



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

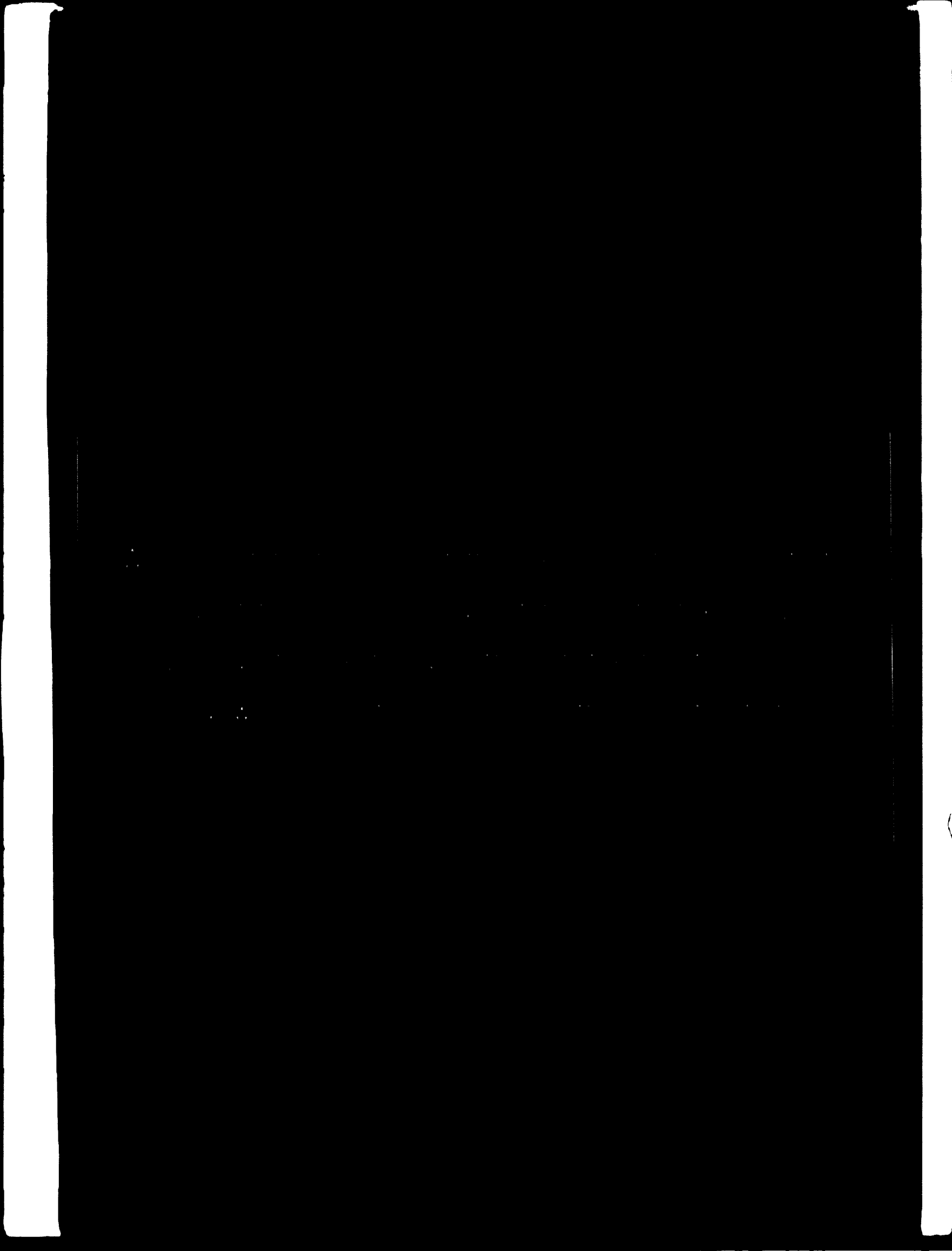
FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org



RESTRICTED

08972

DP/ID/SER.R/186
24 November 1978
English

(R)

DESIGN AND MANUFACTURE OF CONTAINERS AND
CONTAINER HANDLING AND TRANSPORTING

EQUIPMENT .

SI/CYP/76/808.

CYPRUS.

Terminal report .

