भारतीय मानक **IS 16150 (Part 5) : 2023**

Indian Standard

मत्स्य आहार — विशिष्टि

भाग 5 पंगेशियस आहार

Fish Feed — Specification

Part 5 Pangasius Feed

ICS 67.120.30

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

Feburary 2023 **Price Group 7**

Fish, Fisheries and Aquaculture Sectional Committee, FAD 12

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Fish, Fisheries and Aquaculture Sectional Committee had been approved by the Food and Agriculture Divisional Council.

Aquaculture is making a rapid progress within the country. A large number of aquaculture farms have been established where aquaculture has been undertaken on scientific lines. It is important that for the production of good quality fish at minimum cost, the fishes are properly fed so as to meet their nutritional requirements. To keep pace with the development of aquaculture, the manufacture of fish feeds and their marketing is important in the country. Therefore, with a view to enable the manufacturers to prepare fish feeds of known quality, this standard is being developed.

The composition of the committee responsible for formulation of the standard is listed in Annex F and considerable assistance has been provided by ICAR-Central Institute of Brackish water Aquaculture, Chennai in development of this standard.

This is one among the series of Indian Standards formulated to ensure availability of feeds of suitable quality for fish. The other Parts of the standard are as follows:

a) Part 1 Carp feed;
b) Part 2 Catfish feed;
c) Part 3 Marine shrimp feed; and
d) Part 4 Freshwater prawn feed.

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 IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FISH FEED — SPECIFICATION

PART 5 PANGASIUS FEED

1 SCOPE

This standard (Part 5) prescribes the requirements and the methods of sampling and test for *Pangasius* (farmed fish of Pangasidae family, primarily, *Pangasianodon hypophthalmus*) feeds for their grow-out culture.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TYPES

The *Pangasius* feeds shall be of the following types:

a) *Nursery Feed* — Feed to be fed to the fry of *Pangasius* fish in tanks or ponds until they reach a size of 5 g.
b) *Starter Feed* — Feed to be fed to fingerlings of *Pangasius* fish in ponds until they attain a mass of about 50 g.
c) *Grower Feed* — Feed to be fed to growing *Pangasius* fish of about 50 g until they attain a mass of about 500 g.
d) *Finisher Feed* — Feed to be fed to growing *Pangasius* fish above 500 g till harvest.

4 REQUIREMENTS

4.1 Description

The *Pangasius* fish feeds shall be fresh, free from insect infestation, and moulds.

4.1.1 *Ingredients*

The ingredients listed in Annex B shall only be used for manufacturing *Pangasius* fish feed.

4.2 Physical Characteristics

4.2.1 *Feed Form and Size*

4.2.1.1 Nursery feed shall be in the form of powder or granules or pellets of 0.2 mm to 1.2 mm diameter

4.2.1.2 Starter, Grower and Finisher feed shall be in the form of pellets in the range of 1.2-2 mm, 2-4.5 mm, and 4-8 mm diameter, respectively.

4.2.2 *Water Stability of Pellets*

The feed pellets shall be stable without disintegration in water for minimum 20 min. The water stability shall not be less than 80 percent after 10 min when tested as per Annex C.

4.3 *Pangasius* fish feeds shall meet the requirements provided in Table 1.

4.4 Antibiotics and Additives

No antibiotics or pharmacologically active substances shall be incorporated in *Pangasius* fish feed.

4.5 Aflatoxin B1 content of *Pangasius* fish feed shall not exceed 0.02 mg/kg at the time of manufacture. Aflatoxin B1 shall be tested by the manufacturer in accordance with the test method prescribed in IS 13427 or IS 14718[1)] and a declaration that the Aflatoxin B1 content is below the prescribed maximum levels shall be made on the label. Sampling of the *Pangasius* fish feed for estimation of aflatoxin B1 content shall be done in accordance with IS 13426.

