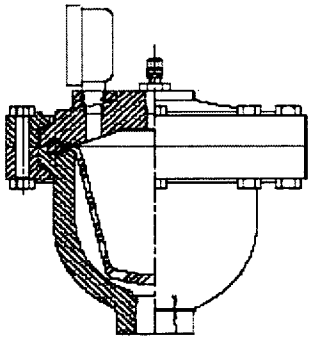
PULSAFEEDER®

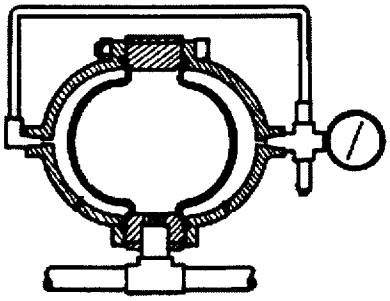
A Unit of IDEX Corporation

PULSuppressor®

Pulsation Dampeners







Installation, Operation & Maintenance

BULLETIN No. PS-IOM-DMP-03 Rev D

PULSAFEEDER®

Manufacturers of Quality Pumps,
Controls and Systems

Engineered Pump Operations
2883 Brighton-Henrietta Townline Road
Rochester, New York 14623
Telephone: (585) 292-8000 Fax: (585) 424-5619
http://www.pulsa.com pulsa@idexcorp.com

FACTORY SERVICE POLICY

If you are experiencing a problem with your PULSuppressor® pulsation dampener, first review the IOM and consult the troubleshooting guide. If the problem is not covered or cannot be solved, please contact your local PULSA Series Sales Organization or our Technical Service Department at (585) 292-8000 for further assistance.

Trained individuals are available to diagnose your problem and arrange a solution. Solutions may include purchasing a replacement unit or returning the pump or components to the factory for inspection and repair. All returns require a Return Material Authorization (R.M.A.) number to be issued by Pulsafeeder.

Certain components may be purchased for replacement. Parts purchased to correct a warranty issue may be credited after examination of the original parts by Pulsafeeder personnel. Parts returned for warranty consideration that test satisfactorily will be sent back to the originator freight collect.

Any field modifications will void the Pulsafeeder warranty. Out-of-warranty repairs will be subject to Pulsafeeder's standard bench fees and testing costs associated with replacement components.

Notice

Information and specifications in this document are subject to change without notice.

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Table of Contents

1. Conventions

For the remainder of this bulletin, the following Conventions are in effect.

A WARNING DEFINES A CONDITION THAT COULD CAUSE DAMAGE TO BOTH THE EQUIPMENT AND THE PERSONNEL OPERATING IT. PAY CLOSE ATTENTION TO ANY WARNING.

Notes are general information meant to make operating the equipment easier.

2. Safety

2.1 General Safety

- The PULSuppressor® was designed as a system pulsation dampener for operation with Pulsafeeder metering pumps. Use for any other application is considered un-safe and voids all certification markings and warranties.
- Pulsafeeder recommends that all systems be protected by a system pressure relief valve. The hydraulic bypass valve in the metering pump is not designed to provide system protection or pressure limiting functions.
- Ensure that the installation adheres to all temperature and pressure limitations for the materials of construction of your PULSuppressor® pulsation dampener. Always check and verify the ratings on the nametag.
- Remove all pressure from both the process and the air/gas chambers of the PULSuppressor® before attempting maintenance or repairs.
- Do not operate any PULSuppressor® that is damaged, leaking, corroded, or unable to contain fluid or gas pressure.
- PULSuppressor® dampeners should be charged with air or nitrogen ONLY.
- PULSuppressor® dampeners have a moving diaphragm or bladder that will require periodic inspection and maintenance. Ensure that this and other accessory items are included in your facility's preventative maintenance program.

