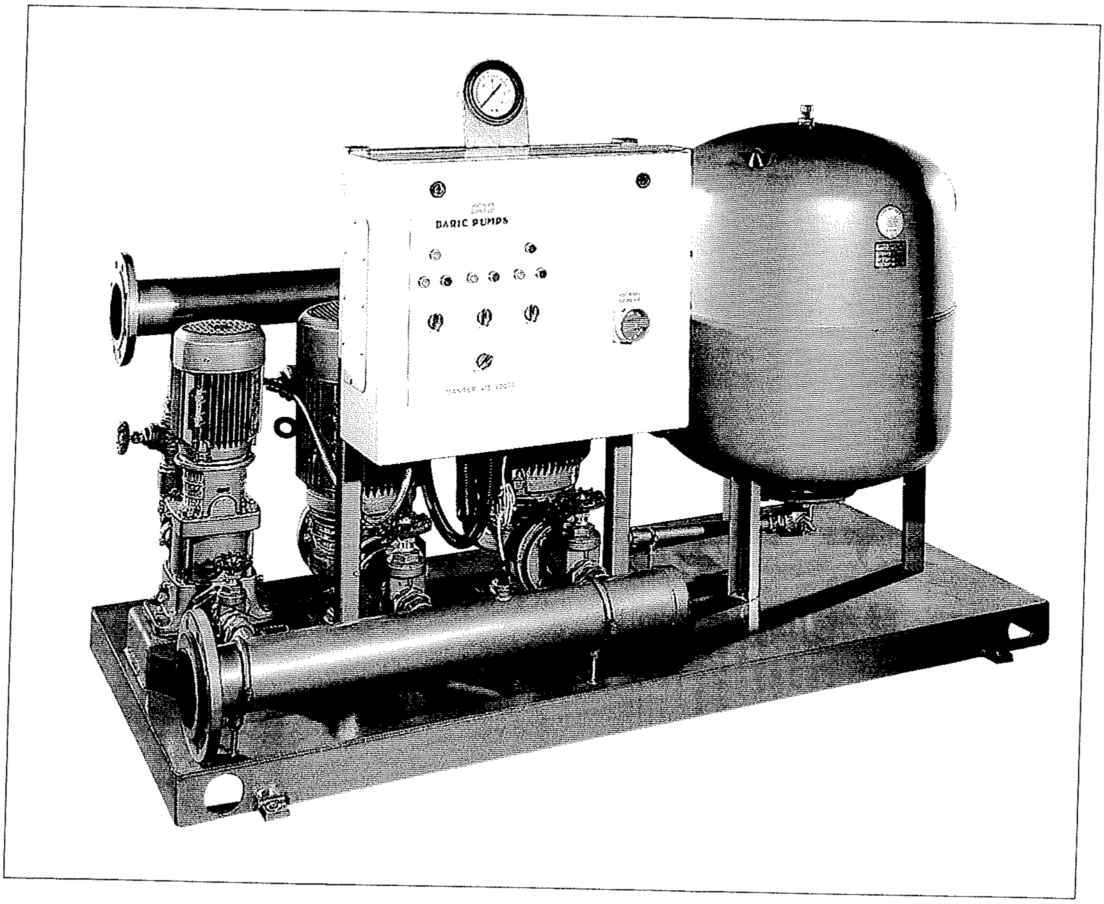
Booster

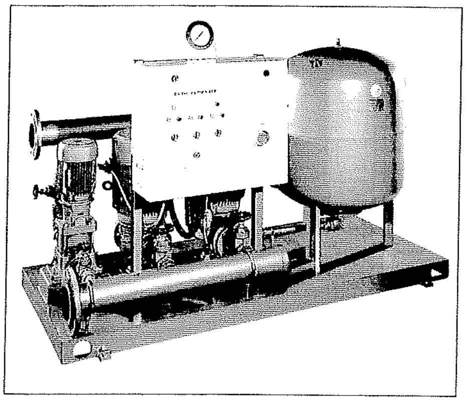


systems

BARIC

Finest in fluid handling

BOOSTER



Baric Pumps Limited, combination base mounted, factory assembled, pressure booster systems to increase the water supply pressure in buildings whilst controlled automatically on water demand.

Proven Performance

Proven performance pumping systems and integral controls are factory assembled, piped, electrically wired and tested ready for site installation.

Design Flexibility

Standard and custom designed flexibility combined with construction and operational options allow selections to be carefully matched to the system and application.

Applications

- Indirect and direct boosting.
- Boosted cold and hot water supply.
- Hose reel systems.
- Wet riser pumping systems.

