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LEATHER TECHNOLOGY CENTRE

DP/CPR/83/004

PEOPLE'S REPUBLIC OF CHINA

Technical report: Demonstrations of modern leather processing techniques

Prepared for the Government of the People's Republic of China
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Mr. H. K. Waeldin, expert in leather tanning

United Nations Industrial Development Organization

Vienna

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Explanatory notes

Besides the common abbreviations, symbols and terms, the following have been used in this report:

NPD	National project director
SIDFA	Senior industrial development field adviser
SLC	Shanghai Leather Corporation
SLRI	Shanghai Leather Research Institute

Mention of the names of firms and commercial products does not imply endorsement by the United Nations Industrial Development Organization (UNIDO).

ABSTRACT

Under the on-going project "Leather Technology Centre" (DP/CPR/83/004), for which the United Nations Industrial Development Organization (UNIDO) is the executing agency for the United Nations Development Programme (UNDP), an expert in leather tanning was fielded for a mission of six weeks, starting on 8 June 1985.

He was assigned to the Shanghai Leather Research Institute, a well-established leather technology centre with a pilot plant for demonstrations, training and the development of leather-processing methods at a semi-industrial level. The objectives of his mission were: (a) to assess the tanning methods employed in tanneries in the Shanghai area and to suggest improvements; (b) to demonstrate in the pilot plant modern processing methods for goatskins, wet-blue sides, light calf and cow hides of Chinese origin; and (c) to prepare modified formulae adapted to local conditions and available auxiliary materials.

Following visits to several tanneries, the expert proceeded with the demonstrations at the pilot plant which were attended by the Institute's staff and visitors from other tanneries. The results of those experiments and demonstrations were mostly very satisfactory and the expert left a set of documents on the various processes with the national project director for further use.

The report contains specific recommendations to the tanneries in the Shanghai area as well as to the Institute, aiming at increasing the efficiency of the existing tanning methods and processes.

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INTRODUCTION

Under the on-going project "Leather Technology Centre" (DP/CPR/83/004), for which the United Nations Industrial Development Organization (UNIDO) is the executing agency for the United Nations Development Programme (UNDP), an expert in leather tanning was fielded for a mission of six weeks, starting on 8 June 1985.

The expert was attached to the Ministry of Light Industry through the Shanghai Leather Corporation (SLC) and worked in close co-operation with the national project director (NPD) at the Shanghai Leather Research Institute (SLRI). The national staff and the expert's counterpart are given in annex I. SLRI is a well-established leather technology centre with a pilot plant for demonstrations, training and the development of leather processing methods at a semi-industrial level.

According to his job description (annex II), the expert was expected to concentrate his activities on:

(a) The assessment of existing tanning methods based on information gathered during visits to tanneries in the Shanghai area, and the identification of processes which could be substantially improved;

(b) The demonstration of modern leather processing methods, especially in retanning, dyeing, fatliquoring and finishing of goatskins and cowsides for various articles;

(c) The preparation of modified formulae taking into consideration local conditions as well as the experiences gained during the demonstrations performed with the available auxiliary materials.

To meet the objectives of his mission, arrangements were made during the preparatory stage of the project for the supply of samples of selected basic products and auxiliary materials by manufacturers in the Federal Republic of Germany and Switzerland to SLRI.

Before being fielded, the expert had an opportunity to meet the NPD at UNIDO headquarters on 28 May 1985 and was informed on that occasion that he should visit only a few tanneries and concentrate on practical work and demonstrations at the SLRI pilot plant. The NPD mentioned as the main tasks of the expert: processing of goat upper leather with plated finish; softy sides with modern finish from wet-blue of Chinese origin and imported from the United States of America; and the processing of calf and light hides of Chinese origin.

When the expert arrived at Shanghai, the counterparts had already arranged visits to tanneries of the Shanghai Leather Corporation, producing pig skins, goatskins and side upper leather from wet-blue hides. Following this, activities at SLRI and the pilot plant could start on 11 June 1985. A comprehensive programme was prepared in co-operation with the NDP with the aim to meet all objectives of the mission within the time available.

