COMBAT RATION NETWORK

FOR

TECHNOLOGY IMPLEMENTATION

Rapid Assembly Module for Traypacks

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Results and Accomplishments (March 2005 – October 2005)

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14. ABSTRACT

Group feeding of military personnel in the field requires food components to be unitized for timely preparation and uniformity. Component assembly of group meals requires coordination, instruction, and quality control. Unitized rations are typically made in the US and shipped as complete units. Using local components closer to the field could reduce the lead time required to use group feeding. Material handling required for the assembly of group rations is time consuming and laborious without support equipment. The project's main purpose was to determine if a mobile assembly system, deployed in a remote location, operated by inexperienced personnel, could be productive. This report outlines the successful use of the module to speed the production rate of unitizing group rations at an OCONUS prime vendor. The net production rate equaled the typical US depot rate. Additionally, operations at a US depot were observed. A standard operating procedure for assembling rations and a recommended list of equipment are included to provide direction for additional lines, management, and supervisors.

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Manual Assembly Operations, Combat Rations, Unitized Group Rations, Packaging, System Design Improvement, Heat and Serve, Cans, Polymeric Traypacks, Handling, OCONUS prime vendor

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Abstract

Group feeding of military personnel in the field requires food components to be unitized for timely preparation and uniformity. Assembly of components for group meals requires logistical coordination, detailed instruction, and robust quality control. Unitized group rations are typically assembled in the US and shipped to where they are needed as complete units. Combining locally available ration components closer to the field of operation could reduce the lead time required to utilize group feeding. The material handling required for the assembly of group rations is time consuming and laborious without support equipment.

The main purpose of this project was to determine if a mobile assembly system, deployed in a remote location, operated by inexperienced personnel, could be productive. This report outlines the successful use of the mobile assembly module to speed the production rate of unitizing group rations at an OCONUS prime vendor. The net production rate equaled the typical US depot rate. Additionally, the assembly operation at a US depot was observed. A standard operating procedure for assembling rations and a recommended list of equipment are included to provide direction for additional lines, management, and supervisors.

1. Results and Accomplishments

1.1. Introduction and Background

Military personnel are fed in the field through one of four core ration groups; Individual self-prepared MREs, Unitized Group Rations Heat and serve (UGR-H&S), UGR-A and UGR-B. This report outlines the activities of assembling UGR rations using a flexible, portable system that can be setup anywhere in a short amount of time. Lead times and capacity can be increased quickly to respond to disaster relief aid, increased military activity, or civil needs.

The system relies on manual handling of materials to load components into corrugated boxes. The complete process of making boxes, assembling UGRs, and sealing boxes can be all done by hand. However, the use of a box erector, conveyors, automatic taping machines, and a pallet wrapper allow throughput to be increased greatly while using fewer workers and less space. If utilities or adequate space are not available for one of the three recommended configurations, alternates can be employed to make the best of available resources.

Generally, each UGR-H&S RAP assembly will consist of three boxes containing a total of 15-20 different items. Boxes 1-3 will contain enough food components and accessories to feed 50 solders one meal. Accessories will include such items as cups, napkins, trays, utensils, garbage bags, etc. Food items will be dry, canned, or other retorted goods that are shelf-stable and require no refrigeration. Ingredients requiring cooking with water, such as rice, will also be common among menus.

Successful UGR assembly requires careful planning and attention to details. Three key areas must be adequately supported to minimize production issues; Quality Control, Production, and Mechanical Support. Each of these areas requires the support of at least one dedicated, experienced, professional. Without the support of dedicated personnel, no attempt should be made to assemble anything.

1.2. Objectives

The purpose of this project was to determine if an assembly operation could be effective and productive if utilized by an inexperienced, OCONUS, prime vendor. This report documents activities of this project including, unpacking, assembly and use of module of components to assemble UGRs in the field during the week of April 11 through April 15, 2005. Production consisted of 320 UGRs to be used in the field to feed soldiers. Testing occurred in a prime vendor's warehouse located in Hawaii. In addition to documenting the unit assembly and production issues, instructions for assembling the unit and UGR manufacture were included. Recommendations for alternative configurations and equipment were also requested.

The sub objectives were:

- Collect information to develop an SOP for setup, operation, and repacking of RAP module
    - Develop workstation task assignment guidelines
        - Interview DDSJ Operations Manager
        - Observe and document DDSJ assembly operations
    - Design and outline alternative layouts based on space limitations
        - Assemble RAP line components at DDSJ in multiple configurations
        - Measure area required for each layout
- Identify equipment to increase system throughput, ease of use, and reliability
- Determine Operational utility requirements , Air SCFM, and 120v/60 or 200-220v/50 power
- Summarize project objectives, results, and recommendations in an executive summary slide presentation

1.3. Results and Conclusions

A prime vendor with no prior assembly experience was selected to produce UGRs using the module and temporary laborers, Y.Hata.

Wornick, a commercial assembler, provided guidance in menu and component selection and two support personnel for line set up, loading order, and operation.

The trailer with equipment and conveyors was configured by DDSJ and shipped to Y.Hata.

Y.Hata hired temp workers for pre-production and assembly operations.

Y. Hata amassed and staged Food components / subassemblies.

A mechanical technician from DDSJ supported unpacking, setting up, running, and re-packing the system.

320 UGRs were assembled, 160 each of two lunch/dinner UGR-RAP menus.

The unit was repacked and sent back to DDSJ - Tracy, CA.

Despite cramped space, equipment, air, and power issues, the group maintained a production rate of about 14 pallets / hour or 112 modules / hour.

The observed production rate was equal to the typical DDSJ assembly operation.

Line balancing and additional optimizations could increase rate 20% – 25%.

Deployment and productive use of the Rapid Assembly Module was successful. Integrated power converters and compressors would allow the system to be deployed worldwide.

1.4. Recommendations

Supply module with voltage step-down transformers of suitable capacity for worldwide use. All equipment will function on both 50 Hz and 60 Hz power. A 20 amp capacity transformer for each would be adequate.

Supply equipment with 500’ 10 gauge cords, plugs, and 100’ 1/2” air hose rated at 250+ psi. Power leads should be lined with a cut resistant sheathing.

Remove the two redundant top-tapers and included a spare taping head.

Include a box of hand tools for the tie-down lag bolts and brackets included in securing the lines together

One sets of open end standard wrenches

One 3/8” drive standard socket set

Two adjustable wrenches (8”)

20” wide, 4” core, pallet wrap

Include an inventory list of tools and include the manufacturers manuals that came with each piece of equipment should any part need replacement in the field.

Spare parts should be included in the container;

Spare belts for the top-taper, various air line fitting, and spare power adaptor plugs

Remove 3 of the 6 pallet levelers.

Replace spring levelers with pallet jack loading electric levelers.

Consider removing box erector and include more tape guns.

Supply modules with 2 additional 20’ flex conveyors and 2, 5’ straight conveyors.

Include reusable, labeled, packing blankets to pad components.

Deploy units only with qualified support personnel

Operational Support Supervisor

Quality Control Specialist

Equipment Support Technician

Modify equipment heights to allow gravity conveyors between pieces to be sloped.

Configure systems as recommended in the "Recommended Module Component List" in appendix 4.3. This list includes specific transformers and compressor specifications.

2. Program Management

The project was awarded on March 9, 2005 under contract SP0103-02-D-0024, delivery order 0009 with a total obligation of $28,376. Performance period for this delivery order was originally set for 6/30/05.

The following modifications were issued:

Date	Modification	Description
06/20/05	0009/01	Obligation increased to $36,394 to cover additional tasks.
		Performance period extended from 06/30/05 to 08/30/05.
08/29/05	0009/02	Performance period extended from 08/30/05 to 10/31/05.

3. Short Term Project Activities

3.1. Preliminary Activities

DSCP personnel involved with the Rapid Assembly Module were interviewed prior to the field test to familiarize ourselves with the operation and to make necessary preparations required for the documentation. Video and photographic supplies and support equipment were acquired and clearance requested for recording the events at the prime vendor's location.

3.2. Phase I, "Rapid Assembly Module System Analysis"

In this phase we conducted a systematic analysis of the Rapid Assembly Module and the UGR assembly requirements in order to document in detail the assembly and disassembly of the module as well as the assembly of the UGRs themselves with particular emphasis on capacity and ways to improve the process and system.

3.2.1. Analysis of the Rapid Assembly Module

Existing manuals and documentation was thoroughly analyzed and interviews were conducted with DSCP personnel to document current know-how of the system.

3.2.2. Analysis of the Unitized Group Ration Assembly Requirements

Available specification requirements for UGR assemblies was amassed and analyzed. Additional requirements were collected during interviews with DSCP personnel.

3.2.3. Documentation of the Assembly of the Rapid Assembly Module

A prime vendor with no prior assembly experience was selected to produce UGRs using the module and temporary laborers. Y.Hata was selected as the vendor. The site selected was an industrial park in Honolulu, Hawaii. The facility included a tractor-trailer height loading docks and multiple fork lifts.

Y.Hata worked closely with DSCP and The Wornick Company, a commercial assembler, in generating menus and selecting suitable components from locally available stock. Additionally, Wornick provided details on estimated labor needs and production instruction. Of the three approved menus, two were selected for the production study.

DDSJ was tasked with configuring the line. The box erector, top-tapers, and h-taper were mounted onto metal platforms to allow for ease of handling with pallet jacks or forklifts. Welded brackets were placed around the parameter of each platform to provide stability during transit. Holes were drilled in the brackets so platforms could be anchored to the shipping container's wooden floor with lag bolts. The flexible conveyors were compressed, stacked, and banded together with metal strapping to reduce the space required to store them. The leg pairs on each end of the straight conveyors were removed, strapped together, shrouded with bubble wrap, and stored along the edges of the container. The tops of the straight conveyors were bolted together and rolled under the (3) top-taper platforms. The pallet lifters were disassembled and the springs wrapped and tied down. Separate metal brackets were fabricated to hold the pallet lifters and the automatic pallet wrapper.

