

DRAFT UGANDA STANDARD

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Bitumen and Bituminous binders – Part 1: Penetration grade bitumen -- Specifications

PUBLIC REVIEW DRAFT

Reference number
DUS DEAS 982-1: 2019

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This Draft Uganda Standard, DUS DEAS 982-1: 2019, *Bitumen and Bituminous binders – Part 1: Penetration grade bitumen -- Specifications*, is identical with and has been reproduced from an International Standard, DEAS 982-1: 2019, *Bitumen and Bituminous binders – Part 1: Penetration grade bitumen -- Specifications*, and is being proposed for adoption as a Uganda Standard.

The committee responsible for this document is Technical Committee UNBS/TC 3, *Building and construction*.

Wherever the words, "East African Standard " appear, they should be replaced by "Uganda Standard."

DRAFT EAST AFRICAN STANDARD

**Bitumen and Bituminous binders – Part 1: Penetration grade
bitumen -- Specifications**

PUBLIC REVIEW DRAFT
DRAFT EAST AFRICAN STANDARD-For Public Comment

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 021, Building and Civil Engineering.

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1 Scope

This **Draft East African Standard** specifies the requirements and test methods for penetration graded bitumen suitable for pavement construction.

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.

ASTM D5, *Standard Test Method for Penetration of Bituminous Materials*

ASTM D6, *Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds*

ASTM D36M, *Standard test method for softening point of bitumen (ring-and-ball apparatus)*

ASTM D 70 *Standard Test Method for Density of Semi-Solid Asphalt Binder (Pycnometer Method)* ASTM D113, *Standard Test Method for Ductility of Asphalt Materials*

ASTM D2042, *Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene*

ASTM D2171, *Standard Test Method for Viscosity of Asphalts by Vacuum Capillary Viscometer*

ASTM D92b, *Standard test method for flash and fire points by Cleveland open cup tester*

ASTM D2872, *Standard test method for effect of heat and air on a moving film of asphalt (rolling thin - film oven test)*

ASTM D3289, *Standard Test Method for Density of Semi-Solid and Solid Asphalt Materials (Nickel Crucible Method)*

ASTM D4402M, *Standard test method for viscosity determination of asphalt at elevated temperatures using a rotational viscometer*

ASTM D7553, *Standard Test Method for Solubility of Asphalt Materials in N-Propyl Bromide*

3 Definitions and abbreviations

For the purposes of this **Draft East African Standard**, the definitions and abbreviations given in ASTM D8 and the following apply.

3.1 Definitions

3.1.1 Bitumen or Asphalt Cement

non-crystalline solid or viscous mixture of complex hydrocarbons that possesses characteristic agglomerating properties, softens gradually when heated, is substantially soluble in trichloroethylene, and is obtained from crude petroleum by refining processes.

3.1.2 Penetration

A measure of hardness or consistency of the bitumen. It is the vertical distance traversed by a standard needle entering the material under specified conditions of load, time and temperature; and is expressed in one-tenths of millimeter.

3.1.3 Lot

that quantity of penetration grade bitumen of the same batch identification, from one manufacturer, submitted at any one time for inspection and testing

3.2 Abbreviations

ASTM: American Society for Testing and Materials

EAC: East African Community

NSB: National Standardization Bureau

4 Requirements

4.1 General

The penetration grade bitumen shall be homogeneous and free from visible water, mineral matter and other impurities, and shall not foam when heated to application temperature.

4.2 Grade requirements

4.2.1 The bitumen shall comply with the requirements given in table 1, relevant to the grade specified by the purchaser (see annex A).

4.2.2 When so required by the purchaser, the supplier shall indicate the viscosity (determined in accordance with annex B) of the bitumen (see annex A), to serve as a guide to the purchaser when the optimum handling temperatures, as in table 1 for the grade concerned, are determined.

