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**FINAL REPORT**  
**FOR**  
**ENGINEERING / ECONOMIC**  
**FEASIBILITY STUDY**  
**MISR RAYON COMPANY**  
**KAFR EL DAWAR, A. R. E.**

**A. SUMMARY AND CONCLUSIONS**



**J. E. SIRRINE COMPANY**

**ARCHITECTS**

**ENGINEERS**

**PLANNERS**



**ARTHUR D. LITTLE INC.**

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December 2, 1977

Dr. A. M. Hafez, Chairman  
MISR Rayon Company  
Kafr El Dawar, Arab Republic of Egypt

SUBJECT: MISR Rayon Company  
Kafr El Dawar, Arab Republic of Egypt  
Engineering/Economic Feasibility Study  
Sirrinc Job No. S-1316  
Arthur D. Little, Inc. Case No. 80561

Gentlemen:

As commissioned by MISR Rayon Company and the United States Agency for International Development, J. E. Sirrine Company and Arthur D. Little, Inc. have prepared the Final Report for the Engineering/Economic Feasibility Study for the proposed expansions at MISR Rayon Company. The Final Report is based on the Draft Report dated September 2, 1977, comments received by telex from MISR Rayon on October 12, 1977, and comments from A.I.D./Cairo on September 12, 1977 and October 17, 1977.

Fifteen (15) copies of the Final Report are enclosed.

We appreciate the opportunity to have been of service to MISR Rayon Company. If additional questions arise, please let us know.

Very truly yours,

J. E. SIRRINE COMPANY

R. L. Whitaker  
Project Manager

RLW/ljb  
Enclosures

cc: A.I.D./Cairo w/5 copies of Final Report  
A.I.D./Washington w/3 copies of Final Report

FINAL REPORT  
FOR  
ENGINEERING/ECONOMIC  
FEASIBILITY STUDY

MISR RAYON COMPANY  
KAFR EL DAWAR, ARAB REPUBLIC OF EGYPT

SIRRINE JOB NO. S-1316  
ARTHUR D. LITTLE CASE NO. 80561

DECEMBER 2, 1977

J. E. SIRRINE COMPANY  
ENGINEERS  
SOUTH CAROLINA DIVISION  
GREENVILLE, SOUTH CAROLINA

ARTHUR D. LITTLE, INC.  
ACORN PARK  
CAMBRIDGE, MASSACHUSETTS

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APPENDIXES FOR NATIONAL ANALYSIS

## SUMMARY

### INTRODUCTION

J. E. Sirrine Company and Arthur D. Little, Inc., were jointly commissioned in March 1977, to conduct a feasibility study of a proposed expansion of facilities for Misr Rayon Company at its Kafr El Dawar Plant, Arab Republic of Egypt. Minor changes to the scope of the proposed project were made during the course of the study and the final scope consists of the following:

- a. A new polyester continuous filament plant having a spinning capacity of 6 metric tons per day of 150 denier and 4 metric tons per day of 100 denier. Polymer chip is to be supplied from an existing polyester polymer plant. Downstream facilities consist of draw twisting, draw texturing, package dyeing, and finishing.
- b. Expansion of nylon-6 production facilities to provide melt spinning of 2 metric tons per day of 1000 denier carpet yarn, 4 metric tons per day of 200 denier upholstery yarn, 2.3 metric tons per day of 70 denier textile yarn and 0.6 metric tons per day of 40 denier textile yarn. Polymer would be supplied from an existing polymer chip production unit, supplemented by purchased chip. Downstream facilities consist of drawing, twisting, texturizing, dyeing, tufting and finishing.
- c. Modernization of existing rayon continuous filament production and expansion of facilities to produce 25 metric tons per day of high wet modulus rayon staple.

INTRODUCTION - Continued

- d. A new polyester staple fiber plant consisting of a polymer chip production unit and a staple fiber unit producing 70 metric tons per day.
- e. A new spinning and weaving facility for the production of cotton/high wet modulus rayon blend yarns. Facilities would include 49,984 spindles, 672 looms, and ancillary equipment for blending, drawing, spinning, weaving, dyeing and finishing.

The scope also required the consultants to conduct an audit of the existing management of Misr Rayon Company in order to identify problem areas and to propose new methods and systems that will permit management to better operate in its current environment.

This feasibility study was conducted by examining the commercial, technical and engineering, financial and national benefit aspects of the proposed project. The proposed production facilities have been divided into nine (9) profit centers for individual evaluation from all aspects.

Since the scope of this project embraces well known products, the engineering and technology aspect of this study involved principally the application of sound engineering practice to economical processes. Licensed processes were examined, where necessary, and evaluated for selection of the most advantageous process. Consideration was given to all viable, alternative methods and processes that offered tangible benefits to Misr Rayon Company.

The economies of the project have been analyzed from two significantly different standpoints: the commercial standpoint taken by the equity investors in the Misr Rayon Company (such investors being the Government

INTRODUCTION - Continued

of Egypt regarded solely as equityholders interested in commercial profit); and the national standpoint taken by Egypt as a national unit.

The commercial standpoint is not particularly helpful in assessing the feasibility of the project because it requires recognition that the prices at which the products of the project are sold are administered prices. The analysis has entailed the calculation of the selling prices needed to obtain a stipulated rate of return, that is, the prices needed for feasibility. Sensitivity has been assessed by hypothesizing alternative rates of return, alternative levels of labor efficiency, alternative foreign exchange rates, and alternative financial structures.

The national standpoint is that of Egypt as an undivided whole. The national economic analysis of the project was designed primarily to show the rate of return to the nation as Egyptian resources are withdrawn from present uses and allocated to the project. The cost value of resources is regarded as production elsewhere in the nation that must be foregone; benefits are regarded as the value of imports that can be avoided, or of exports that can be made. Thus taxes, subsidies, official exchange rates, and administered domestic prices are rightly set aside in national analysis. In conducting national analysis, sensitivity was tested by hypothesizing alternative levels of labor efficiency and alternative means of financing. The financing alternatives were posed by utilizing two materially different assumptions. Under the first assumption, all funds needed are provided from Egyptian sources, whether the inputs to be financed are Egyptian or foreign in origin. Under the second assumption, all funds needed to pay for imported fixed assets

## INTRODUCTION - Continued

are based from abroad on an aid basis; the loans are assumed to carry a ten-year grace period with interest at 2%, followed by a thirty-year repayment period with interest at 3%. The latter assumption is intended to be realistic; the former assumption is posed to indicate the economic worth of each of the project components to Egypt if financing from abroad were not available.

## CONCLUSIONS AND RECOMMENDATIONS

The results of the national benefits analysis show that the overall project is positive; if foreign assistance loans on the assumed terms are obtained, the project can yield a 22% annual national rate of return based on current utilization of labor and 29% if labor efficiency goals are attained.

The only investment that is clearly negative is the high wet modulus rayon portion of the project. If this component is set aside, the overall national rate of return would rise, under the assumed foreign financing, to 26% based on current utilization of labor and to 32% based on the more efficient utilization of labor. The spinning component, although estimated to yield a national rate of return as high as 24%, is postponable because of adequate existing capacity in the company and projected for the industry.

Markets in Egypt will exist for almost all the products to be produced by 1982. The only exports expected from the project are a portion of the finished bedsheets to be manufactured.

Evaluation of the commercial feasibility was made under two sets of assumed conditions. The first set includes: the use of existing exchange rates (official and parallel) throughout the analysis, continuation of

## CONCLUSIONS AND RECOMMENDATIONS - Continued

existing duties, and 100% equity financing of the project. The second set includes: the use of an exchange rate of \$U.S. 1.35/Egyptian pound throughout the analysis, continuation of existing duties, no additional subsidies, and financing of the foreign exchange portion of the project by debt at a 10% interest rate.

The commercial analysis included consideration of each of the products to be produced under the two sets of assumed conditions. In spite of the restraints on the validity of using commercial analyses in an administered economy, this was done chiefly to provide a basis for judgment as to the probable relative commercial viability of the different products under consideration.

The commercial analysis specifies prices which are necessary to provide predetermined internal rates of return. We then used our best judgment to determine whether these prices were attainable under the two sets of assumed conditions.

Under the first set of conditions (existing exchange rates, etc.) spun yarn is the only product judged not to be able to achieve a 10% internal rate of return. For all other products, it appears that prices will be available such as to yield a 10% internal rate of return or better. Continuous filament yarns tufted nylon carpet and woven apparel products appear to be the most profitable products judged from the point of view of the commercial analysis.

Under the second set of conditions, (\$U.S. 1.35/Egyptian pound, etc.), the products which do not appear capable of achieving prices such as to yield a 10% internal rate of return are spun yarn and finished bedsheets. The conditions assumed severely penalize the export of textile products from Egypt through assuming high fiber prices.

