

**JD GRAY ASSOCIATES
MANUFACTURING PRODUCTIVITY CONSULTANTS**

**Semi-Automated Paced Conveyor Assembly
System with Robotic Work Cell
For Inline Liquid Filling**

**Industrial Engineering Service Proposal
And
Paced Assembly Conveyor Budget Quotation
And
Automated Liquid Filling Cell Budget Quotation**

January, 2016

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A. FORWARD

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Paced Assembly with Robotics Equipment and attendant Industrial Engineering Services

- JD Gray Associates has used the four families of glass bottles, pumps, jars and plastic bottles of different build sequences or container configurations in the preparation and costing of our industrial engineering service proposal. We will time study your existing generic operations including 1- Bottle preparation 2- filling and capping of bottles (with phenolic cap) 3- labeling 4- sealing the cap with plastic 5- putting bottles and droppers in white individual boxes 6- putting FNKSU (bar code unique to Amazon) and individual boxes into big cardboard shipping box...via YouTube observations or direct observations. We will then create customized team time line balances, work station instructions with tools, work station layouts, visual aids & bills of material and then training / implementation of your products to a semi-automated assembly line technique.
- Our proposed semi-automated assembly conveyor system will incorporate the labor savings or output gain of our standards and methods program (15%), our paced assembly system (10%-25%) and our semi-automated cells (30%-35%)...for an overall cost reduction between 55% to 75%.when all work cells that can be automated are completed. In addition to the preliminary conveyor equipment specification supplied, we will need input regarding sales forecasts on existing products as well as future products with their respective output projections to ensure the conveyor system is sized correctly and that there are sufficient in-line workstations to meet Company's throughput parameters.
- Typical operation of a Paced Assembly Line with Robotics system - supervisor plots setting on variable dwell timer for the length of time the pallet is to remain in a stationery position before indexing to the next station...this is the station control time we would develop during the team time line balancing segment of our proposal. The entire chain-driven string of 18 pallets will index automatically (eliminating manual movement of sub assembly from one station to another) approximately 24 inches at the same time at a speed of one foot per second...then remain stationery for the time set on the variable dwell timer which will create a pace for the six operators to finish their respective work task before a chime goes off indicating the dwell time has been depleted and signaling the next automatic index. The projected dwell time is .500 minutes or 30 seconds which will allow sufficient time for Phase Two glass bottle automated liquid filling on a fixture containing four glass bottles per pallet or .125 minutes per bottle or the rate of 3600 per shift that will net approximately 3000 per shift when allowing time for changeovers.
- There will be overhead lighting mounted to the conveyor system, a tool rail running the entire length of each side of the rotary conveyor and electrical/pneumatic outlets spaced at intervals servicing each of the six operators. The variable speed-indexing feature adjusts traverse timing depending on pallet width. Work cell automation has been addressed by the addition of a precision pallet locating system that will allow for glass bottle filling as well as other robotic operations such as mounting components, filling jars and pumps with cream, container labeling, capping or adding/removing the container to/from the pallet. Our equipment manufacturer has fixture fabrication capabilities as well as PLC programming and if increasing the number of workstations at a future date is desired, they will expand the conveyor to whatever number of pallets required.

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B. SAVINGS

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Semi-Automation

By Joseph Gray

**Can't Justify Full Automation?
Semi-Automate!!
With Paced Assembly and Robotic Work Cells!**

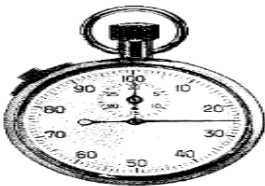
The rule of thumb for manufacturers today is that annual sales volume must exceed 1 million before a given product can be cost justified for full automation. The initial investment and payback periods are high when total automation is the goal.

Semi-automation is a cost-effective alternative. The equipment ingredients of such a system are:

- Synchronous platform conveyor
- Vibratory part feed system
- Robotics

Semi-automation addresses a segment of a given product for automation and creates special work cells to accomplish it. It combines the disciplines of materials handling, product mechanization and direct labor control systems. Labor gains of 75% are possible using this method of assembly.