Table 1 — Grade requirements

Property	Penetration grades												Test Methods
	20/30		35/50		40/60		50/70		70/100		160/200		
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
PENETRATION @25 °C, dmm	20	30	35	50	40	60	50	70	70	100	150	200	ASTM D 5
SOFTENING POINT °C	55	63	50	58	48	56	46	54	43	51	38	44	ASTM D 36M ^a
DENSITY @25 °C, Kg/m3					1010	1060	1010	1060	1000	1050	1000	1050	ASTM D70 OR D3289
VISCOSITY @60 °C, Pa.s					3600	4800	1960	2400	900	1200	200	300	ASTM D2171
Kinematic viscosity at 135°C, mPa.s (min)	530		370		325		295		230		150		ASTM D4402M ^b
FLASH POINT (Cleaveland Open) °C (min)	240		240		230		230		230		218		ASTM D 92 ^b
Solubility in Trichloroethylene or n-propyl Bromide*, wt% (min)	99		99		99		99		99		99		ASTM D2042/ASTM D7553
DUCTILITY @25 °C cm (min)					100		100		100		100		ASTM D113
LOSS ON HEATING wt% (max)						0.2		0.2		0.2		0.5	ASTM D6
DROP IN PENETRATION AFTER HEATING % (max)						20		20		20		20	ASTM D5

Thin film oven test (ASTM D1754)

Change of mass (by mass fraction), % (max.)		0.5		0.5		0.5		0.5		0.8		0.8	ASTM D 2872
Dynamic Viscosity @60°C, Pa.s (min)	440		225				145		90		55		ASTM D4402M ^b
Softening point (Ring and Ball) °C (min)	57		52		49		48		45		41		ASTM D 36M ^a
Increase in softening point (R&B), (max)		8		8				11		8		7	ASTM D 36M ^a
Retained Penetration 25°C, 100g, 5s (% of original)	55		53		50		50		46		46		ASTM D5

^a Shouldered ring can also be used.

^b The RV viscometer, using SC 4 spindles with thermosel system can also be used.

PUBLIC REVIEW DRAFT

NOTE 1: ASTM D7553 covers determination for the degree of solubility of N-propyl bromide on asphalt material. It is intended to be a replacement for test method ASTM D2042 specifying a solvent like trichloroethylene. N-propyl bromide is safe in that it has no flash point and has similar solubilizing characteristics to trichloroethylene, but is not considered to be an ozone-depletor by the Kyoto protocol.

5 Packaging and marking

5.1 Packaging

The condition of each drum and tanker into which the penetration grade bitumen is packed shall be such that it will have no detrimental effect on the quality of the product during normal transport and storage.

5.2 Marking

The following information shall appear in legible and indelible marking on each drum or, when the bitumen is supplied in tankers, on the relevant consignment documents:

- a) the manufacturer's identification;
- b) a description of the contents;
- c) the grade designation;
- d) manufacture date;
- e) the batch identification; and
- f) the quantity.

6 Sampling and compliance with this East African Standard

6.1 General

This clause applies to the sampling for inspection and testing before acceptance or rejection of single lots (consignments) in cases where no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of the lot. It is also used as the procedure for adjudicating in cases of dispute.

6.2 Sampling

The relevant sampling procedure as described in annex B shall be applied in determining whether a lot complies with the appropriate requirements of this East African Standard. The samples so drawn shall be deemed to represent the lot.

6.3 Compliance

The lot shall be deemed to comply with the requirements of this East African Standard if, after inspection and testing, the sample taken in accordance with 6.2 is found to comply with all the appropriate requirements of this standard.

Compliance of bitumen with this East African Standard does not guarantee compatibility with various modifiers. Consequently, the onus rests with the manufacturer of modified binders to ensure compatibility through testing.

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Annex A

(informative)

Notes to purchasers

The following requirements shall be specified in tender invitations and in each order or contract:

- a) The grade (see 4.2.1);
- b) The viscosity (see 4.2.2); and
- c) Information on currently valid national and international standards can be obtained from the EAC Partner States NSBs Office.

Annex B

(normative)

Standard practice for sampling asphalt materials

B.1 General

This practice applies to the sampling of asphalt materials at points of manufacture, storage, or delivery.

B.1.1 Significance and use

Sampling is as important as testing, and precautions shall be taken to obtain samples to show the true nature and condition of the materials.

B.1.2 Samples are taken for either of the following two purposes:

B.1.2.1 To represent as nearly as possible an average of the bulk of the materials sampled, or

B.1.2.2 To ascertain the maximum variation in characteristics that the material possesses.

B.1.3 Precautions

Because of the numerous types and grades of asphalt materials that are alternately shipped and stored in the same or similar containers, the opportunity for contaminating these containers with residues, precipitates, or cleaning solvents is present. Numerous opportunities also exist for obtaining samples that are not strictly representative of the material or are contaminated after removal. Therefore, it is incumbent upon the producer, transporter, user, and sampler to exercise continuous precaution in the sampling and handling of these materials.

