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16114

FINANCIAL - STATEMENT

UNIDO Project No. US/INT/86/125 - UNIDO Contract No. 86/58
9 th In-Plant-Troup Training Programme in the Field of
Mould Making and Mould Design in Austria, Vienna (6 Participants)
17.11. - 12.12.1986

4 weeks each 5 days

Premium: Mr. Ing. Markus WERSONER ... AS 57.750,00
Mr. Heinz Schrödl AS 34.650,00 AS 92.400,00

Design department:

20 h Theory, 55 h Practice AS 68.850,00

Workshop and Production departments:

Mould Making Dept.

Injections Mould Dept.

Blow Moulding and Extrusion Dept.

Press Moulding Dept.

60 h Practice, Equipment, Material, Personal AS 127.575,00

Plan-visit: 12 Companies AS 10.715,00

Samples of production,

construction desin: AS 8.000,00

Diverse AS 8.400,00

1 further Participant AS 70.000,00

AS 385.940,00

(each Participant AS 63.158,00
1 further Participant AS 70.000,00)

22.12.1986

702

37.10 030

16114

FINAL REPORT

NINTH 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 GesmbH

held in Vienna, 17 November to 12 December 1986


701

37.10

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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 Organisation (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.

The in-plant training programme in the field of mould design and mould making was of four weeks duration (17 November to 12 December 1986). It was the ninth course on the subject held at the Schmidberger Factory in Vienna. The course was attended by six participants from China, Korea, Sri Lanka, Syria, Tanzania and Thailand. 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 Single Cavity, Multiple Cavity, Two- and Three-plate Mould, Four-plate Moulds, Split- and Side-pull Mould, 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 demonstration 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. Also were shown how to produce an good article, depending on time and temperature.

III.3.3. Extruder and Blow-Moulding Department

Various features particular to the production with extruder and blow-moulding machines; such as sizing dye, 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

It 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 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 1986

Yu Hui Xiang	Beijing Institute of Machinery and Electricity San Li Tun Beijing Tel 596401-287 P.R. of China
An Ung Nam	Chemical and light industrial committee Nam heung Co. Juche Tab Street SINLI PYONGYANG D.P.R. KOREA
Dharmasena W.	Ceylon Leather Products Corporation 141. Church Road Mattakkuliya Telex 22210-CE. CLPC Sri Lanka
Achi Mikhail	Aleppo Tractor Alfrat company Syria
Evarest M. Mshana	Tanganyika Tegry (Plastics) Ltd. P.O. Box 2219 Dar Es Salaam Tanzania 17/18 Pugu Road Tel 63222/3/4 Telex 41319
Nart Suwannetr	Srithai Superware Co., Ltd 355 Suksawat Rd. Soi 36 Bangkok Rasburana Bangkok Thailand Tel 427-0200 Telex 82010 SRITHAI TH.

ANNEX - II

	75	76	77	78	79	83	84	85	86
BENIN	-	-	-	-	-	-	-	x	-
BOLIVIA	-	-	x	-	-	-	-	-	-
BULGARIA	-	x	-	-	-	-	-	-	-
BURMA	-	-	-	x	x	-	x	x	-
CHILE	-	-	-	-	-	x	-	-	-
CHINA	-	-	-	-	x	-	-	-	x
COLOMBIA	-	-	x	x	-	-	-	-	-
COSTA RICA	-	-	-	-	x	-	-	-	-
CUBA	x	-	-	-	-	-	-	-	-
CYPRUS	x	-	-	-	-	-	-	-	-
EGYPT	-	x	x	x	-	-	-	-	-
GHANA	-	-	-	-	-	x	-	-	-
INDIA	x	-	-	x	-	xx	-	x	-
INDONESIA	x	-	-	-	-	-	-	-	-
IRAQ	-	x	-	-	-	-	-	-	-
JORDAN	x	-	-	-	-	-	-	-	-
KOREA	-	-	-	-	-	-	-	x	x
MALAYSIA	x	-	-	x	-	-	-	-	-
MALAWI	-	-	-	-	-	x	-	-	-
MAURITIUS	-	-	-	-	-	-	-	x	-
MOZAMBIQUE	-	-	-	-	-	-	x	-	-
PANAMA	-	-	-	-	x	-	-	-	-
EL-SALVADOR	-	-	x	-	-	-	-	-	-
SINGAPORE	-	-	-	-	-	-	x	-	-
SRI LANKA	-	x	-	-	-	-	-	-	x
SUDAN	-	-	-	-	-	-	x	-	-
SYRIA	-	-	-	-	-	-	-	-	x
TANZANIA	x	-	-	-	-	-	-	-	x
THAILAND	-	-	-	-	-	-	-	-	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 Manager
Herbert Mayerhofer	Plant Manager
Ing Markus Wersonig	Production Manager
Ing Markus Wersonig	Training Manager
Heinz Schroedl	Design Department
Roman Brunner	Mould Making Department
Miroslav Radusic	Injection Mould Department
Martin Walzer	Blow moulding Department
Martin Walzer	Extrusion Department
Margit Hegedues	Compression Moulding Department