Each piece of equipment and conveyor was labeled for ease of re-assembly. Labeled brackets with nuts and bolts were provided to anchor the conveyors to the platform and to other conveyors. The labeling followed the suggested straight-line configuration. A layout with the suggested straight-line layout and utility hookups was included with the container. The packet also included a layout of the container with all the components to help when reloading the container.

On April 11, 2005, the Rapid Assembly Module was unloaded from the trailer and assembled in one of Y.Hata's warehouses located in Honolulu, Hawaii by a mechanical specialist from Defense Depot San Joaquin, Tracy, CA. (DDSJ) and two Y.Hata employees using a fork lift, pallet jacks, and hand tools. The line was setup in about 6 hours. The module was configured by the DDSJ for a straight line configuration. The space available for the operation was about 1/3 of the recommended area. Wornick personnel recommended a line configuration to make all three boxes concurrently, instead of all of box 1's, followed by box 2's, etc. Without a change in layout, congestion would have made effective production impossible. Space constraints also disallowed use of pallet levelers and two other top-tapers. Boxes had to be hand carried from two lines to be top- & H-taped. Conveyors were not sloped, so materials had to be pushed continuously to move.

3.2.4. Documentation of the UGR Assembly Operation

Y.Hata amassed and staged all of the food components, cartons, carton liners, labels, pallet wrap, carton sealing tape, and pallets for the production run as approved by DSCP. The boxes obtained were printed upside down. The box erector made boxes with printing on top. Also, the locally supplied boxes were too stiff to be properly handled by the box erector. It would jam often and required the constant attention. Mini-trays were used instead of common pillow packs for the jelly item. Several trays were prone to leakage.

Components requiring counting and bundling were assembled the preceding days as suggested by Wornick. Several items were wrapped with rubber bands instead of sealed in zip closure bags. Some bundles unraveled during production.

Y.Hata hired temp workers for pre-production and assembly operations. 19 temporary workers were hired for the production operations. Two supervisors and two fork lift drivers were present from Y.Hata. A mechanical technician from DDSJ supported the lines, while two production managers from Wornick helped orchestrate and support production.

In the course of the production day, April 14, 2005, 320 UGRs were assembled, 160 each of two lunch/dinner UGR-RAP menus. Quality control issues were observed. No dedicated outside QC support was provided to the assembly operation. QC inspection was not specifically assigned to any worker. A

bundle of service items was missing from the entire first menu and caused the lot to be reworked. Workers did not always reject dented cans or defective components. Finished product pallets were previously used and were not inspected for integrity or cleanliness.

The equipment also caused some problems. The first rented air compressor failed during production. After failing, the oil level was found to be low. The compressed air required to run the erector, top-taper, and H-taper exceeded the capacity of the second 3-hp air compressor rented by Y.Hata. In an effort to reduce air usage, the air-actuated top-taper box closer was disabled. Top flaps were closed by hand. During the run, the top-taper was not adjusted correctly. The pinch rollers that move the boxes through the taping mechanisms were too close together and would bind as the box went through. Each box had to be pushed through the top-taper.

During production, an excessive compressed air pressure drop to the equipment was noted. The lines supplied with the system were too small to maintain proper pressures in use. The box erectors, top-taper, H-taper, and pallet wrapper were all initially placed on the same 20 amp electrical circuit. When powered up, the circuit breaker inevitably tripped. Eventually, a pile of 14 ga. cords were located and the electrical load was spread to other circuits throughout the room. The box erector ceased to work effectively as the run continued. Stiff boxes, low air pressure, adjustment were cited as problems. Boxes were then assembled by hand. Two workers armed with hand tape guns were able to make boxes faster than the box erector had been running.

Despite cramped space, equipment, air, and power issues, the group maintained a production rate of about 14 pallets / hour or 112 modules / hour during the two production runs. The observed production rate was equal to the typical DDSJ assembly operation.

Work cell line balancing and use of one of the recommended line configurations could increase the production rate 20% – 25% by reducing handling time and wasted movement.

3.2.5. Documentation of the Disassembly of the Rapid Assembly Module

The unit was disassembled and repacked on Friday, April 15, 2005. Two Y.Hata mechanics, a fork lifter operator, and the DDSJ mechanical technician took 6 hours to repack the container using hand tools and a rechargeable drill. Each piece was re-wrapped with bubble wrap, strapped with metal banding, and lag bolted down as needed to the container floor as outlined in the container diagram. (Appendix 4.5)

3.2.6. Manual for Assembly and Disassembly of the Rapid Assembly Module

DDSJ has included a diagrammed assembly manual for a system as the container is currently configured. It is Appendix 4.5. Specific instruction relating to the details of assembling and disassembling a module are specific to the components within the container. The diagrams are labeled with equipment locations and bolt down locations are marked on the floor of the container with ink. When an alternative configuration is selected, a new manual will be issued by the PI. The revised manual will include content similar to that found in Appendix 4.5. Additionally, information regarding maintenance and troubling shooting will also be included. Three alternative layouts using the same or very similar equipment are included in Appendix 4.4. These layouts include specific worker station placement as well and aisle way allowances.

3.2.7. Standard Operating Procedure for UGR Assembly

The SOP for UGR assembly is the attachment in Appendix 4.2. Alternative line layouts are in Appendix 4.4.

3.3. Final Report

This document is the final report for this Short Term Project.

4. Appendix

4.1. Executive Summary Slide Presentation

4.2. Standard Operating Procedure for UGR Assembly

4.3. Recommended Module Components List

4.4. Recommended Line Layout Diagrams

4.5. DDSJ Module Support Manual

Rapid Assembly Module
UGR-H&S RAP
Field Testing in Hawaii

April 11 - 15, 2005

Testing Methodology: Feasibility of RAP unit deployment

- Identify a remote prime vendor with no assembly experience
- Task vendor with building a significant quantity of standard format, three-box UGR-H&S using local inventory
- Deploy the assembly module with minimal technical and operational support
- Observe and document assembly, production and re-packing issues
- Measure production throughput

Operational Summary

- A prime vendor with no prior assembly experience was selected to produce UGRs using the module and temporary laborers, Y.Hata.
- Wornick, a commercial assembler, provided guidance in menu and component selection and two support personnel for line set up, loading order, and operation.
- The trailer with equipment and conveyors was configured by DDSJ and shipped to Y.Hata.
- Y.Hata hired temp workers for pre-production and assembly operations.

Operational Summary - 2

- Y. Hata amassed and staged Food components / subassemblies
- A mechanical technician from DDSJ supported unpacking, setting up, running, and re-packing the system.
- 320 UGRs were assembled, 160 each of two lunch/dinner UGR-RAP menus.
- The unit was repacked and sent back to DDSJ - Tracy, CA.

Implementation Issues

- Unit Set-up
  - The module was configured for a straight line operation. All conveyors and equipment were labeled for a long, continuous line. A long line could not be used as recommended by DDSJ. Only 1/3 of the recommended space was available.
  - An alternate configuration was implemented using available space and two separate assembly lines for two of the three boxes. Boxes were transferred to the sealing line by hand.

Implementation Issues - 2

- Materials
  - Boxes were printed upside down; box erector made boxes with printing on top.
  - Locally supplied boxes were too stiff to be properly handled by the box erector.
  - Mini-trays were used instead of common pillow packs. Trays were prone to leakage.
  - Pre-counted service items bundled with bands/string unraveled during assembly

Implementation Issues - 3

- Quality Control
  - No dedicated outside QC support was provided
  - No dedicated QC inspection workers were assigned
  - A bundle of service items was missing from the entire first menu and caused reworked
  - Workers did not always reject dented cans or defective components
  - Finished product pallets were previously used and were not inspected for integrity or cleanliness

Implementation Issues - 4

- Equipment
  - The first rented air compressor failed during production, low oil
  - The compressed air requirements of the erector, top-taper, and H-taper exceeded the capacity of the second 3-hp air compressor rented by Y.Hata.
  - The top-taper box closer was disabled to save air. Top flaps were closed by hand.
  - The top-taper was not adjusted correctly and boxes had to be pushed through
  - Excessive pressure drops to equipment due to smaller than recommended air lines
  - The box erectors, top-taper, H-taper, and pallet wrapper were all placed on the same electrical circuit. 14 ga. cords spread the load to other circuits when breakers tripped.
  - The box erector ceased to work effectively. Boxes were assembled manually. Two workers made boxes faster than the box erector.

Implementation Issues - 5

- Operations
  - The space available for the operation was about 1/3 of the recommended area
  - Wornick personnel recommended a line configuration to make all three boxes concurrently, instead of all of box 1's, followed by box 2's, etc.
  - Without a change in layout, congestion would have made effective production impossible
  - Space constraints disallowed use of pallet lifter tables and two other top-tapers
  - Boxes had to be hand carried from two lines to be top- & H-taped
  - Line balancing was not optimal. One line ran significantly faster than others
  - Conveyors were not sloped, so materials had to be pushed continuously to move

Production Results

- Despite cramped space, equipment, air, and power issues, the group maintained a production rate of about 14 pallets / hour or 112 modules / hour
- The rate was equal to the typical DDSJ assembly operation
- Line balancing and additional optimizations could increase rate 20% – 25%

- 19 temp workers, 2 supervisors, 2 fork lifter operators, and 3 outside support personnel made 320 modules in 2 runs in a single day.

