OCCASION

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

DISCLAIMER

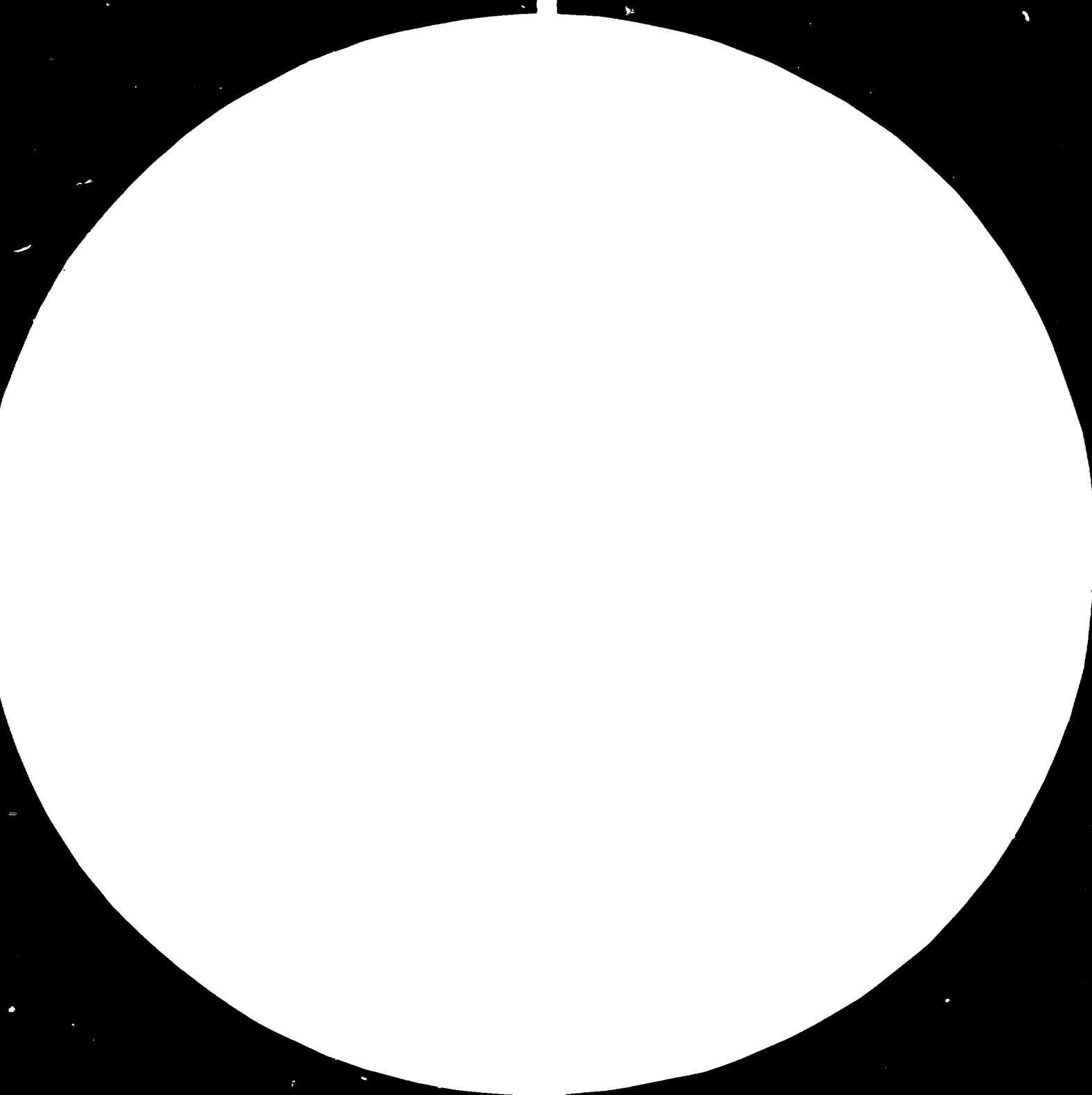
FAIR USE POLICY

CONTACT

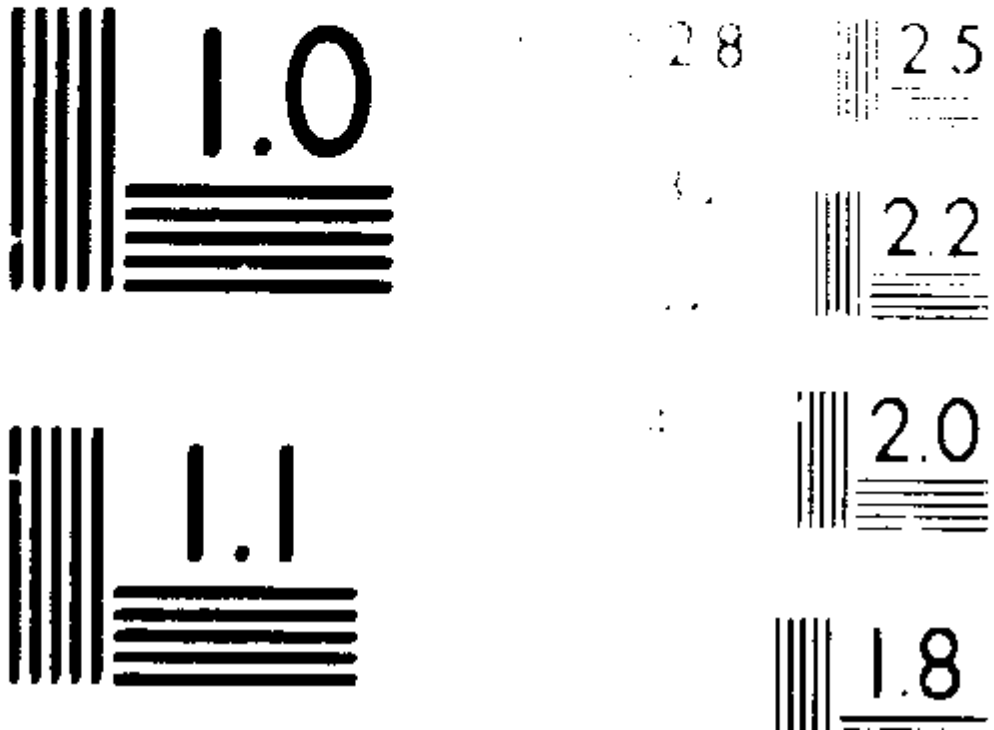
Please contact publications@unido.org for further information concerning UNIDO publications.

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

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



1.25 1.4 1.6


1.0
1.1
2.8
2.5
2.2
2.0
1.8

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

11487

REPORT

on

Mission to CIPET, Madras

June 1981

by

J. E. Nightingale

DP/IND/74/052/11-03B/32. 1. H

Summary

After 13 years operation CIPET has been established as one of the most comprehensive and best equipped complexes in the world, for the training of injection moulding, tool design, and mould making technologies.

It is considered that the present injection moulding machines are adequate for a year or two, when the present developments in design have become established and an increased number of trainees calls for an expansion in this area of training equipment.

Mould making is largely a matter of experience and it is considered that this can be achieved economically only by the establishment of two tool rooms. The first would be a production shop run on commercial lines, so that it could give realistic delivery times and make a financial contribution to the centre. Production personnel would have first call on any machines in this shop. The second shop would have less sophisticated equipment but in numbers to allow simultaneous training of about 18 students. When equipment was not being used by one side, it should be made available to personnel from the other shop.

The training drawing office with 18 boards appeared to be the most serious limitation to the number of trainees passing through the courses. It is considered that this could and should be duplicated at least, still run with the existing staff.

