# *CONSTRUCTION OF A SAMPLING PIPE NETWORK*

This section covers the physical aspects of the sampling pipe network. It is assumed the reader will be familiar with the basic design parameters given in the section covering System Design.

The recommendations given below are general and the designer/estimator/installer should also refer to applicable local Codes, Standards or Regulations that may have specific material and fixing requirements.

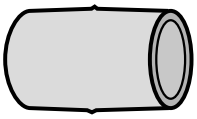
### *Sampling pipe*

- The sampling pipe should be smooth bore and non-permeable.
- Wherever possible, for main pipe runs an ABS pipe with an internal diameter of between 19 and 25 mm (3/4 and 1 inch) should be used. Whatever grade of material is selected, the ID should be measured and recorded for use in any PipeCAD® modelling process for the installation.
- ABS is the preferred material as it has superior significant mechanical properties to PVC-u in equivalent sizes, particularly impact strength and operating temperature range.
- The grade of pipe selected should have sufficient mechanical strength to resist accidental damage and permanent distortion, particularly where it is accessible or suspended between fixing points. For this reason it is considered light gauge PVC-u electrical conduit is unsuitable for this application.
- Suitable ABS red coloured pipe and associated fittings and accessories can be sourced from Aspirating Pipe Supplies Ltd.
- The sampling pipe should be clearly and permanently marked to indicate its purpose. Ideally the pipe should be pigmented or painted red which identifies it as being part of a fire protection system.
- Where mandatory or where particular physical or aesthetic characteristics required, metallic pipe can be used. e.g. galvanised steel, stainless steel, copper. The general requirements given above apply.
- Metallic sampling pipe networks should be permanently bonded to the building earth. (Ground) Reference should be made to local Electrical Codes, Standards or Regulations for detailed guidance.
- Consideration must be made to the thermal coefficient of expansion of the sampling pipe material used. If a sampling pipe network is installed at ambient temperature in an application where the actual operating temperature would be significantly higher or lower (E.g. a cold store), allowance must be made for the expansion or contraction in the sampling pipe. See Special Applications - Cold Stores for an example.

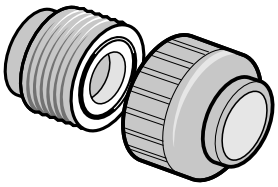
## *Fittings*

Only fittings or jointing systems compatible with the sampling pipe should be used. Illustrations are given below of the range of fittings available for ABS pressure pipe systems and air sampling accessories derived from them.

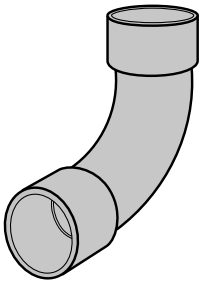
- Socket – Used to permanently join standard lengths of pipe together.



- Socket Union – Used where sections of sampling pipe need to be removed for access to other equipment or for routine maintenance. E.g. across air handling units or pipe entries to Stratos-HSSD® detector.



- 90° Bend - The recommended way of changing direction



***Note.*** *Elbow joints should* not be used.

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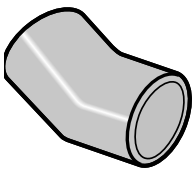
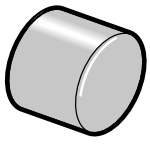
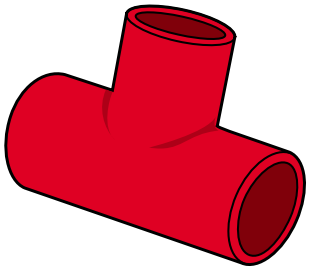
- 45° Bend – For bridging obstructions or making adjustments to the sampling pipe route.



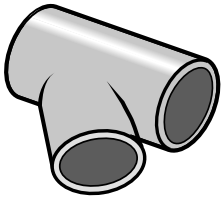
- End Cap - For terminating sampling pipe branches or extended sampling points



- 90° Tee – For extended sampling points or equal splits in sampling pipe branches.