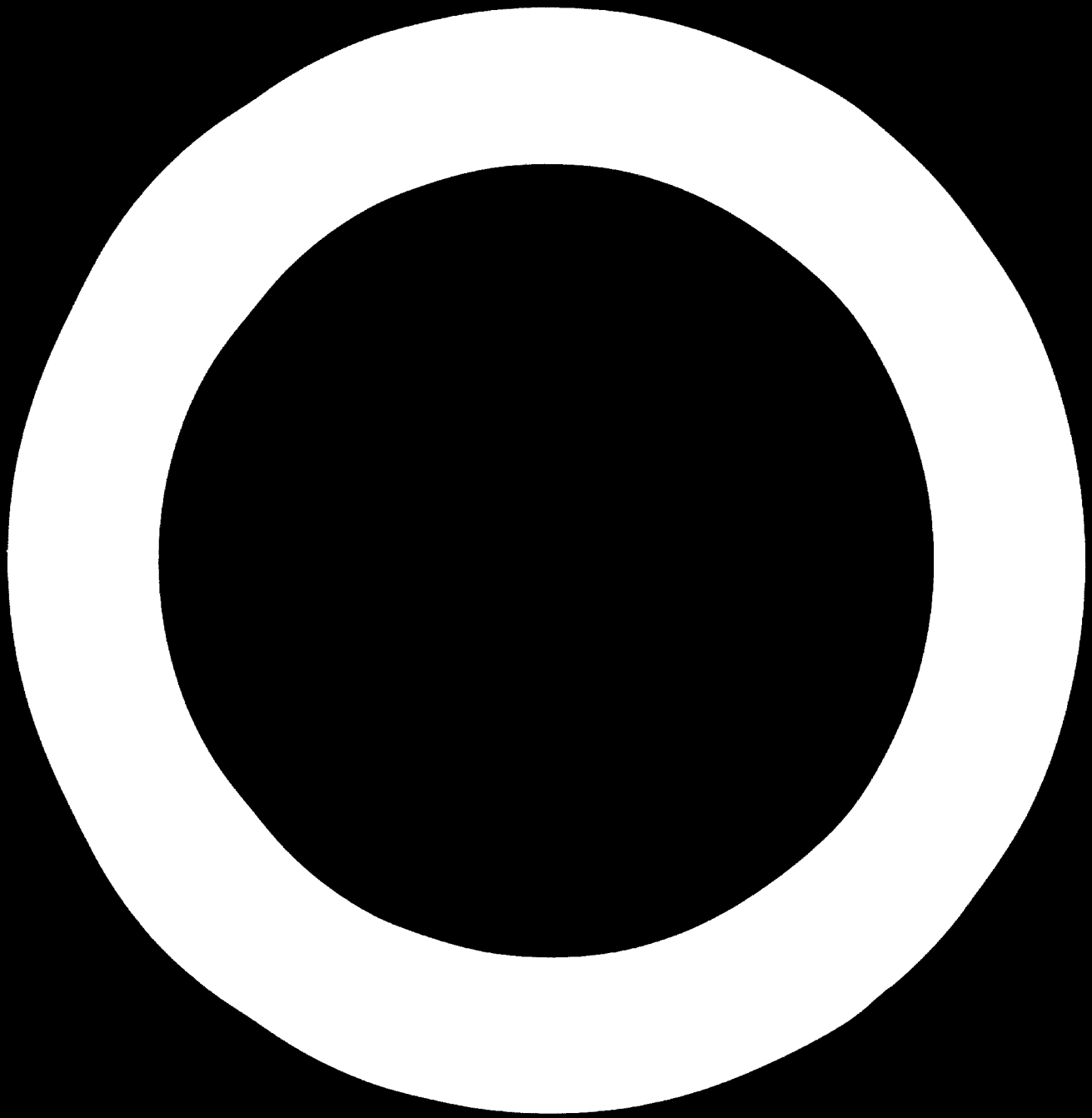
Prepared for the Government of Cyprus by the
United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Ulrich Greiner,
engineering consultant

0000.0

United Nations Industrial Development Organization
Vienna

id.78-8276



ABSTRACT

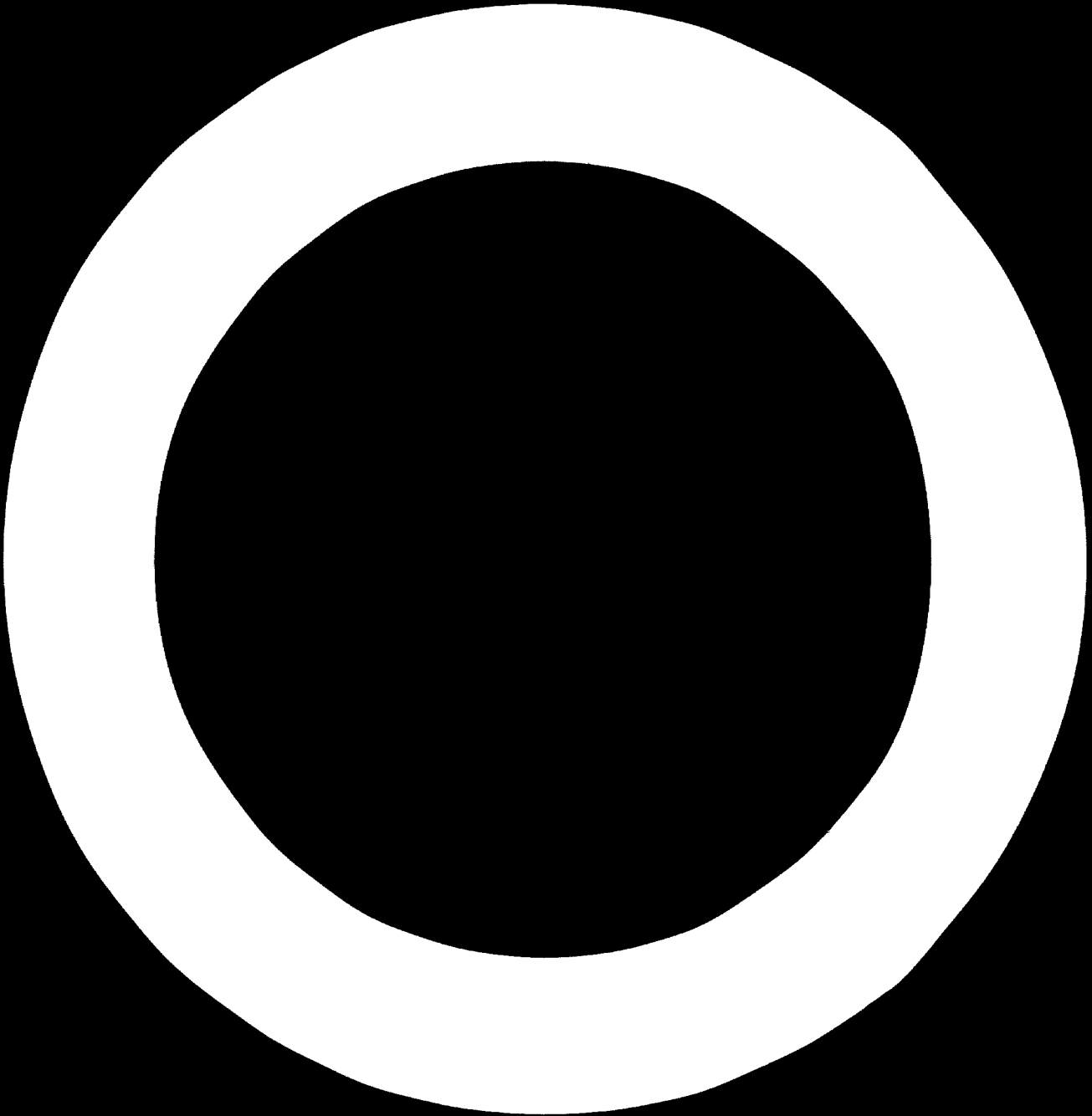
The project "Design and manufacture of containers and container handling and transporting equipment" (SI/CYP/76/008) originated in a request submitted by the Government of Cyprus to the United Nations Development Programme (UNDP) in January 1975 and approved in May 1975, with the United Nations Industrial Development Organization (UNIDO) serving as executing agency and Cyprus specialists and officials providing government co-operation. The purpose of the mission covered by this report was to assist in the production of small-scale 20' GRP-plywood containers at existing container repair and refurbishing facilities, to contribute to work on the establishment of a container maintenance and repair facility, and to review the present status of the transportation of citrus fruits in ventilated dry freight containers.