DURING NORMAL OPERATION, THE PULSATION DAMPENER WILL CONTAIN PROCESS FLUID. ENSURE THAT APPROPRIATE SAFETY PRECAUTIONS, INCLUDING USE OF PERSONAL PROTECTIVE EQUIPMENT, ARE FOLLOWED WHEN MAINTAINING OR REPAIRING THE PULSUPPRESSOR®

2.2 Hydraulic Safety

Thoroughly review and adhere to the contents of the latest version of the your Pulsafeeder Installation, Operation and Maintenance (IOM) manual for hydraulic installation and operation of your metering pump. This document contains information specific to the PULSuppressor® pulsation dampener only.

3. Equipment Inspection

When you receive your order, check all equipment for:

- Completeness against the shipping document / purchase order
- Evidence of shipping damage.

Shortages or damage should be reported immediately to the carrier and your PULSAFEEDER representative.

4. Storage Instructions

The PULSuppressor® can be successfully stored for extended periods. The key to this success is temperature and humidity control.

Be certain to follow the additional storage instructions provided in the IOM for your Pulsafeeder pump, and also those included in the IOM for any controllers (DLC, DLCM, ECA, ELMA, PULSAmatic®) that are attached to the pump.

4.1 Short Term (0 - 12 months)

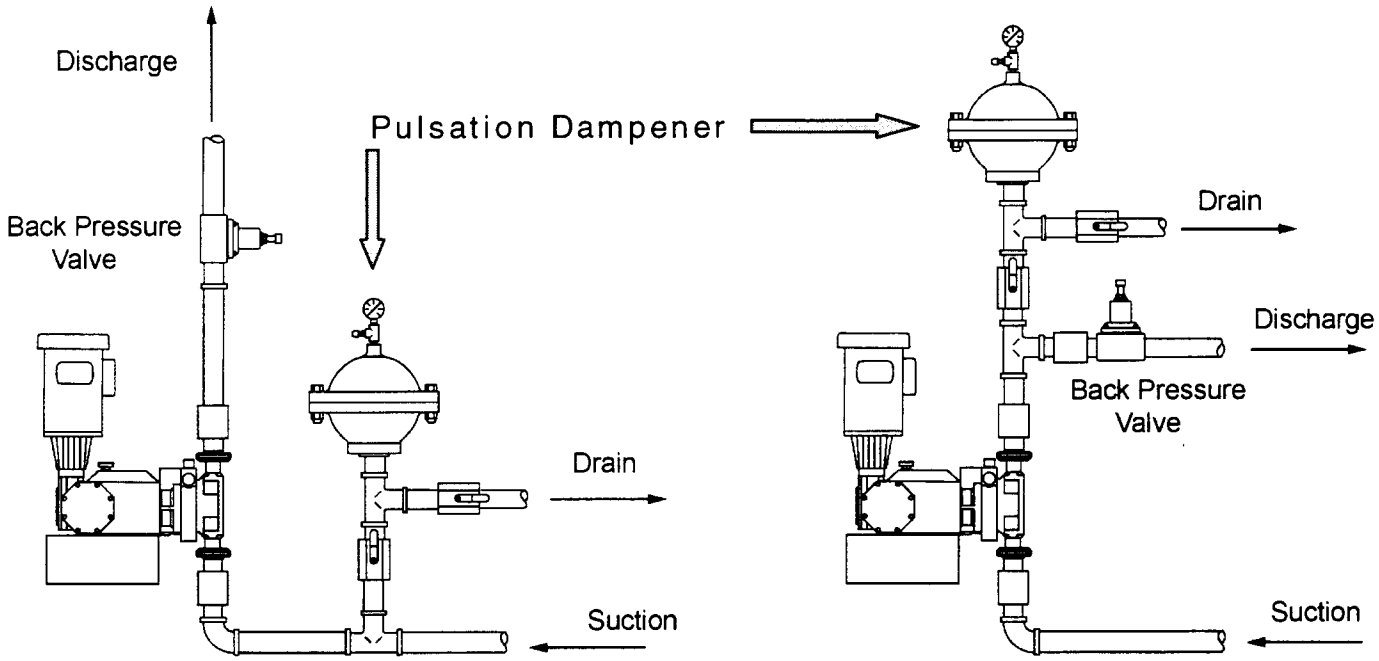
The PULSuppressor® should be stored in a temperature and humidity controlled environment. It is preferable to keep the temperature constant in the range of -18 to 60° Celsius (0 to 140° Fahrenheit). The relative humidity should be 0 to 90% non-condensing.

