

# *Caribbean Community*

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CRS 29 (2010) (English): Poultry Feed  
and Feed Ingredients



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## **CARICOM REGIONAL STANDARD**

**Specification for poultry feed and feed ingredients**

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**CRS 29: 2011**



**Caribbean Community**



**CARICOM Regional Organisation for Standards and Quality (CROSQ)**

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|                          |                          |                              |                                 |                              |

**ATTACHMENT PAGE FOR CRS AMENDMENT SHEETS**

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This CARICOM Regional Standard was prepared under the supervision of Regional Technical Committee (RTC 3) for Foods (hosted by the CARICOM Member State, Barbados) which at the time comprised the following members:

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## **Foreword**

This CARICOM Regional Standard was developed as an initiative of the Caribbean Poultry Association in response to the need to harmonize standards for the production and use of poultry feeds within CARICOM. Representatives of several national poultry associations and standards bodies were involved in the discussions leading to the elaboration of the standard.

This standard is designed to:

- a) ensure that poultry animals, used either as poultry meat or for the production of eggs used for human food, are fed rations, which are appropriate for the category of bird; and
- b) help to ensure the safety of food for human consumption through adherence to recommended poultry feeding practice at the farm level and good manufacturing practices during the procurement, handling, storage, processing and distribution of poultry feed and feed ingredients.

This standard was approved by the Council for Trade and Economic Development (COTED) on 3-4 May 2011.

In the development of this standard, assistance was derived from the following:

- a) National Research Council, USA, Nutrient Requirements of Poultry – Ninth Revised Edition 1994;
- b) CODEX Alimentarius, CAC/RCP 54 – 2004, Recommended Code of Practice on Good Animal Feeding;
- c) Nutrient Requirements of Poultry, Ninth Revised Ed.; 1991 (1994);
- d) William F. Dean, Ph. D, Duck Nutrition.

## 1 Scope

This standard establishes specifications for nutrient requirements in the rations fed to poultry. It provides guidance on good manufacturing practices for the production of poultry feeds and good on-farm feeding practices. It applies to the production and use of all materials designed for poultry feed and feed ingredients at all levels, whether produced industrially or on farm.

## 2 Terms and definitions

For the purposes of this standard, the following terms and definitions shall apply.

### 2.1

#### **adulterant**

any substance which if it is included in a poultry feed is likely to be deleterious to poultry when fed in proportions commonly used or as specified in the feeding instructions

### 2.2

#### **apparent metabolisable energy (ME)**

gross energy of the feed consumed minus the gross energy contained in the excreta. A correction for nitrogen retained in the body is usually applied to yield a nitrogen-corrected ME, a  $ME_n$  value. Typical dietary energy values are expressed in kcal  $ME_n$  /kg diet

### 2.3

#### **breeder**

female bird which is reared primarily for its fertile eggs

### 2.4

#### **broiler**

bird which is reared for its meat

### 2.5

#### **broiler breeder grower ration**

poultry feed fed to breeder pullets 3 weeks to 23 weeks of age

### 2.6

#### **broiler breeder ration**

poultry feed fed to breeder pullets over 23 weeks of age

### 2.7

#### **broiler breeder starter ration**

poultry feed fed to breeder pullets 0 weeks to 3 weeks of age

### 2.8

#### **broiler finisher ration**

poultry feed fed to broilers 6 week to 8 weeks of age

### 2.9

#### **broiler grower ration**

poultry feed fed to broilers 4 and 5 weeks of age

### 2.10

#### **broiler ration**

poultry feed fed to broilers from a day old to the time slaughter

### 2.11

#### **broiler starter ration**

poultry feed fed to broilers 0 weeks to 3 weeks of age

**2.12**

**crumbles**

feed particles which can be individually picked up and swallowed whole by poultry

NOTE Crumbles may be broken pellets.

**2.13**

**duck breeder developer**

poultry feed typically fed to ducks until they commence to lay eggs

**2.14**

**duck breeder layer**

poultry feed typically fed to ducks after the commencement of egg production

**2.15**

**duck grower ration**

poultry feed typically fed to ducks 2 week to 7 weeks of age

**2.16**

**duck starter**

poultry feed typically fed to ducks 0 weeks to 2 weeks of age

**2.17**

**feed additive**

any intentionally added ingredient not normally consumed as feed by itself, whether or not it has a nutritional value, which affects the characteristics of feed or animal products

**2.18**

**feed ingredient**

component part or constituent of any combination or mixture making up a feed, whether or not it has a nutritional value in the animal's diet, including feed additives

NOTE Ingredients are of plant, animal or aquatic origin, or other organic or inorganic substances.

**2.19**

**label**

any mark, stamp, ticket or tag applied to, affixed to, printed on, accompanying, sold with or referring to poultry feed or any package or container containing poultry feed

**2.20**

**layer**

bird that is reared principally for the laying of table eggs

**2.21**

**layer ration**

poultry feed fed to layers over 20 weeks of age

**2.22**

**medicated feed**

any feed which contains veterinary drugs as defined in the CODEX Alimentarius Commission Procedural Manual

**2.23**

**poultry**

any domesticated bird including, but not limited to, chickens, turkeys, ducks geese, guinea-fowls and pigeons

**2.24**

**poultry feed (feeding stuff)**

any single or multiple material whether processed, semi-processed or raw, which is intended to be fed directly to poultry animals

**2.25**

**pullet**

young female bird which will later develop into a layer

**2.26**

**pullet developer ration**

poultry feed fed to pullets 14 weeks to 20 weeks of age

**2.27**

**pullet grower ration**

poultry feed fed to replacement pullets 6 weeks to 14 weeks of age

**2.28**

**pullet starter ration**

poultry feed fed to replacement pullets 0 week to 6 weeks of age

**2.29**

**turkey breeder ration**

poultry feed fed to turkeys over 20 weeks of age

**2.30**

**turkey grower ration**

poultry feed fed to growing turkeys, 8 weeks to 20 weeks of age

**2.31**

**turkey pre-starter ration**

poultry feed fed to turkey poults, 0 weeks to 4 weeks of age

**2.32**

**turkey starter ration**

poultry feed fed to turkey poults, 4 weeks to 8 weeks of age

**2.33**

**undesirable substances**

contaminants and other substances, which are present in and or on feed and feed ingredients and which constitute a risk to the health of consumers, including food safety related poultry health issues

### **3 Nutrient requirements**

#### **3.1 General requirements**

Poultry feeds shall be free from rancidity, musty odour, adulterants, toxic substances, moulds insects and harmful foreign matter.

NOTE See Annex A for list of adulterants and toxic substances.

#### **3.2 Energy values**

In formulating poultry feeds, a suitable blend of ingredients shall be used to ensure that the energy level, which is appropriate for the type and age of the flock being fed, is attained. Recommendations for energy levels for various categories of poultry flocks are set out in 3.12. These values should not be regarded as energy requirements. They represent the dietary energy concentrations frequently used under practical conditions of feed formulation and poultry management.

### **3.3 Ingredients and supplements**

**3.3.1** The ingredients to be used in the manufacture of poultry feeds are given in Annex B. The list of mineral and vitamins supplements which shall be allowed are given in Annex C. Other ingredients, supplements or mixtures shall be used provided they have been approved by the appropriate competent authority.

**3.3.2** The finished feed shall be in the form of pellets, crumbles or mash and have a homogenous distribution of all ingredients.

**3.3.3** If the feed is in the form of pellets, these shall not exceed 5 mm in diameter for general feeds however; for duck pellets shall be 3.18 mm for starter feed and 4.76 mm for grower feeds.

**3.3.4** Feeds sampled and tested in accordance with ISO 6497:2002 shall conform to the requirements as stated in 3.12.

**3.3.5** In addition to the requirements set out in 3.12, the poultry feed shall contain essential amino acids as listed in 3.12 and other supplemental requirements (inclusive of vitamins, minerals and other amino acids) as listed in 3.12, and in the quantity(s) indicated therein.

### **3.4 Protein and amino acids**

An appropriate level of protein shall be provided in the diet to ensure that the range and concentration of amino acids available are adequate to satisfy the physiological needs of the poultry flock. Dietary requirements for protein and essential amino acids are set out in 3.12. These values should not be regarded as absolute requirements. They represent the dietary concentrations frequently used under practical conditions of feed formulation and poultry management.

### **3.5 Essential fatty acids**

An adequate concentration of Linoleic acid shall be provided to satisfy the physiological needs of the poultry flock.

### **3.6 Macro minerals**

Appropriate levels of the macro minerals (calcium, phosphorus, sodium, potassium, magnesium and chloride) shall be provided to satisfy the physiological needs of the poultry flocks.

NOTE Recommended levels of macro minerals are set out in 3.12.

### **3.7 Micro (trace) minerals**

Poultry feeds shall be formulated to provide adequate concentrations of micro nutrients to satisfy the physiological needs of poultry flocks. The requirements for trace minerals are often fulfilled by concentrations present in conventional feed ingredients. However feedstuffs grown in certain geographic areas may be marginal or deficient in specific elements. Therefore poultry rations may require supplementation to ensure adequate intake of trace minerals.

NOTE Recommended levels of trace elements are set out in 3.12.

### **3.8 Vitamins**

Poultry feeds shall be formulated to provide adequate concentrations of vitamins to satisfy the physiological needs of poultry flocks.

NOTE Recommended levels of vitamins are set out in 3.12.

### **3.9 Xanthophylls and synthetic colouring agents**

Xanthophylls and or synthetic carotenoid pigments, approved for use in human food and listed in the CODEX Alimentarius General Standard for Food Additives, may be added to poultry feeds at the levels established by the CODEX Alimentarius Commission or in Good Manufacturing Practices (GMPs).

### **3.10 Anti-microbial agents**

**3.10.1** Antibiotics, if required and approved by the appropriate competent authority, may be incorporated into starter and grower feeds, but their concentration in the starter and grower feeds shall not exceed 100 parts per million by weight except as determined by national authorities.

**3.10.2** Antibiotics which shall not be in starter and grower feeds except on the authority of a registered veterinarian (and shall be so only in the case of special customer feeds) are listed in Annex D.

**3.10.3** Antibiotic use as a growth enhancer is not permitted.

### **3.11 Other additives**

**3.11.1** Coccidiostats approved by the appropriate competent authority shall be added at the levels recommended by the medical manufacturer.

**3.11.2** The quantity of all nutrients, for example, calcium to phosphorus ratio, percentage of fibre, fats and molasses, shall be such that the performance or health of the bird is not adversely affected.

## 3.12 Recommended nutrient requirements tables

Table 1 — Recommended nutrient requirements, broiler

|                                                              | Broiler starter ration |       |     |    | Broiler finisher ration |           |     |    | Broiler ration |       |     |    |
|--------------------------------------------------------------|------------------------|-------|-----|----|-------------------------|-----------|-----|----|----------------|-------|-----|----|
|                                                              | %                      | mg/kg | ICU | IU | %                       | mg/kg     | ICU | IU | %              | mg/kg | ICU | IU |
| Minimum crude protein                                        | 23.00                  | -     | -   | -  | 20.00                   | -         | -   | -  | 18.00          | -     | -   | -  |
| Minimum crude fat                                            | 5.00                   | -     | -   | -  | 5.00                    | -         | -   | -  | 5.00           | -     | -   | -  |
| Maximum crude fibre                                          | 4.50                   | -     | -   | -  | 4.50                    | -         | -   | -  | 4.50           | -     | -   | -  |
| Minimum amino acid requirements in amt. per kg of dry matter |                        |       |     |    |                         |           |     |    |                |       |     |    |
| Arginine                                                     | 1.25                   | 12500 | -   | -  | 1.10                    | 111000000 | -   | -  | 1.00           | 10000 | -   | -  |
| Glycine and/or Serine                                        | 1.25                   | 12500 | -   | -  | 1.14                    | 11400     | -   | -  | 0.97           | 9700  | -   | -  |
| Histidine                                                    | 0.35                   | 3500  | -   | -  | 0.32                    | 3200      | -   | -  | 0.27           | 2700  | -   | -  |
| Isoleucine                                                   | 0.80                   | 8000  | -   | -  | 0.73                    | 7300      | -   | -  | 0.62           | 6200  | -   | -  |
| Leucine                                                      | 1.20                   | 2000  | -   | -  | 1.09                    | 10900     | -   | -  | 0.93           | 9300  | -   | -  |
| Lysine                                                       | 1.10                   | 11000 | -   | -  | 1.00                    | 10000     | -   | -  | 0.85           | 8500  | -   | -  |
| Methionine + Cystine                                         | 0.90                   | 9000  | -   | -  | 0.72                    | 7200      | -   | -  | 0.60           | 6000  | -   | -  |
| Methionine                                                   | 0.50                   | 5000  | -   | -  | 0.38                    | 3800      | -   | -  | 0.32           | 3200  | -   | -  |
| Phenylalanine + Tyrosine                                     | 1.34                   | 13400 | -   | -  | 1.22                    | 12200     | -   | -  | 1.04           | 10400 | -   | -  |
| Phenylalanine                                                | 0.72                   | 7200  | -   | -  | 0.65                    | 6500      | -   | -  | 0.56           | 5600  | -   | -  |
| Threonine                                                    | 0.80                   | 8000  | -   | -  | 0.74                    | 7400      | -   | -  | 0.68           | 6800  | -   | -  |
| Tryptophan                                                   | 0.20                   | 2000  | -   | -  | 0.18                    | 1800      |     | -  | 0.16           | 1600  | -   | -  |
| Valine                                                       | 0.90                   | 9000  | -   | -  | 0.82                    | 8200      | -   | -  | 0.70           | 7000  | -   | -  |
| Linoleic acid                                                | 1.00                   | 10000 | -   | -  | 1.00                    | 10000     | -   | -  | 1.00           | 10000 | -   | -  |
| NOTE Metabolisable energy is 3200 kcal/kg = 13 397.76 kJ/kg  |                        |       |     |    |                         |           |     |    |                |       |     |    |

