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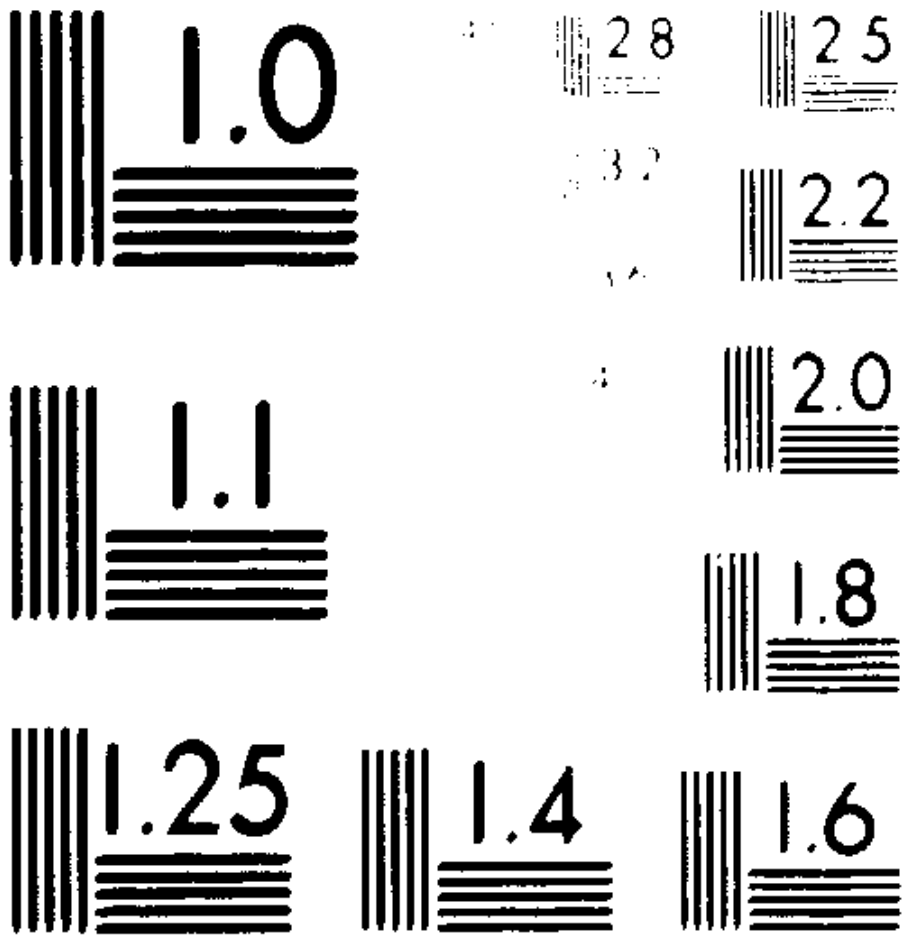
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org



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ASSISTANCE IN PUTTING INTO OPERATION THE LABORATORY EQUIPMENT FOR THE SUDANESE TANNERIES

US/SUD/78/267

DEMOCRATIC REPUBLIC OF THE SUDAN

Terminal report *

Prepared for the Government of the Democratic Republic of the Sudan by the United Nations Industrial Development Organization, acting as executing agency for the United Nations Development Programme

Based on the work of Roy G.H. Elliott,
expert on quality control

United Nations Industrial Development Organization
Vienna

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Explanatory Notes

During the period of the mission 1 US$ was approximately equivalent to £ 0.89. £S = Sudanese pounds

UNDP - United Nations Development Programme
UNIDO - United Nations Industrial Development Organization
SIDFA - Senior Industrial Development Field Adviser
ARR - Assistant Resident Representative
SATRA - Shoe and Allied Trades' Research Association, U.K.
ISO - International Organization for Standardization
IULTCS - International Union of Leather Technologists' and Chemists Societies

ACKNOWLEDGEMENT

During the mission to the Democratic Republic of the Sudan, the consultant expert was accorded extensive and willing co-operation by all those with whom he came in contact. In addition, he would like to record his sincere appreciation of the generous hospitality shown to him on many occasions. Special thanks are due to Mr. El Sheikh M.A. Tambal, General Manager, Khartoum Tannery, to Mr. M.E. Tayeb El Shayeb, General Manager, White Nile Tannery and to Mr. Ahmed M.Ahmed, General Manager, Gezira Tannery and their respective Technical Managers, Messrs. Abdel Rahman Joda, Ibrahim Said Ahmed and Salih Awooda for their assistance in enabling the consultant to complete his duties satisfactorily. The extemely helpful co-operation of Mr. Ahmed Hag El Sheik Abbo, Manager of the Hides, Skins and Leather Institute, Khartoum South and members of his staff and technicians was warmly appreciated and contributed greatly to the success of the mission by providing a convenient and very suitable venue and factilities for the training sessions given to the staff of the three tannery laboratories. The help provided by Mr. Farouk Salim M. Elhomouli, Deputy Manager of that institute in making possible discussions with the Director of the Industrial Research Institute, Mr. Zakeria Abdel Nabi and members of his staff was most helpful. Similarly, the consultant would like to acknowledge the kind assistance given to him by Dr. Farid Nawas, Senior Trade Promotion Adviser (ITC), based in the Ministry of Co-operation, Commerce and Supply, in providing an introduction to Mr.M.O. Tlanafi, Deputy Under Secretary and Director, Quality Control Department, Ministry of Commerce, which led to useful discussions. Thanks are also offered to Miss Dionysia Capaya, Trade Documentalist (ITC) for her assistance in providing data at the request of the consultant.

The guidance, advice and assistance received by the consultant from Dr. Paavo Harju, SIDFA (UNIDO), Mr. Peter Quennell, ARR and other personnel at the UNDP office, Khartoum is readily acknowledged, with warm appreciation. On numerous occasions, the support given to the consultant in this way was material to the successful operation of the project.

Finally, the consultant wishes to pay a warm personal tribute to the excellent co-operation and support given so readily by his counterpart, Mr. Mustafa Mahdi Azrag, Quality Controller, Khartoum Tannery. The degree of collaboration achieved contributed enormously to the success of the project and to the satisfactory transfer of the project and to the satisfactory transfer of relevant technology.

ABSTRACT

The project US/SUD/78/267 was entitled "Assistance in putting into operation the laboratory equipment for the Sudanese tanneries" and had, as its overall objective, the assistance of the three largest tanneries in Sudan to improve the quality of their leather production by the application of process and quality control. The project began in Sudan on 6 April 1982 and concluded there on 16 June 1982.

The intention was to provide physical test equipment, glassware and other special apparatus and chemicals for the three large tanneries formerly under the auspices of the Leather Industries Corporation.

A leather quality control expert was recruited, on assignment of approximately three months duration to secure the proper operation of the equipment provided with the financial support of the Federal Republic of Germany. He was also to train local counterpart personnel in the relevant techniques appropriate to process and quality control of production in the three tanneries.

The expert was also required to advise on the development of suitable norms for leather quality related to domestic and export market requirements.

The introduction of process and quality control in the tanneries can only be regarded as a beginning and it is recommended that, in approximately six months time, a short (one month) follow-up assignment should be made by the expert to examine progress made after that interval and to give any necessary further guidance.

It is strongly recommended that all possible means should be investigated by the Government in consultation with UNDP/UNIDO to upgrade the present Hides, Skins and Leather Institute to enable it to function as both a training and operational centre for process and quality control for the Sudanese Leather Industry generally and, specifically, for the three main tanneries.

It is also recommended that consideration should be given by UNIDO or the Government to the provision of adequate essential equipment at Gezira Tannery as well as at a suitable common centre (e.g. the leather institute) at Khartoum South for continuous quality control purposes.

Measures to improve Sudanese contacts with the international leather community are suggested.

Among the annexes attached to the report are those setting out the guidance given to the three tanneries and their laboratory staff in respect of the analysis and tests required for quality control of pickled skins and chrome-tanned (wet-blue) hides and skins which constitute the exports of the three tanneries, also a working plan for process control following the sequence of processing in the tanneries (annexes IV, V and VII). A photocopy of an aerial view of the Hides, Skins and Leather Institute and the adjacent Khartoum Tannery together with a brief note on the institute and a plan of its layout (abstracted from the 1968 report on the FAO project FAO/SF:58/SUD-2) is shown in annex II.

CONTENTS

I N T R O D U C T I O N

A. Background

Serious efforts are being made by Sudan to improve the status of its leather industry. In particular, the Government is conscious of the need to establish quality control in the industry and thereby, through the anticipated improvement of the quality of the output by the industry, to expand the market acceptability of Sudanese leather.

According to the report made by S. Patel, leather industry adviser for UNIDO (Project SI/SUD/77/803, April 1979), some 1 million cattle hides, 5.5 million sheepskins and 1.9 million goat skins are available annually in Sudan.

An FAO mission (Project Norad TF-RAF 81 NOR which was concerned with hides, skins and animal by-products) of which the present consultant was a member, drew express attention to the need for the improvement of the treatment and preservation of hides and skins in Sudan when it came in 1975. The point was made that the good condition of raw stock was fundamental to the production of acceptable leather.

Two of the three largest tanneries in Sudan are situated close to each other in Khartoum South. These are the Khartoum Tannery, established in 1962 and the White Nile Tannery which came into production in 1975. The third and largest tannery, Gezira Tannery, is situated near Wad Medani and started production in 1976.

The total annual capacity of the three tanneries has been estimated at some 20 million square feet of leather from cattle hides and 2 million pieces from sheep and goat skins, the pattern of production in the three tanneries is similar. Their present, actual production is , however, estimated to be only about one third of their total potential capacity. The principal exports are wet blue hides and sheep skins and pickled skins; these constitute about 40 % of production at the Khartoum and White Nile tanneries and bout 75 % of the production at Gezira Tannery.

It was decided that, in order to improve the quality of the leathers produced, substantial improvement was essential in respect of process and quality control operated in these tanneries and that such control should be carried out in a systematic and well-organized way. To facilitate this objective, certain specialized equipment and a supply of appropriate chemicals were considered to be required and it was also decided that one control centre (to serve both Khartoum and White Nile Tanneries) should be established at Khartoum and a second one at Gezira Tannery.

An amount of some US$ 42,636 (inlcuding overheads) to cover the provision of the chemicals and special equipment was provided from a special purpose donor contribution by the Government of the Federal Republic of Germany in December 1979. Subsequently, an additional amount of some US$ 39,149 (including 14 % overheads) to cover the cost of equipment and expert services was agreed by the Government of the Federal Republic of Germany in December 1980, to secure the proper operation of the equipment provided.

B. Official arrangements

The expert, Mr. R.G.H. Elliott (United Kingdom) was selected for the project by the Sudanese Government but his fielding was delayed by re-organization changes associated with the status of the former Leather Industries Corporation in Khartoum. He was eventually fielded in April 1982 (for post 11-01) and began his duties in Sudan on 6 April. The project terminated on 19 June when the debriefing had been concluded in Vienna.

The expert worked directly with the three tanneries and with Mr. Mustafa Mahdi Azrag (Quality Controller, Khartoum Tannery) as his counterpart by agreement between the respective managements of the tanneries.

