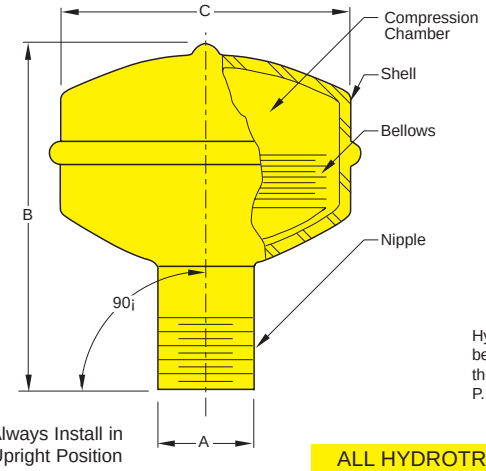
HYDROTROL
WATER HAMMER ARRESTERS

SMITH
CUSTOMER DRIVEN

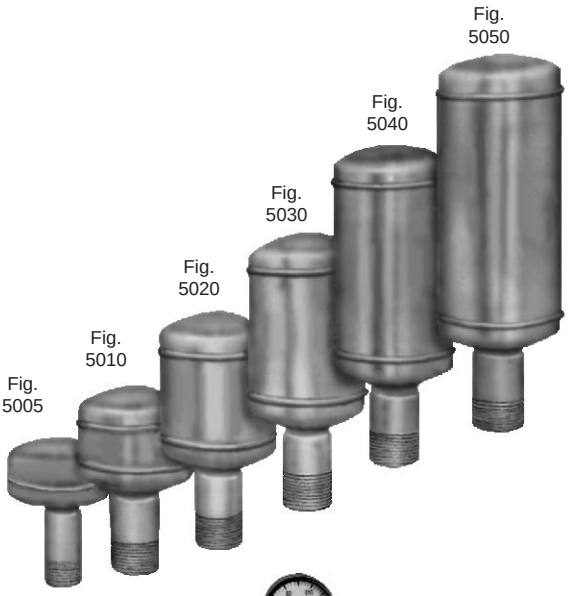


Always Install in Upright Position

Hydrotrols Fig. 5005 to 5050 inclusive have been tested and certified in accordance with the Plumbing Drainage Institute "Standard P.D.I. WH-201"

ALL HYDROTROLS ARE CONSTRUCTED ENTIRELY OF STAINLESS STEEL

HYDROTROLS ARE PRE-CHARGED AND PERMANENTLY SEALED AT THE FACTORY



PCN/ Fig. No.	P.D.I. Symbol	Fixture Unit Rating	A SIZE	B	C
5005	A	1-11	3/4	4	3
5010	B	12-32	1	5	3
5020	C	33-60	1	6	3
5030	D	61-113	1	7	3
5040	E	114-154	1	8	3
5050	F	155-330	1	9	3

See Pg. 5-03 for Sizing and Placement.

