

## uPVC COLUMN PIPES

 **Zirantec**



[www.zirantec.com](http://www.zirantec.com)

## SUBMERSIBLE COLUMN PIPES

### ABOUT ZIRANTEC uPVC COLUMN PIPES

FIPS's vast experience & successful track record in pump industry spanning about 4 decades facilitate not only to enhance the range of pumps & motors, but also to produce and supply quality pumping accessories. ZIRANTEC's uPVC pipes are one among such accessories produced with specially designed formulation under integrated quality control system, right from sourcing raw materials. Also adequate safety factors has been considered in designing the pipes to have maximum weight carrying capacity.

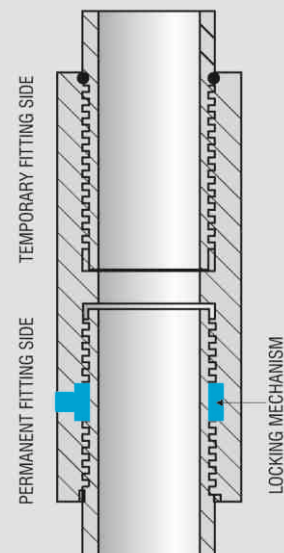
These pipes are specially designed for submersible pumps, capable of handling both internal hydrostatic pressure as well as high tensile load caused by the pump weight & column water pressure and weight. In general the first pipe fitted with the pump will be subjected to high hydrostatic pressure and the top most one has to withstand the entire weight of the column water & pump.

The unique formulation used in the manufacture of these pipes ensures that the threads do not turn brittle, break or chip during the entire life cycle. The threading & dimension standards maintained make these pipes ideally suitable for using as column pipes for submersible pumps worldwide. These pipes are produced in difference types which can be selected according to the installation requirements.

### FEATURES

- Rigid construction & longer life span upto 25 years.
- The best alternative for G.I Pipes and cost effective.
- Can be used for potable water supply.
- Special care is taken while fixing couplers with pipes to avoid column slippage.
- Specially designed square threads are capable of withstanding heavy load and are corrosion free.
- PBTS locking system which enhances reliability.
- Special rubber seal is provided at the end of threads to ensure 100% leak proof even at high pressure.
- A special rubber (EPDM - Highstrand) ring is provided in the coupling between the 2 pipes to absorb the vibration caused due to high pump pressure.
- Internal surface of these pipes are very smooth, resulting in very low head loss due to friction and increases water discharge upto maximum of 30%, compared with traditional G.I. pipes thereby saving power.
- Because of its light weight characteristic & special square thread design these pipes can be tightened easily by hand and no need of using pipe wrench.
- uPVC column pipes are resistant to chemical reactions when used in acidic or alkaline waters assuring long life.
- Can handle water with maximum temperature upto 45°C.
- These pipes come in 3m Standard length and are of light weight ensuring easy handling and storage.
- Can be used in sun light because of its formulation to with standard UV exposure.

#### PBTS - LOCKING SYSTEM (Polymer Bonded Thread Sink)



## PHYSICAL & MECHANICAL PROPERTIES

| PROPERTY                    | UNIT                       | STANDARD           |
|-----------------------------|----------------------------|--------------------|
| Specific Gravity            | 1,4 gms/cm <sup>3</sup>    | -                  |
| Tensile Strength            | 627 kg/cm <sup>2</sup>     | as per ASTM D 1785 |
| Flexural Strength           | 647 kg/cm <sup>2</sup>     | as per ASTM D 1785 |
| Izod Impact Strength        | 15 kg - cm/cm <sup>2</sup> | as per ASTM D 1785 |
| Charpy Impact Strength      | 17 kg - cm/cm <sup>2</sup> | as per ASTM D 1785 |
| Impact Strength             | No Fracture                | -                  |
| Vicat Softening Temperature | 87.3°C                     | as per ASTM D 1525 |