C. Objectives

The objectives of the project were as follows:

a) to give advice on the proper use of the laboratory equipment provided for the three tanneries;

b) to train local counterpart personnel in the relevant chemical analysis and physical test methods appropriate to the establishment of process and quality control;

c) to advise on and assist in the establishment of suitable norms for leather quality as required for export and domestic markets;

d) to assess the items of equipment and chemicals received by the tanneries (as successors to the former Leather Industries Corporation) and the extent to which these items are in actual use by the tanneries.

RECOMMENDATIONS

The introduction of process and quality control in the three largest tanneries can only be regarded as a beginning and further guidance and support will clearly be needed. It is therefore recommended that the Government of the Sudan should:

1. in consultation with UNDP/UNIDO, investigate all possible means to upgrade the quality control facilities available at the Hides, Skins and Leather Institute, e.g. by the installation of a constant temperature and humidity room, protected with air-lock doors, to meet conditioning requirements for physical tests, and to enable the institute to enlarge its present role so as to become a reference and training laboratory for process and quality control.

2. to seek further aid in the form of additional, essential equipment to make possible the complete examination of all leathers for export and for the domestic market, both a Gezira Tannery and at the two large tanneries - White Nile and Khartoum - at Khartoum South. For the purpose of a centre, suitable and convenient to the latter two tanneries, the institute would provide a site for its development at minimum cost.

3. through the agency of the three tannery laboratories and with the collaboration of the Hides, Skins and Leather Institute, direct that a comprehensive survey should be carried out, under the supervision of the Quality Controller, Khartoum Tannery, of all leathers currently produced by the three tanneries with a view to drafting realistic national Sudanese standards on the basis of the data thus collected.

4. encourage the tanneries to seek advice a) on the recovery and re-cycling of chromium in the tanning process and b) on the general treatment of tannery effluents. Strong interest was expressed in the tanneries in securing optimum utilization of imported chemicals both to reduce local costs and the demand of foreign exchange. The likely future demand by municipal authorities for more stringent control of trade effluent was also recognised.

5. request UNIDO to recruit a quality control expert for a follow-up mission of one month duration for the purpose of studying progress made by the three tanneries on the lines put forward in the present project for process and quality control (see annexes IV, V and VII). The project should commence approximately six months after the present project is concluded. The consultant would advise on further action as necessary.

6. encourage the management and all technicians in the three tanneries to take the widest interest in the world leather scene. International contacts are of the first importance together with an adequate knowledge of technological developments occuring elsewhere. Technicians, particularly those concerned with quality control, should be supported financially, if necessary, in the formation of a national association of leather chemists and, thereafter, in seeking to join the International Union of Leather Technologists' and Chemists' Societies. Membership of IULTCS would lead to the exchange of ideas at an international level and make it possible to collaborate in the examination of new test methods.

8. examine the possibility of providing an annual membership subscription in respect of the technical (leather) journals listed in annex XI. The journals could readily be circulated between the three tanneries and the hides, skins and leather institute. The latter establishment could undertake the combined tasks of circulation of journals, production and circulation of appropriate abstracts and the eventual storage of the journals. Technical books and trade literature (e.g. on tannery chemicals, equipment and machinery, oils, adhesives and finishes) could be collected by the institute as part of the reference library seem to be a serious need of the leather industry in the Sudan.

I. PRELIMINARY ACTIVITIES

A. Workplan

During the briefing in Vienna it had been understood that the work to be carried out in Sudan was to be aimed at setting up two centres where process control and quality control could be undertaken, one in the area of the two tanneries at Khartoum South and the other at Gezira Tannery.

When the consultant arrived in Sudan and investigated the situation, it became clear that the glassware and equipment that had been sent to Khartoum over a year before the consultant was fielded, had been distributed between the three tanneries soon after its delivery. It appeared from information given to the consultant (during his briefing in Vienna) that a second set of physical testing apparatus had been ordered in January 1982 and was scheduled for delivery in Sudan in March 1982. It has not been possible to confirm the arrival of this order either at the UNDP office (where no relevant documentary record exists) or at the tanneries. A comment was made in the interim report regarding the distribution of the original physical test apparatus and the approach to the execution of the project had to be reconsidered. The decision was made to establish a temporary centre at the Hides, Skins and Leather Institute near the two Khartoum tanneries where all the original groups of physical test apparatus could be re-assembled after consultation with the management of the three tanneries and with Dr. Harju (SIDFA). The three tanneries accepted and supported the proposal to have one centre to which all relevant technical staff from their three laboratories could go for the same period. By these means, the available apparatus could be employed to the greatest benefit and the tannery staff attending had the longest possible period of training and familiarisation with the special equipment. Further, the institute had classroom facilities available for a series of talks on specific topics given by the consultant.

The re-assembly of the apparatus and negotiation with the tannery managements before the plan could be put into operation took about three weeks but this time also included talks with managements regarding production and types of leather in the respective tanneries. The ready co-operation of Mr. Ahmed Hag El Sheikh Abbo, the manager of the institute was of very great assistance at this time and Mr. El Sheikh M.A. Tambal, General Manager, Khartoum Tannery, was particularly helpful in assisting the consultant to re-assemble the necessary equipment.

In addition to the physical testing apparatus, certain items such as the Dean and Stark apparatus for determination of water content in raw, pickled and wet-blue hide samples, the Kjeldahl apparatus for Nitrogen (hide substance) determination and glassware for determination of chromic oxide content were also assembled in the institute laboratories.

Staff from the laboratories of all three tanneries came together each working day during the whole of May and demonstrations were given by the consultant of all the physical test methods. Each member of the training group was enabled and encouraged to perform the relevant operations, with repetition, on the assembled equipment.

Repeated tests were also made in respect of the water content of a variety of samples supplied by the laboratories.

Three members of the technical staff of the institute, Mr. Ahmed Hussein Doud (graduate of the Khartoum University), Mr. Abbas Mustafa Gamil and Mr. Gaffar Abrahim Hassan also participated in the training course. Talks attended by the members of the training group covered a wide range of topics designed to give useful background information on quality control and process control related to raw/cured hides and skins, pickled stock, wet-blue stock and dry, finished leathers. In connection with process control, talks were also given covering relevant methods for the testing of basic chemicals employed in tanning processes. A special emphasis was placed on the need to record results accurately, preferably using a card index or similar system, with the particular purposes a) of ready reference and b) to build up reliable and extensive data, obtained in a practical context, with a view to the establishment of realistic standards in the longer term.

During this period also, at the invitation of the managements of each of the three tanneries, a meeting was held in each tannery to which all the respective heads of tannery sections came, together with representatives of the management (most usually the respective technical and deputy technical managers). The consultant, accompanied by his counterpart, explained in detail the plan (which he had formulated and which had been approved by the managements) for process control. The respective laboratory staff were also present at these meetings and time was given, either during the talk or at the end, for clarification of any items included in the talk. An interested and positive response was obtained on each occasion. Copies of the plan of tests to be operated by the respective tannery sectionsin conjunction with the laboratory staff were distributed and arrangements made for translation into Arabic of the part of the plan relevant to each section (see annex VII).

At these meetings, stress was laid on the need to consider partial recycling or re-use of certain liquors in the tanning process a) to achieve optimum use of imported chemicals and thereby assist in reducing foreign exchange requirements and b) to reduce anticipated charges for effluent treatment by local authorities. Emphasis was also placed on the absolute need for consistency in production at each process stage.

B. Production by the three tanneries

As mentioned under Work Plan, above, some time was spent in enquiring of the three tanneries the nature of their overall production. This was considered essential if the contact time of the consultant with the tanneries and, in particular, with the laboratory staff, was to be put to the best use, viz. in directing the training along lines which could be expected to give assistance to the tanneries, through these technicians, that was most appropriate. In the context of the large output, oriented towards export, of pickled goods and wet-blue leathers, it was clearly important that special attention required to be paid to ensuring proficiency in the determination of those parameters related to these exports. To this end, specific instruction sheets and guidance notes were produced and distributed by the consultant (see annexes IV and V; note annex VIII for reference)

C. The Hides, Skins and Leather Institute

The institute was established some twenty years ago under the guidance of Mr. Ernest Knew, FAO consultant (project reference FAO/SF: 58/SUD-2). The site chosen for the institute, west of and in line with the frontage of the Khartoum Tannery was officially approved in July 1961. Among the operational units of the institute are the laboratories and the lecture room (see annexes II).

The institute which currently comes under the auspices of the Ministry of Agriculture and Natural Resources, was visited by the FAO Norad Mission in 1975, hence the foreknowledge of the consultant of the facilities available there, including a cutter mill, essential for the preparation of leather samples for analysis but not installed in any of the tannery laboratories. Contrary to an earlier understanding, a room for standard temperature and relative humidity was not available; humidors were used instead.

On being approached by the consultant with a view to using the facilities available at the institute for the purpose of practical demonstrations and talks, Mr. Abbo was extremely co-operative and did everything possible to assist in furthering the aims of the project. His support was of the greatest value in achieving those objectives.

The laboratory facilities at the institute are currently under-utilized and would provide an ideal centre for training for process and quality control and, in view of its proximity to the Khartoum and White Nile tanneries, would provide a very convenient centre for these tanneries (with a minimum of expenditure) for day-to-day control testing.

II FINDINGS AND OBSERVATIONS

A. The tannery laboratories

As indicated in the introduction, the Khartoum Tannery is considerably older than the other two tanneries involved in the project now reported, but apart from a general layout, its laboratory facilities were not significantly different from those of the other two.

A general problem which seemed to present difficulties in the laboratories was that of low water pressure, particularly at the Khartoum Tannery. The consultant was given to understand that steps were being taken to improve this situation.

The common problem which seriously affected both the laboratories and the production areas in all three tanneries, was the frequent loss of electronical power. This particular difficulty caused serious interruptions in the operation of certain physical testing equipment and the work plan had to take this into account, so that work could continue on equipment not requiring electricity to operate at such periods.

The need to improve the laboratory facilities and the standard of cleanliness observed was drawn to the attention of management and laboratory personnel. It was pointed out that, if process control and quality control was to be taken seriously in future, and if the present project was to lead to worthwhile improvement of standards, it would be essential a) to upgrade any poor facilities in the laboratories and b) to give greater responsibility to the laboratory personnel which could also raise their morale.

B. Laboratory equipment

None of the three tannery laboratories was as well equipped as might have been hoped. The extent to which the glassware supplied under this project had been put into operation by the laboratories varied between absorbing the greater part into general use and keeping almost the whole of it carefully locked away.

When the plan for process control was drawn up by the consultant both management and laboratory staff were urged to use the extra equipment to the fullest extent. Assurances were given that this would be done and that regular testing would be extended. A prompt improvement in the general appearance of the laboratories was achieved.

The serious lack of rubber tubing was remarked upon in the interim report by the consultant. Several determinations were simply not possible due to this fundamental problem because in each procedure it was essential to have a continuous supply of water conducted by the tubing. A request was made to Vienna to obtain a supply of tubing for distribution to the tanneries with a view to the proper employment of much of the glassware supplied under the project. The request had not been met when this report was being prepared.