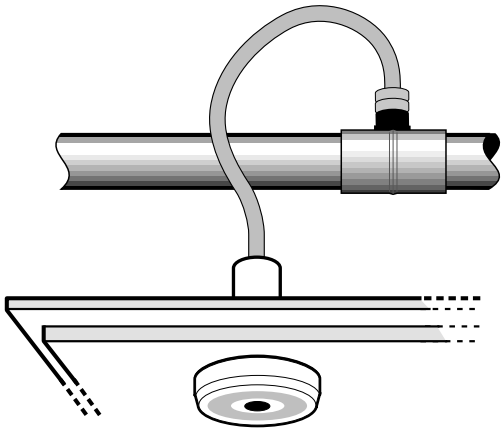


- Y-piece - Used for dividing a pipe branch.

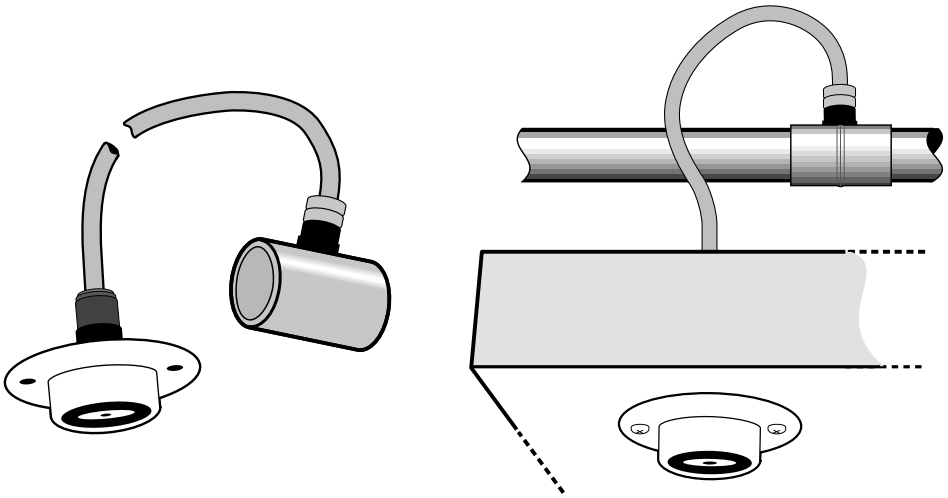


Within the ranges available there are numerous adapters (ABS to metal etc.) which allow the designer or installer to devise a sampling pipe network suitable for everypossible application. The same ranges lend themselves to the fabrication of a range of accessories. A selection is shown below.

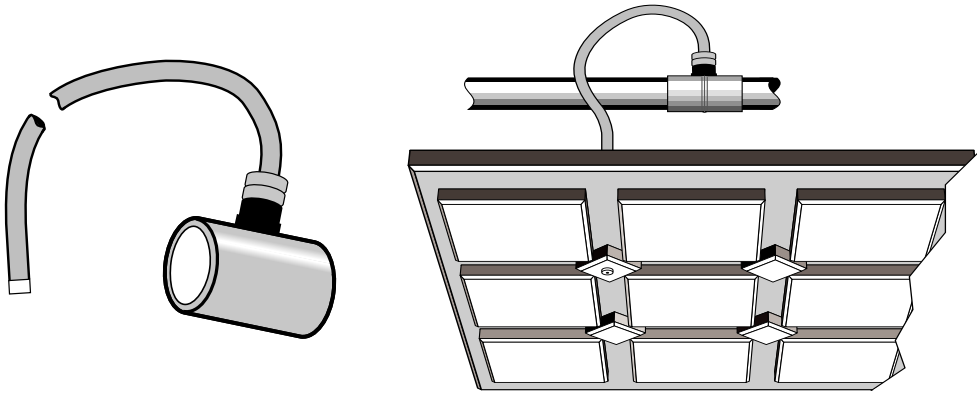
- In-line remote sampling point assembly - Suitable for sampling below a false ceiling constructed of standard fibre compound or sheet metal.