Table 2 — Recommended nutrient requirements, broiler

| Minimum vitamin and mineral requirements in amt per kg feed | Broiler starter ration |         |     |      | Broiler finisher ration |       |     |      | Broiler ration |       |     |      |
|-------------------------------------------------------------|------------------------|---------|-----|------|-------------------------|-------|-----|------|----------------|-------|-----|------|
|                                                             | %                      | mg/kg   | ICU | IU   | %                       | mg/kg | ICU | IU   | %              | mg/kg | ICU | IU   |
| Vitamin A                                                   | -                      | -       | -   | 1500 | -                       | -     | -   | 1500 | -              | -     | -   | 1500 |
| Vitamin D <sub>3</sub>                                      | -                      | -       | 200 |      | -                       | -     | 200 | -    | -              | -     | 200 | -    |
| Vitamin E                                                   | -                      | -       | -   | 10   | -                       | -     | -   | 5    | -              | -     | -   | 5    |
| Vitamin K                                                   | -                      | 0.50    | -   |      | -                       | 0.5   | -   | -    | -              | 0.5   | -   | -    |
| Thiamine                                                    | -                      | 1.00    | -   | -    | -                       | 1.0   | -   | -    | -              | 0.8   | -   | -    |
| Riboflavin                                                  | -                      | 3.60    | -   | -    | -                       | 1.8   | -   | -    | -              | 1.8   | -   | -    |
| Pantothenic acid                                            | -                      | 10.00   | -   | -    | -                       | 10.0  | -   | -    | -              | 10.0  | -   | -    |
| Niacin                                                      | -                      | 27.00   | -   | -    | -                       | 11.0  | -   | -    | -              | 11.0  | -   | -    |
| Pyridoxine                                                  | -                      | 3.00    | -   | -    | -                       | 3.0   | -   | -    | -              | 3.0   | -   | -    |
| Biotin                                                      | -                      | 0.15    | -   | -    | -                       | 0.1   | -   | -    | -              | 0.10  | -   | -    |
| Choline                                                     | -                      | 1300.00 | -   | -    | -                       | 900.0 | -   | -    | -              | 500.0 | -   | -    |
| Folacin (starch diet)                                       | -                      | 0.60    | -   | -    | -                       | 0.3   | -   | -    | -              | 0.6   | -   | -    |
| Folacin (sugar diet)                                        | -                      | -       | -   | -    | -                       | -     | -   | -    | -              | -     | -   | -    |
| Vitamin B12                                                 | -                      | 0.01    | -   | -    | -                       | 0.003 | -   | -    | -              | 0.003 | -   | -    |
| Calcium                                                     | 0.9                    |         | -   | -    | 0.8                     |       | -   | -    | 1.0            |       | -   | -    |
| Phosphorus, available                                       | 0.5                    |         | -   | -    | 0.4                     |       | -   | -    | 0.4            |       | -   | -    |
| Phosphorus                                                  | -                      | -       | -   | -    |                         |       |     |      | -              | -     | -   | -    |
| Sodium                                                      | 0.2                    |         | -   | -    | 0.2                     |       | -   | -    | 0.2            |       | -   | -    |
| Chlorine                                                    | 0.2                    |         | -   | -    | 0.2                     |       | -   | -    | 0.2            |       | -   | -    |
| Potassium                                                   | 0.25                   |         | -   | -    | 0.3                     |       | -   | -    | 0.3            |       | -   | -    |
| Manganese                                                   | -                      | 60.0    | -   | -    | -                       | 30.0  | -   | -    | -              | 30.0  | -   | -    |
| Iodine                                                      | -                      | 0.4     | -   | -    | -                       | 0.4   | -   | -    | -              | 0.4   | -   | -    |
| Magnesium                                                   | -                      | 600.0   | -   | -    | -                       | 500.0 | -   | -    | -              | 400.0 | -   | -    |
| Iron                                                        | -                      | 80.0    | -   | -    | -                       | 60.0  | -   | -    | -              | 60.0  | -   | -    |

| Minimum vitamin and mineral requirements in amt per kg feed | Broiler starter ration |       |     |    | Broiler finisher ration |       |     |    | Broiler ration |       |     |    |
|-------------------------------------------------------------|------------------------|-------|-----|----|-------------------------|-------|-----|----|----------------|-------|-----|----|
|                                                             | %                      | mg/kg | ICU | IU | %                       | mg/kg | ICU | IU | %              | mg/kg | ICU | IU |
| Copper                                                      | -                      | 5.0   | -   | -  | -                       | 4.0   | -   | -  | -              | 4.0   | -   | -  |
| Zinc                                                        | -                      | 40.0  | -   | -  | -                       | 35.0  | -   | -  | -              | 35.0  | -   | -  |
| Selenium                                                    | -                      | 0.2   | -   | -  | -                       | 0.1   | -   | -  | -              | 0.1   | -   | -  |
| NOTE Metabolisable energy is 3200 kcal/kg = 13 397.76 kJ/kg |                        |       |     |    |                         |       |     |    |                |       |     |    |

Table 3 — Recommended nutrient requirements, pullet

|                                                              | Pullet starter ration |       |     |    | Pullet grower ration |       |     |    | Pullet developer ration |       |     |    |
|--------------------------------------------------------------|-----------------------|-------|-----|----|----------------------|-------|-----|----|-------------------------|-------|-----|----|
|                                                              | %                     | mg/kg | ICU | IU | %                    | mg/kg | ICU | IU | %                       | Mg/kg | ICU | IU |
| Minimum crude protein                                        | 18                    | -     | -   | -  | 16                   | -     | -   | -  | 15                      | -     | -   | -  |
| Minimum crude fat                                            | 3                     | -     | -   | -  | 3                    | -     | -   | -  | 3                       | -     | -   | -  |
| Maximum crude fibre                                          | 6                     | -     | -   | -  | 7                    | -     | -   | -  | 16                      | -     | -   | -  |
| Minimum amino acid requirements in amt. per kg of dry matter |                       |       |     |    |                      |       |     |    |                         |       |     |    |
| Arginine                                                     | 1.00                  | 10000 | -   | -  | 0.83                 | 8300  | -   | -  | 0.67                    | 6700  | -   | -  |
| Glycine and/or Serine                                        | 0.70                  | 7000  | -   | -  | 0.58                 | 5800  | -   | -  | 0.47                    | 4700  | -   | -  |
| Histidine                                                    | 0.26                  | 2600  | -   | -  | 0.22                 | 2200  | -   | -  | 0.17                    | 1700  | -   | -  |
| Isoleucine                                                   | 0.60                  | 6000  | -   | -  | 0.50                 | 5000  | -   | -  | 0.40                    | 4000  | -   | -  |
| Leucine                                                      | 1.1                   | 11000 | -   | -  | 0.85                 | 8500  | -   | -  | 0.70                    | 7000  | -   | -  |
| Lysine                                                       | 0.85                  | 8500  | -   | -  | 0.60                 | 6000  | -   | -  | 0.45                    | 4500  | -   | -  |
| Methionine + Cystine                                         | 0.62                  | 6200  | -   | -  | 0.52                 | 5200  | -   | -  | 0.42                    | 4200  | -   | -  |
| Methionine                                                   | 0.30                  | 3000  | -   | -  | 0.25                 | 2500  | -   | -  | 0.20                    | 2000  | -   | -  |
| Phenylalanine + Tyrosine                                     | 1.00                  | 10000 | -   | -  | 0.83                 | 8300  | -   | -  | 0.67                    | 6700  | -   | -  |
| Phenylalanine                                                | 0.54                  | 5400  | -   | -  | 0.45                 | 4500  | -   | -  | 0.36                    | 3600  | -   | -  |
| Threonine                                                    | 0.68                  | 6800  | -   | -  | 0.57                 | 5700  | -   | -  | 0.37                    | 3700  | -   | -  |

|                                                             | Pullet starter ration |       |     |    | Pullet grower ration |       |     |    | Pullet developer ration |       |     |    |
|-------------------------------------------------------------|-----------------------|-------|-----|----|----------------------|-------|-----|----|-------------------------|-------|-----|----|
|                                                             | %                     | mg/kg | ICU | IU | %                    | mg/kg | ICU | IU | %                       | Mg/kg | ICU | IU |
| Tryptophan                                                  | 0.17                  | 1700  | -   | -  | 0.14                 | 1400  | -   | -  | 0.11                    | 1100  | -   | -  |
| Valine                                                      | 0.62                  | 6200  | -   | -  | 0.52                 | 5200  | -   | -  | 0.41                    | 4100  | -   | -  |
| Linoleic acid                                               | 1.00                  | 10000 | -   | -  | 1.00                 | 10000 | -   | -  | 1.00                    | 10000 | -   | -  |
| NOTE Metabolisable energy is 3200 kcal/kg = 13 397.76 kJ/kg |                       |       |     |    |                      |       |     |    |                         |       |     |    |

Table 4 — Recommended nutrient requirements, pullet

| Minimum vitamin and mineral requirements in amt per kg feed | Pullet Starter Ration |       |     |       | Pullet Grower Ration |       |     |       | Pullet Developer Ration |       |     |       |
|-------------------------------------------------------------|-----------------------|-------|-----|-------|----------------------|-------|-----|-------|-------------------------|-------|-----|-------|
|                                                             | %                     | mg/kg | ICU | IU    | %                    | Mg/kg | ICU | IU    | %                       | mg/kg | ICU | IU    |
|                                                             |                       |       |     |       |                      |       |     |       |                         |       |     |       |
| Vitamin A                                                   | -                     | -     | -   | 1 500 | -                    | -     | -   | 1 500 | -                       | -     | -   | 1 500 |
| Vitamin D <sub>3</sub>                                      | -                     | -     | 200 | -     | -                    | -     | 200 | -     | -                       | -     | 200 | -     |
| Vitamin E                                                   | -                     | -     | -   | 10    | -                    | -     | -   | 5     | -                       | -     | -   | 5     |
| Vitamin K                                                   | -                     | 0.50  | -   | -     | -                    | 0.50  | -   | -     | -                       | 0.50  | -   | -     |
| Thiamine                                                    | -                     | 1.0   | -   | -     | -                    | 1.0   | -   | -     | -                       | 0.80  | -   | -     |
| Riboflavin                                                  | -                     | 3.60  | -   | -     | -                    | 1.80  | -   | -     | -                       | 1.80  | -   | -     |
| Pantothenic acid                                            | -                     | 10    | -   | -     | -                    | 10    | -   | -     | -                       | 10    | -   | -     |
| Niacin                                                      | -                     | 27    | -   | -     | -                    | 11    | -   | -     | -                       | 11    | -   | -     |
| Pyridoxine                                                  | -                     | 3.00  | -   | -     | -                    | 3.00  | -   | -     | -                       | 3.00  | -   | -     |
| Biotin                                                      | -                     | 0.15  | -   | -     | -                    | 0.10  | -   | -     | -                       | 0.10  | -   | -     |
| Choline                                                     | -                     | 1 300 | -   | -     | -                    | 900   | -   | -     | -                       | 500   | -   | -     |
| Folacin (starch diet)                                       | -                     | 0.55  | -   | -     | -                    | 0.25  | -   | -     | -                       | 0.25  | -   | -     |
| Folacin (sugar diet)                                        | -                     | -     | -   | -     | -                    | -     | -   | -     | -                       | -     | -   | -     |
| Vitamin B12                                                 | -                     | 0.009 | -   | -     | -                    | 0.003 | -   | -     | -                       | 0.003 | -   | -     |
| Calcium                                                     | 0.9                   | 9000  | -   | -     | 0.8                  | 8000  | -   | -     | 0.8                     | 8000  | -   | -     |