It was not possible in any of the laboratories to use ceramic candles to filter diluted vegetable tan liquors, either because adequate water pressure was not available or because there was no simple means of creating a vacuum e.g. by means of a glass water pump. Before the consultant left Khartoum, steps had been taken at Khartoum Tannery to remedy this.

Among the apparatus provided, under the project, for physical testing of leather, one model of the SATRA Shrinkage Temperature apparatus was available for the three tanneries. The cost of this item is currently (1982) about £St 1400. In order to make it possible for all three laboratory staffs to carry out this important determination, the consultant devised a simple apparatus from minor items found in the Khartoum Tannery laboratory. This simplified version could be used for pickled skins samples (using a 5 % sodium chloride bath), for vetetable tanned leather (using a distilled water bath) and for chromium tanned (wet blue or finished) leather (using a bath of 70 parts glycerol and 30 parts water) and followed the lines of the diagram given in the Official Methods of Analysis, Society of Leather Technologists and Chemists, London 1966. Satisfactory tests, giving results in very close agreement with parallel tests done on the SATRA apparatus, were made on this 'home-made' apparatus.

The Lastometer (SATRA model) provided was found to be defective in respect of the load gauge and the Penetrometer (Bally model) proved to be partly ineffective in that there was a continuing electrical leak which made determination of penetration times frequently unreliable. Repeated attempts to remedy this fault were not successful.

Comment was made in the interim report on the supply of a sole adhesion tester as part of the project equipment. This item is obviously very useful in a laboratory where footwear samples are required to be tested but appeared to be quite irrelevant to the tannery laboratories except on the premise that, in the event of a complaint by a buyer who was a shoe manufacturer, a shoe might be returned to the tannery laboratory for examination.

In one copy requisition, dated July 1981, passed to the consultant during his Vienna briefing, it was noted that there was a Kubelka apparatus (SATRA model) listed (cost US$ 100,-). This was not traced and the laboratories had no knowledge of its being delivered. For training purposes, a model possessed by the Hides, Skins and Leather Institute was used for demonstration purposes.

At the end of the period of training at the Hides, Skins and Leather Institute, the special physical testing and other assembled apparatus was returned to the respective tannery laboratories from which it had come, as specifically requested by the three tanneries. Regrettably, the final situation, at the termination of the project, is that no one of the tanneries has complete facilities for the physical testing of dry, finished leathers although, by the revised plan of operations carried out by the consultant and agreed with the tanneries, all members of each tannery laboratory are now familiar with and can use all the types of equipment provided. The wish was expressed that each tannery should have a complete replicate of the basic set of physical testing apparatus.

This would be advisable for practical reasons in respect of Gezira Tannery but it is considered that one further complete assembly of such special and expensive equipment could more profitably be sited at the Hides, Skins and Leather Institute which is within walking distance of either of the adjacent tanneries. A list of the equipment supplied is given in annexes III (a) and III (b).

C. Laboratory chemicals

At the time of writing this report, the arrival of the chemicals ordered for use in conjunction with the project were still awaited. The order had apparently been placed in Denmark in February 1982 and the estimated delivery period was 3-4 months. The latest proforma from the Danish suppliers, dated February 1982 (with UNIDO Purchase Orders and Amendments dated February 1982 and April 1982 respectively) indicates that certain items ordered are not available including ethanol, bromocresol blue indicator and hide powder. The last of these items is essential to the evaluation of vegetable tans and an alternative source of supply could be sought through the good offices of the Society of Leather Technologys and Chemists (1 Edges Court, Moulton, Northampton NN3 1VJ, England). There are some unusual inclusions and omissions in the list of chemicals ordered, for example 1x1 litre of buffer solution pH 4.0 and 5x1 litre of buffer solution pH8-0 either of which could more suitably and economically have been supplied as solids. Similarly, for the purpose of operating the Dean and Stark apparatus, toluene is a very much more efficient solvent than benzene which is included in the order. During the training period, this particular point was demonstrated to the group of laboratory and institute personnel. A list of the chemicals ordered for the tanneries is to be found in annex III (c).

D. Leather quality: establishment of norms

The consultant was asked to advise and assist in the establishment of suitable norms for leather quality as required for export and domestic markets.

With regard to domestic markets, the trade requirements listed as an Annex clearly constitute and determine 'suitable norms' as far as domestic buyers such as the shoe manufacturers are concerned. For this reason, the consultant endeavoured by demonstration of the chemical and physical test methods involved, as well as by specific discussions with laboratory personnel, to ensure that the tannery laboratories would be able to meet these trade requirements. There were a very few procedures related to items quoted in one set of trade requirements which could not be demonstrated because the apparatus was not available. A set of trade requirements is given in annex VI.

In respect of the pickled and chrome-tanned exports, however, special attention was paid by the consultant to process and quality control as these were related to the main exports of pickled skins and chrome-tanned (wet blue) hides and skins. Talks were given to the training group which went into detailed explanations of the important methods of chemical and physical testing involved in the quality control of both types of exports; the talks were followed by question and answer sessions. A plan for process control sampling was drawn up by the consultant and distributed (see annex VII).

Full notes on relevant methods together with guidance on normal requirements and sources of further technical information were prepared and distributed to the laboratory personnel and to managements (for information). These are included in the annexes attached to this report.

As mentioned earlier, under I. Preliminary Activities, A. Work Plan, the need to build up reference data on production in the tanneries was specifically stressed, at every opportunity, to management, to laboratory staff, to heads of production sections and to technicians. Emphasis was placed on the necessity of using the accumulated data, in course of time, as a practical basis for the formulation of specifications.

Discussions were held with Mr. Zackeriah Abdel Nabi, Director of the Industrial Research Institute (Ministry of Industry) and members of his staff and with Mr.M.O.Hanafi, Deputy Under Secretary and Director of the Quality Control Department, Ministry of Commerce on separate occasions. The purposes of these meetings were (a) to determine facilities available for relevant physical testing of leather (via Mr. Zackeriah's establishment) and b) the possible level of interest of Mr. Hanafi's Department in specifications which could be based on the tests listed in the annexes and which could provide a basis for encouraging exports to meet specified requirements for pickled and chrome tanned leathers.

Mr. Zackeriah's institute currently tests leather products (footwear for the services, e.g.) for the Ministry of Industry, thus acting as a official test station. Tne institute would be interested in the future development of official Sudanese specifications.

Mr. Hanafi expressed similar interest, with particular reference to the exports of pickled and chrome tanned (wet blue) productions. He considered that there would be material advantages to be gained by development of National Sudanese Standards in the future on the lines suggested by the consultant.

National standards can only be formulated efficiently and effectively on the basis of a broad survey of good and bad leathers which would indicate the critical factors in each applied test upon which these standards must be based.

The need and the practicality of this approach was suggested to the consultant by his experience in formerly being responsible for the operation of a British Government approved test station serving the British leather industry and his membership of relevant British standards institution committees over a long period.

Whenever it is considered appropriate to undertake the task of formulating national Sudanese standards, guidance would be available from international and other national sources as indicated in annexes IX and X (a) and (b); these also provide useful reference lists for the guidance of the laboratory personnel.

The three tanneries involved in the project

A. Khartoum Tannery

This tannery is the oldest of the three and was established in 1962. The General Manager is Mr. El Sheikh M.A. Tambal, the Technical Manager is Mr. Abdel Rahman Joda and the Technical Manager's Deputy is Mr. Mustafa Abu Rafad. Among the leathers produced are suedes, vegetable tanned upper and sole leathers, box side, semi-chrome upper, embossed upper, nappa leather and belting leather. About 40 % of the production, chiefly wet blue chrome tanned hides and skins and pickled skins is exported. The tannery employs over 500 workers and staff. According to S.Patel, UNIDO consultant, in his report on project SI/SUD/77/803, actual production is only about one third of the tannery's capacity.

B. White Nile Tannery

This is a modern turnkey tannery established in 1975 at a cost of some £S 2.5 million. The General Manager of the White Nile Tannery is Mr. M.El Tayeb El Shayeb and the Technical Manager is Mr. Ibrahim Said Ahmed. The range of leathers produced is very similar to that of the Khartoum Tannery and there is much the same apportionment of production for exports and for domestic sales. The tannery employs about 500 workers and staff. Again, according to Patel (above), the actual production is a similar fraction of the potential capacity for a variety of reasons including the regrettable consequences of shoddy or inefficient installation of the production equipment when the tannery was built.

C. Gezira Tannery

The tannery is situated near Wad Medani, some 220 km. south of Khartoum. The General Manager of the Gezira Tannery is Mr. Ahmed M. Ahmed, the Technical Manager is Mr. Salih Awooda and the Assistant Technical Manager is Mr. Abbas Elamin. It was built and equipped at a cost of £S 2.8 million, with technical assistance by a French consortium (S.A.Krebs-Promo Industries, S.A.Costil-Tanneries de France, S.A.Alric and S.A. Mercier Frères) and has functioned since November 1976 and officially opened by President Nemeri in February 1977. Gezira Tannery has a total workforce of over 500. The output from this tannery includes a similar range to that of the other two but about 75 % is exported in the form of pickled sheep and goat skins and wet blue chrome tanned hides and sheep skins.

The Hides, Skins and Leather Institute

The institute was constructed as a major part of the contribution of the Government of Sudan towards the "Hides, Skins and Leather Development and Training Project" - FAO/SF:58/SUD-2 for which the final report was published in Rome in 1969.

The site chosen for the institute, west of and in line with the frontage of the Khartoum Tannery, was approved in July 1961. The main reason for the choice of site was this enabled the institute tannery to use the tannery's effluent disposal settling tanks.

The main operational units of the institute include a laboratory, a lecture room, administrative offices, a tannin extract plant (currently inoperative), a leather utilization workshop, with an interest in orthopaedic work and a tannery. Figure 1 shows the institute and the Khartoum Tannery as seen from the air and Figure 2 the site plan of the institute (both abstracted from the 1969 FAO report quote above.

The tannery building has facilities for carrying out all the essential tanning operations. The leather utilization workshop is an extension of the tannery and is a closed building with glass lourred windows and lit with fluorscent lighting. There are numerous electric power points supplying the necessary sewing and other machines; the workshop was designed for training technicians in the manufacture of footwear and leathergoods.

The laboratories, forming part of the administrative building, include a general laboratory where chemical analysis of leather can be conducted, a room which houses the currently limited physical test apparatus and which could be easily and economically be converted to function as a constant temperature and humidity room and an office which could be adapted to serve as a reference library in addition to its present use. Much of the equipment now needs to be updated or replaced in both the general laboratory (the fume cupboard, Kjeldahl apparatus, Soxhlet apparatus cutter mill and distilled water still need to be improved) and in the physical test laboratory, where all the present equipment needs much renovation or replacement as well as the addition of further equipment.

A specially important factor in respect of the institute staff and technicians is the interest and keeness to take part in the training sessions conducted as part of the project now concluded (ref. Patel's report, re laboratories and R+D).