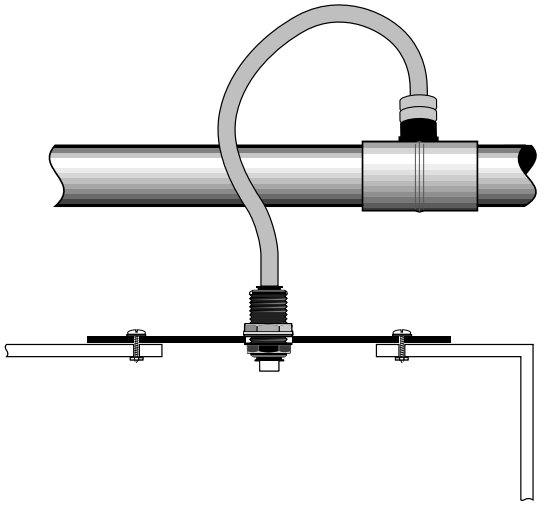
- In-line remote sampling point assembly - Suitable for sampling below a thicker ceiling or roof.



- In-line remote sampling point assembly - Capillary tube with drilled end plug suitable for concealed or in-cabinet sampling.



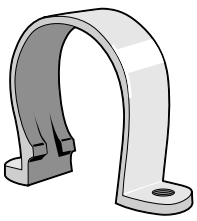
■ In-line remote sampling point assembly - Capillary tube with a bulkhead fitting and drilled end plug.



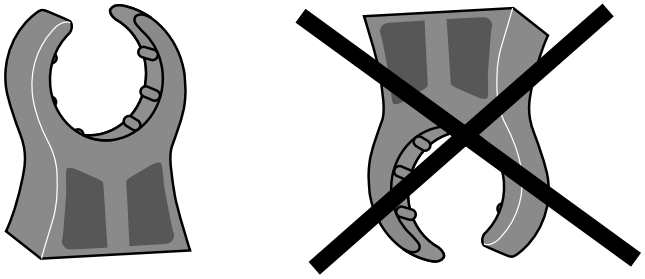
***Fixings*** There are wide ranges of fixings suitable for pressure pipe systems. It is the designer's responsibility to ensure the correct type is specified for the application. These ranges include:

- *Plastics and metal saddle clamps- normally secured with 2 x roundhead screws*
- *Plastics clips with or without safety locks - secured by single screw or bolt*
- *Pipe clamps on stands*
- *Pressed spring steel-clips - ranges available to secure pipe to almost any part of a building*
- *Metal and plastics straps*

■ Saddle clamp



■ Plastic pipe clip



***Note:*** *This type should not be used inverted*

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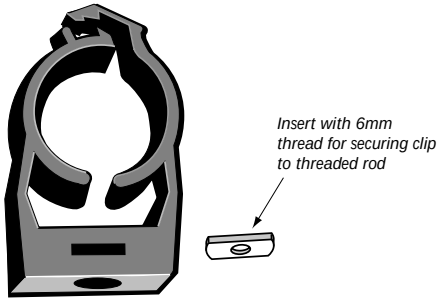
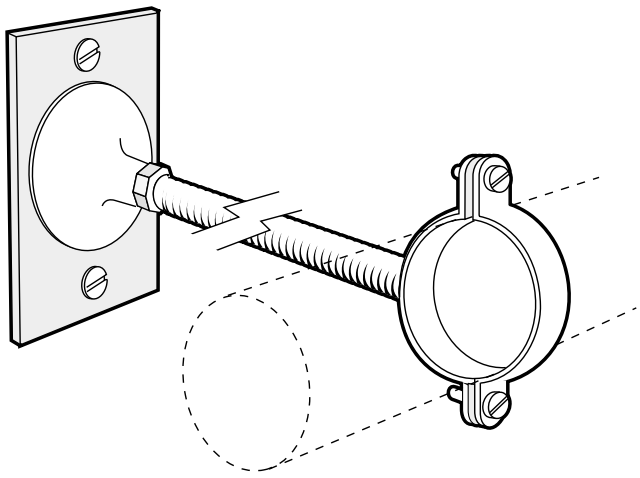
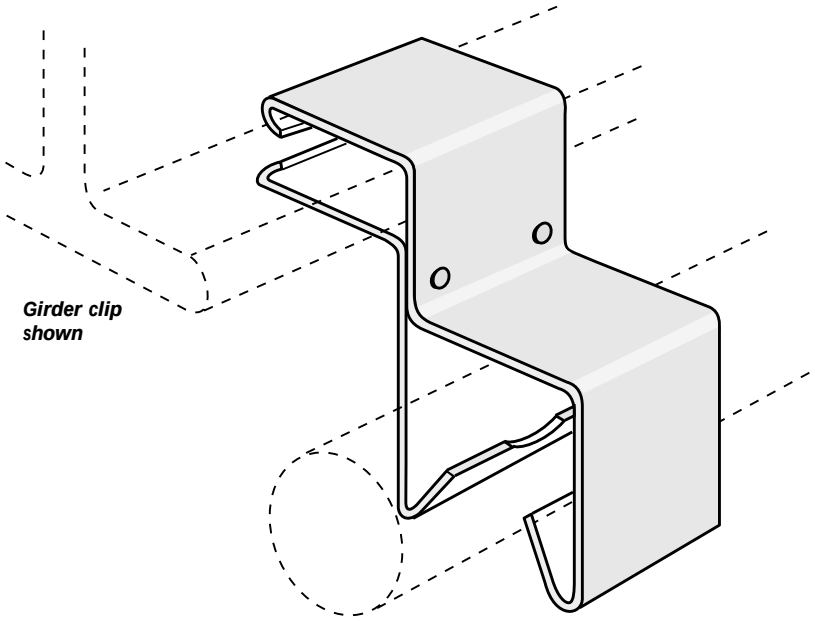
■ Plastic pipe clip with retainer




