PUBLISHED DOCUMENT

PD CEN/TR
15310-2:2006

Characterization of waste — Sampling of waste materials —

Part 2: Guidance on sampling techniques

ICS 13.030.10; 13.030.20

BSI
British Standards

National foreword

This Published Document was published by BSI. It is the UK implementation of CEN/TR 15310-2:2006.

The UK participation in its preparation was entrusted by Technical Committee B/508, Waste management, to Subcommittee B/508/3, Characterization of waste.

A list of organizations represented on B/508/3 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 29 December 2006

ISBN 0 580 49834 4

Amendments issued since publication

Amd. No.	Date	Comments

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 15310-2

November 2006

ICS 13.030.10; 13.030.20

English Version

Characterization of waste - Sampling of waste materials - Part 2: Guidance on sampling techniques

Caractérisation des déchets - Prélèvement des déchets - Partie 2 : Guide relatif aux techniques d'échantillonnage

Charakterisierung von Abfall - Probenahme - Teil 2: Anwendung von Probenahmetechniken

This Technical Report was approved by CEN on 21 February 2006. It has been drawn up by the Technical Committee CEN/TC 292.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. CEN/TR 15310-2:2006: E

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Foreword

This Technical Report (CEN/TR 15310-2:2006) has been prepared by Technical Committee CEN/TC 292 “Characterization of waste”, the secretariat of which is held by NEN.

This Technical Report has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This Technical Report is one of a series of five, dealing with sampling techniques and procedures, which provide essential information for the application of the EN-standard:

EN 14899, Characterisation of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan.

The principal component of the EN Standard is the mandatory requirement to prepare a Sampling Plan. This EN 14899 standard can be used to:

— produce standardised sampling plans for use in regular or routine circumstances (i.e. the elaboration of daughter/derived standards dedicated to well defined sampling scenarios);

— incorporate specific sampling requirements into national legislation;

— design and develop a Sampling Plan on a case by case basis.

The Technical Reports display a range of potential approaches and tools to enable the project manager to tailor his sampling plan to a specific testing scenario (i.e. a ‘shop shelf’ approach to sampling plan development for waste testing). This approach allows flexibility in the selection of the sampling approach, sampling point, method of sampling and equipment used.

This Technical Report describes a range of techniques that could be used to sample a range of waste types from a variety of locations and arisings. Information is also provided on the selection and preparation of equipment and apparatus needed to complete the sampling exercise.

This report does not attempt to provide a definitive procedure for each and every situation that may arise from sampling a given waste type or specific analytical requirement, rather it aims to expose the factors that influence the selection of these practical field activities to ensure the most appropriate procedure is selected for any given sampling scenario. The most appropriate approach, tools, and methodology, in the absence of an existing recognised Sampling Plan should be chosen on a scenario-specific basis. However, this does not present a barrier to technical innovation, and there is no reason why methodologies other than those detailed in this Technical Report cannot be substituted.

Introduction

Wastes are materials, which the holder discards, or intends or is required to discard, and which may be sent for final disposal, reuse or recovery. Such materials are generally heterogeneous and it will be necessary therefore to specify in the testing programme the amount of material for which the characteristics of interest need to be defined. The testing of wastes allows informed decisions to be made on how they should be treated (or not), recovered or disposed. In order to undertake valid tests, some sampling of the waste is required.

The principal component of the standard EN 14899 is the mandatory requirement to prepare a Sampling Plan, within the framework of an overall testing programme as illustrated in Figure 1 of EN 14899:2005. This standard can be used to:

— produce standardised sampling plans for use in regular or routine circumstances (i.e. the elaboration of daughter/derived standards dedicated to well defined sampling scenarios);

— incorporate specific sampling requirements into national legislation;

— design and develop a Sampling Plan on a case by case basis.

The development of a Sampling Plan within this framework involves the progression through three steps or activities.

1) Define the Sampling Plan

2) Take a field sample in accordance with the Sampling Plan

3) Transport the laboratory sample to the laboratory

This Technical Report provides information to support Key Step 2 of the Sampling Plan process map and describes a selection of sampling techniques that can be used in the recovery of a sample for a wide variety of waste types and arisings. The sampling technique is the physical procedure employed by the sampler to collect part or parts of a discarded or secondary material for subsequent investigations. Specifically this Technical Report provides information to support 4.2.8.1 (Identify the sampling technique) of the Framework Standard.

This Technical Report should be read in conjunction with the Framework Standard for the preparation and application of a Sampling Plan as well as the other Technical Reports that contain essential information to support the Framework Standard. The full series comprises:

— EN 14899, Characterization of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan;

— CEN/TR 15310-1, Characterization of waste – Sampling of waste materials – Part 1: Guidance on selection and application of criteria for sampling under various conditions;

— CEN/TR 15310-2, Characterization of waste – Sampling of waste materials – Part 2: Guidance on sampling techniques;

— CEN/TR 15310-3, Characterization of waste – Sampling of waste materials – Part 3: Guidance on procedures for sub-sampling in the field;

— CEN/TR 15310-4, Characterization of waste – Sampling of waste materials – Part 4: Guidance on procedures for sample packaging, storage, preservation, transport and delivery;

— CEN/TR 15310-5, Characterization of waste – Sampling of waste materials – Part 5: Guidance on the process of defining the Sampling Plan.

The Technical Reports contain procedural options (as detailed in Figure 2 of EN 14899:2005) that can be selected to match the sampling requirements of any testing programme.

1 Scope

This Technical Report describes techniques for sampling liquid and granular waste material, including paste-like materials and sludges, found in a variety of locations. The Technical Report provides information to allow the selection and preparation of equipment and apparatus to be used in the sampling activity.

NOTE 1 This Technical Report provides a shop shelf of example sampling techniques that can be selected to meet a wide range of sampling situations. For a specific situation one of the presented procedures may be appropriate.

NOTE 2 The procedures listed in this Technical Report reflect current best practice, but these are not exhaustive and other procedures may be equally relevant.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13965-1:2004, *Characterization of waste - Terminology - Part 1: Material related terms and definitions*

EN 13965-2:2004, *Characterization of waste - Terminology - Part 2: Management related terms and definitions*

3 Terms and definitions

For the purposes of this Technical Report, the terms and definitions given in EN 13965-1:2004 and EN 13965-2:2004 and the following apply.

3.1
bottom sediment
solid layer of material on the bottom of liquid storage tanks

3.2
characteristic
property, which helps to identify or differentiate between items of a given population
[ISO 3534-1]

NOTE The characteristic may be either quantitative (by variables) or qualitative (by attributes).

3.3
composite sample
two or more increments/sub-samples mixed together in appropriate proportions, either discretely or continuously (blended composite sample), from which the average value of a desired characteristic may be obtained
[ISO 11074]

3.4
column sample
type of sample, more specifically related to the sampling of liquids where column samplers are used

NOTE A column of material is of equal length to the depth of the sub-population at that sampling point.

3.5
core sample
type of sample, more specifically related to the sampling of solids where augers and other core samplers are used

NOTE A vertical or direction sample is taken through the material whereby the integrity of the sub-population is maintained.

3.6
directional sample
geometric sample, usually in only one dimension, which is related to the single principal axis of variability of material in the sampling unit/lot

3.7
laboratory sample
sample sent to or received by the laboratory (IUPAC)

3.8
geometric sample
type of sample of specific shape, whose dimensions are related to the axes of variability of material in a sampling unit/lot

3.9
heterogeneity
degree to which a property or a constituent is not uniformly distributed throughout a quantity of material

NOTE 1 A material may be homogeneous with respect to one analyte or property but heterogeneous with respect to another.

NOTE 2 The degree of heterogeneity (the inverse of homogeneity) is the determining factor in sampling error.

3.10
homogeneity
degree to which a property or a constituent is uniformly distributed throughout a quantity of material. [ISO 11074]

3.11
increment
individual portion of material collected by a single operation of a sampling device

NOTE 1 Increments may be reduced and tested individually or combined with other increments, with the resulting composite reduced in size and tested as a single unit.

NOTE 2 Increments are created by the sampling operation and are usually taken from parts of a lot separated in time or space.

3.12
judgemental sampling
sampling undertaken from a practically convenient (perhaps relatively small) sub-population, not conducted fully in accordance with the statistical principles of sampling

3.13
laboratory sample
sample(s) or sub-sample(s) sent to or received by the laboratory

NOTE 1 When the laboratory sample is further prepared (reduced) by subdividing, mixing, grinding, or by combinations of these operations, the result is the test sample. When no preparation of the laboratory sample is required, the laboratory sample is the test sample.

NOTE 2 The laboratory sample is the final sample from the point of view of sample collection but it is the initial sample from the point of view of the laboratory.

NOTE 3 Several laboratory samples may be prepared and sent to different laboratories or to the same laboratory for different purposes. When sent to the same laboratory, the set is generally considered as a single laboratory sample and is documented as a single sample.

3.14
population
totality of items under consideration
[ISO 3534-1]

3.15
probabilistic sampling
sampling conducted according to the statistical principles of sampling

3.16
representative
sample resulting from a sampling plan that can be expected to reflect adequately the properties of interest in the parent population
[ISO 11074]

3.17
sample
an amount of material taken from a population and intended to provide information on the population

3.18
sampling plan
predetermined procedure for the selection, withdrawal, preservation, transportation and preparation of the portions to be removed from a population as a sample
[ISO 11074]

3.19
sampler
person carrying out the sampling procedures at the sampling locality
[ISO 11074]

NOTE Tools and other devices to obtain samples are sometimes also designated ‘samplers’. In this case it is recommended to write ‘sampling devices’ or ‘sampling equipment’.

3.20
stratified sampling
in a population which can be divided into mutually exclusive and exhaustive strata (i.e. sub-populations), sampling carried out in such a way that specified proportions of the sample are drawn from the different strata and each stratum is sampled with at least one sampling unit
[ISO 3534-1]

NOTE The objective of taking stratified samples is to obtain a more representative sample than that which might otherwise be obtained by random sampling.

3.21
sub-population
defined part of the population that will be targeted for the purposes of sampling

3.22
sub-sample
sample taken from a sample of a population
[ISO 3534-1]

3.23
test sample/analytical sample
sample, prepared from the laboratory sample, from which test portions are removed for testing or for analysis

3.24
viscous liquid
liquid with high viscosity, resulting in slow flow and adhering to containers and sampling equipment

3.25
sludge
mixture of solid particles within a liquid, either in suspension or as a colloidal mixture, resulting in physical characteristics which are different to the parent liquid, particularly increased viscosity

4 Principle of sampling technique selection

This Technical Report details a wide range of sampling techniques that can be used to take a sample. The procedures identified in this document target two fundamental objectives of sampling, as outlined in the Framework Standard EN 14899:

— probabilistic sampling - the preferred method of sampling or recovering material where a quantifiable level of reliability is required in the results for the population being tested. The basis for probabilistic sampling is that each element within the population being sampled has an equal chance of being sampled. This means that the Sampler has access to the whole population and can collect a sample that is representative of that population;

— judgemental sampling – this is used where representative sampling from the whole population is practically impossible, given available resources (time or money) or when sampling is required to target a specific item or point within the population.

The sampling techniques identified in this Technical Report form only part of the approach required to achieve probabilistic sampling, reference should be made to the remaining Technical Reports in this series to ensure all requirements have been fulfilled. For example, key advice on the design of an appropriate Sampling Plan and selection of an appropriate sampling pattern, numbers samples and sample size needed to meet the requirements of probabilistic sampling can be found in CEN/TR 15310-5 and CEN/TR 15310-1 respectively.

Sampling procedures are provided from a wide range of process streams and common storage conditions. The preferred sampling technique will depend on a combination of different characteristics of the material and circumstances encountered at the sampling location. Relevant determining factors include:

— the type of material / the physical state of the material (e.g. solid, liquid, paste, sludge);

— the situation at the sampling location / the way in which the material occurs (e.g. in a tank, a stockpile, on a conveyer belt);

— the (expected) degree of heterogeneity (e.g. homogeneous liquids, layered liquids, segregated sludges, mixtures of solid materials);

— the level of testing, which may influence the approach to the selection of composite or individual samples as detailed in CEN/TR 15310-1.

A series of process maps or flow charts provide route maps to the user to relevant clauses in the document for a wide range of potential sampling situations that arise when the range of different waste types, locations and storage vessels are considered. This approach allows the tools, and methodology to be chosen on a scenario-specific basis. The procedures listed in this Technical

Report reflect current best practice, but these are not exhaustive and other procedures may be equally relevant.

5 Route maps for the selection of sampling techniques

This Technical Report has been structured to address the selection of sampling techniques and equipment by physical form (e.g. liquid, sludge or solid) and nature of the arising (e.g. drum, hopper, pile). This Technical Report does not present a definitive process, but reflects current practice for commonly occurring scenarios, this, however, does not mean that other solutions are not available. The selection of an appropriate sampling technique should be related to the objectives for sampling and the physical form and chemical characteristic to be sampled. The route maps presented in this document supports the guidance provided in EN 14899 - A Framework for the preparation and application of a Sampling Plan. The following flow diagrams guide the reader to the appropriate clauses within the Technical Report.