Fig. 5060 - "HY-DUTY" HYDROTROL

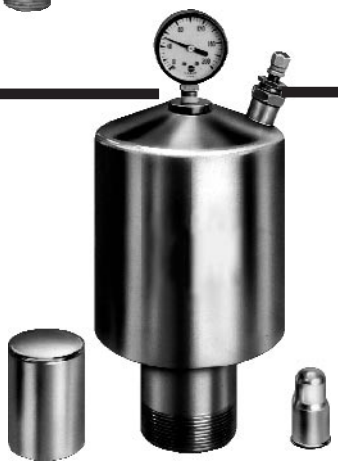


Fig. 5060

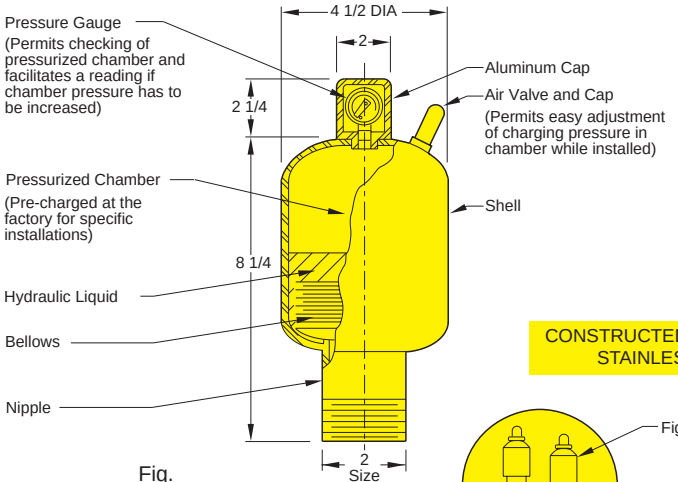
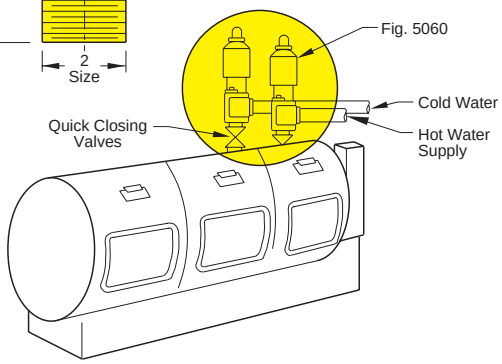


Fig. 5060

CONSTRUCTED ENTIRELY OF STAINLESS STEEL



TYPICAL LARGE CAPACITY LAUNDRY MACHINE INSTALLATION

The "Hy-Duty" HYDROTROL has been specially designed to absorb and control the extreme hydrostatic shock pressures that occur in applications such as commercial and institutional laundries, bus and truck washing stations, pumping systems and other large piping systems. Because of the special nature of this unit, all requests for sizing should be sent to the Smith Engineering Dept. for review. To enable the company to properly size units for specific jobs, the following information must be furnished.

1. Length of piping run from main to location of discharge valves for equipment.
2. Size of branch pipe and main.
3. Velocity (flow rate) through the branch and main.
4. Water pressure - both static and flowing.
5. Types of equipment served - name, number, flow rate.
6. Sketch or layout of the complete piping system related to the equipment to be protected. This is desirable so that a complete survey of the installation can be made.

Design • Construction • Operation

Built to last without mechanical failure or material deterioration, the HYDROTROL unit is constructed entirely of stainless steel.

HYDROTROL uses heavy duty balanced expansion bellows to internally absorb the hydrostatic shock pressure occurring in water lines. These bellows are both pneumatically and hydraulically controlled in a pressurized expansion chamber so that they never come into metal to metal contact with other parts of the unit, and cannot be subjected to excessive stresses or strains which might cause metal fatigue and bellows failure.

Stainless steel construction combined with unique engineered design make HYDROTROL -

- Compact in size
- Big in performance
- Maximum capacity
- Light-weight - needs no support straps
- Requires no service or maintenance
- Extremely durable - May be installed in concealed areas

Bellows in normal position

- Pressurized compression chamber charged and factory sealed. Controls bellows expansion under normal water-line pressure so that full expansion capacity is available to control shock.
- Hydraulic Fluid–Pure non toxic mineral oil surrounds bellows, holding bellows in uniform alignment.
- Welded Nesting–Type Expansion Bellows
- In-Line Design–Direct action type bellows respond instantly to control shock pressure.
- Threaded Nipple Connection–Screws directly into tee.

With HYDROTROL'S in-line design, expansion bellows are an integral part of the waterline, so that they respond instantaneously in absorbing and controlling hydrostatic shock.

A pressurized compression chamber provides a pneumatic cushion that governs the bellows' expansion under normal waterline pressure, so that the full bellows expansion capacity is available for controlling hydrostatic shock.