Operation

- Constant run.
- Intermittent run.
- Intermittent run including diaphragm vessel.
- Pressure control.
- Flow control.
- Variable speed control.

Construction

- Single or multi pump.
- Integral controls.
- Copper pipework.
- Buffer or demand sized vessel to control pump running cycle.
- Combination base mounted.
- Integral low water protection option.

Pumped Systems

Whilst there are many ways of using pumped systems to increase the water pressure in high rise buildings, hospitals and hotels for example, these can be sub-divided into direct boosting and indirect boosting systems.

Direct Boosting

Direct connection of the booster system to the incoming water supply. Permission must be obtained prior to direct connection to the incoming mains since it may be prohibited by the mains water supplier. The pumpset should be sized to increase the incoming mains pressure, and the pump control should be by means of a level switch installed in a cold water storage cistern at a high level.

Indirect Boosting

The more commonly used system, where the water supplier insists on a break cistern being installed between the incoming mains supply and booster system.

Booster Selection

In addition to the standard pumping systems described, custom designed systems may be necessary to suit particular applications.
The installation arrangement examples given are of the more commonly used type of design and include the following.

- Indirect boosting to storage cistern.
- Direct boosting to storage cistern
- Indirect boosting with diaphragm vessel.
- Direct boosting to header and cistern.
- Indirect boosted hot water supply system.

Standard booster systems described include the following.

- Single pump with buffer diaphragm vessel.
- Multi pump with buffer diaphragm vessel.
- Multi pump with diaphragm vessel.
- Fire hosereel pumpset.
- Wet riser pumpset.

Apart from the selection of the appropriate booster system arrangement to suit a particular installation, it is necessary to determine the total head and flow rate requirements.

Design Flow Rate

Normally calculated as the probable demand using the customary design process, or from data derived from experience for particular building applications. Fire pumpsets have specific requirements in accordance with the appropriate standards or regulations.

Total Head

The total head will generally be calculated as the sum of the following.

	Static height to highest outlet.
plus	pressure head required at highest outlet fitting.
plus	system head loss, downstream of pumpset, to highest outlet.
minus	minimum pressure head at pumpset inlet.

Vessel Selection

Traditionally hydro-pneumatic booster vessels, by nature of design and sizing procedure, economically and effectively controlled the pump running cycle, on the principle of stored pressurised water under a cushion of air.
Close differentials between pump cut in and cut out pressures and the designers control over the frequency of pump starts, results in smooth pump control and minimum system pressure variations over variable demands.

It was essential that the vessel size was carefully calculated to control the pump running cycle, at maximum system demand, thus preventing malfunction of the system, due to the pressurised air cushion escaping into the system pipework.
The more recent introduction to booster systems of diaphragm cushion vessels, permitted the use of smaller buffer vessels since this design incorporates a permanent diaphragm to separate the gas cushion from the stored water.
Generally, diaphragm vessel sizing tends to be arbitrary and invariably the duty pump will operate more frequently than is economically ideal, relying on a minimum run timer to control the number of starts.

The principle of stored pressurised water to accommodate variable system demands economically, relies on sizing the diaphragm vessel to control the pump running cycle within an acceptable frequency of pump starts.
Any compromise on diaphragm vessel size, based on, for example, initial cost or plant room space will result in a reduction in stored pressurised water and subsequent increase in pump starts.
The pump may then be run on minimum run timer control irrespective of system demand.

Vessel Sizing

Whilst standard pumpsets, depending on demand, may frequently rely on operation of the minimum run timer, the optimum diaphragm vessel volume, to control pump running, can be calculated according

$$V = 1080.\frac{Q}{n} \quad \frac{(P\ out + P\ a)}{(P\ out - P\ in)} \quad \text{litres}$$

where V	=	total vessel volume - litres.
Q	=	flow rate - litres per second.
P out	=	cut out pressure - bar g.
P in	=	cut in pressure - bar g.
P a	=	atmospheric pressure = 1 bar.
n	=	number of permissible pump starts per hour.

Clearly, it can be seen that the vessel size is substantially effected by the pressure differential (P out - P in) and the pump start frequency (n).

Typical Selection Example

The selection of the most practical vessel size, taking into account , flow rate, pressure differential, pump start frequency, initial cost and economy may be best illustrated using an example as follows -

Design flow rate	2.2 litres per sec.
Static height	31 metres.
Outlet head	10 metres.
System head loss	5 metres.
Minimum inlet head	3 metres.

