



Badrakh Energy LLC
Zuuvch-Ovoo Uranium Project
H376512

Technical Specification
Mechanical Engineering
Packing, Marking and Shipping Requirement

Technical Specification

Packing, Marking and Shipping Requirement

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1. Purpose

To define the minimum packaging marking and shipping requirements for materials and equipment destined for the Zuuvch Ovoo Uranium project located in the aimag (province) of Dornogobi in Mongolia, approximately 530 km south-east of the city of Ulaanbaatar, ensuring protection against extreme environmental conditions during transport, handling, marking and storage.

2. Scope

- 2.1 These instructions define the Contractor's responsibilities for ensuring that all materials and equipment are:
- Appropriately packed for transportation by road, rail, sea, and air to various logistics points including consolidation hubs, modularisation/preassembly yards, and laydown/staging areas
 - Preserved effectively prior to packing, considering the site's harsh climate – extreme temperatures, sandstorms, and low humidity
 - Clearly and correctly marked on all cases and crates to facilitate safe handling and identification
 - Supported with all necessary services to ensure compliance with project requirements and environmental resilience.
- 2.2 This document outlines the minimum packing requirements for materials and equipment destined for the Zuuvch Ovoo Uranium Plant in Dornogobi, Mongolia. Given the site's challenging environmental conditions – including temperature extremes – refer “Site Climatic Conditions” specifications to know temperature extremes, frequent sandstorms, low annual rainfall, and high wind speeds – packaging must be designed to withstand multimodal transportation, handling, and prolonged outdoor storage. Materials will be shipped via sea, air, road, or rail through airports, terminals, consolidation hubs, modularisation/preassembly yards, and laydown/staging areas before reaching the site. Both standard and abnormal loads are expected, requiring a broad range of packing solutions.
- 2.3 Where specific packing instructions are provided in the purchase order and differ from or supplement this specification, the instructions in the purchase order shall take precedence.
- 2.4 Final packing authorisation and shipping release from the project team must be obtained for each item prior to dispatch.

3. Application

This document applies to all Contractor's of material and equipment to the project.

4. Definitions

Table 4-1: Definitions

Term	Description
Client	Badrakh Energy LLC, its authorised representatives and respective affiliates
IMDG	International Maritime Dangerous Goods
FCL	Full Container Load
Freight Forwarder	The company responsible for performing the freight forwarding activities required to transport the equipment and materials from the Vendors shipping locations to the project site
LCL	Less than Container load
Material and equipment	All or part of the material, equipment, including technical documentation, as described in the purchase order, to be provided by the Contractor
Contractor	Either same as the Vendor or the Vendor's sub-supplier and subcontractor
Vendor	The company(ies) with whom the Project has placed a purchase order for materials and/or equipment
FIBC	Flexible Intermediate Bulk Containers

5. Responsibilities and Guarantees

- 5.1 This section outlines the minimum requirements to be implemented by the Contractor, in accordance with international best practices. These requirements are not exhaustive. If the Contractor has a specification that exceeds the standards outlined herein, it must be adopted after consultation with the project team. Under no circumstances shall any specification used to be of a lower standard than the highest applicable ISO-rated specification.
- 5.2 Considering the logistical challenges associated with transporting and storing equipment in a remote and climatically demanding region, the Contractor bears full responsibility for ensuring that all materials are adequately packed, protected, and preserved throughout their journey – from dispatch to final installation. This includes accounting for diverse transport modes and potential exposure to harsh environmental factors. The Contractor must select suitable packing categories based on the nature of the cargo and the anticipated transit conditions. In cases of uncertainty or deviation from standard practice, the Contractor must consult the project representative to confirm the appropriate packing approach.
- 5.3 All packaging, marking, and loading activities are subject to inspection by the project representative. The project reserves the right to reject any packing that fails to meet these specifications or does not provide adequate protection for the materials and equipment.
- To ensure accountability and protection against claims of damage during shipment, the shipper must prepare photographic or video evidence of the loading and packing process. This documentation will serve as the primary reference for verifying delivery conditions



and assessing any damage that may occur in transit.

- 5.4 The Contractor remains accountable for ensuring that all items arrive at the site in a condition suitable for installation, with adequate preservation and protection measures in place.
- 5.5 Compliance with these instructions does not absolve the Contractor of liability for damage resulting from inadequate packing, preservation, or protection. This includes costs associated with the return, replacement, or repair of damaged items.
- 5.6 The Contractor is responsible for the accuracy of declared weights and dimensions, and for ensuring that all documentation precisely reflects the contents of each package.
- 5.7 Packing must guarantee the integrity of materials and equipment for a minimum of 6-12 months of outdoor storage at the project site, considering exposure to dust, snow, and temperature extremes.
- 5.8 The Contractor must provide storage and preservation recommendations tailored to the equipment and materials supplied. For long-term storage, access must be granted to the packed equipment for pre-operational maintenance activities (e.g., motor rotation), as required by warranty conditions.
- 5.9 The Contractor is liable for any damage, degradation, or loss of functionality resulting from poor packing, inadequate stowing, or corrosion due to insufficient protection. All direct costs arising from such failures will be backcharged to the Contractor.
- 5.10 All shipments must comply with MNS4598:2025, which specifies that the maximum haulage on asphalt roads is 44 tons, including truck and trailer weight. For standard cargo, the maximum allowable weight is 27.5 tons, inclusive of cargo and container. Detachable cargo must adhere to this rule. For undetachable oversized cargo, please refer to the attached MNS4598 guidelines.

6. Packing Expertise

In circumstances where the Contractor or their subcontractors lack sufficient expertise in export-grade industrial packing – particularly for heavy equipment and materials exposed to harsh transit and site conditions – they are required to engage a qualified packing company with proven experience in heavy-duty, climate-resilient packaging.

7. General Requirements

- 7.1 Packing materials must be carefully selected and packaging must be engineered to endure repeated handling – both manual and mechanical – across various transport modes including truck, rail, air, and sea. Unless otherwise specified in the purchase order, all packaging must be capable of withstanding open, uncovered storage for up to 6-12 months under the site's demanding conditions, which include low humidity, dust exposure, snow accumulation, and wide temperature fluctuations. Accordingly, packaging must ensure:

- Safe and efficient handling
- Cost-effectiveness without compromising durability
- Protection against damage and theft
- Resistance to corrosion and rust
- Preservation coatings and fluids remain effective under ambient extremes
- Prevention of dust, moisture, and rainwater ingress.

7.2 Package design and construction must accommodate:

- Repeated handling at ports, terminals, laydown areas, and modularisation yards
- Loading and unloading across all transport modes
- Lifting lugs where required. Lifting lug type and position to be indicated on drawings. Drawings and calculations submitted as part of engineering design review cycles
- Temporary supports inside equipment where required, also marked up on drawing and instructions to remove temporary supports after installation
- Use of standard cargo handling equipment (e.g., forklifts, cranes)
- Exposure to altitude-related pressure changes and weather variability
- Transit-induced forces such as vibration, pitching, and rolling
- Stacking during transport and storage
- Harsh road conditions en-route to site, including impact on tri-axle trailers
- All packages must be clearly marked with appropriate storage codes, handling instructions, and cautionary symbols.

7.3 Packaging must be structurally sound to absorb and distribute stresses encountered during transit, ensuring delivery in install-ready condition.

7.4 The Contractor is responsible for identifying and complying with quarantine regulations for timber packaging materials. All timber must be free from bark, pests, and fungal contamination, and must be certified to international phytosanitary standards (e.g., fumigation or heat treatment).

7.5 Use of hay, straw, or any organic packing material prone to fungal or microbial growth is strictly prohibited.

7.6 Before dispatch, all equipment and materials must be inspected and cleaned to ensure they are free from soil, plant matter, and living organisms. The Contractor must take corrective action in case of non-compliance.

7.7 All saddles, supports, lifting beams, and dedicated lifting tackle required for transport must be supplied by the Contractor. These must be tested and certified, with documentation available for project review.

- 7.8 Manufacturer-specific packing instructions and recommended shipping methods shall take precedence over this specification, provided they offer superior protection.
- 7.9 Additional packing requirements specified in the enquiry, purchase order, or contract must be followed. These may supplement or override general guidelines.
- 7.10 Packaging must protect against mechanical, chemical, and moisture-related damage during all transport phases. It must comply with applicable standards in the country of origin of equipment, transport authorities in Mongolia, and international regulations (ISO, IATA, IMO).
- 7.11 Where certain requirements are impractical due to the nature of the equipment, the Contractor must propose alternative industry-standard methods that offer equivalent protection. These must be reviewed and approved by the project team.
- 7.12 If the Contractor's or manufacturer's standard packing methods provide equal or better protection at comparable cost, this must be communicated to the project team for consideration.
- 7.13 The project encourages Contractor s and manufacturers to share recommendations and insights regarding packing, protection, and handling of equipment and materials.
- 7.14 All packing materials – including crates, pallets, drums, saddles, and supports – are considered part of the purchase order and are non-returnable.
- 7.15 Supplier will be responsible for all export documentation, detailed packing list and loading and securing on to the mode of transport provided by the Client's nominated freight forwarder in the event of collection FCA Supplier's Works as per Incoterms 2020
- 7.16 The Contractor may be required to align with client-supplied material management systems, which may influence packing and documentation procedures.

8. Preservation

8.1 Preservation Plan

- 8.1.1 The Contractor is required to submit a comprehensive preservation plan covering all materials and equipment supplied. This plan must be tailored to the expected transit duration and the site's environmental exposure, including prolonged outdoor storage in a dry, windy, and temperature-extreme climate.
- 8.1.2 The preservation strategy should align with the construction schedule and include a tracking system for expiry-sensitive items. The plan must incorporate an early warning mechanism for approaching expiry dates and a prioritisation protocol to ensure materials are consumed in the correct sequence.
- 8.1.3 For rotating and mechanical equipment – such as pumps, compressors, electric motors, gearboxes, and components with shafts or bearings, the preservation plan must detail inspection intervals and specific actions to maintain operational integrity. These may include warming, drying, rotation, lubrication, and other protective measures during both transit and storage phases.



8.2 Painting and Corrosion Prevention

- 8.2.1 All paint systems and corrosion-preventive coatings specified in the purchase order shall be subject to inspection and verification by the project's Quality Control personnel and comply to "Protective Coatings Specification". Coatings must be suitable for prolonged exposure to dry, dusty, and temperature-extreme conditions, and must retain their protective properties during extended storage and transit.

8.3 Oil and Lubricants

- 8.3.1 Gearboxes and similar components that are not pre-filled with oil must be protected using vapor-phase inhibitors or equivalent preservation methods commonly accepted in the Contractor's industry. These protective measures must be capable of withstanding the environmental stresses expected during transport and storage, including temperature swings, low humidity, and airborne particulates.

8.4 Protection of Openings

- 8.4.1 All flanged openings must be securely sealed using either metal blank flange covers or plywood covers with a minimum thickness of 5.5 mm. Covers must be bolted with at least three bolts; wire attachments are strictly prohibited. A suitable gasket must be placed between the flange and the cover to ensure a tight seal. If plywood is used, all joints must be sealed with waterproof adhesive tape to prevent ingress of moisture and dust.
- 8.4.2 Desiccant bags must be placed inside all moisture-sensitive openings prior to sealing. These areas must be clearly tagged with warning labels indicating the presence of desiccants and the requirement for removal before installation.
- 8.4.3 Unconnected pipe threads must be protected using threaded metal plugs or caps. Each protected thread must be tagged with metal labels indicating its purpose, connection reference, or drawing identification as per project documentation.
- 8.4.4 All closures that are part of the original equipment must be properly fitted and secured to prevent environmental ingress or mechanical damage during transit and storage.

