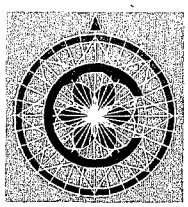

CHEMONICS INTERNATIONAL INC.

FRUIT DEHYDRATION IN EGYPT FOR TRADE DEVELOPMENT CENTER AFFILIATES

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Cairo, Egypt

Prepared under:
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ACKNOWLEDGMENT

This report was prepared by Chemonics International Consultant Dr. Kamal Hyder, food processing specialist, for the Trade Development Center, Egypt, as a pre-investment investigation on the possibility of starting fruit dehydration industries in Egypt. The author wishes to express his gratitude for the help and support given by the Trade Development Center, Egypt, during preparation of this report.

EXECUTIVE SUMMARY

Apple production in Egypt in 1994 was estimated by the Ministry of Agriculture to be 312,514 tons. Mango production was 180,000 tons, while 459,000 tons of bananas and 359,000 tons of peaches were produced. There is a growing interest in producing fruits in the newly reclaimed areas. However, prices drop during the peak season due to heavy surge of fruits and low levels of utilization. Postharvest losses are estimated at 20 to 30 percent.

Dehydrated fruits and fruit products are appreciated by consumers in Egypt and in the Arabian Gulf States. Moreover, growing demand for dried fruits in Europe makes it attractive for Egyptian investors to process such fruits as apples, grapes, peaches, and figs, which can compete against European and Asian processors. The Trade Development Center in Cairo has already identified at least seven investors who are eager to start food dehydration for export. Some of these investors already have access to surplus fruits and some are aware of the export potential of dried fruit.

Infrastructure already developed at locations like Sadat City and Sixth of October City should make it ideal for food processors to get into dehydration, which requires little processing water and inexpensive packaging materials. Labor and energy costs are higher than many Asian countries like Thailand and Philippines, but the close proximity to the market may offset these costs due to lower costs of handling and distribution.

It is recommended that the dehydrated fruits segment of the business place an emphasis on utilizing apples, grapes, and other deciduous fruits. First of all, market studies should be done to establish the windows of opportunity. Technical assistance for pilot production of air, vacuum, and freeze dried products should be provided. Market linkages should be stressed, as well as quality assurance programs to establish a long-term reputation for high quality exports. Accentuating value-added possibilities will produce healthy and nutritious products that bring in higher margins.

The Trade Development Center, in this regard, can serve as a catalyst in getting this industry on the right track by serving as a coordinator. USAID programs in the agro-processing and technology transfer areas can work together to assist in fruit dehydration and export market development. Developing this industry will help generate income for farmers, bring in export dollars, and create sustainable sources of income for Egypt.

SECTION I
INTRODUCTION

Fruit production in Egypt consists mostly of apples, oranges, lemons, bananas, peaches, plums, apricots, mangos, guavas, watermelons, cantaloupes, cherries, grapes, figs, and dates. These are mainly used for fresh consumption in domestic markets. Production figures for some of the selected varieties of fruits are given in Table 1 and the areas of production are shown on the map in Figure 1. The preliminary production figures for 1994 are given below.

Data on the production of selected fruits and vegetables in Egypt for 1994

PRODUCTION DATA IN TONS

FRUITS

APPLE	312,514
MANGO	180,286
BANANA	459,012
PLUM	31,195
PEACH	359,981
APRICOT	41,625

Provided by Mr. Mahmoud Nazif (1)
Undersecretary for Agricultural Economics and Statistics
Ministry of Agriculture, Cairo, July 11, 1995

These figures represent per a capita production of 4.8 kg per person per year for apples, 7.06 for bananas, and 5.54 for peaches, based on a total population of 65 million. It can be assumed that processing will not only enhance the production figures, but will also help reduce postharvest losses with the increased demand for fruits at the processing plants.

The Trade Development Center (TDC) in Cairo has been in contact with a number of processors who have expressed interest in fruit dehydration. They have identified the market for dried fruits for domestic and international consumption. They also feel that the introduction of dried fruits in breakfast cereals, fruit snacks, and nutritional fruit bars may be appropriate at this time. This assistance in technology and pre-feasibility work will certainly be a catalyst in starting up fruit dehydration industries in Egypt.

SECTION II
SCOPE OF THIS STUDY

The scope of this study is as follows:

- To provide technical assistance to potential investors in Egypt interested in fruit processing through the Trade Development Center (TDC).
- To introduce the concept of various techniques of dehydration of fruits to potential investors.
- To investigate the availability of fruits that can be dehydrated for domestic and international markets.
- To provide pre-feasibility information to investors regarding type and cost of processing plants based on available fruits for initial start-up.
- To indicate the market targets and initiate the process of developing overseas market linkages for dehydrated fruits.
- To outline the processes for specific investors and assist them with technical information which will enable them to procure proper equipment and packaging supplies.
- To help develop quality control parameters for maintaining product quality on a consistent basis.
- To suggest means of developing an information database for future development of processing and marketing of dehydrated fruits.

SECTION III
RATIONALE FOR DEHYDRATION OF FRUITS IN EGYPT

The value of processed fruits and vegetables exported in 1993 was estimated in the TDC Baseline Survey Report (2) to be $ 25.49 million, which represents just 3.86 percent of the $659.2 million in fruits and vegetables exported that year. These figures suggest that the processing of fruits and vegetables deserves attention so that this segment of business can be developed for export as well as for the domestic market.

Moreover, estimated losses due to spoilage in the peak season are estimated to be in the 20 to 30 percent range. Therefore, minimizing postharvest losses and increasing shelf life through processing is certainly the right approach. All types of processing methods, such as freezing, canning, pickling and dehydration, can be considered to minimize these losses. Selection of processing, however, will depend upon type of product, ease of processing and subsequent market development. Particular attention to dehydration of fruits in Egypt is given in this report for the following reasons:

A. Consumer Acceptance

Dried dates, figs, raisins, and apricots are appreciated in the domestic, European, and Middle Eastern markets, particularly in the month of Ramadan. Addition of dehydrated apples, grapes, peaches, pears, mangoes, and bananas will expand this market without a major marketing effort.

B. Product and Market Development

Snacks like apple and banana chips are considered to be naturally acceptable and nutritious items for the younger population. Dried fruit pieces in cereals can be easily incorporated for import substitution in Egypt. Crunchy dried fruits and nuts as toppings for ice cream and frozen yoghurt may be adapted without great marketing difficulty. Dried fruit pieces can be easily added to breakfast cereals.

C. Packaging and Distribution

Dried products can be packaged in pouches of laminated films and foils with or without vacuum or inert gases. They can be subsequently stored and transported as dry goods without the need of refrigeration or specialized handling which can result in cost savings for consumers and higher profit margins for producers.

SECTION IV
THE VARIOUS DEHYDRATION TECHNIQUES APPLICABLE IN EGYPT

A. Solar Dryers

Fruits can be dehydrated directly under solar radiation or they may be subjected to machine drying.

Solar drying is practiced in many parts of the world where the solar radiation is available for long periods of the day without interruption during harvesting season. Recently solar-assisted dryers have been built for fruits and vegetables, but for higher consistent production yield, mechanical dryers are used in industry around the world. In Egypt, the first phase of drying of such fruits as grapes, peaches, and plums can be done by solar energy, which can be finished in a mechanical dryer.

B. Air Dryers

Cross current air dryers using heated air under controlled conditions of temperatures and air flow rates may be used efficiently to reduce the moisture contents of fresh as well as partially dried fruits. A box type dryer with trays or a continuous machine with moving belt dryers can be used. Dry hot air circulation over the exposed fruit surface can pick up moisture which can be continuously removed until the desired moisture content of the fruit is reached. The limiting factors in this case would be the humidity of air, air temperature desired for product quality, and the equilibrium moisture content of the dried product at the finished storage condition.

Air drying can use electricity, gas, oil or steam as energy sources. In the case of geothermal energy, air dryers have been used successfully for onions and garlic, which require higher drying temperatures. As electricity costs are high in Egypt, air dryers operating on steam or on a direct gas and oil heating system can be used. Schematic diagrams of air dryers are shown in Figure F1. They may be batch or continuous dryers depending upon production requirements.

C. Vacuum Dryers

Vacuum dryers are used in batch systems where the product quality has to be enhanced by drying at lower temperatures and the removal of the vapor is very rapid. Fruit pieces and slices for cereals and confectionary are produced using this system. Low temperature and vacuum make the product dry faster and retain better texture, color, and flavor. The cost of production is usually higher than the air drying. These dryers can utilize steam, gas, or electricity as sources of energy. Additional expense comes from the vacuum pumps.

D. Freeze Dryers

Freeze dryers are very expensive but can produce products of highest quality. In this process, the fruits are first frozen and then are placed in the drying chamber. Heat is applied at a controlled rate to the frozen fruits, with vacuum applied at the same time to evacuate ice crystals without allowing the product to undergo changes. The final products can be dried to very low moisture levels. Color, flavor, and texture are retained to such an extent that when the fruits are rehydrated for use, the product comes back very close to original condition of freshness.

Strawberries can be dried for use in cereals or confectionary in this way. Instant coffee crystals are produced by this method. In Egypt, this method can be used in those operations where value-added products of high price are produced. It can be used also for field operations where ready-to-eat meals are needed. Freeze drying should certainly be considered but only for high price, low volume items.

E. Spray and Drum Drying

There are many other means of drying food products. Among the extensively used are: spray drying of milk and drum drying of potato flakes and granules which are quite popular in the United States. Milk and eggs in fluid condition are sprayed through the nozzles to the drying chamber where hot air turns them into dry granules or particles. Potato starch is dried over a rotating drum from which the potato is scraped off as dry powder. Such products used in the food industry as ingredients for formulating food products. In Egypt, excess potato production may make this an appropriate technology. Similarly excess production of tomato may be a good source of tomato flakes and granules, which are also used in food formulation. As agricultural production increases, such value-added products should be considered.

F. Typical Fruit Drying Plant Layout (Shown in Figure 1)

A fruit dehydration plant can be built on a 80 ft x 120 ft site with water, steam, and power available at site. The plant can be divided into the following functional areas:

- **Raw material storage.** In this area, fruits are unloaded and stored for processing. Post-harvest conditions should be given due consideration for heat and ventilation.

- **Preparation room.** This is a typical wet area where washing, peeling, coring, trimming, slicing, and blanching are done.

- **Drying.** The prepared raw materials are loaded in the dryers for the initial reduction of moisture. They may be finished in a second stage dryer to achieve the final moisture content. The choice of dryers and the rate of drying are chosen according to type of fruit and quality of final product.

- **Packaging.** The dry products are packaged under dry conditions in flexible or rigid containers for which proper selection of equipment are needed.

- **Finished goods storage.** This area is dry and temperature controlled.

SECTION V
PROPOSED PROCESSING AND PACKAGING FACILITIES

A. Raisin Drying Plant at Sadat City

The owner of a large grape export house, Mr. Hussein El Eighezy, expects to have a surplus of 1,000 tons of grapes in August of 1995. He is extremely interested in drying them for domestic and international markets. Using this technology will help him combat market price fluctuations in Europe due to seasonality.