The expert began his one-month mission on 10 July 1978. The following findings are noteworthy:

1. Previous problems pertaining to repairs of GRP-plywood containers employed in world trade have been solved by introducing firm repair procedures and developing new techniques;

2. The proposed production of GRP-plywood containers is based on the assumption that container repair and refurbishing facilities under construction in Cyprus can be used. The facilities are designed to handle all steel, GRP-plywood and aluminium container repairs, parts replacement and refurbishing;

3. The use of neither flat rack containers nor the Lafi-Roll trailer provides a solution to the imbalance in citrus fruit container traffic. However, ventilation requirements for citrus fruits could be met by installing a one-pipe "CON AIR" system between the ship's cells and modifying the standard dry freight containers in such a way that a mechanical ventilation hose could be easily connected.



CONTENTS

<u>Chapter</u>		<u>Page</u>
I.	SMALL-SCALE 20' GRP-PLYWOOD CONTAINER PRODUCTION AT EXISTING CONTAINER REPAIR AND REFURBISHING FACILITIES.....	6
	A. Production requirements and operators handling 20' GRP-plywood containers.....	11
	B. Materials list for 20' x 8' x 6' GRP-plywood containers	16
	C. Equipment investment.....	18
II.	ESTABLISHMENT OF A CONTAINER MAINTENANCE AND REPAIR FACILITY AT LIMASSOL, CYPRUS.....	19
III.	PRESENT STATUS OF THE TRANSPORTATION OF CITRUS FRUITS IN VENTILATED DRY FREIGHT CONTAINERS.....	22
	A. Mechanical ventilated containers for the transport of citrus fruits.....	22

Figures

I.	GRP-plywood container production flow diagram I: container frame assembly.....	8
II.	20' GRP-plywood container production flow diagram II: painting of container frame, including doors and floor, side walls, front and roof panel installation.....	9
III.	20' GRP-plywood container production flow diagram III: finish station.....	10

**I. SMALL-SCALE 20' GRP-PLYWOOD CONTAINER PRODUCTION
AT EXISTING CONTAINER REPAIR AND REFURBISHING FACILITIES**

This report was prepared at the request of the Ministry of Commerce and Industry, of the Government at Cyprus, and local industries involved already in the repair and refurbishing of 150 steel and GRP-plywood containers.

GRP-plywood container production in Cyprus is viable because of low investments in production machinery and equipment and low labour costs compared with present centres for producing 20' GRP-plywood production, namely, France, Federal Republic of Germany, Japan, Netherlands, United Kingdom and the United States.

Furthermore, a trend has been noted in the Mediterranean area to GRP-plywood containers.

The cost of 20' GRP-plywood containers is approximately 40 per cent higher than containers formerly manufactured, however they offer the following advantages:

- Longer life
- Less maintenance
- Less maintenance cost
- Better insulation
- Less sweat
- Clean appearance

Previous problems pertaining to repairs of GRP-plywood containers employed in the world-wide trade have been solved by introducing firm instructions on GRP repair procedures and developing new techniques.

Certain trades that used routes passing through several climate zones such as Europe/Caribbean, Europe/South Africa and Europe/New Zealand, opted for GRP-plywood containers.

Some operators in the trade using the routes: Europe/Australia, Europe/United States west coast, Europe/Asia, Europe/Middle East, and Europe/Mediterranean have adopted GRP-plywood containers for the same reason.

