COSMOD

A COMPUTERISED CAPITAL COST ESTIMATING SYSTEM

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A COMPUTERISED CAPITAL COST ESTIMATING SYSTEM

BY

SYED IFTIKHAR AHMED

A Thesis

Submitted to the Faculty of Graduate

Studies in Partial Fulfilment of the

Requirements for the Degree of

Master of Engineering

McMaster University

December, 1982

MASTER OF ENGINEERING (1982) McMASTER UNIVERSITY

(Chemical Engineering) Hamilton, Ontario

TITLE: COSMOD A Computerised Capital Cost Estimating System

AUTHOR: Syed Iftikhar Ahmed, B.Sc., Chemical Engineering

SUPERVISORS: Dr. D. R. Woods, Dr. T. W. Hoffman

NUMBER OF PAGES: viii, 53

SIGNIFICANCE AND CONCLUSIONS

A computerised cost estimating system, which can be used for making preliminary estimates of fixed capital investment of process plants, has been developed. The contituents of the system are

(1) a cost calculating routine, COSMOD, compatible with existing modular executive programs, such as GEMCS,

(2) an equipment data base, and

(3) an equipment catalogue.

The following are the significant characteristics of the cost estimating system.

It has flexibility. It can be used as an independent cost estimating system, or as part of a modular executive-aided computer program. As part of an executive aided system, it may be used as a subroutine to a 'module' or 'unit computation', or as a 'module' or 'unit computation' itself.

It will estimate the cost of one or more equipment but is capable of accepting costs generated external to itself.

It requires relatively little computer space and time. The COSMOD program is concise and efficient. Its common block

requirements in executive-aided systems is small. It adds little to the cost or time of running equipment design cases on the computer.

It has access to a large quantity of data on equipment costs. Its data base contains cost information on nearly 300 different types of equipment, ensuring satisfactory fulfilment of its varying and often complex data requirements.

The data are organised in a multiple record, random access file. This allows direct access to the equipment data of interest. It also allows easy addition, deletion or change to the data on file.

An equipment catalogue is provided for the user. It provides information about the equipment whose cost data are available in COSMOD's data file, and serves as a guide for the user in selecting and in providing data required by COSMOD.

In conclusion, this work makes available, complete with cost estimating data and equipment catalogue, a preliminary capital cost estimating system, the absence of which has discouraged or impeded economic evaluations in plant design studies on the computer.

ACKNOWLEDGEMENTS

This is to put on record the author's sincere gratitude to all those who assisted in the conduct and completion of this work.

Special thanks go to Dr. D.R. Woods and Dr. T. W. Hoffman, the author's thesis supervisors, for their invaluable guidance, and to the Department of Chemical Engineering for providing the support for pursuing the Master of Engineering program at McMaster University.

Not forgotten, of course, is my wife who held the fort (and the kid) all on her own in order to help me complete the writing of this thesis.

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1.0 INTRODUCTION

The estimation of capital and operating costs is a vital part of the process of designing, evaluating and operating industrial plants. Alternatives are screened, processing sequences are chosen, equipment is sized and operating plans are formulated on the basis of cost-benefit analyses.

However, a review of published information on computerised capital cost estimating systems and of executive programs which aid equipment or plant design indicated that while significant advances have been made or claimed in each of the two areas, the need of an integrated design-cost system has largely remained unfulfilled.

A computerised capital cost estimating system, compatible with modular executive-aided design systems, has now been developed to fill this need. The development and evaluation of this system, named COSMOD, is the subject matter of this thesis.

In order to present COSMOD in proper perspective, recent developments in modular executive routines and computerised capital cost estimating systems have been briefly reviewed in the following sections. Following this, COSMOD and its application to three real costing problems are presented. The results of these applications are used in evaluating COSMOD as a preliminary capital cost estimating system.

All programs, data and instructions needed for the use of COSMOD have been filed in the appendicies.

1.1 EXECUTIVE ROUTINES AND CAPITAL COST ESTIMATION SYSTEMS

Computers were being used as an aid in the design and analyses of processes long before executive systems were developed. The development of executive routines provided a simple, systematic and highly efficient procedure for the simulation and design of processes.

Several executive systems have been reported in the literature. PACER (20), MACSIM (12), and later, GEMCS (11), appear to be the most significant developments in modular executive systems.

The overall strategy for an orderly development of a process simulation in a modular system was outlined and illustrated by Crowe et al. (3). Shaw (21) documented his experiences with the application of MACSIM to the simulation of an alkylation plant.

Studies such as those mentioned above helped to identify needs in executive programs and led to the development of auxiliary programs such as physical property packages and convergence promotion routines.

An obvious need, though not emphasised in the various studies done to date, was that for a capital cost estimating system which would be compatible with executive-aided equipment or plant design systems. A survey by Flower and Whitehead (4) noted the absence of such a system. In recent years, however, some cost estimating systems have been described in the literature. Details of such systems have either been kept proprietory or are missing. Some systems that have been reported are mentioned below.

In 1960, representatives of M.W. Kellogg Co. indicated at the AACE meeting in Houston that M.W. Kellogg was working on building an integrated design cost system. It was reported that, with the help of such a system, estimating time for 'average' estimates had been cut down from four man-weeks to about 45 minutes. Apart from drastically reducing costs, errors in estimating were virtually eliminated. (19)

In 1969-1970, Diamond Shamrock (14) reported the development of various systems which were integrated into a system called 'PROVES'. The services of 'PROVES' were for hire.

In 1974, Cadman* reported the use of Icarus Corporation's 'COST' program in design courses. In the same year, Lashmet (16) and

* Ref. (2)

Gaddy (5) reported the development of design-cost systems for the same purpose. In 1976, Gaddy and Gaines (6) reported the development of 'PROPS', which appears to be a modified version of Gaddy's earlier 'CHEESE' program. More recently, in the years between 1977 and 1982, a modified version of 'FLOWTRAN', which could undertake cost calculations and economic evaluations, was released by CACHE Books, a 'PCOST COSTING PROGRAM' was described by Soni (30) and the development of 'ASPEN' and 'ASPEN PLUS' (31) was reported.

The computer programs and data bases of systems which have been reported as complete design-cost systems are not freely available. The cost estimation part of most of these systems appear to be based on Guthrie's (7) factor method.

A review of capital cost estimating methods and their data and manhour requirements would help illustrate the benefits of an integrated design-cost system. These are presented in the next section.

1.2 CAPITAL COST ESTIMATION

Estimates of capital costs may be made in several ways. The methods chosen may depend upon the purpose of the estimate or the amount of information available at the time the estimate is made.

In this section, AACE[1] classification of capital cost estimations is reviewed. Some available information on the cost of making estimates is then presented. The purpose is to identify the situation where a computerised design-cost system would be feasible and to obtain some idea of the economic incentives for developing such a system.

1.2.1 METHODS

AACE proposed the classification of capital cost estimates into five groups. These were

(1) Order of Magnitude Estimate

(2) Study Estimate

(3) Preliminary Estimate

(4) Definitive Estimate

(5) Detailed Estimate

Order of Magnitude and Study Class estimates are based on cost correlations in which the correlating parameter is usually plant capacity. Unit costs and some description of the process may also be considered. These methods provide a quick, back of the envelope estimate and their accuracy is over $\pm$ 30%.

Preliminary estimates are based on single or multiple factor methods. The information required for making a preliminary

1. American Association of Cost Engineers, Ref. (29).

estimate include the following.

(1) A flow plan in some stage of development.

(2) The type, size and material of construction of required equipment. All equipment as large as or larger than a pump is normally included. The 'size' of interest is the one to which the cost of the equipment is correlated. Other information, such as temperature and pressure of the service, may also be required.

(3) Cost data based on the size of the equipment.

(4) Cost factors for labour and material required to install the equipment, and for associated expenses such as for site development, buildings, offsites, engineering, field expenses, contractor's fee , etc.

The accuracy of preliminary estimates is within $\pm$ 20%.

Definitive estimates are based on the following.

(1) Firm or preliminary equipment quotations.

(2) Craft man-hours for labour and their wage rates.

(3) Architectural drawings for building projects, including accessories.

(4) Definitive capacities.

(5) Definitive requirements of utilities and services.

(6) Storage and handling requirements.

(7) Final detailed flow diagrams.

(8) Plot plans.

(9) Complete equipment lists with specifications.

(10) An exact location.

The accuracy of definitive estimates is within ± 10%.

Detailed estimates are based on the following.

(1) Complete engineering drawings.

(2) Firm bids from contractors.

(3) Labour rates and craft hours.

(4) Material take-off from detailed drawings.

The accuracy of detailed estimates is within ± 5%.

1.2.2 COSTS

Table (1.1) on page (8) has been reproduced from Jelen (13). It is based on Nichol's (17) data of 1951. Table (1.2) on page (9) has been reproduced from Peters and Timmerhaus (18).

It is evident that the cost of making an estimate varies considerably, depending upon the type of estimate being made and the size of the project being estimated. Fig.(1.1) on page (10), reproduced from Woods (22), indicates that there is a large step change in manhour requirements when estimates of accuracies within ± 30% are needed.

ACCURACY RANGE (%)		PROJECT COST (MILLIONS OF 1951 $)				
	0.5	1.0	5.0	10.0	15.0	20.0
		COST OF ESTIMATE ('51$)				
-3 to +12	15000	25000	45000	70000	90000	120000
-5 to +15	7000	13000	20000	35000	45000	60000
-10 to +28	2500	4500	8000	13000	16000	20000
-20 to +40	900	1700	2800	4500	6300	8000
-30 to +50	500	950	1500	2500	3500	4500
-40 to +60	300	600	1000	1700	2300	3000
-50 to +70	250	350	600	900	1300	1700

TABLE (1.1)

TYPICAL COSTS FOR PREPARING ESTIMATES (13)

COST OF PROJECT	LESS THAN $ 1000000	$ 1000000 to $ 5000000	$ 5000000 to $ 50000000
ORDER OF MAGNITUDE	$ 500	$ 1000	$ 2000
STUDY ESTIMATE	2000	5000	8000
PRELIMINARY ESTIMATE	7000	16000	24000
DEFINITIVE ESTIMATE	12000	35000	45000
DETAILED ESTIMATE	50000	125000	250000

TABLE (1.2)

TYPICAL COSTS FOR PREPARING ESTIMATES (18)

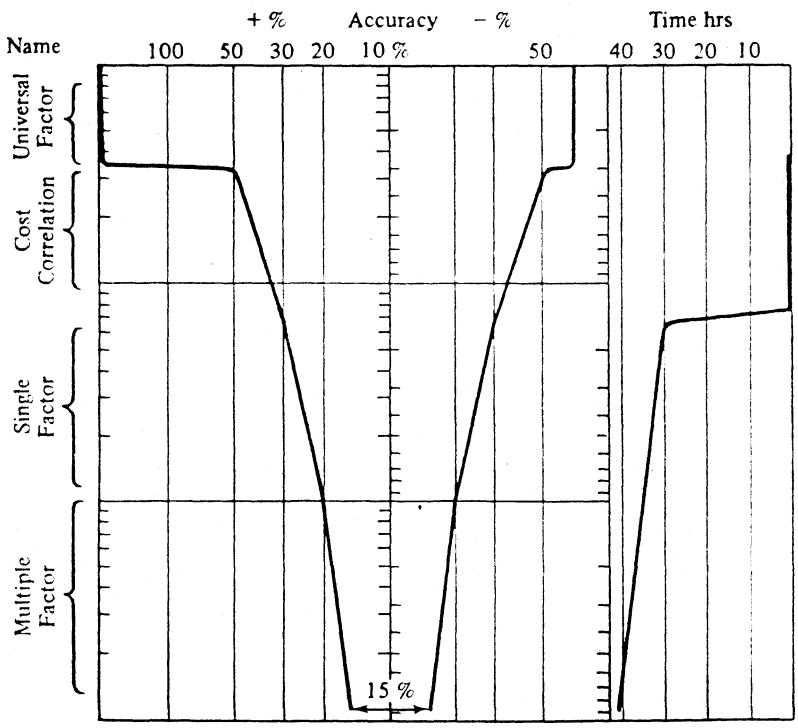

FIG. (1.1)

QUALITATIVE RELATIONSHIP BETWEEN TIME AND PRELIMINARY CAPITAL COST ESTIMATE ACCURACY (22)

These and other data show that the cost of making a single preliminary capital cost estimate can run into thousands of dollars. Thus, process design or optimisation studies, which require several estimates in order to define the economic optimum , could become extremely expensive. There is, therefore, the potential for substantial reduction of estimation costs in the development of a preliminary capital cost estimation system which is compatible with process design systems.

A review of the state of the art of published design-cost systems formed the basis upon which the specific objectives of the present work were formulated. These objectives are enunciated in the following section.

1.3 OBJECTIVES OF PRESENT WORK

The objectives of this work were

(1) to create a computerized preliminary capital cost estimating system compatible with modular executive-aided design systems, and

(2) to set up a data base and equipment catalogue which would be required for the use of the system.

2.0 DEVELOPMENT OF COSMOD

COSMOD, a computerised preliminary capital cost estimating system compatible with modular executive design systems, has been developed to fulfil these objectives.

The description of COSMOD is presented in the next four sub-sections. In the first sub-section, the background and details of the cost estimating technique used in COSMOD is described. The computerisation of this technique, the equipment cost data base and COSMOD's interface with a modular executive routine, GEMCS, are described in the sub-sections that follow.

2.1 ESTIMATING TECHNIQUE IN COSMOD

COSMOD uses the factor method of preliminary capital cost estimation as developed by Guthrie (7). The roots of this method lie in the factor method of Lang (15). Lang divided all processes into three main categories. The preliminary estimate for a plant was obtained by multiplying the total cost of delivered equipment by a single factor. These factors were 3.9 for solids processing plants, 4.1 for solid-fluid processing plants, and 4.8 for fluid processing plants. These factors were based on a study of 14 plants, 9 of which were actually constructed. However, Lang factors could not yield reliable estimates for processing sequences which

were radically different from those upon which the factors were based.

Hand (10) attempted to improve Lang's method by subdividing process equipment into seven major equipment groups and applying a different overall factor to each group to arrive at total battery limit costs. Hand's method can be said to be the begining of the 'module' approach to preliminary capital cost estimating.

Wroth (26) further elaborated on Hand's method, subdividing equipment into twenty groups, and providing an overall factor for each group.

This technique of cost estimation was formally defined and outlined by Guthrie (7) in 1969. Before Guthrie's 'module' approach is described, the terms used in the method are explained below.

Material Factor: The material factor, M, is defined as the ratio of the sum of the cost of an equipment and the cost of all material required to install the equipment to the cost of the equipment alone, i.e.,

$$M = \frac{E+m}{E} \quad ,$$

where E = FOB cost of equipment, and

m = total cost of materials.

Labour Factor: The labour factor, L, is the ratio of the cost of field labour required to install the equipment and associated materials to the FOB cost , E, of the equipment alone. In equation form,

$$L = \frac{l}{E},$$

where l is the cost of field labour and E is the FOB cost of the equipment to be installed.

Direct Cost Factor or L+M Factor: The direct cost factor, also called the L+M factor, is the sum of the labour and material factors.

Bare Module Cost: The bare module cost is the L+M cost plus the cost of freight, taxes, insurance, engineering and field expenses. This cost, expressed as a fraction of the FOB equipment cost, is known as the Bare Module Factor.

Total Module Cost: The total module cost is the bare module cost plus contractor's fee and contingency. The Total Module Factor is this cost expressed as a fraction of the FOB equipment cost.

All the above module factors apply to a single or a single group of equipment such as shell and tube heat exchangers, centrifugal pumps, etc.

Guthrie (9) and Woods (25) have provided module factors for many different types of equipment. Guthrie indicates that his factors are based on a large number of construction experiences, and are normalised to U.S. Gulf coast conditions of mid 1970. However, Guthrie's method of allocating various material and labour costs to particular equipment groups are not clearly indicated.

Woods indicates that the bare module cost of an equipment may be visualised as the installed cost of the equipment and all material within three meters of the boundary of the equipment. This is indicated in Fig.(14) of Woods (23).

The application of Guthrie's method is outlined in Table (1) of his paper (9). L+M costs are estimated in several "modules" or groups. In the 'Chemical Processing' module, equipment are divided into sub-groups, such as heat exchangers, pumps, pressure vessels, etc. The L+M cost for each group is obtained by multiplying the FOB cost of each sub-group of equipment by the L+M factor for that type of equipment. Expressing in equation form,

$$\text{L+M Cost} = \text{FOB Cost} \times \text{L+M Factor.}$$

The total L+M cost is obtained by adding the L+M costs of the sub-groups of equipment.

The L+M factors are applicable to the FOB cost on a carbon steel basis. L+M factors are sensitive to alloy ratios and pressure

rating of equipment. Guthrie suggests that labour and material expenses, excluding piping, be calculated on a 'base' cost for carbon steel equipment. The cost of piping should then be calculated as a factor of the actual cost of equipment and multiplied by 0.7 to compensate for non-process components of piping.

L+M factors are also affected by the $ magnitude of equipment groups, by labour productivity, wage rates and conditions at the actual site of construction. A method to compensate for local conditions is shown by Blecker (1).

2.2 COMPUTERISATION OF ESTIMATING PROCEDURE

COSMOD's procedure for estimating the L+M cost of equipment follows closely the procedure that an estimator would use in manual calculations. The estimator would need information on:

(1) cost data or correlations for various types of equipment,

(2) the size, i.e. the value of the correlating parameter, of the equipment to be costed,

(3) material of construction of the equipment,

(4) design pressure, if applicable,

(5) design temperature, if applicable

(6) L+M factor for the equipment, and

(7) other equipment specifications which are likely to affect the cost of the equipment.

Supplied with all necessary information, the estimator would then look up tables, graphs, correlations or perhaps vendor quotations to estimate an FOB , delivered or installed cost of the equipment. If necessary, the estimator would then adjust the cost for material of construction, design pressure, design temperature, etc. An L+M factor would be used to obtain the L+M cost. Finally, an appropriate inflation index could be used to update the cost to the time frame of interest.

Information such as those listed above are also needed by COSMOD. Some of the information are stored in COSMOD's data base. Others have to be supplied to COSMOD by the user, in numerical codes and in a format recognized by COSMOD. For obtaining the FOB cost of equipment, COSMOD has nearly 300 cost correlations stored in its data file. COSMOD will accept from the user the codes of only those equipment for which it has correlations. When all the required information is supplied, COSMOD will retrieve the necessary information from its data file, calculate the L+M cost and update the cost using the inflation index supplied by the user. This cost then becomes available to any other part of a design-cost system where a financial analysis may be conducted if desired.

The method of coding information required by COSMOD and the particular information that must be supplied for various types of equipment are defined in the equipment catalogue. (See Appendix C).

The cost calculations made in COSMOD are illustrated in the following example. Table (2.1) on page (19) shows Woods' (25) data on the cost of shell and tube exchangers. The cost data has been correlated in the form

$$C_1 = (S_1/S_o)^n \times C_o \times f_1 \times f_2 \times f_3 \times .....$$

where

C_1 = cost being calculated, in thousand dollars, 1970 basis

C_o = base cost, used in correlation

S_1 = size of interest, specified by user

S_o = base size, used in correlation

n = exponent in correlation

f_i = adjustment or correction factors for pressure, temperature, material of construction, L+M factor, etc.

The size of interest, S_1, and the adjustment factors are selected and specified to COSMOD by the user. In COSMOD, the size may either be supplied to COSMOD directly by the user or may be calculated and supplied by a design program in an executive aided design-cost system. Similarly, factors for temperature and pressure, where applicable, may be supplied directly by the user or the actual design temperature and pressure may be generated in the design program and supplied to COSMOD. COSMOD will then select the appropriate factor. The factor for the material of construction would have to be supplied directly by the user. The base cost, the base size, and the exponent are retrieved by COSMOD from its data file.

	Size	Unit	Cost 10^3 $	Range	n	Error %	L+M	L/M	BM	Comments
SHELL AND TUBE										
Floating head, 150 psi, c/s in c/s shell, bare tube. Delivered cost: standard 16 ft. length, with either 1" or 3/4" O.D. tubes on square or triangular pitch.	1	10^2 m² (1076 ft²)	8	0.02 to 20	0.71	40	2.30	0.36	3.14	Fixed tube x 0.85 U-tube x 0.87 Kettle reboiler x1.35 Tubes only x 0.3 Expansion joint on fixed tube x 1.25
Pressure, psi 300 x 1.15 — 1000 x 1.55 400 x 1.25 — 3000 x ~2.5 600 x 1.45 — 4000 x ~2.8 800 x 1.52 — 5000 x ~3.1										
tubes in c/s shell: Al x 1.2 — s/s 316 x 2.4 Cu x 1.35 — s/s 304 x 2.0 Brass x 1.3 — Monel x 3.0 Admiralty x 1.5 — Ti x 9.0 70-30 Cu-Ni x 1.7 — Inconel x 2.4 Ni x 2.8 — Hastalloy C x 8.5										
tubes and shell: s/s 316 x 3.0 — Monel x 4.0 s/s 304 x 2.8 — Ti x 13.0										
After cooler for compressor, c/s with water on shell side. excl: separator, integral piping, support stand and instrumentation.	0.1	m³/sec	0.38	0.03 to 0.3	0.58					
Cross bore in c/s shell. Karbate. Delivered.	10 108	m² (ft²)	4	0.7 to 70	0.69					

TABLE (2.1)

EXAMPLE OF EQUIPMENT COST DATA (25)

Cost correlations stored in COSMOD's data base for various equipment are applicable within various size ranges of the equipment. In many cases, the range is divided into several size intervals, and a different correlation applies to each interval. In such cases, COSMOD selects the values of the parameters which apply to the size of interest.

If the specified or generated size, temperature or pressure is below the range of the correlation, COSMOD assumes the minimum size, pressure or temperature to which the correlation applies, and flags this to the user. If the user specified data is above the range of the correlations, COSMOD does not calculate the cost and prints a message to that effect. The user may then choose to overide the limits of the correlation or perhaps duplicate equipment.

The cost generated by COSMOD may be an FOB, delivered or installed cost, depending upon the data available in its data file. However, before applying the L+M factor supplied by the user, COSMOD will divide delivered cost by 1.15, and installed cost by 1.5 to obtain an estimate of the FOB cost. This is because the L+M factor is applied to the FOB cost. The basis of the cost data for various equipment in COSMOD is indicated in the equipment catalogue. The user selecting L+M factors should take note of this

basis and be aware of the reduction factors used in COSMOD.

L+M data are based on carbon steel equipment. When the equipment to be costed is of a material other than carbon steel, COSMOD automatically adjusts the L+M factor to compensate for the material of construction.

If the user desires an adjustment for the piping, which may not all be of the same material as the equipment, COSMOD will do so if the piping factor is supplied by the user. The method of adjustment is illustrated by Woods (24).

No adjustments are made to the supplied L+M factor for the effect of temperature, pressure or dollar magnitude on the L+M factor. Examination of Guthrie's (9) data indicate that the effect of dollar magnitude of equipment on the L+M factor is negligible in the first one million dollar range. Information on the variation of L+M factors with dollar magnitudes is not available for a large number of equipment types. However, the user wishing to adjust L+M factors can do so easily in COSMOD.

Available L+M factors have been listed in the equipment catalogue. (See Appendix). These L+M factors assume the same labour and geographical conditions as Guthrie's (9), i.e., U.S. Gulf Coast conditions. Adjustments may be made to the listed L+M factors if labour productivity, wage rates and site

conditions relative to the U.S. Gulf Coast is known for a particular location. Adjustments may also be made if the L/M factors for a particular location are known.

The user has the option to bypass the calculation of cost based on correlations in COSMOD and introduce an externally generated cost into COSMOD. This may be a cost based on an actual quotation. For consistency, this externally generated cost must be expressed as an L+M cost, updated to the time of interest. COSMOD will not make any modification to an externally supplied cost.

COSMOD will detect certain types of coding errors and print appropriate messages. Also, in order to allow the user to re-check whether the appropriate size units have been used, COSMOD will print the units of size.

The user has the choice of two types of printouts in COSMOD - a concise or a detailed output. The concise output will print the 'equipment codes' supplied by the user, the equipment size with units, the cost and its basis (FOB, Del. or Instld.), and the L+M cost updated to the time frame of interest. The detailed output shows all the parameter values and units used in the calculations. This is to help debug possible errors in coding, in the data base or in the COSMOD program itself.

2.3 DATA BASE IN COSMOD

Cost data on the wide variety of equipment and materials used in process plants are essential to the development of an effective computerised capital cost estimating system.

COSMOD depends almost entirely upon the extensive works of Woods (25) for data on equipment costs. Several aspects of the cost tabulations by Woods make his data very compatible with a computerised cost estimating system.

The data of Woods covers a wide variety of equipment. Data on nearly 300 different types of equipment have been selected and stored in COSMOD's data file. These data provide information on almost all types of equipment normally encountered in the design phase of a project.

Wood's data are correlated in a simple mathematical form, as follows.

$$\text{Cost } (\$) = C_o(\text{size}/S_o)^n$$

C_o, S_o and n are constants, with values depending upon equipment type and size. This common form of correlation for all equipment makes it possible to use the same calculation routine for all the equipment in the data file.

The cost data are normalised to a reference year of 1970 when the MS index was 300. A single index may thus be used to update all costs to the time of interest.

The values for the exponents and constants; the size range in which the exponents and constants are applicable; correction factors for material of construction, design temperature and pressure, and other equipment characteristics which may effect cost; the basis (FOB, Del., or Installed) of the cost data; and the accuracy of the data where available; are all clearly indicated. This allows COSMOD to handle cost data on a consistent basis, especially when applying the L+M factors. Much of Woods' data also provide a description of what is included in the price, and what is not. These information aid the choice of L+M factors for the equipment in question.

L+M factors have been suggested by Woods for a large number of equipment. These have been included in the equipment catalogue. In many cases where no L+M data were available, an arbitrary value of 2.0 has been suggested in the catalogue.

All data on each type of equipment have been organised in a list and identified with a unique number. Each list, together with its identification number is referred to here as a 'record' and its identification number as its 'key'. Nearly 300 records

are available in COSMOD's data file . The file is arranged as a multiple record, random access file.

