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14 January 1987
ENGLISH

BANGLADESH INSULATOR AND SANITARY-WARE FACTORY LTD.

DP/BGD/81/037

BANGLADESH

Terminal report *

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

Based on the work of J. Kout
expert for insulators and sanitary-ware

Backstopping officer: N. G. Siering, Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

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Annex VIII

Page No.

INTRODUCTION

The project was approved on July 1984 and field work began in July 1985. The duration of the project was planned to be one year but this was extended by six months in July 1985 to compensate for delays in the commencement and in implementation.

The final UNDP budget has been settled at $357,754 with an amount of $54,450 - allocated to be utilized in 1987. The contribution from the BGD Government in the budget was 520,000 Taka. The project number was DP/BGD/83/037 - Bangladesh Insulator and Sanitaryware Factory Limited.

A. DEVELOPMENT OBJECTIVE

The primary objective was to provide the market with an increasingly broad range of locally produced insulators, sanitaryware and tiles based, to the extent possible on locally available natural resources as a means to conserve scarce foreign exchange, and more specifically to contribute to an effective utilization of installed manufacturing capacity in the ceramic industry and thus to a consolidation of its position in the overall national economy.

B. IMMEDIATE OBJECTIVE

The immediate objective was specifically directed towards increasing the capacity of staff at all levels of the BISF to generate its three production lines comprising insulators, sanitaryware and tiles in an efficient manner, especially:

1. Contribute to the solution of technological problems in the insulator and sanitaryware lines such as equipment defficiencies and standard product quality.

2. Devise strategies and initiate actions conducive to increased productivity (in terms of both quantity and quality), higher sales and improved financial viability of the plant.

C. BACKGROUND AND JUSTIFICATION

The ceramic industry in Bangladesh is still in the stage of development in spite of a several century's old tradition in the manufacture of fired clay bricks of high quality and handicraft products.

The Bangladesh Insulator and Sanitaryware Factory (BISF) was constructed to improve the industrial development of the country based on the now only available local natural resources which exist in accessible locations and economically significant quantities i.e. natural gas and non-metalic minerals comprising clay, kaolin, feldspar and quartz.

The BISF was established in 1976 and its trial operation period was in the period April 1980 up to May 1983 under the cooperation with Messrs Pragoinvest of Czechoslovakia. With a designed capacity of 4,000 tons of sanitaryware and 2,400 tons of insulators it is the largest ceramic factory in Bangladesh.

.../...

Since 1983 the BISF has been operated by local personnel, more than 20 of whom had been trained in foreign countries.

During last years the demand of local market has constrained (in spite of an embargo imposed the importation of sanitaryware in mid 1983) the output of the factory far below the rated output and moreover the ware produced during this period suffered additionally from serious faults downgrading its properties.

In spite of the progress made in certain areas of the production the BISF suffered for the whole period from lack of apparatus for basic quality control requirements and also of competent technical advise. In order to counteract the above situation and to solve the underlying technological problems faced in the production and to establish effective control over the quality of ceramic products, the BISF asked in 1984 for the UNDP assistance.

D. PROJECT OUTPUTS

The planned outputs in the insulator and sanitaryware lines were:

a. Correction of equipment defficiencies or malfunctioning to the extent this can be done through repairs and minor adjustments.

b. A composition for the sanitaryware body perfectly adjusted to the coefficient of thermal expansion of the glaze in use and based on a maximum of local raw materials as well as technological guidelines how to maintain glaze crazing at a minimum.

c. A technology for disc insulators production which may eliminate the high rate of failure of these items during the flash-over test.

d. Specification of factors in the production process responsible for down grading of product quality and introduction of effective measures including intensified in-plant training to raise the overall quality standard.

e. Enhanced capacity of the personnel to deal with all types of problems in the production in a confident manner.

f. A well equipped quality control and product development laboratory capable of providing adequate service to the production plant.

g. A small library with a core of basic textbooks, hand books, articles and periodicals on ceramics and electrical insulation.

.../...

h. A strictly reinforced system of quality control covering raw materials and body/glaze control as well as control of products before firing and at the end of the production.

i. An enhanced marketing and export promotion function including a programme for product development in accordance with customer requirements.

E. TRAINING

The training of the counterpart technical personel was carried out mainly on the on-the-job day-by-day contacts with counterparts in the actual operation procedures.

This training in the manufacture of insulators and sanitaryware has been supported by Technical Reports (in total 24 - see Annex VI) which have been written in order to give to the counterpart technical staff the guidelines in the technological procedures and quality control in the production.

F. EQUIPMENT

The most part of the equipment ordered by UNIDO has not arrived till the writting of this report and will have to be received by the BISF. Those items already supplied arrived safely and were installed competently by the BISF's engineers. A small library has been already received.

All the equipment and the library have been formally handed over to the BISF including the confirmed purchase orders for those items which are still awaited.

G. RECOMMENDATIONS

To the Government of Bangladesh

1. To arrange for an organized geological survey with organized drilling programme for the whole Bijoypur kaolinitic clay area with Bangladesh Geological Survey and assistance of an experienced expatriate geologist/ clay mining engineer.

2. To arrange for prospection and detailed exploration of the sand in the Sylhet feldspar field to find out whether the feldspar occurence in the sand is in sufficient concentration and form to be worth mining and purifying. (See documentary output No.VII/1)

Recommendation to the Bangladesh Insulator and Sanitaryware Factory

1. To follow carefully the results of the geological survey of BISF mining area from the point of view of technological properties of the raw material tested on the samples from the drilling.

.../...

2. To start the manufacture and marketing of pressed porcelain and other technical porcelain ware as agreed upon in the Trisartite Review Meeting.

3. In the short-term to introduce the electroresistance drying of extruded porcelain rolls for all types of solid-core insulators, post bushings and others to take this procedure under full control with favourable results and reduction of reject.

4. Promissing staff from the supervision grades should be niminated for the 10 m/m followship training abroad within shortest possible term.

5. The introduction of incentives should introduced based firstly on the quality parameters and duction of the reject.

Recommendations to UNDP/UNIDO

1. To provide support to BISF and other ceramic manufacturers in the country by providing the whole industry with further services (as e.g. with the Project BGD/85/006).

.../...

CHAPTER - I

ACTIVITIES AND OUTPUTS

A. Composition of Bodies and Glazes

After careful tests of the behaviour of basic ceramic raw materials especially from local resources and the study of insulator and sanitaryware production lines the composition of bodies and glazes were stabilized and later within the mission time changed only for the purpose of replacing the clays from U.K. by clays from India and of maximum use of local raw materials.

The detailed report on the findings "Local Ceramic raw Materials their Potential use in White Ceramic Industry" is attached to this report as Annex No. VII/1.

As it is apparent no one from the two local raw materials Bijoypur kaolinitic clay and feldspar Sylhet is of he best quality for the manufacture of fine ceramic products. That the reason why still a high volume of materials has to be imported for the body and especially for the glazes.

The supplies of Bijoypur kaolinitic clay vary in broad range as the result of un-coordinated manner of mining especially because of no precise geological information of the mine area.

The tests have shown in last two supplies of this clay the following variation in the content of the main mineralogic constituents:

Date of supply	Clay Substance	Quartz	
17 July 1985	56 %	30 %	(Calculated from chemical composition)
23 March 1986	43 %	46 %	

When considering that the Sylhet feldspar (which is actually a pegmatite) is also not best and consistent in its composition it is very difficult to adjust a permanent body composition and even to maintain the percentage of local raw material on a constant level.

It is considered that the improvement would be achieved by supplying more consistent raw materials from the mines by observing recognised clay mining based on proper geological survey and clay stockpiling practices and for the feldspar by improved way of its sorting.

.../...

In spite of this situation the percentage of local raw materials in body and glaze formulas of both types of products has been kept all the time over 60% and for insulators it was even increased up to 66% as it is given in the Table 1 below:

Raw Material	Insulator Body					Sanitaryware Body
Bijoypur Clay	30	25	20	32	32	13,9
Feldspar Sylhet	25	35	35	32	34	40,7
Quartz Sylhet	4					
Fired Broken Body	4					4,7
China Clay U.K.	5	5			1,35	
Feldspar India	12,5	3,5	10	10	8,5	
Ballclay India b.	9	11,5	10	8	4,25	9,2
Ball Clay India w.					6,5	4,6
China Clay Rajmahal	17,5	15		7	6,5	26,9
China Clay Spec.I			10	11	6,25	
Local Raw Materials	59%	60%	55%	64%	66%	59,3%

A glaze for the sanitaryware has been developed with the replacement of imported expensive wollastonite by limestone with subsequent improvement of the glaze by addition of 2% of the frit and adjusted coefficient of thermal expansion for the body to glaze fit the prevent the glaze crazing.

A brown glaze was developped for insulators containing local waste sludge from water treatment as the main raw material reducing substantially the volume of imported raw materials, production cost and at the same time improving the properties of glazed insulators.

In both production lines a temporary body composition was proposed and introduced into manufacture prepared from the growing dry waste and all of accumulated waste has been successfully re-used.

B. Equipment and Literature

In the first months of the mission additional apparatus and equipment for the Quality Control and Product Development laboratory has been ordered after mutual agreement with the counterpart staff at a cost of approx. US$ 30,000.

Experience showed that the lead time in most cases was mostly more than 8 months so that the main part of this equipment has not arrived yet and will have to be received by BISF after the end of the experts mission.

.../...

The equipment already received has been formally handed over to the BISF and was installed by the BISF's engineers. A small technical library was purchased at a cost of around US$ 3,000.