The typical consulting activity sequence necessary to convert products from a bench method of assembly to a semi-automated system is:

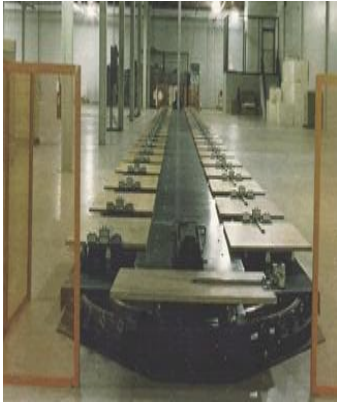


- Phase One - Indexing Paced Conveyor System
 - Work measurement
 - Line balance
 - Final equipment specifications
 - Work station layout
 - Training
 - Paced system installation

- Phase Two - Semi-Automated Work Cells
 - Design and fabrication
 - Programming
 - Electrical and mechanical installation

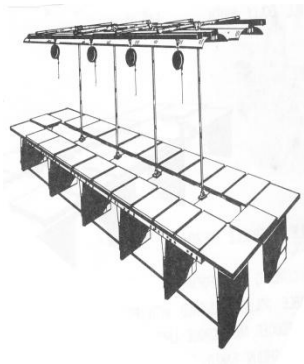
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The time-balanced Phase One system prepares for Phase Two semi-automation by eliminating future time bottlenecks for operations not to be mechanized. Phase One gains include:




Improvement Comparison

From Bench or Progressive Line	To Paced Assembly Line	Labor Gain
<p>Handling:</p> <ul style="list-style-type: none"> • Excessive moves/storages • Minor operations separate • Work area scattered 	<ul style="list-style-type: none"> • Assembly where transported • Coordinated work flow • Space saving by consolidation 	5-10%
<p>Methods:</p> <ul style="list-style-type: none"> • Tooling inadequate • Balanced by sequence • Long work span • Inefficient work place • Quality separated 	<ul style="list-style-type: none"> • Tooling specialized • Balance controlled • Short station times • Optimum work place • Quality integrated 	5-10%
<p>Performance:</p> <ul style="list-style-type: none"> • High responsibility • Output pegged to slowest • Measurement late • Long training period • Poor work habits 	<ul style="list-style-type: none"> • Lower responsibility • Efficiency level created • Measurement immediate • Reduced learning curve • Controlled work atmosphere 	15-20%
Total Average Improvement		25-40%



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Phase Two gains in product mechanization leads to additional savings. They include:

From Bench or Progressive Line	To Semi-Automated Cells	Labor Gains
<p>Work Cell Sub Assembly Mechanization:</p> <ul style="list-style-type: none"> • Manual part placement into container • Manual removal of part from container and alignment into fixture • Manual pneumatic/electric part fastening 	<ul style="list-style-type: none"> • Bulk hopper part feed • Precision vibratory bowl part positioning into fixture • Robotic part fastening 	25-30%
 <p>Work Cell S/A to Paced Assembly F/A Line Handling:</p> <ul style="list-style-type: none"> • No precision platform • Manual placement of sub assembly to final assembly 	<ul style="list-style-type: none"> • Precision in-line paced conveyor platform positioning • Robotic pick from S/A work cell and place on fixturized paced conveyor F/A platform 	5%
Total Average Improvement		30-35%

The initial investment in the semi-automation technique is modest and a first-year return-on-investment guaranteed.