8.5 Preservation of Electric/Electronic Items

- 8.5.1 Contact preservatives and impregnated paper must not be applied to any electrical or electronic equipment. Instead, all openings must be sealed using waterproof tape or laminated moisture-resistant barriers to prevent ingress of dust and humidity during transit and storage.
- 8.5.2 Electronic components must be enclosed in sealed polyethylene bags with an appropriate quantity of desiccants, in accordance with industry best practices for the specific equipment type. These measures are essential to maintain functionality and prevent moisture-related degradation under prolonged exposure to dry, dusty, and temperature-variable conditions.

8.6 Use of Desiccants

- 8.6.1 The use of desiccants is critical for protecting sensitive equipment and instrumentation from moisture-related damage, particularly in environments subject to temperature



fluctuations that may cause condensation. Enough bagged desiccants must be used to ensure consistent internal and external protection.

8.6.2 Desiccants must be placed in a manner that prevents spilled crystals from contacting or damaging components. The required quantity should be calculated based on the surface area and volume of the enclosed space.

8.6.3 Desiccant bags must not be in direct contact with electrical terminals, threaded connections, or any surfaces prone to corrosion, discoloration, or marking.

8.6.4 If moisture-absorbing dunnage or structural supports are present within the enclosure, additional desiccants must be included to compensate for the increased absorption demand.

8.6.5 All equipment shipped with enclosed dehydrating materials must be clearly marked with a large red warning tag stating:

CAUTION: “Desiccant materials are enclosed in this equipment. Do not operate before removing. If the enclosure is opened prior to operation, the desiccant must be replaced, and the enclosure resealed for continued storage.”

8.7 Storage and Protection

8.7.1 The Contractor and/or their subcontractors must ensure that all packing and preservation measures are sufficient to prevent deterioration of materials and equipment for a minimum of 6-12 months after delivery to site. These measures must account for the site's challenging conditions, including exposure to dust, wind, snow, and temperature extremes.

8.7.2 No later than four months prior to shipment, the Contractor must provide detailed long-term storage instructions for each item, including the assignment of appropriate storage codes as follows:

- **F** – Outdoor storage with no special requirements
- **R** – Outdoor storage with specific requirements and conditional protection
- **W** – Storage in an enclosed warehouse
- **T** – Storage in a controlled environment (for specialised equipment only).

8.7.3 The instructions must also include:

- Maintenance requirements for items left undisturbed in shipping containers or storage
- Identification of items requiring periodic inspection, rotation, or operation to prevent internal damage (e.g., shaft deflection, bearing wear)
- Special procedures to be followed after unpacking and prior to commissioning.

8.7.4 Refer to Table 9-1 for guidance on appropriate storage classifications for various types of materials and equipment.

9. Hazardous Material

- 9.1 All hazardous materials must be clearly identified, packaged, labelled, stored, and transported in full compliance with applicable local and international regulations. This includes adherence to IMDG, IATA, and other relevant transportation codes. Each shipment must be accompanied by the appropriate Material Safety Data Sheets (MSDS) and marked with standardised hazard symbols, signage, and documentation.
- 9.2 Upon receipt of the purchase order, the Contractor must notify the project in writing if any materials or equipment to be supplied are classified as hazardous or toxic under applicable laws or regulations.
- 9.3 Hazardous materials must be listed on a separate packing list from non-hazardous items to ensure clear segregation and traceability.
- 9.4 Each hazardous item must be identified by its correct hazard class, technical name, and proper shipping name, in accordance with international transport regulations.
- 9.5 Certain hazardous materials may require an import permit. All hazardous chemicals must be reported well in advance, not merely prior to shipment dispatch, to allow sufficient time for verification and permit approval.
- 9.6 All packing lists for hazardous materials must include the following certification statement:
“This is to certify that the above-named material is properly classified, described, packaged, marked and labelled, and is in proper condition for transportation according to the appropriate IMDG/IATA/Transportation Authority regulations.”

Table 9-1 Hazardous Labelling Template

Name		Contractor
Title		Signature
		Technical Shipping Name
Hazardous Class N°.		
UN Number	IMDG page	Flashpoint (if any)

- 9.7 The Contractor is responsible for obtaining and providing all required hazardous cargo certificates in accordance with applicable government and international transportation regulations for each shipment containing hazardous materials.
- 9.8 All materials and equipment containing hazardous substances must be shipped in a dry state and packed separately from non-hazardous items. Clear and specific shipping instructions must accompany each hazardous item.
- 9.9 Hazardous materials transported by air must be packaged and labelled in full compliance with the latest edition of the IATA Dangerous Goods Regulations. Each shipment must include a properly completed Shipper's Declaration for Dangerous Goods, clearly identifying the consignee and all relevant details.
- 9.10 Hazardous materials and equipment transported by road or rail must be packaged and labelled in accordance with the current Clear Language Regulations for the

Transportation of Dangerous Goods. Each shipment must include a properly completed Clear Language Bill of Lading for Dangerous Goods, detailing all required classification and handling information.

- 9.11 For marine transport, hazardous materials must comply with both the Clear Language Regulations and the International Maritime Dangerous Goods (IMDG) Code. All such shipments must be accompanied by documentation specifying the Proper Shipping Name, UN ID number, hazard class, and quantity shipped, and must be contained in UN-approved packaging.
- 9.12 Any material or equipment that is nitrogen-purged for transport or storage must be clearly labelled as such. The Contractor is responsible for providing the relevant hazard classification and documentation to the project team for review and compliance.

10. Suitability/Preparation for Transportation

10.1 General

- 10.1.1 The Contractor must ensure that all equipment is prepared for shipment and capable of being handled using mechanical lifting systems, including port and vessel lifting gear.
- 10.1.2 Each equipment item must be skidded, pre-slung, or fitted with lifting lugs or other suitable lifting provisions. All lifting points and the centre of gravity must be clearly and accurately marked to facilitate safe handling during loading, unloading, securing, and transport.
- 10.1.3 All lifting accessories supplied with major equipment – such as lifting beams, spreader bars, cables, slings, shackles, and lugs – must be certified by a recognised authority and acceptable to handling facilities at all transit points, including ports and airports.
- 10.1.4 Shipping cradles and supports must be engineered to safely bear the equipment's weight and stresses during transit. Contractor is accountable for making sure that these are designed by certified professionals and constructed to withstand road shocks, vibration, and stacking loads. Use of tilt / shock indicators are recommended for the sensitive equipment and instruments.
- 10.1.5 All necessary lifting and handling gear, including slings, shackles, and eye/ring bolts, must be securely fitted to each item to facilitate safe movement during transit and installation.
- 10.1.6 All lifting devices must be certified for the applicable load and clearly marked with their intended use and any relevant handling precautions (e.g., sling angles). Lifting device certificates to be shipped with the lifting device.
- 10.1.7 Lifting and sling points must be positioned to evenly distribute the load and maintain a stable, horizontal orientation during lifting operations.
- 10.1.8 For abnormal loads or items requiring multi-point lifting, a detailed rigging diagram must be affixed to the equipment. This diagram must specify the lifting method, gear to be used, and any safety considerations.

- 10.1.9 The centre of gravity must be visibly marked on at least one side and one end of the package. If the centre of gravity is offset, it must be marked on all sides and ends.
- 10.1.10 The footprint (length and breadth) of any item must be equal to or greater than the height of its centre of gravity to ensure stability during handling.
- 10.1.11 Adequate lashing points must be provided on each item to secure it during transport. These points must be clearly marked, positioned above the centre of gravity, and capable of withstanding combined vertical, transverse, and longitudinal forces.
- 10.1.12 All exposed surfaces of unpacked items that may come into contact with lifting slings must be protected using timber boards, rubber padding, or equivalent cushioning materials to prevent scratches, dents, or other damage during handling.
- 10.1.13 Vendor should provide document which includes instructions to prevent liquids from freezing during transit.

10.2 Preparation for Ocean Carriage

- 10.2.1 All equipment and materials must be packed to seaworthy standards, ensuring they are adequately secured for marine transport. Securing lugs must be provided to allow balanced load distribution and effective lashing. Lugs should be positioned to accommodate lashings at angles up to 60° from the horizontal, without obstruction, and ideally located at or above the centre of gravity.
- 10.2.2 Any protrusions or structural features not intended for securing must be clearly marked to prevent misuse during handling.
- 10.2.3 Where securing lugs cannot be optimally positioned, the base structure must be reinforced to allow the installation of steel clips or restraints to prevent uplift and lateral movement.
- 10.2.4 All securing points must be designed to withstand the following minimum acceleration forces during marine transit:
- Vertical: 1.0 g
 - Transverse: 0.7 g
 - Longitudinal: 0.5 g.
- 10.2.5 If specific orientation of cargo is required (e.g., longitudinal or transverse stowage), the Contractor must notify the project team well in advance to ensure proper planning and vessel arrangement.
- 10.2.6 Internal components of equipment must be braced and secured to withstand the same acceleration forces as external securing points, ensuring no internal damage occurs during transit.
- 10.2.7 Saddles used for cylindrical or heavy equipment must be designed to prevent tipping or instability during ship movement or land transport braking. They must be of sufficient width and thickness to provide stable support.

- 10.2.8 Saddles must extend to at least one-third of the equipment's diametric height to ensure adequate support.
- 10.2.9 Items resting in saddles must be independently secured. Saddles alone must not be relied upon for restraint unless they are permanently integrated and structurally capable of securing the load.
- 10.2.10 Cargo items exceeding 25 tons must include reinforced base sections to accommodate stopper plates. These must be clearly marked and capable of resisting localised forces during stowage.
- 10.2.11 Cylindrical items over 25 tons must be equipped with dedicated securing mechanisms that eliminate reliance on belly lashings around the circumference.

10.3 Preparation for Overland Transportation

- 10.3.1 Transportation saddles must be engineered to support the equipment securely throughout its journey from the Contractor's facility to the project site. These saddles must be robust enough to withstand dynamic loads, road vibrations, and handling stresses until final installation.
- 10.3.2 For cylindrical equipment, saddles must extend to at least one-third of the item's diametric height to ensure stability and prevent rolling or tipping.
- 10.3.3 Saddles must be of sufficient width and thickness to prevent "tripping" or toppling along the longitudinal axis, especially during rail shunting or emergency braking of transport vehicles.
- 10.3.4 All securing mechanisms must be designed to withstand acceleration forces equivalent to those required for ocean carriage.
- 10.3.5 The maximum allowable dimensions for overland shipment shall be X m (length) × X m (width) × X m (height). Most of the consignments will be dispatched via freight train.

10.4 Preparation for Air Transportation

- 10.4.1 Equipment and materials intended for air transport must be capable of withstanding acceleration forces typically encountered during flight operations, including turbulence, take-off, and landing. This applies to both external securing mechanisms and internal components. Where necessary, the Contractor must consult the designated air carrier to ensure compliance with aircraft-specific handling requirements.
- 10.4.2 Smaller items must be packaged to fit standard air pallets or containers. These are typically secured using cargo nets; however, if additional restraints are required due to the nature of the item, the Contractor must specify and provide suitable securing arrangements.
- 10.4.3 Large items intended for transport via heavy-lift cargo aircraft (e.g., Hercules C130, Ilyushin 76, Antonov 124) must be equipped with robust securing points and reinforced upper edges to accommodate standard aircraft restraints such as straps, chains, and turnbuckles. These securing features must be designed to prevent movement and ensure safe stowage throughout the flight.