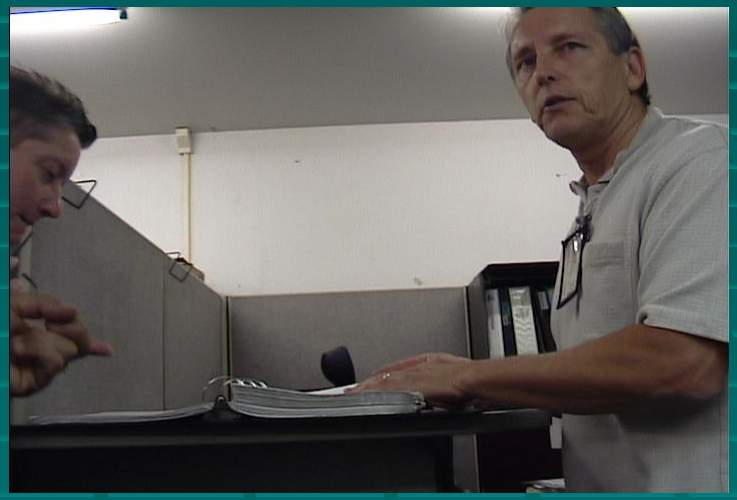
Closing Words in Hawaii

Follow Up Actions

- Collect information to develop an SOP for setup, operation, and repacking of RAP module
  - Develop workstation task assignment guidelines
    - Interview DDSJ Operations Manager
    - Observe and document DDSJ assembly operations
  - Design and outline alternative layouts based on space limitations
    - Assemble RAP line components at DDSJ in multiple configurations
    - Measure area required for each layout
- Identify equipment to increase system throughput and reliability
- Determine Operational utility requirements
  - Compressed Air SCFM
  - Power for 120v/60 and worldwide 220v/50

DDSJ Operations

- DDSJ Operations Manager outlined workstation and assembly guidelines



- UGR Assembly line was recorded and line speed measured

DDSJ Operations

- RAP module was assembled in multiple configurations in an open space

- Operational footprints of each layout were measured

Recommendations

- Supply module with voltage transformers of suitable capacity for worldwide use
- Supply equipment with 500’ 10ga. cords, plugs, and 100’ 1/2” hose
- Include only one top-taper per module with one extra head
- Reduce leveler count to 3 per module
- Replace spring levelers with pallet jack loading electric levelers
- Consider removing box erector, include more tape guns
- Supply modules with 2 additional flex, and 2, 5’ straight conveyors
- Include reusable packing blankets to pad components
- Deploy units only with qualified support personnel
  - Operational Support Supervisor
  - Quality Control Specialist
  - Equipment Support Technician

Unitized Group Rations Rapid Assembly Module

Introduction

Military personnel are fed in the field through one of four core ration groups; Individual self-prepared MREs, Unitized Group Rations Heat and serve (UGR-H&S), UGR-A and UGR-B. This document outlines the SOP for assembling a UGR rations using a flexible, portable system that can be setup anywhere in a short amount of time. Lead times and capacity can be increased quickly to respond to disaster relief aid, increased military activity, or civil needs.

The system relies on manual handling of materials to load components into corrugated boxes. The complete process of making boxes, assembling UGRs, and sealing boxes can be all be done by hand. However, the use of a box erector, conveyors, automatic taping machines, and a pallet wrapper allow throughput to be increased significantly while relying on fewer workers and less space. If utilities or adequate space are not available for one of the three recommended configurations, alternates can be employed to make the best of available resources.

Generally, each UGR-H&S RAP assembly will consist of three boxes containing a total of 15-20 different items. Boxes 1-3 will contain enough food components and accessories to feed 50 solders one meal. Accessories will include such items as cups, napkins, trays, utensils, garbage bags, etc. Food items will be dry, canned, or other retorted goods that are shelf-stable and require no refrigeration. Ingredients requiring cooking with water, such as rice, will also be common among menus.

Successful UGR assembly requires careful planning and attention to details. Three key areas must be adequately supported to minimize production issues; Quality Control, Production, and Mechanical Support. Each of these areas requires the support of at least one dedicated, experienced, professional. Without the support of dedicated personnel, no attempt should be made to assemble anything.

Outline of Tasks to Unitized Group Rations delivery

1. Vendor requested to provide production capacity / availability
2. Appraisal of available floor space, power, and labor
3. Line configuration selection – Request for RAP unit shipment
4. Recipe development and pricing
5. Recipe submission and approval
6. Food component ordering / delivery (lot documentation for traceability)
7. Sub-assembly fabrication (counting, packing utensils and condiments, etc.)
8. RAP unit delivery
9. RAP unit setup
10. UGR-H&S RAP assembly, packaging, and documentation
11. Lot acceptance / Lot shipment
12. RAP unit repacking
13. RAP unit shipping

Tasks to Unitized Group Rations delivery

1. Vendor requested to provide production capacity / availability
The sponsor or buyer will contact companies to determine the suitability and level of interest in supporting the assembly of UGRs. Interested parties will then supply the sponsor or buyer details regarding their facilities and resources.
Space; Room dimensions, space conditioning?
Electrical service; Number of circuits, voltage/amperage of each
Compressed air; Air pressure, cfm, inline dryer? filtered?
Estimated workers available, shifts/day, days/week

2. Appraisal of available floor space, power, and labor
The sponsor or buyer will then determine the best recipient for the system based on availability of suitable space, utilities, and labor/experience.

3. Line configuration selection – Request for RAP unit shipment – Order Boxes
The selected recipient will review the assembling process procedure and determine a suitable configuration based on space, labor, and resources. The recipient will coordinate with the RAP Unit custodian for shipment of the RAP unit. Boxes should be ordered as soon as practical. Boxes should meet the sponsor's requirements.

4. Recipe development and pricing
The sponsor or buyer will supply the assembler with suggested menu configurations (recipes). The assembler will then select locally available items to fulfill the menu item requirements. If matching items are not available, substitutions can be made. Nutritional statements must be included with the menus.

5. Recipe submission and approval
The list of candidate items available in the required volumes and costs must be submitted for approval by the sponsor or buyer. Unacceptable items will require substitution. Diligent communication with the sponsor or buyer will speed the process. No items over 90 days old should be assembled into UGRs. The oldest or most perishable component will determine the UGR's shelf life. Specific shelf life requirements as specified by the buyer must be followed.

6. Food component, accessory, and label ordering/delivery (documentation / traceability)
Approved recipe items should be ordered in sufficient quantities to fulfill the order. Lot numbers of all incoming materials should be documented to provide traceability of finished goods should there be a recall. Each production day will represents an assembled lot. Associated component lot numbers should be cross-referenced to the day's production run by concise records. Incoming materials should be inspected for package integrity and freshness. Storage of incoming materials should be covered and protected from the elements.

7. Sub-assembly fabrication (counting and packing utensils, etc.)

Food components and accessory items should be inventoried upon receipt. Counted items should be made ahead of UGR assembly operations. Each counted unit should be labeled and bundled adequately to maintain proper counts. Sealable bags should be used if available, not string or rubber bands. Components should be inspected as they are handled. Any foreign debris or defective item should be noted and discarded.

8. RAP unit delivery

The shipping container should be placed as close as practical to the assembling area. Inspect the outside and the interior of the container for damage or loose equipment. Note any damage and report to the sponsor. Missing or damaged equipment should be reported as soon as possible to allow for shipment of replacement pieces.

9. RAP unit setup

Open the container and remove the inventory sheet from the crate just inside. Follow the inventory sheet attached at the end this document to insure that all RAP unit equipment and components are included. Remove tie down bolts and lift equipment with pallet jacks or fork lifts when removing heavy equipment. A tool box with appropriate hand tools is included at the entrance of the container. Be certain that all tools are placed back into the toolbox and that the toolbox inventory form is filled out after work is completed.

The included configuration diagrams will serve as the guide for equipment placement. Move all equipment into position before connecting braces together. The following is a typical chronology of assembly stations and their labor requirements. Become familiar with the station functions and the order of operations. If space or resources cannot accommodate any of the three suggested layouts completely, the conveyors and tape sealing stations represent the best use of very limited space.

Box assembly

Using Box Erector

1 mechanic loads boxes and tape, and maintains machine

OR

Manual method

2 workers assemble boxes / tape bottoms with handheld dispensers

Insert Placement

2 workers fold and place box inserts into each box and labels each box, 1, 2, or 3 with the appropriate labels.

Box transfer to assembly stations (Needed for ‘2 into 1 Configuration’ only)

1 worker transports boxes to stations as needed

Box 1 Station A

1 Worker (1A) **Inspects** and loads 3-5 components into box 1

Box 1 Station B

1 Worker (1B) **Inspects** and loads 3-5 components into box 1

Box 1 Station C

1 Worker (1C) **Inventory check for box 1 contents**, loads 0-1 component(s) and inventory sheet into box 1.

Box 2 Station A

1 Worker (2A) **Inspects** and loads 3-5 components into box 2

Box 2 Station B

1 Worker (2B) **Inspects** and loads 3-5 components into box 2

Box 2 Station C

1 Worker (2C) **Inventory check for box 2 contents**, loads 0-1 component(s) and inventory sheet into box 2

Box 3 Station A

1 Worker (3A) **Inspects** and loads 3-5 components into box 3

Box 3 Station B

1 Worker (3B) **Inspects** and loads 3-5 components into box 3

Box 3 Station C

1 Worker (3C) **Inventory check for content in boxes 1, 2, & 3**, inventory sheet into box 3, maintain box order going into top taper, push all boxes into top taper.

Second labeling / H – tape feeder

1 Worker affixes second box label and pushes all boxes from top taper to H-taper in-feed conveyor.

Pallet loading

2 Workers remove boxes from H-tape conveyor and load boxes onto pallets for wrapping

Fork Lift/Pallet Jack operators

2 Workers to replenish assembly stations, remove pallets from wrapper, move materials.

Waste Management

Worker(s) circulate among stations to remove accumulated waste material

U Line or Straight Line

2 Workers

2 into 1 Line

1 Worker

Utility requirements and hook-up instructions are included at the end of this package. Cords and hoses are color-coded for ease of assembly. Equipment and conveyors should be connected securely using the marked clamp assemblies between each piece.

10. UGR-H&S RAP assembly, packaging, and documentation

Worker stations should be equipped with a list of the components the worker is loading and their placement within the box. All assembly stations are also QC check points. Dented cans, opened packages, defective components, etc. should not be packaged. All

stations with should be monitored periodically to insure consistent quality. Products over 90 old should not be packaged. Only new, or clean, used pallets should be used to transport finished modules.

11. Lot shipment
The assembled lot is shipped to the sponsor or buyer with all appropriate labeling and documentation. Each day's production should be issued a unique lot number for traceability.

12. RAP unit repacking
The inventory sheet used to check the contents of the shipping container on receipt should be used to inventory equipment being reloaded. Each piece of equipment should be disconnected and covered with the packing blankets and strapping material. Each piece should be restacked as required and repacked into the container following the diagram. Tie-downs should be bolted tight and loose panels secured. Each item on both the master and toolbox inventory sheets should be checked before loading into the container. Any missing, damaged, or defective equipment should be noted and reported to the sponsor or buyer as soon as possible.

