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15237

FINAL REPORT

Austria.

EIGHTH 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 , 11 November to 6 December 1985

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## I. INTRODUCTION

Trained man-power requirements have been continuously increasing during the last years, particularly in developing countries, parallel to the observed rate of developments in plastic technology. In response to this need of trained staff, the United Nations Industrial Development Organization (UNIDO), has been offering training opportunities to technicians and engineers from developing countries in the field of plastics processing. 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, has been organizing the training programmes in the fields of plastics technology, synthetic fibres, mould making, and mould design.

Within this context, it is noteworthy to mention that the Laboratorium für Kunststofftechnik at the Technische Gewerbemuseum (LKT/TGM), has held fourteen training programmes since 1970 in the field of plastics technology. In 1974, training in a synthetic-fibre programme was initiated, and in 1975, mould-making and mould-design group was included within the overall scope of the plastics-technology programme.

The in-plant training programme in the field of mould design and mould making was of four weeks duration ( 11 November to 6 December 1985). It was the eighth course on the subject held at the Schmidberger Factory in Vienna. The course was attended by six participants from Burma, India, Benin, Korea, Trinidad and Mauritius.

The participants, prior to this course on mould design and mould making also attended a six-week training programme on "Plastics Technology" at LKT/TGM. A full list of participants of this year's training programme on mould design and mould making is given in Annex I. An overall list of participants which have taken part in all the past training courses held at the Schmidberger Factory since 1975, is given in Annex II, to give an overall view of the training provided in this particular field.

## II. GENERAL SCOPE OF THE TRAINING PROGRAMME

The main objective of the training programme as in earlier years, has been the provision of intensive training covering relevant theoretical and practical aspects of mould-design, mould-making technology and related topics in plastic processing.

The scope of the programme was accordingly developed, to provide detailed information on theoretical and practical aspects of mould design. 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 most of the main equipment. Necessary documentation was provided 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 introductory visit to the factory where the participants had the opportunity to meet the key staff of the factory. A list of the key staff of the Schmidberger Factory and the main equipment in use on its premises are given in Annex III and IV. At the beginning of the training the individual interests of the participants and the general framework of the training programme were discussed and the overall time-table of the programme was finalized. Details of the time-table are listed in Annex V. The actual in-plant training conducted at Schmidberger covered all three main phases of "Design", "Mould-making", and "Production". The essential training activities of each of these phases are described in the following paragraphs.

#### III.1 Mould Design

Training provided as regard to this particular topic included the overall phases of selection of suitable materials for various articles. Detailed discussions were held concerning types of available material and their physical and chemical properties. 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 made and indepth discussions with respect to wall thickness, rounding of outer and inner edges, ribs undercut, screw nuts, metal inserts, etc., were made. Information on practical tests to distinguish various materials, in which simple properties such as hardness, smoke when heated or burnt, and its smell and sound-reflection properties, was provided to the participants.

Various types of machinery available for the mounting and the mould and dye were described. This includes detailed discussions on:

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

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

The main objective of the training was to provide full information on specific topics related to mould and dye design and other related 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, etc.

Moreover, 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.

Review of various types of mould units, which are mostly standard, were made, their specifications and appropriate use for different purposes were discussed. Furthermore, various supplementary units of mould design such as; runner and gates; elements of sprocket-gear moulds; elements used in hot-runner systems; and cooling systems, etc. were discussed and reviewed and their computational procedure was explained.

The participants were provided also the opportunity to examine, different selected layouts (designs) , available at Schmidberger during which all the above mentioned aspects of mould and dye design were discussed and reviewed.

### III.2 Mould-Making

The training programme dealing with mould making was mostly undertaken in the workshop. Practical illustrations dealing with various aspects of the use of the milling machine, copy milling machine, boring machine, spark erosion machine, grinding machine, lathe machine, etc., were given. The overall process of mould-making in relation to the above machinery was shown in the workshop. The participants also had the opportunity to observe actual moulds being made. Furthermore, a number of old dyes 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 their mounting. The final stage of the surface finishing of moulds was shown and different types of surface-finishing methods were discussed. Finally, steel hardening processes involved in mould making were illustrated during a visit made to a plant specialized in steel hardening.

### III.3 Production

The training programme concerning production of moulds and dyes was conducted primarily in the form of practical demonstrations in the workshop of the Schmidberger Factory. During this part of the training programme, the main types of production machines mentioned earlier were demonstrated.