11. Packing Requirements

11.1 Definition and Selection of Packaging

- 11.1.1 Packaging must be selected based on the nature, fragility, and dimensions of the material or equipment, using the standardised categories outlined in section “Packing Categories” 12.2.
- 11.1.2 These categories are designed to ensure adequate protection during multimodal transport – including road, rail, sea, and air – while accommodating the environmental and handling challenges specific to the project.
- 11.1.3 Wherever feasible, materials and equipment must be packed in a manner that allows efficient stowage into general-purpose shipping containers, optimising space and minimising handling risks.
- 11.1.4 If the Contractor is uncertain about the appropriate packaging method, they must consult the project representative to agree on a suitable solution that meets both logistical and environmental requirements.

11.2 Preparation of Material and Equipment

- 11.2.1 Before packing, all equipment must be thoroughly cleaned – internally and externally – to remove weld spatter, rust, scale, filings, and other contaminants. Critical wear surfaces must be cleaned using appropriate solvents (e.g., petroleum, naphtha, or alkaline compounds). After hydrotesting or operational testing, all fluids must be drained and surfaces dried using lint-free cloths or compressed air.

11.3 Machined Surfaces

- 11.3.1 Machined surfaces must be protected using industry-standard preservation materials such as Tectyl, protective tape, or equivalent.
- 11.3.2 Large exposed machined surfaces must be covered with securely bolted plywood or timber panels to prevent damage.
- 11.3.3 Warning labels must be prominently displayed near machined surfaces to prevent improper rigging or contact during handling.

11.4 Items with Finite Shelf Life

Solvents, adhesives, coatings, and other materials with limited shelf life must be carefully managed to avoid premature expiry. These items should be scheduled for delivery in alignment with their intended use and tracked within the preservation plan to ensure timely consumption.

11.5 Removal of Components

- 11.5.1 Fragile components such as instruments and protection relays must be removed, sealed in plastic bags, and packed in shock-absorbing materials (e.g., expanded polystyrene) within timber, plywood, or fibreboard boxes. Withdrawable relays may remain in their cases but must be packed as a complete unit. Removed items must be securely supported, packed separately from heavy equipment, and clearly labelled with their function and location.

11.5.2 Large equipment requiring disassembly must be match-marked prior to shipment to facilitate accurate reassembly on site.

11.6 Switchboards, Motor Control Centres, and Similar Electrical Equipment

11.6.1 Disassembled electrical equipment must be clearly match-marked to ensure proper reassembly.

11.6.2 Loose accessories must be individually labelled with purchase order number, tag number, equipment name, quantity, and part number. Spare parts and tools must be distinctly marked as “Spare Parts” or “Tools.”

11.6.3 Each unit – whether an assembly, subassembly, or part – must be labelled with its match-marked number and description, consistent with installation and erection drawings.

11.6.4 A complete list of match-marked part numbers must be submitted in Microsoft Excel format by the Contractor or their subcontractors.

11.6.5 Withdrawable circuit breakers and instrument transformers for MV switchgears shall be shipped separately and not inside switchgears if suitable means and assurances cannot be provided by the supplier to prevent damage to switchgear operating mechanisms or shutters or the instrument transformer/circuit breaker during transportation. Use of tilt / shock indicators are recommended for the sensitive equipment and instruments.

11.7 Transformers

11.7.1 Transformers weighing less than 50 tons should be shipped fully assembled and, where applicable, ready for service upon unpacking, excluding oil filling.

11.7.2 Each transformer must be dried at the manufacturer’s facility and delivered in a condition that does not require further drying at site.

11.7.3 Protruding components such as cooling fins must be securely supported with brackets to prevent cracking or detachment during transit.

11.7.4 Large transformers must be drained of oil prior to shipment. All openings must be sealed, and the tank filled with dry air or inert gas (e.g., nitrogen) at a pressure not exceeding 0.5 bar(g). A reserve supply must be attached via a regulator to maintain positive pressure for the duration of transit plus 50%. For dry shipment, contractor has to make the provision for filling properly at site.

11.7.5 Sensitive components (e.g., marshalling kiosks, gauges) must be protected using timber crates or boxes suitable for sea and road transport. Rail transport should be avoided due to impact risks from shunting.

11.7.6 Manufacturers must implement vibration mitigation measures, including securing of cores and coils if necessary. All components must be braced to withstand acceleration forces equal to or greater than those specified below.

11.7.7 If a specific orientation is required for stowage aboard a vessel, the Contractor must notify the project team well in advance of shipment.

- 11.7.8 Transformers must have clearly marked external securing points located above the centre of gravity, capable of withstanding:
- Vertical: ≥ 1 g
 - Transverse: ≥ 1 g
 - Longitudinal: ≥ 0.5 g.
- 11.7.9 Transformers over 25 tons must include reinforced base sections for stopper plates to prevent sliding during stowage. These must be clearly marked and structurally capable of resisting horizontal forces.
- 11.7.10 Lifting trunnions or lugs must be prominently marked and easily identifiable.
- 11.7.11 Each transformer must be fitted with one or more impact recorders / passive recorder with battery life sufficient for the transit duration plus 50%.
- 11.7.12 The Contractor must define inspection and testing procedures at key handling stages. These may include:
- Dry air/gas pressure checks
 - Impact recorder downloads
 - Tilt/inclinometer readings
 - Vibration monitoring
 - Megger testing
 - SFRA (Sweep Frequency Response Analysis).
- 11.7.13 Test bushings or terminals must be clearly marked if Megger or SFRA testing is required.
- 11.7.14 All inspections and tests must be conducted by qualified personnel and may be witnessed by the project representative.
- 11.8 Electric Motors**
- 11.8.1 Motors must be packed in cases mounted on two cross bearers (hardwood or steel) with a minimum cross-section of 100 mm × 100 mm.
- 11.8.2 Holding bolts must pass through the motor feet, bearers, and case base, and be fitted with flat washers and locknuts. Washers must be sized to prevent pull-through.
- 11.8.3 Rotors must be restrained to prevent bearing damage during transit.
- 11.9 Cables**
- 11.9.1 All cables must be packed for sea or road transport on timber or steel drums.
- 11.9.2 Drums must be export-grade and fitted with solid timber cleats nailed around the perimeter, secured with steel bands. Cable ends must be fixed to prevent movement.
- 11.9.3 Drums shall be able to withstand impact loads during shipment to avoid collapse.

11.9.4 The inner cable end must be protected with a cover. Drums must include a reinforced axle hole for rotation during cable removal.

11.9.5 Both cable ends must be sealed to prevent moisture ingress.

11.10 Insulators

11.10.1 Each insulator must be individually wrapped in two layers of corrugated board or blister plastic and cushioned with shock-absorbent materials (e.g., foam chips, shredded paper). Insulators must not contact each other or case walls due to vibration. Cases must be clearly marked with cautionary labels.

11.10.2 Cases containing bushings must be rigidly constructed to maintain structural integrity during handling.

11.11 Mechanical Equipment

11.11.1 Hydraulic power packs and consoles must be carefully braced, especially around unsupported pipework, instruments, and suspended motors or pumps. Felt-covered bracing (minimum 100 mm × 50 mm) must be securely fixed to the crate or case body.

11.11.2 Bearings must be protected against brinelling. Shafts must be blocked using centring brackets or false bearings to relieve bearing loads during transit.

11.11.3 Vertically mounted motors must be specially supported to prevent rotor and stator plate damage.

11.11.4 Gearboxes shipped without oil must be protected internally using vapor-phase inhibitors (e.g., Shell VPI powder or equivalent). This must be noted on the packing list and tagged on the gearbox.

11.11.5 Certified steel lifting and support frames must be provided where required.

11.12 Structural Steel

11.12.1 Steelwork dismantled for transport must be clearly marked to facilitate reassembly.

11.12.2 Adequate dunnage and protective packing must be used to prevent surface damage during transit, especially from ropes, straps, or chains.

11.12.3 Structural members should be bundled uniformly with intermediate and top/bottom timber dunnage, fixed using threaded bars and locknuts. Spacing must not exceed 200 cm, and dunnage must be placed within 100 cm of each end.

11.12.4 Lifting points must be clearly designated and marked.

11.12.5 Fixing devices (e.g., bolts, nuts) must be packed in sealed steel drums or solid timber cases.

11.12.6 Light or slender members must be securely bundled and splinted for rigidity. Bundles must carry stamped metal tags with drawing and part numbers.

11.12.7 Small parts must be packed in sealed drums or cases.

11.12.8 Special care must be taken during stowage and stacking to ensure proper dunnage separation and prevent deformation or damage.



11.13 Flexible Connections

- 11.13.1 Flexible connections prone to damage during shipment must be disconnected and all loose ends adequately protected and supported.

11.14 Shaft Couplings

- 11.14.1 Flexible couplings must be removed and protected. Rigid couplings must be supported and protected in accordance with manufacturer recommendations.

11.15 Bearing Journals, Ball and Roller Bearings

- 11.15.1 Bearing journals resting on timber or moisture-prone supports must be specially protected.
- 11.15.2 Ball and roller bearings supporting heavy shafts must be securely locked to prevent movement.

11.16 Precision Instruments, Office Machines, and Calibrated Mechanical Equipment

- 11.16.1 These items must be enclosed in waterproof, heat-sealed barrier bags (minimum 250 microns) with desiccants to maintain low humidity. They must be packed in shock-absorbing cases, double-cased if necessary.
- 11.16.2 Where applicable, such equipment must be transported using air suspension or cushioned vehicles.

11.17 Small Loose Parts

Small or loose components must be tagged and packed separately, with a packing list referencing the purchase order line item. If shipped with main equipment, they must be securely attached using steel strapping or bolts – wire or string ties are not acceptable.

11.18 Spare Parts

- 11.18.1 Spare parts must be packed to the same standard as main equipment and kept separate. Different classes of spares must be packed individually.
- 11.18.2 Spare part crates must be labelled as:
- Critical Spare Parts
 - Installation/Pre-operational Testing/Commissioning and Performance Test Spare Parts
 - General Spare Parts
 - Start-up Spare Parts
 - Two-Year Spare Parts.
- 11.18.3 Labels must be in large capital letters and include the relevant purchase order, package number and equipment number.
- 11.18.4 For spare parts, the manufacturer must also provide clear storage recommendations to ensure proper handling and preservation.

11.19 Special Tools

11.19.1 Special tools for construction and commissioning must be packed separately from those intended for plant operation. Crates must be labelled accordingly:

- Special Tools for Construction and Commissioning
- Special Tools for Plant Operation.

11.19.2 Labels must be in large capital letters and include the relevant purchase order and equipment number.

11.19.3 Large tools (e.g., disassembly cradles, lifting beams) must be packed to the same standard as main equipment and listed on a separate packing list.

11.20 Pipes

11.20.1 Scaloped cradles or bolsters must be provided between each layer of pipes. Where necessary (e.g., coated pipes), these cradles or bolsters must be lined with high density felt or rubber on scallops which are of sufficient size to bear on the full contact area of the pipe. The cradles or bolsters must be fixed in position by means of long threaded bar with lock nuts. Such dunnage must be spaced not more than 200 cm apart.

11.20.2 Where practicable, pipe lengths must be limited to 11.8 metres.

11.20.3 All pipes 50 mm (2-inch) diameter and below must be packed in crates. All pipes must be capped.

11.20.4 Pipes over 50 mm (2-inch) diameter, up to 150 mm (6-inch) diameter, must be secured in bundles of uniform length. Bundling must be secured inside channel iron sections or transverse timber, joined with threaded connecting rods with locknuts. Quantities and strapping positions depend on the lengths, but with no more than 200 cm spacing to prevent distortion. Bundle weight must not exceed 2,000 kg. All pipes must be fitted with end caps.

11.20.5 Pipes larger than 150 mm (6-inch) diameter must be shipped as single lengths, with the ends capped. End caps are to be of the recessed type to enable the use of soft faced pipe hooks, but still completely sealing the ends and protecting the weld chamfers.