Thus, ***Total head*** = 31 + 10 + 5 - 3 = ***43 metres.***

Demand Sized Vessel

The optimum vessel size, to control the pump running cycle economically, can be calculated using the formula previously shown, where -

Q	=	***2.2 litres per sec.***
P out	=	***5.0 bar.***
P in	=	***4.0 bar.***
N	=	***20 starts per hour,*** at the maximum probable demand.

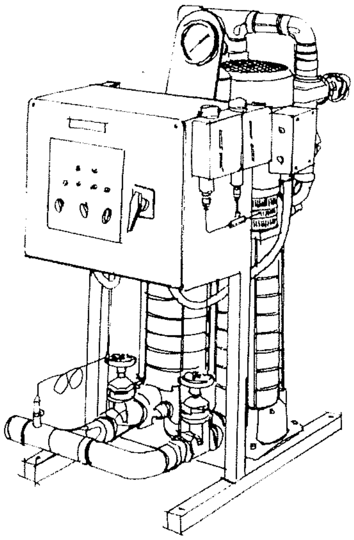
Thus, vessel volume $V = 1080.\frac{2.2}{20} \quad \frac{(5 + 1)}{(5 - 4)}$ litres

V = 713 litres.

The nearest practical vessel size can be selected from the Expak diaphragm vessel section of our literature.

SYSTEMS

Fire Hose Reel Boosters



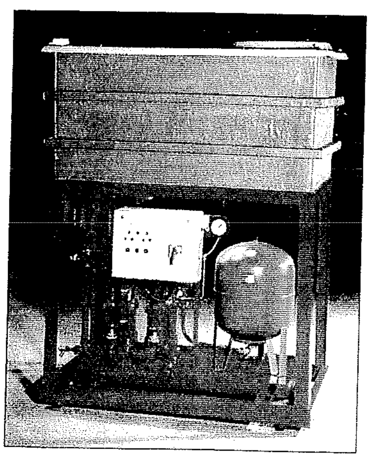
Fire hose reel pumpsets to automatically boost the water supply pressure to fire extinguishing, hose reel , installations

- In compliance with British Standard code of practice BS 5306 Pt. 1 and local Fire Brigade regulations.
- Intermittent automatic boosting controlled by pressure control switch, buffer diaphragm vessel and minimum run timer.
- Duplicate, duty and standby pumpsets arranged to operate in sequence support. The standby will operate automatically in the event of the duty pump failing to start.
- Integral controls with low water pump protection and terminals for remote alarm.
- Optional, overhead suction tank.

Selection Considerations

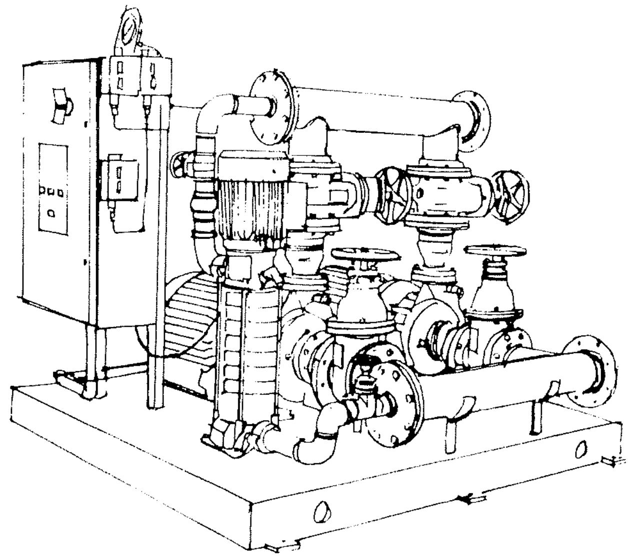
Two pump, duty and standby operation	●
Automatic standby, on failure of duty pump	●
Buffer, diaphragm cushion vessel	●
Integral controls	●
Terminals for remote alarm to indicate operation of pumpset	●
Overhead suction tank minimum capacity 1125 litres (BS 5306 Part 1)	○
Enhanced custom controls	○

● Standard ○ Optional



A typical fire hose reel booster system, with overhead suction tank in compliance with British Standard code of practice BS 5306 Pt. 1.

Wet Riser Main, Boosters



Wet riser main sets to automatically boost the water supply pressure to fire extinguishing, wet rising main, installations.

