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ASSISTANCE TO THE NATIONAL BUREAU OF
STANDARDS AND METROLOGY

DP/NEP/84/031

NEPAL

Technical report: Findings and recommendations*

Prepared for the Government of the Kingdom of Nepal
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of M. M. Abou El-Khair,
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Explanatory Notes

NBSM	:	Nepal Bureau of Standards and Metrology.
BLSF	:	Bansbari Leather and Shoe Factory.
ISO	:	International Standards Organisation.
IUP	:	Methods for Physical Leather Testing.
IUC	:	Methods of Chemical leather Analysis.
		International Union of Leather Chemist Association
IUF	:	International Fastness Commission.

Abstract

The project "Assistance to the Nepal Bureau of Standards and Metrology" DP/NEP/84/031 has a provision for leather industry - where a consultant was assigned for two weeks on the first part of split-mission.

The purpose of this mission was to identify the NBSM requirements for testing and other relevant facilities in the light of present industry situation and possible future developments.

At this stage, a priority is given to equipping the physical testing facilities- being a key entrant - in preparation for subsequent activities as geared to the introduction of quality evaluation, process control and standardization in the various aspects of the sectors' industrial performance where the catalytic role of the NBSM needs to be established.

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Introduction

The Nepal Bureau of Standards and Metrology is shaping-up its role in the industrial sector's activities where various units are established including a provision for leather and leather products. It is within this context, that the consultant assignment has taken place for the first part of a split mission over a duration of two weeks between 6 - 18 January 1991.

As the construction work for establishing testing laboratories is near completion. The purpose of this mission is to advise on specific requirements of the institute for leather and leather products. This has covered: arrangements for the leather laboratory, specifications of testing equipment as well as staff requirements and reference material.

Whilst performing this task, a cross reference is made to the prevailing conditions at the industry level which did not require specific assessment : as the consultant is fully familiar with the situation through previous advisory services to HMG/Nepal on leather industry development. However, thorough reference has been made to the equipment list, present inventory list and other recommended arrangements for light industry laboratories in order to avoid duplication and make the necessary adjustments as appropriate.

The scope of the mission is considered a preparatory activity for a return mission as envisaged to take place at a later date for about two-months upon procurement of the priority equipment- for which an outline work plan is also made.

CONCLUSIONS AND RECOMMENDATION

Scanning the Industrial situation for the sector and future development trends for its allied subsector highlights the order of priorities in the various activities at NBSM level with a view for establishing eventual linkage at the industry level.

Standardization role should give first priority to raw hides and skins grading, elaborating standards for methods of testing as well as finished light leathers destined for prevailing applications. This should be preceded by extensive investigations on the locally attainable quality levels to be guided by parameters of quality as stipulated by standards at international and regional levels.

Properties for testing facilities are given into two distinct directions, first for evaluation of physical properties of finished products in preparation for establishing national standard specifications and second for demonstration and introduction of means for process control particularly in the tanning sector. Provision should also be made for testing components other than leather as employed by the footwear sector.

An important dimension is the gradual introduction of the quality control concept in terms of totality. Considering the present limited size of the industry, this approach is quite feasible through industry seminars at managers and key technicians levels, entailing the flavour of human resources development. View the location of the industry as grouped in certain regions, this activity shall require direct involvement of NBSM regional centers for necessary follow up.

For preparatory arrangements and order to carry out tasks outlined in the work plan during the return mission, it is recommended to :

- 1) Take necessary actions for procurement of ;
 - Physical testing equipment as per annex I
 - reference material as per annex IIItogether with necessary budget adjustments as per updated estimates.
- 2) Complete necessary leather physical testing laboratory arrangements for prescribed fixtures and utilities before equipment scheduled arrival.
- 3) Implement staff fellow-ship training either before or after completion of the consultant return mission.
- 4) Assign national counterpart staff to the return mission - comprising;
 - Head, Leather Testing Laboratory,
 - Standardization Chemical Engineer,
 - Chemical Engineer of Promotion/Technical Services Section, and
 - Inspectors of Branch Offices at Birgunj and Biratnagar.

ACTIVITIES

1. Review of Industrial Situation:

This brief presentation is made in order to provide an overall picture of the sector's activities as determinant to the NBSM requirements and the order of priorities in subsequent functions.

1.1 Leather Tanning:

It is considered the main activity of the sector started in the country by 1966 and is undertaken by 14 tanneries as located in Kathmandu, Birgunj, Heatauda, Biratnagar and Bhairahwa. By and large, four tanneries concentrate on hides processing whilst the rest are mainly oriented to goat skins production.

**Regional
Activities**

Raw Material. The sector is dependent in its basic raw material supply on the country's wealth of hides and skins which is considered one of Nepal's most renewable natural resource. Some 284,000 hides are collected per annum whilst only some 128,00 pieces are processed into various forms. For goatskins, the industry collects some 4 M. pieces per annum while the installed processing capacity exceeds the collected material by some 40 per cent.

Generally, the production of the raw material is featured by lack of proper extraction facilities and subsequent post-mortem defects. The trade reflects active across-the-boarder business as supplying the industry with material of mixed origins. For the indigenous trade, transactions are made on all-in basis in the absence of quality/quantity grading as basics for clear price structure.

**Hides &
Skins
Grading**

Product Mix. reflects a minimum of industrialization at this stage. Some 37 per cent of the processed hides are made into medium/low quality finished leather giving approximately 1 M. sq. ft. upper leather per annum mainly of buffaloe and cow material as well as limited quantities of sole leather made of buffaloe material. The balance of the hides material is exported into semi-processed form (wet-blue) of full thickness hides as well as unfinished splits.

Finished uppers are mainly consumed by local cobblers for civil shoes as well as army shoes with embossed grain upper whilst the bottom material has a limited application of sole leather made of buffaloe which would not suit basic requirements for abrasion resistance and waterproofness due to the natural properties of the raw material. Meanwhile, the cow material available at the least quality does not meet substance thickness requirements for sole leathers. Conversion of buffaloe material into light leathers for upholstery, upper material and leather goods material would represent optimal utilization of natural properties.

**Light Leather
Standards/
Testing,
Shoe uppers
Upholstery**

Likewise, goat skins are mainly processed into wet-blue with recent increase in the proportion of crust production whilst a limited quality is finished into high standard of aniline shoe uppers as all goes for export. The excellent natural properties of goat skins give good prospects for processing into gloving leathers

as it seems to be largely applied by the ultimate importers of the semi-processed material at the market end.

**Gloving
Leathers.**

Machines/Equipment Profile. reflects sizeable total investment of some NC Rs. 100 M., nation wide where ninety per cent of the employed machinery shows a modest level of technology as indicated by the import sources. However, in attempts to improve mechanical operations and eventual physical properties, a recent trend indicates gradual substitution and/or new resourcing of quality machinery at a limited scale.

Among operating tanneries, four are producing or equipped to produce finished leathers with an investment level in machinery ranging from NC. Rs 10-25 M. which are unevenly distributed. For finished leathers, the capability of quality finishing is always dependent to a greater extent on technology levels as applied through mechanical operations which are currently subject to gradual upgrading.

**Physical
Properties
Evaluation.**

Process Profile. is dominated by wet operations being the major activity befitting the current production orientation to the semi-processed leathers. Whilst operating tanneries are varied in their level of mechanization for mechanical operations, the applied technology in the wet-process is almost similar. It is featured by excessive use of chemicals and high volume water consumption with least or almost non-existing appropriate measures of process control.

For the dry process and finished leathers, with the exception of one tannery recipient of technical assistance from foreign collaborator, the lack of process control concept, quality consistency and process control facilities is a common feature.

**Process
Control,
Concept/
Facilities**

Personnel Profile. Among some 600 people employed by the industry, there are 35 key technicians performing the task of production management and/or supervision of skilled and unskilled workers.

Being the candidates for the application of process control measures, the key technicians experience is mainly limited to wet operation as gained through on-the-job training and/or formal education in Indian institutions with the exception of BLSF where the staff had the access to overseas training in Europe. However, it could be generalized that the industry task force has an exposure limited to production running of certain stages of the process with a vacuum in total quality control aspects. Considering that the size of the whole industry nation-wide does not justify the establishment of a specialized leather institute; this would emphasize a partial role of NBSM in human resources development as so far quality aspects are concerned.

**Industry
Group
Seminars**

Tannery Effluent Treatment. house keeping practices and the application of environment friendly technology is receiving the least consideration at industry level with eventual negative impact on the future sector's development. Activities along this line as initiated through the project SI/NEP/88/801 "Effluent Control in Leather Tanning Industry"; underlines the NBSM role in testing facilities,

monitoring function and establishing of standards befitting local industry conditions.

**Effluent
Testing/
Monitor**

Export Performance, of the sector fluctuates between the fourth and the fifth rank in foreign currency earnings among other sectors at the current stage of development. This level is subject to raise of 300 to 500 per cent added values for further stages of processing i.e. towards finished leathers and finished goods, which would bring the sector to the rank of first/second in export earning. Needless to say, for this to materialize continued support on quality aspects is a prerequisite for the sectors major contribution to the national economy.

**Role in
Economy**

1.2 Footwear Industry

It is the second largest industrial activity as undertaken by 6 medium scale semi-mechanized factories as well as some 3,000 cobblers located in rural and the urban areas. Generally, the domestic production of footwear represents only some 50 percent of the local demand for leather footwear as estimated at 0.5 M. pairs/annum whilst the balance is resourced through imports which take place in various forms and ways. The present large manufacturing base - although falls under the unrecognized sector together with sizeable imports, opens up future prospects of domestic production at least for the import substitution in the near future.

By and large, the current applied technology follows components preparations and manufacture under one roof with limited/irregular access to variety material-compelling the application of unsuitable components such as threads, glues and bottom material as well as upper material too. Mechanized operations encounter particular difficulties in upper closing and procurement of upper material suitable for converting operation from hand to machine lasting.