The PULSuppressor® should be stored in the original shipping carton if possible.

4.2 Long Term (12 months or more)

Storage of the PULSuppressor® for periods of longer than twelve months is not recommended. If extended storage is unavoidable the PULSuppressor® should be stored in accordance with those conditions stipulated for Short Term Storage. In addition, replacement of the diaphragm or bladder may be required prior to installation and use. The bladders may be constructed of an elastomer material that has a limited lifespan.

5. System Diagram



SUCTION INSTALLATION

DISCHARGE INSTALLATION

6. Process Limits

	Minimum	Maximum
Temperature	40° F / 4° C	150° F / 65° C
Viscosity	none	1000 cps
Slurry Service	Consult Factory	

6.1 Materials

Pulsation dampener housings and diaphragms are available in a wide range of materials to ensure compatibility with the process fluid. It is the customer's responsibility to ensure these materials are appropriate for the intended use. Use special caution if the process conditions change, or if the dampener is moved from one service to another. This can often cause compatibility problems.

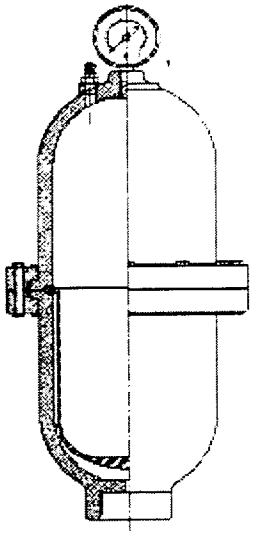
7. Theory of Operation

Pulsation dampeners smooth out the pulsating flow caused by positive displacement piston and diaphragm type pumps. They feature a diaphragm barrier to isolate the air cushion from the fluids in the piping system. This eliminates variations in effectiveness and the need for recharging due to air cushion absorption into the process fluid.

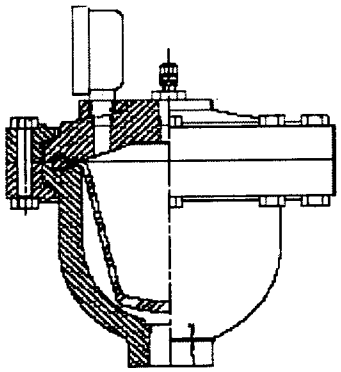
7.1 Benefits

- significantly reduces hydraulic hammer in pipe lines
- reduces peak velocity in the flow characteristics of reciprocating pumps
- helps to protect piping and pipe joints from peak pressures and leakage
- can create more favorable NPSH conditions on the inlet side of the pump
- can allow for the use of smaller piping to reduce system costs
- changes pulsating flow to more linear flow

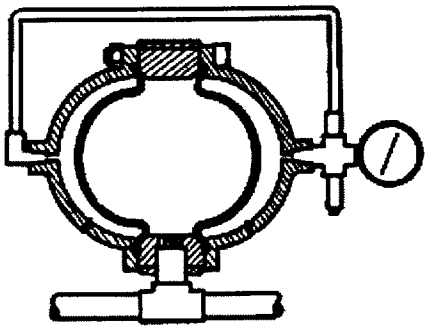
The pulsation dampener has a volume of air or gas sealed under pressure in its outer chamber. Liquid is isolated in the inner portion by a diaphragm. Pressure changes within the product piping due to reciprocating pump operation are absorbed by the compressible air or gas volume. The diaphragm prevents the loss of the air cushion into the process stream, as is common with non-isolated pressure dome or surge chamber devices.