COSMOD merely needs the key for the record of any equipment in order to access and retrieve all the data on that equipment. Woods' data constitute the bulk of the data in each record. Other data of algebraic notations have been included in order to enable COSMOD to recognize the various types of data in its file.

COSMOD reorganises the data it retrieves into several lists and matrices for use in its cost calculation routine. Data in each record have been arranged in a sequence which is compatible with the interpretation and reorganisation logic in COSMOD.

The organisation of data in a multiple record, random access file has yielded the following advantages.

(1) It enables the retrieval and loading into COSMOD only that data which is relevant to the equipment being costed. Hence, while the data base may be large, the cost calculation routine does not require a large data space.

(2) Accessing the data file for checking, updating, deleting or adding data is very easy.

(3) It enables storage of records of various lengths without wasting space on the data file.

There are over 7000 numerical data in the data file at the present time. A listing of all these data and information on how to organise, create, manipulate and use the file are included in the Appendix.

2.4 USE OF COSMOD IN GEMCS

Cosmod can be interfaced with the GEMCS system as suggested in Fig.(2.1) on page (28). Information on the structure and operation of GEMCS is contained in a publication by A.I. Johnson and Associates (11). The GEMCS system is not described in detail here. The flow plan, Fig.(2.1), without the steps in dotted line, is the flow plan of GEMCS.

There are two ways in which COSMOD can be used within GEMCS to form a design cost system.

(1) COSMOD may be used as a 'Unit Computation' or 'Module' in GEMCS. In this arrangement, GEMCS would call upon COSMOD to calculate L+M costs after each design module has sized the equipment. The costs generated by COSMOD could then be used in a 'financial analysis module' as suggested in Fig.(2.1).

(2) COSMOD may be called in as a sub-routine by a Unit Computation or design module itself. Such a need may arise if a design optimisation is conducted within a design module. For example, cost data are needed for optimising the area of a waste heat recovery exchanger.

In either case, COSMOD obtains its information from the 'EN VECTOR' (11) of the design module which immediately preceeded it or which called it in. COSMOD checks a special location in the EN vector to determine where its input data begin in

COSMOD'S INTERFACE WITH GEMCS/6400

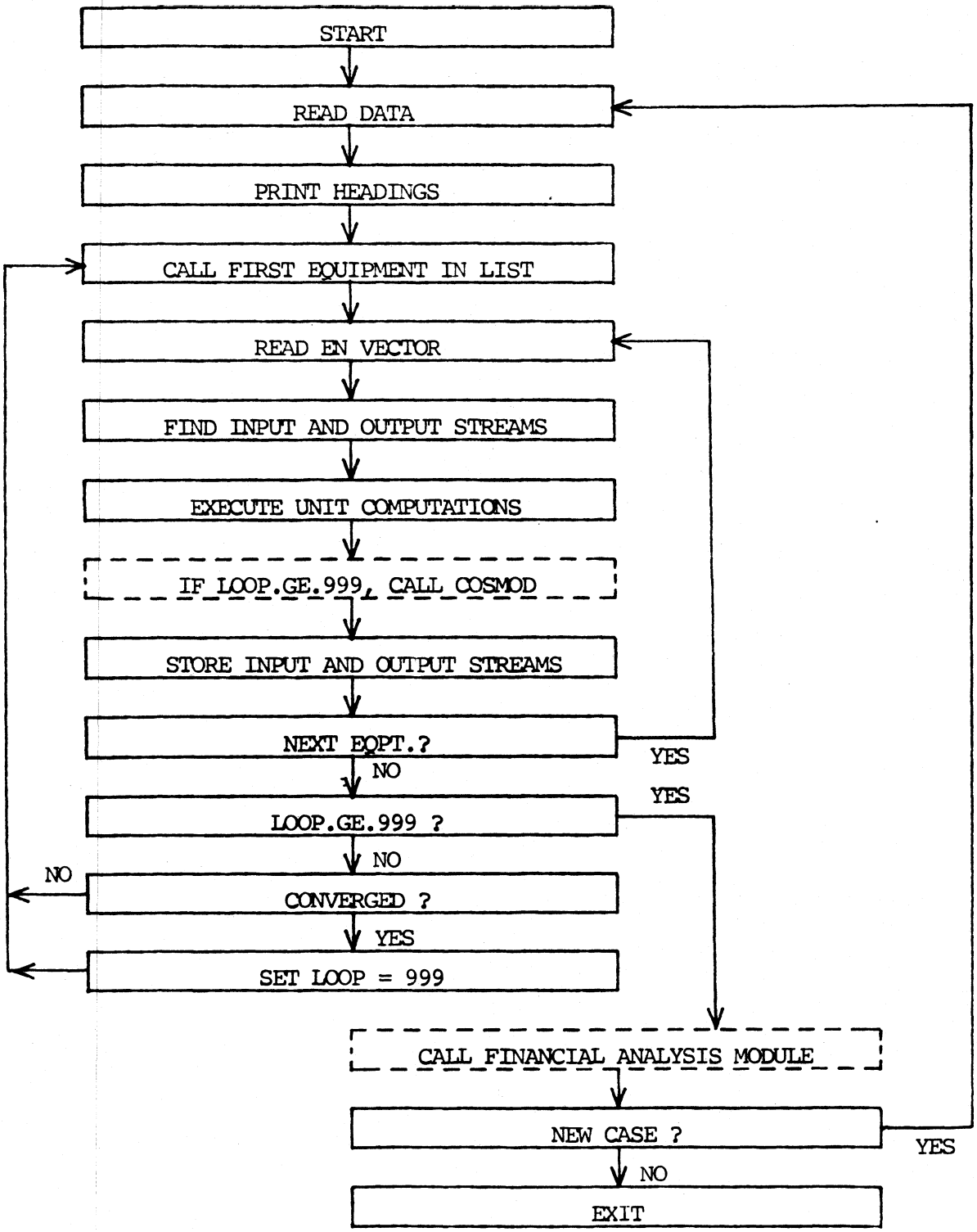

FIG (2.1)

the EN vector. This location is EN(4).

The following information must be supplied to COSMOD begining in the location indicated by EN(4).

(1) Whether or not COSMOD should begin costing the equipment.

(2) Whether a short or a detailed output is desired.

(3) Whether or not the equipment to be costed is the last one in the Unit Computation

(4) The number of identical equipment.

(5) A unique reference number for the equipment, to be used for storage of the calculated cost in a list by COSMOD, as well as to serve as a reference number for the user's convenience.

(6) The 'key', i.e. the COSMOD Reference Number in the equipment catalogue (see Appendix)[1], for the cost correlation to be used.

(7) The factors for design temperature, design pressure, material of construction, etc.

(8) The size of the equipment in appropriate units.

(9) The L+M factor.

(10) The 'piping factor', if desired, or 0.0.

1. Appendix C.

All these information must be coded in five EN locations for each equipment to be costed. This is further explained in the Equipment Catalogue. (See Appendix)[1].

When the cost calculations are complete, COSMOD will store the results in a list which may later be accessed by any other module in GEMCS. COSMOD will also print the calculated cost and then go on to the next equipment to be costed if more than one equipment is specified by the user. COSMOD requires all the information that are given by the user to be placed consecutively if more than one equipment is to be costed in a Unit Computation. If there are no more equipment to be costed, COSMOD will release control to the routine from which it received control.

The evaluation of the COSMOD system, which has been described in the next section, was conducted within GEMCS. Minor changes were made to the GEMCS program for use with COSMOD. The modified listing can be found in the Appendix.[2] Incidentally, the name 'COSMOD' was chosen in the early stages of its development when it was visualised as a 'COSting MODule' for GEMCS.

1. Appendix C

2. Appendix A. Line Nos. 9, 31 - 39 were added to GEMCS.

3.0 EVALUATION OF COSMOD

COSMOD was used within GEMCS to produce estimates of fixed capital investment required for battery limit installations of three process plants, referred to here as plants #1, #2 and #3.

Table (3.1) summarises the results of these applications. The results generated by COSMOD are compared with costs generated by other sources.

Plant #1 is an Alkylation plant described in Crowe et al (3), page(318). Fig(3.1) is the process flow diagram reproduced from Crowe et al (3). Table (3.2), based on Woods' (22) equipment list for the plant, is the list of equipment on which the estimate of the plant was made. The source of the estimate with which COSMOD's result is compared in Table (3.1) is Crowe et al (3), page (319). An MS index ratio of 472/344 was used to escalate the 1973 cost from the source to 1976 cost, to be on the same basis as COSMOD's cost.

Table (3.3) shows the equipment list for plant #2. The estimate provided by the source is said to have been based on detailed drawings, with an expected accuracy within $\pm$ 10%. The cost was based on the first quarter of 1975. An MS index ratio of 472/437 was used to escalate the cost to 1976. Fig(3.2) shows the process flow diagram for Plant #2. (p. 37a)

PLANT #	COSMOD ESTIMATE (1976 $)	SOURCE ESTIMATE (1976 $)	DIFFERENCE (% OF COSMOD'S ESTIMATE)
1	4,053,022 (BL COST)	3,430,233 (BL COST)	15
2	569,060 (BL COST)	527,452 (BL COST)	7
3	1,323,938 (L+M COST)	1,137,533 (L+M COST)	14

BL = battery limits; L+M = labour + material

TABLE (3.1)

COMPARISON OF COSTS GENERATED BY COSMOD

WITH COSTS AVAILABLE FROM ANOTHER SOURCE

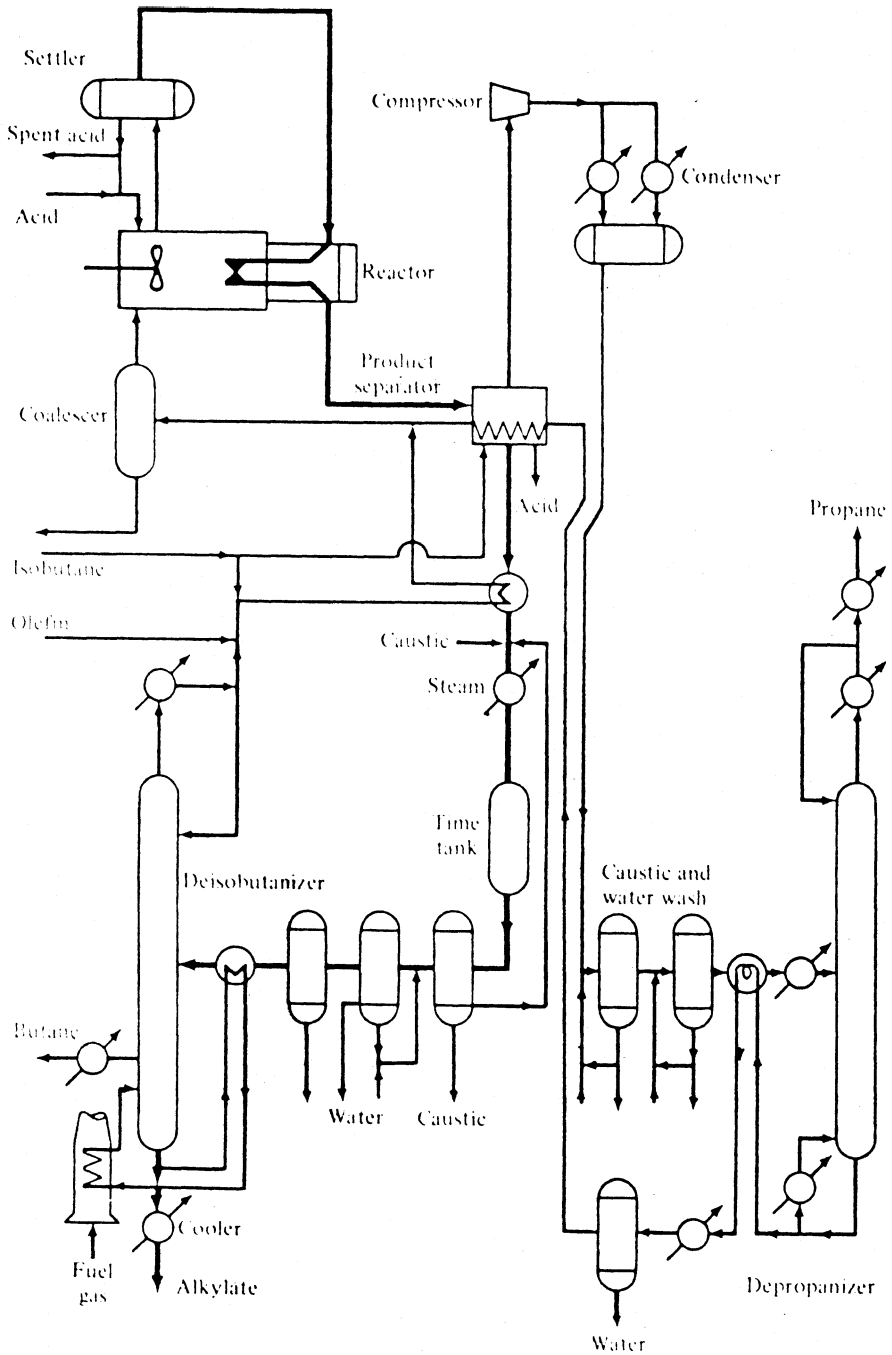

FIG. (3.1)

FLOW PLAN FOR PLANT #1 (3)

TABLE 3.2

EQUIPMENT LIST FOR PLANT #1

Ref. No.	Description
1	One reactor vessel, horizontal, 11000 gals. , 70 psig, monel, average complexity.
4	One coalescer, vertical, 1000 gals., 70 psig, c/s, non-jacketed.
5	One settler vessel, horizontal, 13000 gals., 70 psig, monel, average complexity.
6	One product separator vessel, 15000 gals.,70 psig, monel, average complexity. Horizontal.
11	One accumulator vessel, 1000 gals., 70 psig, c/s, average complexity, horizontal.
12	One caustic settler vessel, 3000 gals.,200 psig, c/s, non-jacketed, vertical.
13	One water settler, 3000 gals., 200 psig, c/s, non-jacketed, vertical.
16	One depropaniser distillation column, 60' length, 48" diameter, 350 psig, c/s, non-jacketed, vertical, 18" tray spacing.
33	37 valve type flexitrays, c/s.
20	One coalescer vessel, 100 gals, 150 psig, c/s, non-jacketed, vertical.

TABLE 3.2 (Continued)

23	One reaction time tank, 3000 gals, 200 psig, c/s, non-jacketed, vertical.
24	One caustic settler, 3000 gals., 200 psig, c/s, non-jacketed, vertical.
25	One water settler, 1000 gals., 200 psig, c/s, non-jacketed, vertical.
26	One coalescer vessel, 1000 gals., 70 psig, c/s, non-jacketed, vertical.
32	Deisobutaniser distillation column, length = 130', diameter = 4', tray spacing = 18", 150 psig, c/s, non-jacketed, vertical.
34	80 valve type flexitrays, c/s.
3	One heat-exchanger coil in reactor, 7300 sq. ft., 70 psig, monel.
7	One heat exchanger coil in product separator, 302 sq.ft., 70 psig, monel.
8	One feed heat exchanger, 1112 sq.ft., 150 psig, c/s in c/s.
10	Two condensers, 2410 sq.ft. each, 150 psig, c/s in c/s.
14	Two feed-bottoms exchanger, 526 sq.ft., 150 psig, c/s in c/s.

TABLE 3.2 (Continued)

15	Two steam feed heaters, 252 sq.ft., 150 psig, c/s in c/s.
17	One reboiler, 460 sq.ft., 150 psig, c/s in c/s.
18	One overhead condenser, 1314 sq.ft., 150 psig, c/s in c/s.
19	One overhead cooler, 252 sq.ft., 150 psig, c/s in c/s.
21	Four bottoms coolers, 1314 sq.ft. each, 150 psig, c/s in c/s.
22	Two heat exchangers, 522 sq.ft., 50 psig, c/s in c/s.
27	One feed heat exchanger, 1051 sq.ft., 150 psig, c/s in c/s.
29	One butane cooler, 630 sq.ft., 150 psig, c/s in c/s.
30	Two DIB overhead condensers, 6220 sq.ft. each, 150 psig, c/s in c/s.
31	Two alkylate coolers, 522 sq.ft. each, 150 psig, c/s in c/s.
2	One mixer in reactor, 400 hp. (Assume cost to be equal to two 200 hp mixers.)
28	One furnace reboiler, 500 psig, 10^6 BTU/ hr.
9	One compressor, 3 stage, centrifugal, 746 kw, 20,000 cu.ft./min.
35	One acid feed pump, 75 hp, monel.

TABLE 3.2 (Continued)

36	Two acid storage cylinders, fresh and spent, 20,000 gals each, atmospheric, monel, non-jacketed.
37	Product separator bottoms pump, 75 hp, c/s.
38	Accumulator bottoms pump, 100 hp, c/s.
39	Two pumps, DIB overhead and bottoms, 125 hp each, c/s.
40	Nine 3 hp pumps, c/s.
41	One deprop pump, 20 hp, c/s.
42	One acid decanter, c/s, cylindrical, 70 psig, monel, non-jacketed, vertical, 940 gals.
43	One acid pump to neutralize caustic, 10 hp, monel
44	Two tanks, 1000 gals. each, c/s.
45	One 20,000 gals. isobutane surge tank, 100 psig, vertical, c/s.

Note: Above equipment list is based on equipment list in Woods (22), pp. 178, 179.

Note: Ref. Nos. in table above are arbitrary, user supplied numbers for equipment, and is used by COSMOD to identify the equipment to the user.

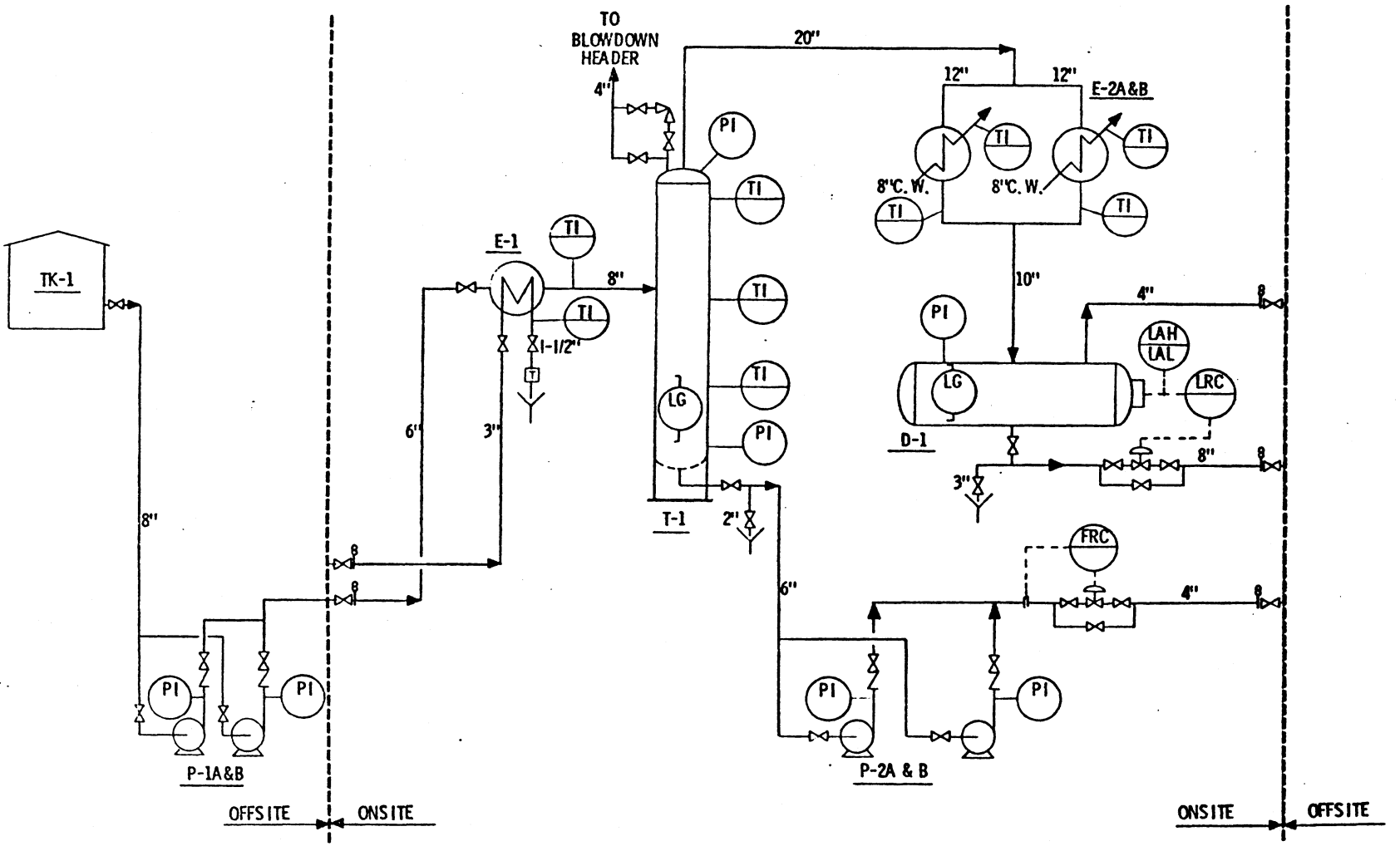

FIG. (3.2)

FLOW PLAN FOR PLANT #2 (27)

TABLE 3.3

EQUIPMENT LIST FOR PLANT #2

Ref. No.	Description
1	One fractionating tower, 7 ft. in diameter, 115 ft. height, 190 psig design pressure, 650°F design temperature, A-282 carbon steel, shop fabricated shell.
1	8 jet trays, type 410, field installed.
1	41 single flow sieve trays, field installed.
2	One distillate drum, 6 ft. diameter, 20 ft. length, horizontal, design pressure 190 psig, design temperature 650°F, A-285 carbon steel, shop fabricated.
3	Two pumps with drives, 650 gpm, delta P = 125 psi, delta H = 360 ft., horizontal, centrifugal, 3600 rpm. 100 hp TEFC motors, 3600 rpm.
4	One c/s, shell and tube heat exchanger, 2550 sq.ft. bare tube area, 16 ft. tube length, 300 psig shell, 150 psig tubes.
5	Two shell and tube overhead condensers, 2750 sq.ft. bare tube area, 300 psig shell, 150 psig tubes, c/s shell, 16 ft. admirality tubes.

Note: Equipment list on previous page is based on information supplied by Imperial Oil. (27)

Note: Same Ref. No. may be used for more than one piece of equipment if the user wishes COSMOD to treat them as part of the same equipment. COSMOD will add up the costs of equipment with the same user Ref. No. before storing the cost in its lists.

Table (3.4) shows the equipment list for plant #3, which is a sulphuric acid plant. The cost provided by the source was based on 1966 costs. This was escalated to 1976 by using an MS index ratio of 472/252.

Table (3.5) shows the additional compilation time, execution time and costs for running the three cases at McMaster University's CDC/6400 computer.

TABLE 3.4

EQUIPMENT LIST FOR PLANT NO. #3

Ref. No.	Description
1	Vertical c/s vessel for drying tower, API, 9662 cu. ft.
1	Acid brick lining for drying tower, assumed 9" thick, 2553 sq. ft.
1	3 cast iron distributor pans and 4 support grids for drying tower. (Assumed similar in cost to sieve trays.)
1	4831 cu. ft. of 4-cell partition rings for drying tower.
2	One centrifugal blower with drive, inlet capacity 10.3 Nm^3/sec.
3	Horizontal c/s vessel for preheater, 941 cu. ft.
3	Insulating firebrick (assumed 9" thick) for horizontal vessel, 410 sq. ft.
3	Shell and tube exchanger for preheater, c/s, 150 psi, fixed tubesheets, 7894 sq. ft.
3	Vertical vessel for preheater, c/s, 578 cu. ft.
3	Insulating firebrick lining for vertical vessel, (assumed 9" thick), 226 sq. ft.
4	C/S heat exchanger, 17,153 sq. ft. bare tube area, 150 psi, fixed tubesheets.

TABLE 3.4 (Continued)

5	C/S heat exchanger, 9948 sq. ft. bare tube area, 150 psi, fixed tubesheets.
6	C/S heat exchanger, 17,153 sq. ft. bare tube area, 150 psi, fixed tubesheets.
7	Two vertical vessels for two converters, c/s, 11,160 cu. ft. each, API.
7	Two shell and tube intercoolers, for converters, c/s, 1156 sq. ft. bare tube area (each), 150 psi.
7	Ten cast iron support grids for converters, assume cost to be similar to that for c/s sieve trays.
7	Firebrick lining, total 5655 sq. ft. for both converters. (Assumed 9" thick).
7	Quartz pebbles, 500 cu. ft. (Cost assumed similar to that for 6" raschig rings).
8	One vertical vessel for an absorbing tower, c/s, API, 9662 cu. ft.
8	Acid brick lining, assumed 9" thick, for absorbing tower. 2553 sq. ft.
8	4835 cu. ft. 4-cell partition rings packing for absorbing tower.
8	Three distributors and three support trays for absorbing tower, c/s. Assume cost to be similar to that for c/s sieve trays.

TABLE 3.4 (Continued)

9	One air compressor, two stage, 9 SCF/M, exhaust pressure 50 psig, 1.5 hp motor.
10	One dual tower dehumidifier, 10 SCF/M, silica gel dessicant, air at 45 to 60 psig.
11	Two vertical vessels for two acid tanks, c/s, 2425 cu. ft. each, non-jacketed.
11	Acid brick linings for acid tanks, linings assumed 9" thick, 1155 sq. ft. each.
12	Two acid circulating pumps, 1100 US gals./min each, 50 ft. head, cast iron, 50 hp, 3/60/550/1800 TEFC motor.
13	One product acid pump, 60 US gals./min, 70 ft. head, 1720 rpm, 7.5 hp, 3/60/550/1800 TEFC motor.
15	Blower for acid stripper. 7.5 hp 3500 rpm 3/60 550 motor. (Because of lack of information, cost assumed to be twice the cost of motor alone.)
16	93% and 98% acid cooler, cast iron pipe rack, 12000 sq. ft. total area, including framing, wood housing, troughs and gates. (Duplication of units assumed)

Note: Above equipment list based on information available on a 370 tons/day H_2SO_4 plant. (28)

PLANT #	ADDITIONAL COMPILATION TIME (sec)	ADDITIONAL EXECUTION TIME (sec)	COST (AT $166/HR) (¢)
#1	5.584	0.625	0.85
#2	5.726	0.166	0.71
#3	5.561	0.735	0.81

TABLE (3.5)

ADDITIONAL COMPUTER TIME AND COSTS

3.1 SUMMARY

Preliminary capital cost estimates for the three test cases were within 15% of estimates available from other sources. Assuming that the estimates available from these sources closely represented actual costs, the accuracy of the estimates from COSMOD were within acceptable limits for preliminary type estimates.