**Physical
Properties/
quick
evaluation**

A recent domestic trend in footwear manufacture tends towards expanding operation by mass production of unit soles made of rubber, PVC and/or PU material ready for assembling. In a parallel fashion, plans are also made for introduction of direct injection moulding technology to upper closed material whether readily imported and/or locally made. This trend produces an appropriate substitute to the application of buffalo leather soles whilst expanding possibilities for local manufacture of sports shoes being popular at domestic market. Current expansions are also oriented towards manufacture of cheaper grades of direct moulded plastic shoes in order to provide a domestic substitute to imported footwear.

**Rubber/
Plastic
Testing**

Firm plans are also made for large scale manufacture of shoe uppers and subsequent production of completed shoes at the higher end of export market utilizing the exotic natural properties of local goat skins material. For this plans to materialize, finished upper leathers at high level and consistent quality shall be required where physical properties particularly those pertaining to finishing and performance should be subject to frequent evaluation.

**Performance
Properties of
Uppers.**

1.3 Leather Goods Industry

The current production is represented at the least developed level through the manufacture of a limited range of non-footwear items as ladies bags and gift articles made mainly of garment leather waste which does not fit products shape and/or function. Realizing the sub-sector's prospects for export/tourist market, special attention is granted to support its development through initiated training facilities. Being of labour intensive nature, it is attracting a good number of new business entrants which is subject to substantial growth. This is creating a domestic demand for specific types of leathers at good finishing levels and special texture properties-particularly out of buffaloe material.

**Finishing
Quality/
Physical
Properties**

2. Institutional Infrastructure

2.1 General

The organisation chart for NBSM reveals that forthcoming key activities for the leather sector would generally fall under the following main divisions/Sections

- Standards Formulation Division
 - * Standards Formulation Section
 - * Promotion and Technical Services Section
- Laboratory Division
 - * Leather Testing Laboratory
- Branch Offices
 - * Kathmandu
 - * Birgunj
 - * Biratnagar

However, specifically for the leather industry, tasks performed within this organizational pattern needs to be further specified together with order of priorities-in order to carry on the functions of standardization, testing and quality assurances - where staff orientation and development shall be required. This is keeping in mind the complimentary nature of the various tasks under these divisions towards a common goal.

2.2 Physical Infrastructure

A provision is made in the present new building of NBSM for two testing laboratories where the construction and utilities are near completion.

2.2.1 Physical Testing laboratory.

For the leather industry, it is located in the new laboratory building on the first floor within the textile and light industry laboratories area. These arrangements are convenient to enable performing some physical testing in other laboratories, particularly at the textile and rubber/plastic laboratories.

Area, the physical testing laboratory for leather and leather products occupies an area of 35 sq.m. i.e. (7 X 5 M) in a closed room which is considered as sufficient to accomodate the required equipment. The laboratory is adjacent to a room for a centralized air-condition plant where a provision is made for samples storage under a standard atmosphere.

Fixtures. at present the laboratory is equipped with two benches as placed on one side as well as the main electrical wiring. For completion, it shall require;

- Additional bench to be placed perpendicularly - with an installed sink and and running water tap.
- Improving the finishing of laboratory benches particularly the bench top.
- Two open hanging shelving units for proper placement of test pieces and auxiliaries following standard dimensions of other laboratories.
- Two tables for the laboratory head and technician.
- Gas pipe connection for Bunsen burners
- Compressed air connection
- Six socket outlets 220v spaced along the laboratory benches
- Floor finishing

Air Conditioning. Arrangements are made for a centralized air conditioning plant to be located in the area of the light industry laboratories in order to provide a standard atmosphere of $20 \pm 2^{\circ}\text{c}$ temp. and $65\% \pm 2$ relative humidity for samples conditioning in an adjacent store. These arrangements shall serve the purpose of leather samples conditioning before the conduct of physical testing, providing the store is equipped with hanging open shelves to enable free air circulation around the samples.

For physical testing laboratory, plan is made to conduct the test under the same atmospheric conditions with allowance up to 5 percent in the relative humidity, which is also permissible providing a mention is made in the standards. In order to secure constant atmosphere under these conditions, insulation arrangements are provided through double glass windows.

Apparently, the insulation function might be hampered by leakage due to shrinkage of wooden frames of the glass window - a matter which should be consulted with the contractor on proper sealing for future consideration. However, the installation of air-conditioning does not seem to be a prerequisite for functioning and operation of the physical testing laboratory at this stage - where priority is given to quick and simple evaluation of physical properties rather than strict application of standard testing which would follow at a later stage after staff training.

2.2.2 Chemical Testing Laboratory

A provision is made for the chemical testing laboratory at the second floor of the new building where the present chemical laboratory currently located at the Mines and Geology compound shall be transferred in due course. Considering the present stage at the industry level, chemical testing for quality evaluation would occupy a second order of priority. However, from an organizational point of view - the chemical testing laboratory should have a provision for tannery waste examination in line with recommendations made under the project SI/NEP/88/801 for effluent control. In the meantime, whilst the chemical testing of leather could be conducted at the present location if required, a code of practice for leather related functions needs to be established within the laboratory among other material testing being performed in a wide variety.

2.3 Human Infrastructure

This should represent the backbone of NBSM activities in the leather and leather products areas both at the institution and the industry levels.

For this purpose, currently the task is assigned to a lady staff with background in chemical engineering as supported by further education in leather technology at the USSR. Within the project, her nomination is finalized for especial training on leather testing at the Central Leather Research Institute (Madras, India) which is deemed as appropriate. However, timing for this training should be made either to be completed preferably before the consultants' return mission or if not possible, it should take place afterwards in order to secure a counterpart support throughout the mission.

Additional staff involved in standards formulation and quality assurance aspects as well as key regional staff at the industry centers in Birgunj and Biratnagar should also be assigned as counterparts during the return mission in order to enable the implementation a staff development on various activities.

3. Physical Testing Equipment

Physical testing represents a first priority at this stage whether for preparation of national standard testing methods and/or evaluation of leather quality.

3.1 Priority Requisitions for Leather Laboratory

Identification of priority equipment for the physical testing laboratory is based on; industry situation, reviewing equipment list previously prescribed for light industries and applicable standards/testing methods. Budget allocation for physical testing equipment in the project document at US\$ 22,325 is noticeably insufficient to cover the minimum needs at present price levels. Therefore, fresh guiding quotations were sought in order to work-out a realistic price estimate for a balanced list of priority equipment as described in annex I and its attachments (physical Testing-Equipment Requirements).

As per Annex I, the equipments recommended for priority requisition-fall into two categories;

- i) Equipment for regular testing at the laboratory in order to support standards formulation and verification, items (1-10 & 12-14)
- ii) Equipment for process control and demonstration purpose items (13 & 16-21)

Accordingly, the total cost of equipment is estimated at FOB US\$ 39,436

Recommended Supplier

Specht Gerberei-Bedarf
 Otto Specht GmbH & Co. HK
 Pocachestr. 11
 D-7000 Stuttgart 40
 FRG

3.2 Equipment for Common Use

3.2.1 Tensile Strength/Elongation, a test of considerable significance for standard physical properties evaluation particularly for light leather. The requisition list (annex I - item 3) comprised a simple tensile tester which should serve the purpose at present for quick evaluation/detection of strength/stretch properties. However, for the purpose of standard testing method, an electronic tensile tester has been prescribed for the textile laboratory - fabric testing (item 7) at an estimated cost of US\$ 45,000 which is also recommended for testing other material including paper/rubber/plastics and leather as well. The machine would serve the purpose - providing it is equipped with a set of grips for leather testing which should be added to the requisition for the textile laboratory. However, the machine is not considered of a priority at this stage and may be procured at the time of equipping the other laboratories.

3.2.2 Rubber and plastic Testing, As already stated that domestic footwear manufacture tends towards the application of a variety of non-leather material for bottom construction. Therefore, some of the testing equipment already prescribed for rubber and plastic laboratories shall be applicable to the sub-sector's needs particularly items No. 1,3, 5 & 6

4. Chemical Testing Equipment

Evaluation of leather quality through chemical testing does not represent a priority at this stage, since the important properties could be evaluated through physical testing. However, for future operation of the chemical laboratory at the new building, the requisition list for equipment and reagents has been reviewed vis-a-vis the important tests to be conducted.

Annex II Chemical Testing of Leather, Equipment/Reagents Status

According to this analysis, all requirements for chemical testing are already covered by the prescribed list for chemical testing laboratory. In the meantime, the staff at the present laboratory shall be able to conduct these tests being of similar nature to those applied to other material for general chemical testing.

5. Reference material

Additional reference material and literature has been prescribed for requisition in order to supplement those currently available at the NBSM library. (Annex III List of Reference material Requirements)

The new list covers additional standards, UNIDO/FAO publications as well as necessary text books-estimated at a total cost of US\$ 1,500.

6. Return Mission

The second part of split-mission is expected to take place after procurement of the prescribed equipment for a duration of about two months. The following work plan reflects time table for preparatory arrangements before the mission as well as the mission activities in line with the Job Description.