Initially the grapes will be sun dried and the air dryer will then condition them to the desired moisture levels. The product should be light yellow in color without stems for table purposes. The following procedure will be followed:

- Harvesting
- Cleaning
- Sun drying and bleaching
- Air drying
- Destemming
- Final conditioning

Estimated cost of the air dryer and ancillary equipment for 50 ton per day capacity:

New dryer	$ 600,000
Used dryer	$ 250,000

B. Apple Drying for Breakfast Cereals (Detailed Proposal Available Upon Request From Innovative Foods, USA)

JAFCO, a company manufacturing roasted peanuts, has expressed interest in adding a dehydrator for fruits for their new breakfast cereal plant near Cairo. They expect to use apples, peaches, strawberries, mangos, and bananas in diced or sliced form.

The process will be as follows for air or vacuum drying:

- Cleaning
- Peeling/coring
- Blanching
- Dicing/slicing
- Drying; storing.

Cost of dryer for processing two tons per day: $300,000 new; $150,000 used.

C. Drying of Figs, Peaches, Plums, Apples, and Bananas for Making Fruit Bars (See Proposal from Micro Diets , USA, in Appendix)

Cateco, a privately owned company by Alaa A. Nabi, is seeking to start a value-added product line utilizing excess fruits available during peak season. Mr. Nabi's initial study indicates that the fruits may be partially dehydrated and then converted into fruit bars for snacks.

Cateco wants to set up a small, efficient processing plant in Sadat City where water, steam, and power are available easily. The fruit sources are within 50 km from there.

Initial dehydration using dry air or vacuum can be carried out in the plant. The dried fruit pieces would be used to produce fruit bars.

Cateco wants assistance in the following areas:

- Formulating products such as fruit bars for market testing in Egypt.
- Equipment selection for drying, fruit bar manufacturing and packaging.
- Plant design, quality control and start-up.

The process will be as follows:

- Cleaning
- Preparation
- Drying
- Packing
- Storage
- Chopping
- Mixing
- Cooking
- Bar Making
- Wrapping
- Packaging

The plant is expected to handle 5 to 7.5 tons of fruits per day during peak season. The cost of dryer and a small fruit bar making equipment is estimated to be $500,000 for new equipment and $300,000 for used and refurbished equipment.

The cost of product development will depend upon the among of time needed at the formulation laboratory, which should be between two to four weeks. Estimated cost is $5,000 to $10,000.

D. Fruit Drying at Aga (Detailed Proposal Available Upon Request from Innovative Foods, USA)

The plant at Aga is owned by Nile Investment Group, Nile Bank. It is currently producing fruit juices and frozen vegetables. A fruit drying tunnel is available for air drying peaches, plums, and apricots. It may be modified with more precise temperature and air flow control

devices to produce better quality product. Some modifications to replace the wooden trays would also be needed.

The cost of modification is estimated to be $50,000 for the process control instrumentation and stainless steel trays.

E. Fruit and Vegetable Drying in Alexandria (Proposal Available Upon Request From Innovative Food, USA)

Agromisr is a privately owned onion drying facility which is kept busy all year round with onion, garlic, leek, parsley, carrot and beans available in the area. Five to six months a year are devoted to onions which are exported to Europe and the Gulf States. The plant employs 100 to 200 persons per day for peeling and sorting onions. An oil-fired boiler provides heat for the five locally built tray type air dryers which can produce one ton of dry onions of 15 percent moisture level per day.

The owners have tried drying apples, raisins, tomatoes, and lemons. The raisins were of reasonably acceptable quality and could have been sold at 7 Egyptian pounds but the drop in price for Turkish raisins to 6.5 Egyptian pounds made the project uncompetitive. The other fruits need better quality for the domestic and international markets.

Agromisr wants help in upgrading and adding fruit dehydration. They want to consider drying tomatoes if possible. They want to add mincing, dicing, and slicing machines for improving their product line. They would also like to add a toaster for making toasted onions.

Since the plant is at least 10 years old and needs upgrading, a detailed look into the redesign is needed. However, in the short term, addition of a few pieces of equipment may increase productivity and profitability. The following equipment will be needed:

- Slicer/dicer/mincer
- Toaster for onions
- Form fill & seal packaging machine
- Vacuum dehydrator, two to four tons per day

Cost of new equipment: $400,000
Cost of used equipment: $250,000 (small equipment such as Urschell dicers are not heavily discounted even as used equipment)

F. Montana Food, 24 Km from Cairo on Agriculture Road to Alexandria (Proposal Available from Stokes Vacuum Inc. USA)

Montana is a large frozen food plant owned by Maamoun Brothers Group. It produces 30 tons of frozen vegetables per day in 400 to 500 g packages. It also produces frozen strawberries in 1 kg packages. The plant is old but functional and very labor intensive, with 500 persons per day at a labor wage of the equivalent of $1.5 to $2 per person per day. The individually quick frozen items are not packaged automatically and must be handled several times prior to packaging and storage, which diminishes quality.

The owners are in the process of upgrading and putting a modern continuous line for freezing and packaging fruits and vegetables. Magdi Maamoun liked the idea of looking into freeze drying of fruits and vegetables, which can bring in high returns from the export market.

It is suggested that Mr. Maamoun visit several freeze drying operations in the United States prior to making a decision. The cost of investment may range between $350,000 to 700,000 depending upon the capacity of one dryer.

G. Avional, Tea Mixing and Packing Co.

The company is located in Baheira and has a successful operation in puffed cheese snacks and packaged tea. They also have a drink concentrate business. The form, fill and seal machines can be utilized in packaging fruit-based snacks. They are eager to explore the possibilities of adding a processing line to prepare apple or banana chips or other extruded and fried snacks which will fit into their distribution system.

Note: The companies listed in the appendix may be contacted directly or through the consultant for specific details on process and equipment.

SECTION VI
MARKETING OF DEHYDRATED FRUITS—DOMESTIC AND INTERNATIONAL

In Egypt the per capita consumption data for fruits are not available. Estimates from 1993 yield the data in Table 1. Dates are consumed locally with the overall consumption of 521 tons representing 8.02 grams per person. Other fruits, such as apricots, peaches, plums, pears, and apples, are not dehydrated in commercial plants for local or export markets. (Note: For further detail on process, equipment and turnkey operation the companies and persons in commercial plants for local or export markets.) Some apricot leathers are produced which are used during the month of Ramadan. It should be noted that during the month of Ramadan the consumption of sweet goods including locally sun dried fruits goes up as a part of the tradition of breaking the day-long fast. Dates and raisins are in great demand at that time. If other fruits such as apples, peaches, plums, and apricots are dried for the consumer market, they will be easily added to this segment, along with dates and raisins. Bananas and mangos are not produced in large quantities but they should also become a part of this market segment if the production goes up and price comes down.

The international markets are gradually increasing due to the availability of dried fruits. Countries like Thailand and Philippines have provided dried and sugar-added candied fruits like pineapple, papaya, mango, banana and coconut. Europe, the Arabian Gulf States, and the United States have seen a rise in consumption of such fruits during the last decade. The trend towards healthy and nutritious snack foods is continuing. More dried fruits are used as toppings for ice cream, yoghurt, fruit bars, and confectionery. Some recent prices of dried fruits in the Los Angeles market at the retail level are given below:

Pineapple rings	12 ounce pack	$3.29
Pineapple snack cubes	8 ounce pack	$2.49
Dried mango slices	8 ounce pack	$3.89
Banana chips	8 ounce pack	$1.49
Papaya spears	12 ounce pack	$3.29
Papaya snack cubes	8 ounce pack	$2.49

Organically grown fruits without pesticides, insecticides, or chemical fertilizers command higher prices. Examples from Morgenland Food Products in Germany are given below:

Dried pineapple rings	125 grams packet	$1.55
Dried apple rings	125 grams packet	$1.40
Whole dried apricot	250 grams packet	$1.50
Whole dried bananas	200 grams	$2.45
Whole dried figs	250 grams packet	$1.25

A detailed market study with the price structure and distribution channels for potential Egyptian dehydrated fruits in Europe and the Gulf States should be carried out to determine the export potential and profitability of the entire sector of this business. Apparent surpluses in apples, grapes, and deciduous fruits should be used as raw materials at farm gate prices during

the peak season. If after adding the cost of processing, packaging, and handling, companies can compete in the export market, then the cost of start up of an industry of this type will be justified.

A quick calculation for grapes shows that the surplus grapes which cannot compete in European markets due to lack of a market window can be dried into raisins and sold at profit at 7 or 8 Egyptian pounds, competing against Turkish raisins, encouraging import substitution.

The bulk trade of dried fruit should be avoided due to commodity market fluctuations. Any concept to add value and sell the finished goods in packaged form as demonstrated in the above-mentioned Los Angeles market, should be given serious consideration. Dried fruits as raw material for breakfast cereals or candy bars can often be sold to such manufacturers under long-term contracts and may be easier than commodity trading.

Market information which is now considered propriety should be opened up for traders and processors so that they have access to it for calculation of profitability. In this connection, the USAID-supported program implemented by Agricultural Cooperative Development International to provide fruit and vegetables marketing information should be expanded to include farm gate prices.

A program to provide market information on a world wide basis should be started, including prices, volumes of raw material, and finished goods bought and sold around the world. This should be published on periodic intervals. A service of this nature could be supported by the groups interested in this business.

SECTION VII
CONCLUSION AND RECOMMENDATIONS

A qualitative analysis of the start-up of fruit dehydration industry in Egypt for export markets in Europe and the Arabian Gulf States shows potential and promise. This conclusion is based on discussions with producers and processors of fruits, nuts, and vegetables in the private sector.

Excessive per capita fruit production in general cannot be seen in the data available from the Ministry of Agriculture. However, it is evident that in peak season, the lack of processing facilities and collection system depresses the market for fruits such as apples, citrus, and grapes. Demand does not increase well enough to cope with the production in peak season. Processing will provide incentives to farmers to continue expansion of fruit production and stabilize the market.

Changing food habits toward more nutritious and natural sweet food products in the Arabian Gulf States and European countries provides Egypt with the opportunity to take advantage of this sector. Production for export and import substitution will certainly help the Egyptian economy.

The infrastructure is available on locations like Sadat City and Sixth of October City. Some industries are already involved in food processing and some business in other locations can easily diversify into fruit dehydration. The cost of energy, storage and transportation has to be given due consideration, as these inputs are not inexpensive in Egypt. Farm labor and industrial workers are available but the rates, at the equivalent of $2 to $3 per day, are higher than labor rates in Asian countries. However, the close proximity to Europe and the Arabian Gulf States may make it relatively advantageous for Egypt to compete.

Local institutions such as Food Technology Research Center in Giza, National Research Center at Dokki, University of Cairo, Al Azhar University, Ain Shams University, and University of Alexandria can be helpful in providing technical assistance to investors. Some of them have received funding from USAID under the National Agricultural Research Project (NARP), and are capable of product development, process development and quality assurance work.

Successfully producing and exporting dehydrated fruits will depend upon the ability of the investors to carry out the following activities:

- Identify specific markets and products based on raw material availability.
- Perform prefeasibility studies to check possible profit margins.
- Select product and process for specific markets.
- Estimate short- and long-term capital needs for equipment, operation, and management.
- Stake out a market share with the value-added concept and brand establishment.