Dome-Top dampener



Flat-Top dampener



Double-Diaphragm dampener

8. Selection

Selection of the proper pulsation dampener involves choosing the appropriate materials of construction for the dampener body and the diaphragm, and choosing the correct size dampener. The physical size of the dampener will determine its internal volume and the ability to absorb pressure fluctuations. This sizing is calculated based on the displacement per stroke of the metering pump. Refer to the Pulsafeeder Sales Manual or your local Pulsafeeder Sales Representative for assistance in pulsation dampener selection. Sizing guidelines for Pulsafeeder metering pumps are included in *Section 12* of this bulletin.

Mean line pressure must be calculated carefully. Use standard pressure drop tables and velocity based on uniform flow, such as would be seen in a non-pulsating pump system, to determine mean pressure. When using an 80% precharge and mean system pressure has been overestimated, the diaphragm might end up working from a 90 or 95% precharge position. This is not an efficient operating position.

If a PULSuppressor® is to be used in a system where process pressure varies - such as a fixed spray nozzle and varied flow rates to it - then PULSuppressor® may require adjustment to the lower flow/pressure situation or an oversized dampener used.

When using a PULSuppressor® in combination with a back pressure valve and flow rate is quickly adjusted, there will be irregular flow downstream of the back pressure valve until the PULSuppressor® adjusts to the new setting.

MAXIMUM PRESSURE/FLOW FLUCTUATIONS
NORMALLY ACCEPTED BY SYSTEM COMPONENT

Component	**% Surge**
Transducer	± 0.5
Gauge and Recorder	± 1.0
Turbine Flow Meter or Rotometer	± 2.5
Gasket and Seal Protection	± 5.0
Horsepower Savings	± 7.5
Piping Vibration & Acceleration	± 10.0

9. Pulsation Dampener Installation

On both discharge and suction lines, it is desirable to mount the PULSuppressor® as close to the pump connection as possible. For best results, mount the dampener at a distance of no more than 7-8 times the pipe diameter from the pump connection.

The dampener can be mounted in any position: horizontally, vertically, or at any angle. Installation in a vertical position with the process outlet directed downwards will facilitate draining liquid from the dampener chamber. Upside down mounting positions are not recommended for heavy, high viscosity products or those containing suspended solids or particles.

A shutoff valve should always be used between the piping system and PULSuppressor®. A drain valve located between the dampener and shutoff valve will aid in service and charging procedures. If the discharge line is open to atmospheric pressure, a backpressure valve should also be incorporated in the system near the PULSuppressor® to assure proper operation.

Remember, even if the dampener is isolated from the process, it will still contain some volume of process liquid. **Follow applicable safety and protective procedures when maintaining or charging the dampener**.

NOTE **IF DIAPHRAGM FAILURE IS SUSPECTED, PROCESS MATERIAL MAY HAVE ENTERED THE AIR SIDE OF THE DAMPENER, AND PROPER PRECAUTIONS SHOULD BE FOLLOWED DURING DISASSEMBLY AND INSPECTION.**

Periodic inspection and replacement of the diaphragm within the PULSuppressor® dampener is recommended. Given the wide variety of applications, each end user must determine the maintenance interval appropriate to their system.

NOTE **IF PRESSURE TESTING OF THE PROCESS SYSTEM IS PERFORMED, ENSURE THAT THE PULSuppressor® DAMPENER IS PRE-CHARGED TO 80% OF THE TEST PRESSURE PRIOR TO TESTING. THIS WILL ENSURE THAT THE DAMPENER IS NOT DAMAGED DURING THE TEST.**

10. Charging and Setup

10.1 Procedures, Discharge Installation

The PULSuppressor® should be pre-charged with 80% of the expected discharge pressure in the system. The charging pressure in the PULSuppressor® should always be less than the actual pump discharge pressure, or the dampener will not function.

The pressure gauge on the PULSuppressor® will read the pre-charge pressure when the unit is first set up. When the pump is brought on line and the system reaches full pressure, the gauge will read full system pressure.

