Packaging Guidelines

Published
04 March 2018

This document supersedes any Packaging Guideline documents previously published by any IR operating company, sector, business unit or site.

Global Logistics Standard Work
GPO-L PL 0010 - 02

This document is controlled by:
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Corporate Services
Davidson, North Carolina, USA
All prior editions are obsolete. It is the supplier’s responsibility to assure that only the latest revision of this guideline is used.
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1 Introduction

- **Purpose:** To clearly define packaging expectations of Ingersoll Rand plants.
- **Scope:** This guideline applies to material shipment to all Ingersoll Rand plants and includes shipments to 3rd party warehouses linked to those plants. These general guidelines may be customized for unique needs of the receiving Ingersoll Rand Plant(s).
- **Partnership:** Packaging and delivery efficiency can only be achieved when both the supplier and the Ingersoll Rand receiving plant work together from proposal to implementation.

These guidelines have been developed to demonstrate packaging best practices that suppliers are expected to adopt in order to best position themselves to provide defect free parts, maximize production efficiency and ensure safety while minimizing overall packaging and transportation costs to meet each Ingersoll Rand plant's operational requirements.

Ingersoll Rand’s strategic packaging objectives, container selection process, and operating procedures are outlined throughout this document. This document shall not supersede any contractual arrangement that a supplier may otherwise have with IR, nor shall adherence to these guidelines diminish a supplier's responsibility of delivering defect-free products.

Ingersoll Rand is focused on sound environmental, safety and health operating practices that are leading to decreased use of hazardous substances; reduced waste and emissions; improved energy and water conservation; greater reuse and recycling of materials; and the prevention of accidents and injuries across our operations. The Ingersoll Rand guidelines on packaging promote a preferred sequence of Reduce, Reuse or Recycle when considering all types of packaging.

The Ingersoll Rand receiving plant must approve deviations or alterations from this guideline in advance of first shipments. We encourage our suppliers to take an active role in the ongoing analysis of packaging methods, materials, and cost reduction.

Conformance with this guideline will be included as part of contract reviews.

2 Supplier Responsibility

It is the supplier’s responsibility to pack and label their parts in a manner that ensures they arrive in good condition. The supplier’s quality obligations include, without limitation, packaging the materials for transport and storage at the receiving facility. Suppliers must quote for all business in compliance with these guidelines, and include a breakdown of packaging cost elements identified by the Ingersoll Rand cost model.

To ensure worker safety and loss prevention, packaging design shall consider all human interaction. The ergonomic section will identify these requirements.

Packaging design must protect the product, be ergonomic for users, and meet lowest total cost requirements particularly with regard to efficient transport utilization and lean management demands (e.g. Line side feeding, batch sizes). The supplier is responsible for ensuring that correct labeling is provided for all packaging in line with this manual.

The supplier is obligated to complete all the packaging shipping documents in accordance with this guideline. As part of the Ingersoll Rand process of continuous improvement, alterations to the approved packaging may be requested by the receiving plant. Suppliers shall respond quickly to such requests and manage packaging changes immediately.

The supplier shall ensure that full contact details of one “Packaging Contact” are provided in all correspondence with IR, including contact name, supplier Code, e-mail address, phone and fax numbers.
Furthermore, directives, laws, rules and regulations specified herein are not inclusive, may not always be the most current version and are specified to assist Supplier in its obligations of compliance. It is the Supplier’s responsibility to be aware of all applicable directives, regulations, laws, and rules whether they apply to Supplier directly or relate to packaging at an Ingersoll Rand receiving plant.

2.1 Request for Quote (RFQ) and Packaging Plans
These guidelines are to be used during the development of packaging plans prior to submitting a quotation for production parts. The guidelines are intended to close the gap between part quotation and product delivery expectations.

The decision to use expendable or returnable packaging is a consideration of many factors such as safety, quality, and cost. To aid in the decision-making process, suppliers should quote the part packaging costs and record the container size and density assumptions made while preparing the RFQ. The Packaging Sketch form explained in the following section should be used to record those assumptions. There is additional reference information in this guideline document to aid in selecting the appropriate solution.

Part quotes that involve a multiple tiered supply chain should quote the part cost with the assumption that IR returnable packaging is used only for the finished part shipment freight on board (FOB) to the Ingersoll Rand receiving plant. Labor associated with packaging is to be included in the manufacturing burden rates, not included with the packaging material cost.