The interface of COSMOD with GEMCS was effective. The two systems are compatible and can be used together in a design-cost system.

The COSMOD program is efficient, and very little computer time is required in the actual costing process, inspite of the vast amount of data that has to be kept available to COSMOD.

4.0 CONCLUSIONS

A computer aided preliminary capital cost estimation program has been developed. This program will operate on any computer that has a multiple record, random access file capability comparable to that of the CDC/6400 computer. The program is written in Fortran IV.

This cost estimating system is complete with an Equipment Catalogue containing cost information on nearly 300 different process equipment, a Data file containing over 7000 bits of data, and instructions for the use of the system.

The program interfaces easily with GEMCS although any modular executive program should be amenable to interfacing with the COSMOD program.

The COSMOD program, through the use of the multiple record, random access file feature, has made it possible to

(i) store a vast quantity of data on equipment costs and make it available to a cost calculating routine and still keep this routine and its memory requirements relatively small, and

(ii) easily access, check, update, delete or add data to the data file.

The application of COSMOD to three primarily fluid handling processes produced results which were within 15% of estimates made by other sources. These results indicate that COSMOD is a viable and fairly accurate system for estimating the preliminary capital costs of fluid handling processes.

Although COSMOD has not been applied to process design optimisation in this study, it should be possible to use COSMOD in a design optimisation program. Convergence problems are possible as a result of discontinuities in cost correlations, but these may be overcome by applying some form of smoothing of the cost data.

5.0 RECCOMENDATIONS FOR FUTURE WORK

The creation of (i) an Operating Cost Estimating module, and (ii) a Financial Analysis module, compatible with the COSMOD-GEMCS system is recommended. The Financial Analysis module would, for example, calculate a discounted cash flow rate of return on investment based on costs generated by COSMOD and the Operating Cost Estimating module. Such a system would become a powerful tool for the screening, evaluation and optimisation of process plant design and operation.

To keep a cost estimation system useful, its data base must be continually updated and expanded as new and better information become available. This applies to COSMOD's data base as well, and COSMOD's data base has been set up to make these changes extremely easy.

It is also recommended that the COSMOD routine itself be modified to generate L+M factors as more L/M factors become available, to apply individual inflation factors to equipment where these factors are available, and to include the effect of $ magnitudes of equipment costs on L+M factors when more of such data become available.

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APPENDIX CONTENTS

APPENDIX A

Listings of programs used for generating the preliminary capital cost estimate of Plant #1 are filed here.

Some important features of the programs are discussed below.

GEMCS PROGRAMS: The Gemcs programs remain essentially as described by Johnson and Associates (11). Two new lists are added to the common block - EQCST(x) and TCOST(2).

Cost of each equipment calculated by COSMOD is stored in EQCST(x), where x is the unique reference number supplied by the user to identify the particular equipment. The length of the list EQCST(x) must be equal to or greater than the number of equipment to be costed.

FOB costs of all equipment are totalled in TCOST(1) and L+M costs are totalled in TCOST(2).

Both EQCST(x) and TCOST(2) are set to 0.0 for each new case in GEMCS.

SUBROUTINE MAINMOD: This routine merely signifies a module in GEMCS which would call in COSMOD to calculate equipment costs. In a design-cost system, it could be any design module which would call in COSMOD after its design calculations are converged, i.e., the equipment has been sized and specified to its EN vector.

SUBROUTINE FINMOD: This routine merely shows where and how a financial analysis module could be used in a design-cost system. Here, it is used to escalate the L+M cost calculated by COSMOD to the time frame of interest, using a user specified inflation factor as well as to estimate costs on a basis other than L+M. These could be the 'bare module' or 'total module' or 'battery limits' costs. Factors for upgrading L+M costs to some other basis must be supplied by the user within the FINMOD program.

COSMOD PROGRAM: COSMOD calculates the L+M cost of equipment for which certain data have been supplied by the user. COSMOD's data requirements are discussed in Appendix C. Here, COSMOD's COMMON, DIMENSION and DATA declarations are discussed.

The COMMON block for COSMOD is the same as that for GEMCS when being used in GEMCS, with the addition of EQCST(x) and TCOST(2).

Five matrices and six lists are declared in COSMOD's DIMENSION statements. A short description of each is given below.

INDEX(448) : This list is used in reading from and writing into the multiple record, random access file in which COSMOD's cost correlation data are stored.

DATA(128) : Cost data for any particular equipment is first retrieved from the data file into this list.

PARVL(5,10): Cost correlation parameter values, L+M factor, and correlation error data are reorganised in this matrix from DATA(128).

RANGE(12) : The range of the size of equipment to which the correlations in PARVL(5,10) apply are reorganised in this list from DATA(128).

CORFR(5,25): Correction factors for pressure, temperature, material of construction of equipment , etc., are retrieved from DATA(128) and organised in this matrix.

FRSLR(5,25): Values of pressures, temperatures, etc., for which the correction factors in CORFR(5,25) apply are stored in this matrix. Its data is also retrieved from DATA(128).

NTCOD(10) : This list also gets its data from DATA(128), and contains information on the units of equipment size, pressure, temperature, etc. that are to be used in a particular equipment cost correlation.

UNIT(65,3) : Data for this matrix is declared in DATA statements in the COSMOD program. The matrix contains alpha-numeric information on the units used in all the correlations and other data stored in COSMOD's data file.

LNREC(326) : This list contains information on the length of record for each equipment in the data file. It is used when retrieving data on any particular equipment from the data file. The values in LNREC(326) are declared in DATA statements in the COSMOD program.

NSPEC(12) : Stores user specified data.

SPEC(12) : Stores user specified data.

```
      PROGRAM TST (INPUT,OUTPUT,PUNCH,COISF=129,TAPE5=INPUT,TAPE6=OUTPUT
     1,TAPE7=PUNCH,TAPE1=COISF)
C     GEMCS/6400                                                        GEM  110
C                                                                       GEM  120
C     ***** COMMON DECLARATIONS - JUNE 8 *****                          GEM  130
C     ***** COMMON DECLARATIONS - JUNE 22,1971  ******                  GEM  140
C
      COMMON EQCST(50),TCOST(2)
      COMMON LLST(120),NS(120),EN(250),SI(4,21),SO(4,21),
     1       SN(58,21),
     2       IS,NE,JJ,LOOP,NIN,NOUT,MSN,MODE,NPLNT,ISP,NC,III
      COMMON KPRNT(10),NCALC,NCOMP,NSR,KTEST
      COMMON EEN(1500),NPOINT(100,2),NCOUNT
      COMMON NOPP,X,XHOLE(16),FPSC(19,16),PPMX(19)
C
C                                                                       GEM  190
C       ***NOTE*** ACHANGE IN THE SN SIZE REQUIRES A CHANGE IN III TO
C       MATCH THIS CHANGED SIZE
C        *** NOTE*** THE SIZE OF THE SN TABLE MUST BE THE NUMBER OF
C      STREAMS WHICH HAVE A 1,2,OR3 STREAM TYPE LABEL PLUS THE MAXIMUM
C      NUMBER OF OUTPUT STREAMS FROM AN EQUIPMENT MODULE WHICH HAVE A
C      7 LABEL
      READ (5,100) NCASE
CC    NCASE=NUMBER OF CASES TO BE RUN.NOTE THIS IS FIRST CARD IN DATASET
      FORMAT IS 2I5
      III=58
      ISP=0
       IQE=1
  755  PRINT 101,IQE                                                    GEM  230
C                                                                       GEM  240
CC    NOTE   LIMLI OF  FOLLOWING DO LOOP MUST EQUAL EQCST DIMENSION
C
      DO 57 K = 1,250
      EQCST(K) = 0.0
   57 CONTINUE
      TCOST(1) = 0.0
      TCOST(2) = 0.0
      NCOUNT=0                                                          GEM  220
      CALL  DLOAD1                                                      GEM  250
C
CC   READIN THE PHYSICAL PROPERTY PACKAGE
C
C                                                                       GEM  270
C     CALCULATING EQUIPMENT IN CALCULATION ORDER LIST                   GEM  280
C                                                                       GEM  290
      NC=1                                                              GEM  300
      IK=1                                                              GEM  310
      KTEST =0                                                          GEM  320
C                                                                       GEM  340
C     PRINT SN TABLE                                                    GEM  350
C                                                                       GEM  360
  707 IF((LOOP.EQ.999).AND.(NC.EQ.1)) WRITE(6,716)
  716 FORMAT(1H1,45X,* FINAL CALCULATION LOOP *,////)
      IF(LOOP.EQ.999) KTEST=1
      IF (KPRNT(8)) 710,710,709
  709 WRITE(6,112) LOOP                                                 GEM  380
```

```
      112 FORMAT(1H0,25HSN TABLE ON ENTERING LOOP,I5)                    GEM  390
          DO 111 IKE=1,III                                              GEM  400
   60     IF(SN(IKE,1).LE.0.) GO TO 111                                 GEM  410
          WRITE(6,103) (SN(IKE,J),J=1,JJ)                               GEM  420
          WRITE (6,115)                                                 GEM  430
      111 CONTINUE                                                      GEM  440
C                                                                       GEM  450
CC    65    READ EN VECTOR                                              GEM  460
C                                                                       GEM  470
      710 NE=LLST(NC)                                                   GEM  480
          MM=NE                                                         GEM  490
          CALL DISKIO(1,MM)                                             GEM  500
   70     NN=EN(3)+.001                                                 GEM  510
          NIN=EN(6)+.001                                                GEM  520
          NOLT=EN(11)+.001                                              GEM  530
          NTYPE = ABS(EN(2)) + .001                                     GEM  540
          KSW=0                                                         GEM  550
   75     IF (EN(2).LE.0.) KSW=1                                        GEM  560
          IF (KPRNT(4)) 40,40,711                                       GEM  570
      711 WRITE(6,106) NE                                               GEM  580
      106 FORMAT(1H0,19HMODULE SET FOR UNIT,I5)                         GEM  590
          WRITE(6,113)(EN(I),I=1,NN)                                    GEM  600
   80 C                                                                 GEM  610
CC        FINDING INPUT STREAMS                                         GEM  620
C                                                                       GEM  630
       40 CONTINUE                                                      GEM  640
          IF(NIN.EQ.0) GO TO 714                                        GEM  650
   85     DO 41 I = 1,NIN                                               GEM  660
          S=EN(I+6)                                                     GEM  670
          CALL STREAM(-S)                                               GEM  680
          IF(IS-III) 43,43,143                                          GEM  690
      143 CONTINUE                                                      GEM  700
   90     SI(I,1)=S                                                     GEM  710
C           IF NO STREAM AVAILABLESET SI(1,-) =0.                       GEM  720
          DO 45 J=2,JJ                                                  GEM  730
       45 SI(I,J)=0.                                                    GEM  740
          GO TO 41                                                      GEM  750
   95     43 DO 44 J=1,JJ                                               GEM  760
          44 SI(I,J)=SN(IS,J)                                           GEM  770
          IF(INT(S+.001)) 41,41,142                                     GEM  780
      142 CONTINUE                                                      GEM  790
          M=S+.001                                                      GEM  800
  100     IF(NS(M)-6)41,141,141                                         GEM  810
      141 CONTINUE                                                      GEM  820
          SN(IS,1)=0.                                                   GEM  830
       41 CONTINUE                                                      GEM  840
          IF (KPRNT(4)) 714,714,713                                     GEM  850
  105     107 FORMAT(1H0,24HINPUT STREAMS FOR MODULE,I5)                GEM  860
      713 WRITE(6,107) NE                                               GEM  870
          DO 108 IKE=1,NIN                                              GEM  880
          WRITE(6,105)(SI(IKE,J),J=1,JJ)                                GEM  890
      108 WRITE(6,115)                                                  GEM  900
  110     714 CONTINUE                                                  GEM  910
C                                                                       GEM  920
CC        FINDING OUTPUT STREAMS                                        GEM  930
C                                                                       GEM  940
          IF(NCUT.EQ.0) GO TO 51                                        GEM  950
```

```
                      DO 46 I=1,NOUT                                          GEM  900
                      S=EN(I+11)                                              GEM  910
                      CALL STREAM(-S)                                         GEM  920
                      IF(III-IS) 46,146,146                                   GEM  930
                  146 CONTINUE                                                GEM  940
                      DO 49 J=2,JJ                                            GEM  950
                   49 SO(I,J)=SN(IS,J)                                        GEM  960
                   46 SO(I,1)=S                                               GEM  970
                   51 CONTINUE
              C                                                               GEM  980
              CC
              CC      CALLING MODULES                                         GEM  990
              C                                                               GEM 1000
                      CALL MODULE(NTYPE)                                      GEM 1010
              C                                                               GEM 1020
              C                                                               GEM 1040
                   50 CONTINUE                                                GEM 1050
              C                                                               GEM 1060
              CC      STORING OUTPUT STREAMS AND PRINTING                     GEM 1070
              C                                                               GEM 1080
                      IF(NOUT)68,68,168                                       GEM 1090
                  168 CONTINUE                                                GEM 1100
                      DO 60 I=1,NOUT                                          GEM 1110
                      S=EN(I+11)                                              GEM 1120
                      M=S+.001                                                GEM 1130
                  164 IF(NS(M).NE.3) GO TO 64
                      IF(ISP.EQ.0) GO TO 64
                  165 WRITE(6,120)M                                           GEM 1160
                  120 FORMAT(1H0,26H OUTPUT FOR PRODUCT STREAM,I5)            GEM 1170
                      WRITE(6,115) (SO(I,J),J=1,JJ)
                   64 IF (NS(M)-6) 66,60,66                                   GEM 1190
                   66 CALL STREAM(-S)                                         GEM 1200
                      IF(IS-III)62,62,171                                     GEM 1210
              C         STORES IN NEXT LOCATION AVAILABLE IN SN
                  171 CALL STREAM(0.)                                         GEM 1220
                      IF (IS-III) 62,62,163                                   GEM 1230
              C       IF NO SPACE AVAILABLE IN SN WRITE (6,102)
                  163 WRITE(6,102)                                            GEM 1240
                      GO TO 60                                                GEM 1250
              C       IF NS(M) =7,SO=S STORED IN SN TABLE TEMPORARILY FOR IMMEDIATE
              CC       USE IN NEXT CALCULATION
              C        IF NS(M) =1,2,OR 3 THEN STORED PERMANENTLY
                   62 DO 63 J=1,JJ                                            GEM 1260
                   63 SN(IS,J)=SO(I,J)                                        GEM 1270
                   60 CONTINUE                                                GEM 1280
              C       STORE INPUT STREAMS IF DESIRED
                   68 CONTINUE                                                GEM 1290
                      IF(NIN.LE.0) GO TO 6899
                      DO 699 I=1,NIN
                      S=EN(I+6)
                      M=S+0.001
                      IF(NS(M).GE.6) GO TO 699
                      CALL STREAM(-S)
                      IF(IS.LE.III) GO TO 6299
                      CALL STREAM (0.)
                      IF(IS.LE.III) GO TO 6299
                      WRITE(6,102)
```

```
                GO TO 699
             6299 DO 6399 J=1,JJ
             6399 SN(IS,J)=SI(I,J)
175           699 CONTINUE
             6699 CONTINUE
                IF(NCUT.EQ.0) GO TO 99
                IF(ISP)98,98,715                                          GEM 1300
              715 WRITE(6,109)NE                                          GEM 1310
180           109 FORMAT(1H0,25HOUTPUT STREAMS FOR MODULE,I5)             GEM 1320
                DO 110 IKE=1,NOUT                                         GEM 1330
                WRITE(6,105)(SO(IKE,J),J=1,JJ)
              110 WRITE (6,115)
               98 IF(LOOP-999)99,97,97                                    GEM 1350
185             97 IF(KSW.NE.0) GO TO 72
                PRINT 114,NE                                              GEM 1370
              114 FORMAT(1H0,31HFINAL OUTPUT STREAMS FOR MODULE,I5)       GEM 1380
                IF (NOUT) 99,99,799                                       GEM 1390
             799  CONTINUE                                                GEM 1400
190             DO 116 IKE=1,NOUT                                         GEM 1410
                WRITE(6,105)(SO(IKE,J),J=1,JJ)                            GEM 1420
              116 WRITE (6,115)
               72 CONTINUE
               99 NC=NC+1
195             IF(NC-NCALC) 707,707,708                                  GEM 1440
             C                                                            GEM 1450
              708  CONTINUE                                               GEM 1460
                IF (LOOP-999) 71,70,70                                    GEM 1470
               71 CONTINUE                                                GEM 1480
200             NC=0                                                      GEM 1490
                GO TO 99                                                  GEM 1500
               70 IF(KTEST) 727,727,728                                   GEM 1510
              727 NC=0                                                    GEM 1520
                DO 729 IG=1,5                                             GEM 1530
205           729 KPRNT(IG)=0                                             GEM 1540
                KTEST=1                                                   GEM 1550
                GO TO 99                                                  GEM 1560
              728 CONTINUE
               59 WRITE(6,1(4)
210               IQE=IQE+1                                               GEM 1580
                IF(IQE.GT.NCASE) CALL EXIT
                GO TO 755                                                 GEM 1590
              100 FORMAT(2I5)                                             GEM 1600
              101  FORMAT(1H1,10X,5HCASE,1X,I5//)                         GEM 1610
215           102 FORMAT(1H ,11HERROR IN SN)                              GEM 1620
              103 FORMAT(1H ,5F15.5)
              104 FORMAT(1H2,16HEND OF EXECUTION)
              105 FORMAT(1H ,5F15.5)
            65478 FORMAT(* -------* F5.2)
220           115 FORMAT(/,1H ,*-----*)
                END
```

```
      SUBROUTINE DLOAD1
C
CCC
CC    ***** COMMON DECLARATICNS - JUNE 22,1971  ******
C
      COMMCN EQCST(50), TCOST(2)
      COMMCN LLST(120),NS(120),EN(250),SI(4,21),SO(4,21),
     1       SN(58,21),
     2       IS,NE,JJ,LOOP,NIN,NCU1,PSN,MODE,NPLNT,ISP,NC,III
      COMMCN KPRNT(10),NCALC,NOCCMP,NSR,KTEST
      COMMCN EEN(1500),NPOINT(100,2),NCOUNT
      COMMCN NOPP,X,XMOLE(16),PPSC(19,16),PPMX(19)
      COMMCN/CC/ KRUN
C                                                                      GEM  200
CCC                                                                    GEM 2640
CCC   ***** PRINTING CONTROL CHARACTERS *****                          GEM 2650
CCC                                                                    GEM 2660
CCC   KPRNT(1)=1  CAUSES PRINTING OF NCONT,LLST,NS                     GEM 2670
CCC   KPRNT(1)=0  SUPPRESSES ABOVE PRINTING                            GEM 2680
CCC   KPRNT(2)=1  CAUSES PRINTING OF INITIAL STREAMS                   GEM 2690
CCC   KPRNT(2)=0  SUPPRESSES ABOVE PRINTING                            GEM 2700
CCC   KPRNT(3)=1  CAUSES PRINTING OF MODULES SETS                      GEM 2710
CCC   KPRNT(3)=0  SUPPRESSES ABOVE PRINTING                            GEM 2720
CCC   KPRNT(4)=1  CAUSES PRINTING OF SN TABLE ON ENTERING LOOP         GEM 2730
CCC   KPRNT(4)=1  CAUSES PRINTING OF EN VECTOR FOR SPECIFIED MODULE SETGEM 2740
CCC   KPRNT(4)=1  CAUSES PRINTING OF SI MATRIX FOR SPECIFIED MODULE SETGEM 2750
CCC   KPRNT(4)=1  CAUSES PRINTING CF STREAM NUMBERS ENTERING AND LEAVINGGEM 2760
CCC               SPECIFIED MCDULES(RE- PIECE OF EQUIPMENT)            GEM 2770
CCC   KPRNT(4)=0  SUPPRESSES ABOVE PRINTING                            GEM 2780
C                                                                      GEM 2790
      DIMENSION TITLE(18), BIBLE(18)
C
CCC *** NOTE*** THE DIMENSION ON ALLST MUST BE THE SAME AS LLST ALSO THE
CCC    DIMENSION ON ANS MUST BE THE SAME AS NS
C
      DIMENSION AKPRNT(10),ALLST(120)
       DIMENSION ANS (120)
      DO 7070 I=1,250
C      ***NOTE*** THE LIMIT ON THIS DO STATEMENT MUST CORRESPOND TO THE
CC     LENGTH OF THE EN VECTOR
7070   EN(I)=0.                                                        GEM 2840
      DO 7073 I=1,21
      DO 7072 J=1,4
C      ***NOTE*** THE LIMIT ON THIS DO STATEMENT MUST CORRESPOND TO THE
C        DIMENSION ON SI AND SO
      SI(J,I)=0.                                                      GEM 2870
7072   SO(J,I)=0.                                                     GEM 2880
      DO 7073 IK=1,III
7073   SN(IK,I)=0.                                                    GEM 2900
      DO 7075 I=1,1500
 7075 EEN(I)=0.
      READ(5,108) KRUN
  116 FORMAT(/,1H ,*RUN NUMBER*,I5,/)
      WRITE(6,116) KRUN
      READ(5,100) TITLE                                               GEM 2920
      PRINT 101,TITLE                                                 GEM 2930
      READ(5,100) BIBLE
```

```
      PRINT 101,BIBLE                                                    GEM 2940
      READ (5,112) AKPRNT                                                GEM 2950
   60 DO 7171 I=1,10                                                     GEM 2960
 7171  KPRNT(I)=AKPRNT(I)                                                GEM 2970
C                                                                        GEM 2980
C     REPORT ON PRINTING EXPECTED                                        GEM 2990
C                                                                        GEM 3000
   65 IF(KPRNT(1)-1) 2,1,2                                               GEM 3010
    1 WRITE(6,103)                                                       GEM 3020
    2 IF(KPRNT(2)-1) 4,3,4                                               GEM 3030
    3 WRITE(6,104)                                                       GEM 3040
    4 IF(KPRNT(3)-1) 6,5,6                                               GEM 3050
   70 WRITE(6,105)                                                       GEM 3060
    6 CONTINUE                                                           GEM 3070
C                                                                        GEM 3080
C     READ NO. OF MODULES IN CALCULATION ORDER, AND NO. OF COMPONENTS    GEM 3090
      READ (5,112) ANCALC,ANOCOM                                         GEM 3100
   75 NCALC=ANCALC                                                       GEM 3110
      NOCOMP=ANOCOM                                                      GEM 3120
      IF(KPRNT(1)-1) 12,11,12                                            GEM 3130
   11 WRITE(6,107)NCALC,NOCOMP                                           GEM 3140
   12 CONTINUE                                                           GEM 3150
   80 IF(-NCALC)510,509,509                                              GEM 3160
  509 NCALC=-NCALC                                                       GEM 3170
      LOOP=999                                                           GEM 3180
      GO TO 511                                                          GEM 3190
  510 LOOP=1                                                             GEM 3200
   85 C                                                                  GEM 3210
C     READ CALCULATION ORDER                                             GEM 3220
C                                                                        GEM 3230
  511  READ (5,112) (ALLST(I),I=1,NCALC)                                 GEM 3240
      DO 7172 I=1,NCALC                                                  GEM 3250
   90 7172  LLST(I)=ALLST(I)                                             GEM 3260
      IF (KPRNT(1)-1)14,13,14                                            GEM 3270
   13 WRITE(6,109)(LLST(I),I=1,NCALC)                                    GEM 3280
   14 CONTINUE                                                           GEM 3290
C                                                                        GEM 3300
   95 C     READ STREAM CODES,MSN IS THE MAXIMUM STREAM NUMBER, IF NEGATIVE GEM 3310
C     OUTPUT STREAMS WILL BE PRINTED DURING EXECUTION                    GEM 3320
C                                                                        GEM 3330
      READ(5,112) AMSN                                                   GEM 3340
      MSN=AMSN                                                           GEM 3350
  100 IF(MSN.EQ.0) GO TO 531                                             GEM 3360
      IF (-MSN)520,519,519                                               GEM 3370
  519 MSN=-MSN                                                           GEM 3380
      ISP=1                                                              GEM 3390
  520 IF(KPRNT(1)-1)16,15,16                                             GEM 3400
  105  15 WRITE(6,110)MSN                                                GEM 3410
       16 READ(5,112)(ANS(I),I=1,MSN)                                    GEM 3420
      DO 7175 I=1,MSN                                                    GEM 3430
 7175  NS(I)=ANS(I)                                                      GEM 3440
      IF(KPRNT(1)-1)18,17,18                                             GEM 3450
  110  17 WRITE(6,109)(NS(I),I=1,MSN)                                    GEM 3460
       18 JJ=NCOMP+5                                                     GEM 3470
      READ(5,112) ANSR                                                   GEM 3480
      NSR=ANSR                                                           GEM 3490
      IF(KPRNT(2)-1)20,19,20
```

```
115              19 WRITE(6,111)NSR                                          GEM 3500
                 20 DO 530 I=1,NSR                                           GEM 3510
                    READ(5,112)(SN(I,J),J=1,JJ)                              GEM 3520
                    IF(KPRNT(2)-1)22,21,22                                   GEM 3530
                 21 WRITE(6,113)(SN(I,J),J=1,JJ)                             GEM 3540
120                 WRITE (6,115)
                 22 CONTINUE                                                 GEM 3550
                530 CONTINUE                                                 GEM 3560
                531 CONTINUE
              C
              CC    READING MODULE SETS,NOE IN NUMBER                        GEM 3570
125           C                                                              GEM 3580
                                                                             GEM 3590
                    READ(5,112) ANCE                                         GEM 3600
                    NOE=ANOE                                                 GEM 3610
                    IF(KPRNT(3)-1)24,23,24                                   GEM 3620
130              23 WRITE(6,114) NCE                                         GEM 3630
                 24 DO 540 I=1,NOE                                           GEM 3640
              C     LIMIT ON DO LOOP MUST BE EQUAL TO DIMENSION OF EN VECTOR
                    DO 541 IZ=1,250
                541 EN(IZ)=0.                                                GEM 3660
135                 READ(5,112)(EN(N),N=1,5)                                 GEM 3670
                    NN=EN(3)                                                 GEM 3680
                    NCOUNT=NCOUNT+NN                                         GEM 3690
                    READ(5,112)(EN(N),N=6,NN)                                GEM 3700
                    IF(KPRNT(3)-1)26,25,26                                   GEM 3710
140              25 WRITE(6,113)(EN(N),N=1,NN)                               GEM 3720
                    WRITE (6,115)
                 26 MM=EN(1)+.001                                            GEM 3730
                    NPOINT(MM,1)=NCOUNT-NN                                   GEM 3740
                    NPOINT(MM,2)=NN                                          GEM 3750
145             540 CALL DISKIO(2,MM )                                       GEM 3760
                    IF(KPRNT(5).GT.0) GO TO 766                              GEM 3770
                    GO TO 768                                                GEM 3780
                766  DO 767 I=1,NOE                                          GEM 3790
                767  WRITE(6,106)  (NPOINT(I,J),J=1,2)                       GEM 3800
150             768  CONTINUE                                                GEM 3810
              C     FORMAT STATEMENTS FOR DLOAD                              GEM 3820
              C                                                              GEM 3830
                100 FORMAT (18A4)                                            GEM 3840
                101 FORMAT(18A4)                                             GEM 3850
155             102 FORMAT (18I1)                                            GEM 3860
                103 FORMAT (1H0,22HPRINTING NCONT,LLST,NS)                   GEM 3870
                104 FORMAT (1H0,24HPRINTING INITIAL STREAMS)                 GEM 3880
                105 FORMAT (1H0,20HPRINTING MODULE SETS)                     GEM 3890
                106 FORMAT (2I5)                                             GEM 3900
160             107 FORMAT(1H0,I5,12H MODULE SETS,I5,11H COMPONENTS//        G1 03930
                   124H CALCULATION ORDER LIST-)                             G1 03931
                108 FORMAT (10I5)                                            GEM 3920
                109 FORMAT (1X,10I5)                                         GEM 3930
                110 FORMAT (1H0,I5,22HSTREAM CODES ARE READ-)                GEM 3940
165             111 FORMAT (1H0,I5,25HINITIAL STREAMS ARE READ-)             GEM 3950
                112 FORMAT(5F12.5)
                113 FORMAT (1X,5F15.5)
                114 FORMAT (1H0,I5,21HMODULE SETS ARE READ-)                 GEM 3980
                115 FORMAT(/,1H ,*----*)
170                 IF(KPRNT(6)-1) 770,769,770
                769 CALL SLIST
```

```
          770 RETURN
              END

--COMMON BLOCKS--
         1B  /CC/                    7634B  //

--EXTERNALS--
              DISKIO    INPCI.    INPCR.    OUTCI.    OUTCR.    OUTPUT=   SLIST     TAPE5=
              TAPE6=

--STATEMENT LABELS--
     .1               67B       .2               72B       .3               74B       .4               77B
     .5              101B       .6              104B       .11             115B       .12             120B
     .13             160B       .14             174B       .15             214B       .16             217B
     .17             243B       .18             257B       .19             271B       .20             274B
     .21             315B       .22             334B       .23             350B       .24             353B
     .25             417B       .26             435B       .100    F       520B       .101    F       522B
     .102    F       524B       .103    F       526B       .104    F       532B       .105    F       537B
     .106    F       543B       .107    F       545B       .108    F       555B       .109    F       557B
     .110    F       561B       .111    F       566B       .112    F       573B       .113    F       575B
     .114    F       577B       .115    F       604B       .116    F       514B       .509            124B
     .510            132B       .511            134B       .519            206B       .520            212B
     .530    D       335B       .531            341B       .540    D       445B       .541    ID        0B
     .766            457B       .767    ID      461B       .768            500B       .769            503B
     .770            506B       .7070   ID        0B       .7072   ID        0B       .7073   ID        0B
     .7075   ID        0B       .7171   ID        0B       .7172   ID        0B       .7175   ID        0B

--VARIABLE MAP--
   AKPRNT     R       1240B              10         ALLST      R  U   1252B              120
   AMSN       R       1215B                         ANCALC     R      1023B
   ANOCOM     R       1444B                         ANOE       R      1445B
   ANS        R  U    1024B              120        ANSR       R       775B
   BIBLE      R       1216B              10         DISKIO     R            SUBROUTINE
   DLOAD1     -        507B ENTRY                   EEN        R      3642B //           1500
   EN         R        444B //           250        EQCST      R         0B //           50
   I          I  U     777B                         III        I      3623B //
   IK         I  U    1443B                         INPCI.     -            EXTERNAL.
   INPCR.     -             EXTERNAL.               IS         I      3610B //
   ISP        I       3621B //                      IZ         I  U   1214B
   J          I  U    1442B                         JJ         I      3612B //
   KPRNT      I       3624B //           10         KRUN       I         0B /CC/
   KTEST      I       3641B //                      LLST       I        64B //           120
   LOOP       I       3613B //                      MM         I      1447B
   MODE       I       3617B //                      MSN        I      3616B //
   N          I  U    1000B                         NC         I      3622B //
   NCALC      I       3636B //                      NCOUNT     I      7106B //
   NE         I       3611B //                      NIN        I      3614B //
   NN         I       1446B                         NOCOMP     I      3637B //
   NOE        I        776B                         NOPP       I      7107B //
```

```
              SUBROUTINE DISKIO(IPNT,MM )                               GEM 2360
        C                                                               GEM 2410
        C     THIS SUBROUTINE SIMULATES DISKIO ON360/30                 GEM 2420
        C     IF IPNT=1.  READS FROM MODULE SETS TABLE                  GEM 2430
        C     IF IFN=2. WRITES ONTO MODULE SETS TABLE                   GEM 2440
        C
        C     ***** COMMON DECLARATIONS - JUNE 22,1971  ******
        C
              COMMON EQCST(50), TCOST(2)
              COMMON LLST(120),NS(120),EN(250),SI(4,21),SO(4,21),
             1       SN(58,21),
             2       IS,NE,JJ,LOOP,NIN,NOUT,MSN,MODE,NPLNT,ISP,NC,III
              COMMON KPRNT(10),NCALC,NCCOMP,NSR,KTEST
              COMMON EEN(1500),NPOINT(100,2),NCOUNT
              COMMON NOPP,X,XMOLE(16),PPSC(15,16),PPMX(19)
        C
              MQ=NPOINT(MM,1)                                           GEM 2450
              ML=NPOINT(MM,2)                                           GEM 2460
              IF(IPNT-1)2,1,2                                           GEM 2470
            1 DO 11 I=1,ML                                              GEM 2480
           11 EN(I)=EEN(MQ+I)                                           GEM 2490
              GO TO 70                                                  GEM 2500
            2 IF(IPNT-2)4,3,4                                           GEM 2510
            3 DO 33 I=1,ML                                              GEM 2520
           33 EEN(MQ+I)=EN(I)                                           GEM 2530
              GO TO 70                                                  GEM 2540
            4 WRITE(6,100)IPNT,MM                                       GEM 2550
          100 FORMAT(1H0,22H DISKIO ERROR-IPNT,MM=,I5,1X,I5)            GEM 2560
           70 RETURN
              END
```