Annex II/2

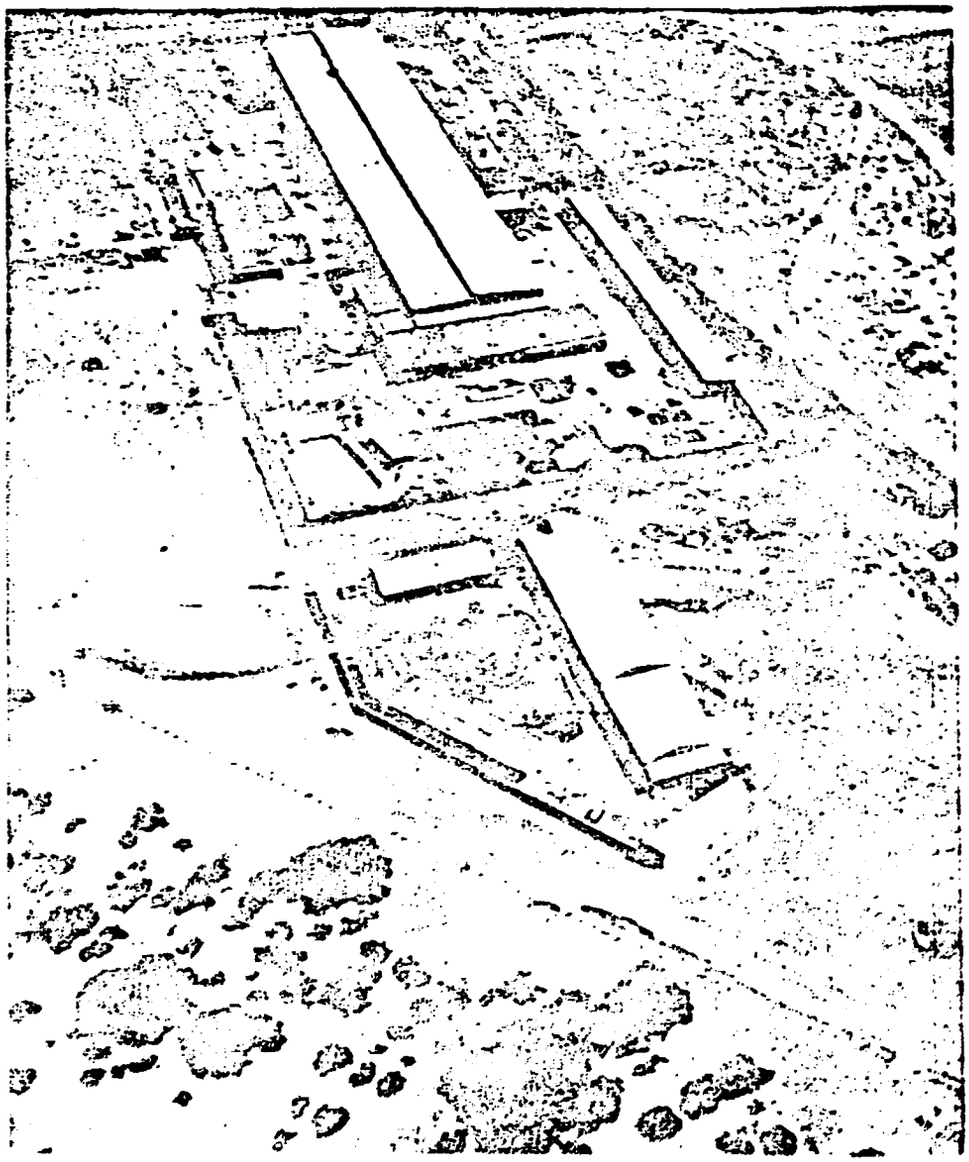

FIGURE 1 THE SUDAN HIDES, SKINS AND LEATHER INSTITUTE

In the foreground the Institute; in the background the Khartoum tannery.

(Abstracted from FAO Report FAO/SF : 55/SUD-2, Rome, 1967)

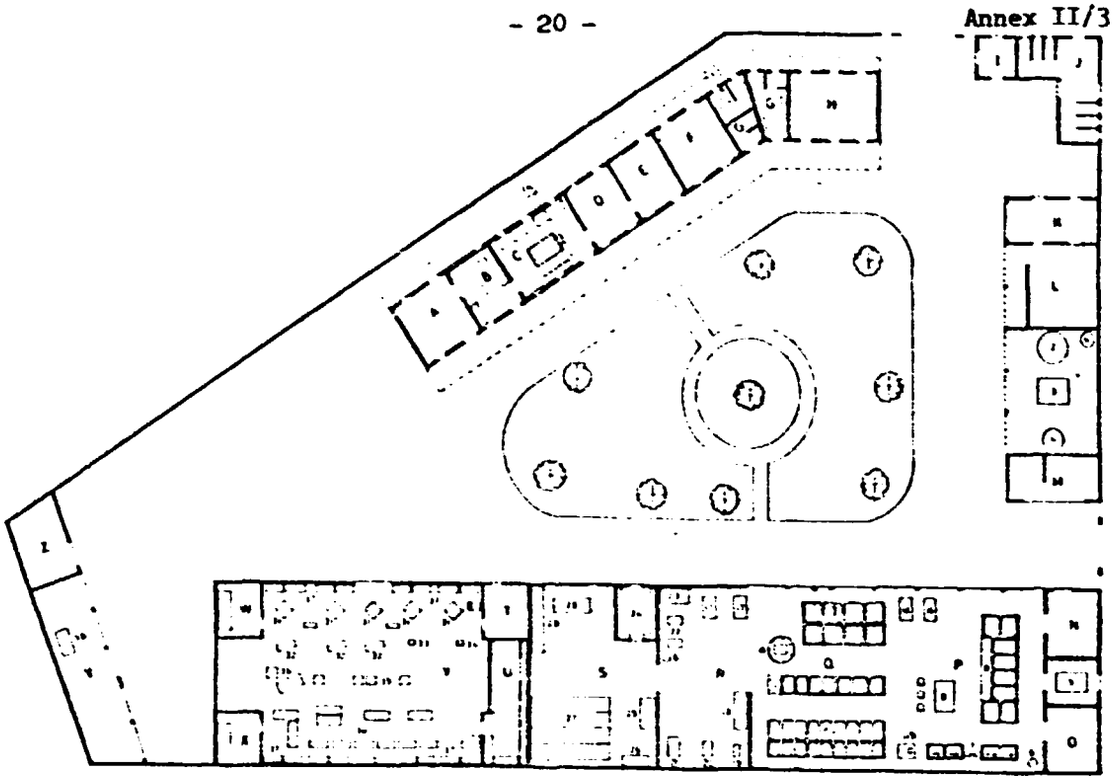

Figure 2 PLAN OF THE SUDAN HIDES, SKINS AND LEATHER INSTITUTE

LEGEND OF FIGURE 2

A. Laboratory Office
B. Physical testing laboratory
C. General laboratory
D. Office (Project Manager)
E. Office (Co-Manager)
F. Office (General)
G. Changing room + toilets
H. Lecture room
I Night watchman
J. Changing room + toilets
K. Carpenter and mechanics workshop
L. Canteen
M. Hide and Skin store
N. General Store and Office
O. General Store + tannery chemicals, fuel
P. Leather processing + limeyard
Q. Leather processing + tannery
R. Leather processing + wet finishing
S. Leather processing + dyeing, drying, warehouse
T. Leather Utilisation- Operations office
U. Leather Utilisation- General Store
V. Leather Utilisation- Training nursery
W. Leather Utilisation- Leather issues and assortment
X. Leather Utilisation- Parkerage office
Y. Tanning materials store
Z. General Store, tannery chemicals, etc.

1. Air-conditioning plant
2. Tannin extract plant - spray drier
3. Tannin extract plant - evaporator
4. Tannin extract plant - tanks
5. Steam generator
6. Pump, steam jacketed
7. Fossier
8. Dressing, lining and water pits
9. Pickler, machine
10. Dressing and lining drums
11. Experimental piece drum
12. Leaches
13. Layers
14. Extract tank
15. Evaporators
16. Jump
17. Tanning and fat-liquoring drums
18. Setting and oiling table
19. Reptile glazing machine
20. Oversized buffing machine
21. Dressing and rolling jack
22. Staking machine
23. Sorbent conditioning bay
24. Dye store
25. Dyeing and finishing table
26. Spray booth
27. Leather drying racks
28. Leather conditioning table
29. Leather storage racks
30. Upper skiving
31. Shoemaking benches
32. Finishing machines
33. Sole cutter
34. Sole attacher
35. Lasting pressure
36. Lasting
37. Moulded cupboards
38. Hare electrolyser

(Abstracted from FAO Report FAO/SF: 58/SUD-2, Rome)

Annex III (a)

Physical Test Equipment provided

Item	Quty.	Unit	Description	Estim.cost US$, Nov.1979
1	1	Each	Lastometer, STD104, with accessories, supplied by SATRA, Kettering, Northants, U.K.	2,800
2	1	"	Adhesion of Finish Tester, STD 112, supplied by SATRA	900
3	1	"	Finish Rub Fastness Tester, STM 102 with 100 felt pads, STM 102/P and Grey Scale cards, also spare parts, supplied by SATRA	4,000
4	1	"	Apparatus for Leather Shrinkage, Temperature Determination, STD 114, supplied by SATRA	1,700
5	1	"	Dome Plasticity Apparatus with Micrometer and Bridge, STD 110, supplied by SATRA	480
6	1	"	Bally Flexometer (12 stations), Supplied by Bally, Switzerland, with spare parts and accessories	2,050
7	1	"	Bally Penetrometer (new type) with 4 stations and electronic device, supplied by Bally, Switzerland	1,700
8	1	"	Sole Adhesion Tester, STD 185, with attachments for different purposes, supplied by SATRA	250
9	1	"	Bottom Leather Grain Crack Tester, STD 132, supplied by SATRA	500
			TOTAL estimated cost	14,380

Annex III (b)

Glassware and other Special Equipment provided

Item	Qutty.	Unit	Description	Estimated cost US$, Nov. 1979
1	2	Each	Electric analytical balances	3,000
2	2	"	Microscope,ordinary,student grade	1,000
3	2	"	Muffle furnance, laboratory size	3,000
4	1	"	Electric mixer and emulsifier	2,000
5	4	"	Kjeldahl digestion units+flasks	1,600
6	2	"	Stopwatch, precision	180
7	2	"	pH Meter, Cambridge, with extra electrodes	2,400
8	1	"	Incubator, standard	302
9	1	"	Shaking machine, SATRA type	600
	Total estimated cost of apparatus listed above			14,082

N.B. Two only Kubelka Apparatus, estimated cost US$ 100, do not appear to have been received; only one muffle furnace was received.

Sundry standard laboratory glassware and equipment was also provided including the following (estimated cost, US$, at November 1979, shown in brackets):

Measuring cylinders, glass (415), volumetric flasks (151), conical flasks (100), beakers (186), funnels (40), burettes (122), dropping bottles (72), soxhlet extraction apparatus (180), pipettes (95), dropping pipettes (27), Dean and Stark apparatus (60), separating funnels (90), crucibles (29), Nessler apparatus (90), Baumé meters (36), filter candles (24), test tubes (40), tongs (189), Buchner funnels (25), thermometers (43), polythene measuring cylinders (329), Procter extractor (10), test tube brushes (43), rubber tubing (179), filter papers (113), pH papers (100).

The total estimated cost of the items listed, at November 1979 prices, is US$ 2,788.