A. Specific Recommendations for Potential Investors Seeking Assistance from the Trade Development Center (TDC)

- El Aguizy Industries has access to grapes. A bleached raisin plant using air dryers can be established without difficulty. Processing of this type is well known. Assistance for equipment and know-how can be provided through American companies.

- JAFCO is well into planning for a drying unit using an American machinery supplier. Additional technical assistance in product development and market development can be provided. They can take advantage of the USAID Private Sector Commodity Import Program.

- Cateco needs total assistance for product, market, and technical know-how. A complete feasibility study with possible licensing of brand names from overseas should be considered.

- Aga Dehydrating Plant can be upgraded with modification in equipment and controls. Some assistance in fruit paste and fruit leather can be given.

- As Agromisr is already involved in onions, it can easily diversify into fruits and vegetables. Equipment selection and technical know-how for fruit drying can be provided.

- Technical assistance to Montana Food and Avional can be provided for their expansion.

B. Overall Assistance to Investors in Fruit Dehydration

Since it is a new segment of business for investors in Egypt, assistance in educating and providing a broad perspective should be given. Information on the current status of this industry and the changing needs of customers on a global basis should be provided regularly. The growing concern about quality and consistency as a supplier should be emphasized. Study tours to markets and overseas processing plants may be useful in this regard. Investors should be encouraged to take such tours as part of their business.

TDC can play a major role in coordinating activities in technical assistance and developing market linkages. It can help during the start-up phase and subsequently monitor the quality and consistency of products and services so that Egypt not only develops an image of becoming a quality supplier but maintains this image for a long time. These activities should be market-driven and sustained through investor participation on a cost sharing basis.

Ministry of Agriculture
Central Administration for Fruit
and Vegetable Affairs
General Department for Horticulture

Table(1): Cultivated areas (Thousand Feddans) and total yield (Tons) of some fruits(1992/1993)

CROP	1992		1993	
	AREAS	YIELD	AREA	YIELD
Citrus	354	2463	401	1892
Grapes	140	708	139	734
Mango	54	174	57	201
Banana	33	422	37	413
Apple	71	256	75	358
Pear	19	96	18	91
Peach	70	197	81	230
Plum	8	35	8	53
Apricot	7	41	7	41
Olive	62	95	70	109
Date Palm (Thousand Date Tree)	4992	516	4979	521

ANNEX B

FIGURE 1: MAP OF EGYPT SHOWING THE FRUIT GROWING AREAS

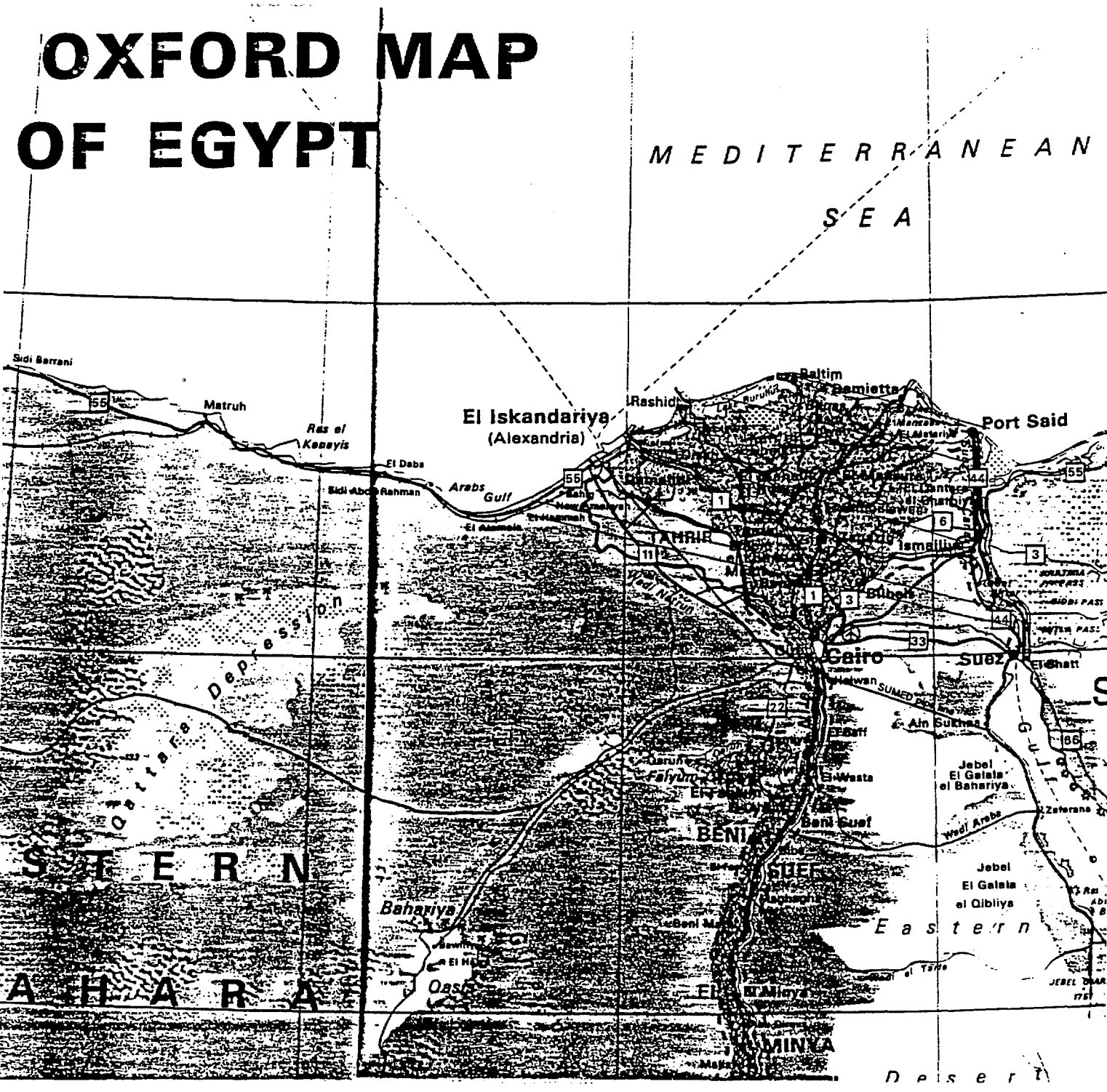

Figure 1. Shaded Areas Showing Fruit Producing Zones

ANNEX C

FIGURE 2: TYPICAL FACTORY LAYOUT FOR FRUIT DEHYDRATION

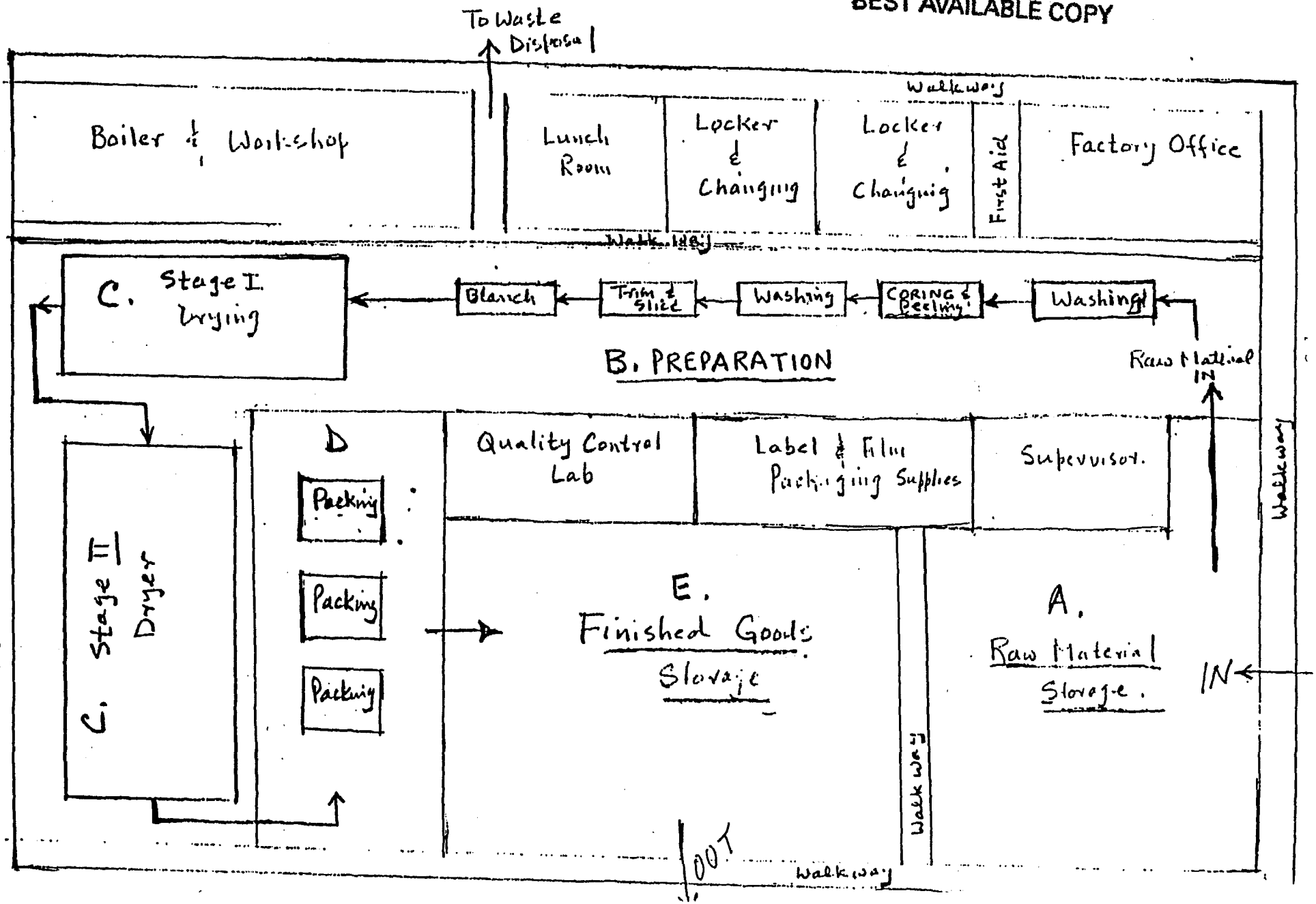

Figure 2 - Typical Fruit Drying Plant Layout

ANNEX D
WORK PLAN AND ITINERARY FOR DR. KAMAL U. HYDER, FOOD PROCESSING SPECIALIST

July 5, 1995	Leave Los Angeles	10 pm by TWA
July 6	Arrive Washington DC	Noon
July 7	Briefing at Chemonics Intl	Morning
	Leave for Cairo	8 pm by TWA
July 8	Arrive Cairo	Afternoon
	Meet Chemonics COP	Afternoon
July 9	Meeting at TDC	Morning
	Meeting with John Smith, ACDI	Afternoon
July 10	Meeting at USAID, David Alverson	Morning
	Meeting investors at TDC	Afternoon
July 11	Work at TDC	Morning
	Meeting with Dr. Maher Galal	Afternoon
July 12	Leave for Alexandria for food plant visits, meeting investors	All day
July 13	Return to Cairo	Morning
	Visit food processing plants	Afternoon
July 14	Friday - weekend	
July 15	Prepare recommendations for food dehydrating plants	All day
July 16	Meeting at USAID, David Delgado	Morning
	Prepare plans for JAFCO	Afternoon
July 17	Visit El Agaizy at Sadat City for raisin drying	All day
July 18	Meeting with JAFCO team for dried fruits for cereals	Morning
	Work at TDC	Afternoon
July 19	Visit Ministry of Agriculture	Morning
	Visit National Research Center	Afternoon
July 20	Visit Chemonics Egypt	Morning
	Visit USAID Library	Afternoon
July 21	Friday - weekend	
July 22	Work on report	All day
July 23	Work on report	All day
July 24	Meeting with Cateco	Morning
	Meeting with Pepsico	Afternoon
July 25	Visit Agromisr, Alexandria	All day
July 26	Visit Montana Foods, near Cairo	Morning
	Work at TDC	Afternoon