C. TRAINING AND FELLOWSHIP

One of the main problems in ceramics manufacture relates to the choice and training of key personnel. This is because the entire profitability of the industry depends on the highest possible quality being obtained in the supervisor grades.

While the individual parts of the experts work programme were being solved and introduced into the production the engineers and foremen were given instructions on different subjects of the technological procedure.

Daily on-the-job collaboration was supplemented with in total 24 separate technical reports (Annex-6) handed over to the counterparts as guidelines for their job.

In accordance with the decision taken during the Tripartite Review meeting held on the 18 May 1986 four engineers of BISF should undertake fellowships for a total of 10 m/m in foreign establishments.

D. PRODUCTION OUTPUT

With continuous improvements in the production of both plants the output and sales in the planned year July 1985 to June 1986 was the following:

Date/Year	Insulators		Sanitaryware	
	Output	Sales	Output	Sales
July to Sept. 1985	63,6 t		324,28 t	291,73 t
Oct. to Dec. 1985	217,75 t	238,17 t	446,32 t	413,71 t
Jan. to Mar. 1986	222,88 t	144,91 t	322,77 t	328,30 t
Apr. to June 1986	280,93 t	293,04 t	370,58 t	347,95 t

In the insulators production together with the increased output there was also a substantial decrease in the reject of all types of insulators especially as the result of the improved adjustment of the tunnel kiln in March-April 1986 by the expert. At that time the reject percentage was below any factory standards of many international manufacturers. Regretably after that period the output has been decreased because of total lack of orders for the supply of insulators in the country.

In sanitaryware production in respect of the same position with the sales throughout the whole year the output of the plant has been kept in the level of the average sales i.e. 120 to 125 tons/months. However also in this plant the reject was lower especially in the green production before the glazing.

.../...

5. OTHER ACTIVITIES

Other activities of the expert to fulfill the immediate objectives included in the work programme drawn up with the concurrance of the National Project Director were set out as follows:

1. Introduction of reinforced system of quality control in both production lines.

2. Developing of 33 KV pin insulators.

3. Production of 10" suspension insulators with 11500 Kg electro-mechanical strength.

4. Proposal and introduction of semi-conductive glaze in insulators production.

5. Adjusting the drier for proper drying conditions in insulator and sanitaryware production.

The above work programme was expected to be completed during the one year mission time of the expert. However on the Tripartite Review Meeting a decision was taken to extend the mission of the expert for other 6 months with additional duties on the field of tunnel kilns and proposal on the manufacture of pressed technical porcelain ware.

CHAPTER - II

ACHIEVEMENT OF IMMEDIATE OBJECTIVES

A. Contribute to the solution of technological problems in the insulator and sanitaryware lines such as equipment defficiencies and standard product quality.

1. Having studied the bodies and glazes composition and properties and having done some trials with the bodies and glazes the formulas of both bodies were stabilized with 60 to 66 % of local raw materials, the remaining volume being the raw materials imported from India. Thus the percentage of local raw materials has been increased for 3 to 4 percent in average.
2. In order to improve the raw materials conditions a geological survey of the BISF mine area has been proposed and funds allocated for an expatriate geologist/mining engineer for three months collaboration with Bangladesh Geological Survey in the budget E of this project.
3. A glaze has been developed with the replacement of wollastonite by the limestone for the sanitaryware with correct body-to-glaze fit preventing the glaze crazing and decreasing the price of imported raw materials.
4. To ensure effective quality control system necessary arrangements have been made towards procurement of a few equipment and apparatus for the quality control and development laboratory at the cost of around US $ 90,000 some of which already arrived at BISF and other are yet to receive.
5. A small library with a core of books on ceramics and insulation has been provided at a cost of around US $ 3,000 for BISF.
6. Technical prescriptions for the quality control process in both production lines has been submitted to counterparts.
7. A new design of 33kV pin type insulator has been proposed by the expert, however because of improved properties of the previous design by adjusting the manufacturing procedure the new design has not been introduced into routine production.
8. Drying of insulators. The expert adjusted the drier of insulators to a correct drying cycle and thus the previous high percentage of the reject from the drying has been substantially reduced.
9. On special request of the counterparts the expert adjusted the insulator tunnel kiln operation in April 1986 to better firing conditions and thus the reject of insulators in the firing process has been decreased in average for at least 15 percent. This work was done over the work programme of the expert in the time when UNIDO Vienna decided to cancel the mission of Mr. Johansen who had been appointed for this job for a period of three months and did not get the clearance for his arrival from the Ministry of Industries of Bangladesh Government.
10. This action of expert was later on extended for the commencement of operation and adjustment of both tunnel kilns for bisque and glost firing of wall tiles which the expert undertook within a short perios of three weeks in June 1986.

.../...

11. In the sanitaryware production the technicaians were given instructions on the drying of the ware in 24 and 48 hours in dependance of the ware size and shape and on the heat recovered from the cooling zone of the sanitaryware tunnel kiln utilization in the casting department during the evening and night shifts in different climatic conditions

12. Production of 10" suspension insulators on the Dorst semi-automstic machine. The 10" suspension insulators manufactured on the Dorst semi-automatic machine showed invariably during the first years of the plant operation lower mechanical strength leading to increased failure of these insulators in routine mechanical tests than those manufactured on hand operated machines. The expert indicated the low rpm of forming tools as the reason for this defficiency caused by some problem in the electrical wiring in the control panel of the machine.
As the deffect could not be detected and remedy, the expert has proposed a change in the design and make of the forming tools which is now being prepared for next operational trial.

13. Manufacture of 6" disc suspension insulators. This insulator has been the only type the reject of which in routine mechanical and electrical tests exceeds largely the standard limits of reject in insulators manufacturing plants. However to this it should be stated:
i/ As the expert has always stressed and as it has been proved in BISF laboratory the 6" suspension insualtors of the characteristics corresponding to ASTM use not to be manufactured from normal classical porcelain body - the imported insulator from USA showed the content of alumina higher than 30 percent. Body marked in the test of high-alumina trial series marked "C" will be the correct solution when introduced into operation.
ii/ The reject of 6" suspension insulators in routine mechanical and electrical tests was in June 1986 only 9,7 percent and in July 8,0 percent i.e. for both months within the standard limits for this type of insulator. It is the evidence that even under very favourable conditions in the operation and in the kiln firing with sufficiently loaded kiln cars the quality of the ware can be substantially improved.

14. Based on the agreement in Tripartite Review Meeting some rout-identification trials have been carried out in the body preparation and pressing of small porcelain parts with body dust containing lower percentage of water and some addition of forming oil. On the results of these tests and of local market survey the expert elaborated a proposal of the pressed porcelain department of 450 to 500 tons capacity to be accomodated in the existing operation hall of BISF to utilize the idle capacity in insulators production including preliminary specification of required machinery and equipment and suggested lay-out of this production (Documentary output-ANNEX VII/3).

15. The opinion of the expert how to control the uncommon behaviour of insulator porcelain body (caused by high percentage of the Bijbipur clay in the body) in pre-drying of rolls to leather-hard conditions before shaping and how to decrease the percentage of reject in this stage of production is to introduce the electroresistance drying. Therefore a complete specification of required equipment for this procedure is due to reach BISF soon in the form of an offer.

.../...

Whether this essential equipment will be provided from a foreign manufacturer or be purchased locally is on the decision of BIDF. The expert has elaborated the technical principles of this procedure as Documentary Output-ANNAX VII/4 of this report.

However it may be concluded that this immediate objective has not been fully achieved in the introduction of the high-strength insulator body into operational conditions for the manufacture of 10" suspension insulators of 11.500 electromechanical strength because of the nonavailability of the alfa-alumina for this purpose.

B. Devise strategies and initiate actions conducive to increased productivity (in terms of both quantity and quality), higher sales and improved financial viability of the plant

As to this immediate objective the expert before the middle of his one years mission proposed to adjust his work programme as per the request of the counterparts.

To this the standpoint of the counterparts expressed

"that the problems being faced in increasing the output is based on technical draw backs which is directly related to production economy. So, any improvement in technical development will definitely give us a way to progress. The matter of Management of labour &introduction of piece rate, it is in process of implementation."

Like that this immediate objective was fully transferred to the solution of technological procedure and problems i.e. to the above immediate objective A.

CHAPTER - III

UTILIZATION OF RESULTS

1. The quality control and development laboratory has been provided with further facilities for upgrading its activities. This laboratory with qualified technical staff is now in a position to render complete services in controlling the quality of raw materials and technological procedures and in solving any technical problem.

   A small library on ceramics and insulation will help the technical staff of the factory to improve their theoretical and practical knowledge of the ceramic production.

2. The guidelines produced in technical reports have been of great help for the counterparts to introduced many technological procedures into operation and a strict quality control sysstem.

3. Some of the technological reports and documentary outputs for the establishment of new procedures will enable the counterparts to take correct decisions in future development of the factory and make the way of their realization easier. It concerns especially the proposals how to utilize the idle capacity of the factory.

4. New products have been introduced and their production started or is about to start which gives to the factory a wider scope of production, reduce the dependance on the import of these products or even open the possibilities of the export.

5. The technical staff who had prior training are gainfully employed in the day-to-day operation of the factory and are now quite confident in the operation of the factory independently.

6. The counterparts will benefit from the findings on local ceramic raw materials and further steps recommended whether on the Mymensingh kaolinitic clay or feldspar from Sylhet area. The contacts with Bangladesh Geological Survey have been established and should continue until the final improvement of these raw materials supply.