## CONCLUSIONS AND RECOMMENDATIONS - Continued

The technical and engineering feasibility analysis clearly indicates that all elements of the project are sound, requiring only the application of proven technology. The polyester project and the high wet modulus project will each require licensing of proprietary technology, which is readily available from U.S. companies that have demonstrated commercial feasibility of the respective processes in the U.S. An engineering evaluation of the project is positive with the exception of the high wet modulus rayon plant and the polyester polymer plant. The high wet modulus rayon plant is too small to be economically viable from the viewpoint of the national economy. The polyester polymer plant using imported DMT feedstock is not as profitable as it would be if it were using imported TA feedstock. Since polyester chip can be produced by either method, it would be more economical to use TA as a raw material. The minimum reduction in operating cost that could be realized is approximately \$2,500,000 per year.

The management audit indicates that the Misr Rayon Company, can handle the proposed expansion in spite of significant deficiencies in physical plant, cost accounting systems, and management for profit maximization. Specific changes must be made for the contemplated project to be viable. These are specified in our findings and include: reassignment of functions among General Managers, upgrading marketing and technical service, development of an upgraded computerized management information and control system, and development of programs for improved management training, safety and plant housekeeping.

## CONCLUSIONS AND RECOMMENDATIONS - Continued

Therefore, it is recommended that, with the exception of high wet modulus rayon and the new spinning plant, the project be implemented as being both a profitable investment for Misr Rayon Company and in the national interest of Egypt. It is further recommended that the need for additional spinning capacity be reevaluated by 1982. The exclusion of the high wet modulus rayon plant and the new spinning plant will not jeopardize the feasibility of the overall project. The existing spinning plant can supply sufficient yarn to manufacture the fabrics evaluated by this study provided air conditioning and refrigeration are added. The high wet modulus rayon can be imported if required or cotton can be substituted.

We do not recommend the exclusion of finished bedsheets from the mix of woven fabrics to be produced unless it appears that the second set of assumed conditions will be realized. Under these conditions most, if not all, Egyptian textile products will have difficulty competing in world markets and the weaving and finishing capacity of the MISR Rayon project should be redirected to the production of other products for domestic sale such as shirting and woven outerwear.

It is important to note that the weaving and finishing plant is recommended for implementation in spite of a predicted low national rate of return. This low rate is brought about by the forecast continuing low international prices for fabrics produced in the Far East. Most textile producing nations, recognizing that a continuation of low Far Eastern fabric prices is not to be relied upon as a basis for national policy, provide protection to their domestic textile industries. Egypt, along with other textile producing nations, has adopted this stand as a matter of policy. The national worth of implementing the weaving and finishing activity within the project includes

## CONCLUSIONS AND RECOMMENDATIONS - Continued

benefits to employment and foreign exchange savings strongly supplementing the marginal calculated rate of national return. In addition, the weaving and finishing activity are an integrated part of a total project which provides a strongly positive national rate of return.

The total escalated project cost, excluding the high wet modulus rayon plant and the new spinning plant, and including air conditioning and refrigeration for the existing spinning plant, is estimated to be approximately 140,000,000 U.S. dollars.

A discussion of the effects of temperature and humidity is provided in Part B, Commercial Aspects. At Misr Rayon's request, a Construction Cost Estimate has been prepared for the addition of refrigeration facilities and chilled water piping to the existing spinning plant. The Construction Cost Estimate is included as Appendix A to the Summary and Conclusions. Although an economic analysis was not performed; in our judgment, while processing polyester staple, the spinning plant capacity would be increased by approximately 5% with the addition of the proposed new refrigeration facilities. Further, it is our understanding that the Egyptian Government now requires all new spinning mills be temperature and humidity controlled.

## FINDINGS

### Markets

The Misr Rayon project was designed to primarily serve Egyptian markets. Exports were to be considered only insofar as the domestic market could not absorb future production.

## FINDINGS - Continued

### Markets - Continued

Our market analysis concludes that of the spectrum of products to be manufactured, only a portion of the production of finished sheets will need to be exported. The contemplated sheet production is so large that if Misr Rayon were to sell only to domestic markets the company would need to capture 27% of the total domestic market by 1982 and thereby become the largest supplier in one step. We expect that a portion of production, estimated at 50%, will need to be exported by 1982 and that this will be exported to the European Common Market. These exports can decline as domestic requirements increase so that by the late 1980's Misr Rayon should be able to shift its entire production into domestic markets.

The production capacity of the other products to be manufactured by the project can be absorbed by the domestic market by 1982 through 1992. Some of the products under consideration can be readily absorbed either through substitution of existing imports or because they represent small increments of existing markets or modest expansions of existing product demands. These include: flat filament polyester, 70 denier two-ply textured nylon, 70 denier flat nylon, 40 denier flat nylon, high wet modulus rayon staple at a price competitive with cotton, woven textured-spun combination outerwear fabrics, shirting fabric and spun outerwear fabric. Other products will require the diligent market development to accommodate the quantities to be sold by 1982. These include: polyester staple, textured polyester yarn, spun polyester/high wet modulus yarn, 200 denier nylon filament and tufted nylon carpet.

## FINDINGS - Continued

### Markets - Continued

Rayon filament is presently in short supply and we expect existing market demand to continue for the product over the period of the analysis, 1982-1992. The sale of the products under evaluation should not affect the capability of Misr Rayon to sell the output of its existing plant.

These conclusions stand only if the Misr Rayon project does not have to compete for domestic markets with a similar project which during the first half of 1977 was being promoted by Misr Bank. The Misr Bank project includes the production of polyester staple, polyester filament and nylon filament and is reportedly oriented to export. Domestic markets do not appear large enough to accommodate both projects. Our conclusions on Misr Rayon's capability to sell the contemplated production of the project in domestic markets are predicated on the assumption that the Misr Bank project, if carried forward, will not be permitted unqualified access to Egyptian markets.

### Technical and Engineering

This project primarily consists of expansion of existing facilities, with the exception of a new weaving, dyeing and finishing plant. Equipment information and operating data were gathered from existing plant operations, where possible, in order to determine how to effectively integrate proposed new facilities with the existing plant.

All proposed elements of the project are technically feasible. The high wet modulus rayon process and the polyester process require licensing of technology, which is readily available. Sufficient space is available on the plant property to accommodate all proposed new facilities without inhibiting the movement of material or personnel.

## FINDINGS - Continued

### Technical and Engineering - Continued

Most raw material requirements will have to be imported for all major production units. Location maps, contained in this summary, indicate distances to major sources of raw materials.

Operator training for the weaving, dyeing and finishing elements of the project will require special attention by Misr Rayon Company. Assistance in this function may be obtained from Egyptian Companies presently engaged in these operations.

With regards to a similar project that is proposed by Misr Bank, it is not possible to make a comparison of capital requirements and operating costs with this project due to lack of information concerning the Misr Bank project. However, it is important to note that there should be a substantial benefit in locating such a proposed project at Misr Rayon in order to take advantage of the existing infrastructure and existing management and personnel who are already trained in the manufacture of synthetic fibers.

### Financial Analysis/Commercial Feasibility

The financial analysis which was performed provided the structure against which commercial feasibility could be judged. Considering the fact of administered prices rather than market-determined (supply and demand) prices in the Egyptian economy, the formal, computerized financial analysis did not attempt to utilize preselected selling prices. Rather the approach of the analysis was to specify the levels of selling prices needed to achieve preselected rates of pre-tax return, 10% and alternatively 15%. As the level of selling price is a linear function of return rates, higher

FINDINGS - Continued

Financial Analysis/Commercial Feasibility - Continued

or lower rates of return can be extrapolated from the calculated data. The calculated necessary price levels (selling prices), each proportioned to costs of production, were found to be sensible (a) relative to one another, and (b) relative to the duty-paid prices of competitive imports. All prices were expressed in U.S. dollars or Egyptian pounds of early 1977 purchasing power; provision was made for the escalation over the next fifteen years of international prices of project inputs that are expected to rise relative to the general level of prices.

The calculations of selling prices necessary to provide a preselected return rate were made under two assumed labor utilization rates. One calculation, Case B, assumed the utilization of Egyptian labor at estimated existing rates: six times the number of man hours required for an equivalent operation in the United States. The other calculation, Case A, assumed labor utilization at half of estimated current practice or three times the number of man hours required for an equivalent operation in the United States.

Commercial feasibility was then judged on the basis of the probability of individual products being able to be sold at market prices high enough to match the prices necessary to achieve pre-selected return rates at the different levels of labor utilization. As specified previously, two different assumed sets of conditions were also postulated concerning future exchange rates and project financing.

The group of products being considered are subject to somewhat different actual degrees of administered pricing within the Egyptian economy. Staple fibers, polyester and rayon, are at one end of the spectrum in that these are essentially commodities for which prices can be set by the Egyptian

FINDINGS - Continued

Financial Analysis/Commercial Feasibility - Continued

Government and effectively controlled as raw materials for the government owned spinning industry. Finished fabrics, on the other hand, although price controlled are in competition in the marketplace with a variety of similar fabrics and the actual control of prices is affected more by the mechanism of the market than are commodity fibers.

In actuality, therefore, our approach of pre-selected prices serves two functions. For staple fibers it provides definition of what the effective administered price must be to provide commercial feasibility. For fabrics and for filament yarns it provides benchmarks against which commercial feasibility can be judged given the present and probably future market prices set by similar imported or domestically manufactured fabrics and imported synthetic filaments.