B.2 Selection of samples

B.2.1 Whenever practicable, asphalt materials shall be sampled at the point of manufacture or storage, and at such time as to allow the tests controlling acceptance or rejection to be made in advance of shipment.

B.2.2 When the samples cannot be taken at the point of manufacture or storage, they shall be taken from the shipment immediately upon delivery.

B.3 Samples size

B.3.1 The sample size of liquid materials shall be as follows:

B.3.1.1 For routine laboratory examination and from barrels or drums, 500 mL to 1 L.

B.3.1.2 From bulk storage, 4 L.

B.3.1.3 For emulsified asphalts, 1 L.

B.3.2 The sample size of semisolid or solid materials shall be as follows:

B.3.2.1 From barrels, drums, or cakes, 1 to 2 kg.

B.3.2.2 From crushed or powdered material in bulk or bags, 1 to 2 kg.

B.4 Containers

B.4.1 Type of Containers:

B.4.1.1 Containers for liquid asphalt materials shall be wide mouth cans with lined screw caps or triple seal friction top cans.

B.4.1.2

B.4.1.3

B.4.2 Size of Containers

The size of the container shall correspond to the required sample size.

B.5 Protection and preservation of samples

B.5.1 Sample containers shall be new. They shall not be washed, rinsed, or wiped with an oily cloth. If they contain evidence of solder flux, or if they are not clean and dry, they shall not be used. Top and container shall fit together tightly.

B.5.2 Care shall be taken to prevent the sample from becoming contaminated. Immediately after filling, the container shall be tightly sealed.

B.5.3 The filled sample container shall not be submerged in solvent, nor shall it be wiped with a solvent saturated cloth. If cleaning is necessary, use a clean dry cloth.

B.5.4 Samples shall not be transferred from one container to another except where required by the sampling procedure.

B.5.5 Immediately after filling, sealing, and cleaning, the sampling containers shall be properly marked for identification with a suitable marking pencil on the container itself, and not on the lid. Labels or tags also may be used for identification if they can be securely fastened to the container in such a manner as to ensure that they will not be lost in transit. Labels or tags shall not be attached to containers by using the lids to secure them. All identification materials shall maintain their integrity at temperatures up to 200 °C.

B.5.5.1 The labeling of the sample must, at a minimum, include an identification of the product or material type and the date of sampling.

B.6 Sampling at place of manufacture

B.6.1 *Vertical tanks not capable of being agitated (liquid materials or materials made liquid by heating) (800 m³ or more capacity)* — Three sampling methods are recommended (Note 2):

B.6.1.1 Sampling-valve method—Valves shall be located, with easy and safe access provided, on the side of the tank with the first in the top third of the tank, but no higher than 1 m from the top; the second in the middle third of the tank; and the third in the bottom third of the tank, but no lower than 1 m from the bottom. A recommended design of the sampling valve is shown in Figure 1.

B.6.1.1.1 A minimum of 4 L of the product shall be drawn from each sample valve and discarded before taking the sample for test in a clean container.

B.6.1.1.2 500 mL to 4 L shall be drawn from each sample valve for test.

B.6.1.2 Thief sampler method (not suitable for asphalt cements) — Samples shall be taken in the top, middle, and lower sections at levels indicated in B.6.1.1, of the tank by lowering a thief sampler into the material. A satisfactory type with instructions for use is shown in Figure 2.

NOTE 2 — Most asphalt materials in the liquid state are of such viscous and adhesive character that, after normal emptying of a container by pouring, the container retains enough material to cause significant contamination of any second samples secured before the container was thoroughly cleaned. The aforementioned properties of asphalt materials also make container cleaning a difficult, tedious, and time-consuming task.

NOTE 3 — The thief sampler described in Figure 2 may be used for repetitive sampling because significant sample contamination by previous contents is avoided by the self-cleaning action provided by the passage of material through the tube-shaped thief sampler which is open at both ends. The practice of raising and lowering the sampler 3 or 4 times through a distance of a metre (several feet) at the sampling depth is recommended.

B.6.1.3 Throw-away container method — Samples shall be taken at top, middle, and lower levels by lowering into the material a container in a suitable weighted holding device. The essential feature of the method is to use a clean container to take the sample, pour this sample into another clean container, and throw away the container used to take the sample from the tank. A satisfactory type with instructions on how to use the device is shown in Figure 3.