| Minimum vitamin and mineral requirements in amt per kg feed | Pullet Starter Ration |       |     |    | Pullet Grower Ration |       |     |    | Pullet Developer Ration |       |     |    |
|-------------------------------------------------------------|-----------------------|-------|-----|----|----------------------|-------|-----|----|-------------------------|-------|-----|----|
|                                                             | %                     | mg/kg | ICU | IU | %                    | Mg/kg | ICU | IU | %                       | mg/kg | ICU | IU |
| Phosphorus, available                                       | 0.40                  | 4 000 | -   | -  | 0.35                 | 3 500 | -   | -  | 0.30                    | 3 000 | -   | -  |
| Phosphorus                                                  | 0.70                  | 7 000 | -   | -  | 0.40                 | 4 000 |     |    | 0.40                    | 4 000 | -   | -  |
| Sodium                                                      | 0.15                  | 1 500 | -   | -  | 0.15                 | 1 500 | -   | -  | 0.15                    | 1 500 | -   | -  |
| Chlorine                                                    | 0.15                  | 1 500 | -   | -  | 0.12                 | 1 200 | -   | -  | 0.12                    | 1 200 | -   | -  |
| Potassium                                                   | 0.40                  | 4 000 | -   | -  | 0.30                 | 3 000 | -   | -  | 0.25                    | 2 500 | -   | -  |
| Manganese                                                   | -                     | 60    | -   | -  | -                    | 30    | -   | -  | -                       | 30    | -   | -  |
| Iodine                                                      | -                     | 0.35  | -   | -  | -                    | 0.35  | -   | -  | -                       | 0.35  | -   | -  |
| Magnesium                                                   | -                     | 600   | -   | -  | -                    | 500   | -   | -  | -                       | 400   | -   | -  |
| Iron                                                        | -                     | 80    | -   | -  | -                    | 60    | -   | -  | -                       | 60    | -   | -  |
| Copper                                                      | -                     | 5.0   | -   | -  | -                    | 4.0   | -   | -  | -                       | 4.0   | -   | -  |
| Zinc                                                        | -                     | 40.00 | -   | -  | -                    | 35    | -   | -  | -                       | 35    | -   | -  |
| Selenium                                                    | -                     | 0.15  | -   | -  | -                    | 0.10  | -   | -  | -                       | 0.10  | -   | -  |
| NOTE Metabolisable energy is 3200 kcal/kg = 13 397.76 kJ/kg |                       |       |     |    |                      |       |     |    |                         |       |     |    |

Table 5 — Recommended nutrient requirements, turkey

|                                                              | Turkey pre-starter ration |       |     |    | Turkey starter ration |       |     |    | Turkey grower ration |       |     |    |
|--------------------------------------------------------------|---------------------------|-------|-----|----|-----------------------|-------|-----|----|----------------------|-------|-----|----|
|                                                              | %                         | mg/kg | ICU | IU | %                     | mg/kg | ICU | IU | %                    | mg/kg | ICU | IU |
| Minimum crude protein                                        | 28.0                      | -     | -   | -  | 26                    | -     | -   | -  | 22                   | -     | -   | -  |
| Minimum crude fat                                            | -                         | -     | -   | -  | 3                     | -     | -   | -  | -                    | -     | -   | -  |
| Maximum crude fibre                                          | -                         | -     | -   | -  | 6.50                  | -     | -   | -  | -                    | -     | -   | -  |
| Minimum amino acid requirements in amt. per kg of dry matter |                           |       |     |    |                       |       |     |    |                      |       |     |    |
| Arginine                                                     | 1.60                      | 16000 | -   | -  | 1.4                   | 14000 | -   | -  | 1.1                  | 11000 | -   | -  |
| Glycine and/or Serine                                        | 1.00                      | 10000 | -   | -  | 0.90                  | 9000  | -   | -  | 0.80                 | -     | -   | -  |

|                                                             | Turkey pre-starter ration |       |     |    | Turkey starter ration |       |     |    | Turkey grower ration |       |     |    |
|-------------------------------------------------------------|---------------------------|-------|-----|----|-----------------------|-------|-----|----|----------------------|-------|-----|----|
|                                                             | %                         | mg/kg | ICU | IU | %                     | mg/kg | ICU | IU | %                    | mg/kg | ICU | IU |
| Histidine                                                   | 0.58                      | 5800  | -   | -  | 0.50                  | 5000  | -   | -  | 0.4                  | 4000  | -   | -  |
| Isoleucine                                                  | 1.10                      | 11000 | -   | -  | 1.00                  | 10000 | -   | -  | 0.85                 | -     | -   | -  |
| Leucine                                                     | 1.90                      | 19000 | -   | -  | 1.75                  | 17500 | -   | -  | 1.50                 | -     | -   | -  |
| Lycine                                                      | 1.60                      | 16000 | -   | -  | 1.50                  | 15500 | -   | -  | 1.30                 | -     | -   | -  |
| Methionine + Cystine                                        | 1.05                      | 10500 | -   | -  | 0.95                  | 9500  | -   | -  | 0.8                  | 8000  | -   | -  |
| Methionine                                                  | 0.55                      | 5500  | -   | -  | 0.45                  | 4500  | -   | -  | 0.4                  | 4000  | -   | -  |
| Phenylalanine + Tyrosine                                    | 1.80                      | 18000 | -   | -  | 1.6                   | 16000 | -   | -  | 1.2                  | 12000 | -   | -  |
| Phenylalanine                                               | 1.00                      | 10000 | -   | -  | 0.90                  | 9000  | -   | -  | 0.80                 | -     | -   | -  |
| Threonine                                                   | 1.00                      | 10000 | -   | -  | 0.95                  | 9500  | -   | -  | 0.8                  | 8000  | -   | -  |
| Tryptophan                                                  | 0.26                      | 2600  | -   | -  | 0.24                  | 2400  | -   | -  | 0.20                 | -     | -   | -  |
| Valine                                                      | 1.20                      | 12000 | -   | -  | 1.1                   | 11000 | -   | -  | 0.9                  | 9000  | -   | -  |
| Linoleic acid                                               | 1.00                      | 10000 | -   | -  | 1.0                   | 10000 | -   | -  | 0.80                 | -     | -   | -  |
| NOTE Metabolisable energy is 3200 kcal/kg = 13 397.76 kJ/kg |                           |       |     |    |                       |       |     |    |                      |       |     |    |

Table 6 — Recommended nutrient requirements, turkey

| Minimum vitamin and mineral requirements in amt per kg feed | Turkey pre-starter ration<br>2800 kcal /kg |       |      |      | Turkey starter ration<br>2900 kcal/ kg |       |      |      | Turkey grower ration<br>3000 kcal/ kg |       |      |      |
|-------------------------------------------------------------|--------------------------------------------|-------|------|------|----------------------------------------|-------|------|------|---------------------------------------|-------|------|------|
|                                                             | %                                          | mg/kg | ICU  | IU   | %                                      | Mg/kg | ICU  | IU   | %                                     | mg/kg | ICU  | IU   |
| Vitamin A                                                   | -                                          | -     | -    | 5000 | -                                      | -     | -    | 5000 | -                                     | -     | -    | 5000 |
| Vitamin D <sub>3</sub>                                      | -                                          | -     | 1100 | -    | -                                      | -     | 1100 | -    | -                                     | -     | 1100 | -    |
| Vitamin E                                                   | -                                          | -     | -    | 12   | -                                      | -     | -    | 12   | -                                     | -     | -    | 10   |
| Vitamin K                                                   | -                                          | 1.75  | -    | -    | -                                      | 1.5   | -    | -    | -                                     | 1.0   | -    | -    |
| Thiamine                                                    | -                                          | 2.0   | -    | -    | -                                      | 2.0   | -    | -    | -                                     | 2     | -    | -    |
| Riboflavin                                                  | -                                          | 4.0   | -    | -    | -                                      | 3.6   | -    | -    | -                                     | 3     | -    | -    |
| Pantothenic acid                                            | -                                          | 10.0  | -    | -    | -                                      | 9.0   | -    | -    | -                                     | 9     | -    | -    |

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| Minimum vitamin and mineral requirements in amt per kg feed | Turkey pre-starter ration<br>2800 kcal /kg |        |     |    | Turkey starter ration<br>2900 kcal/ kg |         |     |    | Turkey grower ration<br>3000 kcal/ kg |        |     |    |
|-------------------------------------------------------------|--------------------------------------------|--------|-----|----|----------------------------------------|---------|-----|----|---------------------------------------|--------|-----|----|
|                                                             | %                                          | mg/kg  | ICU | IU | %                                      | Mg/kg   | ICU | IU | %                                     | mg/kg  | ICU | IU |
| Niacin                                                      | -                                          | 60.0   | -   | -  | -                                      | 60.0    | -   | -  | -                                     | 50     | -   | -  |
| Pyridoxine                                                  | -                                          | 4.5    | -   | -  | -                                      | 4.5     | -   | -  | -                                     | 3.50   | -   | -  |
| Biotin                                                      | -                                          | 0.25   | -   | -  | -                                      | 0.2     | -   | -  | -                                     | 0.125  | -   | -  |
| Choline                                                     | -                                          | 1600.0 | -   | -  | -                                      | 1400.0  | -   | -  | -                                     | 1100.0 | -   | -  |
| Folacin (starch diet)                                       | -                                          | 1.0    | -   | -  | -                                      | 1.0     | -   | -  | -                                     | 0.8    | -   | -  |
| Folacin (sugar diet)                                        | -                                          | -      | -   | -  | -                                      | -       | -   | -  | -                                     | -      | -   | -  |
| Vitamin B12                                                 | -                                          | 0.003  | -   | -  | -                                      | 0.003   | -   | -  | -                                     | 0.003  | -   | -  |
| Calcium                                                     | 1.20                                       | 2000.0 | -   | -  | 1.00                                   | 10000.0 | -   | -  | 0.85                                  | 8500   | -   | -  |
| Phosphorus, available                                       | 0.60                                       | 6000.0 | -   | -  | 0.50                                   | 5000.0  | -   | -  | 0.42                                  | 4200   | -   | -  |
| Phosphorus                                                  | -                                          | -      | -   | -  | 0.80                                   | 8000.0  |     |    | 0.70                                  | 7000   | -   | -  |
| Sodium                                                      | 0.17                                       | 1700.0 | -   | -  | 0.15                                   | 1500.0  | -   | -  | 0.12                                  | 1200   | -   | -  |
| Chlorine                                                    | 0.15                                       | 1500.0 | -   | -  | 0.14                                   | 1400.0  | -   | -  | 0.14                                  | 1400   | -   | -  |
| Potassium                                                   | 0.70                                       | 7000.0 | -   | -  | 0.60                                   | 6000.0  | -   | -  | 0.50                                  | 5000   | -   | -  |
| Manganese                                                   | -                                          | 60.0   | -   | -  | -                                      | 60.0    | -   | -  | -                                     | 60     | -   | -  |
| Iodine                                                      | -                                          | 0.4    | -   | -  | -                                      | 0.4     | -   | -  | -                                     | 0.4    | -   | -  |
| Magnesium                                                   | -                                          | 500    | -   | -  | -                                      | 500     | -   | -  | -                                     | 500    | -   | -  |
| Iron                                                        | -                                          | 80     | -   | -  | -                                      | 60      | -   | -  | -                                     | 60     | -   | -  |
| Copper                                                      | -                                          | 8      | -   | -  | -                                      | 8       | -   | -  | -                                     | 6      | -   | -  |
| Zinc                                                        | -                                          | 70     | -   | -  | -                                      | 65      | -   | -  | -                                     | 50     | -   | -  |
| Selenium                                                    | -                                          | 0.2    | -   | -  | -                                      | 0.2     | -   | -  | -                                     | 0.2    | -   | -  |

