भारतीय मानक
Indian Standard

IS 16150 (Part 3) : 2023

मत्स्य आहार — विशिष्टि

भाग 3 समुद्री श्रिम्प आहार

(पहला पुनरीक्षण)

Fish Feed — Specification

Part 3 Marine Shrimp Feed

(First Revision)

ICS 67.120.30

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
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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 has also commenced in the country.

This standard was first published in 2014 with a view to enable the manufacturers to prepare fish feeds of known quality. This first revision is being brought about to address changes in feed manufacturing practices and regulatory requirements. In this revision, new nutrient requirements for shrimp *Penaeus indicus* have been added. In addition, there is a revision in the phosphorus requirement owing to the usage of considerable level of plant protein sources and use of increased inorganic phosphorus supplementation in the shrimp feed formulations used. Similarly, the nutrient content and aflatoxin B1 limits have been revised based on national and global best practices. The requirement on usage of antibiotics has been modified to prohibit their usage altogether. In addition, some new ingredients are also included for use in marine shrimp feed formulations.

The composition of the Committee responsible for formulation of the standard is given in Annex E and considerable assistance has been provided by ICAR-Central Institute of Brackishwater Aquaculture, Chennai in development of this standard.

In the formulation of this standard due consideration has been given to *Coastal Aquaculture Authority Act*, 2005 and the Rules framed thereunder. This standard is, however, subject to the restrictions imposed under these rules, wherever applicable.

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:

Part 1 Carp feed
Part 2 Catfish feed
Part 4 Freshwater prawn feed
Part 5 *Pangasius* 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 3 MARINE SHRIMP FEED

(First Revision)

1 SCOPE

This standard (Part 3) prescribes the requirements and the methods of sampling and test for marine shrimp (*Penaeus monodon*, *Penaeus indicus* and *Penaeus vannamei*) 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 marine shrimp feed shall be of the following types:

a) *Starter Grade* — feed to be fed to post larvae of Penaeid shrimp in grow-out ponds until they attain a mass of about 7.0 g;

b) *Grower Grade* — feed to be fed to growing shrimp of about 7.0 g until they attain a mass of about 20 g; and

c) *Finisher Grade* — feed to be fed to growing shrimp of above 20 g mass.

4 REQUIREMENTS

4.1 Description

The marine shrimp feed shall be fresh and free from moulds and insect infestation.

4.1.1 *Ingredients*

The ingredients listed in Annex B shall only be used for manufacturing marine shrimp feed.

4.2 Physical Characteristics

4.2.1 *Feed Form and Size*

4.2.1.1 Starter grade feed shall be in the form of granules of 0.4 mm to 1.4 mm or pellets of 0.5 mm to 1.4 mm diameter and 2 mm to 3 mm length.

4.2.1.2 Grower grade and finisher grade feed shall be in the form of pellets of 1.4 mm to 2.2 mm diameter.

4.2.2 *Water Stability of Pellets*

The feed pellets shall be stable without disintegration in water for 2 h minimum. The water stability shall not be less than 90 percent after 1 h when tested as per Annex C.

4.3 *Penaeus monodon* feed shall also conform to the requirements given in Table 1, *Penaeus indicus* feed shall also conform to the requirements given in Table 2 and *Penaeus vannamei* feed shall also conform to the requirements given in Table 3.

Table 1 Requirements for *Penaeus monodon* Feed
(*Clauses* 4.3 *and* 7.1)

Sl No.	Characteristics	Requirements			Method of Test, No. Ref to
		Starter	Grower	Finisher	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Moisture, percent by mass, *Max*	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*	38.0	35.0	32.0	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*	5.0	5.0	5.0	IS/ISO 6492 or 7 of IS 7874 (Part 1)*
iv)	Crude fibre, percent by mass, *Max*	3.0	4.0	5.0	IS/ISO 6865 #
v)	Acid insoluble ash, percent by mass, *Max*	4.0	4.0	4.0	IS 14826 or 10 of IS 7874 (Part 1)*
vi)	Gross energy, kcal/kg, *Min*	3 400	3 300	3 200	Annex D
vii)	Phosphorus, percent by mass, *Max*	1.5	1.5	1.5	IS 14828* or 6 of IS 7874 (Part 2)

NOTES
1 The values for requirements specified at Sl No. ii) to vii) are on moisture-free basis.
2 For routine analysis, the characteristics at Sl No. ii) to vii) 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.

Table 2 Requirements for *Penaeus indicus* Feed
(*Clauses* 4.3 *and* 7.1)

Sl No.	Characteristics	Requirements			Method of Test, No. Ref to
		Starter	Grower	Finisher	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Moisture, percent by mass, *Max*	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*	36.0	34.0	32.0	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*	5.0	5.0	5.0	IS/ISO 6492 or 7 of IS 7874 (Part 1)*
iv)	Crude fibre, percent by mass, *Max*	3.0	4.0	5.0	IS/ISO 6865 #
v)	Acid insoluble ash, percent by mass, *Max*	4.0	4.0	4.0	IS 14826 or 10 of IS 7874 (Part 1)*
vi)	Gross energy, kcal/kg, *Min*	3 300	3 200	3 000	Annex D
vii)	Phosphorus, percent by mass, *Max*	1.5	1.5	1.5	IS 14828* or 6 of IS 7874 (Part 2)

NOTES
1 The values for requirements specified at Sl No. ii) to vii) are on moisture-free basis.
2 For routine analysis, the characteristics at Sl No. ii) to vii) 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.

