

# PressureCalc

## Help and Operating Instructions

### Overview

The programme is designed to allow the user to design a pressurized water supply system based on the Fixture units connected to each branch of the system. The programme can also be used to check the pipe sizing of an existing system. Once a drawing of the piping network has been prepared the network should be divided into sections. Each section should be identified with a start and finish number and the length of each section should be measured. The user should then identify the index point of the system, this is normally the furthest and highest point from the pumpset or incoming supply. (The starting point). Having identified the pipe sections that join the pumpset to the index point the user should input the pipe sizes proposed for each section, the length of each section and the number and type of fittings. The user should use the Fixture unit input page to establish the Fixture units in each pipe section and the total Fixture units required. Once the Fixture units are input into the 'WaterSupply' page the programme will calculate the flow rate in gallons per minute.

The user should input the residual head required at the index point and the static head between the pumpset or incoming supply and the index point. The programme will then advise the user of the total pumpset or incoming water supply head required. The programme will also advise the total pumpset or incoming supply flow rate required.

The user should then repeat the exercise for all the other branches in the water supply network.

### Pages

The programme contains a number of pages, these are named 'Help', 'Cover sheet', 'Water Supply' and 'Fixture unit input'

**'Help' page -** 'Help' page contains the Help and Operating instructions for the programme.

**'Cover Sheet' page -** The 'Cover Sheet' page contains the cover sheet template for the programme print out.

**'Water Supply' page -** The 'Water Supply' page contains the main part of the programme.

**'Fixture unit input' page -** The 'Fixture unit input' page contains a sub programme that allows the user to input the number and type of fixtures and automatically calculates the matching number of Fixture units. The programme also allows the user to define an unlisted fixture and input the flow rate for this fixture. The programme will automatically convert the GPM figure to a number of Fixture Units for the item. The programme automatically transfers the total number of Fixture Units to the Water Supply page.

## **Help and Operating Instructions**

### **Inputting data**

### **Only place data in boxes marked in white**

If the cursor is moved using the 'Tab' key it will only move between 'white' cells making data inputting easier to perform.

### **Water Supply page -**

**Service -** The user should identify the type of service that is being calculated.

**Water temperature -** The user should input the temperature of the service in degrees. The temperature of the water will automatically determine the density of the water and amend the flow rate figure. 'Hot' water is less dense than 'cold' water and for any given fixture unit figure cold water will always have a lower flow rate than hot water, as the flow rate is measured as a volume per second.

**Pipe Reference No. -** In the pipe reference number column the user should input the start and end numbers for the pipe section being described. These numbers should match the numbers shown on the drawing that indicates the water supply network.

**Pipe Material -** The pipe material for the section of the water supply network should be selected from the drop down menu. The programme allows the user to select a different pipe material for each section of the system. This can be particularly useful when checking an existing system or a when the user is adding to or modifying an existing system. Once the pipe material has been selected the programme automatically selects a design friction coefficient for the material. If for any reason the user is not satisfied with the friction coefficient proposed the user may adjust the coefficient using the coefficient adjustment box.

**Pipe Type or Schedule -** The pipe type or schedule for each section of the water supply network should be selected from the drop down menu. The programme will automatically present the user with the correct types or schedules available for the selected pipe material. For example if copper pipe is selected as the pipe material the pipe type list presented to the user will be "K", "L" or "M".

**Pipe Coefficient -** The pipe friction coefficient is automatically selected by the programme once the pipe material is selected. The selected values are design values most of which are proposed by The American Society of Plumbing Engineers.

**Coefficient Adjustment -** The user may adjust the proposed pipe coefficient by the use of this box. To adjust the pipe coefficient the user should input a positive or negative figure. For example if the design figure is 130 but the piping is an old existing network and the user is aware that the piping is in poor condition he or she could enter -30 changing the final coefficient to 100.

**Final Pipe Coefficient -** The programme will automatically indicate the final pipe coefficient. The final pipe coefficient is the value used by the programme to calculate the friction loss in the section of piping. The programme uses the Hazen-Williams formula to calculate pipe friction.

