PS: 5295/2017(2nd Rev.)

PAKISTAN STANDARD SPECIFICATION

FOR

BIO ORGANO PHOSPHATE (BOP) FERTILIZER

(2nd Revision)

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0.0 FOREWORD

0.1 This Pakistan Standard was adopted by Pakistan Standards & Quality Control Authority on 28-02-2017 after the draft finalized by the Fertilizers and Allied Product Technical Committee had been approved by the National Standards Committee for Chemical Division.

0.2 Bio Organo phosphate (BOP) fertilizer products provide minimum 20% Total P_2O_5 and 15% organic matter. The product provides multiple benefits to the farmer by improving soil and crop health. The bio available P component is more efficient with low P fixationation tendency in soil and prolonged availability to crop than chemical fertilizer, under Pakistani soil and climatic conditions. The product can positively contribute in promoting balanced fertilizer use and breaking current stagnancy in crop yields thus improving agricultural productivity.

0.3 This standard was first established in 2013 and 1st revised in 2014, now the technical committee feels too necessary to revise further on the bases of stack holders recommendations and the trade practice followed in the country.

0.4 Bio Organo Phosphate (BOP) produced by an innovation and has better use efficacy due to less probability of P fixation, precipitation or insolubilization than current commercial and soluble chemical fertilizers. This will help resolve issue of P bio availability to plants and improve farmers benefit from applied P in the soil from BOP. The innovation has capability to produce variable grades of BOP to suit different crops and soil need. At this stage, standard of 20 % total P_2O_5 is to be published /notified, however, standards for other grades, if desired by the manufacturer in future, will be considered for incorporation and / or separate notification/publication on need bases.

0.5 The fertilizer committee responsible for the preparation of this draft felt that it is necessary to lay down the specifications on BOP fertilizer to safeguard the interests of the farmer community and to protect them from using fake type fertilizers.

0.6 While preparing this standard the views of all stake holders including manufacturers, importers, testing authorities, technologist/experts and consumers have been taken into consideration and also the existing trade practice in this field in the country, by the Technical Committee. Furthermore, due weightage had given to the need for international co-ordination among standards prevailing in different countries of the world.

0.7 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 analysis shall be rounded off in accordance with PS: 103 – 1991 "Rules for Rounding Off Numerical Values". The number of places retained in the rounded off value should be the same as those of the specified value in the standard.

0.8 In order to keep abreast with the progress of trade and Industry Pakistan Standards are revised periodically. Suggestions from the members are welcomed and will be placed before the Technical Committees for consideration at the time of revision.

0.9 This standard is intended mainly to cover the technical provisions relating to the supply of the material, and it does not cover all the necessary provision of a contract.

1.0 SCOPE

1.1 This standard provides requirement and methods for Bio Organo Phosphate for use as fertilizer. The material is known as BOP.

2. REQUIREMENT:

2.1 The material shall consist essentially of BOP and shall be in the form of free flowing granules. It shall be free from visible foreign matters and shall be according to the requirements specified in Table 1, when tested according to the methods prescribes in column 4 of same table.

Table-1:
REQUIREMENTS FOR BIO ORGANO PHOSPHATE (BOP) FERTILZER

S. No	Characteristics	Requirements	Method of tests
01	Physical condition	Free flowing Granules	Visual inspection
02	Moisture% by weight, max	10%	Appendix – B
03	Total P content (P_2O_5%) by weight on dry basis (min)	20%	Appendix – C C-3
04	Organic matter % by weight on dry basis (min)	15%	Appendix – C C-4
05	Bioavailable P content (P_2O_5) ppm in soil spiked with BOP	Standard values in Table IV (Only to differentiate BOP from other fertilizers, on need basis)	Appendix – C C-5
06	Particle size	Granules (90% between 2 to 4 mm)	Appendix – D

3.0 PACKING AND MARKING:

3.1 **Packing**: The material shall be packed and supplied in sound, strong, moisture proof packages or container as agreed to between producer/marketer/distributor and purchaser/vendor, such as natural or synthetic fiber bags of multi wallpaper with bitumen or polyethylene moisture proofing layer. Mono film bags of heavy polyethylene (0.15-0.2 mm thickness) or in such other suitable containers. Jute or woven polypropylene bags with mono-film polyethylene liners.

