BLACKHALL
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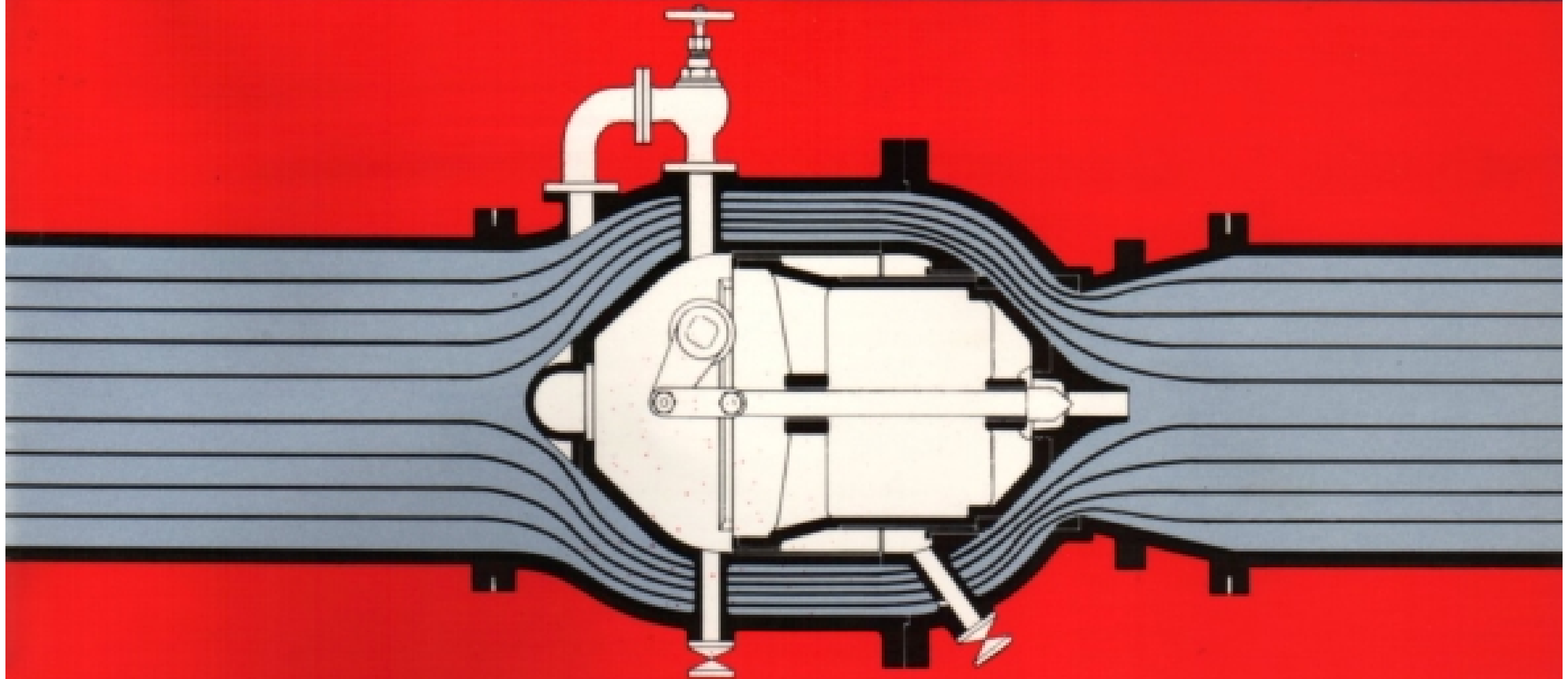
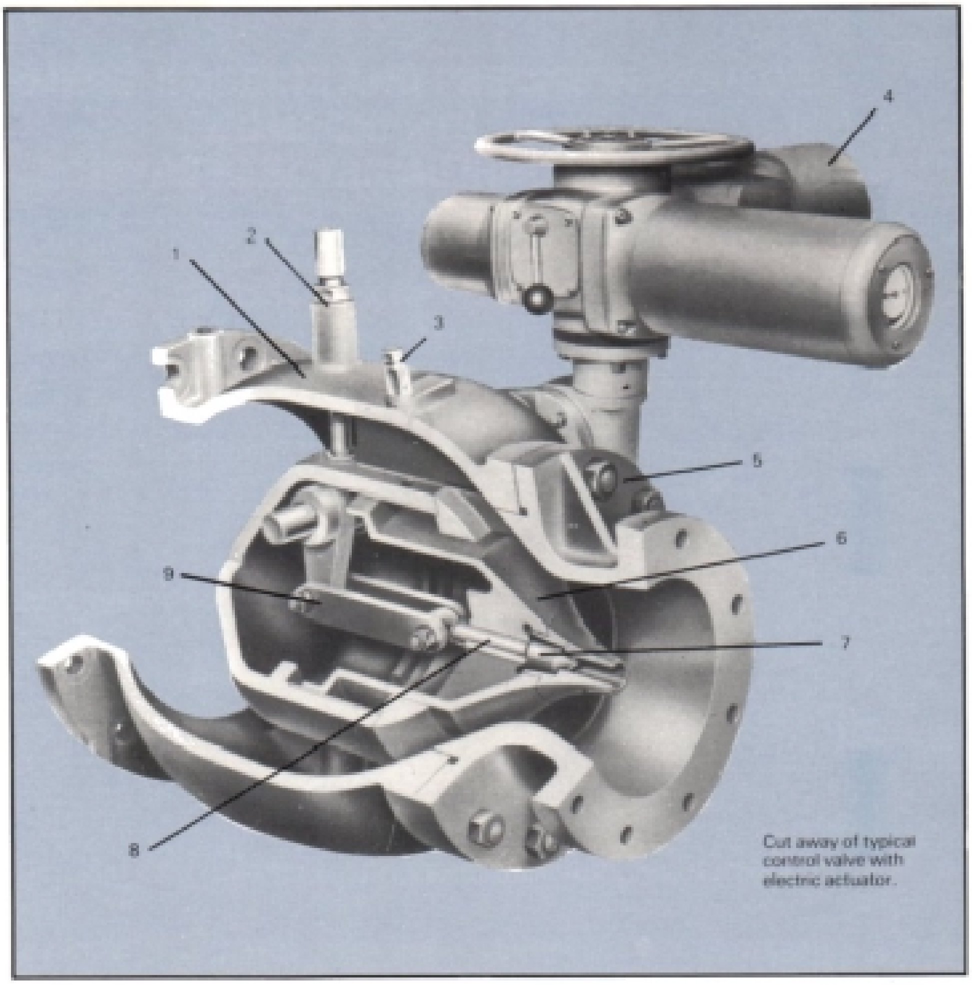
BLAKEBOROUGH

LARNER-JOHNSON VALVE





Cut away of typical control valve with electric actuator.

1 Body
2 Adjustable pressure supply to central chamber
3 Air valve
4 Electric actuator
5 Discharge section
6 Plunger
7 Pilot valve
8 Pilot valve stem
9 Lever operating mechanism

CONTENTS

INTRODUCTION

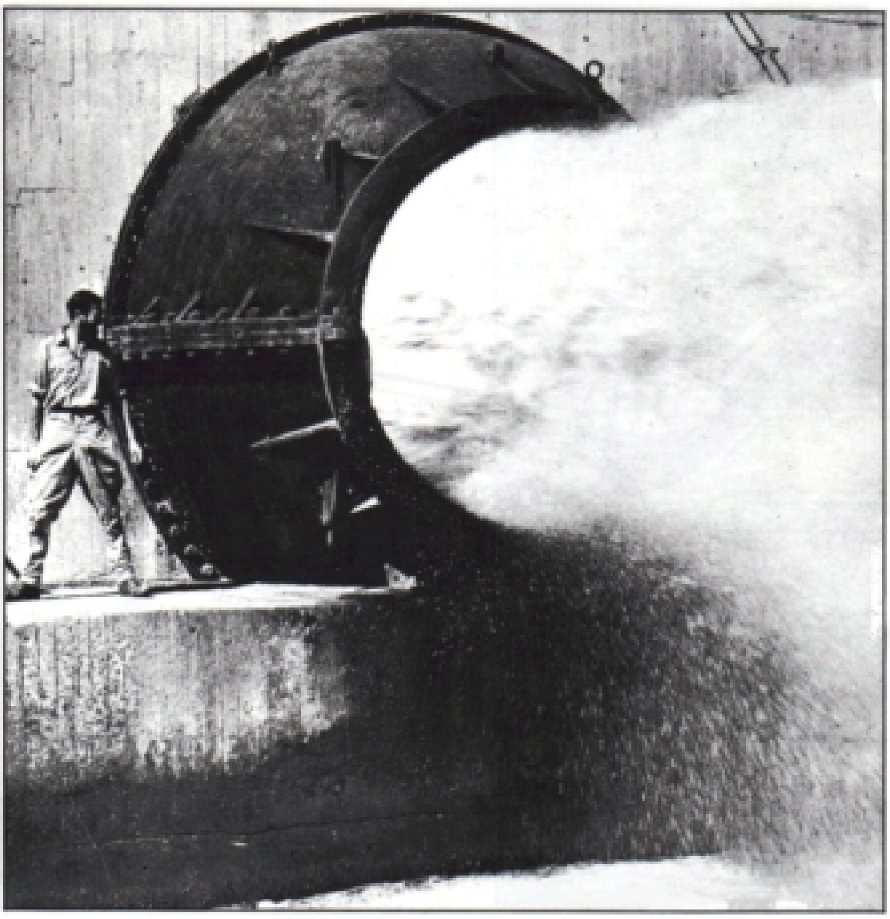
The Larner-Johnson valve was originally developed for use on hydro-electric power plants in the U.S.A., where it pioneered the application of the needle valve principle to the problems of flow control in pipelines and conduits.

J. Blakeborough & Son Ltd.'s interest in the Larner-Johnson valve began in the early 1920s. The association was consummated in 1937 when Blakeboroughs obtained manufacturing and selling rights of the patents. Extensive development work was carried out at this point laying down sound technical foundations, which were to prove the product time and again.

Blackhall Engineering Ltd., in 1989, purchased the sole manufacturing and intellectual rights for the Larner-Johnson valve when Blakeboroughs closed. To date, the design has been applied to almost all the principle valve duties, resulting in the series of manual, power-operated and self-acting types set out in the following pages.

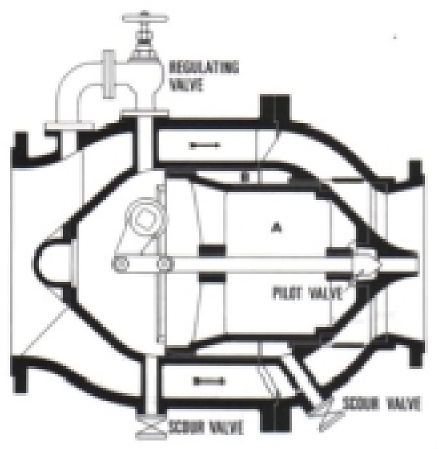
Thousands of installations have been carried out, covering the widest range of sizes, duties and conditions, and providing ample evidence of a capacity for sustained high level performance.

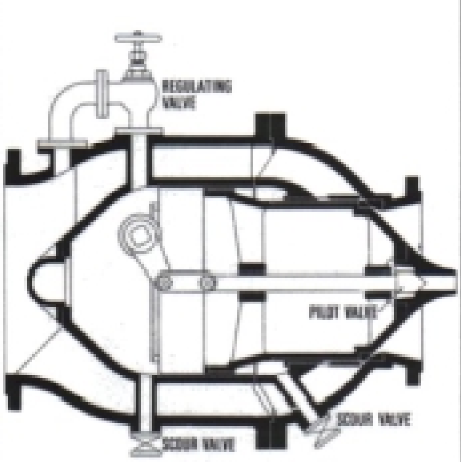
152mm inlet x 76 mm outlet Larner-Johnson Float Valve on inlet to break pressure tank. This valve was installed in 1932 and has given continuous service without attention (barring dismantling for inspection and cleaning on one occasion during alterations to the system).



4 metres inlet x 2.25 metres outlet diameter Larner-Johnson regulator discharging in half open position under a running head of 30 metres. One of seven units on a river regulation dam.