In Table A-1 we provide our judgments as to the most likely category of internal rates of return as provided by: (a) the commercial analysis carried out under the two sets of assumed conditions regarding exchange rates and project financing, and (b) the two cases of labor productivity under each set of assumed conditions. In most cases these judgments were based on our estimates of future average prices of imported competitive products and/or competitive domestically produced products.

From the point of view of the commercial analysis, therefore, only two product areas are lower than 10% internal rate of return (IRR). These are spun yarns and the export of sheets. The export of sheets is expected to be necessary only until the late 1980's. Under the first set of assumed conditions, the return is greater than 15% even including 50% as export

Table A-1

<u>Product</u>	<u>Internal Rate of Return</u>			
	<u>At Existing Exchange Rates and 100% Equity</u>		<u>At \$ U.S.1.35/L.E. and Debt Financing</u>	
	<u>Case A</u>	<u>Case B</u>	<u>Case A</u>	<u>Case B</u>
	<u>3:1</u>	<u>6:1</u>	<u>3:1</u>	<u>6:1</u>
✓Polyester Staple	10%	<10%	10%	<10%
High Wet Modulus Rayon	>15%	>10%	>15%	>15%
Rayon Filament	>15%	>15%	>15%	>15%
Dyed 150 Denier Textured	>15%	>15%	>15%	>15%
✓Flat Polyester Filament - 100 Denier	>15%	>15%	>15%	>15%
Nylon Filament - 200 Denier	>15%	>15%	>15%	>15%
Textured Nylon Filament	>15%	>15%	>15%	>15%
Flat Nylon Filament - 40 Denier	>15%	>15%	>15%	>15%
Flat Nylon Filament - 70 Denier	>15%	>15%	>15%	>15%
Spun Yarn: 20/1 HWM Rayon/Polyester	< 5%	< 5%	< 5%	< 5%
✓Tufted Nylon Carpet	>15%	>15%	>15%	>15%
Finished Bedsheets - Total	>15%	>10%	≈10%	<10%
Domestic Sale of Bedsheets	>15%	>15%	>15%	>15%
Export Sale of Bedsheets	< 5%	< 5%	< 5%	< 5%
Woven Textured - Spun Outerwear	>15%	>15%	>15%	>15%
Shirting Fabric	>15%	>15%	>15%	>15%
Spun Twill Outerwear	>15%	>15%	>15%	>15%

FINDINGS - Continued

Financial Analysis/Commercial Feasibility - Continued

sales in 1982-1987 providing efficient labor utilization. Under the second set of assumed conditions, the IRR is approximately 10% with efficient labor utilization and below 10% with less efficient labor utilization.

National Benefit Analysis

As previously described, the financial analysis and consequent evaluation of commercial feasibility is heavily influenced by conditions surrounding the project which are established by the Egyptian Government. These include: the use of the official exchange rate for imported materials, duty barriers, administered prices and wages, and the direct subsidization of some components of production. Under these circumstances a more definitive contribution to the assessment of feasibility was made by an evaluation of national economic benefits rather than the financial-commercial evaluation.

The project was evaluated from a national economic standpoint primarily in order to determine whether fewer national resources would be required to produce the stipulated fiber and textile goods in Egypt (by Misr Rayon) than would be required to pay for the same goods if imported. The chosen measure of project merit by this criterion was the national rate of return which is similar to a commercial rate of return except that it measures returns to the nation as a whole from the project rather than to equity investors alone.

The national analysis was, then, designed to measure the rate of return to Egypt on all the Egyptian resources needed for the implementation and operation of the project. Rather than undertake to designate prices, as was the objective of financial analysis used in the assessment of commercial feasibility, the national analysis accepted the prices in international

## FINDINGS - Continued

### National Benefit Analysis - Continued

markets that are anticipated over the next fifteen years (all expressed in currency of constant 1977 purchasing power) and used them in calculating rates of return. Such rates of return can be regarded as measures of the extent to which the Egyptian national income or product can be increased by the project.

The national rate of return on the total project depends upon (a) the efficiency with which Egyptian labor is used, and (b) the extent to which assistance loans from abroad can be obtained. Rates of return for the total project, shown in Table A-2 in the second row from the bottom, range from 8% per year with existing efficiency and no foreign financing up to 29% with improved efficiency and foreign financing on the assumed terms.

The national rate of return also varies markedly from profit center to profit center within the project, as shown in Table A-2. Rayon staple shows a negative return under each of the four sets of assumptions. The negative return is to be explained largely by the high portion of costs that is imports and the relatively low price expected for HWM rayon in international markets over the next fifteen years. Rayon filament looks to be a highly profitable center from the national standpoint because much of the physical facility is already in existence and has no alternative use value. Among the other centers, weaving-finishing is relatively less attractive from a national standpoint because of the sizable labor component that competes internationally with efficient, low-wage Far Eastern labor.

TABLE A-2

NATIONAL EVALUATION  
PROSPECTIVE NATIONAL EGYPTIAN RATES OF RETURN

	<u>All Egypt Finance</u>		<u>Egypt &amp; Foreign Loan</u>	
	<u>3:1</u>	<u>6:1</u>	<u>3:1</u>	<u>6:1</u>
Labor Ratio <sup>a</sup>				
<u>Profit Center</u>				
✓ Polyester Staple	18%	16%	34%	32%
Rayon Staple (HWM)	negative	negative	negative	negative
✓ Polyester Filament	23	21	48	44
Rayon Filament	46	44	>100	>100
Nylon Filament	15	0	31	negative
✓ Nylon Carpet	41	35	70	61
Spinning	8	7	24	22
Weaving/finishing	1	negative	negative	negative
Consolidated Project (8 centers)	11	8	29	22
Consolidated Project without rayon staple (7 centers)	12	9	32	26

<sup>a</sup>Ratio of man-time per task in Misr Rayon to man-time per task in U.S. mills.

FINDINGS - Continued

National Benefit Analysis - Continued

Although a national rate of return at each alternative efficiency level was computed for each profit center, the centers cannot be regarded as autonomous as the calculated rates of return include distribution of overhead and utilities over the entire project. Each project center is part of a proposed integrated complex that is to be appended to the combined existing and under-construction facilities of the Misr Rayon Company. If one or more centers were dropped from the project, the national rates of return would be lower to the degree that the total overhead and utility costs were not correspondingly reduced.

Our evaluation, however, also considers the project as a total excluding the production of high wet modulus rayon which we believed should be dropped from the project because of its negative rate of return. The high wet modulus rayon staple operation requires only a modest capacity increase over the existing rayon staple operation and hence its exclusion will not significantly affect the returns on the other profit centers. If the high wet modulus rayon staple portion of the project is dropped, the national rate of return rises by as much as four percentage points, as shown in the lowest row of Table A-2.

FINDINGS - Continued

National Benefit Analysis - Continued

The project carries national economic benefits beyond those measured by the national rate of return. Foreign exchange savings are to be obtained because the costs of imported equipment and material total less than the exchange required if the same textiles were to be purchased abroad over the period of evaluation. Moreover, the workers hired to construct and operate the projected facilities will ease the nation's severe unemployment problems.

In addition, the project is an element in a national industrialization program that calls for building a fully integrated textile industry by which Egypt can become self-reliant in fibers and their products. In comprehensive national economic terms, the project's worth cannot be measured solely by evaluating the investment as an increment to Egyptian economic activity. Rather, it must be viewed as an important part of an industry that contributes far more to Egypt's economic well-being than is apparent by examining the project in isolation.

## FINDINGS - Continued

### Management Audit

The MISR Rayon Company is not presently in a good overall position for profit improvement due to: a) its old plants which have not been well maintained, b) lack of an effective cost accounting system and c) its General Managers' lack of experience in managing for profit maximization. Much of this present circumstance is due to the general environment which, over the last decade, led to decreased efficiency and the company's inability to produce consistent high quality products. The capability of the existing organization to undertake the major expansion contemplated by the project being evaluated must include consideration of the historical circumstances which led to its present position.

We believe the organization can handle the proposed expansion provided specific changes are brought about. These recommended changes are:

- 1) Reassignment of functions among the General Managers including the following:
  - a. Establish a Production Materials Management organization reporting to the Production General Manager.
  - b. Establish the position of Human Resources General Manager including Personnel, Industrial Relations, Worker Services, and Training.
  - c. Transfer to the General Manager of Engineering responsibility for Building and Grounds, Safety and Utilities, Engineering and Maintenance Materials Management for the fiber operation.

FINDINGS - Continued

Management Audit - Continued

- 1) Continued
  - d. Establish the position of General Manager of Finance and Administration including responsibilities for finance and accounting, legal services, information services including computer operation.
- 2) Upgrade the marketing and technical service functions including the addition of new marketing management personnel.
- 3) Direct the General Manager of Finance to develop and implement a major crash program for upgrading and computerizing management information and control systems including:
  - a. A standard cost system for the new project elements.
  - b. Achieving a substantially larger and more sophisticated central computer support system for production planning and scheduling, plant cost control, inventory control and producing new financial and management reports.
- 4) Installation of a dedicated mini-computer, remote from the central computer, for production applications.
- 5) Direct the Manager of Engineering to develop and implement a rigorous safety and general housekeeping program.
- 6) Direct the General Manager of Human Resources to develop and implement a program for expanding present Management Training activities and providing more support for worker and supervisory training.