10.1.1 Charging

1. Isolate the PULSuppressor® from the process piping
2. Carefully drain off process fluid from the dampener, follow safety precautions
3. Leave the drain valve open so dampener is open to the atmosphere
4. Apply the precharge pressure, **note that additional liquid may drain from the dampener as the diaphragm moves to fill the internal volume**
5. Close the drain valve
6. 'Return the dampener to the process system

To ensure proper precharge, dampeners should be isolated from the process and open to the atmosphere on the product side during charging.

Observe the process pressure on a discharge pressure gauge. Adjustments to the air charge can be made by bleeding off small amounts of air. Perform this adjustment until pressure variation is minimized.

10.2 Procedures, Suction Installation

Installation of a PULSuppressor® dampener on the suction side of the pump allows the unit to function as an accumulator, improving the net positive suction head (NPSH) available to the pump. Liquid between the tank and the dampener will have more uniform flow characteristics.

Suction side installations should be charged as follows, depending on operating conditions:

Positive static pressure:	Charge to 50% of mean pressure
Suction lift conditions:	Charge to 5 inches of vacuum

10.2.1 Charging

1. Isolate the PULSuppressor® from the process piping
2. Carefully drain off process fluid from the dampener, follow safety precautions
3. Leave the drain valve open so dampener is open to the atmosphere
4. Apply the precharge pressure, **note that additional liquid may drain from the dampener as the diaphragm moves to fill the internal volume**
5. Close the drain valve
6. Return the dampener to the process system
7. Observe the indication on the compound gauge

When the accumulator is functioning correctly, the gauge needle will go from pressure to vacuum on each pump stroke.

NOTE **FOR SUCTION LIFT APPLICATIONS, CONSULT THE FACTORY FOR SPECIAL PULSUPPRESSOR® CONFIGURATIONS THAT INCLUDE A VALVE WHICH ALLOWS FOR VACUUM TO BE DRAWN.**

11. Maintenance

11.1 Cautions

- Ensure that process liquid has been drained, flushed, and/or neutralized before performing maintenance or repair on any pulsation dampener
- Ensure that air or gas pressure has been relieved from the upper chamber prior to disassembly

11.2 Intervals

The wide variety of process applications make accurate predictions of pulsation dampener lifespan impossible. Pulsation dampeners contain a movable bladder or diaphragm that is a wearable part and will require periodic replacement. Periodic inspection of the diaphragm will determine the proper interval for each specific process.

11.3 Materials

Always ensure that the correct materials are utilized to repair your PULSuppressor® pulsation dampener. Many materials, such as different types of elastomers, may appear visually similar. These material are usually coded with a colored dot system to identify the material. Using the incorrect diaphragm material may lead to premature failure and damage to the dampener and/or process system.

Many dampeners are designed with a lower (wetted) chamber that is resistant to the process chemistry, but utilize an upper chamber of an alternate material to contain the gas charge. If the diaphragm in a dampener has failed, inspect all components of the dampener carefully for damage, corrosion, etc. Replace parts as necessary to ensure proper and safe operation of the dampener in the future.

11.4 Procedures

PULSuppressor® dampeners come in many sizes, materials, and configurations. The following is a general service procedure:

1. Isolate the dampener from the process system, and remove from piping if necessary
2. Drain, flush, and neutralize the dampener as required
3. Remove the flange bolts which secure the dampener upper section to the lower section. Use caution, as some additional liquid may exit the dampener as the sections separate
4. Carefully remove the upper dampener section and the diaphragm from the dampener
5. Inspect all components; replace any that appear damaged, corroded, cracked, etc.
6. Inspect the diaphragm for evidence of chemical attack, physical damage, abrasion, rips or tears
7. Thoroughly clean all parts
8. Reinstall the diaphragm, seating it carefully into the retention grooves in the dampener body
9. Realign the upper and lower dampener sections, use care to maintain the position of the diaphragm
10. Reinstall the flanges and/or bolts and tighten them, working in an alternating pattern
11. If desired, the gas and/or liquid sides can be tested prior to returning the dampener to service
12. Return the dampener to the process and follow the appropriate charging instructions in Section 10