B.6.1.4 The three samples from bulk storage tanks may be tested separately for consistency to detect stratification. They may be combined, thoroughly mixed, and a 500-mL to 4-L sample may be taken for other tests that may be required for determining average characteristics of the material.

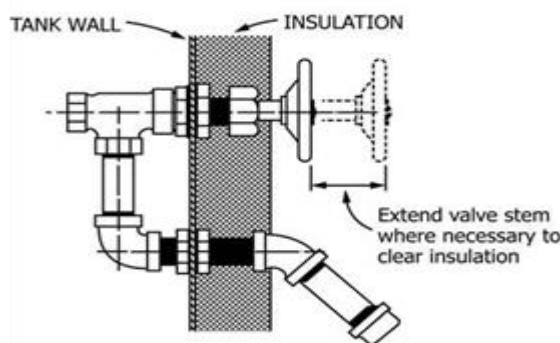


Figure 1 — Typical submerged sampling device

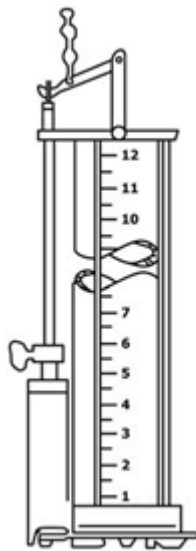


Figure 2 — Thief sampler

NOTE 4 — This type sampler is lowered into the tank with bottom valve open (there is no top closure). When the desired depth is reached, the lowering chain is given a snap tug, which closes the bottom valve. The sampler is then withdrawn from the tank and the contents transferred to the sample container. This sampler may be used for repetitive sampling in the same tank.

B.6.2 Bulk Storage tanks (liquid materials or materials made liquid by heating) equipped with mechanical agitators — When the tank is equipped with operating mechanical agitators which, by observation through the sampling or inspection hatch, are performing adequate mixing of the tank contents, a single sample taken by any of the methods described in B.6.1.1, B.6.1.2, or B.6.1.3 will be satisfactory to use for test purposes.

B.7 Sampling from tank cars, vehicle tanks, distributor trucks or recirculating storage tanks

B.7.1 The sample may be taken from the sample valve or tap if the tanks are provided with them. When such sampling devices are required, they are to be built into the tank itself. A sampling device of this type is shown in Figure 1. Before the sample is taken, 4 L shall be drawn from the sample valve and discarded before taking the sample for test in a clean container.

B.7.2 Samples of liquid materials and materials made liquid by heating may be taken by the dip method using a clean wide-mouth or friction-top can in a suitable holder as shown in Figure 4. A clean container must be used to take each sample, and the material sampled shall then be transferred to another new and clean container for retention or testing sample.

B.7.3 A detachable fitting, similar in design to the one shown in Figure 5 may be inserted in the discharge line. Before the sample is taken 4 L shall be drawn from this sampling valve and discarded before taking the sample in a clean container.

B.8 Sampling from tankers and barges

B.8.1 For liquid materials (including all cutbacks made liquid by heating) top, middle, and lower samples shall be taken using the methods as described in B.6.1.2 and B.6.1.3.

B.8.2 For all other materials made liquid by heating, a top sample only shall be taken by the dip, thief, or throw-away container method.

B.9 Sampling from pipe lines during loading or unloading

B.9.1 When tankers and barges are being loaded or unloaded samples may conveniently be taken from the pipe line through which the material is flowing by insertion of a sampling pipe into a rising section of the pipe line on the discharge side of the pump or in a completely filled line in which gravity creates the materials flow. A suitable in-line sampling pipe is shown in Figure 5. The sampling pipe shall be not more than one eighth the diameter of the pipe line and its opening should be turned to face the flow of the liquid. This pipe shall be provided with a valve or plug cock and shall discharge into a sample receiver. At least three 4-L samples shall be taken at uniform intervals throughout the entire loading or unloading. At the completion of the loading or unloading, the individual 4-L samples shall be combined, thoroughly mixed without altering its characteristics, and a 4-L sample taken therefrom.