Table 3 Requirements for *Penaeus vannamei* Feed
(*Clauses* 4.3 *and* 7.1)

Sl No.	Characteristics	Requirements			Method of Test, No. Ref to
		Starter	Grower	Finisher	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Moisture, percent by mass, *Max*	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*	35.0	32.0	30.0	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*	5.0	5.0	5.0	IS/ISO 6492 or 7 of IS 7874 (Part 1)*
iv)	Crude fibre, percent by mass, *Max*	3.0	4.0	5.0	IS/ISO 6865 #
v)	Acid insoluble ash, percent by mass, *Max*	4.0	4.0	4.0	IS 14826 or 10 of IS 7874 (Part 1)*
vi)	Gross energy, kcal/kg, *Min*	3 200	3 000	2 800	Annex D
vii)	Phosphorus, percent by mass, *Max*	1.5	1.5	1.5	IS 14828* or 6 of IS 7874 (Part 2)

NOTES
1 The values for requirements specified at Sl no. ii) to vii) are on moisture-free basis.
2 For routine analysis, the characteristics at Sl No. ii) to vii) 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.

4.4 Antibiotics and additives

No antibiotics or pharmacologically active substances shall be incorporated in marine shrimp feed.

4.5 Aflatoxin B1 content of marine shrimp 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 and declared on the label. Sampling of marine shrimp feed for estimation of aflatoxin B1 content shall be done in accordance with IS 13426.

NOTE — 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 and hand stitched.

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 shrimp 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 marine shrimp feed;
b) Name and quantity of additives added, if any;
c) Moisture content;
d) Crude protein content;

e) Crude fibre content;
f) Crude fat content;
g) Gross energy;
h) Aflatoxin B1 content; 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

Tests shall be carried out as prescribed in **4.2.2**, **4.5** and col (6) of Table 1, 2 and 3.

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 4307 : 1983	Specification for fishmeal as livestock feed ingredient (*second revision*)
IS 4193 : 2022	Guar meal as livestock feed ingredient — Specification (*second revision*)
IS 5470 : 2002	Dicalcium phosphate, animal feed grade — Specification (*first revision*)
IS/ISO 5983-1 : 2005	Animal feeding stuffs — Determination of nitrogen content and calculation of crude protein content: Part 1 Kjeldahl method

IS No.	*Title*
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 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
IS 14828 : 2000/ISO 6491 : 1998	Animal feeding stuff — Determination of total phosphorus content – Spectrophotometric method

ANNEX B
(*Clause* 4.1.1)

INGREDIENTS FOR MARINE SHRIMP FEED

B-1 In the compounding of marine shrimp 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;
f) Fish oil;
g) Squid oil;
h) Squid liver oil;
j) Insect meal and oil
k) Krill oil;
m) Krill meal;
n) Silk worm Pupae meal;
p) Bone meal (*see* IS 1942);
q) Porcine blood meal;
r) Fish meal hydrolysate; and
s) 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 oilcake (*see* IS 1932);
h) Wheat and wheat products;
j) Rice and its products/broken rice;
k) Maize and maize products;
m) Any other edible cereal and its product;
n) Rice bran (*see* IS 3648);
p) Wheat bran;
q) Edible vegetable oils;
r) Soybean lecithin;

s) Algal meals and oils;
t) Sea weeds;
u) Corn gluten;
v) Wheat Gluten;
w) Dried distillery grains with solubles (DDGS);
y) Detoxicated jatropha meal; and
z) 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 meal.

ANNEX C
(*Clause* 4.2.2)

DETERMINATION OF WATER STABILITY OF SHRIMP FEED PELLETS

C-1 PRINCIPLE

Water stability of dry marine shrimp 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 litre beaker containing one litre seawater (30 parts per thousand). Record water temperature, salinity and *p*H of the seawater. After prescribed time, slowly take out pouches with pellets out of the water. Examine the pellets for their physical shape. Wash the adhering salt on the pellets by dipping in fresh water for 5 min. 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:

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

ANNEX D

[*Table* 1, *Sl No*. vi), *Table* 2, *Sl No*. vi) *and Table* 3, *Sl No*. vi)]

GROSS ENERGY

Gross energy in raw materials and finished marine shrimp 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 calorimeter. 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 = rise in temperature (°C).

D-5.2 Gross Energy Estimation of Feed

Weight 0.5 g - 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; and

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
1 ml of N/10 Na_2CO_3 solution = 1.43 cal

D-5.3.1 *Calculations*

$$\text{Nitric acid correction (cal)} = 1.43\,(B - C)$$
$$\text{Sulphuric acid correction (cal)} = 3.60\,[A - (B - C)]$$

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 marine shrimp 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, 9.45 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
(*Foreword*)

COMMITTEE COMPOSITION

Fish, Fisheries and Aquaculture Sectional Committee, FAD 12

Organization	*Representative(s)*
Indian Council of Agricultural Research, New Delhi	DR JOY KRUSHNA JENA (***Chairperson***)
All India Shrimp Hatchery Association, Hyderabad	SHRI D. RAMRAJ SHRI K. MADHUSUDAN REDDY (*Alternate*)
College of Fisheries, CAU (Imphal), Tripura	DR R. K. MAJUMDAR
Central Institute of Fisheries Education, Mumbai	DR GOPAL KRISHNA DR B. B. NAYAK (*Alternate*)
Coastal Aquaculture Authority, Chennai	SHRI ANTONY A. XAVIER
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*)
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