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July 27	Visit Agricultural Research Center	Morning
	Visit Chemonics Egypt	Afternoon
	Meet COP to discuss report	Afternoon
July 28	Friday - weekend	
July 29	Visit Fruit Orchard of Alaa Nabi and discuss fruit bar production with Cateco	All day
July 30	Prepare Draft Report	Morning
	Discuss report with executive director, TDC	Afternoon
July 31	Finalize draft report	All day
	Meet El Aguizy Industries	Afternoon
August 1	Presentation of draft report Fenton Sand and David Delgado, USAID Agriculture Office, Cairo	Morning
	Meeting with Alaa Nabi, Cateco	Afternoon
August 2	Follow up meetings with investors	All day
August 3	Complete draft report for distribution	All day
	Discuss recommendation and future course of action with TDC executive director	
August 4	Leave for Los Angeles via New York	1 am by TWA

ANNEX E
LIST OF PERSONS VISITED DURING THE STUDY

Potential Investors

Mr. Hussein El Aguizy, President, El Aguizy Industries, Box 68, Sadat City
Mr. Alaa El Bahay, JAFCO, P.O. Box 880, Cairo
Mr. Salah Ali El Gendy, Avional Tea Mixing & Packing Co. Damnhor
Mr. Salah Morsy, Agromisr, 5A El Bostan St. Tahrir Sq. Cairo
Mr. Beshir M. El Sharoud, Nile Agricultural Industry Co. Box 2741, Cairo
Mr. Magdi Maamoun, Montana Foods, 102 Gamal El Dol, Mohandseen
Mr. Alaa A. Nabi, Managing Director, Cateco Co. 52 Lebnan St. Mohandseen

Ministry of Agriculture

Eng. Mahmoud Nazif
Undersecretary for Agricultural Economics & Statistics

USAID, Office of Agriculture, Cairo Center, Cairo

Mr. David Alverson, Director
Mr. Fenton Sands
Mr. David Delgado
Dr. Abdel M. Moustafa

Agriculture Research Center

Dr. Nabih Ibrahim, Deputy Director
Dr. Samir M. Rabie

Al Azhar University

Dr. Maher Galal

National Research Center, Dokki

Dr. Mohsen M. Shoukry

University of Alexandria, Faculty of Agriculture

Dr. Omar Barbary
Dr. Ibrahim Rehab

Agricultural Cooperative Development International, Cairo

Mr. John Smith

ANNEX F

MARKET INFORMATION PROGRAM BY ACDI

Agricultural Economic Research Institute

Agricultural Cooperative Development International

FRUIT & VEGETABLES

MARKETING INFORMATION PROJECT

- **GOAL:**

To increase income from fruit and vegetable enterprises for Egyptian small and medium holder farmers through increased marketing efficiency.

- **PURPOSE:**

To establish a sustainable fruit and vegetable marketing information system that provides accurate and timely data, which will enable farmers to improve their marketing strategies.

- **CONCEPT & METHODS:**

The Marketing Information Project is a pilot activity to test the effectiveness of making fruit and vegetable marketing information easily accessible to producers and training them to use it. One component is the establishment of a Marketing Information System headquarters located in Cairo, which will collect, analyze and disseminate information about horticultural marketing from wholesale markets in Cairo, Alexandria and Mansoura. Spot prices and other daily information on market activity is broadcast regularly through a radio station in Cairo, which can be heard through out Egypt. It is also telephoned or faxed to participating farmer associations in the governorates. Time-series data is reported in a Monthly Wholesale Price Bulletin distributed to public sector and private sector users. In addition to prices, the system is designed to collect information on product quality, transport, marketing costs and other market related factors which are important to improving market efficiency. As the project progresses, export information will be included in the data collected.

A second component links market information to farmers through training in accessing information and applying it to their marketing needs. The project works closely with selected farmers, assessing their marketing problems and determining the most profitable post-harvest improvements in such areas as: on-farm grading, storage, packaging, supplying alternative markets, farmer managed point-of-sale facilities, ...etc.

The project is implemented by the Agricultural Economics Research Institute (AERI), the Economic Affairs Sector and Agricultural Cooperative Development International (ACDI). AERI provides the professional staff for the project and guidance through a Technical Committee. ACDI provides technical assistance through a Marketing Information Advisor and administrative support for the project. The involvement of AERI ensures that at the end of project funding, the marketing information system will continue operating through this government institution. The farmers' marketing associations will develop an organizational structure which will give them the capability of sustaining their improved marketing activities.

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ANNEX G

USAID CIP FUNDING PROGRAM

U.S. ECONOMIC ASSISTANCE PROGRAM IN EGYPT

THE USAID PRIVATE SECTOR COMMODITY IMPORT PROGRAM

One of the U.S. Government's Economic Assistance activities in Egypt is the Private Sector Commodity Import Program (PRCIP) implemented through 22 Egyptian commercial banks. This program provides foreign exchange at fixed exchange rates and short to medium term credit to Egyptian private sector firms to finance the importation of U.S.-manufactured commodities from the United States. Individual Egyptian entrepreneurs and private sector firms are eligible to participate, whether they are importing for resale (traders) or for their own use (endusers). Companies which are established in a free trade zone or which have public sector ownership exceeding 40% are excluded from the program.

CREDIT TERMS OFFERED UNDER THE PROGRAM

		Maximum Interest-free grace periods from the time of payment to the U.S. supplier	Maximum repayment periods following the interest-free grace periods
1.	Traders	6 months	6 months
2.	Endusers		
	a) Raw Materials	9 months	18 months
	b) Intermediate Goods	9 months	18 months
	c) Capital Equipment	9 months	8 years
3.	Project Financing Facility (PFF) Capital equipment for new plant or expansion or modernization of existing facilities.	18 months	8 years

ANNUAL LIMITS FOR INDIVIDUAL IMPORTERS

The minimum size for regular individual transaction is USD $10,000.
For PFF transactions the minimum is USD $100,000.

The maximum use of the program per year per importer is as follows:

1) Traders	USD $ 1.5 million
2) Endusers	USD $ 2.0 million
3) Bulk Commodities	USD $ 5.0 million
4) U.S. Supplier Agents/Authorized Distributors	USD $ 10.0 million
5) PFF	USD $ 15.0 million

The above ceilings may be increased upon receipt of written approval from the Ministry of International Cooperation (MIC). All payments made by the importer are in Egyptian pounds with an exchange rate fixed at the date of opening the Letter of Credit. If you need any further information, please contact the USAID offices in Cairo (tel nos. 357-2143, 357-3789) and in Alexandria (tel nos. 482-9301, 482-8458).

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ANNEX H
LIST OF PROCESS AND EQUIPMENT SUPPLIERS

The following list of potential suppliers is furnished. They may be contacted for obtaining technology and equipment. The level of interest in receiving response from these companies will depend upon profitability for all parties concerned.

Drying Equipment

Proctor & Schwatrz, 251 Gibraltar Rd. Horsham. PA 19044, USA. Phone (215) 443 5200

National Drying Machinery, 2190 Horning Road, Philadelphia, PA 19116, USA. Phone (215) 464 6070

Stokes Vacuum Inc. 5500 Tabor Road, Philadelphia, PA 19120, USA. Phone (215) 831 5400

Snack Making Equipment

Heat and Control Inc. 225 Shaw Road, S. San Francisco, CA 94080. Phone (415) 871 9234

APV Crepaco Inc. 9525 West Bryn Mawr Avenue, Rosemont, IL 60018. Phone (708) 678 4300

Filling and Packaging Equipment

W.A. Lane Inc. 998 South Sierra Way, San Bernardino, CA 92408. Phone (714) 885 0715

Magnuson Corp. 475 Edison Way, Reno, NV 89510, USA. Phone (702) 329 9700

Triangle Package Machinery Co. 6655 W. Diversey Avenue, Chicago, IL 60635. Phone (312) 889 0200

Process Development Companies for Dehydrated Fruits

Ed Hirschberg, Innovative Foods Inc. 179 Starlite Street, S. San Francisco, CA 94080

Rick Murphy, International Raisins Inc. 1445 Nebraska Avenue, Selma, CA 93662.

Dianne Nury, Vie-Del Company, PO BOX 2896, Fresno, CA 93745, USA

Dick Rabinsky, Micro Diet Inc. Vista, CA. USA. Fax (619) 598 0572

Bob Norris, Enersyst Development Center, 2051 Valley View Lane, Dallas, TX 75234 USA. Phone (214) 247 9624

Quality Assurance and Quality Control Consultants

Dr. O. Pete Snyder, HITM, 830 Transfer Road, Suite 35, St. Paul, MN 55114 USA. Phone (612) 646 7077

Dr. Andre Bolaffi, Bolaffi International, 2331 Bush Street, San Francisco, CA 94115, USA. Phone (415) 595 5335

Dr. Charles Radanovics, John Sexton & Co. 1800 Churchman , Indianapolis, IN 46203, USA. Phone (317) 783 3422

ANNEX I

PROPOSAL FOR EL AGUIZY FOR GOLDEN RAISIN PRODUCTION

Cerechem Corp.

4195-1 Carpinteria Ave, Carpinteria, Ca. 93013

Telephone (805) 566-3410
Facsimile (805) 566-3416

TO: KIM KENNEDY, CHEMONICS INTL

FROM: KAMAL HYDER

DATE: Sept. 20, 95

TOTAL PAGES (INCLUDING COVER) 10

COMMENTS:

The attached proposal for raisin drying was mailed to TDC/EED on Sept.8, 1995. I have not received any confirmation yet.

~~After~~ After my return from Egypt I visited with Mr. Rick Murphy, General Manager, International Raisins, Inc., 1445 Nebraska Avenue, Selma, California 93662, Phone 209 896 2140 , Fax 209 896 4304. He is willing to show his plant and explain the technology of golden raisin drying to Mr. Aguizy. Valley Welding & Machine Works, Fresno, California, fabricates the equipment. The tunnel dehydrating proposal from Valley Welding is included. The total cost of drying equipment ex-factory in Fresno comes to $ 130,000. Itemized proforma invoice can be developed upon request.

I will be glad to assist, if time permits. Additional information from the equipment manufacturers can be sent to TDC directly or thru Chemonics. Please advise me as to how you plan to handle it.