## DIMENSION & WEIGHT DETAILS

### STANDARD TYPE

| NOMINAL DIAMETER |     | OUTER DIAMETER (mm) |       | WALL THICKNESS AT ENDS (mm) |      | WALL THICKNESS AT CENTER (mm) |     | EFFECTIVE LENGTH OF PIPE (mm) | WEIGHT PER PIPE (kg) | NO. OF PIPES PER BUNDLE |
|------------------|-----|---------------------|-------|-----------------------------|------|-------------------------------|-----|-------------------------------|----------------------|-------------------------|
| Inches           | mm  | Min                 | Max   | Min                         | Max  | Min                           | Max |                               |                      |                         |
| 1                | 25  | 32,8                | 33,1  | 5,4                         | 5,7  | 3,3                           | 3,6 | 3010                          | 1,72                 | 25                      |
| 1¼               | 32  | 41,8                | 42,1  | 5,7                         | 6,0  | 3,5                           | 3,8 | 3010                          | 2,52                 | 20                      |
| 1½               | 40  | 47,8                | 48,1  | 6,3                         | 6,6  | 4,0                           | 4,3 | 3010                          | 3,13                 | 15                      |
| 2                | 50  | 59,8                | 60,1  | 6,5                         | 6,8  | 4,0                           | 4,3 | 3010                          | 3,98                 | 10                      |
| 2½               | 65  | 74,7                | 75,2  | 6,8                         | 7,1  | 4,4                           | 4,7 | 3010                          | 5,62                 | 8                       |
| 3                | 80  | 87,7                | 88,2  | 8,0                         | 8,3  | 5,4                           | 5,7 | 3010                          | 7,93                 | 5                       |
| 4                | 100 | 112,3               | 113,3 | 8,2                         | 8,5  | 5,7                           | 6,0 | 3010                          | 11,26                | 4                       |
| 5                | 140 | 139,5               | 140,2 | 12,7                        | 12,5 | 7,7                           | 8,0 | 3010                          | 15,30                | 3                       |

### HEAVY TYPE

| NOMINAL DIAMETER |     | OUTER DIAMETER (mm) |       | WALL THICKNESS AT ENDS (mm) |      | WALL THICKNESS AT CENTER (mm) |      | EFFECTIVE LENGTH OF PIPE (mm) | WEIGHT PER PIPE (kg) | NO. OF PIPES PER BUNDLE |
|------------------|-----|---------------------|-------|-----------------------------|------|-------------------------------|------|-------------------------------|----------------------|-------------------------|
| Inches           | mm  | Min                 | Max   | Min                         | Max  | Min                           | Max  |                               |                      |                         |
| 1¼               | 32  | 41,8                | 42,1  | 6,6                         | 6,9  | 4,5                           | 4,8  | 3010                          | 2,82                 | 15                      |
| 1½               | 40  | 47,8                | 48,1  | 7,6                         | 7,9  | 5,2                           | 5,5  | 3010                          | 3,68                 | 12                      |
| 2                | 50  | 59,8                | 60,1  | 8,1                         | 8,4  | 5,4                           | 5,7  | 3010                          | 5,18                 | 10                      |
| 2½               | 65  | 74,7                | 75,2  | 9,2                         | 9,6  | 6,4                           | 6,7  | 3010                          | 7,62                 | 6                       |
| 3                | 80  | 87,7                | 88,2  | 10,1                        | 10,4 | 7,6                           | 7,9  | 3010                          | 10,19                | 5                       |
| 4                | 100 | 112,3               | 113,3 | 11,9                        | 12,3 | 9,4                           | 9,7  | 3010                          | 14,42                | 3                       |
| 5                | 140 | 139,5               | 140,2 | 16,7                        | 17   | 12,7                          | 13   | 3010                          | 23,30                | 2                       |
| 6                | 165 | 164,7               | 165,5 | 16,5                        | 17   | 13,8                          | 14,5 | 3010                          | 33                   | 1                       |

\* Super Heavy pipe can't be connected to regular adaptor & require special adaptor.

Note : Installation depth depends on recommended permissible hydrostatic pressure rating of the pipes and refer pump delivery pressure chart on page 4 for more details.