■ Pipe clamp and stand.



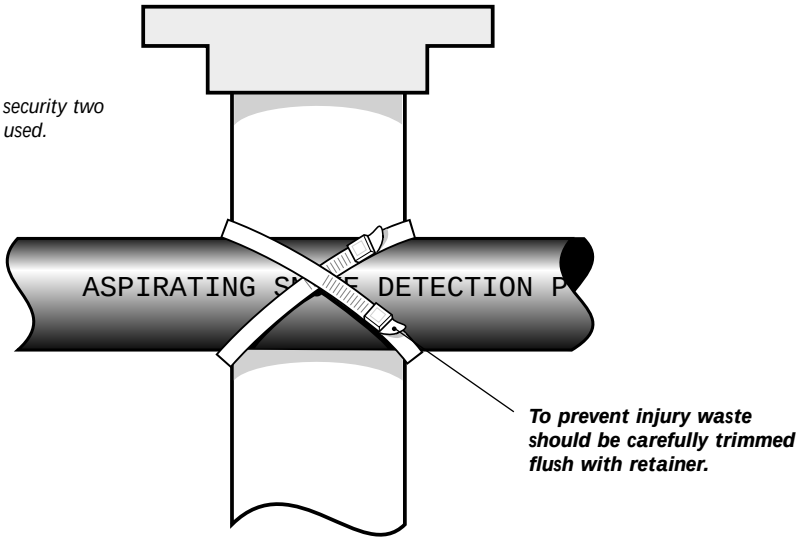
■ Pressed steel spring clip



***Girder clip shown***

■ Plastic ratchet strap

NB ☞ ***Note:*** *For added security two straps should be used.*




***To prevent injury waste should be carefully trimmed flush with retainer.***

## INSTALLING THE SAMPLING PIPE NETWORK

An installer should be familiar with local Codes, Standards and Regulations regarding the requirements for the application and materials being used.

Reference should be made to the manufactures or suppliers recommended procedures for the assembly of the particular materials being used for the project.

- It is assumed the installer has been provided with system design drawings and, if appropriate, PipeCAD® models.
- The spacing of fixings should be in accordance with the manufacturers or suppliers recommendations. For plastic pressure pipes, the fixing centres are normally quoted for pipe filled with water. As air sampling pipe is empty, extending the fixing centres by 20% would be acceptable, but should never be greater than 1.5 metres. Consideration must be given to the working temperatures of the installed pipe networks as fixing centre distances decrease as temperatures increase.
- If the working temperature of the installation is to be above or below the temperature at which the sampling pipe is installed, it is important to allow for the subsequent expansion or contraction of the sampling pipework. To achieve this it is advisable to allow for expansion/contraction U-bends in longer pipe runs. See fig. 1.