New container production capacity should be assigned mainly to satisfy:

Special requirements of a local nature

Small quantity orders

Replacement demand

Large-scale container production is mainly suited for the initial supply for the outfitting of container ships and for container lessors.

Production flow diagrams for 20' GRP-plywood containers are presented in figures I, II and III below.

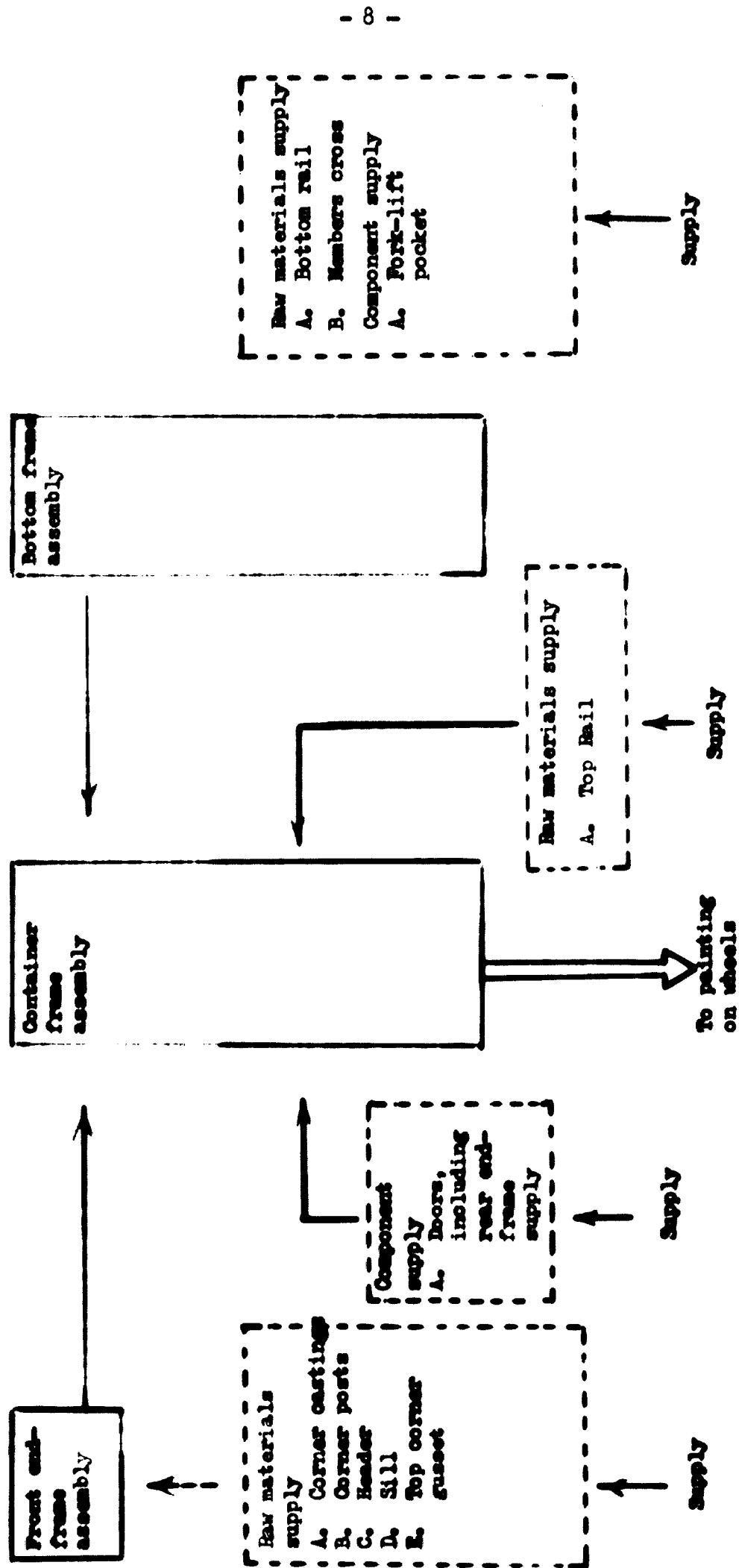


Figure I. 20' OGP-plywood container production flow diagram I: container frame assembly