- In compliance with British Standard code of practice BS 5306 Pt.1.
- Intermittent automatic jockey pump controlled by pressure control switch, buffer diaphragm vessel and minimum run timer.
- Duplicate, duty and standby pumpsets arranged to operate in sequence. Optional duplicate electric driven, or duty pump electric driven and diesel driven standby to suit site power supply arrangements. The duty pump will operate, whilst the excess of a predetermined minimum flow rate is required. The standby will operate automatically in the event of the duty pump failing to start.
- Integral controls with low water pump protection and terminals for remote alarm.

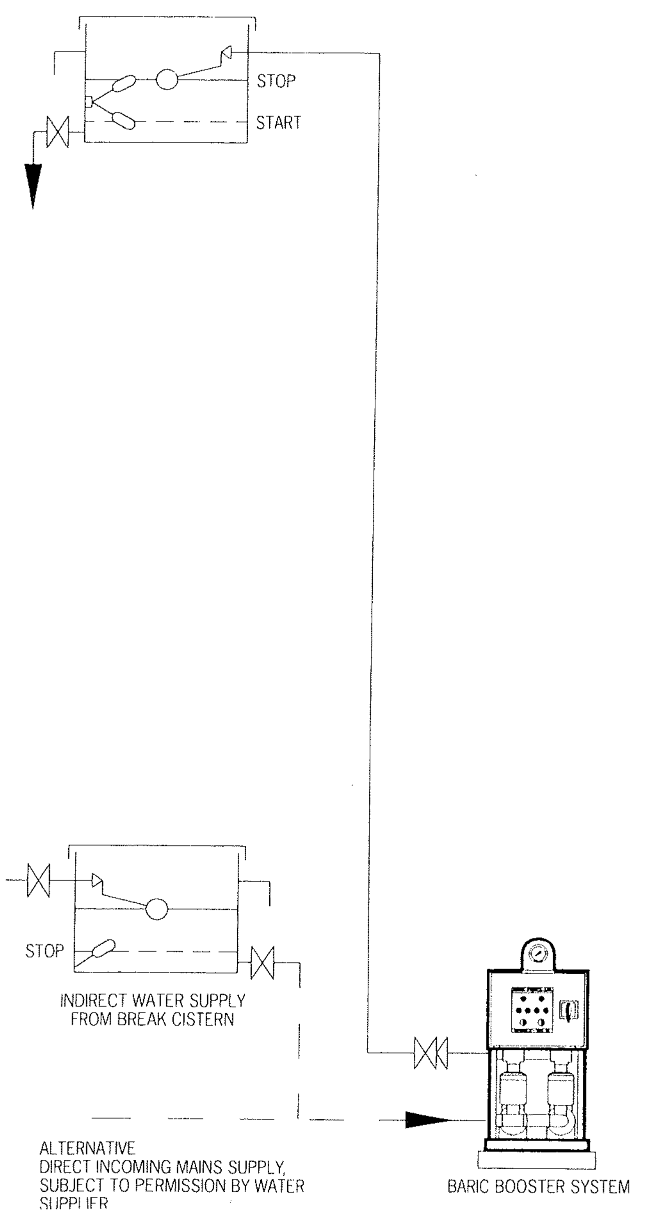
Selection Considerations

Two main electric driven pumpsets, duty and standby operation	●
One electric driven duty, one standby diesel driven pumpset	○
Automatic standby, on failure of duty pump	●
Automatic electric driven jockey pump, pressure switch control	●
Buffer diaphragm cushion vessel	●
Integral controls	●
Terminals for remote alarm to indicate operation of pumpset	●
Enhanced custom controls	○