OPERATION





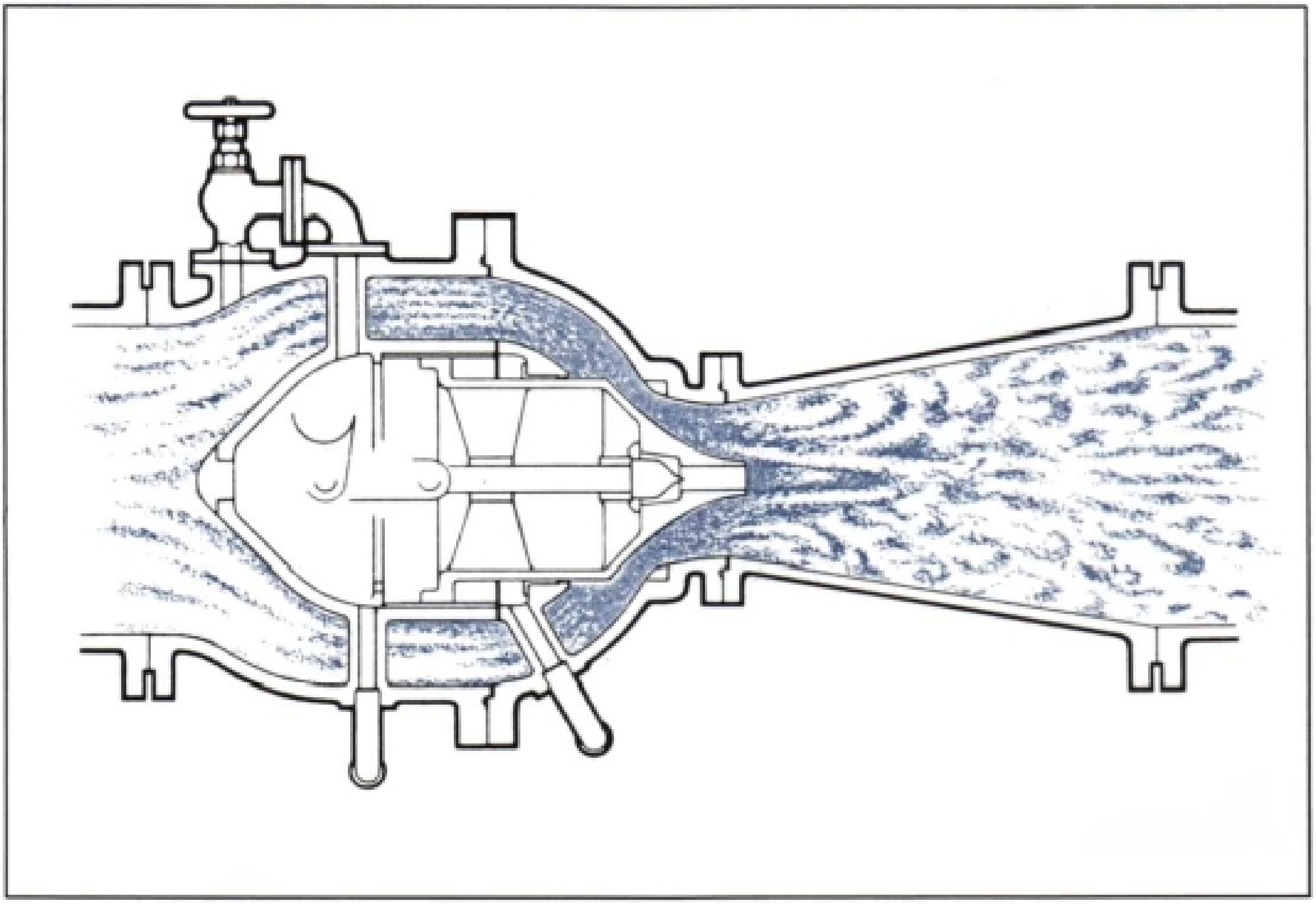
The operating force is obtained from the line pressure in the valve body and is governed by an internal pilot valve, which opens or closes an orifice in the plunger nose. The plunger is shaped to form two chambers, A and B, which receive a continuous supply of pressure water from the valve body - the first through a regulating valve, and the second through clearance round the plunger. The regulating valve is adjusted so that the water entering the plunger is less than the discharge capacity of the fully-open pilot valve.

The throat of the valve is of smaller diameter than the inlet so that the velocity is greatest and the pressure is lowest in the region of the plunger nose.

The static pressure on the downstream or outer face of the plunger is thus lower than the pressure admitted through the regulating valve to the chamber A, and, if the pilot valve is closed, pressure builds up in the plunger and causes movement in the closing direction. When the pilot valve is opened, the discharge from the orifice exceeds the supply to the chamber A, and the pressure in the latter falls to the downstream value. The pressure in the annular chamber B is not sensibly affected and thus creates an unbalanced force moving the plunger in the opening direction. When the pilot valve is halted, the plunger stops in a position giving balance between the hydraulic forces on its inner and outer faces.

In the case of pipeline valves the outlet is provided with a taper pipe, as shown on page 4. This converts the high velocity energy at the throat back into pressure with only a slight loss.

Chambers A and B are usually provided with blow-off ports for removing any silt deposits which might accumulate if the valve remains unoperated for long periods. These connections can also be used to obtain auxiliary operating force if the plunger tends to stick for any reason. Slight opening of the blow-off from chamber A lowers the pressure in this chamber and creates an extra opening force. Similarly the pressure can be reduced in chamber B to obtain extra closing force. Normally the blow-off valves would never need to be fully opened for this purpose, but considerable hydraulic forces are actually available if ever required. Smaller valves may only have one blow-off connection, this being on chamber A.



GENERAL CHARACTERISTICS

Strength and Compactness

The simple circular cross-sectional form is the most favourable for resistance to distortion. Working stresses can be calculated on the basis of well-established formulae for circular shells, and the valve can thus be designed with certainty for any size or pressure.

The valve is highly compact in vertical and lateral dimensions.

Leak-proof Closure

When seating and unseating, the faces on body and plunger meet and part cleanly, there is no relative movement with the surfaces in contact. The absence of friction and wear, coupled with freedom from risk of distortion and the fact that when shut the plunger is held by line pressure, means that once ground in in the normal way the valve will remain tight.

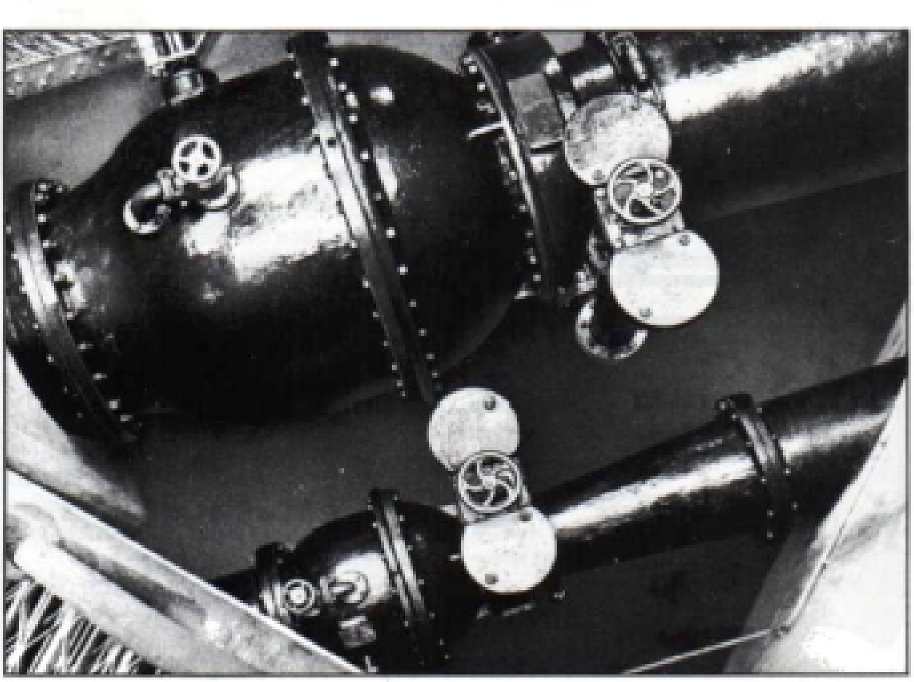
Durability

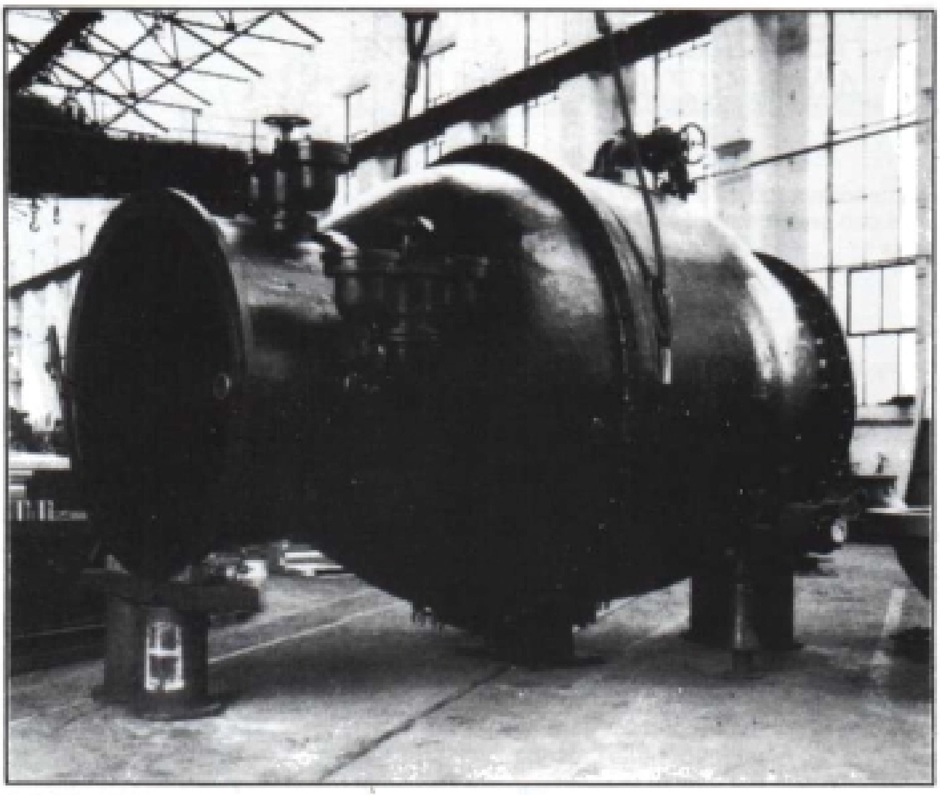
The smooth flow conditions at all stages of opening minimize erosion, cavitation and vibration. Wear and tear are negligible due to the relatively small operating forces, the absence of sliding contacts under pressure (except for the effective weight of the plunger riding on its guides) and the freedom from vibration. All internal operating mechanism is located in the internal chamber, where there is no appreciable flow.

Ease of Operation

The pilot control makes the valve the easiest of types to operate by hand, and simplifies the arrangement of power drive and self-acting mechanisms where these are required. *No by-pass is necessary for balancing purposes.*

915 x 760 mm and 460 x 270 mm Larner-Johnson regulators on reservoir draw-off; one of two pairs supplied for duplicate control houses. Maximum static head 36 metres.





A 1500 x 1300 x 1500 mm Larner Johnson motor operated regulator complete with air belt/Africa.

APPLICATION

The valve is essentially for liquid service. Its principle application is the control of water, but there is also a regular demand from industrial sources, and from the petroleum field for oil service.

Although available in certain sizes and adaptations on a standardized basis, the valve is obviously not an 'off the shelf' proposition for indiscriminate use. Employed selectively, however, where enhanced durability, safety and smoothness of control are important, it can prove a profitable investment.

We shall be glad to advise on the prospects for any particular duty, given the relevant data.

MATERIAL SPECIFICATIONS

Valves are of high grade manufacture throughout. Materials are carefully selected for the service conditions and checked in our own chemical and mechanical laboratories to maintain set standards of quality.

Cast Iron

For bodies and larger plungers. High-duty iron by the 'Meehanite' process corresponding to B.S. 1452 Grade 220. The superior qualities of 'Meehanite' in toughness, density and consistency render it eminently suitable for pressure castings.