Physical Testing - Equipment Requirements

It	Qu	Un	Name	Specifications	Reference	Est.	Est.	Rece	Manufac	Note
em	an	it				unit	total	ipt	turer	
ity	ty	ty				price	all	date		
1	1	pc	Hand Punching dies for cutting leather samples	Type 3 for : Bulk density - 28801 Tensile - 28805 Strength 28806 ' 28807 ' 28810 Waterabsorption-28815 kubelka Tear Strength - 28820 Stitch tear Strength 28821 Penetrometer 28830 Shrinkage temp. 28855 Flexometer 28860 Rub Fastness tester 28866 Adhesion of finish tester 28870	attach No. 1				Specht	
					total	total				
					500	500				
2	1	pc	Leather thickness Grange with base	Anvil 10 mm diameter pressure 500p/cm2	attach No. 2	166	166		Specht	
3	3	pc	Pocket thickness gauge	Model No. 30010 0,1 mm calibration 10 mm flat anvil	attach No. 3	40	121		Specht	
4	1	pc	Leather thickenss gauge	Model No. 30130 10 mm flat anvil 300 mm depth	attach No. 4	92	92		Specht	

5	2	pc	Device for determination of shrinkage temp.	Model No. 32604	attach No. 5	233	466		Specht	
6	2	pc	Device for determination of water absorption Kubelka	Model No. 32603	attach No. 6	173	346		Specht	
7	1	pc	Lastometer	Model No. STD 104	attach No 7-a	4,966	4,966		Specht	
8	1	pc	Adhesion of finish tester	Model No. STD 112 (+adhesive sample 2 kg)	attach No 7-b	2,000	2,000		Specht	
9	1	pc	Rub fastness tester	Model No. STD 421 (+Standard felt 500 pcs)	attach No. 7-c	4,700	4,700		Specht	
10	1	pc	Flexometer	testing stations Model No. STM 408	attach No 4 d	5,493	5,493		Specht	
11	1	pc	Simple Tensile Tester	Model No. STD 172	attach No. 7-e	2,660	2,660		Specht	
12	1	pc	Penetrometer	Model Bally	attach No. 8-a	7,666	7,666		Specht	
13	1	pc	Stiffness meter	Model Bally	attach No. 8-b	2,500	2,500		Specht	
14	1	pc	Toe and Heel Adhesion Tester	SATRA STD 185	attach No. 9	5,000	5,000		SATRA or Specht	
15	1	pc	Laboratory PH meter	Digital Model No. CG 840 /2042 with extra set of accessories	attach No. 10	1,040	1,040		Specht	
16	2	pc	Digital pocket PH meter	Model No. 838/2037	attach No. 11	470	940		Specht	
17	2	pc	Leather moisture meter	model "Aqua-piccolo" Model No. 32810 with leather case	attach No. 12	313	626		Specht	
18	10	box	PH Indicator paper	Type PEHNON	attach No. 13	7	70		Specht	
19	2	pc	Baume Hydrometer	0-15		15	30		Specht	
20	2	pc	Baume Hydrometer	0-25		15	30		Specht	
21	2	pc	Baume Hydrometer	0-60		15	30		Specht	

Total

39,436

* Equipment of second priority in case of budget restrictions

Chemical Testing of Leather

Equipments/Reagents Status

Test	Equipment	Status	Reagents	Status	
Volatile Matters	- Desiccator				
	- Oven	102° ± 2° c	*		
	- Weighing Bottles & Dishes flat, shallow with ground in stopper, or flat open dishes.		*		
Moisture	- Flask	500 ml	*	Potassium Dichromate	*
	- Glass reflux condenser jacket	400 mm long	*	Sulphuric Acid	*
	- receiver		*	Toluene	*
Total ash	- Crucible - platinum or silica		*	Sulphuric acid	*
	- Desiccator		*		
	- Muffle furnace with pyrometer and thermostatic control		*	Ammonium nitrate solution	*
Solvent extractable substances	- Desiccator		*	Dichloromethane	*
	- Filter paper thimbles or glass filter bells		*	Petroleum Hydrocarbon Solvent (40/60)	*
	- Oven	102° ± 2° c	*		*
	- Soxhlet Extraction Apparatus with extraction flask		*		*
Nitrogen and hide substances	- Distillation apparatus		*	Fuming or conc. sulphuric acid	*
	- kjeldahl flask	200 - 300 ml	*	- Catalyst mixture anhydrous copper sulphate + potassium sulphate	*
	- Receiver	300 - 400 ml	*	- Phenolphthalein indicator	*
				- Sodium hydroxide solution	*
				- Solution of boric acid	*
Water soluble matter	- Desiccator		*		
	- Evaporating basin with flat bottom - quartz porcelain or platinum	50 ml bottom			
	- Flask	650 - 750 ml	*		
	- Oven	102 ± 2° c	*		
	- Shaker	50 ± 10 rev/min	*		
Sulphated ash of water soluble	- Apparatus as in water soluble matter		*	- Sulphur	*
Water insoluble ash	- Crucible		*	- Sulphuric acid	*
	- Desiccator		*	- Ammonium nitrate solution	*
	- Muffle Furnace & apparatus as in water soluble matter		*		

Water soluble organic substances	- Apparatus as in water soluble matter	*		
Chromic oxide	- Kjeldahl or Erlenmeyer flask (round stopper) 300 ml	*	- Conc. sulphuric acid	*
	- Conical Flask	*	- Perchloric acid	*
	- Crucible (iron or nickel)	*	- Phosphoric acid	*
			- Starch solution	*
			- Sodium Thiosulphate solution	*
Aluminum (Method a)	- Conical flask 100 ml	*	- Potassium iodide solution	*
	- Hot plate	*	- Potassium hydroxide solution	*
	- Muffle furnace	*	- Conc. Hydrochloric acid	*
			- Thymol blue and cresol red indicator	*
			- Potassium Fluoride Solution	*
Zirconium	- Analytical balance, sensitivity 0.001	*	- Standard Hydrochloric acid	*
	- Conical flasks 250 ml/500 ml	*	- Potassium Bisulphate	*
	- Desiccator	*	- Sulphuric acid	*
	- filter apparatus, Acid resistance filter paper	*	- Hydrogen peroxide	*
	- Muffle furnace	*	- Barium chloride	*
	- Measuring cylinders	*	- Hydrochloric acid	*
	- Pipettes	*	- Ammonium Phosphate	*
	- Platinum basin or crucible	*	- Ammonium nitrate	*
	- Tall - form beaker	*		
Free-formaldehyde	- Kjeldahl 500 ml	*	- sulphuric acid-dilute	*
			- Sodium bisulphate solution	*
			- Standard iodine solution	*
			- Starch solution	*
			- Sodium carbonate solution	*
Combined oil	- Flask with reflux condenser	*	- Alcoholic potassium hydroxide solution	*
	- Oven 102 ± 2° c	*	- Concentrated hydrochloric acid	*
	- Separating funnel	*	- Ether	*
Epsom salt			- Hydrochloric acid	*
			- Ammonium chloride solution	*
			- Ferric chloride solution	*
			- Nitric acid	*
			- Ammonium hydroxide solution	*
			- Zinc granules	*
			- Ammonium oxalate solution	*
			- Ether, Ethyl alcohol	*
			- Sodium hydroxide solution	*
		- Sodium chloride solution	*	

Glucose			- Lead acetate solution	*	
			- Potassium oxalate	*	
			- Conc. Hydrochloric acid	*	
			- Anhydrous sodium carbonate	*	
			- Fehling's solution No. 1 and No. 2	*	
			- Rectified spirit	*	
			- Ether	*	
PH and difference figure of water soluble matter	- Flask	200 ml	*	- Buffer solution	*
	- PH meter, range 0 to 14 accuracy 0.05		*	- Distilled water	*
	- Electrode system		*		
	- Glass electrodes with spherical or cylindrical membranes		*		
Total chlorides			- Conc. nitric acid	*	
			- Standard silver nitrate solution	*	
			- Calcium carbonate	*	
			- Potassium chromate solution	*	
Total sulphates			- Conc. hydrochloric acid	*	
			- Barium chloride solution	*	
Bound organic substances and degree of tannage	Apparatus as in volatile matter, total ash, solvent extractable substances, Nitrogen and hide substances, and water soluble organic substance				
Corrosion produced by leather in contact with metal	- Desiccator		*	- Non-corrosive oil	*
	- Analytical balance		*	- Petroleum - hydrocarbon solvent	*
	- Forceps		*		
	- Metal plates		*		
	- Non-abrasive cloth		*		
	- Piece of glass		*		
	- Weight	10 ± 1 g	*		
Iron and aluminium oxides	- Platinum crucible		*	- Methyl Red	*
				- Potassium Carbonate	*
				- Conc. hydrochloric acid	*
				- Ammonium hydroxide	*
				- Ammonium Chloride	*
Preparation of Samples for chemical testing	Cutter Mill	*			
Refractive Index	ABBE Refractometer	*			

Legend * Equipment or reagents included in the List of the project Document (1989) Annex XII Chemical Testing laboratory - for initial requisition

• Equipment already procure.d

ANNEX III

List of Reference Material Requirements

A. **Standards :**I) **IUP/TUC Standard Testing Methods :****Methods of Physical Leather Testing (IUP)**

IUP/1	General Remarks (Das Leder 10, 14 [1959]) (JSLTC 42, 382-386 [1958])
IUP/2	Sampling (Das Leder 10, 14-15 [1959]) (JSLTC 42, 386 [1958])
IUP/3	Conditioning (Das Leder 10, 15-16 [1959]) (JSLTC 42, 386-387 [1958])
IUP/4	Measurement of Thickness (Das Leder 10, 16 [1959]) (JSLTC 42, 387-388 [1958])
IUP/5	Measurement of apparent density (volume weight) (Das Leder 10, 16 [1959]) (JSLTC 42, 388-389 [1958])
IUP/6	Measurement of tensile strength and elongation (Das Leder 10, 16-18 [1959]) (JSLTC 42, 389-392 [1958])
IUP/7	Measurement of absorption of water (static) (Das Leder 12, 36-37 [1961]) (JSLTC 44, 367-368 [1958])
IUP/8	Measurement of tearing load (Das Leder 12, 36-37 [1961]) (JSLTC 44, 368-370 [1960])
IUP/9	Measurement of distension and strength of grain by the ball burst test (Lastometer) (Das Leder 12, 37-38 [1971]) (JSLTC 44, 371-373 [1960])
IUP/10	Dynamic waterproofness test for boot and shoe upper leather (penetrometer) (Das Leder 12, 38-40 [1961]) (JSLTC 44, 374-379 [1960])
IUP/11	Dynamic waterproofness test for boot and shoe sole leather (Das Leder 12, 64-65 [1961]) (JSLTC 44, 495-497 [1960])

Annex III cont.