## WEIGHT CARRYING CAPACITY

### STANDARD TYPE

| NOMINAL DIAMETER |     | RECOMMENDED DEPTH IN (m) | PIPE WEIGHT (kg) APPROX FOR LENGTH (m) | COLUMN WATER WEIGHT (kg) FOR LENGTH (m) | PUMP SET WEIGHT (kg) APPROX. | CABLE WEIGHT (kg) APPROX. | TOTAL WEIGHT (kg) | MAX. LOAD CAPACITY (kg) FOR PULLING WITH CHAIN PULLY | ULTIMATE BREAKING LOAD (kg) |
|------------------|-----|--------------------------|----------------------------------------|-----------------------------------------|------------------------------|---------------------------|-------------------|------------------------------------------------------|-----------------------------|
| Inches           | mm  |                          |                                        |                                         |                              |                           |                   |                                                      |                             |
| 1                | 25  | 300                      | 172                                    | 150                                     | 65                           | 150                       | 539               | 1300                                                 | 1800                        |
| 1¼               | 32  | 260                      | 198                                    | 238                                     | 85                           | 150                       | 674               | 1500                                                 | 2500                        |
| 1½               | 40  | 260                      | 249                                    | 329                                     | 130                          | 150                       | 861               | 1700                                                 | 3000                        |
| 2                | 50  | 200                      | 271                                    | 433                                     | 170                          | 150                       | 1028              | 2100                                                 | 3800                        |
| 2½               | 65  | 160                      | 282                                    | 541                                     | 290                          | 150                       | 1269              | 2700                                                 | 5000                        |
| 3                | 80  | 170                      | 441                                    | 827                                     | 400                          | 150                       | 1826              | 4000                                                 | 7000                        |
| 4                | 100 | 150                      | 559                                    | 1300                                    | 530                          | 150                       | 2551              | 5700                                                 | 10300                       |
| 5                | 140 | 160                      | 667                                    | 1773                                    | 660                          | 150                       | 3250              | 9650                                                 | 16500                       |

### HEAVY TYPE

| NOMINAL DIAMETER |     | RECOMMENDED DEPTH IN (m) | PIPE WEIGHT (kg) APPROX FOR LENGTH (m) | COLUMN WATER WEIGHT (kg) FOR LENGTH (m) | PUMP SET WEIGHT (kg) APPROX. | CABLE WEIGHT (kg) APPROX. | TOTAL WEIGHT (kg) | MAX. LOAD CAPACITY (kg) FOR PULLING WITH CHAIN PULLY | ULTIMATE BREAKING LOAD (kg) |
|------------------|-----|--------------------------|----------------------------------------|-----------------------------------------|------------------------------|---------------------------|-------------------|------------------------------------------------------|-----------------------------|
| Inches           | mm  |                          |                                        |                                         |                              |                           |                   |                                                      |                             |
| 1¼               | 32  | 350                      | 324                                    | 280                                     | 90                           | 220                       | 917               | 1550                                                 | 3100                        |
| 1½               | 40  | 350                      | 422                                    | 403                                     | 140                          | 220                       | 1188              | 2000                                                 | 4000                        |
| 2                | 50  | 270                      | 447                                    | 491                                     | 180                          | 220                       | 1342              | 2850                                                 | 4700                        |
| 2½               | 65  | 260                      | 658                                    | 758                                     | 310                          | 220                       | 1952              | 4200                                                 | 7000                        |
| 3                | 80  | 260                      | 881                                    | 1200                                    | 425                          | 220                       | 2764              | 5700                                                 | 9500                        |
| 4                | 100 | 260                      | 1243                                   | 2167                                    | 560                          | 220                       | 4202              | 9500                                                 | 16000                       |
| 5                | 140 | 260                      | 1605                                   | 3133                                    | 500                          | 220                       | 5458              | 14600                                                | 24500                       |
| 6                | 165 | 260                      | 1967                                   | 4099                                    | 1000                         | 220                       | 7016              | 23500                                                | 40000                       |

## PUMP DELIVERY PRESSURE

Pump delivery pressure is the maximum delivery head of the pump. In the pump performance curves the value of head at which the flow becomes nil (zero), is the max. head in metres. Hence the max head of the pump must not exceed the recommended permissible hydrostatic pressure of the pipes published in the following table.