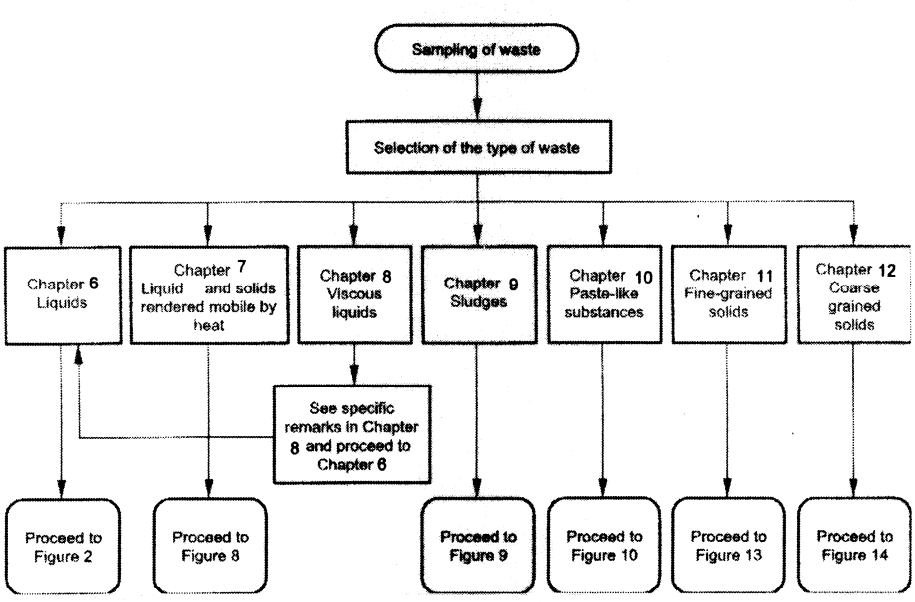


Figure 1 — Generic process map for sampling

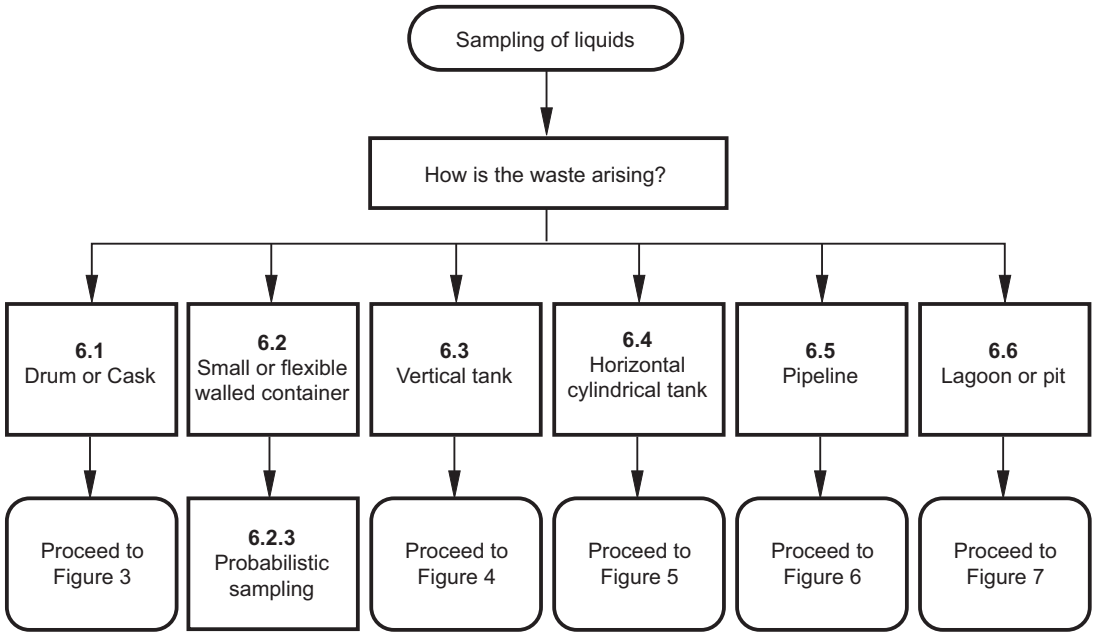


Figure 2 — Sampling of liquids

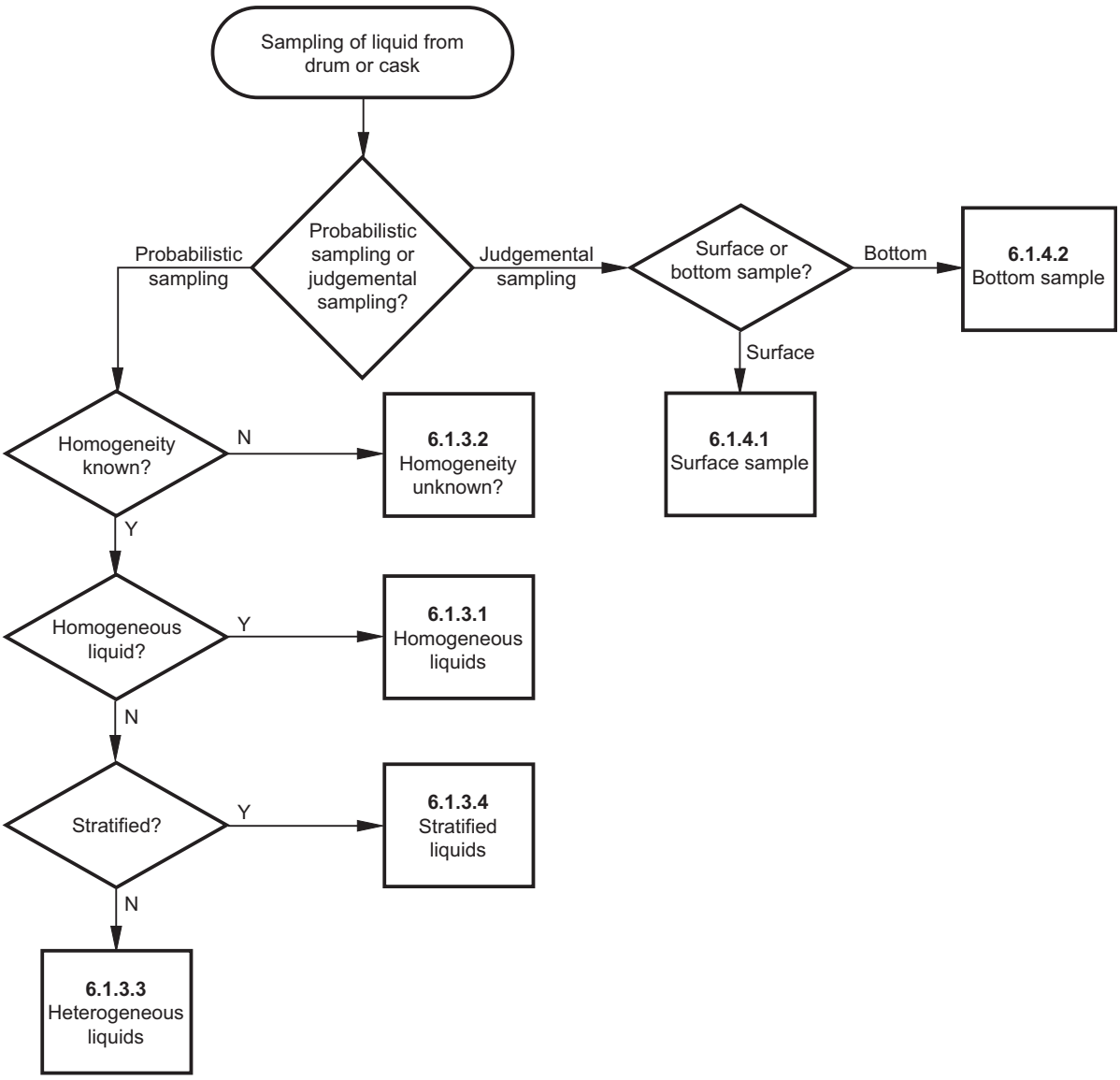


Figure 3 — Sampling of a liquid from a drum or cask

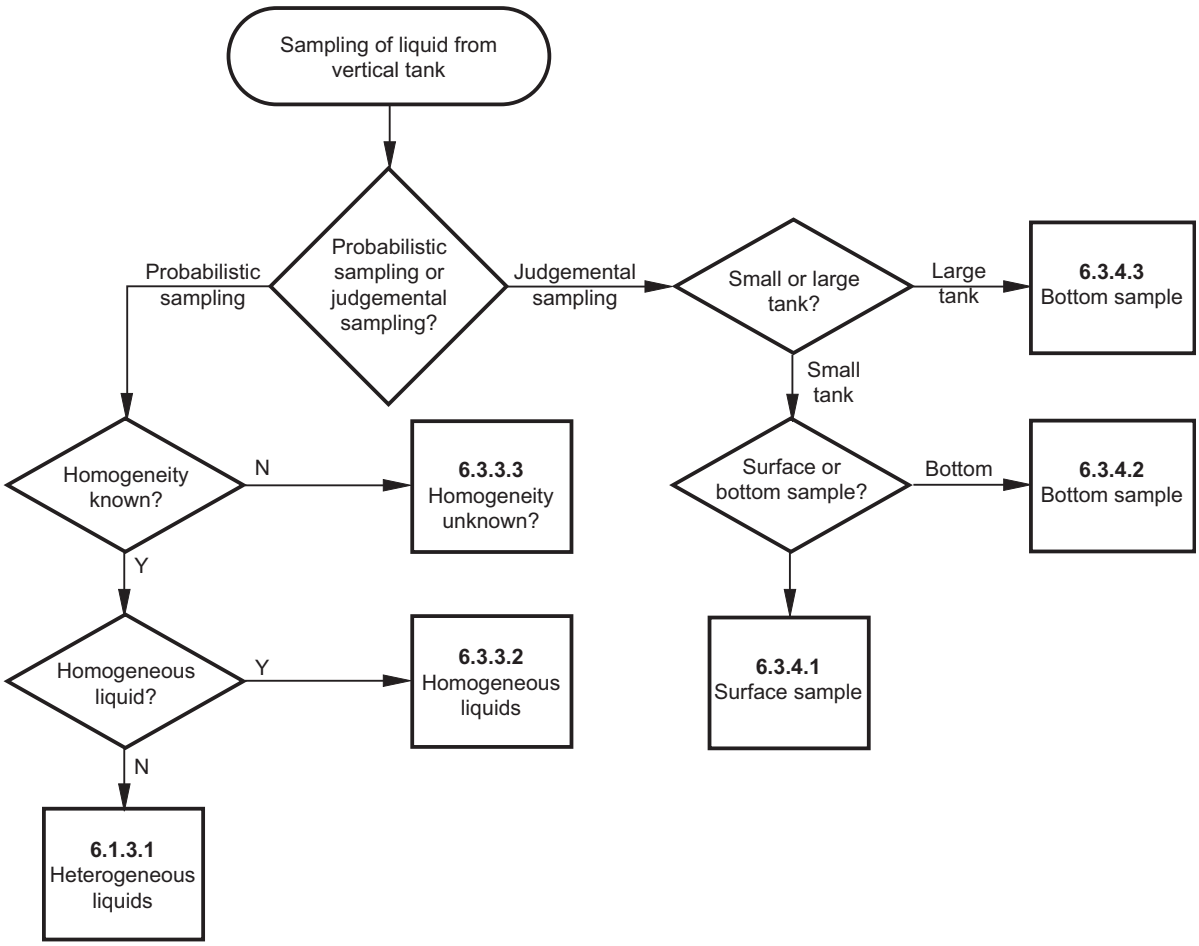


Figure 4 — Sampling of a liquid from a vertical tank

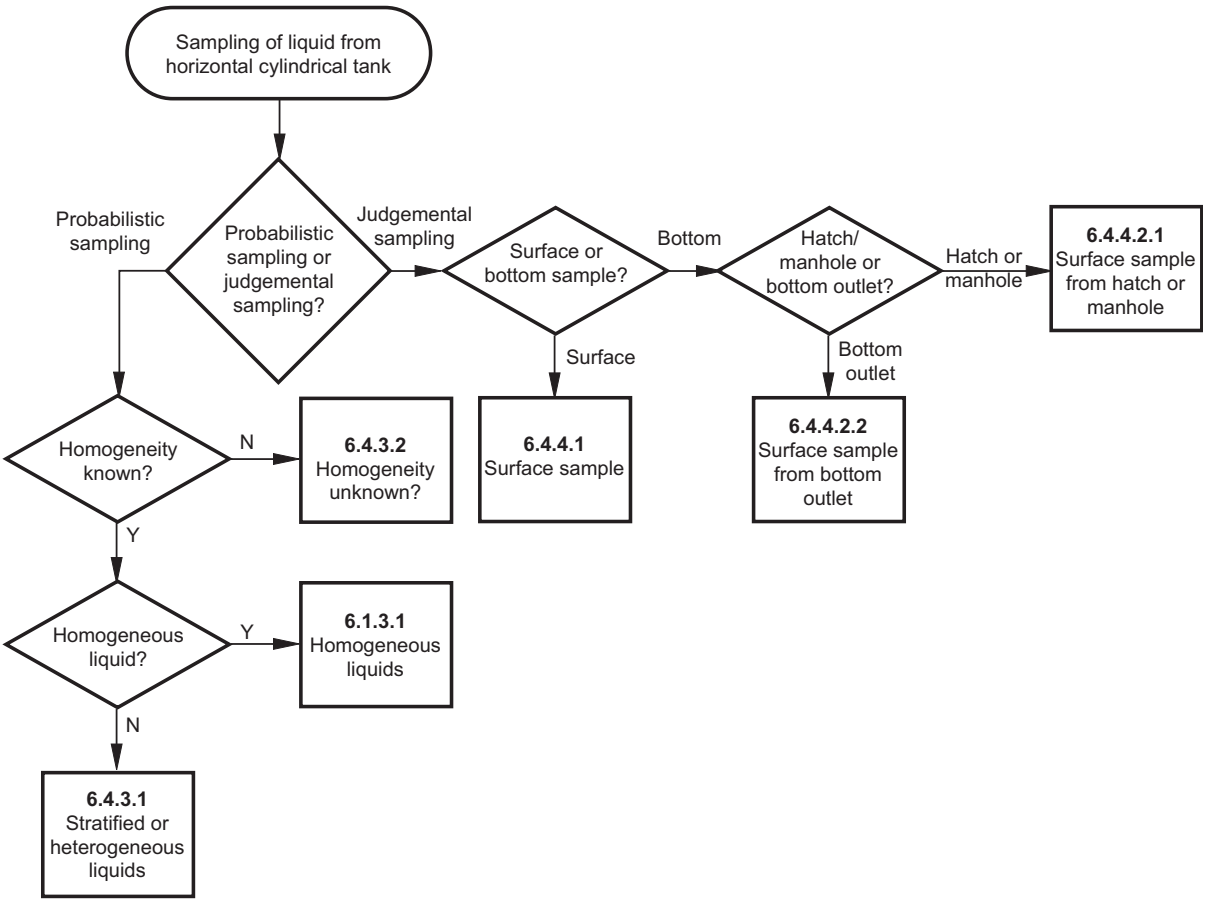


Figure 5 — Sampling liquids in a horizontal cylindrical tank

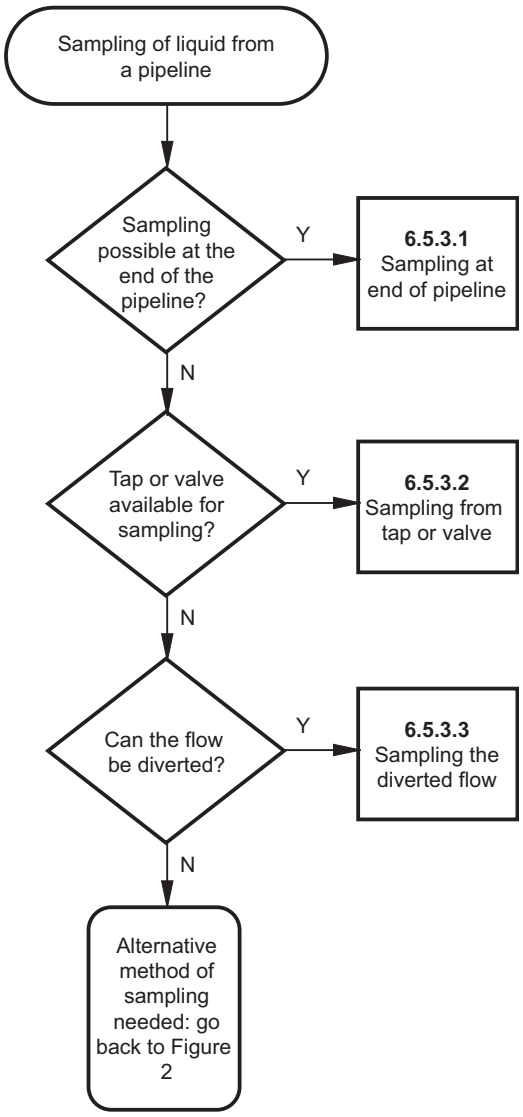


Figure 6 — Sampling liquids from a pipeline

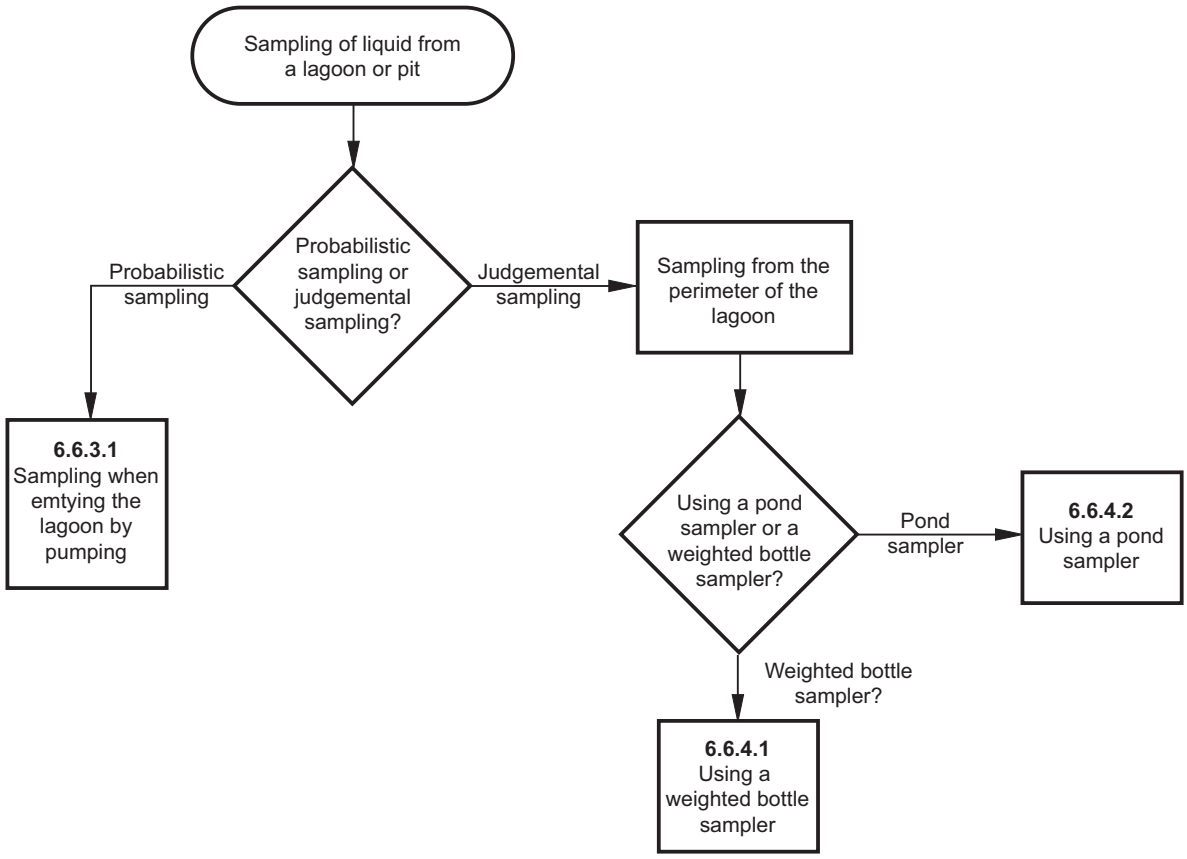


Figure 7 — Sampling a liquid from a lagoon or pit

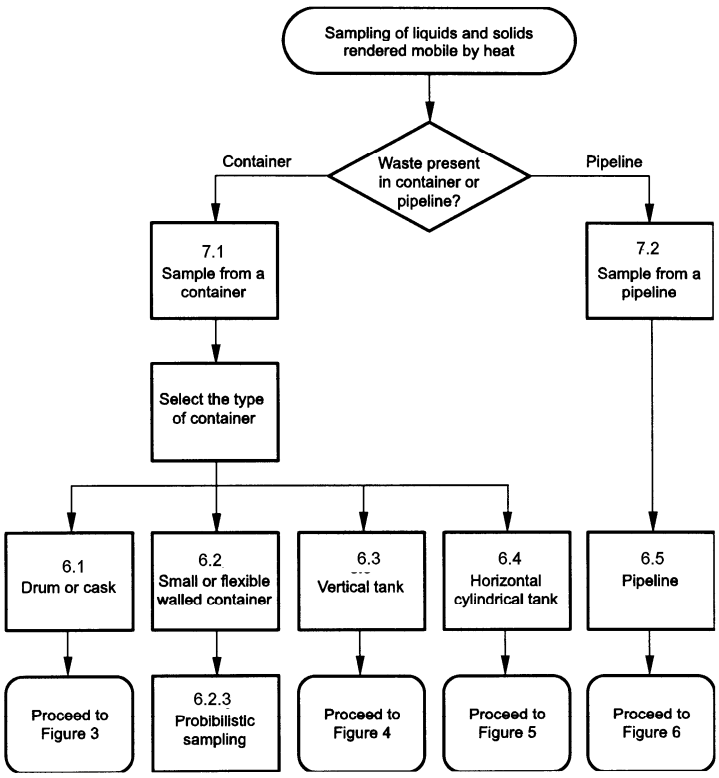


Figure 8 — Sampling of liquids and solids rendered mobile by heat

