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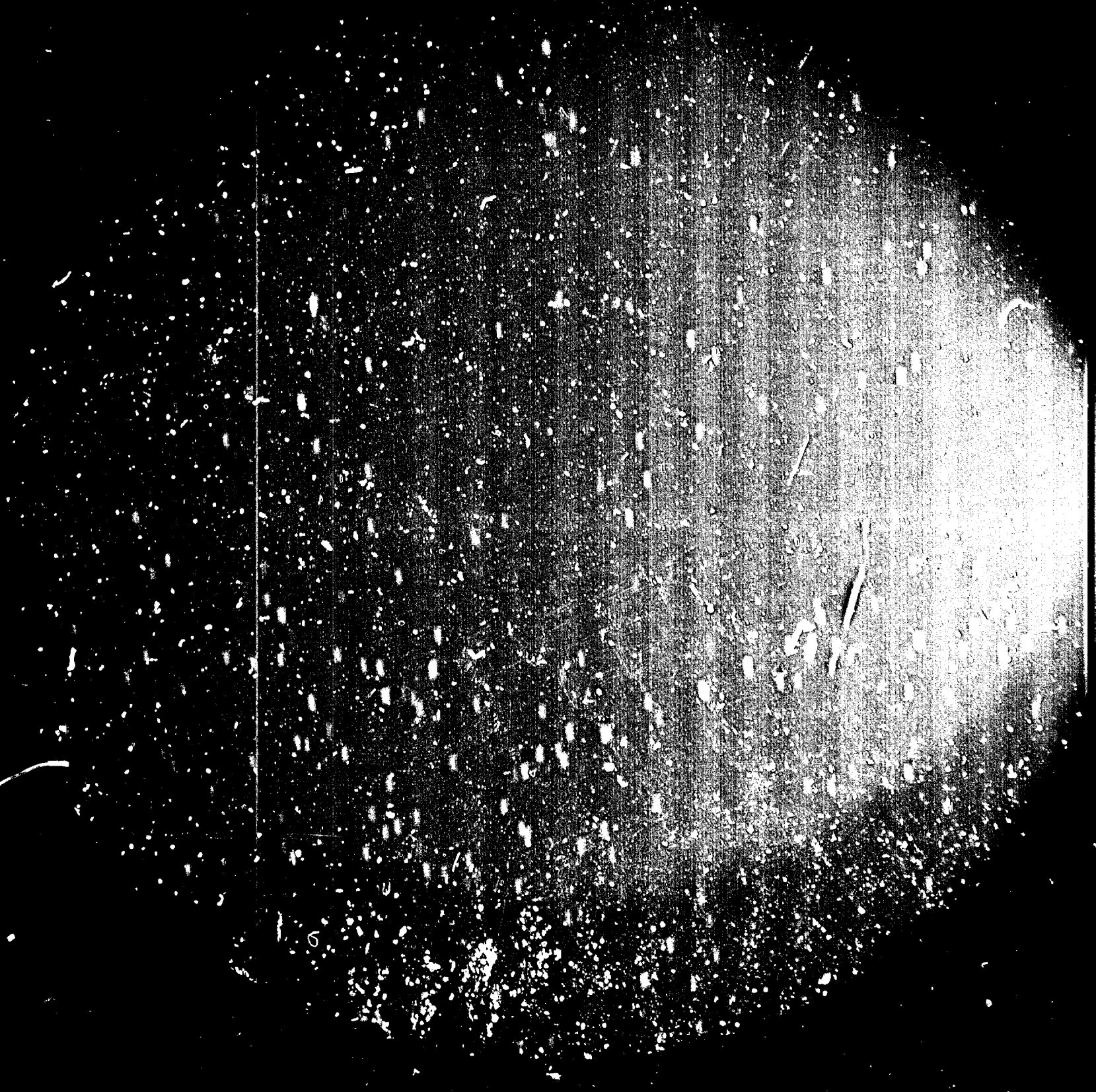