FINDINGS - Continued

Scope of Manufacturing Facilities

The final scope of the polyester, Nylon 6 and high wet modulus rayon plants as planned for this project is shown on Charts MF-1, MF-2 and MF-3. Planned capacities and production balances are indicated for maximum production of the fibers selected.

# POLYESTER PROJECT

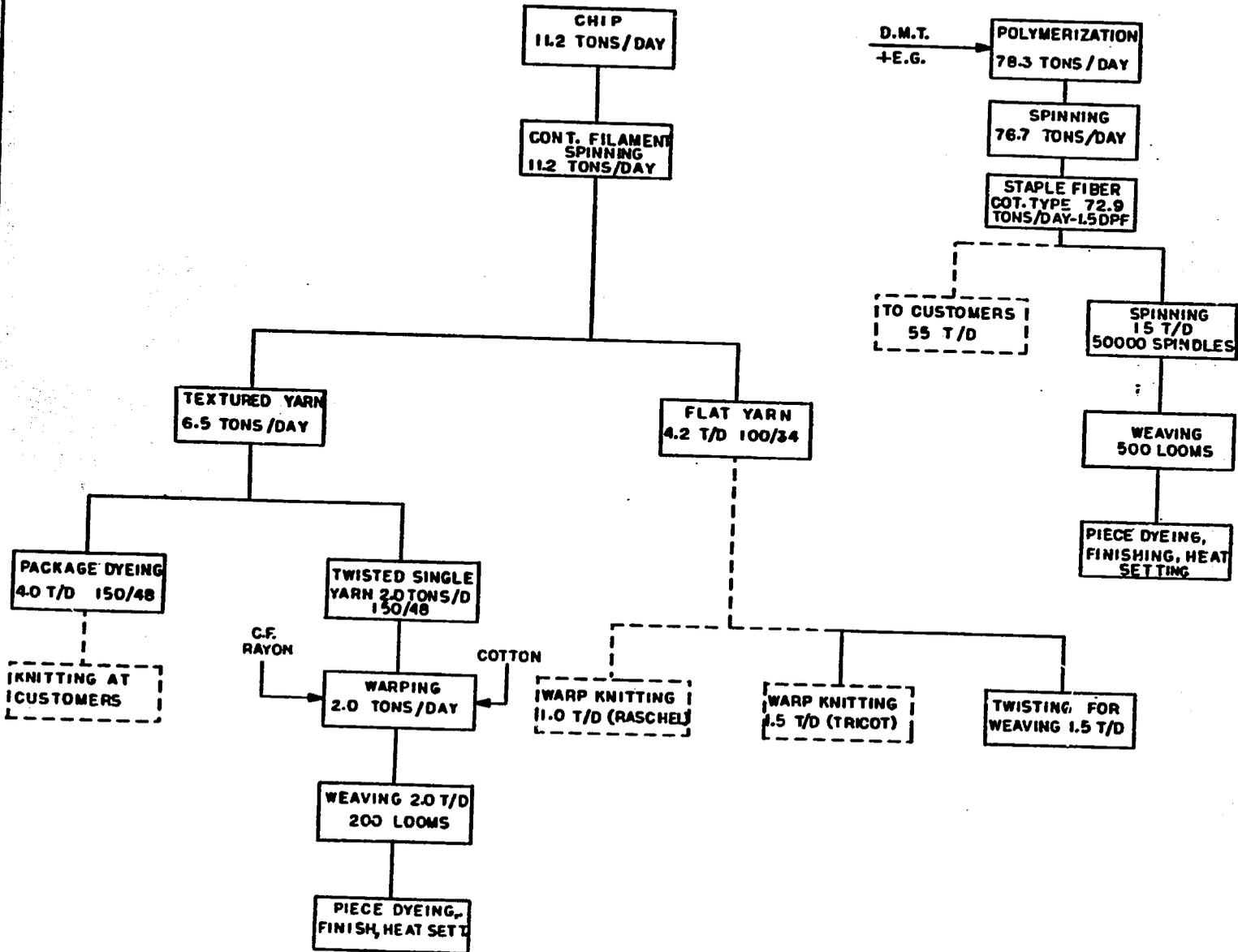


CHART MF-1

**EXISTING CAPACITY**

DEN 40 FLAT	.2 TPD
DEN 70 FLAT	.2 TPD
DEN 70 TEXT	.8 TPD
DEN 200 FLAT	.5 TPD
STAPLE	1.3 TPD
<b>TOTAL</b>	<b>3.0 TPD</b>

**MISR NYLON 6 PLANT EXPANSION**

**CAPACITY AFTER EXPANSION**

DEN 40 FLAT	.6 TPD
DEN 70 FLAT	1.0 TPD
DEN 70 TEXT	1.3 TPD
DEN 200 FLAT	4.0 TPD
CARPET	2.0 TPD
<b>TOTAL</b>	<b>8.9 TPD</b>

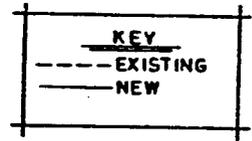
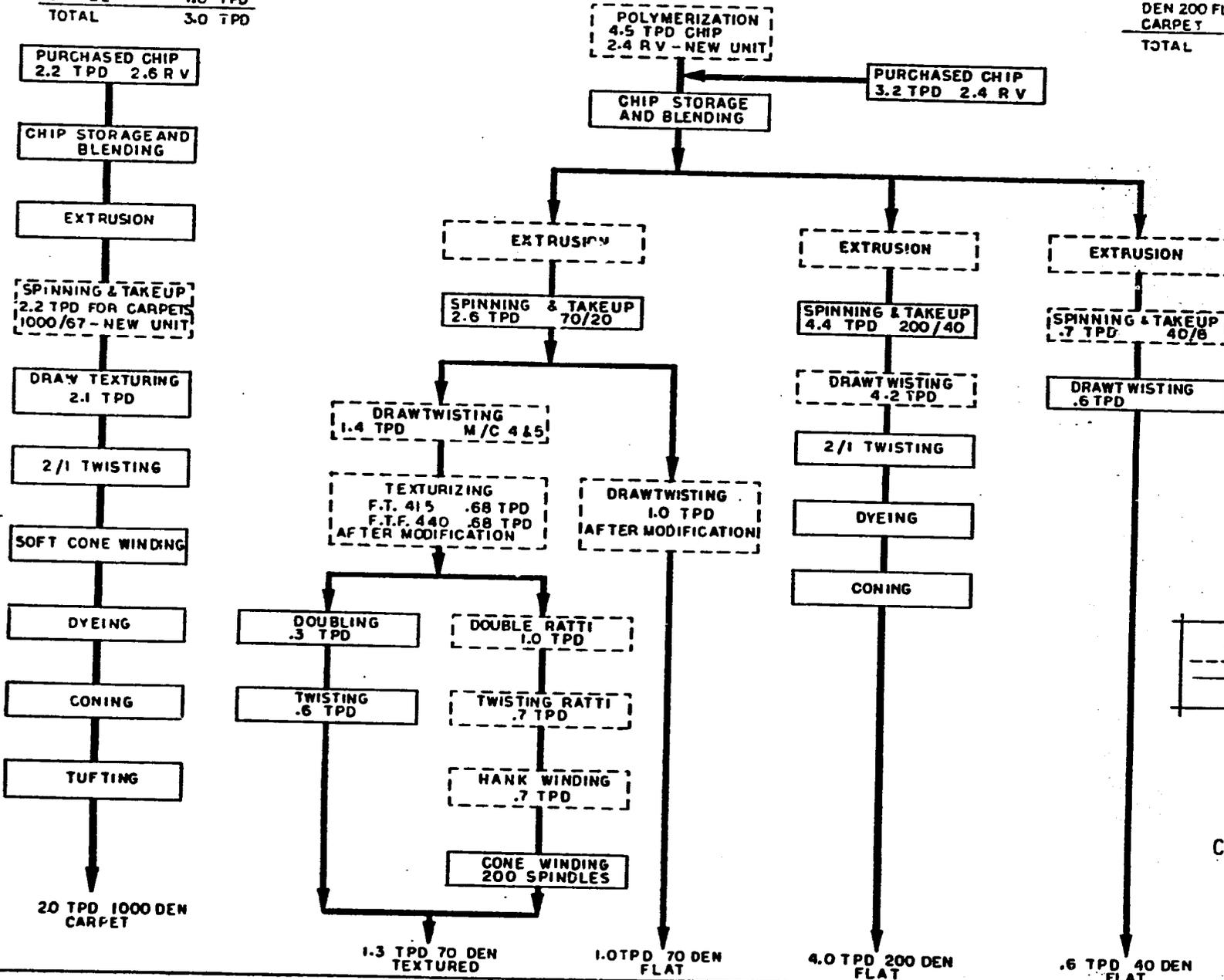