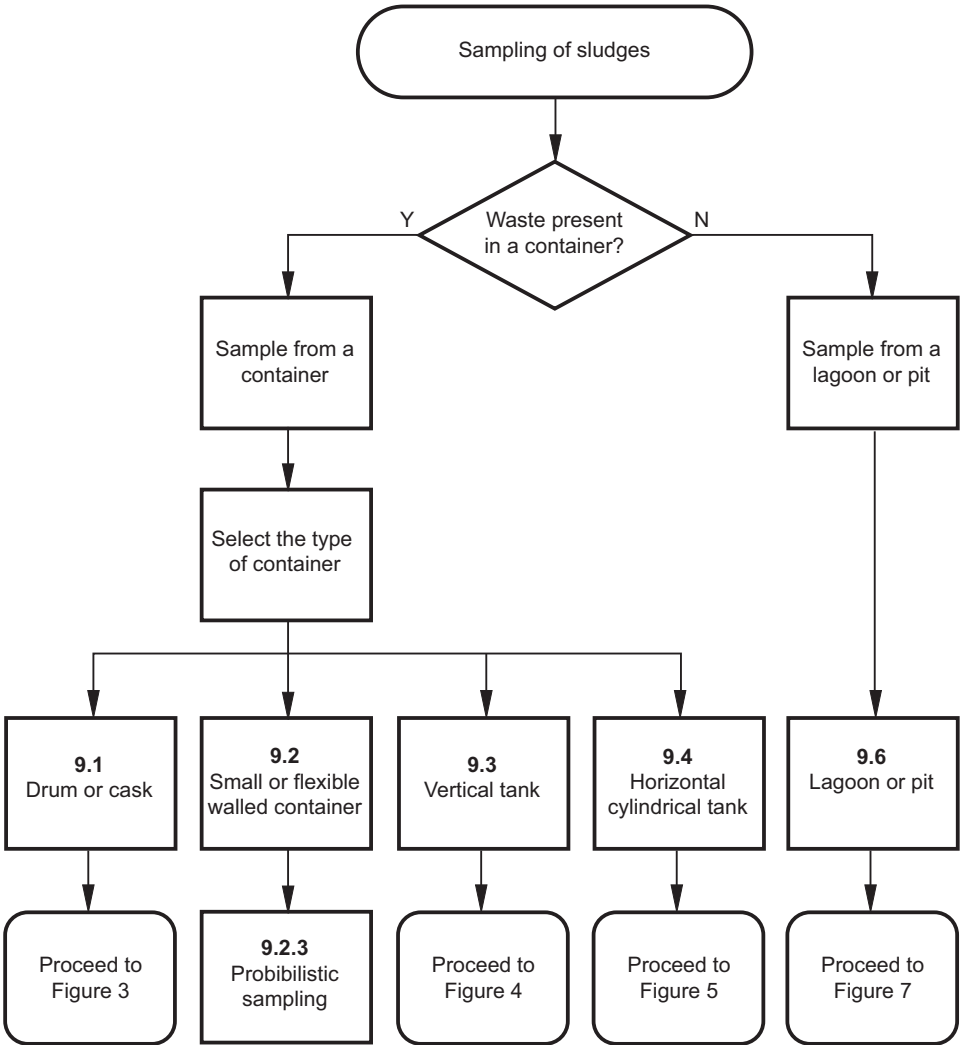


Figure 9 — Sampling of sludges

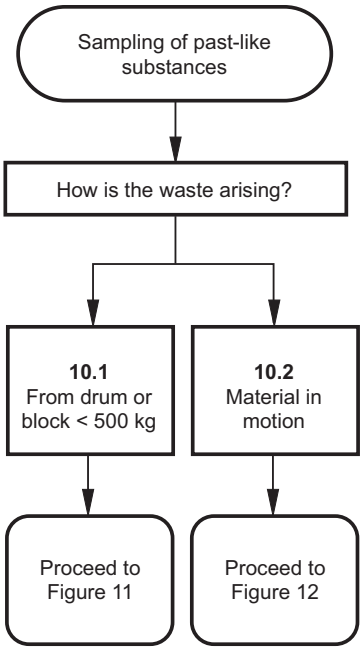


Figure 10 — Sampling of paste-like substances

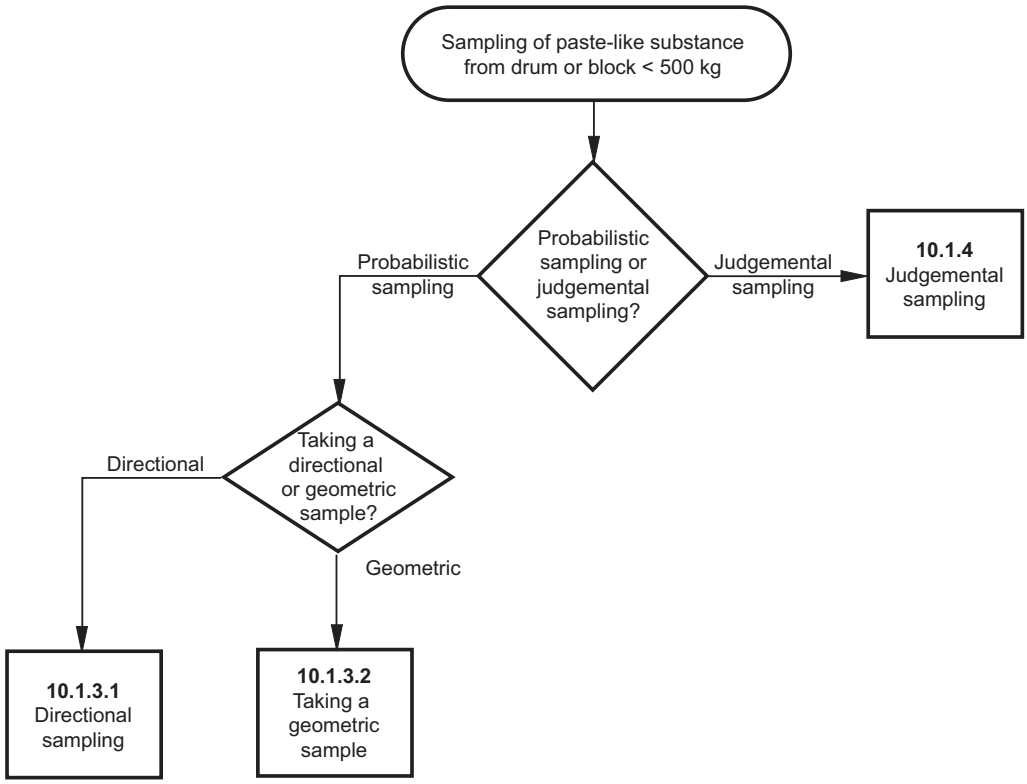


Figure 11 — Sampling of paste-like substances from a drum or block< 500kg

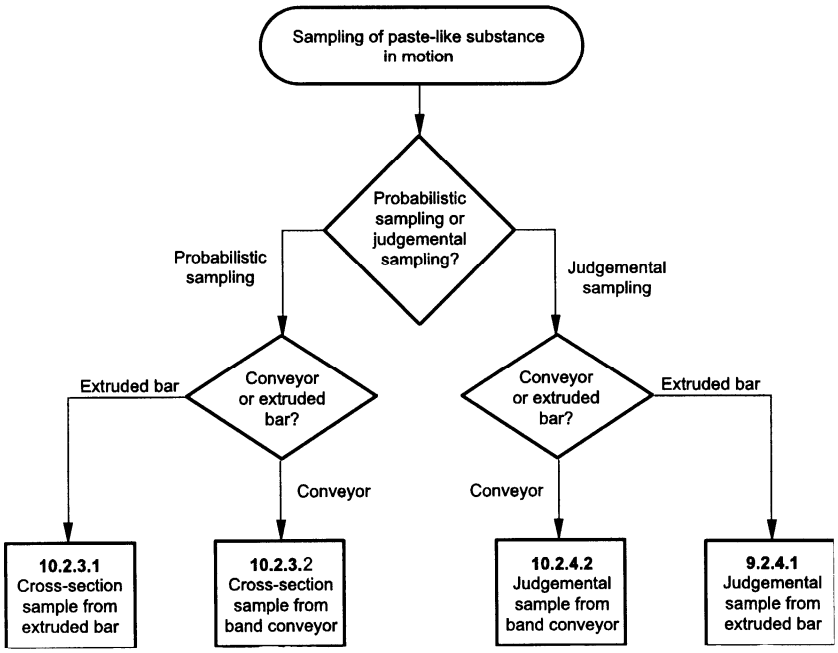


Figure 12 — Sampling of paste like substances in motion

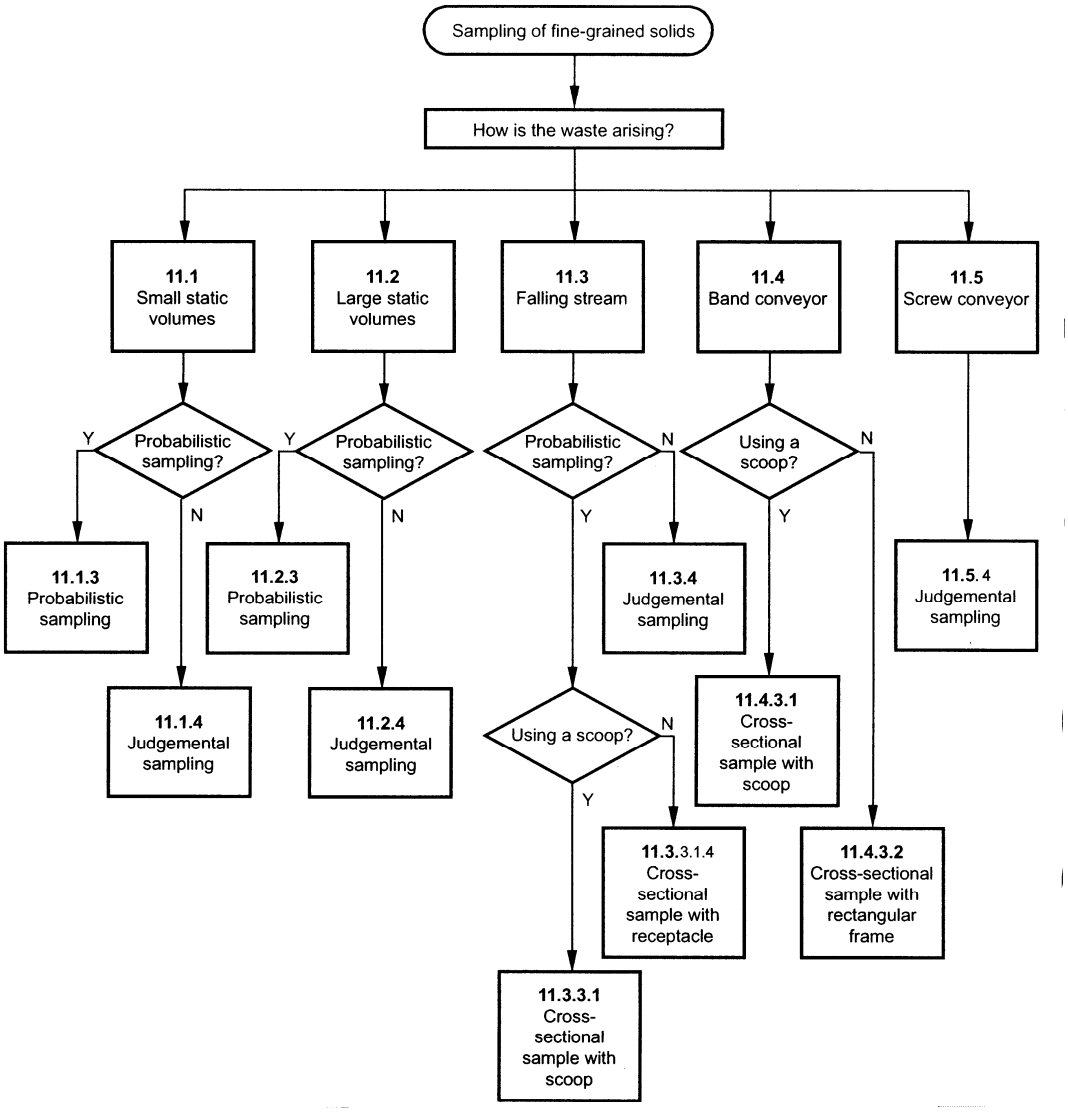


Figure 13 — Sampling of fine grained solids

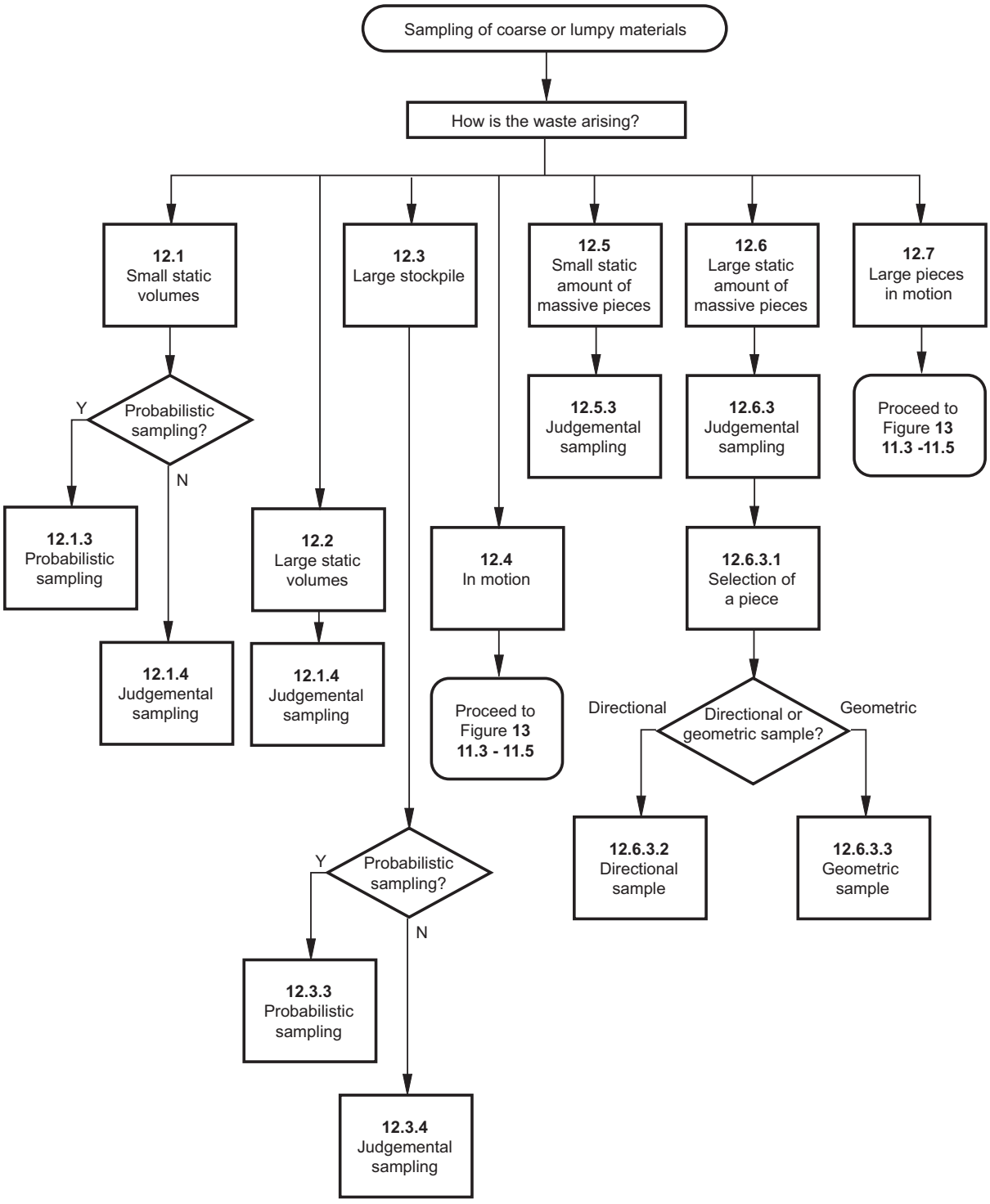


Figure 14 — Sampling of coarse or lumpy materials

6 Sampling of mobile liquid waste

6.1 Sampling from a drum or a cask

6.1.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

6.1.2 Preparation for sampling

— position the drum with the bung uppermost;