During the following weeks practical work or demonstrations were conducted every day. The staff of the pilot plant was instructed and trained on wet-process methods, machine operations and finishing. SLRI had invited visitors from a number of tanneries throughout the country (listed in annex III) to attend those activities, and they observed the demonstrations of modern leather processing with great interest. Their involvement and understanding could be

deepened thanks to an intensive preparation of all processes and operations and by explaining the purposes and objectives in advance. The visitors could then from time to time participate in the execution of the processing in guided small groups.

It was possible to process all raw material available at SLRI to crust state, and the most important samples and products from goatskins and sides were finished by applying appropriate methods. Only some skins and sides had to be left to the staff to finish, due to a delay in the delivery of certain chemicals required.

The expert prepared a documentation containing all formulae and recipes used during the practical work and demonstrations at the pilot plant, and that complete file was left with the NPD. He also had some in-depth discussions with the NPD on all important aspects of his mission, during which his views based on his experience at SLRI were sought.

The documentation constitutes a reliable base for a reproduction of the processes demonstrated as well as for further developments, and can also be used as information material for visitors, depending on the production programme and needs of their tanneries.

In the expert's opinion, the main objectives of his mission have been fully met.

On 10 July 1985 a meeting was held with the UNDP resident representative who happened to visit SLRI, and the expert informed him about the progress of his mission. Consequently the expert did not travel to Beijing at the end of his mission, but returned from Shanghai directly to Europe.

RECOMMENDATIONS

A. To tanneries in the Shanghai area

1. Larger drums should be provided for the lime yard, the tanning section and partly for the dyeing section to enable processing of bigger lots with greater uniformity. The use of mixers could then be confined to those steps of process where optimum results are secured.

2. Raw materials should be properly conserved, inspected and carefully graded into uniform production lots.

3. Useless parts of skins and hides should be trimmed-off already in the raw (wet-salted) stage.

4. Sammying should be introduced before splitting in chrome state and shaving, instead of saw-dusting the material in drums or piles. The shaving dust should be kept clean so that it can be put to further use.

5. Chrome-tanned hides and skins should be trimmed again before further processing.

6. All standard operations after dyeing and retannage should be carried out; a combined sammying-setting machine should be used, even when followed by vacuum drying.

7. No excess temperature should be applied (i.e. over 70-75°C) in the vacuum dryer; the material should be air-dried (in a chamber, tunnel etc.) before proceeding with further operations.

8. Adequate conditioning before staking should be introduced such as saw-dusting; after staking the moisture content should be reduced to 12-14 per cent by airing-off and, depending on the type of the material processed and the type of the article to be produced, the material should be toggled.

9. All soft leather should be toggled to obtain the best yield and to prevent it from becoming too stretchy.

10. The quality of finishing systems should be improved by drum-dyeing or applying an aniline base by spray or pad; by plating or machine-ironing base coats; by not applying too heavy and too wet spray coats; and by drying the finish applications at standard temperatures (e.g. 50-60°C).

11. Regular process controls should be established as well as checks of product properties.

12. Based on the results of experiments and demonstrations, conventional recipes and formulae should be revised in order to make best use of the raw and auxiliary materials.

13. Ways to save energy, to reduce the water consumption and to improve waste-water situation, and to make best use of by-products (fleshings, trimmings, fat, hair, splits, shaving dust etc.) should be studied.

B. To the Shanghai Leather Research Institute

1. To increase the efficiency and output of the pilot plant, the existing equipment and installations should be partly adopted, partly supplemented by new machines, depending on future objectives and the creation of model production sections. Specific recommendations are given below.

2. Of the wet-process installations the following need improvement: the inner outfit and cleansing device of the wooden drum (1,100 x 800 mm) and the switches and heating system of the Dose VG steel drums.

3. The possibility of controlling the quantity and temperature of the water supply for the wet departments should be investigated and the warm water preparation improved.

4. The following points concerning machinery for operations in the wet state should be considered:

(a) The Mercier sammying machine is suitable only for small chrome-tanned skins and splits, and should not be used for skins after dyeing or retannage;

(b) Regular maintenance of the knife cylinder of the Moenus-Turner shaving machine is indispensable to overcome existing shaving problems; at present small and thin skins cannot be shaved properly;

(c) The Mercier setting-out machine is not suitable for small skins. Proper setting-out can be carried out only on sammyed material.