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**COSMETIC CONTAINERIZATION @2600 UNITS PER SHIFT
RETURN ON INVESTMENT**

ITEM	ESTIMATED EXISTING CONVENTIONAL OPERATORS FOR Steps: 1- Bottle preparation 2- filling 3-capping of bottles 4- sealing the cap 5- Small box 6- Shipping box	INDUSTRIAL ENGINEERED STANDARDS ONLY	SEMI- AUTOMATIC PACED ASSEMBLY SYSTEM – PHASE 1	SEMI- AUTOMATIC PACED ASSEMBLY SYSTEM – PHASE 1 & 2
COSMETIC CONTAINERIZATION OPERATORS	7	6	4	3
% SAVINGS		15%	40%	60%
OPERATOR SAVINGS		1	3	4
DOLLAR SAVINGS - USING A LABOR RATE OF \$20/HR (\$15/ HR + 33% FRINGE)		\$40,000	\$120,000	\$160,000
COST		\$25,500	\$127,500	\$178,800
ROI		7.7 MONTHS	12.7 MONTHS	13.4 MONTHS

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C. PHASE ONE

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INDUSTRIAL ENGINEERING PROPOSAL

Phase One - Paced Assembly with Robotic Work Cells – Quotation No 1808

- Phase One allows an upfront initial gain of 25%-40% before any automation takes place.
- The time-balanced Phase One System prepares for Phase Two Semi-Automation by eliminating future time bottlenecks for operations not to be mechanized.
- Our staff has time and motion, performance leveling, and split station methodology know-how developed over the processing of thousands of assemblies for the paced platform technique.

FOUR COSMETIC FAMILIES: GLASS BOTTLES – 2 OZ, 4 OZ, 10 ML, PUMPS – 5 OZ, 1.7 OZ, JARS – 4 OZ, 8.8 OZ & PLASTIC BOTTLES – 8 OZ, 16 OZ

Service Activity	Fee Per Family	Number of Families	Service & Fee Selection
Work Measurement	\$1,800	4	\$7,200
Line Balance	\$1,200	4	\$4,800
Final Equipment Specification/Quote	\$ 900	4	\$3,600
Component Part Containerization	\$1,200	4	\$4,800
Work Station Layout	\$1,800	4	\$7,200
Work Station Visual Aids	\$1,500	4	\$6,000
Work Station Fixtures/Tooling	\$ 600	4	\$2,400
Work Station Bill of Material	\$ 600	4	\$2,400
Work Station Instructions	\$ 900	4	\$3,600
Group Leader Training	\$ 600	4	\$2,400
Paced System Set-up	\$ 900	4	\$3,600
Paced System Installation	\$1,500	4	\$6,000
Paced System Follow-up	\$1,500	4	\$6,000
Industrial Engineering Fixed Price	\$15,000	4	\$60,000
Expenses – Travel and Per Diem for Two Weeks Onsite System Training, Set-up, Installation and One Week follow-up	\$4,500		\$4,500
Industrial Engineering and Expenses			\$64,500

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Terms:

Payment Schedule

NUMBER	PERCENT AND TIMING	AMOUNT
1	20% upon approval and Purchase Order Assignment	\$12,900
2	20% end of 1 st month	\$12,900
3	20% end of 2 nd month	\$12,900
4	20% end of 3 rd month	\$12,900
5	20% upon implementation	\$12,900

If there are additional families desired to be added to our assembly conveyor industrial engineering service activity, an additional consulting fee of \$16,125 plus travel expenses per family is required.

Four cosmetic families of:

GLASS BOTTLES – 2 OZ, 4 OZ, 10 ML

PUMPS – 5 OZ, 1.7 OZ

JARS – 4 OZ, 8.8 OZ

PLASTIC BOTTLES – 8 OZ, 16 OZ

YouTube videos to be used for the purpose of offsite time study in lieu of onsite observations.

Including links on:

https://www.youtube.com/watch?v=YtZLybuDi_s - 1oz 2oz 4oz 8oz Amber/Boston Glass dropper bottle filling machine for eliquid oil

<https://www.youtube.com/watch?v=G2hL5Bo8WUA> - Review 2oz Amber Glass Bottles for Essential Oils with Glass Eye Dropper

<https://www.youtube.com/watch?v=YvpIIViuvrE> - Review 2oz Amber Glass Bottles for Essential Oils with Glass Eye Dropper