The pack design and part count (pieces per container) shall not vary and containers are to be shipped completely filled, except when a release is marked in a way to flag its exception.

2.2 Packaging Sketch Form [GPO-L FR 0010 – 01]
The packaging sketch form is a tool used to communicate packaging plans between all internal and external stakeholders. The form is used to communicate the concept and/or final packaging plans, as well as the primary and backup packaging plans. The form should also be used to communicate any recommended changes for review and approval prior to implementation. An electronic copy of this form may be obtained from your procurement representative.

Please include photos of the internal dunnage, the primary package, and the unitized pallet load. Ingersoll Rand receiving locations will use this information to review transportation efficiency, plan warehouse storage, material handling delivery methods, and assembly line layouts. This data will directly input to the Ingersoll Rand Plan for Every Part processes.

All standard and customer built packaging, containers and packaging must be risk assessed prior to use with Ingersoll Rand receiving plant and the packaging sketch form must be submitted to the supplier’s single point of contact at the receiving plant – this is a requirement.
3 Packaging Design

In general, Ingersoll Rand is responsible for the design, development, and implementation of returnable packaging. In cases where the supplier has design responsibility, IR must review and approve the application to the receiving plant. Suppliers are responsible for the design and procurement of an expendable back-up package that is of a similar footprint (not to exceed returnable footprint) and part density. This expendable back-up design is required to be completed prior to the product launch. Proper documentation of back-up packaging is required with the Packaging Sketch form. NOTE1: expendable back-up packaging may be the primary shipping method for service parts, to be determined by the service parts business unit. NOTE2: in cases where returnable packaging is the primary solution, the supplier must get plant approval when shipping expendable back-up packaging.

It is the responsibility of the supplier to design and develop expendable packaging. Expendable packaging must provide adequate protection to ensure safe delivery of parts. It is important to begin the design process early in the part development cycle. IR must review the proposed packaging to ensure that it meets internal logistic and ergonomic requirements. Although IR may assist in packaging process, the supplier is responsible for the performance of expendable packaging. The Packaging Sketch Form and a firm packaging plan should be in place and validated as part of the PPAP (production part approval process) and indicate a complete production plan for the parts.

3.1 Ergonomic Requirements

Safety and ergonomics are a primary concern for Ingersoll Rand. Suppliers must consider human interaction when designing packaging to ensure safety and prevent injuries both at IR and supplier facilities. Suppliers are encouraged to initiate ideas to improve safety, quality, cost, and efficiency of any existing product packaging. Consideration of the human tolerance to fatigue must be given priority when developing packaging to prevent injuries.
All containers and packaging must be designed with consideration given to ergonomics and ease of part removal. Appropriate consideration must be given to unit load height restrictions, weight restrictions, disassembly, and other requirements which may affect ergonomics and worker safety. Specific design requirement will be listing in APPENDIX 1 to include both English and Metric weights and dimensions.

Drop panels on the side of the container should be considered for boxes exceeding 25”/645 mm in height, including the pallet. Side walls exceeding this height make it difficult for employees to load and unload parts and reach the bottom center of the container. The drop panel must create an opening of 50 percent of the container wall height and 80 percent of the container wall width dimension.

The use of wood crates to ship product to Ingersoll Rand facilities is strongly discouraged. There are a few commodities in which wood and metal banding may be required, such as bundles of steel, aluminum, and copper tube. However, double and triple wall corrugated has been found suitable for shipping heavy parts, even engines. There are few components that weigh more individually than an engine, so part weight should not be a driver of wood crate material. The use of saws and crowbars to remove parts from packaging is not acceptable, nor safe.

The following photos show the safety and ergonomic risk factors associated with wood packaged products.

3.2 Environmental Requirements

As part of its environmental policy, Ingersoll Rand is committed to eliminating packaging waste and packaging systems that are not environmental friendly. This includes considerations such as transport, recycling of packaging material and waste disposal concerns.

The aim of this guideline is to enable you, the supplier, to select the most appropriate packaging to meet Ingersoll Rand packaging quality, environmental and economic objectives.

Preferred packaging systems in order of priority are:

1. Returnable - Packaging is returned and reused on a continuous basis.
2. Reusable - Packaging material can be productively reused in its present state.
3. Recyclable - Packaging material can recycle using normal recycling processes.
Packaging methods that include elements which have to be disposed of through a landfill are not acceptable for deliveries to Ingersoll Rand Facilities or associated 3rd party warehouses.