5. The above-mentioned machinery for operations in the wet state should be supplemented by the following equipment:

(a) A fleshing machine (about 1,200 mm) for experiments on skins; at present such work is carried out in nearby tanneries;

(b) A splitting machine; at present splitting is done in other tanneries. At a later stage this type of equipment will be required for splitting work in lime, based on which a full range of experiments on chrome tannage could be carried out;

(c) A sammying machine (about 1,800 mm), preferably a combined type with one felt roller, which can be used for sammying heavier chrome-tanned material as well as for retanned or dyed sides and larger skins before the proper setting-out operation;

(d) A shaving machine for small skins;

(e) A setting-out machine for small skins is urgently needed. A combined sammying-setting-out reversible machine would be the best solution.

6. Due regard should be given to the proper drying and conditioning of hides and skins. A better arrangement of the machinery and equipment, now installed in different places of the pilot plant, is strongly recommended, preferably the creation of a separate section which would serve as a model for other tanneries. Concerning the existing machinery, the following points should be observed:

(a) The vacuum drier is suitable for small skins. Vacuum drying should be introduced for the processing of certain articles from goatskins and for the processing of splits;

(b) The drying unit "Forni Varese" should not be shared by the wet department and the finishing section;

(c) For conditioning (moisturing of material), which is becoming increasingly important, proper facilities should be provided (saw-dusting, machine-moisturing and damp chamber);

(d) The Cartigliano staking machine should be used mainly for large skins and sides, as it is not suitable for small and stretchy material;

(e) The Slocomb-type staking machine should be reconditioned and activated;

(f) The toggling installation has not yet been connected to the current and steam supply. This should be done without further delay.

7. The following observations concerning machinery and equipment of the finishing section should be taken into consideration:

(a) The buffing machine (200/250 mm) should be reactivated and generally used in the future;

(b) The polishing machine "Aletti/Ficini" works at present with the felt polishing cylinder. Since a stone polishing cylinder is available, it would be preferable to use that cylinder because it is more effective;

(c) The compressed-air supply of the hand spray unit should be improved and a pressure regulation valve urgently fitted;

(d) An independent drier for the finishing section should be installed. At present the sides are dried, after spray finish application, in the "Forni Varese" unit, which should only be used to dry the sides and skins after retanning or dyeing;

(e) The glazing machines "Riat" which are available but not in use, should be installed in the finishing section;

(f) A special table for the hand ironing of skins and sides should be set up, to demonstrate the advantages of that operation in the course of production;

(g) A coating machine with reverse roll coating should be acquired. With that type of equipment an increased quality of finish applications is achieved as well as considerable savings in the consumption of chemicals.

8. Regular process controls should be implemented in the pilot plant. In addition to the existing practice of checking only a few parameters, the Institute's facilities for process control and research and development work shall be more extensively used in the work of the pilot plant. Besides, the following equipment should be provided for the pilot plant:

(a) A portable pH-meter, as problems seem to exist with the determination of exact values due to fluctuation of the voltage;

(b) A humidity meter to control the conditioning of materials.

9. The following items of equipment should be improved: tanner beam; table for trimming, inspection and grading of skins; table for padding of skins; table for hand-ironing; stationary and mobile wheel horses; balances; and appropriate recipients and vessels.

10. The storage of chemicals and auxiliary materials should be improved and suppliers' instructions observed, especially with regard to climatic conditions. Regular inventories should be made and a card-index system established.

ACTIVITIES AND FINDINGS

A. Visits to tanneries in the Shanghai area

The Shanghai tanneries are organized under the Shanghai Leather Corporation (SLC) and manufacture a wide range of final products from raw cowhides, pigskins and goatskins, all of Chinese origin, and from imported wet-blue sides. They are listed in annex IV.

Between 7 and 10 June 1985, the expert visited the following ones:

Tannery	Raw material
Yi Ming	Pigskins and wet-blue cowhides
Xing Xing	Pigskins
Hong Guang	Pigskins
Giu Xing	Goatskins
Xing Yi	Goatskins

The production lots of hides and pigskins are relatively small. The drums for the wet process, available in the lime-yard and the tanning section, are small; larger drums (e.g. 3 x 3 m or 3.5 x 3.5 m) are not in use. Mixers are popular and are often used, although inappropriate for some processes.