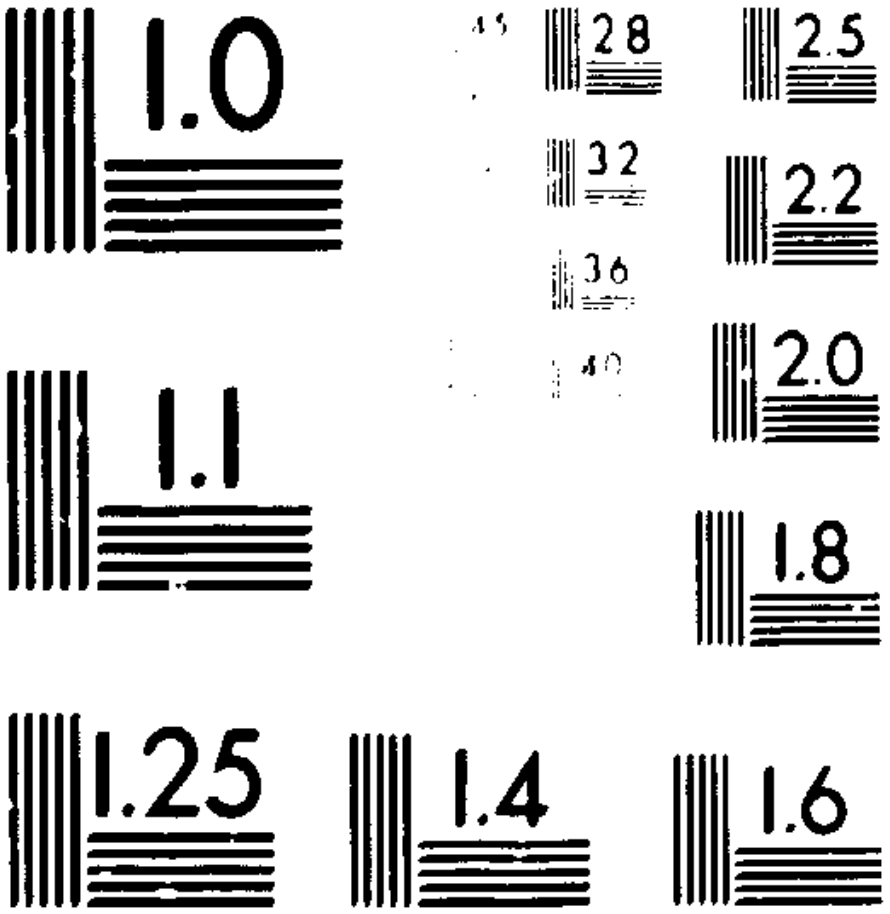

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FINAL REPORT

SIXTH IN-PLANT GROUP TRAINING PROGRAMME IN THE FIELD OF MOULD DESIGN AND MOULD MAKING

organized by the

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

(UNIDO)

in cooperation with

THE GOVERNMENT OF AUSTRIA AND

HEINRICH SCHMIDBERGER G M B H

held in Vienna, 22.10. - 19.12. 1983

1984

3300

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I. INTRODUCTION

The rate of growth of the plastic industry in developing countries has been rapidly increasing during the past years and consequently, the demand for trained staff increased as well.

The United Nations Industrial Development Organization (UNIDO), therefore, offered training opportunities to technicians and engineers from developing countries in the field of plastic processing. Within this context, UNIDO, in cooperation with the Austrian Federal Ministry of Education and Fine Arts, the Austrian Federal Chamber of Commerce and the Association of Austrian Industrialists have been organizing the following training programmes in this field:

1. Training programme in plastics technology
2. Training programme on Synthetic fibres, and
3. Training programme in mould making and mould design.

Since 1970 the Laboratorium fuer Kunststofftechnik at the Technische Gewerbemuseum (LKT/TGM) has held thirteen seminars in the field of plastics technology.

In 1974 training in a synthetic-fibre programme was initiated and a mould-making and mould-design group was included in the plastics-technology programme in 1975.

A training programme for the latter has been conducted since then by Schmidberger.