**Service Type -** The service type should be selected by the user from the drop down. The user is offered the choice of 'Hot water', 'Cold water' or 'Hot and Cold water', these being the three different types of water supply pipe that are possible in a water supply network. The 'Hot and Cold water' being reserved for the piping between the pumpset or incoming supply and the point in the network where the supply splits into a 'Cold water' only supply and the feed to the hot water system. The programme automatically adjusts the Fixture Unit value for the connected fixtures in the pipe section based on the Service Type that is selected.

**Pipe Location -** The pipe location for the section of the water supply network should be selected from the drop down menu. The programme allows the user to select a different pipe location for each section of the system. Each type of location has a suggested maximum velocity based on the table below. If a water velocity is proposed that exceeds the maximum for the location the figure in the 'velocity' cell will change from black to red. If noise is not a consideration the user can select the Uniform Plumbing Code option where a maximum velocity of 10 feet per second is permitted.

**Pipe size -** The pipe size for the section of the water supply network should be selected from the list that is presented to the user. The list presented will be automatically selected by the programme based on the pipe 'Material' and pipe 'Type' or 'Schedule' that is selected. The programme will automatically select the correct internal pipe diameter based on the nominal diameter that is selected by the user. The programme uses the internal pipe diameter to calculate the pipe friction and water velocity.

**Type of use -** The type of use is selected from a drop down menu. There is a choice of 3 categories 'Private', 'Public' and 'Assembly'. Private is used for domestic situations and small offices where appliance use is infrequent. Public is used for larger buildings such as hospitals, schools, restaurants and hotels where appliance use is more frequent. Assembly is used for buildings such as shopping malls, theatres, concert halls and sports events locations. Because the type of use can be selected for each pipe section it is possible to have all three types of use in the same building if

## **Help and Operating Instructions**

**Type of WC -** The user should select the type of WC that is generally used within the building. Once the correct type has been selected the programme will automatically select the matching 'Fixture Unit' to GPM curve. Once again because the 'Type of WC' can be selected for each pipe length it is possible to select a 'Flush valve' option for a particular branch in a building that is generally served by 'Flush Tank' WC's. If no WC's are connected to a section and no 'Flush valve' WC's were connected to a branch prior to this section the 'Flush tank' option should be selected. Once a 'Flush valve' option has been selected on the index run of piping only the 'Flush valve' option should be used from this point to the pumpset or incoming supply point.

**Fixture Units -** Each appliance is allocated a number of fixture units based on the appliance type, it's capacity, flow rate, period of use and frequency of use characteristics. The user can use the Fixture unit input page to assist in calculating the number of fixture units required for each section of the network. Once the connected fixtures have been selected on the Fixture unit page the programme will automatically transfer the total fixture units for the particular length to the water

**Flow rate -** The flow rate is automatically calculated by the programme based upon the Fixture units total for a particular pipe section. This flow rate is based on the data given in the Uniform Plumbing Code and other sources such as the American Society of Plumbing Engineers Data Book.

**Constant Flows -** If a section of the network supplies a constant supply of water to an item such as a cooling tower or an industrial process the user should include the flow at this point. If however the flow is not constant but the item is not listed on the Fixture unit input page the user should use the unlisted item section at the end of the Fixture unit input page. This item allows the user to describe the fixture and state the maximum flow of the item. This flow rate is automatically converted to a number of Fixture units.

**Total Flow Rate -** The programme states the 'Total Flow Rate' in GPM and includes any constant flows. The programme automatically adjusts the flow according to the temperature of the water. As hot water is less dense than cold water the volume of water increases with the temperature of the water, for a given number of Fixture Units.

**Velocity -** The water velocity is automatically calculated by the programme based upon the total flow rate and the pipe size. It is suggested that the following table should be used for selecting the maximum velocities in pipework. The programme will automatically warn the user if the suggested maximum velocities are exceeded in any length. The programme does this by changing the colour of the velocity from black to red. The velocities stated in the programme are likely to be greater than those shown on tables in books as this programme works out the velocity based on the inside diameter of the pipe whereas tables are often only based on nominal diameters.