12. Troubleshooting

Symptom	Probable Cause	Possible Solution
Excessive pressure fluctuation in discharge piping	Dampener not charged correctly	Apply proper gas charge pressure to dampener
	Dampener bladder or diaphragm is damaged	Remove dampener from system and inspect, replace failed components
PULSuppressor® gauge always reads zero	Dampener has no air or gas charge	Apply proper gas charge pressure to dampener
	Gauge Damaged	Replace gauge
PULSuppressor® gauge always reads high pressure	Dampener is overcharged	Bleed off excess air or gas pressure
	Gauge Damaged	Replace gauge
PULSuppressor® loses pressure	Bladder failed	Examine and replace
	Improper assembly	Check bladder position and bolt torque

13. Sizing Charts

13.1 For PULSAR metering pumps:

MODEL	PISTON DIAMETER (MM)	STROKE LENGTH (MM)	DISPLACEMENT (MM^3/STROKE)	DISPLACEMENT (IN^3/STROKE)
25HJ	10	11	863.9	0.1
	13	11	1460.1	0.1
	19	11	3118.8	0.2
	30	11	7775.5	0.5
	40	11	13823.0	0.8
	50	11	21598.5	1.3

MODEL	PISTON DIAMETER (MM)	STROKE LENGTH (MM)	DISPLACEMENT (MM^3/STROKE)	DISPLACEMENT (IN^3/STROKE)
25HL	10	23	1806.4	0.1
	13	23	3052.8	0.2
	19	23	6521.2	0.4
	30	23	16257.8	1.0
	40	23	28902.7	1.8
	50	23	45160.5	2.8

MODEL	PISTON DIAMETER (MM)	STROKE LENGTH (MM)	DISPLACEMENT (MM^3/STROKE)	DISPLACEMENT (IN^3/STROKE)
55HL	10	23	1806.4	0.1
	13	23	3052.8	0.2
	19	23	6521.2	0.4
	30	23	16257.8	1.0
	40	23	28902.7	1.8
	50	23	45160.5	2.8

13.2 For Pulsa Series metering pumps:

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
200	0.280	0.500	0.03

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
340	0.500	0.625	0.12
	0.750	0.625	0.30

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
680	0.250	0.500	0.02
	0.375	0.500	0.06
	0.625	0.500	0.15
	0.750	0.500	0.20
	0.875	0.500	0.30
	1.000	0.500	0.40
	1.125	0.500	0.50
	1.250	0.500	0.60
	1.375	0.500	0.70
	1.500	0.500	0.90

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
R1[(2)]	0.779	1.125	0.20
	0.834	1.125	0.30
	1.000	1.125	0.50
	1.187	1.125	0.90

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
880	1.125	0.625	0.60
	1.250	0.625	0.80
	1.500	0.625	1.10
	1.750	0.625	1.50
	2.125	0.625	2.20

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
7120	0.500	1.00	0.20
	0.750	1.00	0.40
	1.000	1.00	0.80
	1.250	1.00	1.20
	1.500	1.00	1.80
	1.750	1.00	2.40
	2.125	1.00	3.50
	2.625	1.00	5.40

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
7440	0.500	1.450	0.30
	0.750	1.450	0.60
	1.000	1.450	1.10
	1.250	1.450	1.80
	1.500	1.450	2.60
	1.750	1.450	3.50
	2.125	1.450	5.10
	2.375	1.450	6.40
	2.625	1.450	7.80
	3.000	1.450	10.20

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
7660	0.375	2.40	0.30
	0.500	2.40	0.50
	0.750	2.40	1.10
	1.000	2.40	1.90
	1.250	2.40	2.90
	1.500	2.40	4.20
	2.000	2.40	7.50
	2.500	2.40	11.80
	3.000	2.40	17.00
	3.250	2.40	19.90
	3.500	2.40	23.10
	4.000	2.40	30.20
	4.500	2.40	38.20