3.2. **Marking:** The container/sack/bag shall be securely closed and marked with the following information:

a. Name of the material, namely "Bio Organo Phosphate (BOP)"
b. Total P content (as %P_2O_5) with tolerance
c. Total Organic matter (%) with tolerance
d. Name and Address of the manufacturer/importer/distributor; trade mark if any
e. Net Weight in kg of the material in the container

3.3 Storage Requirements

a. Store in cool, clean, dry and well-ventilated area at room temperature.
b. Avoid contact with moisture, as it may cause product-handling problems
c. Store away from oxidizers, acids, and food and drinkable items.

4.0 SAMPLING:

4.1 Representative sample of the material shall be drawn as prescribed in Appendix – A.

APPENDIX – A

SAMPLING OF BIO ORGANO PHOSPHATE (BOP) FERTILIZER

A-1 GENERAL REQUIREMENTS OF SAMPLING

A-1.0 Following precautions and directions shall be observed in drawing, preparing, storing and handling test samples.

A-1.1 Samples shall be taken at a place protected from damp air, dust and soot.

A-1.2 The sampling instruments shall be clean and dry when used.

A-1.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instruments and the containers for samples from adventitious contamination.

A-1.4 To draw a representative sample, the contents of each container/bag selected for sampling shall be mixed as thoroughly as possible by suitable means.

A-1.5 The samples shall be placed in clean, dry and airtight glass or other suitable containers on which the material has no action.

A-1.6 The sample containers shall be of such a size that they are almost completely filled by the sample.

A-1.7 Each sample container shall be sealed airtight after filling and marked with full details of sampling, date of sampling and other important particulars of the consignment.

A-1.8 Samples shall be stored at dry place.

A-2 SCALE OF SAMPLING:

A-2.1 **Lot** – All the containers in a single consignment of the material drawn from a single batch of manufacture shall constitute a lot. If a consignment is declared to consist of different batches of manufacture, the batches shall be marked separately and the groups of containers in such batch shall constitute separate lots.

A-2.2 The number of sampling containers/bags to be chosen from a lot shall depend on the size of the lot and shall be in accordance with column 1 and 2 of Table II.

TABLE – II
NUMBER OF CONTAINERS TO BE SELECTED FOR SAMPLING

Lot Size	No. of Containers/bags to be selected
N	N
Up to 100	5
101 to 300	6
301 to 500	7
501 to 800	8
801 to 1300	9
1301 and above	10

A-2.3 These containers/bags shall be chosen at random from the lot, and in order to ensure randomness of selection the following procedure may be adopted.

A-2.4 Arrange all the containers in the lot in a systematic manner and starting from any container, count them 1,2,3, …… etc up to r and so on, r being equal to the integral part of N/n. Every rth containers thus counted shall be withdrawn and all such containers shall constitute the sample.

A-3 TEST SAMPLE AND REFEREE SAMPLE:

A-3.1 Draw with an appropriate sampling instrument small portions of the material from different parts of the containers selected, the total quantity taken out from each container being sufficient to conduct the tests for all characteristics given in table-1.

A-3.2 Mix thoroughly all portions of the material drawn from the same container to form an individual test sample. Equal quantities from all individual test samples so formed shall be mixed together to form a composite test sample.

A-3.3 All the individual test samples and the composite test sample shall be divided into three equal parts, thus forming three sets of test samples. These parts shall be immediately transferred to thoroughly dried bottles, which shall then be sealed air tight with stopper. One of these sets of test sample shall be sent to the purchaser and another to the vendor.

A-3.4 ***Referee Sample*** – The third set of test samples bearing the seals of the purchaser and the vendor, shall constitute the referee sample and shall be used in case of dispute between the purchaser and the vendor. It shall be kept at a place agreed to between the purchaser and the vendor.

A-4 NUMBER OF TEST:

A-4.1 Test for the determination of total phosphate as P_2O_5% content shall be conducted on each of the individual test samples.

A-4.2 Test for the determination of bioavailability of P after soil incubation over a period of time shall be conducted on each of the individual samples only to differentiate BOP from other chemical phosphatic fertilizers. This test should be conducted on each of individual test samples..

A-4.3 Test for the determination of moisture % shall be conducted on each of the individual test samples.

A-4.4 Test for the remaining characteristics given in Table-1 shall be conducted on the composite test sample.