The bellows are of balanced design and construction with heavier and stronger convolutions positioned in the bellows assembly to insure each convolution expanding evenly and equally, thereby providing the maximum surface area for absorbing and dissipating the shock pressure into the pneumatic cushion.

- As shock occurs, bellows expand, creating a pneumatic pressure cushion which absorbs and controls shock.
- Hydraulic fluid flows in between nesting type bellows, holding bellows in uniform alignment during expansion and controlling rate of contraction after shock has been dissipated.
- Bellows in expanded position due to the hydrostatic shock in the system.

As hydrostatic shock occurs, these pressures cause the bellows to expand into the pneumatic cushion of the compression chamber. This expanding movement of the bellows provides the displacement required to absorb and control the shock pressure generated in the line. The force of the shock expanding the bellows creates a self-energizing pneumatic pressure, which prevents the bellows from over-expanding and coming into contact with the top of the compression chamber. This same action forces the hydraulic fluid (pure mineral oil) between each convolution of the bellows and the sides of the compression chamber, creating a hydraulic pressure cushion which holds the bellows in uniform alignment during expansion and controls the rate of contraction after the shock force has been dissipated.

The combined cushioning effect of both the pneumatic and hydraulic pressures governs the bellows action, so that shock waves do not bounce back into the piping system and acts to quickly stabilize the water and piping system.

SIZING AND PLACEMENT OF HYDROTROLS

All Sizing and Placement Data is in Accordance with Plumbing and Drainage Institute Standard PDI WH-201

SIZING - Single and Multiple Fixture Branch Lines

Most engineers employ the fixture unit method of sizing water piping systems. Smith uses the P.D.I. simplified method of sizing HYDROTROLS based on fixture unit weight. The correct size HYDROTROL can therefore be specified and located at the same time that the pipe sizes are determined.

Table 1 indicates the fixture unit weights for most popular plumbing fixtures and is based upon information offered in the National Plumbing Code. Certain local codes may vary and should be reviewed prior to using Table 1.

Fixture	Type of Supply Control	Weight in Fixture Units Public C.W.	Public H.W.	Private C.W.	Private H.W.
Water Closet	Flush Valve	10	-	6	-
Water Closet	Flush Tank	5	-	3	-
Pedestal Urinal	Flush Valve	10	-	-	-
Stall or Wall Urinal	Flush Valve	5	-	-	-
Stall or Wall Urinal	Flush Tank	3	-	-	-
Lavatory	Faucet	1 1/2	1 1/2	1	1
Bathtub	Faucet	2	3	1 1/2	1 1/2
Shower Head	Mixing Valve	2	3	1	2
Bathroom Group	Flush Valve Closet	-	-	8	3
Bathroom Group	Flush Tank Closet	-	-	6	3
Separate Shower	Mixing Valve	-	-	1	2
Service Sink	Faucet	3	3	-	-
Laundry Tubs (1-3)	Faucet	-	-	3	3
Combination Fixture	Faucet	-	-	3	3

Table 1

Table 2 indicates fixture unit ratings for P.D.I. certified water hammer arrester categories and the corresponding Smith HYDROTROL for each category. Where several fixtures are installed in a branch usually only one fixture valve at a time will be closed. Table 2 takes into consideration other design factors including the simultaneous usage of one or more fixtures, pipe size, length, flow pressure and velocity. Therefore, this method offers a simple fast determination of the proper size water hammer arrester for a given battery of plumbing fixtures.

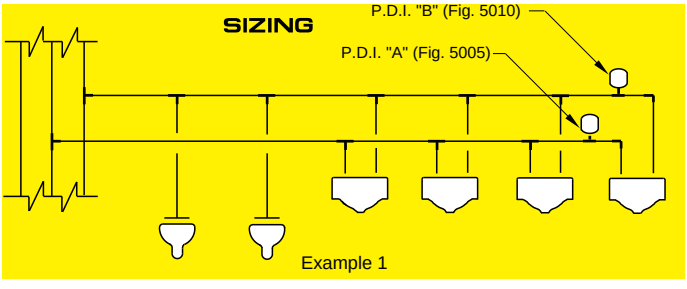
HYDROTROL SIZING TABLE

P.D.I. ▲SYMBOLS	A	B	C	D	E	F
HYDROTROL	5005	5010	5020	5030	5040	5050
Fixture Unit Rating	1-11	12-32	33-60	61-113	114-154	155-330

NOTE: When Water Pressure in line exceeds 65 psi, specify the next larger Hydrotrol.