Cast Steel

Alternative for bodies and plungers under special conditions. Normally a plain carbon steel to B.S. 1504-161-Grade 480A.

Stainless Steel

For pilot valve, pilot valve stem, operating shaft, linkage pins, and in special cases for seat rings. To B.S.970 431-S29 combining high strength and hard-wearing corrosion-resistant properties. (Where stainless steel components are in working contact with each other, types with suitably differentiated properties are used to prevent galling.)

Gunmetal

For bushes, liners, seat rings, and the smaller valve plungers. Normally to B.S.1400-LG2 but alloys of other compositions can be substituted according to requirements.

Aluminium Bronze

For pilot valve and stem. To B.S. 2874-CA-104. A high strength bronze with special corrosion resistant properties.

High Tensile Brass

Sundry trim components in certain sizes. To B.S.2874-CZ-114.

HEADLOSS AND SIZING

The headloss across a Larner-Johnson valve can be expressed in the following terms

$$H = K \frac{V^2}{2g}$$

where K = Headloss coefficient
H = Headloss in metres (or feet)
V = Inlet velocity in m/s (or ft/s)
$g = 9{\cdot}81\ m/s^2$ (or $32{\cdot}2\ ft/s^2$)

The values of the headloss coefficient have been established over the years, and in the smaller sizes have been confirmed by flow laboratory tests. Account is taken of the substantial recovery of head in the outlet taper pipe which is normally fitted for smooth transition from throat to line diameter.

Experience has shown that for general purposes the most favourable balance of advantage in the way of plunger control, flow control, and headloss is obtained with a throat diameter equal to about half the inlet. As far as possible this 2:1 ratio is adopted as regular practice. To facilitate sizing of valves of these proportions, in throat diameters up to 380 mm, use may be made of the nomograms on page 7.

If necessary, smaller ratios may be employed, of the order of, say, 3:2 or 4:3, and one result of this is to reduce the headloss across the valve, which is the benefit usually sought. On the other hand, by the same process the flow control characteristic tends to be disturbed, and effective regulation confined to a shorter portion of the stroke. The consequences are not critical, however, and the valve remains an eminently practical proposition for most requirements.

To find the headloss across valves of such ratios, the formula given above can be used in conjunction with charts 1 and 2. These can also be used for sizing purposes. Given inlet velocity (V) and overall valve headloss under maximum flow conditions (H), insert these in the formula above to obtain the value of K, which may then be used in conjunction with the inlet diameter to find the throat diameter from the appropriate chart.

Note
Valves should always be sized for the maximum flows required at the time. The practice of installing a valve of larger capacity to cover possible future increases in demand is a frequent cause of unsatisfactory performance through loss of sensitivity in control.

It is preferable to provide for higher flows when the need arises, by installing a replacement valve appropriate to the changed conditions.

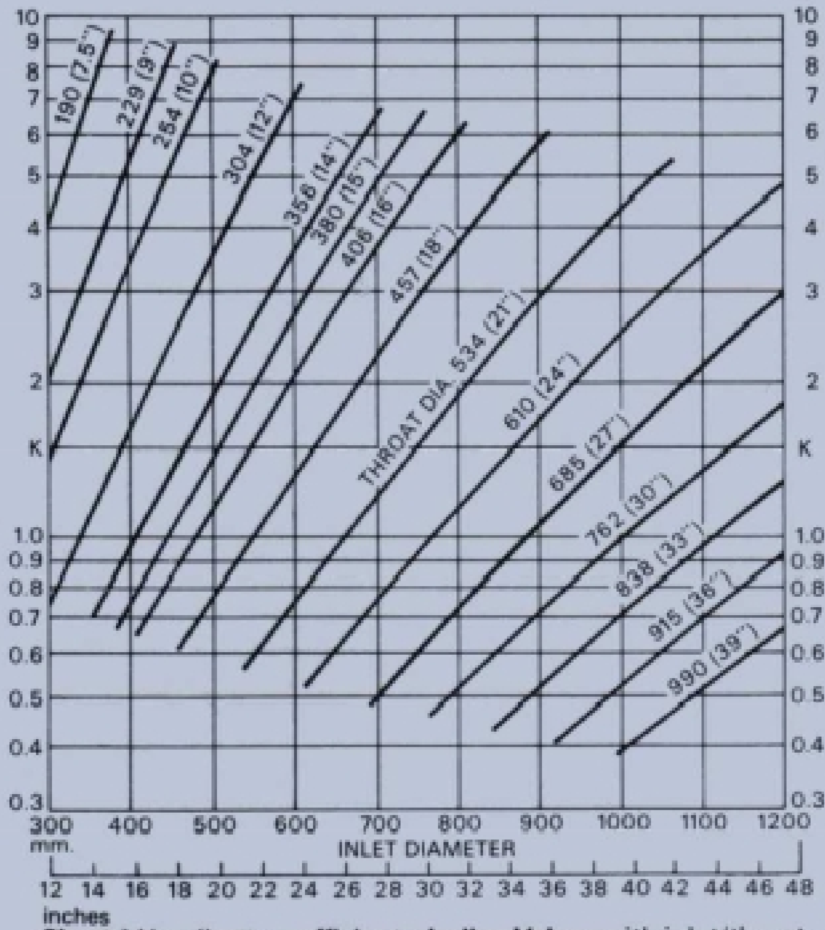


Chart 1 Headloss co-efficients. **In-line Valves** with inlet/throat ratios less than 2:1, except those with air belt or cavitation".

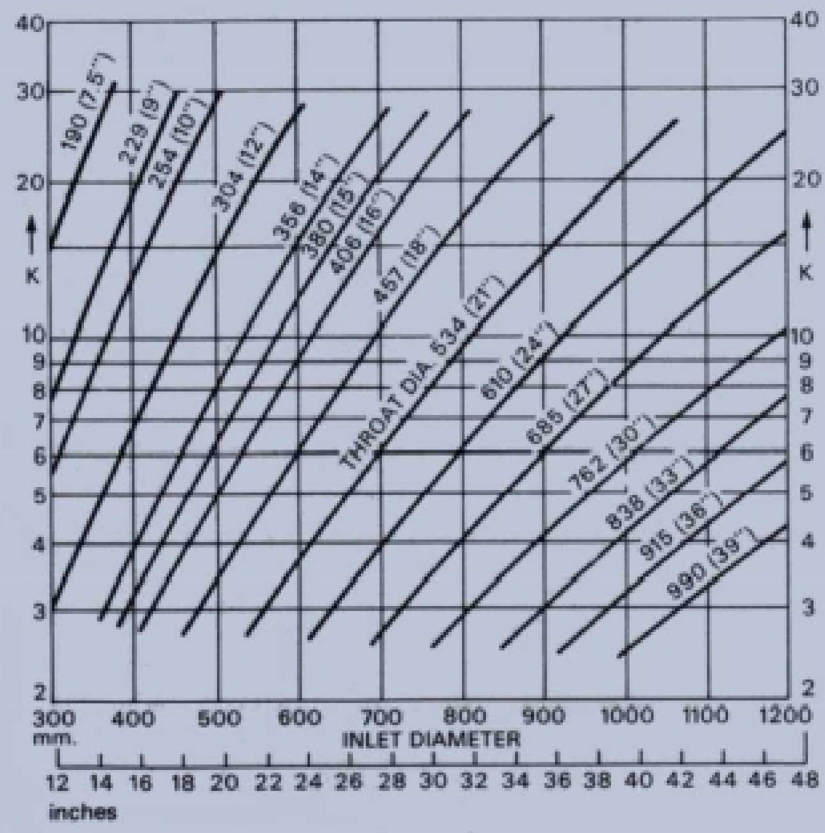


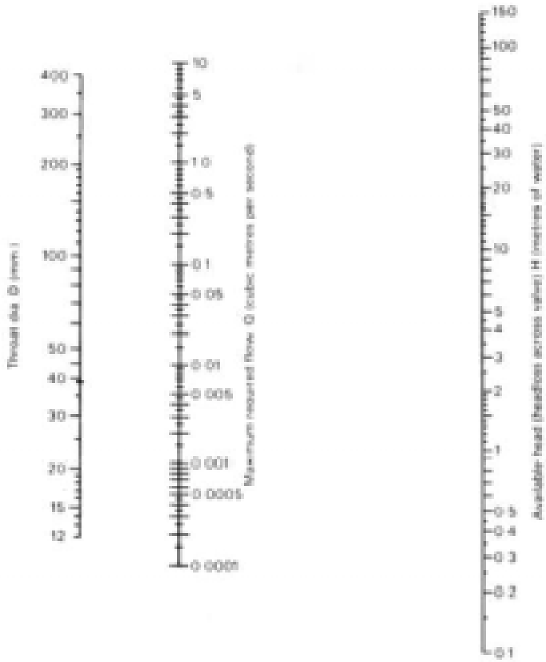
Chart 2 Headloss co-efficients. **Free Discharge Valves** with inlet/throat ratios less than 2:1. except those with air belt or cavitation.

Sizing Nomograms Valves with 2 to 1 inlet to throat ratio only.

In-line Valves except those with air belts.
(i.e. valves in which the throat runs full. There must be no cavitation or air drawn into the throat).

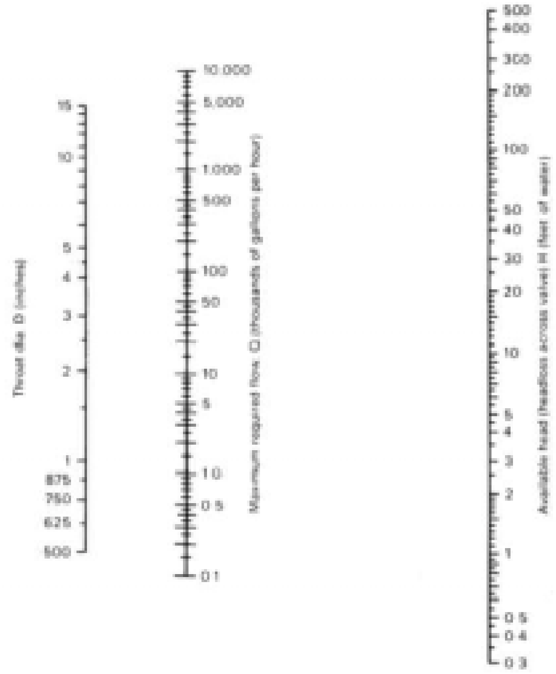
A1. Metric Units

Basic formula: $D = 420\left[\frac{Q}{\sqrt{H}}\right]^{0.441}$



A2. Imperial Units

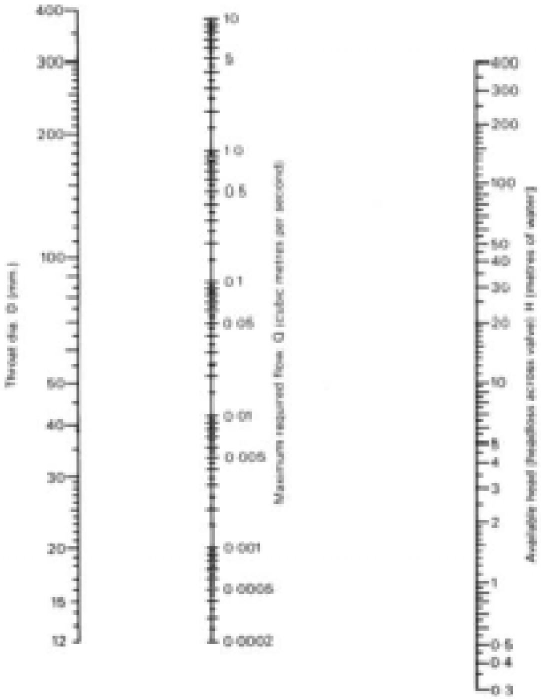
Basic formula: $D = 1.131\left[\frac{Q}{\sqrt{H}}\right]^{0.441}$



Free Discharge Valves and valves with air belts.
(i.e. Valves with very short outlet pipe where air may be present in the valve throat. See notes on page 8 for valves with air belts and cavitating valves.