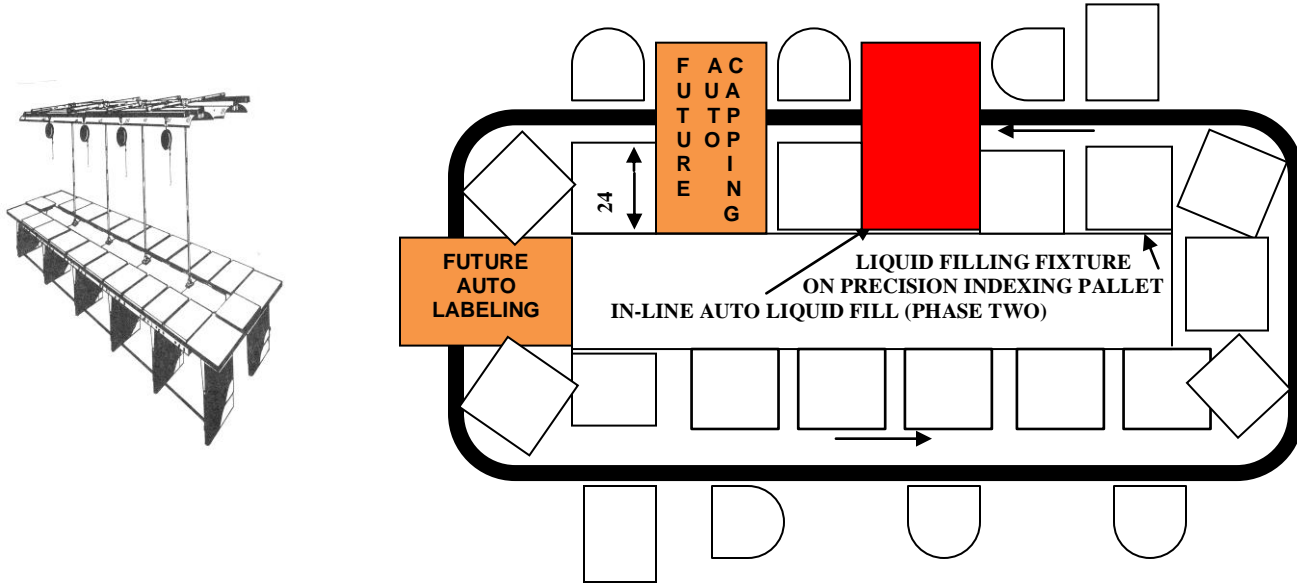
<https://www.youtube.com/watch?v=YpECA0wWNAQ> - Airless Pump Bottle Containers

<https://www.youtube.com/watch?v=30ANdqPJWL4> - Four Head Screw Capping Machine for Cosmetic Cream Jar, Gel Jar, Petroleum Jelly Jar

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**PRECISION INDEXING PACED ASSEMBLY CONVEYOR WITH WORK
CELL ROBOTICS BUDGET PROPOSAL - QUOTATION NO 1809**

**FILLING FIXTURE TO PALLET – BOTTLE PREPARATION – BOTTLE TO FIXTURE - FILLING OF BOTTLE –
CAPPING OF BOTTLE**



**LABELING – SEALING THE CAP WITH PLASTIC – PACK BOTTLES AND DROPPERS TO SMALL BOX – PACK
SMALL BOX AND FNKSU TO SHIPPING CARTON – SHIPPING CARTON TO PALLET – WRAP SHIPPING CARTON
WITH PLASTIC**

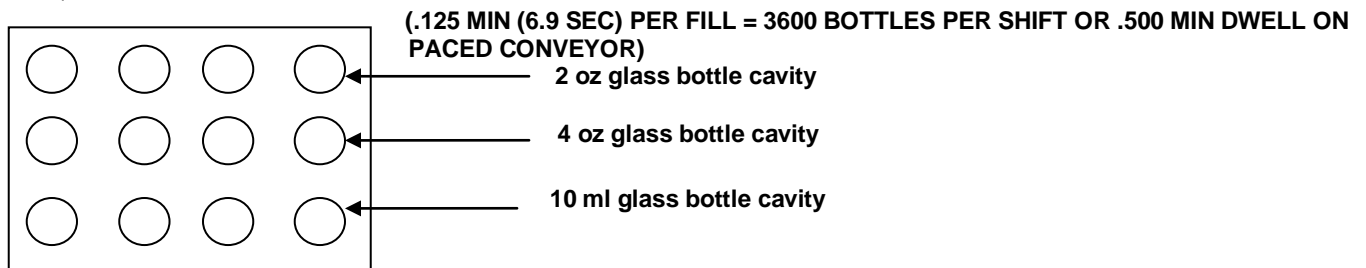
**Standard Rotary Assembly Conveyor Model 2424, 22' 6" OL, 18 pallets, 6 pallets/side (3 pallets on each
end), Variable Dwell time, 3 operator/side with 4 supports.....\$40,000**