### III.3.1. Injection Moulding Department

During the training in this department, emphasis was given to the major stages involved in production, such as fixing of the mould, trial manual runs for the selection of the best production settings (temperature, injection speed, post pressure, cooling, timing, etc. ) To illustrate the effects of these parameters on the final production, a series of practical exercises were carried out during which each of the above parameters were intentionally varied. Auxiliary units used with injection-moulding machines were also described.

### III.3.2. Thermosetting Moulding Department

Specific topics related to production with thermosetting moulding, such as tableting, pre-heating, metal inserts, etc., were discussed. These production methods were demonstrated to the participants, in addition to the general procedure involved in mould fixing and production setting as earlier described.

### III.3.3. Extruder and Blow-Moulding Department

Various features particular to the 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.

## IV. INFORMATION ON FURTHER TRAINING ACTIVITIES

As can be noted from earlier described activities the main emphasis of the programme at Schmidberger was theoretical and practical training in mould design and mould making. However, the participants, made brief visits to other relevant departments of the factory, such as compounding, hot-forming, finishing, etc., to have an overall view of the processes involved in plastics technology.

Furthermore, a number of visits to other factories and institutes of interest were also organized. A list of such visits made during the period of training is given in Annex VI. Relevant documentation and reports that were available at Schmidberger and various booklets of other factories which were visited were distributed to the participants. Annex VII lists the documents provided to the participants within this context.

V. GENERAL COMMENTS

It is noteworthy to mention that the cooperation between the participants and the staff of the Schmidberger Factory was smooth and very fruitful throughout the entire duration of the training programme. Particular attention was devoted to the design of the scope of the training programme so as to meet the needs of the participants, and it is hoped that the training will prove most useful to the participants in their future activities in this particular field. We would like to express our thanks and appreciation to all institutions involved in the organization of the training programme and simultaneously express our willingness to be the host institute for future training courses.



ANNEX - I

List of participants in the Training Programme on Mould - design  
and Mould - making in 1985

GLELE ANANHANZO Bonaventure	Société Nationale de Commercialisation des Produits Petroliers (SONACOP) Avenue d'Ornano P.O.Box 245 Cotonou
MAUNG MAUNG AYE	Heavy Industries Corp. 370 G.P.O. Rangoon
BONG DOK HAN	Institute of High - Molecular Chemistry Academy of Sciences Pyongyang
SHEO CHAP SING Daniel J.	Plastic Industry (MTIUS) Ltd. Quay 'D' Road Port Louis
ST. ROSE Ricardo	Metal Industries Company Ltd. Private Bag 121 Port of Spain
B. M. PATEL	Central Institute of Plastics Engineering and Tools A2-549, Phase II Vatva Industrial Estate Ahmedabad - 382445

## ANNEX - II

	1975	1976	1977	1978	1979	1983	1984	1985
BENIN	-	-	-	-	-	-	-	x
BOLIVIA	-	-	x	-	-	-	-	-
BULGARIA	-	x	-	-	-	-	-	-
BURMA	-	-	-	x	x	-	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	-	x
INDONESIA	x	-	-	-	-	-	-	-
IRAQ	-	x	-	-	-	-	-	-
JORDAN	x	-	-	-	-	-	-	-
KOREA	-	-	-	-	-	-	-	x
MALAYSIA	x	-	-	x	-	-	-	-
MALAWI	-	-	-	-	-	x	-	-
MAURITIUS	-	-	-	-	-	-	-	x
MOZAMBIQUE	-	-	-	-	-	-	x	-
PANAMA	-	-	-	-	x	-	-	-
EL-SALVADOR	-	-	x	-	-	-	-	-
SINGAPORE	-	-	-	-	-	-	x	-
SRI LANKA	-	x	-	-	-	-	-	-
SUDAN	-	-	-	-	-	-	x	-
TANZANIA	x	-	-	-	-	-	-	-
TRINIDAD-TOBAGO	-	-	-	x	-	-	-	x
YEMEN	-	-	-	-	-	x	x	-

ANNEX - III

STAFF

KR Friederike WITT	Director General
KR Dr, Erich WITT	Director
Mag. Gabriele WITT	Deputy Director
Herbert MAYERHOFER	Plant Manager
Ing. Markus WERSONIG	Production Manager
Ing. Markus WERSONIG	Training Manager
Heinz SCHRÖDL	Training Assistant
Design Dept:	Heinz SCHRÖDL
•Mould Making Dept:	Roman BRUNNER
. Injections Mould Dept:	Miroslav RADUSIC
Blow Moulding and Extrusion Dept:	Anton SPRENGNAGEL
Press Moulding Dept:	Ingeborg KOMAREK

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	FK 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 Dept.