Permissible hydrostatic Pressure

(10m = 1kg/cm<sup>2</sup>)

| NOMINAL DIAMETER |     | ELITE | MEDIUM | STANDARD | HEAVY | SUPER HEAVY |
|------------------|-----|-------|--------|----------|-------|-------------|
| Inches           | mm  |       |        |          |       |             |
| 1                | 25  | 15    | 21     | 30       |       |             |
| 1¼               | 32  | 15    | 21     | 26       | 35    |             |
| 1½               | 40  | 15    | 21     | 26       | 35    |             |
| 2                | 50  | 6     | 13     | 20       | 27    | 35          |
| 2½               | 65  |       | 10     | 16       | 26    | 35          |
| 3                | 80  |       | 11     | 17       | 26    | 35          |
| 4                | 100 |       | 10     | 15       | 26    | 35          |
| 5                | 125 |       |        | 16       | 26    | 35          |
| 6                | 150 |       |        |          | 26    |             |

\* Installation depth depends on recommended permissible hydrostatic pressure rating of the pipes and refer pump delivery pressure chart for more details.

## SELECTION OF PIPES

The column pipes must be selected from the types available, so that the pump delivery pressure does not exceed the permissible hydrostatic pressure. In the column, for every 10m above the pump, there is a pressure drop of 1 kg/cm<sup>2</sup>. If the pump delivery pressure is high, two different class pipes of the same size can be used, instead of using same type of pipes alone for the entire depth, to make it cost effective. Heavy type pipes can be used upto required length starting from pump and medium plus / standard type pipes can be used for the remaining length. An illustration is given below.

As per above illustration 40m of Heavy class pipes must be used starting from the pump, even for the lower depth installations since the pump delivery pressure is 24kg/cm<sup>2</sup>.

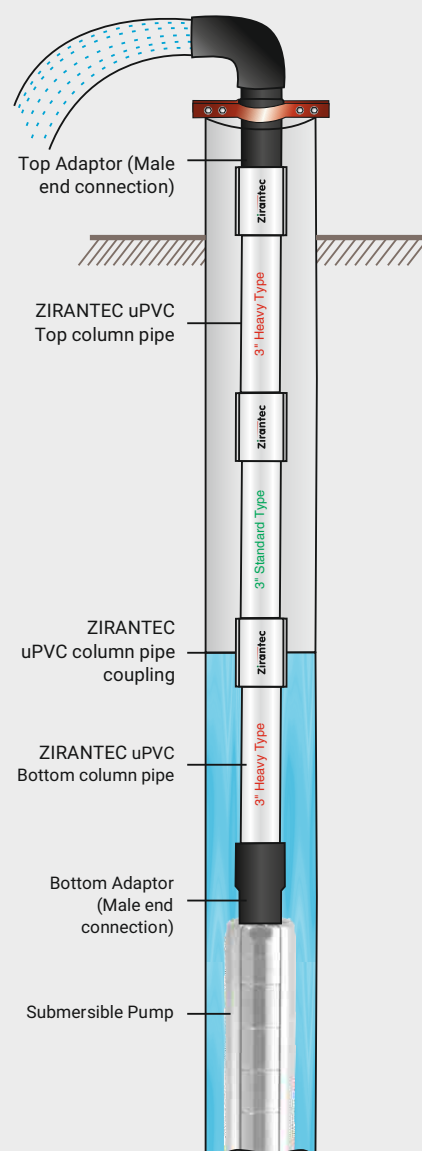
While selecting the pipe it must be ensured that the total load is very well within the recommended ultimate breaking load.

## EXAMPLE

|                                                                                                           |                            |                                    |
|-----------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------|
| Pump delivery pressure                                                                                    | 24 kg/cm <sup>2</sup>      |                                    |
| Pump outlet size & Pipe size                                                                              | 2" (50mm) Nominal Diameter |                                    |
| Standard type pipe recommended permissible pressure                                                       | 20 kg/cm <sup>2</sup>      | Refer pump delivery pressure chart |
| Heavy type pipe recommended permissible pressure                                                          |                            |                                    |
| 24 - 20 = 4 kg/cm <sup>2</sup> , Extra Pressure over Standard pipes 4x10=40m (10m = 1kg/cm <sup>2</sup> ) |                            |                                    |