VALLEY WELDING & MACHINE WORKS

TUNNEL DEHYDRATION SYSTEM

INDEX

For: Mr. Aguirre
From: Dr. Karel Hyder
Calif USA
Fax: 805 566 3416
Sept 8, 95

DRY OUT RATIO/DEHYDRATION

1.6 Dry tons per tunnel per day.

4.8 dry out ratio = 7.6 tons of grapes needed per tunnel per day.

Grapes from the field are dumped into cold water tank where they are washed. They are then conveyed on to a wash shaker and sorting belt for removal of debris and leaves. As the grapes are conveyed into the hot tank the hot water cracks the grape to aid in drying, then proceeds to load grapes on trays via a spreader shaker.

The clean trays are being conveyed by the tray conveyor. This tray conveyor is loaded with trays that have already been dried once the raisins are removed. The trays are first washed then reloaded with fruit.

Once the trays are loaded with grapes they are hand stacked onto the fruit cars (25). Then the cars are rolled into the drying tunnels, where they are dried for approximately 24 hours.

If golden raisins are desired then follow sulfur drying system information sheet prior to loading cars into drying tunnel.

SULFUR DRYING SYSTEM

There are two types of sulfur systems, Burning Sulfur or Liquid Sulfur.

BURNING SULFUR

Cars of fruit are put into a closed tunnel made of brick, plywood or tar paper. Sulfur is burned at 1-1/2 pound per fruit car. The fruit is left in the fumes for 6 hours without the door being opened. Then the door is opened and the fruit is put into drying tunnels.

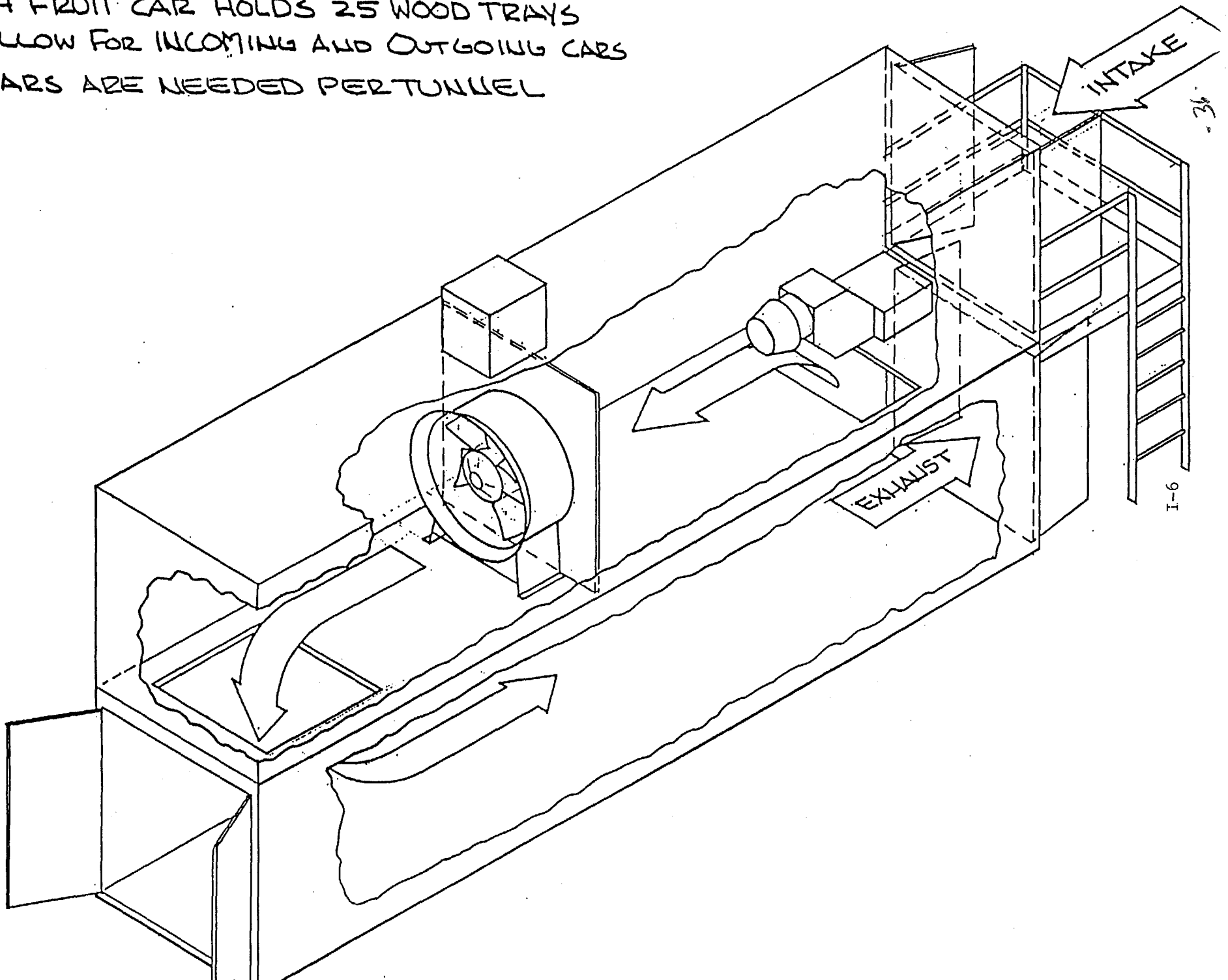
LIQUID DIOXIDE (LIQUID SULFUR)

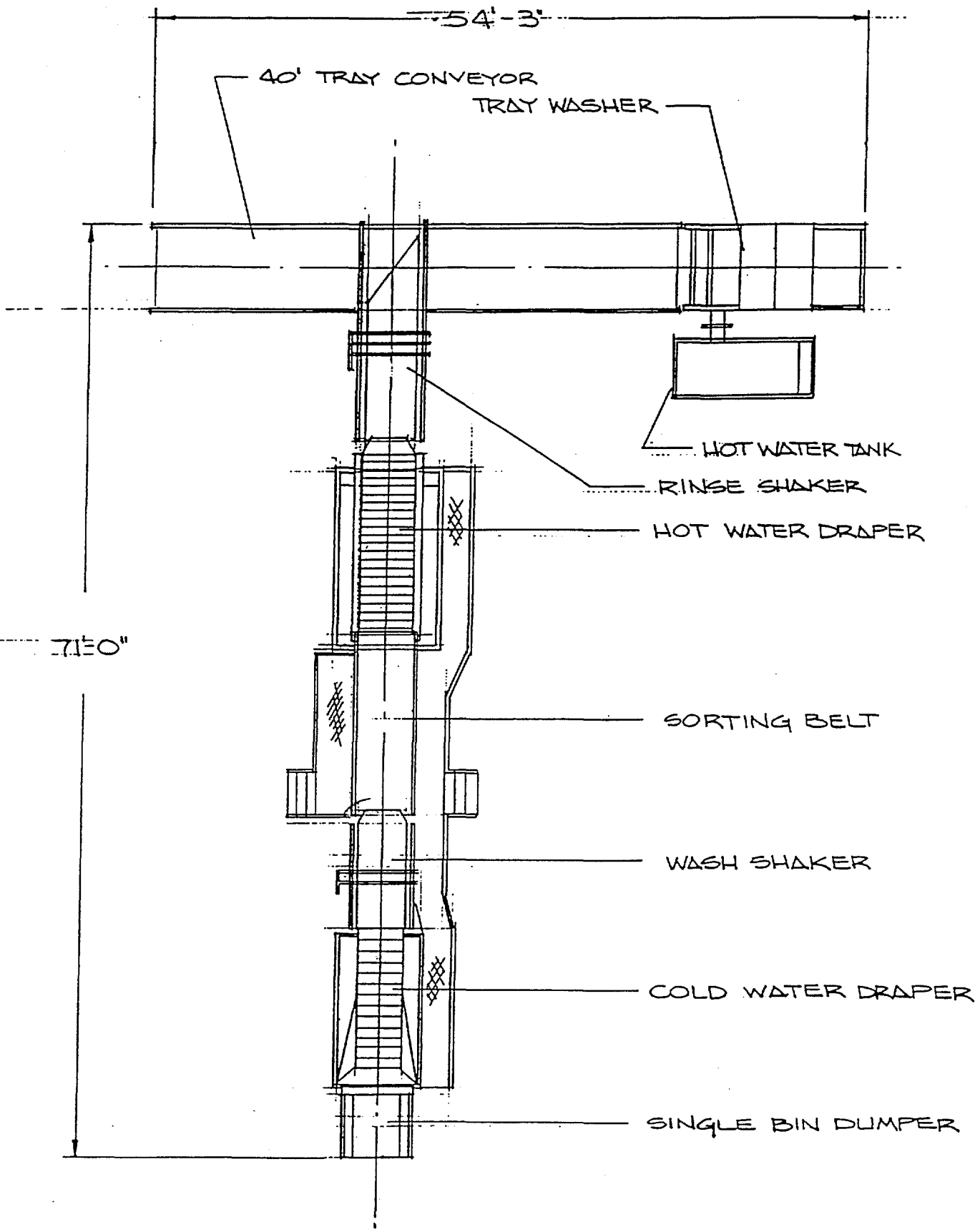
10 cars (26 trays per car) of fruit are put into a closed room which is made of brick, plywood or tar paper. Approximately 5 pounds of Liquid Dioxide (liquid sulfur) per fruit car is fed into the closed room. The fruit must remain undisturbed in the fumes for 6 hours. AA G - 2 gas mask must be worn when removing the fruit if the fumes are strong. The fruit cars are then put into the tunnel to dry for approximately 48 hours if the Cold Water Oleate system was used or 24 hours if the Hot Water Caustic Soda system was used.

EACH FRUIT CAR HOLDS 25 WOOD TRAYS

TO ALLOW FOR INCOMING AND OUTGOING CARS

25 CARS ARE NEEDED PERTUNNEL





VALLEY WELDING & MACHINE WKS.

DEHYDRATOR WET LINE (REF. 956A)

1/7/94 JP.

GRAPE PREP LINE

1 - VWM SINGLE BIN DUMPER
3 HP self contained hydraulic power pack.

1 - VWM COLD WATER TANK WITH DRAPER
3/16" steel tank with clean out doors, 4" gate valve drain and service catwalk. 42" draper conveyor with electric drive.

1 - VWM WASH SHAKER
48" shaker with sprays and water collection hopper for removal of substandard grapes. 1/4 x 2 x 4 rectangular tube frame. Mild steel construction.

1 - VWM SORTING BELT
Complete with service catwalks and stairway. This unit for hand removal of leaves with trash discharge chutes.

1 - VWM 3 - BURNER HOT TANK WITH DRAPER
Three Eclipse gas burners with control and safety shutoff. Clean out doors and 4" drain with draper conveyor.

1 - VWM RINSE SHAKER
This shaker to spray grapes and load them onto incoming trays.

1 - VWM TRAY CONVEYOR
Hydraulic control chain conveyor 40 FT. long with vari-speed control. This unit to convey trays for scraping of fruit and loading of grapes.