11.20.6 All threaded end connections must be capped or plugged.

11.20.7 All nonferrous pipes, including copper, stainless steel and aluminium piping must be packed separately in timber crates. Any strapping of bundles must be with the same material. Any alternative way of packing and transporting pipes needs to be approved by the Client Representative

11.20.8 Different sizes of pipe must not be nested.

11.20.9 Coated pipes must be provided with maximum protection to prevent damage by abrasion or impact.

11.20.10 All flanges must be protected from mechanical damage by 3 mm thick steel cover plates or 12 mm thick plywood cover plates.

- 11.20.11 If pipes are to be stockpiled at site, the Contractor and/or their subcontractors must provide sufficient dunnage or gluts at the destination to ensure that the pipes are stacked clear of the ground and provide bearers between each layer of pipes. Wedges must be used to prevent movement of stacked pipes. The height and/or layers of stacked pipe must be such as to avoid undue pressure on bottom layers during all stages of the transit.

11.21 Pipe Fittings, Flanges and Valves

- 11.21.1 All pipe fittings, flanges and valves up to 6" (150 mm) diameter, must be packed in cases/crates. For items over 6" (150 mm) diameter, these may be fixed securely to a pallet base and enclosed in an open boarded crate, for protection.
- 11.21.2 Where valves have actuators attached, rigidity must be ensured for the valve and actuator. The vulnerable parts of the actuator are to be completely protected within a timber case or crate.
- 11.21.3 All nonferrous fittings, including copper, stainless steel and aluminium fittings, flanges and valves of all sizes, must be packed separately in timber cases or crates. Any strapping must be with the same material.
- 11.21.4 Pipe fittings and flanges must be grouped according to material specification. Like materials must be boxed together. Different materials must not be shipped in one case or crate. This applies to different ferrous materials as well as to different nonferrous materials.

11.22 HDPE Piping

All HDPE piping are nested into trailers and all stanchions are to be covered with rubber to ensure that the stations do not damage the HDPE piping during transit. The stations are to be steel and not timber as timber cannot withstand the extreme requirements caused by the poor road conditions. HDPE piping shall be protected from sun radiation effect during transit. Each trailer should have a minimum of 10x 50mm nylon ratchet straps securing the load. Alternative packing and transporting configuration need to be approved by the Client representative.

11.23 Dissimilar Metals

Ferrous and nonferrous metal items (i.e. dissimilar metals) must not be packed in the same case or crate.

12. Packing Methods, Material and Workmanship

12.1 Methods

- 12.1.1 Materials used for wrapping, packaging, taping, sealing, moisture barriers and retardants, and corrosion prevention must be recognised brands and of acceptable grade in the Contractor's industry. Materials and supplies must also conform to the best standards in the export packing industry and must be capable of performing all their functions without damage to, and/or contamination of the purchase order items packed.

- 12.1.2 The nature of the commodity and degree of protection required will govern final selection and quantity of the packing materials used. See Section 13 of this specification for selection criteria and methods of construction.
- 12.1.3 In general, material and equipment may be packaged in one of four methods:
- Full Container Load (FCL): Complete utilisation of sea container volume by the Contractor in filling a sea container. The Contractor must install a bolt seal with unique number prior to shipping FCL containers
 - Less than Container Load (LCL) Cargo: Materials/packages that are shipped loose and may require containerisation once received at a consolidation facility
 - Break Bulk Cargo: Materials that are not or cannot be containerised or material that would not be cost effective to containerise
 - Bulk Cargo: Material shipped in bulk form. This may be in Flexible Intermediate Bulk Containers (FIBCs) otherwise called “Big Bags” containing 1 ton to 1.5 tons or may be in larger volumes. FIBC cargo can usually be accommodated in shipping containers. Larger quantities (up to about 20 tons) can usually be accommodated in specialised shipping containers. Quantities larger than 20 tons are usually shipped as free bulk cargo, using appliances to load and discharge into/out of ships.
- 12.1.4 Only timber, steel or plywood must be used for constructing export cases/crates and/or reels. Any other material such as chipboard, fibreboard, cardboard, is strictly prohibited for external packaging.
- 12.1.5 Packing cases/crates must be designed to ensure the best possible packaging. They must be sufficiently strong to be stacked in several layers. The seller must stipulate the number of layers to which his packages can be safely stacked, bearing in mind the dynamic vertical acceleration forces that are customary in road, sea and air transportation.
- 12.1.6 The cases/crates must be made up of good quality hardwood or softwood, dry and sound, free of rot or fungus and meeting the following general requirements:
- Dryness of about 18% – 20%
 - Thickness 18 mm (0.7-inch) to 38 mm (1.5-inch) depending on the weight of the packed goods and on the dimensions of the cases/crates
 - Free of knots exceeding one third of the board's width
 - Free of cracks or splits longer than 25 cm (10-inches)
 - Width of the board used: 12 cm (4.7-inches) to 25 cm (10-inches) for cases and crates
 - Ends must be screwed or nailed in such a manner that no sharp ends are exposed.

- 12.1.7 All items of fragile nature must be suitably packed with special precautions against risk of breakage. Where material and equipment are encased or otherwise completely enclosed, the Contractor must be responsible for suitable inner packing.
- 12.1.8 All mobile or overhanging parts such as pipes, gauges, valves or other components situated inside the material or equipment must be fully braced/supported or other adapted type of immobilisation installed by the Contractor. The items are to be secured inside the cases/crates to guarantee immobility during transport.
- 12.1.9 Felt, polyester cuttings, crepe cellulose or other equally efficient materials may be used for padding or cushioning.
- 12.1.10 Hay, straw or similar vegetable fibres subject to disease or fungus must not be used in packing.
- 12.1.11 Packages of bulk materials must be kept as small as possible, with gross weight not exceeding 3,000 kg and dimensions corresponding to inside dimensions of containers.
- 12.1.12 Cases/crates with a height of 2 metres and above, must have a minimum of three straps vertically disposed around them.
- 12.1.13 Cases/crates must be equipped with angle iron plates at slinging points and fastened by means of nails or screws, appropriate for all packing cases or crates weighing 3,000 kg or over.
- 12.1.14 Plywood may be used instead of sawn timber to make up the packages. The board thickness depends on case/crate dimensions, weight and density of the material and equipment and the package type to be used. The plywood is to be moisture resistant (e.g. shutter board) and/or marine type.
- 12.1.14.1 In consideration of the above, the following thicknesses are given for guidance:
- | | |
|--|---------------|
| Gross weight up to 500 kg | 6 mm – 8 mm |
| Gross weight between 500 kg and 5,000 kg | 10 mm |
| Gross weight between 5,000 and 10,000 kg | 12 mm – 16 mm |
- 12.1.15 Metal parts of packages must be painted or galvanised, particularly for bundles and packages on supports.
- 12.1.16 Cases/crates weighing more than 135 kg and up to 1,000 kg must have a raised skid platform or pallet base 100 mm (4-inches) high to permit sling or forklift access.
- 12.1.17 Cases/crates exceeding 1,000 kg must be provided with skid runners. The quantity must evenly distribute the weight of the package. The cross section must not be less than 100 mm (4-inches).
- 12.1.18 Corners of cases and crates must be lapped double post.
- 12.1.19 Nails must be spaced at 75 mm (3-inch) maximum intervals.
- 12.1.20 All case and crate frame members must be inside the crate.

- 12.1.21 Adequate clearance must be allowed around the contents of any case or crate to prevent contact of the contents with the case/crate structure during handling and transportation.
- 12.1.22 Horizontal braces are required when cases and crates are 150 cm or more in height.
- 12.1.23 Slings points must be provided with angle irons for cases or crates having a gross weight over 5 tons.
- 12.1.24 When bundles are made up, the strapping and other bundle retainers must be spaced no more than 200 cm apart, nor more than 100 cm from each end.
- 12.1.25 Although the sketches of the crates and packing cases in Section 12.2 show sledge runners, unless these are bolted into position through the base frame, preference will be given to providing full length/width 100 mm (4-inch) cross section bearers. Gaps must be provided only where forklift tines can be located.

12.2 Packing Categories

12.2.1 Bundling – Packing Category I

12.2.1.1 Contents

Material and equipment that is not subject to damage by corrosion or mechanical effect, e.g. uncoated pipes, structural steel.

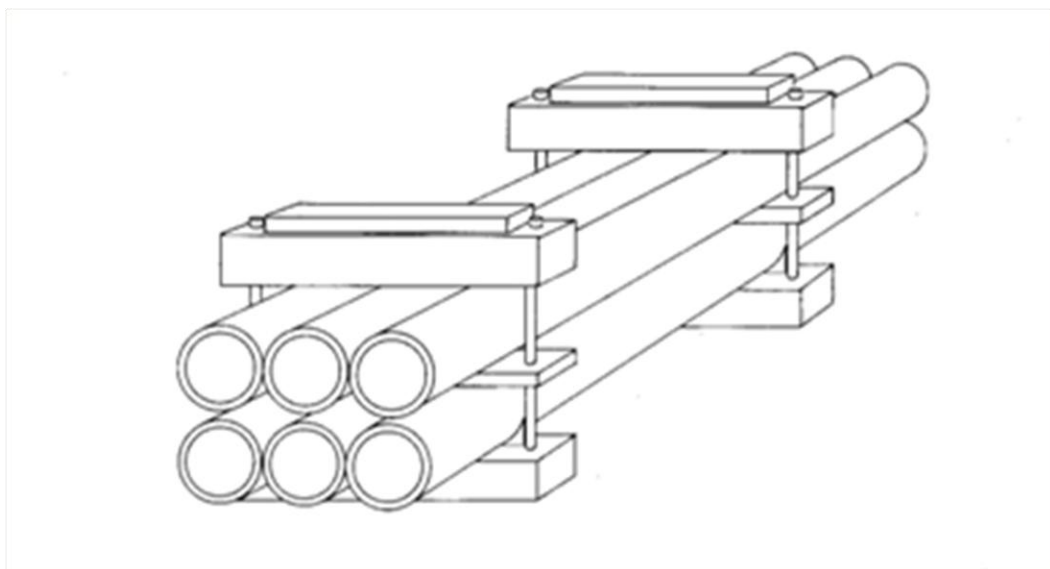


Figure 12-1: Packing Category I

12.2.1.2 Construction

- Bundle containment by squared timber and threaded rods
- With an intermediate layer (threaded on tightening bolts) according to the weight of the package
- Wedge shaped timbers must be attached at the outer ends of the lower bearer

- A spacer must be nailed between the bolts
- The bolts must be secured by locking nuts
- If single parts protrude, protection must be installed (flat iron or plates)
- Bundling with steel straps or PVC straps alone is not accepted.