### **Pipework velocities**

Location	Noise rating	Pipe material	
		Metal- Copper, S/S, G/S	Plastic- UPVC, ABS, PE, Glass Fibre
Service duct, riser shaft, plant room	50	6.6	8.2
Service enclosure, ceiling void	40	4.9	4.9
Circulation area, entrance corridor	35	4.9	4.9
Seating area, lecture/meeting room	30	4.1	4.1
Bedroom	25	3.3	3.3
Theatre, cinema	20	2.5	2.5
Recording studio	<20	1.6	1.6
Uniform Plumbing Code	N/A	10.0	10.0

**Pipe length -** The user should input the length of the section as measured from the network drawing.

**Fittings Length -** The fittings length is automatically generated by the programme and represents the equivalent length of each fitting multiplied by the number of each type of fitting. The figure also includes the equivalent length of each type and number of valves included in the length. The equivalent length of fittings is based on a multiple of the pipe diameter so the equivalent length for a fitting automatically increases with an increase in the pipe diameter.

## **Help and Operating Instructions**

**Total pipe Length -** The total pipe length is automatically generated by the programme and represents the total of the measured pipe length and the equivalent length of the fittings and valves included in the section.

**Head Loss -** The head loss is automatically generated by the programme and represents the loss of head due to friction along the section of pipe and through any valves and fittings.

**Sub-Total Head Loss -** The sub-total head loss is automatically generated by the programme and represents the sum of the head losses in each section of the water supply network to that point.

**Static Head Required -** The static head required should be input by the user for the first section only. The programme will show the static head required for all other pipe sections. The static head is the vertical distance from the pumpset or incoming supply to the highest point on the index run of the network. If for any reason the index point is below the pumpset or incoming supply then the static head should be entered as a negative figure.

**Type of elbow -** The user should select the type of elbow or bend from the drop down list. Mitre fabricated bends will only be necessary if larger diameter glass fibre bends are required. Generally if copper or polybutylene pipes are specified standard bends should be selected.

**Number of elbows -** The user should input the number of elbows in the section of the network.

**Type of Tee -** The user should select the type of tee from the drop down list. Where a 3/4 tee is specified this represents a tee where the outgoing pipe is reduced to 3/4 of the size of the incoming pipe. Similarly where a 1/2 tee is specified this represents a tee where the outgoing pipe is 1/2 the size of the incoming pipe.

**Number of tees -** The user should input the number of tees in the section of the network.

### **Enlargements &**

**Contractions -** The user should select the type of enlargement or contraction from a drop down list. The 3/4, 1/2 and 1/4 figures should be used in the same way as the figures described above for the tees. The abrupt entrance should be used when water is passing from a tank to a pipe or from a pipe to a tank.

**Type of valve -** The user should select the type of valve from the drop down list. A globe valve should not be proposed where limited head is available as there is considerable head loss through a globe valve. Where lavatory basin taps are specified these should be considered to be angle valves.

**Number of valves -** The user should input the number of valves in the section of the network.

**Number of gate valves -** The user should input the number of gate valves in the section of the network. As gate valves are very common on piping networks they have been given a listing of their own. There is also a possibility that a gate valve and a globe valve may be located in the same section of piping.

**Type of check valve -** The user should select the type of check valve from the drop down list. Lift check valves should be used with care as they have a very high head loss.

**Number of check valves -** The user should input the number of check valves in the section of the network. Check valves should not be located in pipe sections where limited head is available, as there is considerable head loss through any type of check valve.

**Backflow Preventer Included -** The user should select whether or not a backflow preventer is included in the section of piping or not from the drop down menu provided. Backflow preventers should be installed as required by the local code or the uniform plumbing code. Normally only one backflow preventer will be required on a system located to separate the building supply from the street main. Additional preventers may be required if the water supply feeds both potable and non-potable networks within the whole building or complex.

**Backflow Preventer size -** The user should select the size of backflow preventer from the drop down menu provided. Only if the user selects the 'yes' option in the previous column will the programme allow the user to select a size of backflow preventer. The size options offered to the user will be based upon the flow rate calculated for the section of piping.

**Backflow Preventer Head Loss -** The programme will automatically suggest a head loss for the backflow preventer based upon the preventer size selected and the flow rate in the section. If the user is proposing a particular backflow preventer with an alternative head loss the suggested head loss can be adjusted to suit the particular situation. The user may also be checking an existing situation where again the suggested head loss is not appropriate and may need adjustment.

**Head Loss Adjustment -** The user can adjust the backflow preventer head loss by including a positive or negative figure in this location.

## **Help and Operating Instructions**

**Final B/F Preventer Head Loss -** The programme will indicate the final backflow preventer head loss based upon the suggested head loss and any adjustment proposed.

**Water Meter Included -** The user should select whether or not a water meter is included in the section of piping or not from the drop down menu provided. Normally only one water meter will be included in the piping network on the incoming supply. There may be situations where sub-meters are provided to measure the volume of water supplied to a particular area or particular service.

**Water Meter size -** The user should select the size of the water meter from the drop down menu provided. Only if the user selects the 'yes' option in the previous column will the programme allow the user to select a size of water meter. The size options offered to the user will be based upon the flow rate calculated for the section of piping.

**Water Meter Head Loss -** The programme will automatically suggest a head loss for the water meter based upon the water meter size selected and the flow rate in the section. If the user is proposing a particular water meter with an alternative head loss the suggested head loss can be adjusted to suit the particular situation. The user may also be checking an existing situation where again the suggested head loss is not appropriate and may need adjustment.

**Head Loss Adjustment -** The user can adjust the water meter head loss by including a positive or negative figure in this location.

**Final Water Meter Head Loss -** The programme will indicate the final water meter head loss based upon the suggested head loss and any adjustment proposed.

**Water Softener Included -** The user should select whether or not a water softener is included in the section of piping or not from the drop down menu provided. Normally only one water softener will be included in the piping network on the incoming supply. There may be rare situations where it is necessary to provide multiple water softeners because the flow rate is too large for an individual softener. In this case a second or third softener should be indicated on a sub-section of the network.

**Water Softener size -** The user should select the size of the water softener from the drop down menu provided. Only if the user selects the 'yes' option in the previous column will the programme allow the user to select a size of water softener. The size options offered to the user will be based upon the flow rate calculated for the section of piping.

**Water Softener Head Loss -** The programme will automatically suggest a head loss for the based upon the water softener size selected and the flow rate in the section. If the user is proposing a particular water softener with an alternative head loss the suggested head loss can be adjusted to suit the particular situation. The user may also be checking an existing situation where again the suggested head loss is not appropriate and may need adjustment. If the head loss value returned is S/M this means special measures are required because the flow is larger than a single softener can handle.

In this case more than one softener will be required and the flow should be split accordingly into 2 or more parallel streams. In this way each stream will then be less than the maximum handled by any one softener.

**Head Loss Adjustment -** The user can adjust the water softener head loss by including a positive or negative figure in this location.

**Final Water Softener Head Loss -** The programme will indicate the final water softener head loss based upon the suggested head loss and any adjustment proposed.

**Residual Head Required -** The user should input the residual head required in the first pipe section. The programme will indicate the residual head required for all the other pipe sections. The residual head required will vary depending on the fixture that is at the index point. Where possible the manufacturers requirements should be used to establish the residual head required.

**Total Head Required -** The programme automatically generates the total head required. This figure represents the minimum pump or incoming supply head required to operate the pressurized water system correctly.

### **Creating an additional section**

To create an additional section activate the "Add Row" menu tab, which will add a new line below the existing line in both the "WaterSupply" and "Fixture unit input" pages. To add a further line activate the "Add Row" menu tab again. The user should complete the 'index run' before producing any additional branches. Where a branch joins the 'index run' the user should include the fixtures that are located on the branch within the section of the 'index run'. Only when the 'index run' has been completed should the user produce the branch connections.

## **Help and Operating Instructions**

### **Removing a section**

To remove a section activate the "Remove Last Row" menu tab, which will remove the last section in the "WaterSupply" and "Fixture unit input" pages. To remove a further section activate the "Remove Last Row" menu tab again. The programme will not allow the user to remove the first line in the "Water Supply" and "Fixture unit input" pages.

### **Creating an additional branch within the network**

Where a network has a number of branches it will be necessary to create additional water supply branches. To create an additional branch activate the "Add New Branch" menu tab, which will add two blank lines on both the "Water Supply" and "Fixture unit input" pages. This action will also add the first row of the new branch on both pages. The user should ensure that an existing branch has been completed before starting a new branch.

