SRI LANKA STANDARD 937 : 1991

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METHODS OF SAMPLING

FOUNDRY SANDS

SRI LANKA STANDARDS INSTITUTION

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SLS 937 : 1991

Gr. 9

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Sri Lanka Standards are subject to periodical revision in order to accommodate the progress made by industry. Suggestions for improvement will be recorded and brought to the notice of the Committees to which the revisions are entrusted.

This standard does not purport to include all the necessary provisions of a contract.

SRI LANKA STANDARD
METHODS OF SAMPLING FOUNDRY SANDS

FOREWORD

This standard was authorized for adoption and publication as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 91-09-27 , after the draft, finalized by the Drafting Committee on foundry Industry had been approved by the Mechanical Engineering Divisional Committee.

This standard is intended chiefly to cover the technical provisions relating to the sampling of foundry sands,and it does not include all the necessary provisions of a contract.

All the values given in this standard are in SI units.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or observation shall be rounded off in accordance with **CS 102**. The number of figures to be retained in the rounded off value shall be the same as that of the specified value in this standard.

The Sri Lanka Standards Institution gratefully acknowledges the use of relevant publications of the Bureau of Indian Standards in the preparation of this standard.

1 SCOPE

This standard, lays down the procedure to be followed in preparing samples from a bluk of sand in order to determine the properties of the sand sampled. Sampling of sand in quarries, in foundries and from consignments have been considered separately.

This standard also includes a method for reporting the quality of the bluk of the sand sampled.

2 REFERENCES

CS 102 - Presentation of Numerical values.
CS 124 - Test Sieves.

3 DEFINITIONS

For the purpose of this standard, the following definitions shall apply:

3.1 **bed of sand** : A layer of sandy strata which is to be quarried or mined.

3.2 **floor sand** : Prepared (ready-made) moulding sand, used for floor moulding purposes.

3.3 **gross sample** : The quantity of sand obtained by mixing or crushing together all the increments or specimens collected from the same sub-lot.

3.4 **increment** : The quantity of sand collected by filling up the sampling scoop to its capacity in a single motion of the scoop (see 3.11) .

3.5 **laboratory sample** : The quantity of sand obtained by reducing a gross sample following a specified procedure, and intended for laboratory testing.

3.6 **lot** : The bulk of sand indicated (by the supplier) to be of the same type and grade, offered for inspection at one time; a lot may consist of the whole or a part of the bulk ordered for.

3.7 **riffle sample divider** : As illustrated in Fig. 1 (see page 7)

3.8 **specimen** : A slab of specified dimensions collected from a bed of rock sand.

3.9 **sub-lot** : The quantity of sand in each of the groups into which a lot or a quarry or a bed of sand is divided for the purpose of sampling.

3.10 **system sand** : A naturally occurring or prepared sand used for a specific class of jobs in a foundry operation, from a central sand control plant.

3.11 scoop : A scoop of capacity 1.5 kg and of suitable shape and dimensions as agreed between the supplier and the purchaser.

NOTE

A scoop is preferable to a flat shovel for handling aggregates, particularly when dry, as undue loss of coarse particles is likely to occur when heaped with a flat shovel. The scoop to be used shall be of such design and dimensions that even the particles of maximum size are accommodated easily along with particles of other sizes.

3.12 sand sampler : A sand sampler of design and dimensions as agreed between the supplier and the purchaser.

4. SAMPLING OF SAND IN QUARRIES

4.1 Sampling of Dunes or Hills of sand, Beach Sand and River Beds

4.1.1 While sampling dunes or hills of sand, beach sand and river beds, each bed of sand shall be sampled separately.

4.1.2 *Sub-Lots*

The bulk of sand in the bed to be sampled shall be divided into the number of sub-lots, of approximately equal quantities specified in Table 1, by suitably marking the line of demarcation on the surface of the bed.