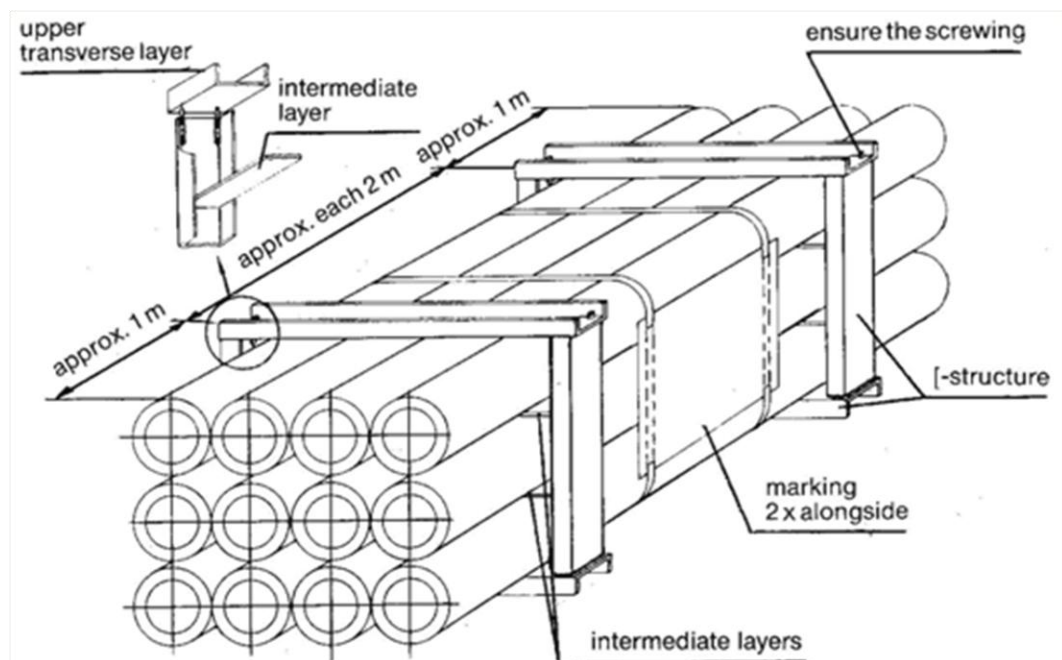


Figure 12-2: Packing Category I A

12.2.2 Skids, Square Timber Constructions, Casings – Packing Category II

12.2.2.1 Contents

Voluminous material and equipment, tanks and/or heavy pieces that is not vulnerable to mechanical or corrosive effects.

Construction:

- The construction can be of timber or of metal
- The fastening of the packages on the skid must be made by steel straps (flat iron) which must be rubber lined; nonslip and securely bolted onto the skids
- Flange openings must be closed with gaskets and blind flanges or, if necessary, provided with a cover
- Skid constructions may not be less than the dimensions of the item of material or equipment, in length or in width, i.e. no part of the packed item must extend beyond the sides or ends of the skid
- Tanks and material/equipment mounted in support saddles must be supplied with an anti-slip lining between the saddles and the item shell.

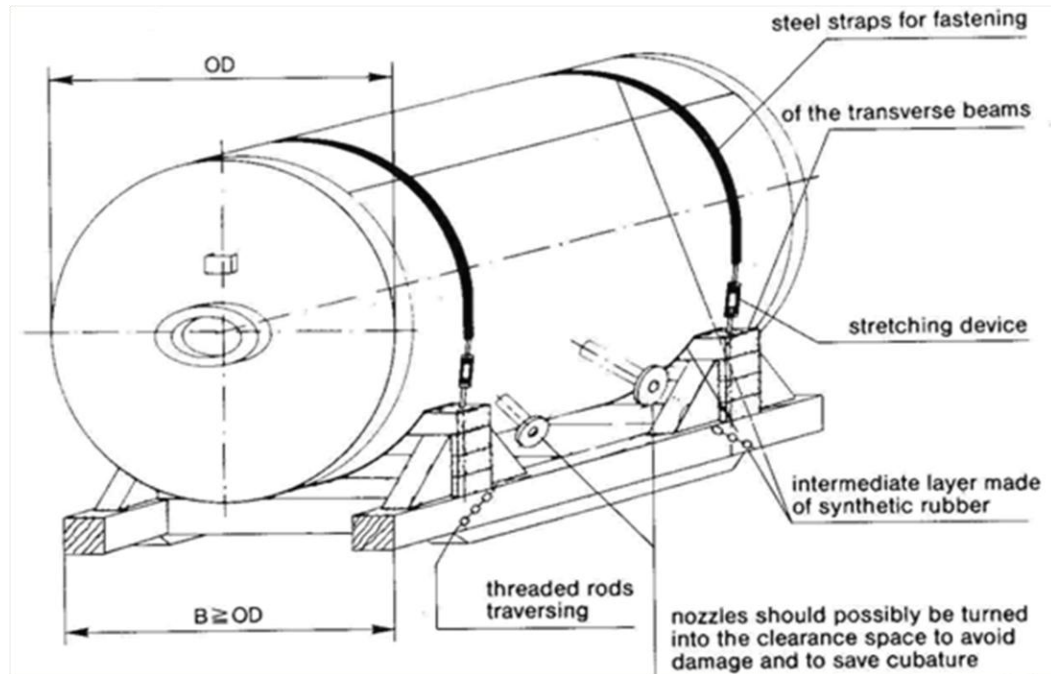


Figure 12-3: Packing Category II

12.2.3 Crates – Packing Category III

12.2.3.1 Contents

Fabricated material and equipment, that cannot be transported on saddles; frame works, prefabricated piping and fittings, mechanical and electrical assemblies.

Items sensitive to rainwater and/or debris must not be packed in crates, but in suitable cases.

12.2.3.2 Construction

The item packed on the base must be securely bolted to the base support skid structure and such bolts must be fitted with large steel washers to prevent pull through. Items with weights of less than 500 kg may be strapped to the base structure. Chocks, wedges and/or cleats must be securely nailed to the base assembly and against the base of the contents, to prevent sliding.

12.2.3.3 Bottom

- Longitudinal runners are required for all shipments and for container stuffing, cross cleats can also be used
- Bottom boarding to be spaced and nailed.

12.2.3.4 Sides

- Side wall casing vertical, inside battens
- Space between wall boards must not exceed average width of the boards.

12.2.3.5 Top

- Longitudinal boarding, diagonal battens, diagonal joists, supported towards the bottom
- Width of boars 10 cm – 18 cm.

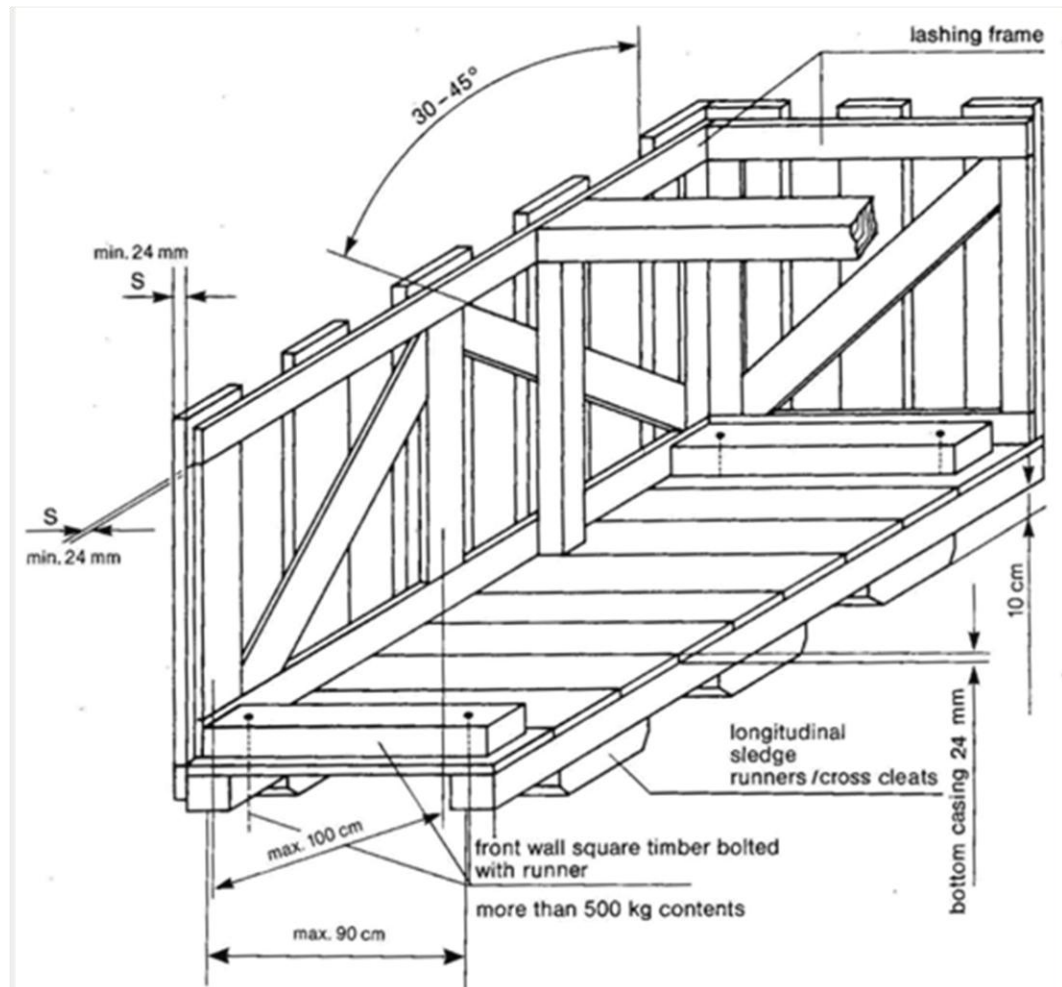


Figure 12-4: Packing Category III

12.2.4 Cases with Lining – Packing Category IV

12.2.4.1 Contents

- Equipment and mechanical parts
- Equipment sensitive to mechanical damage or parts and components that are particularly at risk of theft or loss, pumps, elbows, flanges, fittings, tools, erection materials, etc.

12.2.4.2 Construction

- The same type of construction as Section 12.2.3, but with all sides completely boarded, without space between the boards

- Sides to be provided with waterproof inner lining. Fabric reinforced waterproof tar paper or polyethylene foil resistant to ultraviolet rays can be used
- Polyethylene foil or heavy corrugated plastic must be fixed under the lid cover to avoid penetration of water
- Items packed on the base will be securely bolted to the base support structure and such bolts must be fitted with large steel washers to prevent pull through. Items with weights of less than 500 kg may be strapped to the base structure. Chocks, wedges, and/or cleats must be securely nailed to the base assembly and against the base of the contents, to prevent sliding
- For ventilation inside the case, an opening in the waterproof lining may be placed between the diagonal battens and diagonal joists. Such opening must be fitted with a steel or plastic slatted vent cover to prevent ingress of rainwater.