- IUP/12 Measurement of resistance to grain cracking
(Das Leder 12, 65-67 [1961])
(JSLTC 44, 380-383 [1960])
- IUP/13 Measurement of two-dimensional extension (Tensometer)
(Das Leder 12, 304-306 [1961])
(JSLTC 45, 311-313 [1961])
- IUP/14 Measurement of the waterprofness of gloving leathers
(Das Leder 12, 85-86 [1961])
(JSLTC 44, 498-502 [1960])
- IUP/15 Measurement of water-vapour permeability
(Das Leder 12, 68-88 [1961])
(JSLTC 44, 502 [1960])
- IUP/16 Measurement of Strinkage temperature
(Das Leder 15, 85-87 [1964])
(JSLTC 47, 122 [1963])
- IUP/17 Determination of the resistance of air-dried insole leather to heat, particularly during direct vulcanization
(Das Leder 19, 130-131 [1968])
(JSLTC 50, 379 [1966])
- IUP/18 Determination of the resistance of air-dried lining leather to heat, particularly during direct vulcanization and in moulding on soles during shoe production
(Das Leder 20, 161-163 [1969])
(JSLTC 53, 151 [1969])
- IUP/19 Determination of the resistance of dry upper leather to heat, particularly during direct vulcanization and in moulding on soles during shoe production
(Das Leder 20, 39-41 [1969])
(JSLTC 52, 378 [1968])
- IUP/20 Measurement of the flexing endurance of light leathers and their surface finishes (dry and wet)
(Das Leder 15-20, 87+163 [1964, 1969])
(JSLTC 47, 126 [1963])
- IUP/21 Measurement of set in lasting with the dome plasticity apparatus (Plastometer)
(Das Leder 15, 294-295 [1964])
- IUP/22 The assessment of surface damage by use of the viewing box
(Das Leder 15, 295-298 [1964])
- IUP/23 The measurement of damage caused by scuff
(Das Leder 15, 298-299[1964])
- IUP/24 Measurement of surface shrinkage by immersion in hot water
(JSLTC 48, 369 [1964])

Annex III cont.

Methods of Chemical Leather Analysis (IUC)

- IUC/1 General remarks and representation of analysis results
(Das Leder 14, 95-96 [1963])
(JSLTC 49, 6 [1965])
- IUC/2 Sampling (same as IUP/2)
(Das Leder 14, 96-97 [1963])
(JSLTC 49, 6 [1965])
- IUC/3 Preparing the test material by disintegration
(Das Leder 14, 98 [1963])
(JSLTC 49, 8 [1965])
- IUC/4 Determination of substances extractable with methylene chloride
(fats and other soluble substances)
(Das Leder 14, 150 [1963])
(JSLTC 49, 10 [1965])
- IUC/5 Determination of Moisture in Leather
(Das Leder 14, 167-168 [1963])
(JSLTC 49, 11 [1965])
- IUC/6 Determination of organic and inorganic substances in leather removable by
washing (loss by washing)
(Das Leder 15, 168-169 [1963])
(JSLTC 49, 13 [1965])
- IUC/7 Determination of ash and water-insoluble mineral substances
(Das Leder 14, 169 [1963])
(JSLTC 49, 15 [1965])
- IUC/8 Determination of chromium content
(Das Leder 14, 170 [1963])
(JSLTC 49, 20 [1965])
- IUC/9 Determination of water-soluble magnesium salts in Leather (epsom salt)
(Das Leder 14, 200-201 [1963])
(JSLTC 49, 20 [1965])
- IUC/10 Determination of nitrogen and skin substance
(Das Leder 14, 201 [1963])
(JSLTC 49, 23 [1965])
- IUC/11 Determination of pH and difference value of aqueous leather extract
(Das Leder 14, 202-203 [1963])
(JSLTC 49, 25 [1965])

Supplier**German Publications :**

- **Edvard Roether Verlag**
Berliner Allee 56
D-6100 Darmstadt
FRG

II) ISO Recommendations

- ISO - 4047/77 Leather - Determination of Sulphated Ash and Sulphated water-soluble Ash
- ISO - 4044/77 Leather - Preparation of Chemical Test Samples
- ISO - 3380/75 Leather - Determination of Shrinkage Temperature
- ISO - 3379/76 Leather - Determination of Distention and Strength of Grain - Ball Burst test
- ISO - 3378/75 Leather - Determination of Resistance of Grain Cracking and of Crack Index.
- ISO - 3376/76 Leather - Determination of Tensile Strength of Elongation
- ISO - 2418/72 Leather - Laboratory Samples - Location and Identification.
- ISO - 2820/74 Leather - Raw Hides of Cattle and Horses-Methods of Trim.
- ISO - 2822/73 Leather - Raw Hides of Cattle and Horses preservation by Stack Salting.

B. UNIDO Publications :

- Acceptable quality levels for leather industry
- Information resources on leather Industry.

C. FAO Publications :

- Hides and Skins production
- Rural Tanning Techniques
- Flaying and Curing of Hides and skins as a Rural Industry.

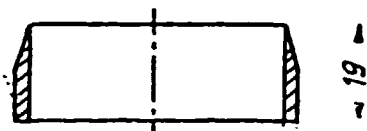
D. Books

- Official Methods of Analysis, 1965 with Ammendements J.S.L.T.C. 1-Edges Court, Moulton Northhampton NN3 IUJ, England.
- Tancous, J.J., W.T. Roddy and F. O'Flaherty. Skins, Hides and Leather Deffects., 1959. Cincinnati, Ohio, western Hills Publishing Co., U.S.A.
- The Chemistry and Technology of Leather Fred O Flaherty, William T. Roddy, Robert M. Lollar.
 Volume 3 : Process Control of Leather Quality, 1961
 Volume 4: Evaluation of Leather, 1965
 Reinhold Publishing Co.
 330 West Forty - Second Street, New York, USA.
- Proctical Leather Technology
 T.C. Thorstenson, 1976
 Van Nostrand Rinhold, Publishing Co.
 New York. U.S.A.
- Pocket Book of Leather Technologists BASF - Ludwigshafen and Rhein, FRG.
- International Glossary of Leather Terms (International Council of Tanners), 1975
 C. Legget & Son, Ltd.
 Mitcham, Surrey CRA 4HY, England

**Hand-resp. machine punching dies (press knives)
for cutting leather samples acc. to DIN and IUP test methods**

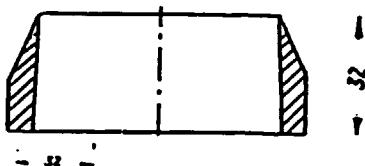
deliverable in 3 types

type 1



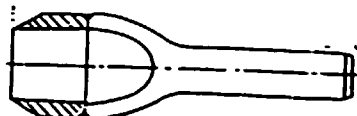
machine punching dies
hocrp steel - 19x2 mm

type 2



machine punching dies
32 mm high

type 3



hand punching dies

TEST METHOD

TEST DEVICE

LEATHER SAMPLE

ORDER NO.

I.U.P. 5

DIN 53327

for determination
of bulk density

∅ 70 mm

28801

I.U.P. 6

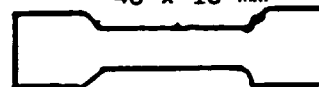
DIN 53328

tensile strength
and extension

strength tester
FPG 7/10-L

STD 172

190 x 40 mm
90 x 20 mm
40 x 10 mm



100 x 13 mm



28805

28806

28807

28810

I.U.P. 7

DIN 53330

water absorption after
Kubelka - Nemeč

device for determination
of water absorption
32603

∅ 70 mm

28815

I.U.P. 8

DIN 53329

(tear strength)

+
DIN 53331

(stitch tear resistance)

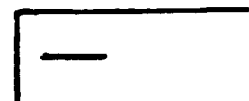
FPG 7/10-L

50 x 25 mm


28820



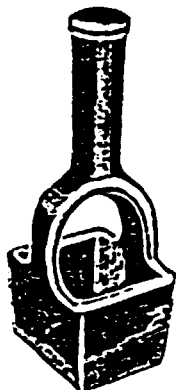
100 x 20 mm



28821

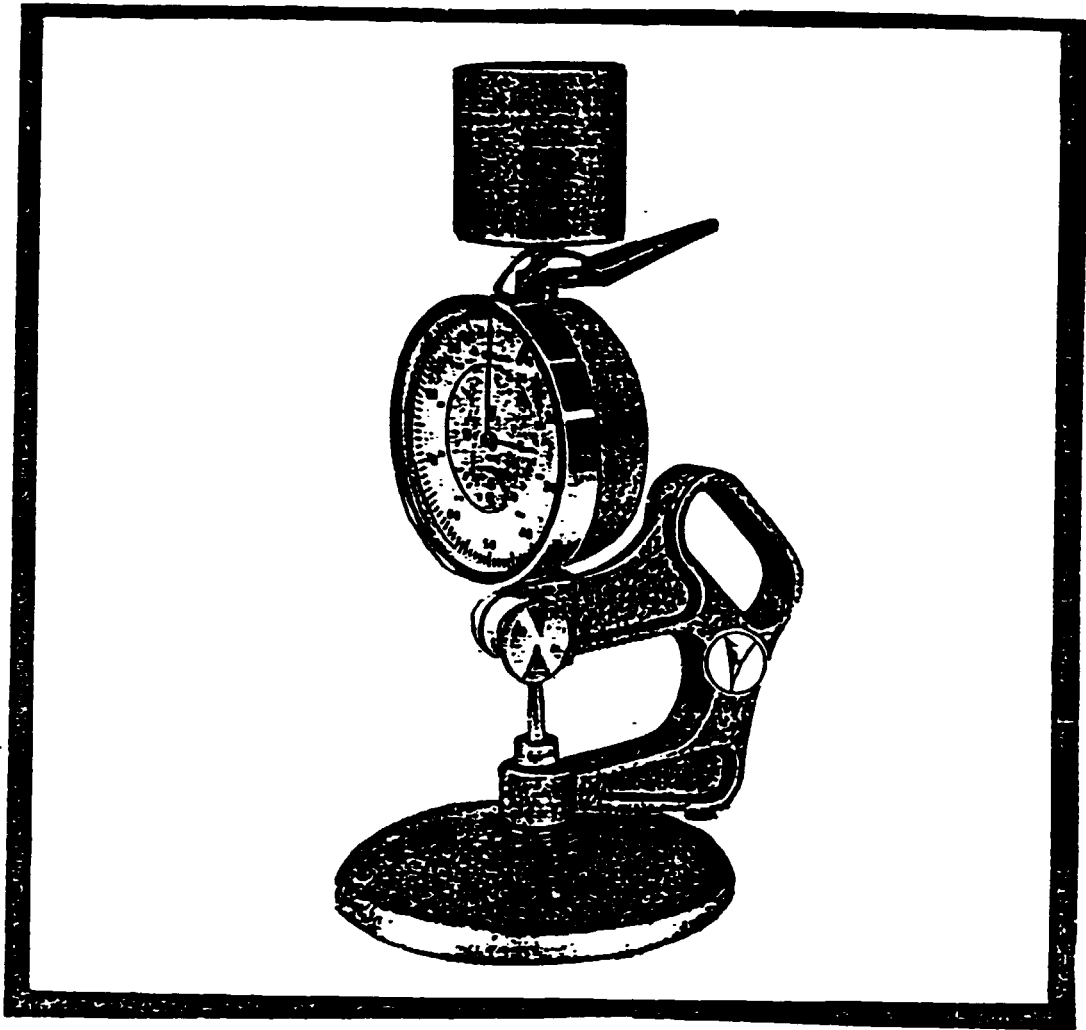
<u>TEST METHOD</u>	<u>TEST DEVICE</u>	<u>LEATHER SAMPLE</u>	<u>ORDER NO.</u>
I.U.P. 9 DIN 53325 (grain extensibility + tensile strength)	Lastometer STD 104	44,5 mm \emptyset 	28825
I.U.P. 10 DIN 53338 T 1 (water absorption + permeability)	Bally Penetrometer	75 x 60 mm	28830
I.U.P. 11 DIN 53338 T 2 (water absorption + permeability of sole leather)	Bally Permeometer	100 x 40 mm	28835
I.U.P. 12 DIN 53324 mandrel bending test	test device for determining resistance of bottom leather to grain crack STD 132	150 x 25 mm	28840
I.U.P. 13 DIN 53323 measurement of the two-dimensional elongation	Bally Tensometer	63 mm \emptyset	28845
I.U.P. 15 DIN 53333 water vapour permeability	test device for water vapour permeability	34 mm \emptyset	28850
I.U.P. 16 DIN 53336 shrinkage temperature	device for determination of shrinkage temperature No. 32604	50 x 3 mm 50 x 2 mm	28855 28856
I. U. P. 20 DIN 53351 flexing fatigue	Bally Flexometer	70 x 45 mm	28860