— where the drum is sampled on its side, secure the drum e.g. using a wedge;

— allow the contents of the drum to settle for 20 min to 30 min;

— if the properties of contents are unknown, or known or suspected of being flammable, place an earthing strap on metal containers either on or near the cap;

— wipe the exterior of the bung and the area around the bunghole e.g. by using a disposable paper wipe;

— slowly remove the bung e.g. by using a bung wrench.

NOTE Where the bung has seized it will be necessary to remove the whole of the top.

6.1.3 Probabilistic sampling

6.1.3.1 Procedure for taking a probabilistic sample of homogenous liquid

— lower the open sampling tube into the drum sufficiently slowly to ensure that the liquid level in the tube does not fall below that of the outside liquid;

— close the tube, withdraw it from the drum and allow any liquid adhering to it to drain from it.

NOTE 1 The tube may be wiped dry before transferring the tube into the sampling container.

— transfer the liquid (sample) into the transparent sample container;

— repeat the procedure until sufficient quantity of sample is collected;

— wipe the outside of the sample container and label as specified in the Sampling Plan.

NOTE 2 It is not recommended to use a pumping action to increase the size of the sample taken in any one procedure.

Follow the sample preservation and handling procedures specified in the Sampling Plan;

6.1.3.2 Procedure for taking a probabilistic sample where homogeneity of liquid is unknown

— take a surface sample as in 6.1.4.1;

— transfer the liquid collected to the bottle, using a funnel if necessary;

— take a bottom sample as in 6.1.4.2;

— transfer to the bottle with the surface sample;

— cap the bottle and invert to mix the samples, then allow to stand for a minimum of 2 min;

— if no layering is observed proceed as described in 6.1.3.1;

— if layering is observed, estimate and record the volume of each layer in the drum and collect a separate sample from each layer using procedure described in 6.1.3.4;

— procedure for taking a probabilistic sample from heterogeneous liquids;

— insert the sampling tube and lower it to the bottom of the drum;

— place the flow restrictor over the tube opening and slowly withdraw the tube from the liquid;

— place the lower end of the tube in the sample container and remove the flow restrictor, allowing the liquid to drain into the sample container;

— repeat the procedure until the specified quantity of liquid is collected;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.1.3.3 Procedure for taking a probabilistic sample from heterogeneous liquids

— insert the sampling tube and lower it to the bottom of the drum;

— place the flow restrictor over the tube opening and slowly withdraw the tube from the liquid;

— place the lower end of the tube in the sample container and remove the flow restrictor, allowing the liquid to drain into the sample container;

— repeat the procedure until the specified quantity of liquid is collected;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.1.3.4 Procedure for taking a probabilistic sample from heterogeneous (stratified) liquids

— establish the volume per layer (to allow calculation at a later stage of the average concentrations within the storage unit and the volumes of the various layers) e.g. using a transparent sampling tube take a sample of the entire depth as in the first two steps of 6.1.3.1. Using the stratification identified in the sampling tube, calculate volume per layer in the drum. Discard the liquid and store for disposal according to national waste disposal requirements;

— take samples from the estimated centre of each layer;

— start sampling from the bottom layer;

— insert the sampling tube to the required depth;

— place the flow restrictor over the tube opening and slowly withdraw the tube from the liquid;

— place the lower end of the tube in the sample container and remove the flow restrictor, allowing the liquid to drain into the sample container;

— wipe or rinse the outside of the sampling apparatus before transferring the sample into the container. Store the samples separately in the sample containers;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

NOTE 1 If on-site homogenisation (e.g. circulation) is possible, sampling may be performed as for homogeneous liquids.

NOTE 2 Where a selective sample of limited depth is required, it is recommended to take increments at depths of every 300 mm from top to bottom until the layer of interest is reached. In this layer it is recommended to take increments at approximately 100 mm intervals. Also it is recommended to take a bottom increment.

6.1.4 Judgemental sampling

6.1.4.1 Procedure for taking a surface sample

— lower a bailer, or weighted can into the drum to just below the surface of the liquid;

— remove the bailer/can before it fills completely;

— transfer the sample to the transparent sample container and examine for contaminant;

— record the probable nature and approximate quantity of any contaminant and repeat the procedure until sufficient quantity of sample is obtained, as specified in the Sampling Plan;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

NOTE Where the sample is not required for further investigation it may be returned to the drum or cast.

6.1.4.2 Procedure for taking a bottom sample

— insert a closed sampling tube, into the liquid until it touches the bottom of the drum;

NOTE The viscosity of the liquid can affect the choice of the sampling tube (see Sampling Plan).

— open the sampling tube and move quickly allowing the mouth of the tube to transverse the bottom of the drum while the tube is filling;

— close the tube and withdraw from the container;

— transfer the sample to the transparent sample container and examine for contaminant;

— record the probable nature and approximate quantity of any contaminant and repeat the procedure until sufficient quantity of sample is obtained as specified in the Sampling Plan;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.2 Sampling from a small container or flexible walled container

6.2.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

6.2.2 Preparation for sampling

— use a transparent sampling tube to determine whether stratification has occurred.

— following visual inspection, wipe the outside of the sample containers and apply a label recording information required in Sampling Plan and other observations.

6.2.3 Probabilistic sampling

— if stratified samples are required, take individual samples from the depths specified in the Sampling Plan;

— if stratification has not occurred, thoroughly shake the container and pour the quantity of liquid specified in the Sampling Plan into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.2.4 Judgemental sampling

— thoroughly shake the container and pour the quantity of liquid specified in the Sampling Plan into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.3 Sampling from a vertical uniform tank or irregular tank

6.3.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

6.3.2 Preparation for sampling

Descriptions of commonly used equipment are provided in Annex A.

Use a transparent sampling tube to determine whether stratification has occurred.

6.3.3 Probabilistic sampling

6.3.3.1 Procedure for taking a probabilistic sample where contents are not mixed or are heterogeneous

— take increments at evenly spaced intervals, measured from the surface of the liquid, either using a tube as in 6.1.3.2 or using a can or cage;

— close the can or cage and lower to the specified depth;

— open the can or cage by pulling sharply on the chain;

— when air bubbles cease to rise, lift the can or cage out;

— carefully pour off the liquid contained in the neck of the bottle or can;

— either transfer the liquid from the can into the transparent sample container; or tightly close the bottle and remove from the cage;

— examine the increments obtained either individually or combined, in the proportions specified in the Sampling Plan, to give a representative sample;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan;

— alternatively as 6.5: Sampling from a pipeline, if the tank is to be emptied.

6.3.3.2 Procedure for taking a probabilistic sample where contents are known to be mixed or are homogenous

— as 6.1.3.1;

— alternatively as 6.5.

6.3.3.3 Procedure for taking a probabilistic sample where homogeneity of liquid is unknown

— lower the bailer into the drum or cask and allow to fill slowly from the liquid surface;

— transfer the liquid collected to the bottle, using a funnel if necessary;

— lower the bailer into the drum and collect a sample from the bottom of the drum and transfer to the bottle with the surface sample;

— cap the bottle and invert to mix the samples, then allow to stand for a minimum of 2 min;

— if no layering is observed proceed as described in 6.4.3.1. If layering is observed, estimate and record the volume of each layer in the drum and collect a separate sample from each layer using procedure described in 6.3.3.1;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan;

— alternatively, if the tank is being emptied as 6.5.

6.3.4 Judgemental sampling

6.3.4.1 Procedure for taking a surface sample from a tank

As 6.1.4.1.

6.3.4.2 Procedure for taking a bottom sample from a tank

— as 6.1.4.2;

— alternatively, if bottom outlet exists as 6.4.4.2.2.

6.3.4.3 Procedure for taking a judgemental sample from within a tank > 2 m deep

— use a weighted sampling can or cage (as specified in the Sampling Plan). Follow the procedure described in 6.3.3.1, completing only one iteration at the sampling depth identified in the Sampling Plan;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.4 Sampling from a horizontal cylindrical tank

6.4.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

6.4.2 Preparation for sampling

Using the transparent sampling tube determine whether stratification of the liquid has occurred.

6.4.3 Probabilistic sampling

6.4.3.1 General

— procedure for taking a probabilistic sample where contents are not mixed or are heterogeneous;

— lower a closed sampling tube to the specified depth into the liquid and open for a short period;

— close the tube, withdraw from the liquid and allow any adhering liquid to drain off;

— discharge the liquid into the sample container;

— repeat the procedure at the same depth until the specified quantity of the liquid is obtained;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.4.3.2 Procedure for taking a probabilistic sample where homogeneity of liquid is unknown

As 6.3.3.3.

6.4.4 Judgemental sampling

6.4.4.1 Procedure for taking a surface sample

As 6.1.4.1.

6.4.4.2 Procedure for taking a bottom sample

6.4.4.2.1 From a hatch or manhole

As described in 6.1.4.2.

6.4.4.2.2 From an outlet at the bottom of the tank

— open the outlet very slightly allowing a small flow, and allow to run for an equivalent of three sample volumes;

— collect the quantity of liquid specified in the Sampling Plan in the transparent sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.5 Sampling a moving liquid within a pipeline

6.5.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use, all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

6.5.2 Preparation for sampling

Check pressure and temperature before sampling. Clean all sampling ports prior to sampling. If sampling from a tap or valve allow a small volume to be discharged before sampling.

6.5.3 Judgemental sampling

6.5.3.1 Procedure for taking a judgemental sample from the end of a pipeline

— to collect a selective sample, using the funnel, place the transparent sample container under the exit stream for the period specified in the Sampling Plan;

— to collect a representative sample, using a funnel, place the transparent sample container under the exit stream at regular intervals during the whole of the transfer of the liquid from the end of the pipeline as specified in the Sampling Plan;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.5.3.2 Procedure for taking a sample from a tap/dripcock or valve

— for liquids without associated sediments, where automatic sampling equipment is not available introduce a tap or dripcock into a horizontal section of the main pipeline. This should be as far from any elbow or T-joint as possible, preferably within 10-15 m of the pressure side of the pump;

— ensure a continuous fall in the sampling line to the outlet;

— fix a cover over the apparatus to minimise contamination of the sample;

— regulate the rate of flow to produce sufficient turbulence in the sample pipeline, for mixing of the liquid to occur;

— maintain the flow at a constant rate;

— purge the sample line immediately before taking a sample;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.5.3.3 Procedure for taking a sample by diverting the flow

Where the pipeline has no open end and the pipeline diameter is too small to permit the fitting of a probe, divert the whole of the flow for a set period of time as specified in the Sampling Plan into a sample container, following the procedure described in 6.4.4.2.2.

6.6 Sampling from a lagoon or pit

6.6.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use, all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

6.6.2 Preparation for sampling

If sampling from a tap or valve allow a small volume to be discharged before sampling.

6.6.3 Probabilistic sampling

6.6.3.1 Procedure for taking a probabilistic sample when a lagoon is emptied via pumping

As in 6.5.3.1 or 6.5.3.2.

6.6.4 Judgemental sampling

6.6.4.1 Procedure for taking a perimeter sampling using a weighted bottle

— lower the weighted bottle sampler or sampling can to the depth specified in the Sampling Plan using the connecting cord or rope to gauge the depth of sampling.

— give a sharp jerk on the cord connected to the bottle stopper and allow sufficient time for the sampler to fill;

— withdraw the sampler and remove the bottle;

— refit the stopper eliminating any air from the neck of the bottle;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

6.6.4.2 Procedure for taking a perimeter sample using a pond sampler

— insert the pond sampler, with a clamped beaker, upside-down into the lagoon and then invert it at the specified location and depth;

— withdraw the sampler and transfer the sample to the transparent sample bottle, eliminating any air from the neck of the bottle;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

7 Sampling liquids and solids rendered mobile by heat

NOTE In general these methods should only be applied to materials (e.g. fats and greases) where their characteristic properties are well known.

7.1 Sampling from a container

7.1.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

7.1.2 Preparation for sampling

— ensure that the container to be heated is in a sound condition and is vented to prevent a build up of pressure during the heating process, e.g. by loosening the bung;

— position the container, with the bung uppermost, on the grid in the tank;

— heat the container to approximately the same temperature as the sample material.

7.1.3 Judgemental sampling

— using a heat source heat the container until the contents are completely converted into a mobile state;

— select the sampling procedure as described in Clause 5.

7.2 Sampling from a pipeline

7.2.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

7.2.2 Preparation for sampling

Clean all sampling ports prior to sampling. If sampling from a tap or valve collect allow a small volume to be discharged before sampling. Ensure sampling lines, stopcocks etc. are suitably heated to prevent solidification of the contents

NOTE It should be ensured that sampling lines, stopcocks etc. are suitably heated to prevent solidification of the contents.

7.2.3 Judgemental sampling

As 6.5.3.

NOTE It is not recommended to heat unknown or uncharacterised materials where the hazards have not been assessed. Sampling from a pipeline can only be realised when it can be assumed that the material within the pipeline is homogeneous. If the material cannot be assumed to be homogeneous, it will not be possible to obtain a representative sample from a pipeline and another method of sampling / sampling location should be used.

8 Sampling viscous liquids

— select a sampling procedure and proceed as described in Clause 5, with the following modifications:

— where a sample tube is used, select a bottom-valved type;

— allow sufficient time for liquid on outside of sampling apparatus to drain off, alternatively wipe the outside of the apparatus.

NOTE 1 It is sometimes more convenient to sample viscous liquids during discharge of the container.

NOTE 2 It is not recommended to heat unknown or uncharacterised materials where the hazards have not been assessed.

9 Sampling sludges

9.1 Sampling from a drum or cask

As in 6.1.

9.2 Sampling from a small container (less than 20 l capacity)

9.2.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

9.2.2 Preparation for sampling

— note and record the thickness and nature of any surface skin;

— carefully remove any surface skin;

— determine the depth and hardness of any material deposit on the inside of the container;

— break up and disperse deposit as specified in the Sampling Plan.

NOTE In the case of small containers the supernatant liquid may be decanted into a separate container, the settled solids worked into a smooth paste and the supernatant liquid returned to the container while stirring continually.

Where the settled materials cannot be re-dispersed, record the depth of each phase.