CHAPTER - IV

CONCLUSIONS

1. The project as a whole

The time allocated for the project was 1 year. This was too short time in which to achieve the objectives listed. The scope of the project was very wide embracing the production of two plants which may be considered as the most complicated in the ceramic industry not only in the manufacturing procedure but also in quality control and development of new procedures. The project was extended on the decision of the Tripartite Review meeting for other 6 months which has been proved to be in favour of the objectives achievement.
With the exception of a minor part the immediate objective has been achieved.

2. Counterparts

The full collaboration of experienced and qualified counterparts was one of essential factors enabling the successful conclusion of the project.

3. Fellowship

Fellowships have been awarded to four technical personnel by the project.
Undoubtedly the fellows who had longer exposure to the project programme and to practical work will benefit from their tour more and will have more opportunity to use their already adopted knowledge for productive results.

4. Training

The methods of on-the-job training coupled with guidelines in the technical reports and documentary outputs provided the counterparts and other engineers in the factory with an universal knowledge of various procedures in ceramic manufacture. It has been conducive to enhanced capacity of the technical staff to solve the problems in the production and maintenance of machinery in large scale.

ANNEX I

COUNTERPART STAFF
OF THE BANGLADESH INSULATOR AND SANITARYWARE FACTORY

National Project Director:

Mr. Nurur Rahman, General Manager, Planning Division BCIC Head office Dhaka appointed on 6 October 1985, lately transferred as General Manager of Chhatak Cement Factory.

Mr. B.B. Dewanjee, General Manager, Bangladesh Insulator and Sanitaryware Factory, appointed as National Project Director 6 November 1985.

Counterpart Staff: Appointed on 6 November 1985

1. Mr. A. Karim Bhuiyan, ACC, BISF as Chief Counterpart Staff.
2. Mr. Giasuddin Ahmed, Chemist, BISF as Counterpart for Insulators.
3. Mr. Kalipada Biswas, Asstt. Chemist, BISF as Counterpart for Sanitaryware
4. Mr. Abdul Awal Khan, Asstt. Chemist, BISF as Counterpart for Tiles.

Note: Regretably the post of the National Project Director was vacant almost four months (due to the quick succession of change in this post) in the time when his presence was most essential for the coordination of the work programme of the experts. This has had an unfavourable effect upon the timely commencement of the project activities.

ANNEX - II

LIST OF EQUIPMENT PROVIDED BY UNIDO

Item of equipment		Quantity	Delivery			Price/Remarks	
			Order	Schedule	Actual	US$	Other Cur.
1.	Glaze stress tester Model 420/2 consisting of	1	4/85	10/85	10/85		
	- Measuring Part					5,849	
	- Temperature Control					1,789	
2.	Manual Typewriter Model SC3N/46 CM	1	12/85	8/86	3/86		12,490 AS
3.	Infrared Hygrometer Model "ULTRAMAT SIMPLEX"	2	12/85	3/86	3/86		8,101.23 DM
4.	Toyota Station Wagon T x RND incl.standard equipment Model 1300-Air-Conditioner	1	12/85	4/86	6/86	5,646.66	
5.	Complete Equipment for Making Screens incl.	1	12/85	8/86	+		
	- Price of Equipment						113,218.40 DM
	- Installation + Training						30,136.00 DM
6.	DTA Measuring Part of Apparatus Differential Thermal Analysis	1	6/86	10/86	+		18,090.00 DM
7.	Gas Ballast Vacuum Pump	2	6/86	10/86	+		9,679.2 DM

+ Equipment not yet arrived till the middle of November 1986.

Last Physical Inventory Check was submitted for the above Item No.1 on the 11 November 1986

ANNEX III

LIST OF BIBLIOGRAPHY PROVIDED BY UNDP FOR BISF LIBRARY

Item No.	Quantity	Particulars	Prices
1.	1	Elements of Ceramics	306.00
2.	1	Techniques of Pottery	142.00
3.	1	World of Japanese Ceramics	237.00
4.	1	Clays and Ceramic Raw Materials	331.00
5.	1	Phase Diagrams for Ceramics	378.00
6.	1	Physics and Chemistry of Ceramics	976.00
7.	1	Properties of Ceramics Raw Materials	222.00
8.	1	Science of Ceramics Vol.3 Out of Print	
9.	1	Science of Ceramics Vol.4	93.00
10.	1	Science of Ceramics Vol.8 Out of Print	
11.	1	Ceramic Processing Before Firing	719.00
12.	1	Handb. for Chemical Technicians	497.00
13.	1	Ill. Dictionary of Ceramics	133.00
14.	1	Stoneware and Procelain	95.00
15.	1	Techniques of Fired Clay Sculpture: TERR	270.00
16.	1	Ceramic Clazemaking	70.00
17.	1	Ceramics: Indust. Processing & Testing Out of Print	
18.	1	Quality Control	121.00
19.	1	Unit Operation	255.00
20.	1	Physical Principles of Semi-Conductor	196.00
21.	1	Andreasen Pipette-Methods	50.00
22.	1	Thermal Expansion	50.00
23.	1	Fracture in Ceramic Raw Materials	397.00
24.	1	Health and Safety in Ceramics	85.00
25.	1	The Tech. of Glass and Ceramics. an Introd	759.00
26.	1	Energy and Ceramics	1892.00
27.	1	Terracotta	270.00
28.	1	Engineering Economy: Anal.of Capital Exp	334.00
29.	1	Fundamentals Temperature, Pressure	695.00
		Dan. Kroner	9573.00

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	AIRMAIL		97.00
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ANNEX - IV

FELLOWSHIP

One of the decisions taken during the Tripartite Review Meeting held on the 18 May 1986 was to provide the training of the Bangladesh Insulator and Sanitaryware Factory staff to broaden their experience in the following fields:

(i) One high level personnel for 2(two) man-month in Ceramic-Management field.

(ii) One Engineer for Design and Manufacturing of Dies and Insulator Tools - 3(three) man-month.

(iii) One Engineer for Training and Making of Pressed Insulator and High-strength Insulators - 3(three) man-month.

(iv) One Chemist/Chemical Engineer for Higher Training one Quality Control and Operation - 2(two) man-month.

ANNEX - V

PROGRESS REPORTS

In accordance with the requirements of the counterparts the following progress reports were submitted by the due dates:

1. August 1985
2. September - October 1985
3. November 1985
4. December 1985
5. February - March 1986
6. May 1986
7. June - July 1986
8. August - September 1986
9. October - November 1986 (under preparation)

A progress report covering the period August 1985 up to January 1986 was prepared in accordance with UNIDO requirements.

The Tripartite Review Meeting was held on 18th May 1986. Minutes of this meeting are available.

ANNEX - VI

TECHNICAL REPORTS - DOCUMENTARY OUTPUTS

During the project the following reports were presented to the BISF. Few of them considered as more substantial are given below in more detail.

Technical Report No.1: Semiconductive Glaze (dated 8 October 1985)

(In connection with the Work Programme Art.4E)
The report includes the formula of a semiconductive glaze which proved to be suitable in other insulators plants including short description of its preparation.

Technical Report No.2: Replacement of Wollastonite by Limestone in the Sanitaryware Glaze (dated 14 October 1985)

(In connection with the Work Programme Art.5A)
The purpose of this report was to reduce the production cost by replacing the imported wollastonite by the limestone and was eaborated on special request of BISF in many varieties from which the glaze No.5 was selected as the most suitable one.

Technical Report No.2: Semiconductive Glaze with the Content of Silver Oxide

(In connection with the Work Programme Art.4E)
Additionally to the Technical Report No.1 another formula of semiconductive glaze was proposed based on the stabilizing function of the silver oxide on the spinell crystalographic structure of the glaze constituents.

Technical Report No.4: Alumina for the High-strength Insulator Body (dated 25 October 1985)

(In connection with the Work Programme Art.4D)
The report gives the basic properties of the alumina required as the raw material for the high-strength insulator body required for the manufacture of 10" disc suspension insulators of 11.500 kg electromechanical strength or other types of high-strength insulators.

Technical Report No.5: Marking of Insulators (dated 15 October 1985)

(In connection with a separate request of BISF)
A paste composition was proposed for better legible marking of insulators.

Technical Report No.6: Insulator Production-Proposal of New Bodies Composition (dated 6 October 1985)

(In connection with the Work Programme Art.4A)
Based on the overall study of the insulators production and on the tests of available raw materials the expert made a proposal of a series of insulator bodies for the testing on the laboratory scale. Simultaneously a temporary body was proposed with 90% of dry waste in order to decrease its growing quantity in the factory.

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Technical Report No.7 and 7a: Testing of body and glaze slip in the factory (dated 5 October and 26 November 1985)

(In connection with the Work Programme Art.3)
This is a report for the introduction a reliable and fast testing of the density of body and glaze slips on individual places in the factory without the need of taking the samples to the process laboratory.

Technical Report No.8: Technological and Manufacturing Principles in the Production of 10" Suspension Insulators on the Dorst Machine (dated 11 November 1985)

(In connection with the Work Programme Art.4C)
This report describes the guidelines inevitible in the procedure of the suspension insulators manufacture based on the experience from other insulator manufacturing plants. However during the operational test the required rpm of the forming tools were not attained and the counterparts were asked to contact Messrs. Dorst with the inquiry for the remedy of this defficiency.

Technical Report No.9: Principles of the technological procedure and quality control in the sliphouse of insulator and sanitaryware plant (dated 11 November 1985)

(In connection with the Work Programme Art. 1 and 3)
This report incl. its Annex gives an overview of procedures and methods used in the operation of the sliphouse. A draft of the procedures for the application in the factory has still to be elaborated by the respective technicians.