<u>TEST METHOD</u>	<u>TEST DEVICE</u>	<u>LEATHER SAMPLE</u>	<u>ORDER NO.</u>
Veslic C 4500 Test of rubbing, buffing and fastness to hot pressing	FEK-VESLIC rub fastness tester	120 x 30 mm 120 x 50 mm 120 x 70 mm	28865 28866 28867
I U F 470 E (araldite adhesive on metal plates)	Adhesion of Finish Tester	100 x 15 mm	28870
I U F 470 E - 8.89 (polyuretane adhesive on plastic plates)	Adhesion of Finish Tester	100 x 10 mm	28871



Punching knives

deliverable in any size
and shape according to
your measurement indications
or your drawing

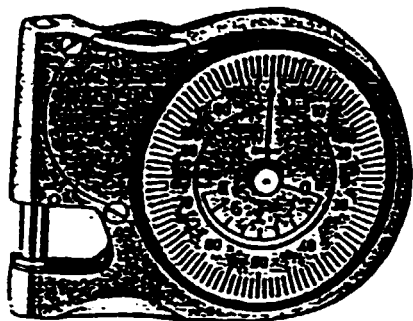
LEATHER THICKNESS GAUGE

Thickness gauge model PL 60

Measuring range 10 mm, depth of bow 60 mm
anvil 10 mm dia., measuring pressure 500 p/cm²
for determination of the thickness of leather
according to TGL and DIN 53326 Standard

No. 30380

SMALL THICKNESS MEASURING GAUGES - POCKET TYPE



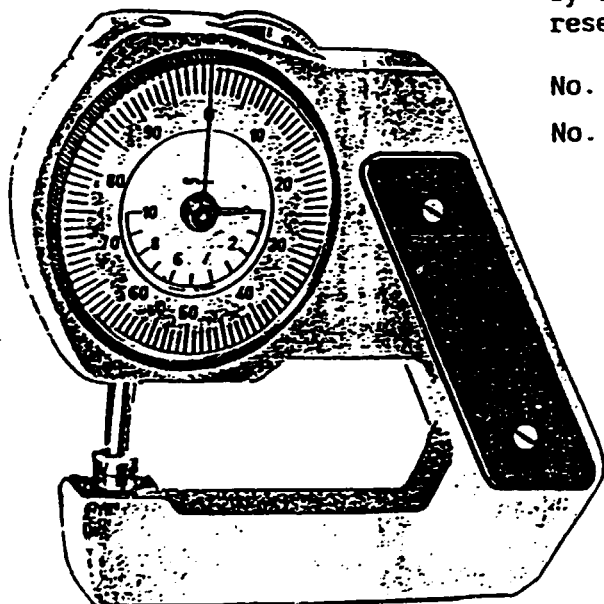
Thickness gauge J 12
 scale dia. 40 mm, 0,01 mm calibration,
 measuring range 8 mm, frame depth 12 mm,
 by turning knurling wheel anvil rod is lifted,
 resetting to " zero " by turning the outer ring

No. 300 02

Thickness gauge K 45
 scale dia. 45 mm, 0,1 mm calibration,
 measuring range 10 mm, frame depth 45 mm
 by turning knurling wheel anvil rod is lifted,
 resetting to " zero " by turning the outer ring

No. 300 04 10 mm flat anvil

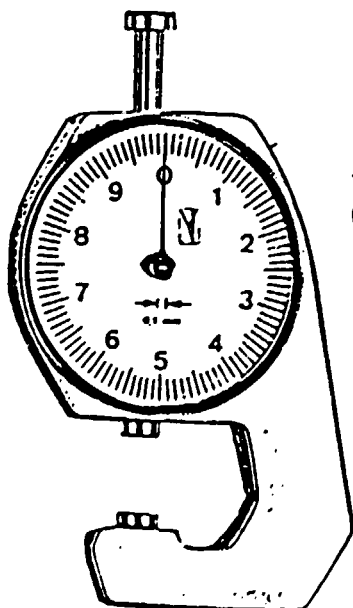
No. 300 05 round anvil



Thickness gauge J 45
 scale dia. 45 mm, 0,01 mm calibration,
 measuring range 10 mm, frame depth 45mm,
 by turning knurling wheel anvil
 rod is lifted, resetting to " zero " by
 turning the outer ring

No. 300 20 10 mm flat anvil

No. 300 21 round anvil



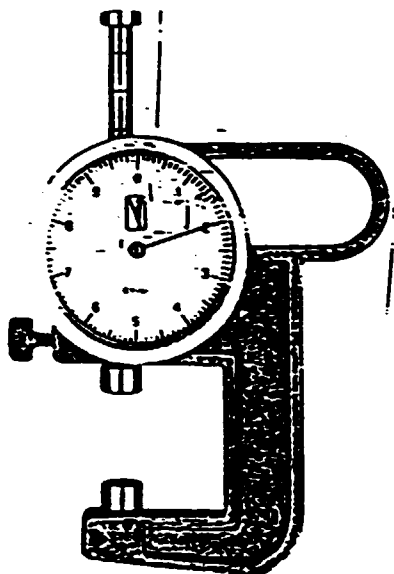
Thickness gauge K 15
 0,1 mm calibration, 10 mm measuring range,
 15 mm frame depth,
 resetting to " zero " by turning the outer ring.

No. 300 10 10 mm flat anvil

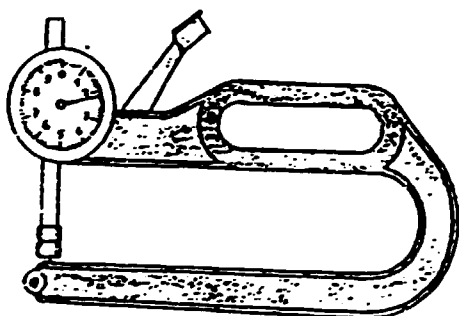
No. 300 12 round anvil

LIST Leather thickness gauges "Tico"

simple sturdy type, developed particularly for the use in the leather manufacturing industry



No. 301 10 25 mm depth of bow
 30 mm measuring range
 10 mm flat anvil

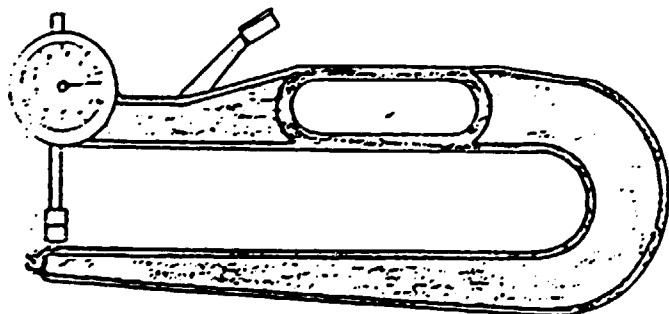


No. 301 20 200 mm depth of bow
 30 mm measuring range
 10 mm flat anvil

No. 301 21 dto. round anvil (ball)

No. 301 30 300 mm depth of bow
 30 mm measuring range
 10 mm flat anvil

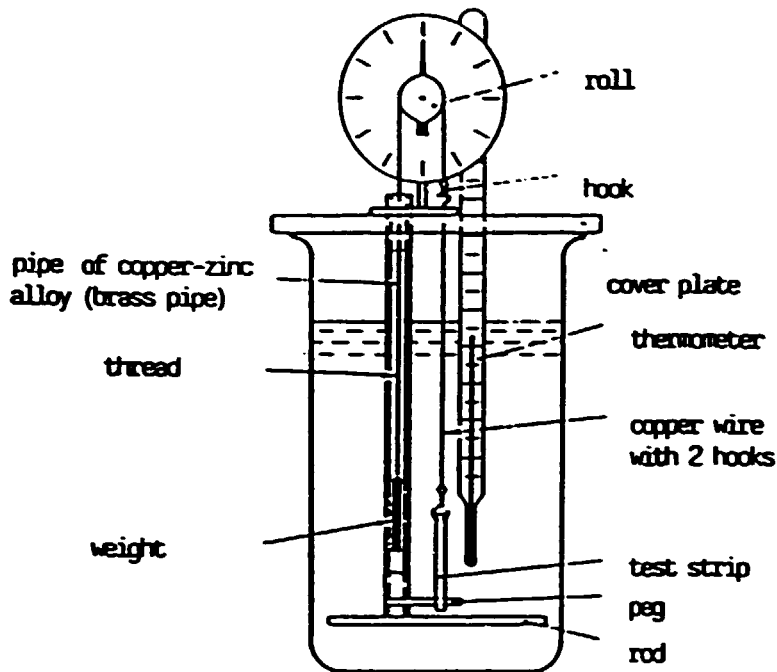
No. 301 31 dto. round anvil (ball)



No. 301 40 450 mm depth of bow
 30 mm measuring range
 10 mm flat anvil

No. 301 41 dto. round anvil (ball)

Prices: ex works without packing.