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
8480	0.500	3.20	0.60
	0.750	3.20	1.40
	1.000	3.20	2.50
	1.250	3.20	3.90
	1.500	3.20	5.70
	2.000	3.20	10.10
	2.500	3.20	15.70
	3.000	3.20	22.60
	3.250	3.20	26.50
	4.000	3.20	40.20
	4.500	3.20	50.90

MODEL	PISTON DIAMETER (IN)	STROKE LENGTH (IN)	DISPLACEMENT (IN^3/STROKE)
9490	1.500	4.00	7.10
	2.000	4.00	12.60
	2.500	4.00	19.60
	3.000	4.00	28.30
	4.000	4.00	50.20
	5.500	4.00	95.00

13.3 Pulsation Dampener Sizing

PISTON DISPLACEMENT PER STROKE (IN3)	DAMPENER SIZE REQUIRED (IN3) FOR % PRESSURE OSCILLATION			
	2.50%	5.00%	7.50%	10.00%
0.03	0.8	0.4	0.3	0.2
0.1	2.5	1.3	0.9	0.7
0.2	5.0	2.7	1.9	1.5
0.3	7.6	4.0	2.8	2.2
0.4	10.1	5.3	3.7	2.9
0.5	12.6	6.6	4.6	3.7
0.6	15.1	8.0	5.6	4.4
0.7	17.7	9.3	6.5	5.1
0.8	20.2	10.6	7.4	5.9
0.9	22.7	11.9	8.4	6.6
1	25.2	13.3	9.3	7.3
1.1	27.8	14.6	10.2	8.1
1.2	30.3	15.9	11.2	8.8
1.3	32.8	17.2	12.1	9.5
1.4	35.3	18.6	13.0	10.3
1.5	37.8	19.9	13.9	11.0
1.8	45.4	23.9	16.7	13.2
1.9	47.9	25.2	17.7	13.9
2.2	55.5	29.2	20.5	16.1
2.4	60.6	31.8	22.3	17.6
2.5	63.1	33.2	23.2	18.3
2.6	65.6	34.5	24.2	19.1
2.8	70.6	37.1	26.0	20.5
2.9	73.2	38.5	27.0	21.3
3.5	88.3	46.4	32.5	25.7
3.9	98.4	51.7	36.3	28.6

PISTON DISPLACEMENT PER STROKE (IN3)	DAMPENER SIZE REQUIRED (IN3) FOR % PRESSURE OSCILLATION			
	2.50%	5.00%	7.50%	10.00%
4.2	106.0	55.7	39.0	30.8
5.1	128.7	67.6	47.4	37.4
5.4	136.2	71.6	50.2	39.6
5.7	143.8	75.6	53.0	41.8
6.4	161.5	84.9	59.5	46.9
7.1	179.1	94.2	66.0	52.1
7.5	189.2	99.5	69.7	55.0
7.8	196.8	103.5	72.5	57.2
10.1	254.8	134.0	93.9	74.1
10.2	257.4	135.3	94.8	74.8
11.8	297.7	156.5	109.7	86.5
12.6	317.9	167.1	117.1	92.4
15.7	396.1	208.2	146.0	115.1
17	428.9	225.5	158.1	124.7
19.6	494.5	260.0	182.2	143.7
19.9	502.1	263.9	185.0	145.9
22.6	570.2	299.7	210.1	165.7
23.1	582.8	306.4	214.8	169.4
26.5	668.6	351.5	246.4	194.3
28.3	714.0	375.3	263.1	207.5
30.2	762.0	400.5	280.8	221.5
38.2	963.8	506.7	355.2	280.1
40.2	1014.3	533.2	373.8	294.8
50.2	CF	665.8	466.7	368.1
50.9	CF	675.1	473.2	373.3
95.0	CF	CF	883.2	696.7

PULSAFEEDER
A Unit of IDEX Corporation
Engineered Pump Operations
2883 Brighton-Henrietta Townline Road
Rochester, NY 14623
Telephone (585) 292-8000 Fax (585) 424-5619
http://www.pulsa.com pulsa@idexcorp.com

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