There is a need for more and better lecture facilities, e.g. two theatres holding 20 - 30 people that could be opened up to provide one of 40 - 60 capacity.

The design of a bolster to fit any of the four existing major injection machines was given to the design training drawing office and during the author's stay, this was detailed so that the tool-room could make it as soon as possible. This bolster would be particularly useful for training purposes, and could be used, in addition, for checking and resolving problems from the tool-room. The design of a second complementary bolster was also sketched out.

Most of the author's time for the first 10 days was occupied in preparing texts and drawings for the seminar given in the third week. An additional three talks were given to CIPET staff and trainees.

Due to the shortage of time, not much attention could be devoted to the Design Centre and Testing Dept., but it was felt that priority should be given to at least duplicating some of the basic testing machines, to allow a greater throughput of trainees.

Details of the Mission

On arrival at CIPET it was suggested that the prime requirement was the presentation of a seminar to a maximum of 15 delegates. A provisional programme had been drawn up by CIPET pr or to arrival, and with small modifications was accepted. Notices were printed within 24 hours and sent out to potentially interested firms, and a notice placed in one of the daily papers. A full compliment of delegates turned up including two from Dehli and district, with a range of interests that covered not only injection moulding and bottle blowing, but also compression and transfer moulding of thermosets, fabrication with fibre glass and resin, quality control and trouble-shooting.