--COMMON BLOCKS--

```
        7634B  //
```

--EXTERNALS--

```
                  OUTCI.     TAPE6=
```

--STATEMENT LABELS--

```
        .1             15B        .2              26B        .3         31B        .4             42B
        .11    ID       0B        .33    ID        0B        .70        45B        .100    F      53B
```

--VARIABLE MAP--

```
    DISKIO    -         47B ENTRY              EEN      R     3642B //       1500
    EN        R       4448 //        250       EQCST    R        0B //       50
    I         I  U      65B                    III      I     3623B //
    IPNT      I  AU      0B                    IS       I     3610B //
    ISP       I      3621B //                  JJ       I     3612B //
    KPRNT     I      3624B //        10        KTEST    I     3641B //
    LLST      I        64B //        120       LOOP     I     3613B //
```

```
      SUBRCUTINE STREAM(S)                                             GEM 2170
C     ***** COMMON DECLARATICNS - JUNE 22,1971  ******
C
      COMMCN EQCST(50), TCOST(2)
      COMMCN LLST(120),NS(120),EN(250),SI(4,21),SO(4,21),
     1       SN(58,21),
     2       IS,NE,JJ,LOOP,NIN,NOUT,MSN,MODE,NPLNT,ISP,NC,III
      COMMCN KPRNT(10),NCALC,NCCCMP,NSR,KTEST
      COMMCN EEN(1500),NPOINT(100,2),NCOUNT
      COMMCN NOPP,X,XMOLE(16),FPSC(19,16),PPMX(19)
C
      DO 1 IS=1,III                                                    GEM 2230
      KLK=IS
      IF(ABS(SN(IS,1)-ABS(S))-.010) 2,1,1
    1 CONTINUE                                                         GEM 2250
      IS=KLK+1
      IF (S) 2,2,3                                                     GEM 2270
    3 CONTINUE                                                         GEM 2280
      WRITE(6,400)S                                                    GEM 2290
  400 FORMAT(1H0,14HERROR...STREAM,F3.0,16HNOT IN SN MATRIX)           GEM 2300
    2 IF(KFRNT(5)) 70,70,71                                            GEM 2310
   71 WRITE(6,401)IS                                                   GEM 2320
  401 FORMAT(1H0,3HIS= ,I3)                                            GEM 2330
   70 RETURN                                                           GEM 2340
      END
```

--COMMON BLOCKS--

```
        7634B  //
```

--EXTERNALS--

```
              OUTCI.     TAPE6=
```

--STATEMENT LABELS--

```
     .1     D     16B       .2          32B       .3          27B       .70       40B
     .71          35B       .400   F    47B       .401   F    55B
```

--VARIABLE MAP--

```
  ABS      R         INTRINSIC              EEN      R     3642B //     1500
  EN       R     444B //        250         EQCST    R        0B //     50
  III      I    3623B //                    IS       I     3610B //
  ISP      I    3621B //                    JJ       I     3612B //
  KLK      I      70B                       KFRNT    I     3624B //     10
  KTEST    I    3641B //                    LLST     I       64B //     120
  LOOP     I    3613B //                    MODE     I     3617B //
  MSN      I    3616B //                    NC       I     3622B //
  NCALC    I    3636B //                    NCOUNT   I     7106B //
  NE       I    3611B //                    NIN      I     3614B //
  NOCOMP   I    3637B //                    NOPP     I     7107B //
  NOUT     I    3615B //                    NFLNT    I     3620B //
```

```
      1                 SUBROUTINE MODULE(NT)
                        GO TO (1,2),NT
                      1 CONTINUE
                        CALL MAINMOD
      5                 RETURN
                      2 CONTINUE
                        CALL FINMOD
                        RETURN
                        END
```

--EXTERNALS--

FINMOD GOTOER. MAINMOD

--STATEMENT LABELS--

.1 148 .2 208

--VARIABLE MAP--

FINMOD	R		SUBROUTINE	
MAINMOD	I		SUBROUTINE	
NT	I AU	08		
GOTOER.			MODULE	

328 PROGRAM-UNIT LENGTH 7 SYMBOLS

440008 CM STORAGE USED .044 SECONDS

```
      EXTERNAL.
25B   ENTRY
```

```
      SUBROUTINE MAINMOD
C
      COMMON EQCST(50), TCOST(2)
      COMMON LLST(120),NS(120),EN(250),SI(4,21),SO(4,21),
     1       SN(58,21),
```

```
                           2           IS,NE,JJ,LOOP,NIN,NOUT,MSN,MODE,NPLNT,ISP,NC,III
                             COMMCN KPRNT(10),NCALC,NOCOMP,NSR,KTEST
                             CCMMCN EEN(1500),NFOINT(100,2),NCOUNT
                             COPMCN NOFP,X,XMOLE(16),PPSC(19,16),PPMX(19)
     10            C
                             IF((LOOP.EQ.999).AND.(KTEST.EQ.1)) CALL COSMOD
                             RETURN
                             END
```

--COMMON BLOCKS--

```
          76348  //
```

--EXTERNALS--

```
                    COSMOD
```

--VARIABLE MAP--

```
     COSMOD     R                SUBROUTINE                      EEN      R       36428 //          1500
     EN         R        4448 //           250                   EQCST    R          0B //          50
     III        I       36238 //                                 IS       I       36108 //
     ISP        I       36218 //                                 JJ       I       36128 //
     KPRNT      I       36248 //           10                    KTEST    I       36418 //
     LLST       I         648 //           120                   LOOP     I       36138 //
     MAINMOD    -         168 ENTRY                              MODE     I       36178 //
     MSN        I       36168 //                                 NC       I       36228 //
     NCALC      I       36368 //                                 NCOUNT   I       71068 //
     NE         I       36118 //                                 NIN      I       36148 //
     NOCCMP     I       36378 //                                 NOPP     I       71078 //
     NOUT       I       36158 //                                 NFLNT    I       36208 //
     NPOINT     I       65768 //           200                   NS       I        2548 //          120
     NSR        I       36408 //                                 PPMX     R       76118 //          19
     PPSC       R       71318 //           384                   SI       R       10368 //          84
     SN         R       13068 //           1218                  SO       R       11628 //          84
     TCOST      R         628 //           2                     X        R       71108 //
     XMOLE      R       71118 //           16
```

```
   76568  PROGRAM-UNIT LENGTH          35 SYMBOLS
    440008 CM STORAGE USED            .084 SECONDS
```

```
      SUBROUTINE COSMOD
      COMMON EQCST(50), TCOST(2)
      COMMCN LLST(120),NS(120),EN(250),SI(4,21),SO(4,21),
     1       SN(50,21),
     2       IS,NE,JJ,LOOP,NIN,NOUT,MSN,MODE,NPLNT,ISP,NC,III
      COMMON KPRNT(10),NCALC,NOCCMP,NSR,KTEST
      COMMCN EEN(1500),NPOINT(100,2),NCOUNT
      COMMON NOPP,X,XMOLE(16),PPSC(19,16),PPMX(19)
      DIMENSION PARVL(5,10), RANGE(12),CORFR(5,25),FRSLR(5,25)
      DIMENSION NSPEC(12),SPEC(12)
      DIMENSION INDEX(448),DATA(128),NTCOD(18),UNIT(65,3),LNREC(326)
      DATA (UNIT(1,I),I=1,3) /*SQ-M     *,*          *,*          */
      DATA (UNIT(2,I),I=1,3) /*DEL.     *,*          *,*          */
      DATA (UNIT(3,I),I=1,3) /*PRESSURE*,* (PSI)    *,*          */
      DATA (UNIT(4,I),I=1,3) /*MATRL OF*,* CONST    *,*          */
      DATA (UNIT(5,I),I=1,3) /*ADDITION*,*AL CONDI*,*TIONS      */
      DATA (UNIT(6,I),I=1,3) /*CU-M/SEC*,*          *,*          */
      DATA (UNIT(7,I),I=1,3) /*FOB      *,*          *,*          */
      DATA (UNIT(8,I),I=1,3) /*KW       *,*          *,*          */
      DATA (UNIT(9,I),I=1,3) /*CU-M/MIN*,*          *,*          */
      DATA (UNIT(10,I),I=1,3)/*METERS   *,*          *,*          */
      DATA (UNIT(11,I),I=1,3)/*TUBE MAT*,*RL         *,*          */
      DATA (UNIT(12,I),I=1,3)/*TYPE OF *,*USAGE      *,*          */
      DATA (UNIT(13,I),I=1,3)/*INSTLD. *,*          *,*          */
      DATA (UNIT(14,I),I=1,3)/*PRESSURE*,*(PSIG)     *,*          */
      DATA (UNIT(15,I),I=1,3)/*KG/HR    *,*          *,*          */
      DATA (UNIT(16,I),I=1,3)/*MG/DAY   *,*          *,*          */
      DATA (UNIT(17,I),I=1,3)/*HP       *,*          *,*          */
      DATA (UNIT(18,I),I=1,3)/*RPM      *,*          *,*          */
      DATA (UNIT(19,I),I=1,3)/*TYPE OF *,*ENCLOSUR*,*E           */
      DATA (UNIT(20,I),I=1,3)/*(HP)/(RP*,*M**0.2) *,*          */
      DATA (UNIT(21,I),I=1,3)/*SUPER-HE*,*AT(DEG F*,*)         */
      DATA (UNIT(22,I),I=1,3)/*HP(NOM R*,*EDUC RAT*,*IO**0.5)*/
      DATA (UNIT(23,I),I=1,3)/*US GAL   *,*          *,*          */
      DATA (UNIT(24,I),I=1,3)/*BARE WT  *,*          *,*          */
      DATA (UNIT(25,I),I=1,3)/*L(0**1.5*,*) (IN FE*,*ET)       */
      DATA (UNIT(26,I),I=1,3)/*CU-M     *,*          *,*          */
      DATA (UNIT(27,I),I=1,3)/*WT       *,*          *,*          */
      DATA (UNIT(28,I),I=1,3)/*FLD ERTD*,*          *,*          */
      DATA (UNIT(29,I),I=1,3)/*CU-FT    *,*          *,*          */
      DATA (UNIT(30,I),I=1,3)/*(US GAL)*,*/DAY       *,*          */
      DATA (UNIT(31,I),I=1,3)/*ACRES    *,*          *,*          */
      DATA (UNIT(32,I),I=1,3)/*CU-FT/MI*,*N          *,*          */
      DATA (UNIT(33,I),I=1,3)/*SQ-FT    *,*          *,*          */
      DATA (UNIT(34,I),I=1,3)/*(SHORT T*,*ONS)/DAY*,*          */
      DATA (UNIT(35,I),I=1,3)/*MEGAGRAM*,*S/HR       *,*          */
      DATA (UNIT(36,I),I=1,3)/*DIA (IN  *,*FEET)     *,*          */
      DATA (UNIT(37,I),I=1,3)/*H(0**1.6*,*5) (IN F*,*EET)      */
      DATA (UNIT(38,I),I=1,3)/*(LBS/YR)*,**0.65      *,*          */
      DATA (UNIT(39,I),I=1,3)/*PRESSURE*,* (MM HG)   *,*          */
      DATA (UNIT(40,I),I=1,3)/*CU-M/DAY*,*          *,*          */
      DATA (UNIT(41,I),I=1,3)/*CU-M/HR  *,*          *,*          */
      DATA (UNIT(42,I),I=1,3)/*LB/HR    *,*          *,*          */
      DATA (UNIT(43,I),I=1,3)/*TEMP(DEG*,* C)        *,*          */
      DATA (UNIT(44,I),I=1,3)/*FT*((FT/*,*SEC)**0.*,*35)       */
      DATA (UNIT(45,I),I=1,3)/*(W)(L**0*,*.2) (IN  *,*FT)      */
      DATA (UNIT(46,I),I=1,3)/*DIA (INC*,*HES)       *,*          */
```

```
      DATA (UNIT(47,I),I=1,3)/*FT      *,*         *,*         */
      DATA (UNIT(48,I),I=1,3)/*(W)(D**1*,*.25) (IN*,* FEET)   */
      DATA (UNIT(49,I),I=1,3)/*(W)(D**1*,*.65) (IN*,*FEET)    */
      DATA (UNIT(50,I),I=1,3)/*(W)(D**1*,*.5) (IN *,*FEET)    */
      DATA (UNIT(51,I),I=1,3)/*INCHES  *,*         *,*        */
      DATA (UNIT(52,I),I=1,3)/*(INCHES**,**0.65)*L*,*B/HR     */
      DATA (UNIT(53,I),I=1,3)/*NM**3/SE*,*C        *,*        */
      DATA (UNIT(54,I),I=1,3)/*DEL+ERTC*,*         *,*        */
      DATA (UNIT(55,I),I=1,3)/*PRESSURE*,* (MPA)   *,*        */
      DATA (UNIT(56,I),I=1,3)/*KG/(H*KP*,*A) (ABS)*,*         */
      DATA (UNIT(57,I),I=1,3)/*KG/DAY  *,*         *,*        */
      DATA (UNIT(58,I),I=1,3)/*(CU-M/SE*,*C) (M**0.*,*5)      */
      DATA (UNIT(59,I),I=1,3)/*(M**2.5)*,*((CU-M/S*,*EC)**.6)*/
      DATA (UNIT(60,I),I=1,3)/*SUCTION *,*PRESSURE*,* (PSI)   */
      DATA (UNIT(61,I),I=1,3)/*EXIT PRE*,*SSURE (P*,*SI)      */
      DATA (UNIT(62,I),I=1,3)/*PUMP ONL*,*Y        *,*        */
      DATA (UNIT(63,I),I=1,3)/*EXTERNAL*,*         *,*        */
      DATA (UNIT(64,I),I=1,3)/*PRICE   *,*         *,*        */
      DATA (UNIT(65,I),I=1,3)/*NM**3/HR*,*         *,*        */
      DATA (LNREC(I),I=1,326)
     1/65,20,20,20,20,30,30,35,20,40,20,35,35,35,25,45,45,35,30,30,
     120,20,25,20,30,30,30,25,25,25,20,20,40,20,20,35,20,20,35,30,
     120,20,20,35,20,20,30,30,30,20,20,20,20,30,20,20,20,45,45,45,
     120,20,35,30,30,20,20,30,25, 0, 0, 0, 0, 0,55,65,55, 0,65,75,
     165, 0, 0, 0, 0, 0,30,20,20,20,35,35,45,45,25,25,30,30,30,40,
     120, 0,20,25,30,25,20, 0, 0, 0,20,20,20,30,30,25,25,30,25,25,
     130,20,20,25, 0, 0,25,25,20, 0,25,30,30,25,30,45,20,30,20,20,
     120,20,20,20,20,20,20,20,20,20,20,20, 0, 0, 0,25,30,25,25,20,30,
     140,20,35,40,40,30,25, 0, 0, 0, 0, 0,25,25,20,20,20,25,20,30,
     120,20,30, 0,25,30,25,20,30, 0,25,25,40,25,25,30,30,25,30,20,
     120,35,25,30,25,25,25,30,30,20,20,35,30,50,30,30,35,20,25,30,
     120,20,25,25,45, 0,25,35,25,20,35,45,20,20,20,20,20,45,30,20,
     120,35,30,25,20,25,20,25,25,25,20,25,30,25,25,25, 0,25,25, 0,
     125,20,20,30,20,25,30,25,25,20,45,20,30, 0, 0, 0,20,20,20, 0,
     140,20,20,25,20,20,30,70,55,55,55,50, 0,40,30,45,20,30,25,45,
     130,35, 0,20,20,20,30,35,25,35,40,20,50,25,30,20,50,20,20,20,
     120,20,20,20,30,30/
      DATA AMSOX, IYR / 472., 1976 /
C
C
      WRITE(6,300) EN(1),IYR
  300 FORMAT(1H0,1X,*COST ESTIMATION     MODULE SET *,F3.1,//,3X,* EQPT.
     1 CODE    REF. NO.      SIZE          *,17X,*1976 COST($)*,10X,*ES
     1TIMATED *,I4,* LOM COST($)*)
      DO 10 J1=1,128
   10 DATA(J1)=0.0
      KEY = 0
      I = 0
      NX=INT(ABS(EN(4))-0.9)
      IF(NX.LT.4) RETURN
  120 CONTINUE
      DO 150 N=1,12
      NSPEC(N)=0.0
  150 SPEC(N)=0.0
      N=NX+1
      IREF=INT(EN(N)*10.**9+0.0001)-(INT(EN(N)*10.**6+0.0001))*10**3
```

```
SUBROUTINE COSMOD     73/73   TS

115                   WRITE(6,301) EN(M), EN(N+1), IREF
                301   FORMAT(1H0,3X,F12.9, /,4X,F12.9, I8)
                100   NX = NX+1
                      JK = 0
                      IF((EN(NX).LT.0.).AND.(I.GE.3)) JK = 1
120             110   A1 =ABS(EN(NX))
                      IF((I.LT.3).OR.(A1.LT.1.)) GO TO 709
                      EQCOST = A1
                      EQCST(IREF) = EQCST(IREF) + A1
                      TCOST(2) = TCOST(2) + A1
125                   NX = NX+1
                      TCOST(1) = TCOST(1) + EN(NX)
                      K2 = 63
                      NX = NX+2
                      GO TO 707
130             709   CONTINUE
                      IF(I.EQ.3) A1=A1*100.0
                101   M = INT(A1+0.001)
                      I = I + 1
                      NSPEC(I) = M
135                   A2 = FLOAT(M)
                      A1 = (A1 - A2)*100.0
                      IF(I.LE.2) A1=A1*10.0
                      IF(I.EQ.3) GO TO 100
                      IF((A1.LT.0.01).AND.(I.GT.3)) GO TO 130
140                   GO TO 101
                130   CONTINUE
                      NX = NX + 1
                      SPEC(1) = EN(NX)
                      NX = NX+1
145                   FACMCO = EN(NX)
                      NX = NX+1
                      PF = EN(NX)
                      DO 103 J1=4,I
                      IF(NSPEC(J1).LE.90) GO TO 102
150                   NX = NX + 1
                      SPEC(J1)=EN(NX)
                102   CONTINUE
                103   CONTINUE
                      NEQPT = NSPEC(2)
155                   IKEY = NSPEC(3)
                      IF((IKEY.EQ.KEY).AND.(JK.EQ.0)) GO TO 209
                      KEY = NSPEC(3)
                      IF(LNREC(KEY).LT.1) GO TO 700
                      LREC = LNREC(KEY)
160                   CALL OPENMS(1,INDEX,448,0)
                      CALL READMS(1,DATA,LREC,KEY)
                      CALL CLOSMS(1)
                      DO 201 J1 = 1,12
                201   RANGE(J1) = 0.0
165                   DO 202 J1 = 1,5
                      DO 214 J2 = 1,25
                      CORFR(J1,J2) = 0.0
                214   FRSLR(J1,J2) = 0.0
                202   CONTINUE
170                   DO 203 J1=1,5
                      DO 204 J2 = 1,10
```

```
      204 PARVU(J1,J2) = 0.0
      203 CONTINUE
          N1 = INT(DATA(1)+0.1)
175       N2 = N1*2 + 2
          DO 205 J1 = 1,N2
          RANGE(J1) = DATA(J1)
      205 CONTINUE
          IF(JK.EQ.0) GO TO 112
180       J1 = INT(RANGE(1) + 2.(1)
          RANGE(2) = 0.
          RANGE(J1)= 999999999999.
      112 CONTINUE
          DO 206 J1 = 1,N1
185       DO 207 J2 = 1,10
          N2 = N2+1
      207 PARVU(J1,J2) = DATA(N2)
      206 CONTINUE
          N2 = N2+1
190       K1 = DATA(N2)
          DO 212 J1 = 1,K1
          N2 = N2+1
          NTCOD(J1) = DATA(N2)
      212 CONTINUE
195       N2 = N2+1
          K2 = 0
      208 K2 = K2+1
          K1 = INT(DATA(N2))
          IF(K1.EQ.0) GO TO 209
200       N2 = N2+1
          K3 = IABS(K1)
          DO 210 J1 = 1,K3
          CORFR(K2,J1) = DATA(N2)
          N2 = N2+1
205       IF(K1.LT.0) GO TO 208
          DO 211 J1 = 1,K3
          FRSLR(K2,J1) = DATA(N2)
          N2 = N2+1
210   211 CONTINUE
          GO TO 208
      209 CONTINUE
          K2 = NTCOD(1)
          AK = RANGE(2)
215       IF(SPEC(1).GE.AK) GO TO 121
      215 K1 = -2
      125 CONTINUE
          K3 = K1 + 3
          WRITE(6,122) SPEC(K3),(UNIT(K2,I),I=1,3)
220   122 FORMAT(6X,*NOTE* SPECIFICATION=*,E12.5,1X,3A8,/,6X,*IS OUTSIDE RA
         1NGE OF DATA.*,/,6X,*EQPT. GENERALLY MANUFACTURED IN FOLLOWING RANG
         1E  *,/)
          IF(K3.GT.1) GO TO 216
          DO 217 J1 = 1,N1
225       J2 = RANGE(N1+J1+2)
          IF(J2.LT.0) GO TO 218
          WRITE(6,219) RANGE(J1+1),RANGE(J1+2),(UNIT(K2,I),I=1,3)
      219 FORMAT(6X,E12.5,2X,*TO*,2X,E12.5,2X,3A8)
```

```
                  218 CONTINUE
230               217 CONTINUE
                      GO TO 220
                  216 DO 221 J1 = 1,25
                      IF(FRSLR(K1,J1).EQ.0.0) GO TO 220
                      WRITE(6,270) FRSLR(K1,J1),(UNIT(K2,I),I=1,3)
235               270 FORMAT(6X,E12.5,2X,3A8)
                  221 CONTINUE
                  220 CONTINUE
                      IF(AK-SPEC(K3))222,223,223
                  222 WRITE(6,224)
240               224 FORMAT(1H0,6X,*EQPT. COST NOT CALCULATED. SPECIFICATION MODIFICATI
                     1ON REQUIRED.*,/)
                      GO TO 703
                  223 WRITE(6,225)
                  225 FORMAT(1H0,6X,*EQPT. OF MIN. AVAILABLE SPECIFICATION ASSUMED.*,/)
245                   SPEC(K3) = AK
                      IF(K3.GT.1) GO TO 302
                  121 CONTINUE
                      N2 = 0
                      DO 111 J1=1,N1
250                   N2 = N2+1
                      AK = RANGE(J1+2)
                      IF(SPEC(1).LE.AK) GO TO 105
                  111 CONTINUE
                      GO TO 215
255               105 CONTINUE
                      J2 = RANGE(N1+J1+2)
                      AK = RANGE(J1+1)
                      IF(J2) 215,215,20
                   20 CONTINUE
260                   IF(FACMOD.NE.0.0) PARVL(N2,5) = FACMOD
                      IF(PF.NE.0.0) PARVL(N2,9) = PF
                      IF(EN(N)) 21,21,22
                   21 CONTINUE
                      WRITE(6,23) NEQPT,PARVL(N2,1),PARVL(N2,2),SPEC(1),PARVL(N2,3),
265                  1(UNIT(K2,I),I=1,3),PARVL(N2,4),PARVL(N2,5),AMSDX,IYR
                   23 FORMAT(2X,*VALUES USED FOR FOLLOWING COST ESTIMATES*,//,6X,
                     1*NUMBER OF IDENTICAL UNITS   *,I5,/,6X,*BASE COST    $*,F10.0,/,6X,
                     1*BASE SIZE    *,E12.5,/,6X,*SPECIFIED SIZE    *,E12.5,/,6X,
                     1*UNITS OF SIZE *E12.5,1X,3A8,/,6X,*EXPONENT    *,F4.2,/,6X,
270                  1*MDL FACTOR    *,F5.3,/,6X,*MS INDEX    *,F6.1,3X,*FOR YEAR   *,I5,
                     1//,2X,*OTHER MULTIPLICATION FACTORS USED *,/)
                   22 EQCOST=PARVL(N2,1)*((SPEC(1)/( PARVL(N2,2)*PARVL(N2,3)))**PARVL(N2
                     1,4))
                      K1 = 0
275                   CM = 1.0
                  115 K1 = K1 + 1
                      M=1
                      K4 = K1+3
                      IF(NSPEC(K4).LT.0.01) GO TO 119
280                   K2 = NTCOC(K1+2)
                      IF(NSPEC(K4).LE.90) GO TO 116
                      AK = FRSLR(K1,M)
                      IF(AK.NE.0.0) GO TO 40
                      WRITE(6,41) SPEC(K4),(UNIT(K2,I),I=1,3)
285                   41 FORMAT(6X,*ERROR* SELECTION OF CORRECTION FACTOR CANNOT BE MADE F
```

```
     10R SPECIFICATION = ',E12.5,1X,3A8,/,6X,'COST NOT CALCULATED.')
         GO TO 703
  40 IF(SPEC(K4).LT.AK) GO TO 125
 302 CONTINUE
290      IF(AK.EQ.0.0) GO TO 125
         IF(SPEC(K4).LE.AK) GO TO 118
         M=M+1
         AK = FRSLR(K1,M)
         GO TO 302
295  115 CONTINUE
         M=NSPEC(K4)
  118 EQCOST = EQCOST*CORFR(K1,M)
         IF(K2.EQ.4) CM = CM*CORFR(K1,M)
         IF(EN(N).LT.0.0) WRITE(6,50) CORFR(K1,M),(UNIT(K2,I),I=1,3)
300   50 FORMAT(6X,F6.3,4X,'FOR',4X,3A8)
         GO TO 115
  119 CONTINUE
         K2 = NTCOD(2)
         IF((EN(N).LT.0.0).AND.(PARVL(N2,8).NE.1.0)) WRITE(6,60) (UNIT(K2,I
305     1),I=1,2), PARVL(N2,8)
   60 FORMAT(1H0,6X,2A8,'COST REDUCED TO FOB BY FACTOR ',F4.2,/)
         EQCOST = EQCOST*FLCAT(NEQPT)*AMSOX/300.
         FOBCST = EQCOST/(CM*PARVL(N2,8))
         TCOST(1)=TCOST(1) + FOBCST
310      IF(CM.NE.1.0) GO TO 708
         A1 = FOBCST*PARVL(N2,5)
         EQCST(IREF) = EQCST(IREF) + A1
         TCOST(2) = TCOST(2) + A1
         GO TO 707
315  708 CONTINUE
                  A1= FOBCST*CM+FOBCST*(PARVL(N2,5)-PARVL(N2,9)-1)+FOBCST*C
     1M*PARVL(N2,9)*0.7
         EQCST(IREF) = EQCST(IREF) + A1
         TCOST(2) = TCOST(2) + A1
320  707 CONTINUE
         J1 = NTCOD(1)
         WRITE(6,706) SPEC(1), (UNIT(J1,I),I=1,3), EQCOST,UNIT(K2,1), A1
  706 FORMAT(1H+,25X,E12.5,1X,3A8,F10.0,2X,A8,9X,F10.0)
  703 IF(IABS(NSPEC(1))) 106,106,702
325  702 I=0
         DO 70 J1=1,LREC
   70 DATA(J1) = 0.0
         GO TO 120
  700 CONTINUE
330      WRITE(6,701) EN(N), EN(N+1)
  701 FORMAT(1H0,///,2X,'***ERROR** CHECK EQPT. CODE ',2F12.10,' COST NOT
     1 CALCULATED')
         GO TO 703
  106 CONTINUE
335      RETURN
         END
```

```
      SUBRCUTINE FINMOD
C
C     COMMCN EQCST(50), TCOST(2)
C
      DATA ENGG,FLDEXP,CONGCY,CONFEE,FTI,BLBLDG,ESCLAF,INYR,CTHER,COMP
     1/0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 1976, 0.0, 0.0/
C     *** NOTE *** EXPRESS ESCLAF IN REAL WHCLE NUMBER (PERCENT ESCALATICN)
C                  INYR IN INTEGER,    REST IN DECIMAL FRACTIONS  ******
C
C
      WRITE(6,10) TCOST(2)
   10 FORMAT(1H1,90X,*--------------*,//,28X,*TOTAL CIRECT L+M COST*43X,
     1F10.0)
      WRITE(6,20) TCOST(1)
   20 FORMAT(1H0,31X,*(ESTIMATED TOTAL EQPT. COST, C/S, FOB, 1976 $*,F10
     1.0,*)*)
      COST = TCOST(1)*FTI
      TCOST(2) = TCOST(2) + COST
      WRITE(6,30) FTI,      COST
   30 FORMAT(1H0,31X,*FREIGHT,TAXES, INSURANCE (AT *,F4.2,* OF FOB C/S C
     1OST)*,10X,F10.0)
      COST = TCOST(1)*ENGG
      TCOST(2) = TCOST(2) + COST
      WRITE(6,40) ENGG,     COST
   40 FORMAT(1H0,31X,*ENGINEERING (AT *,F4.2,* OF FOB C/S COST)* 23X,F10
     1.0)
      COST = TCOST(1)*FLDEXP
      TCOST(2) = TCOST(2) + COST
      WRITE(6,50) FLDEXP,     COST
   50 FORMAT(1H0,31X,*FIELD EXPENSES (AT *,F4.2,* OF FOB C/S COST)*,28X,
     1F10.0)
      COST = TCOST(1)*CONFEE
      TCOST(2) = TCOST(2) + COST
      WRITE(6,60) CONFEE,     COST
   60 FORMAT(1H0,31X,*CONTRACTOR FEE (AT *,F4.2,* OF FOB C/S COST)*,
     120X,F10.0)
      COST = TCOST(1)*CONGCY
      TCOST(2) = TCOST(2) + COST
      WRITE(6,70) CONGCY,     COST
   70 FORMAT(1H0,31X,*CONTINGENCY (AT *,F4.2,* OF FOB C/S COST)*,
     123X,F10.0)
      COST = TCOST(1)*BLBLDG
      TCOST(2) = TCOST(2) + COST
      WRITE(6,80) BLBLDG,     COST
   80 FORMAT(1H0,31X,*BL BUILDING (AT *,F4.2,* OF FOB C/S COST)*,
     123X,F10.0)
      COST = TCOST(1)*OTHER
      TCOST(2) = TCOST(2) + COST
      WRITE(6,90) OTHER,      COST
   90 FORMAT(1H0,31X,*OTHER COSTS (AT *,F4.2,* OF FOB C/S COST)*
     123X, F10.0)
      IF(COMP.EC.0.0) GO TO 140
      COST = TCOST(2)*COMP
      WRITE(6,120) COMP, COST
  120 FORMAT(1H0,31X,*ADDITIONAL CONTINGENCY (AT *,F4.2,* OF TOTAL COST)
```

```
                     1$,18X,F10.0,/,31X,$(FOR STAGE OF DEVELOPMENT OF FLOWSHEET)$)
                      TCOST(2) = TCOST(2) + COST
60                  140 CONTINUE
                      WRITE(6,100) TCOST(2)
                    100 FORMAT(1H0,90X,$--------------$,//////, 28X,$TOTAL FIXED CAPITAL
                     1INVESTMENT   1976 $ $24X,F10.0,/,28X$(EXCL. SITE PREP. AND AUX.)$)
                      IF(INYR.EQ.1976) GO TO 200
65                    TCOST(2) = TCOST(2)*(1.+ESCLAF/100.)**(INYR-1976)
                      WRITE(6,110) INYR, ESCLAF, COST
                    110 FORMAT(1H0,//,11X,$ESTIMATED COST IN $I4,$ (AT$, F3.1,
                     1$ PERCENT INFLATION)$, 23X,F10.0)
                    200 CONTINUE
70                    RETURN
                      END
```