Table 2

▲Plumbing and Drainage Institute established these size symbols to correspond to those units covered by the Certification and Testing Program described in P.D.I. Standard Manual WH-201.



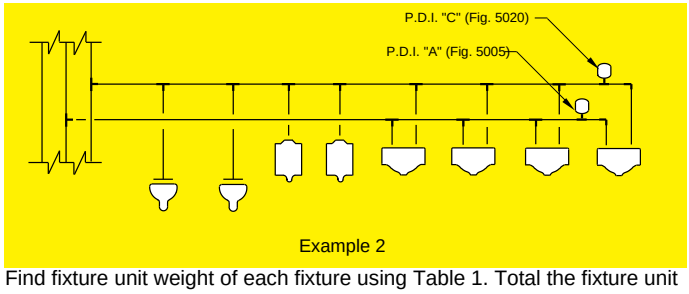
Example 1

Find fixture unit weight of each fixture using Table 1. Total the fixture units weights for both hot and cold branches.

Cold Water Branch
2 WC. at 10 F.U. ea. = 20
4 Lav. at 1 1/2 F.U. ea. = 6
Total 26

Hot Water Branch
4 Lav. at 1 1/2 F.U. ea. = 6
Total 6

Select P.D.I. "B" Unit
Select P.D.I. "A" unit
Select correct size HYDROTROL using Table 2.
Cold Water Branch Fig. 5010
Hot Water Branch Fig. 5005



Example 2

Find fixture unit weight of each fixture using Table 1. Total the fixture unit weights for both hot and cold water branches.

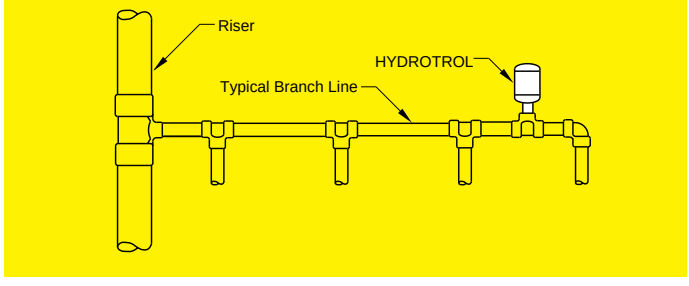
Cold Water Branch
2 WC. at 10 F.U. ea. .= 20
2 Ur. at 5 F.U. ea. ..... = 10
4 Lav. at 1 1/2 F.U. ea. = 6
Total 36

Hot Water Branch
4 Lav. at 1 1/2 F.U. ea. = 6
Total 6

Select P.D.I. "C" unit
Select P.D.I. "A" unit
Select correct size HYDROTROL using Table 2.
Cold Water Branch Fig. 5020
Hot Water Branch Fig. 5005

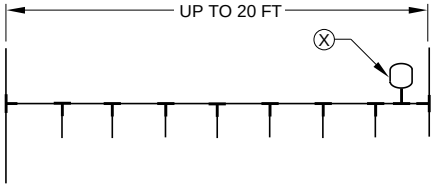
PLACEMENT

It has been established that the preferred location for the water hammer arrester is at the end of the branch line between the last two fixtures served.