B.9.2 When sampling tankers and barges 4000 m³ or less, capacity, at least five 4-L samples shall be taken at uniform intervals throughout the entire loading or unloading (4000 m³, or larger, capacity requires at least ten 4-L samples. At completion of the loading or unloading, the individual 4-L samples shall be combined, thoroughly mixed in a manner designed to not alter its characteristics, and a 4-L sample taken therefrom.

B.10 Sampling from drums or barrels

After thorough mixing, samples of liquid asphalt material from barrels or drums shall be secured by tube or thief sampling by taking 1 L of material from packages selected at random according to B.11.

B.11 Sampling semisolid or uncrushed solid materials

Drums, Barrels, Cartons, and Bags —Where the lot of material to be sampled is obviously from a single run or batch of the producer, one package shall be selected at random and sampled as described below. Where the lot of material to be sampled is not obviously from a single run or batch of the producer, or where the single samples selected as described above fails on test to conform to the requirements of the specifications, a number of packages shall be selected at random and equivalent to the cube root of the total number of packages in the lot. The following table is given, showing the number of samples to be selected for shipments of various sizes.

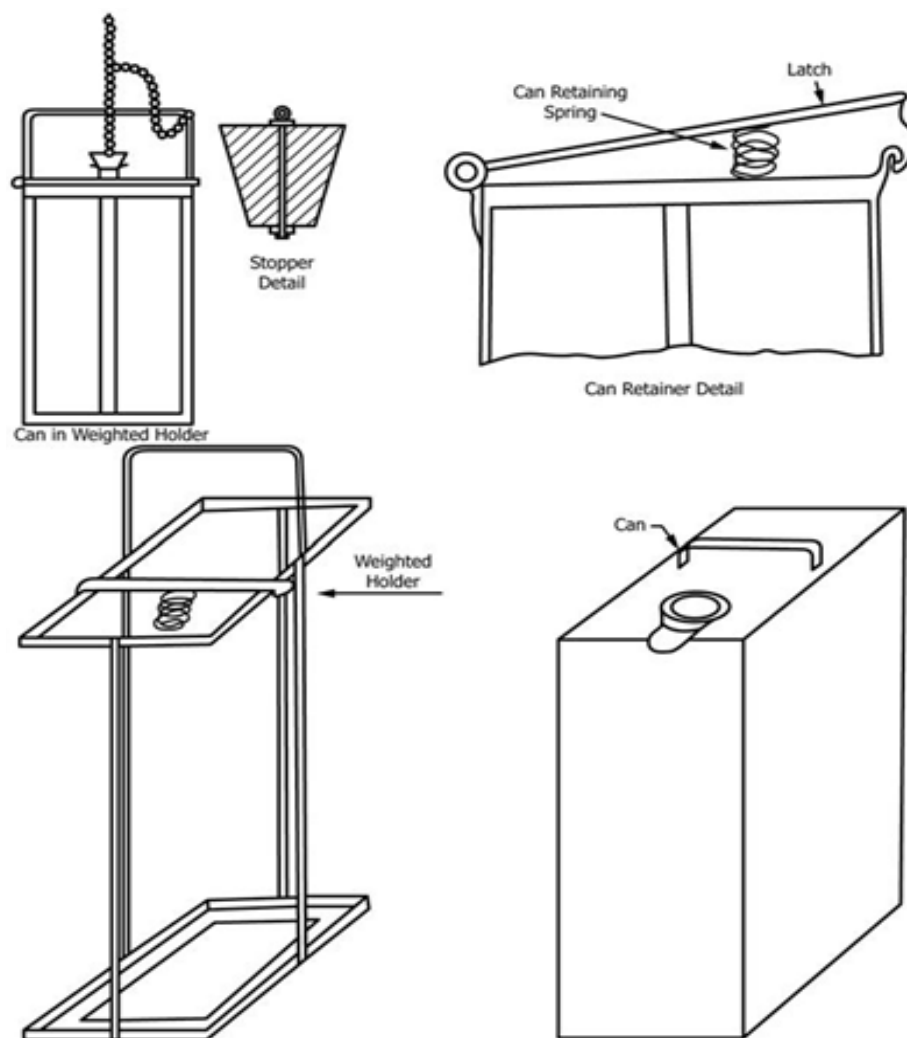


Figure 3 — Throw-away container sampler

NOTE 5 — This type sampler is lowered into the tank with the stopper in place. When the desired depth is reached, the stopper is removed by means of the attached wire, cord, or chain and the container allowed to fill. Complete filling is indicated by the cessation of bubbles of air from the can at the surface of the liquid. The sampler is then withdrawn from the tank and the contents poured into the clean sampler container. A clean can (bottle) must be used for each sample taken.