TABLE 1 - Number of sub-lots into which a quantity * of sand is to be divided
(Clauses 4.1.2 , 5.1.1, 5.2.2 and 6.1)

Quantity of Sand		No. of Sub-lots
In tonnes	In cubic metres	
(1)	(2)	(3)
less than 8	less than 5	2
9 to 15	6 to 10	3
16 to 25	11 to 16	5
26 to 50	17 to 33	7
above 50	above 33	8

* *The quantity of sand in a bed., or in a consignment, or on the floor of a foundry.*

4.1.3 *Gross Samples*

From each sub-lot the number of increments specified in **Table 2**, each weighing about 1.5 kg, shall be collected making use of a scoop; the increments shall be collected from the front, centre and rear of the bed at a depth of not less than 150 mm below the surface of the sand.

4.1.3.1 All the increments collected from the same sub-lot shall constitute a gross sample. Thus the bed of sand sampled shall be represented by as many gross samples as the number of sub-lots into which it has been divided. Each gross sample shall be separately reduced in accordance with 7.2 and tested in accordance with 10.

TABLE 2 - Number of specimens or increments to be collected from a sub-lot (Clause 4.1.3, 5.1.2, 5.2.3, and 6.2)

Quauntity of Sand in the Sub-Lot		Number of Specimens or Increments
(1)	(2)	(3)
In tonnes	In cubic metres	
less than 5	less than 4	3
6 to 8	4 to 5	4

5 SAMPLING OF SAND IN FOUNDRIES

5.1 Sampling of Floor Sand

5.1.1 *Sub-Lots*

The quantity of sand on the floor shall be divided into the number of sub-lots, of approximately equal quantities, specified in Table 1 by suitably marking the line of demarcation on the surface of the sub-lot.

5.1.2 *Gross Samples*

From each sub-lot the number of increments specified in **Table 2**, each weighing about 1.5 kg, shall be collected making use of a scoop; the increments shall be collected from the front, centre and rear at a depth of not less than 150 mm below the surface of the sand. The increments shall be collected just immediately after the floor sand has been prepared to avoid variation in moisture, permeability, strength and such other physical properties as are affected by the exposure.

5.1.2.1 All the increments collected from the same sub-lot shall constitute a gross sample. Thus the quantity of floor sand sampled shall be represented by as many gross samples as the number of sub-lots into which it has been divided. Each gross sample shall be separately reduced in accordance with **7.1** and tested in accordance with **10**.

5.2 Sampling of System Sands

5.2.1 Gross samples shall be collected from each system of sand mixed at one time from the conveyor after the sand has gone through the sand mixer and aerator; samples could also be collected from hoppers at moulding station. But sampling from conveyor is generally preferable because any changes in the sand can be ascertained more quickly.

5.2.2 *Sub-Lots*

The quantity of sand in the system shall be divided into the number of sub-lots, of approximately equal quantities, specified in **Table 1**.

5.2.3 *Gross Sample*

From each sub-lot the number of increments specified in **Table 2**, each weighing 1.5 kg, shall be collected. When the increments are to be collected from the conveyor belts, they shall be collected at regular intervals of time during transit of the quantity of sand in sub-lot. When increments are to be collected from overhead bins or hoppers, half the number of increments shall be collected from the discharge chute at regular intervals of time and the remaining are to be collected at different places at least 150 mm below the sand surface of the sub-lot in the chute.

5.2.3.1 All the increments collected from the same sub-lot shall constitute a gross sample. Thus the system of sand sampled shall be represented by as many gross samples as the number of sub-lots into which it has been divided. Each gross sample shall be separately reduced in accordance with 7.1 and tested in accordance with 10.

6. SAMPLING OF SAND FROM CONSIGNMENTS

6.1 Sub-Lots

The quantity of sand in a consignment shall be divided into the number of sub-lots, of approximately equal quantities, specified in Table 1 by suitably marking the line of demarcation on the surface of the consignment.

6.2 Gross Samples

From each sub-lot, the number of increments specified in Table 2, each weighing 1.5 kg, shall be collected. Wherever possible, the increments are to be collected at regular intervals when the quantity of sand classified into a sub-lot is being loaded into or unloaded from wagons, ships or trucks. In all the cases, it is necessary to scrap off the top 100 mm to remove the contaminated layer by means of a scoop. Where it is not possible to collect samples during loading or unloading, increments shall be collected from the front, centre and rear of each wagon, truck, etc., from varying depths but not at a depth of less than 150 mm from the sand surface.