NOTE — [1)] In case of any dispute, the test method given in IS 14718 shall be the referee method.

5 PACKING AND MARKING

5.1 Packing

The material shall be packed in clean, dry and polythene lined bags (jute/laminated paper bags/HDPE/PP bags). The mouth of each bag shall be machine stitched or rolled over.

Table 1 Requirements for *Pangasius* Fish Feed
(*Clauses* 4.3 *and* 7.1)

Sl No.	Characteristics	Requirements				Method of Test, No. Ref to
		Nursery	Starter	Grower	Finisher	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Moisture, percent by mass, *Max*	12.0	12.0	12.0	12.0	IS/ISO 6496* or 4 of IS 7874 (Part 1)
ii)	Crude Protein (N × 6.25), percent by mass, *Min*	30.0	24.0	22.0	20.0	IS/ISO 5983, Part 1* or IS/ISO 5983, Part 2 or 5 of IS 7874 (Part 1)
iii)	Crude fat, percent by mass, *Min*	4.0	3.5	3.0	3	IS/ISO 6492 or 7 of IS 7874 (Part 1)* (Sample has to undergo acid hydrolysis as per Annex E)
iv)	Crude fibre, percent by mass, *Max*	6.0	7.0	8.0	10.0	IS/ISO 6865 #
v)	Acid insoluble ash, percent by mass, *Max*	4.0	4.0	4.0	4.0	IS 14826 or 10 of IS 7874 (Part 1)*
vi)	Gross energy, kcal/kg, *Min*	2600	2550	2500	2400	Annex D

NOTES

1 The values for requirements specified at Sl No. (ii) to (vi) are on moisture-free basis.
2 For routine analysis, the characteristics at Sl No. (ii) to (v) may be tested by near infrared-analyzer.
3 In case of dispute, the methods indicated by '*' shall be the referee method.
4 # The standard includes both manual and semi-automatic procedure. In case of any dispute, manual method given in standard shall be the referee method.

5.2 Marking

5.2.1 Each bag should be suitably marked so as to give the following information legibly:

a) Name of the material and brand name, if any;
b) Type of the *Pangasius* fish feed;
c) Name and address of the manufacturer;
d) Net quantity when packed;
e) Batch or Code number;
f) Date of manufacture (MM/YY);
g) Best before (MM/YY); and
h) Any other markings required under the *Legal Metrology (Packaged Commodities) Rules*, 2011.

5.2.2 In addition to the information listed in 5.2.1, each bag shall have a label or tag attached to it or contain a leaflet giving the following information:

a) Type of *Pangasius* fish feed;
b) Name and quantity of the additives added, if any;
c) Moisture;
d) Crude protein;
e) Crude fibre;
f) Crude fat;
g) Gross energy;
h) Aflatoxin B1; and
j) Directions for use.

5.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

6 SAMPLING

Representative samples of the material shall be drawn according to the method prescribed in IS 1374.

7 TESTS

7.1 Tests shall be carried out as prescribed in **4.2.2, 4.3** and col (6) of Table 1.

8 QUALITY OF REAGENTS

Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities, which affect the result of analysis.