**Standard Rotary Options. Variable speed indexing, fluorescent lighting fixtures, electrical outlets
beneath pallet for six operators, upper supports to support lighting fixtures, pneumatic quick disconnect
with air piping for six operators, tool tray railing, overhead rail with trolleys for six operators.....\$12,000**

**Standard Rotary Precision Pallet Locating System for One Work Cell. 1 shot pin locating device and 18
pallet shot pin blocks..... \$11,000**

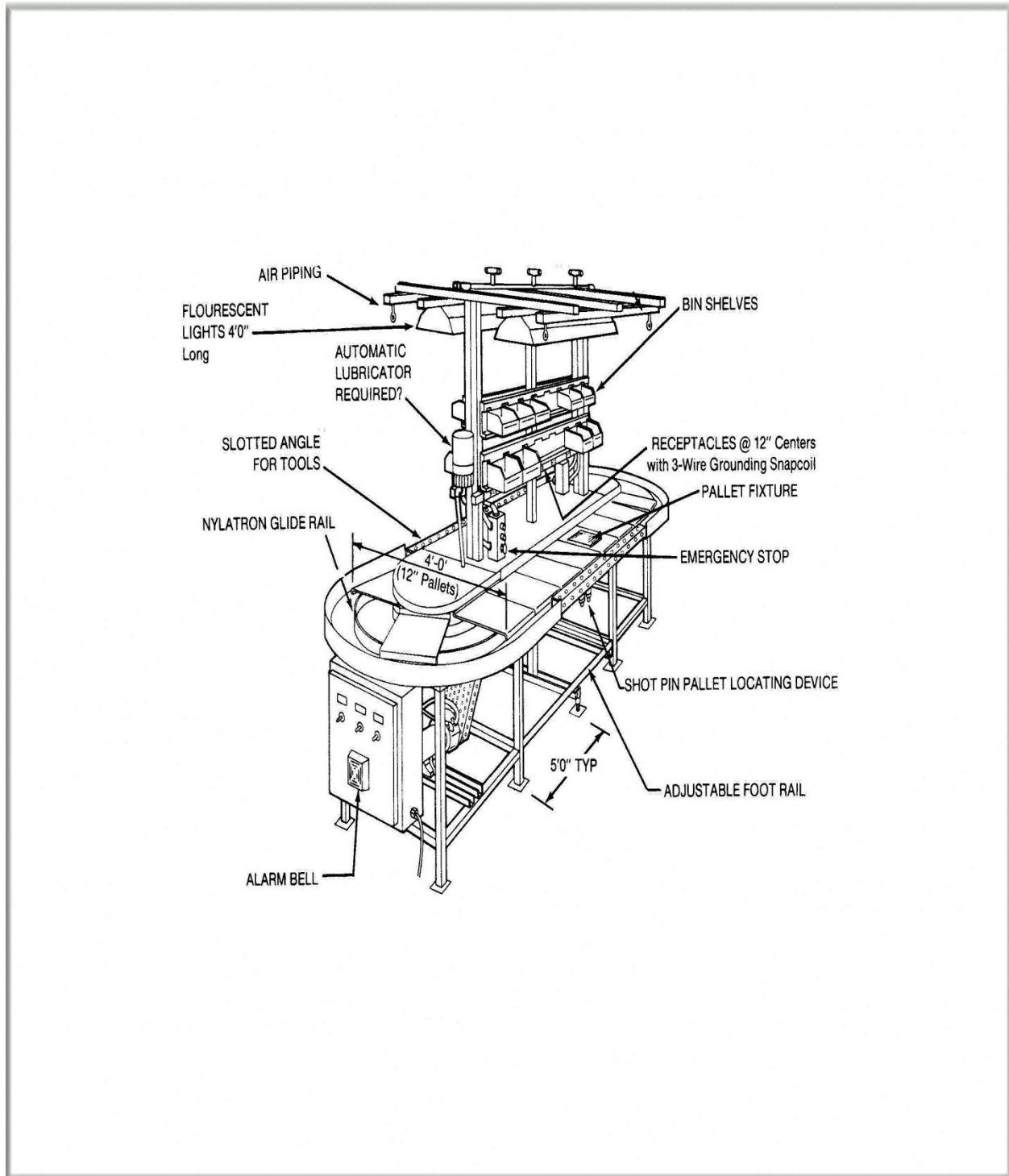
**Terms: 33% down payment upon purchase order assignment. 33% mid term (approx 4 weeks). 33%
final payment upon inspection and test run of assembly conveyor at manufacturer's facility. Shipping
and Installation: As agreed upon. Delivery: 60 days.**