II. SCOPE AND OBJECTIVES

An in-plant training programme in the field of mould design and mould making held in 1983 was the sixth course on the subject being held at the Schmidberger Factory in Vienna. The course lasted for four weeks (22 November to 19 December 1983) and was attended by six participants from five different countries. Prior to the course on mould design and

mould making, the participants also attended a similar training programme on "Plastics Technology" at LKT/IGM. A list of participants which attended the training programme on mould design and making is attached as Annex I. The overall number of participants which have taken part in all the past training courses held at the Schmidberger Factory since 1975 is given in Annex II.

It is the main objective of the programme to provide intensive training covering both the theoretical and practical aspects of mould-design and mould-making technology and related topics in plastic processing.

To achieve this objective, the scope of the programme was developed to provide detailed information on theoretical and practical aspects of mould design and emphasis was given to practical work both in the workshop for mould making and for production.

The participants had the opportunity to get first-hand information on various equipments used and had practical training on most of the main equipment. Furthermore, necessary documentation was given to the participants and several visits to other plants were organized.

III. DESCRIPTION OF THE TRAINING PROGRAMME

The training programme at Schmidberger started with an overall visit to the factory during which the participants had also the opportunity to meet the key staff of the factory. The list of the key staff of the Schmidberger Factory and the main equipment available there are given in Annex III and IV.

The general framework of the training programme and the individual interests of the participants were discussed and the time-table of the overall training programme was finalized. Details of the adopted time-table are given in Annex V.

The actual in-plant training programme at Schmidberger was conducted so as to cover all three main phases of "Design", "Mould-Making", and "Production". The training activities involved in each of these phases are described in the following paragraphs.

III.1 Training Activities concerning Mould Design

The overall phases of selection of suitable materials for various articles were thoroughly discussed and major types of available material and their physical and chemical properties were reviewed. Materials that are most commonly used for this purpose,, such as low-density PE, high-density PE, PP, PS, ABS, rigid PVC, plasticized PVC, PA, PC, POM, PMMA, MF, HF, etc. were described and introduced to the participants.

The design requirements for these kinds of material in relation to article design were reviewed and various considerations with respect to wall thickness, rounding of outer and inner edges, ribs, undercut, screw nuts, metal inserts, etc., were discussed.

The trainees were also provided with information on practical tests with which they could distinguish between various materials comparing simple properties such as hardness, smoke when heated or burnt, and its smell and sound-reflection properties.

Various types of machinery available for the mounting and the mould and die were described. Among these, the following were discussed in detail:

1. Injection-moulding machines
2. Thermosetting-mould machines
3. Extruder and blow-moulding machines.

Various types of units and equipment were used together with this machinery, their classification and technical specifications were explained in detail.

It was the objective of the training to provide full information on specific topics related to mould and die design and relevant information on Simple Cavity, Multiple Cavity, Two- and Three-plate Moulds, Four-plate Moulds, Split- and Side-pull Moulds, Sprocket-gear Moulds, Two- and Multiple-colour Moulds, Isolation-channel and Hot-runner Moulds were provided.

Furthermore, the available types of steel used for mould making were reviewed and criteria for selection of suitable steel for different types of moulds and steel-hardening processes were explained.

Various types of mould units, which are mostly standard, were reviewed, their specifications and appropriate use for different purposes were discussed.

Furthermore, the following listed topics related to various supplementary units of mould design were discussed and reviewed and their computational procedure explained.

i) Various types of sprues, runner and gates;
ii) Different elements of sprocket-gear moulds;
iii) Different types of elements used in hot-runner systems;
iv) Cooling systems;
v) Comparative illustration of compression moulds, transfer moulds, injection moulds for thermosetting materials;
vi) Extruder dies, blow moulds and their different types of units.

All the above mentioned aspects of mould and die design were discussed and reviewed with the participants by examining more than 90 different selected layouts (designs).

III.2 Training Activities in Mould-Making

The training programme concerning mould making was mostly conducted in the workshop with practical illustrations. The training in the workshop covered various aspects of the use of the milling machine, copy milling machine, boring machine, spash erosion machine, grinding machine, lathe machine, etc. The overall mould-making process in the workshop and proper use of the above major machinery were illustrated and participants had the opportunity to observe their use by watching actual moulds being made in the workshop for three different sizes of an article during the period of training.