Technical Report No.10: Routine Control and Investigations of basic Raw Materials (dated 29 November 1985)

(In connection with the Work Programme Art. 3)
This report includes a list of methods used to measure and control quality of all raw materials supplied to the factory.

Technical Report No.11: Routine Control of Insulators Production and Classification and Defect Analysis (dated 1 December 1985)

(In connection with the Work Programme Art. 3)
This report gives the description of routine tests in the insulators production including the analysis of process loss and defects in the inspection and sorting of insulators after firing.

Technical Report No.12: Body for Insulator Production (dated 9 December 1985)

(In connection with the Work Programme Art. 4A)
This report includes the proposal of a new insulator body composition to be tested on pilot plant scale in the factory and to be introduced gradually into the production.

Technical Report No.13: Routine Control of Sanitaryware Production and Defect Analysis (dated 9 December 1985)

This report gives the description of routine tests in the sanitaryware production including the analysis of process loss and defects in the inspection and sorting of sanitaryware after firing.

.../...

Technical Report No.14: Production of pressed Porcelain Ware (dated 9 February 1986)

The idea of pressed porcelain ware manufacture in BISF was raised by the expert on the meeting in BCIC head office held on 12 January 1986: this report was then written to encourage this idea that additional to the manufacture of electrical porcelain, the manufacture and marketing of other technical porcelain ware should be considered to use the idle capacity of the insulator plant of BISF.

Technical Report No.15: Cementing of Insulators (dated 14 February 1986)

(In connection with the Work Programme Art. 3f)
This report includes detailed technological procedure in cementing of insulators including the requirements on the properties of the cement and other auxiliary materials and their testing.

Technical Report No.16: Adjusting of Insulator Tunnel Kiln (dated 29 March 1986)

(In connection with the Work Programme Art. 4)
This report is a reply on the BISF comments upon the changes proposed by the expert for the improvement of the insulator tunnel kiln operation and the realization of these changes within the second half of March.

Technical Report No.17: Control of Plaster Moulds Manufacture (dated 8 April 1986)

(In connection with the Work Programme Art.3g & 5c-2)
This report based on the results of plaster tests explains very poor quality decreasing the service life of plaster moulds in the production and stresses the need of maintaining the plaster/water ratio based on the daily routine tests of the plaster by the quality control department.

Technical Report No.18: Cement for cementing of Insulators (dated 8 April 1986)

(In connection with the Work Programme Art. 3f)
This report was written following the expert's visit of the Chattak Cement Factory and testing the properties of collected samples of the cement in BISF. It shows that the so called "special" cement used for the cementing of insulators does not always means the improved quality of assembled insulators pointing out the need to get on with the continuous testing of the cement suitability for this special use in insulators production.

Technical Report No.19: Adjustment of the Insulator Tunnel Kiln (dated 10 May 1986)

(In connection with the Work Programme and modified by TRM)
This report includes the details of the insulator tunnel kiln adjustment done on the request of BISF Management in the letter of 24 March 1986 in the second half of April 1986. It gives three successive steps leading to the final adjustment of the kiln operation resulted in the decrease of the reject below one percent from the total fired ware in the first half of May.

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Technical Report No.20: Operational Test of the High-Alumina Body (dated 1 August 1986)

(In connection with the Work Programme Art.4D)
This report describes the unsuccessful operational test of high-alumina porcelain body caused by the negligence during the body charging to the ball mill in the sliphouse.

Technical Report No.21: Drying of 10" Suspension Insulators (dated 1 August 1986)

(In connection with the Work Programme Art.3D&4D)
The method of 10" suspension disc insulator drying was described leading to a better and more economical process of the manufacture.

Technical Report No.22: Sanitary Casting Slip from the Green Waste Body (dated 27 August 1986)

(In connection with the Work Programme Art. 5A)
This report gives the results of successful introduction of the operational casting slip prepared from 100 percent of dry waste body to consume steadily growing quantity of this waste in the factory.

Technical Report No.23: Proposal of Pressed Porcelain Department

(In connection with the extension of the Work Programme in TRM)
On the request of BISF Management based on the recommendations in TRM held on the 18 May 1986 a proposal of the pressed porcelain manufacturing department was given in this report including a preliminary specification of the required machinery and equipment for the output 450 to 500 tons of saleable ware per year.

Technical Report No.24: Manufacture of Solid Core Insulators

(In connection with the manufacture of new types of insulators)
This report includes a detailed description of the technological procedure in the production of solid core insulators including the requirements on the raw materials, the factory house keeping, the attendance and maintenance of the main machines, especially the de-airing extruder.

ANNEX-VII/1

Local Ceramic Raw Materials - their potential use in White Ceramic Industry

The Project Document stresses that the non metalic minerals comprising of clay, kaolin, feldspar and quartz belong to the only few local natural resources available in accessible locations and economically significant quantities which offer an ideal base for the development of a domestic ceramic manufacture and therefore should have a potential role to play in the industrial development of the country.

Now what is the position of BISF as the manufacturer of white ceramic products in view of local raw material resources?

In the following two Tables are the results of tests of local raw materials as well as others available presently for the production of insulators and sanitaryware in BISF.

Bijoypur Clay

The Bijoypur kaolinitic clay is the only clay found in the country which has already a definite potential use as a basis of local ceramic industry.

The deposit is presently mined by hand, two grades being extracted, No.1 grade being of lower iron content than No.2 grade. The white clay (No.1) which is used in BISF production of insulators and sanitaryware occurs beneath the clay No.2 mostly in several beds of varying thicknesses interbedded with yellowish brown clay. The clay is variable in its composition and properties not only between different beds but within the same bed.

The deposit is mined in an un-coordinated manner in several locations, mainly where the white clay is exposed in the hillocks, the BISF managed mine being the largest one in the area. However also this organization has no precise geological information of the mine area which affects the quality of the extracted clay and the consistency of its properties.

The chemical composition of individual supplies of this clay is given in the Table II. On the first look it is apparent that the clay is supplied in very variable quality.

When taking into consideration two supplies on 7 July 1985 and on 23 March 1986 as the most extreme in the composition we can find by calculations that the individual mineral constituent in the clay vary within the following range:

	Supply (7 July 1985)	Supply (23 March 1986)
Clay Substance (Kaolinite)	56%	43%
Quarts	30%	46%
Feldspar	10%	9%

.../...

This shows an enormous difference in the clay composition and adequately in technological properties influencing substantially the conditions in the ceramic ware manufacture. With the material supplied on 23 March 1986 it is very difficult to maintain the the normal level of local raw material percentage in the body composition because of a very high content of quartz.

Compared with China Clasys and Ball Clays from U.K. and India the plasticity of the Bijoypur clay is very low above all as the normal unprocessed raw kaolins are never of the high plasticity type because of the high percentage of sand and other minerals. Moreover the Bijoypur clay has also not favourable properties for the casting process in the sanitaryware production. That is why the clay does not play any favourable role in the so called green production of ceramic ware. To the contrary-in higher percentage it influences the properties of the body which are somewhat unusual and require special technological procedures to be applied.

However the clay shows very favourable properties in the second half of the ceramic production starting from the drying process of the ware.

The clay has already a definite potential use in the ceramic industry in the country and from the economical point of view it has to be introduced as the only local "plastic" constituent into the operational bodies in the highest possible percentage.

In order to prevent any operational problems in BISF and in the plants of other users it is essential to achieve the supply of more consistent material from the mine by observing recognised clay mining based on proper geological survey and correct stockpiling practices.

A need of an organized geological survey with organized drilling programme has been considered as the only way of improving the consistency of the clay quality.

In order to achieve these objectives the expert initiated first negotiations with Bangladesh Geological Survey of the clay mine and laboratory tests of the deposit close to the area of BISF mining place to classify the deposit.

An experienced expatriate geologist/clay mining engineer has been proposed by UNIDO expert of the project BGD/83/037 to work as a consultant with Bangladesh Geological Survey to evaluate the geological works and to advise in the correct mining of the deposit. The work of the expert has been proposed to be provided under the budget E of the said project.

Sylhet Feldspar

The raw material from Sylhet is actually a pegmatite type the feldspatic part of which consists of K and Na feldspar in the ratio of approx. 1 to 1 with a low content of Ca feldspar. The average content of the feldspar in the material is 62 to 64 percent and the material supplied to BISF is surprisingly consistent in the composition.

.../...

After the visit of the deposit the expert is of the following opinion:

a. In the first step at least a part of the feldspar of better quality could be sorted out in the deposit which would even replace the imported Indian feldspar at least in the body composition.

b. Further it is the opinion of the expert that the sand in the whole area near the feldspar sorting contains 20 to 25 percent of first quality feldspar in the particle size below 3 to 4 mm (see the picture-arrow).

If this opinion is correct then the country is very rich in first class quality feldspar reserves amounting to thousands of tons. It is just the question whether the feldspar occurence is in sufficient concentration and form to be worth mining and purifying. Otherwise the modern methods of feldspar purifying especially the flotation (or froth flotation) have been developed and are very efficient.

Grinding Pebbles

To the contrary of the opinion of the BISF Quality Control Laboratory the expert is of the opinion that the pebbles from the Sylhet District are of suitable quality to be used as grinding media in the ball mills for all types of bodies instead of imported pebbles.