In addition to talks, supported by slides and other visual aids, there were demonstrations in the moulding shop, and visits to local firms. (Copy of programme - Appendix I).

In addition three talks were given to CIPET staff and trainees on "Prototyping", "Insert and Outsert Moulding" and "The Principles of Injection Moulding".

About two thirds of the mission was spent in preparing, collating, and presenting the seminar, and consequently time in the moulding shop, tool-room, design offices and testing laboratories, was somewhat curtailed.

Moulding Shop - The moulding shop was adequately equipped with machines (List in Appendix II), which included 6 hand operated machines, which are very well suited to training, as the student appreciates at first hand the variations of pressure and speed.

During the mission a detailed drawing was made under the author's supervision, by Mr. Kuppaswamy's section of a side-gated bolster, that would fit on any of the four major machines. Rectangular inserts can be clamped into the bolster to produce mouldings. Usually the changing of an insert for simple cavities is merely releasing the clamping screws, exchanging the blocks and retightening the screws. [illegible] of change, the cylinder can be kept at temperature [illegible] of time. The different types of gates, and moulding faults can be demonstrated quickly and effectively. With an insert with a flat face in one half of the bolster, it is necessary to cut [illegible] the other half. This is particularly useful in [illegible] specimens. It is simple to produce mouldings [illegible] the study of impact strength of Izod bars, with different gate positions and types, different notch radii, changing depths of notch, for a wide range of moulding materials.

The bolster could be easily made by CIPET's tool-room, as no special steels are required.

The bolster could be used also for the resolution of design/ manufacturing problems for outside customers for the production of moulds by the tool-room.

When this bolster has proved its worth, then the need will arise for a centre gated (circular) bolster, and outline details were left with Mr. Kuppaswamy.

As far as could be judged there was no urgent need for more moulds, but it would be worth sending a circular to injection moulding firms, that CIPET would be interested in [illegible] no longer required for production, if they would be suitable for training purposes. These could be at token prices, or on long term loans.

It was considered that the existing machines, if fully utilized, would be adequate for the next two years at least. By then, the time would be right for the purchase of at least one machine with "closed loop" control.

Drawing Office - This was equipped with 18 drawing boards and constituted the equipment limitation to the number of students that could pass through the centre. It was considered that this section should be given top priority in any expansion of the institute.

Design Office - This appeared to be adequately equipped and staffed for current needs.

Testing Section - Although the section appeared to be under-utilized at the time of the visit, it may need expansion in the near future to allow specialist training in testing, and work connected with the establishment of Indian Standards for Plastics. In these events some of the basic pieces of equipment e.g. tensile and impact testing machines, solution and melt viscosity determination equipment, simple melting point apparatus, and density columns, would need multiplying by three or four times. Priority should be to the acquisition of at least one, and preferably two Infra red Spectroscopes. One or two X-Y plotters would find a number of uses for general testing, in addition to their use with tensile testing machines.
Relavent are the comments on the Phase II document which are given under its own section.

The Mould Making Shop - This was adequately equipped for current needs (see list Appendix III) but the through-put of production moulds is about one third of its potential, due to the requirements of the training programme. Since experience is one of the most important assets of a tool-room, the division of the existing shop into two would be a dual advantage. The production part would have first priority on the existing machines, so that realistic deliveries could be achieved, and its output trebled. This should allow this section to make a profit and useful financial contribution to the running of the centre.
The training part of the shop would have a multiplicity of simple basic machines such as lathes, vertical milling machines, and surface grinders, to allow a greater through-put of trainees than at present. When equipment in one part was not being utilised it would be made available to the other section if required. Thus, trainees could have demonstrations of spark erosion, while plates for production could be surface ground in the training section.

It was understood that a catalogue of standard mould parts was being obtained from Hasco G.m.b.H. The author promised to have a similar catalogue sent from D.M.E. Europe Ltd., Belgium.

The volumes will allow the mould design section to base their drawings on standard parts, thereby saving design time; while the tool-room can make standard parts during slack periods, so that they can draw on these parts when the need arises to give faster deliveries. Alternately their manufacture could be part of the training of students.

Comments on the Project Document "CIPET - P.T.C. Phase II and the Gujarat Extension Centre".

Introduction The author was given the document only a few days before departure from Madras, and consequently, with the planned commitments both of the Centre personnel and the author, there was little chance of discussions.