● Standard ○ Optional

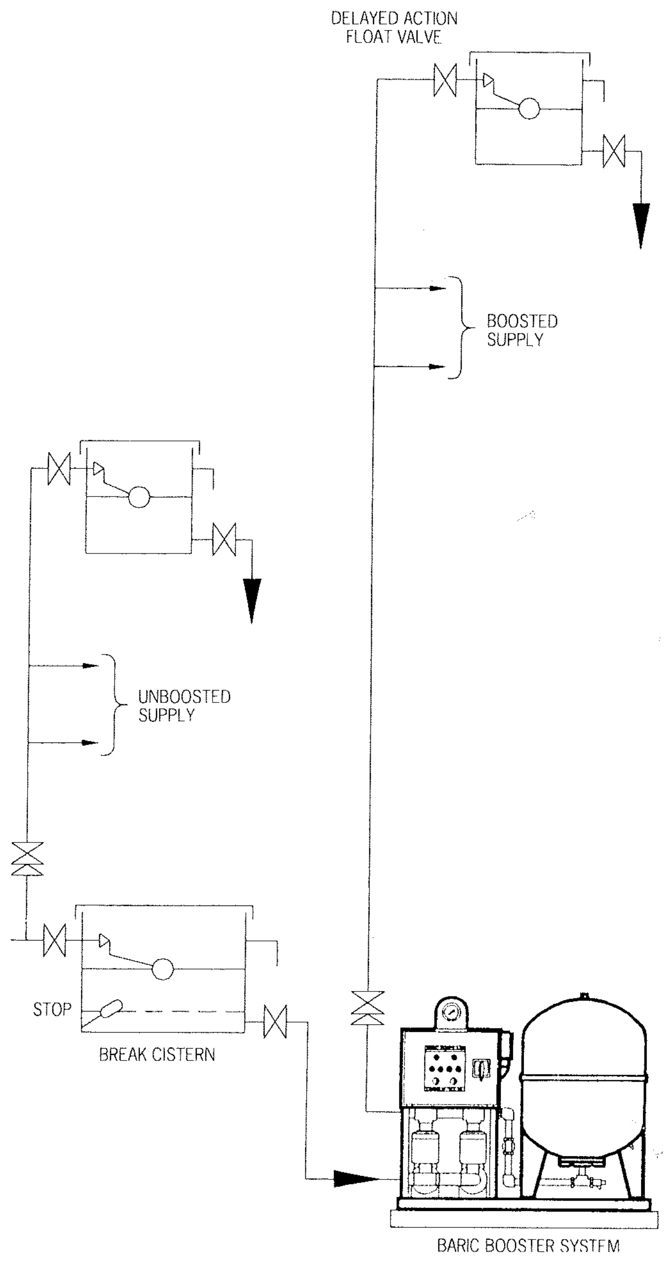
Typical Installation Arrangements

Typical Indirect or Direct Boosting to Storage Cistern



The water level in the overhead storage cistern is controlled by means of a level switch controlling the duty pump.
When the level drops to a predetermined level, the pump will start and then stop when the water level rises to approximately 50mm below the float operated valve shut - off level.
A level switch positioned in the water supply break cistern will protect the booster pumps in the event of a low water condition. Alternatively, an integral low water device will be included within the booster pumpset for this purpose.

Typical Indirect Boosting with diaphragm vessel



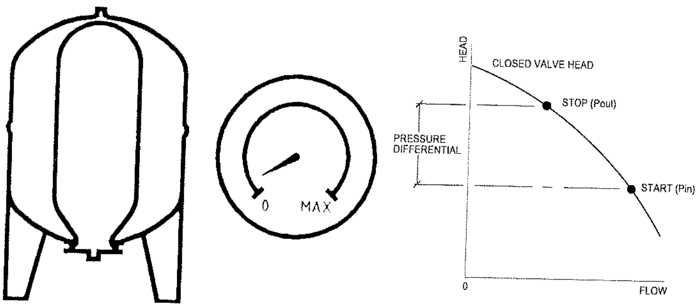
As stored pressurised water is drawn from the diaphragm vessel, on system demand, the duty pump will operate automatically when the system pressure drops to a predetermined value.
As the demand reduces, the vessel storage will be restored and the pump will then stop on pressure switch control. The pump may run at closed valve condition, on minimum run timer control, depending on the size of vessel selected. A level switch positioned in the water supply break cistern will protect the booster pumps in the event of a low water condition. Alternatively, an integral low water device will be included within the booster pumpset for this purpose.

Within the scope of these schematics it is not our intention to cover a particular design, nor cover particular statutory or local requirements.

Demand Sized Vessel

By calculating the vessel size at the maximum probable demand, the duty pump will operate between predetermined start and stop pressure positions, only running whilst required.
The designer has control over operating pressure differentials and the frequency of pump starts, whilst meeting variations in demand economically.

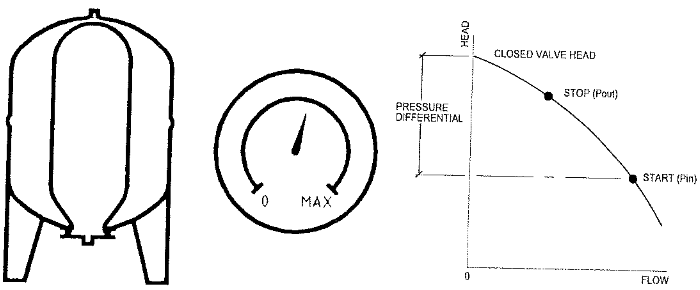
Relationship between demand sized vessel and minimum run timer setting.