No. 32604 DEVICE FOR DETERMINATION OF SHRINKAGE TEMPERATURE
after DIN 53 336

Testing method:

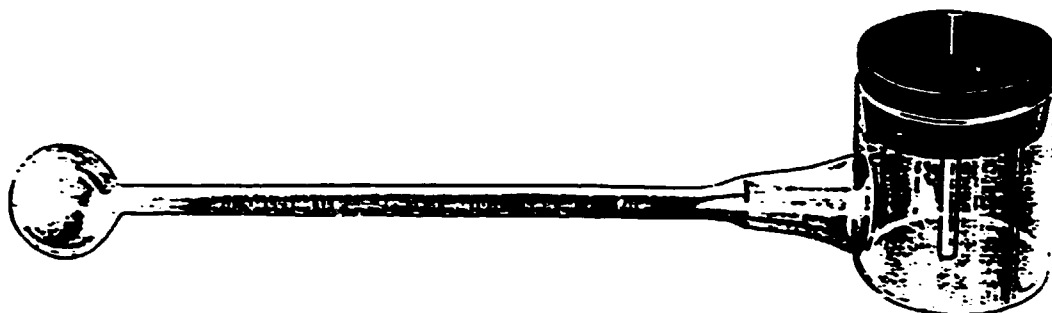
This device can be used for all kinds of leather where the shrinkage temperature is below 100° C.

The glass bowl is filled with distilled water, so that the test sample is completely immersed. Subsequently the water is slowly heated by means of a magnetic stirrer with a heating device.

The contracting hide or leather strip transmits its motion to an indication system which is sensitive to tension. The temperature when the pointer starts to move is to be read.

Static determination of water absorption by
leather wetted by complete immersion

=====



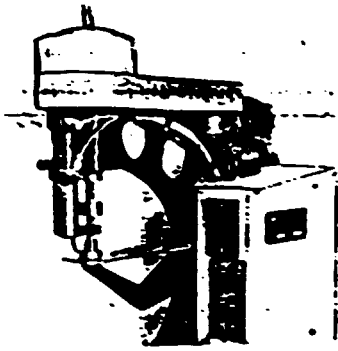
"71. 000"
abt. 1/2 actual size

No. 32603 Device designed for the volumetric determination of water absorption by leather according to DIN 53 330 and Kubelka/Némec

Principle of use:

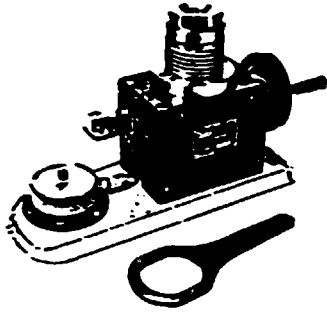
Volumetric determination according to DIN Sheet 53 330 suitable for all types of leather.

Punch out a circular leather disc having a diameter of 7 cm, weigh it to 0.1 g accuracy and place it into the flask of the apparatus specified by Kubelka/Némec (see above figure) after the apparatus had been filled with distilled water in the vertical position (small round flask downwards) up to the zero mark on the scale. Close the flask with a rubber stopper and fill it with water by tilting the apparatus so that the leather disc will become completely wet and remain immersed. Return the apparatus to the vertical position after 2 and 24 hours and read the water level in the graduated neck of the flask after 10 minutes. First determine by way of calibration the amount of water remaining on the flask walls, which is also taken into account when making the actual measurement. It will not exceed 0. ml provided the apparatus is cleaned properly (see also pocket book on tanning chemistry by Prof. Dr. A. Küntzel, page 290).

S A T H A - TESTING DEVICES

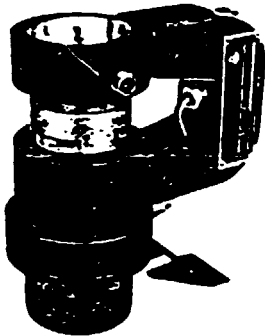
STM 103
AUTOMATIC FINISH RUB
FASTNESS TESTER

for determination of dry/wet rub
 fastness, with pre-set counter
 Nr. 32621



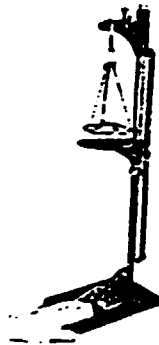
STD 104 LASTOMETER

for measurements as per DIN 53 325,
 IUP 9, ISO 3379.
 " Ball Burst Test" - crack - extensibility
 Nr. 32625



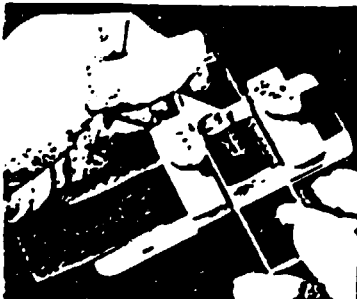
STD 190 LASTOMETER

to check tendency to crack on lasting
 Nr. 32628



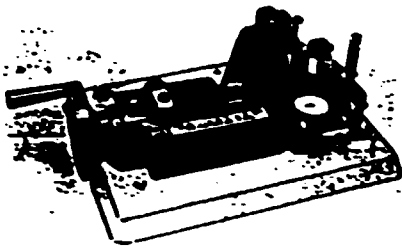
STD 112 ADHESION OF FINISH TESTER

measures the strength of finish adhesion
 on leather
 Nr. 32630



STD 119 WRINKLEOMETER

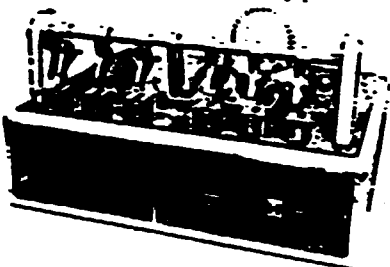
to check tendency to form wrinkles
 or pleats
 Nr. 32634



STM 172 SIMPLE TENSILE TESTER

hand operated instrument which can measure the strength and stretch and tear strength up to a breaking load of 75 kg

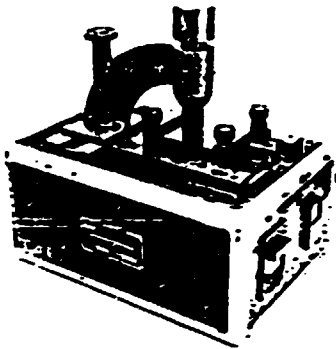
Nr. 32601



STM 408 FLEXING MACHINE

with 6 test stations, provides the flexing conditions required by method DIN 53 340, IUP 20

Nr. 32640



STM 421 RUB FASTNESS TESTER

determines the effect of dry and wet rubbing on the finish of upper leather per DIN 53339, IUF 450

Nr. 32644

Accessories as punches for specimens, felts, grey scales, adhesives

- please demand special list

BALLY

BALLY SCHUHFABRIKEN AG

BALLY Leather Testing Apparatus

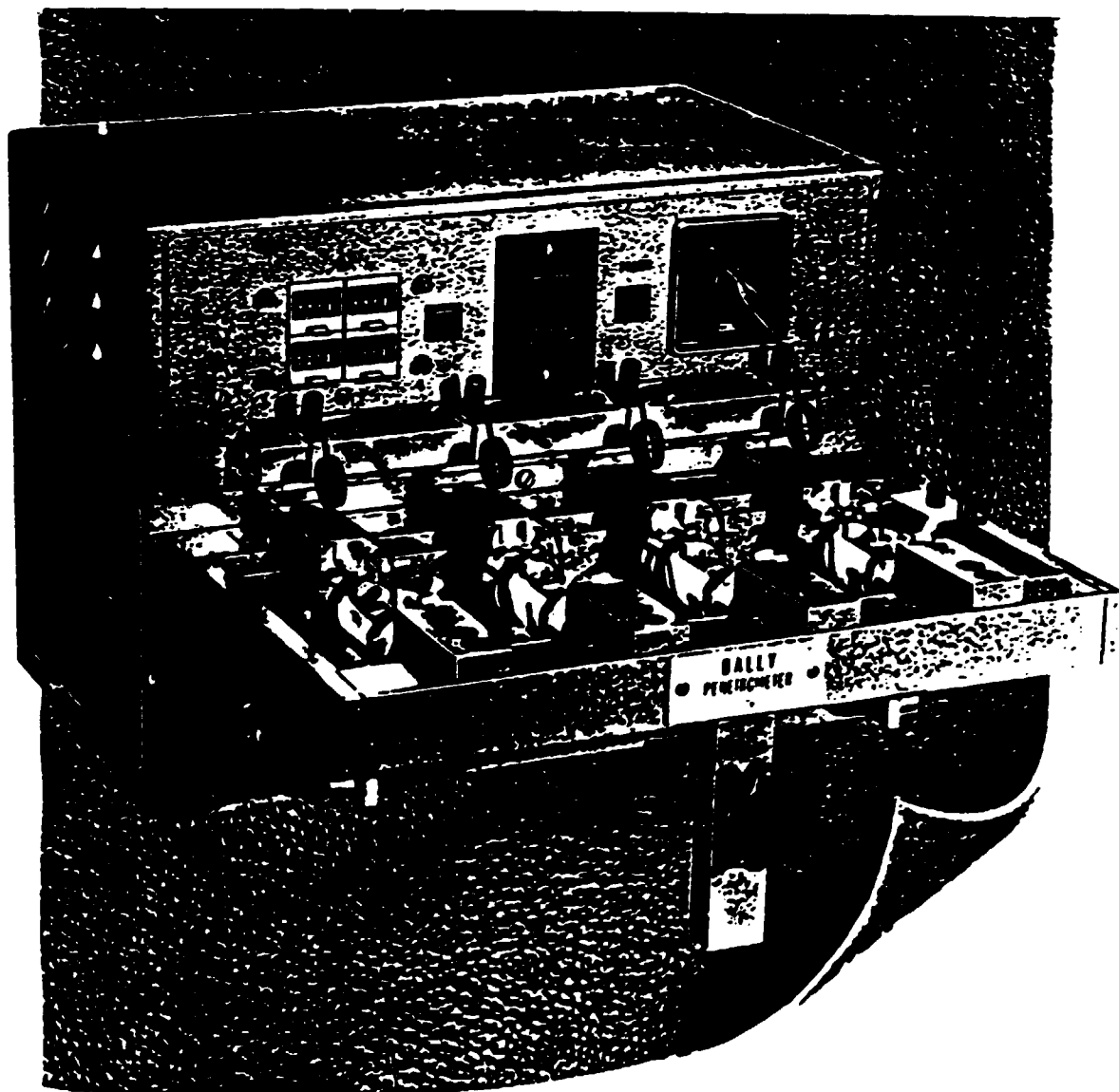
Bally leather testing apparatus have been declared official and been standardised by the International Union of the Societies of Leather Chemists under the denomination I.U.P./10...20. They also are suitable for testing a great variety of plastic foils and artificial leathers.