Packages in Shipment	Packages Selected
2 to 8	2
9 to 27	3
28 to 64	4
65 to 125	5
126 to 216	6
217 to 343	7
344 to 512	8
513 to 729	9
730 to 1000	10
1001 to 1331	11

Samples shall be taken from at least 75 mm below the surface and at least 75 mm from the side of the container. If the material is hard enough to shatter, use a clean hatchet. If the material is soft, use a broad, stiff putty knife. When more than one package in a lot is sampled, each individual sample shall have a mass of not less than 0.1 kg in weight. When

the lot of material is obviously from a single run or batch of the producer, all samples from the lot shall be melted and thoroughly mixed, and an average 4-L sample taken from the combined material for examination. In case more than a single run or batch of the producer is

B.12 Sampling crushed or powdered materials

B.12.1 Bulk storage — Solid asphalt materials in crushed fragments or powder shall be sampled in accordance with Practice ASTM D346. The gross sample shall be not less than 25 kg from which shall be selected the 1 to 2-kg sample for test.

B.12.2 Drums, barrels, bags and cartons — Where the crushed or powdered material is in barrels, drums, or bags, a number of packages shall be selected at random as described in B.11 sample at least 0.5 kg in mass shall be selected from near the center of each container to yield a gross sample weighing not less than 25 kg from which the 1 to 2 kg sample for test shall be selected as prescribed in Practice ASTM D346.

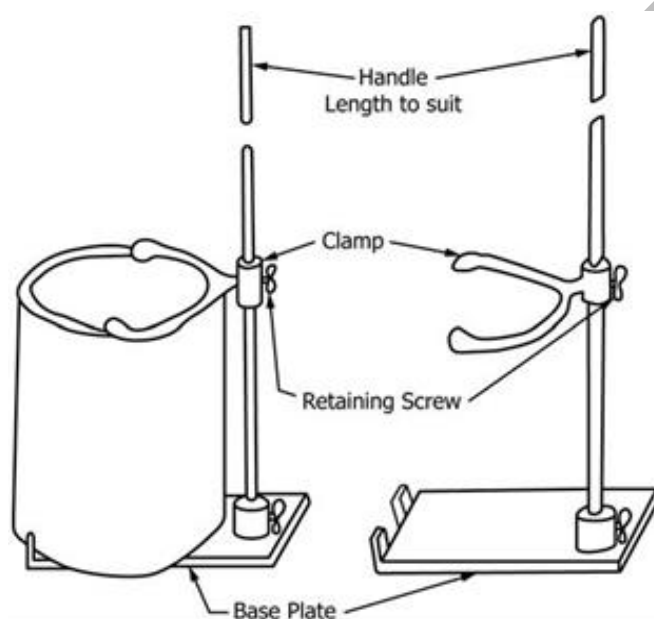


Figure 4 — Dip sampler

NOTE 6 — Sampler with can secured in place is rapidly lowered into tank to desired depth and allowed to fill with sample. The sampler is then withdrawn from the tank and the contents transferred to the sample container. A clean container must be used to take each sample.

B.13 Sampling at point of shipment delivery

B.13.1 Sampling of asphalt materials shall be done as soon as practicable after the asphalt material has arrived at plant site, storage site, or job destination or at the time of unloading.

B.13.2 The required number of samples shall be taken from each delivery of asphalt material. In the case of small delivery units such as distributors, the samples shall be taken to represent a maximum of 40 m³.

B.13.3 Sampling shall be done by one of the three following methods:

B.13.3.1 In accordance with B.10.

B.13.3.2 By bleeding through a sample valve or tap in the transfer line during the unloading of the approximate middle third of the load, or

B.13.3.3 By means of a sampling device inserted to a level of approximately the middle third of the load or tank.

B.13.4 Tests for material acceptability shall be made on one of the samples taken. The other samples are to be retained for confirmation in the event the first sample tested should fail to comply with requirements.

B.14 Keywords

asphalt materials; crushed materials; emulsified asphalts; liquid asphalts; powdered materials; sampling; semi-solid materials; uncrushed solid materials



Figure 5 — In-line asphalt sampling device

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