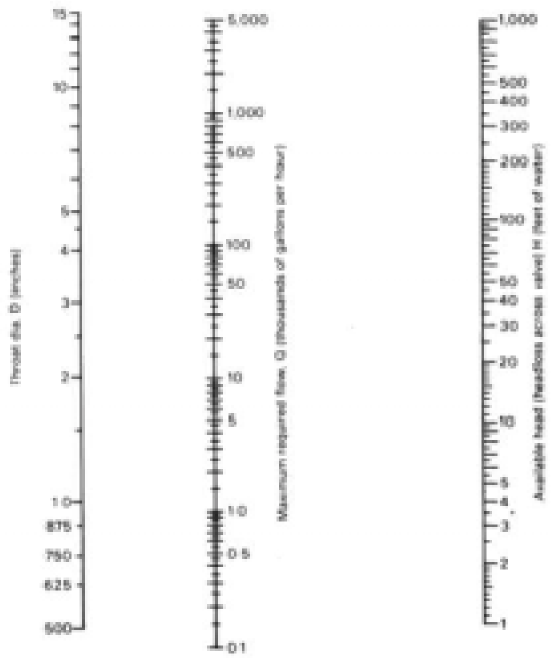
B1. Metric Units

Basic formula: $D = 605\left[\frac{Q}{\sqrt{H}}\right]^{0.482}$



B2. Imperial Units

Basic formula: $D = 1.267\left[\frac{Q}{\sqrt{H}}\right]^{0.482}$



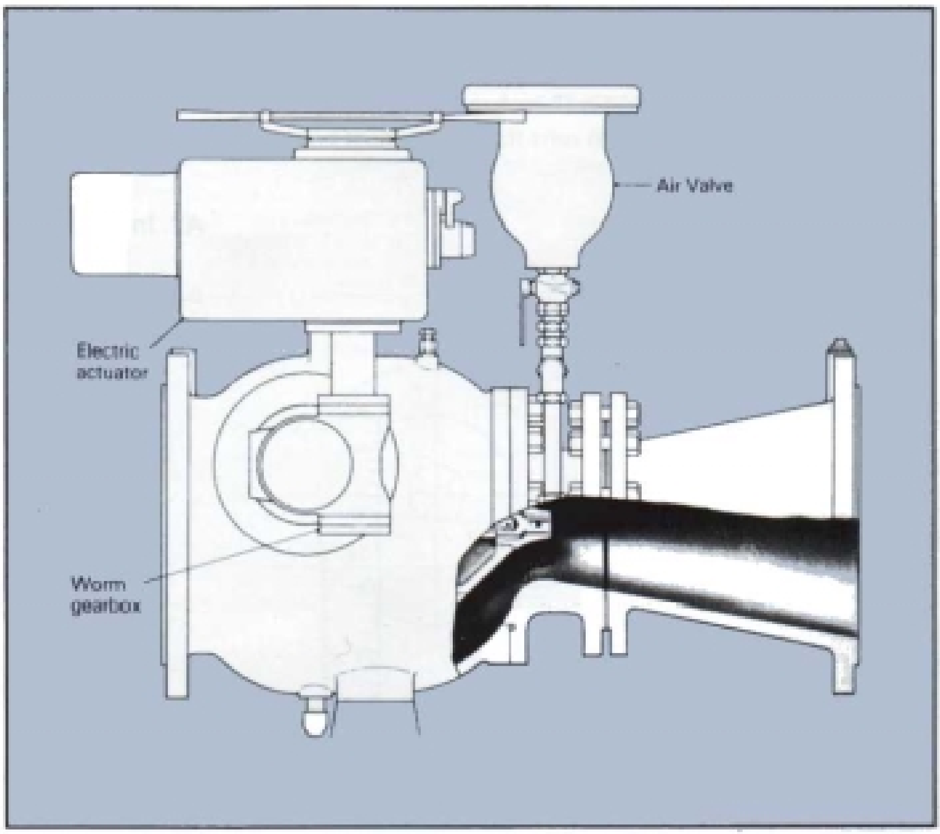
CAVITATION

What is Cavitation?

When water squeezes through a reduced area as in a throttled valve, its velocity increases and its pressure falls. Changes of velocity and pressure can also occur when the stream lines are unable to follow sudden changes in the direction of the valve walls.

In such circumstances the water pressure may fall to less than the vapour pressure, and minute vapour bubbles form in the low pressure zone. This is known as 'cavitation'.

After passing through this high velocity zone the water decelerates and increases in pressure, as in the outlet taper pipe of the Larner-Johnson Valve. As soon as the pressure rises above the vapour pressure the bubbles disappear. It is their collapse which produces 'cavitation noise'.



When does cavitation occur?

Each type of valve has its own cavitation characteristics, and those of Larner-Johnson valves have been determined by laboratory tests on a range of sizes. These are available when required, but in most cases it is only necessary to make a rough assessment. This is done by comparing the valve headloss, dH, with the inlet head, H. If dH is greater than 0.5H, then cavitation is probable and anti-cavitation measures would be considered. In case of doubt the conclusion would be checked by a full scale cavitation calculation.

It should be noted that a valve may be cavitation-free when open, but cavitation may still occur when the valve is throttled to reduce the flow. The throttled position may be checked for cavitation by comparing H, and dH for the throttled valve. dH must not be more than 0.5H.

Cavitation Damage

The collapse of the cavitation bubbles produces both noise and shock waves. When the bubbles are collapsing near to the valve walls, the shock waves will cause erosion of the metal surfaces, the rate of erosion depending on the intensity of cavitation. The intensity increases (a) with increase of inlet pressure and (b) with increase in pressure drop ratio, dH/H.

Thus the cavitation would be quite light in a valve with 10m inlet head and 6m headloss, but it would be severe in a valve with 100m inlet head and 90m headloss.

Damage is most likely to affect the valve seat and the throat immediately downstream of the seat, also the seat and sloping face of the plunger.

Protection against cavitation

One or more of the following may be employed according to circumstances.

(a) Airbelts

This device is basically an automatic air valve connected to one or more points at the Larner-Johnson throat. When the throat pressure is positive the air valve remains closed, but when the pressure is sub-atmospheric it opens to admit air. Within limits this actually prevents cavitation and reduces noise and vibration. It does so however at the expense of reduced flow capacity and the presence of air in the downstream main. The valve size may be increased to restore the capacity, but the customer must be satisfied that he can accept air in the main. It will probably be acceptable, for example, when the valve discharges almost immediately into a reservoir where the air can escape.

(b) Special Materials

Cavitation resistance is increased if the affected components are constructed in materials that are corrosion-resistant, and hard or tough. Use may be made of stainless steel, aluminium bronze, nickel alloy, deposited hard facings etc.

The noise and vibration would of course still be present, but the service life would be increased.

(c) Sudden Enlargement

The normal outlet taperpipe may be replaced by a sudden step immediately downstream of the main seat. The diameter increases immediately from seat diameter to downstream pipe diameter at this step. Flow through the valve seat discharges down the middle of the outlet pipe in a gradually expanding stream. The cloud of cavitation bubbles is carried away by this stream and does not come into contact with the pipe walls. Noise and vibration may occur, but cavitation damage to the pipe downstream of the seat is avoided.

Valve Sizing - Cavitation and Airbelts

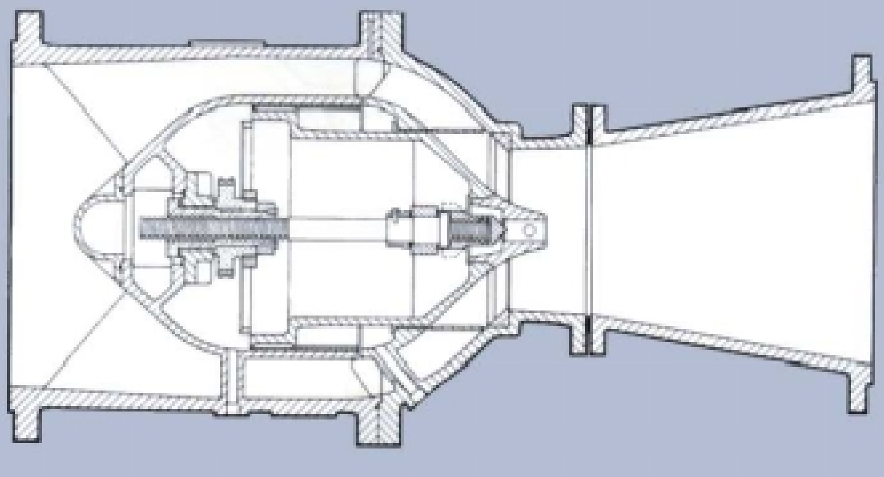
In a normal in-line valve the throat and downstream taper pipe run full of water, giving maximum flow capacity. Such valves are sized from the 'in-line' flow charts on page 6.

In a cavitating valve the throat is partly filled with vapour cavities and the flow capacity is reduced. The more intense the cavitation, the lower the flow capacity becomes, the lower limit being about equal to the flow through a free discharge valve.

If an airbelt is fitted and air is drawn into the throat the valve will also behave like a free discharge valve.

In both these cases if the cavitation occurs or the air is drawn in when the Larner-Johnson valve is full open, the 'free discharge' sizing charts should be used.

It should however be noted that if cavitation is present or air is drawn in only when the valve is throttled, and when full open the valve behaves like an 'in-line' valve, then the maximum flow should be found from the 'in-line' sizing charts.



Type E construction. Fig. 3137

PIPELINE STOP & REGULATING VALVES

The Type 'E' valve, illustrated typically above, is used for this duty. It is available for pipe diameters ranging from a few centimetres up to several metres and while its advantages are most evident in the larger sizes and under high pressures the valve is also well worth considering for smaller units.

Since the valve is pilot controlled, ease and simplicity of operation are ensured without necessity for a bypass even under substantial pressure differentials.

Regulation or throttling of flow involves destruction of pressure energy, and the only way of accomplishing this in a valve is first to convert such pressure energy into kinetic energy and subsequently to dissipate the kinetic energy by impact and turbulence. The first step involves the creation of relatively high flow velocity, and in the Larner-Johnson design this is the only part of the process carried out within the actual valve. Flow passes smoothly through the streamline waterway, accelerates past the conical face of the plunger and discharges in an axial jet, the excess energy being absorbed by turbulence of the downstream water column.

The zone of maximum disturbance is located in the downstream taper piece - a simple length of pipe easily replaced, although in our experience the necessity for this has proved very rare indeed. Compare this with the situation in valves where high velocity and turbulence are concentrated in a more or less tortuous form of waterway, with heavy vibratory and erosive tendencies on the principal valve members.

Operating Gear

Choice of control includes simple handwheel, manual geared or power actuator, and a variety of servo-mechanisms, some examples of which are illustrated on later pages. Self-contained or extension rod/floor column arrangements are available as required.

Drive from the external gear is taken by shaft through the valve body and applied to the pilot valve through an internal mechanism. According to the characteristics required this consists of either (a) worm gear, with revolving nut engaging threads machined on the pilot valve stem, or (b) lever and links, giving full travel with 60° rotation of the shaft. This type of arrangement is employed regularly in valves up to 305 mm x 152 mm bore and selectively in larger sizes.

While in normal circumstances no more is required of the operating gear than to give positive control of the pilot valve, sufficient mechanical advantage is always provided for traversing the plunger 'dry' or under slack water conditions.

Materials for Water Service

Cast iron body with bronze seat ring, and gunmetal liner and guides for the plunger; cast iron plunger with bronze face ring and gunmetal-faced bearing surfaces (or solid gunmetal with integral face according to size); aluminium bronze or stainless steel pilot valve and stem; aluminium bronze machine cut internal worm gear with gunmetal revolving nut (or alternatively, forged bronze lever and links); stainless steel operating shaft working in gunmetal bushed bearings.

For Oil Service

Cast Steel body with deposited hard seat face and plunger guides and stainless steel liner, cast steel plunger with deposited hard seat face; stainless steel or aluminium bronze pilot valve on stainless steel stem; gunmetal revolving nut; aluminium bronze machine cut wormwheel; stainless steel worm and operating shaft working in manganese bronze bearings.

Variations are possible to meet special conditions.