## INSTALLATION PROCEDURE

- First connect the male end of the bottom adaptor (C.I. / S.S) firmly to the pump discharge housing using a pipe wrench and first pipe can be connected to the female end.
- Before connecting clean both the ends of the pipes with clean water and check rubber seal ring for any damage.
- The pipe can be tightened by hand itself but, while tightening water has to be poured on pipe threads for lubrication. Anyhow for better grip strap wrench can be used to tighten / hold the pipes.
- Tighten the pipes by hand, until the rubber seal ring in the pipe end completely enters in to the coupling.
- Submersible pump cable need to be tied in regular intervals along with the column pipes, for securing the cable from getting damaged.
- At the time of lowering the pump into borehole the C-clamp must be fastened only to the pipe portion marked as "CLAMP HERE".
- Then all other pipes can also be connected in the same way. Pipe wrench should not be used on the pipe for support.
- Once the top column pipe reaches the ground level, connect the top adaptor with male end connection.
- Finally from the ground level regular plumbing accessories can be used to transfer water to required delivery point.



ILLUSTRATION

NOTE : Separate earth conductor should be used for earthing the submersible pump, as these pipes are insulators.

## ACCESSORIES



## STORAGE

These pipes should be stored in a covered area protected from direct sunlight.

### APPROXIMATE FRICTIONAL HEAD LOSS IN ZIRANTEC STANDARD TYPE COLUMN PIPES

| FLOW              |         | NOMINAL DIAMETER OF PIPE (INCHES/MM) |           |           |        |           |        |        |
|-------------------|---------|--------------------------------------|-----------|-----------|--------|-----------|--------|--------|
| m <sup>3</sup> /h | l/min.  | 1" 25                                | 1 1/4" 32 | 1 1/2" 40 | 2" 50  | 2 1/2" 65 | 3" 80  | 4" 100 |
| 1                 | 16,67   | 1,758                                | 0,570     | 0,199     | 0,056  | 0,018     | 0,009  |        |
| 1,5               | 25,00   | 3,575                                | 1,158     | 0,404     | 0,121  | 0,037     | 0,018  | 0,005  |
| 2                 | 33,33   | 5,914                                | 1,917     | 0,668     | 0,200  | 0,061     | 0,029  | 0,009  |
| 2,5               | 41,67   | 8,739                                | 2,832     | 0,987     | 0,296  | 0,090     | 0,043  | 0,012  |
| 3                 | 50,00   | 12,023                               | 3,897     | 1,358     | 0,407  | 0,123     | 0,059  | 0,017  |
| 3,5               | 58,33   | 15,747                               | 5,103     | 1,779     | 0,533  | 0,162     | 0,077  | 0,022  |
| 4                 | 66,67   | 19,892                               | 6,447     | 2,247     | 0,674  | 0,204     | 0,098  | 0,028  |
| 4,5               | 75,00   | 24,446                               | 7,922     | 2,761     | 0,828  | 0,251     | 0,120  | 0,034  |
| 5                 | 83,33   | 29,396                               | 9,526     | 3,320     | 0,996  | 0,302     | 0,144  | 0,041  |
| 6                 | 100,00  | 40,443                               | 13,107    | 4,568     | 1,370  | 0,415     | 0,198  | 0,056  |
| 7                 | 116,67  | 52,967                               | 17,165    | 5,983     | 1,794  | 0,544     | 0,260  | 0,074  |
| 8                 | 133,33  |                                      | 21,683    | 7,557     | 2,267  | 0,687     | 0,328  | 0,093  |
| 9                 | 150,00  |                                      | 26,647    | 9,287     | 2,785  | 0,844     | 0,403  | 0,115  |