ANNEX A
(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
IS 920 : 1972	Specification for common salt and cattle licks for animal consumption (first revision)
IS 1070 : 1992	Reagent grade water — Specification (*third revision*)
IS 1162 : 2021	Cane molasses — Specification (*first revision*)
IS 1374 : 2007	Poultry feeds — Specification (*fifth revision*)
IS 1712 : 2022	Cottonseed oilcake as livestock feed ingredient — Specification (*third revision*)
IS 1713 : 2022	Decorticated groundnut oilcake as livestock feed ingredient — Specification (*third revision*)
IS 1932 : 2022	Mustard and rapeseed oilcake as livestock feed ingredient — Specification (*third revision*)
IS 1934 : 2016	Sesamum oilcake as livestock feed ingredient — Specification (*second revision*)
IS 1942 : 1968	Specification for bone-meal as livestock feed supplement (*first revision*)
IS 2154 : 2014	Coconut oilcake as livestock feed ingredient — Specification (*third revision*)
IS 3441 : 2022	Solvent extracted groundnut oilcake (meal) as livestock feed ingredient — Specification (*second revision*)
IS 3591 : 1985	Specification for solvent-extracted coconut oilcake (meal) as livestock feed ingredient (*second revision*)
IS 3592 : 1985	Specification for solvent extracted decorticated cottonseed oilcake (meal) as livestock feed ingredient (*second revision*)
IS 3648 : 1975	Specification for rice bran as livestock feed (*first revision*)
IS 4193 : 2022	Guar meal as livestock feed ingredient — Specification (*second revision*)
IS 307 : 1983	Specification for fishmeal as livestock feed ingredient (*second revision*)
IS 5470 : 2002	Dicalcium phosphate, animal feed grade — Specification (*first revision*)
IS/ISO5983 : Part 1 : 2005	Animal feeding stuffs — Determination of nitrogen content and calculation of crude protein content: Part 1 Kjeldahl method
IS 5983 : Part 2 : 2021/ ISO 5983-2 : 2009	Animal feeding stuffs — Determination of nitrogen content and calculation of crude protein content: Part 2 Block digestion and steam distillation method (*first revision*)
IS 6492 : 1999/ISO 6492 : 1999	Animal feeding stuffs — Determination of fat content
IS 6496 : 1999/ISO 6496 : 1999	Animal feeding stuffs — Determination of moisture and other volatile matter content
IS 6865 : 2000/ISO 6865 : 2000	Animal feeding stuffs — Determination of crude fibre content — Method with intermediate filtration
IS 7874	Methods of tests for animal feeds and feeding stuffs:
(Part 1) : 1975	General methods
(Part 2) : 1975	Minerals and trace elements

IS No.	*Title*
IS 13426 : 1992	Animal feeds and feeding stuffs — Methods of sampling for aflatoxin analysis
IS 13427 : 1992	Animal feeds and feeding stuffs — Determination of aflatoxin B1 content
IS 14718 : 1998	Animal feeding stuffs — Determination of aflatoxin B1 content of mixed feeding stuffs — Method using high performance liquid chromatography
IS 14826 : 2000/ISO 5985 : 1978	Animal feeding stuff — Determination of ash insoluble in hydrochloric acid

ANNEX B
(*Clause* 4.1.1)

INGREDIENTS FOR *PANGASIUS* FISH FEED

B-1 In the compounding of *Pangasius* fish feed a variety of ingredients are used. This Annex gives a list of such ingredients.

B-1.1 Ingredients of Animal Origin

a) Fishmeal (*see* IS 4307) and all other fish products;
b) All crustacean meals including prawn head meal, prawn shell meal, Acetes and Krill meal;
c) Squid meal and all other squid products;
d) Molluscan meal (clam, mussel, etc);
e) Fish solubles and hydrolysates;
f) Fish oil;
g) Squid oil;
h) Squid liver oil;
j) Chicken oil;
k) Insect meals and oils;
m) Silk worm Pupae meal;
n) Bone meal (*see* IS 1942);
p) Meat and Bone meal;
q) Poultry byproduct meal;
r) Blood meal;
s) Krill oil;
t) Tallow; and
u) Squid liver paste.