Comments Without knowledge of the conditions and industries to be covered by the Gujarat Centre, it is difficult to foresee in detail what calls will be made on the Centre. However, the list appears to be completely adequate to cater for most of the basic requirements for setting up, and gives a good foundation for the future.

The second phase of the Madras Centre is more complex. Since its main objectives are to advise all sides of industry on the testing of plastics raw materials and finished products, the adjudication on quality, and to investigate technical problems, it is essential that the "end-user" is familiar with test procedures, and the interpretation of results. This might entail the running of courses on testing, to be run concurrently with the "productive" side of the Centre. Tests and apparatus, therefore, should be kept as simple as possible consistant with the acquisition of adequate information.

Many of the pieces of equipment listed do not give numerical results that can be interpreted immediately, as can tensile strength and elongation. Considerable experience and judgement may be necessary to extract the full extent of the test information. Since time, money and manpower are restricted, it is considered that better and more useful results would be obtained, as above, with comparatively few pieces of equipment that are well and widely understood, with extensive experience, rather than a less comprehensive knowledge of a wide range of tests, some of which would give only parallel or confirmatory results.

Since one of the serious enviromental hazards connected with plastics is fire, it is considered that an Oxygen Index Determination apparatus should be included in the list.

Recommendations

1) Provide and equip one, or preferably two, extra drawing offfices each with capacities for 16-18 students. This should double or treble the through-put of trainees.

2) Consider the possibility of evening classes for local students who are working during the day.

3) Consider courses for 1 or 2 days per week, day-release students.

2) and 3) could be on a modular basis to give flexibility in the rate at which students can qualify.

4) Provide and equip two lecture rooms of 20-30 seating capacity side-by-side, so that they could be combined, when required, into one room of 40-60 capacity.

5) Construct in the tool-room a side gated bolster, as designed in conjunction with Mr. Kuppaswamy's section.

A list of original literature or duplicated copies left with ClPET

"Principles of Injection Moulding" I.C.I. Plastics Div. Technical Note G.103

"Presentation and Use of Data on the Mechanical Properties of Thermoplastics" G.123

Reprint of the chapter on "Mould Design and Manufacture" from "Injection Moulding Developments - I" Applied Science Publishers Ltd., London.

The following papers read at the Plastics Institute (later the Plastics and Rubber Institute) symposia in the U.K. :-

"Tool Steels for the Plastics Industry"
"Low Cost Moulds"
"Prototyping and Short Run Moulds"
"Setting up a Mould Making Tool Room"
"Mould Beginnings"

Acknowledgements

The author would like to record his appreciation of the assistance and the information given by Mr. Manaon and Mr. Sat Pal U.N.D.P. Office, Delhi.

The hospitality and assistance given by Dr. N.M. Raghavendra was of the highest order and made the stay in Madras both pleasant and memorable.

The day-to-day companionship of Mr. A. Kuppuswamy was much appreciated, ensuring the maximum utilization of time. It was largely due to his cheerful energy that ensured all the notes for the seminar were collated, printed and bound into a thick and impressive book, in a remarkably short time. Any requests made to him were promptly and accurately carried out.

Thanks are also due to Dr. K. Ramamvrthy, Mr. M.A. Razack, Mr. D.N. Pandey and others for explanations of the running of their various departments.

A special thanks to Dr. V. Kumar and Dr. D.Sudhakar for devoting their spare time at a weekend, touring some of the interesting places around Madras.

CIPET

Offers
Five Day Advanced Course
in

RECENT DEVELOPMENTS IN PLASTICS MOULDING TECHNOLOGY

From 15th To 19th June 1981

Course Co-ordinators

Mr. NIGHTINGALE
(UNIDO Expert in Injection Moulding Technology)

AND

Mr. J. L. WAJSMAN
(UNIDO Expert in Blow Mould Design)

CENTRAL INSTITUTE OF PLASTICS ENGINEERING AND TOOLS
GUINDY, MADRAS-600 032

Grams: CIPET Telephone: 432371

Course Content :

Introduction to Plastics Raw Materials
Injection Moulding of Plastics
Compression & Transfer Moulding
Blow Moulding of Plastics
Recent Developments in Injection Moulding
Recent Developments in Blow Moulding
Plastics Mould Making Technology-Developments
Plastics Product Design
Quality Control & Standardisation of Plastics Products

Methodology :

Lecture Classes, Inpl practice, Film Programme, Case Study Discussions and industrial visits.

Intake Capacity :

FIFTEEN.