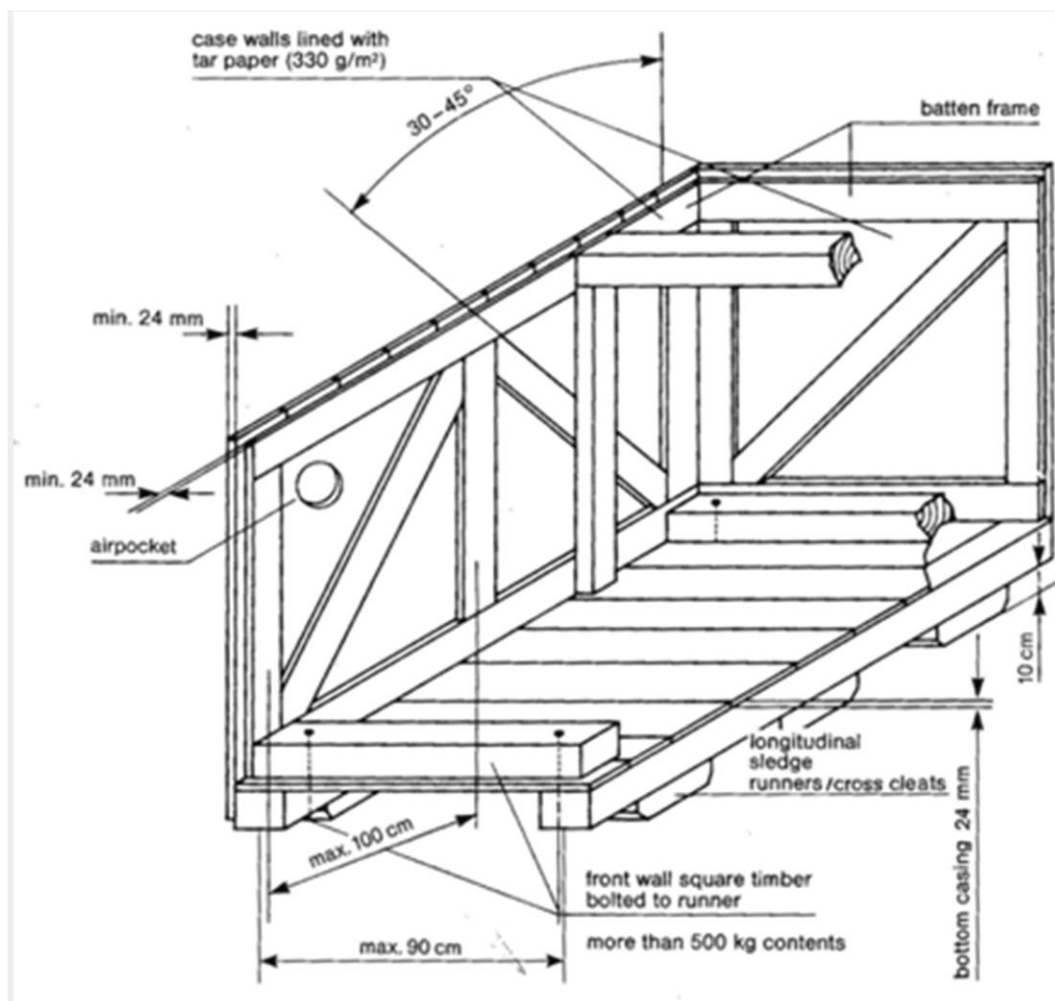
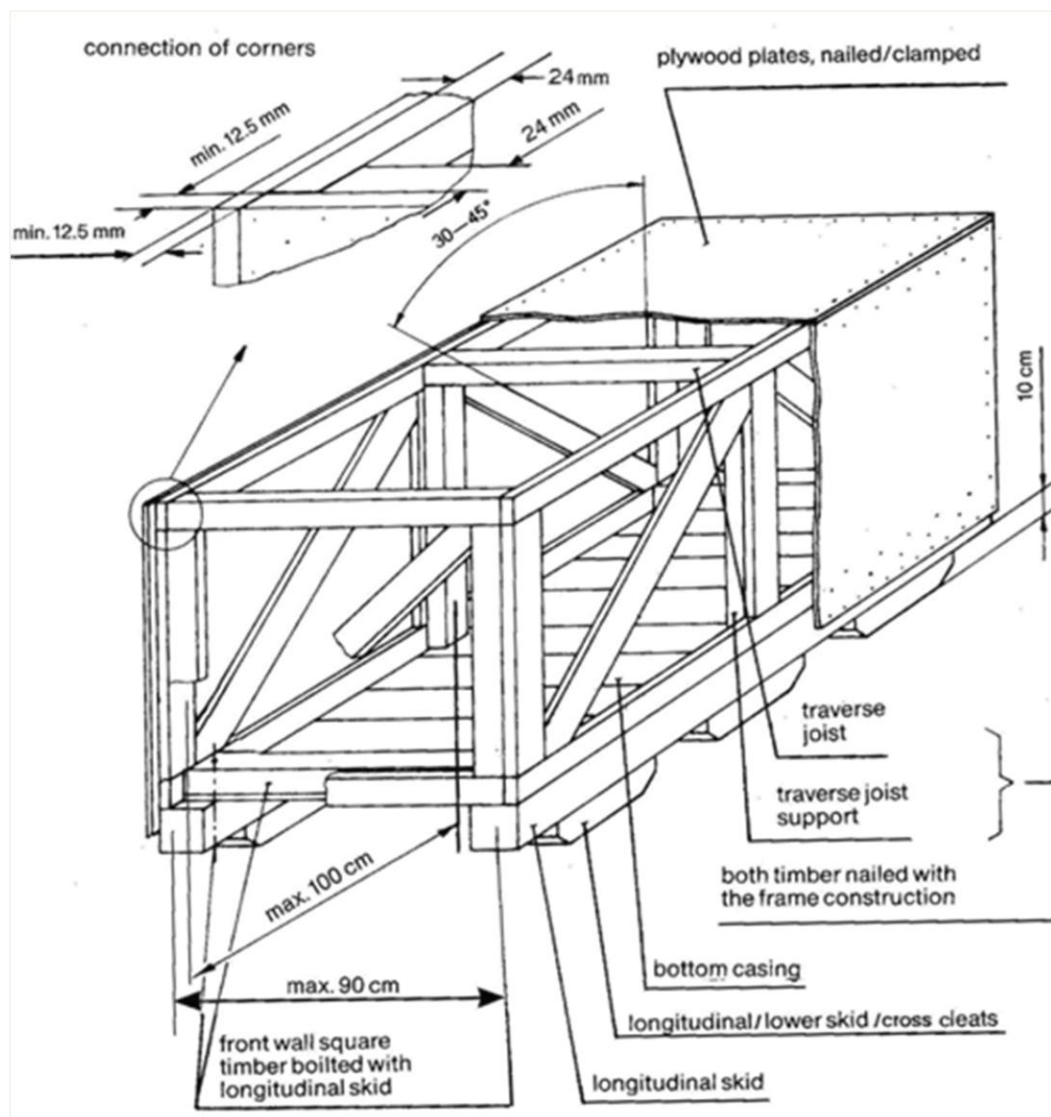


Figure 12-5: Category IV

12.2.5 Plywood Cases

12.2.5.1 Plywood Box – Packing Category IV A

- Case constructed of suitable exterior grade (C-D) plywood with a total thickness of 12.5 mm
- The frame must be constructed from minimum 24mm thick timber and must be suitable for the weight and nature of the parts to be packed. If applicable, construction of the cover and sides is to include diagonal bracing
- Covers consisting of plywood must be sealed with durable elastic putty and/or additional water-resistant sheets must be fitted.



12.2.6 Cases made of Corrugated Cardboard for Transportation as Inner Packaging or in Shipping Containers, Covered Overland Transport and Airfreight – Packing Category IV B

12.2.6.1 *Contents*

Spare parts, electrical and electronic parts, homogeneous parts.

12.2.6.2 *Construction*

Case made of tested, water resistant, glued corrugated cardboard, two ply and three ply, on a one-way pallet, folding of boxes and corrosion protection as per individual instruction in purchase order.

12.2.7 **Frame Construction with Corrugated Cardboard – Packing Category IV C**

Timber frame construction according to Section 12.2.5, with cladding made of three-ply water resistant and glued cellular cardboard.

12.2.8 **Case with Barrier Material – Polyethylene Foil – Packing Category V**

12.2.8.1 *Contents*

Sensitive equipment, simple electrical equipment, insulation materials, fire resistant materials, with non-corrosion guarantee for a period up to 6-12 months.

12.2.8.2 *Construction*

Preservation by adding in polyethylene foil with addition of desiccants and if necessary, application of non-corrosive contact agents. Construction as indicated in Section 12.2.4.

Air ventilation inside the case, according to type of construction as indicated in Section 12.2.4.

A moisture indicator must be fitted to the cocoon in such a manner that it can be checked (visible) from the outside of the package.

Additional marking:

- “Case contains desiccants”.

12.2.9 **Case with Barrier Material – Aluminium Compound Foil – Packing Category VI**

12.2.9.1 *Contents*

Electrical equipment such as switchboards, electric motors, sensitive equipment, with non-corrosion guarantee, for a period of up to 6-12 months.

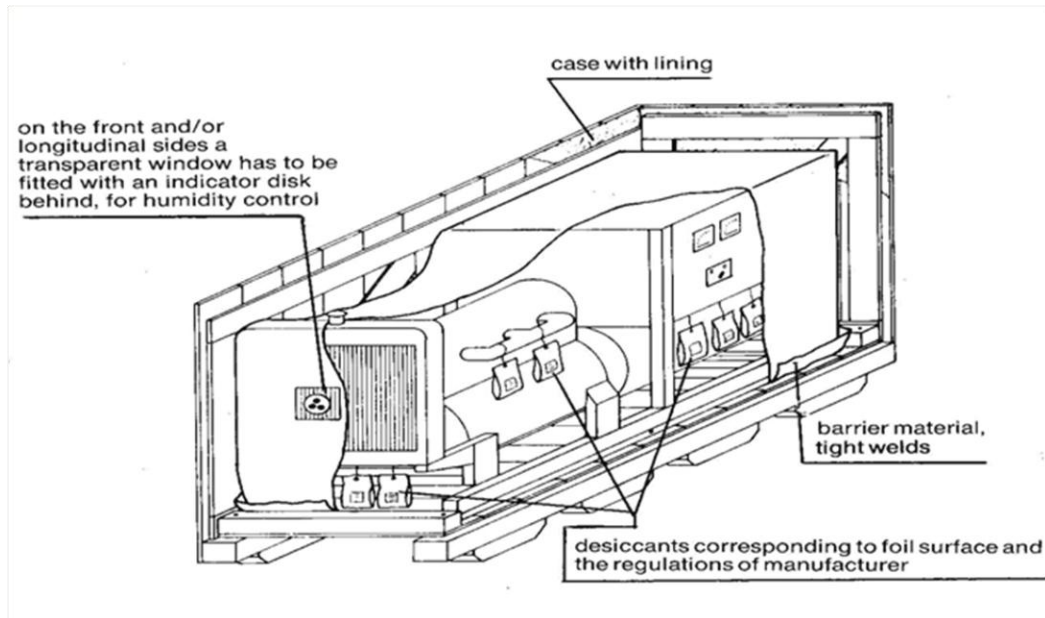
12.2.9.2 *Construction*

Type of construction as indicated in Section 12.2.4

Preservation by sealing an aluminium compound foil, with the addition of desiccants. Humidity indicators, if required and installed in the barrier wrapping, must allow easy visibility from the outside.

Additional marking:

- “Case contains desiccants”.



12.2.10 Double Case – Packing Category VII

12.2.10.1 Contents

Material and equipment that is of high sensitivity to shock, impact and vibration, for instance, special electrical equipment like computers, switchboards, laboratory instruments.

This mode of packing must always be agreed with and released by the project appointed representative, prior to packing.

12.2.10.2 Construction

- Case construction as indicated in Section 12.2.4, with additional floating inner packing (case-in-case principle), padding corresponding to weight and sensitivity of the contents. Preservation by sealing in aluminium compound foil with the addition of desiccants
- The inner case must be made of plywood or equivalent material with a thickness of 8 mm to 12 mm, depending on the weight of the material and equipment to be packed
- The inner buckles and/or frame borders must be dimensioned so that the full stability of the inside case will be reached, and no twisting is possible
- The inner sides of the inside case must be lined with bituminous paper or plastic on all sides (except the base).

See also Sections 11.6, 11.10 and 11.17. Cable Drum – Packing Category VIII.

12.2.10.3 Contents

All types of cables, wires, ropes, hoses and similar.

12.2.10.4 Construction

New or practically new cable drums must be used. Planking of the cable drums by use of boards, thickness minimum 20 mm/0.8 inch, with additional double steel strapping, nailed, and carefully preserved/protected cable ends prior to packing.

See also Section 11.9.

12.2.11 Hazardous Materials – Packing Category IX

12.2.11.1 Contents

Hazardous materials are described as explosives, compressed gases, liquefied gases dissolved under pressure or deeply refrigerated, flammable liquids, flammable solids: substances liable to spontaneous combustion; substances which, on contact with water, emit flammable/toxic gases, oxidising substances, organic peroxides, poisonous (toxic) and infectious substances; radioactive materials, corrosives, miscellaneous dangerous goods.