9.2.3 Procedure for taking a probabilistic sample

Immediately following mixing, sample as described in 6.2.3.

9.3 Sampling from a vertical uniform tank

As 6.3.

9.4 Sampling from a horizontal cylindrical tank

As 6.4.

9.5 Sampling from a pipeline

As 6.5.

9.6 Sampling from a large container, pit or lagoon

9.6.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

Prior to use all apparatus and tools should be cleaned in order to reduce the risk of cross-contamination. Where it is not possible to clean any sampling equipment between samples this should be recorded in the sampling record.

9.6.2 Preparation for sampling

— note and record the thickness and nature of any surface skin;

— carefully remove any surface skin.

9.6.3 Probabilistic sampling

As 6.6.3.

9.6.4 Judgemental sampling

— lower the sampler, with cork in position, to the base of the pit;

— tug on the line to remove the cork and allow sampler to fill;

— retrieve the sampler;

— record the depths of the liquid and sludge phases (using the length of line as a guide);

— using the funnel if necessary, transfer the contents of the sampler to the container and securely cap;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan;

— alternatively use the procedures described in 6.3.4.3.

10 Sampling paste-like substances

10.1 Sampling static material from drum or block up to 500 kg

10.1.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

10.1.2 Preparation for sampling

Expose surface of paste.

10.1.3 Probabilistic sampling

10.1.3.1 Procedure for taking a directional sample

— push the sampling tube through the material at the appointed area and in the direction identified in the Sampling Plan so that the full cross-section is traversed;

— remove the sample from the tube (using a spatula) and place in a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

10.1.3.2 Procedure for taking a geometric sample

— cut out the required shape and amount of material as identified in the Sampling Plan using a knife, a cutting wire or core sampler;

— place the sample in a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

10.1.4 Judgemental sampling

— using a scoop take the required amount from the appointed area as specified in the Sampling Plan;

— transfer the sample to a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

10.2 Taking samples in motion

NOTE It is recommended to take care when sampling material from a moving conveyor.

10.2.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

10.2.2 Preparation for sampling

Immediately prior to sampling stop the extruder.

10.2.3 Probabilistic sampling

10.2.3.1 Procedure for taking a cross-section sample from extruded bar

— cut out a piece of the extruded bar of length specified in the Sampling Plan by cutting at right angles through the bar at two places with the knife or cutting wire;

— remove the sample from the cut extruded bar of specified length (using a spatula) and place into a sample container;

— repeat procedure as defined in the Sampling Plan;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

10.2.3.2 Procedure for taking a cross-section sample from a band conveyor

Proceed as described in 10.1.3.1.

10.2.4 Judgemental sampling

10.2.4.1 Procedure for taking a judgemental sample from an extruded bar

— cut or scoop out the required amount of material as identified in the Sampling Plan;

— transfer the sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

10.2.4.2 Procedure for taking a judgemental sample from a band conveyor

Stop the band conveyor and proceed as described in 10.1.4

11 Sampling powders, granules and small crystals

11.1 Sampling small static volumes from hoppers, heaps and silos

11.1.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

11.1.2 Preparation for sampling

Obtain access to material.

11.1.3 Probabilistic sampling

As described in 10.1.3 using a core sampler.

11.1.4 Judgemental sampling

— dip the scoop into the material at the area identified in the Sampling Plan;

— withdraw the scoop and level off the material so there is none above the sides of the scoop;

— transfer the sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.2 Sampling large static volumes from hoppers, heaps and silos

11.2.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

11.2.2 Preparation for sampling

Obtain safe access to material.

11.2.3 Probabilistic sampling

— push the vacuum probe or sampling auger/scoop through the material in the identified direction taking a series of individual samples until the traverse is complete as specified in the Sampling Plan;

— combine the individual samples to give a directional sample;

— transfer the directional sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.2.4 Judgemental sampling

— push the vacuum probe or sampling auger/scoop through the material to the identified point and extract the sample as specified in the Sampling Plan;

— transfer the sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.3 Sampling from a falling stream

11.3.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

NOTE Automatic sampling exists where the demand is high. The following techniques apply only to manual sampling.

11.3.2 Preparation for sampling

Sample as close to point of exit as possible.

NOTE It is recommended to take care when sampling material from moving machinery or conveyors.

11.3.3 Probabilistic sampling

11.3.3.1 Procedure for taking a cross-sectional sample with a scoop or sample container

11.3.3.1.1 Method 1; where width and depth of stream is small

Put the scoop into the stream using a single one directional action.

NOTE It is recommended to place the sampling container at 90° to the falling stream.

— hold the scoop in place for the period as specified in the Sampling Plan, to gather the specified volume of material;

— remove the scoop in the direction of entry;

— transfer the sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.3.3.1.2 Method 2: where width of stream is large and depth is small

— insert the container at one end of the stream and, at a uniform rate designed to collect the required amount of material, move the container through the width of the stream to the opposite end;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.3.3.1.3 Method 3: where width and depth of stream is large

— follow method 1 as detailed in 11.3.3.1.1;

— repeat procedure at 90° to the first direction of sampling;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.3.3.1.4 Procedure for taking a cross-sectional sample with a receptacle with aperture

— place a closed receptacle (whose width is greater than the width of the falling stream) under the falling stream;

— open the aperture and collect the amount of material as specified in the sample plan;

— close the aperture and remove the receptacle from the falling stream;

— transfer the sample to a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.3.4 Judgemental sampling

— Put a sample container into the stream to the location identified in the Sampling Plan using a single one directional action.

NOTE The placement of the sampling container may be in the same axis as the falling stream or at 90° to the falling stream. The sample container should be held in place for the period as specified in the Sampling Plan.

— remove the container in the direction of entry;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.4 Sampling from a band conveyor

11.4.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

11.4.2 Preparation for sampling

Immediately prior to sampling stop the conveyor.

11.4.3 Probabilistic sampling

11.4.3.1 Procedure for taking a cross-sectional sample using a scoop

— using a scoop, take the required amount of material from the entire width of the conveyor at a point as specified in the Sampling Plan;

— transfer the sample into a sample container;

— repeat procedure as defined in the Sampling Plan;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.4.3.2 Procedure for taking a cross-sectional sample using a rectangular frame

— stop the conveyor and insert the rectangular frame into the material, as identified in the Sampling Plan, until it is in contact with the band across its full width;

— using a brush or shovel remove all the material bound by the sides of the frame and place in a suitably sized sample container. Particles which have stuck against the conveyor belt under the sides of the frame are included in the sample from one side and excluded from the opposite side;

— repeat procedure as defined in the Sampling Plan;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.4.4 Judgemental sampling

As 11.4.3, once only.

11.5 Sampling from a screw conveyor

NOTE Consideration should be given to taking samples at the discharge, as described in 11.3.

11.5.1 Apparatus

Descriptions of commonly used equipment are provided in Annex A.

11.5.2 Preparation for sampling

Immediately prior to sampling switch off the screw conveyor.

11.5.3 Probabilistic sampling

— insert the vacuum probe through suitably positioned access ports in the screw housing;

— collect the sample as specified in the Sampling Plan;

— repeat procedure as defined in the Sampling Plan;

— transfer the sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

11.5.4 Judgemental sampling

— insert the vacuum probe through suitably positioned access ports in the screw housing;

— collect the sample as specified in the Sampling Plan;

— transfer the sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

12 Sampling coarse or lumpy solid materials

12.1 Sampling small volumes from a bag, keg or drum

12.1.1 Apparatus

Select apparatus capable of handling the larger and heavier components. Descriptions of commonly used equipment are provided in Annex A.

12.1.2 Preparation for sampling

Carefully empty the material onto a clean surface.

12.1.3 Probabilistic sampling

— using a straight edge, make a cut into the material at the spot identified in the Sampling Plan;

— move the material to one side away from the pile;

— make a parallel cut into the remaining material as identified in the Sampling Plan;

— take the material between the parallel cuts to form the directional sample;

— transfer the sample to a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

12.1.4 Judgemental sampling

— dip the scoop into the material at the spot identified in the Sampling Plan;

— take the required sample size, as identified in the Sampling Plan;

— transfer the sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

12.2 Sampling large volumes from hoppers or silos

12.2.1 Apparatus

Select apparatus capable of handling the larger and heavier components. Descriptions of commonly used equipment are provided in Annex A.

12.2.2 Preparation for sampling

Obtain access to material.

12.2.3 Procedure for taking a judgemental sample during filling the silo

— suspend the tube in the silo before filling and withdraw the tube after filling to obtain several individual samples in one direction, or using the scoop take an individual sample from the position on the surface as identified in the Sampling Plan;

— transfer the sample to a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

12.3 Sampling a large stockpile

12.3.1 Apparatus

A mechanical digger.

12.3.2 Preparation for sampling

Obtain access to material.

12.3.3 Probabilistic sampling

— using a mechanical digger flatten out the stockpile and collect samples across the length and breadth of the material as specified in the Sampling Plan;

— place individual increments into a new pile, mix with the digger and repeat until the sample volume can be handled manually;

— transfer the sample into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

12.3.4 Judgemental sampling

— collect individual samples from the specific part of the stockpile as detailed in the Sampling Plan e.g. an identified hot-spot of potentially contaminated area;

— transfer the samples into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

12.4 Sampling coarse or lumpy materials in motion

Follow the procedures described in 11.3 to 11.5.

12.5 Sampling a small amount from a massive piece

12.5.1 Apparatus

Select apparatus capable of handling the larger and heavier components. Descriptions of commonly used equipment are provided in Annex A.

12.5.2 Preparation for sampling

Obtain access to material.

12.5.3 Judgemental sample

— take a lump from the position identified in the Sampling Plan in the container and chip material from the lump;

— alternatively, chip, drill or saw the lump at the position identified in the Sampling Plan;

— collect the chippings, drillings or sawdust as the sample;

— transfer the sample to a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan.

12.6 Sampling from a pile of large pieces

12.6.1 Apparatus

Select apparatus capable of handling the larger and heavier components. Descriptions of commonly used equipment are provided in Annex A.

12.6.2 Preparation for sampling

Obtain access to material.

12.6.3 Judgemental sampling

12.6.3.1 Selection of a piece

Having selected the particle at the position identified in the Sampling Plan near the surface, proceed as described in 12.5.

12.6.3.2 Procedure for taking a directional sample of the selected piece

— using the chipping tool, chip a channel of depth and width specified in the Sampling Plan in the direction specified in the Sampling Plan;

— collect the chippings;

— transfer the chippings into a sample container;

— wipe the outside of the sample container and label as specified in the Sampling Plan;

— follow the sample preservation and handling procedures specified in the Sampling Plan;

— alternatively use the procedure described in 12.5.3

12.6.3.3 Procedure for taking a geometrical sample of the selected piece

Cut out the required shape and amount of material as identified in the Sampling Plan.

12.7 Sampling large pieces in motion

Select apparatus capable of handling the larger and heavier components, follow the procedures described in 11.3 to 11.5.

12.8 Incorporation in the Sampling Plan

The selected technique(s) for sampling and necessary equipment should be specified by the Project Manager in the Sampling Plan, see EN 14899, prior to commencing sampling.

Annex A
(informative)

Support on the selection of equipment and apparatus

A.1 General

Equipment selection is an important part of Sampling Plan development. Advice should be sought on:

— the hazard assessment of the sampling activities and the safety procedures to be implemented during sampling and transport;

— the solid-liquid ratio;

— the consistency;

— the physical structure;

— the accessibility of sampling points.

Other considerations to be taken into account include:

— where and how the waste is being stored (e.g. hopper or drum);

— the final quantity of sample required (as specified in the Sampling Plan);

— whether the sample is intended for preliminary inspection or analysis.

In the case of liquid or semi-liquid wastes, equipment used for water quality sampling should be used. In the case of solid wastes, sample borers, shovels, trowels, drills and corers are used. Sampling instruments, ancillary apparatus and sampling containers (including caps and liners) should be made of materials, which do not interact physically or chemically with the sample.

A.2 Common issues for all sampling equipment and apparatus

These include:

— suitability for purpose;

— safety in operation;

— ability to take a representative sample from the required sampling point;

— capability of preserving the integrity of the sample until it can be transferred to a sample container;

— ability to be cleaned;

— simplicity in use;

— practicality of use;

— ability to withstand rough usage;

— simplicity of construction where a commercial prototype is not available.

Suggested applications for generic applications for generic types of equipment are detailed in Table A.1. Detailed descriptions of the equipment identified are presented in Figures A.1 to Figures A.13.

NOTE The size of the instrument should vary according to the quantity of sample required and the accessibility of the waste sample.

The sample size will be specified in the Sampling Plan (EN 14899) and determined following the principles outlined in CEN/TR 15310-1. Procedures for subsampling and pretreatment in the field and packaging, storage, preservation, transport and delivery of samples are provided in CEN/TR 15310-3 and CEN/TR 15310-4.

Table A.1 - Suggested applications for generic types of sampling equipment

Generic sampling apparatus	Liquid	Sludge	Pierceable solid	Dry solid (fine powder)	Dry solid (coarse grained)	Dry solid (massive)
Bailer						
Dipper	+ (1)	+	-	-	-	-
Weighted bottle	+ (2)	+	-	-	-	-
Depth sampler	+	+	-	-	-	-
Pond sampler	+	+	-	-	-	-
Column sampler (liquid)	+	+	-	-	-	-
Pump	+	+	-	+	-	-
Auger	- (3)	-	+	-	-	-
Corer	-	-	+	-	-	-
Sampling drill	-	-	+	-	-	-
Sampling tube	+	+	+	-	-	-
Spatula	-	-	+	+	+ (4)	+ (7)
Scoop	-	-	+	+	+ (4)	+ (7)
Trowel	-	-	+	+	+ (4)	+ (7)
Thief/trier	+	+	+	+	+ (5)	+ (7)
Tap	+	+	-	-	+ (6)	-

Key	Notes
+ appropriate	(1) For liquid depths < 3,5 m
- not appropriate	(2) Not suitable for viscous liquids
	(3) Does not collect undisturbed core
	(4) Not suitable for deep containers
	(5) May be difficult to retain the sample with very dry granular material
	(6) If gravity fed
	(7) If crushed prior to sampling

A.3 Sampling equipment

A.3.1 Bailer

Weighted depth samplers, pond samplers and column samplers or other sampling tubes are classified under the generic term 'bailer' for the purposes of this document. Their probabilistic application is liquid or sludge sampling.

a) Weighted bottle samplers.

The sampler consists of a glass or plastic bottle, sinker, stopper and line that is used to lower, raise and open the bottle and is used to sample liquids of free-flowing slurries (Figure A.1). The bottle may either be lowered to a specified depth (e.g. to collect upper, middle and lower samples) or all-level samples may be collected, depending on the time of removal of the cork (by a sharp jerk of the chain) and the speed at which the sampler is withdrawn. The successful operation of a weighted bottle sampler to collect a representative sample does require a considerable degree of skill. The use of weighted bottles is not advisable for particularly viscous liquids. An advantage of this method of sampling is that the sampling bottle may also be used as the sample container.

b) Simple weighted sample can

The simple weighted sample (see Figure A.2) can be used for sampling at various depths in all sizes of tanks. It consists of a cylindrical container (of capacity about 500 ml) made of stainless steel with a weighted base in a separate compartment and conical neck.

A wire loop is fitted to shoulders at the top of the device, with a ring at the apex through which a cord is passed and is then attached to a cork fitting the neck of the can.

The empty sampler with the cork inserted is lowered into the liquid to the required depth. The cord is jerked to remove the cork and the can is allowed to fill with product.

c) Weighted cage for sample bottle

The weighted cage (see Figure A.3) is designed to contain a standard glass sample bottle (of capacity about 500 ml) and can be used for sampling at varying depths in all types of tanks. It consists of a weighted base to which the attached three vertical straps with a retaining clip at their upper end. Two of the straps are angled and to these is fixed a wire loop with a ring at the apex.

Also attached to these straps is a wire hoop, which is secured to the third strap to retain the bottle in the cage. A cord passes through the ring of the wire loop and is attached to a cork fitting the neck of the bottle.

The sampler is operated in the same way as the weighted can.

d) Valve sampling cylinder (sinker sampler)

The valve sampling cylinder (see Figure A.4) consists of an open headed cylinder with a bottom valve. This valve remains open, owing to the pressure of the liquid in the valve whilst the instrument is being lowered through the liquid. This ensures that an even flow of liquid passes through the cylinder. When lowering ceases, the valve closes and a sample of liquid is drawn from the depth reached by the instrument.