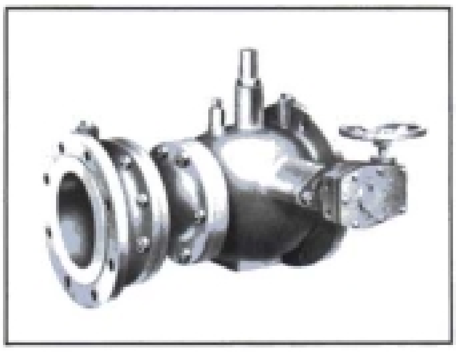
Small Sizes

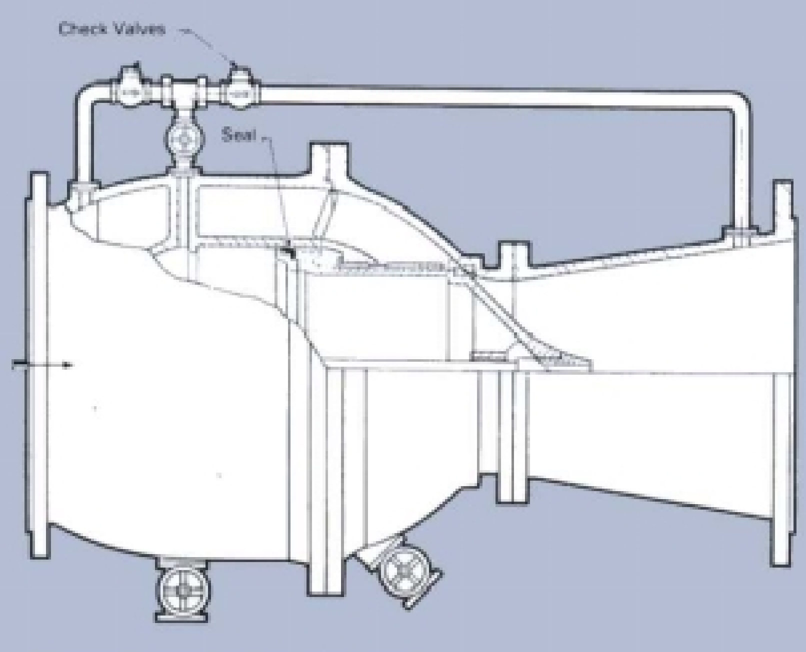
Valves up to 305 mm x 152 mm are available on standardised basis, as tabulated on Page 10. Operation is by external worm gear unit on the pilot valve through internal lever and links.

Dimensions: millimetres

Bore		Length over flanges	Outreach from centre of valve over rim of wheel	Max. Working Pressure
Inlet & Outlet	Throat			
76	38	645	254	
102	51	572	273	
152	64	445	349	
152	76	445	349	16 bar
203	102	559	375	
254	114	667	394	
254	127	667	394	
305	152	914	464	

Standard 152 x 76 mm Larner-Johnson Type 'E' Valve.



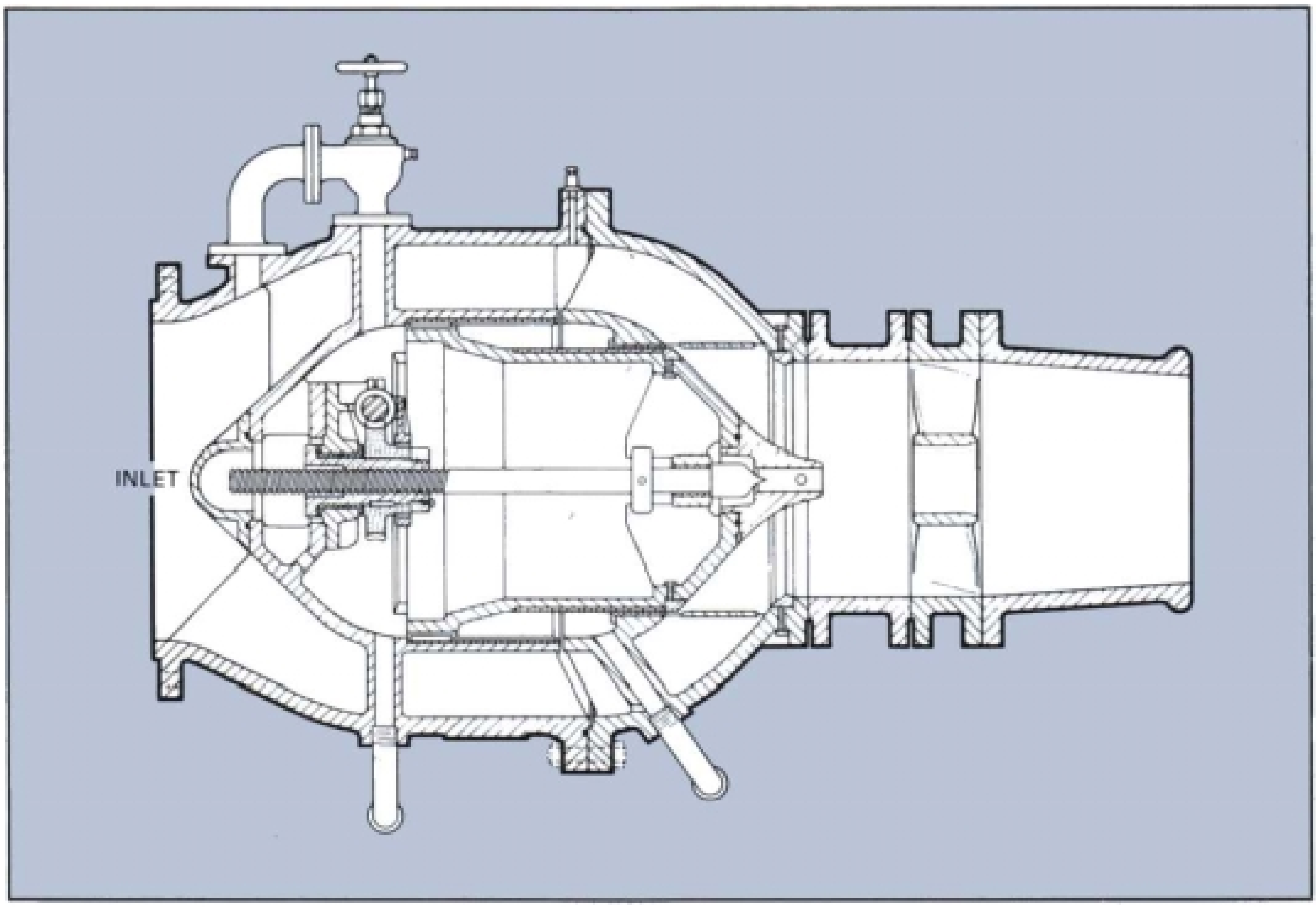


Type D construction. Fig. 3116

TYPE 'D' CONSTRUCITON

Tight closing against reverse pressure

Where the valve is required to close tight against reverse pressure on the nose of the plunger, with the valve body exhausted or under a lower pressure, the construction shown here is adopted. An external pipe taken from the outlet end of the valve admits reverse pressure to the chamber behind the plunger, and is connected in to the normal supply by-pass to the internal cylinder. Check valves on each branch ensure that either normal or reverse pressure is collected, whichever is the higher at any time. Means are provided to prevent escape of reverse pressure through the plunger clearance.



FREE DISCHARGE REGULATORS

The duty here is control of discharge to atmosphere as on the outlets from storage or river regulation dams and pressure pipelines (also the marginal case of piped discharge to very low back pressure).

The problem of heavy upstream to downstream pressure differential with associated high velocity flow, though present in certain circumstances in the pipeline regulator, arises here in an acute form due to the free outlet and brings into full prominence the Larner-Johnson features of streamline flow and hydraulically balanced plunger.

Ease of operation, smooth vibrationless discharge and high durability are characteristics which have given the valve its outstanding success for the duty.

The particular form employed is the Type 'E' valve previously described.

The permissible size range is practically unlimited, the large numbers supplied including valves from a few centimetres in diameter up to such units as the 4 metres x 2.25 metres regulators mentioned on page 3.

For the types of operating gear and materials of construction reference should be made to these headings on page 9. The remarks on power operation also apply (page12).

JET DISPERSER

Where there is not an adequate water cushion existing to receive the jet, the effect of the high velocity discharge on works downstream of the valve must be considered and it may be necessary in certain cases to fit a suitable disperser to ensure that the energy of the jet is dissipated harmlessly. This can be arranged to order.

The type generally recommended is the vortex pattern, as shown fitted to the valve above and in action. Radial vanes impart a tangential twist to the jet, the centrifugal force increasing directly with the radius so that no two filaments follow the same trajectory after emerging to atmosphere. The result is that the jet is divided into a series of diverging thin streams which ultimately disintegrate into drops and fall harmlessly at much reduced velocity over a large area.

It must be added that the use of this device entails some increase in headloss across the valve, with corresponding reduction in capacity.

ANGLE TYPE REGULATOR

On certain locations it may be more convenient for the valve to be arranged for downward discharge from the horizontal pipe terminal and for this an angle type valve is available. It has the advantage of compactness, consisting of a Type 'E' regulator with the body inlet section in the form of a 90° bend through which the pilot valve stem is extended vertically to the operating gear. Examples have been supplied with deflector plate bolted to the floor of the receiving basin for protection against the main shock of the jet, and this can be furnished to order.

POWER OPERATION

Power-driven operating gear is advantageous, and is nowadays frequently supplied for remote, centralized or automatic control. Typical examples are described briefly here, and we shall be glad to provide further information or submit proposals on request.

CYLINDER ACTUATOR

Valves can be furnished with actuating cylinder of hydraulic or pneumatic type, with associated controls and pressure supply equipment to order. The cylinder is mounted on the valve casing or elsewhere, according to type or preference, the connecting rod being coupled to a lever on the valve operating shaft, which acts upon the pilot valve through internal lever and link mechanism.

ELECTRIC MOTOR OPERATION

Electrical operation is applicable throughout the valve size range from 76 x 38 mm upwards. The comparatively small operating torque associated with the Larner-Johnson principle brings special advantages in the way of low power requirements and lightly stressed, durable mechanism.

Actuators are by recognised makers specialising in this type of equipment, and are carefully selected for the requirements of the valve and service. Basic features include reversing motor, precision reduction gearing, limit switches, automatic torque limiting control, local travel indication, enclosed weatherproof construction, and provision for manual operation with safety interlock. Integral starter, additional switches for interlocking, etc., transmitter for remote indication, anti-condensation heaters, are amongst the options available.

Control of simple manual push-button type can be provided, for local or remote operation. A frequent demand, however, is for modulating control, giving automatic positioning of the valve according to changes in such variables as flow, pressure, time, or liquid level. This is discussed briefly under the next heading.

200x100mm electrically operated Larner-Johnson Valve.

Two cylinder operated Larner-Johnson regulators, sizes 915 x 760 mm and 915 x 530 mm installed on a reservoir outlet for scour and supply control respectively. The cylinders are side mounted on the valve and operate by hydraulic oil maintained at the required pressure by means of an electrically driven pump unit with supply tank. Remote control of the regulators and associated wedge gate type isolating valves is from a console in the valve house at the top of the tower, where flow recording and electrical valve position indicators are also installed.

915 x 716 mm (left) and 915 x 530 mm electrically operated Larner-Johnson modulating valves for flow regulating under remote automatic control with monitoring over UHF radio link. The valves discharge to atmosphere through jet dispersers (not shown on the photograph).

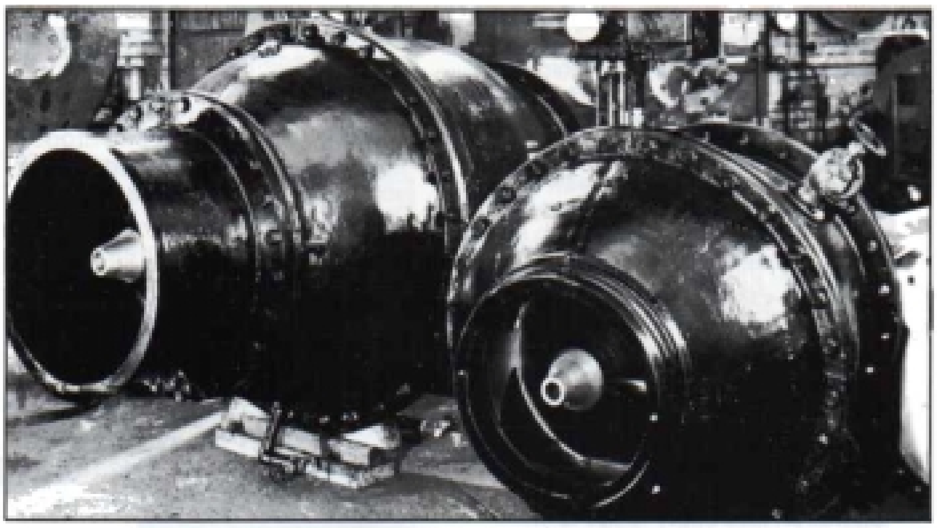


Fig. 3078

FLOAT CONTROLLED VALVES

This type of control is principally used on the inlets to service reservoirs or tanks, for regulation of flow according to water level in the receiving chamber (or other tank or channel). Operation is effected automatically by change of displacement of the float, the alternate actuating forces provided by weight and buoyancy being transmitted by lever mechanism to the valve element.