13. RAP unit shipping
The repackaged shipping container is shipped back to the custodian, or the next assembly point.

UGR-RAP Assembly Module Recommended Components

Box Erector

Existing Model, COMBI Packaging 2EZ Plus

Air; Requires **24.33** SCFM @ 80 PSIG @ 12 cartons/min

Power; 120vac/15amps/1ph 50/60hz

Recommended current Model, COMBI Packaging 2EZ HS Plus

Air; Requires **12.56** SCFM @ 80 PSIG @ 15 cartons/min

Power; 120vac/15amps/1ph 50/60hz

Pallet Wrapper

Existing Model, Wulftec International, Model WHP-150

Power; Requires 120vac/15amps/1 ph 50/60hz

Requires forklift and aisle space to load and unload

Recommended model, Vestil Semi-Automatic Stretch Wrapper

Power; Requires 120vac/5amps/1ph 50/60hz

Part 49-007d & 49-009d @ www.chdist.com

Can be loaded by pallet jacks

Load Levelers

(6/module) Existing Models, Southworth Products, Pallet Pal Level Loader

Requires forklift and aisle space to load and unload

(2/module) Recommended model, Southworth Products, Roll-On Level Loaders

Requires 120vac/5amps/1 ph 50/60hz

Part 72-561DX @ www.chdist.com

Can be loaded by pallet jacks

Top Taper

Existing Model, COMBI Packaging, Model TBS100FC, 3" tape head

Air; Requires 5cfm @ 60psi

Power; 120vac/15amps/1 ph 50/60hz

(Include spare tape head)

H- Taper

Existing Model, Best Pack, Model 6SAM130, 3" tape head

Air; Requires 5cfm @ 60psi

Power; 120vac/20amps/1 ph 50/60hz

Conveyors

(2) Bestflex Model BFR24-20, Flexible/Expandable Gravity conveyors, 20'x2'

(5) Hytrol Model 19SR21-3, Straight Gravity Conveyor, 10'x2'

(2) Hytrol Model 19SR21-3, Straight Gravity Conveyor, 5'x2'

Air compressor; 15 hp with existing system

or 2 x 5hp with recommend system (Separate compressor for erector alone)

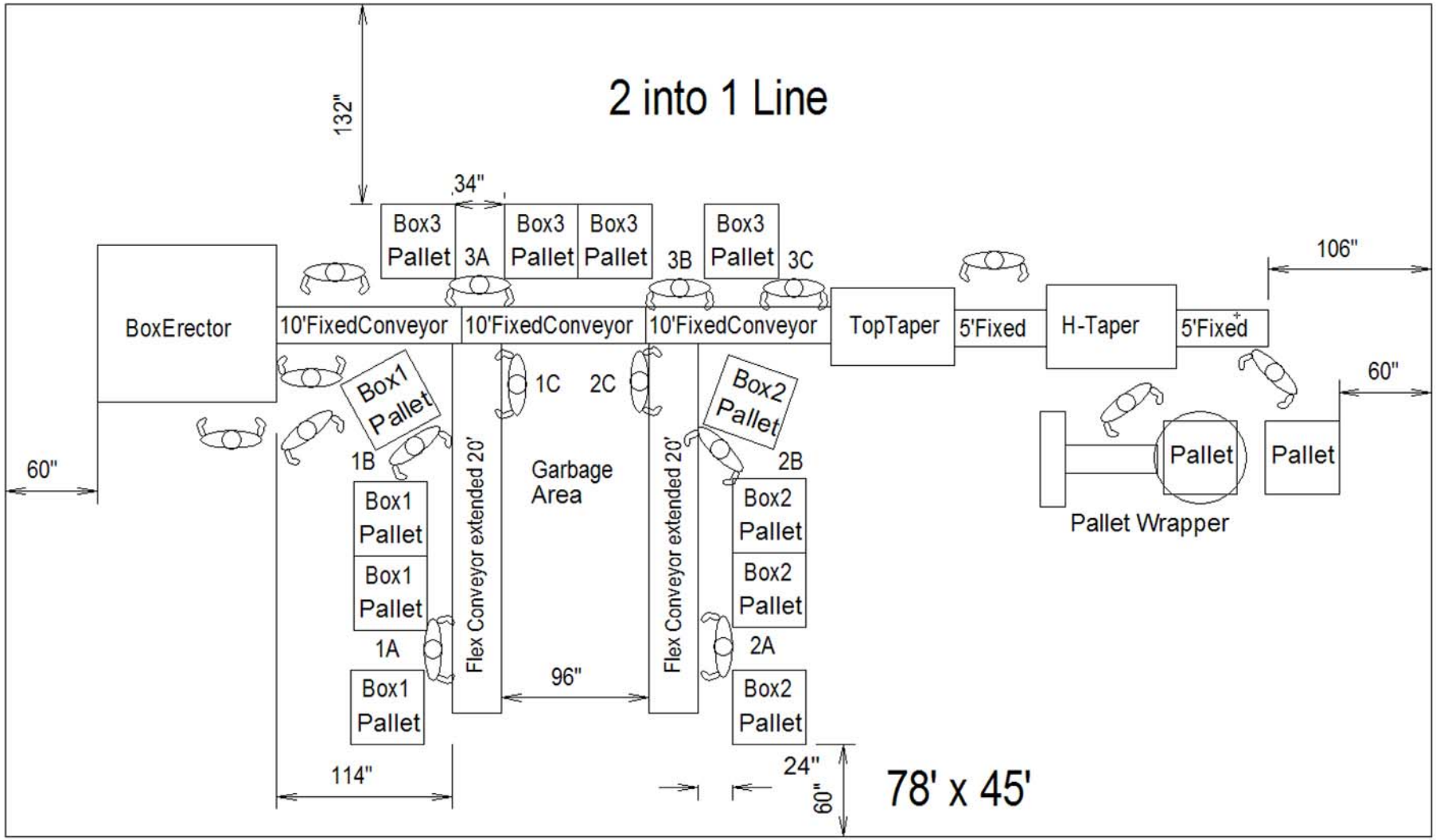
Power transformer (220-230/50hz step down to 110/120vac)