Annex III (c)

Chemicals to be provided

1. Acids: Hydrochloric acid (62), nitric acid (110), perchloric acid (652), sulphuric acid (84), boric acid (2), oxalic acid (2), acetic acid (12), phosphoric acid (2).

   Total estimated cost at November 1979 - US$ 926.

2. Solvents: Ethanol * (76), ether (30), dichloromethane (72), benzene (10),methanol (6), butyl acetate (420), petroleum ether (boiling point range not stated)(32), acetone (12), carbon tetrachloride (14).

   Total estimated cost at November 1979 - US$ 672

3. Indicators: Bromothynol blue (10), bromophenol blue (10), methyl orange (4), phenolphthalein (3), thymolphthalein (3), bromocresol green (24), bromocresol blue * (12).

   Total estimated cost at November 1979 - US$ 66.

4. Bases: Ammonia solution (17), sodium hydroxide (6), potassium hydroxide (2).

   Total estimated cost at November 1979 - US$ 25.

5. General laboratory chemicals: Hydrogen peroxide (120), sodium peroxide (4), silver nitrate (360), potassium dichromate (8), potassium chlorate (5), chromium potassium sulphate (24), formaldehydealanalar (1), zine sulphate (4), potassium iodide (90), sodium thiosulphate (12), ammonium chloride (3), potassium thiocyanate (2), barium chloride (1), sodium diphosphate (1), potassium chromate (2), aluminium oxide (2), sodium carbonate (5), sodium chloride (4), ammonium ferric sulphate (2), ammonium nitrate (2), ferrous sulphate (3), silver sulphate (50), copper sulphate (5), mono diorthophosphate * (10), disodium phosphate (10), lead acetate (5), mercuric iodide (4), sodium sulphate (3), sodium nitrate (3), sodium acetate (14), sodium dichromate (3), sodium bicarbonate (1), potassium sulphate (2).

   Total estimated cost at November 1979 - US$ 792.

6. Miscellaneous items: Glycerin (18), Buffer solutions 4 and 8 (2x6), and hide powder * (20).

   Total estimated cost at November 1979 - US$ 50

   Overall estimated cost at November 1979 - US$ 2,531. Corrected for items marked * (not available for supply by the company from which the chemicals were ordered) - US$ 2,310.

N.B. At the time of preparation of this report the chemicals had not been delivered.

Annex IV

Quality control analysis and tests for pickled sheepskins

To economise and avoid unnecessary waste of skins, sampling can be done by taking cuttings in the neck instead of taking them from the official sampling position (SLC 1, 1966).

Tests which can be carried out include:

(a) Moisture content
(b) Salt content as sodium chloride
(c) pH of water extract
(d) Acidity of water extract
(e) Shrinkage temperature, Ts
(f) Material extractable by dichloromethane
(g) Collagen content.

a) Moisture content by Dean+Stark Method

Weigh 10g diced (i.e. finely cut up) pelt to the nearest 0.01 g and transfer it to a 250 ml flat bottomed quickfit B 24 neck flask. Add 100 ml toluene or other suitable solvent. Fit the flask to the Dean+Stark apparatus and condenser. Turn on the water supply to the condenser and begin heating the flask on a hot plate. Continue heating until no further change occurs in the water level in the Dean+Stark receiver vessel. Record the volume of water collected in the receiver.

Calculation: Let W = mls. water collected, then

$$\% \text{ moisture in the pickled pelt} = \frac{W \times 100}{\text{weight of pelt, g.}}$$

b) Salt content

Plave 5g diced pelt into a 250 ml conical flask, add 50 ml of distilled water and place a stopper in the neck of the flask. Allow the flask and contents to stand for 24 hours with occasional shaking by hand. At the end of this time, decant the free liquid and filter through a No.54 or No.541 Whatman 15 cm. filter paper and 75 mm filter funnel. Add 4 drops of methol Orange indicator solution and neutralize with 0.1 N.NaOH solution. Titrate 10 ml. of the neutralised filtrate with 0.1N silver nitrate solution after adding 3 drops of 5% potassium chromate solution as indicator.

Calculation: Let T=mls 0.1N silver nitrate solution required: - % sodium chloride based on pickled pelt weight

$$= \frac{T \times 5.85 \times 100 \times 5}{1000 \times \text{weight of pickled pelt.g}} = \frac{T \times 5.85 \times 100}{1000} = T \times 0.585$$

N.B. See collagen content determination, Method (g) below.

c) pH of Water Extract

Place 10g. diced pickled pelt in a 500 ml stoppered bottle or flask with 100 ml. 0.01 N sodium chloride solution and shake for 2 hours. Determine and record the pH of the decanted liquor using a pH meter standardised on buffer 4.0.

d) Acidity of Water Extract

Titrate 5 ml of filtered extracted liquor (from the test (c) above) with 0.01 N NaOH solution. Carry out repeat tests on 5ml samples using (a) bromophenol blue indicator (pH 4.6 - 5.3) solution and (b) phenol phthalein solution.

Calculation: Let T = mls. 0.01N NaOH required to titrate 5 ml extract to the end-point for (a) bromophenol blue; (b) phenol-phthalein:- Acidity, mgm. equivalents of H_2SO_4 per 100.g pelt
= T x 0.49 x 200 Two results in good agreement are required.

e) Shrinkage temperature determination

This should be carried out in 5% sodium chloride solution.

f) Material extractable by dichloromethane

Weigh accurately approx. 10g ± 0.1 g diced pickled pelt into a dry dish, dry overnight in an oven at 100 ± 2° C, cool and reweigh. Transfer the dried pelt to a Soxhlet thimble and extract with 150 mls dichloromethane in the Soxhlet apparatus (using a 250 ml. quickfit flat bottomed flask) as for normal fat extraction. Dry the flask and its residue in an oven at 100 ± 2°C overnight after distilling off the solvent in the normal way. Cool the dried flask in a desiccator and reweigh.

Calculation: % extractable matter on pelt weight = $\frac{\text{g. extract}}{\text{g. pelt}} \times 100$

g) Collagen content

The pelt remaining from the sodium chloride content determination, method (b) above, is extracted (by shaking for 2-3 hours) with 50 mls. of acetone. Decant off the solvent after this period and dry the residue in pre-dried, weighed evaporating basin in an oven at 100 ± 2°C overnight (or until the weight remains constant).

Calculaation: Let the dried residue weight = W:-
% collagen by weight = $\frac{W \times 100}{\text{weight of pickled pelt, g}}$

N.B: this is only a crude method of determining collagen but is sufficiently accurate for the intended purpose. The sodium chloride content, moisture content and dichloromethane extractables content can, alternatively, be expressed on collagen or on pelt weight.

QUALITY CONTROL ANALYSIS AND TESTS FOR WET BLUE HIDES AND SKINS

1. Water content

The water content of cattle hides and calfskins can vary widely between 50% and 75%. The water content should not be too low because mineral salts present may crystallise out if the leather becomes over-dried. Other difficulties may also occur such as creases formed by pressure during storage and transport of leather that is too dry and which become permanent and persist through subsequent operations. For these reasons, it has been proposed that the water content of hides and calfskins in the wet blue condition should be not less than 50% and for small skins such as sheepskins or goatskins it should be at least 60%.

The determination can be made in a Dean and Stark apparatus on a representative sample of hides or skins, cut into small pieces. The sample weighing approx. 10 grammes should be weighed quickly and transferred to a 250 ml. B24 round-bottomed quickfit flask; 100 ml of toluene added and the flask then connected to the Dean and Stark apparatus fitted with a water-cooled condenser. All connecting joints should be ground glass. The flask containing the sample and toluene should then be heated electrically and the volume of water collected in the graduated side of the Dean and Stark apparatus is noted after heating is discontinued when no more water is distilled over.

$$\% \text{ water content} = \frac{\text{Volume of water collected}}{\text{Weight of Wet Blue sample, g.}} \times \frac{100}{1}$$

2. Chromic oxide content

Wet blue leather which is available in the leather trade can vary between about 3% and 7.5% but, in Europe, it has been recommended that the minimum should be 2% and the maximum should be 5% on the dry leather. This maximum would be equivalent to about 4% on wet blue hides and 6-7% on skins. In Europe it has also been proposed that wet blue should be at least washed after tannage and drained before packing and despatch. This would help to remove excess un-fixed chromium compounds which can give falsely high figures for chromic oxide content. Washing at the end of tannage also removes excess mineral salts. Unwashed leathers have been found to contain variable quantities of salts which, when expressed as a difference between total sulphated ash content (see method SLC.10, Official Methods) and chromic oxide content can give results of between 1% and 18% excess. These high levels of salts are undesirable. They cause increased crystallisation of solid salts on the surface of the leather; they also increase transport costs and give rise to an artificial increase in price when the wet blue is sold by weight. The figure obtained by subtracing % Cr_2O_3 from % total sulphated ash should never exceed 10 % on dry (zero moisture) leather.

The chromic oxide content can be determined on a representative sample cut into small pieces. A satisfactory determination can be made on 1g. - 2g. of the wet blue leather as the weight taken should thus make allowance for the relatively high water content of the sample. After the sample has been transferred to a Kjeldahl or conical flask, 10 mls of concentrated nitric acid should be added and after allowing to stand at room temperature for 10 minutes, 15 mls of perchloric acid - sulphuric acid oxidising mixture (230 mls 70% perchloric acid + 70 mls concentrated sulphuric acid) is added. After a further period of 10 minutes at room temperature, the heating of the flask and its contents can be started. Heating a fume-cupboard is continued until the liquid remaining in the flask becomes clear yellow-orange in colour. The flask is then cooled rapidly in a bath of cold water and 100 mls cold distilled water added immediately. The flask and its contents are then returned to fume cupboard to be brought to the boil and boiling continued for 10 minutes to displace chlorine from the solution of dichromate produced by the oxidation. The flask is again cooled after removal from heating and the test solution analysed by volumetric titration with standard sodium thiosulphate after addition of 20 mls 10% potassium iodide solution or 2g. solid potassium iodide, using freshly prepared 1% soluble starch solution as indicator. The Method SLC 8:1966 in SLTC Official Methods describes the determination procedure.

Calculation: % chromic oxide content at zero moisture content

$$= \frac{\text{mls. 0.1 N sodium thiosulphate solution requd.}}{\text{weight of sample taken, g}} \times 0.002534 \times \frac{100}{100\text{-water content}}$$

If the result is required to be expressed at 14% moisture content

$$= \text{mls. 0.1N sodium thiosulphate reqd.} \times 0.002534 \times \frac{100 - 14}{100\text{-water content}}$$

The actual water content of the sample will be determined by the Dean and Stark method already described.

3. Grease and Fat Content

Because of the high water content of wet blue material the fat content cannot be determined directly on the sample by extraction with dichloromethane. That solvent can be used if the leather sample (15 - 20g. of wet blue cut up into small pieces) is first dried in an oven at 80 - 100°C. for 4 hours in a dish and then transferred, without further weighing, to a Soxhlet extractor fitted with either a standard paper thimble or a pad of degreased cotton wool. Alternatively, the wet blue sample can be transferred directly into the paper thimble or the Soxhlet extractor vessel after weighing and then extracted with acetone instead of dichloromethane but there may be an error due to salts being carried down into the receiving flask and giving a high result. In either case, as in the normal method used for fat extraction, the receiving flask must be weighed previously so that, after removal of solvent, the flask can be re-weighed after drying and the fat content calculated. The same correction to zero or 14% moisture content would require to be made as explained above for chromic oxide content.