The article and the above-mentioned mould had the following characteristics: fuel automatic, cycles approx. 8 sec., wall thickness of 1 mm, hot nozzle, sleave ejector plate, article weight of about 55 gr. (for 1 liter size) which would be used in the production machinery of the type ES 500/250 with material PP, and shrinkage of 1.5%.

Construction of a full-scale model of the article prior to mould making was also demonstrated and the participants were informed on the various types of material used for model making.

The final stage of the surface finishing of moulds was shown and different types of surface-finishing methods were discussed.

Steel hardening processes involved in mould making were illustrated during a visit made to a plant specialized in steel hardening.

Furthermore, a number of old dies and moulds were dismantled for repair and the participants had the opportunity to observe the details of the moulds, methods of repair of the damaged part of the mould and the re-mounting.

III.3 Training Activities Concerning Production Phase

The training programme regarding production was mostly in the form of practical demonstrations in the workshop of the Schmidberger Factory. The main types of production machines mentioned earlier were discussed during this part of the training programme.

III.3.1 Injection Moulding Department

The training emphasized the major stages involved in production, such as fixing of the mould, trial manual runs for the selection of the best production setting (temperature, injection pressure, injection speed, post pressure, cooling, timing, etc.).

A series of practical exercises were carried out during which each of the above parameters were intentionally varied to illustrate to the participants the effect of each of these parameters on final production.

Furthermore, auxiliary units used with injection-moulding machines were described.

III.3.2 Thermosetting Moulding Department

In addition to the usual procedure as regards mould fixing and production setting as described above, specific topics related to production with thermosetting moulding, such as tabletting, pre-heating, metal inserts, were discussed and demonstrated.

The comparative demonstrations on the effects of pre-heating on the production as related also to the varying wall thicknesses were made.

III.3.3 Extruder and Blow-Moulding Department

Special features of production with extruder and blow-moulding machines, such as sizing die, cooling bath, take-off equipment, winding and packaging equipment, wall thickness control equipment, blowing equipment, transporting equipment, etc., were demonstrated in addition to other general aspects as described before.

IV. ADDITIONAL TRAINING ACTIVITIES

While the main emphasis of the programme at Schmidberger was given to theoretical and practical training in mould design and mould making as summarized above, the participants were also given the opportunity to visit other relevant departments of the factory, such as compounding, hot-forming, finishing, etc., to offer them an overall view of the processes involved in mould design and mould making.

Furthermore, a number of visits to other factories and institutes were organized and a list of such visits made is given in Annex VI. The participants were also provided with relevant documentation and reports that were available at Schmidberger and various booklets of other factories which were visited. Annex VII lists the documents given to the participants.

V. GENERAL REMARKS

Throughout the four-week training programme the cooperation between the participants and the staff of the Schmidberger Factory was smooth and fruitful.

The scope of the training programme was designed to meet the needs of the participants, and it is expected that the training will prove useful to the participants.

We would like to express our sincere thanks and appreciation to all involved in the organization of the training programme and would like to re-iterate our willingness to be the host institute for these training courses.

VI. PROPOSAL FOR THE FUTURE

Most of the participants are coming from tropical countries. According to our opinion a training programme in early autumn would be best.

Before coming to Vienna, the participants should be informed of the bus service available from the airport to the city.

ANNEX-I

List of participants in the Training Programme on Mould-design and Mould-making in 1983

GOVINDAN K.P.	Central Institute of Plastics Engineering and Tools, Guindy MADRAS 600 032, INDIA
MOHAMED NAINAR S.M.	Central Institute of Plastics Engineering and Tools, Guindy MADRAS 600 032, INDIA
DULANTO Gonzalo	Duratec S.A. Casilla 1011 SANTIAGO, CHILE
HAGAN Albert Aidoo	Gihoc Electronics Co. Ltd. P.O. Box 577 TEMA, GHANA
MUWERO Keegan Maovuto Vensley	Plastic Products Limited P.O. Box 907 BLANTYRE, MALAWI
NASSER Hussein Alala	Al-Gundi Plastic Factory P.O. Box 4206 ADEN, YEMEN