Hides and pigskins are split after liming or chrome-tanning, depending on the technology used and the envisaged end products. Sammying of the tanned material before chrome-splitting or shaving is not a standard procedure, the sides and skins are saw-dusted instead. This way the shaving operation can be performed by machines, but the results are varied because the water content is too high.

After dyeing, the sides and pigskins are mostly neither machine-sammyed nor set-out, but put directly into vacuum units followed by air drying. The applied temperatures of about 90° C are too high and lead partly to an irreversible drying out of the materials' grain, which has a negative effect on the quality achieved.

All tanneries should therefore intensify the setting-out of the material to improve their end products. It is evident that the conditioning of sides and skins, i.e. moisturing, staking and airing-off is not properly done.

Also, most products of the tanneries are not toggled; this entails a loss of surface area and some leathers such as softies, pigsuede and nubuc, garment leather as well as certain qualities of goat uppers consequently become too stretchy and show excessive elasticity.

Finishing is done in compact systems by wet spray of concentrated applications, followed by drying at high temperatures. This method, again, is not suitable to achieve a maximum surface area.

Furthermore, the trimming of sides and skins at different production stages should be reviewed and the rational use or discharge of cuttings be checked regularly.

B. The Shanghai Leather Research Institute

The expert began his work at the Shanghai Leather Research Institute (SLRI) on 11 June 1985. After his introduction to the personnel and the staff he familiarized himself with the Institute's facilities, comprising:

(a) The pilot plant with machinery and installations;

(b) The available raw materials for practical work and demonstrations;

(c) The stock of chemical products and auxiliary materials, a full list of which is contained in annex V.

In co-operation with the national project director (NPD) the expert established a work programme, including:

(a) Input of raw materials and wet-blue sides;

(b) Specifications for finished products and selection of tanned material.

As the demonstrations progressed, discussions were held from time to time on working procedures and finishing processes for leather.

The pilot plant is furnished with processing equipment and some basic machinery to perform small-scale research and production. A list of the equipment is given in annex VI. With the existing capacity, wet-processing of the following quantities is possible:

(a) Small skins, mainly goats - 100 to 150 skins per lot, depending on size;

(b) Light calf in whole skins, heavy calf in sides only;

(c) Light hides (up to 20 to 22 kg salted weight) in sides, in lots of about 100 kg.

Heavier raw material (hides of 22 to 27 kg or more) can be treated less easily and only in the form of sides. Splitting in lime condition is suggested.

Pigskins can be processed, according to their size and weight, in a similar way.

While the pilot plant is well equipped for the finishing operations, there is still some machinery and equipment lacking for processing in the wet stage and for conditioning. Also, the arrangement of the machines could be improved, possibly by creating separate sections.

Basic products and materials for wet-processing were mostly available in sufficient quantities. A delay in the delivery of certain chemicals hampered the finishing of some articles. In those cases instructions were prepared and given to the staff to enable them to apply the adequate finish.

The co-operation between the pilot plant with its practical tasks and the research section with its control capacity and facilities should be increased.

In its present state, however, the SLRI pilot plant can already be considered as the competent place, for the region and beyond, for the demonstration of modern methods of leather processing using the usual range of raw materials and achieving a representative collection of finished products, as well as a training centre for the technical staff and middle management of tanneries.

C. Demonstration of modern leather processing techniques

Raw materials for demonstrations

The Institute had provided a small stock of different hides and skins for process demonstrations and leather finishing. It had also prepared some wet-blue sides from Chinese cowhides and sides imported from the United States of America. The collection included the following:

(a) Calf. Chinese light calf, wet salted, 2 to 5 kg. The skins showed defects from flaying, especially in the tail area. Red discolouration due to poor conservation, with partly hairless stains, indicated inferior quality;

(b) Heavy calf. Chinese origin, wet salted, 12 to 15 kg;

(c) Light cow hides. Chinese origin, wet salted, 16 to 20 kg. The raw material had been pre-fleshed in a tannery, probably after pre-soaking, and had then been washed in the pilot plant and resalted before soaking. As a consequence, the skins showed hairless spots; the quality was also partly inferior owing to natural grain defects;

(d) Wet-blue sides from the United States. Twelve sides had been delivered by a tannery, shaved to 1.4 mm substance. A check revealed that this material had been stocked for some time and was lightly infected by some mould. Therefore the sides were washed with a disinfectant before processing;

(e) Sides from Hong-Wei tannery, Shanghai. Sixteen heavy sides were delivered in tanned state. They were of fair quality and good appearance with a rather clean surface;

(f) Goatskins. SLRI had 100 goatskins from the Sichuan province in stock. The skins had not been selected, and included small, light and medium-size skins with different hair colour (mainly black, mixed, and a few white) all in run quality. Those skins had already been trimmed in a tannery in dry state.