B-1.2 Ingredients of Plant Origin

a) Soybean cake (meal);
b) Groundnut oilcake (expeller-pressed or solvent extracted) (*see* IS 1713 and IS 3441);
c) Sesame (*Sesamum indicum orientale*) oilcake (expeller-pressed or solvent extracted) (*see* IS 1934);
d) Cottonseed oilcake (decorticated) (expeller-pressed or solvent extracted) (*see* IS 1712 and IS 3592);
e) Sunflower oilcake (decorticated or undecorticated);
f) Copra cake, coconut oilcake (expeller-pressed or solvent extracted) (*see* IS 2154 and IS 3591);
g) Mustard oil cake (*see* IS 1932);
h) Palm kernel meal;
j) Rapeseed oil cake;
k) Wheat and wheat products;
m) Rice and its products/broken rice;
n) Maize and maize products;
p) Any other edible cereal and its product;
q) Rice bran (*see* IS 3648);
r) Wheat bran;
s) Edible vegetable oils;
t) Soybean lecithin;
u) Algal meals and oils;
v) Sea weeds;
w) Corn gluten;
y) Wheat Gluten;
z) Dried distillery grains with solubles (DDGS);
aa) Detoxicated jatropha meal; and
bb) Detoxicated Mahua oil cake.

B-1.3 Other Ingredients

a) Vitamins;
b) Minerals;
c) Common salt (*see* IS 920);
d) Dicalcium phosphate (*see* IS 5470), Mono Calcium Phosphate (*see* IS 5470), Mono sodium phosphate, Mono potassium phosphate, Mono ammonium phosphate;
e) Yeast and Yeast extracts;
f) Spirulina;
g) Brewery by-products;
h) Molasses (*see* IS 1162);
j) Tapioca and its products;
k) Binders;
m) Single cell protein;
n) Attractants;
p) Nucleotides;
q) Amino acids;
r) Pigments;
s) Toxin binders and Clay;
t) Dunaliella;
u) Antifungals;
v) Peptidoglycans;
w) ß-glucans;
y) Fuccoidan;
z) Organic acids;
aa) Guar meal (*see* IS 4193); and
bb) Seaweed.

ANNEX C

(*Clause* 4.2.2)

DETERMINATION OF WATER STABILITY OF *PANGASIUS* FISH FEED PELLETS

C-1 PRINCIPLE

Water stability of dry *Pangasius* fish feed pellets is determined by the loss in mass of pellets kept in water for a specified time interval. The loss in mass of pellets indicates the stability, higher the loss poorer the stability.

C-2 APPARATUS

C-2.1 Oven

C-2.2 Nylon Mesh

C-2.3 Sieve (2.4 mm)

C-2.4 Balance

C-2.5 Glass Beaker (1 litre)

C-2.6 Stop Watch

C-3 PROCEDURE

Wash cone shaped pouches made of nylon mesh (1 mm mesh size) thoroughly and dry at 70 °C to constant mass in an oven. Take about 2 g of feed pellets in each pouch and record exact initial mass. Take 5-6 such pouches for each sample. Place the pouches with feed pellets at the bottom of 1 liters beaker containing one liters water. Record water temperature. After prescribed time, slowly take out pouches with pellets out of the water. Examine the pellets for their physical shape. Dry the pouches with pellets at 70 °C to constant mass. Difference in the initial mass and final mass of the pellets gives loss in mass at 70 °C.

C-4 CALCULATION

Water stability is calculated using the following formula:

Percent Water Stability =

$$\frac{Final\ mass\ (g) \times Percent\ dry\ matter}{Initial\ mass\ (g) \times Percent\ dry\ matter} \times 100$$

ANNEX D

[*Table* 1, *Sl No.* (vi)]

GROSS ENERGY

Gross energy in raw materials and finished *Pangasius* fish feeds can be either directly estimated by bomb calorimeter (Method D-1) or calculated by Physiological Fuel Values (Method D-2) and the detailed procedures are given below.

D-1 DETERMINATION OF GROSS ENERGY

The bomb calorimeter provides a means of assessing the amount of energy (gross) made available during the catalytic degradation of combustible solids, liquids and gases in a pressurized oxygen atmosphere. Gross energy is the amount of heat liberated when a substance is completely burnt to carbon dioxide and water. It is also known as heat of combustion.