TABLE - I

Chemical analysis of ceramic raw materials

(BIsF laboratory-August 1985)

Raw material	LOI %	SiO_2 %	Al_2O_3 %	CaO %	MgO %	Fe_2O_3 %	TiO_2 %	K_2O %	Na_2O %
1. Bijaipur clay - I	9,57	62,20	24,50	0,21	0,07	0,84	1,30	0,68	0,59
2. China clay Rajmahal	12,80	50,00	34,58	0,48	0,17	0,72	0,71	trace	0,33
3. Ball clay India-black	11,98	59,84	24,59	0,66	0,19	0,94	1,00	0,91	0,34
4. Ball clay India-white	12,58	51,30	30,85	0,23	0,08	1,30	1,20		
5. Ball clay WBB-U.K.	13,18	50,93	31,22	0,55	Trace	1,19	0,52	1,80	0,20
6. Quartz Sylhet	0,35	97,8						0,20	0,10
7. Feldspar Sylhet	0,75	74,33	14,28	0,38	0,13	0,65	Trace	5,57	3,50
8. Feldspar India	0,93	63,31	19,70	0,52	0,09	0,20	Trace	11,49	2,76
9. Limestone Sylhet	40,82	3,50	2,11	50,41	1,54	0,30			
10. China clay CC - U.K.	12,30	47,31	36,10	0,58	0,21	1,03	0,21	1,50	Trace
11. China clay 50 - U.K.	11,90	48,42	35,76	0,83	0,20	1,08	0,21	1,40	Trace
12. China clay-Grade I	10,50	47,76	34,98	1,47	0,50	0,97		2,32	1,46
13. Pitchers	2,39	73,8	19,21	0,54	0,07	0,52			
14. Insulator body-green	5,90	65,2	22,09	0,48	0,24	0,76	0,67	2,8	1,82
15. Insulator body-fired		69,28	23,47	0,51	0,25	0,81	0,71	2,97	1,91
16. Sanitaryware body-green	6,47	64,90	23,08	0,48	0,39	0,67	0,46	2,44	1,97
17. Sanitaryware body-fired		67,94	24,16	0,51	0,42	0,72	0,49	2,55	2,06
18. Wollastonite	1,98	50,70	0,60	45,70	0,20	0,32	Trace		
19. Dolomite-India	41,45	3,69		29,17	19,54	0,19			

TABLE-II

CHEMICAL COMPOSITION OF INDIVIDUAL SUPPLIES OF BIJOYPUR CLAY

Components		Date of delivery					
		12 May 1985	4 June 1985	16 June 1985	30 June 1985	17 July 1985	23 March 1986
LOI	%	8,01	7,57	7,9	6,9	9,57	6,74
SiO_2	%	64,94	69,4	66,61	69,32	62,2	71,86
R_2O_3	%	22,07	19,84	20,81	19,59	24,5	18,34
Cao	%	0,81	0,96	0,29	1,09	0,21	0,11
MgO	%	Trace	0,19	0,57	0,19	0,07	0,06
Fe_2O_3	%	0,97	1,13	1,28	0,95	0,84	0,98
TiO_2	%	0,97	0,67	0,63	0,85	1,3	0,56
K_2O	%					0,68	0,65
Na_2O	%					0,59	0,54

CHEMICAL COMPOSITION OF INDIVIDUAL SUPPLIES OF SYLHET FELDSPAR

Components		Date of delivery					
		12 May 1985	August 1985	1 Sept 1985	23 Sept 1985	16 Nov 1985	20 Jan 1986
LOI	%	0,50	0,75	0,76	0,64	1,10	0,96
SiO_2	%	73,65	74,33	74,0	72,98	73,68	72,92
Al_2O_3	%	14,00	14,28	14,5	15,66	14,90	14,84
Cao	%	0,67	0,38	0,30	0,54	0,54	0,61
MgO	%	0,29	0,13	0,10	Trace	0,13	0,37
Fe_2O_3	%	0,55	0,65	0,70	0,82	0,82	0,81
TiO_2	%	Trace	Trace	Trace	Trace	Trace	Trace
K_2O	%	4,81	5,57	5,29	4,88	4,86	4,79
Na_2O	%	4,08	3,50	3,63	4,03	3,84	3,82

MINERALOGICAL COMPOSITION OF SYLHET FELDSPAR SUPPLIES (CALCULATED)

Components		D	E	L	I V E R Y
K Feldspar	%		32,91	31,26	28,34 26,36 28,31
Na Feldspar	%		29,61	30,62	34,09 32,48 32,30
Ca Feldspar	%		1,88	1,49	- 2,68 3,02
Feldspar-total	%		64,40	62,37	62,93 61,52 63,62
Quartz	%		29,45	29,83	26,51 29,89 28,44
Clay Substance	%		4,62	6,56	5,82 9,48 7,08

MINERALOGICAL COMPOSITION OF OTHER RAW MATERIALS (CALCULATED)

Raw material	Clay substance from composition	Water LOI	Feldspar	Quartz
Ball Clay I-black	58,1 %		10,3 %	27,4 %
Ball Clay I-white	76.0 %	77,6 %	13 %	10 %
China Clay Rajmahal	91,1 %	91,6 %	2,8 %	5,7 %
China Clay Grade I	75,5 %	75,2 %	27,2 %	
Quartz Sylhet	2 %	2,5 %		96,5 %
Feldspar Sylhet (aver.)	6,6 %	6,5 %	63,2 %	29,8 %
Feldspar India	4,6 %	6,6 %	93,8 %	0,1 %
China Clay CC	86,5 %	88,1 %	8,9 %	1,3 %
China Clay 50	86,0 %	85,2 %	8,3 %	3 %

MANUFACTURE OF SOLID CORE INSULATORS

From the development of new types of insulators it is apparent in last years that solid core insulators of different types are considered as new types suitable for many purposes. This situation that in many countries the manufacture of suspension disc insulators, pin and post type insulators, etc. is no longer a viable operation. With the exception of some Japanese and U.S. companies and certain countries where foreign trade and monetary exchange are strictly controled the suspension-disc market is shared between NGK and manufacturers of glass suspension insulators manufacturers espec. SEDIVER. However both of these manufacturers are working under extremely favourable conditions. In Europe mostly the long rod insulators or other type of solid core insulators are now used for high-voltage electric power distribution.

From the manufacturing point of view, the difference between solid core insulators and hollow core insulators resides mainly in the different method of shaping, drying, glazing and firing. Solid core insulators are extruded, shaped by wet or dry turning, dried very carefully sometimes by so called resistance drying, glazed by dipping or spraying. The raising of the firing temperature for larger pieces (of 700 mm length and the weight over 15 kgs) must be very slow so that firing therefore takes longer, and is performed invariably in suspension.

As the BISF is starting to manufacture some type of solid core insulators and it is to be expected that this type of ware will increase in demand the main guidelines for those solid core insulators which can be manufactured in the existing plant are given below.

A. Ceramic Raw Materials

The main attributes required of the raw materials, short of the unachievable high characteristics and high purity, are that all supply batches should be always of equal properties and of entirely homogenous quality. These attributes are also important for the existing production in the factory, however they do not exist in the actual supply of local raw materials and sometimes even in the raw materials obtained from India. The question of local raw materials which must be dealt with very seriously in the future will be discussed in a separate report.

B. Purity of the Body

Hard porcelain and vitrified ceramic bodies are more seriously affected by different factors than other ceramic products-this includes purity of raw materials as well as contamination of the body during the production process.

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Impurities remaining in the body must be very finely ground and evenly distributed (sieving and magneting) throughout the body when reduction during the firing will correct the iron to the almost colourless and harmless ferrous form. This is what mostly happens with the impurities in the raw materials in the batch wet grinding.

However in BISF the body becomes mostly contaminated during the handling of the return scrap by iron particles which are not all magnetic susceptible and thus cannot be separated when the return body slip is passing through the magnetic separator.

The main reasons for this conditions is BISF are:

- the location of the maintenance workshop in the sliphouse.
- the continuous and endless construction works inside the production hall (incl. sieving of sand, mixing of mortar, etc)
- the unsuitable cleaning of floors instead of watering due to the clogging of the sewerage system, etc.

In a ceramic plant aiming either at mechanically and electrically strong product or at a fine and white product the contamination of any sort cannot be tolerated.

One of the advantage of solid core insulators is that they can be considered as punctureproof. However the impurities in the body reduce especially the mechanical strength in green, dry and fired state of the porcelain sometimes for up to 60 to 70 percent of the required value.

Main sources of the impurities in the body are the following:

- Damaged mesh in vibrating screens - check daily.
- Negligence in the inspection of permanent magnets efficiency - check regularly - however at least once in a month.
- Negligence in timely detachment of squeezed out rubber packing on filter press plates. Detach twice a week - check daily.
- Placing of the body on contamined platform cars, working tables, etc., covering of the body with dirty PVC foil.
- The main reason however is in the handling of the waste returning scrap and reject after drying laying on the floor littered with plaster of Paris, wood, metal parts, dust, etc.

.../...

C. Filter Pressing and Extrusion

The production of solid core insulators requires a special care to be taken starting from the sliphouse. A body of lower moisture content will enable faster drying of rolls and therefore is generally prepared in the sliphouse i.e. it means that extended pressing cycle and higher pressure are applied. The suitable moisture content of the body will have to be found out at the beginning of the production of individual types of solid core insulators, the difference against other type of insulators however is rather small - around I percent.

For the continuous trouble-free operation it is necessary to observe and to check the following:

- Prior to closing of the filter press check carefully the condition of filter cloths and of the sealing rubber on individual filter plates.