A-5 CRITERION FOR CONFORMITY:

A-5.1 The test results for total phosphate as P_2O_5% shall be recorded as shown in Table III. The mean and the range of the test result shall be calculated as follows:

$$\text{Mean } (\overline{X}) = \frac{\text{The sum of the test results}}{\text{Number of test results}}$$

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

A-5.1.1 The appropriate expression as shown in col. 6 of Table III shall be calculated for the characteristic. If the condition given in col. 6 of Table III is satisfied, the lot shall be declared to have satisfied the requirement for this characteristic.

A-5.2 For the remaining characteristics, the test results on the individual and composite test sample shall satisfy the requirements specified in table-1.

A-5.3 A lot shall be declared as conforming to the specification only when it has satisfied each of the requirements specified in table-1.

TABLE – III
CRITERION FOR CONFORMITY

S.#	Characteristic	Test Results 1,2,…. n	Mean	Range	Criterion for Conformity
i.	ii.	Iii	iv	V	Vi
1	Total P_2O_5, percent by weight on dry basis	--	$\overline{X}$	R	$\bar{x}$–0.6 R≥ the value specified in Table (1)
2	Organic Matter percent by weight on dry basis	--	$\overline{X}$	R	$\bar{x}$–0.6 R≥ the value specified in Table (1)

APPENDIX - B

DETERMINATION OF MOISTURE IN BOP (OVEN METHOD)

B-1 **APPARATUS:**

a. Analytical Balance

b. Weighing bottle- size 50 mm x 30 mm, fitted with ground glass stopper with a hole.

c. Air oven; heated electrically with temperature control system.

d. Mortar and Pestal

e. Desiccator with Silica-gel

B-2 PROCEDURE

B-2.1 Preparation of Sample – Place 100 gram of sample in a mortar and grind quickly particle size required is less than 1 mm, weigh 5 g of the ground sample into a weighing bottle using an analytical balance.

B-2.2 Determination – Place the weighing bottle containing the sample in the electric air circulating oven maintained at 105 ± 2^0C. After 4 hours take the sample bottle out, and cool in a desiccator for 15 – 20 minutes. Silica-gel is desirable as desiccating agent. Reweigh the sample using an analytical balance.

B-3 **CALCULATION:**

$$\text{Moisture percentage} = \frac{(A - B)}{\text{Weight of Sample (g)}} \times 100$$

Where
A = Weight in g before over drying
B = Weight in g after oven drying.

APPENDIX – C

C-0 ANALYSIS OF BIO ORGANO PHOSPHATE (BOP)

C-1 QUALITY OF REAGENTS:

C-1.1 Unless specified otherwise, Analytical grade chemicals and distilled water (see PS: 593-1996*) shall be used in tests.

NOTE: - *'Pure Chemicals' shall mean chemicals that do not contain impurities that affect the results of analysis.*

C-2 PREPARATION OF SAMPLE:

C-2.1 Grind 100 g of BOP to pass through 40 mesh sieve. Dry to constant weight to obtain the prepared sample and keep in clean glass-stoppered weighing bottle in a desiccator for subsequent tests.

C-3 ANALYSIS OF TOTALP CONTENT (P_2O_5) IN BOP

C-3.1 **PRINCIPLE**:

Phosphorus as orthophosphate can be determined as ammonium phosphomolybdate after precipitation. Precipitates are filtered, washed to acid free and dissolved in standardised 0.1N sodium hydroxide. The excess of which is back titrated against standardised 0.1N sulphuric acid.

C-3.2 **EQUIPMENTS/APPARATUS**

- Weighing balance
- Volumetric flask-100 ml
- Volumetric flask 1000 ml
- Beaker-100 ml
- Bulb type pipette-10 ml
- Graduated pipette 10 ml
- Conical flask-250 ml
- Bunsen burner
- Wash Bottle
- Whatman No.42 filter paper
- Funnel with stand
- Blue Litmus paper
- Burette 100 ml

C-3.3 **REAGENTS/CHEMICALS**:

(a) Concentrated Nitric Acid

(b) Ammonium Molybdate Solution, (3%)
Dissolve 30 gram Ammonium Molybdate tetra hydrate ($(NH_4)Mo_7O_{24}.4H_2O$, Analytical grade) salt in 1000ml volumetric flask and make up volume by DI water up to the mark.

(c) Ammonium Nitrate Solution, (50 %)
Dissolve 500 gram Ammonium Nitrate (NH_4NO_3, 80.04g/mol, Analytical grade) salt in 1000ml volume metric flask and make up the volume with DI water up to the mark.