--COMMON BLOCKS--

```
            648  //
```

--EXTERNALS--

```
                  OUTCI.    TAPE6=    XTOI.
```

--STATEMENT LABELS--

.10	F	1358	.20	F	1458	.30	F	1578	.40	F	1668
.50	F	1768	.60	F	2068	.70	F	2168	.80	F	2268
.90	F	2368	.100	F	2638	.110	F	3018	.120	F	2468
.140		1058	.200		1268						

--VARIABLE MAP--

BLBLDG	R	4138			COMP	R	4118		
CONFEE	R	4108			CONGCY	R	4168		
CCST	R	4208			ENGG	R	4158		
EQCST	R	08	//	58	ESCLAF	R	4148		
FINMOD	-	1308	ENTRY		FLOEXP	R	4128		
FTI	R	4078			INYR	I	4178		
OTHER	R	4068			OUTCI.	-		EXTERNAL.	
TAPE6=	-		EXTERNAL.		TCOST	R	628	// 2	
XTOI.	-		EXTERNAL.						

5058 PROGRAM-UNIT LENGTH 31 SYMBOLS

440008 CM STORAGE USED .328 SECONDS

APPENDIX B

GEMCS and COSMOD outputs for preliminary capital cost estimations of Plants #1, #2 and #3 are filed here.

It may be noted that the equipment code supplied by the user is truncated in the GEMCS output, but not in the COSMOD output. (Refer to Appendix C for explanation of equipment code).

An example of a detailed output from COSMOD is also included. How such an output may be obtained is explained in Appendix C.

Note that the input data for the three cost estimation cases are shown in the GEMCS output. Outputs for Plant #1 are on pages B-2 to B-7, for Plant #2 on pages B-8 to B-10 and for Plant #3 on pages B-11 to B-14.

```
          CASE      1


RUN NUMBER     1
      TEST OF COST-ESTIMATING SYSTEM
      ALKYLATION PLANT
PRINTING NCONT,LLST,NS
PRINTING INITIAL STREAMS
PRINTING MODULE SETS
   -2 MODULE SETS     0 COMPONENTS
CALCULATION ORDER LIST-
     1     2
     2MODULE SETS ARE READ-
        1.00000        1.00000          240.00000          16.00000
        0.00000        0.00000            0.00000           0.00000
        0.00000        0.00000            0.00000           0.00000
        1.00108         .01060        11000.00000           0.00000
        1.00108         .01060        13000.00000           0.00000
        1.00108         .01060        15000.00000           0.00000
        1.00108         .01010         1000.00000           0.00000
        1.00108         .01010         1000.00000           0.00000
        1.00108         .03010         3000.00000           0.00000
        1.00108         .03010         3000.00000           0.00000
        1.00108         .04010         5650.00000           0.00000
        1.00108         .01010         1000.00000           0.00000
        1.00108         .03010         3000.00000           0.00000
        1.00108         .03010         3000.00000           0.00000
        1.00108         .03010         1000.00000           0.00000
        1.00108         .01010         1000.00000           0.00000
        1.00108         .01010        12200.00000           0.00000
        1.00208         .01010         1000.00000           0.00000
        1.00108         .01110          940.00000           0.00000
        1.00208         .01110        20000.00000           0.00000
        1.00108         .01010        20000.00000           0.00000
        1.03716         .01030            4.00000           0.00000
        1.08016         .01030            4.00000           0.00000
        1.00100         .01160          678.00000           2.00000
        1.00100         .01160           28.00000           2.00000
        1.00100         .01010          103.00000           0.00000
        1.00200         .01010          224.00000           0.00000
        1.00200         .01010           49.00000           0.00000
        1.00200         .01010           24.00000           0.00000
        1.00100         .01010           43.00000           0.00000
        1.00100         .01010          122.00000           0.00000
        1.00100         .01010           24.00000           0.00000
        1.00400         .01010          122.00000           0.00000
        1.00200         .01010           49.00000           0.00000
        1.00100         .01010           98.00000           0.00000
        1.00100         .01010           59.00000           0.00000
        1.00200         .01010          578.00000           0.00000
        1.00200         .01010           49.00000           0.00000
        1.00212         .05000          199.90000           0.00000
        1.00104         .01010          500.00000           0.00000
```

1.00129	.01010	56.00000	0.00000
1.00129	.01020	56.00000	0.00000
1.00129	.01020	75.00000	0.00000
1.00229	.01020	93.00000	0.00000
1.00129	.01020	2.50000	0.00000
1.00129	.01020	15.00000	0.00000
1.00129	.01010	8.00000	0.00000
.00127	0.00000	746.00000	2.20000

2.00000	2.00000	15.00000	0.00000
0.00000	0.00000	0.00000	0.00000

0.000000
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000
0.000000

0.000000
0.000000
0.000000

FINAL CALCULATION LOOP

COST ESTIMATION MODULE SET 1.0

EQPT. CODE	REF. NO.	SIZE	1976 COST($)		ESTIMATED 1976 L+M COST($)
1.001075001 .010601000	1	.11000E+05 US GAL	83287.	FOB	118085.
1.001075005 .010601000	5	.13000E+05 US GAL	92376.	FOB	130972.
1.001075006 .010601000	6	.15000E+05 US GAL	100947.	FOB	143123.
1.001075011 .010101000	11	.10000E+04 US GAL	2989.	FOB	6577.
1.001080004 .010101000	4	.10000E+04 US GAL	3199.	FOB	9596.
1.001080012 .030101000	12	.30000E+04 US GAL	8083.	FOB	24248.
1.001080013 .030101000	13	.30000E+04 US GAL	8083.	FOB	24248.
1.001080016 .040101000	16	.56500E+04 US GAL	15902.	FOB	47706.
1.001080020 .010101000	20	.10000E+04 US GAL	3199.	FOB	9596.
1.001080023 .030101000	23	.30000E+04 US GAL	8083.	FOB	24248.
1.001080024 .030101000	24	.30000E+04 US GAL	8083.	FOB	24248.
1.001080025 .030101000	25	.10000E+04 US GAL	3998.	FOB	11995.
1.001080026 .010101000	26	.10000E+04 US GAL	3199.	FOB	9596.
1.001080032 .010101000	32	.12200E+05 US GAL	22535.	FOB	67606.
1.002080044 .010101000	44	.10000E+04 US GAL	6397.	FOB	19192.
1.001080042 .011101000	42	.94000E+03 US GAL	20121.	FOB	30927.
1.002080036 .011101000	36	.20000E+05 US GAL	454844.	FOB	699130.

1.001080045 .010101000	45	.20000E+05	US GAL
1.037163033 .010300000	33	.40000E+01	DIA (IN FEET)
1.080163034 .010300000	34	.40000E+01	DIA (IN FEET)
1.001001003 .011604000	3	.67800E+03	SQ-M
1.001001007 .011604000	7	.28000E+02	SQ-M
1.001001008 .010100000	8	.10300E+03	SQ-M
1.002001010 .010100000	10	.22400E+03	SQ-M
1.002001014 .010100000	14	.49000E+02	SQ-M
1.002001015 .010100000	15	.24000E+02	SQ-M
1.001001017 .010100000	17	.43000E+02	SQ-M
1.001001018 .010100000	18	.12200E+03	SQ-M
1.001001019 .010100000	19	.24000E+02	SQ-M
1.004001021 .010100000	21	.12200E+03	SQ-M
1.002001022 .010100000	22	.49000E+02	SQ-M
1.001001027 .010100000	27	.98000E+02	SQ-M
1.001001029 .010100000	29	.59000E+02	SQ-M
1.002001030 .010100000	30	.57800E+03	SQ-M
1.002001031 .010100000	31	.49000E+02	SQ-M
1.002120002 .050000000	2	.19990E+03	HP
1.001036028 .010100000	28	.50000E+03	KW
1.001292035			

34988.	FOB	104964.
7824.	DEL.	13607.
16916.	DEL.	29420.
58785.	DEL.	63897.
6118.	DEL.	6649.
12854.	DEL.	22354.
44629.	DEL.	77616.
15170.	DEL.	26382.
9139.	DEL.	15894.
6913.	DEL.	12023.
14495.	DEL.	25209.
4569.	DEL.	7947.
57981.	DEL.	100837.
15170.	DEL.	26382.
12407.	DEL.	21578.
8654.	DEL.	15050.
87480.	DEL.	152139.
15170.	DEL.	26382.
73820.	FOB	127704.
16713.	FOB	27576.

.010100000	35	.56000E+02 KW
1.001292037 .010200000	37	.56000E+02 KW
1.0012o2038 .010200000	38	.75000E+02 KW
1.002292039 .010200000	39	.93000E+02 KW
1.0022o2040 .010200000	40	.25000E+01 KW
1.001292041 .010200000	41	.15000E+02 KW
1.0012o2043 .010100000	43	.80000E+01 KW
.001271009 0.000000000	9	.74600E+03 KW

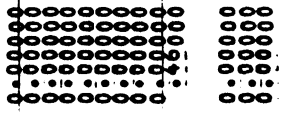
3147.	FOB	7553.
4091.	FOB	8498.
4847.	FOB	10066.
10982.	FOB	22808.
9863.	FOB	20484.
2204.	FOB	4578.
1327.	FOB	3184.
205463.	DEL.	393061.

TOTAL DIRECT L+M COST	2774934.
(ESTIMATED TOTAL EQPT. COST, C/S, FOB, 1976 $ 824573.)	
FREIGHT,TAXES, INSURANCE (AT .08 OF FOB C/S COST)	65966.
ENGINEERING (AT .40 OF FOB C/S COST)	329829.
FIELD EXPENSES (AT .50 OF FOB C/S COST)	412287.
CONTRACTOR FEE (AT .17 OF FOB C/S COST)	140177.
CONTINGENCY (AT .40 OF FOB C/S COST)	329829.
BL BUILDING (AT 0.00 OF FOB C/S COST)	0.
OTHER COSTS (AT 0.00 OF FOB C/S COST)	0.
TOTAL FIXED CAPITAL INVESTMENT 1976 $ (EXCL. SITE PREP. AND AUX.)	4053022.

END OF EXECUTION

```
          CASE      1


RUN NUMBER     1
      TEST OF COST-ESTIMATING SYSTEM
      IOEL PLANT
PRINTING NCONT,LLST,NS
PRINTING INITIAL STREAMS
PRINTING MODULE SETS
    -2 MODULE SETS     0 COMPONENTS
CALCULATION ORDER LIST-
     1     2
     2MODULE SETS ARE READ-
          1.00000          1.00000          50.00000          16.00000
          0.00000          0.00000           0.00000           0.00000
          0.00000          0.00000           0.00000           0.00000
          1.00108           .02010      110000.00000           0.00000
          1.00816           .01020           7.00000           1.40000
          1.04116           .01010           7.00000           1.50000
          1.00108           .02010        4230.00000           0.00000
          1.00229           .01020           2.50000           0.00000
          1.00100           .01010         237.00000           0.00000
           .00200           .01050         256.00000           0.00000
-----
          2.00000          2.00000          15.00000           0.00000
          2.00000          2.00000          15.00000           0.00000
          0.00000          0.00000           0.00000           0.00000
-----
```



FINAL CALCULATION LOOP

COST ESTIMATION EQPT. CODE	MODULE SET 1.0 REF. NO.	SIZE	1976 COST($)		ESTIMATED 1976 L+M COST($)
1.001081001 .020101000	1	.11000E+06 BARE WT	47542.	FOB	142625.
1.008163001 .010200000	1	.70000E+01 DIA (IN FEET)	3700.	DEL.	4505.
1.041163001 .010100000	1	.70000E+01 DIA (IN FEET)	18965.	DEL.	24737.
1.001075002 .020101000	2	.42300E+04 US GAL	8406.	FOB	18494.
1.002204003 .010200000	3	.25000E+01 CU-M/MIN	11238.	FOB	23341.
1.001001004 .010101000	4	.23700E+03 SQ-M	19742.	DEL.	39485.
.002001005 .010501000	5	.25600E+03 SQ-M	62561.	DEL.	102382.

TOTAL DIRECT L+M COST	355568.
(ESTIMATED TOTAL EQPT. COST, C/S, FOB, 1976 $ 137736.)	
FREIGHT, TAXES, INSURANCE (AT .08 OF FOB C/S COST)	11019.
ENGINEERING (AT .40 OF FOB C/S COST)	55094.
FIELD EXPENSES (AT .50 OF FOB C/S COST)	68868.
CONTRACTOR FEE (AT .17 OF FOB C/S COST)	23415.
CONTINGENCY (AT .40 OF FOB C/S COST)	55094.
BL BUILDING (AT 0.00 OF FOB C/S COST)	0.
OTHER COSTS (AT 0.00 OF FOB C/S COST)	0.
TOTAL FIXED CAPITAL INVESTMENT 1976 $ (EXCL. SITE PREP. AND AUX.)	569060.