LIQUID FILLING FIXTURE



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DELUXE ASSEMBLY CONVEYOR WITH ALL STANDARD OPTIONS



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EQUIPMENT WARRANTY

Our New York manufacturer warrants to the original purchaser that all materials and equipment furnished will be new unless otherwise specified and approved by purchaser.

Our New York manufacturer further agrees to furnish the purchaser without charge, F.O.B. NY any part proved to be defective within one year from date of shipment, provided the purchaser gives JD Gray Associates immediate notice in writing and examination proves the claim that such materials or parts were defective when furnished. Our New York manufacturer will not repair or replace any parts that become inoperative because of improper maintenance, overloading, chemical or abrasive action, excessive heat, or other abuse.

Equipment and accessories not fabricated by our New York manufacturer are warranted by their original manufacturer.

Equipment that has been altered or modified by anyone without our New York manufacturer authorization is not warranted.

Unless otherwise agreed in writing by our New York manufacturer, purchaser shall bear the expense of the installation. The liability of our New York manufacturer shall be limited to furnishing such part or parts found to be defective.

Other than the above, there are no warranties, which extend beyond the description of the face hereof. Consequential damages of any sort are wholly excluded.

Basic Unit

MOTOR – ¾ HP, AC motor with variable speed control (customer to specify voltage upon order)

CONTROLS – Variable Frequency drive with potentiometer and knob for speed control. Start stop buttons and Emergency stop switch.

SUPPORTS – Adjustable 35” to 36 ½” to top of pallet, with pipe foot rail on both sides.

WHEEL RAIL – Wheels 1 15/16” diameter, zinc coated, on 3” centers.

FINISH – Industrial Enamel (Customer to specify color)

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D. PHASE TWO

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Phase Two — Semi-Automated Work Cells - Quotation Number - Q1810

- Phase Two includes custom robot design and fabrication, programming, and electrical and mechanical installation of robots to fill glass bottles
- Future Phase Three includes robotic filling of jars and pumps with cream, robotic capping and robotic container labeling, To be proposed under separate cover upon completion of Phase Two.
- The shot pin platform-locating device under the cell to be mechanized permits gradual Phase Two and Phase Three semi-automation and cost. Product mechanization leads to an additional 30-35% savings

ONE COSMETIC FAMILY: GLASS BOTTLES – 2 OZ, 4 OZ, 10 ML,

Service Activity	Fee Per Family	Number of Families	Service & Fee Selection
Final Equipment Specification/Quote	\$ 900	1	\$ 900
Work Station Instructions	\$ 900	1	\$ 900
Group Leader Training	\$ 600	1	\$ 600
Paced System Set-up	\$ 900	1	\$ 900
Paced System Installation	\$1,500	1	\$1,500
Paced System Follow-up	\$1,500	1	\$1,500
TOTAL	\$6,300	1	\$6,300