**Table 7 — Recommended nutrient requirements, turkey**

|                                                              | Turkey Breeding Ration |       |     |    |
|--------------------------------------------------------------|------------------------|-------|-----|----|
|                                                              | %                      | mg/kg | ICU | IU |
| Minimum crude protein                                        | 12                     | -     | -   | -  |
| Minimum crude fat                                            | 3                      | -     | -   | -  |
| Maximum crude fibre                                          | 7.5                    | -     | -   | -  |
| Minimum amino acid requirements in amt. per kg of dry matter |                        |       |     |    |
| Arginine                                                     | 0.5                    | 5000  | -   | -  |
| Glycine and/or Serine                                        | 0.4                    | 4000  | -   | -  |
| Histidine                                                    | 0.2                    | 2000  | -   | -  |
| Isoleucine                                                   | 0.4                    | 4000  | -   | -  |
| Leucine                                                      | 0.50                   | 5000  | -   | -  |
| Lysine                                                       | 0.5                    | 5000  | -   | -  |
| Methionine + Cystine                                         | 0.40                   | 4000  | -   | -  |
| Methionine                                                   | 0.20                   | 2000  | -   | -  |
| Phenylalanine + Tyrosine                                     | 0.8                    | 8000  | -   | -  |
| Phenylalanine                                                | 0.4                    | 4000  | -   | -  |
| Threonine                                                    | 0.4                    | 4000  | -   | -  |
| Tryptophan                                                   | 0.1                    | 1000  | -   | -  |
| Valine                                                       | 0.5                    | 5000  | -   | -  |
| Linoleic acid                                                | 0.8                    | 8000  | -   | -  |
| NOTE Metabolisable energy is 2900 kcal/kg = 12 141.72 kJ/kg  |                        |       |     |    |

**Table 8 — Recommended nutrient requirements, turkey**

| Minimum vitamin and mineral requirements in amt per kg feed | Turkey breeding ration |       |      |      |
|-------------------------------------------------------------|------------------------|-------|------|------|
|                                                             | %                      | mg/kg | ICU  | IU   |
|                                                             |                        |       |      |      |
| Vitamin A                                                   | -                      | -     | -    | 5000 |
| Vitamin D <sub>3</sub>                                      | -                      | -     | 1100 | -    |
| Vitamin E                                                   | -                      | -     | -    | 10   |
| Vitamin K                                                   | -                      | 0.5   | -    | -    |
| Thiamine                                                    | -                      | 2.0   | -    | -    |
| Riboflavin                                                  | -                      | 2.5   | -    | -    |
| Pantothenic acid                                            | -                      | 9.0   | -    | -    |
| Niacin                                                      | -                      | 40.0  | -    | -    |
| Pyridoxine                                                  | -                      | 3.0   | -    | -    |
| Biotin                                                      | -                      | 0.1   | -    | -    |
| Choline                                                     | -                      | 800.0 | -    | -    |
| Folacin (starch diet)                                       | -                      | 0.7   | -    | -    |
| Folacin (sugar diet)                                        | -                      | -     | -    | -    |
| Vitamin B12                                                 | -                      | 0.003 | -    | -    |

| Minimum vitamin and mineral requirements in amt per kg feed | Turkey breeding ration |       |     |    |
|-------------------------------------------------------------|------------------------|-------|-----|----|
|                                                             | %                      | mg/kg | ICU | IU |
| Calcium                                                     | 0.5                    | 5000  | -   | -  |
| Phosphorus, available                                       | 0.25                   | 2500  | -   | -  |
| Phosphorus                                                  | 0.75                   | 7500  | -   | -  |
| Sodium                                                      | 0.12                   | 1200  | -   | -  |
| Chlorine                                                    | 0.12                   | 1200  | -   | -  |
| Potassium                                                   | 0.4                    | 4000  | -   | -  |
| Manganese                                                   | -                      | 60.0  | -   | -  |
| Iodine                                                      | -                      | 0.4   | -   | -  |
| Magnesium                                                   | -                      | 500.0 | -   | -  |
| Iron                                                        | -                      | 50.0  | -   | -  |
| Copper                                                      | -                      | 6.0   | -   | -  |
| Zinc                                                        | -                      | 40.0  | -   | -  |
| Selenium                                                    | -                      | 0.2   | -   | -  |
| NOTE Metabolisable energy is 2900 kcal/kg = 12 141.72 kJ/kg |                        |       |     |    |

Table 9 — Recommended nutrient requirements, layer rations

| Nutrient                 | Unit | White-egg-laying strains                                  |                                                            |                                                               |                                                                      | Brown-egg-laying strains                                  |                                                              |                                                               |                                                                      |
|--------------------------|------|-----------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------|
|                          |      | 0 to 6 weeks;<br>450 g <sup>a</sup><br>2,850 <sup>b</sup> | 6 to 12 weeks;<br>980 g <sup>a</sup><br>2,850 <sup>b</sup> | 12 to 18 weeks;<br>1,375 g <sup>a</sup><br>2,900 <sup>b</sup> | 18 weeks to first egg;<br>1,475 g <sup>a</sup><br>2,900 <sup>b</sup> | 0 to 6 weeks;<br>500 g <sup>a</sup><br>2,800 <sup>b</sup> | 6 to 12 weeks;<br>1,100 g <sup>a</sup><br>2,800 <sup>b</sup> | 12 to 18 weeks;<br>1,500 g <sup>a</sup><br>2,850 <sup>b</sup> | 18 weeks to first egg;<br>1,600 g <sup>a</sup><br>2,850 <sup>b</sup> |
| Protein and amino acids  |      |                                                           |                                                            |                                                               |                                                                      |                                                           |                                                              |                                                               |                                                                      |
| Crude protein            | %    | 18.00                                                     | 16.00                                                      | 15.00                                                         | 17.00                                                                | 17.00                                                     | 15.00                                                        | 14.00                                                         | 16.00                                                                |
| Arginine                 | %    | 1.00                                                      | 0.83                                                       | 0.67                                                          | 0.75                                                                 | 0.94                                                      | 0.78                                                         | 0.62                                                          | 0.72                                                                 |
| Glycine + serine         | %    | 0.70                                                      | 0.58                                                       | 0.47                                                          | 0.53                                                                 | 0.66                                                      | 0.54                                                         | 0.44                                                          | 0.50                                                                 |
| Histidine                | %    | 0.26                                                      | 0.22                                                       | 0.17                                                          | 0.20                                                                 | 0.25                                                      | 0.21                                                         | 0.16                                                          | 0.18                                                                 |
| Isoleucine               | %    | 0.60                                                      | 0.50                                                       | 0.40                                                          | 0.45                                                                 | 0.57                                                      | 0.47                                                         | 0.37                                                          | 0.42                                                                 |
| Leucine                  | %    | 1.10                                                      | 0.85                                                       | 0.70                                                          | 0.80                                                                 | 1.00                                                      | 0.80                                                         | 0.65                                                          | 0.75                                                                 |
| Lysine                   | %    | 0.85                                                      | 0.60                                                       | 0.45                                                          | 0.52                                                                 | 0.80                                                      | 0.56                                                         | 0.42                                                          | 0.49                                                                 |
| Methionine               | %    | 0.30                                                      | 0.25                                                       | 0.20                                                          | 0.22                                                                 | 0.28                                                      | 0.23                                                         | 0.19                                                          | 0.21                                                                 |
| Methionine + cystine     | %    | 0.62                                                      | 0.52                                                       | 0.42                                                          | 0.47                                                                 | 0.59                                                      | 0.49                                                         | 0.39                                                          | 0.44                                                                 |
| Phenylalanine            | %    | 0.54                                                      | 0.45                                                       | 0.36                                                          | 0.40                                                                 | 0.51                                                      | 0.42                                                         | 0.34                                                          | 0.38                                                                 |
| Phenylalanine + tyrosine | %    | 1.00                                                      | 0.83                                                       | 0.67                                                          | 0.75                                                                 | 0.94                                                      | 0.78                                                         | 0.63                                                          | 0.70                                                                 |
| Threonine                | %    | 0.68                                                      | 0.57                                                       | 0.37                                                          | 0.47                                                                 | 0.64                                                      | 0.53                                                         | 0.35                                                          | 0.44                                                                 |
| Tryptophan               | %    | 0.17                                                      | 0.14                                                       | 0.11                                                          | 0.12                                                                 | 0.16                                                      | 0.13                                                         | 0.10                                                          | 0.11                                                                 |
| Valine                   | %    | 0.62                                                      | 0.52                                                       | 0.41                                                          | 0.46                                                                 | 0.59                                                      | 0.49                                                         | 0.38                                                          | 0.43                                                                 |
| Fat                      |      |                                                           |                                                            |                                                               |                                                                      |                                                           |                                                              |                                                               |                                                                      |
| Linoleic acid            |      | 1.00                                                      | 1.00                                                       | 1.00                                                          | 1.00                                                                 | 1.00                                                      | 1.00                                                         | 1.00                                                          | 1.00                                                                 |
| Macro-minerals           |      |                                                           |                                                            |                                                               |                                                                      |                                                           |                                                              |                                                               |                                                                      |
| Calcium                  | %    | 0.90                                                      | 0.80                                                       | 0.80                                                          | 2.00                                                                 | 0.90                                                      | 0.80                                                         | 0.80                                                          | 1.80                                                                 |