### **Fixture Unit Input page -**

The programme will automatically create a Fixture unit input line for each pipe length in the "Water Supply" page. Where a pipe has no connected appliances the number of appliances should be set to zero in the matching Fixture unit input line.

**Pipe Reference No. -** The pipe reference number will be automatically copied from the "Water Supply" page.

**Type of use -** The 'type of use' will be automatically copied from the "Water Supply" page.

**Service Type -** The 'Service Type' will be automatically copied from the "Water Supply" page.

**Total Fixture Units -** The 'Total Fixture Units' for the section will be calculated by the programme.

**WC Flushometer Valve -** The first item on the Fixture Input page is the Flushometer type WC. If there are any of these fixtures connected to this section of piping they should be selected at this point. The fixture type should be selected from the drop down list and if none is present then 'None' should be selected from the list.

**No. of WC's -** The number of flushometer WC's should be input by the user at this point if applicable.

**Fixture Units -** The programme will automatically generate the correct number of Fixture Units for the selected flushometer WC.

**Sub-Total Fixture Units -** The programme will automatically calculate the correct number of Fixture Units for the number of flushometer WC's connected to the section of piping.

**Urinal Flush Valve -** The second item on the Fixture Input page is the Flushometer type urinal. Details of the flushometer urinal are input into the programme in the same way as the Flushometer

**Appliance Type 3 -** The third item on the Fixture Input page is selected from the drop down menu. The list offered to the user will depend on the 'Service Type' and the 'Type of use'. For example if the 'Service Type' is 'Cold only' and the 'Type of use' is 'Private' only fixtures that are served by cold supplies and are used in a 'Private' situation will be presented to the user for selection.

**Appliance Types 4 to 19 -** Appliances 4 to 19 can be selected in the same way as appliance type 3. As the user moves away from the index point and gets nearer to the pumpset or input point of the network more and more appliances of different types will be connected to the system. This programme allows up to 19 different types of standard appliance to be connected to a single network.

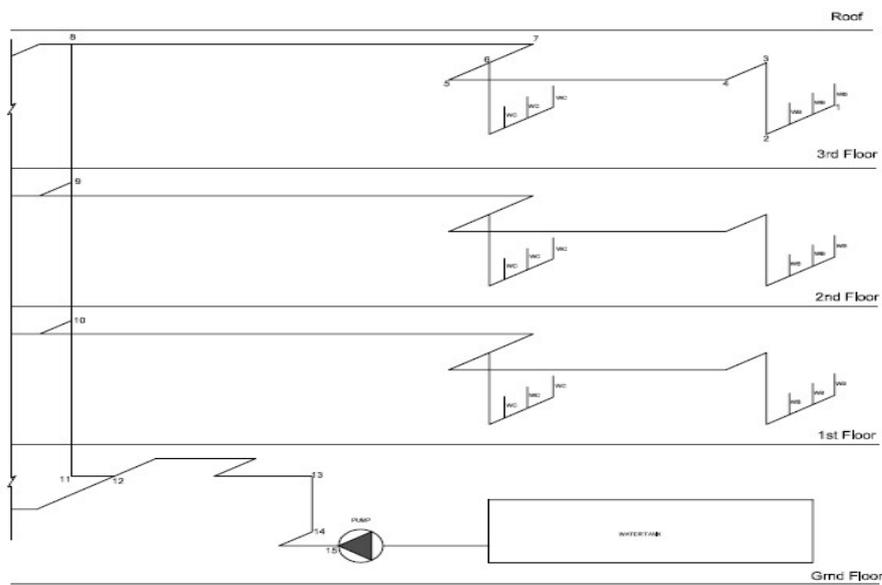
**Appliance Type 20 -** Appliance Type 20 is reserved for an appliance that is not listed on any of the inbuilt drop down menus. As long as the maximum flow rate of the appliance is known the programme will automatically convert the flow rate to a number of Fixture Units.

### **Creating a print area for a page**

To set the print area for a page the user should activate the "Set Print Area" menu tab, which will fix the print area for the page. This action will work for both "Water Supply" and "Loading unit input" pages.

## Help and Operating Instructions

### Typical water supply drawing



The drawing or drawings should be marked up with section numbers or letters to match with the lengths shown in the programme. The 'index' length should be considered first this is normally the highest and furthest point from the pumpset supplying the system.