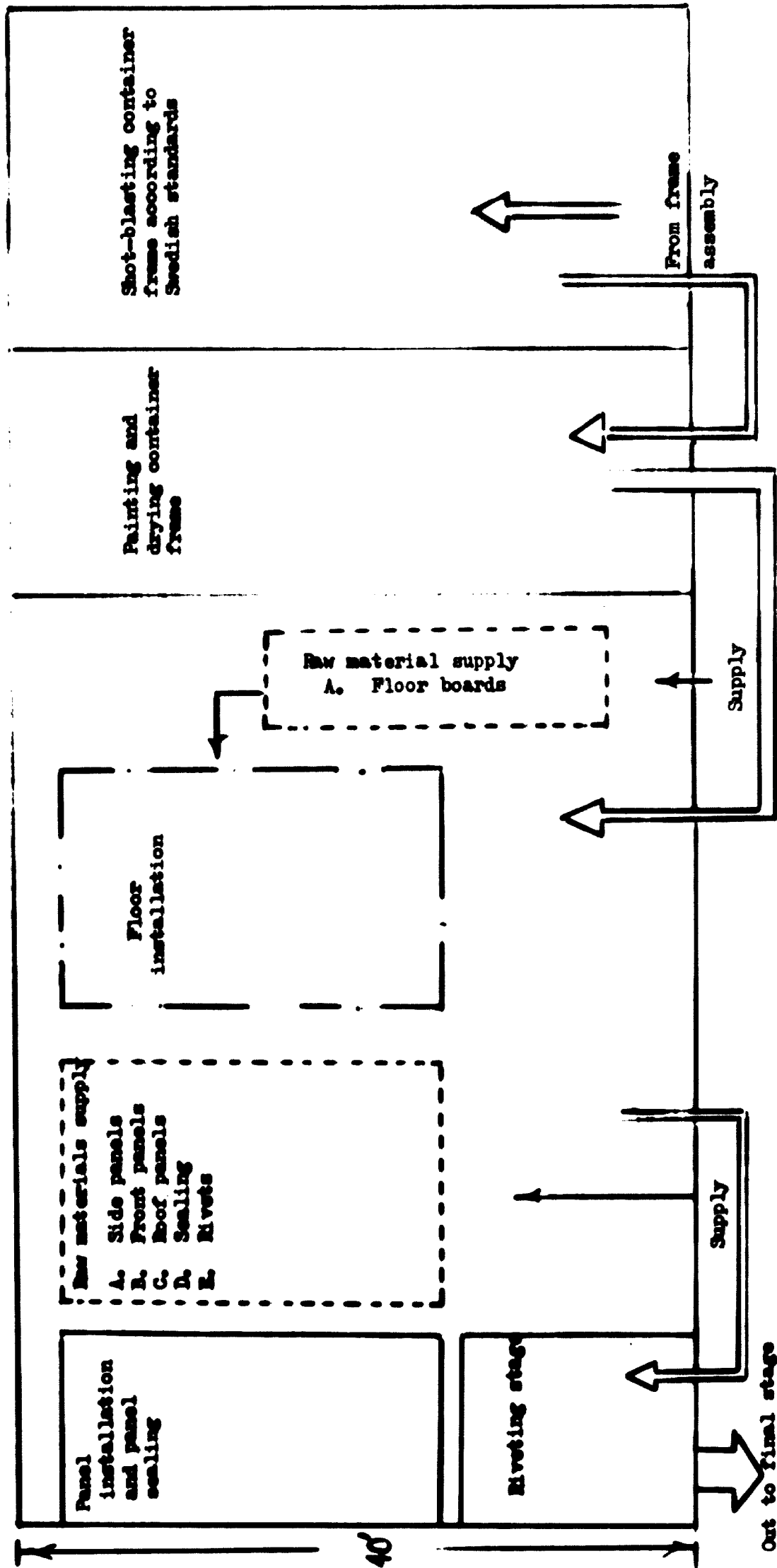


Figure II. 20' OSB-plywood container production flow diagram II: painting of container frame, including doors and floor, walls, side, front and roof panel installation

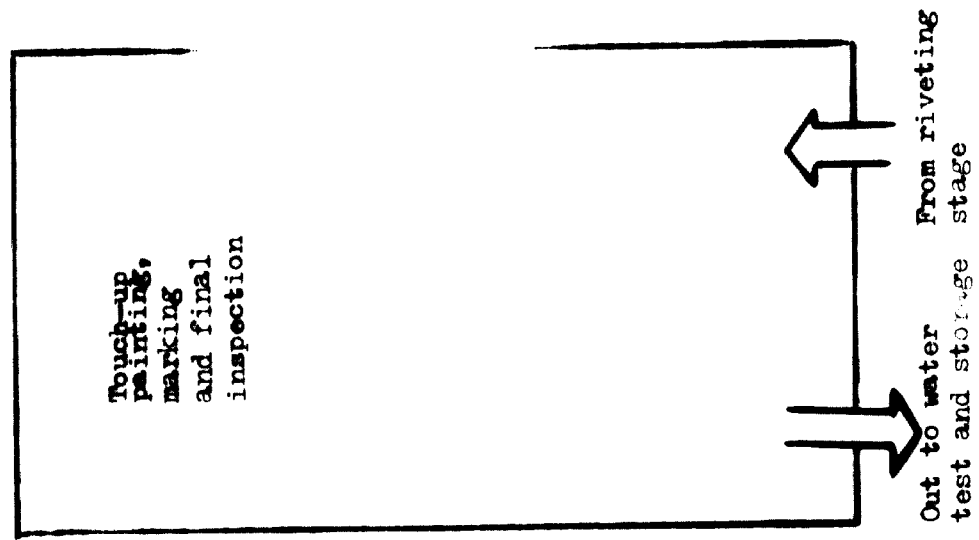


Figure III. 20' GRP-plywood container production flow diagram III: finish station

A. Production requirements and operators handling 20' GSP-plywood containers

Jigs and racks

Front frame assembly jig
Raw material racks and boxes (front wall)
Component storage rack (doors + end frame)
Container frame assembly jig
Raw material rack (top rail)
Bottom frame assembly jig
Raw material rack (bottom frame + fork-lift pockets)
Wheels for transfer
Raw material rack (floor)
Raw material rack (side, front, roof-panel)
Panel: installation jig
Riveting walkways

Machinery and equipment

1 MIG - Welder
1 MIG - Welder
2 MIG - Welder

Shot-blast equipment:

- (a) Rubber coating;
- (b) Air compressor, 10,000 1/min - 6 bars;
- (c) Air conditioning and cleaning;
- (d) Grit recovering and cleaning or one automatic wheel abrasive shot-blasting facility.