Demonstration of the processing

Before the demonstration could start on 12 June 1985, some operations had to be carried out on equipment in neighbouring tanneries and the work had to be organized.

The expert prepared in advance all formulas and recipes for processes and operations carried out in the pilot plant. This information was shown on a blackboard to permit the visitors from other tanneries to follow the demonstrations easily.

During the wet process controls were made at certain production stages. All materials were inspected regularly, the check results made known, and comments and information on the progress of the work were given. To facilitate observation, explanations were given from time to time outlining the next stage or stages in the process.

The expert also suggested forming small groups of visitors to be able to follow the demonstrations more closely at specific production stages. This was achieved, and even practical work could be done on several types of leather, in the wet process and from the crust state to the finished product.

The expert repeatedly stressed the importance of regular controls of experiments as well as in industrial production, to guarantee constant production output and to facilitate the reproduction of experiments also on an industrial scale.

So far the Institute's facilities have been used for the verification and control of only a few process parameters, such as temperature, density and pH values.

Types of leather produced

The types of leather that were finished, or finishing of which can be completed as soon as the necessary chemicals are available, are listed on pages 16 and 17.

Documentation for demonstrations

To control and to document the various processes demonstrated, the expert designed the following forms, which are given in annexes VII and VIII:

(a) For wet processes, a form to document all steps from soaking to retannage and dyeing;

(b) For finishing work, a form to register products and compositions used, as well as the methods of finish applications and other operations executed.

At the end of his mission the expert left a complete set of all recipes with the NPD. SLRI thus has a complete set of documentation covering all experiments and demonstrations undertaken, and therefore is in a position to repeat the processes to achieve certain products and to continue working along the lines demonstrated by the expert.

Raw material	Type of leather	Process/finishing	Remarks
Calf, 2 to 5 kg input 20 pieces (57.5 kg)	4 box, brown (one test skin)	Semi-aniline effect. Polished and plated finish	Good grain, feel a little firm; more intensive dyeing needed.
	10 soft calf, brown	a/	Good grain, feel adequate.
	6 soft calf, white	Milled, plated finish	Grain with typical milling effect.
Heavy calf, 12 to 15 kg input 6 pieces = 12 sides (80 kg)		a/	
Hides, 16 to 18 kg input 4 pieces = 8 sides (64 kg) 4 sides of low quality (i.e. with grain defects)	4 softy, brown 19	Semi-aniline effect. Polished liquid dyestuff finish.	Good grain, good feel.
Wet-blue sides (imported from United States)	7 milled, softy, grey 1.1-1.2 mm	a/	
	5 softy sides, brown 31 1.1-1.2 mm	a/	
Wet-blue sides from Hong-Wei	6 softy sides, brown 23 1.4 and 1.8 mm		Good grain; feel a little too firm, which can be rectified by appropriate neutralization and fatliquoring.
	4 softy sides, brown 1.4 mm	Plated waxy finish	Good grain, round feel.
	6 softy sides, beige 1.8 mm		Regular grain, full feel. Softer feel can be achieved by fatliquoring.

continued

Raw material	Type of leather	Process/finishing	Remarks
Goatskins, input 100 pieces in two lots, average 0.3-0.5 kg	6 upper leather, blue	Plated pigment finish	All types of leather from goatskins have good, tight grain, firm feel and are not too stretchy.
	10 upper leather, white	Plated pigment finish, casein-albumine finish, white lacquer emulsion top	
	12 upper leather, white	a/	Finishing to be improved.
	8 upper leather, bordeaux	Plated pigment finish	
	8 upper leather, blueish-grey	a/	Dyeing to be improved. Spray-dye before finish application.
	8 upper leather, black	Plated pigment finish, hand-padded, with self-fixing casein-albumine finish	
	8 nappa, blue	Direct dye process a/	Soft, but grain not very good. Filling and adjustment of fatliquor required.
	8 nappa, red	Process with intermediate drying a/	Very good, full feel and even colour. Possibly already somewhat too soft.
	12 nappa black	Direct dye process. Plated, pigment finish	Improved blue nappa. One test skin could be finished with available chemicals.
	20 small and light-substance skins	Retanned for glove-leather	To be finished like red nappa.

a/ These articles are ready to be finished as soon as the required finishing products are available.