BALLY Leder-Prüfgeräte

Bally Lederprüfgeräte sind von der Internationalen Union der Leder-Chemiker-Verbände unter der Bezeichnung I.U.P./10...20 genannt und als offiziell erklärt worden. Die Geräte eignen sich auch zur Prüfung zahlreicher Kunststoff-Folien und Kunstleder.

Appareils BALLY pour tester les cuirs

Les appareils Bally pour tester les cuirs sont normalisés sous la désignation I.U.P./10...20 par l'union internationale des Associations des chimistes en cuir, et reconnus officiellement. Ces appareils conviennent également pour examiner de nombreuses feuilles de matières synthétiques et cuirs artificiels.



Bally Stiffness Meter

for the determination of the stiffness of leather samples (auxiliary apparatus for the Bally Penetrometer).

Maximum measuring force
12 kp

Most leathers absorb water very slowly if they are not submitted to a bucking motion. With most leathers, the water penetration can be accelerated substantially by increasing the amplitude of the bucking motion. Experience shows that when all leathers are bucked in the same way the impermeability of thick leathers is underrated in comparison with their behaviour in actual wear and overrated in the case of thin leathers.

On principle, the relation between the applied pressure and the degree of compression changes with the leather.

As the test report has to mention the degree of compression of the test piece (length reduction by 5, 7.5, 10 or 15%) with which the impermeability test has been carried out, it is indispensable to find out before each test, by means of the Stiffness Meter, the appropriate compression amplitude for the considered leather.

Bally Steifheitsmesser

zur Bestimmung des Steifheitsgrades (Zusatzgerät zu Bally Penetrometer).

Maximale Messkraft 12 kp

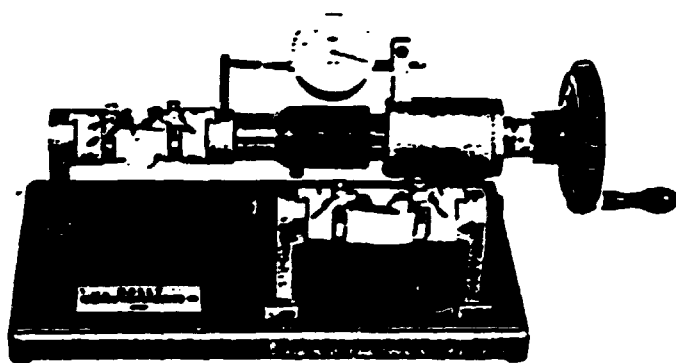
Die meisten Oberleder würden ohne Knickbewegung nur sehr langsam Wasser aufnehmen. Die Geschwindigkeit des Durchdringens von Wasser wurde bei den meisten Ledern durch Intensivierung des Knickens, zum Beispiel durch Vergrößerung der Amplitude der Hebelbewegung, erheblich beschleunigt. Die Erfahrung zeigt, dass – wenn alle Oberleder in gleicher Weise gestaucht werden – die Wasserdichtigkeit dicker Leder gegenüber dem Verhalten beim Tragen unterbewertet und die von dünnen Ledern überbewertet wird. Es gilt der Grundsatz, dass die Beziehung zwischen angewandtem Stauchdruck und dem Grad des Zusammendrückens für verschiedene Leder unterschiedlich ist. Da im Untersuchungsbericht bei der Wasserdichtigkeitsprüfung für jeden Probekörper der angewendete Grad der Stauchung (Abstandsverringerung um 5, 7,5, 10 oder 15%) angegeben werden muss, ist es unerlässlich, dass vor jeder durchzuführenden Prüfung zuerst mit dem Steifheitsmesser die geeignetste Stauchungsamplitude für das entsprechende Leder bestimmt wird.

Appareils Bally pour la mesure de la rigidité

pour déterminer le degré de rigidité (appareil complémentaire au Bally Penetromètre)

Force de mesure max. 12 kp

Sans mouvement de pliage, la plupart des cuirs pour tiges n'absorberait l'eau que très lentement. Pour la plupart des cuirs, la rapidité de la pénétration de l'eau est sensiblement accélérée par l'intensification du pliage, par exemple par l'agrandissement de l'amplitude du mouvement de levier. L'expérience prouve que si tous les cuirs pour tiges sont refoulés de la même manière, l'imperméabilité des cuirs épais est sous-évaluée par rapport à leur comportement lors du port des chaussures, alors que celle des cuirs minces est sur-évaluée. Il existe un principe selon lequel le rapport entre la pression de refoulement appliquée et le degré de la compression varie d'un cuir à l'autre. Etant donné que dans le rapport d'analyse du test d'imperméabilité à l'eau, il faut indiquer pour chaque échantillon le degré de refoulement appliqué (réduction de la distance de 5, 7,5, 10 ou 15%), il est indispensable, avant chaque essai, de déterminer tout d'abord, au moyen de l'appareil à mesurer la rigidité, l'amplitude de refoulement la mieux appropriée pour le cuir à tester.



BALLY

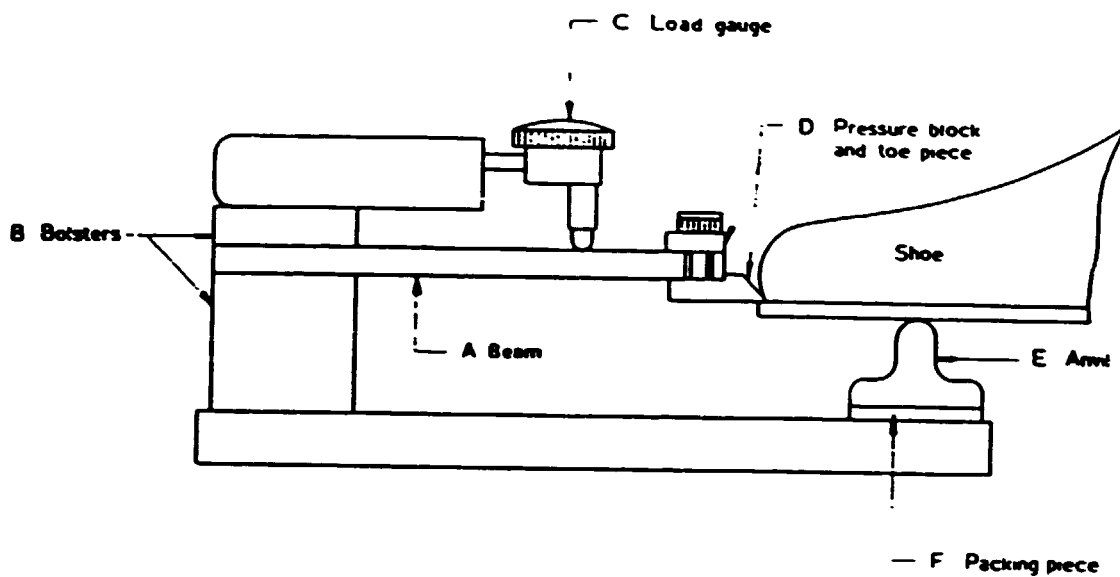


Figure 5.1/1. Diagram of the apparatus set up for toe adhesion testing (see clause 4 for key to lettering)