Standard Sized Vessel

By selecting a smaller diaphragm vessel, a reduced quantity of stored pressurised water will be available, which will satisfy lower demand periods, however, it will be necessary to supplement control over the frequency of the pump starts by the appropriate minimum run timer setting. The pump may then run on timer control, at closed valve condition, irrespective of demand.

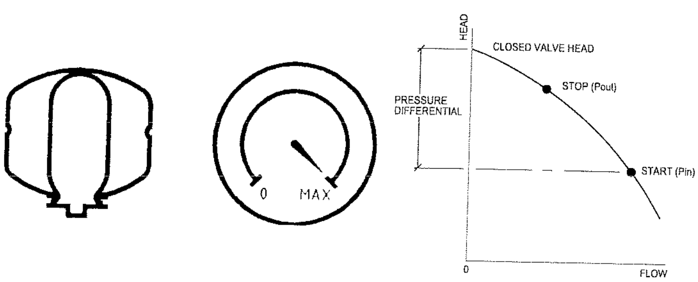
Relationship between standard sized vessel and minimum run timer setting.



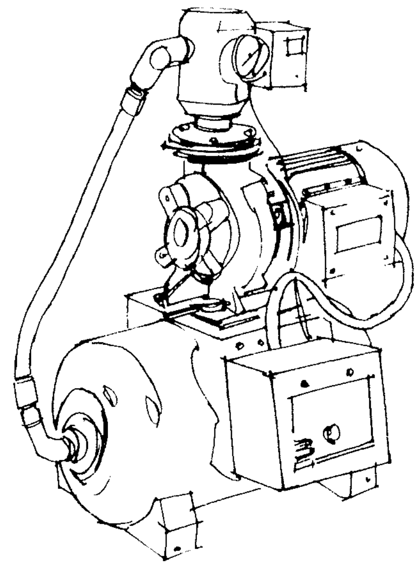
Buffer Sized Vessel

Whilst a small buffer diaphragm vessel will store only a small quantity of pressurised water, it will assist in the reduction of pump start and stop pressure bounce.
It will be necessary to control the pump running cycle by setting the minimum run timer to ensure an acceptable pump start frequency. The duty pump will continue to run on timer control irrespective of demand. Under zero demand conditions the pump will run at closed valve pressure.

Relationship between buffer sized vessel and minimum run timer setting



Single Pump, Intermittent Run Boosters



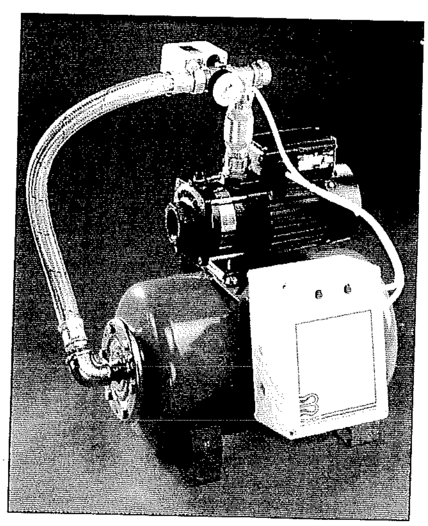
Factory assembled, automatic single pump booster systems, with diaphragm cushion vessel.

- Compact, single pump booster system, arranged for automatic operation at preset pressure settings.
- Intermittent automatic boosting controlled by pressure control switch, buffer diaphragm vessel and minimum run timer.
- Integral auto-pump controller.

Selection Considerations

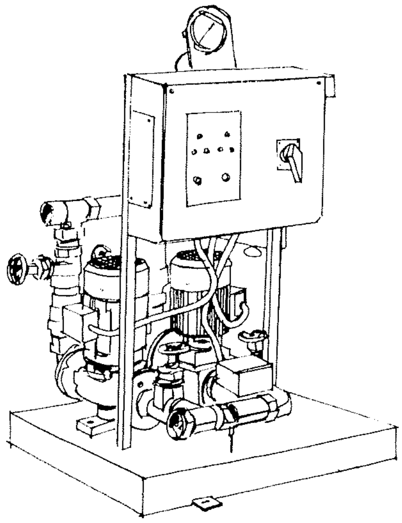
Single pump	●
Automatic, pressure switch control	●
Buffer, diaphragm cushion vessel	●
Auto-controller with minimum run timer	●
Demand sized diaphragm cushion vessel	○
Enhanced custom controls	○

● Standard ○ Optional



Typical single pump booster system

Constant and Intermittent Run Boosters



Factory assembled, constant run or automatic intermittent run, booster systems, incorporating two, three or four pumps, depending on the method of operation