| Nutrient                | Unit | White-egg-laying strains                                  |                                                            |                                                               |                                                                      | Brown-egg-laying strains                                  |                                                              |                                                               |                                                                      |
|-------------------------|------|-----------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------|
|                         |      | 0 to 6 weeks;<br>450 g <sup>a</sup><br>2,850 <sup>b</sup> | 6 to 12 weeks;<br>980 g <sup>a</sup><br>2,850 <sup>b</sup> | 12 to 18 weeks;<br>1,375 g <sup>a</sup><br>2,900 <sup>b</sup> | 18 weeks to first egg;<br>1,475 g <sup>a</sup><br>2,900 <sup>b</sup> | 0 to 6 weeks;<br>500 g <sup>a</sup><br>2,800 <sup>b</sup> | 6 to 12 weeks;<br>1,100 g <sup>a</sup><br>2,800 <sup>b</sup> | 12 to 18 weeks;<br>1,500 g <sup>a</sup><br>2,850 <sup>b</sup> | 18 weeks to first egg;<br>1,600 g <sup>a</sup><br>2,850 <sup>b</sup> |
| Non-phytate phosphorous | %    | 0.40                                                      | 0.35                                                       | 0.30                                                          | 0.32                                                                 | 0.40                                                      | 0.35                                                         | 0.30                                                          | 0.35                                                                 |
| Potassium               | %    | 0.25                                                      | 0.25                                                       | 0.25                                                          | 0.25                                                                 | 0.25                                                      | 0.25                                                         | 0.25                                                          | 0.25                                                                 |
| Sodium                  | %    | 0.15                                                      | 0.15                                                       | 0.15                                                          | 0.15                                                                 | 0.15                                                      | 0.15                                                         | 0.15                                                          | 0.15                                                                 |
| Chlorine                | %    | 0.15                                                      | 0.12                                                       | 0.12                                                          | 0.15                                                                 | 0.12                                                      | 0.11                                                         | 0.11                                                          | 0.11                                                                 |
| Magnesium               | mg   | 600.0                                                     | 500.0                                                      | 400.0                                                         | 400.0                                                                | 570.0                                                     | 470.0                                                        | 370.0                                                         | 370.0                                                                |
| Trace minerals          |      |                                                           |                                                            |                                                               |                                                                      |                                                           |                                                              |                                                               |                                                                      |
| Manganese               | mg   | 60.0                                                      | 30.0                                                       | 30.0                                                          | 30.0                                                                 | 56.0                                                      | 28.0                                                         | 28.0                                                          | 28.0                                                                 |
| Zinc                    | mg   | 40.0                                                      | 35.0                                                       | 35.0                                                          | 35.0                                                                 | 38.0                                                      | 33.0                                                         | 33.0                                                          | 33.0                                                                 |
| Iron                    | mg   | 80.0                                                      | 60.0                                                       | 60.0                                                          | 60.0                                                                 | 75.0                                                      | 56.0                                                         | 56.0                                                          | 56.0                                                                 |
| Copper                  | mg   | 5.00                                                      | 4.0                                                        | 4.0                                                           | 4.00                                                                 | 5.0                                                       | 4.0                                                          | 4.0                                                           | 4.0                                                                  |
| Iodine                  | mg   | 0.35                                                      | 0.35                                                       | 0.35                                                          | 0.35                                                                 | 0.33                                                      | 0.33                                                         | 0.33                                                          | 0.33                                                                 |
| Selenium                | mg   | 0.15                                                      | 0.10                                                       | 0.10                                                          | 0.10                                                                 | 0.14                                                      | 0.10                                                         | 0.10                                                          | 0.10                                                                 |
| Fat-soluble vitamins    |      |                                                           |                                                            |                                                               |                                                                      |                                                           |                                                              |                                                               |                                                                      |
| A                       | IU   | 1500.0                                                    | 1500.0                                                     | 1500.0                                                        | 1500.0                                                               | 1420.0                                                    | 1420.0                                                       | 1420.0                                                        | 1420.0                                                               |
| D3                      | ICU  | 200.0                                                     | 200.0                                                      | 200.0                                                         | 300.0                                                                | 190.0                                                     | 190.0                                                        | 190                                                           | 280.0                                                                |
| E                       | IU   | 10.0                                                      | 5.0                                                        | 5.0                                                           | 5.0                                                                  | 9.5                                                       | 4.7                                                          | 4.7                                                           | 4.7                                                                  |
| K                       | mg   | 0.5                                                       | 0.5                                                        | 0.5                                                           | 0.5                                                                  | 0.47                                                      | 0.47                                                         | 0.47                                                          | 0.47                                                                 |
| Water-soluble vitamins  |      |                                                           |                                                            |                                                               |                                                                      |                                                           |                                                              |                                                               |                                                                      |
| Riboflavin              | mg   | 3.6                                                       | 1.8                                                        | 1.8                                                           | 2.2                                                                  | 3.4                                                       | 1.7                                                          | 1.7                                                           | 1.7                                                                  |
| Pantothenic acid        | mg   | 10.0                                                      | 10.0                                                       | 10.0                                                          | 10.0                                                                 | 9.4                                                       | 9.4                                                          | 9.4                                                           | 9.4                                                                  |
| Niacin                  | mg   | 27.0                                                      | 11.0                                                       | 11.0                                                          | 11.0                                                                 | 26.0                                                      | 10.3                                                         | 10.3                                                          | 10.3                                                                 |
| B12                     | mg   | 0.009                                                     | 0.003                                                      | 0.003                                                         | 0.004                                                                | 0.009                                                     | 0.003                                                        | 0.003                                                         | 0.003                                                                |
| Choline                 | mg   | 1300.0                                                    | 900.0                                                      | 500.0                                                         | 500.0                                                                | 1225.0                                                    | 850.0                                                        | 470.0                                                         | 470.0                                                                |
| Biotin                  | mg   | 0.15                                                      | 0.10                                                       | 0.10                                                          | 0.10                                                                 | 0.14                                                      | 0.09                                                         | 0.09                                                          | 0.09                                                                 |
| Folic acid              | mg   | 0.55                                                      | 0.25                                                       | 0.25                                                          | 0.25                                                                 | 0.52                                                      | 0.23                                                         | 0.23                                                          | 0.23                                                                 |
| Thiamin                 | mg   | 1.0                                                       | 1.0                                                        | 0.8                                                           | 0.8                                                                  | 1.0                                                       | 1.0                                                          | 0.8                                                           | 0.8                                                                  |
| Pyridoxine              | mg   | 3.0                                                       | 3.0                                                        | 3.0                                                           | 3.0                                                                  | 2.8                                                       | 2.8                                                          | 2.8                                                           | 0.28                                                                 |

**Table 10 — Recommended nutrient requirements, duck rations**  
**(as percentages or units per kilogram of diet (90 percent dry matter))**

| Nutrient                   | Starter     |             | Grower-finisher |             |
|----------------------------|-------------|-------------|-----------------|-------------|
|                            | High energy | Low energy  | High energy     | Low energy  |
| (% or amt./ kg diet)       |             |             |                 |             |
| Met. Energy, kcal/kg (/lb) | 3086 (1400) | 2646 (1200) | 3086 (1400)     | 2646 (1200) |
| Protein, % (approx.)       | 22.0        | 19.1        | 16.1            | 14.0        |
| Lysine, %                  | 1.20        | 1.04        | 0.80            | 0.70        |
| Methionine, %              | 0.47        | 0.41        | 0.35            | 0.31        |
| Methionine + cystine, %    | 0.80        | 0.70        | 0.60            | 0.52        |

| Nutrient<br>(% or amt./ kg diet) | Starter     |            | Grower-finisher |            |
|----------------------------------|-------------|------------|-----------------|------------|
|                                  | High energy | Low energy | High energy     | Low energy |
| Tryptophan, %                    | 0.23        | 0.20       | 0.20            | 0.17       |
| Arginine, %                      | 1.20        | 1.04       | 1.00            | 0.88       |
| Valine, %                        | 0.88        | 0.77       | 0.80            | 0.70       |
| Threonine, %                     | 0.80        | 0.70       | 0.60            | 0.52       |
| Histidine, %                     | 0.44        | 0.38       | 0.35            | 0.31       |
| Isoleucine, %                    | 0.88        | 0.77       | 0.70            | 0.61       |
| Leucine %                        | 1.40        | 1.22       | 1.30            | 1.14       |
| Phenylalanine %                  | 0.80        | 0.70       | 0.70            | 0.61       |
| Phenylalanine + tyrosine %       | 1.50        | 1.31       | 1.30            | 1.14       |
| Calcium, %                       | 0.70        | 0.57       | 0.65            | 0.57       |
| Phosphorus, avail., %            | 0.40        | 0.35       | 0.35            | 0.31       |
| Sodium, %                        | 0.15        | 0.13       | 0.14            | 0.12       |
| Potassium, %                     | 0.60        | 0.52       | 0.60            | 0.52       |
| Magnesium, mg/kg                 | 500         | 435        | 500             | 435        |
| Manganese, mg/kg                 | 50          | 44         | 40              | 35         |
| Zinc, mg/kg                      | 60          | 52         | 60              | 52         |
| Selenium, mg/kg                  | 0.15        | 0.13       | 0.15            | 0.13       |
| Iodine mg/kg                     | 0.40        | 0.35       | 0.40            | 0.35       |
| Iron, mg/kg                      | 80          | 70         | 80              | 70         |
| Copper, mg/kg                    | 8           | 7          | 6               | 5          |
| Vitamin A, IU/kg                 | 5000        | 4350       | 4000            | 3480       |
| Vitamin D3, IU/kg                | 600         | 522        | 500             | 435        |
| Vitamin E, IU/kg                 | 25          | 22         | 20              | 17         |
| Vitamin K, IU/kg                 | 2           | 2          | 1               | 1          |
| Choline, mg/kg                   | 1300        | 1130       | 1000            | 870        |
| Riboflavin, mg/kg                | 4           | 4          | 3               | 3          |
| Niacin, mg/kg                    | 50          | 44         | 40              | 35         |
| Panthothenic a., mg/kg           | 12          | 10         | 10              | 9          |
| Vitamin B12, mg/kg               | 0.01        | 0.01       | 0.005           | 0.004      |
| Pyridoxine, mg/kg                | 3           | 3          | 3               | 3          |

Table 11 — Recommended-nutrient levels for duck rations

| Nutrient<br>(% or amt/ kg diet) | Breeder-developer |            | Breeder-layer |             |
|---------------------------------|-------------------|------------|---------------|-------------|
|                                 | High Energy       | Low Energy | High Energy   | Low Energy  |
| Met. Energy, kcal/ kg (/lb)     | 2866 (1300)       | 2205(1000) | 2866 (1300)   | 2646 (1200) |
| Protein, % (approx.)            | 17.6              | 12.8       | 17.5          | 16.2        |
| Lysine, %                       | 0.88              | 0.64       | 0.80          | 0.74        |
| Methionine, %                   | 0.38              | 0.28       | 0.40          | 0.37        |

| Nutrient<br>(% or amt/ kg diet) | Breeder-developer |             | Breeder-layer |             |
|---------------------------------|-------------------|-------------|---------------|-------------|
|                                 | High Energy       | Low Energy  | High Energy   | Low Energy  |
| Methionine + cystine, %         | 0.66              | 0.48        | 0.65          | 0.60        |
| Tryptophan, %                   | 0.22              | 0.16        | 0.20          | 0.18        |
| Arginine, %                     | 1.10              | 0.80        | 0.87          | 0.80        |
| Valine, %                       | 0.88              | 0.64        | 0.75          | 0.69        |
| Threonine, %                    | 0.66              | 0.48        | 0.58          | 0.54        |
| Histidine, %                    | 0.38              | 0.28        | 0.37          | 0.34        |
| Isoleucine, %                   | 0.77              | 0.56        | 0.72          | 0.67        |
| Leucine, %                      | 1.43              | 1.04        | 1.22          | 1.13        |
| Phenylalanine, %                | 0.77              | 0.56        | 0.70          | 0.65        |
| Phenylalanine + tyrosine, %     | 1.43              | 1.04        | 1.10          | 1.02        |
| Calcium, %                      | 0.75              | 0.55        | 3.00          | 2.77        |
| Phosphorus, avail. %            | 0.40              | 0.29        | 0.40          | 0.37        |
| Sodium, %                       | 0.16              | 0.12        | 0.15          | 0.14        |
| Potassium, %                    | 0.66              | 0.48        | 0.60          | 0.56        |
| Magnesium, mg/kg                | 550               | 400         | 500           | 465         |
| Manganese, mg/kg                | 44                | 32          | 40            | 37          |
| Zinc, mg/kg                     | 66                | 48          | 60            | 56          |
| Selenium, mg/kg                 | 0.16              | 0.12        | 0.15          | 0.14        |
| Iodine, mg/kg                   | 0.44              | 0.32        | 0.40          | 0.37        |
| Iron, mg/kg                     | 88                | 64          | 70            | 65          |
| Copper, mg/kg                   | 7                 | 5           | 6             | 6           |
| Vitamin A, IU/kg                | 4400              | 3200        | 6000          | 5580        |
| Vitamin D3, IU/kg               | 550               | 400         | 600           | 558         |
| Vitamin E, IU/kg                | 22                | 16          | 30            | 28          |
| Vitamin K, IU/kg                | 2                 | 2           | 2             |             |
| Choline, mg/kg                  | 1100              | 800         | 1000          | 930         |
| Riboflavin, mg/kg               | 4                 | 3           | 4             | 4           |
| Niacin, mg/kg                   | 44                | 32          | 50            | 46          |
| Pantothenic acid, mg/kg         | 11                | 8           | 12            | 11          |
| Vitamin B12, mg/kg              | 0.01              | 0.01        | 0.01          | 0.01        |
| Pyridoxine, mg/kg               | 3                 | 2           | 3             | 3           |
| Met. Energy, kcal/kg (/lb)      | 3086 (1400)       | 2646 (1200) | 3086 (1400)   | 2646 (1200) |
| Protein, % (approx.)            | 22.0              | 19.1        | 16.1          | 14.0        |
| Lysine, %                       | 1.20              | 1.04        | 0.80          | 0.70        |
| Methionine, %                   | 0.47              | 0.41        | 0.35          | 0.31        |
| Methionine + cystine, %         | >0.80             | 0.70        | >0.60         | 0.52        |
| Tryptophan, %                   | 0.23              | 0.20        | 0.20          | 0.17        |
| Arginine, %                     | 1.20              | 1.04        | 1.00          | 0.88        |
| Valine, %                       | 0.88              | 0.77        | 0.80          | 0.70        |
| Threonine, %                    | 0.80              | 0.70        | 0.60          | 0.52        |

| Nutrient<br>(% or amt/ kg diet) | Breeder-developer |            | Breeder-layer |            |
|---------------------------------|-------------------|------------|---------------|------------|
|                                 | High Energy       | Low Energy | High Energy   | Low Energy |
| Histidine, %                    | >0.44             | 0.38       | 0.35          | 0.31       |
| Isoleucine, %                   | 0.88              | 0.77       | 0.70          | 0.61       |
| Leucine, %                      | 1.40              | 1.22       | 1.30          | 1.14       |
| Phenylalanine, %                | 0.80              | 0.70       | 0.70          | 0.61       |
| Phenylalanine + tyrosine, %     | 1.50              | 1.31       | 1.30          | 1.14       |
| Calcium, %                      | 0.70              | 0.57       | 0.65          | 0.57       |
| Phosphorus, avail. %            | 0.40              | 0.35       | 0.35          | 0.31       |
| Sodium, %                       | 0.15              | 0.13       | 0.14          | 0.12       |
| Potassium, %                    | 0.60              | 0.52       | 0.60          | 0.52       |
| Magnesium, mg/kg                | 500               | 435        | 500           | 435        |
| Manganese, mg/kg                | 50                | 44         | 40            | 35         |
| Zinc, mg/kg                     | 60                | 52         | 60            | 52         |
| Selenium, mg/kg                 | >0.15             | 0.13       | 0.15          | 0.13       |
| Iodine, mg/kg                   | 0.40              | 0.35       | >0.40         | 0.35       |
| Iron, mg/kg                     | 80                | 70         | 80            | 70         |
| Copper, mg/kg                   | 8                 | 7          | 6             | 5          |
| Vitamin A, IU/kg                | 5000              | 4350       | 4000          | 3480       |
| Vitamin D3, IU/kg               | 600               | 522        | 500           | 435        |
| Vitamin E, IU/kg                | 25                | 22         | 20            | 17         |
| Vitamin K, IU/kg                | 2                 | 2          | 1             | 1          |
| Choline, mg/kg                  | 1300              | 1130       | 1000          | 870        |
| Riboflavin, mg/kg               | 4                 | 4          | 3             | 3          |
| Niacin, mg/kg                   | 50                | 44         | 40            | 35         |
| Pantothenic a., mg/kg           | 12                | 10         | 10            | 9          |
| Vitamin B12, mg/kg              | 0.01              | 0.01       | 0.005         | 0.004      |
| Pyridoxine, mg/kg               | 3                 | 3          | 3             | 3          |

NOTE In addition to the vitamins listed in Tables 10 and 11, it is recommended that duck rations contain at least 0.25 mg/kg of folic acid and a minimum of 0.13 mg/kg of biotin.