While in-line versions are available (page 18), the most widely used valve is the angle type illustrated here, mounted terminally on the supply line for downward discharge to the water surface, usually with open outlet.

The Larner-Johnson design has marked advantages for this duty, which become most evident on high pressure applications. The favourable flow pattern gives smooth handling of high velocities without the vibration, erosion and noise to which conventional types are liable. The float action has generally only to operate the pilot valve, giving sensitive response to small mechanical forces and float gear of compact dimensions. Closure is drop tight, and the valve is noted for its high durability in service.

Size Range

Standard 76 x 38 mm to 305 x 152 mm (inlet and outlet diameters). Larger patterns available.

Maximum Working Pressure

Standard 14 bar. Higher pressures to order.

Inlet Flange

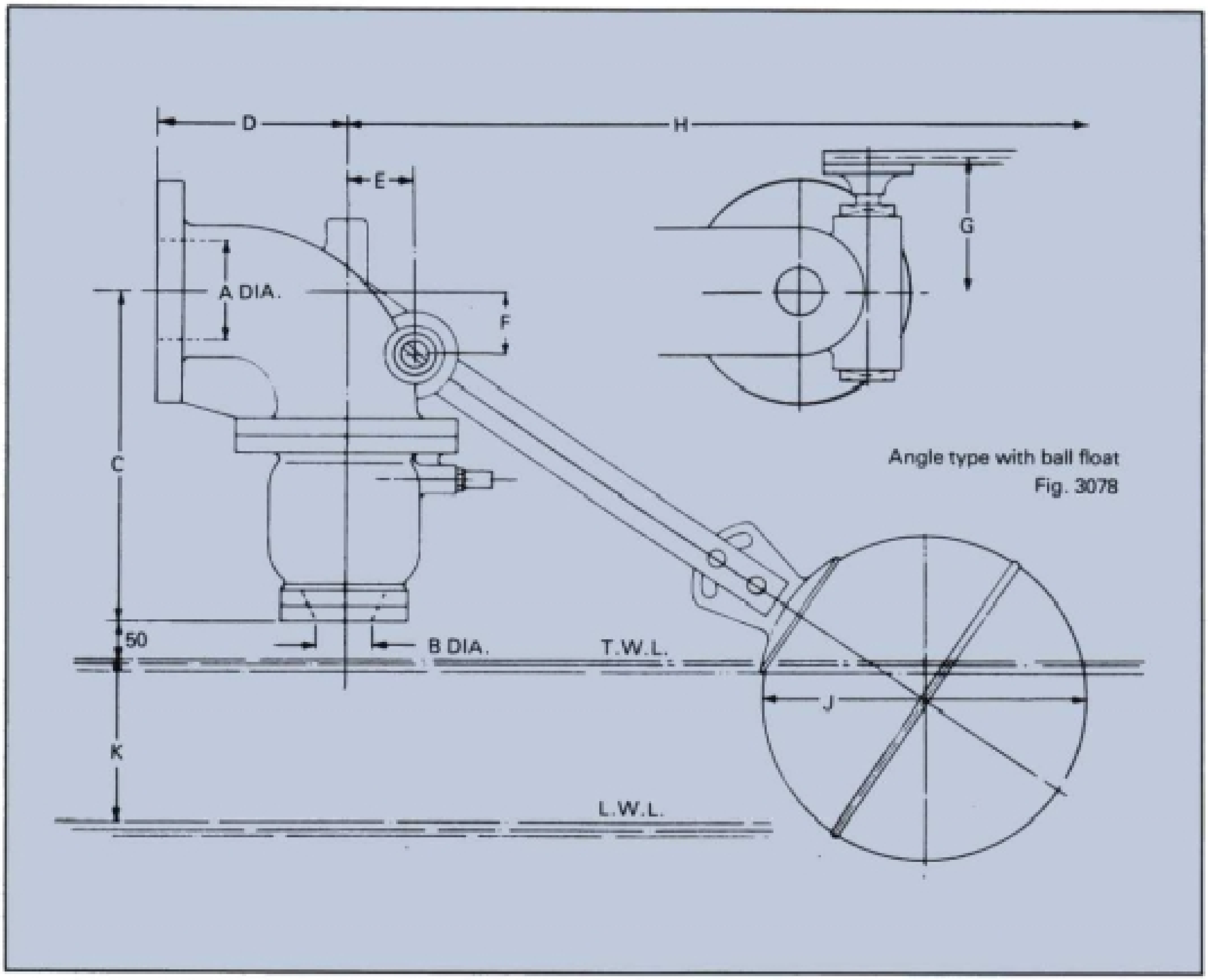
B.S. 4504: Metric or B.S. 10: 1962 Other flanges available to suit customer requirements.

Materials

Cast iron body: gunmetal discharge section with integral plunger seating and guides; gunmetal plunger; aluminium bronze pivot valve and stem; gunmetal internal forked actuating lever; stainless steel cross-shaft with gunmetal coupling to mild steel external float lever. Gunmetal bearings are provided for plunger, pilot valve stem, and cross-shaft at all contacting surfaces.

Float Gear

The simplest arrangement consists of a plain spherical float attached to the actuating lever by adjustable gunmetal connector (see below). Special attention is drawn, however, to the cheese float with float tank alternatives on pages 15 to 17, which are generally preferred.



Angle type with ball float
Fig. 3078

Dimensions: millimetres

A Inlet	B Throat	C	D	E	F	G	H	J	K Approx.
76	38	260	152	51	48	114	584	254	127
102	51	330	178	64	60	121	787	305	210
152	64	394	178	89	64	143	1067	356	330
152	76	394	178	89	64	143	1067	356	330
203	102	556	279	140	102	168	1207	356	257
254	114	714	305	162	159	165	1397	356	324
254	127	714	305	162	159	165	1397	356	324
305	152	810	381	187	178	187	1537	432	378

All floats are of copper or glass fibre and furnished with filling and drain plugs for water or sand ballasting.

The float lever is normally mounted on the right hand side of the valve looking upstream, but can be positioned on the opposite side if so ordered. The mounting allows angular adjustment of the lever in either case.

STILLING TANK ARRANGEMENTS

It is strongly recommended that all float controlled valves should be furnished with an auxiliary tank for the float. The effect is to eliminate erratic float movements due to wave action on the surface of the reservoir, or disturbance caused by the discharging jet - a frequent source of trouble on float valve installations and a possible cause of surge effects in the supply main.

Alternative standard arrangements are available, Figs. 3078B (illustrated on page 16) and 3078A (page 17). In each case the valve operating lever is connected to a vertical tubular stem which passes through a sealed internal tube at the centre of a copper or fibreglass cheese float, and telescopes with a guide rod flexibly mounted at the base of a float tank, (galvanized wrought iron or fibre glass according to size).

The difference lies in the method of admission and discharge of water from the tank, Fig 3078B having special advantages in control of valve action.

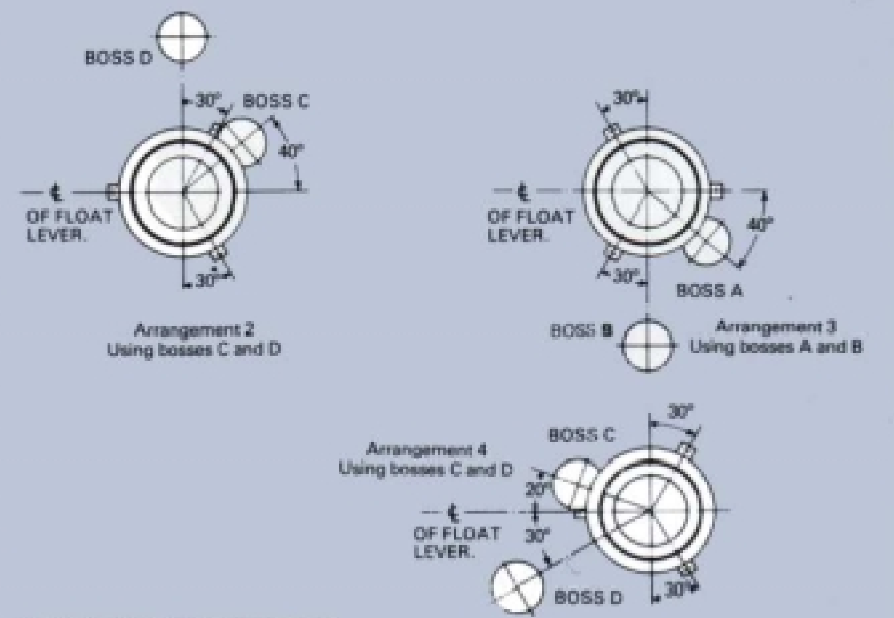
Both arrangements are available for floor mounting or suspension from roof. Orders should specify the method preferred, with appropriate vertical dimensions.

Fig. 3078B Siphon Type Stilling Tank

In addition to ensuring still water for the float, this device also eliminates the unfavourable condition of prolonged operation in part open positions. The tank fills through a siphon pipe and empties through a subsidiary ball cock. It cannot begin to fill until the water in the main reservoir reaches top level, when it fills completely and the valve moves from the full open to the full closed position in a continuous stroke. Similarly the opening movement cannot begin until low water level is reached in the reservoir, when the tank empties and the full opening stroke is effected.

The siphon inlet has been specially designed and tested to overcome the difficulties often experienced with slowly rising water levels, as well as meeting all normal requirements (conventional siphons can stop the float valve in a part open position due to failure to establish true siphonic action).

A choice of three siphon pipe diameters is given for each valve size in the table on page 16, with corresponding times for the closing stroke, i.e. filling of the tank. The diameter best suited to the characteristics of the reservoir should be selected and specified on order, or data furnished as to the conditions if a recommendation is desired.



ALTERNATIVES TO ARRANGEMENT 1 FOR FLOOR MOUNTED TANKS

Top Water Level and Reservoir Overflow

The T.W.L. marked on the drawing is the level at which the inlet valve starts to close. Since inflow continues during closing, the true T.W.L. will be slightly higher.

This point is particularly important in cases where the water level rises quickly, e.g. small reservoirs with large inlet valves. A particular case may occur when a large valve is installed to cope with increased future demands. In the early stages of such a scheme when the draw-off rate is small, the water level will rise faster than in the later stages.

The reservoir overflow should therefore be set at a level above that of the siphon inlet, the difference between the two levels being calculated using the flow through the valve during closing stroke and the surface area of the reservoir. Assume full flow continues for the full closing time shown in the table. (The throttling effect of the valve during closing will depend on the characteristics of the supply system and is best ignored).

The stilling tank top should always be set at a level above that of the overflow; otherwise overflow into the stilling tank would cause the valve to close quickly and surge pressures would occur.

Positioning of Tank Fittings

The recommended (and standard) position for the siphon and ball cock is on the opposite side of the tank from the main float valve, to minimize turbulence effects. (See plan view on page 16.)

Where space does not allow this, other positions are possible, the alternatives for floor mounted tank being as illustrated above. Orders should specify by reference number the arrangement preferred.

In the case of suspension from the roof, the tank with its fittings can be rotated to any of four positions at 90° intervals on the bolt circle, to suit requirements.