D-1.1 Preparation of Sample Material

It is essential that the test sample is truly representative of the sample material. In general, the sample material needs to be dried before combustion and here the sample characteristics will determine the method of drying to be used that is whether oven drying or vacuum drying at low temperature should be done before or after selection of a working sample. The drying process should not volatilize or destroy any of the combustible material. If complete dryness cannot be achieved easily without loss, preliminary tests should be made to determine the maximum water content at which this sample material can be ignited and completely burnt in the bomb. All material which have low bulk density and high surface area must be compacted.

D-2 PRINCIPLE

A known quantity of a sample is ignited electrically and burnt in excess of oxygen in the bomb. The maximum temperature rise is measured with the thermometers in a controlled system. By comparing this rise with that obtained when a sample of known calorific value is burnt, the calorific value of the sample material can be determined.

D-3 APPARATUS

D-3.1 Adiabatic Bomb Calorimeter

D-3.2 Pellet Press

D-3.3 Metallic Crucible

D-3.4 Hot Air Oven

D-3.5 Balance

D-3.6 Fuse Wire

D-3.7 Cotton Thread

D-3.8 Beaker

D-3.9 Burette

D-3.10 Pipette

D-3.11 Whatman Filter Paper No. 1

D-4 REAGENTS

D-4.1 Benzoic Acid (Calorimeter Grade, Gross Energy Content 6 318 cal/g)

D-4.2 Distilled Water

D-4.3 Oxygen Gas

D-4.4 Barium Hydroxide

D-4.5 Sodium Carbonate

D-4.6 Hydrochloric Acid

D-4.7 Methyl Red Indicator

D-4.8 Phenolphthalein Indicator

D-5 PROCEDURE

D-5.1 Determination of Bomb Equivalent

a) Take about 0.35 g of benzoic acid and make a pellet with the help of a pellet press;

b) Place the pellet in a pre-weighed metallic crucible. Weigh the pellet and crucible accurately;

c) Put the bomb top on the stand. Thread a piece of fuse wire through the electrodes and tie a single strand of cotton to it. Keep the lengths of fuse wire and cotton thread constant in order to facilitate the calculation of caloric value;

d) Swing the crucible into position, clamp the ring and arrange the ends of the cotton thread so that they are in contact with the sample;

e) Pipette 1 ml of distilled water into the bomb;

f) Place the electrode assembly into the bomb body ensuring that it fits correctly;

g) Tighten the bomb closure ring by hand only;

h) Fill the bomb to 25 atmospheric pressure with oxygen (oxygen must be free from hydrogen);

j) Fill water into calorimetric vessel to submerge the bomb completely. The vessel and water should give a total mass of 3 kg. The quantity of water used is not critical but it must be constant for all tests to an accuracy of ± 0.5 kg.

k) Place the bomb on three supports in the calorimeter vessel and check for the gas leakage that the bomb should not show any sign of gas leakage;

m) Gently slide the top of the calorimeter console onto the bomb. Switch on the main and press down the bomb firing plug to contact the bomb;

n) Adjust the initial temperature and press the fire switch; and

p) After 8 min read the temperature on main thermometer. Note final temperature when it stabilizes.

D-5.1.1 *Calculation*

$$\text{Bomb equivalent} = \frac{(6\,318 \times M) + A}{T}$$

where

M = Mass of benzoic acid (g);
A = Correction factor for wire and thread [heat of combustion of thread and wire may be taken as 3 962 cal/g and 1 400 cal/g (or 2.3 cal/cm) respectively]; and
T = R ise in temperature (°C).

D-5.2 Gross Energy Estimation of Feed

Weight 0.5-1 g of finely ground representative sample and make a pellet with the help of pellet press. All the materials which have low bulk density and high surface area must be compacted to reduce their rate of combustion, or otherwise, it will lead to a false result due to loss of sample from the crucible, even more serious is the possibility that the combustion will be so rapid that it resembles an explosion. Weigh samples for dry matter determination at the time of pelleting. Put the pellet in a pre-weighed crucible and weigh again. Follow the steps (c) to (p) as described in **D- 5.1**. Switch off the main switch. Remove the bomb from the vessel. Release pressure of the bomb using pressure release cap. Open the bomb and wash the electrodes and inside top and body of the bomb with distilled water. Collect these washing in a beaker for corrections for nitrogen and sulphur contents.