Annex I

NATIONAL STAFF COUNTERPARTS AT SLRI

Shi Xianglin	Director of SLRI and national project director
Zhu Jun	Vice director
Ding Zhijie	Vice director
Cao Xuanhui	Vice director and counterpart at the pilot plant
Liu Ren Rong	Assistant director
Zhu Rigjun	Interpreter

Annex II

JOB DESCRIPTION

Post title: Leather tanning expert

Duration: 1.5 months

Date required: First quarter of 1985

Duty station: Shanghai, with travel within the country

Purpose of project: To complete the establishment of a well-functioning leather technology centre at Shanghai including a laboratory/pilot plant for demonstrations and training and the development and improvement of tannery processing methods.

Duties: The expert will be attached to the Ministry of Light Industry through the Shanghai Leather Corporation and work in close co-operation with the national project director. The expert will be specifically expected to :

(a) Before starting his mission, advise the Shanghai Leather Corporation what materials, chemicals and auxiliaries will be needed for the demonstrations to give the Corporation sufficient time to procure these items;

(b) On the basis of information obtained from the counterparts and collected during tannery visits in the Shanghai area, to assess the present leather tanning methods and identify processes where major improvements could be achieved;

(c) Advise on and demonstrate modern leather processing methods especially in retanning, fatliquoring, dyeing and finishing of cowhides and goatskins for various articles as required;

(d) Based on experiments carried out with raw materials regularly used in tanneries, prepare formulae adjusted to local conditions, equipment and chemicals available, for a few articles of major importance.

Qualifications: Extensive experience in leather industry with in-depth knowledge of modern leather processing methods especially retanning, fatliquoring and finishing of both hides and skins.

Language: English

Annex III

VISITORS WHO ATTENDED THE EXPERT'S DEMONSTRATIONS AT THE PILOT PLANT

Leather Research Institute of Ministry of Light Industry	Liu Zhi-xue Yang Lu-hong
Tianjin Leather Research Institute	Yang Dong-quan
Tianjin Tannery	Chui Kun
Chen-du Tannery	Yie Kui-lin Wu Shi-gang
Dong-feng Tannery (at Beijing)	Chang Jin-quan
Kei-fong Tannery	Wang Li-ying
Ren-min Tannery (at Guang-Zhou)	Huang Yao-wen
Beijing Tannery	Wang Wei-chun
Xin Yi Tannery	Liu Li

Annex IV

TANNERIES OF THE SHANGHAI LEATHER CORPORATION

Cowhide and heavy leather:

Shanghai Heavy Leather Tannery
Shanghai Hu Guang Tannery
Shanghai Dong Fang Tannery (Hong Wei)
Shanghai Yi Ming Tannery a/

Pigskins:

Shanghai Hong Guang Tannery a/
Shanghai Xing Xing Tannery a/

Goatskins:

Shanghai Xing Yi Tannery a/
Shanghai Giu Xing Tannery a/

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a/ Visited by the expert.