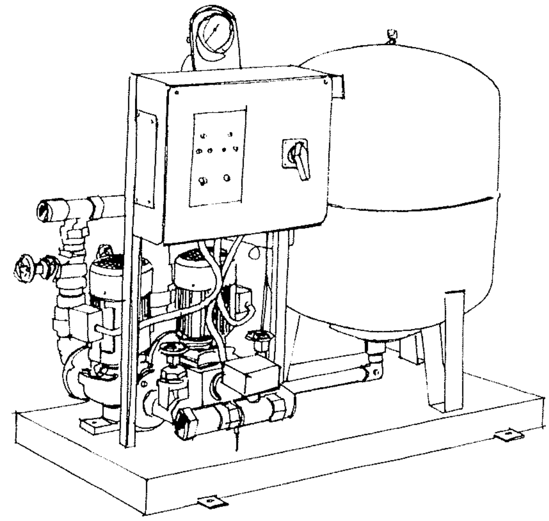
- Boosting to main storage cistern or cisterns controlled by level switches or electrodes.
- Boosting to drinking water header controlled by pipeline level switch.
- Intermittent automatic boosting controlled by pressure control switch, buffer diaphragm vessel and minimum run timer.
- Two pumpsets arranged as duty and standby or duty and support operation.
- Three and four pumpsets arranged as duty and sequence controlled support to share the total system demand.
- Integral controls with low water pump protection.

Selection Considerations.

	Booster Type	
	Constant Run	Intermittent Run
Two Pump, duty and standby operation	●	●
Two Pump, duty and auto support operation	○	○
Automatic, level switch control	●	
Automatic, pressure switch control		●
Three or four pumpsets arranged for duty and sequence support		○
Buffer, diaphragm cushion vessel and minimum run timer		●
Integral controls	●	●
Enhanced controls	○	○
Variable speed control	○	○

● Standard ○ Optional

Intermittent Run Booster, With Diaphragm Cushion Vessel



Factory assembled, combination base mounted, automatic booster systems incorporating two, three or four pumps and diaphragm cushion vessel.

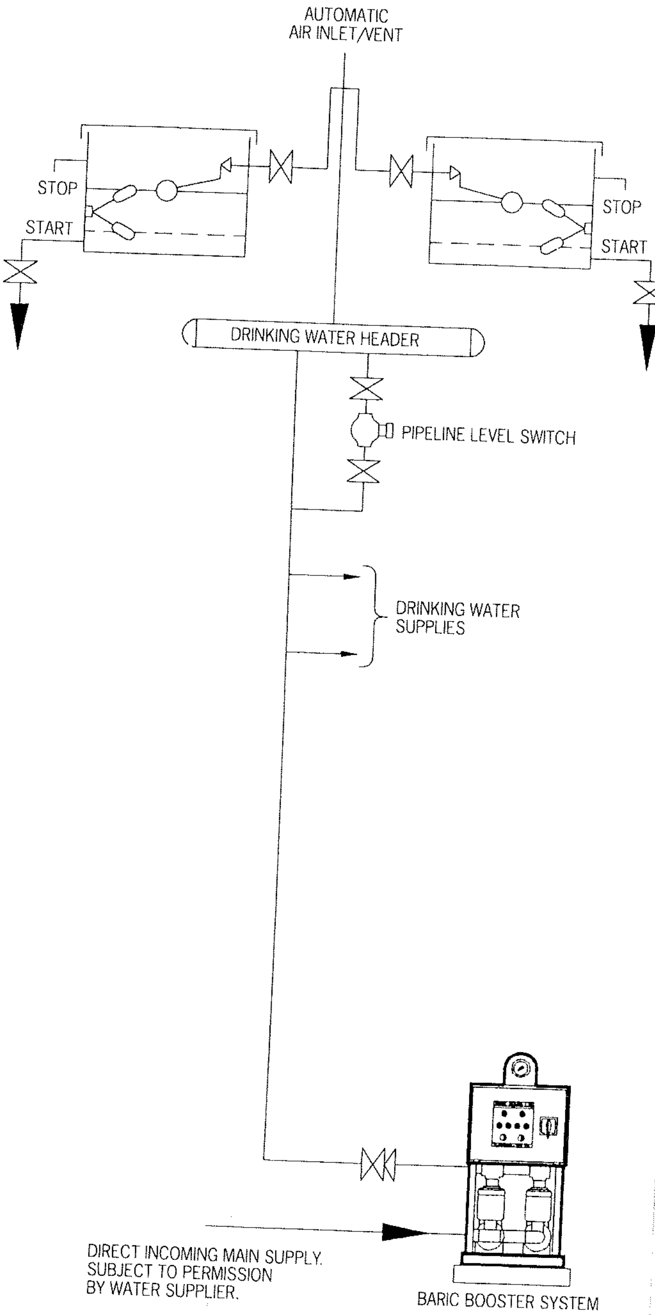
- Intermittent automatic boosting, controlled by pressure control switch, diaphragm cushion vessel and minimum run timer.
- Diaphragm cushion pressure vessel provides a reservoir of pressurised water, and depending on the size of vessel selected controls the pump running cycle. An adjustable minimum run timer is included to ensure the optimum running cycles.
- Two pumpsets arranged as duty and standby or duty and support operation.
- Three and four pumpsets arranged as duty and sequence controlled support to share the total system demand.
- Integral controls with low water pump protection.