(d) Phenolphthalein indicator

(e) Standardized 0.1 N Sulphuric Acid

(f) Standardized 0.1 N Sodium Hydroxide

(g) Potassium Hydrogen Phthalate Solution, (0.1 N).
Dissolve 20.423gram Potassium Hydrogen Phthalate ($C_8H_5KO_4$, 204.23g/mol Analytical grade) salt in 1000 ml volumetric flask and make up volume with DI water up to the mark.

C-3.4 **PROCEDURE**

Weigh accurately 0.5 g BOP fertilizer sample in 100 ml volumetric flask, add 5 ml concentrated nitric acid, add about 50 ml distilled water place the sample on hot plate and raise the temperature up to 65^{o}C on hot plate. Shake for 60 minutes on mechanical shaker. After shaking make volume up to mark distilled water. Filter and take 10 ml solution from filtrate, in a 250 ml conical flask. Add 5 ml, concentrated nitric acid and 15 ml, ammonium nitrate solution (50 %). Heat the contents gently on a hot plate at 65^{o}C and then add gradually 50 ml ammonium molybdate solution (3%). Shake the conical flask during ammonium molybdate solution addition. Yellow precipitate of ammonium phosphomolybdate will form depending on the concentration of phosphorus present in the given BOP sample. Stay for one night. Next day filter the yellow precipitates using Whatman No. 42 and wash with ice cold distilled water till the filtrate does not turn blue litmus to red. This indicates that precipitates are now acid free. Now transfer the acid free precipitates along with filter paper into the same conical flask. Care should be taken that the same conical flask should also be acid free. Dissolve the precipitates completely in 0.1 N sodium hydroxide by adding 10 ml each time. Note the amount of alkali used. Now add 2-3 drops of phenolphthalein indicator. Pink color will develop. Titrate against

0.1 N sulphuric acid with continuous shaking till colorless end point. Note the volume of sulphuric acid used.

C-3.5 **CALCULATIONS:**

$$\% P_2O_5 = \frac{0.000309 \times X - Y \times 100 \times 100}{10 \times 0.5}$$

Where,

X = 0.1N NaOH used to dissolve precipitate

Y = 0.1N H_2SO_4 used for back titration.

OR

$\%P_2O_5 = (x-y) \times 0.618$

If 0.5 gm fertilizer sample is used

DETAIL OF CULCULATIONS

During chemical reaction out of 23 molecules of NaOH only one molecule of Na is used to form Na (NH_4) HPO_4 which contain one molecule of P.

Therefore, ammonium phosphomolybdate precipitate contains Na and P in the ratio of 1:1.

i .e, normal solution of NaOH (23gm Na/L) =1 N solution of P (31g P / L).

So 31/ 23 =1.3478g P/ L

1 N NaOH =1.3478x2.29g P_2O_5/ L (for P to P_2O_5 use 2.29)

-do- =3.0864g P_2O_5 / litre

-do- =0.003086g P_2O_5/ml

1 ml of 0.1 N NaOH =0.0003086g P_2O_5/ml

R ml of 0.1 N NaOH =0.0003086x R g P_2O_5 / ml (R = reading)

10ml of 0.1 sample contains = 0.000386 x R g P_2O_5 (If 10 ml aliquot is used).

1 ml of sample contains =0.0003086 x R/10

100ml of sample contains=0.0003086 x R x 100/10

0.5 gm BOP contain P_2O_5=0.0003086 x Rx 100/10 (where sample taken is 0.5 g)

1 gm BOP contain P_2O_5 =0.0003086 x R x 100/10 x 0.5

100 gm BOP contain P_2O_5=0.0003086 x R x 100 x 100/10 x 0.5

So

P_2O_5 (%) =0.618 x R (Where sample taken is 0.5g)

C-4 ANALYSIS OF ORGANIC MATTER IN BOP

C-4.1 **PRINCIPLE :** Loss of weight on ignition.

C-4.2 **APPARATUS:**

- Crucible
- Analytical Balance
- Muffle Furnace
- Desiccator with silica-gel
-

C-4.3 **PROCEDURE**

a) Weigh clean dry crucible (W_1).

b) Add 5 g of sample in a tarred crucible and oven dry at 105 ^oC for 4 hours.

c) Weigh sample and crucible. This yields the oven dry weight (W_2).

d) Place crucible with same oven dried sample in furnace at 550 to 600 ^{o}C for 6 hours to burn sample and form ash. Cool the crucible and ash in desiccator and weigh. This yields the ash weight (W_3).

C-4.4 **Calculation**

$$\text{Ash (\%)} = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

$$\text{Organic matter (\%)} = 100 - \text{Ash (\%)}$$

Precaution**:** Muffle furnace temperature must not exceed from 600 ^{o}C

C-5 DETERMINATION OF BIOAVAILABLE P (P_2O_5) CONTENT IN SOIL SPIKED WITH BOP FERTILIZER

C-5.1 **PRINCIPLE:**

The bio available P will be measured by comparison of Olsen extractable P from soil spiked with BOP and non-BOP after incubation at 28 ± 2 ^{O}C for forty days at field capacity moisture level.

C5.2 PREPARATION OF SAMPLE

Air dried soil passed through 2mm sieve having parameters of ECe less than 4 dSm^{-1} and pH less than 7.5 will be incubated with BOP at the ratio of one percent at 28^{O}C for 40 days.

To minimize the experimental error, the mixing of BOP in soil will be done in two steps. In first step 100g ground BOP will be thoroughly mixed with 900g soil. In second step, the 50g soil from first step (BOP+Soil at ratio of 10:100) will be mixed with 450 g soil (soil without BOP) in triplicate in plastic beakers. Since the soil in these three beakers is spiked with BOP, it is labeled as "Fertilizer". Three beakers with 500g soil each without BOP will be labeled as "Soil". The soil moisture level in each beaker will be maintained at field capacity level (50% of soil saturation percentage). The soil sampling will be done after 1, 10, 20 30 and 40 days for bioavailable P content.

C5.3 APPARATUS

- Analytical balance
- Spectrophotometer or colorimeter, 882-nm wavelength.
- Mechanical shaker, reciprocating.
- Extraction bottle, 250 mL with stopper.
- Standard laboratory glassware: Beakers, volumetric flasks, pipettes, funnels.
- Incubator and plastic beakers for incubation
- Desiccator
- Oven

C5.4 REAGENTS

1. Sodium Hydroxide Solution (NaOH), 5 N
   Dissolve 200 g sodium hydroxide in DI water, and transfer the solution to a 1-L volumetric heavy walled Pyrex flask, let it cool, and bring to volume with DI water.
2. Sodium Bicarbonate Solution ($NaHCO_3$), 0.5 M
   Dissolve 42 g sodium bicarbonate in about 900 mL DI water, adjust to pH 8.5 with 5 N NaOH solution. Bring to 1-L volume with DI water. Keep the bottle closed and do not store over one month in a glass container; or use polyethylene container for periods more than one month.
3. Sulfuric Acid Solution (H_2SO_4), 5 N
   Dilute 148 mL concentrated sulfuric acid (in fume hood) with DI water, mix well, let it cool, and bring to 1-L volume with DI water.
4. p-nitrophenol Indicator, 0.25 % w/v

5. Standard Stock Solution
   a) Dry about 2.5 g potassium dihydrogen phosphate (KH_2PO_4) in an oven at 105°C for 1 hour, cool in desiccator, and store in a tightly stoppered bottle.
   b) Dissolve 2.197 g dried potassium dihydrogen phosphate in DI water, and bring to 1-L volume with DI water. This solution contains 500 ppm P (Stock Solution).
   c) Dilute 50 mL Stock Solution to 250 mL final volume by adding DI water. This solution contains 100 ppm P (Diluted Stock Solution).
   d) Prepare a series of Standard Solutions from the Diluted Stock Solution as follows:
   Dilute 5, 10, 15, 20 and 25 mL Diluted Stock Solution to 500 mL volume. These solutions contain 1, 2, 3, 4, and 5 ppm P, respectively.
6. Colour Developing Reagents
   Reagent A
   Dissolve 12 g ammonium heptamolybdate tetrahydrate $(NH_4)_6Mo_7O_{24}.4H_2O$ in 250 ml DI water. Dissolve 0.2908g antimony potassium tartrate ($KSbO.C_4H_4O_6$) in 100 ml DI water. Add and dissolve both reagents to a 2-L volumetric flask, and add 1-L 5N H_2SO_4 solution (148 mL concentrated H_2SO_4 per liter) to the mixture. Mix thoroughly, and dilute to 2-L volume with DI water. Store in a Pyrex bottle in a dark cool place.
   Reagent B
   Dissolve 1.056g L-Ascorbic acid ($C_6H_8O_6$) in 200 ml Reagent A and mix. This reagent should be prepared as required because it does not keep for more than 24 hours.

C5.5 PROCEDURE

1. Weigh 5 g air-dry soil sieved from 2-mm sieve from each beaker and transfer into a 250-mL Erlenmeyer flask; add 100 ml 0.5 M sodium bicarbonate solution with pH 8.5 in each flask.
2. Close the flask with a rubber stopper, and shake for 30 minutes on a shaker at 200 - 300 rpm. Include one flask containing all chemicals but no soil as a blank.
3. Filter each solution through a Whatman No. 40 filter paper, and pipette 10 mL clear filtrate into a 50-mL volumetric flask.
4. Acidify with 5 N sulfuric acid to pH 5.0. This can be done by taking 10 mL 0.5 M $NaHCO_3$ solution and determining the amount of acid required to bring the solution pH to 5.0, using P-nitrophenol indicator (color change is from yellow to colorless). Then add the required acid to all the unknowns. Adding 1 mL 5 N H_2SO_4 is adequate to acidify each 10 mL $NaHCO_3$ extract.
   Important: Do not swirl flasks immediately after adding 1 mL 5 N H_2SO_4 because this may result in excessive frothing.
5. Add DI water to about 40-mL volume, add 8 mL Reagent B, and bring to 50 mL volume.
6. Prepare a standard curve as follows:
   Pipette 2 mL of each standard (1- 5 ppm), and proceed as for the samples. Also make a blank with 10 mL 0.5 M $NaHCO_3$ solution, and proceed as for the samples. Read the absorbance of blank, standards, and samples after 10 minutes at 882 nm wavelength.
7. Prepare a calibration curve for standards, plotting absorbance against the respective P concentrations.
8. Read P concentration in the unknown samples from the calibration curve.

C5.6 CALCULATION

Extractable Phosphorus in soil:

$$\text{Extractable } P_2O_5 \text{ (ppm)} = \text{ppm P (from calibration curve)} \times \frac{A \times 50}{\text{Weight} \times V} \times 2.29$$

Where

A = Total volume of the extract (ml)
Weight = Weight of air-dry soil (g)

V = Volume of extract used for measurement (ml)
50 = Volume made after color development
2.29 = Conversion factor to convert P to P_2O_5

Calculate average extracted P from *"Fertilizer"* and *"Soil"* (6 samples, 3 replications); and record average of *"Fertilizer"* under column A and of *"Soil"* under column B in table IV.

a. Calculate Bioavailable P content as per following formula.

   = Average extracted P_2O_5 from *"Fertilizer"* – Average extracted P_2O_5 from *"Soil"* samples

b. Compare Bioavailable P values of column C in table IV with corresponding standard value given in column D. If values of column C are in close proximity or follow the trend of values given in column D then the product will be BOP, if not then it is either chemical fertilizer or some other material.

c. This test may be continued for 40 days. Readings should be taken at the interval of 10 days each.

Table-IV

Days	Bioavailable P (ppm) calculation			Standard values
	Average extracted P_2O_5 (ppm) from spiked soil (*"Fertilizer"*)	Average extracted P_2O_5 (ppm) from soil without spiking (*"Soil"*)	Bioavailable P_2O_5 (ppm) from spiked soil	Bioavailable P_2O_5 (ppm) from soil spiked with BOP
	A	B	C = A – B	D
1				Min 100
10				Min 110
20				Min.120
30				Min.130
40				Min.140

APPENDIX – D

D-0 DETERMINATION OF SIZE DISTRIBUTION OF BOP

D-1 APPARATUS / EQUIPMENT

- Stainless steel sieves of 2mmto 4mm size with lid & bottom pan.
- Sieves Shaker
- Top loading balance
- Brush

D-2 PROCEDURE

a. Arrange the individually tare sieves in descending order of mesh size from top to bottom.

b. Place receiving pan on the bottom of stack

c. Weigh about 300g of sample taken through sample divider.

d. Transfer sample onto the top sieve and place lid on top of stack.

e. Place the sieve stack on shaker and tighten the belts evenly on both sides.

f. Set timer of vibrator to 5 minutes amplitude at 3.0 mm and start the vibrator.

g. After shaking switch-off the vibrator and remove the sieves one by one.

h. Weigh sieve + sample on top loading balance.

i. Calculate the weight of samples retained on each sieve.

D-3 **CALCULATION**

Calculate weigh percent on each sieve by following formula

$$= \frac{\text{Weight of sample (g) on sieve}}{\text{Total Weight of Sample}} \times 100$$