6.2.1 All the increments collected from the same sub-lot shall constitute a gross sample. Thus the consignment of sand sampled shall be represented by as many gross samples as the number of sub-lots into which it has been divided. Each gross sample shall be separately reduced in accordance with 7.1 and tested in accordance with 10.

7 REDUCTION OF GROSS SAMPLE

7.1 Graded Sand (like Floor Sand, System Sand, etc) Samples

7.1.1 For reducing a gross sample of graded sand (such as floor sand, system sand, etc) into a laboratory sample, a riffle sample divider as shown in Fig. 1 or a similar sample divider can be employed. The method detailed in 7.1.2 shall be adopted for greater accuracy.

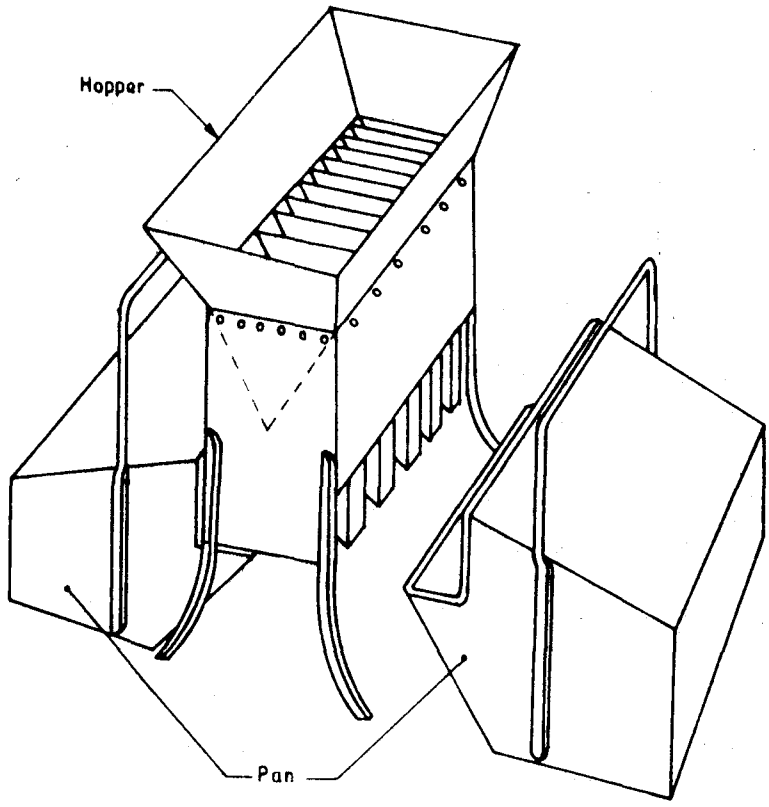


FIGURE 1a – Isometric view of riffle sample divider

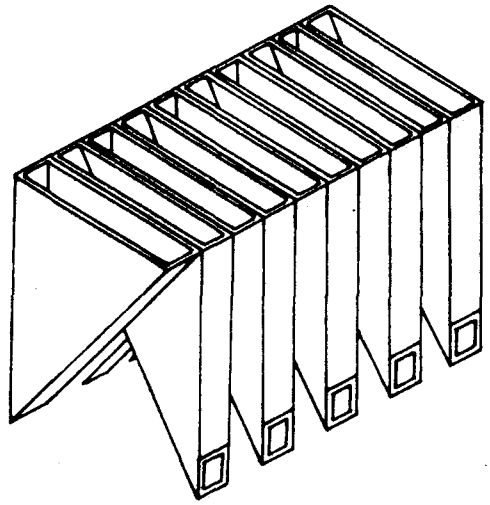


FIGURE 1b – Internal details of riffle sample divider

Figure 1 – Riffle Sample Divider

7.1.2 The gross sample shall be reduced in stages as indicated below :

a) The gross sample shall be thoroughly mixed by heaping it into a cone and turning over to form a new cone until the operation has been carried out three times. Each conical heap shall be formed by depositing each scoopful of the material on the apex of the cone so that the portions which slide down the sides shall be distributed as evenly as possible and so that the centre of the cone is not displaced. Some of the large particles may roll down and scatter round the base; these shall be pushed back to the edge of the heap.