| 10                | 166,67  |                                      | 29,534    | 11,168    | 3,349  | 1,015     | 0,485  | 0,138  |
| 12                | 200,00  |                                      | 36,849    | 12,699    | 4,608  | 1,397     | 0,668  | 0,190  |
| 14                | 233,33  |                                      | 48,657    | 16,761    | 6,035  | 1,830     | 0,874  | 0,248  |
| 16                | 266,67  |                                      |           | 21,321    | 6,312  | 2,310     | 1,104  | 0,314  |
| 18                | 300,00  |                                      |           | 26,368    | 7,803  | 2,840     | 1,357  | 0,386  |
| 20                | 333,33  |                                      |           | 31,891    | 9,435  | 3,080     | 1,502  | 0,464  |
| 22                | 366,67  |                                      |           | 37,883    | 11,204 | 3,351     | 1,696  | 0,548  |
| 24                | 400,00  |                                      |           | 44,334    | 13,108 | 3,920     | 1,859  | 0,638  |
| 26                | 433,33  |                                      |           |           | 15,146 | 4,528     | 2,147  | 0,734  |
| 28                | 466,67  |                                      |           |           | 17,316 | 5,176     | 2,453  | 0,835  |
| 30                | 500,00  |                                      |           |           | 19,615 | 5,862     | 2,778  | 0,979  |
| 35                | 583,33  |                                      |           |           | 25,921 | 7,743     | 3,669  | 1,028  |
| 40                | 666,67  |                                      |           |           | 33,010 | 9,856     | 4,669  | 1,307  |
| 45                | 750,00  |                                      |           |           | 40,863 | 12,196    | 5,776  | 1,617  |
| 50                | 833,33  |                                      |           |           | 49,466 | 14,759    | 6,988  | 1,955  |
| 55                | 916,67  |                                      |           |           |        | 17,540    | 8,303  | 2,323  |
| 60                | 1000,00 |                                      |           |           |        | 20,537    | 9,720  | 2,718  |
| 65                | 1083,33 |                                      |           |           |        | 23,746    | 11,237 | 3,142  |
| 70                | 1166,67 |                                      |           |           |        | 27,164    | 12,853 | 3,592  |
| 75                | 1250,00 |                                      |           |           |        | 30,789    | 14,566 | 4,070  |
| 80                | 1333,33 |                                      |           |           |        | 34,619    | 16,375 | 4,575  |
| 85                | 1416,67 |                                      |           |           |        | 38,651    | 18,281 | 5,106  |
| 90                | 1500,00 |                                      |           |           |        | 42,885    | 20,280 | 5,664  |
| 95                | 1583,33 |                                      |           |           |        | 47,317    | 22,374 | 6,247  |
| 100               | 1666,67 |                                      |           |           |        |           | 24,560 | 6,856  |
| 105               | 1750,00 |                                      |           |           |        |           | 26,839 | 7,491  |
| 110               | 1833,33 |                                      |           |           |        |           | 29,209 | 8,151  |
| 115               | 1916,67 |                                      |           |           |        |           | 31,670 | 8,837  |