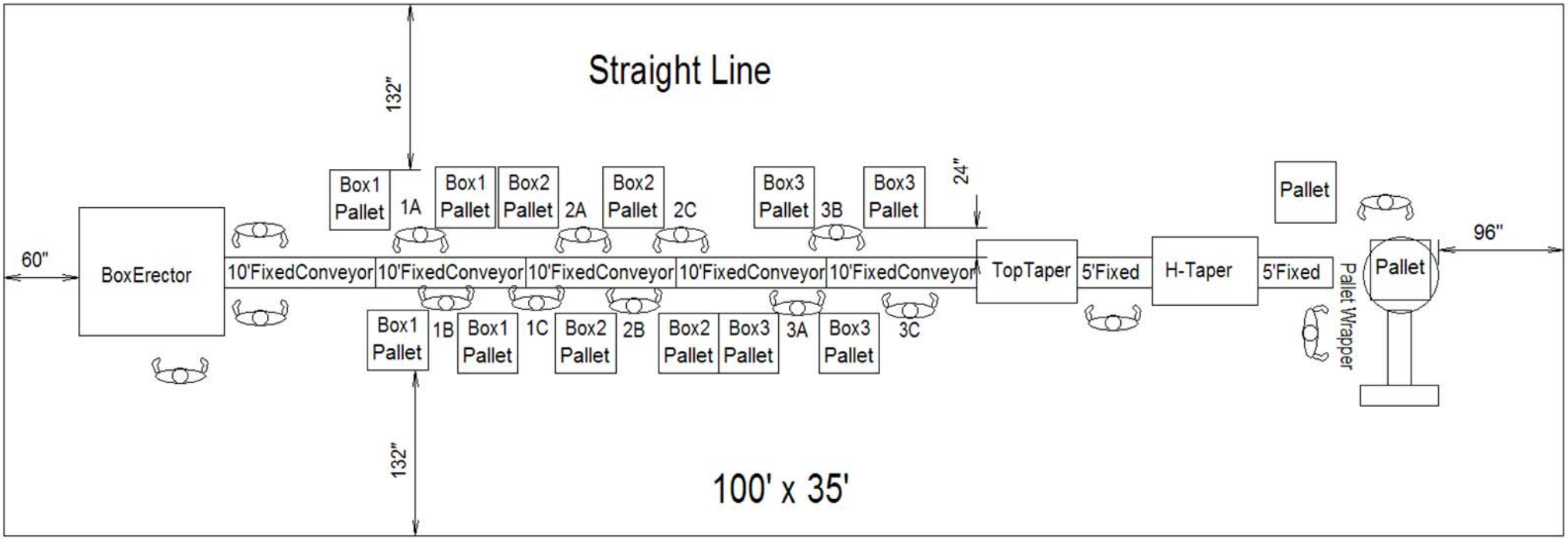
Multiple transformers

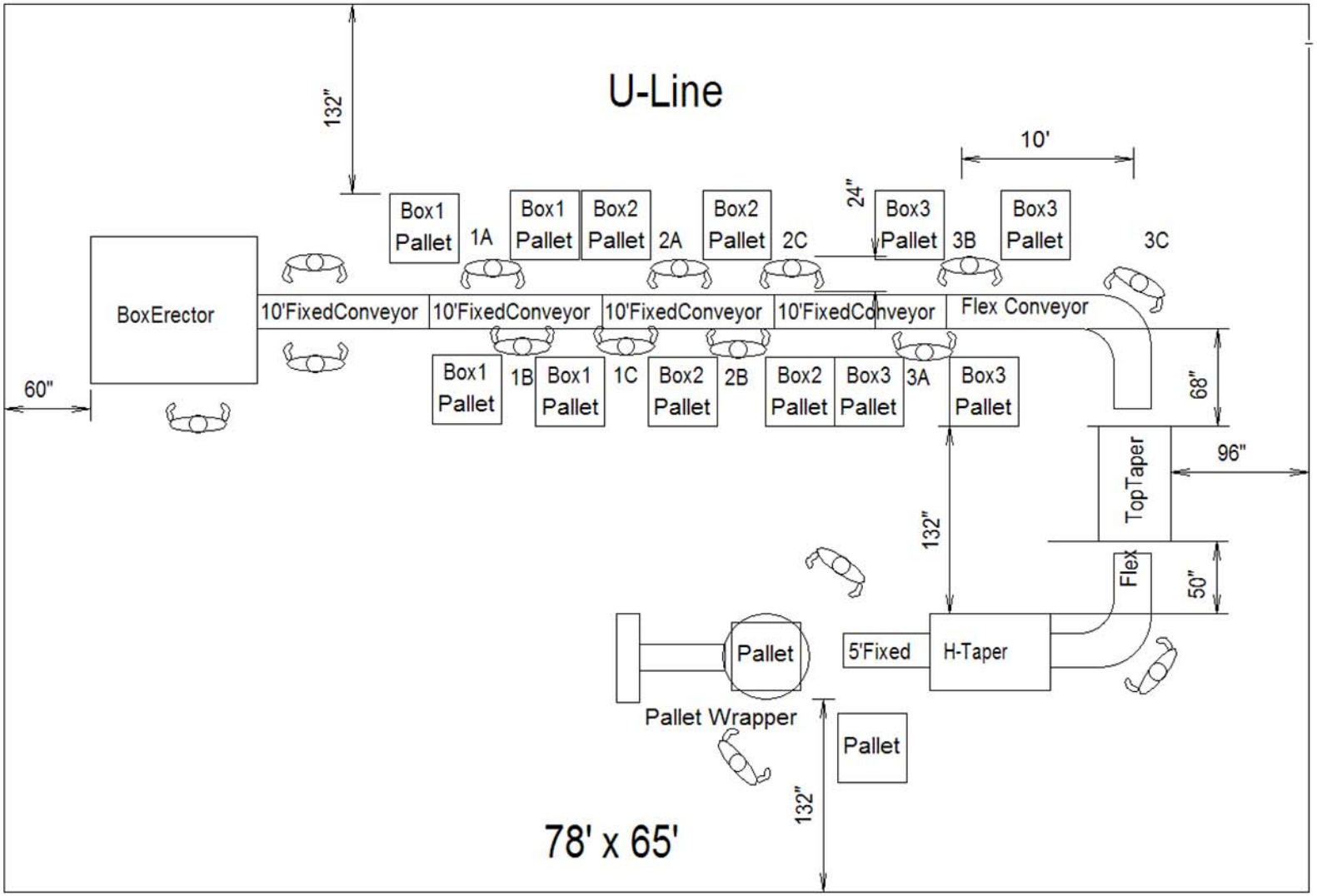
Each piece would have an integrated off-the-shelf 3000watt capacity step down transformer/regulator. (37lbs, ~$150 each)
Model SVC3000, from www.voltagetransformers.com

Alternatively, one transformer could supply power to the whole system

90amps for existing system
50amps for recommended system


2 into 1 Line
132"
34"
Box3 Pallet
3A
Box3 Pallet
Box3 Pallet
3B
Box3 Pallet
3C
106"
BoxErector
10'FixedConveyor
10'FixedConveyor
10'FixedConveyor
TopTaper
5'Fixed
H-Taper
5'Fixed
60"
Box1 Pallet
1C
2C
Box2 Pallet
1B
2B
60"
Garbage Area
Box1 Pallet
Box1 Pallet
Box2 Pallet
Box2 Pallet
1A
2A
Flex Conveyor extended 20'
Flex Conveyor extended 20'
96"
Box1 Pallet
Box2 Pallet
Pallet
Pallet
Pallet Wrapper
114"
24"
60"
78' x 45'


Straight Line
132"
Box1 Pallet
1A
Box1 Pallet
Box2 Pallet
2A
Box2 Pallet
2C
Box3 Pallet
3B
Box3 Pallet
24"
Pallet
60"
BoxErector
10'FixedConveyor
10'FixedConveyor
10'FixedConveyor
10'FixedConveyor
10'FixedConveyor
TopTaper
5'Fixed
H-Taper
5'Fixed
Pallet Wrapper
Pallet
96"
Box1 Pallet
1B
Box1 Pallet
1C
Box2 Pallet
2B
Box2 Pallet
Box3 Pallet
3A
Box3 Pallet
3C
132"
100' x 35'


U-Line
132"
10'
24"
Box1 Pallet
1A
Box1 Pallet
Box2 Pallet
2A
Box2 Pallet
2C
Box3 Pallet
3B
Box3 Pallet
3C
BoxErector
10'FixedConveyor
10'FixedConveyor
10'FixedConveyor
10'FixedConveyor
Flex Conveyor
60"
Box1 Pallet
1B
Box1 Pallet
1C
Box2 Pallet
2B
Box2 Pallet
Box3 Pallet
3A
Box3 Pallet
68"
96"
TopTaper
132"
Flex
50"
Pallet
5'Fixed
H-Taper
Pallet Wrapper
Pallet
132"
78' x 65'

Unitization Equipment Kit

UGR, Heat and Serve (UGR H&S)

NSN = 7360-01-476-4173
1 each
Case Erector
"Left-handed feed/w 3 inch tape heads"
Combi Packaging Systems LLC
Canton, OH
Model Number: 2-EZ Plus

3 each
Sealing System/Case Taper
"3 inch tape heads"
Combi Packaging Systems LLC
Canton, OH
Side Belt Drive Pressure Sensitive Taper
Model Number: TBS 100FC

1 each
Edge Sealer
Best Pak 6 Series Model 6 SAM
Semi-Automatic Adjustable
BestPack Packaging Systems
Rancho Cucamonga, CA

1 each
Stretch Wrap System
Wulftec International
Ayer's Cliff, Quebec
Model WHP-150

6 each
Pallet Level Loader
Southworth Products Corp.
Portland, ME
Model Number: Pallet Pal Level Loader
Fully Automatic, Spring Actuated

4 each
Non Driven Conveyor/w 2 supports/stands
Hytrol Modal 19SR20-3
Gravity roller
Inline – 24 inches wide by 10 feet long

2 each
Non Driven Conveyor/w supports
Bestflex Model BFR24-20
Flexible/Extendible Gravity roller
Flex – 24 inches wide by 20 feet long

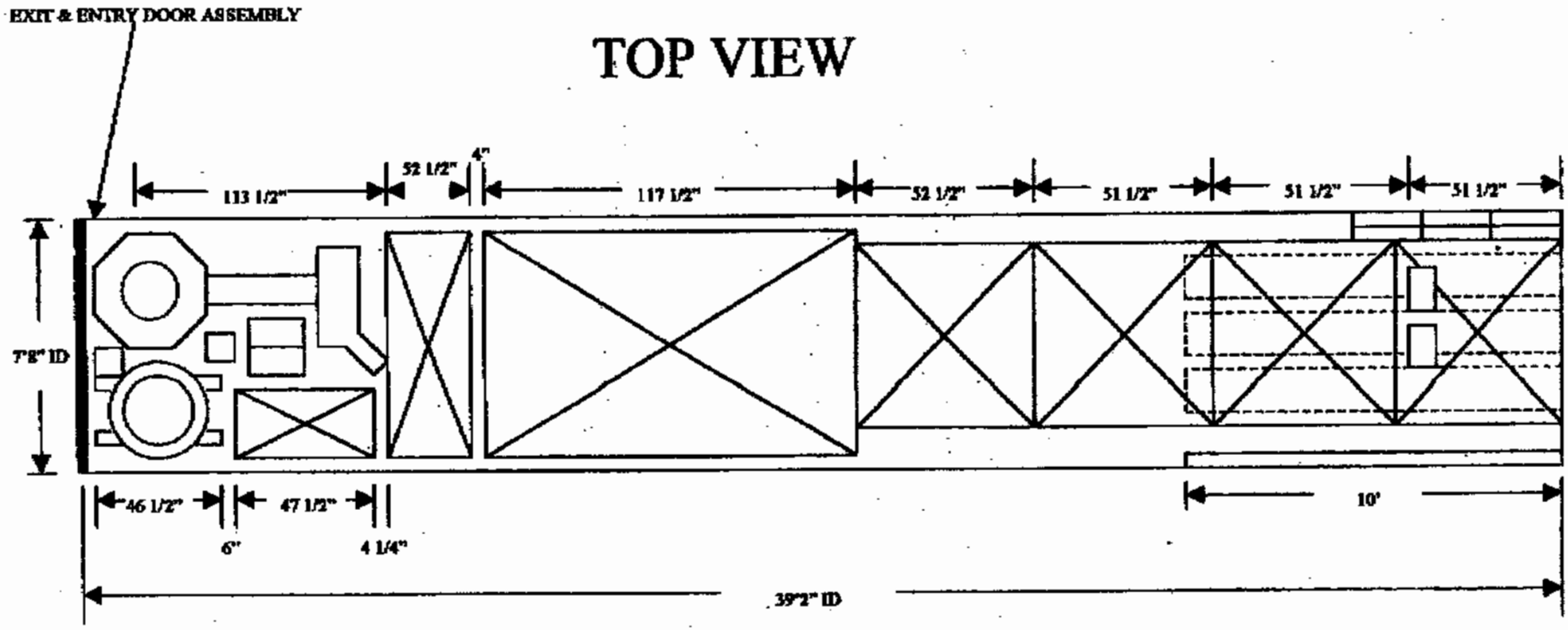
1 each
Container 40 ft L, 9.6' H
NSN: 8145-01-463-8555
Painted OD Green

TABLE OF CONTENTS:

INVENTORY OF EQUIPMENT & MATERIALS IN SHIPPING CONTAINER BY ALPHABETICAL LOCATION			
DESCRIPTION	***SERIAL NUMBER***	***EQUIPMENT NUMBER***	***QUANTITY***
(A) AIR HOSES	N/A	N/A	3 EA.
(B) STRETCH WRAP	0900-6625	0X8003	1 EA.
(C) LEVELER LOADER	9999 8	0X4300	1 EA.
(C) LEVELER LOADER	9999 6	0X4301	1 EA.
(C) LEVELER LOADER	9999 5	0X4302	1 EA.
(C) LEVELER LOADER	6340 1	0X4303	1 EA.
(C) LEVELER LOADER	9999 7	0X4304	1 EA.
(C) LEVELER LOADER	6340 2	0X4305	1 EA.
(D) WRAPPING FILM	N/A	N/A	32 RL.
(E) COIL , SPRINGS	N/A	ATTACHED TO OX4300	1 EA.
(E) COIL , SPRINGS	N/A	ATTACHED TO OX4301	1 EA.
(E) COIL , SPRINGS	N/A	ATTACHED TO OX4302	1 EA.
(E) COIL , SPRINGS	N/A	ATTACHED TO OX4303	1 EA.
(E) COIL , SPRINGS	N/A	ATTACHED TO OX4304	1 EA.
(E) COIL , SPRINGS	N/A	ATTACHED TO OX4305	1 EA.
(F) CONVEYOR, GRAVITY	N/A	0R7013	1 EA.
(F) CONVEYOR, GRAVITY	N/A	0R7014	1 EA.
(G)CASE ERECTOR-BOTTOM TAPER	2EZ050144435	0X7013	1 EA.
(H) CARTON SEALER	006005	0X7016	1 EA.
(I)AUTOMATIC CASE SEALER	TB1090036196	0X7015	1 EA.
(J)AUTOMATIC CASE SEALER	TB1090036195	N/A	1 EA.
(K) LEGS , CONVEYOR	N/A	N/A	2 EA.
(L)AUTOMATIC CASE SEALER	TB1090030202	N/A	1 EA.
(M) CONVEYOR , GRAVITY	N/A	N/A	1 EA.
(N) LEGS , CONVEYOR	N/A	ATTACHED TO 0R7015	2 EA.
(N) LEGS , CONVEYOR	N/A	ATTACHED TO 0R7016	2 EA.
(N) LEGS , CONVEYOR	N/A	ATTACHED TO 0R7017	2 EA.
(O) CONVEYOR , GRAVITY	N/A	0R7015	1 EA.
(O) CONVEYOR , GRAVITY	N/A	0R7016	1 EA.
(O) CONVEYOR , GRAVITY	N/A	0R7017	1 EA.
(P) TAPE FOR BOX SEALER	N/A	N/A	1 BX.
(Q) HAREWARE MISC.	N/A	N/A	1 METAL BX.
LITERATURE DESCRIPTION	***MODEL***	***MANUFACTURER***	***QUANTITY***
(Q) LITERATURE: AUTOMATIC CASE SEALER	TBS100FC	COMBI PACKAGING SYSTEM INC.	1 BINDER
(Q) LITERATURE: CARTON SEALER	6SAM130	BEST PACK	1 BINDER
(Q) LITERATURE: CASE ERECTOR-BOTTOM TAPER	2EZPLUS	COMBI PACKAGING SYSTEM INC.	1 BINDER
(Q) LITERATURE: STRETCH WRAP	WHP-150	WULFTEC INTERNATIONAL	1 BINDER

(Q) LITERATURE: PORTABLE UGR ASSEMBLY,LAYOUT, ASSEMBLY INSTRUCTION,INVENTORY LISTING,SHIPPING CONTAINER LAYOUT			1 BINDER
RAMP , LOADING			1 SET

OVERALL LAYOUT OF SHIPPING CONTAINER FOR UGR ASSEMBLY LINE

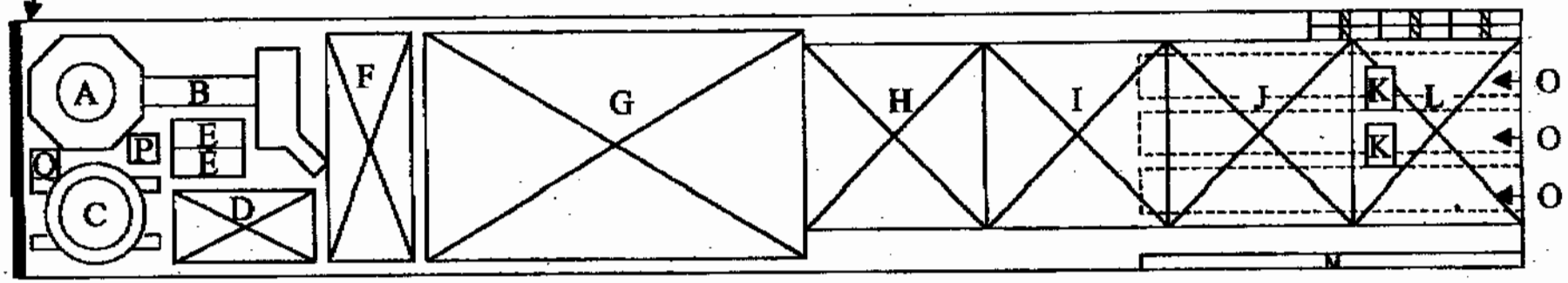


DATA: SHIPPING CONTAINER
TYPE: SAC-1AH-18
MANUFACTURER'S NUMBER: 9903168
MANUFACTED BY: SUZHOU ASIA CONTAINER INTERNATIONAL
MFR. DATE: 1999

LAYOUT OF UGR EQUIPMENT & MATERIALS IN SHIPPING CONTAINER

EXIT & ENTRY DOOR ASSEMBLY

TOP VIEW



LISTS OF EQUIPMENT & MATERIALS LOCATION IN SHIPPING CONTAINER:

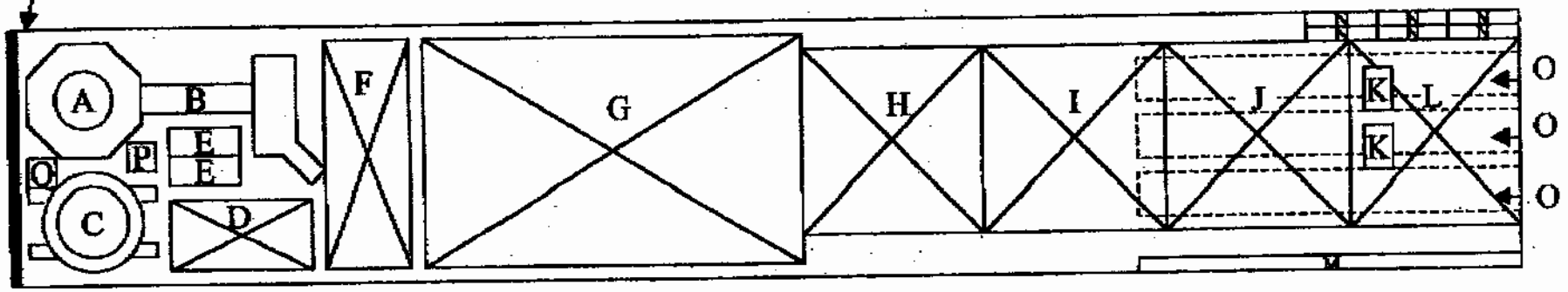
(A) AIR HOSES	NOTE! PLACE ON TOP OF TURN-TABLE ON STRETCHWRAP.
(B) STRETCHWRAP (EQUIPMNET# 0X8003), S/N: 0900-6625	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS & 4 EA SPECIAL BRACKETS
(C) LEVELER LOADER (PALLETPAL) 6 EA. EQUIPMENT# OX4300, 0X4301, 0X 4302, 0X4303, 0X4304, 0X4305	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS & 3 EA. SPECIAL BANDS. STACK 6 HIGH & BANDED TOGETHER AND ALSO WRAP WITH WRAPPING FILM.
(D) WRAPPING FILM FOR STRETCHWRAP (OX8003) 32 RL.	NOTE! BLOCK WITH 3 EA. ANGLE IRON AT PALLET BASE TO FLOOR DECKING. STACK 2 HIGH WRAP WITH WRAPPING FILM.
(E) COIL, SPRINGS FOR LEVELER LOADER (PALLETPAL) 6EA.	NOTE! 2 ROW, STACK 3 HIGH. WRAP IN BUBBLE PACK.
(F) GRAVITY ROLLER (BEST FLEX) EQUIPMENT# 0R7014, 0R7013	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS & 4 SPECIAL BRACKETS. STACK 2 HIGH & BANDED TOGETHER.

GO TO NEXT PAGE

LAYOUT OF UGR EQUIPMENT & MATERIALS IN SHIPPING CONTAINER

EXIT & ENTRY DOOR ASSEMBLY

TOP VIEW



LISTS OF EQUIPMENT & MATERIALS LOCATION IN SHIPPING CONTAINER:

(G) CASE ERECTOR- BOTTOM TAPER (EQUIPMENT# 0X7013) S/N:2EZ050144435	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS AT PLATFORM LEGS.
(H) CARTON SEALER (EQUIPMENT# 0X7016) S/N:006005	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS & 2 EA SPECIAL BRACKETS TOWARD ENTER DOOR SIDE & OPPSITE SIDE SECURE TO FLOOR DECKING AT PLATFORM LEGS.
(I) AUTOMATIC CASE SEALER (EQUIPMENT# 0X7015) S/N: TB1090036196	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS AT LEGS.
(J) AUTOMATIC CASE SEALER (SPARE UNIT NOT PART OF UGR ASSEMBLY LINE) S/N: TB1090036195	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS AT LEGS.
(K) LEGS, CONVEYOR (HYTROL) 2 EA. (SPARE UNIT NOT PART OF UGR ASSEMBLY LINE)	NOTE! PLACE ON PLATFORM (L). WRAP WITH BUBBLE WRAP & WRAPPING FILM.
(L) AUTOMATIC CASE SEALER (SPARE UNIT NOT PART OF UGR ASSEMBLY LINE) S/N: TB1090030202	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS AT LEGS.