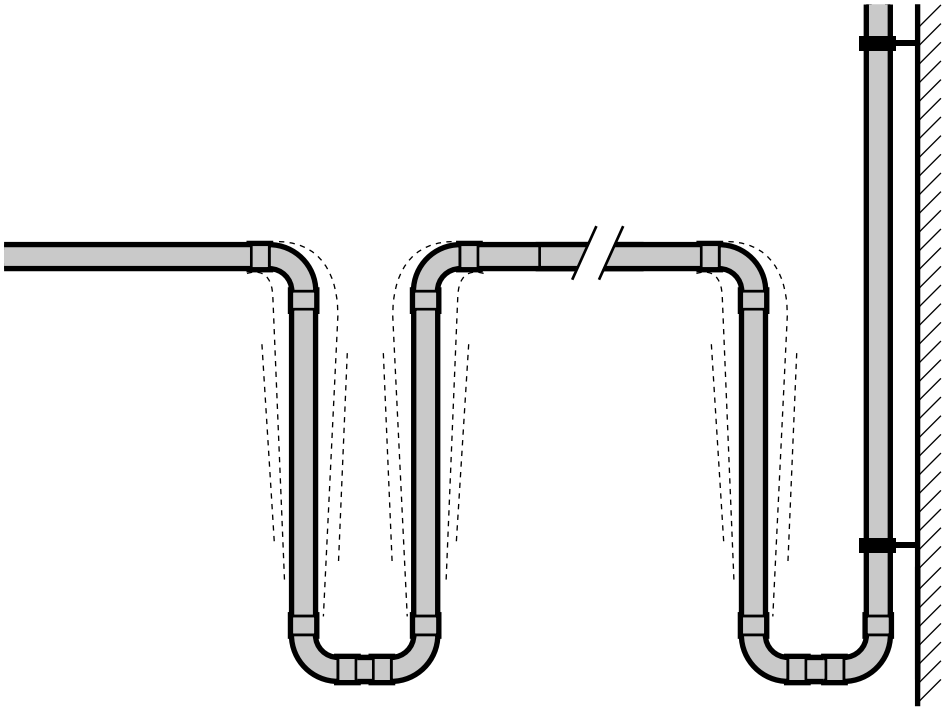


***Fig. 1*** ***Expansion/contraction assemblies. These allow longer main sampling pipe runs to expand or contract without excessive buckling.***

The point at when these become adjustable is dependent on the temperature differentials expected within an application. The length of the various pipes and the coefficient of linear expansion for the pipe material e.g. ABS = 10.1 x $10^{-5}$/°C.

***Fig. 2*** ***If considerable expansion/contraction of the sampling pipe is anticipated the supporting clip should allow for movement.***

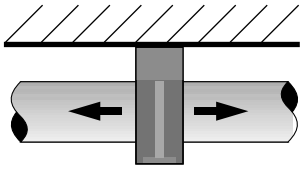


***Fig. 3*** ***When using extended pipe clamps the clamp should be loose enough to allow for expansion.***

- Where expansion or contraction is anticipated, it is advisable to use pipe clips that allow the pipework to move within them along the pipe axis or to allow flexibility within the support system.
- Plastic sampling pipe should be cut with purpose-made shears rather than a saw to ensure an accurate cut and to avoid problems with swarf.
- The type of fixing used should be fit for the purpose. Open clips should not be used inverted, particularly where there is the risk of others using the pipe as a handhold. Where the pipe is normally accessible (e.g. across low-level air extract points) the type and spacing of the fixings should reflect the increased possibility of accidental (or malicious) damage.
- Starting at the Stratos-HSSD® or Stratos-Quadra® the installer should install each pipe branch according to the drawings provided. If for practical reasons deviations are necessary, the installer should make a note of the changes, including the increase (or decrease) in any pipe and fittings (or manipulations) used. If any deviations are significant, the installer should refer to the designer to check whether the variations will adversely affect the specified performance criteria.
- For an aspirating smoke detection system to be effective and predictable it is imperative joints in the sampling pipe network are permanently fixed and air tight. With a plastics pipe system each joint should be cemented following the procedure recommended by the supplier. The exception to this is the inlet manifold to the detector which has tapered inlets designed for pressure pipe systems. For an air tight seal the pipe should be firmly twisted into the inlet. Do not use cement or glue.