ANNEX-II

	1975	1976	1977	1978	1979	1983
BOLIVIA	-	-	X	-	-	-
BULGARIA	-	X	-	-	-	-
BURMA	-	-	-	X	X	-
CHILE	-	-	-	-	-	X
CHINA	-	-	-	-	X	-
COLOMBIA	-	-	X	X	-	-
COSTA RICA	-	-	-	-	X	-
CUBA	X	-	-	-	-	-
CYPRUS	X	-	-	-	-	-
EGYPT	-	X	X	X	-	-
GHANA	-	-	-	-	-	X
INDIA	X	-	-	X	-	X X
INDONESIA	X	-	-	-	-	-
IRAQ	-	X	-	-	-	-
JORDAN	X	-	-	-	-	-
MALAYSIA	X	-	-	X	-	-
MALAWI	-	-	-	-	-	X
PANAMA	-	-	-	-	X	-
EL-SALVADOR	-	-	X	-	-	-
SRI LANKA	-	X	-	-	-	-
TANZANIA	X	-	-	-	-	-
TRINIDAD-TOBAGO	-	-	-	X	-	-
YEMEN	-	-	-	-	-	X

ANNEX III

STAFF

KR Friederike WITT	Director General
KR Dr. Erich WITT	Director
Magist. Gabriele WITT	Deputy Director
Herbert MAYERHOFER	Plant Manager
Franz HINTERECKER	Production Supervisor
Training Manager	Training Assistant
Ing. Ing. Batu ÖZHAN	Ing. Marcus WERSONIG
Designing Dept.:	Ing. Ing. Batu ÖZHAN
Mould Making Dept.:	Roman BRUNNER
Injections Mould Dept.:	Miroslav RADUSIC
Blow Moulding and Extrution Dept.:	Anton SPRENGNAGEL
Press Moulding Dept.:	Ing. Marcus WERSONIG

ANNEX-IV

EQUIPMENT

Mouldmaking workshop:

Copy-milling machine	2000 x 1000 mm TOS
Copy-milling machine	1000 x 1200 mm TOS
Copy-milling machine	Deckel KF 1
Milling machine	Deckel FP 1
Milling machine	Deckel FP 2 LB
Milling machine	6 T 75
Milling machine	Thiel
Milling machine	F 086
Horizontal boring machine	HCW
Div. drilling machines:	
Turning lathe	Heid
Turning lathe	Hopfgärtner
Turning lathe	TOS
Turning lathe	Nils, and others
Shaping machines:	
Grinding machine	Zocca
Grinding machine	Elb and others
Sand-blast unit	
Electro-erosion machine	Dieter HANSEN 750/S, and others
Diprofil equipment	
Biax equipment	
Measuring equipment	

Injection Moulding Department

TRIULZI	10 Kg.
ENGEL	1200/900
IDRA	MP 85
BATTENFELD	3000
STÜBBE	2000
ENGEL	1500/500
ENGEL	500 P
IDRA	MP 40
IDRA	MP 35
ENGEL	350 P
IDRA	MP 30
NETSTAL	350
ENGEL	500/250
ENGEL	250/650
ENGEL	300/150
ENGEL	150/90
IDRA	MP 10
ENGEL	100/50
ENGEL	90/50
ENGEL	50/50
ARBURG	UNIMAT
BATTENFELD	7,5 gr.
BATTENFELD	2 gr.

and others

Div. Conveyor and inking equipment
Div. Mills

Blow Moulding Dept.
KAUTEX Blow-Moulding Machines up to 50 L.
BEKUM Blow-Moulding Machines HBD BA 2 .... and others
Div. Conveyor and Colouring Equipment
Printing-machines DUBUIT
Printing-machines KAMANN witt elevator
Printing-machines SIMA ..... and others

ANNEX-V

Sixth In-Plant group Training Programme in the field of Mould-design and Mould-making

TIME TABLE

Beginning	08.00 hrs	
Lunch	12.00 to 13.00 hrs	(except Friday)
End	16.00 hrs	(Friday 13.00 hrs)

FIRST WEEK

22 November		
Tuesday	08.00-12.00	Meeting at Schmidberger Visit of the factory
	13.00-16.00	Design Department Discussion of the trainees' individual interests in the subject matter, questions and answers.
23 November		
Wednesday	08.00-12.00	Design Department Calculation of mould elements, types of injection moulds.
	13.00-16.00	Design Department Calculation of steel, type of steel choosing, hardening.
24 November		
Thursday	08.00-12.00	Design Department Design of Mould in respect to material.
	13.00-16.00	Design Department Shrinkage, cooling system, design of sprue runners and gates and mould units.