1 - TURN TABLES

1 - METAL DOORS

1 - 354 AXIFLOW FANS

1 - 25 HP BALDOR MOTOR

1 - MOTOR BASE

1 - MOTOR COVERS

1 - SET BELTS AND SHEAVES

1 - SURE LITE BURNERS

1 - SURE LITE PILOTS

1 - PLUMBING FOR BURNER WITH VALVES

1 - SULPHUR HOUSE DOORS

1 - ROOF OPENING FOR AIR

1 - BELT OPENING

1 - FIRE BOX OPENING

1 - FRUIT CAR

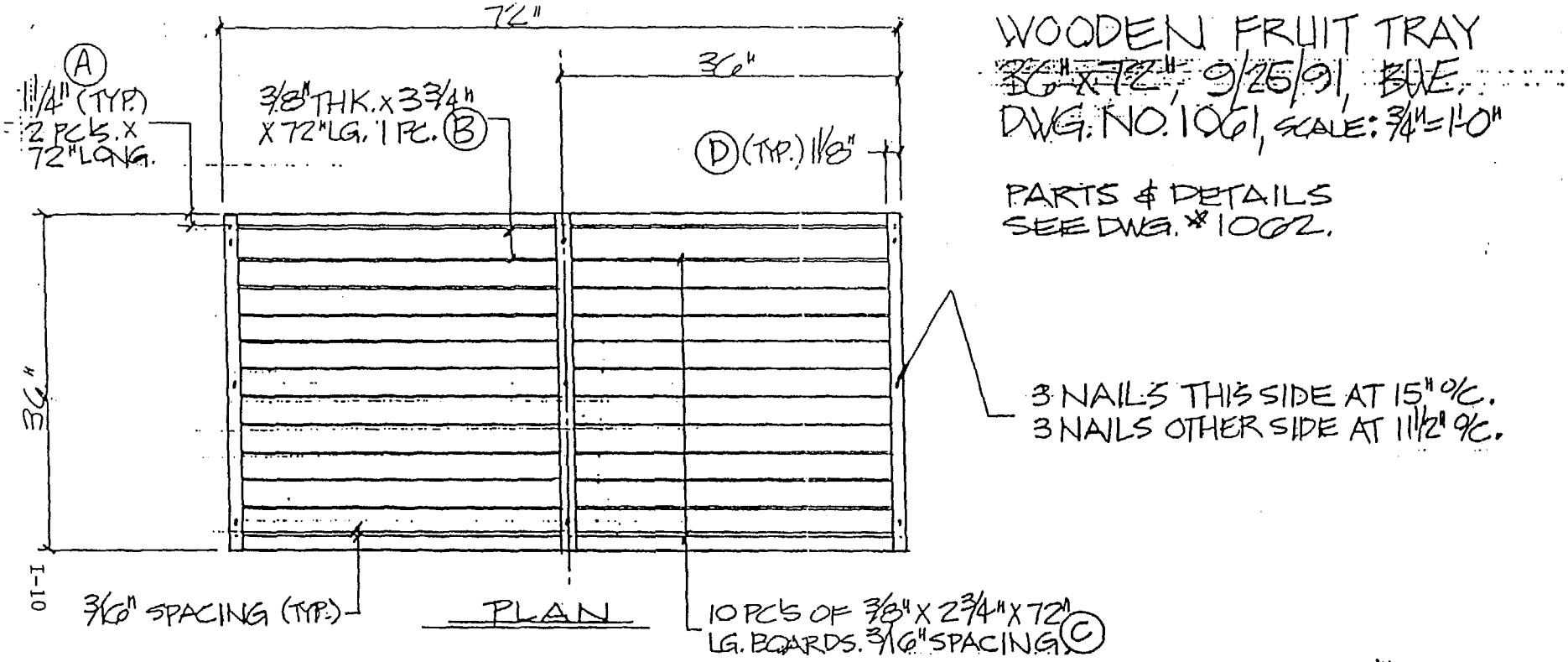
1 - VWM TRAY WASHER WITH HEAT TANK AND PUMP

Total cost:
$ 130,000
Ex factory
Fresno, CALIF.
USA

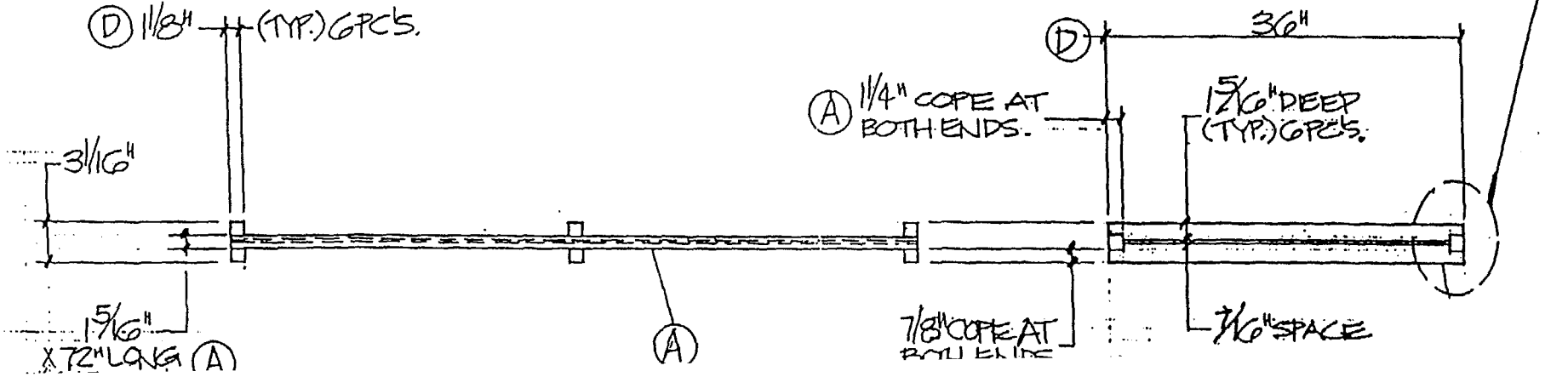
WOODEN FRUIT TRAY

36" x 72", 9/26/91, BWE.
DWG. NO. 1061, SCALE: 3/4" = 1'-0"

PARTS & DETAILS SEE DWG. # 1062.



SEE DWG. # 1062



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ANNEX J

PROPOSAL FOR ALAA NABI FOR DRIED FRUIT BAR MANUFACTURE

File Copy

CERECHEM CORPORATION

September 27, 1995

NOTATIONS

TDC - Egypt
P.O. Box Giza 12211
Giza, Egypt

ATTENTION: Emad Abdel Razek/ Tony Shiels

SUBJECT: FRUIT & NUT BARS for Alaa Abdel Nabi

Dear Mr. Razek,

These sample fruit bars are an example of nutritionally complete formulations that we can prepare for the Egyptian/Gulf market. The peanut bar is a sample of a bar for the school children. Please taste them and send your comments so that we might select that which you feel will be most acceptable. Approximate cost for 5000 bars is US$1.10 each, however the price drops to $0.77 per bar for 250,000 quantity.

Please note that the bars are numbered for reference. Also the nutritional content with the ingredient statement is attached. Micro Diet of Vista, California, has agreed to manufacture these products for initial market development. They will help set up a complete plant on a turn key basis in Egypt. The plant cost is estimated to be US$ 1.2 million exclusive of the land and building. This cost can be reduced if some used machinery and equipment can be acquired.

If Mr. Nabi can come to California in October we will be glad to show him similar facilities to help him make the decision.

Sincerely,

Kamal Hyder

Kamal Hyder, PhD
Vice President

4195-1 Carpinteria Ave. , Carpinteria, Ca. 93013

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MICRO DIET DIRECT

Access Inter Marketing
2420 Grand Avenue, Suite D, Vista, CA 92083

FAX

To: _____ Sender Richard Rabinsky

Fax No. 805-566-3416 Fax 619 • 598 • 0572

Phone No. 805-566-3410 Phone 619 • 598 • 5474

Attention: Karen Hyder Date: 9-27 Pages: of __

BAR # 2150084903

PRODUCT: Fruit & Nut 2150849D3

CUSTOM FORMULATED FOR:

Customer OK

Labelling OK

NUTRITION INFORMATION PER SERVING

Serving Size: 1.50 oz. (43 g)
No. of Servings: 1

Calories	160		
Protein	3 g		
Carbohydrate	25 g	Dietary Fiber	3 g
Fat	7 g		
Sodium	5 mg		
Potassium	260 mg		

PERCENTAGE OF U.S. RECOMMENDED DAILY ALLOWANCE (% USRDA)

Protein	4 %
Vitamin A	*
Vitamin C	*
Thiamine-B1	6 %
Riboflavin-B2	2 %
Niacin	8 %
Calcium	*
Iron	4 %

* Contains less than 2 % of the U.S. RDA of this nutrient

INGREDIENTS:

Dates, raisins, peanut butter, peanuts, coconut, cashews, walnuts, honey

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MICRO DIET DIRECT

Access Inter Marketing
2420 Grand Avenue, Suite D, Vista, CA 92083

FAX

To: _____ Sender Richard Rabinsky

Fax No. 805-566-3416 Fax 619 • 598 • 0572

Phone No. 805-566-3410 Phone 619 • 598 • 5474

Attention: Karen Hyder Date: 9-27 Pages: of __

SEP-27-95 WED 09:54 AM MICRO DIET DIRECT 619 598 0572

Bar # F 313-3

FRUIT AND NUT BAR
ORANGE COCONUT FLAVOR
F#313-3

INGREDIENTS: DATES, RAISINS, PEANUT BUTTER, HONEY, COCONUT, MALTED BARLEY EXTRACT, SESAME SEEDS, APPLES, PEANUTS, APPLE FIBER, OAT BRAN, GLYCERIN, MALTODEXTRIN, NATURAL FLAVORS, LECITHIN.

COATING: SUGAR, COCOA BUTTER, CHOCOLATE LIQUOR, WHOLE MILK POWDER, LECITHIN (added as an emulsifier), and VANILLIN (an artificial flavor).

NUTRITIONAL INFORMATION PER SERVING:

SERVING SIZE	1.50 oz. (42.53 grams)
CALORIES	170
PROTEIN	4 grams
CARBOHYDRATES	24 grams
FAT	6 grams
DIETARY FIBER	4 grams

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MICRO DIET DIRECT

Access Inter Marketing
2420 Grand Avenue, Suite D, Vista, CA 92083

FAX

To: _____ Sender Richard Rabinsky

Fax No. 805-566-3416 Fax 619 • 598 • 0572

Phone No. 805-566-3410 Phone 619 • 598 • 5474

Attention: Karen Hyder Date: 9-27 Pages: of _

SEP-27-95 WED 09:55 AM MICRO DIET DIRECT 619 598 0572

FRUIT AND NUT BAR Bar # F313-2

TROPICAL FRUIT FLAVOR

F0313-2

INGREDIENTS: RAISINS, DATES, MIXED FRUIT BLEND (APRICOTS, PEACHES, PEARS, APPLES, NATURAL AND GOLDEN RAISINS), PEANUT BUTTER, HONEY, MALTED BARLEY EXTRACT, PEANUTS, SESAME SEEDS, APPLES, APPLE FIBER, OAT BRAN, COCONUT, GLYCERIN, MALTODEXTRIN, NATURAL FLAVOR, LECITHIN.

COATING: SUGAR, COCOA BUTTER, CHOCOLATE LIQUOR, WHOLE MILK POWDER, LECITHIN, (added as an emulsifier), and VANILLIN (an artificial flavor).