12.2.11.2 Construction

- Hazardous materials must always be packed and documented separately from any other material
- Selection of packaging materials, execution of packing and marking as well as documentation must always be following the applicable laws and regulations
- Any certificates required for transportation or for authorities to be supplied before shipment of the material and equipment.

12.2.12 Timber Base as a Transport Support (Pallet) – Packing Category X

12.2.12.1 Contents

Any materials to be stuffed in containers or on flat racks and that are not stowed on standard pallets or otherwise suitably packed.

12.2.12.2 Construction

- The items packed on the pallet must be securely bolted to the base support skid structure and such bolts must be fitted with large steel washers to prevent pull through
- Chocks, wedges and/or cleats must be securely nailed to the base assembly and against the base of the contents, to prevent sliding
- Longitudinal internal square timbers bolted to the front wall runners, longitudinal skids
- Maximum distance between longitudinal runners must be 90 cm (middle to middle of the runners)
- Full boarding of the floor
- Attaching of lifting lugs and/or slings for lifting the units off the transport equipment

- If applicable, preservation of the equipment by sealing in polyethylene-foil or aluminium compounds foil and the addition of desiccants.

12.3 Packing Material

12.3.1 Dimensional Timber

Dimensional timber must be new, well-seasoned; un-warped and must be free from defects that cause weakness. Knots, or knot clusters, must not exceed 1/3 width of the board and must not cause interference when nailing/stapling. Timber with bad cross grains must be avoided. Timber dimensions used in this specification are nominal.

12.3.2 Plywood

Only new, clean C-D exterior grades of plywood must be used for the construction of shipping cases.

12.3.3 Nails

All nails must be galvanised or coated against corrosion and must be deformed shank or clinched wire box nails. For maximum strength, they must be driven into the side grain of the timber. The species and thickness of the timber will govern the size of the nail to be used. The nails must penetrate the full depth of the items to be joined. Corrugated fasteners may be substituted for nails when packed items are susceptible to pilferage.

12.3.4 Bolts

12.3.4.1 Carriage bolts 10 mm/³/₈-inch diameter when fastening pieces up to 70 mm/²/₈ inches thick.

12.3.4.2 Carriage bolts 13 mm/¹/₂-inch diameter when fastening pieces over 70 mm/²/₈ inches thick up to 95 mm/³/₈ inches thick.

12.3.4.3 Carriage bolts 16 mm/⁵/₈-inch diameter Carriage Bolts when fastening pieces over 95 mm/³/₈ inches thick.

12.3.4.4 Lock washers and lock nuts to prevent loosening.

12.3.4.5 Bolts must be fitted with large outer diameter steel washers to prevent pull-through of the bolts.

12.3.4.6 No bolt ends/heads must project below the underside of the base structure.

12.3.5 Strapping

Unless otherwise specified, metal strapping will be non-annealed steel, minimum ³/₄-inch (19 mm) x 0.028 inch (0.6 mm) applied with a tensioning tool and secured with crimped steel seals. Metal straps must be cut evenly at the seal, leaving no sharp edges. Corner protectors must be provided to keep strapping from cutting into packages. Not less than two straps per box, and not to exceed 36-inches (90 cm) centre to centre, must be used.

12.4 Workmanship

All workmanship must be in accordance with the best commercial practices and within the requirements of the applicable specifications. There must be no defects, imperfections, or omissions that would impair or lessen the protection afforded by the package.

13. Packing Types

13.1 General

- 13.1.1.1 Packing materials and shipping container types must be selected to afford the best protection from the rigors of rough handling and international transport to items to be shipped. It is imperative that the selection of materials to be used be equal to the item to be shipped itself and to consider the shipping environment, as well as the duration the item will be in (open) storage.
- 13.1.1.2 Items that completely fill the container and do not contribute to the strength of the package are normally the most economical to package. Articles that do not completely fill the selected container must be cushioned, braced, fastened, or chocked to prevent damage to the article itself or to the container.
- 13.1.1.3 Material and equipment must be shipped fully assembled whenever practical. If a fully assembled piece of material or equipment is too large or might be susceptible to damage during the shipping and handling process, then it may be shipped disassembled. In such cases the parts must be clearly match-marked to facilitate reassembly at site. Small, cantilevered attachments must be either removed and packaged separately or adequately supported/secured and shrouded if removal is impractical.
- 13.1.1.4 Minor disassembly and nesting to conserve shipping volume and prevent damage must be followed. Materials requiring special jigs, fixtures, tooling or recalibration for reassembly must not be dismantled. Parts, attachments, or fixtures of the item packed must be boxed, or chocked and braced within the shipping container (where practical) containing the main unit.
- 13.1.1.5 If the load must be kept upright, the container must be fitted with lift handles, skids, top peaks or gables, or some similar device to ensure stowage and handling in an upright position. Break bulk items must be equipped with lifting lugs.
- 13.1.1.6 The weight capacity of shipping containers as declared by the manufacturer must not be exceeded.

13.2 Bundles and Pallets

- 13.2.1 Material and equipment must be unitised, palletised, or assembled to the largest practical unit consistent with handling, weight and dimension limitations at consolidation/transshipment points and destination. Palletised materials must be capped and strapped or shrink wrapped to four-way entry pallets. Material must fit the pallet without large voids and must be capable of withstanding stacking without damage to the materials.
- 13.2.2 Materials shipped in bundles will be segregated by length and size and must be secured with high tensile steel strapping (40x 1 mm/1½ x 0.035 inch) with a tensioning tool and with crimped steel seals (spaced 90 cm/36 inches apart) and skidded to permit stacking without damaging the item.
- 13.2.3 Sturdy commodities such as rough castings, structural or fabricated steel, heavy wall pipe, or tanks not subject to water or handling damage, may be bundled, skidded, and/or palletised for handling and shipment.

13.3 Fibreboard Boxes

- 13.3.1 Fibreboard boxes, when used, will be export quality (resistant to compression, puncture and moisture). Flaps should be stapled or may be glued with a water-resistant adhesive applied to the entire area of contact between the flaps. All seams must be sealed with a water-resistant packing tape.
- 13.3.2 Unitising, palletising, or by over packing several fibreboard boxes in consolidation boxes must be employed as far as possible. When this is not possible, securing must be achieved by two tension straps applied at right angles and crisscrossing at top and bottom, and/or with two girth straps.
- 13.3.3 In every instance, the fibreboard box and contents must bear the weight of a superimposed load (minimum 245 kg/m² or 50 lbs/ft²) without compression or collapse. Boxes with bursting test strength of less than 125 kg or 275 lbs must not be used.
- 13.3.4 Fragile/sensitive materials subject to handling or stowage damage must be packaged and cushioned in crates or boxes.
- 13.3.5 Packages or pieces over 35 kg/80 lbs must be provided with four-way entry pallets that permit handling by forklift and/or slings. The minimum pallet height must be 130 cm/ 5-inches and pallet edges must be chamfered.

13.4 Skidded and Framed Boxes

- 13.4.1 Skidded and framed boxes must be constructed upon skid members joined by headers and must be floored with 50 mm/2-inch timber. Each header must be double bolted to each skid member. Each bearing surface of machinery or equipment must rest over a skid member and bolts used to secure the equipment to the skid must pass through the skid member. Lag screws are not acceptable. The framed construction must use cross bracing with 50x 100 mm/2-inch x 4-inch timber. The clear distance between the skids must not exceed 120 cm/48-inches.
- 13.4.2 Rub strips must be used to allow entry by forklift on four sides.
- 13.4.3 Boxes must be constructed to allow slings to be inserted under the box for lifting purposes.

13.5 Crates and Cases

- 13.5.1 Open crates may be used for items that are not susceptible to weather damage, and packing is required only to facilitate handling and stowage. Crates may also serve as over packs to consolidate fibreboard boxes or to provide unit pack stiffness to resist crushing. Three-way corner construction reinforced with diagonals must be used for all crates that are not plywood sheathed.
- 13.5.2 Large crates must be constructed to bear superimposed loads. Top strength must be provided by top joists spaced no more than 100 cm/38-inches apart. When sheathed, joists must be positioned under the sheathing. Joist ends must be fully supported from below.
- 13.5.3 Crate/case bases must be reinforced at load bearing points when between skids or sill members.

- 13.5.4 On cases; to permit safe forklift entry, end sheathing will terminate at the base lower edge. Side-sheathing must terminate 13 mm/ $\frac{1}{2}$ -inch above the skid base. To transfer the load to the forklift tines, depending upon the crate dimensions and weight, base bearers will be positioned to engage standard length tines (1.2 metre/1.8 metre/2.4 metres) or not more than 60 cm apart.
- 13.5.5 Ventilation holes may be located at intervals around the sides and ends of sheathed crates. Drainage holes through the base must be provided, or floor boards spaced 10 mm/ $\frac{3}{8}$ inches apart when the crate structure above the base is not weatherproof, or if condensation can occur within fully sheathed crates/cases.
- 13.5.6 Additional ventilation holes may be provided when excessive heat and humidity are anticipated. These ventilation holes must be placed through the ends near the top, but not through any frame members. The diameters of these holes should not be greater than 40 mm/ $1\frac{1}{2}$ inches nor more than three holes per 60 cm/2 lineal feet of crate length or width.

13.6 Plywood Cases

13.6.1 Plywood Specifications

- 13 mm/ $\frac{3}{8}$ inch C-D exterior grade plywood for cases bearing up to 4.5 tons/10,000 lbs, and/or spans of 60 cm/2 feet or less
- 16 mm/ $\frac{5}{8}$ inch C-D exterior grade plywood for cases bearing 4.5 tons/10,000 lbs and over, and/or spans up to 120 cm/4 feet
- If exceptionally rough and abusive handling or pilferage is anticipated, 16 mm/ $\frac{5}{8}$ inch C-D exterior glued plywood must be used, regardless of size.

13.7 Frame Members

- 25x 100 mm/1x 4-inch timber for up to 450 kg/1,000 lbs
- 50x 100 mm/ 2x 4-inch timber for 450 kg to 5 tons/1,000 to 11,200 lbs.

13.8 Skids and Rub Strips

- Up to 450 kg/1,000 pounds, 50x 100 mm/2-inch by 4-inch
- 450 kg to 5 tons/1,000 pounds to 11,200 pounds, 100 mm x 100 mm/4-inch by 4-inch.

13.9 Fasteners

13.9.1 Nails – Refer to 12.3.3.

13.9.2 Staples may be used to secure plywood to struts. The following applies when staples are used:

- Maximum length possible must be used and clinched where accessible to do so
- Crown width must be at least 13 mm/ $\frac{1}{2}$ inch
- The crown will be orientated 45 degrees to the outer grain of the plywood



- Mating members must be in contact with each other since staples do not draw parts together.