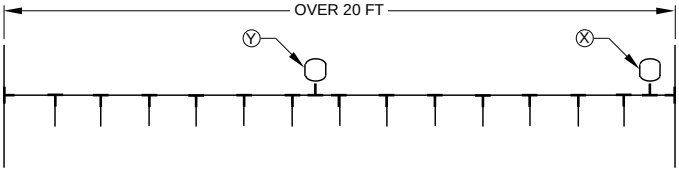
Two basic rules were established - one for branches up to 20 ft. in length, and another for branches over 20 ft. in length.

Rule 1



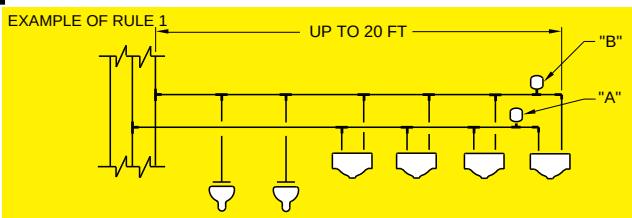
Rule 1, covers multiple fixture branch lines which do not exceed 20 ft. in length. Hydrotrol Sizing Table 2 is used to select the required unit.

Rule 2

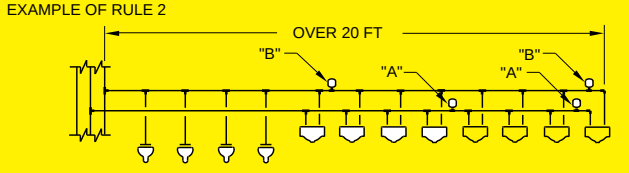


Rule 2, covers multiple fixture branch lines which do exceed 20 ft. in length. Hydrotrol Sizing Table 2 is used to select the required units. The sum of the Fixture Unit Ratings of units (X) and (Y) shall be equal to or greater than the demand of the branch.

EXAMPLE OF SIZING AND PLACEMENT



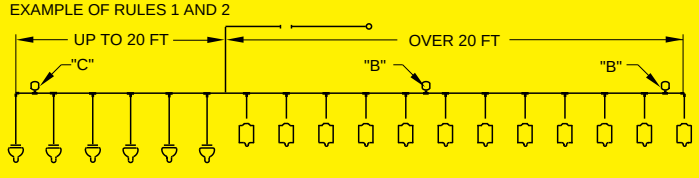
Cold Water Branch = 26 Fixture Units
Requires P.D.I. Unit "B" or Fig. 5010
Hot Water Branch = 6 Fixture Units
Requires P.D.I. Unit "A" or Fig. 5005



Cold Water Branch = 52 Fixture Units
Requires two P.D.I. Units "B" or two Fig. 5010
Hot Water Branch = 12 Fixture Units
Requires two P.D.I. Units "A" or two Fig. 5005

PLACEMENT ON EXTRA LONG BATTERIES

It is recommended that for extra long branches (in excess of 40' in length), the water supply should tie into the branch at some mid-point location. The example shows a branch of approximately 60' in length which can be fed at some mid-point location; thus applying Rules #1 and #2 at either side of the feed line for sizing and placement.



Up to 20 ft. - Cold Water Branch = 60 Fixture Units
Requires P.D.I. Unit "C" or Fig. 5020
Over 20 ft. - Cold Water Branch = 60 Fixture Units
Requires two P.D.I. Units "B" or two Fig. 5010

SIZING AND PLACEMENT IN MULTI-STORY BUILDINGS

By using Rules #1 and #2 almost every battery situation can be sized and the HYDROTROLS properly located. Fig. 1 shows the method of sizing and placement in a typical multi-story building which has a great variety of fixtures and fixture locations.