NUTRITIONAL INFORMATION PER SERVING:

SERVING SIZE	1.50 oz. (42.53 grams)
CALORIES	170
PROTEIN	4 grams
CARBOHYDRATES	24 grams
FAT	6 grams
DIETARY FIBER	4 grams

45

MICRO DIET DIRECT

Access Inter Marketing
2420 Grand Avenue, Suite D, Vista, CA 92083

FAX

To: _____ Sender Richard Rabinsky

Fax No. 805-566-3416 Fax 619 • 598 • 0572

Phone No. 805-566-3410 Phone 619 • 598 • 5474

Attention: Karen Hyder Date: 9-21 Pages: of __

BAR # 1945074Z9

SEP-21-1995 17:25 P.03

CONFIDENTIAL CONFIDENTIAL 7/20/95

Product: Chewy Crisp - Peanut
Name: Peanut Chewy Crisp

1945075AZ9 \ Table Bar

Nutrition Facts
Serving Size 1 Bar (50 g / 1.8 oz)

Amount Per Serving		% Daily Value based on 2000 Calories	DRV for 2000 Calories
Calories	210		
Calories from Fat	60		
Total Fat	7 g	11 %	65 g
Saturated Fat	1.5 g	8 %	20 g
Polyunsaturated Fat *	2 g		
Monounsaturated Fat *	3.5 g		
Cholesterol	0 mg	0 %	300 mg
Sodium	105 mg	4 %	2400 mg
Potassium *	135 mg	4 % *	3500 mg
Total Carbohydrate	35 g	12 %	300 g
Dietary Fiber	2 g	8 %	25 g
Soluble Fiber * less	1 g		
Insoluble Fiber *	1 g		
Sugars	14 g		
Sugar Alcohol *	0 g		
Other Carbohydrate *	g		
Protein	4 g		

Vitamin A	**	Folate *	**
Vitamin C	**	Vitamin B12 *	**
Calcium	**	Biotin *	**
Iron	8 %	Pantothenic Acid *	**
Vitamin D *	**	Phosphorus *	8 %
Vitamin E *	**	Iodine *	**
Thiamin *	15 %	Magnesium *	6 %
Riboflavin *	10 %	Zinc *	**
Niacin *	10 %	Copper *	J-5 2 %
Vitamin B6 *	2 %		

Not to be included in the nutritional panel.

Percent Calories from:

Protein	8
Carbohydrate	62
Fat	30
	100

ANNEX K

INFORMATION ON VACUUM DRYERS

ORIGINAL

Cerechem Corp.

4195-1 Carpinteria Ave, Carpinteria, Ca. 93013

Telephone (805) 566-3410
Facsimile (805) 566-3416

TO: Kim Kennedy, Chemonics Intl.

FROM: Kamal Hyder

DATE: Oct. 16, 1995

TOTAL PAGES (INCLUDING COVER) 5

COMMENTS:

Hope you have received the final draft of the report on fruit processing in Egypt with specific recommendations for Mr. El Aguizy and Mr. Alaa Nabi. They are in the appendix.

Here is an update on rest of the TDC clients which should be included in the appendix for future reference.

1. Jafco is already in touch with Proctor & Schwartz. They are working on breakfast cereal processing. They did not want our assistance but if they want to include apple dehydration they can contact Mr. John Tumee of Tree Top Inc at 509 697 7251.

2. Montana Foods are in frozen fruits and vegetables. They were not interested in drying but they can get into freeze drying without difficulty. I have talked to Mr. Ed Hirschberg of Innovative Foods who is willing to assist them in freeze drying. He can be reached at 415 871 8912.

3. Aga Dehydrating Plant needs upgrading. Agro Misr also needs similar help. I am including the bulletin from Stokes Vacuum Dryer which may be sent to them and included in the appendix. The contact at Stokes can assist in the upgrades with proper dryers. They can be reached at 215 831 5400.

4. Avional is in tea and snacks business. Fried fruit snacks will require additional research. I cannot suggest any innovative idea other than banana chips. This technology can be obtained from Thailand or the Phillipines.

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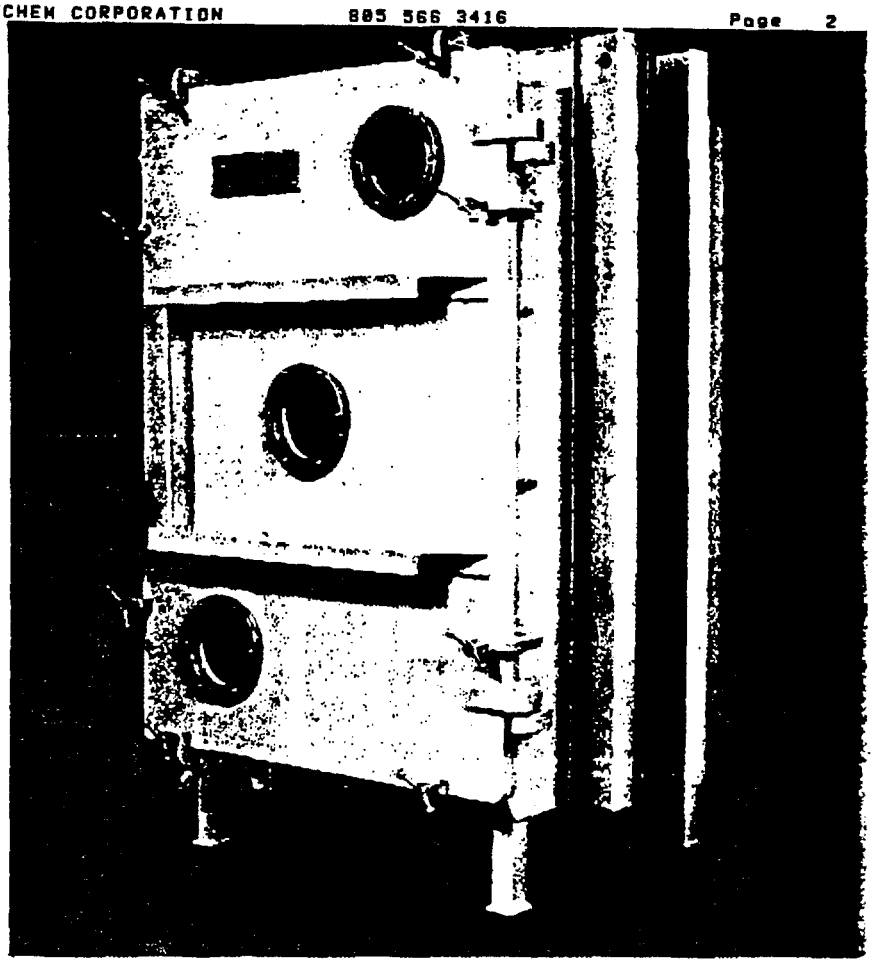
Vacuum Shelf Dryers

Bulletin 338P-3



The Stokes Model 338 Vacuum Shelf Dryers provide rapid drying of heat-sensitive, air-sensitive, and pyrophoric materials, or materials that require drying without agitation. Heat-sensitive materials can be dried at low temperatures under vacuum, since the environmental pressure is reduced below the vapor-pressure of the contained water or solvents. Oxidation or contamination by air is eliminated. Recovery of expensive solvents can be virtually complete. Hollow fibers, medical devices, chemical salts, fine chemicals, dyes, glandular products, pharmaceuticals and food extracts (gluten, glues, pepsin), rubber, explosives, etc., are ideally suited for drying in this manner.

ASME Code Certification

These dryers carry ASME Code Certification on all pressure parts as a standard feature. The shelves are rated at 50 psig, and each one undergoes hydrostatic tests before and after assembly.

Outstanding Design Feature

A major design feature incorporated in this series of vacuum dryers is the placement of all shelf and mainfold connections outside of the chamber, avoiding the possibility that leaks might develop within the chamber and contaminate the product being dried. This feature also simplifies the maintenance of these connections by making access to them more convenient.

Protective Convenience

Stokes Vacuum Shelf Dryers are of welded steel construction for maximum operating protection and dependability under full vacuum operation. The steel door is hung on floating hinges so that the gasket seats and seals uniformly when closed.

Systems

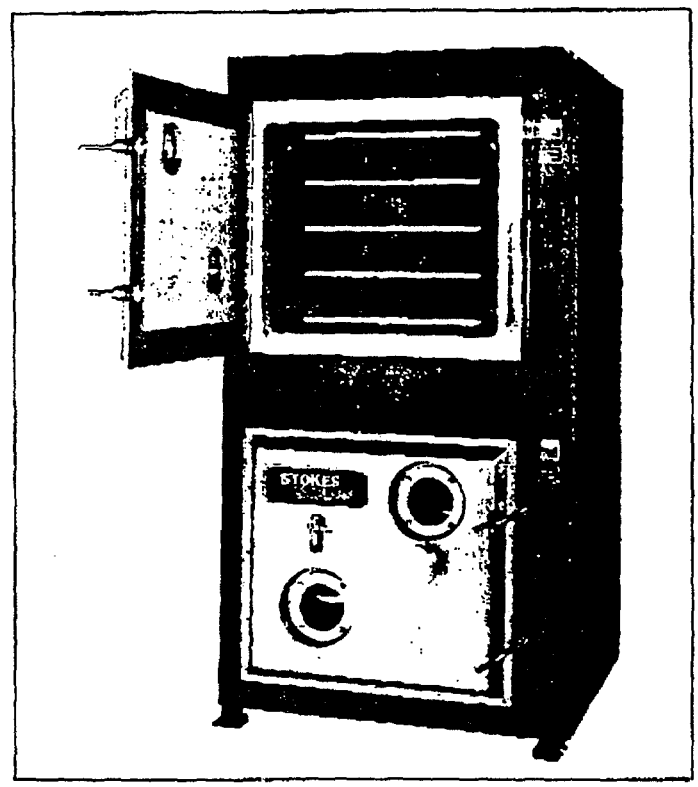
Pretested package systems are available for single source responsibility, reduced installation time and cost. All components and controls are supplied by Stokes with a one-year warranty, from date of delivery.

Optional Equipment

1. All process contact surfaces of stainless steel construction
2. Pharmaceutical finish
3. Internal corrosion-resistant coatings
   a. Heresite—baked Phenolic
   b. Urethane—white or black
   c. Halar
   d. Teflon
4. Heating systems (standard open or explosion proof)
   a. Electrically heated hot water
   b. Steam heated hot water
   c. Electrically heated hot oil (up to 550°F)
5. Stainless steel drying trays (see Data Sheet No. 4380).
6. Surface condensers
   a. Water cooled
   b. Refrigerated
7. Vacuum pumps
   a. Mechanical
   b. Liquid ring
8. Instrumentation
   a. Temperature indicating or indicator/controllers
   b. Vacuum indicating controllers

Bulletin SH-1

Stokes® Vacuum Shelf Dryers



Applications:

- *Heat- or air-sensitive chemicals*
- *Pharmaceuticals*
- *Food and glandular extracts*
- *Dyes and fibers*
- *Medical devices*

Stokes Vacuum shelf dryers are designed to save money on installation, and enhance your productivity for years to come. They provide rapid drying of sensitive and pyrophoric materials that require drying without being exposed to air, high temperature, or agitation.