Painting:

(a) Paint booth
(b) 1 airless paint sprayer
1 paint mixer;
2 drilling machines and 2 electrical screwers
1 sealing pump
3 drilling machines
2 rivet guns

Miscellaneous hammers, brushes

Water spray test equipment

Lifting equipment

2 monorail hoists, each handling a maximum of 500 kg and used for:

Front - endframe assembly

Container frame assembly

Bottom frame assembly

1 lift in the shot-blast booth

1 lift in the paint booth

1 monorail hoist handling a maximum of 250 kg and used for panel installation

One 1.5 ton fork-lift truck

One 7.5 ton fork-lift truck

Productivity

At maximum efficiency, 65 man-hours will be required per container.

Taking break-time into consideration, 70 man-hours per container should be the basis for calculating the productivity.

For the proposed production, the assembled doors and door end-frame will be imported.

For the proposed production the labour consumption remains at a rate of 54 man-hours per container

The break-up of the manpower required for individual production stages according to the production plan is given below in the section dealing with labour.

The daily production rate based on 20 productive men will be 3 containers per shift of 8 hours per day, 240 days per year.

The annual production is 720 containers per shift.

Labour

Fork-lift drivers , 2

Welders - endframe assembly 2

Welders - bottom frame assembly 4

Welders - frame assembly	2
Shot-blasting	1
Painter	1
Carpenters - floor installation	2
Carpenter panel installation	5
Painter - marking and final station	1
Total	20 men

Not included is unproductive labour

Foreman	1
Maintenance mechanic	1
Quality controller	1
Total	3 men

Components^{1/}

TYPE

GRP-panels

Steel sections

Doors + door end-frame

Floors

Corner castings

Paint

Sealing

Fasteners

Lashings, door retainer

Major operators capable of handling 20' GRP-plywood containers

Belgium

CBM (Dart) (Compagnie Belge Maritime)

France

CGM (Caroll) (Compagnie Générale Maritime)

^{1/} A list of component suppliers and 20' GRP-plywood container manufacturers may be obtained on request from the responsible substantive office in the Industrial Operations Division of UNIDO.

Germany, Federal Republic of

Kapag - Lloyd
Columbus - Line (Hamburg Sld)
Hansa - Line
DMOL (Deutsche Nahost Linie)
DAL (Deutsche Africa Linie)
Contrans (leasing company)

Israel

PI (100 ton equivalent units (teu) on trial)

Netherlands

Nedlloyd (Scandutch)
KNSM (Koninklijke Nederlandse Stoomboot Maatschappij)

South Africa

SAP - (South African Freight) Marine

United Kingdom

Harrison Line (Carroll, South Africa)

United States

American Export Lines
Parrell Lines
American President Lines
Prudential Lines

Leasing companies

Flexi Van / Uni-Flex
ICS (International Container Service Inc.)
CTI (Container Transport International)
Inter Pool

Additional features

- Insulated containers
- Refrigerated containers

These containers are of the same basic design and can be assembled on the same production line without any additional equipment.

B. Materials list for 20' x 8' x 6' GWP-plwood container^{2/}

<u>Component</u>	<u>Type</u>	<u>Quantity</u>
GWP panels	21.6 mm	26.1 m ² sides
(sides-front-roof)	15.2 mm	4.76 m ² front
		12.53 m ² roof
Doors, including locking gear, hinges, sealing, and end frame		1 set
2 top rails		1 set
2 bottom rails		
11 cross members		
2 front corner posts		
Corners		1 set
Floor of laminated softwood	35 mm	11.8 m ²
Paint	One-coat system	35 kg
Nackbolts		136
		16
		24
		54
		222
		156
		608
Nackring		
Side-wall seal		10.3 kg
Roof seal		
Front-wall seal		
Side-wall and floor sealing		11.36 m

^{2/} A list of manufacturers may be obtained on request from the responsible substantive officer in the Industrial Operations Division of UNIDO.

<u>Component</u>	<u>Size</u>	<u>Quantity</u>
Marking, including logotype		1 set
Inside rivet rail	Galvanized steel profile, 1.50 m.	54.5 m 48 kg
2 fork-lift pockets		182 kg
Front-header		18.3 kg
Front-sill		31.3 kg
Lashings for floor rings		8
Lashings for roof rings		8
Roof bows	30 x 110 x 50 x 2.5	4 27.5 kg
Corner reinforcement		26.6 kg
Bottom corner reinforcement		2.39 kg
Crash plate		14 kg
Door retainer		2
Lashing corner-post		4
Screws		28
Rivet-nut		28
Washer		160
Self-tapping screws		20
Backstainer		4

C. Equipment investment

For the production of 20' x 8' x 8'6" GRP-plywood containers as dry cargo, open-top, insulated, and refrigerated containers at container repair and maintenance facilities, the equipment listed below will be required.