ANNEX - IV

Equipment

Mould Making 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	Hopfgaertner
Turning lathe	TOS
Turning lathe	Nils and others
Shaping machines	
Grinding machines	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

ENGEL	1200/9000
IDRA	MP 85
ENGEL	4400/550
STUEBBE	2000
ENGEL	1500/500
ENGEL	500 P
ENGEL	350 P
ENGEL	500/250
ENGEL	250/650
ENGEL	250/650
ENGEL	250/650
ENGEL	300/150
ENGEL	150/90
ENGEL	100/50
IDRA	MP 10
ENGEL	90/50
ENGEL	50/50
AREURG	UNIMAT
BATTENFELD	7,5 gr
BATTENFELD	2 gr

and others

Div. Conveyer and inking equipment

Div. Mills

Blow Moulding Department

KAUTEX	Blow moulding machine up to 50 l
Bekum	Blow moulding machine HED BA 2

and others

Div. Conveyer and colouring equipment

Printing machine DUBUIT
Printing machine KAMANN with elevator
Printing machine SIMA and others

Compression Department

Bucher Guyer	Compression machine up to 150 to
Bucher Guyer	Compression machine up to 150 to
Bipel	Compression machine
Bipel	Compression machine
TOS	Compression machine up to 40 to

and some other compression machines from 20 to up to 300 to

ANNEX - V

Ninth In - Plant group Training Programme in the field of Mould Design and Mould Making, Vienna 17 Nov. to 12 Dec. 1986

TIME TABLE

Beginning	08.00 hrs
Lunch	12.00 to 13.00 (except Friday)
End	16.00 (Friday 14.00 hrs)
First Week	
17 November Monday	Visit to the factory
18 November Tuesday	Design department: Discussion with trainees concerning individual interest in the subject matter, questions and answers. Discussion about different materials which are used in plastics industry.
19 November Wednesday	Discussion about steel hardness, steel quality and steel hardening
20 November Thursday	Plant Visit: PCS - Schwechat Calculation of mould elements, types of injection moulds
21 November Friday	Design of mould in respect of material, shrinkage, cooling system, design of sprue, runners and gates and mould units.
Second Week	
24 November Monday	Plant Visit: HASCO Calculation of clamping force of injection and compression machines
25 November Tuesday	Plant Visit: Poeltner Workshop and injection mould department
26 November Wednesday	Single cavity, multi cavity mould Split, side pull mould

27 November
Thursday

Plant Visit: Cincinnati Milacron
Workshop and compression mould department

28 November
Friday

Three plate, four plate mould.
Isolation channel, hot runner mould.
Two and multi colour mould
Sprocket gear mould

Third Week

01 December
Monday

Plant Visit: ENGEL
Workshop and injection mould department

02 December
Tuesday

Extruder machines, design of dies and
blow moulds. Blow mould department.
Discussion about flexible pipes (core inside)

03 December
Wednesday

Plant Visit: Sedlak, Porit
Technical mould designs. Foaming - expanded
polystyrene, mould of expanded materials

04 December
Thursday

Plant Visit: BEKUM
Workshop

05 December
Friday

Compression department, production of cups
tablets and plates, how to produce articles
of melamine with pictures and photos fixed
on the article, how to produce melamine
articles with better quality and shorter
cycle time.

Fourth Week

09 December
Tuesday

Plant Visit: Battenfeld
Thermosetting materials, design of
thermosetting moulds, transfer moulds.

10 December
Wednesday

Copies of interesting moulds and designs for
the trainees, Discussion about technical
moulds.

11 December
Thursday

Plant Visit: RAUSCHER
Workshop, Closing session in the head quarter
of Schmidberger company including the closing
session of UNIDO.

12 December
Friday

Individual discussion in the factory about
special questions.

ANNEX - VI

PLANT - VISIT

20 November Thursday	PCS - Schwechat Chemical industry	Schwechat
24 November Monday	HASCO Mould units	Guntramsdorf
25 November Tuesday	Ing Stefan Poeltner K 6 Steel hardening	Wien 22
27 November Thursday	CINCINNATI Milacron Extruder and injection machines	Wien 23
01 December Monday	ENGEL Injection Machines	Schwertberg
03 December Wednesday	Sedlak Modern mould maker Porit Foaming - expanded Polystyrene	Wien 23
04 December Thursday	BEKUM Blow mould machines	Traismauer
09 December Tuesday	BATTENFELD Injection machines	Kottingbrunn
12 December Friday	BATTENFELD Germany especially for Mr. Nart Suwannetr Steyr Daimler Puch A G especially for Mr. Achi Mikhail	
10 December Wednesday	Dinner - Goesser Bierlinik	Wien 1

ANNEX - VII

Special Papers

- HASCO Mould Making Standards
- HUELS 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
- Degussa Special Papers about steel hardening
- Some Papers about materials
- Prospects of visited factories
- Some copies about interesting moulds and mould designs

Social Events

Dinner - Goesser Bierklinik (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 m² includes two large workshops sized about 27.000 m². 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.