D-5.2.1 *Calculation*

$$\text{Gross energy (cal/g)} = \frac{(\text{Bomb equivalent} \times T) - A}{\text{Dry mass of sample (g)}}$$

where

T = Rise in temperature; and
A = Correction factors for wire, thread, nitrogen and sulphur.

D-5.3 Nitrogen and Sulphur Corrections

a) Boil the washings (*see* **D-5.2**) collected in the beaker for 5 min;
b) Cool and titrate against N/10 $Ba(OH)_2$ solution using phenolphthalein indicator.
c) Add 20 ml of N/10 Na_2CO_3 solution and boil again;
d) Cool the contents and filter through Whatman filter paper No. 1 and give 2-3 washings with hot distilled water;
e) Titrate the washings against N/10 HCl using methyl orange indictor;
f) Heat liberated due to production of H_2SO_4 and HNO_3 can be calculated by using the following factors:

1 ml of N/10 $Ba(OH)_2$ solution = 3.60 cal; and
1 ml of N/10 Na_2CO_3 solution = 1.43 cal.

D-5.3.1 *Calculations*

Nitric acid correction (cal) = 1.43 (B – C)
Sulphuric acid correction (cal) = 3.60 [A – (B – C)]

where

A = amount of N/10 $Ba(OH)_2$ solution used (ml);
B = amount of N/10 Na_2CO_3 solution added (ml); and
C = amount of N/10 HCl used (ml).

D-2 CALCULATION OF GROSS ENERGY

Moisture, crude protein, crude fat, crude fibre, and total ash in the *Pangasius* fish feed may be estimated as per the test methods referred in the Table 1.

Nitrogen free extractives (NFE) which represents the available carbohydrate portion of the feed material shall be calculated as below:

Nitrogen free extractives = 100 – (% Moisture + % Crude Protein + % Crude Fat + % Crude Fibre + % Total Ash).

Based on the protein, fat and carbohydrate, the heat of combustion can be calculated and the gross energy equivalent of the test sample can be estimated. The Physiological Fuel Value (gross energy equivalent) for Crude Protein, Crude Fat and Nitrogen free extractives shall be 5.65 kcal/g, 9.45 kcal/g and 4.2 kcal/g, respectively and the Gross Energy of the feed in kcal/kg shall be calculated as given below:

Gross Energy of the feed (kcal/kg) = (crude protein (g/kg) × 5.65) + (crude fat (g/kg) × 9.45) + (NFE (g/kg) × 4.2).

ANNEX E

[*Table* 1, *Sl No*.(iii)]

ACID HYDROLYSIS

The test for crude fat in finished feeds of *Pangasius* may be carried our as per the method described at Sl No. (iii) of table 1. However, the samples has to undergo acid hydrolysis before subjecting it for fat estimation. The procedure for acid hydrolysis is given below.

E-1 PRINCIPLE

The extruded feed samples forms complexes with fat, protein and carbohydrates. This complexes will not be released in the convention fat estimation by soxhlet method. Hence to break the complexes the feed has to under go acid hydrolysis and then subjected for fat estimation.

E-2 APPARATUS

E-2.1 Oven

E-2.2 Hot Plate

E-2.3 Conical Flask

E-2.4 Balance

E-2.5 Whatman Filter Paper

E-2.6 Stop Watch

E-3 PROCEDURE

About 1 gm sample has to be weighed in a 250 ml conical flask into which 50 ml 3N HCl is added and thoroughly mixed. The flask containing the mixture is gently heated in a hot plate at 90 °C for 30 min. The heated mixture is filtered using Whatman filter paper on Buchner funnel. The residual acid is removed by rinsing three times the filtered content with distilled water. The filter paper with the feed content has to be carefully removed from Buchner funnel and has to be dried in an oven at 105 °C for 3 h. The dried sample is used as such for estimating the fat content using soxhlet method and fat is estimated as described in the Table 1.