**Table 12 — Suggested nutrient levels for duck starter and grower-finisher rations**

| Ration type:               | Starter     |             | Grower-finisher |             |
|----------------------------|-------------|-------------|-----------------|-------------|
|                            | Hi-energy   | Low-energy  | High-energy     | Low-energy  |
| Energy classification:     | Hi-energy   | Low-energy  | High-energy     | Low-energy  |
| Energy level, kcal/kg (lb) | 3086 (1400) | 2646 (1200) | 3086 (1400)     | 2646 (1200) |
| Ingredient                 | %           | %           | %               | %           |
| Ground corn (maize)        | 64.44       | 35.37       | 73.37           | 47.81       |
| Sorghum grain              | ---         | 10.00       | ---             | ---         |
| Wheat middlings            | ---         | 4.39        | 3.04            | 15.63       |
| Wheat bran                 | ---         | 20.00       | ---             | 15.06       |
| Rice bran                  | ---         | 10.00       | ---             | 10.00       |
| Soybean, 48.5%             | 26.54       | ---         | 17.20           | ---         |

| Ration type:             | Starter       |               | Grower-finisher |               |
|--------------------------|---------------|---------------|-----------------|---------------|
| Energy classification:   | Hi-energy     | Low-energy    | High-energy     | Low-energy    |
| Corn (maize) gluten meal | ---           | 1.63          | ----            | ---           |
| Sunflower meal           | ---           | ---           | ---             | 5.00          |
| Fish meal, menhaden      | 1.50          | 8.50          | ---             | 5.00          |
| Meat & bone meal         | 5.00          | ---           | 4.86            | ---           |
| Brewers yeast            | ---           | 9.17          | ---             | ---           |
| Fat, animal-veg blend    | 1.51          | ---           | 0.56            | ---           |
| Limestone                | 0.07          | 0.21          | 0.11            | 0.57          |
| Dicalcium phosphate      | ---           | ---           | ---             | 0.18          |
| DL-methionine            | 0.11          | ---           | 0.05            | ---           |
| Salt                     | 0.22          | 0.15          | 0.21            | 0.14          |
| Trace-mineral mix        | 0.10          | 0.10          | 0.10            | 0.10          |
| Vitamin mix              | 0.50          | 0.50          | 0.50            | 0.50          |
| <b>TOTAL</b>             | <b>100.00</b> | <b>100.00</b> | <b>100.00</b>   | <b>100.00</b> |

Table 13 — Suggested nutrient levels for duck breeder developer and layer rations

| Ration Type:                                | Breeder-developer |                | Breeder-layer |               |
|---------------------------------------------|-------------------|----------------|---------------|---------------|
| Energy Class                                | Hi-energy         | Low-energy     | Hi-energy     | Low-energy    |
| Energy level, kcal/kg (lb)                  | 2866 (1300)       | 2205 (1000)    | 2866 (1300)   | 2646 (1200)   |
| Ingredient                                  | %                 | %              | %             | %             |
| Ground corn (maize)                         | 61.18             | 17.88          | 62.49         | 53.92         |
| Sorghum grain (milo)                        | ---               | 15.00          | ---           | ---           |
| Wheat middlings                             | 14.33             | ---            | 5.62          | 6.14          |
| Wheat bran                                  | ---               | 50.51          | ---           | 10.00         |
| Rice bran                                   | ---               | 10.00          | ---           | 5.00          |
| Soybean meal, 48.5%                         | 19.50             | ---            | 16.68         | ---           |
| Sunflower meal                              | ---               | 0.47           | ---           | 3.18          |
| Fish meal (menhaden)                        | ---               | 4.75           | 1.00          | 8.00          |
| Meat & bone meal                            | 2.00              | ---            | 5.00          | 2.00          |
| Brewers yeast                               | ---               | ---            | ---           | 5.00          |
| Fat, animal-veg blend                       | 0.38              | ---            | 1.50          | ---           |
| Limestone                                   | 0.72              | 0.62           | 6.71          | 6.01          |
| Dicalcium phosphate                         | 0.96              | ---            | 0.09          | ---           |
| DL-Methionine                               | 0.08              | ---            | 0.09          | ---           |
| Salt                                        | 0.26              | 0.16           | 0.22          | 0.16          |
| Trace mineral mix                           | 0.10              | 0.10           | 0.10          | 0.10          |
| Vitamin mix                                 | 0.50              | 0.50           | 0.50          | 0.50          |
| <b>TOTAL</b>                                | <b>100.00</b>     | <b>100.00</b>  | <b>100.00</b> | <b>100.00</b> |
| Feed/duck/day, g                            | 171 (490kcal)*    | 222 (490kcal)* | ---           | ---           |
| NOTE * Developer is fed on restricted basis |                   |                |               |               |

NOTE 1 Recommendations on nutrient concentrations are constantly being revised by the National Research Council. The values listed in the tables should be replaced by those in the most recent revision of this text.

NOTE 2 Breeder Organizations publish recommendations for nutrients for breeds of flocks being that are developed by them. These recommendations may differ from those published by the National Research Council. When Breeder Organizations recommendations are followed in the formulation of feeds, labels of packaged feeds and documentation accompanying bulk shipments are required to provide this information as outlined in 4.

## **4 Labelling and packaging**

### **4.1 Labelling**

**4.1.1** Labelling on retail packages or the documents accompanying bulk shipments of poultry feed, shall be legibly labelled in the English language and contain the following information:

- a) brand or trade name of product;
- b) country of origin of the feed;
- c) name of the product, together with an indication of whether the feed is in the form of pellets or crumbles;
- d) information about the species, category or breed of poultry flock for which the feed is intended;
- e) the purpose for which the feed is intended; in the case of medicated feeds, the name and quantity of the active medicating ingredient, precautions to be observed in using the feed and the withdrawal time, if applicable shall be declared;
- f) a list of feed ingredients, including appropriate reference to additives, in descending order of concentration in the product;
- g) weight of the feed as required by the competent authority;
- h) maximum moisture content expressed as a percentage by weight of the feed;
- i) nutrition declaration:
  - 1) minimum crude protein (%);
  - 2) minimum crude fat (%);
  - 3) maximum crude fibre (%);
  - 4) minimum and maximum calcium (%);
  - 5) total phosphorus (%);
  - 6) minimum sodium (%); and
  - 7) minimum chloride (%);
- j) name and address of manufacturer or registrant;
- k) registration number, if applicable;
- l) directions for safe storage;
- m) directions and precautions for use;

- n) feeds containing medication shall be clearly marked as to the inclusion and method of use;
- o) lot identification;
- p) date of manufacture; and
- q) "best before" or "use by" date.

**4.1.2** Feed ingredients suspected of consisting, containing or being produced from Genetically Modified Organisms (GMOs) should be labelled with precautionary statement "May Contain Genetically modified material" as a risk management measure.

## **4.2 Packaging requirements**

**4.2.1** Poultry feed and feed ingredients shall be packaged in sound, clean packages or containers. Materials suitable for packaging include laminated paper, polyethylene sheeting, polypropylene bagging material and jute bagging materials.

**4.2.2** The feed shall not sift out of the package during transport, handling or storage.

## **5 Methods of sampling and analysis**

### **5.1 Sampling**

Sampling protocols set out in ISO or CODEX Alimentarius Standards should be followed.

### **5.2 Analysis**

Laboratory methods developed and validated using scientifically recognized principles and procedures should be used. When selecting methods, consideration should also be given to practicability, with preference given to those methods, which are reliable and applicable for routine use. Laboratories conducting routine analyses of feed and feed ingredients should ensure their analytical competency with each method used and maintain appropriate documentation.

## **6 Hygiene requirements**

Products covered by this standard shall be produced in compliance with the hygienic principles and requirements set out in 7, 8 and 9.

## **7 General hygienic principles and requirements**

### **7.1 General**

Feed and feed ingredients should be obtained and maintained in a stable condition so as to protect feed and feed ingredients from contamination by pests, or by chemical, physical or microbiological contaminants or other objectionable substances during production, handling, storage and transport. Feeds should be in good condition and meet generally accepted quality standards. Where appropriate, good agricultural practices, good manufacturing practices (GMPs) and, where applicable, Hazard Analysis and Critical Control Point (HACCP) principles should be followed to control hazards that may occur in food. Potential sources of contamination from the environment should be considered.

**NOTE** Entities that produce feed or feed ingredients, those that rear animals for use as food and those that produce such animal products need to collaborate to identify potential hazards and their levels of risk to consumers' health. Such collaboration will enable the development and maintenance of appropriate risk management options and safe feeding practices.

## **7.2 Feed ingredients**

Feed ingredients should be obtained from safe sources and be subjected to a risk analysis where the ingredients are derived from processes and/or technologies not hitherto evaluated from a food safety point of view. The procedure used should be consistent with the Working Principles for Risk Analysis for Application in the Framework of the CODEX Alimentarius. Manufacturers of feed additives in particular should provide clear information to the user to permit correct and safe use. Monitoring of feed ingredients should include inspection and sampling and analysis for undesirable substances using risk-based protocols. Feed ingredients should meet acceptable and, if applicable, statutory standards for levels of pathogens, mycotoxins, pesticides and undesirable substances that may give rise to consumers' health hazards.

## **7.3 Traceability or product tracing and record keeping of feed and feed ingredients**

**7.3.1** In order to facilitate product tracing of feed and feed ingredients, including additives, proper labelling and record keeping should be done at all stages of production and distribution. This should facilitate the prompt trace-back or trace-forward of materials and products if any actual or potential health risks are identified, and prompt and complete withdrawal or recall of products where necessary. Records should be maintained and readily available regarding the production, distribution and use of feed ingredients for as long as appropriate to enable trace-back should a safety problem emerge, and representative samples of feed and feed ingredients should be kept where applicable for a suitable period of time not less than six months.

**7.3.2** Feed manufacturers should keep records containing full details of the supplier and date of receipt of feed ingredients, of the manufacturing process and the destination of all feed. These records could include:

- a) inventory records (including labels and invoices on received goods);
- b) actual formulae;
- c) mixing sheets;
- d) daily production logs;
- e) files of complaints;
- f) files on manufacturing errors and corrective actions taken;
- g) analytical results and investigations of out-of-tolerance sample results;
- h) records respecting the disposition of returned and recalled feeds and feed ingredients;
- i) records of the disposition of flushed or recovered material;
- j) records of mixer validation; and
- k) scale or metering device verification.

## **7.4 Special conditions applicable to emergency situations**

**7.4.1** Feed manufacturers should as soon as reasonable inform the competent authorities in the country in which they manufacture if they considered that a feed or feed ingredient does not satisfy the feed safety requirements established in this Standard. The information should be as detailed as possible and should at least contain a description of the nature of the problem, a description of the feed or feed ingredients, the category of bird for which it is intended, the lot number identifier, the name of the manufacturer and the country of origin. The competent authorities and operators should

immediately take effective measures to ensure that those feeds or feed ingredients do not pose any danger to consumers' health.