Not all manufacturing plants are currently using returnable packaging; however efforts are being made to increase the presence of returnable packaging throughout Ingersoll Rand facilities. Suppliers are asked to support these efforts to reduce waste and cost. Cost/benefit analysis will help determine the appropriate use of returnable packaging at each facility.

Other environmental considerations include:
- Use minimal internal expendable packaging.
- Use only expendable materials which can be recycled. (Appendix 3)
- All plastics (expendable & returnable) must be marked with the material identification symbol to aid recycling (Appendix 2).
- All wood elements of packaging must be heat-treated or fumigated with methyl bromide before leaving one country for another.

The European Union is seeking to harmonize national measures concerning the management of packaging and packaging waste to provide a high level of environmental protection and ensure the functioning of the internal market. In order to meet the requirements of environmental protection, the supplier must comply with the latest revision of European Communities Directive 94/62/EC1, as updated. In shipping parts to various IR global destinations, suppliers must take each country's regulations into consideration.

4 Returnable Packaging

Returnable packaging reduces the consumption of waste materials and protects the environment. Wherever possible and reasonable, returnable packaging is encouraged. Returnable packaging must be capable of being used for multiple return trips. Returnable packaging must prove to be economically feasible in all aspects including freight, tooling, and total cost per container. Capital funding for owned returnable packaging, or expense budgets for leased returnables, must be supported by a cost/benefit analysis.

The design of returnable packaging requires the following areas of consideration:
- Able to be double or triple stacked in transit and for storage
- Prefer ability to collapse for storage and higher return ratio
- Durable, washable, lightweight and strong
- Able to palletize for easy lifting and handling, if a pallet is not included in the design
- Minimize ergonomic risk to employees

4.1 Returnable Packaging Implementation

An Ingersoll Rand project manager or equivalent will work with internal plant stakeholders and suppliers. The team will determine the project scope and requirements and determine if the returnable packaging will be purchased by IR, purchased by the supplier, or leased.

As a general rule, if the parts and/or application require a unique designed solution, it will be a returnable container that either IR or the part supplier owns. If the parts and/or application are able to use a standard off-the-shelf bin or tote solution – the returnable containers will be leased or pooled.
Examples of returnable packaging

Collapsible plastic pallet bins  Stackable Pallet Bins  Pallet of Hand-Held plastic bins

Hand-held type plastic bins  Re-usable hardware & small parts bag
Different types of packaging being applied all of which is custom made.

(on left) Engines in returnable packaging (on right) stacked 6 high with collapsed sides
4.2 Container System Quantities – Owned Containers

In cases where the returnable packaging is owned by either Ingersoll Rand or by the Supplier, container system quantities are determined by defining the value stream of the component(s) being packaged. The goal of the value stream map is to define all internal and external process requirements and to minimize the quantity of returnable containers required to support delivery of parts to the Ingersoll Rand facility. Minimizing the quantity of returnable packaging in the system is a conscious effort to control total cost and promote lean manufacturing. IR provides returnable packaging for finished goods only. Suppliers must not use IR provided returnable packaging for internal processes, WIP, or multi-tiered supply chains.

Variables of a value stream map may include, but are not limited to:

- Days of inventory at the supplier
- Days in transit to and from IR
- Days of inventory at IR
- Days allocated for return/sorting

In addition to the total numbers of “days” defined in the value stream, there are two additional variables required to calculate the total number of containers. These include the part’s average daily usage (ADU) and the container pack quantity (CPQ). Once all variables are defined, the following formula is used to calculate the system requirements:

\[
\text{ADU} ÷ \text{CPQ} * \text{System Days} = \# \text{ containers}
\]

4.3 Leased Returnable Packaging

Ingersoll Rand has a supplier agreement and negotiated pricing for leasing returnable containers with CHEP in North America, and is using CHEP’s IcoCube container for inter-continental shipments. There are other container pooling/leasing company’s globally, but Ingersoll Rand plants should check with the Global Logistics team to see if there are any supplier agreements in place for a specific geographic region.