ANNEX F
(*Foreword*)

COMMITTEE COMPOSITION

Fish, Fisheries and Aquaculture Sectional Committee, FAD 12

Organization	*Representative(s)*
Indian Council of Agricultural Research, New Delhi	DR JOYKRUSHNA JENA **(*Chairperson*)**
All India SHRIMP Hatchery Association, Hyderabad	SHRI D. RAMRAJ SHRI K. MADHUSUDAN REDDY (*Alternate*)
Central Institute of Fisheries Education, Mumbai	DR GOPAL KRISHNA DR B. B. NAYAK (*Alternate*)
Coastal Aquaculture Authority, Chennai	SHRI ANTONY A. XAVIER
College of Fisheries, CAU (Imphal), Tripura	DR R. K. MAJUMDAR
Defence Food Research Laboratory, Mysore	DIRECTOR
Export Inspection Council of India, New Delhi	SHRI R. M. MANDALIK
Food Safety and Standards Authority of India, New Delhi	DR A. K. MISHRA MS ANJU KAVI (*Alternate*)
ICAR-Central Inland Fisheries Research Institute, Kolkata	DR DHARMENDRA KUMAR MEENA DR. BIJAY KUMAR BEHERA (*Alternate*)
ICAR-Central Institute for Fisheries Technology, Kochi	DR SATYEN KUMAR PANDA DR C. O. MOHAN (*Alternate* I) DR T. V. SANKAR (*Alternate* II)
ICAR-Central Institute of Brackish Water Aquaculture, Chennai	DR K. AMBASANKAR DR SUBHENDU KUMAR OTTA (*Alternate* I) DR P. K. PATIL (*Alternate* II)
ICAR-Central Institute of Fresh Water Aquaculture, Bhubaneswar	DR P. C. DAS DR KEDAR NATH MOHANTA (*Alternate*)
Marine Products Export Development Authority, Kochi	DR RAM MOHAN M. K. SHRI V. VINOD (*Alternate*)
National Fisheries Development Board, Hyderabad	DIRECTOR
National Institute of Fisheries Post Harvest Technology and Training, Ernakulam	DR JAI SINGH MEENA SHRI VARGHESE JOHN (*Alternate*)
Seafood Exporters Association of India, Kochi	SHRI NORBERT KARIKKASSERY
Society of Aquaculture Professional, Chennai	SHRI RAVIKUMAR YELLANKI SHRI P. K. SENTHIL KUMAR (*Alternate*)

Organization	*Representative(s)*
BIS Directorate General	SHRIMATI SUNEETI TOTEJA, SCIENTIST 'E'/DIRECTOR AND HEAD (FOOD AND AGRICULTURE) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRIMATI NAVITA YADAV
SCIENTIST 'D'/JOINT DIRECTOR
(FOOD AND AGRICULTURE), BIS

FAD 12/Panel II, Expert Panel for Review and Revision of Indian Standards on Fish Feed

Organization	*Representative(s)*
ICAR-Central Institute of Brackishwater Aquaculture, Chennai	DR K. AMBASANKAR (***Convenor***)
ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar	DR S. S. GIRI
Society of Aquaculture Professionals, Chennai	SHRI VICTOR SURESH

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.

This Indian Standard has been developed from Doc No.:FAD 12 (17792).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices:		*Telephones*
Central	: 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	2323 7617
Eastern	: 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	2367 0012 2320 9474
Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	265 9930
Southern	: C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	2254 1442 2254 1216
Western	: Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093	2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi