



Document 1: MSM KERNEL STANDARDS AND SPECIFICATIONS VER:5.0 (14 Jan 2025)

Document 2: WMO Macadamia Kernel Product Standard (May 2024)

MSM KERNEL STANDARDS AND SPECIFICATIONS VER:5.0 (14 Jan 2025)

Raw material description	
Item	Description and Background
Macadamia Plant and Raw Macadamia Nut Description	Botanical Overview and Varieties The macadamia tree, belonging to the Proteaceae family, is a tropical, broadleaf evergreen tree native to Australia. Macadamia integrifolia and Macadamia tetraphylla are the primary species cultivated for edible nuts. Each species is characterized by unique features and thrives in warm, subtropical climates, with Australia, South Africa, and Hawaii being major production regions. • Macadamia integrifolia: Known as the smooth-shell macadamia, this species produces round nuts with a high oil content, making it highly valued for both culinary and commercial applications. The tree grows up to 50 feet tall with an umbrella-like canopy, and it features shiny, oval leaves. Its new growth tends to be green, and the creamy white kernels are enclosed in a relatively thin, smooth shell. • Macadamia tetraphylla: Often called the rough-shell macadamia, this species produces oval-shaped nuts with a thicker, textured shell. The trees have a cone-shaped form and can tolerate slightly cooler climates than <i>M. integrifolia</i>. The leaves of <i>M. tetraphylla</i> are long and spiky, often with a pinkish tint on new growth. This species generally has a slightly lower oil content but higher natural sugars, enhancing its sweeter flavour profile. In addition to these species, hybrid varieties like 'Beaumont' (a cross of <i>M. integrifolia</i> and <i>M. tetraphylla</i>) are also commercially cultivated, offering various benefits such as increased yield and adaptability to different growing conditions. Some popular hybrid varieties include: • Beaumont: A well-known hybrid that combines the durability of <i>M. tetraphylla</i> with the higher oil content and milder flavor of <i>M. integrifolia</i>. Beaumont is particularly valued for its vigorous growth, high yields, and pinkish new leaf shoots, which are unique traits of <i>M. tetraphylla</i>. • Renown and Nelmac II: Other hybrids that blend characteristics from both species to produce trees that bear large, high-quality nuts, often with a good balance of sweetness and fat content, making them suitable for different market demands. Hybrid varieties have been selectively bred to address specific challenges within the industry, such as better performance in a range of climates, improved resistance to environmental stressors, and greater resilience against pests and diseases. This selective breeding approach has helped commercial producers cultivate trees that are both more productive and more adaptable than pure species, which is why hybrids dominate most macadamia orchards today.

Macadamia Plant and Raw Macadamia Nut Description	Raw Macadamia Nut in Shell (NIS) The macadamia fruit matures with a green, leathery husk that eventually splits, revealing the nut in shell (NIS). This hard shell contains the edible kernel (nut), which is creamy white, smooth in texture, and highly prized for its rich flavor. Raw NIS can contain between 20% and 25% moisture initially, requiring drying to reduce moisture levels for storage and processing. Drying helps prevent spoilage and prepares the nuts for cracking and further processing. A detailed diagram of a macadamia nut in its shell. The diagram shows a cross-section of the nut. Labels with arrows point to the following parts: 'HUSK (fleshy pericarp)' pointing to the outer green layer, 'SHELL (hard external)' pointing to the brown, textured outer layer, and 'KERNEL (creamy white nut)' pointing to the smooth, light-colored inner part. Chemical Composition and Quality Factors • Oil Content: <i>M. integrifolia</i> generally contains higher oil content (76% - 80%), which contributes to its buttery texture. In contrast, <i>M. tetraphylla</i> tends to have slightly lower oil content, ranging from 74% to 76%, along with a distinct, sweet flavor due to its higher sugar content. • Moisture and Storage: Properly dried NIS should have a moisture content of around 1.5% to 2%, which enhances its storage life. For optimal shelf life, raw NIS should be stored in cool, dry conditions (ideally below 15°C) to maintain quality and prevent pest infestation. Plant Growth and Harvesting Macadamia trees are relatively low-maintenance once established, with young trees needing regular irrigation and protection from frost. They thrive in USDA Zones 9-11 and prefer well-drained soils and consistent sun exposure. The trees bloom with racemes of white or pinkish flowers, eventually leading to fruiting after pollination. Mature nuts naturally drop to the ground, where they can be collected, dehusked, and dried further. For further details on macadamia cultivation and product standards, you can consult resources from the Missouri Botanical Garden, Epic Gardening, and California Rare Fruit Growers, Inc., as well as commercial product standards from organizations like the World Macadamia Organisation.
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Composition of formulated ingredients, including additives and processing aids	This product should contain no added ingredients, no artificial additives, and no processing aids. Rationale: • Purity Commitment: Macadamia nuts are sold in their natural form, with no chemical additives or processing aids introduced during harvesting, drying, or packaging. This approach preserves the nuts' natural flavor and nutritional profile, meeting consumer demand for minimally processed products. • Standards Compliance: All handling and processing methods comply with Global Food Safety Initiative (GFSI) standards, ensuring that the nuts are safe for consumption without the need for chemical processing aids. Additionally, most macadamia nuts meet HACCP guidelines, affirming that food safety risks are controlled through rigorous monitoring, without relying on external additives. Potential Allergens: While macadamia nuts are a tree nut, they contain no gluten, dairy, or other common allergens unless exposed to these in a cross-contact environment, which MSM mitigates through strict disclosure protocols in line with applicable food safety and quality standards.
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Origin	Source Macadamia nuts are classified as tree nuts, harvested from the Macadamia integrifolia and Macadamia tetraphylla species, as well as several hybrid cultivars developed for improved yield and resilience. These evergreen trees produce nuts with a thick, durable shell that protects the edible kernel, known for its creamy, buttery texture and high oil content. Geographic Origin Native to the rainforests of Queensland, Australia, macadamia trees thrive in subtropical climates. Today, the main producers are South Africa, Australia, Kenya, and Hawaii, where these trees benefit from the ideal growing conditions. South Africa currently leads global production, attributed to favourable weather, large-scale orchards, and efficient harvesting practices. In Australia, new plantations are expanding in regions like Bundaberg and New South Wales, ensuring a steady growth in the global macadamia market. The nuts processed by MSM originate from these prime growing regions. Upon harvest, the nuts are transported in bulk to the processing facilities where they undergo dehusking and drying to maintain freshness and quality. Cultivars and Method of Production The macadamia kernels listed on the MSM platform are from a variety of cultivars. These cultivars have been selectively grafted onto robust rootstocks that enhance tree growth and nut quality. Grafted macadamia trees typically reach commercial maturity within 5 to 7 years, producing nuts that naturally fall when mature, a feature that reduces labor during harvest. Once harvested, nuts are immediately dehusked, revealing the Nut in Shell (NIS), which undergoes a drying process to reduce moisture content from around 30% to an optimal 1.5-3%. This drying stage not only stabilizes the nuts for storage but also helps maintain kernel quality, making them suitable for cracking and processing. With minimal processing, the nuts retain their natural flavor and nutritional value, meeting consumer preferences for pure, whole foods. Cultivar Disclosure While MSM does not require specific cultivar disclosure for kernel sales, the country of origin remains an essential identifier, ensuring product traceability and compliance with quality standards.
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Storage and Packaging	Suggested Storage Requirements Macadamia kernels should be stored under controlled conditions to maintain their quality and extend shelf life: • Temperature: Kernels should be kept in a cool, dry area, ideally at temperatures below 10-15°C (50-59°F), to preserve flavor and prevent rancidity. • Humidity: Relative humidity should be maintained below 55% to prevent moisture absorption, which can negatively affect kernel texture and stability. • Ventilation: Airflow around storage containers should be sufficient to prevent moisture buildup. Kernels should be stored in moisture-resistant, sealed packaging to avoid exposure to environmental humidity. For extended storage periods, a temperature-controlled environment is recommended to maintain optimal freshness and quality for up to 12 months, safeguarding the product's flavor profile and nutritional value. Suggested Packaging Specifications Macadamia kernels should be packed in food-grade, airtight containers to protect them during storage and transportation. Packaging specifications should include: • Primary Packaging: Kernels should be packed in vacuum-sealed or nitrogen-flushed bags made from multi-layer materials that offer superior moisture and oxygen barriers. This ensures the preservation of natural oils and reduces the risk of rancidity. • Secondary Packaging: For bulk orders, vacuum-sealed bags should be packed into strong corrugated cartons. Cartons should be palletized and shrink-wrapped to secure the load and protect against physical damage during transit. • Labeling: Packaging should include essential product information as specified in the next section. This approach to packaging and storage follows international standards to ensure that macadamia kernels remain protected from contaminants and environmental factors during distribution and storage.
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END PRODUCT SPECIFICATION:

Please note that the following specifications are based on the best practices available to MSM at the time of writing. For the most current and authoritative guidelines, please refer to the latest World Macadamia Organisation (WMO) specifications, which take precedence in case of any discrepancies. All MSM sellers agree to comply with MSM specifications AND WMO specifications.

Product Description	Macadamia nut kernels sourced from both Macadamia integrifolia and hybrid varieties, graded according to standard styles. Kernels are dried and vacuum-packed and boxed for preservation and quality control, ensuring they are suitable for further processing or direct sale.
Composition	The final product consists of vacuum-packed, food-grade macadamia nut kernels, sorted by style and packed into new cartons.
Method of Preservation	Kernels should be vacuum-packed and flushed with nitrogen or CO ₂ to extend shelf life by reducing exposure to oxygen, which can cause oxidation and rancidity.
Primary Packaging	Kernels should be packed in laminated foil or plastic pouches designed to provide an excellent barrier against moisture and oxygen, preserving the nuts' flavor and quality. Each style may require different packaging volumes to suit specific style grades and customer preferences. The WMO recommended structure of the liner is 12 µm PET / 9 µm Foil / 120 µm LLDPE with packs to be nitrogen or carbon dioxide flushed and vacuum-sealed with a residual oxygen level of less than 2%. The target transmission rates are specified in Table 5 of the WMO specification attached.
Secondary Packaging	For larger shipments, the pouches are then placed in corrugated board cartons. The packaging should ensure durability for storage and transportation. Cartons should be palletized as needed and shrink-wrapped for added security during transit.
Storage Conditions	To maintain optimal quality, kernels should be stored in cool, dry conditions with relative humidity below 55%. The storage area should be well-ventilated and free from contaminants such as dust, odors, and pests. It is suggested that the storage temperature should not exceed 25°C to prevent the macadamia oil within the kernel from turning rancid.
Carton Markings	Each carton should be labeled with essential product information, including: • Product name • Packer or seller's name, address, and contact details • Style and grade • Country of origin • Net weight • Lot or batch number for traceability • Date code or best before date • Allergen information • Storage instructions
Distribution Method	Products should be distributed either loose-packed or palletized, depending on customer requirements. Cartons may be packed into standard shipping containers, following export packaging and labelling requirements for international shipments.

Shelf life	The current industry consensus is that macadamia shelf life of up to 24 months from the date of packing if stored in adherence to specified storage conditions. Opened packaging should be resealed and stored in a cool, dry area to maintain quality. Each carton's shelf life should be indicated on it through a best-before date as determined by the seller.
Intended Use	These kernels are suitable for further processing by industrial food companies. They are intended for use in products like snacks, and baked goods. Only pasteurized products are suitable for direct retail packaging.
Final Customer Preparation	Intended for further processing, roasting, packaging, and marketing by other industrial food companies.
Foreign Materials	Foreign matter includes any product that is not kernel and/or shell. Macadamia kernels should be subject to strict controls to ensure they are free from foreign materials, including metals, plastic, and glass. Quality control measures should include: Metal Detection - Kernels should pass through metal detectors set to detect any metals > 2mm. Visual Inspections: Production lines employ regular visual inspections to identify and remove any visible foreign materials, such as shell fragments, plastic, or glass, which could enter during processing. X-Ray Inspection: For added security, some facilities may utilize X-ray systems to detect denser foreign objects like glass and certain plastics. These controls align with the requirements set by HACCP to ensure consumer safety and maintain high product quality

PHYSICAL SPECIFICATION:	
Allergens	Macadamia kernels are tree nuts and can trigger reactions in individuals with nut allergies. While macadamia processing facilities generally prioritize allergen control, MSM requires potential allergen disclosure from all sellers on the platform. Therefore, there is a potential for cross-contact with other nuts, including peanuts, depending on each facility's specific protocols.
Additives	Macadamia kernels on the MSM platform should be free from any additives, aligning with best practices for natural product purity. All kernels are minimally processed to preserve natural quality.
Intrinsic character	Macadamia kernels have a naturally low water activity, which reduces microbial growth potential. This characteristic supports long-term stability when stored under recommended conditions.
Appearance	Kernels should range from creamy white to light golden in colour, free from excessive dust or oil. Natural colour variation may occur due to seasonal and varietal differences, which do not affect the quality.
Flavor	Should be rich and creamy, characteristic of fresh macadamias, without rancid or off flavours.
Texture	Kernels are expected to be firm, crunchy, and plump/unshrivelled reflecting their freshness and appropriate processing.
Loose Shell	Loose shell is defined as pieces of shell that cannot pass through a 3mm round hole. Maximum allowable amounts are: • Style 0-4: 1 piece per 10 kg • Style 5-6: 3 pieces per 10 kg
Impacted Shell	Should not exceed 1% by weight to maintain high product quality. Impacted shell is defined as shell that is embedded in the kernel and cannot pass through a 2mm round hole
Unsound Kernels	A combined total of unsound kernels should not exceed 3% by weight, with reject-grade kernels limited to 2%.
Chemical Properties	Moisture Content: Should be maintained below 1.8% to extend shelf life. Flash Point: Approximately 346°C Boiling Point: Estimated at 260°C Specific Gravity: Typically 0.926 Water Solubility: Insoluble
Pests	The product should be free from any living or dead insects or rodents.

Microbiological Specification

On the MSM Trading Platform, for any product sold, the Microbiological and Chemical test results as outlined below must be submitted at least 14 days prior to the estimated shipment date. Also before that date, the seller must submit the required referee samples to MSM.

Organism	Test Method	Maximum Limit
E-Coli	ISO 16649	Absent/Negative
	AS 5013.15-2006	<3/g
Salmonella	ISO 16649	Absent/Negative
	AS 5013.10-2009	Absent/Negative
Plate Count	AOAC 990.12	<30 000cfu/g
	AS 5013.1	<30 000cfu/g
Yeast	AS 17662.2-2009	<20 000 cfu/g
Mould	AS 17662.2-2009	<20 000 cfu/g
Coliforms (Style 0-4)	ISO 4832:2006	<300 cfu/g
Coliforms (Style 5-8)	ISO 4832:2007	<350 cfu/g
Listeria Monocytogenes	WI-AN-079	Absent / 25g
Staphylococcus aureus	ISO 6888:1999	<10 cfu/g
Enterobacteria	ISO 21528:1999	<100 cfu/g
B. cereus	ISO 7932:2004	<1000 cfu/g

Chemical Specification

Chemical	Test Method	Maximum Limit
Total Aflatoxin	WI-AN-017 HPLC AOAC 991.31	<4 ppb
Aflatoxin B1	WI-AN-017 HPLC AOAC 991.31	< 2 ppb
Free Fatty Acid	AOCS Ca-5a-40	< 0.5%
Peroxide Value (2-year shelf life)	AOCS Cd-8b-90	≤2 meq/kg
Peroxide Value (1-year shelf life)	AOCS Cd-8b-90	≤3 meq/kg
Maximum Chemical Residue	Comply with export country MRL specifications.	

Heavy Metal Specification

Metal	Test Method	Maximum Limit
Lead (Pb)	ISO 6633:1984	<0.1 mg/kg
Mercury (Hg)	ISO 6637:1984	<0.03 mg/kg
Cadmium (Cd)	ISO 6561:2005	<0.05 mg/kg
Arsenic (As)	AOAC 2013.06 (ICP-MS)	<0.01 mg/kg

NUTRITIONAL ANALYSIS:		
Chemical Composition per 100g:		
Proximates:		
Water	1.36	g
Energy kcal	718	kcal
Energy kJ	3004	kJ
Protein (N x 5.3)	7.91	g
Total lipid (fat)	75.77	g
Ash	1.14	g
Carbohydrate, by difference	13.82	g
Fiber, total dietary	8.6	g
Sugars, total	4.57	g
Sucrose	4.43	g
Glucose	0.07	g
Fructose	0.07	g
Starch	1.05	g
Minerals:		
Calcium	85	mg
Iron	3.69	mg
Magnesium	130	mg
Phosphorus	188	mg
Potassium	368	mg
Sodium	5	mg
Zinc	1.30	mg
Copper	0.756	mg
Manganese	4.131	mg
Lipids:		
Fatty acids, total saturated	12.061	g
12:0	0.076	g
14:0	0.659	g
16:0	6.036	g
17:0	0.124	g
18:0	2.329	g
20:0	1.940	g
22:0	0.616	g
24:0	0.281	g
Fatty acids, total monounsaturated	58.877	g
16:1	12.981	g
18:1	43.755	g
20:1	1.890	g
22:1	0.233	g

24:1	0.018	g
Fatty acids, total polyunsaturated	1.502	g
18:2	1.296	g
18:3	0.206	g
Cholesterol	0	mg
Caloric Factors:		
Protein	3.47	kcal/g
Fat	8.37	kcal/g
Carbohydrate	4.07	kcal/g
Varietal differences and crop conditions can cause variations to the above		
Source: USDA National Nutrient for Standard Reference, Release 25, 2012		

Macadamias are often claimed to be naturally cholesterol-free, with a rich profile of unsaturated fats that contribute to the nut's health benefits, such as anti-inflammatory properties.

Varietal differences and growing conditions may result in slight variations in these values. This nutritional profile aligns with data from sources such as the USDA and World Macadamia Organisation, underscoring macadamias' high-energy, low-carbohydrate content, and their significant concentration of healthy monounsaturated fats, particularly oleic acid, making them a favourable addition to a balanced diet.

These values reflect an updated and reliable analysis that provides the foundation for nutritional labelling and dietary considerations for macadamia kernels on the MSM platform

Kernel Definitions and Sizing Criteria	
Grade 1/ Premium grade kernel	Fully mature kernels that are free from significant defects. These kernels must be without off odours or flavours, suitable for high-quality consumption.
Commercial grade kernel	Kernels exhibiting minor visual defects such as slight discolouration or immaturity. These kernels are free from off odours and flavours, making them suitable for further processing, typically by dicing and/or coating.
Industrial grade Reject kernel	Kernels with defects that include insect damage, mould, pitted centres, internal discolouration, and significant surface flaws. Kernels with pink or blue staining or off odours/tastes fall into this category and are considered unsuitable for consumption.
Whole Kernel	A whole kernel is defined as a macadamia nut kernel that remains intact and is not split or separated into halves. It may have up to 25% of its mass missing, as long as this does not materially affect the overall contour of the kernel. Whole kernels are sized using round sieves to ensure consistency.
Half Kernel	Defined as approximately half of a whole kernel, with no more than 12.5% of its mass missing. The measurement is taken across the widest axis to confirm size and shape. This standard ensures that half kernels retain a substantial portion of their mass and visual appeal, making them suitable for applications requiring intact halves
Pieces	Pieces include kernels that have naturally broken apart or have been intentionally diced. These pieces adhere to the size specifications as outlined in the style definitions. They are screened to match the specified size ranges, ensuring uniformity in the product.
Sizing Methodology	Unless otherwise specified, size ranges are based on round sieve measurements. A product should be able to pass over a smaller round sieve (measured in mm) and through a larger round sieve. Sizing tolerances allow for a 10% variance in kernel sizes, meaning a slight deviation above or below the specified size is acceptable. Alternative sizing methods may be used if they achieve comparable results to the standard round sieve process, allowing for flexibility while maintaining the integrity of the size specifications.

STYLE SPECIFICATIONS	
First Grade Styles	
Style 0	Minimum 95% whole kernels (>20mm)
Style 1/1L	Minimum 90% whole kernels (16mm - 20mm)
Style 1S	Minimum 90% whole kernels (13mm - 18mm)
Style 2	Minimum 50% whole kernel (>13mm)
Style 3	Min 15% whole kernel (>13mm)
Style 4L/4	Minimum 80% halves (>13mm)
Style 4S	Minimum 50% halves (10mm - 14mm)
Style 5	Pieces (8mm - 12mm)
Style 6	Pieces (5 - 9mm)
Style 7	Chips (3 - 6mm)
Style 8	Fines or Meal (<3mm)

Commercial Grade Styles

- **Intended Use:** These styles are typically used for processing into other food products, where the visual appearance of the kernel is secondary to its utility as an ingredient.
- **Insect Damage:** For Style M, kernels may include minor imperfections due to late insect damage. These kernels are appropriate for industrial food applications but are generally not suitable for direct consumer sale in their raw state.
- **Style convention:** The style convention from premium may also be used, and indicated by prefixing the style with "COM" e.g. COM Style 1S. Additional styles for commercial use are shown below.

Commercial grade styles	
COM Style M – mixed style	Mix style – late insect damage

INTENDED USE	
Product use and preparation	Product is intended to be baked, roasted, pasteurized, or heat-treated before consumption. In compliance with the Preventive Controls for Human Food regulation (FSMA 21 CFR Part 117), MSM has conducted a hazard analysis and identified potential microorganisms (including, but not limited to, Salmonella) as hazards that require preventive controls. Buyers agree that they will implement the necessary processing controls for identified hazards and accept responsibility for processing the product to ensure safety.
Customer target group	All customers, particularly those in the food processing and value-adding sectors, where further processing is required before reaching end consumers.
High-risk groups	Consumers with nut allergies are at higher risk due to the product's classification as a tree nut. Appropriate allergen labelling and handling precautions are advised.

Dietary Requirements	
Coeliac	No gluten in the product, no gluten in production line. MSM cannot guarantee against cross-contamination during post-shipment handling.
Vegetarian	No animal products in the product, no animal products in the production line. MSM cannot guarantee against cross-contamination during post-shipment handling.
Vegan	No animal products in the product, no animal products in the production line. MSM cannot guarantee against cross-contamination during post-shipment handling.
Lactose Intolerant	No dairy products in the product, no dairy products in the production line. MSM cannot guarantee against cross-contamination during post-shipment handling.

Referee Samples

To maintain quality standards and support dispute resolution, MSM requires the submission of referee samples from sellers, as follows:

Sample Collection Requirements

- **Quantity:** Sellers must provide two distinct samples for each production batch in a consignment:
 - **One quality sample:** Minimum 1 kilogram, used for immediate quality and organoleptic verification.
 - **One food safety sample:** Minimum 500 grams, retained in an unopened, sealed condition for analysis in the event of a food safety dispute.

Purpose of Referee Samples

- **Quality and Safety Verification:** The samples serve as a standard reference in disputes, allowing for objective verification against MSM's quality and food safety specifications.
- **Dispute Resolution:** MSM may request these samples for third-party analysis by a qualified institution if a quality or food safety dispute arises between the parties.

Sampling Method

- **Sample Size:** Collect a test sample of at least 1 kilogram for each production lot or batch of kernel.
- **Sub-Samples:** This 1-kilogram test sample should comprise a minimum of 20 sub-samples, taken representatively throughout the production of the lot to ensure it accurately reflects the entire batch.
- **Lot Size:** Each lot should not exceed 20 tons of kernel. If a validated pasteurization process is employed, the lot size may be increased to 30 tons.
- **Sampling Point:** Samples must represent each style produced and should be collected at the point of kernel packing.

Additional Certification

Different countries have different requirements pertaining to the import and export of macadamia DNIS and/or kernel. Since these can only be determined once both the buyer and seller countries are known, MSM cannot explicitly state what is required. The platform will provide the functionality to upload and filter according to these certifications as it does for PPECB, Kosher, Halal, Organic and other certifications – but the onus rests on the buyer and seller to ensure that all the required certifications and registration are in place for successful export(seller) and import(buyer) of the product.

Disclaimer on Acceptance Criteria

MSM requires all products listed on its platform to conform to the standards outlined in this specification document. Sellers are responsible for ensuring their products consistently meet the specified physical, chemical, microbiological, and packaging parameters. Non-compliance with these standards may result in the rejection of individual product batches or, in cases of repeated non-conformance, the removal of the seller from the platform.

Acceptance criteria include, but are not limited to:

1. **Adherence to Product Specifications:** Sellers must ensure products conform to the physical, sensory, and compositional characteristics defined in these specifications. Deviations from specified parameters will be deemed non-compliant.
2. **Compliance with Microbiological Standards:** Products must meet acceptable microbiological thresholds to ensure consumer safety. Non-compliance with these safety standards may result in batch rejection.
3. **Accuracy of Declared Weight:** Products must meet the specified net weight. Any significant discrepancies may lead to product rejection.
4. **Packaging Integrity:** All products should be securely packaged to maintain quality. Defective packaging, which could compromise product safety or quality, will result in batch rejection.

By listing products on the MSM platform, sellers agree to comply with these requirements. MSM reserves the right to reject products or suspend sellers from the platform if they fail to meet these standards, to ensure that only quality-assured products are available to buyers.

Certified HACCP system

Each processor must have a 3rd party certified HACCP system in place. The system must be certified by a registered accredited certification body.

Approved supplier program

It is best practice for nut-in-shell (NIS) suppliers of certified processors to have in place a food safety based approved supplier program that is at least 2nd party audited.

Country of origin

All macadamia nuts sold must be labelled with the country of origin in which they were grown.

Nut-in-shell storage and handling

- Prior to being dried to the moisture level for cracking, NIS must be stored by the processor in conditions that provide forced ventilation.
- NIS should be dried to less than 7.5% NIS moisture within 14 days following intake (by processor or other drying facility).
- NIS held in ambient conditions should be processed within 90 days.
- NIS held for longer than 90 days must be stored in a temperature-controlled environment at <15°C and, if possible, a relative humidity not exceeding 70% for up to 270 days.

An alternative validated process may also be used, as long as it does not adversely affect kernel quality

Kernel product classification and labelling

Standard description format

This standard requires that the product be descriptively labelled using the following terminology or abbreviation:

- Wholes (W), Halves (H), Pieces (P), Natural (N), Diced (D)
- Minimum % wholes, with wholes always being the first stated in a blend of wholes and halves
- Size range in mm

Wholes – kernels which are not split into halves, nor with more than 1/4 of the kernel missing, provided that the kernel contour is not materially affected by the missing portion.

Halves – means that approximately half of a whole kernel, with not more than 1/8 of its mass missing.

Pieces – pieces can be naturally broken or diced with the size specifications listed in Table 1.

Unless otherwise defined, the size ranges stated will be understood to indicate that product will pass over a smaller round screen (with size expressed in mm diameter) and pass through a larger round screen (with size expressed in mm diameter). Alternative sizing methods may be used but must obtain equivalent sizing to that achieved by passing over a round screen. Size range in mm with a 10% tolerance for over or under-sized kernels.

The three different grades are defined as:

Premium kernel

Defined as kernel that is fully mature kernel free from significant defects. Must be free from off odours and flavours.

Commercial grade kernel

Defined as kernel that exhibits minor visual defects, such as surface discolouration and immaturity. The kernel must be free from off odours and flavours. This kernel is suitable for food usage but is usually further processed by dicing and/or coating.

Reject kernel

Defined as kernel that contains defects such as insect damage, mould, pitted centre, internal discolouration, pink and/or blue staining and major defects for disorders such as basal discolouration, immaturity, discoloured crest, adhered skin or if the kernel exhibits off-odour or off-taste.

Different quality grades of product should use the following abbreviations:

Premium PREM

Commercial COM

The standard terminology and abbreviation for roasted product is as follows:

Dry Roasted (unsalted) DR

Dry Roasted & Salted DRS

Oil Roasted (unsalted) OR

Oil Roasted & Salted ORS

Raw RAW

Non-standard kernel styles must incorporate the prefix “SP” to indicate a special (non-standard) specification. SP ‘styles’ should use “SP” and the closest standard style that they represent.

An example of the descriptive labelling convention, for a special blend of 70% whole kernel and 30% half kernel of the size range 17-20mm, which is deemed closest to Style 1, and has been dry roasted and salted would be labelled as follows:

PREM STYLE SP 1 70%W 17-20mm DRS

An example of the descriptive labelling convention, for an in-specification Style 1, with 90% whole kernel and size range 16-20mm which has been dry roasted and salted would be labelled as follows:

PREM STYLE 1 90%W 16-20mm DRS

Style conventions

“Style” is to define the various kernel sizes and blends.

Table 1. Accepted definitions for labelling

Style 0	Min 95% whole kernel	>20mm
Style 1	Min 90% whole kernel	16-20mm
Style 1S	Min 90% whole kernel	13-18mm
Style 2	Min 50% whole kernel	>13mm
Style 3	Min 15% whole kernel	>13mm
Style 4L	Min 80% halves	>13mm
Style 4S	Min 50% halves	10-14mm
Style 5	Pieces	8-12mm
Style 6	Pieces	5-9mm
Style 7	Pieces	3-6mm
Style 8	Fines or Meal	<3mm

The style convention in Table 1 is also applicable for commercial grade kernel but must use the prefix of COM as follows:

COM Style 2 50%W >13mm DRS

Final kernel product testing

Microbiological standards

Table 2. Microbiological testing requirements and limits

Organism	Max limits raw kernel	Max limits roasted kernel	Test method
E-coli	Not detected <3	Not detected <3	ISO16649 OR internationally accredited test method, including: /g (AS 5013.15 – 2006)
Salmonella	N.D.	N.D.	Sample size minimum 250g ISO6579 OR internationally accredited test method, including: /g (AS 5013.10 – 2009)
Standard plate count	<30,000 cfu	<3,000 cfu	/g (AOAC 990.12) or (AS 5013.1)
Yeasts and moulds	<20,000 cfu	<2,000 cfu	/g (AS1766.2.2 – 2009)

Chemical standards

Table 3. Chemical testing requirements and limits (at time of packing)

Chemical	Maximum limits	Test method
Total aflatoxin (µg/kg)	Must meet consuming country's limits	HPLC/LCMS
B1 (µg/kg)	Must meet consuming country's limits	HPLC/LCMS
Free fatty acid	0.5%	(AOCS Ca-5a-40)
Peroxide value	≤2 meq/kg (2 years shelf-life)	(AOCS Cd-8b-90)
Peroxide value	Between 2 and 3 meq/kg (1 year shelf-life)	(AOCS Cd-8b-90)

Sampling for microbiological and chemical analysis

Sampling should follow the guidelines of ISO 3951-4:2011:

“Sampling procedures for inspection by variables — Part 4: Procedures for assessment of declared quality levels” or the following sampling prescriptions as a minimum procedure to ensure representative sampling of the lot:

- All products must be sampled and tested at the minimum rate of not less than 1.0kg for each production lot (or batch) of kernel. A 1.0kg test sample must be collected using a minimum of 20 sub-samples, taken representatively throughout the production of the lot.
- Lot size for this purpose must not exceed 20 tonnes of kernel.
- If a validated pasteurisation process is used, lot sizes may be increased to 30 tonnes.
- Samples must represent each style produced and are to be collected at the point of kernel packing.

Laboratory accreditation

All laboratories undertaking microbiological and chemical analysis must be accredited by NATA or an ISO17025 Accredited or another equivalent Food Physico-Chemical and Microbiological analytical laboratory.

Kernel retention samples

Retention samples for microbiological and chemical analysis must be retained for each batch of product at a minimum rate of 400g per lot (lot size must not exceed the defined limits) under the recommended storage conditions of the finished product and for the shelf-life of the product in packaging that will protect the integrity of the product for the intended test purpose.

Physical kernel specifications at the point of packing

Macadamia kernel sold as premium grade must meet the acceptable limits for kernel moisture, appearance, taste, foreign material, shell, and defective kernel as set out in Table 4 or meet agreed customer specifications.

All products must be representatively sampled and tested. Lot size for this purpose shall not exceed 1 tonne of kernel for each test. Samples are to represent each style produced and are to be collected prior to or at the point of kernel packing.

Table 4. Physical kernel specifications

	Premium grade
	Raw
Kernel moisture content	Not to exceed 1.8%
Appearance and taste	White/cream in colour or as specified for roasted product
	Free from excessive dust or oil.
	Crunchy texture (excluding meal) with a typical macadamia flavour
	Free from off odours and flavours
	Each style must be reasonably uniform in shape, colour and size.
Foreign matter*	Target nil
Loose shell**	Style 0-4: max 1 piece per 10kg
	Style 5-8: max 3 pieces per 10kg
Impacted shell***	Not more than 1% of kernels by weight
Unsound kernel (reject plus commercial grade kernel)	Not more than a combined total of 3% unsound kernel by weight, of which reject grade kernel must not exceed 2% by weight
Wholes, halves, piece count	Must meet specification per Table 1 and/or as per customer requirements

Definitions

* Foreign matter includes any product that is not kernel and/or shell.

** Loose shell is defined as pieces of shell that cannot pass through a 3mm round hole.

*** Impacted shell is defined as shell that is embedded in the kernel and cannot pass through a 2mm round hole

Agrichemical residue testing

All products must conform to importing country's maximum residue levels (MRL) for agricultural chemicals.

Bulk packaging specifications for kernel

All macadamia kernel sold must be packaged in a form and manner appropriate to the claimed shelf-life. To claim the optimal shelf-life, product must be packed in a modified atmospheric packaging (MAP).

The recommended structure of the liner is 12µm PET / 9µm Foil / 120µm LLDPE with packs to be nitrogen or carbon dioxide flushed and vacuum-sealed with a residual oxygen level of less than 2%. The target transmission rates are specified in Table 5.

Table 5. Bulk packaging transmission rate specifications

O2 Barrier	H2O Barrier
<0.10cc / m2 / 24h (at 25°C, 75% RH, 1 atm)	<0.25gm / m2 / 24h

All packers should implement a process for ensuring the integrity of the inner and outer packaging is maintained

Packing and labelling of finished kernel product

All bulk packaging must comply with regulatory standards and display the following information:

- Packer or seller's name, address, and contact details
- Country of origin
- Product style code
- Lot code or unique code
- Net weight
- Shelf-life (either by best before date or pack date and shelf-life statement)

It is recommended that all bulk packaging display the following information:

- Pack date
- Best before date
- Recommended storage conditions

Final product storage

Storage should be in conditions that preserve quality and prevent insect infestation.

It is recommended that finished product be stored under suitable climate-controlled conditions prior to dispatch to the customer. The recommended maximum temperature for storage of macadamia kernel is 12°C.

Kernel product specification sheets

Processors must have a product specification sheet for each product sold under the WMO Global Product Standard which must contain the following:

- Product code
- Product size details
- Description of acceptable taste and aroma
- Maximum acceptable moisture content
- Maximum levels of defective kernel, impacted shell and foreign material
- Maximum microbiological levels for salmonella, E-coli, standard plate count, yeasts and moulds
- Maximum levels for aflatoxin, peroxide value and free fatty acid
- Description of the pack date, shelf-life and/or best before date
- Recommended storage conditions

Reprocessing and blending of finished material

When product is blended from batches of different production dates then the blended lot shall use the shelf-life of the oldest component.

In order for an extended shelf-life to be claimed, the finished product must be tested and show chemical and microbiological results consistent with that extended shelf-life.

All production and re-processing activities are to be conducted in a manner which is consistent with the delivery of high-quality outcomes to customers throughout the supply chain.

Product traceability

All finished product must have forward and backwards traceability.

Pasteurisation/ready to eat

If macadamias are sold as ready to eat it is recommended that kernel be pasteurised in a system that has been validated to provide a 5-log reduction in salmonella using the Almond Board of California Guidelines for Process Validation Using *Enterococcus faecium* NRRL B-235.



Macadamia Kernel Style Guide

All styles set out below are premium grade



Style 0

Min 95% wholes

> 20 mm



Style 1

Min 90% wholes

16 - 20 mm



Style 1S

Min 90% wholes

13 - 18 mm



Style 2

Min 50% wholes

> 13 mm



Style 3

Min 15% wholes

> 13 mm



Style 4L

Min 80% halves

> 13 mm



Style 4S

Min 50% halves

10 - 14 mm



Style 5

Pieces

8 - 12 mm



Style 6

Pieces

5 - 9 mm



Style 7

Pieces

3 - 6 mm



Style 8

Fine pieces and meal

< 3mm

Wholes

Kernels which are not split into halves, nor with more than 1/4 of the kernel missing, provided that the kernel contour is not materially affected by the missing portion.

Halves

Means that half of a whole kernel, with not more than 1/8 of its mass missing.

Pieces

Pieces can be naturally broken or diced with the size specifications listed above.

Fines / Meal

Fines / meal are produced when macadamias are diced and consist of any small material less than 3mm in size.



Comparison Chart

20mm



Style 0

> 20 mm



Style 1

16 - 20 mm



Style 1S

13 - 18 mm



Style 2

> 13 mm

10mm

0mm

20mm



Style 3

> 13 mm



Style 4L

> 13 mm



Style 4S

10 - 14 mm



Style 5

8 - 12 mm

10mm

0mm

20mm

10mm

0mm



Style 6

5 - 9 mm



Style 7

3 - 6 mm



Style 8

< 3 mm

Macadamia storage and handling

Macadamias are known for their “good fats”, but this high fat content means there are some special considerations when it comes to storage and handling. Macadamia kernel have the potential for a long shelf life if handled correctly. The two most influential factors in achieving this are moisture and oxygen.

BULK PACKING

To maximise shelf life, control both moisture and oxygen and employ high-barrier packaging kept consistently below 12°C.

Recommended packaging

- Pack under vacuum or controlled atmosphere (MAP)
- Use high barrier foil films (e.g. 12µm PET/9µm Foil/120µm LLDPE)
- Flush and seal with nitrogen or carbon dioxide
- Ensure residual oxygen is <2%
- Oxygen barrier <0.10cc/m²/24h; water barrier <0.25g/m²/24h (tested at 25°C, 75% RH, 1 atm)

Handling opened bulk packs

- Reseal immediately or transfer to airtight plastic container
- Store below 12°C (preferably 5–10°C) to retain crunch, flavour and prevent oxidation

BULK HOPPERS/LOOSE NUTS

When selling macadamia kernel through bulk hoppers, it is more challenging to maintain the product's freshness and crunch as there is no barrier to oxygen or moisture.

However, by adopting some simple practices, the product's freshness can be maintained:

- Use hoppers with lids that close after each use
- Keep volumes low and ensure stock turnover every 2–3 days
- Fully empty and clean hoppers before refilling
- Add fresh stock first, then older stock on top

STORAGE

Macadamias have a high fat content, which makes them sensitive to oxygen and moisture. When stored properly, kernels can achieve a 24-month shelf life.

Storage guidelines

- Always store in original, unopened packaging in a cool, dry place
- Ideal storage temperature: ≤12°C
- Once opened, reseal or transfer to an airtight container
- Avoid exposure to ambient air to prevent moisture uptake and texture loss

RETAIL PACKING

Retail packs are generally not packed under a vacuum so the barrier properties will heavily influence the shelf life of the final product.

There are many types of retail packaging available. The higher the barrier to oxygen and water, the longer the use-by date can be.

Recommended retail materials

- High barrier flexible packaging
- Hermetically sealed metal cans or glass jars
- Use modified atmospheric conditions when possible
- Retailers must determine shelf life based on packaging and kernel treatment

KERNEL ROASTING

Roast at low temperatures and test parameters to achieve an even, creamy kernel colour.

Generally the best roasting results are achieved by roasting at a lower temperature for a longer time.

Before roasting a full batch of kernel, a small test batch should be trialled to determine whether the roasting parameters need adjustment. This could involve changes to the roasting time and/or temperature.

A suggested starting point for a continuous nut roaster such as a Proctor or Aeroglide is 125°C for approximately 11 minutes. If an adequate level of roast is not achieved, the time and/or temperature can be increased.

The consumer is typically looking for a final roasted product that has an even creamy colour, contains no dark kernel and has a pleasant roasted flavour that is not over-done.