**7.4.2** As soon as it becomes likely that a particular feed or feed ingredient is to be traded internationally and may pose a danger to consumers' health, the competent authorities of the exporting country should notify, at least, the competent authorities of the relevant importing countries. The notification should be as detailed as possible and should at least contain the particulars indicated in the previous paragraph.

## **7.5 Inspection and control procedures**

**7.5.1** Feed and feed ingredients manufacturers and other relevant stakeholders in the industry should practice self-regulation or internal controls to secure compliance with required standards for production, storage and transport. Risk-based official regulatory programs should be established to check that feed and feed ingredients are produced, distributed and used in such a way that poultry products for human consumption are both safe and suitable. Inspection and control procedures should be used to verify that feed and feed ingredients meet requirements in order to protect consumers against food-borne hazards. Inspection systems should be designed and operated on the basis of objective risk assessment appropriate to the circumstances. The risk assessment methodology employed should be consistent with internationally accepted approaches. Risk assessment should be based on current available scientific evidence.

**7.5.2** Monitoring of feed and feed ingredients, whether by industry or official inspection bodies, should include inspection and sampling and analysis to detect unacceptable levels of undesirable substances.

## **7.6 Health hazards associated with animal feed**

### **7.6.1 General**

All feed and feed ingredients should meet minimum safety standards. It is essential that levels of undesirable substances such as aflatoxins are sufficiently low in feed ingredients that their concentration in food for human consumption is consistently below the level of concern. CODEX Maximum Residue Limits and Extraneous Substances Maximum Residue Levels set for feed should be applied. Maximum residue limits set for food, such as those established by the CODEX Alimentarius Commission, may be useful in determining minimum safety standards for feed.

### **7.6.2 Feed additives and veterinary drugs used in medicated feed**

**7.6.2.1** Feed additives and veterinary drugs used in medicated feed should be assessed for safety and used under stated conditions of use as pre-scribed by the competent authorities.

**7.6.2.2** Veterinary drugs used in medicated feed should comply with the provisions of the CODEX Recommended International Code of Practice for the Control of the Use of Veterinary Drugs.

**7.6.2.3** Feed additives should be received, handled and stored to maintain their integrity and to minimize misuse or contamination. Feed containing them should be used in strict accordance with clearly defined instructions for use.

**7.6.2.4** Antibiotics should not be used in feed for growth promoting purposes.

### **7.6.3 Feed and Feed Ingredients**

**7.6.3.1** Feed and feed ingredients should only be produced, marketed, stored and used if they are safe and suitable, and, when used as intended, should not represent in any way an unacceptable risk to the health of consumer. In particular, feed and feed ingredients contaminated with unacceptable levels of undesirable substances should be clearly identified as unsuitable for animal feed and not be marketed or used.

**7.6.3.2** Feed and feed ingredients should not be presented or marketed in a manner, which may confuse or mislead the user.

#### **7.6.4 Undesirable Substances**

**7.6.4.1** The presence in feed and feed ingredients of undesirable substances such as industrial and environmental contaminants, pesticides, radio nucleotides, persistent organic pollutants, pathogenic agents and toxins such as mycotoxins should be identified, controlled and minimized. Control measures applied to reduce unacceptable levels of undesirable substances should be validated as to their attaining the desired impact on food safety.

**7.6.4.2** The risks to the health of consumers, associated with the presence in the feed of each undesirable substance, should be assessed. This assessment should form the basis for the setting of maximum limits for feed and feed ingredients or the prohibition of certain materials from poultry feeding.

### **8 Production, processing, storage, transport and distribution of feed and feed ingredients**

#### **8.1 General**

**8.1.1** The production, processing, storage, transportation and distribution of safe and suitable feed and feed ingredients is the responsibility of all participants in the feed chain, including farmers, feed ingredient manufacturers, feed compounders, truckers, etc. Each participant in the feed chain is responsible for all activities, which are under their direct control including compliance with any applicable statutory requirements.

**8.1.2** Feed and feed ingredients should not be produced, processed, stored, transported or distributed in facilities or using equipment where incompatible operations may affect their safety and lead to adverse effects on the health of consumers.

**8.1.3** Where appropriate, operators should follow GMPs and, where applicable, HACCP principles to control hazards that may affect food safety. The aim is to ensure feed safety and in particular to prevent contamination of poultry feed and poultry food products as far as this is reasonably achievable, recognizing that total elimination of hazards is often not possible.

**8.1.4** GMPs and HACCP-based protocols should be implemented with particular reference to the following areas.

#### **8.2 Premises**

**8.2.1** Buildings and equipment used to process feed and ingredients should be constructed in a manner that permits ease of operation, maintenance and cleaning and minimizes feed contamination. Process flow within the manufacturing facility should also be designed to minimize feed contamination.

**8.2.2** Water used in feed manufacture should meet hygienic standards and be of suitable quality for animals. Tanks, pipes and other equipment used to store and convey water should be of appropriate materials, which do not produce unsafe levels of contamination.

**8.2.3** Sewage, waste and rain water should be disposed of in a manner which avoids contamination of equipment, feed and feed ingredients.

#### **8.3 Receiving, storage and transportation**

**8.3.1** Chemical fertilizers, pesticides and other materials not intended for use in feed and feed ingredients should be stored separately from feed and feed ingredients to avoid the potential for manufacturing errors and contamination of feeds and feed ingredients.

**8.3.2** Processed feed and feed ingredients should be stored separately from unprocessed feed ingredients and appropriate packaging materials should be used. Feed and feed ingredients should be received, stored and transported in such a way so as to minimize the potential for any cross-contamination to occur at a level likely to have a negative impact on food safety.

**8.3.4** The presence of undesirable substances in feed and feed ingredients should be monitored and controlled.

**8.3.5** Feed and feed ingredients should be delivered and used as soon as possible. All feed and feed ingredients should be stored and transported in a manner, which minimises deterioration and contamination and enables the correct feed to be sent to the right category of birds.

**8.3.6** Care should be taken to minimize deterioration and spoilage at all stages of handling, storage and transport of feed and feed ingredients. Special precautions should be taken to limit fungal and bacterial growth in moist and semi-moist feeds. Condensation should be minimized in feed and feed ingredient manufacturing and processing facilities. Dry feed and feed ingredients should be kept dry in order to limit fungal and bacterial growth.

**8.3.7** Waste feed and feed ingredients and other material containing unsafe levels of undesirable substances or any other hazards should not be used as feed, but should be disposed of in an appropriate manner including compliance with any applicable statutory requirements.

## **8.4 Personnel training**

All personnel involved in the manufacture, storage and handling of feed and feed ingredients should be adequately trained and aware of their roles and responsibilities in protecting food safety.

## **8.5 Sanitation and pest control**

**8.5.1** Feed and feed ingredients, processing plants, storage facilities and their immediate surroundings should be kept clean and effective pest control programs should be implemented.

**8.5.2** Containers and equipment used for manufacturing, processing, transport, storage, conveying, handling and weighing should be kept clean. Cleaning programs should be effective and minimize residues of detergents and disinfectants.

**8.5.3** Machinery coming into contact with dry feed or feed ingredients should be dried following any wet cleaning process.

**8.5.4** Special precautions should be taken when cleaning machinery used for moist and semi-moist feed and feed ingredients to avoid fungal and bacterial growth.

## **8.6 Equipment performance and maintenance**

**8.6.1** All scales and metering devices used in the manufacture of feed and feed ingredients should be certified by the competent authority and shall be appropriate for the range of weights and volumes to be measured, and be tested not less than twice a year for accuracy.

**8.6.2** All mixers used in the manufacturer of feed and feed ingredients should be appropriate for the range of weights or volumes being mixed and be capable of manufacturing suitable homogeneous mixtures and homogeneous dilutions, and be tested regularly to verify their performance.

**8.6.3** All other equipment used in the manufacturer of feed and feed ingredients should be appropriate for the range of weights or volumes being processed, and be monitored regularly.

## **8.7 Manufacturing controls**

**8.7.1** Manufacturing procedures should be used to avoid cross-contamination, for example flushing, sequencing and physical clean-up between batches of feed and feed ingredients containing restricted or otherwise potentially harmful materials such as certain animal by-product meals, veterinary drugs. These procedures should also be used to minimize cross-contamination between medicated and non-medicated feed and other incompatible feeds. In cases where the food safety risk associated with cross-contamination is high and the use of proper flushing and cleaning methods is deemed insufficient, consideration should be given to the use of completely separate production lines, transfer, storage and delivery equipment.

**8.7.2** Pathogen control procedures, such as heat treatment or the addition of authorized chemicals, should be used where appropriate, and monitored at the applicable steps in the manufacturing process.

## **8.8 Recalls**

Records and other information should be maintained, as indicated at 4.3, to include the identity and distribution path of feed and feed ingredients so that any feed or feed ingredient considered to pose a threat to consumers' health can be rapidly removed from the market and the birds exposed to the relevant feed can be identified.

# **9 On-farm production and use of feed and feed ingredients**

## **9.1 General**

**9.1** This section provides guidance on the cultivation, manufacture, management and use of feed and feed ingredients on poultry farms and should be used in conjunction with the applicable requirements of 6 and 7.

**9.2** To help ensure the safety of food used for human consumption, good agricultural practices should be applied during all stages of on-farm production of cereal grains used as feed or feed ingredients for food producing animals. Three types of contamination represent hazards at most stages of on-farm production of feed and feed ingredients, namely:

- a) biological, such as bacteria, fungi and other microbial pathogens;
- b) chemical, such as residues of medication, pesticides, fertilizer or other agricultural substances; and
- c) physical, such as broken needles, machinery and other foreign material.

## **9.2 Agricultural production of feed**

Adherence to good agricultural practices is encouraged in the production of natural, improved and cultivated cereal grain crops used as feed ingredients for poultry animals. Following good agricultural practice standards will minimize the risk of biological, chemical and physical contaminants entering the food chain. Crops that produce bedding material or bedding materials such as straw or wood shavings should also be managed in the same manner as animal feed ingredients. Good flock management practices, such as cleaning and sanitation of pens between batches of birds, should be used to reduce the risks of cross contamination.

### **9.2.1 Site selection**

Land used for production of poultry feed and feed ingredients should not be located in close proximity to industrial operations where industrial pollutants from air, ground water or runoff from adjacent land would be expected to result in the production of foods of animal origin that may present a food safety

risk. Contaminants present in runoff from adjacent land and irrigation water should be below levels that present a food safety risk.

### **9.2.2 Fertilizers**

**9.2.2.1** Where manure fertilization of crops or pastures is practiced, an appropriate handling and storage system should be in place and maintained to minimize environmental contamination, which could negatively impact on the safety of foods of animal origin.

**9.2.2.2** Manure, compost and other plant nutrients should be properly used and applied to minimize biological, chemical and physical contamination of foods of animal origin, which could adversely affect food safety.

**9.2.2.3** Chemical fertilizers should be handled, stored and applied in a manner such that they do not have a negative impact on the safety of foods of animal origin.

### **9.2.3 Pesticides and other agricultural chemicals**

**9.2.3.1** Pesticides and other agricultural chemicals should be obtained from safe sources. Where a regulatory system is in place, any chemical used shall comply with the requirements of that system.

**9.2.3.2** Pesticides should be stored according to the manufacturer's instructions and used in accordance with Good Agricultural Practice (GAP) in the use of pesticides. It is important that farmers carefully follow the manufacturer's instructions for use for all agricultural chemicals.

**9.2.3.3** Pesticides and other agricultural chemicals should be disposed of responsibly in a manner that will not lead to contamination of any body of water, soil, feed or feed ingredients that may lead to the contamination of foods of animal origin which could adversely affect food safety.

## **9.3 Manufacturing of feed on-farm**

### **9.3.1 Feed ingredients**

**9.3.1.1** On-farm feed manufacturers should follow the applicable guidelines established in 7.2 of this standard when sourcing feed ingredients off the farm.

**9.3.1.2** Feed ingredients produced on the farm should meet the requirements established for feed ingredients sourced off the farm.

**NOTE** Seed treated for planting should not be fed.

### **9.3.2 Mixing**

**9.3.2.1** On-farm feed manufacturers should follow the applicable guidelines established in 7. Particular attention should be given to 7.6.