Benefits to leasing containers include:

- No reverse logistics costs
- No cleaning and repairing containers required
- Flexes with demand
- No reclaiming assets when parts go obsolete
- Less management of containers required

Plants using leased returnable containers will need to provide finance with rental cost estimates for annual budget planning. Even though Ingersoll Rand will pay all usual and expected costs for leasing returnable packaging, suppliers will be responsible to sign an agreement with the leasing company assuming financial liability for the safety and security of the containers while at their business.

4.4 Maintenance of Returnable Packaging

Both the supplier and Ingersoll Rand are responsible for maintaining the cleanliness and integrity of owned returnable packaging. Suppliers are responsible for ensuring their product is shipped in clean undamaged packaging. Leased returnable packaging is maintained by the leasing company that owns the assets.

Both the supplier and IR are responsible for monitoring and reporting damage. All damaged packaging will be identified for removal from the system. It is the supplier’s responsibility to notify IR of any damaged
containers received within 24 hours of receipt. The supplier may not scrap packaging without prior approval from the appropriate IR procurement representative. If the supplier owns the returnable packaging, repair and replacement is the supplier’s responsibility.

Ingersoll Rand is responsible for the expenses incurred for the repair or replacement of returnable packaging and caused by normal wear and tear. The cost of repairs which are required due to accidents or misuse will be the responsibility of the party causing the damage. All containers that are repaired must meet the original container specifications. Items that are to be checked when inspecting returnable containers include, but are not limited to:

- Cracks in the corner joints
- Missing or broken access gate hinges
- Extensive damage to the container base
- Broken off pieces
- Pierces or cuts
- Bowing sidewalls
- Any conditions which may adversely affect employee safety and/or part quality.

4.5 Obsolete Packaging

Ingersoll Rand is responsible for the disposition of all obsolete returnable packaging material. Suppliers who have any obsolete dunnage or containers at their facility should contact their procurement representative. Disposition of IR assets is strictly prohibited without prior authorization.

5 Expendable Packaging

Although Ingersoll Rand utilizes an increasing amount of returnable packaging, expendable packaging will continue to be used. As mentioned in the design section, suppliers are responsible for the design of expendable packaging, and for ensuring delivery of quality parts.

Preferred methods used for securing containers should minimize the need for cutting the container to gain access to parts. If tape is used to secure the lid of a container, paper-packaging tape that can be torn is preferred. Staples and glues are not acceptable methods of closure for container tops, but may be used elsewhere in the body of the container. Sealing tape must be a minimum of two inches wide and have a tensile strength of 45 pounds per square inch width. Polyester film reinforced with glass, or rayon fiber combined with a laminate of paper is not acceptable.

All expendable packaging material must be legally and economically disposed of at the IR location, regardless of the initial location using the packaging material. Ingersoll Rand strongly encourages the use of recyclable packaging materials. Packaging material going to a landfill will be considered unacceptable.

5.1 Expendable Dunnage

All parts shall be packed in an economical manner utilizing packaging designs and materials suitable to protect the part(s) from physical damage and corrosion. The packaging must provide adequate protection from the hazards of transportation and storage environments and shall be designed for safe and damage free handling and transport within Ingersoll-Rand facilities.

For cosmetic parts, fragile parts, or parts with sensitive machined surfaces, expendable dunnage should be used to protect the quality of the parts. Nylon mesh netting, bubble wrap, or heavy paper wrap are examples of materials which can be used to assure damage free transport.

For parts that are non-cosmetic or non-machined, bulk packaging is acceptable and no internal dunnage is required.
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Moisture sensitive parts that are subject to corrosion shall be processed or packaged with suitable preservation to protect the parts from corrosion, examples of acceptable packaging include Volatile Corrosion Inhibitors (VCI) paper, VCI bags, VCI emitters, or desiccant bags.

Baging, wrapping, masking and taping parts should be minimized to ease the process of removing parts from the packaging. Parts should never have wrap secured in a manner that requires a knife to remove it.

Key considerations for internal dunnage:
- Ensure part quality while minimizing cost
- Ensure parts do not become tangled during transit
- Ensure all materials are recyclable

5.2 Expendable Box Sizes

Note: part quantity per box should align with specific Ingersoll Rand site material flow considerations to include consumption requirements and inventory entitlement. If you are not using a plant-specific guideline for inventory entitlement, please use the following suggestion below. As stated above, Packaging Sketch forms must be reviewed and approved by the appropriate Ingersoll Rand site personnel.