25 November		
Friday	08.00-13.00	Workshop and injection-mould Department.
		SECOND WEEK
28 November		
Monday	08.00-12.00	Design Department
		Single-cavity. Multi-cavity Mould.
	13.00-16.00	Workshop
29 November		
Tuesday	08.00-12.00	Design Department
		Split, side pull Mould.
	13.00-16.00	Split, side pull Mould.
30 November		
Wednesday	08.00-12.00	Design Department
		Three-plate, Four-plate Mould.
	13.00-16.00	Workshop and Injection-mould Department.
1 December		
Thursday	08.00-12.00	Design Department
		Isolation channel, hot runner moulds.
	13.00-16.00	Isolation channel, hot runner moulds.
2 December		
Friday	08.00-13.00	Workshop
		THIRD WEEK
5 December		
Monday	08.00-12.00	Design Department
		Sprocket gear moulds.
	13.00-16.00	Sprocket gear moulds.
6 December		
Tuesday	08.00-12.00	Design Department
		Two- and Multi-colour moulds.
	13.00-16.00	Workshop and Injection-mould Department.

7 December		
Wednesday	08.00-12.00	Design Department Technical mould designs.
	13.00-16.00	Technical mould designs.
8 December		
Thursday		Public Holiday
9 December		
Friday	08.00-13.00	Workshop

FOURTH WEEK

12 December		
Monday	08.00-12.00	Design Department Thermosetting materials, design of thermosetting moulds, transfer moulds.
	13.00-16.00	Thermosetting Department.
13 December		
Tuesday	08.00-12.00	Design Department Extruder machines, design of dies and Blow moulds.
	13.00-16.00	Blow mould Department.
14 December		
Wednesday	08.00-12.00	Design Department Foaming-Expandet polystrol, mould of expandet materials.
	13.00-16.00	To visit SCS
15 December		
Thursday	08.00-12.00	Design Department Copies of interesting designs for the Trainess.
	13.00-16.00	To meet with Mr. Gummen at the VIC.

16 December		
Friday	08.00-13.00	Workshop.

FIFTH WEEK

19 December		
Monday	08.00-12.00	Individual discussions.
	13.00-16.00	Closing session.

ANNEX-VI

PLANT VISIT

28 November	Hasco Mould Units	Guntramsdorf
2 December	Dieringer Modern mould-making and Injection-moulding company	1230 Wien
6 December	Porit Hartschaum G.m.b.H. Foaming-Expandet Polystyrol	Schmidberger
7 December	Ing. Stefan Pöltner K.G. Steel hardening	1220 Wien
14 December	Kunststoffinstitut Research and Test Laboratory	1030 Wien
16 December	SCS Shopping	Vösendorf
	Allgemeine Unfallversicherungsanstalt Test Laboratory	1200 Wien

ANNEX-VII

Special Papers

HÜLS - Injection moulding

DME - Hot runner catalog

PLASTIC Service G.m.bH. - Hot runner systems "Thermoject"

Prospects of visited factories

Social Events

Lunch	-	Shopping City Süd	(Schmidberger)
Dinner	-	Chinatown	(Schmidberger)

ANNEX-VIII

FACTS ABOUT SCHMIDBERGER

HISTORY

The company was founded in 1922 by Mr. Heinrich SCHMIDBERGER.

Mr. Schmidberger, who died in 1965, foresaw the importance of plastics already in the begining of his work.

A number of production sites that had originally been located in different areas were concentrated at the Vienna-Liesing plant in 1960.

This plant, which covers an area of 73.000 m^2 includes 2 large workshops sized about 27.000 m^2. The company's management and administration are located in their own office-building in the second district of Vienna.

The company's management is headed by Mrs. F. Witt, the founder's daughter, and Dr. Witt, her husband.