TRIMLZI	10 Kg
ENGEL	1200/9000
IDRA	MP 85
BATTENFELD	3000
ENGEL	4400/550
STÜBBE	2000
ENGEL	1500/500
ENGEL	500 P
IDRA	MP 40
IDRA	MP 35
ENGEL	350 P
IDRA	MP 30
ENGEL	500/250
ENGEL	250/650
ENGEL	250/650
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. Conveyer and inking equipment

Div. Mills

Blow Moulding Dept.

KAUTEX Blow - Moulding Machines up to 50 l  
SEKUM Blow - Moulding Machines HBD BA 2  
and others.

Div. Conveyer and colouring Equipment

Printing - machines DUBUIT

Printing - machines KAMANN with elevator

Printing - machines SIMA and others

ANNEX - V

Eighth In-Plant group Training Programme in the field of  
Mould Design and Mould Making, Vienna 11 Nov. to 6 Dec. 1985

TIME TABLE

Beginning	08.00 hrs
Lunch	12.00 to 13.00 (except Friday)
End	16.00 hrs (Friday 14.00 hrs)

First Week

11 November

Monday

Visit to the factory;

Design department:

Discussion with trainees concerning individual interest in the subject matter, questions and answers.

12 November

Tuesday

Calculation of mould elements, types of injection moulds.

13 November

Wednesday

Design of mould in respect to material, shrinkage, cooling system, design of sprue, runners and gates and mould units.

14 November

Thursday

Workshop and injection mould department.

15 November

Friday

Single-cavity, multi-cavity mould.

Second Week

18 November

Monday

Split, side pull mould.

19 November

Tuesday

Three-plate, four-plate mould.

Workshop and injection mould department.

20 November

Wednesday

Isolation channel, hot runner moulds.

21 November

Thursday

Sprocket gear moulds.

22 November

Friday

Workshop.

Third Week

25 November

Monday

Sprocket gear moulds.

26 November

Tuesday

Two and multi colour moulds.

27 November

Wednesday

Workshop and injection mould department  
technical mould designs.

28 November

Thursday

continued from the above.

29 November

Friday

Workshop.

Fourth Week

2 December

Monday

Thermosetting materials, design of  
thermosetting moulds, transfer moulds,  
Thermosetting department.

3 December

Tuesday

Extruder machines, design of dies and  
blow moulds.  
Blow mould department.

4 December

Wednesday

Foaming - expanded polystyrol mould of  
expanded materials.

5 December

Thursday

Copies of interesting designs for the  
trainees.  
Discussion with substantive officers  
at UNIDO.

6 December

Friday

Workshop  
Individual discussions.  
Closing session.

PLANT - VISIT

<u>14 Nov.</u> Tuesday	Kunststoffinstitut Research and Test Laboratory	Wien 3
<u>18 Nov.</u> Monday	Dieringer Modern mould maker.	Wien 23
<u>20 Nov.</u> Wednesday	Porit Hartschaum GmbH. Foaming-expanded Polystyrol Sedlak Modern mould maker	(Schmidberger) Wien 23
<u>21 Nov.</u>	Battenfeld	Kottingbrunn
<u>22 Nov.</u>	Ledl Reinforced Plastics	Tattendorf
<u>27 Nov.</u>	Bekum Blow mould machines	Traismauer
<u>29 Nov.</u>	Cincinnati MILACRON	Wien 23
<u>03 Dec.</u>	Hasco Mould units	Guntramsdorf
<u>04 Dec.</u>	Huber&Drott	Wien 22
<u>05 Dec.</u>	Ing Stefan Röltner K.G. Steel hardening	Wien 22
<u>05 Dec.</u>	Dinner - Gösser Bierklinik	Wien 1



Special Papers

- HASCO Mould Making Standards
- HÜLS Injection Moulding Technology  
Part I: Design of Mouldings  
Part II: Mould Construction
- HOECHST Introduction to the  
Technology of Plastics  
Part I: The structure and properties of plastics  
Part II: The processing of plastics  
Plastics in action
- Prospects of visited factories
- Some Papers about materials
- Some copies about interesting moulds and mould designs

Social Events

Dinner - Gösser Bier Klinik (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 in the earliest stages of his activities.

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<sup>2</sup> includes 2 large workshops sized about 27.000 m<sup>2</sup>. The company's management and administration are located in their own office-building in Vienna II.

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