14. Inner Packaging

- 14.1 All items must be braced and/or cushioned within the container to prevent damage from shock, vibration, rough handling, and transportation. Water absorbing cushioning material must be avoided. Under no circumstances must newspaper or periodicals be used as packing material. The use of hay, straw, flax combinations, palm packing fibre or brown coconut fibre for packing material is not permitted.
- 14.2 Identical small items must be packaged in cartons, bags or boxes prior to packing in the actual shipping containers. They must not be packed loose.
- 14.3 Protection of material and equipment tops and sides by using waterproof shrouds or waterproof case liners must be provided. If waterproof barriers contain asphalt, an additional plastic liner may be necessary to prevent the asphalt material from "bleeding" onto the materials to be shipped.
- 14.4 Preserved surfaces must be insulated from hygroscopic materials (timber, fibreboard, etc.) with greaseproof, noncorrosive barriers. Do not place polyethylene film in contact with rust inhibitor coatings. Finished and painted surfaces must be protected from abrasion. Material and equipment must be placed on skids, pallets, or dunnage to keep items above collected drainage. Crates and other large containers must have drain holes in their flooring to prevent the collection of moisture within the shipping container. Commodities must be nested or packed to reduce volume as much as possible. Items must be packed firm but not tight.
- 14.5 Moisture sensitive commodities (precision instruments, electrical, and electronic assemblies, etc.) subject to moisture damage must be protected by sealing materials and including ample supplies of desiccants to form a vapor/moisture barrier.
- 14.6 It will be the responsibility of the manufacturer/Contractor to warrant that the commodity is free and dry of all moisture both internally and externally. Recertification may be required for items which are known to have undergone hydro testing.
- 14.7 The amount of desiccant to be used will be in proportion to the total volume of the shipping container. Suitable cushioning must be used on all corners, edges and protrusions to protect flexible barriers from puncture. Included air volume must be kept to a minimum. When flexible barriers are used, the barrier must cling snugly to the enclosed item without puncture. Desiccant must not come into contact with critical working surfaces or finished surfaces.

15. Markings

- 15.1.1 Indelible inks, paint, and waterproof labels must be used to prevent obliteration of shipping labels, instructions, and handling symbols.



- 15.1.2 In general, shipping labels and instructions will be 75 mm/3-inches to 130 mm/5-inches in height, where practical. However, the size of the container will dictate the acceptable size of the shipping labels/marks.
- 15.1.3 Only those shipping instructions/marks required in the Purchase Order, plus any cautionary markings, and/or special handling symbols must appear. Under no circumstance will the Contractor 's/manufacturer's advertising or symbols which indicate the contents or other extraneous information appear.
- 15.1.4 Where several packages are included in the same consignment, each package must be numbered and the total number of packages indicated. For example, if a consignment consists of four packages, they must be numbered 1 of 4, 2 of 4, etc.
- 15.1.5 When a box, package, case or crate should not be transported on its side or inverted, the "Twin Arrow" marking must be applied to the upper left-hand corner of each side of the box/package/crate, meaning "This Way Up".
- 15.1.6 Where articles are easily breakable or fragile and require special care in handling, the "Wineglass" marking will be applied to the upper right-hand corner of each side of the box/package/crate/case. The English words "FRAGILE" or "HANDLE WITH CARE" must also appear on the box/package/crate/case.
- 15.1.7 Sling locations and/or crane lifting points must be identified with the "Chain" markings, applied to the bottom of both sides of the box/package/crate in an extended, upward position. The minimum lengths of the marking must be 200 mm/8 inches. The English words "SLING HERE" or "LIFTING POINT" etc. must also appear.
- 15.1.8 The Contractor will be fully responsible for any loss or damage caused by incorrect marking.
- 15.1.9 Crates / Containers etc. should be clearly marked / list attached indicating the equipment or item tag numbers that are inside

15.2 Warning Tags for Special Equipment

15.2.1 This Section covers special warning tag requirements for prohibition of any welding on certain types of equipment during its transportation from the Seller's plant to the project job site.

15.2.2 The Contractor of material and equipment, such as pressure vessels, heat exchangers, etc., must attach to each piece of equipment a warning label stencilled in red with the following statement (as applicable):

"Welding is prohibited during transportation from Factory to the Job Site".

or

"Post-weld heat treated. Do not impact, heat or weld on this item".

or

"Do not secure to any Nozzles".

16. Packing of Steel Shipping Containers

- 16.1 The stuffing of a shipping container must be planned before packing commences to optimise the container capacity. Packages of uniform size and strength must be selected to maximise the loading space and limit excessive chocking and bracing requirements.
- 16.2 Where moisture sensitive cargo (e.g. cardboard cartons, bags, etc.) is packed into shipping containers, this must not be in direct contact with the container floor. Cartons, bags and the like must be placed on pallets or dunnage to permit forklift handling and to prevent direct contact with the container floor.
- 16.3 Cases, crates and the like must have fixed dunnage under them to permit forklift handling.
- 16.4 Cargo must be loaded into shipping containers to the maximum volume and payload available within the container. However, a full container may not be possible. The following is relevant:
- Full Load (FCL) Container: Complete utilisation of shipping container volume or weight by the Contractor when packing a shipping container. The Contractor must install a bolt seal with unique number prior to shipping FCL containers
 - Less than Full Container Load (LCL) Cargo: Materials/packages that are shipped loose and will require containerisation into a shipping container once received at the consolidation facility at the Canadian Consolidation Hub
 - Break Bulk Cargo: Materials that are not and cannot be containerised or material that would not be cost effective to containerise.
- 16.5 The planned shipping container load of cargo must not exceed the container's weight capacity. The relevant limitations on highway or road axle weight in the country of loading and/or transit must not be exceeded.
- 16.6 Cargo must be packed in shipping containers in such a manner as to evenly distribute the weight over the length and breadth of the container.
- 16.7 For cargo integrity and safety purposes, containers must be CSC safety approved and have a valid inspection date. The containers must be inspected both inside and out before packing. The containers must be free of odours. The container's interior floor, walls and roof must be checked for evidence of leaks and cleanliness, and the doors must operate freely. The doors' waterproof gaskets must be complete and functional. There should be no deformation of the container structure; specifically, upper and lower rails, corner posts, corner twist lock castings and the undercarriage.
- 16.8 The cargo stowed in a shipping container must be prevented from shifting and movement during transit and therefore all cargo must be chocked, braced or strapped tightly against adjacent cargo, and/or container surfaces. Securing lugs fitted on containers must not be loaded beyond their Mean Securing Load. Where chocking or bracing is fitted against container walls, as far as possible, this must be positioned inside the outer corrugations and supported in such a manner as to prevent slipping or vibrating out of position during

the transit. Air bags may be used in certain circumstances but must not be over-inflated. Cognizance must be taken of the transit and any atmospherically changes (e.g. altitude) that may lead to bags bursting in transit.

- 16.9 Plywood "Slip Sheets", pallets or other suitable dunnage must be used between layers of stacked cargo to prevent damage to and to distribute the weight of the over-stowed cargo.
- 16.10 Heavy cargo items must be loaded on the bottom layers of cargo with the lighter items placed on top. The centre of gravity will be below the half-height of the shipping container.
- 16.11 Damaged packages must be repaired before packing into a shipping container.
- 16.12 Chocking, bracing, strapping or other void-filling at the shipping container entrance must be used to prevent cargo from tumbling out when the container doors are opened.

17. Shipping Documentation and Packing List Requirements

- 17.1 The Contractor will be required to furnish all relevant shipping documentation to facilitate all aspects of export, import, invoicing and packing as required by the project and/or the Freight Forwarder.
- 17.2 Each package must have two copies of a detailed un-priced packing list in a waterproof cover. One packing list copy must be placed inside each package and one packing list copy on the outside of each package, within a steel cover securely attached to the outside of the case.
- 17.3 The Contractor must attach a packing list to all pieces (shipping containers, pallets, boxes, crates, bundles or other packages) prior to shipping. The packing lists must be weatherproof. The packing list must detail the complete description of the contents of any shipment, including the quantities of each item being shipped. The packing list must be in the same item number order as shown on the Purchase Order. Packing lists must not contain terms such as "miscellaneous", "lot", "assembly" or any words that may obscure the exact meaning or quantity of items shipped. The packing list must be prepared in Excel format and sent by email to the expeditor as identified in the Purchase Order.
- 17.4 Shipping containers must have one copy of a detailed packing list (container manifest) in waterproof cover listing the contents of the container. This manifest must be secured on the inside of the container door.
- 17.5 Unloading guidelines for containers and lifting plans for heavy equipment must be included in the shipping documents or shared via email. The document must also specify the load distribution inside each container.
- 17.6 A Commercial Invoice must be prepared by the Contractor for each shipment indicating all items that are listed on the Bill of Lading and Packing Lists. The Commercial Invoice must be complete with a value for each Packing List item in the same currency as the Purchase Order.

- 17.7 Weight (net and gross) and export packed dimensions must be actual and must be consistent between packing list, invoices and Bills of Lading.

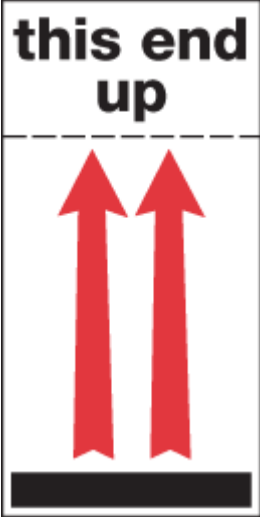
18. Reference Documents

- 18.1 The latest amendments and/or editions of standards from the following organisations will be used as reference documents:

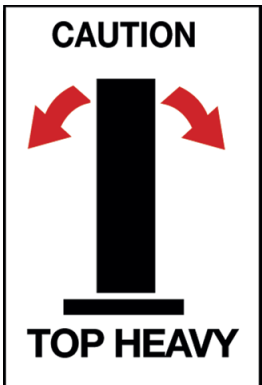
- ISO 780 – International Standards Organisation Graphic Symbols for Handling of Goods
- ISO 1496 – International Standards Organisation Freight Containers
- IATA – International Air Transport Association Dangerous Goods Regulations
- IMDG – International Maritime Dangerous Goods Code
- ICAO – International Civil Aviation Organisation Regulations.



Appendix A : Examples of Pictorial Markings on Cargo

Commonly Used International Shipping and Handling Symbols		
		
The symbol should be applied to easily broken Cargoes. Cargoes marked with this symbol should be handled carefully and should never be tipped over or slung.	The package must always be transported, handled and stored in such a way that the arrows always point upwards. Rolling, swinging, severe tipping or tumbling, or other such handling must be avoided.	
		
The symbol indicates where the Cargo should be slung, but not the method of lifting.	Indication of the position of the center of gravity, this symbol should only be used where the center of gravity is not central.	Stating that the package may be clamped at the indicated point and do not clamp anywhere else.
		
This symbol should only be applied to the sides where the forklift truck cannot be used.	Do not move or lift with a hand-truck.	Do not use hooks.

Commonly Used International Shipping and Handling Symbols

 do not lift		 do not stack
Cargo is too heavy to safely lift manually.	The maximum stacking load must be stated as "... kg max." Cargo bearing this symbol should be stowed in the uppermost layer.	Do not stack other Cargo on this Cargo. Cargo bearing this symbol should be stowed in the uppermost layer.
 CAUTION TOP HEAVY		
Cargo is top heavy. Handle with care when lifting or moving.	Do not destroy barrier, which protects Cargo from water vapour and corrosion.	Tear off here; intended only for the receiver.
 DO NOT USE BLADES TO OPEN	 ATTENTION OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES	 CAUTION SENSITIVE ELECTRONIC DEVICES DO NOT SHIP OR STORE NEAR STRONG ELECTROSTATIC, ELECTROMAGNETIC, MAGNETIC OR RADIOACTIVE FIELDS
Opening the Cargo with a blade may damage the contents.	Electrostatic sensitive device: contact with packages bearing this symbol should be avoided at low levels of relative humidity, especially if insulating footwear is being worn or the ground/floor is nonconductive.	

Commonly Used International Shipping and Handling Symbols		
		
According to regulations, provide temperature limitations or a temperature range, and note on the packing list.	Keep away from solar radiation or other sources of heat.	
		
Keep away from solar radiation, other sources of heat, and radiation.	Protect from excessive humidity and store under cover or cover with tarpaulins.	Cargo must be kept cool but cannot be frozen.
		
Cargo must be kept frozen.	Example of the use of multiple symbols.	



Appendix B : Packing List



Technical Specification
Mechanical Engineering
Packing, Marking and Shipping Requirement

H376512-8000-200-242-0002, Rev. 0,
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