- Observe the terms for the washing of filter cloths (every 2 weeks), checking of screen and channels on filter plates (once per month), rinse diaphragm pumps with water (daily) and the whole pipeline system (at least once a week). Otherwise the deposited board in the pipeline decreases the through-flow diameter in the pipes and makes the filter pressing conditions worse.

- Check the requisite pressing time and the moisture content of the filter cakes regularly.

- Cover the chamber of the extruder with PVS foil to prevent the drying of the body remaining in the extruder and let it be covered after the start of the belt conveyors system for a while to catch all the dry body releasing from the conveyors.

Plateform cars with rolls are transported to the aging room (in the dry season) where they are stored separately from other rolls. The laboratory employees check daily the rolls moisture throughout the whole room and draw attention to any difference. The body in the ageing room is maintained on the required moisture content by steaming for 1 to 2 hours every day. In the rainy wet season the handling of rolls after the first extrusion must be adjusted in accordance with the moisture of the air prevailing in the production hall.

D. Extrusion on the De-airing Pugmill

The vacuum pump of the de-airing pugmill has to be in operation 10 minutes prior the start of the rolls extrusion. Taking into consideration that the de-airing pugmill is the most significant equipment in insulators production, and especially in solid core insulators production, the correct de-airing of the rolls must be checked all the time by the staff of technological department as well as of the process laboratory. The same employees check also the correct handling of the rolls after extrusion i.e. theircovering to prevent the surface drying and/or their transfer to the ageing room.

.../...

When Operating the De-airing Pugmill keep the following Principles:

1. Check daily the de-airing chamber of the pugmill. Take off the sight glass on the chamber and clean it from sticking body. Clean the chamber space from accumulated excess body. During the extrusion check visually the edges of the shredding cutter. Should the distance of the cutter edge from the inner circumference flange be 2 mm or more carry out the following test:

   Insert twice folded carton paper (around 1,2 mm thickness) under the shredding edge of the cutter. Tighten the edge to the level of the paper by means of the set screw. In this position the edge cuts the porcelain body to fine pieces enabling easy de-airing of the body. When this inspection and procedure is neglected and the distance of the cutter edge or the screen distance from the inner circumference flange is more than approx. 1,5 mm then the resulting body strips are to coarse and difficult foe de-airing. Do this inspection at least once in 2 months.

2. Together with this it is necessary to check the cutter itself. When the saw-shaped recesses of the cutter are to much worn out, the edge does not cut the body to fine pieces and the body is fed to the extrusion auger in the shape of a hollow cylinder. In this shape is the body very difficult to be de-aired. When the cutter is at the end close to the edge smaller for 5-6 mm, replace it with a new cutter.

3. When closing the de-airing chamber, clean by means of a slightly moistened sponge the sealing areas of the cover and of the sealing rubber and tighten by means of screws thoroughly the cover to the outer jacket of the de-airing chamber.

4. In the event that the required value of the de-airing after the start of the de-airing pump operation fails to be attained and the source (place) of the air leakage cannot be found out visually, then force in air by means of a compressor into the de-airing chamber (or oxygen from the pressure cylinder) to the value of 0.10 to 0.12 MPa overpressure. Then paint with a brush the diluted suds on all sealing places on the de-airing pugmill, especially the place near to the main shaft of the pressure auger, sight-glass, joints of the scrapper cylinder and all other places which could be the reason of the leakage. Soap bubbles on the painted surface indicate the place of the undesired air leakage.

5. The table in the front of the de-airing pugmill mouthpiece must be placed in such a way that the wooden support for the extruded roll (essential for solid core insulators rolls !!) will be aligned with the mouthpiece of the pugmill. This is a condition for the extrusion of straight and correct rolls. When this condition is not kept and the extruded roll is not straight, then this deffect will reappear in the following steps of the manufacturing process and will result in the rejection of the fired product due to its curvature. The porcelain body property to maintain its shape like extruded is one of the most significant reeological property.

   Both faces of the cut roll must be normal to its axis-therefore it is necessary to guide the cutting wire on the edge of the de-airing pugmill mouthpiece.

.../...

6. After the extrusion check each roll for de-airing on a 15-20 mm body bat. A well de-aired body does not crack on folding, it is compact and flexible. Unsificient de-aired body cracks on folding in places with remaining air. This body must not be used for the production of solid core insulators. Especially for solid core insulators it is necessary to use the body perfectly and uniformly homogenized-without the difference in the moisture content and perfectly de-aired. Moreover it is essential that the rolls be of prescribed length and diameter, they must not be rumpled, sticked together and otherwise deformed.

Very Important !

Mark the rolls extruded into the wooden supports (in which they will remain till the shaping) with an arrow indicating the direction of their extrusion. This instruction is important especially for solid core rolls (but also it is applicable for bushings, bottom part of 33 KV pin insulators, etc) with the following principle:

Place the roll after hardening (i.e. in leather-hard state-for the hardening of solid core rolls the resistance method is the most suitable one) on the revolving wheel of the turning (shaping) machine always with the arrow showing up i.e. towards the upper centre or the upper disc of the insulator's copying machine. The reason for this instruction is the fact that all turning machines have the counter-clockwise sense of rotation of their driving spindles or revolving wheels. On the other side by the rolls extrusion is the "assembling" of the body in the pugmill mouthpiece by means of pressure augers of all de-airing pugmills performed by augers clockwise sense of rotation. Therefore in this case is the auger texture (worm texture) of the roll effaced/smoothed by the edge of the turning tool.

When this principle is broken i.e. when the rolls are turned with the arrow showing downwards, the auger structure is unfavourably affected ("denuded") by the edge of the turning tool which may result in further manufacturing process in the formation of worm cracks especially in the lower part of the insulator.

Efficiency test of rolls perfect compactness on the de-airing pugmill consists in the cutting of approx. 3 body bats of approx. 20 mm thickness. These bats are placed into the laboratory drier heated to around 80°C. When after 3 hours of intensive drying the cracks in the shape of reversed S(worm cracks) do not appear, the body has been properly de-aired and compacted. The cracks of other shape as e.g. cross ward cracks, radial cracks or normal cracks are permissible on tested bats as the drying in this case has not followed the course of the Bigot surve. The body generally does not show any cracks of reversed S shape when the de-airing pugmill works under following conditions:

1. The positioning of the well designed compressive nozzle is in approx. 1/3 distance between the triple-bladed pressure auger point and the end of the mouthpiece.

.../...

2. Correct position of the triple-bladed pressure auger point portion (which depends on the type of the body and must be adjusted on the experimental findings).

3. Perfect vacuum in the de-airing pugmill vacuum chamber. No air leakage must appear at the overpressure test.

4. The body through put of the pugmill must be within the range 65 to 35 kg per minute.

5. The gap between the terminal pressure augers and the directing lining of the mouthpiece must not be more than 3 to 5 mm.

6. At the formation of excess body in the vacuum chamber of the pugmill it is possible to assume that the pressure augers are too much worn out and the body in this case comes back between the auger and the mouthpiece lining into the chamber. Under these circumstances disassemble the pressure auger and replace it by a new one.

7. The above (see point 6) in the event that the directing grooves of the mouthpiece lining are not worn out. In the case of their excess wear replace also this inner lining of the mouthpiece by a new one.

ANNEX-VII/3

Pressed Porcelain Production

Minutes of the Tripartite Review Meeting held on 18 May 1986 include the following article:

Develop/adjust the body and glaze composition for pressed porcelain production with a view to utilize idle insulator kiln capacity.

Moreover to that the Management of BISF has requested to prepare a preliminary proposal of machinery and equipment required for this manufacture to be accommodated in the existing plant.

The idea of pressed porcelain ware manufacture in BISF to utilize the idle capacity of the whole insulator plant was raised by the expert on the meeting held in BCIC head office on 12 January 1986 and was referred in the Technical Report No.14 in February 1986.

After its acceptance in TRM the final proposal of the expert was elaborated in the Technical Report No.23 which is given herewith in full working.

TECHNICAL REPORT NO.23: PROPOSAL OF PRESSED PORCELAIN DEPARTMENT

As requested by the Management of BISF I am enclosing herewith a preliminary proposal of a pressed porcelain manufacturing department incorporated as integrated part of the factory to cover the idle capacity in the insulators production plant.

The following are the basic considerations:

a. The installation of a pressed porcelain manufacturing department in BISF under actual conditions of idle capcity in insulators plant is to be considered as a correct step, for the improvement of the economy of the factory. The reasons consisting mainly in the utilization of installed equipment have been already stated in my Technical Report No.14.

b. The results of the local market study have shown high requirements of this ware. However it seems that these results see Annex No.1 are on a incredibly high side and should be once more checked in detail.

c. Anyhow when considering the actual situation in sales and a yearly production of up to 1800 tons of LT and HT insulators in the future, the factory could accommodate further installations for the production of 450 to 500 tons of pressed porcelain ware under no additional extension of the production area.

   This increased capacity would require additional investment mainly for the actual press body preparation, pressing, final surface treatment of some ware and for the dies manufacture with few auxiliary aids in other factory departments.

d. Cut-outs, switch bases and bus bars as given in the Annex No.1 are considered as the main products with the addition of appr. 10 tons of porcelain for the textile industry and approx. 5 tons of chemical porcelain.

e. The dry vaste body from the insulators production and the actual white glaze has been considered to be used for the pressed ware production. This proposal has to be tested and finalized till the end of my mission in Bangladesh.

   A preliminary specification of machinery and equipment is given in the Annex No.2.

There you can find one complete mechanized production line equipped with semi-automatic presses. This line has been considered for the flow mass production of small size ware required on the market in higher quantities as e.g. cut-outs 10A-15A, 30A, buss bar support insulators, etc.