The fat content of wet blue leather should not exceed 2% when expressed on leather at zero moisture. The low fat content is an important criterion for wet blue leather to distinguish it from crust leather or other leathers which have been dressed. If the upper limit of 2% fat is exceeded, a buyer may require tests to be made to determine the type of fat present. Apart from the variation necessary due to the relatively high water content, the procedure should follow SLTC Method SLC.4.

4. pH Value of Water Extract

When the pH of wet blue leather is to be determined, approx. 10g. of cut-up sample should be shaken mechanically for 2 hours and allowed to stand in a closed flask with 20 volumes of distilled water for each gramme of sample at zero moisture. If the water content determined on the wet blue is 50% then 100 mls of distilled water would be required, if 40%, 120 mls or if 60%, 80 mls. would be required. The pH of the extract should be determined accurately on a pH meter standardised immediately before hand using buffer pH 4.0. The pH value of the aqueous extract should not be lower than 3.0 because lower values indicate a possibility of acid damage and a reduction in the strength of the leather. If a pH value of 3,8 is reached during neutralisation at the end of tannage and maintained, the pH value of the leather, after being stored for some time, will not be below pH 3.0. (see Method SLC.13:1966 and note particularly Note 8.6 on page 3 of the Method Sheets).

5. The Boil Test

A quick guide to the completion of tannage in the wet blue production process can be given by this test. The area loss permitted may vary between buyers, some insisting that the area loss may not exceed 5%, others allowing up to 10%. The test sample is dropped into boiling distilled water and boiling maintained for 2 minutes. The change in area is recorded. The estimation of the loss in area, if any, is much easier to record accurately if a true rectangular sample is cut from the hide or skin initially and the area measured by ruler in millimetres. For example, a smaple 50 mm square will be adequate to enable the area loss to be calculated with reasonable accuracy after remeasurement following the 2 minute boil. A more precise procedure is described in Method SLP.17 in SLTC Official Methods.

6. Shrinkage Temperature

This is a much more precise guide to the thermal stability of the wet blue leather. The temperature at which the test sample measuring 8 cms x 1 cm. shows a rapid reduction in length and causes the movement of an indicator set against a marked dial is normally very sharp and sensitive to 1-2° C variation on repeat tests.

The test can either be carried out in the SATRA Shrinkage Temperature apparatus Ref. STD 114 (in water under pressure) when the Ts is likely to exceed 100 ^{o}C or in the simpler apparatus illustrated in diagram form in Method SLP.18, SLTC Official Methods, if a mixture of 70 parts glycerin and 30 parts distilled water is used instead of distilled water. The results obtained by the latter method may vary by a small amount from those obtained by the SATRA apparatus but will give a useful and reliable guide to the standard of thermal stability. The Ts also provides some guidance concerning the effectiveness of the chrome tanning operation because there is some degree of correlation between Ts and chromic oxide content. It is possible to determine both of these parameters on the wet blue or dry chrome leather produced in a given tannery and to construct a simple graph from data obtained from the tests made on a good number of samples. The graph produced can be used as a rough guide to the likely chromic oxide level of a new batch if the Ts is determined.

Annex VI

Trade requirements for various leathers: data collected in Sudan

A. Khartoum Tannery : April 1982 current

a) Wet blue hide (Rumanian requirements)

Thickness 20-4.5 mm; area per side 10 -20 sq. ft;
Chrome content at 14% moisture 3.5%; must stand the boil test.

b) Full chrome box side patent leather (BATA)

Thickness 1.6 - 1.8 mm; General appearance should be acceptable.
No chemical requmts. quoted.

Physical tests:		
	Lastometer, grain crack	min 7 mm
	Burst	min 10 mm
	Flex resistence	1 m flexes

c) Full chrome box side, smooth (BATA)

Thickness 1.6 - 1.8 mm; very shiny, level. Looseness unacceptable.
Chemical requirements: Fat, max. 2%, % Cr_2O_3 min 3%.

Physical tests:		
	Lastometer, grain crack	min. 7 mm
	Burst	min. 10 mm
	Linear shrinkage	max. 5 %
	Flex resistence	1 m. flexes
	Dry rub	500 revs.
	Wet rub	120 revs.

d) Full chrome, embossed (BATA)

Thickness 1.6 - 1.8 mm; General appearance and feel should be uniform and full. Pipiness, stretchy and fleshy material not acceptable.

Chemical requmts.	Physical tests	
Fat max. 2%	Lastometer, grain crack	7 mm min
% Cr_2O_3 min 3.0 %	Linear shrinkage	5% max.
	Burst	10 mm min
	Flex resistence	0.5 m. min flexes

e) Full chrome box side, embossed (BATA)

Thickness 2.3 - 2.5 mm; General appearance and feel should be uniform and full. Pipiness, stretchy and fleshy material will not be accepted.

Chemical requts.	Physical tests	
Fat max. 4 %	Flex resistance	100,000 flexes
% Cr_2O_3 min. 6%	Linear shrinkage	5% max.
	Dry rub 1000 revs; wet rub 500 revs.	

f) Full chrome sheepskin (BATA)

Thickness 0.8 mm, important
General appearance should be level and uniform.

g) Full chrome patent leather (BATA)

Thickness 1.4 - 1.6 mm; General appearance should be acceptable.
Chemical requmts. - none quoted
Physical tests: Lastometer, grain crack 7 mm. min.
Burst 10 mm. min.
Flexometer resistance 1 m. flexes

h) Full chrome retanned sheepskin lining (BATA)

Thickness 0.9 - 1.0 mm. - more important
General appearance should be level and uniform.

i) Hunting calf (sand and brown) BATA

Thickness 2.0 - 2.2 mm; General appearance and feel should be uniform, finishing on the flesh side with full feel. Dye to be uniform. Patchiness will be unacceptable, no fibrous side will be acceptable.

Chemical requmts.	Physical tests	
Fat max. 3%; Cr_2O_3 min.3.0-3.5%	Lastometer, grain crack	min 7 mm
	Burst	min 10 mm
	Linear shrinkage	max. 5%

j) Full chrome DVP embossed black leather (for Army Boots) (BATA)

Thickness 2.3 - 2.5 mm; General appearance should be uniform and full. Pipiness, stretchy and fleshy material will not be acceptable.
Chemical requmts: Fat max. 4%, Cr_2O_3 max. 6%
Physical tests: Flex resistance 1 m. flexes
Linear shrinkage max. 5%
Dry rub 1,000 revs; wet rub 500 rev

k) Chrome leather insole, 'natural',for Army boots (BATA)

Thickness
Chemical requmts: Fat max 6%; Cr_2O_3 2.8 - 3.0%
Insoluble ash below 2%
Total water solubles, below 8%
Physical tests: Tensile strength, min. 200 kgs/cm^2
Water absorption after 15 minutes, below 20% (Q15)

1) Vegetable tanned upper leather, brown/black (BATA)

Thickness 2.0 - 2.2 mm
General appearance should be uniform. Patchiness and loss of grain will be unacceptable.

Chemical requmts.	Physical tests	
Fat max. 4%	Tensile strength	25 kg/cm^2
Total ash below 2%	Lastometer, grain crack	7 mm min.
Total water solubles, below 8%	Water absorption after	15 min., max. 20% (Q15)

n) Vegetable tanned insole, smooth, asserted colours (BATA)

Thickness 2.5 - 2.7 mm
Chemical requmts: Fat max 4%; total ash max. 1½; water solubles max.5%
Physical tests: Tensile strength 250 kg./cm^2
Water absorption after 15 min. max. 20% (Q15)

o) Semichrome smooth, assorted colours (BATA)

Thickness 1.8 - 2mm; very shiny, level, looseness unacceptable.
Chemical requmts: Fat max. 2%; Cr_2O_3 min. 3%

p) Vegetable upper smooth (BATA) : Thickness 2.0 - 2.2 mm
Vegetable insole smooth: Very shiny, level, looseness unacceptable.
Chemical requmts: Fat max. 4%, total ash max. 1%, total water solubles max. 5%.

q) Syrian specification for Army upper leather

Tensile strength min. 250 kg/cm^2 (IUP.6)
Elongation at break, % max. 60 "
Elongation under 1 kg/cm^2 max.30 "
Volatile matter (water etc.), % max. 18 (IUC.5)
Total sulphated ash
(excluding Cr_2O_3), % max. 2 (IUC 7)
Hexane solubles (fat etc.), % max. 7 (IUC4)
Acidity (pH) of water solubles min. 3.5 (IUC 11)
Flexometer resistance min. 30,000 flexes (IUP 20)

B. Gezira Tannery

BATA requirements for vegetable tanned sole leather chemical and physical test requirements related to method of tannage, a) pit (old method) or b) drum (modern method):-

	a)	b)
% Fat	0.7 max.	3.0 max.
% water solubles	6.0 max.	16.0 max.
Degree of tannage	60-95 for both	
Tensile strength	200 kg/cm^2 for both, min.	
% Elongation at break,	35.0 max.	30.0 max.
Stitch tear, kg/cm^2	130 min.	100 min.
% water absorption, after 2 hrs	40.0 max. for both (Q2)	
" after 24 hrs	50.0 max for both (Q24)	
Volume/unit weight	1.15 max. for both	
Air Permeability l/cm^2/hr.	20.0 min, for both	
Water vapour permeability mg/cm^2/hr.	200 min. for both	
Wear coefficient	2.0	3.0

Annex VII

PROCESS CONTROL IN TANNERIES

Planned Sampling for Analysis and Physical Testing

A. Liming Process

1. Lime Liquor to be sampled before the soaked hides or skins go in
2. " " " " " after the limed goods are removed
3. Lime/sulphide paint to be sampled before use on hides or skins
4. Delimed hides or skins at the end of deliming.

Determination to be made

Samples 1 and 2: pH (by meter) checked with buffer 9 or 10 or 12.6 (limebuffer), see method SLM/1

Sample 1 only: total strong alkali - method 4/5)
" 2 " : (total available alkali - method SLM 4/6) SLTC official method
(chloride content - method SLM 4/3)
Samples 2 and 3 sulphide content - method SLM 4/2)
Sample 4 shrinkage temperature (determined in water) method SLP 18

Regular tests should also me made on solid lime and sodium.

Sulphide as bought in by the tannery to check that their quality is acceptable. Limed goods should be weighed after unhairing and fleshing to calculate weight yield as a percentage on the green weight.

B. Bating process

Delimed goods must be checked for pH by testing with indicator on a cut made freshly; if phenolphthalein used as indicator should only show faint pink streak in centre.

Bate powder should be tested regularly by the gelatine liquefaction test. The pH of the bate liquor should be tested with testpaper before bating is carried out. The pH should be about pH 8. A suspension of bate powder can be made, filtered and titrated to determine ammonium salts present.