The following table contains standard box sizes for suggested use. These box sizes cube out standard pallet dimensions and are provided in both English and Metric units:

<table>
<thead>
<tr>
<th>IMC Carton Number</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Height (mm)</th>
<th>Max # per Pallet</th>
<th>No. per Layer</th>
<th>OD % Cube Efficiency</th>
<th>Length (in)</th>
<th>Width (in)</th>
<th>Height (in)</th>
<th>Max # per Pallet</th>
<th>No. per Layer</th>
<th>OD % Cube Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMC200</td>
<td>1120</td>
<td>960</td>
<td>960</td>
<td>1</td>
<td>1</td>
<td>96%</td>
<td>40</td>
<td>48</td>
<td>38</td>
<td>1</td>
<td>1</td>
<td>96%</td>
</tr>
<tr>
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<td>1120</td>
<td>960</td>
<td>480</td>
<td>2</td>
<td>1</td>
<td>96%</td>
<td>24</td>
<td>40</td>
<td>22</td>
<td>4</td>
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<td>96%</td>
</tr>
<tr>
<td>IMC170</td>
<td>1120</td>
<td>480</td>
<td>480</td>
<td>4</td>
<td>2</td>
<td>96%</td>
<td>24</td>
<td>20</td>
<td>11</td>
<td>16</td>
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<td>96%</td>
</tr>
<tr>
<td>IMC140</td>
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<td>960</td>
<td>480</td>
<td>4</td>
<td>2</td>
<td>96%</td>
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<td>13</td>
<td>11</td>
<td>16</td>
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<td>96%</td>
</tr>
<tr>
<td>IMC130</td>
<td>560</td>
<td>960</td>
<td>240</td>
<td>8</td>
<td>2</td>
<td>96%</td>
<td>12</td>
<td>20</td>
<td>11</td>
<td>16</td>
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<td>6</td>
<td>6</td>
<td>32</td>
<td>32</td>
<td>94%</td>
</tr>
</tbody>
</table>

Factors in Choosing Box Size
- Part Dimensions – best fit box to part
- Part Weight – ergonomic limit for hand-held containers is an important consideration. (Each IR facility may have different max weight requirements. Check with the receiving plant’s project manager.)
- Part Quality – partition cells, wrap, and/or cushion material required
- Number of Parts – formula below to estimate the target number of parts per container
- Smallest box possible – but fill the box with parts or dunnage fill to eliminate head space

**EAU ÷ 250 = parts per box**

*NOTE: Derived from 250 production days per year and nets approximately 1 day inventory per box (EAU is Estimated Annual Usage).

The calculation above and the quantity of Packaging required are derived from a number of factors:
- Customer demand will fluctuate and a Kanban system may be required to be responsive to these fluctuations to ensure inventories are minimized and supplies are sustained. For package design purposes, estimated volumes would need to be communicated by the receiving plant.
- Size of part – footprint space in factory must be minimized therefore this should be reflected in package footprint – good use of vertical space within ergonomic limits is encouraged.
- Value of part – low value parts can have larger quantities, high value parts inverse.

6 Pallet & Unit Load Information

All incoming pallets should be documented on the Packaging Sketch form and approved by an Ingersoll Rand representative. Used pallets are acceptable, but they must be inspected and free from damage, as this poses safety and facilities concerns. All pallets must conform to the following requirements.

Specific pallet sizes may be required by the IR manufacturing site, however, common pallet specifications and dimensions can be viewed at [http://www.chep.com/pallets/pallet_sizes/](http://www.chep.com/pallets/pallet_sizes/)

6.1 Pallet Construction

All incoming material must be four-way notched stringer pallets. They must be flush (no winged) reversible or nonreversible stringer pallets. For safety considerations, block style pallets are generally not accepted.

Wood, metal and plastics are acceptable materials as long as the pallets meet the criteria in this document. Expendable corrugated pallets are not acceptable unless approved by an IR project engineer. Ingersoll Rand does not provide expendable pallets for supplier shipments, however if the IR plant is receiving leased containers, leased pallets may be an option. The IR receiving plant must provide direction and approval on leased pallets.

6.2 Pallet Loading

Supplier will guarantee the stability and stack ability of the packaging and handling units. Incomplete layers shall be avoided. Edge protection and strapping shall be used if it is required by the security of the handling unit or fixed in the packaging instruction.