CHART MF-2

MISR RAYON HIGH WET MODULUS RAYON STAPLE

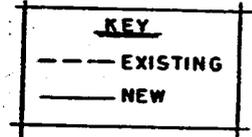
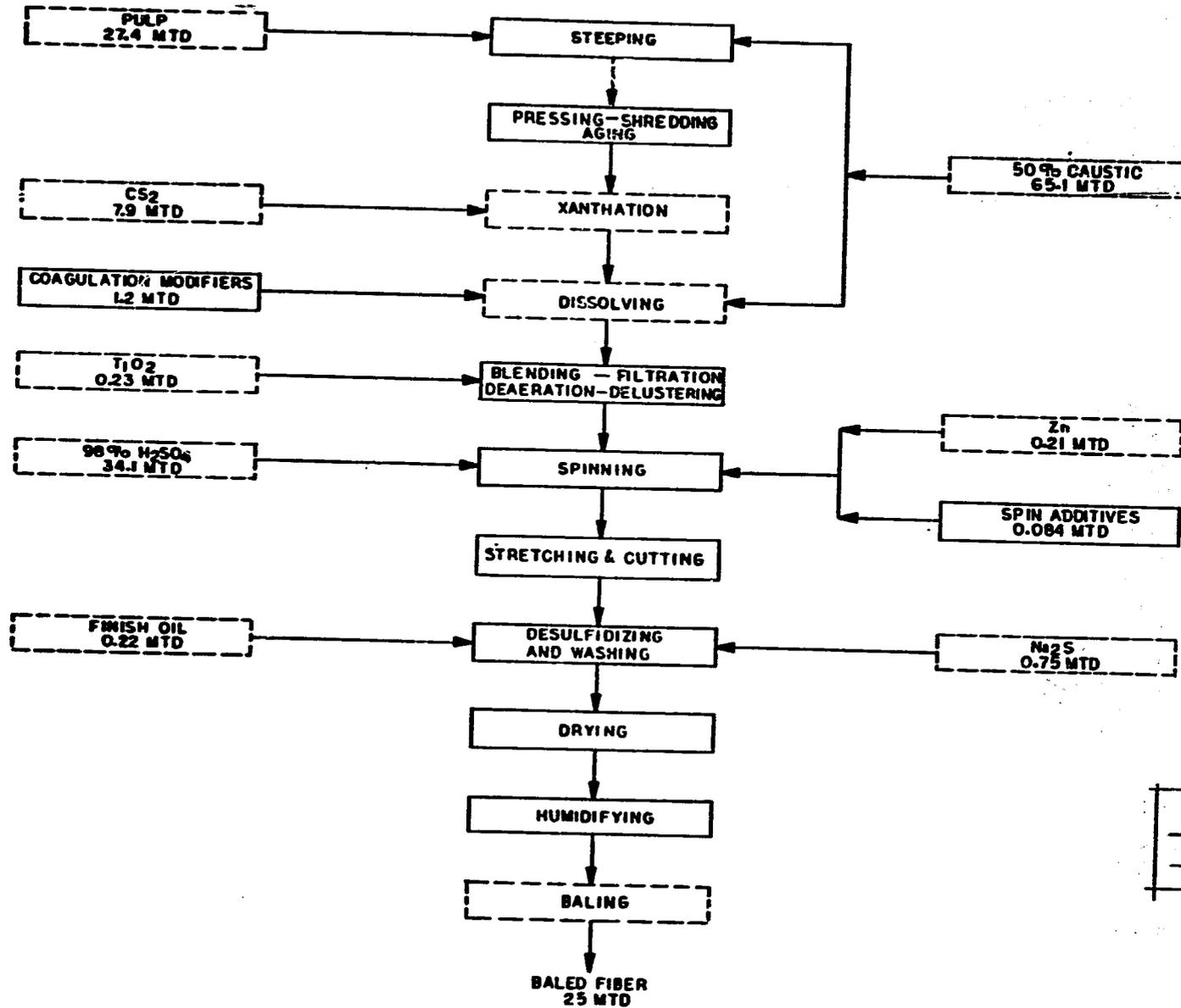
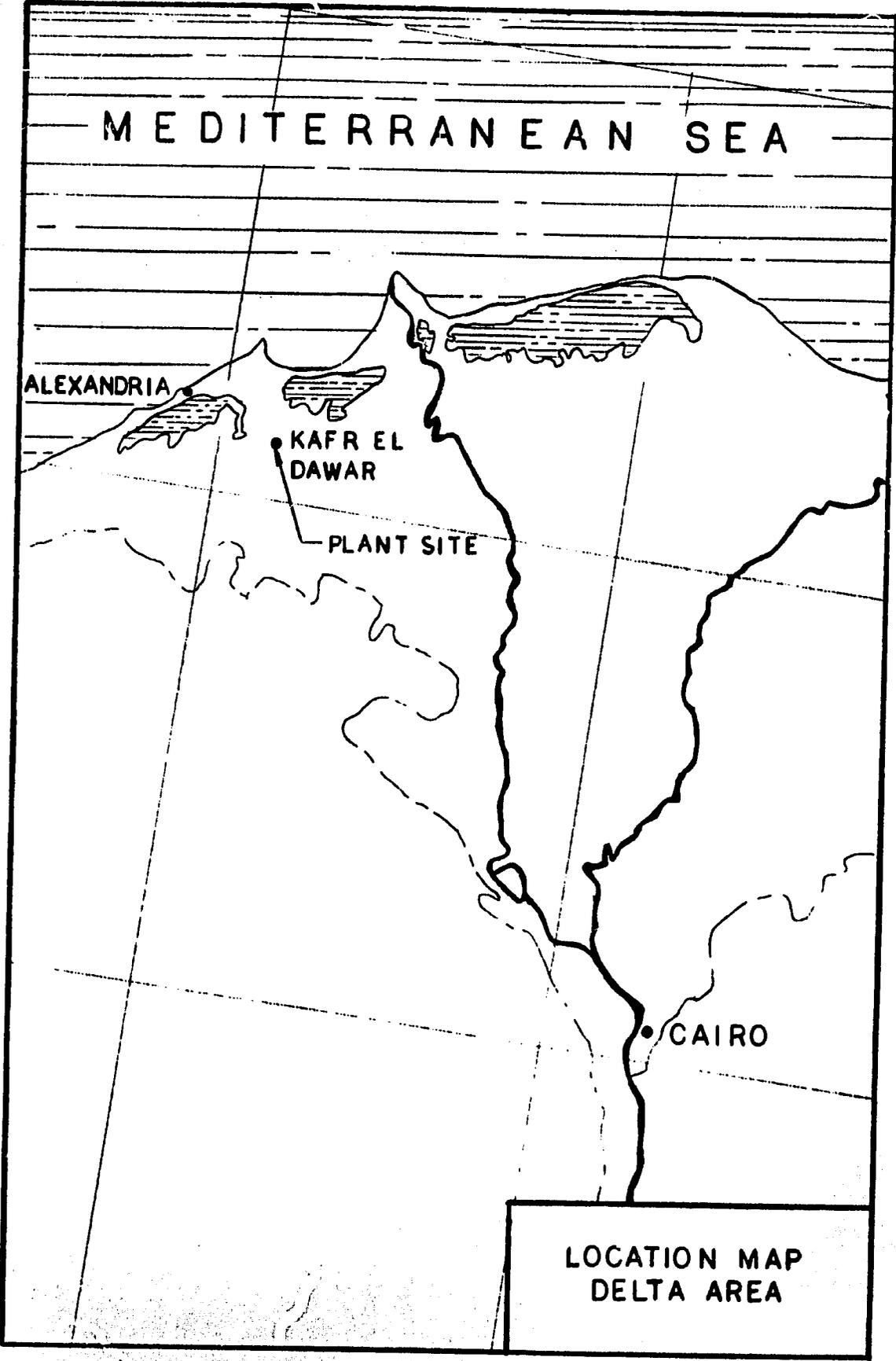
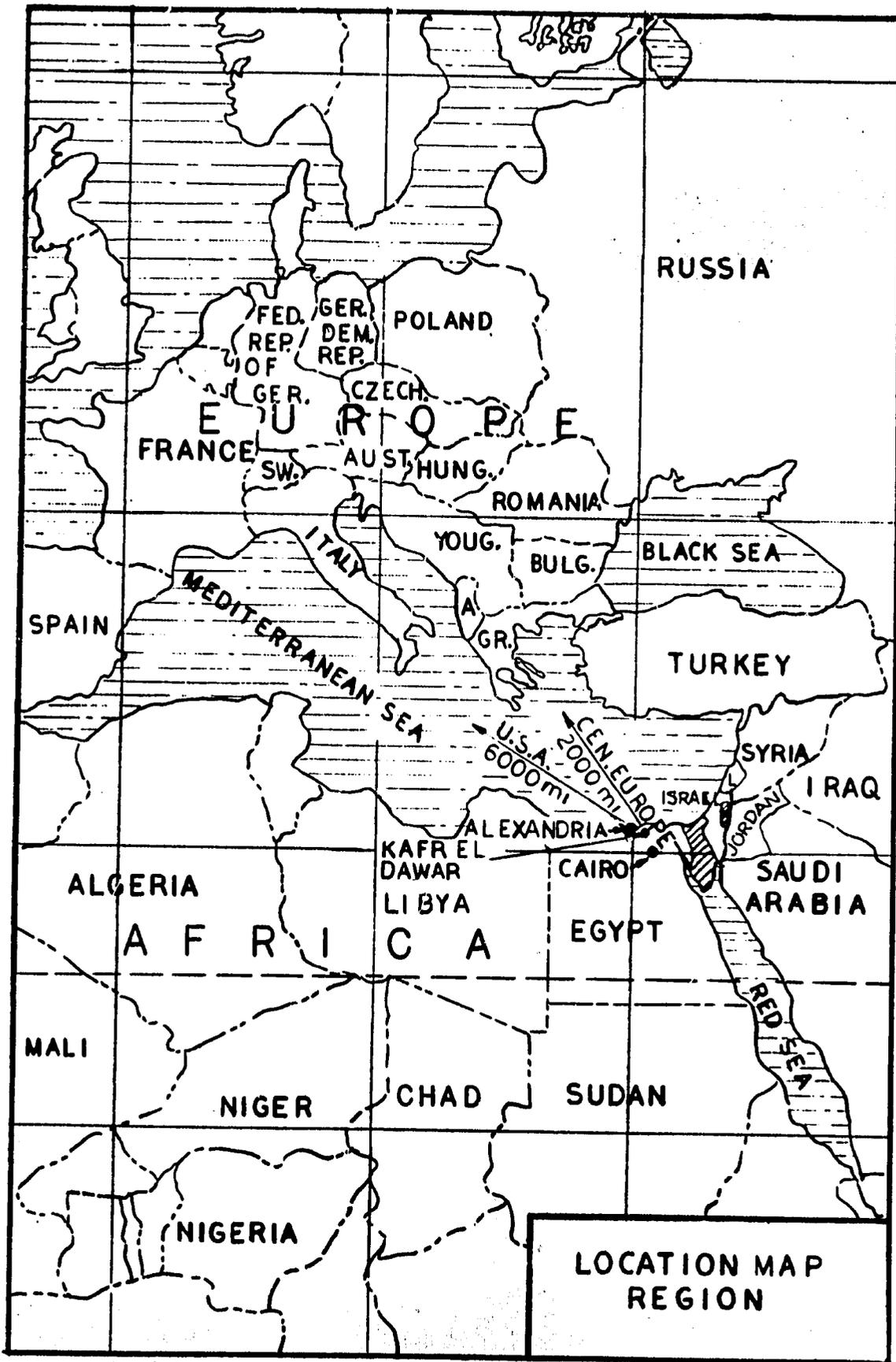