HEAD LOSS IN METERS, FOR 100M LENGTH OF PIPE

Friction loss calculated using  
Darcy - Weisbach equation  
 $h_{fs} = 4f (L/D) (V^2 / 2)g$   
for H<sub>2</sub>O at 20°C

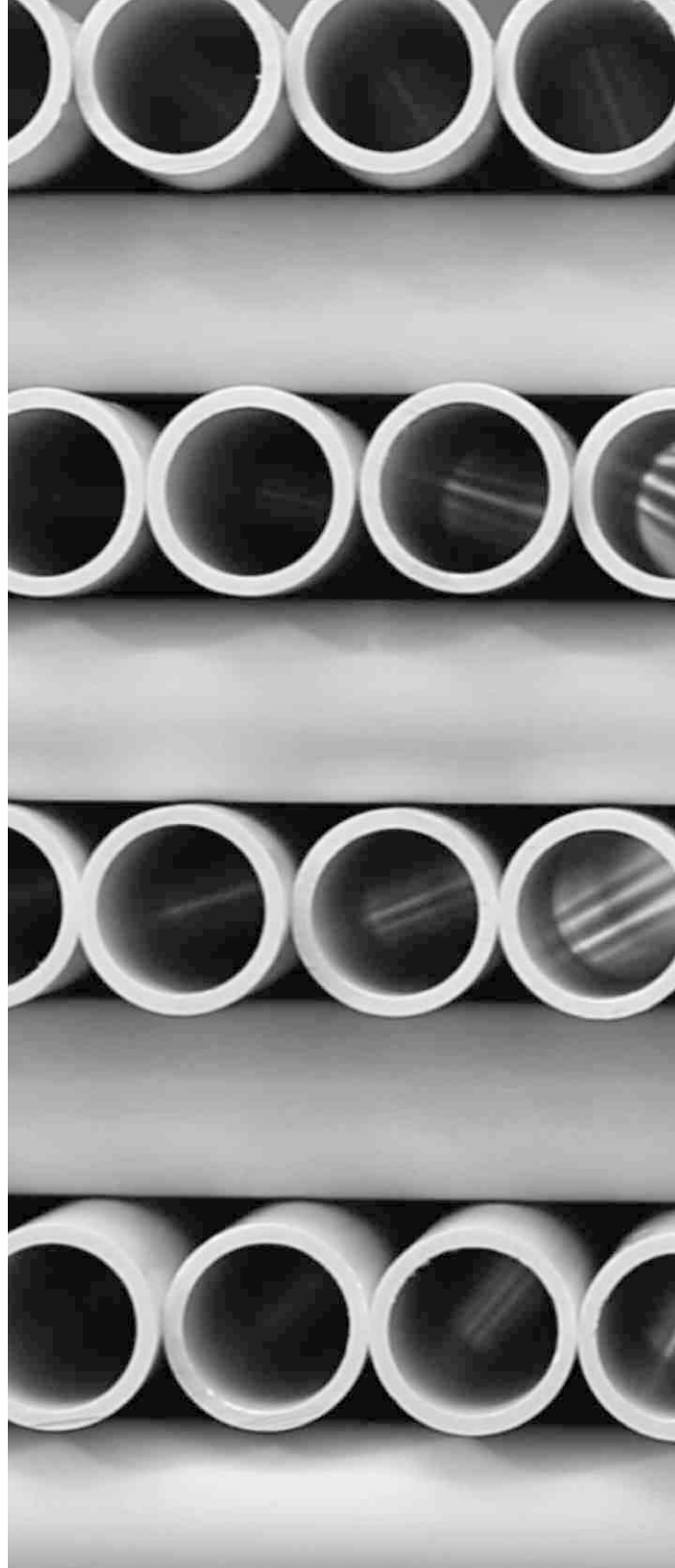
# APPROXIMATE FRICTIONAL HEAD LOSS IN ZIRANTEC HEAVY TYPE COLUMN PIPES

| FLOW |         | NOMINAL DIAMETER OF PIPE (INCHES/MM) |                                                                                                                               |         |        |         |        |        |                                              |
|------|---------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------|--------|---------|--------|--------|----------------------------------------------|
| m³/h | l/min.  | 1" 25                                | 1 ¼" 32                                                                                                                       | 1 ½" 40 | 2" 50  | 2 ½" 65 | 3" 80  | 4" 100 | HEAD LOSS IN METERS, FOR 100M LENGTH OF PIPE |
| 1    | 16,67   | 2,596                                | 0,587                                                                                                                         | 0,295   | 0,089  | 0,029   | 0,014  |        |                                              |
| 1,5  | 25,00   | 5,277                                | 1,193                                                                                                                         | 0,599   | 0,181  | 0,060   | 0,028  | 0,009  |                                              |
| 2    | 33,33   | 8,731                                | 1,974                                                                                                                         | 0,990   | 0,299  | 0,099   | 0,046  | 0,015  |                                              |
| 2,5  | 41,67   | 12,902                               | 2,917                                                                                                                         | 1,464   | 0,442  | 0,147   | 0,068  | 0,021  |                                              |
| 3    | 50,00   | 17,751                               | 4,013                                                                                                                         | 2,014   | 0,609  | 0,203   | 0,094  | 0,029  |                                              |
| 3,5  | 58,33   | 23,248                               | 5,257                                                                                                                         | 2,638   | 0,797  | 0,265   | 0,123  | 0,039  |                                              |
| 4    | 66,67   | 29,368                               | 6,640                                                                                                                         | 3,332   | 1,007  | 0,335   | 0,155  | 0,049  |                                              |
| 4,5  | 75,00   | 36,090                               | 8,160                                                                                                                         | 4,095   | 1,237  | 0,412   | 0,190  | 0,060  |                                              |
| 5    | 83,33   | 43,398                               | 9,812                                                                                                                         | 4,924   | 1,488  | 0,495   | 0,229  | 0,072  |                                              |
| 6    | 100,00  | 59,708                               | 13,500                                                                                                                        | 6,774   | 2,047  | 0,682   | 0,315  | 0,099  |                                              |
| 7    | 116,67  | 64,634                               | 17,680                                                                                                                        | 8,871   | 2,681  | 0,893   | 0,412  | 0,130  |                                              |
| 8    | 133,33  |                                      | 22,335                                                                                                                        | 11,207  | 3,387  | 1,128   | 0,521  | 0,164  |                                              |
| 9    | 150,00  |                                      | 27,448                                                                                                                        | 13,772  | 4,162  | 1,386   | 0,640  | 0,201  |                                              |
| 10   | 166,67  |                                      | 32,340                                                                                                                        | 16,560  | 5,002  | 1,667   | 0,770  | 0,242  |                                              |
| 12   | 200,00  |                                      | 37,969                                                                                                                        | 18,910  | 6,886  | 2,293   | 1,059  | 0,334  |                                              |
| 14   | 233,33  |                                      | 50,135                                                                                                                        | 24,963  | 7,448  | 3,002   | 1,387  | 0,438  |                                              |
| 16   | 266,67  |                                      |                                                                                                                               | 31,759  | 9,472  | 3,793   | 1,652  | 0,553  |                                              |
| 18   | 300,00  |                                      |                                                                                                                               | 39,281  | 11,711 | 3,854   | 1,903  | 0,679  |                                              |
| 20   | 333,33  |                                      |                                                                                                                               | 47,513  | 14,161 | 4,659   | 2,134  | 0,817  |                                              |