Unit loads should be modularized to maximize the cubic load of the shipping conveyance. Pallets should be loaded flat, to allow stacking both in the trailer as well as in the warehouse. All packs must have sufficient vertical strength and stability to withstand tiered height of 100” or 2200 mm. Remember that
7 Material Handling

Warehouse operations seek to store and deliver parts effectively to assembly lines without damage to parts and with minimal waste utilizing lean principles. It is the supplier’s responsibility to provide quality parts in specified packaging to prevent damage during transportation and delivery. In order to maximize warehouse storage and efficiency, the following considerations will be taken during development and testing of packaging programs:

- Packaging dimensions should not exceed current material presentation equipment (racks, conveyors, etc.) This allows existing conveyance equipment to be utilized without additional capital requirements or extensive modifications to material presentation racks.
- Packaging weight should not exceed Ingersoll Rand forklift requirements of 2,000 lbs/900 kg. All capacities and load heights should be verified with the IR receiving plant, prior to approval with the maximum capabilities and preferred methods of conveyance.
- Maximum pallet stack height is 48 in/1220 mm to fit in warehouse rack heights.
- Returnable and/or expendable packaging must be designed to be stored inside IR and supplier facilities and should not be exposed to outdoor elements that degrade the package integrity.
- Packaging must conform to all government and transportation rules and regulations.
- The packaging must deliver the part to the point of use, in a production ready and damage-free condition, assuming normal handling in transportation, storage, and in-plant movement.
- Container systems should be designed to withstand temperature variations from -30°F to +150°F (-34.4°C to 65.6°C) and able to withstand 90% humidity at 150°F/65.6°C exposure.
8 Labeling - Identification of Packaging

Labeling specifications are detailed in the document titled “Doing Business with Ingersoll Rand” in the section titled LABELING. If a standard labelling spec exists for the receiving plant, it should be used in place of the next section.

Each carton on a pallet should be individually labelled as described in the above referenced document. In addition, a master label may be used, and a mixed load pallet should have a label indicating it as such.

9 Supplier Scorecard

Having developed a package suitable for the intended distribution cycle, it is mandatory for the Supplier to continue to supply material in the appropriate container in accordance with the relevant shipping guidelines. The receiving plant will monitor packaging received to ensure conformance. The Supplier Rating will be negatively impacted by non-compliance with these guidelines and may result in automatic rejection of shipment and/or negative impact on the overall supplier rating.

The measurement and monitoring of a suppliers performance may be managed differently by each IR receiving plant, or by the Corporate Supplier Quality group.

10 Delivery

The following section may include information that may pertain to some Ingersoll Rand facilities and not others. Always check with the material planner at the receiving facility for clarification on delivery requirements and expectations.

10.1 Delivery Frequencies

To help to achieve inventory targets a higher frequency of deliveries might be required for higher value parts as will be the case for large bulky parts where space is at a premium. This must be reflected in the packaging plans.

10.2 Delivery times

Suppliers may be required to make deliveries at pre-allocated delivery time windows to help improve the efficiency of unloading and traffic management on site.
10.3 Just in Sequence deliveries
As part of continuous supply chain improvement and lean manufacturing practices, it may be a requirement that suppliers agree to support Just in Sequence delivery concepts. The use of a third party logistics partner may be considered to help achieve this, and it will vary by Ingersoll Rand manufacturing sites.

10.4 Delivery performance
IR requires 100% OTIF (on time, in full) delivery performance from all suppliers for all components and services.

10.5 Supplier stock levels
All parts replenished using the kanban system must be supported by a supplier stock of not less than two times the daily usage, where the supplier is delivering daily. This is extended pro rata of the delivery frequency.

Finished goods stock is the responsibility of the supplier, IR does not take responsibility for stocks in excess of those required to support the kanban system and ensure uninterrupted supply, unless otherwise negotiated.

10.6 Backflushing
IR may require the option to implement payment for components based on backflushing of components from later stages in the assembly process. Backflushing is automatic accounting of material consumed for production, at the time of confirmation. For example, when a vehicle is rolled off an assembly line, four wheels and tires are deemed to be consumed and issued to production order automatically by way of backflushing by the system.

10.7 Continuous improvement
Reduction of material lead times are key to supporting IR achieve higher levels of customer satisfaction which can lead to increased sales. Shorter lead-times improve supplier performance in terms of responsiveness to changes in demand.