CHART MF-3









APPENDIX A  
TO  
SUMMARY & CONCLUSIONS

CONSTRUCTION COST ESTIMATE  
FOR  
REFRIGERATION FACILITIES  
FOR  
EXISTING SPINNING PLANT

I. INTRODUCTION

Since the economic analyses of the total project resulted in the recommendation in the Draft Report that the proposed new spinning plant not be constructed, MISR Rayon requested that this Construction Cost Estimate be prepared and included in the Final Report. The request was included in MISR Rayon's comments on the Draft Report. The comments were received by telex on October 12, 1977.

This Appendix includes the estimated costs to install new refrigeration facilities and chilled water piping systems for the existing spinning plant. No costs for air conditioning systems have been included since the existing plant currently includes eight (8) air conditioning rooms with equipment.

II. SUMMARY

It is estimated that the existing spinning plant output can be increased by 5% with the addition of temperature and humidity controls. The installation of the refrigeration facilities and chilled water piping systems should result

II. SUMMARY - Continued

in the capability to control the temperature and humidity at the necessary levels assuming that the existing air conditioning systems are properly sized and controlled.

The estimated construction cost for the refrigeration facilities and chilled water piping systems is \$2,591,500.

It is anticipated that the construction can be accomplished in approximately eighteen (18) months from start of design to start-up of the facilities.

III. COST SUMMARY

See following page.

IV. DESCRIPTION OF PROCESS AND FACILITIES

The process is shown schematically on drawings S-1316-650FX-1 and -2. The addition to the existing building is shown on S-1316-650GX-1. These drawings are included at the end of this Appendix.

The system will consist, basically, of two (2) 1200 T.R. centrifugal refrigeration machines, chilled water supply pumps, condenser water pumps, chilled water return pumps, concrete chilled water return sumps, rotary screen filters for chilled water return, instrumentation, electric wiring and controls, and necessary piping and valves.

REFRIGERATION FOR "TEXTIMA"  
SPINNING PLANT

III. COST SUMMARY

	US BASE			EGYPTIAN BASE		
	ESTIMATED FOREIGN EXCHANGE IN US \$	LOCAL CURRENCY IN US \$	TOTAL IN US \$	ESTIMATED FOREIGN EXCHANGE IN US \$	LOCAL CURRENCY IN US \$	TOTAL IN US \$
EQUIPMENT	626,900	-	626,900	626,900	-	626,900
EQUIPMENT ERECTION	8,700	26,000	34,700	10,400	31,300	41,700
EQUIPMENT FOUNDATIONS AND STRUCTURAL COSTS	-	15,400	15,400	-	18,500	18,500
BUILDING AND STRUCTURES	-	93,400	93,400	-	112,100	112,100
ELECTRICAL INSTALLATION COSTS	121,700	40,600	162,300	204,500	68,200	272,700
INSTRUMENTATION INSTALLATION COSTS	10,400	41,600	52,000	14,600	58,200	72,800
PIPING COSTS	99,000	33,000	132,000	148,500	49,500	198,000
AREA COSTS	-	<u>500,000</u>	<u>500,000</u>	-	<u>600,000</u>	<u>600,000</u>
TOTAL DIRECT COSTS	866,700	750,000	1,616,700	1,004,900	937,800	1,942,700
CONTINGENCY	<u>86,700</u>	<u>75,000</u>	<u>161,700</u>	<u>100,500</u>	<u>93,800</u>	<u>194,300</u>
TOTAL CURRENT DIRECT COST PLUS CONTINGENCY	953,400	825,000	1,778,400	1,105,400	1,031,600	2,137,000
<hr/>						
ENGINEERING	150,000	-	150,000	215,000	-	215,000
CONSTRUCTION MANAGEMENT	18,700	-	18,700	65,000	-	65,000
OWNER'S GENERAL OVERHEAD	-	17,800	17,800	-	21,400	21,400
SPARE PARTS	<u>15,700</u>	-	<u>15,700</u>	<u>31,400</u>	-	<u>31,400</u>
TOTAL CURRENT INDIRECT COST	184,400	17,800	202,200	311,400	21,400	332,800
TOTAL CURRENT PROJECT COST	1,137,800	842,800	1,980,600	1,416,800	1,053,000	2,469,800
ESCALATION ALLOWANCE	<u>44,000</u>	<u>50,600</u>	<u>94,600</u>	<u>58,500</u>	<u>63,200</u>	<u>121,700</u>
TOTAL ESCALATED PROJECT COST	1,181,800	893,400	2,075,200	1,475,300	1,116,200	2,591,500

A-3

IV. DESCRIPTION OF PROCESS AND FACILITIES - Continued

Cooling water will be pumped from the raw water canal to the spinning plant and then be returned to the canal. The system will include a pumping station, two (2) vertical pumps and underground supply and return piping.

With the exception of the chilled water return pumps, the process equipment will be located in a new machine room addition to the existing building.

The new machine room will be approximately 11m x 24m and will be ventilated by roof mounted exhaust fans and wall louvers.

The chilled water return pumps will each be located in an existing air conditioning room. The existing recirculation pumps will be reused with the addition of the chilled water supply on the suction side of the pumps.

V. DESIGN CRITERIA

In general, the Design Criteria are the same as those outlined in Part D. Financial Aspects.

VI. DERIVATION OF COSTS

The Derivation of Costs is the same as outlined in Part D. Financial Aspects.

VII. ITEMIZED CONSTRUCTION COSTS

The itemized estimated construction costs are shown on the following pages.