.../...

Other ware of lower demand would be pressed on separately installed presses of various types (mechanical, hydraulic) and the ware of larger size and of intricated shape on hand operated presses of various working pressure.

The ware will be dried mainly in the existing channel drier in the factory - just another small capacity drier has been included into the specification for drying the ware liable to damage by handling or requiring another drying cycle.

The glazing will be carried out either by dipping or spraying by methods provided in the existing ware production.

The firing of the ware is considered to be carried out in the existing insulator tunnel kiln. For the purpose of bisque firing (which is for some special types of pressed ware and for the manufacture of chemical porcelain essential) one electrical chamber furnace has been suggested.

The surface finishing of some types of ware and the dies manufacture will require the installation of a few special machines as e.g. centreless grinding machine, tool milling machine, etc. The purchase of these machines especially for the dies manufacture as to be considered as indespensible for the pressed porcelain ware production as to relay in this matter on other manufacturers would never assure a smooth run of the production.

The assembling of the produced ware with metal parts has not been considered in the enclosed specification as this is being obviously provided by various organizations in Bangladesh. However it is necessary to take into consideration in the future that the assembling is the procedure which represents the highest profit in the supply of the ware to the market i.e. by which the actual profit could be many times multiplied and moreover it is a very simple work, much easier than the production of the porecelain ware itself.

PRESSED PORCELAIN WARE - LOCAL MARKET REQUIREMENTS

Sl. No.	Name of Item	Country of origin	Annual consumption Pcs.	Wt/Pc Kg.	Total in M.T.
1.	Cut out 10-15A/250V	China & India	60 lac pcs.	0.175 Kg.	1050
2.	Cut out 30A/500V	China Other than China	30 lac pcs.	0.5 Kg.	1500
3.	Cut out 60A/500V	China & India	10 lac pcs.	0.7 Kg.	1050
4.	Cut out 100A/500V	China & India	5 lac pcs.	1.3 Kg.	650
5.	Cut out 200A/500V	China & India	1 lac pcs.	2.15 Kg.	215
6.	Bus-bar support insulator	India	10 to 15 lac pcs.	0.15 Kg.	225
7.	Main Switch Porcelain D.P.(30A)	India	4 to 5 lac pcs.	0.5 Kg.	250
8.	Main Switch Porcelain D.P.(15A)	India	50 lac set	0.3 Kg.	1500
9.	Ceramic Holder	India	1 lac pcs.	0.3 Kg.	30
10.	Main Switch T.P. Base(30A)	India	2 lac set	0.75 Kg.	150
11.	Main Switch Base (60A)	India	1 lac set	1.0 Kg.	100
12.	Main Switch Base with Cover(100A)	India	1 lac	1.85 Kg.	85
13.	Main Switch Base with Cover(60A)	India	1 lac	0.4 Kg.	40
14.	Main Switch Base with Cover (30A)	India	1 lac	0.2 Kg.	20
15.	Main Switch Base 30A (2 types) without Cover	India	1 lac	.08 Kg.-Big .05 Kg.-Small	8 5
16.	Main Switch Base 60A (2 types) without Cover	India	1 lac 1 lac	0.25 Kg.-Big 0.1 Kg.-Small	25 10
17.	Bus Bar Support Smaller Size	India	1 lac	0.05 Kg.	5
18.	Cut out 30A (Special Type)	India		0.2 Kg.	20
19.	Cut out 60A (Special Type)	India		0.7 Kg.	70
	Total				7008

Ch = China, I = India, O = Other

ANNEX VII/3/2

A. Pressing Body Preparation Shop

Item No.	Quantity	Denomination
1.	1	Electric Pulley Block lifting capacity: 500 kg.
2.	2	Throw-off Carriage
3.	15	Wooden Case
4.	1	Set of Auxiliary Equipment - oil supply piping to the mixers including all fittings; - water supply piping to the mixers including all fittings - supporting structures of machines - platforms, frames, bridges - railage for the electric pulley - feeding hoppers, chutes - material for the adjustment of belt conveyors

B. Pressing Body Preparation Shop

1.	1	Battery-type high lift truck lifting capacity: 2.500 kg
2.	10	Container for the Transportation of waste body
3.	1	Belt feeder for Uniform Feeding of the material
4.	1	Edge Runner Mill Type MKS 800
5.	1	Worm Feeder Dia 200 mm
6.	1	Belt and bucket type Elevator capacity: 6 tons/hour
7.	1	Worm Conveyor Dia 200 mm
8.	2	Flat Slide Valve Closure
9.	2	Storage Silo Made of Steel Sheet
10.	2	Flat Slide Valve Closure
11.	2	Rotary Feeder Type RP 200
12.	1	Container made of Steel Sheet
13.	2	Flat Slide Valve Closure
14.	2	Tensimetric Pressure Indicator
15.	1	Mixing Machine, Capacity: 400 lit.
16.	1	Inclined Conveyor With Rubber Belt
17.	1	Screening Machine
18.	1	Centrifugal Pump, Cpac. 13 lit
19.	20	Truck with Container

C. Forming Department

Item No.	Quantity	Denomination
1.	1	Set of complete supply system of the steam for the heating of the dryer
		The Steam supply system consists of the following:
		Piping, Bends, Closing and Measuring and Packing Material.
2.	1	Set of complete collection system of the condensate from the dryer
3.	1	Set of material for the manufacturing of piping suspensions, brackets
4.	1	Set of insulation Insulation of Steam Piping System
5.	10	Chutes to the Presses
6.	6	Wooden table with a Box
7.	1	Set of Pressing Tools
8.	4	Hydraulic Press Working Pressure: 2.000 kg.
9.	3	Hydraulic Press Working Pressure: 2.000 kg.
10.	2	Hydraulic Press Working Pressure: 10 tons
11.	2	Hand operated lever press working pressure: 500 kg.
12.	1	Semi-automatic press Working Pressure: 5.000
13.	10	Wooden Fettling Table
14.	2	Wooden Working Table
15.	12	Wooden Vessels for the Glaze Slip Capacity: 20 1
16.	20	Wooden Working Table
17.	1	Propeller Blunger for
18.	1	Propeller Mixer
19.	1	Bench Conveyor
20.	8	Wooden Working Table
21.	2	Universal Mechanical Potter's Wheel
22.	10	Wooden Fettling Table
23.	1	De-airing Pugmill Type 200 L
24.	10	Travelling platform carrying capacity: 600 kg.

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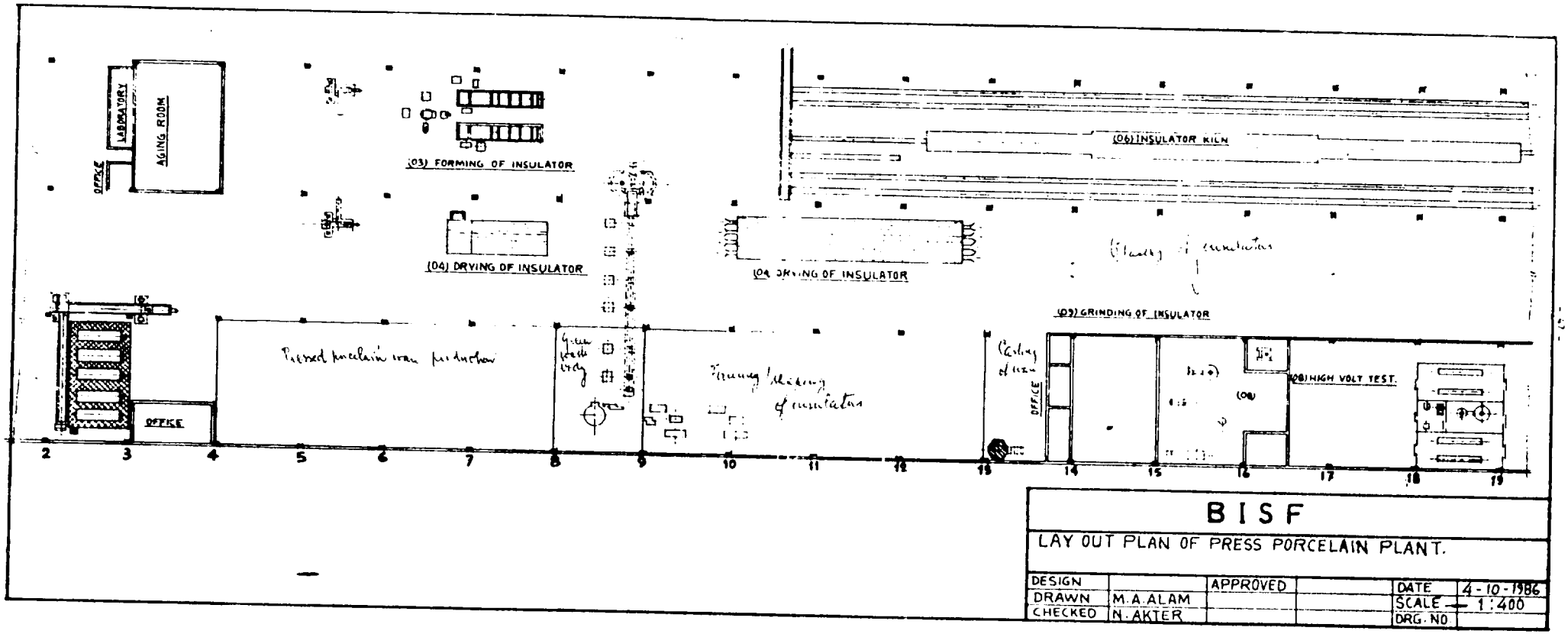
Item No.	Quantity	Denomination
25.	3	Universal Hand Truck
26.	20	Vessel for the Casting Slip
27.	1	Set of Auxiliary Equipment as e.g. supporting constructions, tanks for blungers and mixers, piping, etc.
28.	3	Semi-Automatic Press Pressing Pressure: 5000 kg.
29.	1	Dryer on belt conveyor consisting of the following:
30.	1	Belt Conveyor
31.	1	Drying Tunnel
32.	1	RNH 315 inlet fan
33.	1	RNH 315 Exhaust Fan
34.	1	Steam Air Heater of OPD Type 1x1
35.	1	Protecting Grill
36.	1	Inlet Piping
37.	1	Exhaust Piping
38.	1	Air Outlet Piping
39.	1	Supporting Constructions and Platforms
40.	1	Supporting Construction and Platforms
41.	2	Thermometers
42.	8	Cleaning Tables
43.	1	Glazing Line
44.	2	Hand Operated Type Crank Press
45.	2	Hand Operated Column Type Crank Press working pressure: 3500 kg.
46.	2	Hand Operated Column Type Crank Press Working Pressure: 10.000 kg.
47.	1	Semi-automatic Press Working Pressure: 10 Tons
D. Drying		
1.	1	Double-Chamber Dryer
2.	2	Two-leaved Insulated Door
3.	1	Grille for the air Exhaust
4.	2	Inlet Fan Type RNH 250
5.	2	Exhaust Fan Type RNE 250