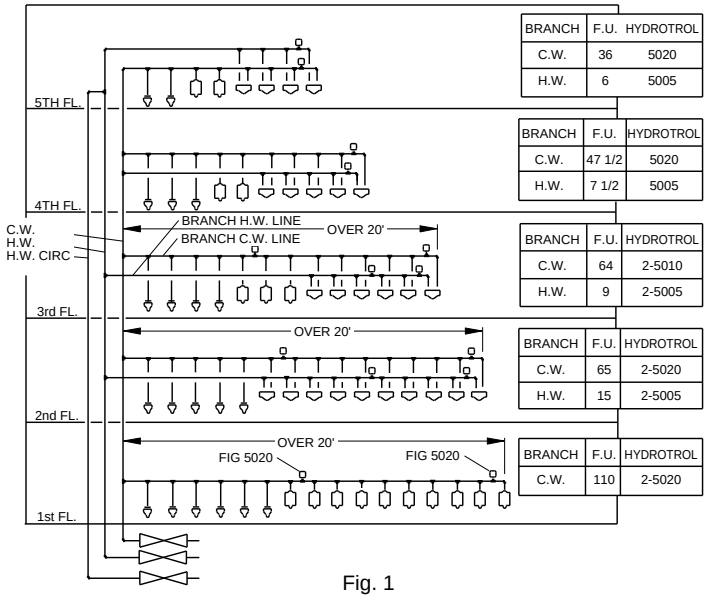
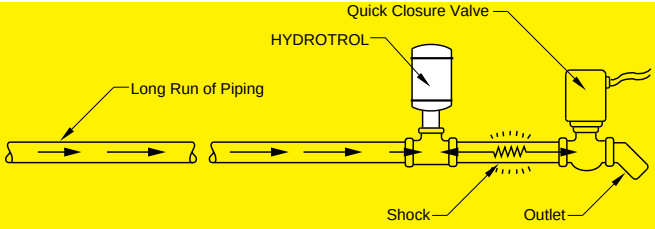


Fig. 1

LONG RUNS OF PIPING TO SINGLE FIXTURES, APPLIANCES OR EQUIPMENT

Table 3 indicates the size HYDROTROL required for long runs of piping which feed a single remote fixture or appliance. HYDROTROL unit should be sized by using Table 3 and located as close to the point of quick closure as possible.



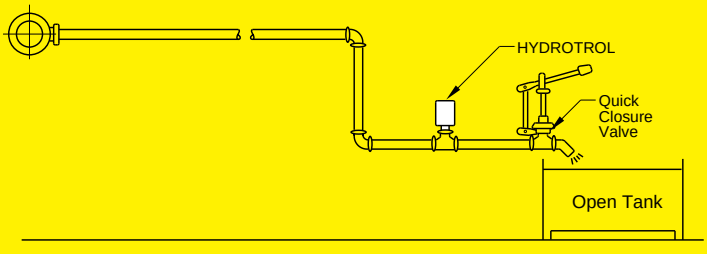
HYDROTROL SELECTION CHART						
LENGTH OF PIPE	NOMINAL PIPE SIZE					
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
25	5005	5005	5010	5020	5030	5040
50	5005	5010	5020	5030	5040	5050
75	5010	5020	5030	1-5005 1-5040	5050	1-5040 1-5050
100	5020	5030	5040	5050	1-5020 1-5050	2-5050
125	5020	5030	5050	1-5005 1-5050	1-5040 1-5050	1-5040 2-5050
150	5030	5040	5050	1-5030 1-5050	2-5050	3-5050

Table 3

Note: Table 3 shows lengths of run of branch piping. The length of run used should be the length of the pipe from the point of valve closure to a point of relief, such as a large pipe twice the size of the branch line, main line or water tank.

All sizing recommendations shown in Table 3 are based on an operating water pressure of 65 PSI or under and an average velocity between 5 and 10 feet per second. If operating pressures are over 65 PSI use the next larger HYDROTROL unit. When pressures are anticipated above 85 PSI a pressure reducing valve is recommended.

SIZING EXAMPLE



CONDITIONS:
Pipe Size .....1 1/4"
Length of Run .....100 ft.
Flow Pressure .....53 P.S.I.G.
Velocity .....8 ft./sec.

RECOMMENDATION:
Smith Fig. 5050 HYDROTROL installed as shown