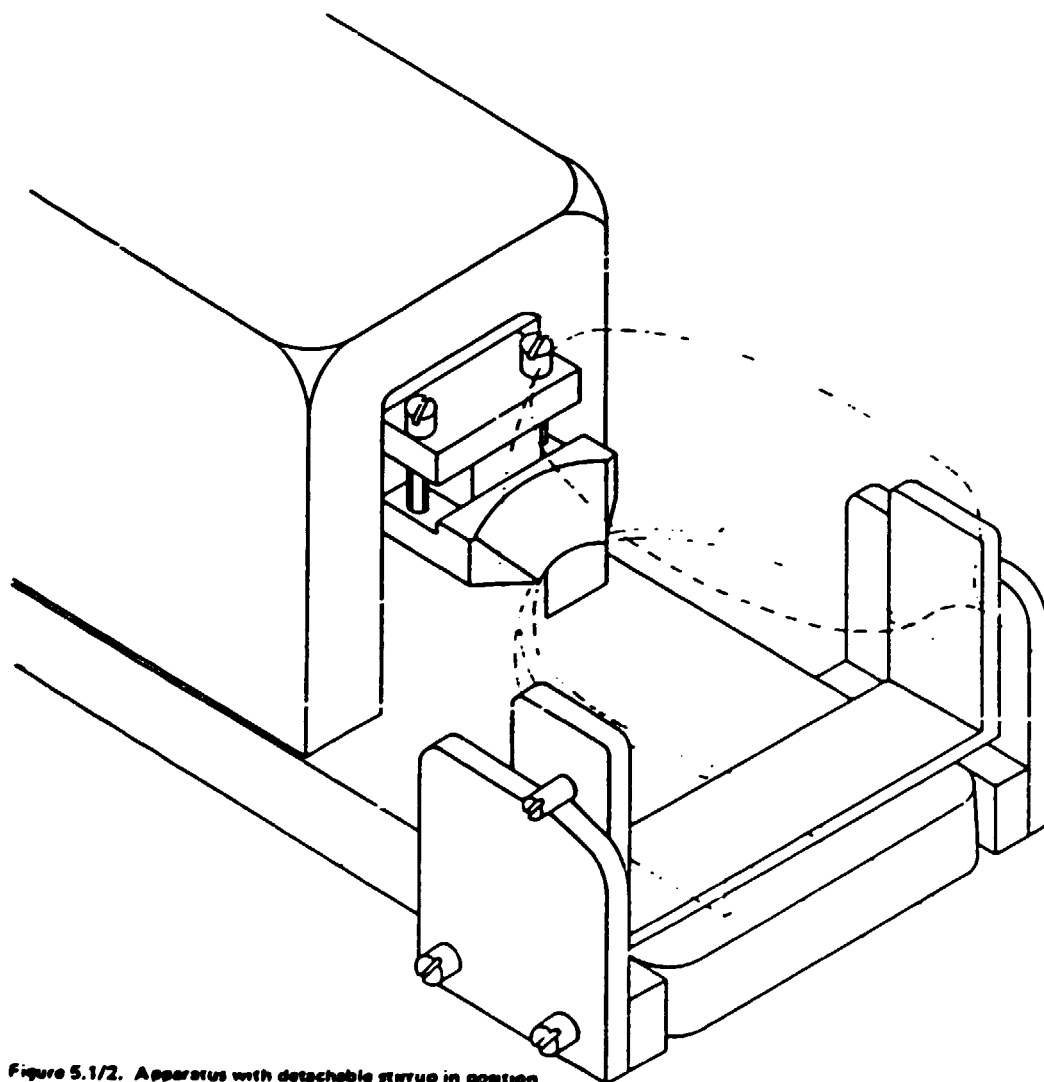


Figure 5.1/2. Apparatus with detachable stirrup in position

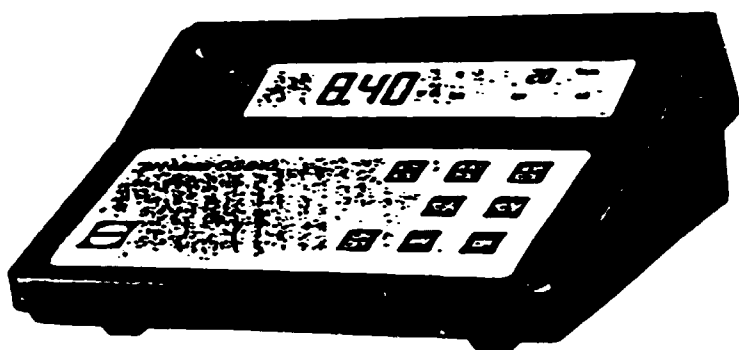
Accessories:

plastic-covered pH combination electrode N 2037 A with integrated temperature sensor for meter CG 838

pH combination electrode type N 42 A with cable and plug for meter 818/42 A

pH combination electrode type N 39 A for measurements on leather surface, can be used for all meters

Shoulder-bag with triple belt Z 381 for meter 818/42

**NEW**

DIGITAL PH-METER
CG 840/2042

Laboratory pH meter of modern design. Easy to operate.

Important characteristics: - LCD measuring value display
- simultaneous temperature display
- manual and automatic temperature compensation
- automatic pH calibration
- printer output

Price for complete equipment
with pH combination electrode N 2042 A

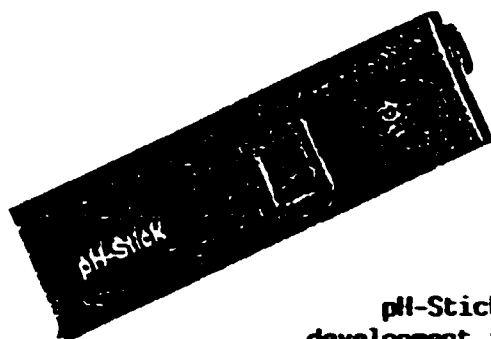
Accessories:

pH combination electrode N 2042 A with cable and plug
stand type Z 351

electrode holder with double-chamber for 3 electrodes type Z 331

buffer/electrolyte-set type L 4893 in ampoules/plastic bottles

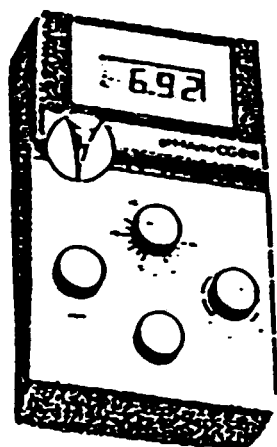
2
LIST
PH - METER



pH-Stick, latest technological development for determination of the pH-value, digital display. Is already used in many tanneries.

Technical data:

measuring range: 0 - 14 pH
readout: 0,1 pH
accuracy: + / - 0,2 pH
working temperature: 0... + 50°C
battery life: 1000 hours

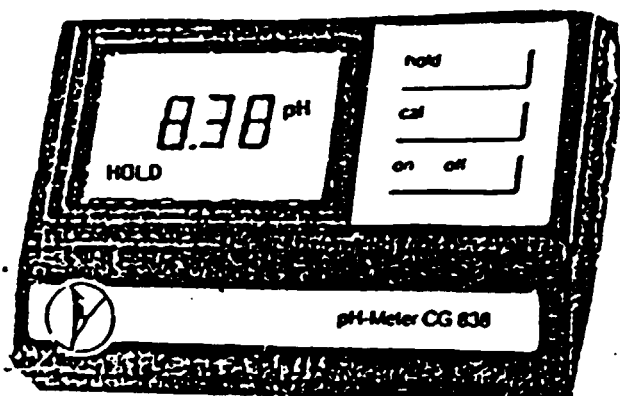


Digital Pocket pH Meter

CG 818/42

with LCD-display, combination electrode type N 42 A, ready to use buffer solutions, potassium chloride solution, plastic beakers, 1 battery 9 V.

Price for complete equipment with transport case



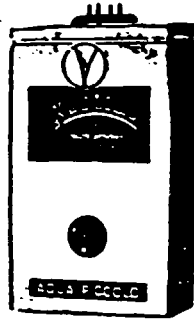
Digital Pocket pH meter

CG 838/2037

with LCD-display, plastic-covered pH combination electrode H 2037 A, with integrated temperature sensor PT 1000, 2 ready to use buffer solutions, 50 ml potassium chloride solution, 4 plastic beakers, container for the electrode, carrying strap, 4 x 1,5 V batteries.

Price for complete equipment with transport case

Further advantages: - automatic single-point or two-point calibration possible;
- high measuring accuracy ;
- operating time apprix. 6 000 hours ;
- correct temperature compensation reading.



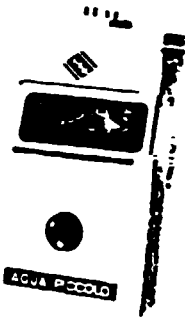
" Aqua - Piccolo "
leather moisture meter

measuring range 6 - 30%
single-knob operation, battery operated
with automatic change-battery signal.
Built-in needle electrode with protective
cover.

Dimensions: 12 x 7 x 3 cm, weight: 220 g

No. 32810

leather case for Aqua - Piccolo



" Aqua - Piccolo ", with digital display
measuring range 8 - 40%

No. 32820

LABORATORY METER

Portable meter for continuous measurements.

This device has three switch-selected overlapping measuring ranges permitting all moisture percentages encountered in practical use to be measured. This gives a total measuring range from 2 - 60%.

Dimensions: 30 x 24 x 20 cm

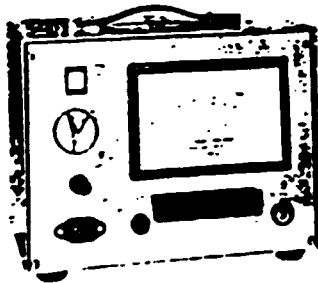
No. 32850 LGN - operated by mains power

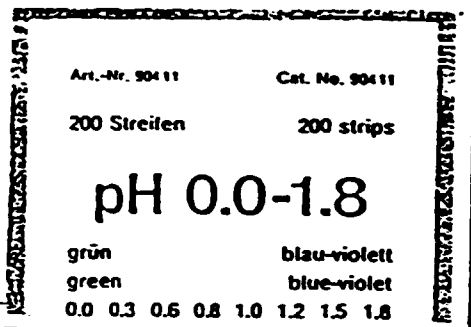
No. 32851 LGB - operated by storage battery

All the electrodes and accessories shown on the reverse are suitable for use with the Aqua Boy and the Laboratory Moisture Meter.

Prices: ex works without packing

Delivery : approx. 1 - 2 weeks



PHANON INDICATOR PAPERIN BOXES OF 200 PIECES

<u>Measuring range</u>											<u>Art.-Nr.</u>
0,0	0,3	0,6	0,8	1,0	1,2	1,5	1,8				904 11
1,0	1,3	1,6	1,8	2,0	2,2	2,5	2,8				904 12
1,8	2,1	2,4	2,7	3,0	3,2	3,5	3,8				904 13
2,8	3,1	3,4	3,6	3,8	4,0	4,3	4,6				904 14
3,8	4,0	4,2	4,4	4,6	4,9	5,2	5,5				904 15
4,0	4,5	5,0	5,5	6,0	6,5	7,0	7,5	8,0	8,5	9,0	904 24
5,2	5,5	5,7	5,9	6,1	6,3	6,5	6,8				904 16
6,0	6,3	6,6	6,9	7,2	7,5	7,8	8,1				904 17
7,2	7,4	7,6	7,8	8,0	8,2	8,5	8,8				904 19
8,0	8,2	8,4	8,6	8,8	9,1	9,4	9,7				904 20
9,5	10,0	10,5	11,0	11,5	12,0						904 21
10,5	11,0	11,5	12,0	12,5	13,00						904 22
12,0	12,5	13,0	13,5	14,0							904 23