**9.3.2.2** In particular, feed should be mixed in a manner that will minimize the potential for cross-contamination between feed or feed ingredients that may have an effect on the safety or withholding period for the feed or feed ingredients.

### **9.3.3 Monitoring records**

**9.3.3.1** Appropriate records of feed manufacturing procedures followed by on-farm feed manufacturers should be maintained to assist in the investigations of possible feed-related contamination or disease events.

**9.3.3.2** Records should be kept of incoming feed ingredients, date of receipt and batches of feed produced in addition to other applicable records set out in 7.3.

## **9.4 Good animal feeding practice**

### **9.4.1 General**

Good animal feeding practices include those practices, which help to ensure the proper use of feed and feed ingredients on-farm while minimising biological, chemical and physical risks to consumers of foods of animal origin.

### **9.4.2 Water**

Water for drinking should be of appropriate quality for the birds being fed.

### **9.4.3 Feeding**

**9.4.3.1** It is important that the correct feed is fed to the right category of bird and that directions for use are followed. Contamination should be minimized during feeding. Information should be available of what is fed to the birds and when, to ensure that food safety risks are managed.

**9.4.3.2** Birds receiving medicated feed should be identified and managed appropriately until the correct withholding period (if any) has been reached and records of these procedures should be maintained. Procedures to ensure that medicated feed are transported to the correct location and are fed to animals that require the medication should be followed. Feed transport vehicles and feeding equipment used to deliver and distribute medicated feed should be cleaned after use, if a different medicated feed or non-medicated feed or feed ingredient is to be transported next.

## **9.5 Hygiene**

**9.5.1** The poultry production unit should be designed so that it can be adequately cleaned. The bird production unit and feeding equipment should be thoroughly cleaned regularly to prevent potential hazards to food safety. Chemicals used should be appropriate for cleaning and sanitising feed manufacturing equipment and should be used according to instructions. These products should be properly labelled and stored away from feed manufacturing, feed storage and feeding areas.

**9.5.2** A pest control system should be put in place to control the access of pests to the bird production unit to minimize potential hazards to food safety from feed.

## **Annex A** **(normative)**

### **Adulterants and toxic substances**

#### **A.1 Adulterants**

The following list includes materials which shall be regarded as adulterants in all types of poultry feed:

- a) seeds of weeds which are not feed ingredients, recommended maximum permissible to be one-half of one percent by mass;
- b) must, mould or damage from heat or other cause that it would make it unsafe for feeding proportions commonly used or according to specified feeding instructions;
- c) any uncooked and/or unsound product of animal origin;
- d) sawdust and raw feathers, exceeding 0.3 % by mass, individually or together;
- e) any hoof, horn, hair, stomach contents or other extraneous material except in such amounts as are unavoidable in good factory practice;
- f) ant chaff, dust, knuckles or like material, except as a declared ingredient, or as a recognized tolerance in a declared ingredient;
- g) any material in quantities that would, when fed in proportions commonly used, or as specified in the feeding instructions, leave in the tissues or products of an animal a residue of poisonous or a harmful substance, contrary to existing statutory laws; and
- h) any material other than those mentioned above, a) to g) inclusive, in quantities likely to be deleterious to poultry when fed in proportions commonly used or as specified in the feeding directions.

#### **A.2 Toxic substances**

The following list includes substances and their maximum safe levels in the feed and any levels greater than these in poultry feed are liable to render them toxic to poultry:

- a) Aflatoxins – 20 ppb;
- b) Arsenic – 100 ppm;
- c) Cadmium – 5 ppm;
- d) Cobalt – 30 ppm;
- e) Copper – 500 ppm;
- f) Cyano-genetic glycosides – none;
- g) Fluorine – 350 ppm;
- h) Glucosinolates – none;

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- i) Gossypol – none;
- j) Iodine – 2500 ppm;
- k) Iron – 2400 ppm;
- l) Lead – 68 ppm;
- m) Magnesium – 8900 ppm;
- n) Manganese – 4800 ppm;
- o) Mercury – 20 ppm;
- p) Molybdenum – 10 ppm;
- q) Nickel – 700 ppm;
- r) Selenium – 10 ppm;
- s) Vanadium – 120 ppm; and
- t) Zinc – 3000 ppm.

**Annex B**  
(normative)

**Ingredients used in the manufacture of poultry feeds**

**B.1** Animal protein products shall include one or more of the following:

- a) casein;
- b) cheese rind;
- c) condensed buttermilk;
- d) condensed cultured skimmed milk;
- e) condensed cultured whey;
- f) condensed fish solubles;
- g) condensed hydrolysed whey;
- h) condensed skimmed milk;
- i) condensed whey;
- j) condensed whey product;
- k) condensed whey solubles;
- l) crab meat;
- m) dried buttermilk;
- n) dried cultured skimmed milk;
- o) dried fish solubles;
- p) dried hydrolysed casein;
- q) dried hydrolysed whey;
- r) dried milk albumin;
- s) dried milk protein;
- t) dried skimmed milk;
- u) dried whey;
- v) dried whey products;
- w) dried whey solubles;
- x) dried whole milk;

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- y) fish liver and glandular meal;
- z) fish meal;
- aa) fish protein concentrate;
- bb) fish residue meal;
- cc) poultry by-product meal;
- dd) poultry by-products;
- ee) poultry hatchery by-product;
- ff) poultry parts;
- gg) shrimp meal;
- hh) whale meal; and or
- ii) whole eviscerated chicken.

### **B.2** Forage products shall include one or more of the following:

- a) alfalfa leaf meal;
- b) alfalfa stem meal;
- c) corn plant pulp;
- d) dehydrated alfalfa meal;
- e) dehydrated alfalfa meal solvent extracted;
- f) dehydrated corn plant;
- g) dehydrated silage pellets;
- h) flax plant products;
- i) ground grass;
- j) ground peanut stems;
- k) ground peanut vines;
- l) ground soybean hay
- m) lespedeza meal;
- n) lespedeza stem meal; and or
- o) sun cured alfalfa meal or ground alfalfa hay.

### **B.3** Grain products shall include one or more of the following:

- a) barley;

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- b) corn feed meal;
- c) cracked corn;
- d) flaked corn;
- e) ground brown rice;
- f) ground corn;
- g) ground grain sorghum;
- h) ground rough rice;
- i) heat processed corn;
- j) mixed feed oats;
- k) oats;
- l) rice;
- m) rolled grain sorghum;
- n) rye;
- o) screened cracked corn; and or
- p) wheat.

**B.4** Liquid fat products shall include one or more of the following:

- a) coconut oil;
- b) corn oil;
- c) palm oil; and or
- d) soyabean oil;

**B.5** Plant protein products shall include one or more of the following:

- a) active dry yeast;
- b) algae meal;
- c) brewers dried yeast;
- d) coconut meal;
- e) cottonseed cake;
- f) cottonseed flake;
- g) cottonseed meal;
- h) dried yeast;

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- i) guar meal;
- j) grain distillers dried yeast;
- k) linseed meal;
- l) low gossypol cottonseed meal;
- m) molasses distillers dried yeast;
- n) peanut meal;
- o) safflower meal;
- p) soyabean meal;
- q) sunflower meal;
- r) torula dried yeast;
- s) whole-pressed cottonseed; and or
- t) yeast culture.

**B.6** Processed grain by-products shall include one or more of the following:

- a) brewers dried grains;
- b) buckwheat middlings;
- c) condensed distillers solubles;
- d) corn bran;
- e) corn flour;
- f) corn germ meal;
- g) corn gluten feed;
- h) corn gluten meal;
- i) corn grits;
- j) defatted wheat germ meal;
- k) distillers dried grains;
- l) distillers dried grains with solubles;
- m) gelatinized sorghum grain flour
- n) grain sorghum gluten feed;
- o) grain sorghum gluten meal;
- p) grain sorghum grits;

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- q) hominy feed;
- r) malt cleanings;
- s) malt sprouts;
- t) molasses distillers condensed solubles;
- u) oat groats;
- v) peanut skins;
- w) pearl barley by-products;
- x) rice bran;
- y) rice polishings;
- z) rye middlings;
- aa) soy grits or soy flour;
- bb) wheat bran;
- cc) wheat feed flour;
- dd) wheat germ meal;
- ee) wheat middlings;
- ff) wheat mill run;
- gg) wheat red dog; and or
- hh) wheat shorts.

**B.7** Roughage products shall include one or more of the following:

- a) barley hulls;
- b) barley mill by-product;
- c) buckwheat hulls;
- d) citrus seed meal;
- e) corn cob fractions;
- f) corn plant pulp;
- g) cottonseed hulls;
- h) dried apple pectin pulp;
- i) dried apple pumice;
- j) dried beet pulp;

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- k) dried citrus meal;
- l) dried tomato pumice;
- m) flax straw by-product;
- n) ground almond hulls;
- o) ground corn cob;
- p) ground straw;
- q) husks;
- r) malt hulls;
- s) oat hulls;
- t) oat mill by-product
- u) peanut hulls;
- v) rice hulls;
- w) rice mill by-product;
- x) soybean hulls
- y) soybean mill feed
- z) soybean mill run; and or
- aa) sunflower hulls.

## Annex C (normative)

### Mineral and vitamin supplements for poultry feeds

**Table C.C.1 — Mineral and vitamin supplements for poultry feeds**

| Mineral supplements           | Vitamin supplements                                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Defluorinated phosphate       | Vitamin A                                                                                                                    |
| Dicalcium phosphate           | Vitamin B                                                                                                                    |
| Limestone                     | Vitamin C                                                                                                                    |
| Calcium carbonate (Aragonite) | Vitamin E                                                                                                                    |
| Calcium iodate                | Choline chloride (also known as heptacholine, biocolina and lipotril source of choline previously referred to as Vitamin B4) |
| Tri-calcium phosphate         | Cod liver oil (source of Vitamin A and D)                                                                                    |
| Cobalt carbonate              | Blended fish oil                                                                                                             |
| Copper carbonate              | Vitamin A feeding oil                                                                                                        |
| Iron carbonate                | Vitamin D feeding oil                                                                                                        |
| Iron sulphate                 | De-activated plant sterol (Vitamin D <sub>2</sub> )                                                                          |
| Iron oxide                    | -                                                                                                                            |
| Manganese sulphate            | -                                                                                                                            |
| Manganese oxide               | -                                                                                                                            |
| Manganese carbonate           | -                                                                                                                            |
| Magnesium carbonate           | -                                                                                                                            |
| Magnesium oxide               | -                                                                                                                            |
| Sodium sulphate               | -                                                                                                                            |
| Sodium chloride (salt)        | -                                                                                                                            |
| Zinc oxide                    | -                                                                                                                            |
| Oyster shells                 | -                                                                                                                            |
| Vegetable charcoal            | -                                                                                                                            |
| Arsanilic acid                | -                                                                                                                            |

## **Annex D (normative)**

### **Antibiotics**

#### **D.1 Antibiotics**

The following list includes antibiotics and similar drugs which shall not be used in broiler starter feed and layer starter feed (except if approved by the appropriate authority or on prescription by a veterinarian):

- a) Chlortetracycline;
- b) Nitrofurans
- c) Oxytetracycline;
- d) Penicillin;
- e) Sulphonamides; and
- f) Tylosin;

NOTE      This list is not complete and shall be revised periodically.

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## **CARICOM REGIONAL ORGANISATION FOR STANDARDS AND QUALITY**

The CARICOM Regional Organisation for Standards and Quality (CROSQ) was created as an Inter-Governmental Organisation by the signing of an agreement among fourteen Member States of the Caribbean Community (CARICOM). CROSQ is the regional centre for promoting efficiency and competitive production in goods and services, through the process of standardization and the verification of quality. It is the successor to the Caribbean Common Market Standards Council (CCMSC), and supports the CARICOM mandate in the expansion of intra-regional and extra-regional trade in goods and services.

CROSQ is mandated to represent the interest of the region in international and hemispheric standards work, to promote the harmonization of metrology systems and standards, and to increase the pace of development of regional standards for the sustainable production of goods and services in the CARICOM Single Market and Economy (CSME), and the enhancement of social and economic development.

### **CROSQ VISION:**

The premier CARICOM organisation for the development and promotion of an Internationally Recognised Regional Quality Infrastructure; and for international and regional harmonized CARICOM Metrology, Standards, Inspection, Testing and Quality Infrastructure

### **CROSQ MISSION:**

The promotion and development of standards and standards related activities to facilitate international competitiveness and the sustainable production of goods and services within the CARICOM Single Market and Economy (CSME) for the enhancement of social and economic development



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