Selection Considerations

Two pump, duty and standby operation	●
Two pump, duty and auto support operation	○
Automatic, pressure switch control	●
Three or four pumpsets arranged for duty and sequence support	○
Standard diaphragm cushion vessel and minimum run timer	●
Demand sized diaphragm cushion vessel	○
Integral controls	○
Enhanced custom controls	○

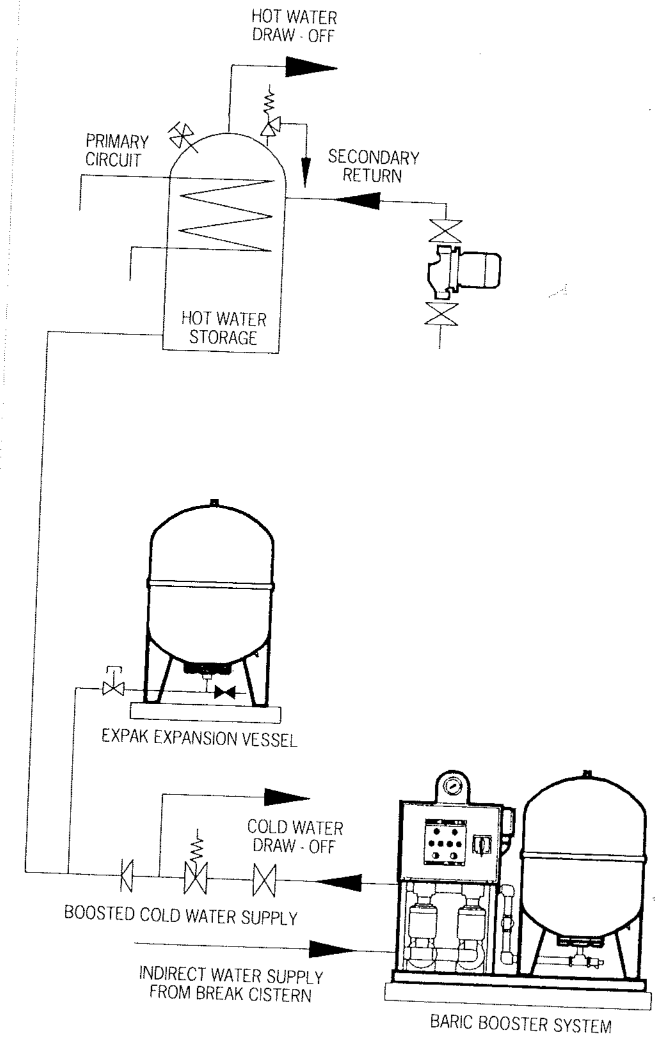
● Standard ○ Optional

Typical Direct Boosting with Header and Storage Cisterns



The duty pump is controlled by a drop in water level from the drinking water header and by level control within the storage cisterns.
When the header pipe starts to empty, a pipeline level switch with minimum run timer control, will start the pump.
If the header is filled before the timer period ends, excess water will be discharged into the cisterns, or the pump will run at closed valve condition if the float valves are closed.
The booster pumps should be protected, in the event of a low water condition at the pumpset inlet.

Typical Indirect Boosting Hot Water Supply System



As stored pressurised water is drawn from the diaphragm vessel, on system demand, the duty pump will operate automatically when the system pressure drops to a predetermined value.
As the demand reduces, the vessel storage will be restored and the pump will then stop on pressure switch control. The pump may run at closed valve condition, on minimum run timer control, depending on the size of vessel selected. The booster pumps should be protected, in the event of a low water condition at the pumpset inlet.

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