Reduction in value stream inventory levels helps to improve responsiveness to changes in customer demand.

11 Hazardous Material
All suppliers and/or shippers are responsible to comply with all applicable international, national, federal, provincial, state or local laws and regulations for packaging hazardous materials (packaging, marking, labeling, describing, and certifying). Examples include but are not limited to:

- U.S. Federal regulations including Hazardous Materials Regulations (Title 49 CFR Parts 100-185) can be found at http://hazmat.dot.gov/regs/rules.htm
- All European Commission website: http://ec.europa.eu
Appendix 1 Ergonomic Considerations in English & Metric Values

All containers and packaging must be designed with consideration given to ergonomics and ease of part removal. Appropriate consideration must be given to unit load height restrictions, weight restrictions, disassembly, and other requirements which may affect ergonomics and worker safety. Each Ingersoll Rand plant may have different maximum weight considerations, some less than indicated below. Utilize the Packaging Sketch Form to obtain plant approval. Considerations include:

11.1 Hand Held Box Maximum Values

**English Maximums**

- 40 lbs.
- 22"
- 24"

**Metric Maximums**

- 18 kg
- 480 mm
- 560 mm

11.2 Bulk Box / Pallet Bins / Gaylord Maximum Values

**Drop panels on the side of the container should be considered for boxes exceeding 25" in height, including the pallet. The drop panel must create an opening of 50 percent of the container wall height and 80 percent of the container wall width dimension.**

**Drop panels on the side of the container should be considered for boxes exceeding 635 mm in height, including the pallet. The drop panel must create an opening of 50 percent of the container wall height and 80 percent of the container wall width dimension.**

**English Maximums**

- 2000 lbs.
- 38"
- 48"

**Metric Maximums**

- 900 kg
- 960 mm
- 1120 mm
Appendix 2 Recycling and Plastics Identification Symbols

Sources:
Recycling symbols are those proposed by European Union.
Plastics Identification codes are those devised by the Society of Plastics Industry (SPI) in USA
1. Polyethylene Terephthalate
2. High Density Polyethylene
3. Polyvinyl Chloride (PVC)
4. Low Density Polyethylene
5. Polypropylene
6. Polystyrene
7. Other

Symbols or Icons Common to Packaging:
1. This Side Up
2. Rain Resistant
3. Fragile
4. Flammable
Appendix 3 Approved Recycle Materials for Expendable Packaging and Dunnage

1. Corrugated (Brown or white paper, Newspaper, Cylinders or blocks, Cardboard)
2. Plastic Sheet (Film, Shrink-wrap)
3. Expanded Foams
4. Polypropylene (20% Calcium Carbonate)
5. TPO
6. Polycarbonate
7. ABS
8. Surlyn
9. Rubber

Separation of mixed media packaging (multiple material types)

Mechanical attachment of different materials is discouraged, as separating the material types to different recycling streams is required to keep the packaging out of the Landfill. For example, foam blocks glued to a corrugated pad would not likely be recycled, as pieces of foam would cling to the corrugated and contaminate the recycling stream.

Care must be taken in the construction of bulk bins to keep wood and corrugated easily separated for recycling. If wood corner posts are required for stacking strength, corrugated die cuts that the wood easily slips in and out of would be preferred to nails, staples, or glue.

Also the pallet and carton should be easily separated, not requiring crow bars, knives, and excessive time to remove. Palletized boxes can be designed with a breakaway feature that will allow the carton to be removed in a matter of seconds – without compromising the carton integrity during storage and shipping.

A corrugated supplier will be versed in the ability to place die cut perforations on the floor of the carton in staple locations that tear away from the pallet for easy separation from the wood.
### Appendix 4 Document Revision History

<table>
<thead>
<tr>
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<th>Date</th>
<th>Reason for update</th>
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<tr>
<td>0</td>
<td>6 May 2014</td>
<td>Initial Issuance</td>
<td>Global Logistics OpEx</td>
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<tr>
<td>1</td>
<td>18 July 2014</td>
<td>Revised Supplier Responsibility Statement per Dirk Tischer</td>
<td>C. Miller/M. Rebilas</td>
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<tr>
<td>2</td>
<td>04 March 2019</td>
<td>Revised Section 5.1 “Expendable Dunnage”</td>
<td>J. Farr</td>
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