END OF EXECUTION

CASE 1

RUN NUMBER 1

TEST OF COST-ESTIMATING SYSTEM
SULPHURIC ACID PLANT

PRINTING NCONT,LLST,NS

PRINTING INITIAL STREAMS

PRINTING MODULE SETS

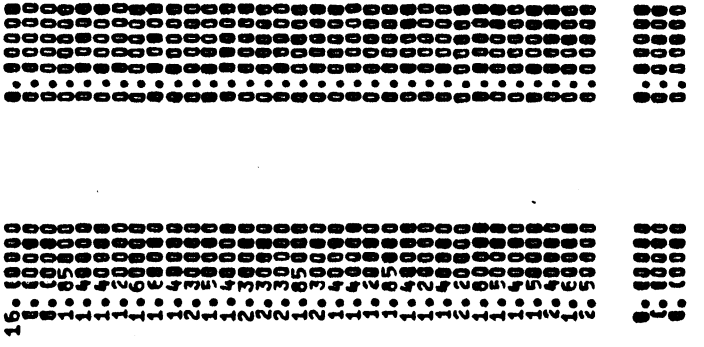
-2 MODULE SETS 0 COMPONENTS

CALCULATION ORDER LIST-
1 2

2MODULE SETS ARE READ-

1.00000	1.00000	165.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000
1.00110	.01000	72277.00000
1.00117	-.02000	2553.00000
1.00716	-.01010	20.25000
1.00117	-.03100	4831.00000
1.00127	.01020	10.30000
1.00109	.01010	7040.00000
1.00117	-.01000	410.00000
1.00100	.01010	734.00000
1.00109	.01010	4324.00000
1.00117	-.01000	226.00000
1.00100	.01010	1594.00000
1.00100	.01010	925.00000
1.00100	.01010	1595.00000
1.00210	.01000	83480.00000
1.00200	.01010	100.00000
1.01016	-.01010	20.75000
1.00117	-.01000	5655.00000
1.00117	-.09000	500.00000
1.00110	.01000	72272.00000
1.00117	-.02000	2553.00000
1.00117	-.03000	4835.00000
1.00616	-.01010	20.25000
1.00127	-.00010	1.20000
1.00126	.02000	17.00000
1.00209	.01010	10140.00000
1.00217	-.02000	1155.00000
1.00230	.01010	30.00000
1.00129	.01010	6.00000
1.00304	-.04010	7.50000
.04501	0.00000	24.99000

2.00000	2.00000	15.00000
0.00000	0.00000	0.00000
0.00000	0.00000	0.00000



FINAL CALCULATION LOOP

COST ESTIMATION MODULE SET 1.0

EQPT. CODE	REF. NO.	SIZE	1976 COST($)		ESTIMATED 1976 L+M COST($)
1.001097001 .010000000	1	.72277E+05 US GAL	18369.	FOB	33983.
1.001173001 -.020000000	1	.25530E+04 SQ-FT	19682.	FOB	27555.
1.007163001 -.010100000	1	.20250E+02 DIA (IN FEET)	27097.	DEL.	32988.
1.001167001 -.030000000	1	.48310E+04 CU-FT	20522.	FOB	24627.
1.001267002 .010200000	2	.10300E+02 NM**3/SEC	78683.	DEL.	109471.
1.001091003 .010100000	3	.70400E+04 US GAL	6708.	FOB	10720.
1.001174003 -.010000000	3	.41800E+03 SQ-FT	3806.	FOB	5328.
1.001001003 .010101000	3	.73400E+03 SQ-M	44053.	DEL.	88106.
1.001093003 .010100000	3	.43240E+04 US GAL	2441.	FOB	3662.
1.001174003 -.010000000	3	.22600E+03 SQ-FT	2098.	FOB	2937.
1.001001004 .010101000	4	.15940E+04 SQ-M	76401.	DEL.	152801.
1.001001005 .010101000	5	.92500E+03 SQ-M	51915.	DEL.	103829.
1.001001006 .010101000	6	.15950E+04 SQ-M	76435.	DEL.	152869.
1.002097007 .010000000	7	.83480E+05 US GAL	38472.	FOB	71174.
1.002001007 .010101000	7	.10800E+03 SQ-M	22599.	DEL.	45198.
1.010163007 -.010100000	7	.28750E+02 DIA (IN FEET)	48645.	DEL.	49481.
1.001174007 -.010000000	7	.56550E+04 SQ-FT	52493.	FOB	73491.

1.001166007 -.090000000	7	.58000E+03	CU-FT
1.001097008 .010000000	8	.72272E+05	US GAL
1.001173008 -.020000000	8	.25530E+04	SQ-FT
1.001167008 -.030000000	8	.48350E+04	CU-FT
1.006163008 -.010100000	8	.20250E+02	DIA (IN FEET)
1.001271009 -.000100000	9	.12000E+01	KW
1.001259010 .020000000	10	.17000E+02	NM**3/HR
1.002093011 .010100000	11	.18140E+05	US GAL
1.002173011 -.020000000	11	.11550E+04	SQ-FT
1.002296012 .010100000	12	.38000E+02	KW
1.001292013 .010100000	13	.60000E+01	KW
1.003044015 -.040100000	15	.75000E+01	HP
.045011016 0.000000000	16	.24990E+02	SQ-M

2423.	FOB	2988.
18369.	FOB	33982.
19682.	FOB	27555.
20539.	FOB	24647.
23226.	DEL.	28275.
629.	DEL.	1283.
1118.	FOB	2012.
7507.	FOB	11260.
17809.	FOB	24932.
6316.	FOB	9474.
1186.	FOB	2846.
746.	FOB	1193.
76899.	DEL.	165432.

TOTAL DIRECT L+M COST	1323938.
(ESTIMATED TOTAL EQPT. COST, C/S, FOB, 1976 $ 718521.)	
FREIGHT,TAXES, INSURANCE (AT 0.00 OF FOB C/S COST)	0.
ENGINEERING (AT 0.00 OF FOB C/S COST)	0.
FIELD EXPENSES (AT 0.00 OF FOB C/S COST)	0.
CONTRACTOR FEE (AT 0.00 OF FOB C/S COST)	0.
CONTINGENCY (AT 0.00 OF FOB C/S COST)	0.
BL BUILDING (AT 0.00 OF FOB C/S COST)	0.
OTHER COSTS (AT 0.00 OF FOB C/S COST)	0.
TOTAL FIXED CAPITAL INVESTMENT 1976 $ (EXCL. SITE PREP. AND AUX.)	1323938.

END OF EXECUTION

EXAMPLE OF DETAILED OUTPUT FROM COSMOD

```
COST ESTIMATION FOR MODULE SET 1.0

EQPT.CODE...1010991412 0 0 0 0 0 0

    *NOTE* SPECIFICATION=   .10000E+01 SQ-M
    IS OUTSIDE RANGE OF DATA.
    EQPT. GENERALLY MANUFACTURED IN FOLLOWING PARAMETER RANGE

      .20000E+01  TO    .22000E+04  SQ-M

     EQPT. OF MIN. AVAILABLE SPECIFICATION ASSUMED.

VALUES USED FOR FOLLOWING COST ESTIMATES

    NUMBER OF IDENTICAL UNITS       1
    BASE COST    $      6000.
    BASE SIZE      .10000E+01
    SPECIFIED SIZE      .10000E+01
    UNITS OF SIZE    .10000E+03 SQ-M
    EXPONENT     .71
    L+M FACTOR    2.300
    MS INDEX     300.0   FOR YEAR    1970

OTHER MULTIPLICATION FACTORS USED

    *NOTE* SPECIFICATION=   .10000E+03 PRESSURE (PSI)
    IS OUTSIDE RANGE OF DATA.
    EQPT. GENERALLY MANUFACTURED IN FOLLOWING PARAMETER RANGE

      .15000E+03  PRESSURE (PSI)
      .30000E+03  PRESSURE (PSI)
      .40000E+03  PRESSURE (PSI)
      .60000E+03  PRESSURE (PSI)
      .80000E+03  PRESSURE (PSI)
      .10000E+04  PRESSURE (PSI)
      .30000E+04  PRESSURE (PSI)
      .40000E+04  PRESSURE (PSI)
      .50000E+04  PRESSURE (PSI)

     EQPT. OF MIN. AVAILABLE SPECIFICATION ASSUMED.

     1.300     FOR     PRESSURE (PSI)
     1.500     FOR     MATRL OF CONST
     1.350     FOR     ADDITIONAL CONDITIONS

     DELIVERED       COST REDUCED TO FOB BY FACTOR 1.19

 1970 DELIVERED        COST   $      616.
ERROR  +  40.  -  40.  PERCENT

ESTIMATED 1970 L+M COST   $     1232.
```

APPENDIX C

COSMOD's USER SPECIFIED DATA REQUIREMENTS

Whether used within or outside GEMCS, COSMOD's user specified data must be placed in the EN vector for the equipment or module.

The data that must be supplied in the specified EN locations are described below.

EN(4) : This location must be reserved to indicate to COSMOD where in the EN vector it will find the data it needs from the user. e.g. If EN(4) = 17, data for COSMOD begins at EN(17).

EN(EN(4)) : A ten digit equipment code in the format

$\pm$ a.bcdefghij

must be placed here.

EN(EN(4)+1) : A nine digit equipment code must be placed in this location, in the following format.

$\pm$ 0.klmnopqr

EN(EN(4)+2) : The size of the equipment, in the units indicated in the Equipment Catalogue, must be given here by the user or a design module.

EN(EN(4)+3) : The L+M factor for the equipment must be given here.

EN(EN(4)+4) : The piping factor ,or if no adjustment for piping is desired, a value 0.0 must be entered here. (For selection and use of piping factors for adjusting L+M costs, see Woods (24)).

EN(EN(4)+5) : COSMOD will check this and following locations in the EN vector only if told to do so in the equipment codes in EN(EN(4)) and EN(EN(4)+1).

In EN(4), a value of 4 or less indicates to COSMOD that no cost calculations are necessary. This may be used as a switch to keep off cost calculations until calculations within the design module have converged.

In EN(EN(4)), a positive code indicates that a short output is desired from COSMOD. A negative code will produce a detailed output from COSMOD.

The value of 'a' in EN(EN(4)) may be 1 or 0. If 'a' is 1, COSMOD will look for data to cost another equipment immediately after the cost of the present equipment is calculated. It will assume that

data for the next equipment is placed after the last EN location which contains data for the present equipment to be costed. Hence, if more than one equipment is to be costed in the same EN vector, COSMOD's data must be placed one after the other.

'bcd' stand for the number of identical equipment. Hence, if two identical equipment are needed, the code bcd would be 002.

'efg' stands for the COSMOD Reference Number for the equipment, as indicated in the Equipment Catalogue. This number must be chosen from the Equipment Catalogue by the user. Thus, if the COSMOD Ref. No. for a particular equipment is 15 in the Equipment Catalogue, the code efg would be 015.

'hij' stands for the unique number given to the equipment by the user for identification. COSMOD uses this number to store the calculated cost in the vector EQCST(x). Hence, if the user gives the number 22 to an equipment, the code hij would be 022 and COSMOD will store the calculated cost in EQCST(22).

Thus, the ten digit equipment code in location EN(EN(4)) would be, using the numbers assumed above,

+1.002015022

A value of 0 for 'a' in the code would mean that there are no other equipment to be costed after this in this EN vector.

(If more than one equipment is to be costed, then the data for the next equipment must be in the same sequence and format as in the previous equipment, and must start immediately after the end of the data for the previous equipment.)

The nine digit equipment code in EN(EN(4)+1) has to be chosen from the Equipment Catalogue. It contains the users choices for correction factors for pressure, temperature, material of construction, etc. The Equipment Data and Coding Sheets in the Equipment Catalogue show what choices are available for the equipment and what choices must be made.

The negative sign in the nine digit code is used to signal to COSMOD that it should ignore the limits within which the cost correlation applies, should such limits be exceeded. This is to allow the user to overide the limits contained in the data file.

COSMOD is able to select some correction factors for the user. Where this option is available, the Equipment Data and Coding Sheet will allow the use of a code '99' in the nine digit equipment code for EN(EN(4)+1). The actual value of the variable for which the correction is needed must be entered in EN(EN(4)+5) either by the user or by a design program. This allows the user to generate a design variable such as pressure in a design module and then get COSMOD to select the correction factor for pressure on the cost of the equipment.

More than one '99' code may be allowed for some equipment. The variable values for which COSMOD must select correction factors must be placed in the appropriate sequence, starting from EN(EN(4)+5).

The EN locations specified above apply to the first equipment whose cost is to be estimated in the EN vector. If more than one equipment's cost is to be estimated in the same EN vector, then what has been described above holds true for the following equipment, except that their data start at an EN location immediately after the data for the previous equipment.

COSMOD allows the user to introduce an externally generated cost for any equipment. In this case, 'efg' in the first ten digit equipment code is entered as 000. The second nine digit equipment code is replaced by the user's FOB cost, escalated to the time frame of interest. This is followed in the next EN location by the L+M cost as estimated by the user, also escalated to the time frame of interest. COSMOD will not modify these costs in any way. The next two EN locations must be left with 0.0 as input. (At least five EN locations must always be filled for each equipment).

The user must also enter the inflation index (MS Index) and the year to which it applies in DATA statements for 'AMSDX' and 'IYR' in COSMODS declarations, in order to have the costs calculated by COSMOD inflated to the time frame of interest.

EQUIPMENT CATALOGUE

The following pages contain COSMOD's Equipment Catalogue. It consists of a collection of Equipment Data and Coding Sheets.

The correlation data apply to the equation shown on p. 23.

The coding information is to help the user coin the nine digit equipment code required by COSMOD, as explained in the begining of Appendix C. Please note that the letters, e,f,g,h,and i used in the following Equipment Data And Coding Sheets should not be taken to correspond to the use of these letters in the explanation of the equipment codes at the begining of this Appendix.

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Heat Exchanger, Shell And Tube

COSMOD Reference Number: 001

Description of Equipment:

Floating head, c/s in c/s shell, bare tubes, standard 16 ft. in length, with either 1" or 3/4" O.D tubes on square or triangular pitch. Delivered cost.

Correlation Data:

C_o = $ 8000

S_o = 100 m^2

n = 0.71

L+M Factor = 2.3

Range : 2.0 to 2000 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
Pressure						
150 psi	1.0		01			
300	1.15		02			
400	1.25		03			
600	1.45		04			
800	1.52		05			
1000	1.55		06			

Coding Data (Continued):

COSMOD Reference Number: 001

Correction For	Factor	e	f	g	h	i
3000 psi	2.5		07			
4000	2.8		08			
5000	3.1		09			
Design program specifies pressure, COSMOD selects factor:			99			
<u>Tubes in c/s shell</u>						
c/s	1.0			01		
Al	1.2			02		
Cu	1.35			03		
Brass	1.3			04		
Admirality	1.5			05		
70-30 Cu-Ni	1.7			06		
Ni	2.8			07		
s/s 316	2.4			08		
s/s 304	2.0			09		
Monel	3.0			10		
Ti	9.0			11		
Inconel	2.4			12		
Hastalloy C	8.5			13		

Coding Data (Continued):

COSMOD Reference Number: 001

Correction For	Factor	e	f	g	h	i
Tubes and shell						
s/s 316	3.0			14		
s/s 304	2.8			15		
Monel	4.0			16		
Ti	13.0			17		
Design Variations						
None	1.0				00	
Fixed tube	0.85				01	
U-tube	0.87				02	
Kettle reboiler	1.35				03	
Tubes only	0.3				04	
Expansion joint on fixed tube	1.25				05	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Heat Exchanger, Shell and Tube

COSMOD Reference Number: 002

Description of Equipment:

After cooler for compressor, c/s with water on shell side. Excluding separator, integral piping, support stand and instrumentation.
FOB cost.

Correlation Data:

C_o = $ 380

S_o = 0.1 m^3/s

n = o.58

L+M Factor = 1.8

Range : 0.03 to 0.3 m^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Heat Exchanger, Shell and Tube

COSMOD Reference Number: 003

Description of Equipment:

Shell and tube exchanger, cross bore in c/s shell. Karbate. Delivered cost.

Correlation Data:

C_o = $ 4000

S_o = 10 m^2

n = 0.69

L+M Factor = 2.2

Range : 0.7 to 70.0 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Heat Exchanger, Shell and Tube

COSMOD Reference Number: 004

Description of Equipment:

Floating head, 150 psi, 1/10 " dia teflon tubes in c/s or s/s shell.

Delivered cost.

Correlation Data:

C_o =	\$ 1900
S_o =	10 m^2
n =	0.5
L+M Factor =	2.0 (assumed)
Range :	2.0 to 70.0 m^2
Error :	15 %

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Heat Exchanger, Shell and tube

COSMOD Reference Number: 005

Description of Equipment:

Floating head, 150 psi, 1/4 " dia teflon tubes.
Delivered cost.

Correlation Data:

C_o = $ 3400

S_o = 10 m^2

n = 0.34

L+M Factor = 2.0 (assumed)

Range : 10 to 40 m^2

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Heat Exchanger, Shell and Tube

COSMOD Reference Number: 006

Description of Equipment:

Floating head, impervious graphite (karbate) in c/s shell.

Delivered cost.

Correlation Data:

C_o =	\$ 2900	\$ 30000
S_o =	10 m^2	300 m^2
n =	0.6	0.97
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	10 to 120 m^2	120 to 1000 m^2
Error :	20 %	20 %

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Heat Exchanger, Shell and Tube

COSMOD Reference Number: 007

Description of Equipment:

Floating head, 150 psi, c/s in c/s shell, finned tube. Standard 16 ft. length. Delivered cost.

Correlation Data:

C_o =	$ 5000	$ 14000
S_o =	100	500
n =	0.57	0.78
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	70 to 300	300 to 1000
Error :	20 %	20 %

Note: Units of Size: m^2, including area of fins.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Air cooled Exchanger

COSMOD Reference Number: 008

Description of Equipment:

Finned tube, 150 psi, c/s with approx. 16 sq. ft. total area per foot of bare tube area. Cost includes tube bundle, fabricated c/s heater, fan, explosion proof motor, case. Excluding foundation, water trim cooler, field erection and subcontractors overheads, fireproofing, steel stairways, freight, export, crating, overheads & contingencies. FOB.

Correlation Data:

C_o = $ 26000

S_o = 280 m^2

n = 0.8

L+M Factor = 1.58

Range : 20 to 2000 m^2

Error : 30 %

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Pressure						
150 psi	1.0		01			
250	1.05		02			
500	1.10		03			
1000	1.15		04			
Tube Material						
c/s	1.0			01		
Admirality	1.08			02		
Aluminum	1.50			03		

Coding Data (Continued):

COSMOD Reference Number: 008

Correction For	Factor	e	f	g	h	i
s/s	2.85			04		
Monel	3.20			05		
Note: For Pressure						
Design program specifies pressure, COSMOD selects factor:			99			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Air-cooled Exchanger

COSMOD Reference Number: 009

Description of Equipment:

Finned tubes for refrigeration service with condensing temperature less than 8°C above ambient. Copper tubes with aluminum plate fins. Dripproof motor included. Mount, springs,piping and safety fence not incl. FOB cost.

Correlation Data:

C_o = $ 1600

S_o = 100 kW

n = 0.78

L+M Factor = 2.0 (assumed)

Range : 30 to 200 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialised Exchangers

COSMOD Reference Number: 010

Description of Equipment:

Plate - coil c/s serpentine or header type exchanger, double embossed.

Delivered cost.

Correlation Data:

C_o =	\$ 55	\$ 160
S_o =	1 m^2	5 m^2
n =	0.37	1.07
L-M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.5 to 2.5 m^2	2.5 to 10.0 m^2
Error :		

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Design Variation						
Double Embossed	1.0			01		
Single Embossed	2.8			02		
Material						
c/s	1.0		01			
s/s	4.4		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 011

Description of Equipment:

Cascade cooler, cast iron.

Delivered cost.

Correlation Data:

C_o = $ 400

S_o = 9.3 m^2

n = 1.0

L+M Factor = 2.0 (assumed)

Range : 4.0 to 25 m^2

Error : 20 %

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 012

Description of Equipment:

Cascade cooler, karbate.

Delivered cost.

Correlation Data:

C_o =	\$ 750	\$ 2200
S_o =	3.3 m^2	14 m^2
n =	0.61	0.82
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	2 to 5 m^2	5 to 35 m^2
Error :		50 %

Coding Data:

X.XX XX XX XX
e f g h i (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
Karbate	1.0		01			
Glass	1.25		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialised Exchangers

COSMOD Reference Number: 013

Description of Equipment:

Double-pipe, c/s in c/s, inner tube finned, total area/bare tube area = 5 to 10. Area increases must be by appropriate selection of fins, tube length. Duplication of units not allowed.

Delivered cost.

Correlation Data:

C_o =	\$ 400
S_o =	2 m^2
n =	0.14
L+M Factor =	2.0 (assumed)
Range :	0.3 to 25 m^2
Error :	20 %

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Pressure						
150 psi	1.0		01			
900	1.1		02			
1000	1.25		03			
Material						
Finned centre tubes						
c/s + c/s fins	1.0			01		
s/s + c/s fins	2.65			02		

Coding Data (Continued):

COSMOD Reference Number: 013

Correction For	Factor	e	f	g	h	i
s/s+s/s in s/s jacket	5.5			03		
Smooth centre tubes						
s/s in c/s	2.1			04		
glass in c/s	2.5			05		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 014

Description of Equipment:

Same as equipment with COSMOD Ref. No. 013, but duplication of units allowed.

Delivered cost.

Correlation Data:

C_o =	\$ 3400
S_o =	20 m^2
n =	0.67
L+M Factor =	1.6 (assumed)
Range :	5 to 200 m^2
Error :	100 %

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
Choose values from equipment with COSMOD Ref. No. 013						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 015

Description of Equipment:

Plate exchanger. 316 s/s plates, 100 psi.

Delivered cost.

Correlation Data:

C_o =	\$ 15000
S_o =	100 m^2
n =	0.65
L+M Factor =	2.0 (assumed)
Range :	10 t0 600 m^2
Error :	20 %

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
s/s	1.0		01			
Ti	1.1		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 016

Description of Equipment:

Spiral plate, c/s, 50 psig.

Delivered cost.

Correlation Data:

C_o =	$ 1400	$ 2200	$ 3700
S_o =	9.3	28	65
n =	0.27	0.48	0.72
L+M Factor =	2.0 (assumed)	2.0 (assumed)	2.0 (assumed)
Range :	4 to 20	20 to 40	40 to 100
Error :			

Note: Units of Size: m^2

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 017

Description of Equipment:

Spiral plate. 316 s/s, 50 psig.

Delivered cost.

Correlation Data:

C_o =	$ 2400	$ 6300	$ 13500
S_o =	6.5	28	79
n =	0.51	0.75	0.53
L+M Factor =	2.0 (assumed)	2.0 (assumed)	2.0 (assumed)
Range :	5 to 10	10 to 70	70 to 100
Error :			

Note: Units of Size: m^2

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 018

Description of Equipment:

Spiral tube, (heliflow), c/s tubes.

Delivered cost.

Correlation Data:

C_o =	\$ 120	\$ 470
S_o =	0.5	3.0
n =	0.43	0.83
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.25 to 0.75	0.75 to 6
Error :		

Note; Units of Site: m^2, coil surface area

Coding Data:

X.XX XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s			01			
s/s			02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 019

Description of Equipment:

Bayonet Heater.

FOB cost.

Correlation Data:

C_o =	\$ 80	\$ 700
S_o =	0.3	5.0
n =	0.25	1.33
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.1 to 1.3	1.3 to 12
Error :	30 %	

Note: Units of Size: m^2

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 020

Description of Equipment:

Tank suction heater, U tube,

150 psi, c/s in c/s.

FOB cost.

Correlation Data:

C_o =	$ 1400	$ 3300
S_o =	20	50
n =	0.58	1.04
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	3 to 25	25 to 150
Error :		

Note: Units of Size: m^2

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 021

Description of Equipment:

Electric Emersion heater.

FOB cost.

Correlation Data:

C_o = $ 700

S_o = 50 kW (Energy input)

n = 0.87

L+M Factor = 2.0 (assumed)

Range : 10 to 200 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 022

Description of Equipment:

Cubic heat exchanger. Graphite in c/s steel shell. Process pressure 75 psig. FOB cost.

Correlation Data:

C_o = \$ 1700

S_o = 6.5 m^2

n = 0.7 (assumed)

L+M Factor = 2.0 (assumed)

Range : 1 to 20 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 023

Description of Equipment:

C/S coil in tank. Excluding tank.

FOB cost.

Correlation Data:

C_o = $ 290

S_o = 2.8 m^2

n = 0.7 (assumed)

L+M Factor = 2.0 (assumed)

Range : 0.1 to 30 m^2

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				
Materials						
c/s	1.0		01			
s/s	2.3		02			
glass	3.5		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 024

Description of Equipment:

Teflon coil in tank. Excluding tanf.

FOB cost.

Correlation Data:

C_o = $ 1400

S_o = 9.3 m^2

n = 0.62

L+M Factor = 2.0 (assumed)

Range : 1.5 to 70 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialised Exchangers

COSMOD Reference Number: 025

Description of Equipment:

Thermal screw. Single screw.

Excluding motor and drive.

FOB cost.

Correlation Data:

C_o =	$ 7500	$ 11000
S_o =	3.0	10
n =	0.13	0.78
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	1 to 7.5	7.5 to 40
Error :		40 %

Note: Units of Size: m^2

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 026

Description of Equipment:

Cryogenic service: lamella or Ramen, plate-fin brazed aluminum. Less than 1000 psig. Delivered.

Correlation Data:

C_o =	$ 4500	$ 19000
S_o =	500	4000
n =	0.34	1.0
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	100 to 1300	1300 to 10000
Error :		

Note: Units of Size: m^2

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Specialized Exchangers

COSMOD Reference Number: 027

Description of Equipment:

Cryogenic service: mandrel wound. Aluminum, less than 3000 psig.

FOB cost.

Correlation Data:

C_o =	$ 55000	$ 130000
S_o =	300	1500
n =	0.42	1.0
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	70 to 1000	1000 to 10000
Error :		30 %

Note: Units of Size: m^2

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Direct Contact Exchangers

COSMOD Reference Number: 028

Description of Equipment:

Barometric condensers, c/s, multijet spray type. Excluding hot well.

Delivered cost.

Correlation Data:

C_o = $ 2800

S_o = 2 m^3/min

n = 0.6

L+M Factor = 2.0 (assumed)

Range : 0.2 to 40 m^3/min

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Materials						
c/s	1.0		01			
cast iron	1.5		02			
rubber lined	2.0		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Direct Contact Exchangers

COSMOD Reference Number: 029

Description of Equipment:

Same equipment as in 028, but with cost correlated to body diameter.