C. Pickling process

1. Pickle liquor to be sampled before the delimed goods go in
2. Pickle liquor to be sampled after the pickled goods come out
3. Cuttings should be taken from 3 hides or 3 skins after pickling and draining (samples from the same batch)

Determination to be made

Samples 1 and 2. Determine pH by Meter (and by paper as a guide); Titrate with dilute alkali (e.g. N/10 NaOH) using first

(Measure the °Be´ (and Specific (Gravity of these (Samples

Bromophenol blue and also phenolphthalein second, independently, (as a check) to determine acidity (Acidity (mgm. equivs. H_2SO_4 per litre) mls. of titre 4.9 x (1000 ÷ aliquot taken), Determine sodium chloride content by normal silver nitrate method on diluted samples using potassium chromate indicator.

Sample 3

pH of water extract (10g cut up hide or pelt put into 500 ml stoppered bottle + 100 ml N/100 NaCl solution. Shake for 2 hours. Determine pH by meter (and paper) on some of the extract. Titrate some more of the same extract with N/100 NaOH solution using (a) dromophonol blue and (b) phenolphthalein as indicators, separately, to determine acidity. Determine water content in the pickled stock by Dean and Stark apparatus or by drying a 10g sample in the oven. Use the dried 10g sample after weighing to calculate moisture, then transfer it completely to a Soxhlet thimble and extract for 3 hours with dichloromethane to determine fats (the grease extraction flask must be weighed before as usual). Determine the shrinkage temp. of the pickled pelt in 5% NaCl solution. Determine sodium chloride content.

D. Chrome tanning process

1. Chrome tan liquor before pickled goods go in
2. Chrome tan liquor after tanned goods come out
3. Cuttings should be taken of 3 hides or 3 skins in the same batch.

Determination to be made

Sample 1 Determination of chromium oxide content by method SLT 6/1
Sample 2 " " " " " " " SLT 6/4
Samples 1 and 2 Determination of pH by meter, see method SLT 6/3 and °Be´or specific gravity

N.B. Analysis should also be made on dry chrome tan powder or strong tan liquors to determine pH (see method SLT 6/3 and basicity (see method SLT 6/2)

Sample 3 Determine pH of water solubles, % water solubles, % moisture (by Dean and Stark or by drying), % Cr203, % Fat (extract the 10g moisture sample after weighing by transferring it to a Soxhlet thimble) extracted by dichloromethane for 3 hours. Shrinkage temp. in the SATRA apparatus. Determine total ash on the water solubles extraction residue - transfer it completely to a weighed basin and dry in the 100°C oven before ashing finally in the muffle furnace (the % total ash should be approx. the sum of % water insolubles + $\%Cr_2O_3$).

N.B. On (wet) blue crust tests can be made to indicate the tensile strength and flexibility of the airdried leather. A cut made in the wet blue stage can indicate the extent of chrome penetration - if neck or butt areas show undertannage more acid or more time was needed at the pickling stage. The thickness of the dry chrome crust leathers should be recorded as a routine.

The moisture content of chrome leathers at intermediate stages of production is very important, e.g. when ready for shaving it should be 30-45%; after drying 8-14%; after conditioning 18-22% and after saw dusting 26-32%.

E. Vegetable tanning process

1. Tan liquors should be sampled regularly from all pits or drums used in order to give an overall picture of the amount of tan required to tan the hide or skin at each stage of the process and to determine the amount of tan discarded when the bottom liquor is thrown away. Determinations required: pH (by meter salts, tans, °Bé (or specific gravity).

2. Solid tan powders or concentrated liquors also require to be analysed for tan content, moisture, total solids, total solubles, non-tans, pH, by methods 2/3 (a-k) of SLTC.

3. Vegetable tanned leathers should be fully analysed; moisture, pH of water solubles, % water solubles, % hide substance, % fats (extractable by dichlore methane), % insoluble ash (it may also be useful to calculate degree of tannage, tanning figure and leather substance (calculated from taking the sum of moisture fats, water solubles and insoluble ash from 100% - all these being determined at 14% moisture basis). Note that leather substance is calculated by taking the sum of the percentages for moisture, fats, water solubles, insoluble ash and hide substance from 100%. For vegetable tanned or combination tanned in sok leather it may be necessary to determine the sulphated ash of water solubles obtained by a) drying 100 mls water solubles extract in a weighed basin, adding dilute sulphuric acid in successive portions to the residue and heating in a muffle furnace to constant weight. This determination may be required to confirm a low salt level in the sole leather. Fat content is also important for leathers used for shoe components. Shrinkage temperature should be determined on all vegetable tanned leathers at all stages of tanning right up to finished leather or crust leather.

PHYSICAL TESTING

The most relevant tests to apply will be those such as shrinkage temperature which can give (a) information on the uptake of tan (vegetable or chrome) during movement of the leather through the leathermaking process or b) information concerning the fitness of the leather for use in a particular shoe making process, e.g. chrome tanned upper must have a high shrinkage temperature to stand the conditions of moulding in the rubber moulded sole footwear process.

Similarly, abrasion resistance, finish flexibility and crack index are important for good shoe upper leather, tensile strength for belting leather and tensile strength and good crack index figures for sole leather. In this way, the tests applied need to be those which give an indication of the likely performance of a leather for a particular purpose.

In many instances, the purpose of the chemical analysis is to support the physical test evidence of suitability of the leather.

N.B. Before all physical tests other than shrinkage temperature, leather samples for testing should have been conditioned in a room maintained at a constant temperature and relative humidity for 48 hours. According to SLTC method SLP 3 (IUP/3) the official conditions required are RH 65 $\pm$ 2% and 20 $\pm$ 2°C.

Exports of pickled skins and chrome tanned (wet blue) hides and skins from Sudan, January - December 1980

Source: Foreign Trade Statistics, Sudan 1980

Export	Importing country	Quantity	Value, cumulative £S
Goat skins, pickled	Italy	6,243 kg	32,000
Sheep skins, pickled	Finland	11,423 "	102,000
	USA	87,075 "	590,023
Calfskins and Kip, chrome tanned	Roumania	222,363 "	390,000

Annex IX

Reference lists (Parts I and II) of International Standards for leather at September 1978

C O N T E N T S

Introduction

The first edition of ISO Bibliography 3 contained details of ISO International Standards and drafts dealing with agricultural products other than food. Since these products vary so widely in their nature and their applications, it has been decided that it would be better to present them separately.

This bibliography therefore contains in Part I details of ISO International Standards, draft International Standards and draft proposals dealing with leather. The other subjects included in the former ISO Bibliography 3 will be covered by other bibliographies.

Part II contains a list of analytical and test methods established by the International Union of Leather Technologists and Chemists Societies (IULTCS). It should be noted that many of the documents listed in Part II form the basis for ISO International Standards and drafts listed in Part I.

A word of explanation is needed regarding the various types of documents listed. A draft proposal (DP) is a document which is still under study in a technical committee of ISO. Once substantial agreement has been reached, it is registered as a draft International Standard (DIS). At this stage it is submitted for approval by the ISO member bodies and subsequent acceptance by ISO Council as an International Standard. It may then be used as such, or implemented through incorporation in the national standards of individual countries.

Additional information on IULTCS methods and activities may be obtained from the IULTCS-Secretariat, Waalwijk, Mr. van Coothstraat 55, Netherlands.

International Standards

	Pages	
ISO 2417-1972	2	Leather - Determination of absorption of water
ISO 2418-1972	3	Leather - Laboratory samples - Location and identification
ISO 2419-1972	1	Leather - Conditioning of test pieces for physical tests
ISO 2420-1972	2	Leather - Determination of apparent density
ISO 2588-1973	1	Leather - Sampling - Number of items for a gross sample
ISO 2589-1972	2	Leather - Physical testing - Measurement of thickness
ISO 2820-1974	2	Leather - Raw hides of cattle and horses - Method of trim
ISO 2821-1974	2	Leather - Raw hides of cattle and horses - Preservation by stack salting
ISO 3376 -1976	3	Leather - Determination of tensile strength and elongation
ISO 3377 -1975	2	Leather - Determination of tearing load
ISO 3378-1975	4	Leather - Determination of resistance to grain cracking, and of crack index
ISO 3379-1976	3	Leather - Determination of distension and strength of grain - Ball burst test
ISO 3380-1975	3	Leather - Determination of shrinkage temperature
ISO 4044-1977	1	Leather - Preparation of chemical test samples
ISO 4045-1977	2	Leather - Determination of pH
ISO 4047-1977	2	Leather - Determination of sulphated total ash and sulphated water-insoluble ash
ISO 4048-1977	2	Leather - Determination of matter soluble in dichloromethane

Draft International Standards

DIS 2822	Leather - Defects in fresh or wet salted raw cattle hides - Vocabulary
DIS 4098	Leather - Determination of water-soluble matter - Water soluble inorganic matter, and water soluble organic matter

Draft proposals

DP 4681	Raw cattle hides and calf skins - Grading according to mass
DP 4682	Raw sheep skins - Designation and presentation
DP 4683	Raw sheep skins - Defects - Vocabulary
DP 4684	Leather - Determination of water and other volatile matter
DP 5147	Leather - Gray scale for assessing staining
DP 5148	Leather - General principles of colour fastness testing
DP 5397	Chemical analysis of leather - Determination of nitrogen and of "hide substance"
DP 5398	Chemical analysis of leather - Determination of chromic oxide (Cr_2O_3)
DP 5399	Chemical analysis of leather - Determination of water soluble magnesium salt
DP 5400	Chemical analysis of leather - Determination of silicones
DP 5401	Chemical analysis of leather - Determination of phosphorus
DP 5402	Physical tests of leather - Measurement of the flexing endurance of light leathers and their surface finishes
DP 5403	Physical tests of leather - Dynamic waterproofness test for boot and shoe upper leather
DP 5404	Physical tests of leather - Dynamic waterproofness test in boot and shoe sole leather
DP 5430	Physical tests of leather - Measurement of the water-proofness of gloving leather
DP 5431	Specification for chromed goat skin in wet blue condition
DP 5432	Specification for chromed sheep skin in wet blue condition
DP 5433	Specification for chromed hides in wet blue condition
DP 5434	Specification of crust leather

PART II – ANALYTICAL AND TEST METHODS DEVELOPED BY THE INTERNATIONAL UNION OF LEATHER TECHNOLOGISTS AND CHEMISTS SOCIETIES

Analytical methods

IUC/1	General comments
IUC/2	Sampling
IUC/3*	Preparation of test material by grinding
IUC/4*	Determination of substances (fats and other solubles) soluble in dichloromethane (CH_2Cl_2)
IUC/5**	Determination of volatile matter in leather (moisture, etc.)
IUC/6**	Determination of water soluble organic and inorganic substances in leather (water soluble matter)
IUC/7*	Determination of total ash and of water insoluble ash
IUC/8**	Determination of chromic oxide (Cr_2O_3)
IUC/9**	Determination of water soluble magnesium salts in leather (epsom salts)
IUC/10**	Determination of nitrogen and of "Hide substance"
IUC/11*	Determination of the pH value and difference figure on an aqueous leather extract
IUC/13	Determination of zirconium
IUC/15**	Determination of phosphorus
IUC/16	Determination of aluminium

Physical test methods

IUP/1	General remarks
IUP/2*	Sampling
IUP/3*	Conditioning (an addition has been approved at the 1975 Congress of IULTCS)