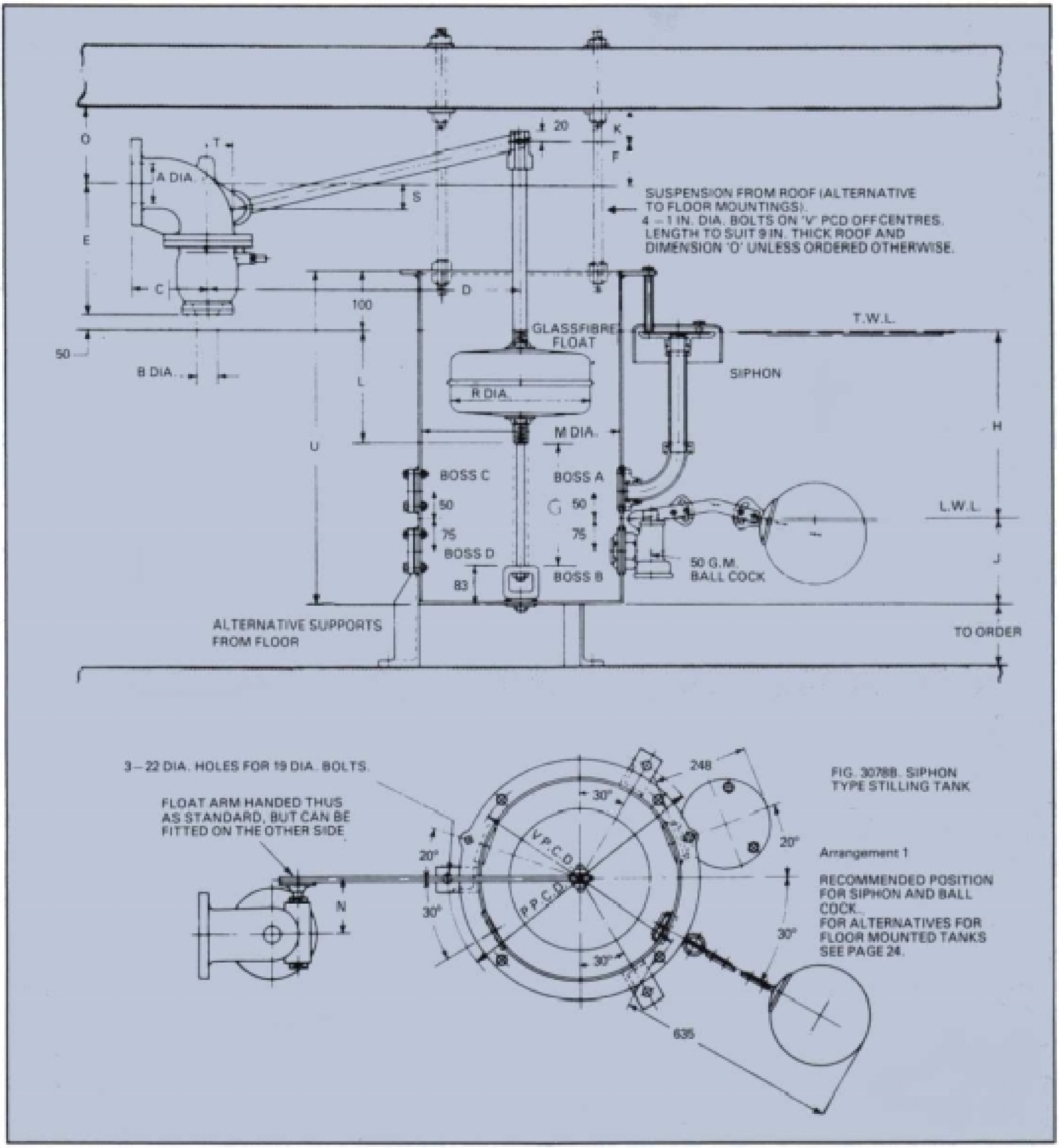


FIG. 3078B. SIPHON TYPE STILLING TANK

Dimensions: millimetres																					Time for closing stroke (minutes)		
A inlet	B throat	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	U	V	25 mm	38 mm dia. siphon std.	51 mm
76	38	152	762	260	86	267	445	216	64	311	508	114	149	711	356	48	51	762	578	2.42	1.07	0.60
102	51	178	762	330	97	314	492	216	64	311	508	122	162	711	356	60	64	810	578	2.66	1.18	0.67
152	64	178	914	394	124	375	572	216	64	330	610	143	187	813	457	64	89	889	680	4.08	1.81	1.01
152	76	178	914	394	124	375	572	216	64	330	610	143	187	813	457	64	89	889	680	4.08	1.81	1.01
203	102	279	1143	553	57	318	533	229	137	362	610	165	194	813	508	102	140	864	680	3.82	1.70	0.95
254	114	305	1219	714	27	372	606	254	227	406	660	165	254	864	559	159	162	962	730	4.86	2.16	1.21
254	127	305	1219	714	27	372	606	254	227	406	660	165	254	864	559	159	162	962	730	4.86	2.16	1.21
305	152	381	1219	810	32	419	667	279	248	445	762	192	279	965	610	178	187	1048	832	6.82	3.04	1.71

NOTE. Float tanks constructed in concrete should conform approximately to the proportions given above, according to valve size Larger tanks may call for special sizing of siphon and ball cock if correct action is to be ensured.

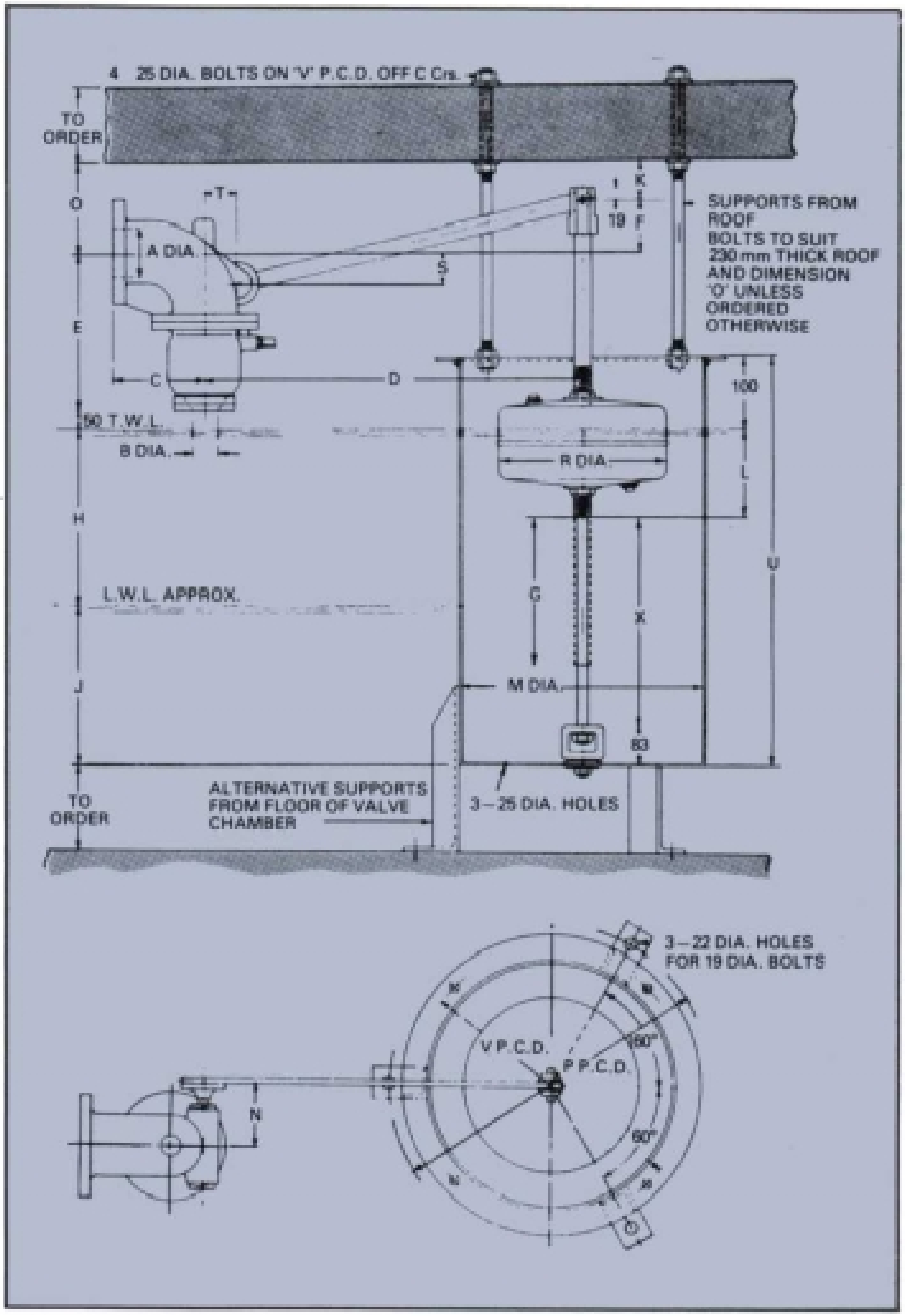


Fig. 3078A Plain Stilling Tank

A simpler arrangement than the siphon type (3078B) previously described, without the action control feature. Communication of water level from the reservoir is through perforations in the base of the tank, and the valvé thus operates directly according with changes in reservoir level.

The same protection is given to the float against surface disturbances, however and the device has a useful range of application for minimum requirements.

Dimensions: millimetres

A inlet	B throat	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	U	V	X
76	38	152	762	260	86	267	343	292	64	187	508	114	149	711	356	48	51	737	579	375
102	51	178	762	330	97	314	391	245	64	187	508	122	162	711	356	60	64	737	578	375
152	64	178	914	394	124	375	464	251	64	206	610	143	187	813	457	64	89	816	680	426
152	76	178	914	394	124	375	464	251	64	206	610	143	187	813	457	64	89	816	680	426
203	102	279	1143	553	57	318	419	295	137	238	610	165	194	813	508	102	140	816	680	394
254	114	305	1219	714	27	372	473	314	229	283	660	165	254	864	559	159	162	889	730	422
254	127	305	1219	714	27	372	473	314	229	283	660	165	254	864	559	159	162	889	730	422
305	152	381	1219	810	32	419	521	352	248	321	762	192	279	965	610	178	187	975	832	470

FLOAT VALVES IN LINE

An alternative design for straight through flow on pipe-line applications. It consists of a normal Type 'E' Larner-Johnson regulator in the lever-operated version, the external lever being connected to suitable float gear, of which various arrangements are possible. In the typical layout illustrated here the float chamber is shown as incorporated in the civil structure, but galvanized wrought iron float tanks can be supplied, of either plain or 'siphon' pattern, adapted from the types described on pages 19 to 21.

For sectional view and details of the valve itself refer to pages 9 and 10.

Size Range

Sizes in most frequent use extend from 102 to 762 mm (line) diameters, but patterns exist for practically any size required.

Maximum Working Pressure

Standard valves:
Up to 305 mm - 16 bar.
Over 305 mm - 10 bar.
Higher pressures to order.

Line Flanges

B.S. 4504: Metric or B.S. 10: 1962. Other flanges available to customer requirements.