| 22   | 366,67  |                                      |                                                                                                                               | 56,445  | 16,819 | 5,531   | 2,533  | 0,965  |                                              |
| 24   | 400,00  |                                      |                                                                                                                               |         | 19,679 | 6,470   | 2,963  | 1,066  |                                              |
| 26   | 433,33  |                                      |                                                                                                                               |         | 22,741 | 7,476   | 3,422  | 1,124  |                                              |
| 28   | 466,67  |                                      |                                                                                                                               |         | 25,994 | 8,545   | 3,911  | 1,220  |                                              |
| 30   | 500,00  |                                      |                                                                                                                               |         | 29,454 | 9,678   | 4,429  | 1,380  |                                              |
| 35   | 583,33  |                                      |                                                                                                                               |         | 38,931 | 12,787  | 5,850  | 1,822  |                                              |
| 40   | 666,67  |                                      |                                                                                                                               |         | 49,585 | 16,280  | 7,446  | 2,319  |                                              |
| 45   | 750,00  |                                      |                                                                                                                               |         |        | 20,148  | 9,213  | 2,868  |                                              |
| 50   | 833,33  |                                      |                                                                                                                               |         |        | 24,385  | 11,148 | 3,469  |                                              |
| 55   | 916,67  |                                      |                                                                                                                               |         |        | 28,984  | 13,248 | 4,121  |                                              |
| 60   | 1000,00 |                                      |                                                                                                                               |         |        | 33,940  | 15,510 | 4,823  |                                              |
| 65   | 1083,33 |                                      |                                                                                                                               |         |        | 39,247  | 17,933 | 5,576  |                                              |
| 70   | 1166,67 |                                      |                                                                                                                               |         |        | 44,901  | 20,513 | 6,376  |                                              |
| 75   | 1250,00 |                                      |                                                                                                                               |         |        | 50,899  | 23,250 | 7,225  |                                              |
| 80   | 1333,33 |                                      |                                                                                                                               |         |        | 57,236  | 26,140 | 8,121  |                                              |
| 85   | 1416,67 |                                      |                                                                                                                               |         |        |         | 29,183 | 9,065  |                                              |
| 90   | 1500,00 |                                      | Friction loss calculated using<br>Darcy - Weisbach equation<br>$h_{fs} = 4f (L/D) (V^2 / 2)g$<br>for H <sub>2</sub> O at 20°C |         |        |         | 32,378 | 10,056 |                                              |
| 95   | 1583,33 |                                      |                                                                                                                               |         |        |         | 35,723 | 11,093 |                                              |
| 100  | 1666,67 |                                      |                                                                                                                               |         |        |         | 39,216 | 12,176 |                                              |
| 105  | 1750,00 |                                      |                                                                                                                               |         |        |         | 42,857 | 13,304 |                                              |
| 110  | 1833,33 |                                      |                                                                                                                               |         |        |         | 46,644 | 14,477 |                                              |
| 115  | 1916,67 |                                      |                                                                                                                               |         |        |         | 50,577 | 15,696 |                                              |

In view of the continuous developments the Information / Descriptions / Specifications / illustrations are subject to change without notice.

# NOTES





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