Mode of Selection :

First come First basis

Course Fee :

Rs. 1,C00/-
(Includes Course materials, Lunch and Tea)
(*Non Residential Course)
Cheque / Draft should be drawn in favour of The Director,
CIPET, Guindy,
MADRAS - 600 032.
*Accommodation if available may be provided at extra cost.

Title :

Five Day Advanced Course
in
Recent Developments in Plastics Moulding Technolog

Venue :

CIPET, Madras.

Duration :

From 15th to 19th June '81

Objectives :

To share the Specialised Experience of the UNIDO EXPERTS Mr. NIGHTINGALE & Mr. J. L. WAJSMAN.

To know about the Plastics Raw Materials, Injection Moulding, Compression Moulding, Transf Moulding and Blow Moulding of Plastics.

Recent Developments in Blow Moulding ar Injection Moulding, Plastics Mould Makir Technology, Plastics Product Design.

Quality Control and Standardisation of Plasti Products.

For whom :

Supervisors, Group Leaders, Senior Technicia and Training Personnel.

APPENDIX I

CENTRAL INSTITUTE OF PLASTICS ENGINEERING AND TOOLS
GUINDY, MADRAS-600 032.

Seminar on

RECENT DEVELOPMENTS IN PLASTICS MOULDING TECHNOLOGY

PROGRAMME

Each subject session will include a nominal half of discussion

At the end of each of the first four days there will be optional Film shows covering.

15.6.81			
09.00-10.00 a.m.	-	Registration	
10.00-10.30 a.m.	-	Inaugural Function	CIPET
10.30-11.00 a.m.	-	Tea	
11.30-12.30 a.m.	-	Introduction to Plastics Raw Materials	CIPET
12.30-13.30 p.m.	-	Lunch	
13.30-14.30 p.m.	-	CIPET Visit	
14.30-16.30 p.m.	-	Plastics Product Design	J L Wajsman J E Nightingale
16.6.81			
09.00-10.30 a.m.	-	The Principles of Injection Moulding	J E Nightingale
10.30-11.00 a.m.	-	Tea	
11.00-12.30 a.m.	-	Moulding of Thermosets (or) Inject Mould Design & Making	J E Nightingale
12.30-13.30 p.m.	-	Lunch	
13.30-16.30 p.m.	-	Practical Demonstration in Processing Shop (or) Film show	CIPET
17.6.81			
09.00-10.30 a.m.	-	Blow Moulding of Plastics	J L Wajsman
10.30-11.00 a.m.	-	Tea	
11.00-12.30 a.m.	-	Mould Design and Making for Blow Moulding	J L Wajsman
12.30-13.30 p.m.	-	Lunch	
13.30-17.00 p.m.	-	Practical Demonstration in Processing Shop (or) Film show	CIPET
18.6.81			
09.00-10.30 a.m.	-	Recent Developments in Injection Moulding	J E Nightingale
10.30-11.00 a.m.	-	Tea	
11.00-12.30 a.m.	-	Trouble Shooting	J E Nightingale
12.30-13.30 p.m.	-	Lunch	
[illegible]			CIPET

18.8.81

08.30-10.30 a.m.	-	Quality control and Standardisation of Plastics Products.	J L Wajsman J B Nightingale
		Demonstrations	CIPET
10.30-11.00 a.m.	-	Tea	
11.00-12.30 a.m.	-	Recent Developments in Blow Moulding	J L Wajsman
12.30-13.30 p.m.	-	Lunch	
13.30-15.00 p.m.	-	Panel Discussion	ALL
15.00-16.30 p.m.	-	Concluding Function	CIPET
16.30-17.00 p.m.	-	Tea	

APPENDIX II

List of machinery in the Processing Shop:

Hand operated Injection Moulding machines:

½ oz. Shot	capacity	- 1 No.
1 oz. Shot	capacity	- 2 Nos.
2 oz. Shot	capacity	- 1 No.

Hydraulic operated plunger machine:

Shot	capacity	- 1 oz.

Locking force (hydro mechanical) 30 tons. - 1 No.

Kril standard 4 oz. screw type injection moulding machine - 1 No.

Plasticizing capacity per hour 20.5 kg.
Screw dia meter 30 mm, effective screw length 190 mm, Injection stroke 160 mm,
Injection pressure upto 2460 kg per cm.sq.
heating cylinder power 4.5 Kilo watts.
HP rating of screw motor 2.2 K.W.
Screw speed r.p.m. 26-40-52
70-120-150,

Clamping unit
Clamping force 90 tons. Minimum mould thickness 228.6mm daylight opening 457.2mm
Maximum stroke 22 .6mm

Mould size: (Horizontal x vertical)
304mm x 381 mm

RH Windsor SP 6 Injection moulding machine - 1 No.