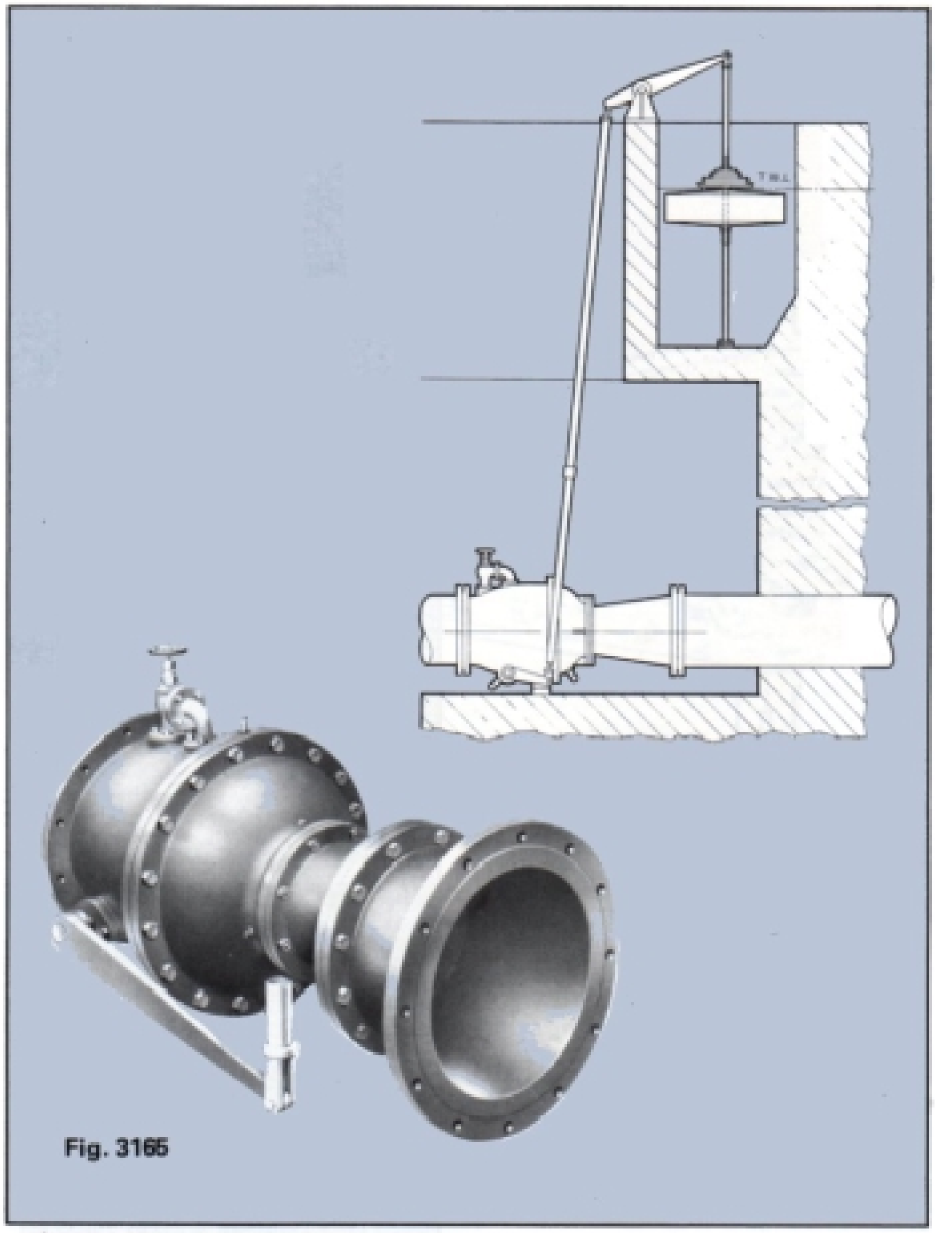


Fig. 3165

SOLID PLUNGER TYPE

A simplified form of streamline valve for sizes below the 76 x 38 mm minimum of the Larner-Johnson series. The valve is of direct-acting type, with solid needle plunger operated by a crank at the end of the float lever, and closing against a seat at the inlet end of the body (an arrangement that does away with the necessity for stem packing). The feature of smooth flow pattern is retained, so the valve is suitable for high pressure service, and in the small sizes concerned the absence of hydraulic balance is no real detriment. Closure is drop tight.

Maximum Working Pressure

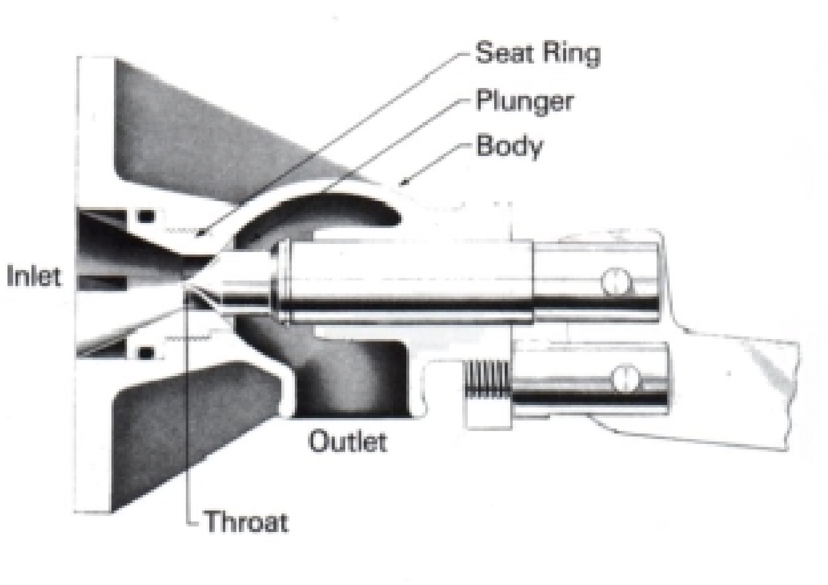
Standard valves: 21 bar.

Materials

Gunmetal body with manganese bronze seat insert; stainless steel plunger; mild steel float lever, with manganese bronze fulcrum and guide.

Inlet Flange

B.S. 4504: Metric or B.S. 10: 1962. Other flanges available to customer requirements.



ALTITUDE VALVE

For control of level in overhead reservoirs. The valve is of Larner-Johnson in-line type, with control cylinder similar to the reducing valves previously described. From the elevated tank, small bore piping communicates with the base of the cylinder, adjacent to which is a leak-off valve giving a suitably adjusted permanent discharge to drain.

When top water level is reached in the reservoir the tank fills, pressure builds up in the control cylinder, raising the piston and closing the main valve. When a sufficient fall in level occurs the tank empties through the ball cock and the system exhausts through the leak-off port, enabling the loading weights to open the valve.

Note

1 The capacity of the tank must be sufficient to balance the leak-off quantity, and prevent the valve opening before the ball cock has opened.

2 The height from valve centre-line to top water level should not be less than 10 metres to ensure adequate pressure for the control cylinder.

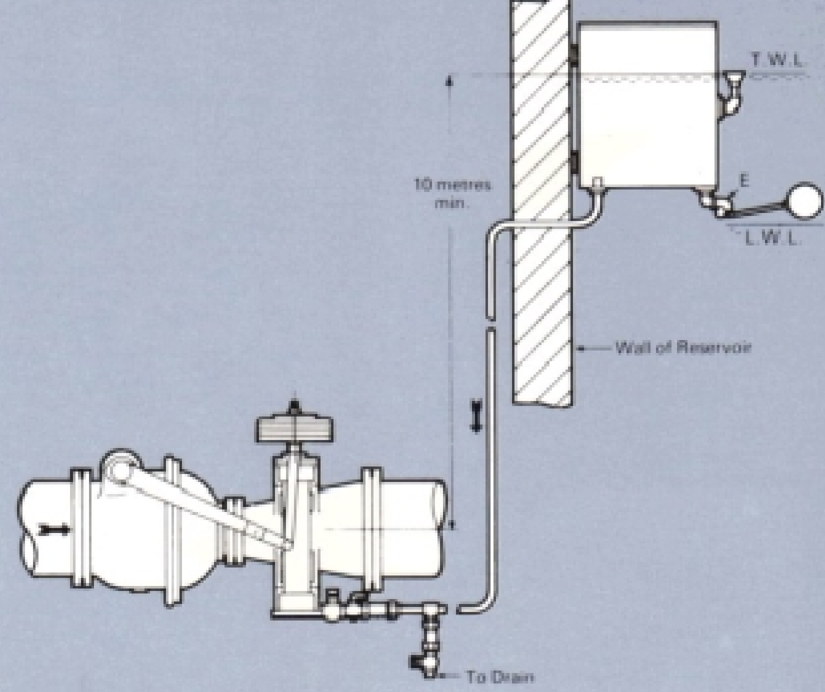


Fig. 3193

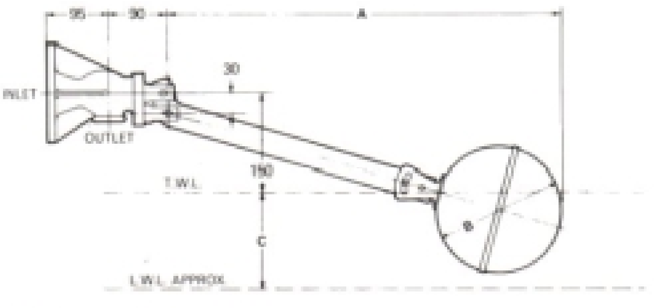


Fig. 3076. With Ball Float.

Dimensions: millimetres										
Valve bore			A	B	C	D	E	F	G	H
Inlet	Throat	Outlet								
50	13	38	1120	200	150	80	150	265	685	230
50	16	38	1150	250	215	100	200	320	735	280
50	19	38	1170	250	250	130	250	370	785	330
50	22	38	1170	300	300	150	300	420	840	380
50	25	38	1200	300	330	180	350	470	890	430

6 & 9 mm throats also available

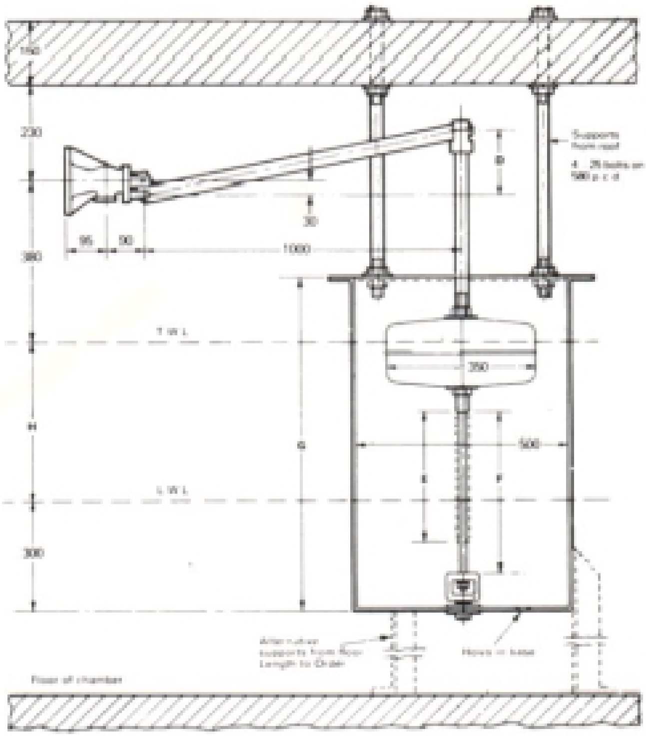


Fig. 3076A. With plain Float Tank. Control tank (p. 21) also available.

DATA REQUIRED FOR ESTIMATING

The following information should accompany enquiries or orders, according to the type of valve. Particulars of the pipe-line (diameter connections, etc.) should be added, and in most cases a sketch of the proposed installation is useful, especially where operating arrangements have to be accommodated to a given space or layout.

Pipe-line Regulators

1. Maximum static pressure.
2. Available head at the valve.*
3. Maximum normal flow.
4. Maximum permissible headloss at full flow.
5. Type of operating gear, with details of any particular control requirement.
6. State if valve is required to hold up reverse pressure.

Free-discharge Regulators

1. Nature of service (outlet from storage reservoir, blow-off from pressure pipe-line, etc.).
2. Maximum static pressure.
3. Available head at valve. If discharge is not direct to atmosphere, give value of any back pressure.
4. Quantity of discharge. If possible give the amounts required at different heads, or at least for maximum, normal and minimum.
5. Type of operating gear, with details of any particular control requirement.
6. State if a jet disperser if required.
7. If discharge is not direct to atmosphere, state whether valve is required to hold up reverse pressure.

Float Controlled Valves

1. Maximum static pressure.
2. Available head at the valve.*
3. Maximum flow through the valve, or discharge quantity.
4. Type of float gear required.

For In-line valves the following should be added:

5. Maximum permissible headloss at full flow.
6. Relative elevation of valve and receiving reservoir.
7. State whether valve is required to hold up reverse pressure (In-line valves only).

*That is, the static head less upstream pipe loss.

ADDITIONAL LARNER JOHNSON CONTROL APPLICATIONS

- **Ported sleeve type for special flow characteristics.**
- **Pressure reducing.**
- **Pressure sustaining.**
- **Combined sustaining & float.**
- **Pressure relief.**
- **Surge supressor.**
- **Compensation water control.**
- **Emergency self-closing.**

SOME OTHER VALVES IN THE BLACKHALL RANGE:

- **By-pass non return valves.**
- **4-way 'cardio' switch valves.**
- **Cryogenic gate & globe valves.**
- **High temperature gate & plate valves.**
- **Bespoke valves — any temperature/any pressure/any fluid.**
- **Complete valve maintenance & service department.**

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