Components supplied:

- Doors complete with end-frame
- Panel
- Floor
- Sections and fittings

To assemble the components, the following equipment is required:

	<u>£</u>
Front frame assembly jig	1,200
Fork pocket assembly jig	900
Bottom frame assembly jig	6,000
2 Semi-automatic welders (£1800 each)	3,600

To assemble the containers, the following equipment is required:

	<u>£</u>
Raw material and component deposits	12,000
Panel installation jig	2,500
Three semi-automatic welders (£1200 each)	3,400

In addition, the following miscellaneous equipment is required:

	<u>£</u>
Raw material and component deposits	6,000
Lifting equipment	6,000
Wheels	3,000
Walk ways	1,000
Rivetting equipment	2,000
Small equipment (drilling machines, screw drivers, sealing pump etc.)	1,000

Total **42,600**

For painting of the assembled container frame an existing shot-blast and paint facility will be used.

II. ESTABLISHMENT OF A CONTAINER MAINTENANCE AND REPAIR FACILITY AT LIMASSOL, CYPRUS

The proposed production of the 20' GRP-plywood container is based on the assumption that container repair and refurbishing facilities in Cyprus can be used.

Previous feasibility studies confirmed the viability of a container maintenance, repair and refurbishing plant in Cyprus. Local enterprises started the construction of a 40' x 40' bay container service station with depot. This project will be completed in six months. During this time, container repair and refurbishing will be carried out at temporary facilities.

Transportation equipment and machinery were supplied from abroad during the expert's mission. The factory is geared to carry out:

- (a) All steel container repairs, part replacements and refurbishing (shot-blasting, repainting and remaking);
- (b) All GRP-plywood container repairs, part replacements and repainting;
- (c) All aluminium repairs, part replacement and steel endframe repainting.

Information concerning the Convention of Safe Containers (CSC), the International Institution of Container Lessors (IICL), the International Organization for Standardization (ISO), TIR (Transport international de merchandise par la route) and other customer requirements were provided to the persons, and a handbook entitled "German Lloyd - Container Repair Recommendations" was introduced by which future repair work will be governed.

New repair techniques especially for the GRP-plywood container were introduced.

Documentation on container spare parts, repair tools, equipment and machinery was passed on to local enterprises.

Assistance was given to obtain the materials and tools.

The layout of the plant is as follows:

- Container bay length/width = 18 x 6 m
- Inside height = 5 m
- Door width/height = 3.5 m x 3.5 m

The length of the building will be fitted with doors giving direct access to each container.

The handling system, outside, will be fork-lift trucks with side spreaders that can turn containers by 90°, inside, by wheels attached to the corner castings in both positions, upright and turned 90°.

The front of the building has general offices, a mess room and stores.

The transformer compound, compressors and paint, fuel and oil stores will be located at the end of the workshop. The last three bays will be assigned for container refurbishing. The last bay will be closed but fully ventilated and lined with rubber, and will contain shotblast equipment with automatic steel grit-recovering devices. The shot-blast equipment is installed outside and consists of:

- Compressor
- Horizontal conveyor
- Vertical conveyor to grit cleaner
- Grit tank
- Shot-blast with hose and nozzle
- Air exhaust
- Air filter

The floor of the shot-blast compartment has steel grating with rails for transport wheels and lifting/turning equipment. The shot blast and painting facility is capable of handling:

- Steel containers
- Steel frames of GRP-plywood containers
- Steel and frames for aluminium containers
- New assembled 20' + 40' containers and 20 + 40' GRP-plywood container frames.

Next to the shot-blast compartment is the paint booth which has airless "Hot" spray equipment and is fully ventilated. For under coating, lifting/turning equipment will be installed. The pumps and paint store is located outside. One or two bays contain the heavy machinery: guillotine shear and brake press for steel sections up to 2.5 m length and 6 mm thick and disc saw with a store for raw material.

Some of the bays have to be separated for GRP repairs where additional exhaust equipment has to be installed. The GRP repair section is equipped with an Avdel huck bolt fastening system and hand tools such as: jig saws for GRP-plywood up to 18 mm; disc-grinders with two different grades of sander; vacuum cleaners; sanders; GRP and paint application rollers.

The aluminium repairs require the following hand tools: pneumatic hammer with 6 mm tool; hammer and scissors, electrical scissors and disc saws.

The steel container repair booth will be equipped with CO₂ welders, argon welder and cutter, as well as straightening tools and hammers, electrical saws and grinders, wire brush equipment and paint brushes. Specialised equipment is mainly required for GSP-plywood. A list of materials and suppliers may be obtained on request from the responsible substantive officer in the Industrial Operations Division of UNIDO.

III. PRESENT STATUS OF THE TRANSPORTATION OF CITRUS FRUITS IN VENTILATED DRY FREIGHT CONTAINERS

A. Mechanical ventilated containers for the transport of citrus fruits

There is a large imbalance in container traffic to and from citrus-growing countries. Empty containers which could be used for the transport of citrus fruits are transported out of these areas.

Tests have shown that in the Mediterranean to the north European area citrus fruits can be shipped in standard dry freight containers on ship decks without any mechanical ventilation during certain times in autumn and spring. Below decks, however the loaded container needs approximately 5 to 6 air changes per hour. This is achieved by blowing air into a standard dry freight container at the front bottom part, using pallets on the floor as air ducts. The air leaves the container through the common air vents at the upper side of the side walls, into the ship's hold. The usual ship's hold ventilation system should be capable of sufficiently ventilating the hold.

The standard dry freight containers should be modified in such a way that a mechanical ventilation hose could easily be connected. This should be automated because of the lack of space between the ship's cells.