Terms:

Payment Schedule

NUMBER	PERCENT AND TIMING	AMOUNT
1	20% upon approval and Purchase Order Assignment	\$1,260
2	20% end of 1 st month	\$1,260
3	20% end of 2 nd month	\$1,260
4	20% end of 3 rd month	\$1,260
5	20% upon implementation	\$1,260

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Automatic Liquid Filling Machine - Budget Quotation Number Q1811

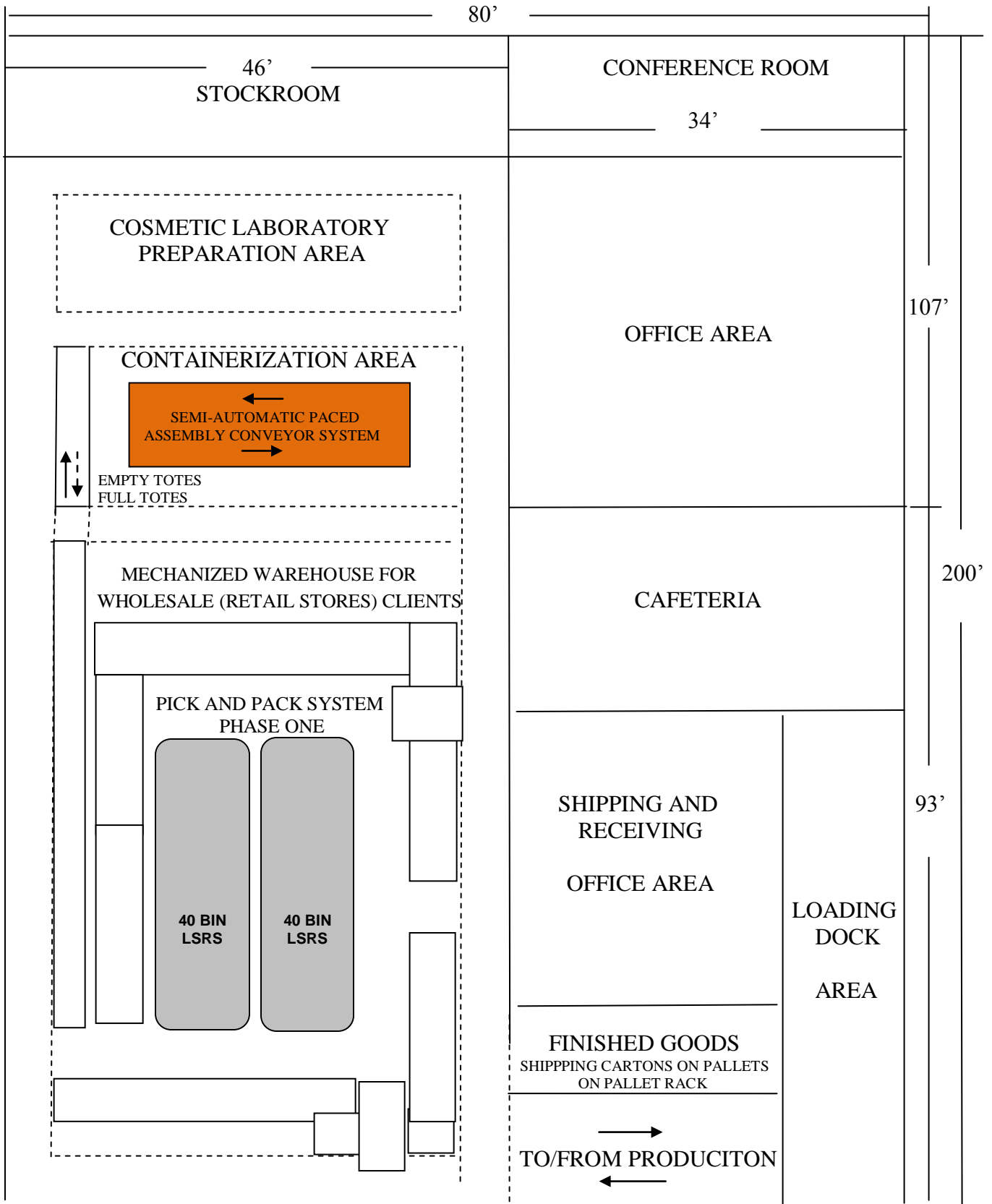


GENERAL SPECIFICATION

- Filling glass and plastic containers, fill volumes are 10 ml, 2oz & 4 oz.
- The containers are placed in fixtures and are positioned in a row of 4 on a pallet that measures 24" square. Fixtures and pallets are provided by others.
- The pallet is designed to hold 4 rows of containers, each row is dedicated to one container size (row #1 contains 4 oz containers, row #2 contains 2 oz containers, row # 3 contains 10 ml containers).
- A pallet conveying system, provided by others, positions one row of containers under the nozzles of the filling system.
- The filling machine can be designed to fill 4 containers at a time using 4 piston pumps and nozzles.
- Two sets of piston pumps and nozzles are required in order to get the best fill accuracy for small to largest containers.
- The piston pump can fill water thin to high viscosity creams.
- The nozzles are held in an adjustable bracket that allows filling one row of containers.
- The filling system includes bottom up filling which reduces product foaming and splashing.
- A budget price for this system is \$40,000. The lead time is 8-10 weeks.

E. CONCEPTUAL PLANT LAYOUT

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CONCEPTUAL PLANT LAYOUT**



F. AGREEMENT AND AUTHORIZATION

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AGREEMENT

- JD Gray Associates shall submit detailed service fee invoices to Company. Said invoices shall contain a detailed itemization of the date(s) on which services were provided and a description of tasks completed during the period with respect to which the invoice is submitted.
- Each compensation payment made by Company to JD Gray Associates shall be within 10 days.