- When cementing joints, only use a jointing compound formulated specifically for the material being used for the sampling pipe network. ABS and PVC-u cements are not the same formulation.
- Jointing compounds may be flammable or harmful. Product hazard data sheets may need to be submitted to the person responsible for health and safety on the site.
- If alternative materials are to be used for the sampling pipe network, the appropriate adapter or composite union should be used to maintain integrity at the connection to the Stratos detector.
- If the sampling pipe does not have clear identification, labels should be attached to the pipework at regular intervals. Where the pipe is concealed in voids ensure the identification is clearly visible from all access points.

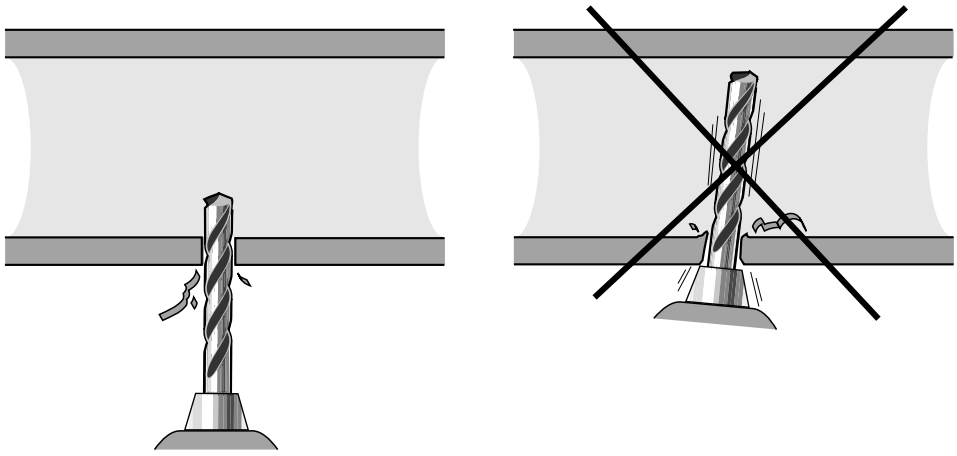


***Fig. 4 Careful drilling of sampling holes ensures correct flow.***

## *Drilling (Calibrating) the Sampling Holes*

The sampling holes of the correct diameter should be drilled in the positions marked on the design drawing(s). These may have been calculated within the PipeCAD® modelling program. If significant deviations from the original sampling pipe network design were necessary during installation, revised PipeCAD® models may need to be produced that illustrate the changes and confirm the system continues to meet the design specification.

For complex or unbalanced sampling pipe networks the designer may use features in PipeCAD® which will calculate the calibration of sampling hole diameters in 0.5 mm steps. The engineer responsible should have a set of good quality drills between 2.5 and 6.0 mm. Care should be taken, particularly if sampling holes are being drilled simultaneously with the erection of the sampling pipe, that the correct diameter hole is drilled against the drawing co-ordinates.

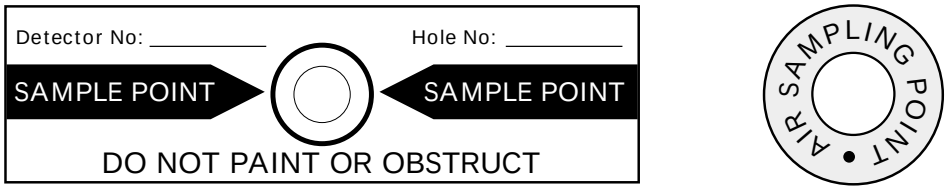
The holes should be drilled at low speed with minimum force.

Using a blunt drill and forcing it into the pipe at high speed will throw swarf into the sampling pipe and cause internal burrs and disruptions. Carelessly drilled holes, particularly in small diameters, can seriously affect the overall response of a system and may ultimately cause a system to fail proof testing. Figure 4 illustrates this.

As the majority of holes will be drilled from below, eye protection should be worn.

As an aid to locating and identifying sampling points, a label should surround each point. Figure 5 describes suitable models.