Correlation Data:

C_o = $ 4600

S_o = 1 m

n = 1.37

L+M Factor = 2.0 (assumed)

Range : 0.1 to 2.5 m

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Materials						
c/s	1.0		01			
cast iron	1.5		02			
rubber lined	2.0		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Direct Contact Exchangers

COSMOD Reference Number: 030

Description of Equipment:

Thermal wheels: Ljungstrom heaters. Low temperature applications. Aluminum or asbestos coated lithium chloride. Based on 700 ft/min face velocity for each side of a gas flow exchanger. Including wheel, housing and motor drive. Excluding air chambers, fans, reheat coil.

FOB cost.

Correlation Data:

C_o = $ 4000

S_o = 5 m^3/s (Nominal std. for one side)

n = 0.43

L+M Factor = 2.0 (assumed)

Range : 0.6 to 20.0

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Associated Eqpt.						
As above	1.0		01			
Incl: inlet and exhaust air chamber, fans, motors, drives, reheat coils, filters, vibration eliminators and panel with electric starters	2.7		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Direct Contact Exchangers

COSMOD Reference Number: 031

Description of Equipment:

Same as in 030, but for high temp., s/s or enamel coated medium. Less than 400°C. FOB cost.

Correlation Data:

C_o = $ 7000

S_o = 5 m^3/s

n = 0.5

L+M Factor = 2.0 (assumed)

Range : 1.2 to 12 m^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Direct Contact Exchangers

COSMOD Reference Number: 032

Description of Equipment:

Same as in 031, but for less than 800°C.

FOB cost.

Correlation Data:

C_o = \$ 22000

S_o = 5 m^3/s

n = 0.75

L+M Factor = 2.0 (assumed)

Range : 2 to 10 m^3/s

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	0 0

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 033

Description of Equipment:

Box type, 500 psi. c/s in convection and radiant sections. Stack and firing included. Excluding tax and import duty.

Delivered cost.

Correlation Data:

C_o = $ 54000

S_o = 12000 kW (Heat absorbed)

n = 0.75

L+M Factor = 1.60

Range : 10000 to 400000 kW

Error : 40 %

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Pressure						
500 psi	1.0		01			
1000	1.1		02			
2000	1.25		03			
3000	1.6		04			
Tube Matrl., Radiant Section						
c/s	1.0			01		

Coding Data (Continued):

COSMOD Reference Number:

Correction For	Factor	e	f	g	h	i
Cr-Mo	1.35			02		
s/s 304	1.75			03		
s/s 316	2.30			04		
Incalloy	2.0			05		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 034

Description of Equipment:

Convection section load, box type as in 033.

Installed cost.

Correlation Data:

C_o = $ 115000

S_o = 12000 kW (Heat absorbed)

n = 0.79

L+M Factor = 2.0 (assumed)

Range : 15000 to 110000 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 035

Description of Equipment:

Box type, as in 033, radiation section load.

Installed cost.

Correlation Data:

C_o = $ 260000

S_o = 12000 kW (Heat absorbed)

n = 0.79

L+M Factor = 2.0 (assumed)

Range : 15000 to 250000 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 036

Description of Equipment:

Cylinder type direct fired furnace. Vertical, 500 psig, high grade c/s or low grade chrome alloy in convection and radiation sections. FOB cost.

Correlation Data:

C_o = $ 40000

S_o = 3000 kW (heat absorbed)

n = 0.74

L+M Factor = 1.65

Range : 500 to 100000 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Pressure						
500 psig	1.0		01			
1000	1.15		02			
1500	1.20		03			
Radiant Section						
c/s or low alloy tubes	1.0			01		
Cr-Mo tubes	1.45			02		
s/s tubes	1.5			03		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 037

Description of Equipment:

Multiple hearth furnace, assumes appropriate increase in the number of hearths as diameter increases. Enclosure, gas scrubber, exhaust included. Installed cost. Also included: ash handling.

Correlation Data:

C_o = $ 250000

S_o = 5 m (outside diameter)

n = 1.55

L+M Factor = 2.0 (assumed)

Range : 3 to 6 m

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 038

Description of Equipment:

Same equipment as in COSMOD Ref. No. 037, but cost correlated to solid feed rate.

Correlation Data:

C_o = $ 750000

S_o = 1000 kg/h (solids feed rate)

n = 0.59

L+M Factor = 2.0 (assumed)

Range : 100 to 30000 kg/h

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 039

Description of Equipment:

Fluid bed combustion furnace, as applied to waste treatment for feed concentration 22% solids. Unit includes solids preparation, grinding, dewatering, conveying, feeding, burning & air supply, gas treatment, ash handling, electrical, piping, engineering and contractor overheads. Installed cost.

Correlation Data:

C_o =	$ 270000	$ 680000
S_o =	230	1000
n =	0.53	0.78
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	180 to 600	600 to 4000
Error :		

Note: Units of Size: kg/h , (solids incinerated)

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
% Solids						
22	1.0		01			
44	0.8		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 040

Description of Equipment:

Burners for furnaces, including blower, motor, and automatic ignited pilot. Fresh air system. FOB cost.

Correlation Data:

C_o =	$ 200	$ 400
S_o =	200	1000
n =	0.16	0.85
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	150 to 500	500 to 3000
Error :		

Note: Units of Size: kW , (heat duty)

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 041

Description of Equipment:

Equipment as in COSMOD Ref. No. 040, but immersion type.

FOB cost.

Correlation Data:

C_o = $ 1000

S_o = 1000 kW (heat duty)

n = 0.26

L+M Factor = 2.0 (assumed)

Range : 300 to 1500 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 042

Description of Equipment:

Equipment as in COSMOD Ref. No. 040, standard incinerator.

FOB cost.

Correlation Data:

C_o = $ 300

S_o = 200 kW (heat absorbed)

n = 0.57

L+M Factor = 2.0 (assumed)

Range : 150 to 500 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnace

COSMOD Reference Number: 043

Description of Equipment:

Tunnel kiln for brick-tile. Excluding labor to erect.

FOB cost.

Correlation Data:

C_o = $ 180000

S_o = 100 Mg/day (brick capacity)

n = 0.98

L+M Factor = 2.0 (assumed)

Range : 60 to 100 Mg/day

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

$e\ f\ g\ h\ i$

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motor

COSMOD Reference Number: 044

Description of Equipment:

AC 3 phase, induction, squirrel cage, TEFC, 1800 rpm. Excluding starter gearing, duty and taxes. FOB cost.

Correlation Data:

C_o =	$ 2100
S_o =	100 hp
n =	1.10
L+M Factor =	1.36
Range :	50 to 200000 hp
Error :	80%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
rpm						
900	1.3		01			
1200	1.5		02			
1800	1.0		03			
3600	1.3		04			
Enclosure						
TEFC	1.0			01		
Open drip-proof	0.7			02		
Gaurded drip-proof	0.9			03		
Explosion proof	1.15			04		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motor

COSMOD Reference Number: 045

Description of Equipment:

AC 3 phase induction, squirrel cage, open drip-proof, 1800 rpm. Including motor, starter, controls. Excluding panel, transformer, duty and tax. Installed cost.

Correlation Data:

C_o = $ 10000

S_o = 200 hp

n = 0.81

L+M Factor = 1.8

Range : 1000 to 500000 hp

Error : 30%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motor

COSMOD Reference Number: 046

Description of Equipment:

AC 3 phase, induction, wound motor, open drip-proof, 1800 rpm. FOB cost.

Correlation Data:

C_o = $ 1000

S_o = 70 hp

n = 0.93

L+M Factor = 1.8

Range : 10 to 200 hp

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motor

COSMOD Reference Number: 047

Description of Equipment:

AC 3 phase, induction, wound motor, TEFC, 1800 rpm. FOB cost.

Correlation Data:

C_o =	$ 3700	$ 5800
S_o =	10 hp	70 hp
n =	0.0	0.77
L+M Factor =	1.8	1.8
Range :	10 to 25 hp	25 to 200 hp
Error :		

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motors

COSMOD Reference Number: 048

Description of Equipment:

AC 3 phase, induction, wound motor, TEFC, 700 rpm. Installed cost.

Correlation Data:

C_o = $ 120000

S_o = 3000 hp

n = 0.55

L+M Factor = 1.8

Range : 2000 to 4500 hp

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
rpm						
200	1.7		01			
500	1.25		02			
700	1.0		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motors

COSMOD Reference Number: 049

Description of Equipment:

AC synchronous, open drip-proof, 1200 rpm. Excluding gears, taxes and duties. Delivered cost.

Correlation Data:

C_o = $ 33000

S_o = 3000 hp

n = 0.81

L+M Factor = 1.8

Range : 700 to 10000 hp

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
rpm						
514	1.25		01			
900	1.10		02			
1200	1.0		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motors

COSMOD Reference Number: 050

Description of Equipment:

AC synchoronous, open drip-proof, 1800 rpm, excluding gears and tax. Delivered cost.

Correlation Data:

C_o = $ 48000

S_o = 3000 hp

n = 0.96

L+M Factor = 1.8

Range : 500 to 10000 hp

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motor

COSMOD Reference Number: 051

Description of Equipment:

DC open drip-proof, 1800 rpm.

FOB cost.

Correlation Data:

C_o = $ 1100

S_o = 20 hp

n = 1.0

L+M Factor = 1.8

Range : 7 to 100 hp

Error :

Coding Data:

X.XX XX XX XX
e f g h i

(Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motors

COSMOD Reference Number: 052

Description of Equipment:

Starters - controls, breaker type, industrial enclosures, larger sizes use part winding, primary resistor, or auto transformer type. Single phase. FOB cost.

Correlation Data:

C_o =	$ 43
S_o =	3 hp
n =	0.26
L+M Factor =	1.8
Range :	1 to 8 hp
Error :	50%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motor

COSMOD Reference Number: 053

Description of Equipment:

Same as equipment in COSMOD Ref. No. 052 but three phase.

FOB cost.

Correlation Data:

C_o =	$ 700
S_o =	100 hp
n =	1.0
L+M Factor =	1.8
Range :	10 to 200 hp
Error :	80%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motors

COSMOD Reference Number: 054

Description of Equipment:

Gear reduced drive: TEFC motor at 1800 rpm plus gear reducer unit giving fixed output rpm. FOB cost.

Correlation Data:

C_o =	$ 200	$ 510
S_o =	1 hp	10 hp
n =	0.2	0.53
L+M Factor =	1.8	1.8
Range :	0.5 to 2.5 hp	2.5 to 25 hp
Error :		

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motor

COSMOD Reference Number: 055

Description of Equipment:

Variable speed drive: TEFC motor at 1800 rpm plus variable speed gear reducer unit. Installed cost.

Correlation Data:

C_o = $ 3500

S_o = 10 hp

n = 0.79

L+M Factor = 1.8

Range : 5 to 25 hp

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electric Motor

COSMOD Reference Number: 056

Description of Equipment:

Variable speed drive: TEFC motor at 1800 rpm plus v-belt unit for speed control 2/1 to 5/1 at maximum rpm of 3480, 520 and 30. Motor included. Starter excluded. (Use 3480, 520 or 30 rpm in correlation.)

Correlation Data:

C_o =	$ 1000
S_o =	2 (input hp) / (max. rpm)$^{0.2}$
n =	0.63
L+M Factor =	1.8
Range :	0.5 to 10.0 (input hp) / (max. rpm)$^{0.2}$
Error :	50%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Gasoline Engine

COSMOD Reference Number: 057

Description of Equipment:

Engine only. FOB cost.

Correlation Data:

C_o = $ 50000

S_o = 400 hp

n = 0.82

L+M Factor = 1.8 (assumed)

Range : 30 to 7000 hp

Error : 70%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Turbine

COSMOD Reference Number: 058

Description of Equipment:

Steam, non-condensing, 300 psig, 200 to 300 ^{o}F superheat. Approximately 25" wheel diameter. Less than 100 psig back pressure. Single valve, single stage. Excluding gears and lubrication. FOB cost.

Correlation Data:

C_o = $ 11000

S_o = 400 hp

n = 0.51

L+M Factor = 1.8 (assumed)

Range : 10 to 400 hp

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
Pressure						
300 psig	1.0		01			
600	1.22		02			
850	1.5		03			
2000	1.6		04			
Superheat						
100 ^{o}F	1.08			01		
200	0.97			02		
300	1.0			03		

Coding Data (Continued):

COSMOD Reference Number: 058

Correction For	Factor	e	f	g	h	i
Superheat (cont.)						
350 ^{o}F	1.05			04		
400	1.10			05		
If design program to specify and COSMOD to select factor						
for pressure:			99			
for superheat:				99		
Design Variation						
Steam condensing at 4" Hg., incl. condenser, integral piping, accessories	1.85				02	
No variation	1.0				01	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Turbine

COSMOD Reference Number: 059

Description of Equipment:

Same as equipment with COSMOD Ref. No. 058, but single valve, multistage.

FOB cost.

Correlation Data:

C_o = $ 100000

S_o = 4000 hp

n = 0.46

L+M Factor = 1.8 (assumed)

Range : 1000 to 20000 hp

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select factors from chart for COSMOD Ref. No. 058						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Turbine

COSMOD Reference Number: 060

Description of Equipment:

Same as equipment with COSMOD Ref. No. 058, but multivalve, multi stage.

FOB cost

Correlation Data:

C_o = $ 160000

S_o = 4000 hp

n = 0.35

L+M Factor = 1.8 (assumed)

Range : 2000 to 20000 hp

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select factors from chart for COSMOD Ref. No. 058						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Turbines

COSMOD Reference Number: 061

Description of Equipment:

Gas driven turbine, excluding equipment pertaining to gas supply.

FOB cost.

Correlation Data:

C_o = $ 250000

S_o = 5000 kW

n = 0.8

L+M Factor = 1.8 (assumed)

Range : 1000 to 30000 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Turbines

COSMOD Reference Number: 062

Description of Equipment:

Combustion gas driven turbine, including min inlet air system, compressor, combustion chamber, firing, turbine, starter and exhaust system.
FOB cost.

Correlation Data:

C_o = $ 520000

S_o = 5000 kW

n = 0.55

L+M Factor = 1.8 (assumed)

Range : 650 to 15000 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Turbines

COSMOD Reference Number: 063

Description of Equipment:

Steam or gas driven turbine plus electricity generator. Steam at 125 to 250 psig or gas driven without regenerator.

FOB cost.

Correlation Data:

C_o =	$ 600000
S_o =	10000 kW
n =	0.73
L+M Factor =	1.8 (assumed)
Range :	3000 to 50000 kW
Error :	20%

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0			00	00
Steam pressure						
Gas driven	1.0		01			
125 psig	1.0		01			
250	1.0		02			
850	1.3		03			
2400	1.5		04			
Gas regenerator						
None or steam gen.	1.0			01		
With gas regenerator	1.25			02		

Coding Data (Continued):

COSMOD Reference Number: 063

Correction For	Factor	e	f	g	h	i
If program to specify pressure of steam and COSMOD to select correction factor			99			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Power Transmission Units

COSMOD Reference Number: 064

Description of Equipment:

Gear units, general, including types single, double, triple reduction on concentric, offset and vertical right angle drives. Excluding motor and lubrication system.

FOB cost.

Correlation Data:

C_o =	$ 580	$ 3600
S_o =	40	500
n =	0.45	0.75
L+M Factor =	1.8 (assumed)	1.8 (assumed)
Range :	4 to 150	150 to 2000
Error :		

Note: Size units: (input hp at 1800 rpm) (nominal reduc. ratio)$^{0.5}$

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Power Transmission Units

COSMOD Reference Number: 065

Description of Equipment:

Gear unit, medium duty, single reduction

20/1 to 50/1.

FOB cost.

Correlation Data:

C_o =	$260	$ 2400
S_o =	40	500
n =	0.54	1.9
L+M Factor =	1.8 (assumed)	1.8 (assumed)
Range :	4 to 250	250 to 1200
Error :		

Note: Size units: (input hp at 1800 rpm) (nominal reduc. ratio)$^{0.5}$

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Power Transmission Units

COSMOD Reference Number: 066

Description of Equipment:

V-belt and pulleys, centre to centre distance 3 ft., 6/1 reduction ratio, input at 1800 rpm, excluding guard.

FOB cost.

Correlation Data:

C_o = $ 140

S_o = 10 hp

n = 0.88

L+M Factor = 1.8 (assumed)

Range : 2 to 30 hp

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Power Transmission Units

COSMOD Reference Number: 067

Description of Equipment:

Sprockets and roller chains, centre to centre distance 3 ft., 6/1 reduction ratio, input at 1800 rpm, excluding guard.

FOB cost.

Correlation Data:

C_o =	$ 55
S_o =	10 hp
n =	0.21
L+M Factor =	1.8 (assumed)
Range :	2 to 10 hp
Error :	

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: AC-DC Power Converters

COSMOD Reference Number: 068

Description of Equipment:

Semi-converter, voltage and current single direction. Input 3-phase AC 230/460/575, Nema 1. FOB cost.

Correlation Data:

C_o =	$ 840	$ 2800
S_o =	5 kW	30 kW
n =	0.75	0.46
L+M Factor =	1.8 (assumed)	1.8 (assumed)
Range :	1.5 to 15 kW	15 to 500 kW
Error :		

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: AC-DC Power Converters

COSMOD Reference Number: 069

Description of Equipment:

Uni-converter, current single direction, voltage either direction, input 3-phase AC 230/460/575, Nema 1. FOB cost.

Correlation Data:

C_o = $ 5500

S_o = 30 kW

n = 0.61

L+M Factor = 1.8

Range : 10 to 80 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
As above	1.0		01			
Dual-converter, voltage and current in either direction, Nema 1, FOB	1.1		02			
Nema 12 enclosure	1.64		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 075

Description of Equipment:

Horizontal, cylindrical, dished ends, c/s 150 psig, unfired. Including manhole, usual nozzles, support saddles. Excluding stress relieving, foundations. FOB cost.

Correlation Data:

C_o = $ 1900

S_o = 1000 US gal.

n = 0.62

L+M Factor = 2.2

Range : 100 to 80000 US gal.

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
Pressure						
150 psig	1.0		01			
200	1.15		02			
300	1.25		03			
500	1.45		04			
600	1.60		05			
700	1.70		06			
800	1.90		07			
900	2.3		08			

Coding Data (Continued):

COSMOD Reference Number: 075

Correction For	Factor	e	f	g	h	i
Pressure (cont.)						
1000	2.5		09			
Design program specifies pressure, COSMOD selects correction factor			99			
Materials						
c/s	1.0			01		
316 s/s	4.0			02		
316 s/s clad	2.25			03		
Titanium	8.0			04		
Titanium clad	4.25			05		
Monel	6.3			06		
Monel clad	3.9			07		
Complexity						
Average complexity	1.0				01	
No accessories	0.8				02	
Complex accessories	1.3				03	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 076

Description of Equipment:

Same as equipment with COSMOD Ref. No. 075, but cost correlated to bare weight of equipment.

FOB cost.

Correlation Data:

C_o =	$ 600	$ 3300
S_o =	1000 lb	10000 lb
n =	0.57	0.79
L+M Factor =	2.2	2.2
Range :	100 to 2000 lb	2000 to 100000 lb
Error :		

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
Select code from sheet for equipment with COSMOD Ref. No. 075.						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 077

Description of Equipment:

Same as equipment with COSMOD Ref. No. 075, but cost correlated to length and diameter of vessel. FOB cost.

Correlation Data:

C_o = $ 11000

S_o = 3.0 (length, ft) (diam., ft)$^{1.5}$

n = 0.84

L+M Factor = 2.2

Range : 12 to 100 (length, ft) (diam., ft)$^{1.5}$

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select code from sheet for equipment with COSMOD Ref. No. 075.						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 079

Description of Equipment:

Vertical cylinders, dished ends, c/s, 150 psig, unfired. Including manhole, usual nozzles and support skirt. Excluding foundations.

FOB cost.

Correlation Data:

C_o = \$ 4800

S_o = 100 (length, ft) (diam., ft)$^{1.5}$

n = 0.81

L+M Factor = 3.0

Range : 8 to 350 (length, ft) (diam., ft)$^{1.5}$

Error : 50%

Coding Data:

X.XX XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
Pressure						
150 psig	1.0		01			
200	1.2		02			
300	1.25		03			
400	1.4		04			
500	1.5		05			
600	1.65		06			
700	1.9		07			
800	2.0		08			

Coding Data (Continued):

COSMOD Reference Number: 079

Correction For	Factor	e	f	g	h	i
Pressure (cont.)						
900 psig	2.4		09			
1000	2.6		10			
Design program to specify, COSMOD to select			99			
Materials						
c/s	1.0			01		
304 s/s	2.75			02		
304 s/s clad	2.50			03		
316 s/s	3.65			04		
316 s/s clad	2.25			05		
310 s/s	3.25			06		
410 s/s	2.1			07		
glass lined	2.3			08		
rubber lined	1.6			09		
nickel	8.2			10		
monel	6.5			11		
monel clad	4.0			12		
titanium	7.9			13		
titanium clad	4.25			14		
inconel	8.2			15		
Design variation						
Non-jacketed	1.0				01	
Jacketed	1.6				02	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 080

Description of Equipment:

Same as equipment with COSMOD Ref. No. 079, but cost correlated to nominal volume of vessel.

FOB cost.

Correlation Data:

C_o =	$ 600	$12000
S_o =	100 US gal.	10000 US gal.
n =	0.53	0.89
L+M Factor =	3.0	3.0
Range :	10 to 2500 US gal.	2500 to 28000 US gal.
Error :	40%	40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
Select code from sheet for equipment with COSMOD Ref. No. 079.						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 081

Description of Equipment:

Same as equipment with COSMOD Ref. No. 079, but cost correlated to bare weight of vessel.

FOB cost.

Correlation Data:

C_o = $ 4700

S_o = 10000 lb

n = 0.7

L+M Factor = 3.0

Range : 100 to 300000 lb

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select code from sheet for equipment with COSMOD Ref. No. 079.						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 087

Description of Equipment:

Spherical storage tanks, c/s, 30 psig, ASME construction. Supports, ladders, walkways, relief valves and gauging devices included. Foundation not included. Field erected cost.

Correlation Data:

C_o =	$ 28000
S_o =	100 m^3
n =	0.7
L+M Factor =	1.65
Range :	40 to 1500 m^3
Error :	40%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Pressure						
30 psig	1.0		01			
50	1.1		02			
75	1.2		03			
100	1.3		04			
200	1.6		05			
Design program to specify pressure, COSMOD to select factor			99			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 088

Description of Equipment:

Spheroid storage vessels, c/s, 15 psig, including manholes, relief valves and staircase. Excluding foundation and dykes. Field erected cost.

Correlation Data:

C_o = $ 90000

S_o = 3780 m^3 (nominal volume)

n = 0.73

L+M Factor = 2.0 (assumed)

Range : 1200 to 5000 m^3

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 089

Description of Equipment:

Underground cavities, salt dome, complete. (Installed cost).

Correlation Data:

C_o = $ 450000

S_o = 30000 m^3 (nominal volume)

n = 0.73

L+M Factor = 2.0 (assumed)

Range : 8000 to 50000 m^3

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pressure Vessels

COSMOD Reference Number: 090

Description of Equipment:

Underground cavities, mined, complete.

(Installed cost).

Correlation Data:

C_o = $ 1400000

S_o = 30000 m^3 (nominal volume)

n = 0.58

L+M Factor = 2.0 (assumed)

Range : 13000 to 100000 m^3

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 091

Description of Equipment:

Horizontal cylinders, flanged and dished heads or flat end, c/s, including nominal accessories, manhole and nozzles. Excluding foundation.

FOB cost.

Correlation Data:

C_o = $ 1400

S_o = 1000 US gal

n = 0.57

L+M Factor = 2.0 (assumed)

Range : 100 to 40000 US gal

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
aluminum	2.8		02			
rubber lined	2.8		03			
lead lined	3.0		04			
s/s 304	4.4		05			
s/s 316	6.8		06			
inconel	7.9		07			
monel	6.6		08			

Coding Data (Continued):

COSMOD Reference Number: 091

Correction For	Factor	e	f	g	h	i
Complexity						
Average	1.0			01		
Minimum for bulk storage	0.5			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 092

Description of Equipment:

Same as equipment with COSMOD Ref. no. 091, but cost correlated to weight of vessel.

FOB cost.

Correlation Data:

C_o = $ 1800

S_o = 3000 lb

n = 0.93

L+M Factor = 2.0 (assumed)

Range : 400 to 20000 lb

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select values from sheet for equipment with COSMOD Ref. No. 091.						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 093

Description of Equipment:

Vertical cylinder, open tank or flat roof, c/s, flat bottom. Including 18" manhole, one 4" nozzle, one 6" nozzle and four 2" nozzles. Excluding foundation.

FOB cost.

Correlation Data:

C_o = $ 1000

S_o = 1000 US gal

n = 0.3

L+M Factor = 1.5

Range : 100 to 20000 US gal

Error : 20%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
aluminum	1.4		02			
rubber lined	1.5		03			
lead lined	1.5		04			
glass lined	4.3		05			
redwood	0.5		06			
s/s 304 alloy	3.0		07			
s/s 304 clad	1.5		08			

Coding Data (Continued):

COSMOD Reference Number: 093

Correction For	Factor	e	f	g	h	i
Material (cont.)						
s/s 316 alloy	3.0		09			
s/s 316 clad	2.5		10			
inconel alloy	5.8		11			
inconel clad	3.0		12			
nickel alloy	5.9		13			
nickel clad	3.0		14			
monel alloy	5.1		15			
monel clad	3.0		16			
Jacketing						
Non- jacketed	1.0			01		
Jacketed	1.2			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 094

Description of Equipment:

Same as equipment with COSMOD Ref. No. 093, but cost correlated to weight of vessel. FOB cost.

Correlation Data:

C_o =	$ 2200
S_o =	3000 lb
n =	0.51
L+M Factor =	1.5
Range :	400 to 20000 lb
Error :	

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select values from sheet for equipment with COSMOD Ref. No. 093.						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 095

Description of Equipment:

Vertical cylinder, open tank, c/s, jacketed.

FOB cost.

Correlation Data:

C_o = $ 4500

S_o = 1000 US gal

n = 0.57

L+M Factor = 2.0 (assumed)

Range : 70 to 1500 US gal

Error : 40%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
304 s/s	1.5		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 096

Description of Equipment:

Vertical cylinder, open tank, c/s, agitated, including motor and drive. FOB cost.