Item No.	Quantity	Denomination
6.	2	Steam Air Heater Type OPC
7.	2	Sets of Air Exhaust Piping
8.	2	Sets of Piping
9.	2	Sets of Air Supply Piping
10.	1	Set of air Piping Supports
11.	6	Thermometers
12.	1	Set of Thermal Insulation
13.	50	Mobile Platform type SINUS 600
14.	50	Deck Collar
15.	10	Double-wheeled tow bar
16.	1200	Plate Hurdles for the Transportation of the Presses
E.	Glazing	
1.	1	Glazing line
2.	2	Belt Type Glaze Cleaning Machine
3.	1	Bench Type Spraying and Blowing Booth Working Space: 900 x 900 x 900 mm
4.	1	Pressure Glaze Container
5.	1	Air Pressure Controller
6.	2	Spray Gun Type RS 13
7.	5	Nozzle for Spray Gun RS 13
8.	1	Rubber Pressure Hose
9.	1	Propeller Mixer Type MV 200
10.	1	Undercarriage
11.	5	Wooden Vat, Capacity: 150l
12.	10	Woodenworking Table
13.	1	Sets of piping
14.	1	Wooden Tank
15.	5	Vessel for the Glaze
F.	Firing and Kiln Car Track Haulage	
1.	1	Electric car-type chamber kiln for the bisque firing of technical porcelain, textile and laboratory porcelain, complete including kiln cars, all refractory and insulating materials for the kiln and kiln cars superstructure, rails, connecting and anchoring material working temperature: 960°C Kiln ware space dimensions approx 1000 x 600 x 1500 mm

G. Storage and Dispatch Room

Item No.	Quantity	Denomination
1.	1	High-lift Truck Lifting Capacity: 2000 kg
2.	25	Wooden Case
3.	20	Travelling Platform Carrying Capacity: 600 kg
4.	5	Universal Wheelbarrow
5.	5	Wooden Working Table
6.	25	Wire Netting Box Pallet Carrying Capacity: 1.000 kg.
7.	15	Fenced Stack Sheet Pallet Carrying Capacity: 1.000 kg.
8.	2	Hydraulic Hand Lifting Truck Carrying Capacity: 1.250 kg.
H. Compressor Station		
1.	1	Double-stage piston Compressor
2.	10	Antivibrating Isolator
3.	1	Pressure Receiver
4.	1	Set of Piping
I. Dust Exhausting and Collecting Equipment		
1.	1	Hose-type cloth filter type FKC
2.	1	Fan Type FVI 1,000 - 5N
3.	1	Set of Suction and exhaust Piping
J. Electrical Equipment		
1.	1	Electrical Installation of the Whole Department



BISF

LAY OUT PLAN OF PRESS PORCELAIN PLANT.

DESIGN		APPROVED		DATE	4-10-1986
DRAWN	M.A.ALAM			SCALE	1:400
CHECKED	N.AKTER			DRG. NO	

ANNEX VII/4

ELECTRORESISTANCE HARDENING OF EXTRUDED ROLLS

The electroresistance hardening of porcelain rolls especially in the manufacture of solid core insulators is nowadays a common practice in many insulator plants.

As per the findings of the expert the particular properties of the insulator body in BISF governed mainly by the characteristics of high percentage of Bijoypur clay in the body and causing a high moisture gradient between the roll surface and its core during the first stage of drying (i.e. from plastic to leather-hard conditions), make it especially essential to introduce this method as the routine procedure in the insulators production.

The method may be applied for leather-hard drying of all solid core insulators, most type of bushings and post insulators and even for lower parts of pin and pin and post type insulators. The benefits will consist in homogeneous drying of rolls throughout their whole section, reduction of reject, etc.

The expert has provided for an offer of this type of equipment to be sent to BISF in a short time by Pragoinvest Praha including a detailed specification of all parts required.

Whether this equipment will be purchased from this supplier or provided locally will be on the decision of BISF. In any case the following instructions may be useful as the main guidelines for its servicing.

Electroresistance hardening service instructions

The rolls after extrusion are transported to the electroresistance drying cage. There they are set on three stands (each stage represents one phase of electric current) in the manner that all three phases are uniformly loaded with the same number of rolls (i.e. total number of rolls must be divisible by three). Then carry out the "spearing" of electrodes on both ends of the rolls.

The electrodes must be pressed into the roll so deep that the molitane plate bears against the end surface of the roll with its whole surface. When placing the electrodes to the roll ends it is necessary to take care that the bottom rim of the electrode be positioned approx.5 mm above the wooden support bottom to enable the shifting of the electrode together with the shrinkage of the roll. In case the electrode would be set on the roll too low, it could during the roll shrinkage get stuck by the support which would result in a gap between the roll and the electrode. In this case the process of electroresistance hardening would be disturbed.

Start the setting of rolls always from the upper stand. Like this is you prevent the contamination of the surface of rolls on lower stand.

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Notice:

Do not place the electrodes on rolls unless the cage is completely loaded with required number of rolls.

1. Inspection of the cage after setting

   a. All electrodes on rolls ends must be connected by means of conductors.

   b. The connecting conductor must not touch either the supporting structure or the floor.

   c. The connecting conductor must not touch the bracket to which it is not connected.

   d. The connecting conductor may touch the bracket to which it is connected by means of cable lug.

   e. When the brackets are loaded only with a small number of rolls, fasten the remaining portion of the conductors to the bracket to which they are connected.

2. Close thoroughly the cage doors and enter all data into the operational recording which are listed in the heading of the log book which are the following:

   a. Date of load and number of cage.

   b. Type of insulator.

   c. Start of the electroresistance hardening (hour).

   d. Initial state of electric supply meter in KWh.

   e. Voltage - volts

   f. Stop of the electroresistance hardening (hour).

   g. Final state of electric supply meter in KWh.

   h. Number of hardened rolls.

   i. In the section "Notice" put the relative air humidity and the temperature of the workshop.

3. The switch of the main switchboard should be always in the position I.

Switching On:

   a. Switch on the main switch on the board for the resective cage from the position towards the position I to the right.

   b. Press down the switching-in push button and the signal lamp marked HARDENING will be switched on. When this red light gets off the cage doors are not properly closed. Close the door to press the terminal switch to stop.

.../...

c. Set the required voltage with the aid of the voltage adjustment button. The increasing of the voltage to the required value is finished when this value can be read on the voltmeter for set up voltage.

d. Switch over the switches of individual phases to the right from the position 0 to the position I.

Note

Check the deflection on ampermeters. When some of the ampermeters stays in zero position, the electroresistance hardening must be interrupted by pressing the red push button.

The fault may be caused by the following reasons:

1. Fall-out of the respective ampermeter fuse.

2. Incorrect connection of electrodes by the connecting wire.

3. Fall-out of the electrode from the roll.

Like that the electroresistance hardening set has been put into operation and will remain switched on for a period required for individual types of insulators, their number, etc.

The voltage applied for the hardening is normally within the limits of 180 to 280 volts in dependance on the type of insulators being hardened. The required period of hardening depends also on the type and number of insulators being normally within the limits of 6 of 11 hours. After the hardening is completed the insulators are let to cool for the period 6 to 8 hours.

The values of the voltage, period of hardening and cooling depend on the ambient temperature and relative humidity of the air and have to be determined for individual types of insulators and climatic conditions by experimental practice.

After the completion of the hardening the equipment is switched off, the time of hardening and the state of electric supply meter in KWh are noted in the log book.

Maintenance and Safety Instructions:

1. During the hardening period a warning light is on and thus on both sides of the cage which signals that the cage is live.

2. Check once in a week the conditions of connecting conductors. Demaged conductor must be replaced.

3. Clean once in a week the brass tips of electrodes by means of abrasive paper.

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4. The molitance plate on electrodes prevents the drying of rolls ends during the electroresistance hardening. Check once in a week the entirety of the molitane. Torn up or otherwise damaged molitane must be immediately replaced.

5. After closing the electroresistance hardening cage doors no body must enter the cage.