- Company – JD Gray Associates agrees that any confidential information furnished by Company to JD Gray Associates or acquired by JD Gray Associates during the period in which JD Gray Associates is retained by Company is and shall remain the sole and exclusive property of Company and shall be placed in the hands of Company by JD Gray Associates upon termination of this Agreement including any copies made thereof.
- Confidentiality – JD Gray Associates agrees that at no time, either during or after the period in which JD Gray Associates is retained by Company shall JD Gray Associates utilize or disclose to any third party any of the confidential information of Company.

AUTHORIZATION

□ **Phase One**

All **Industrial Engineering Consulting Services** on Phase One Paced Assembly Rotary Table performed by JD Gray Associates. FOUR family fee \$64,500. Quotation No Q1808.

Equipment Budget Quotation - Fabrication and Assembly of a Paced Assembly Rotary Table

Deluxe assembly conveyor with all standard options \$63,000 Quotation Number Q1809

TOTAL \$127,500 - Project Commencement upon receipt of our IE Services Down Payment \$12,900. Final Paced Assembly Conveyor Equipment Quotation by Vendor upon submission of our Final Equipment Specification – All Payments made directly to Equipment Vendor.

- OR -

□ **Phase One and Phase Two**

All **Industrial Engineering Consulting Services** on Phase One Paced Assembly Rotary Table performed by JD Gray Associates. FOUR family fee \$64,500. Quotation No Q1808. On Phase Two for ONE family fee of \$6,300 Q1810

Equipment Budget Quotation - Fabrication and Assembly of a Paced Assembly Rotary Table

Deluxe assembly conveyor with all standard options \$63,000 Quotation Number Q1809

Automated Work Cell Equipment Budget Quotation – Liquid Filling of Glass Bottles \$40,000 - Pallet Fixtures \$5,000 Quotation Number Q1811

TOTAL \$178,800 - Project Commencement upon receipt of our IE Services Down Payment \$14,160. Final Paced Assembly Conveyor Equipment Quotation and Final Automatic Liquid Filling Machine Quotation by Vendors upon submission of our Final Equipment Specification – All Payments made directly to Equipment Vendors.

Date _____

Purchase Order No _____

Company
(signature)

JD Gray Associates
(signature)