November 9, 1977

REFRIGERATION FOR "TEXTIMA" SPINNING PLANT

	<u>COSTS SUMMARY</u> <u>USA BASE</u>	
	<u>U.S. DOLLARS</u>	<u>ONE POUND EGYPTIAN</u> <u>EQUAL \$1.35</u>
EQUIPMENT	626,900	464,370
EQUIPMENT ERECTION	34,700	25,700
EQUIPMENT FOUNDATIONS AND OTHER STRUCTURAL COSTS	15,400	11,410
BUILDING AND STRUCTURES	93,400	69,190
ELECTRICAL INSTALLATION COSTS	162,300	120,220
INSTRUMENTATION INSTALLATION COSTS	52,000	38,520
PIPING COSTS	132,000	97,780
AREA COSTS	<u>500,000</u>	<u>370,370</u>
TOTAL DIRECT COST	1,616,700	1,197,560
CONTINGENCY	<u>161,700</u>	<u>119,760</u>
TOTAL CURRENT DIRECT COST PLUS CONTINGENCY	1,778,400	1,317,320

REFRIGERATION FOR "TEXTIMA"  
SPINNING PLANT

November 9, 1977

DIRECT CAPITAL COSTS

ITEM NO.	EQUIPMENT NO.	EQUIPMENT DESCRIPTION	MOTOR HP	EQUIPMENT		EQUIPMENT ERECTION		EQUIP. FDMS. & OTHER STRUCT. COST	
				U.S. DOLLARS	EGYPTIAN POUNDS	U.S. DOLLARS	EGYPTIAN POUNDS	U.S. DOLLARS	EGYPTIAN POUNDS
001		Refrigeration Machine (2)		\$ 230,400	170,670	\$ 8,000	5,930	\$ 4,000	\$ 2,960
		Motor (2 @ 1000 HP)	2,000	FWE	FWE	Incl	Incl	Incl	Incl
		Oil Pump		FWE	FWE	Incl	Incl		
		Motor (2 @ 1 HP)	2	FWE	FWE	Incl	Incl		
	Insulation (2)		4,000	2,960	D&E	D&E			
002		Chilled Water Pump (2)		19,200	14,220	1,000	740	1,600	1,190
		Motor (2 @ 150 HP)	300	FWE	FWE	Incl	Incl	Incl	Incl
		Insulation (2)		1,000	740	D&E	D&E		
003		Condenser Water Pump (2)		21,600	16,000	1,000	740	1,600	1,190
		Motor (2 @ 125 HP)	250	FWE	FWE	Incl	Incl	Incl	Incl
004		Air Washer Return Pump (8)		22,400	16,590	2,400	1,780	4,000	2,960
		Motor (8 @ 20 HP)	160	FWE	FWE	Incl	Incl	Incl	Incl
		Insulation (2)		2,400	1,780	D&E	D&E		
005		Control System (2)		7,200	5,330	5,000	3,700		
006		Rotary Screen Filter (2)		14,400	10,670	2,000	1,480	1,000	740
		Motor (2 @ 3 HP)	6	FWE	FWE	Incl	Incl	Incl	Incl
007		100 <sup>2</sup> Wall Louvers		1,200	890	400	300	2,000	1,480
008		Roof Exhausters (2)		4,800	3,560	1,000	740	1,200	890
		Motor (2 @ 5 HP)	10	FWE	FWE	Incl	Incl		
009		Condenser Water Supply Pump		15,000	11,110	700	520		
		Motor	200	FWE	FWE	Incl	Incl		
		Insulation		700	520	D&E	D&E		
010		Condenser Water Return Pump		15,000	11,110	700	520		
		Motor	200	FWE	FWE	Incl	Incl		
		Insulation		700	520	D&E	D&E		
011		Instruments		67,000	49,630	W/Inst.	W/Inst.		

9-V

REFRIGERATION FOR "TEXTIMA"  
SPINNING PLANT - Continued

November 9, 1977

DIRECT CAPITAL COSTS

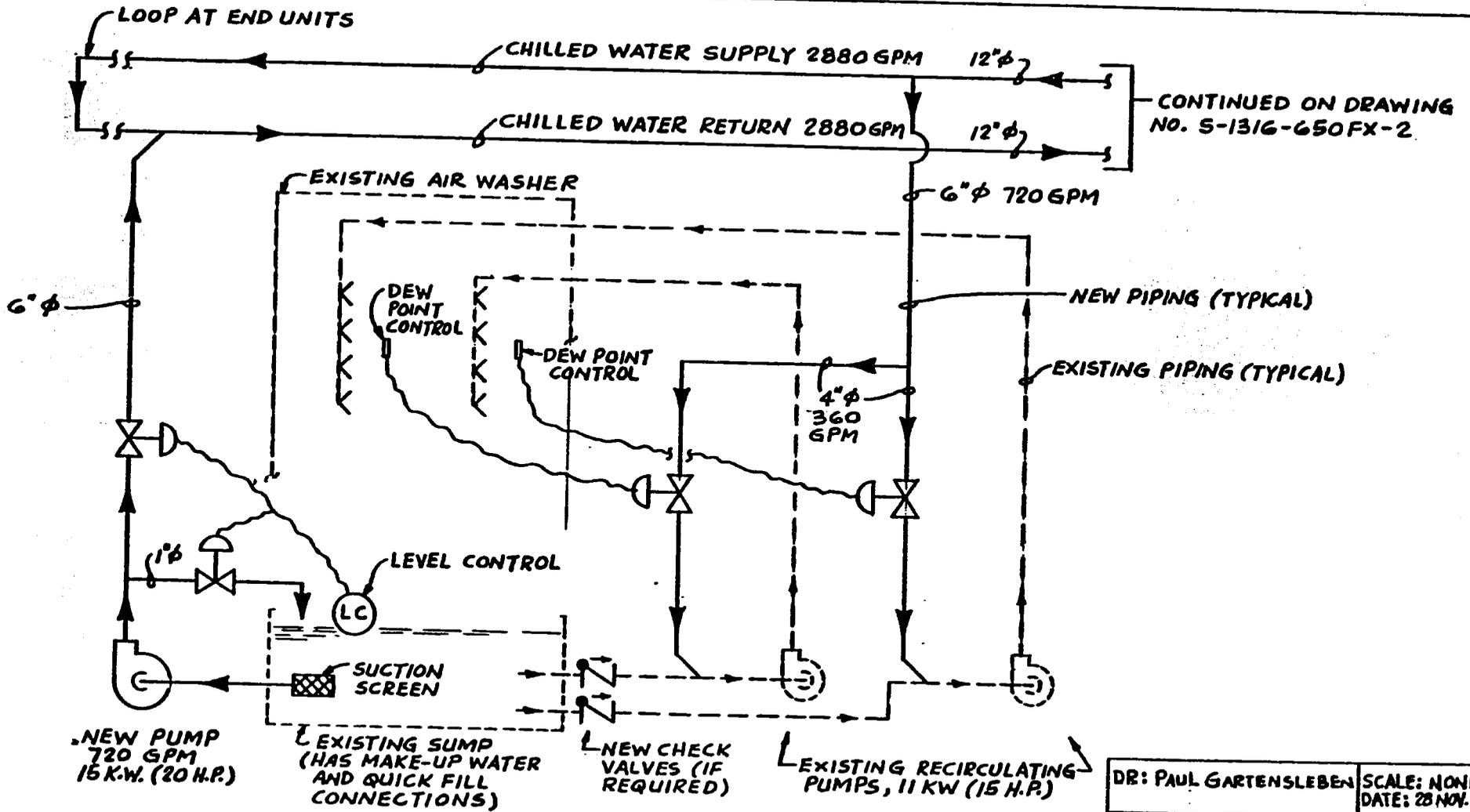
ITEM NO.	EQUIPMENT NO.	EQUIPMENT DESCRIPTION	MOTOR HP	EQUIPMENT		EQUIPMENT ERECTION		EQUIP. FDMS. & OTHER STRUCT. COST	
				U.S. DOLLARS	EGYPTIAN POUNDS	U.S. DOLLARS	EGYPTIAN POUNDS	U.S. DOLLARS	EGYPTIAN POUNDS
012		Switchgear		\$ 24,000	17,780	\$ 2,000	1,480		
013		Motor Controls		70,300	52,070	6,500	4,810		
014		Substation (2)		105,600	78,220	4,000	2,960		
		Sub-Total, Equipment	3,128	\$ 626,900	464,370	\$ 34,700	25,700	\$ 15,400	11,410

REFRIGERATION FOR "TEXTIMA"  
SPINNING PLANT

November 9, 1977

DIRECT CAPITAL COSTS

		<u>U.S.</u> <u>DOLLARS</u>	<u>EGYPTIAN</u> <u>POUNDS</u>
015	<u>Buildings &amp; Structures Costs</u>		
	HVAC Room		
	Concrete Water Sumps (2)	\$ 86,400	64,000
		7,000	5,190
	Total, Buildings & Structures Costs	93,400	69,190
016	<u>Electrical Costs</u>		
	Power Wiring		
	Feeders	\$ 70,300	52,070
	Grounding	90,000	66,670
		2,000	1,480
	Total, Electrical Costs	\$ 162,300	120,220
017	<u>Instrumentation Costs</u>	52,000	38,520
018	<u>Piping Costs</u>	\$ 132,000	97,780
019	<u>Area Costs</u>	\$ 500,000	370,370