Annex V

CHEMICALS AND AUXILIARY MATERIALS SUPPLIED TO SLRI TO SUPPORT THE EXPERT'S ACTIVITIES

Name of product	Application	Manufacturer (Code No.)
Basyntan DLE	Synthetic retan, white	1
Cartan O	Dyeing leveller, bleaching	5
Coripol BZN	Fatliquor, special effects	6
Coripol DXA	Fatliquor, general purpose	6
Coripol ICA	Fatliquor, synthetic neutral	6
Decaltal N	Deliming agent, masking effects	1
Eulinol CPK	Fatliquor for white	6
Invaderm LU	Dyeing leveller, penetrating effect	3
Irgatan HO	Synthetic retan, white	3
Irgatan 4293	Synthetic retan, leveller	3
Immergan A	Fatliquor, synthetic neutral oil	1
Levotan C	Retan, polimer base	2
Lipodermliquor SC	Fatliquor, general purpose	1
Neutrigan	Neutralizing, masking agent	1
Neutrigan HO	Basification, high chrome uptake	1
Pellan ED	Fatliquor, stabilizer	4
Pellan S	Fatliquor, stabilizer	4
Pellastol RV3	Fatliquor, general purpose	7
Pellgrasol MB	Fatliquor, special effects	7
Perdol N a/	Soaking agent for dry material	4
Relugan GT 50	Retan, Dialdehyde base	1
Relugan RE	Retan, polimer base	1
Retingan R7	Retan, filling effect	2
Sandolix WWL	Fatliquor, disperser	5
Sellasol NG	Neutralizing, masking agent	3
Sirial S 62	Fatliquor, stabilizer	4
Sirial S 86	Fatliquor, stabilizer	4
Tanesco H	Retan, chrome synthetic	3
Tanigan AN a/	Synthetic retan	2
Tanigan PAK	Synthetic, neutralizing	2
Tanigan 3LN	Synthetic retan, white	2
Tergolix A Paste	Special emulsifier, disperser	5
Tergotan GS	Retan, filling agent	5
Xeroderm DH	Hydrophobic agent	2

Code numbers:

(1) BASF
(2) Bayer
(3) Ciba Geigy
(4) Henkel
(5) Sandoz AG
(6) Stockhausen
(7) Zschimmer and Schwarz

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a/ Not available at SLRI pilot plant.

Annex VI

MACHINERY AND EQUIPMENT OF THE PILOT PLANT

A. Wet-process installations

Number of units	Type	Min. speed	Volume (litres) Total	Volume (litres) Usable	Max. load (kg)	Suitable for: Raw materials	Suitable for: Process
1	Paddle, steel with filter-bottom a/	n.a.	400		n.a.	Small skins	Limeyard process skins
1	Drum, wood 1.10 x 0.80 m	3	760	340	80-120	Small skins and heavy calf, veal sides (15/16 kg SW)	Calf limeyard process
3	Drum, steel, Dose VG, 1.40 x 0.60 m b/	variable	920	400	100-120	Small skins and veal sides cowhides in sides	Calf limeyard process tannage dyeing.
1	Drum, wood 0.95 x 0.60 m c/	n.a.	425	200	n.a.	Small skins only	

a/ Not yet installed.

b/ Switches and heating device should be checked and repaired.

c/ Without timer.

B. Other machinery and equipment

Unit	Machine and manufacturer	Year or type	Working width (mm)	Observations
1	Sammying machine Mercier		1 200	For small skins only
1	Shaving machine Moenus-Turner	36/A	1 500	Knife problems because not suitable for thinner skins
1	Setting machine Mercier		2 000	With polished heated roller; not suitable for small skins
1	Drying unit Forni Varese	1984 RO 180		
1	Vacuum dryer Incoma		1 000 x 600	Mini unit for demonstrations
1	Staking machine Cartigliano	1984 150	1 500	For calf and sides, not appropriate for small skins
1	Staking machine Slocomb type		180	
1	Toggling unit	1984	10 frames 3 000 x 1 400 Glass plates 3 000 x 1 400	
1	Buffing machine		250/200	
1	Hand-spray unit with exhaust		Frame 2 600 x 1 400	

continued

Unit	Machine and manufacturer	Year or type	Working width (mm)	Observations
1	Compressor (cart type)			Without pressure regulating valve
1	Printing machine Dornbusch		1 500	
1	Polishing machine Ficini	1984	600	Machine by Aletti, polishing cylinder by Ficini
1	Hydraulic press Mostardini	1984 MP3MS	1 350 x 1 000	
1	Ironing machine Mercier		1 800	
1	Glazing machine Riat	1984 0102		
1	Glazing machine Riat	1982 1102		

Annex VII

FORM FOR WET PROCESSES

Formula/process control:	Experiment No.:	Date:
Section:		

Hides or skins	Number of pieces:	Article:	Colour:	Substance:	Weight (kg)

Process	Chemicals		Float temperature (°C)	Time	pH	Observations
	Percentage	Weight (kg)				

Annex VIII

FORM FOR FINISHING WORK

Customer:

Date:

Type of leather:

Finish:

Colour:

Product	1st Coat	2nd Coat	3rd Coat	4th Coat	5th Coat	6th Coat	Procedure/remarks

Pigment Mix	Dye Mix