***Fig. 5*** ***Self adhesive labels suitable for identifying air sampling holes.***




## Noisy sampling holes

Occasionally one or more of the sampling holes will ‘whistle’. The causes of this phenomenon are functions of the air density, relative humidity, air velocity and the shape of the sampling hole itself.

Little can be done about air density and relative humidity so a cure lies with the shape of the sampling hole and the air velocity through it. The whistle is caused by the sampled air being drawn over the sharp edges of the hole with sufficient velocity to make it resonate. It should be remembered that under these conditions the airflow through the hole would not be efficient.

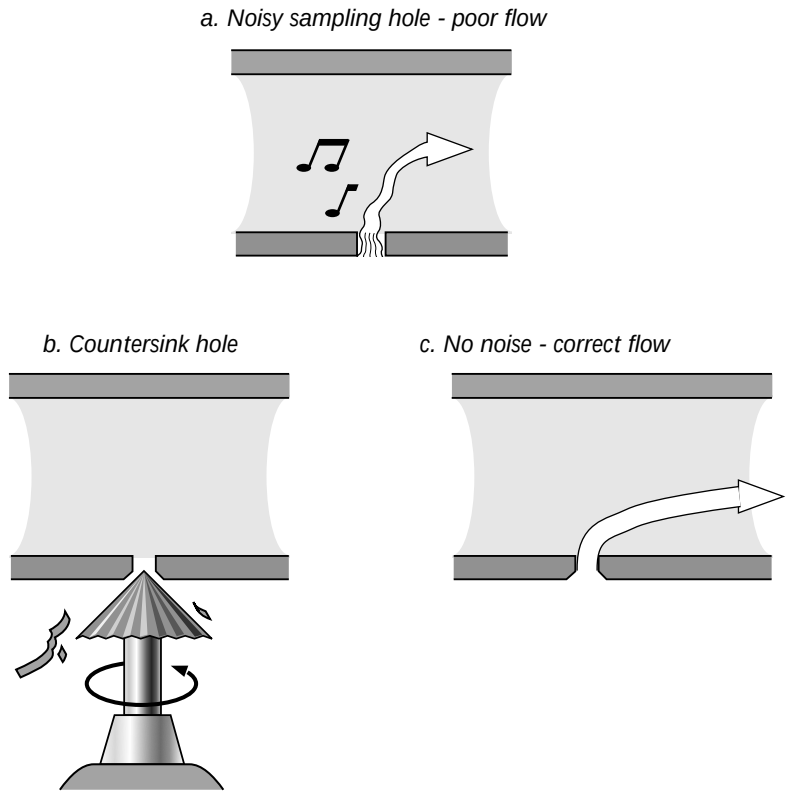
Assuming the sampling holes have been drilled in accordance with the PipeCAD® model for the system, there are two possible remedies.

1. Countersink the inlet to the hole to remove the sharp-edged 90° turn into it. This smoothes the air flow and reduces the depth of the hole itself. It is recommended eye protection is worn. See figure 6.

2. Reduce the speed of the aspirating fan. Although it would be reasonable to assume the system response times would deteriorate, this may not be true. The type of aspirator used in the Stratos requires a certain inlet area for a particular impeller speed to achieve maximum efficiency. Reducing the speed of the aspirator may well reduce or eliminate the resonance at the holes and improve the airflow through them. This will better satisfy the demand of the aspirator making it more efficient and improve response times.

On smaller sampling pipe networks it may be possible to increase the size of the sampling holes. The PipeCAD® modelling program has a feature whereby hole sizes can be altered and the consequent effects on system performance are calculated.

***Fig. 6*** ***Modifying sampling holes to reduce noise.***




## *Testing the Sampling Pipe Network*

The importance of having a sampling pipe network that is robust and without uncalibrated air leakage paths has already been stressed.

Wherever practical, the network should be completed without sampling holes and using simple adapters, tested to a maximum air pressure of 1.0 bar (15 p.s.i.). Each branch in the network should hold pressure for one minute.

If specialist access equipment is required for installation of the sampling pipe network it may make any recommendation to test the pipework prior to drilling sampling holes impractical.