Some samplers of this type and function incorporate a light flap valve at the head, which closes off the cylinder when the filled sampler is raised.

e) bottom sampler

— with spring loaded valve.

This bottom sampler (see Figure A.5a) is constructed of stainless steel and comprises a cylindrical body (of capacity about 500 ml) with screw-on base and top. The base incorporates a disc valve to permit entry of the liquid into the bottom of the sampler. The top also incorporates a disc valve to permit release of air from the sampler.

Attached to the screw-on top is a fixed hoop, which serves to suspend the sampler from a cord and provides a guide and spring retainer for the central valve spindle.

The valve spindle projects below the bottom of the sampler and, when this grounds on the tank bottom, the spindle is pushed up into the cylinder against the light spring, opening first the valve in the base, followed after a short delay by that at the top. This is made possible by the small gap in the sleeve at the upper part of the cylinder. The purpose of this short delay between opening of the inlet and the outlet valves is to ensure that the liquid first enters through the base. This causes a slight increase in pressure inside the vessel which prevents liquid entering at the top, when the upper valve opens.

Buoyancy may be overcome by adding weights in the form of stainless steel annular rings which are slipped over the body of the sampler and held in place by the screwed base.

— With deadweight valve

This bottom sampler (see Figure A.5b)) is basically similar to the bottom sampler with the spring-loaded valve in design and operation, except that the lower valve is kept closed by deadweight and the release of air is through a reduced section of the valve spindle at its upper end.

f) column sampler

This is one of the most important hazardous waste samplers used for containerised waste (Figure A.6).

The main parts of the equipment consist of a hollow PVC tube and concentric PVC rod attached to a neoprene stopper which form the sampling tube, closure locking mechanism and closure system. The sampler is lowered into the liquid or sludge to cut across a column of liquid. Used correctly, the sampling rate must be fairly slow, with the equipment being lowered sufficiently slowly for the liquid height inside and outside the sampling tube to remain approximately equal. The sampler is pushed against the bottom of the container to close the sampler and locked by turning the T-handle. The sampler is withdrawn, wiped with a disposable cloth and discharged into the sample bottle by turning the T-handle to ‘open’. Column samplers are manufactured from either plastic (usually PVC) or glass. The former can be used for most containerised liquids, except those containing ketones, nitrobenzene, dimethyl foramide, mesityl oxide and tetrahydrofuran. Strong alkali and hydrofluoric acid solutions cannot be sampled with a glass column of liquid sampler.

g) ‘slick stick’™

A similar device to the column sampler is the ‘Slick Stick™’. It consists of a 1 m length of clear uPVC tube (through which the liquid may be viewed) with an automatic valve assembly and removable strainer at the base. The ‘Slick Stick™’ is usually used to collect a composite sample of stratified liquids (e.g. floating oils) from different depths.

h) tube sampler

The tube sampling procedure is applicable for sampling liquids in drums and cans. The tube consists generally of glass, PTFE or stainless steel. Different sized tubes (500 ml and 1000 ml) are used to sample drums of different capacities. The technique is crude, but effective; the tube is lowered into the liquid, sealed at the top with a (gloved) thumb and discharged into a sampling device by removing the thumb. Two rings can be attached to opposite sides of the tubes at the upper end for two fingers to slip through, leaving the thumb free to close the opening (Figure A.7 and A.8).

By leaving the upper end open at various levels in the tank, bottom, middle, upper or all-level samples may be taken.

i) pond sampler

The pond or dipper sampler consists of a glass, plastic or other non-reactive beaker clamped to the end of a 2 or 3 piece telescopic aluminium or fibreglass pole (Figure A.9). Liquids and free-flowing slurries can

be sampled up to 4 metres from the bank. The sampler is inserted into the liquid upside down and inverted at the required sampling depth. When a discharge stream is sampled, the dipper should be passed through the stream at such a rate that it is filled in one pass, making sufficient passes to cover the entire cross-sectional area of the stream. The use of this type of sampler is not advisable when the total depth of the liquid is greater than around 4 metres.

A.3.2 Pumps

A range of pumps are available for sampling liquids. Vacuum pumps are less suitable for sampling volatile or highly volatile material than other types as the vapour formed reduces the vacuum so the pump no longer works effectively.

A.3.3 Augers

a) auger

Soils, sand, packed powders, granular material and piercable solids can all be sampled with a soil auger. However, the equipment may not be useful for non-cohesive solids (i.e. sandy soils etc.).

An auger consists of a hard metal central shaft with sharpened spiral blades, which discharge cuttings upwards as the shaft is rotated down through the material. A disturbed sample is obtained (i.e. it is not possible to distinguish layered material taken between the surface and the base of the profile), removed from the catch-pan and bottled (Figure A.10).

b) drill

This equipment is used for drilling hard and tough materials.

c) sampling tubes

The sampling tube is a stainless steel instrument consisting of two concentric tubes closely fitted into each other throughout their entire length, so that one tube can be rotated with the other. Longitudinal openings are cut in each tube. In one position the tube is open and admits the sample and by turning the inner tube it becomes a sealed container (Figure A.11).

The inner tube is 20 mm to 40 mm in diameter and undivided in its length. The two tubes are provided with holes to be aligned when emptying, so placed that the sample contained in the instrument can be drained through them when the longitudinal openings are closed.

The sampling tube type may be made of glass, although extreme care should be taken to avoid breakages. More usually the equipment is of stainless steel, aluminium or PTFE. It is inserted either closed by a gloved finger at the top or open, as desired. It is then closed by the finger and withdrawn.

The sampling tube may be used for taking samples at various levels from drums by keeping top closed until the required sampling depth is reached.

Volatile material quickly boils under vacuum; it is therefore advisable to use a tube with a bottom seal. The ball valve pump is highly suitable. However, it cannot be used for viscous or aggressive liquids.

A.3.4 Scoops

Dry granular or powdered materials in bins or other shallow containers or on conveyor belts may be sampled using a laboratory scoop or shovel. A polypropylene scoop is preferable, being resistant to corrosion and chemical reaction and is disposable. This equipment is not suitable for sampling significant depths of liquid.

— sampling scoops

From the viewpoint of bias, scoops with sides are preferable to shovels in that large particles tend to roll off the heap, which is formed, on a shovel. Figure A.12 shows the design of the scoop, and Table A.1 gives the dimensions of the scoop for particles of different sizes.

A.3.5 Thief

The sampling thief or grain sampler consists of two concentric tubes of stainless steel or brass, one fitting closely inside the other (Figure A.13a)). The outer tube has a conical pointed tip to facilitate sample penetration, the inner tube is rotated to open/close the sampler. Samples of dry granular and powdered material can be collected where the particle diameter is less than one-third the width of the slots. The closed sampler is inserted into the material from a point near a top edge or corner, through the centre to a point diagonally opposite the point of entry. The inner tube is rotated to open the sampler and shaken to allow material to enter the open hatches. The sampler is then closed and withdrawn, placed in a horizontal position (slot upward), the inner tube removed and its contents transferred to the sample container.

A.3.6 Trier

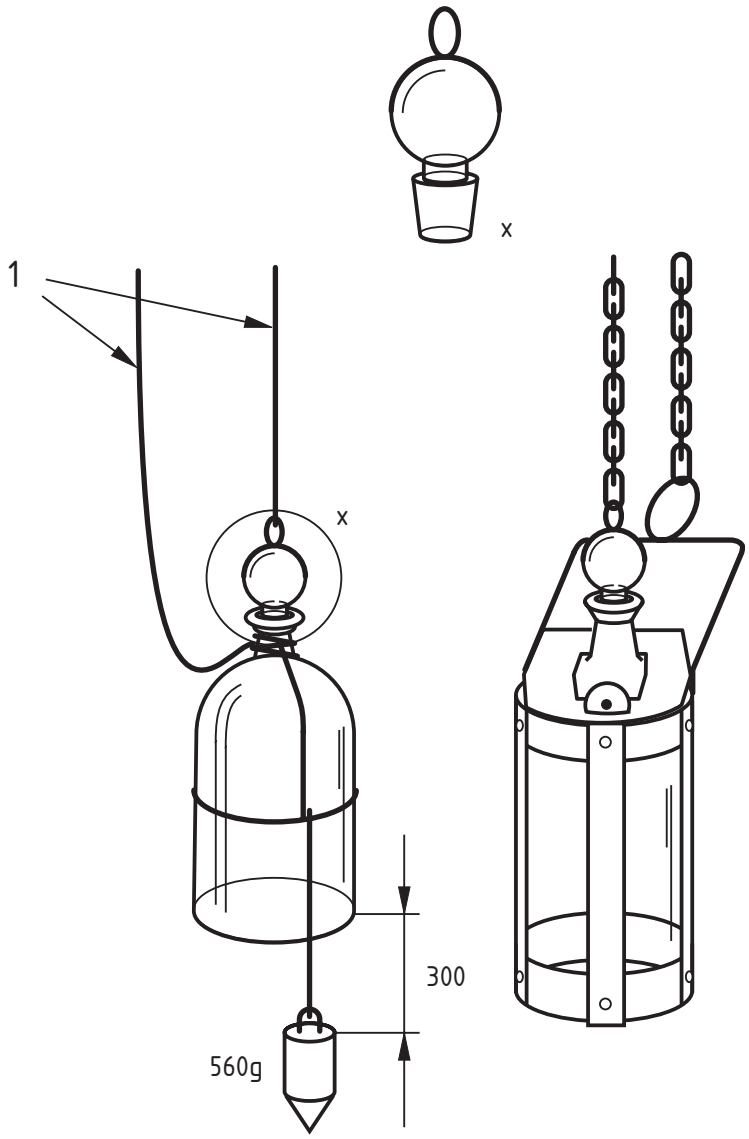
A trier consists of a tube cut in half lengthways, with a sharpened tip. It is used to collect moist or sticky solids with a particle diameter less than half the trier diameter. They may also be used for soft or loose consistency samples up to a depth of 60 cm. Tiers of lengths varying between 60 cm to 100 cm and 127 cm to 254 cm are available at laboratory supply stores (Figure A.13b)).

A.3.7 Pile sampler

Where samples are in large heaps with cross-sectional diameters of 1 m or more, a much larger trier (pile sampler) may be used.

It is commercially available but easily fabricated from PVC pipe. A 1.5 m length of pipe (e.g. ID 300 mm, wall thickness 0.3 mm) is sawn lengthways (with a 60/40 split) to the last 100 mm. The narrow piece is removed to leave a slot in the pipe, the slot edges are sharpened to allow the sampler to cut into the waste and the uncut end is used as a handle, this sampler can also be used for material in bins or trucks where a normal trier is not long enough. Samples are likely to be suspect where particle diameters are greater than half the trier diameter (Figure A.13c)).

Dimensions in millimetres



Key

1 Clean cotton twine

Figure A.1 - Weighted bottle sampler for liquid bottle wastes [8]

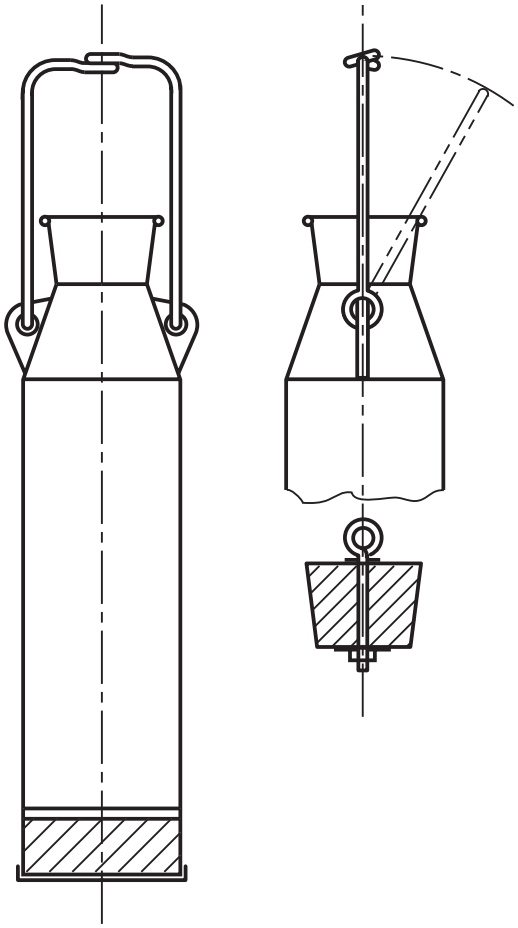


Figure A.2 - —Simple weighted sample can [ISO 5555]

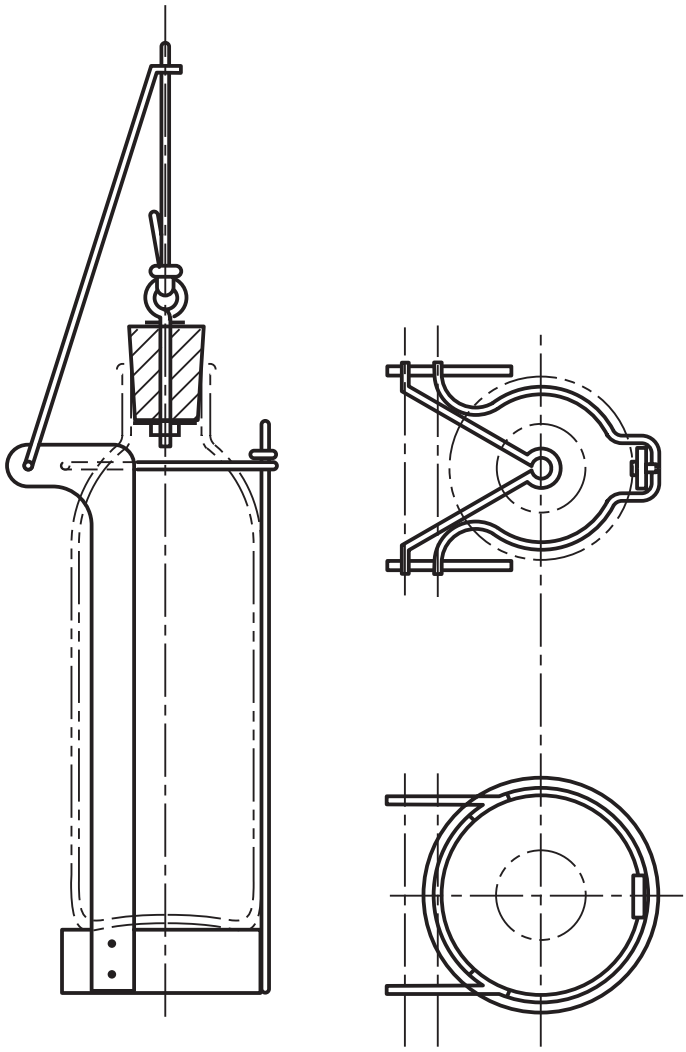


Figure A.3 - Weighted cage for sample bottle [ISO 5555]

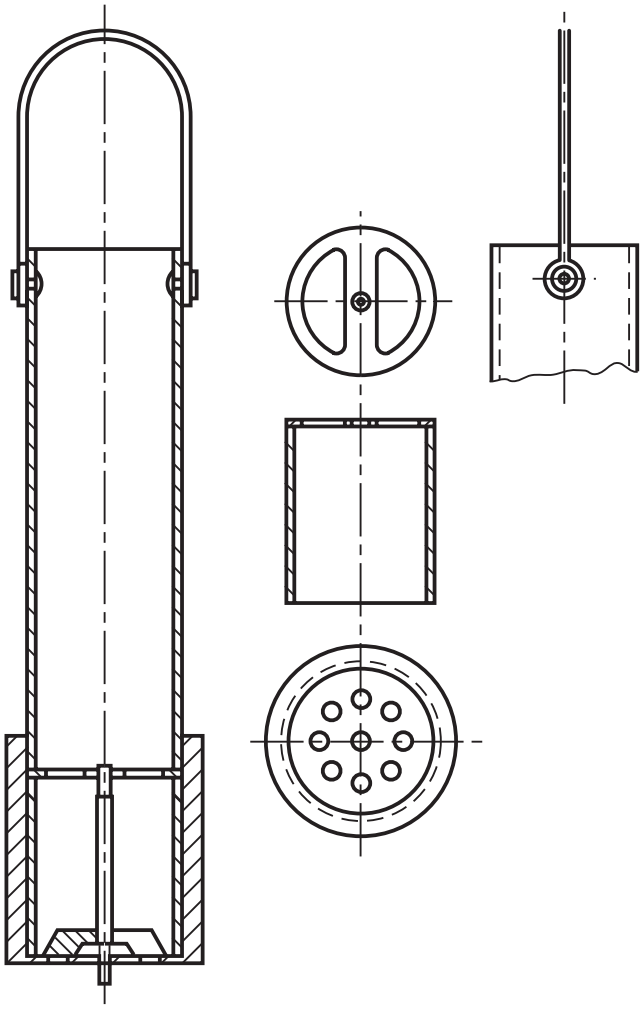


Figure A.4 - Valve opening cylinder (sinker sampler) [ISO 5555]