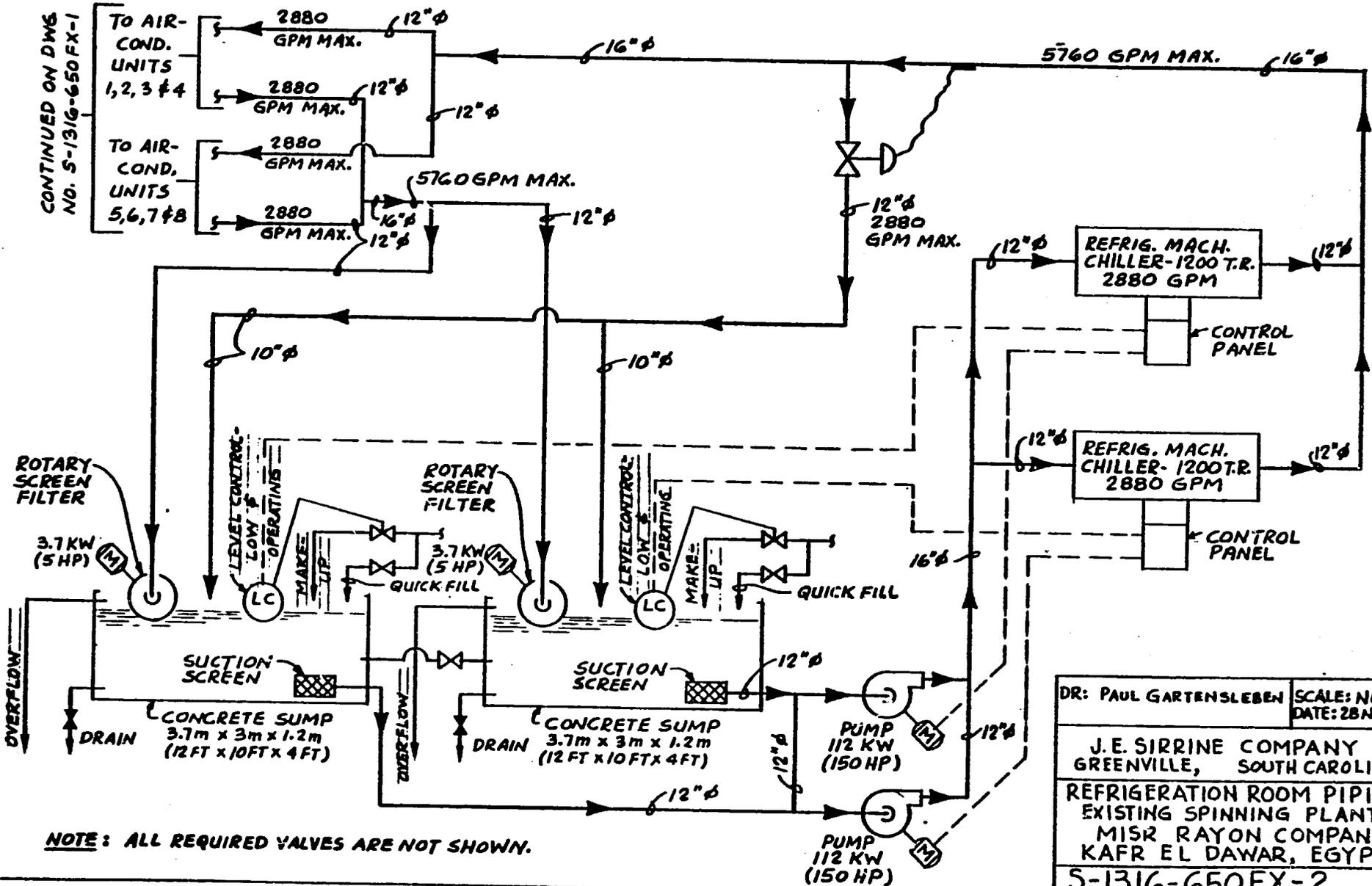


AIR COND. UNITS NO. 1, 2, 3 & 4 (NORTH-EAST SIDE OF BUILDING)

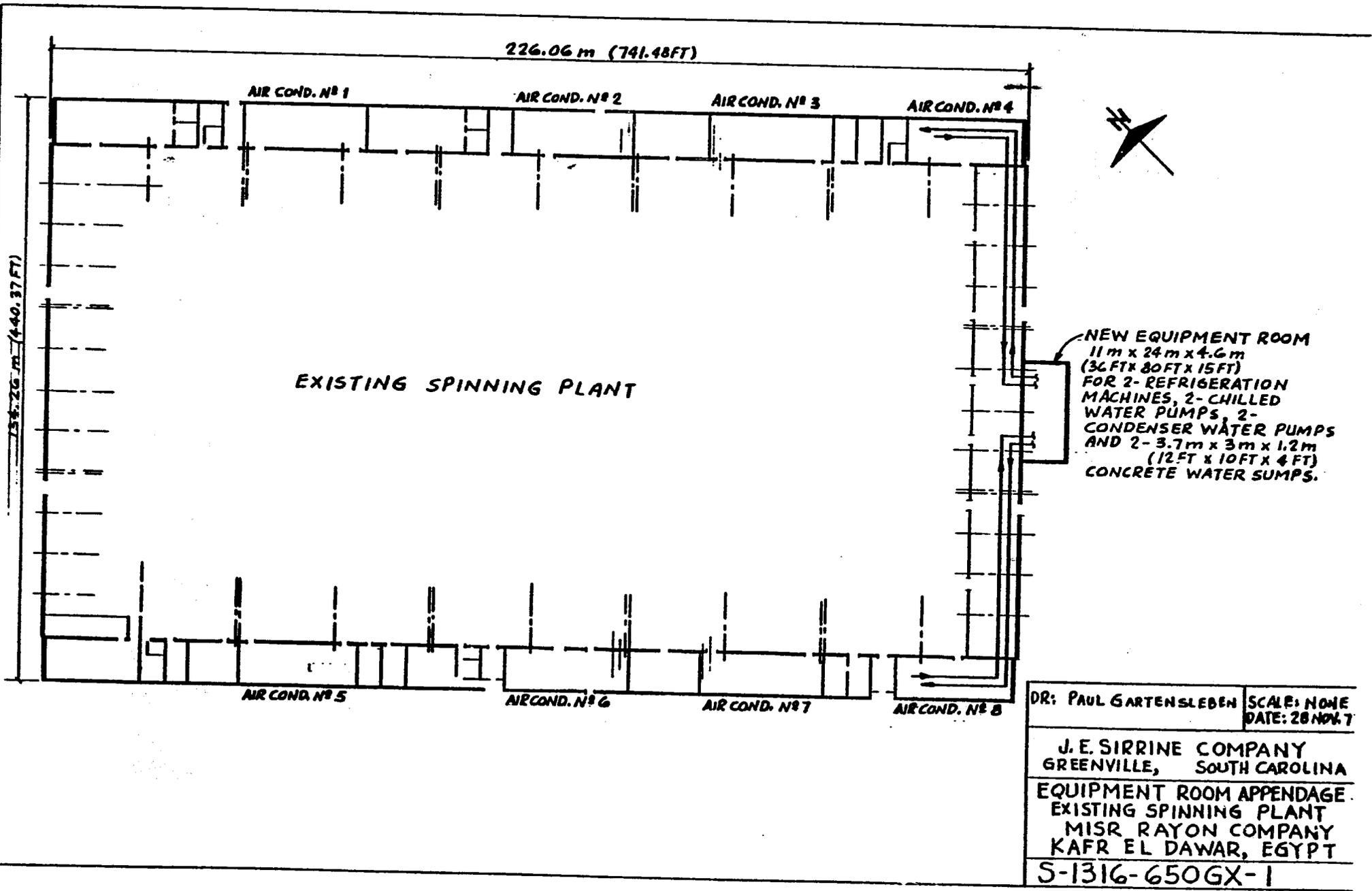
AIR COND. UNITS NO. 5, 6, 7 & 8 (SOUTH-WEST SIDE OF BUILDING)

DR: PAUL GARTENSLEBEN	SCALE: NONE DATE: 28 NOV. 7
J.E. SIRRINE COMPANY GREENVILLE, SOUTH CAROLINA	
MODIFICATIONS TO AIR WASHERS EXISTING SPINNING PLANT MISR RAYON COMPANY KAFR EL DAWAR, EGYPT	
S-1316-650FX-1	

CONTINUED ON DWS  
NO. S-1316-650FX-1



DR: PAUL GARTENSLEBEN	SCALE: NONE DATE: 28 NOV. 71
J. E. SIRRINE COMPANY GREENVILLE, SOUTH CAROLINA	
REFRIGERATION ROOM PIPING EXISTING SPINNING PLANT MISR RAYON COMPANY KAFR EL DAWAR, EGYPT	
S-1316-650FX-2	



226.06 m (741.48FT)

AIR COND. NO 1

AIR COND. NO 2

AIR COND. NO 3

AIR COND. NO 4

EXISTING SPINNING PLANT

134.26 m (440.37 FT)



NEW EQUIPMENT ROOM  
 11 m x 24 m x 4.6 m  
 (36 FT x 80 FT x 15 FT)  
 FOR 2- REFRIGERATION  
 MACHINES, 2- CHILLED  
 WATER PUMPS, 2-  
 CONDENSER WATER PUMPS  
 AND 2- 3.7 m x 3 m x 1.2 m  
 (12 FT x 10 FT x 4 FT)  
 CONCRETE WATER SUMPS.

AIR COND. NO 5

AIR COND. NO 6

AIR COND. NO 7

AIR COND. NO 8

DR: PAUL GARTENSLEBEN SCALE: NONE  
 DATE: 28 NOV 7

J. E. SIRRINE COMPANY  
 GREENVILLE, SOUTH CAROLINA  
 EQUIPMENT ROOM APPENDAGE  
 EXISTING SPINNING PLANT  
 MISR RAYON COMPANY  
 KAFR EL DAWAR, EGYPT  
 S-1316-650GX-1



**J. E. SERRINE COMPANY**

**ARCHITECTS**

**ENGINEERS**

**PLANNERS**

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2610 WYCLIFF ROAD • RALEIGH, NORTH CAROLINA 27607 • TELEPHONE 919/762-8900