Tests have been carried out with containers having a porthole mechanically closed by a shutter or pipe screw-cover. The cost for this modification on a standard dry freight container was approximately \$50-150 per container. This type of modification does not affect TIR approval, the structural strength, the water tightness nor the inside cube specifications of the container. The modified container can be used without any limitation as a dry freight container as well. The latest research and development (R and D) is working on a modification without any moving parts. Such R and D has to be done in close co-operation with the suppliers of the mechanical ventilation system on board the ships.

Present solutions for the transportation of citrus fruits by sea are as follows:

(a) A one-pipe "CON AIR" system is installed between the ship's cells. The air supply comes from a blower installed on deck. The present price for such an installation, including automatic connectors to the containers, is \$2,500

per container based on north European Shipyard quotations. If this modification is carried out in the Mediterranean area, the cost will be drastically reduced. The design and supply of aggregates come from specialized companies in the Federal Republic of Germany and the United Kingdom, such as that which invented the "CON AIR" system;

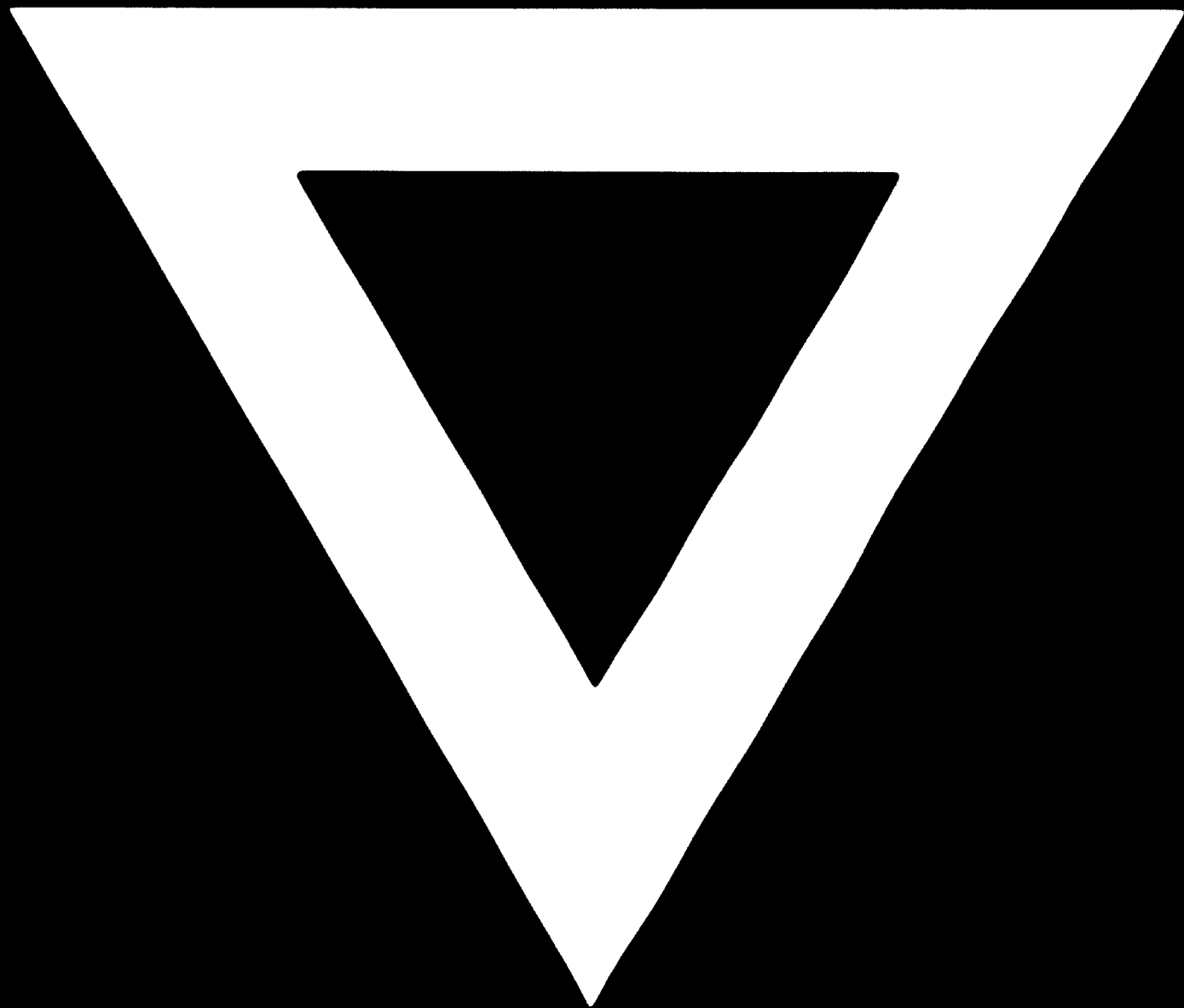
(b) Palletized on flat rack containers using the usual ship's hold ventilation;

(c) Palletized on a Mafi-Roll trailer on board the Ro-Ro ships.

The use of flat rack containers, however, does not solve the imbalance in the container trade. Again, extra shipping capacity has to be employed during the fruit season for one way transports. Neither does the use of Mafi-Roll trailer help to balance the utilization of containers, and it is applicable only for trades with a specific cargo structure, i.e. one way with wheeled cargo, the other way with fruit on Roll-trailers.



B - 499



81.05.27