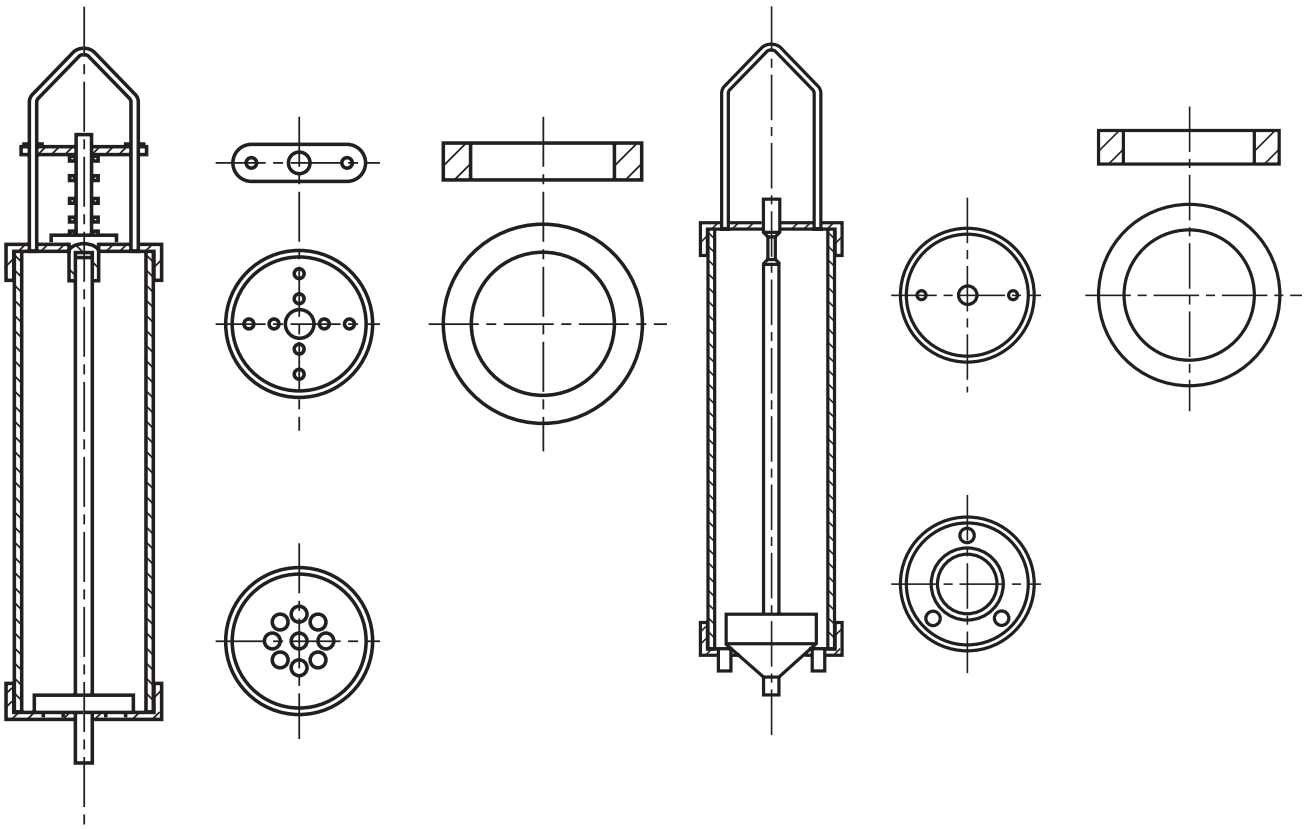
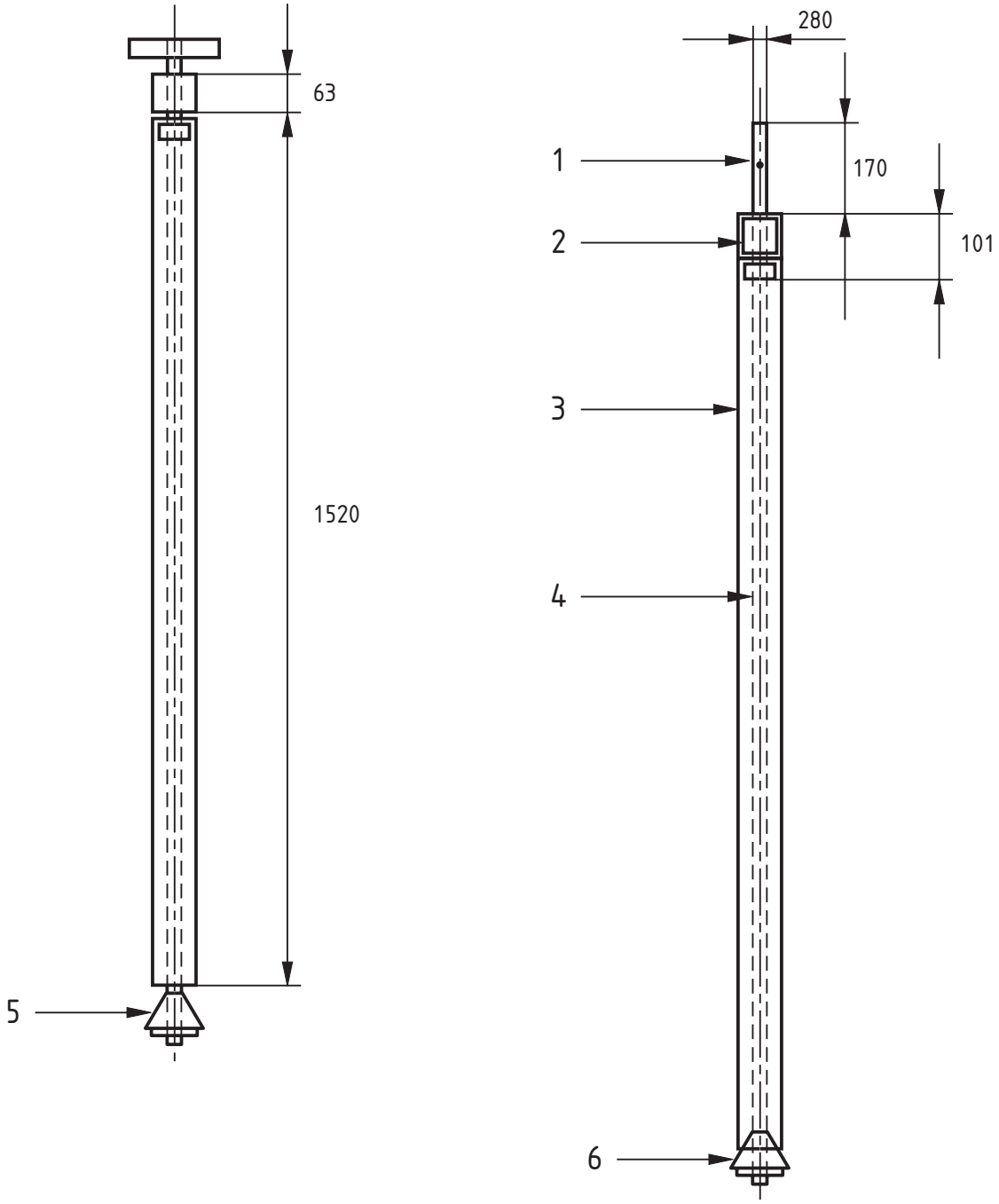


Figure A.5 - Bottom sampler [ISO 5555]

Dimensions in millimetres



Key
1 = T-Handle
2 = Locking Block
3 = Pipe, PVC Transluscent
4 = 13cm I.D.,4,26cm O.D.
5 = Stopper
6 = Stopper, neoprene, #9, tapered, 0,95cm, PVC lock nut and washer

Figure A.6 -. Column sampler [3]

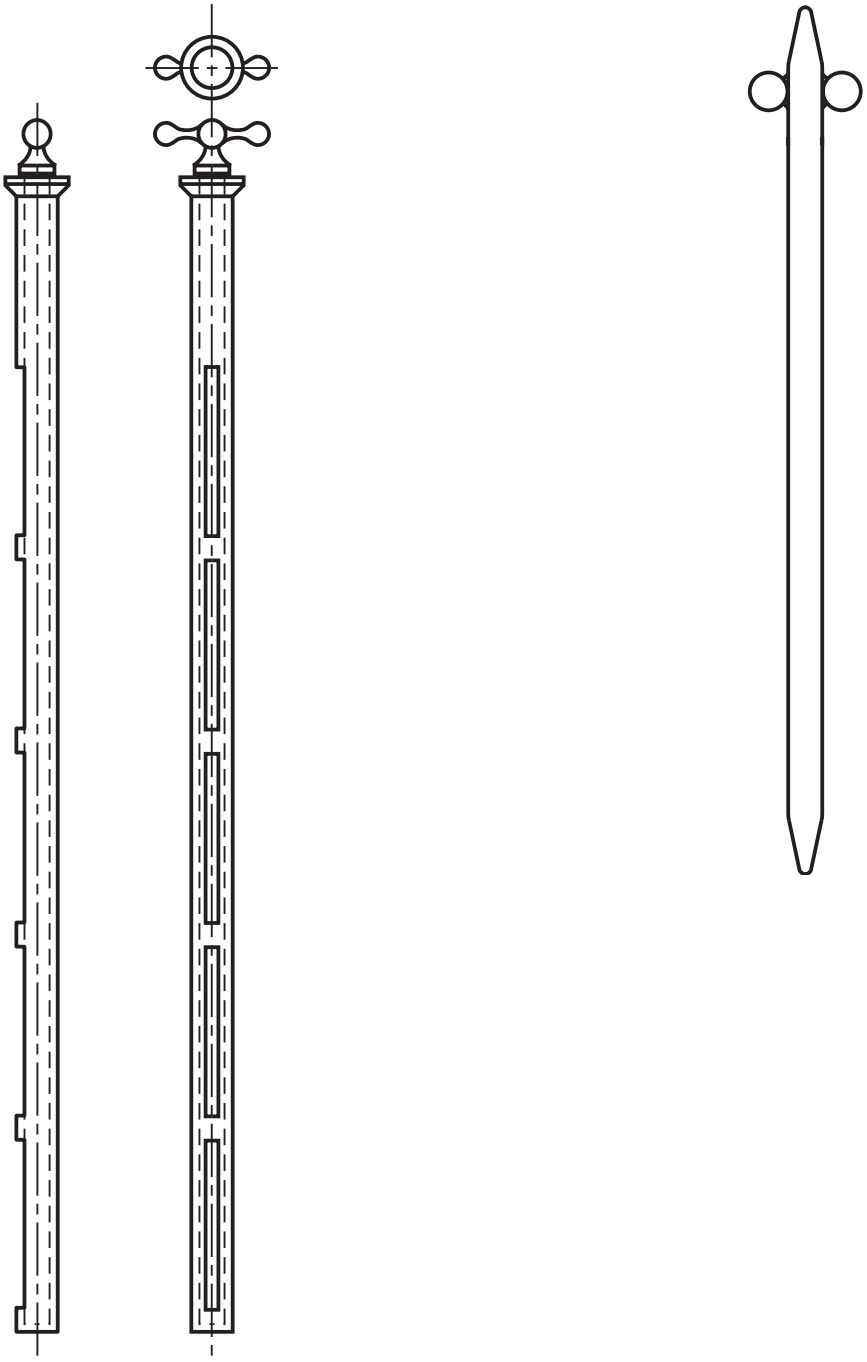
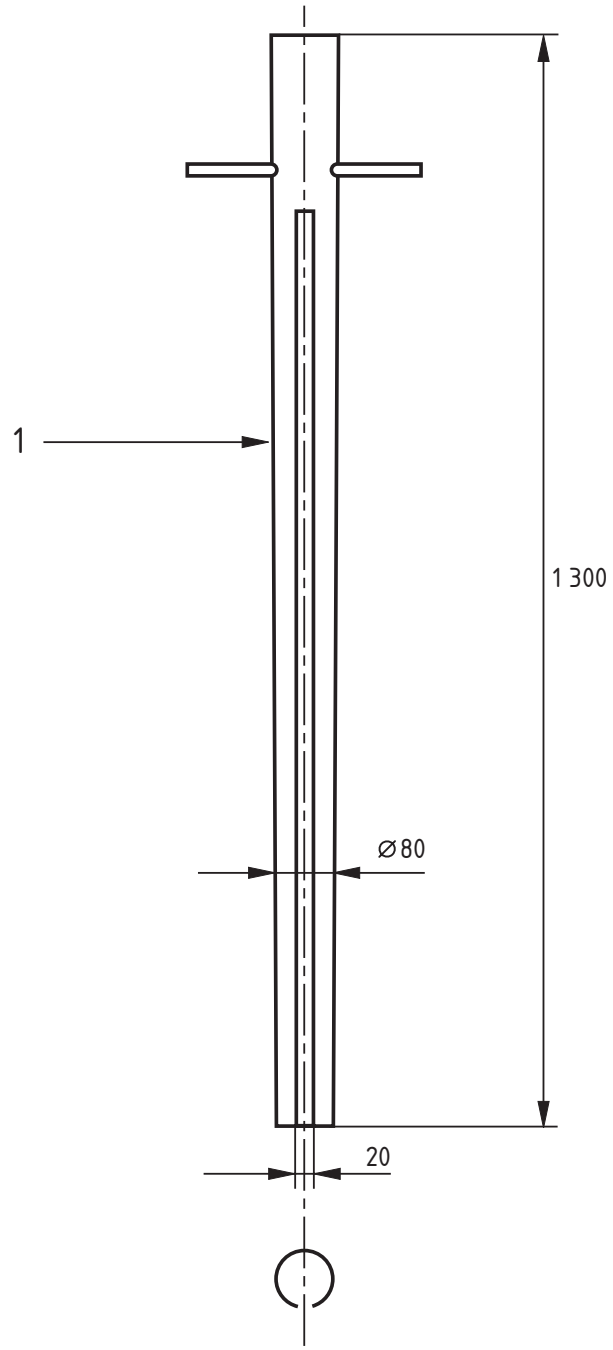


Figure A.7 - Sampling tubes [ISO 5555]

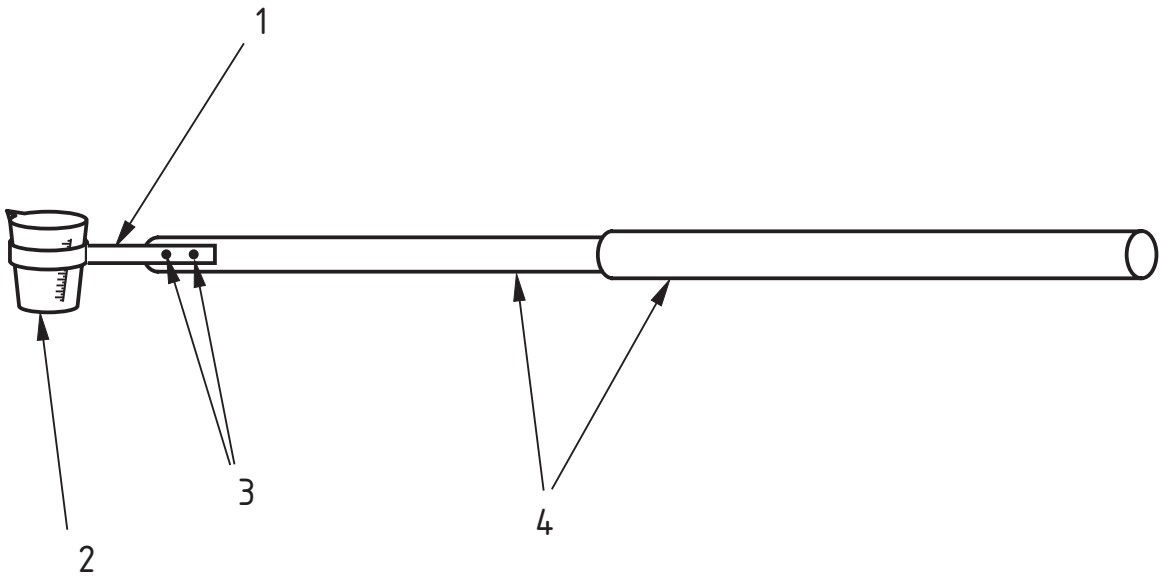
Dimensions in millimetres



Key

1 Tube (glass, PTFE or stainless steel)

Figure A.8 — Probe: slotted tube sampler [NVN 5860]