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* Basis for ISO International Standard - see Part I

** Basis for ISO document - see Part I

N.B. See also B.S. 1309 : 1974 et seq

Physical test methods (continued)

IUP/4*	Measurement of thickness
IUP/5*	Measurement of apparent density
IUP/6*	Measurement of: (a) Tensile strength; (b) Percentage elongation caused by a specified load; (c) Percentage elongation at the break (some modifications have been approved at the 1975 Congress of IULTCS)
IUP/7*	Measurement of absorption of water
IUP/8*	Measuring of tearing load
IUP/9*	Measurement of distension of grain by ball burst test
IUP/10**	Dynamic waterproofness test for boot and shoe upper leather
IUP/11**	Dynamic waterproofness test for boot and shoe sole leather
IUP/12*	Measurement of resistance to grain cracking
IUP/13	Measurement of two-dimensional extension
IUP/14**	Measurement of the waterproofness of gloving leather
IUP/15	Measurement of water vapour permeability
IUP/16*	Measurement of shrinkage temperature
IUP/17	Assessment of the resistance of air dry insole leather to heat, with special reference to the direct moulded and injection moulded processes of footwear manufacture
IUP/18	Assessment of the resistance of air dry lining leathers to heat, with special reference to the direct moulded and injection moulded processes of footwear manufacture
IUP/19	Assessment of the resistance of air dry upper leather to heat, with special reference to the direct moulded and injection moulded processes of footweatr manufacture
IUP/20**	Measurement of the flexing of light leathers and their surface fisnishes
IUP/21	Measurement of set in lasting with the dome plasticity apparatus

* Basis for ISO International Standard - see Part I
** Basis for ISO document - see Part I

Physical test methods (continued)

IUP/22	Assessment of damage by the use of the viewing box
IUP/23	Measurement of scuff damage produced by impact
IUP/24	Measurement of surface shrinkage by immersion in boiling water
IUP/26	Measurement of the resistance to abrasion of sole leather
IUP/28	Measurement of the resistance to bending of heavy leather

Colour fastness test methods for leather and tests for leather dyes***

IUF 105	Numbering code for the standard methods of test and standards for methods of testing
IUF 120**	General principles of colour fastness testing of leather
IUF 131	Grey scale for assessing change in colour
IUF 132**	Grey scale for assessing staining
IUF 201	Approximate determination of the solubility of leather dyes
IUF 202	Fastness to acid of dye solutions
IUF 203	Stability to acid of dye solutions
IUF 205	Stability to hardness of dye solutions
IUF 401	Colour fastness of leather to light: daylight
IUF 402	Colour fastness of leather to light: xenon light
IUF 420	Colour fastness of leather to water spotting
IUF 421	Colour fastness of leather to water
IUF 423	Colour fastness of leather to washing
IUF 424	Colour fastness of leather to formaldehyde
IUF 426	Colour fastness of leather to perspiration
IUF 441	Colour fastness of leather in respect of staining or raw crepe rubber
IUF 442	Colour fastness of leather in respect of staining of plasticised polyvinyl chloride
IUF 450	Colour fastness of leather to rubbing
IUF 454	Fastness to buffing of dyed leather

** Basis for ISO document - see Part I

*** Usually published in the specialized magazines on leather: SLTC Journal (Redbourn, Herts) and Leder (Darmstadt)

Annex X (a)

British Standard Specifications *)

B.S. 1000 (675):	1971	Leather industry. Processing of animal skins Universal Decimal Classification (U.D.C.)
B.S. 1006	1978	Method of test for colour fastness of textiles and leather Section A01 SDM: 1978 Standard depths " A02 C: 1978 Geometric grey scale for assessing the effect on the pattern in fastness testing " A03 C: 1978 Geometric grey scale for determining the degree of staining in fastness testing " B01, LFS1 to LFS8: 1978 Reference standards (obtainable individually) " B02: 1978 Humidity test control
B.S. 1309	1974	Methods for sampling and chemical testing of leather
B.S. 1397	1967	Industrial safety belts and harnesses
B.S. 1651	1966	Industrial gloves
B.S. 1870	-	Safety footwear Part I: 1970 Safety footwear other than all-rubber types
B.S. 2723	1956	Firemen's leather boots
B.S. 2780	1972	Glossary of leather terms
B.S. 2797	1976	Specification for leather for gas meter diaphragms
B.S. 3144	1968	Methods of sampling and physical testing of leather
B.S. 3662	1962	Methods for the determination of the colour fastness of leather
B.S. 3805	1964	Leather safety harness for baby carriages with and without leading rein
B.S. 3935	1974	Classification and marking of cattle hides and calfskins
B.S. 4804	1972	Classification and measurement of chamois leather

*) taken from Sectional List SL12, dated September 1979 and still current January 1982: published by the British Standards Institution, 101 Pentonville Road, London N19ND, England (tel: 01-837, telex: 23218)

Annex X (b)

Indian Standard Specifications *)

IS:575	- 1956	Chrome belt lace leather
IS:576	- 1954	Glazed Kid for shoe upper leather (plus amendment)
IS:578	- 1964	Box and willow kip and side leather (revised)
IS:580	- 1962	Harness leather (revised)
IS:581	- 1962	Vegetable tanned hydraulic leather (revised)
IS:1016	- 1956	Oil tanned leather
IS:1017	- 1962	Chamois leather
IS:1225	- 1958	Picking band leather (plus amendment)
IS:1638	- 1960	Sizes and fittings of footwear
IS:2051	- 1962	Sampling of leather footwear
IS:2240	- 1962	Power transmission belting
IS:2241	- 1962	Round belting leather for small machines
IS:2249	- 1963	Adhesives for belting
IS:2573	- 1963	Gauntlets for welders
IS:2574	- 1963	Gauntlets for iron and steel workers
IS:2575	- 1963	Mittens for iron and steel workers
IS:2954	- 1964	Vegetable tanned belting
IS:2960	- 1964	Bookbinding leather
IS:2961	- 1964	Chrome retan upper leather

*) These issues were current in 1967, some will have been either revised or discontinued since that time. They are published by the Indian Standards Institution, Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 1, India. The I.S.I. also holds stocks of Standards issued by B.S.I., England; Deutscher Normenausschuss (DNA), English Editions only; American Society for Testing and Materials (ASTM); Japanese Standards Association (JIS), English editions only; the International Organization for Standardisation (ISO) and the International Electrotechnical Commission (IEC).

Annex XI

List of books and and journals (with costs where known) recommended to form the nucleus of a common reference library for the Sudanese tanneries

a) Books	Estimated cost US$
1. Official Methods of Analysis, 1965, with amendments (from J.S.L.T.C., 1 Edges Court, Moulton, Northants NN3 1UJ, England)	50,0
2. Leather Technical Dictionary (English, French, German,Italian,Russian and Spanish sections) from Eduard Roether Verlag, Berliner Allee 56, D-6100 Darmstadt, FRG)	140,0
3. The Laboratory Handbook (including a section on the leather laboratory) Geo. Newnes, London, England	-
4. Hides, Skins and Leather Under The Microscope (B.L.M.R.A., Moulton Park, Northampton, England)	25,0
5. Official Standardised and Recommended Methods of Analysis (1963, 1967 (rev.edn.) or 1973 (2nd edn.), (originally published by the society for analytical chemistry, now the Analytical Division of the Royal Society of Chemistry, Burlington House, Piccadilly, London W1, England) Section on Leather includes all international standards then in existence.	-
6. Tropical Products Institute reports *:	
G56 The Tanning of Hides and Skins (Elliott and Lockhart-Smith), 1974	2,0
G134 The Manufacture of Upper Leathers (Tuck), 1981	9,0
G135 Gloving, Clothing and Special Leathers (Briggs) 1981	9,0
7. The Manufacture of Sole and Other Heavy Leather (Jones and Humphreys) 1966, Pergamon Press, Oxford, England	40,0
8. Quality Control Handbook (Juran-Gryna); McGraw Hill Book Co. Inc., London England.	100,0
Books, total	375,0

Annex XI/2

b) Booklets	Estimated cost US$
books, carried forward	375,0
1. Acceptable Quality Levels in Leathers: Maintaining control in semi-processed and finished leathers produced in developing countries (Higham),UNIDO, Vienna, Sales No.E76.II.B.6	2,50
2. Information Sources on Industrial Quality Control: Guides to Information Sources No.6; available on request from Industrial Documentation Unit, UNIDO, Vienna, Austria	-
3. SATRA Test Methods and Specifications IS.3199, latest edition (Shoe and Allied Trades Research Association, Satra House, Rockingham Road, Northants, England: tx 34323	-
4. International Standards and the necessity for developing countries to participate effectively in International Standardisation (Report on UNIDO Standardisation and Quality Control in the Industrialisation Process of Developing Countries Group Meeting, Avandjelovac, Yugoslavia, September 1981: UNIDO, Vienna, Austria	-

c) Journals	Cost of yearly subscription, US$
1. Journal of the Society of Leather Technologists and Chemists (S.L.T.C.,52 Crouch Hall Lane, Redbourne, Herts. AL3 7EU, England	30,0
2. Leather Science (C.L.R.I., Adyar, Madras 600-20, India	40,0
3. Leather (Benn Bros. Publications Ltd., Sovereign Way, Tonbridge, Kent TN9 4RW, England)	60,0
4. Das Leder (Eduard Roether Verlag, Berliner Allee 56, D-6100 Darmstadt, FRG	60,0
Estimated overall cost	567,50

Annex XII

Contacts Made in Sudan by the consultant in the course of the project

Khartoum Tannery

General Manager: Mr. El Sheikh M.A Tambal

Technical Manager: Mr. Abdel Rahman Joda

Ass. Technical Manager: Mr. Mustafa Abu Rafad

Quality Controller and Counterpart: Mr. Mustafa Mahdi Azrag

Laboratory staff: Mrs. Heliti Eldawi Abdullah and Mrs. Awatif Abdelgadir

White Nile Tannery

General Manager: Mr. M.El Tayeb El Shayeb

Technical Manager: Mr. Ibrahim Said Ahmed

Laboratory staff: Mr. Ahmed Mekki El Fehel and Mr. Abdeslam Bushera

Gezira Tannery

General Manager: Mr. Ahmed M. Ahmed

Technical Manager: Mr. Salih Awooda

Ass. Technical Manager: Mr. Abbas Elamin

Administration: Mr. Elsir Sharaf Eldin

Laboratory staff: Mr. Osman Mohamed Ahmed

Hides, Skins and Leather Institute

Manager: Mr. Ahmed Hag El Sheik Abbo

Deputy Manager: Mr. Farouk S. Mahmoud Elhamouli

Graduate Staff/Technicians: Mr. Ahmed Hussein Doud, Mr. Abbas Mustafa Gamil and Mr. Gaffar Abrahim Hassan

Industrial Research Institute

Director (consultant engineer and project analyst): Mr. Zakeria Abdel Nabi M.Sc. (Mech.Eng.), M.Sc.(Quality Eng.); also other members of the staff of the institute

Ministry of Industry

Executive Director: Mr. M.A. Hamo

Ministry of Commerce

Director, Quality Control Dept., Deputy Under Secretary: Mr. M.O. Hanafi