Injection Unit: Plasticizing capacity 30 kg per hour. Capacity moulded per shot

with injection chamber	42 Ø 130 cc. at	1780 kg/cm^2
" " "	50 Ø 250 cc.at	1260 kg/cm^2
" " "	57 Ø 330 cc. at	970 kg/cm^2
Maximum injection stroke		140 mm

Locking Unit

Mould clamping force	130 tons
size of mould plates	550 x 550 mm
Distance between the Tie bars	
horizontal	330 mm
Distance between tie bars vertical	380 mm
Diameter of tie bars	65 mm
Mould opens	550 mm
Min. Mould thickness	200 mm

SP 12 Injection Moulding machine - 1

*Plasticising capacity	50 kg/hr	
capacity moulded per shot		
With Injection chamber 50 Ø	225 cc at	1260 kg/cm^2
" " " 60 Ø	370 cc at	875 kg/cm^2
" " " 70 Ø	500 cc at	640 kg/cm^2
Maximum injection stroke		140 mm
Screw speed, infinitely variable upto		130 rpm.

Locking unit

Mould clamping force	130 tons
size of mould plates	660x650 mm
Distance between tie bars horizontal	430 mm
Distance between tie bars vertical	470 mm
Diameter of tie bars	80 mm
Mould opens	550 mm
Min. Mould thickness without spacer	350 mm
" " " with spacer	200 mm

*Actual moulding output depends on mould and material.

Practical values are between 70% to 90% of working volume.

SP 24 Injection Moulding machine - 1 No.

Minimum mould height	300 mm
Moulding clamping force	300 tons.
Mould opens	900 mm

SS 65 mm Extruder with Euromatic blow moulding attachment - 1

Prince Extruder 50 mm with attachment for Rigid PVC pipe/tubular film extrusion/recycling - 1

Daniel 100 tons press - 1

Vacuum forming machine Drape type - 1.

Rotational moulding machine - 1

Fluidised bed coating machine - 1

Hand compression moulding machines - 1

High frequency pre heater - 1

Thermoset moulding machine 130 tons. (RH Windsor Screw type) - 1

Hand blow moulding machine (small) - 1

" " " " (big) - 1

Scrap Grinder - 1

.....

APPENDIX III

TOOL ROOM MACHINERY

MACHINE	MODEL / CAPACITY
1. Power Hacksaw	12"
2Bench Drilling Machines	½"
1 Petler Drilling Machine	¼"
1 Pillar ?" "	25 mm.
1 Radial Drilling Machine	50 mm.
1 Shaping Machine	630 mm. stroke
1 Planing Machine	Capacity - 6' X 3' X 3'.
1 Pedestal Grinder	
1 Centre Lathe	MBD 1
1 " "	H.M.T. LB 17
1 " "	H.M.T. LB 25
1 " "	Geedee Weiler LZ 300
1 " "	" " RDU 260
1 " " with copy turning attachment	H.M.T. H 22
1 Ram Type Milling Machine	
2 Vertical Milling Machine	Table -1100 X 310 mm.
1 Universal " "	" 950 X 260 mm.
1 " " "	Praga Model 22
1 Tool and Cutter Grinder	Jones & Shipman Model 310
1 Surface Grinder	Working Surface - 18" X 6"
1 " "	" " - 450 X 150 mm.
1 " "	" " - 600 X 500 X 450 mm.thick.
1 " "	" " - 800mm.Ø
vertical, rotary table	max.height - 350mm.
1 Cylindrical Grinding Machine	" grinding length - 550 mm.
1 " " "	" " " - 206 mm.
1 Pantograph Engraving M/c.	Deckel GK12 - Ratios 10:1 to 1.5:1
2 " " "	" GK21 - " " " "
Single Lip Cutter Grinders	" Type SOE.
" " "	" " SO
Duplicating Milling M/c.	Bridgeport, Table - 42" X 12"
1 Universal Copy Milling M/c.	Deckel KFS2S Table - 700 X 250 mm.
1 Die Sinking Machine	Copying area - 400 X 400 mm.
	Daniels, Table - 330 X 330 mm. 500 tonnes
	Table - 800 X 400 mm.
Profile Grinding Machine	Screen Size - 500 X 500 25X and 50X
1 Spark Erosion Machine	Chamilles - Working Surface 600 X 400 mm.