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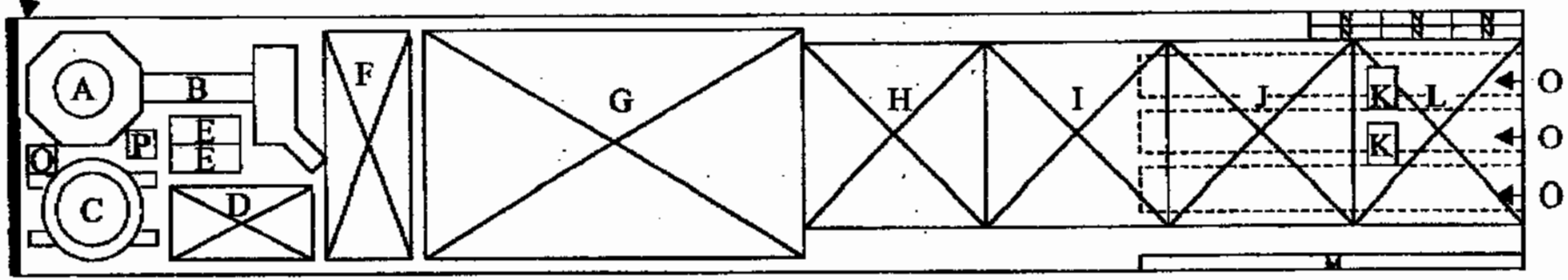
LAYOUT OF UGR EQUIPMENT & MATERIALS IN SHIPPING CONTAINER

EXIT & ENTRY DOOR ASSEMBLY

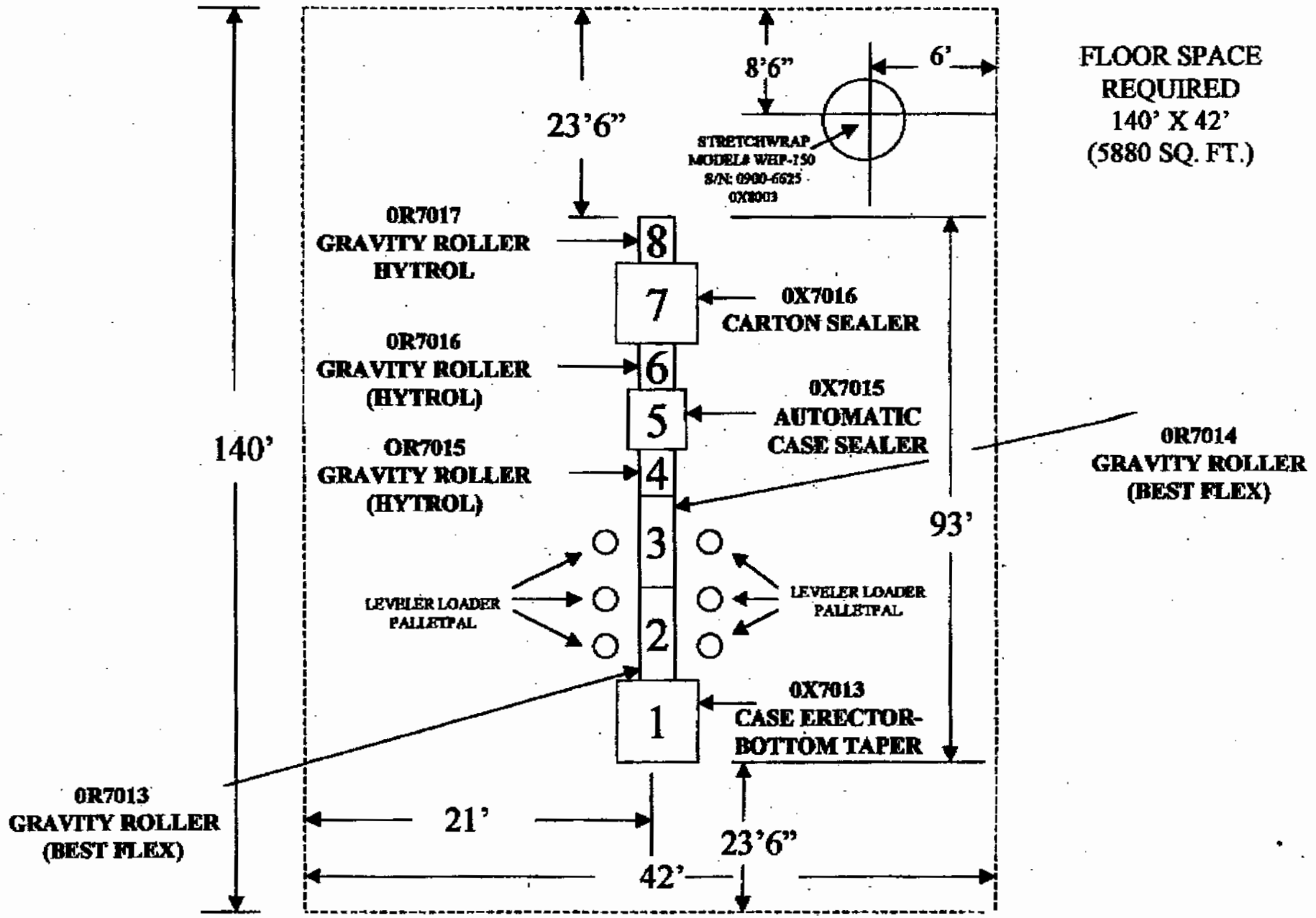
TOP VIEW



LISTS OF EQUIPMENT & MATERIALS LOCATION IN SHIPPING CONTAINER:

(M) CONVEYOR,HYTROL 1 EA. (SPARE UNIT NOT PART OF THE UGR ASSEMBLY LINE)	NOTE! STANDING ON EDGE & MOUNTED WITH LAG BOLTS TO FLOOR DECKING. SOME OF THE ROLLERS MUST BE REMOVE TO BE ABLE TO REMOVE LAGS BOLTS.
(N) LEGS , CONVEYOR (HYTROL) 6 EA. LEGS MOUNT ON CONVEYOR (HYTROL) EQUIPMENT# 0R7015 , 0R7016 , 0R7017	NOTE! WRAP BUBBLE PACK & WRAPPING FILM. STACK SIDE BY SIDE.
(O) CONVEYOR (HYTROL) 3 EA. (EQUIPMENT # 0R7015 , 0R7016 , 0R7017	NOTE! SECURE TO FLOOR DECKING WITH LAG BOLTS .LAYING FLAT ON THE FLOOR UNDER (I) , (J) , (L)
(P) TAPE,BOX SEALER MFR: 3M (371) 1 BOX.	NOTE! TAPE ROLLS INSIDE OF BOX FOR THE BOX SEALER
(Q) LITERATURE BINDER	NOTE! INSIDE BOX
(Q) HAREWARE MISC.	NOTE! INSIDE BOX WITH LITERATURE BINDER

LAYOUT OF FLOOR PLAN UGR ASSEMBLY LINE

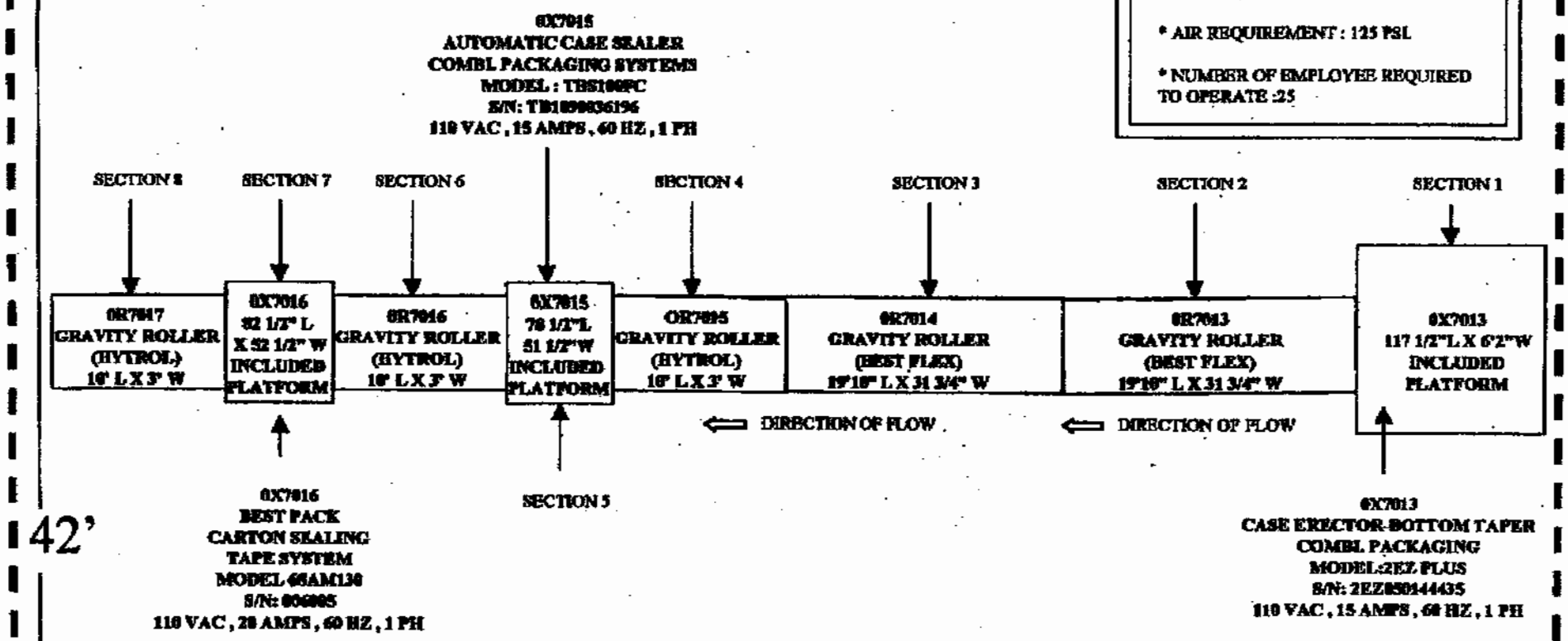


PORTABLE UGR ASSEMBLY LINE

NOTE! NOT TO SCALE

EQUIPMENT LAYOUT , SPACE REQUIRED , EQUIPMENT DIMENSIONS & POWER / AIR REQUIREMENT

REQUIREMENT:
* FLOOR SPACE REQUIRED : 5880 SQ. FT.
* POWER REQUIREMENT : 120 VAC, 50 AMP , 1PH.
* AIR REQUIREMENT : 125 PSI.
* NUMBER OF EMPLOYEE REQUIRED TO OPERATE :25