As in all Stokes dryers, quality engineered materials are employed throughout for maximum dependability. Shelves and other components subjected to pressure are ASME code-certified and rated to 50 psig. Welded-steel construction ensures the highest degree of structural integrity and operating protection under full vacuum conditions. Floating hinges are used to provide uniform gasket seating and sealing when the door is closed.

To minimize the possibility of product contamination, all shelf and manifold connections are placed outside of the vacuum chamber. This design feature also simplifies maintenance by making access to these connections more convenient.

Stokes Vacuum engineers will work with you to design a shelf dryer matched to your application and production requirements, or you may choose a complete, pretested system to reduce installation time and cost. Options include a variety of construction and lining materials, heating systems, condensers, vacuum pumps, and instrumentation. All components and controls are covered by a one-year warranty.

STOKES® VACUUM Inc.

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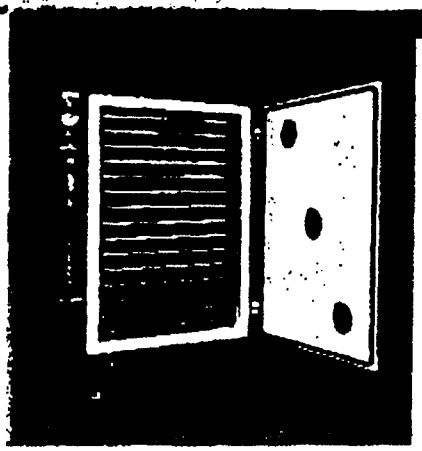


Shelves are ASME Code Certified. They are ground smooth and fitted with internal baffles to assure proper distribution of heating mediums.

All mainfold connections are outside the chamber... minimizing possibility of product contamination.

Overall Dimensions (Inches)

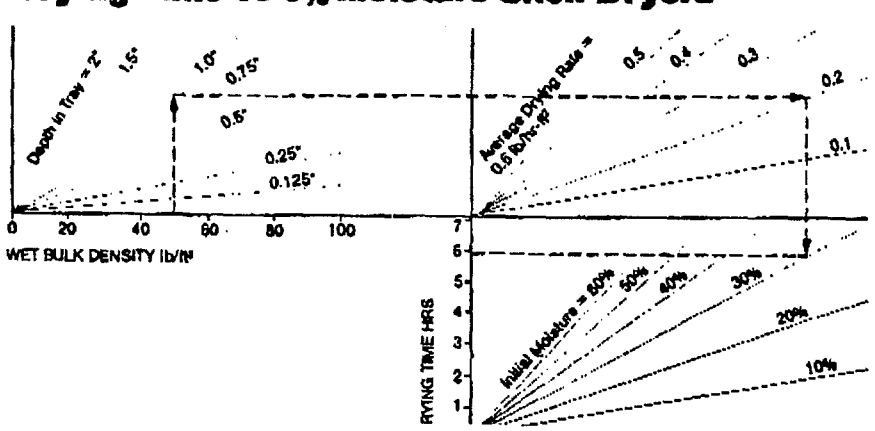
Model	Width	Depth (Door Open)	Height
338B	40.5	75.0	56.0
338D	40.0	77.0	66.0
338F	40.5	85.5	75.0
338H	62.0	107.0	77.5
338J	66.0	110.0	99.0

Larger sizes can be fabricated to special order.

Sizes and Specifications No. 338 Stokes Vacuum Shelf Dryers

Model	Shelf Size (Inches) Width Depth	Usable Shelves	Shelf Area Sq. Ft.	Clearance between Shelves (Inches)	Net Wt. (Lbs.)
338B-1	24 x 24	1	4	16.3	920
338B-2	24 x 24	2	8	7.6	1030
338B-3	24 x 24	3	12	4.8	1140
338B-4	24 x 24	4	16	3.3	1250
338B-5	24 x 24	5	20	2.5	1360
338B-6	24 x 24	6	24	1.9	1470
338D-1	24 x 36	1	6	23.0	1270
338D-2	24 x 36	2	12	11.0	1420
338D-3	24 x 36	3	18	7.0	1570
338D-4	24 x 36	4	24	5.0	1720
338D-5	24 x 36	5	30	3.8	1870
338D-6	24 x 36	6	36	3.0	2020
338D-7	24 x 36	7	42	2.4	2170
338D-8	24 x 36	8	48	2.0	2320
338D-9	24 x 36	9	54	1.7	2470
338F-1	24 x 36	1	6	35.0	1920
338F-2	24 x 36	2	12	17.0	2080
338F-3	24 x 36	3	18	11.0	2240
338F-4	24 x 36	4	24	8.0	2400
338F-5	24 x 36	5	30	6.2	2560
338F-6	24 x 36	6	36	5.0	2720
338F-7	24 x 36	7	42	4.1	2880
338F-8	24 x 36	8	48	3.5	3040
338F-9	24 x 36	9	54	3.0	3200
338F-10	24 x 36	10	60	2.6	3360
338F-11	24 x 36	11	66	2.3	3520
338F-12	24 x 36	12	72	2.0	3680
338H-1	44 x 40	1	12.2	44.0	4170
338H-2	44 x 40	2	24.4	21.5	4490
338H-3	44 x 40	3	36.7	14.0	4810
338H-4	44 x 40	4	48.9	10.3	5130
338H-5	44 x 40	5	61.1	8.0	5450
338H-6	44 x 40	6	73.3	6.5	5770
338H-7	44 x 40	7	85.5	5.4	6090
338H-8	44 x 40	8	97.8	4.6	6410
338H-9	44 x 40	9	110.0	4.0	6730
338H-10	44 x 40	10	122.2	3.5	7050
338H-11	44 x 40	11	134.4	3.1	7370
338H-12	44 x 40	12	146.7	2.8	7690
338H-13	44 x 40	13	158.9	2.5	8010
338H-14	44 x 40	14	171.0	2.2	8330
338H-15	44 x 40	15	183.0	2.0	8650
338J-1	44 x 40	1	12.2	86.0	4840
338J-2	44 x 40	2	24.4	32.0	5160
338J-3	44 x 40	3	36.7	21.0	5480
338J-4	44 x 40	4	48.9	15.5	5800
338J-5	44 x 40	5	61.1	12.2	6120
338J-6	44 x 40	6	73.3	10.0	6440
338J-7	44 x 40	7	85.5	8.4	6760
338J-8	44 x 40	8	97.8	7.2	7080
338J-9	44 x 40	9	110.0	6.3	7400
338J-10	44 x 40	10	122.2	5.6	7720
338J-11	44 x 40	11	134.4	5.0	8040
338J 12	44 x 40	12	146.7	4.5	8360
338J-13	44 x 40	13	158.9	4.0	8680
338J-14	44 x 40	14	171.0	3.7	9000
338J-15	44 x 40	15	183.0	3.4	9320
338J-16	44 x 40	16	195.5	3.1	9640
338J-17	44 x 40	17	207.7	2.8	9960
338J-18	44 x 40	18	220.0	2.6	10280
338J-19	44 x 40	19	232.2	2.4	10600
338J-20	44 x 40	20	244.4	2.3	10920
338J-21	44 x 40	21	256.6	2.1	11240
338J-22	44 x 40	22	268.8	2.0	11560

Drying Time To 0% Moisture Shelf Dryers



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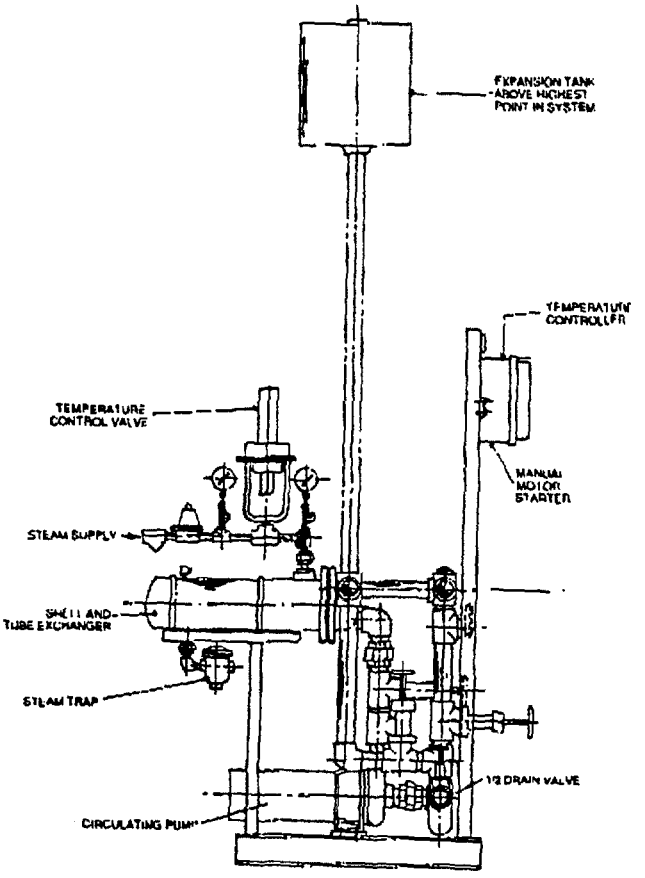
Stokes Advisory and Engineering Service

The Stokes Advisory and Engineering Service is available to help manufacturers plan for profitable production by vacuum drying or other vacuum processing operations. Practical information on the application and use of vacuum processing equipment is offered. Our staff includes electrical, chemical, and mechanical engineers as well as production people with practical operating experience.

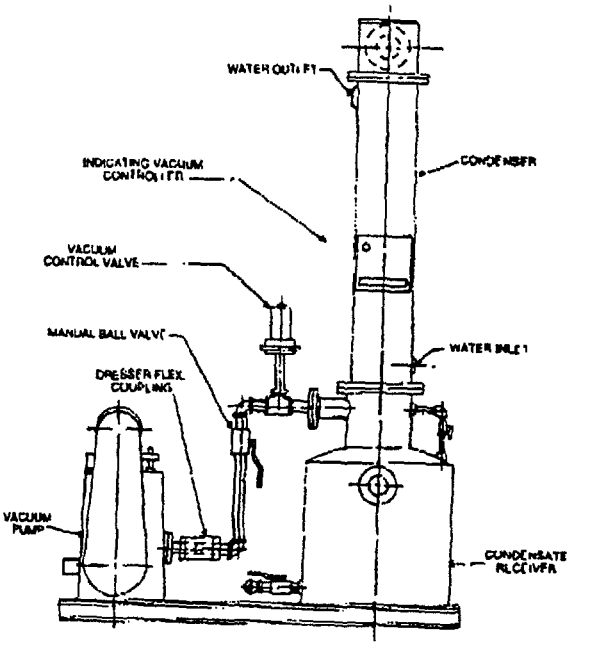
Problems in vacuum processing are thoroughly analyzed, with your technical and practical considerations evaluated before conclusions are reached. Whenever necessary, controlled tests are made in our demonstration laboratory. Here, on semi-plant-scale equipment, results are obtained which can be duplicated on production equipment. Selection of equipment, operating procedures, and cost estimates are developed from these tests.

Companies submitting problems are invited to send representatives to observe test results.

Typical Heating and Condensing VacuumSystems for Model 338 Vacuum Shelf Dryers



Typical Steam Heated Hot Water System



Typical Vacuum Condensing System

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ANNEX L
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