b) The cone obtained after heaping the gross sample thrice as in (a) shall be flattened by means of a wooden board of seasoned wood of fairly sufficient thickness so as to retain the flat surface without warping, lifting the board clear of material after each insertion. The flattened heap shall be uniform in thickness and diameter, and its centre shall coincide with the centre of the original cone.

c) The heap shall then be quartered along two diameters intersecting at right angles. The use of a quartering cross made up of sheet metal of 0.5 mm thickness which can be forced through the heap often facilitates this operation. One pair of diagonally opposite quarters shall then be scooped and discarded; the remainder is made into a heap once again.

d) The process of mixing and reduction shall be repeated on the retained half of the gross sample until the required mass of the material is obtained from a pair of diagonally opposite quarters. This shall constitute the laboratory sample.

For routine testing the laboratory samples shall be riddled to pass through a screen of the same mesh as that used in the foundry. For research work the laboratory samples may be pulverized to pass through 150 m sieve (See CS - 124).

7.2 Naturally-Bonded Sand or Wet Sand Samples

7.2.1 The gross samples from a lot of naturally bonded sand or wet sand, are likely to contain lumps. Therefore, each gross sample shall be crushed and reduced in different stages (see Fig. 2)

a) The material in the gross sample shall be crushed, over a hard and clean surface protected from rains and free from cracks, to pass through the sieve of square mesh 13.2 mm. This crushed material shall be well mixed and then scooped into a cone shaped pile. Care shall be taken to drop each scoopful exactly over the same spot, otherwise the central axis of the cone will be slackened and an uneven distribution of lumps and fines will result. This cone shall be disturbed and made into a long pile, which is later halved by the alternate scoop methods. Scoopfuls 1,3,5 etc., shall constitute the cone A_1, and scoopfuls 2,4,6, ect, shall constitute the cone B_1 ; cone B_1 shall be rejected and cone A_1 shall be processed through the second stage.

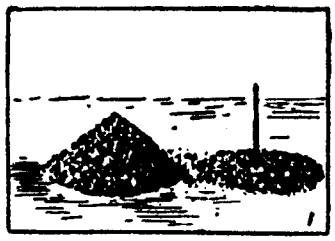
b) The material in the cone A_1 shall be further crushed to pass through the sieve of square mesh 9.50 mm and made into a cone again. This cone shall be disturbed and made into a long pile which shall be halved by the alternate scoop method to form cones A_1 and B_2; cone A_2 shall be retained and cone B_2 shall be rejected.

c) The material in cone A_2 shall then be reduced to the requisite quantity as detailed in 7.1.2, to constitute a laboratory sample.

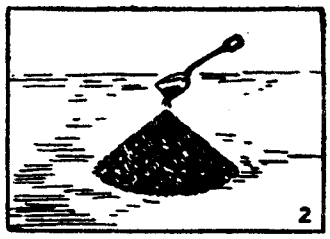
8 PACKING OF SAMPLES

8.1 It is important that containers in which laboratory samples are sent to testing laboratories should be strong enough to withstand rough treatment without being susceptible to such damages as result in the loss of fine, dust, etc. The actual type of container required depends upon the methods of transit; but in most of the cases strong closely woven sacks, wooden boxes or metal drums will be required. When filled with fine aggregates or fillers, sacks and wooden boxes should be lined with clean multiply paper bages. Tin containers are suitable provided that the lids are securely fixed, but it may also be necessary to use a protective outer case, such as a wooden crate. Each laboratory sample shall be loosely packed (without applying pressure) in separate containers.

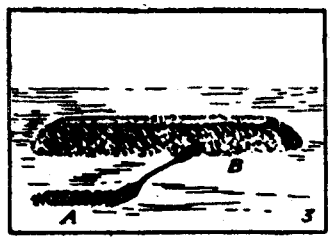
FIRST STAGE



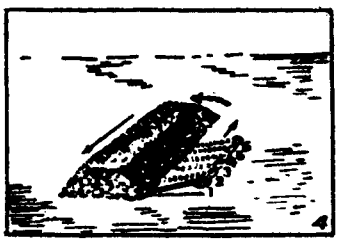
Crush sample on hard, clean surface to 12·70 mm (or $\frac{1}{2}$ in.) in size