Key

1 = Varigrip
2 = Beaker 150 ml to 600 ml
3 = Bolt Holes
4 = Telescoping Aluminium Pole 2,5 m to 4,5 m (8 to 15ft)

Figure A.9 - Construction of a pond dipper/sampler for liquid waste [3]

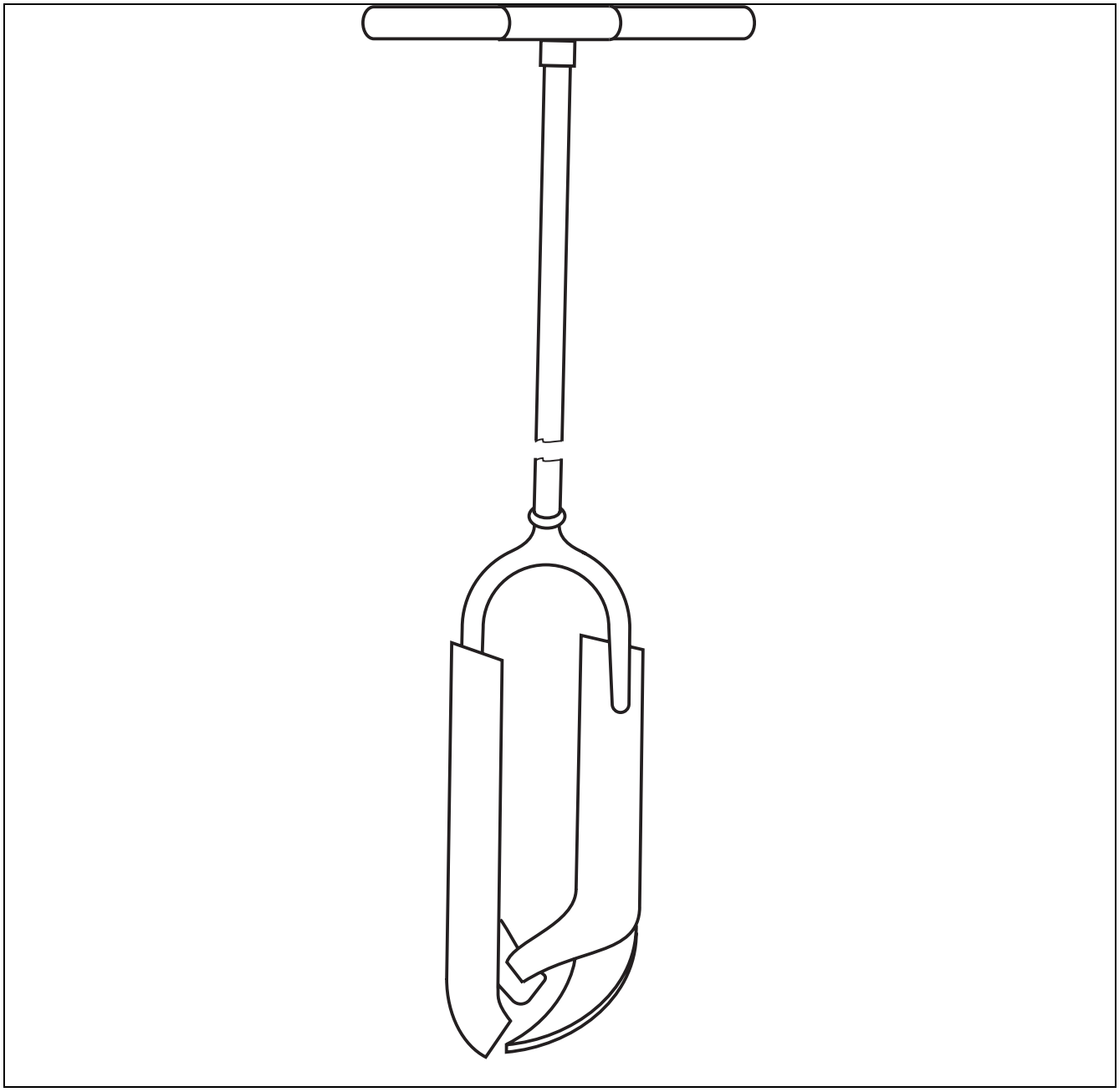


Figure A.10 - Soil auger [NVN 5860]

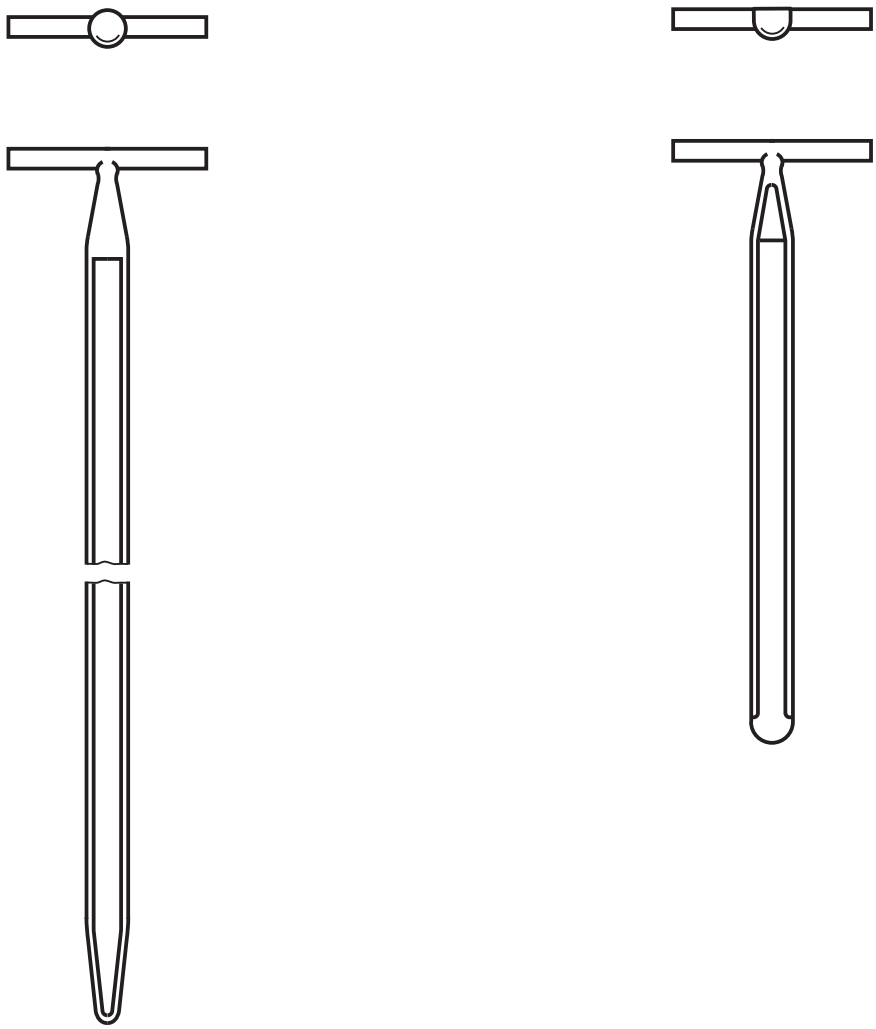


Figure A.11 - Sampling tubes [ISO 5555]

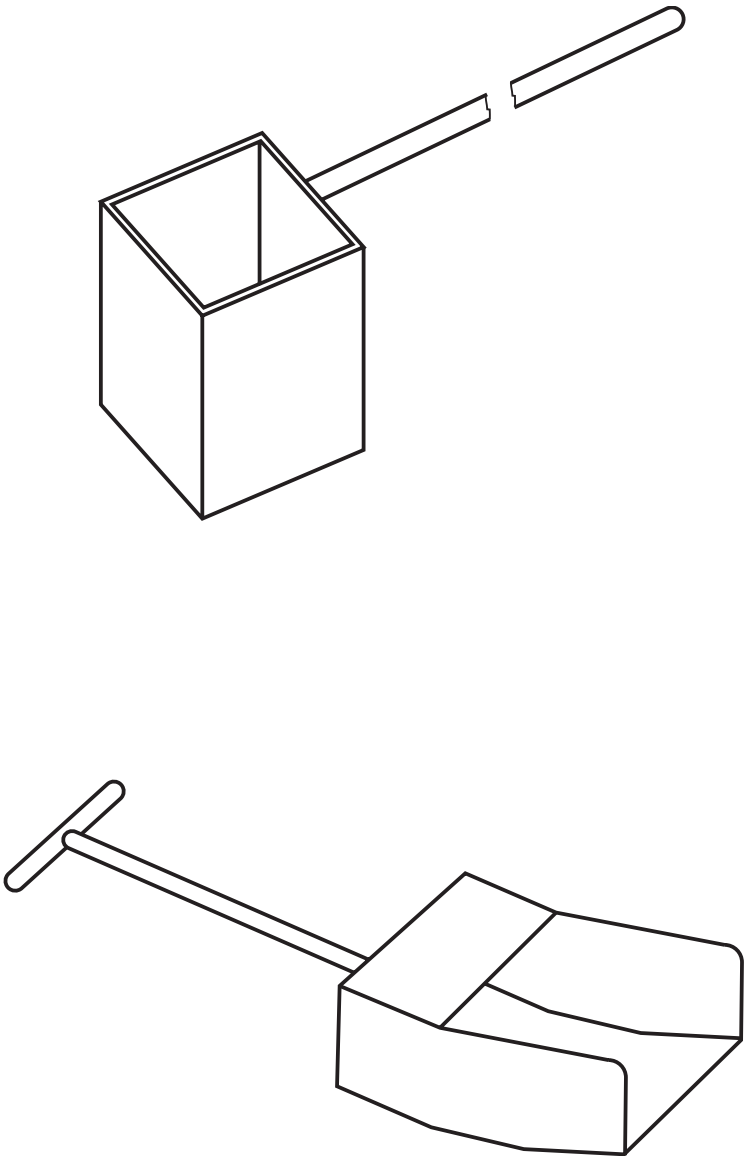


Figure A.12 - Sampling scoops [ISO 9411]

Dimensions in millimetres

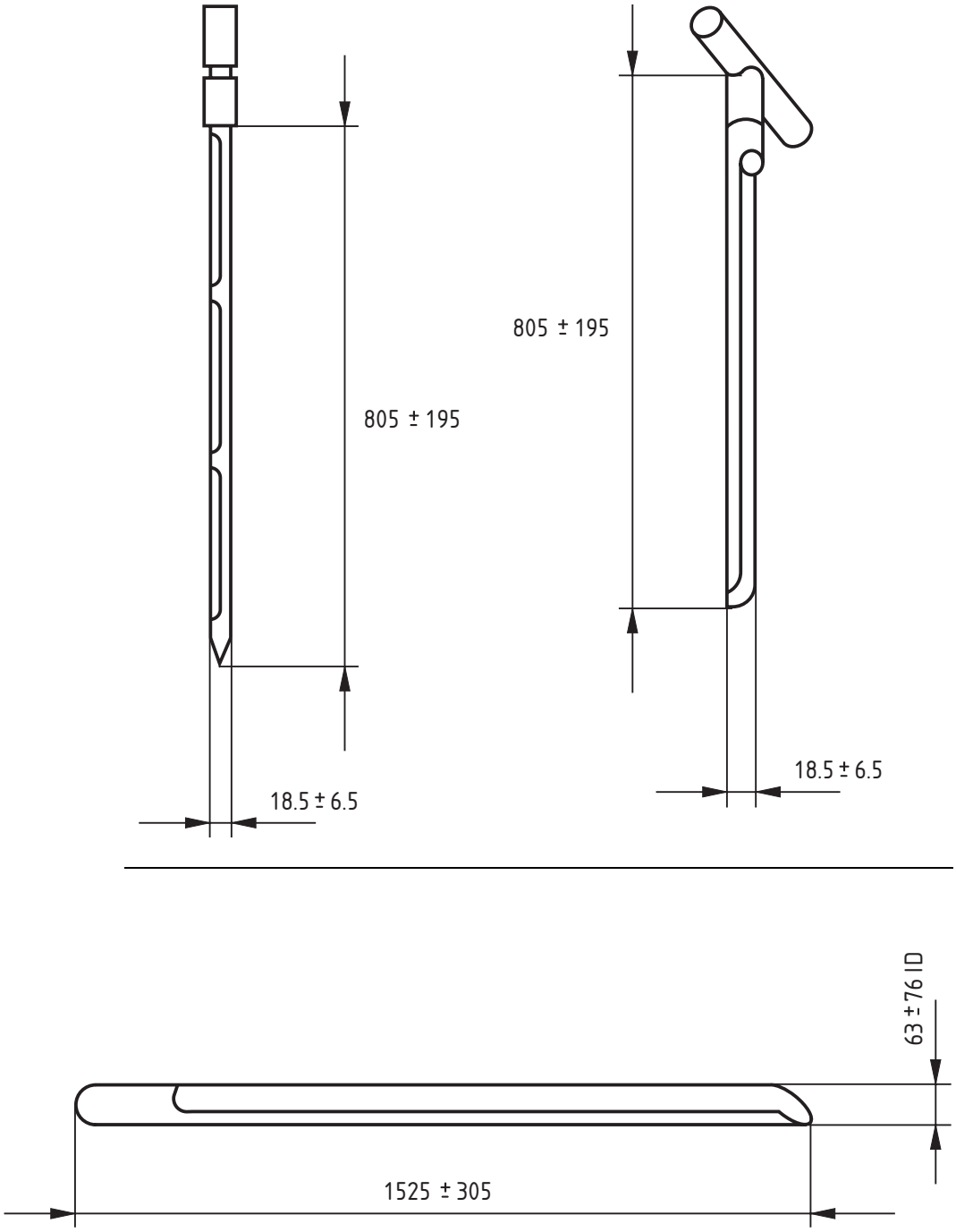


Figure A.13 - Samplers for solid waste a) thief, b) trier and c) waste pile sampler [3]

Bibliography

EN 14899:2005 *Characterization of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan*

CEN/TR 15310-1:2006 *Characterization of waste - Sampling of waste materials - Part 1: Guidance on selection and application of criteria for sampling under various conditions*

CEN/TR 15310–3:2006, *Characterization of waste – Sampling of waste materials – Part 3: Guidance on procedures for sub-sampling in the field*

CEN/TR 15310–4:2006, *Characterization of waste – Sampling of waste materials – Part 4: Guidance on procedures for sample packaging, storage, preservation, transport and delivery*

CEN/TR 15310–5:2006, *Characterization of waste – Sampling of waste materials – Part 5: Guidance on the process of defining the Sampling Plan*

ISO 3534-1*Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 11074 *Soil quality — Vocabulary*

ISO 13909-1:2001 *Hard coal and coke - Mechanical sampling - Part 1: General introduction*

ISO 13909-2:2001 *Hard coal and coke - Mechanical sampling - Part 2: Coal - Sampling from moving streams*

ISO 13909-3:2001 *Hard coal and coke - Mechanical sampling - Part 3: Coal - Sampling from stationary lots*

ISO 13909-4:2001 *Hard coal and coke - Mechanical sampling - Part 4: Coal - Preparation of test samples*

ISO 13909-5:2001 *Hard coal and coke - Mechanical sampling - Part 5: Coke - Sampling from moving streams*

ISO 13909-6:2001 *Hard coal and coke - Mechanical sampling - Part 6: Coke - Preparation of test samples*

ISO 5555 (2001) *Animal and vegetable fats and oils – Sampling*.

NEN 5860, NVN 5860: 1999, *Afvalstoffen – Bemonstering van Afval*

[1] IUPAC (1990) Nomenclature for sampling in analytical chemistry. Pure Appl. Chem, 62: 1193-1208.

[2] American Society For Testing Materials (2003) E300-03 Standard practice for sampling industrial chemicals.

[3] United States Environment Protection Agency (1980) Samplers and sampling procedures for hazardous waste streams. US EPA 600/2-80-018.

[4] United States Environment Protection Agency (1994) Waste analysis at facilities that generate, treat, store, and dispose of hazardous wastes, a guidance manual OSWER 9938.4-03

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