TOP VIEW LAYOUT

PORTABLE UGR ASSEMBLY LINE

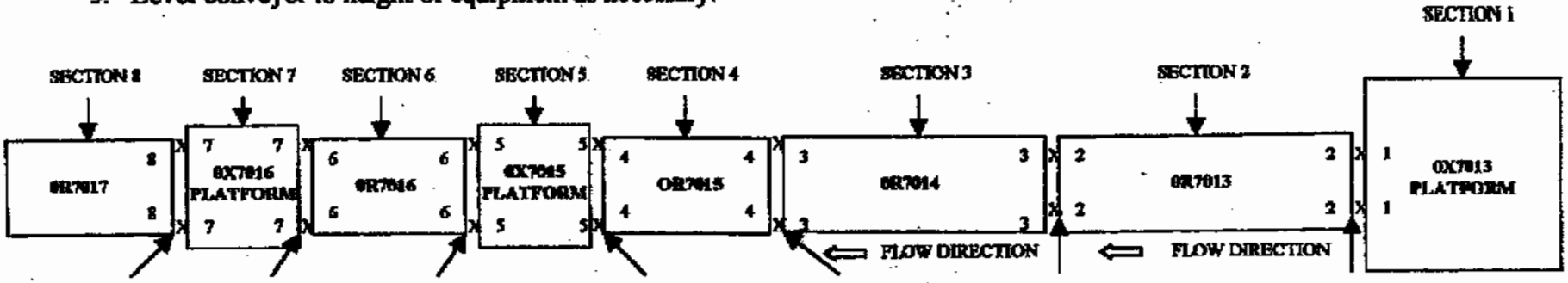
NOTE! NOT TO SCALE

ASSEMBLY INSTRUCTIONS

1. Assemble conveyor legs onto sections 4 , 6 , & 8.
2. Match number on legs to conveyor section number.
3. Match direction of flow on leg assembly to conveyor section. **See Note 1**
4. Attach equipment by sequence number - section 1 through 8. **See Note 2**
5. Make sure the direction of flow is the same as drawing.
6. Assemble brackets in each section corresponding to each section as listed on drawing. **See Note 3 , 4 , & 5.**

NOTES:

1. Instruction is attached showing which direction facing toward leg assembly.
2. Make sure to follow the direction of flow as shown per drawing.
3. Brackets are attached to the lower section of equipment to be used for connecting equipment.
4. See "X" mark on the drawing for connecting equipment.
5. Level conveyor to height of equipment as necessary.



2 BRACKETS #7 2 BOLTS W/NUTS 3/8" X 1"L #8 2BOLTS W/NUTS 3/8" X 1"L	2 BRACKETS #6 2 BOLTS W/NUTS 3/8" X 1"L #7 2 BOLTS W/NUTS 3/8" X 1"L	2 BRACKETS #5 2 BOLTS W/NUTS 3/8" X 1"L #6 2 BOLTS W/NUTS 3/8" X 1"L	2 BRACKETS #4 2 BOLTS W/NUTS 3/8" X 1"L #5 2 BOLTS W/NUTS 3/8" X 1"L	2 BRACKETS #3 2 BOLTS W/NUTS 3/8" X 2 1/4"L #4 2 BOLTS W/NUTS 3/8" X 1"L	2 BRACKETS #2 2 BOLTS W/NUTS 7/16" X 2"L #3 2 BOLTS W/ NUTS 7/16" X 2"L	2 BRACKETS #1 2 BO;TS W/NUTS 3/8" X 1 1/2"L #2 2 BOLTS W/NUTS 7/16" X 1 1/2"L

TOP VIEW OF LAYOUT

42'

140'

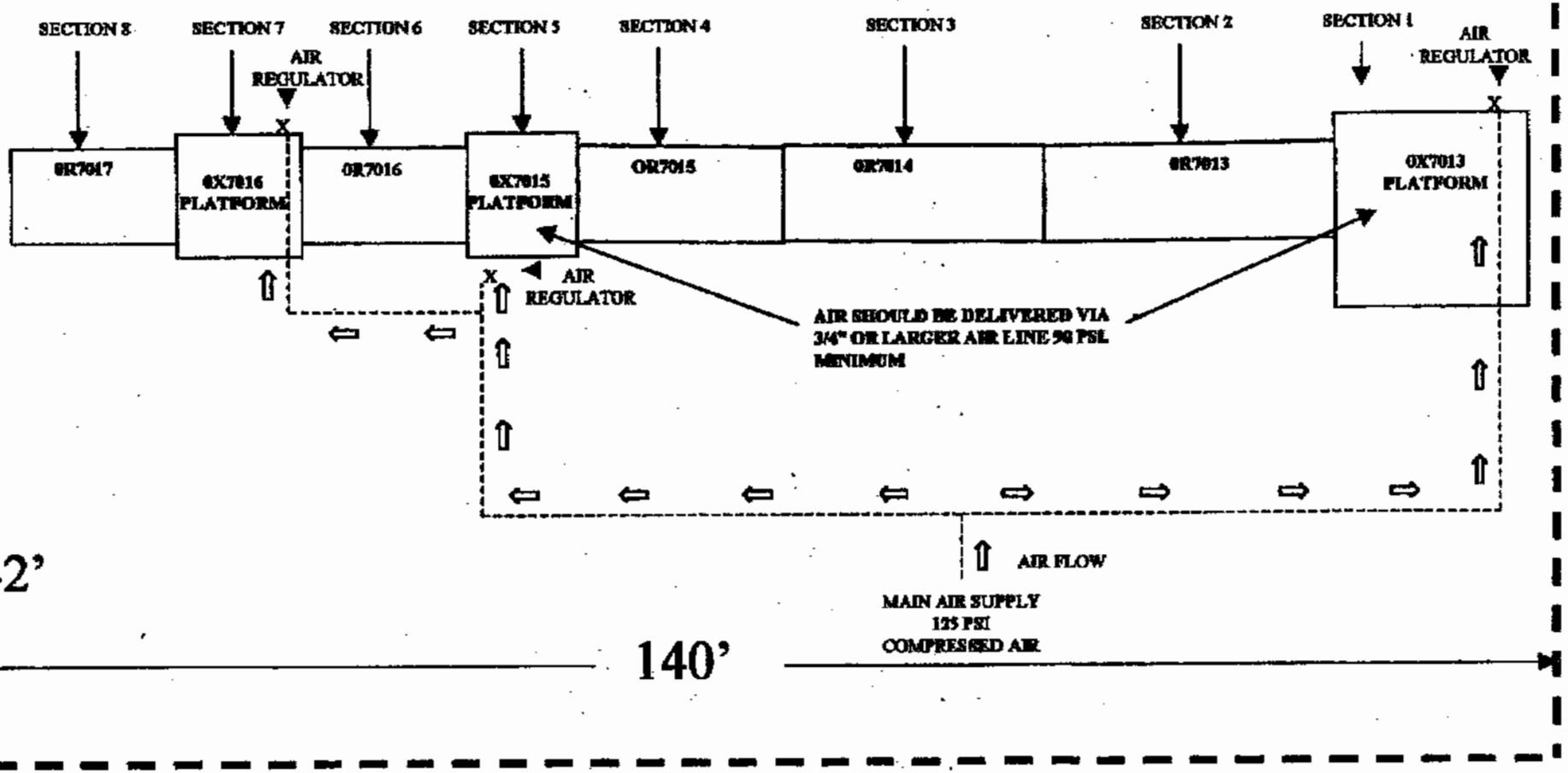
PORTABLE UGR ASSEMBLY LINE

NOTE! NOT TO SCALE

ASSEMBLY INSTRUCTIONS

4. INSTALL AIR LINE HOSE FROM MAIN AIR SUPPLY TO EQUIPMENT AS SHOW IN DRAWING

TOP VIEW OF LAYOUT



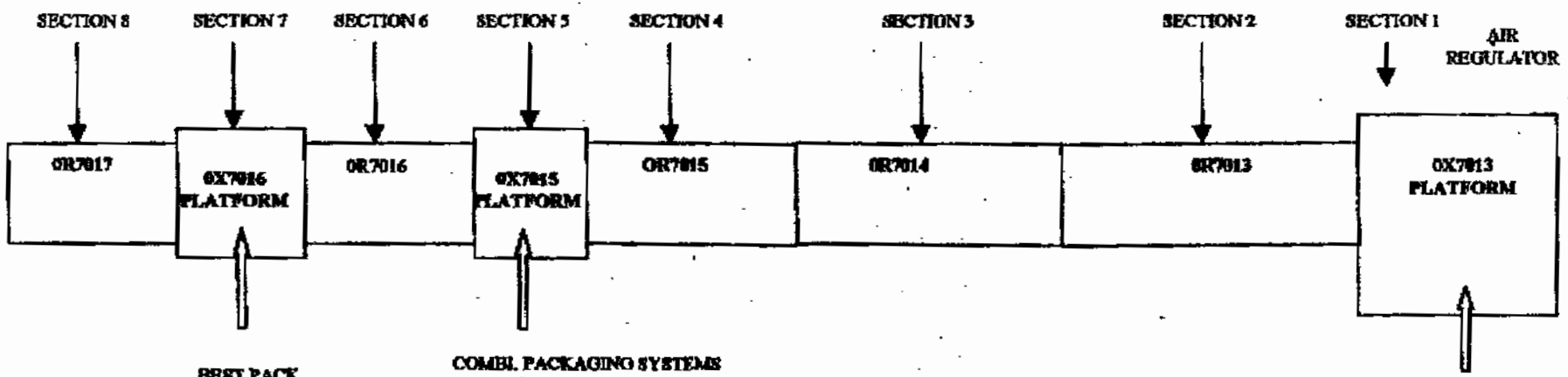
PORTABLE UGR ASSEMBLY LINE

NOTE! NOT TO SCALE

ASSEMBLY INSTRUCTIONS

5. RUN ELECTRIAL POWER TO EQUIPMENT.
NOTE! LOOK AT POWER REQUIREMENT IN DRAWING FOR EACH EQUIPMENT REQUIRING ELECTRIAL POWER & HOOK UP ACCORDING TO SPECIFICATIONS.

TOP VIEW OF LAYOUT



42'

140'