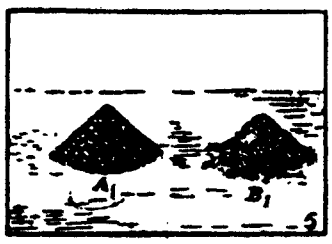
Sample crushed to 12·70 mm (or $\frac{1}{2}$ in) and coned



Mix by forming long pile. A—Spreading out first shovelful, B—Long pile completed

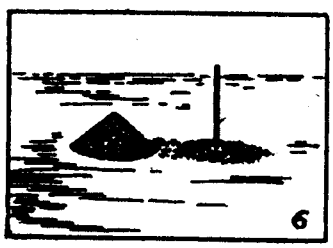


Halving by alternate shovel method. Shovelfuls 1,3,5, etc, reserved; and 2, 4, 6, etc, rejected

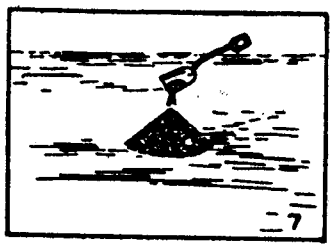


Long pile divided into two parts. A_1—Reserved, B_1—Rejected

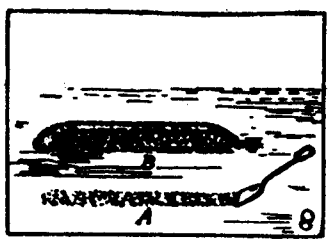
SECOND STAGE



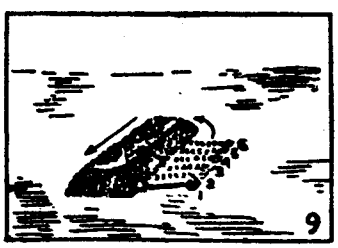
Crush sample to 9·52 mm (or $\frac{3}{8}$ in) size



Crushed sample coned



Mix by forming long pile. A—Spreading out first shovelful, B—Long pile completed



Halving by alternate shovel method. Shovelfuls 1,3,5, etc, reserved; and 2, 4, 6, rejected

Long pile divided into two parts. A_2—Reserved, B_2—Rejected

Fig.2 - Method of Reducing Naturally-Bonded and Wet Sands

9 MARKING

Each sample bag shall be marked legibly and indelibly with the following informations:

a) Manufacturer's name and address or trade mark;
b) Place of origin;
c) The type and the grade of sand;
d) The lot number; and
e) Date of sampling.

10 NUMBER OF TESTS

10.1 All the laboratory samples shall be tested individually for important characteristics of the samd sampled. For the remaining characteristics, a composite sample prepared by mixing equal quantities of material from each of the laboratory samples shall be analysed. The importance or otherwise of the various characteristics of the sand shall be specified by the purchaser for this purpose.

11 REPORTING

11.1 For those characteristics, where a composite sample has been tested, only one test result will be available and that result shall be reportd as the value of the characteristic for the bulk of sand sampled.

11.2 For those characteristics where only one laboratory sample has been tested, the result of testing that sample shall be reported as the value of the characteristic for the bulk of sand sampled.

11.3 When only two laboratory samples have been analysed individually, the average of the two available test results shall be reported as the value of the characteristic for the bulk of sand sampled. The individual results shall also be reported to give an indication of the Range variation in quality.

11.4 When three or more laboratory samples from a lot have been analysed individually with reference to any characteristic, the following procedure shall be followed to asses the average quality and its limits of variation :

Let x_1, x_2, x_3, ... x_n be the results of analysing 'n' laboratory samples for a particular characteistic.

Calculate,

$$\text{Average } (x) = \frac{(x_1+x_2+.....x_n)}{n}$$

and Range (R) = the difference between the maximum and the minimum values.

The avrage level of that characteristic in the lot shall be reported as equal to (x).

The limits of variation in the average level of the bulk of sand sampled shall be reported as (x + hR), where 'h' is a factor, whose value depends upon the number of samples analysed. The appropriate value of the factor 'h' shall be taken from Table 3 .

TABLE 3 - Values of the factor 'h'

Number of Laboratory Samples Analysed	Value of the Factor 'h'
(1)	(2)
3	1.30
4	0.72
5	0.51
6	0.40
7	0.33
8	0.29
9	0.25
10	0.23

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