Correlation Data:

C_o = $ 3700

S_o = 10 US gal

n = 0.5

L+M Factor = 2.0 (assumed)

Range : 1 to 200 US gal

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
304 s/s	1.9		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 097

Description of Equipment:

Vertical cylinder, API, flat bottom, fixed cone roof. Including 18" manhole, one 4" nozzle, one 6" nozzle, four 2" nozzles and spiral staircase. Excluding foundations and dyking.

FOB cost.

Correlation Data:

C_o = $ 6200

S_o = 10000 US gal

n = 0.32

L+M Factor = 1.85

Range : 1000 to 850000 US gal

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
aluminum	1.4		02			
rubber lined	1.5		03			
lead lined	1.5		04			
glass lined	4.3		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 098

Description of Equipment:

Same as equipment with COSMOD Ref. No. 097, but field erected cost.

Correlation Data:

C_o = $ 70000

S_o = 1000000 US gal

n = 0.58

L+M Factor = 2.0 (assumed)

Range : 30000 to 3000000

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
rubber lined	1.5		02			
lead lined	1.6		03			
304 s/s	3.2		04			
316 s/s	3.5		05			
nickel	5.9		06			
inconel	5.8		07			
monel	5.1		08			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 099

Description of Equipment:

Vertical cylinder, API movable roof, c/s, lifter type, 5 ft. lift, liquid seal. Including manholes, relief valves, roof supports, glide slides, spiral stairway, ladder, usual flanged connections. Excluding foundations and dyking. Field erected cost.

Correlation Data:

C_o = $ 88000

S_o = 1000000 US gal

n = 0.63

L+M Factor = 2.0 (assumed)

Range : 250000 to 3000000 US gal

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Design Variations						
None	1.0		01			
Pontoon	0.85		02			
Lift						
5 ft.	1.0			01		
10 ft.	1.3			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 100

Description of Equipment:

Trickling filter (rock media).

Including earthwork, structure, underdrain system, filter media and rotary feed distributor. Excluding engineering overheads.

Installed cost.

Correlation Data:

C_o =	\$ 35000	\$ 160000
S_o =	1000 ft^3 (filter media)	100000 ft^3
n =	0.45	0.79
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	4000 to 25000	25000 to 300000
Error :		

Note: Units of range : ft^3 filter media volume

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 101

Description of Equipment:

Complete plant for waste water treatment. Feed at 200 ppm BODs. Excluding bonding cost and sludge disposal equipment cost. Installed cost.

Correlation Data:

C_o = $ 160000

S_o = 220000 US gal/day (throughput)

n = 0.79

L+M Factor = 2.0 (assumed)

Range : 100000 to 100000000 US gal/day (throughput)

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 103

Description of Equipment:

Activated sludge unit. Conventional aeration chamber plus secondary clarifier with necessary pumps, aerators and piping. Excluding sludge disposal and overheads. Installed cost.

Correlation Data:

C_o = \$ 54000

S_o = 10^6 US gal/day (throughput)

n = 0.78

L+M Factor = 2.0 (assumed)

Range : 10^4 to 10^8 US gal/day (throughput)

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 104

Description of Equipment:

Activated sludge unit. Aeration tank only (conventional). Excluding aeration equipment, air piping, diffusers, recirculating and intermediate pumps, secondary clarifier and overheads. Installed cost.

Correlation Data:

C_o = \$ 120000

S_o = 10^5 ft^3 (liquid volume)

n = 0.77

L+M Factor = 2.0 (assumed)

Range : 3000 to 10^6 ft^3 (liquid volume)

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 105

Description of Equipment:

Concrete chlorination contact basin, including basin structure, normal earthwork, baffles to prevent short circuit. Excluding sludge collection mechanism, chlorination feed system and overheads.

Installed cost.

Correlation Data:

C_o = $ 32000

S_o = 10^5 US gal (liquid volume)

n = 0.63

L+M Factor = 2.0 (assumed)

Range : 10^3 to 10^6 US gal (liquid volume)

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Overheads						
Without	1.0			01		
With	1.25			02		
Additional Eqpt.						
none	1.0		01			
Including sludge collection mechanism and chlorination system	1.7		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 106

Description of Equipment:

Equalization basin earthwork.
Excluding engineering and contingencies.
Installed cost.

Correlation Data:

C_o = $ 19000

S_o = 10^5 US gal (liquid volume)

n = 0.51

L+M Factor = 2.0 (assumed)

Range : 7×10^4 to 7×10^7 US gal (liquid vol.)

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Engineering and Contingencies						
Not included	1.0		01			
Included	1.25		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 107

Description of Equipment:

Oxidation ponds or aerated lagoon earthwork. Excluding land cost and sludge disposal. Installed cost.

Correlation Data:

C_o = $ 90000

S_o = 10^6 US gal (liquid volume)

n = 0.67

L+M Factor = 2.0 (assumed)

Range : 10^5 to 2×10^8 US gal (liquid volume)

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 111

Description of Equipment:

Sludge lagoons, for storage and drying of sludge after digestion. Including normal excavation, dike construction, sludge distribution and piping.
Installed cost.

Correlation Data:

C_o = $ 26000

S_o = 10^4 m^3

n = 0.6

L+M Factor = 2.0 (assumed)

Range : 10^3 to 10^6 m^3

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 112

Description of Equipment:

Concrete sludge holding tank.
Excluding engineering and overheads.
Installed cost.

Correlation Data:

C_o = $ 92000

S_o = 10^3 m^3

n = 0.56

L+M Factor = 2.0 (assumed)

Range : 28 to 10^4 m^3

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessel

COSMOD Reference Number: 113

Description of Equipment:

Imhoff plant for anaerobic sludge digestion. Packaged Imhoff. Excluding clarifier. Installed cost.

Correlation Data:

C_o = $ 37000

S_o = 10^6 US gal

n = 0.82

L+M Factor = 2.0 (assumed)

Range : 10^5 to 10^7 US gal

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Atmospheric Vessels

COSMOD Reference Number: 114

Description of Equipment:

Anaerobic sludge digester, including heaters, mixers, pumps, concrete tank cover and control building. Excluding overheads. Installed cost.

Correlation Data:

C_o =	\$ 37000	\$ 480000
S_o =	283 m^3	8500 m^3
n =	0.41	0.97
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	28 to 297 m^3	297 to 140000 m^3
Error :		

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid Mixing (Mechanical)

COSMOD Reference Number: 115

Description of Equipment:

Propeller mixer, c/s, portable, TEFC motor.

FOB cost.

Correlation Data:

C_o = $ 600

S_o = 2 hp (drive)

n = 0.58

L+M Factor = 2.0 (assumed)

Range : 0.25 to 7.5 hp (drive)

Error : 30%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
304 s/s	1.12		02			
316 s/s	1.17		03			
rubber covered	1.36		04			
monel	1.37		05			
Drive						
direct drive	1.0			01		
gear drive	1.2			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid Mixing (Mechanical)

COSMOD Reference Number: 116

Description of Equipment:

Propeller mixer, c/s, top entry, fixed open tank. Including TEFC motor, gear reduction unit. Excluding starter, wiring, taxes and duties.

FOB cost.

Correlation Data:

C_o =	$ 1100
S_o =	5 hp (drive)
n =	0.52
L+M Factor =	1.62
Range :	1 to 30 hp (drive)
Error :	40%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i

(Select values from data below)

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
304 s/s	1.12		02			
316 s/s	1.17		03			
rubber covered	1.36		04			
monel	1.37		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid Mixing (Mechanical)

COSMOD Reference Number: 117

Description of Equipment:

Propeller mixer, c/s, top entry, fixed closed tank. Including TEFC motor and mechanical seal.

FOB cost.

Correlation Data:

C_o =	$ 1800
S_o =	5 hp (drive)
n =	0.57
L+M Factor =	1.62
Range :	1 to 50 hp (drive)
Error :	40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
304 s/s	1.12		02			
316 s/s	1.17		03			
rubber covered	1.36		04			
monel	1.37		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid mixing (Mechanical)

COSMOD Reference Number: 118

Description of Equipment:

Propeller mixer, c/s, side entry, fixed mechanical seal. Including TEFC motor, belt, drive and seal.
FOB cost.

Correlation Data:

C_o =	$ 920	$ 1550
S_o =	2 hp (drive)	10 hp (drive)
n =	0.19	0.48
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	1 to 5 hp (drive)	5 to 30 hp (drive)
Error :		

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid Mixing (Mechanical)

COSMOD Reference Number: 119

Description of Equipment:

Turbine mixer, c/s, top entry, fixed open tank. Including TEFC motor, gear reduction unit. Excluding starter, wiring and taxes. FOB cost.

Correlation Data:

C_o =	$ 2100
S_o =	10 hp (drive)
n =	0.45
L+M Factor =	1.67
Range :	2 to 30 hp (drive)
Error :	50%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
304 s/s	1.13		02			
316 s/s	1.17		03			
rubber covered	1.36		04			
monel	1.40		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid Mixing (Mechanical)

COSMOD Reference Number: 120

Description of Equipment:

Turbine mixer, c/s, top entry, fixed closed tank. Including TEFC motor, mechanical seal. Single speed. Excluding starter, wiring and taxes.
FOB cost.

Correlation Data:

C_o =	$ 3200
S_o =	10 hp (drive)
n =	0.56
L+M Factor =	2.0 (assumed)
Range :	2 to 200 hp (drive)
Error :	20%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
304 s/s	1.15		02			
316 s/s	1.17		03			
rubber covered	1.36		04			
monel	1.37		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid Mixing (Aeration)

COSMOD Reference Number: 121

Description of Equipment:

Sparger diffusion, diffused air system. Including blowers, drives, building for air compressor, air piping to the diffusers. Installed cost.

Correlation Data:

C_o =	\$ 46000	\$ 250000
S_o =	4000 ft^3/min	30000 ft^3/min
n =	0.66	0.93
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	400 to 7500 ft^3/min	7500 to 50000
Error :		

Note: Units of size and range: ft^3/min (capacity)

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid mixing (Aeration)

COSMOD Reference Number: 122

Description of Equipment:

Diffused air system for the aeration tank of a secondary waste water treatment unit. Installed cost.

Correlation Data:

C_o = $ 280000

S_o = 10^6 US gal (vol. of aeration tank)

n = 0.8

L+M Factor = 2.0 (assumed)

Range : 2×10^5 to 4×10^6 US gal

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Liquid Mixing (Aeration)

COSMOD Reference Number: 123

Description of Equipment:

Surface aerators, single unit capacity. Including cost of supports and motor. FOB cost.

Correlation Data:

C_o = $ 8500

S_o = 20 hp (drive)

n = 0.55

L+M Factor = 2.0 (assumed)

Range : 1 to 200 hp (drive)

Error :

Coding Data:

$\underline{X.XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Viscous Liquid Mixing (Mechanical)

COSMOD Reference Number: 124

Description of Equipment:

Anchor mixing, c/s, top entry, closed tank. TEFC motor, constant speed gear drive included.
FOB cost.

Correlation Data:

C_o = $ 1350

S_o = 2 hp (drive)

n = 0.41

L+M Factor = 2.0 (assumed)

Range : 1 to 3 hp (drive)

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
304 s/s	1.14		02			
316 s/s	1.18		03			
rubber covered	1.54		04			
monel	1.40		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crystallization (Batch)

COSMOD Reference Number: 127

Description of Equipment:

Vacuum, welded, c/s, including vacuum equipment, mixer, central draft tube. Delivered cost.

Correlation Data:

C_o = $ 30000

S_o = 2000 US gal (working capacity)

n = 0.68

L+M Factor = 1.6

Range : 500 to 10000 US gal

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
rubber lined	1.27		02			
304 s/s clad	2.35		03			
316 s/s clad	2.4		04			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crystallization (Mechanical)

COSMOD Reference Number: 128

Description of Equipment:

Swenson- Walker, c/s.

FOB cost.

Correlation Data:

C_o = $ 5500

S_o = 70 ft^2 (cooling area)

n = 0.55

L+M Factor = 2.0 (assumed)

Range : 30 to 150 ft^2 (cooling area)

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
s/s	2.0		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crystallization (Mechanical)

COSMOD Reference Number: 129

Description of Equipment:

Scraped surface, c/s. Excluding motor and drive.

FOB cost.

Correlation Data:

C_o = $ 6500

S_o = 100 ft^2 (cooling area)

n = 0.79

L+M Factor = 2.0 (assumed)

Range : 70 to 600 ft^2 (cooling area)

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crystallization (Growth)

COSMOD Reference Number: 131

Description of Equipment:

Conventional forced circulation, c/s, including pump, drive, heat exchanger, vacuum equipment and crystallizer. Excluding foundation.

Correlation Data:

C_o = $ 85000

S_o = 100 short tons/day (crystal capacity)

n = 0.53

L+M Factor = 1.75

Range : 10 to 1000 short tons/day

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
cast iron	1.0		02			
rubber lined	0.75		03			
s/s	3.0		04			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crystallization (Growth)

COSMOD Reference Number: 132

Description of Equipment:

Growth and classifying type, c/s, including vapour body, retention chamber, heating element, recirculation pump, piping, TEFC motor, condenser and ejectors.

FOB cost.

Correlation Data:

C_o =	$ 130000
S_o =	100 short tons/day (crystal capacity)
n =	0.62
L+M Factor =	1.75
Range :	10 to 10000 short tons/day
Error :	1000%

Coding Data:

X.XX XX XX XX
e f g h i (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
rubber lined graphite	1.2		02			
s/s	1.1		03			
Type						
Oslo	1.0			01		
Krystall	1.0			02		
Pachuca	0.7			03		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crystallization (Growth)

COSMOD Reference Number: 133

Description of Equipment:

Same as equipment with COSMOD Ref. No. 132, but with cost correlated to heating surface. FOB cost.

Correlation Data:

C_o =	\$ 90000
S_o =	1000 ft^2 (heating surface)
n =	0.57
L+M Factor =	1.75
Range :	200 to 1200 ft^2 (heating surface)
Error :	30%

Coding Data:

$\underset{e}{\underline{X}}.\underset{f}{\underline{XX}}\ \underset{g}{\underline{XX}}\ \underset{h}{\underline{XX}}\ \underset{i}{\underline{XX}}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
Select values from sheet for equipment with COSMOD Ref. No 132.						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Coagulation- Flocculation

COSMOD Reference Number: 134

Description of Equipment:

Coagulation unit, municipal waste, including rapid mix, mixer, coagulation basin, mechanical coagulator, drive and settling basin.
Installed cost.

Correlation Data:

C_o = $ 62000

S_o = 10^6 US gal/day (capacity)

n = 0.62

L+M Factor = 2.0 (assumed)

Range : 10^5 to 10^8 US gal/day

Error : 60%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Source of Waste						
municipal	1.0		01			
industrial	3.0		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 135

Description of Equipment:

Jaw crushers, c/s, including drive, excluding motor.

FOB cost.

Correlation Data:

C_o =	$ 10000	$ 85000
S_o =	7.5 kW (drive power)	75 kW (drive power)
n =	0.65	0.81
L+M Factor =	1.57	1.57 (assumed)
Range :	0.7 to 42 kW	42 to 280 kW
Error :	40%	

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i

(Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 136

Description of Equipment:

Same as equipment with COSMOD Ref. No. 135, but with cost correlated to grinding capacity. FOB cost.

Correlation Data:

C_o =	$ 14000	$ 100000
S_o =	10 Mg/h	350 Mg/h
n =	0.58	1.11
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.5 to 30 Mg/h	350 to 1000 Mg/h
Error :		

Note: No data available for intermediate range.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 137

Description of Equipment:

Same as equipment with COSMOD Ref. No. 135, but with cost correlated to feed opening. FOB cost.

Correlation Data:

C_o = $ 70000

S_o = 1 m^2 (feed opening)

n = 1.28

L+M Factor = 2.0 (assumed)

Range : 0.2 to 1.9 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 138

Description of Equipment:

Gyratory crushers, c/s, including lubrication system. Excluding motor, drive and tax. FOB cost.

Correlation Data:

C_o =	$ 9000	$ 90000
S_o =	10 kW (drive)	100 kW (drive)
n =	0.5	1.19
L+M Factor =	1.57	1.57 (assumed)
Range :	1 to 70 kW	70 to 750 kW
Error :	50%	40%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 139

Description of Equipment:

Same as equipment with COSMOD Ref. No.138, but with cost correlated to grinding capacity.

FOB cost.

Correlation Data:

C_o = $ 310000

S_o = 1000 Mg/h (grinding capacity)

n = 0.92

L+M Factor = 2.0 (assumed)

Range : 150 to 4000 Mg/h

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 140

Description of Equipment:

Same as equipment with COSMOD Ref. No. 138, but with drive included and cost correlated to receiver opening. Used as secondary crusher. FOB cost.

Correlation Data:

C_o = $ 160000

S_o = 1 m^2 (receiver opening)

n = 0.95

L+M Factor = 2.0 (assumed)

Range : 0.5 to 1.3 m^2

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 141

Description of Equipment:

Cone crusher, c/s, including drive.

Excluding motor.

FOB cost.

Correlation Data:

C_o = $ 50000

S_o = 100 kW (drive power)

n = 0.92

L+M Factor = 2.0 (assumed)

Range : 20 to 200 kW (drive power)

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 142

Description of Equipment:

Same as equipment with COSMOD Ref. No. 141, but cost correlated to grinding capacity. FOB cost.

Correlation Data:

C_o =	$ 35000
S_o =	100 Mg/h (grinding capacity)
n =	0.64
L+M Factor =	1.57
Range :	25 to 1000 Mg/h (grinding capacity)
Error :	100%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 143

Description of Equipment:

Same as equipment with COSMOD Ref. No. 141, but cost correlated to diameter of discharge annulus.

FOB cost.

Correlation Data:

C_o = $ 33000

S_o = 1 m (diameter of discharge annulus)

n = 1.8

L+M Factor = 2.0 (assumed)

Range : 0.6 to 2.1 m

Error :

Coding Data:

$\underset{e}{\underline{X}}.\underset{f}{\underline{XX}}\ \underset{g}{\underline{XX}}\ \underset{h}{\underline{XX}}\ \underset{i}{\underline{XX}}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 144

Description of Equipment:

Rotary crusher, c/s, excluding drive and motor.

FOB cost.

Correlation Data:

C_o = $ 2500

S_o = 10 kW (drive)

n = 0.65

L+M Factor = 2.0 (assumed)

Range : 1 to 100 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 145

Description of Equipment:

Twin, smooth roll crushers, c/s, excluding drive, motor and tax. Light duty. FOB cost.

Correlation Data:

C_o = $ 2600

S_o = 1 kW (drive)

n = 0.94

L+M Factor = 2.0 (assumed)

Range : 0.5 to 15 kW

Error : 60%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 146

Description of Equipment:

Same as equipment with COSMOD Ref. No. 145, but heavy duty.

FOB cost.

Correlation Data:

C_o =	$ 8500
S_o =	10 kW (drive)
n =	0.61
L+M Factor =	2.0 (assumed)
Range :	0.75 to 200 kW
Error :	60%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i

(Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 147

Description of Equipment:

Same as equipment with COSMOD Ref. No. 145, but cost correlated to grinding capacity. FOB cost.

Correlation Data:

C_o =	$ 9400
S_o =	10 Mg/h (grinding capacity)
n =	0.61
L+M Factor =	2.0 (assumed)
Range :	1 to 60 Mg/h
Error :	100%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 148

Description of Equipment:

Sawtooth roll crusher, c/s, excluding drive, motor and tax.

FOB cost.

Correlation Data:

C_o = $ 2300

S_o = 10 kW (drive power)

n = 0.59

L+M Factor = 2 (assumed)

Range : 3 to 30 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Size Reduction (Liquids into Liquids)

COSMOD Reference Number: 149

Description of Equipment:

Homogenizer, reciprocating plunger, 6890 kPa, (1000 psig), c/s, including baseplate and gears, excluding motor.

Correlation Data:

C_o = $ 60000

S_o = 100 kW (drive)

n = 0.52

L+M Factor = 2.0 (assumed)

Range : 8 to 150 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Size Reduction (Liquids into Liquids)

COSMOD Reference Number: 150

Description of Equipment:

Colloid mill, s/s, including open dripproof motor and drive.

FOB cost.

Correlation Data:

C_o = $ 6500

S_o = 7.5 kW (drive)

n = 0.61

L+M Factor = 2.0 (assumed)

Range : 3 to 25 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Crushers

COSMOD Reference Number: 151

Description of Equipment:

Same as equipment with COSMOD Ref. No. 138, but including drive and cost correlated to receiver opening. Used as primary crusher. FOB cost.

Correlation Data:

C_o = $ 300000

S_o = 2 m^2 (receiver opening)

n = 1.41

L+M Factor = 2.0 (assumed)

Range : 1.1 to 4.0 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Evaporators (External Circulation)

COSMOD Reference Number: 155

Description of Equipment:

Natural, short tube heater, c/s, including vapour piping, barometric condenser, vacuum equipment, integral piping and condensate receivers. FOB cost.

Correlation Data:

C_o = $ 10000

S_o = 50 ft^2 (heating surface area)

n = 0.5

L+M Factor = 1.9

Range : 20 to 200 ft^2

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
As described above	1.0		01			
Evaporator body only	0.3		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Evaporators (External Circulation)

COSMOD Reference Number: 156

Description of Equipment:

Forced circulation, short tube heater, c/s, including vapour piping, condenser, vacuum equipment, integral piping, receivers, circulating pump and drive. FOB cost.

Correlation Data:

C_o =	\$ 65000
S_o =	1000 ft^2 (heating surface area)
n =	0.74
L+M Factor =	1.9
Range :	200 to 5000 ft^2
Error :	40%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
cast iron + Cu tubes	1.0		02			
monel clad	1.8		03			
nickel clad	1.5		04			
Design Variations						
As described above	1.0			01		
Evap. body only	0.35			02		
Kettle type	1.0			03		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Evaporators (Internal Circulation)

COSMOD Reference Number: 157

Description of Equipment:

Horizontal tube, internal circulation, c/s, including all auxiliaries such as vapour piping, barometric condenser, vacuum ejectors and condensate receivers.

FOB cost.

Correlation Data:

C_o =	\$ 20000
S_o =	500 ft^2 (heating surface area)
n =	0.47
L+M Factor =	1.90
Range :	100 to 9000 ft^2
Error :	30%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
cast iron body with Cu tubes	1.0		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Evaporators (Internal Circulation)

COSMOD Reference Number: 158

Description of Equipment:

Vertical tube-basket, calandria, internal circulation, c/s, including all auxiliaries such as vapour piping, barometric condenser, vacuum ejectors and condensate receivers.

FOB cost.

Correlation Data:

C_o =	\$ 21000
S_o =	500 ft^2 (heating surface area)
n =	0.55
L+M Factor =	1.9
Range :	100 to 6000 ft^2
Error :	60%

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
cast iron body with						
Cu tubes	1.0		02			
lead lined	2.0		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Evaporators (Internal Circulation)

COSMOD Reference Number: 159

Description of Equipment:

Same as equipment with COSMOD Ref. No. 158, but with forced circulation via internal propeller, including propeller and drive.

FOB cost.

Correlation Data:

C_o = $ 550000

S_o = 30000 ft^2 (heating surface area)

n = 0.70

L+M Factor = 2.0 (assumed)

Range : 10000 to 70000 ft^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Evaporators (Long Tube)

COSMOD Reference Number: 160

Description of Equipment:

Vertical rising or falling film, c/s, including thermal section, separator, vacuum equipment, integral piping and all auxiliaries.
FOB cost.

Correlation Data:

C_o = $ 23000

S_o = 1000 ft^2 (heating surface area)

n = 0.68

L+M Factor = 2.0 (assumed)

Range : 10 to 10^5 ft^2

Error : 70%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
Cast iron body with Cu tubes	2.0		02			
Rubber lined body + Karbate tubes	3.0		03			
all Cu	3.5		04			
all Ni	10.0		05			

Coding Data (Continued):

COSMOD Reference Number: 160

Correction For	Factor	e	f	g	h	i
Auxiliaries						
Including auxiliaries	1.0			01		
Excluding auxiliaries. (Evaporator only)	0.85			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Evaporators (Wiped Film)

COSMOD Reference Number: 161

Description of Equipment:

Vertical, 316 s/s, including thermal section, separator and drive. Excluding vacuum equipment and auxiliaries.

FOB cost.

Correlation Data:

C_o =	\$ 10000	\$ 45000
S_o =	5 ft^2	100 ft^2
n =	0.36	0.62
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	1 to 18 ft^2	18 to 250 ft^2
Error :	30%	30%

Note: Units of size : Evaporation heating surface area, ft^2.

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
316 s/s	1.0		01			
304 s/s	0.9		02			
Vacuum Equipment						
Not included	1.0			01		
Included	1.5			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Evaporators (Jacketed)

COSMOD Reference Number: 162

Description of Equipment:

Jacketed glass lined vessel.

FOB cost.

Correlation Data:

C_o = $ 16000

S_o = 100 US gal (capacity)

n = 0.48

L+M Factor = 1.75

Range : 50 to 1000 US gal

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Liquid Contacting)

COSMOD Reference Number: 163

Description of Equipment:

Trays, cost per tray, sieve type, c/s, installed in sections.
Delivered cost.

Correlation Data:

C_o = $ 600

S_o = 10 ft (tray diameter)

n = 2.0

L+M Factor = 2.0 (assumed)

Range : 3 to 15 ft

Error : 30%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For		Factor	e	f	g	h	i
			0			00	00
Material	c/s	1.0		01			
	copper	1.15		02			
	s/s 304	2.5		03			
	s/s 316	2.7		04			
	monel	9.9		05			
Type	Sieve tray	1.0			01		
	Turbogrid	1.0			02		
	Valve	1.4			03		

Coding Data (Continued):

COSMOD Reference Number: 163

Correction For	Factor	e	f	g	h	i
Type (continued)						
Trough	1.4			04		
Buble cap	2.8			05		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Liquid Contacting)

COSMOD Reference Number: 164

Description of Equipment:

Tray Unit at 24" plate spacing, sieve trays, c/s. Including trays, supports, fittings and all installation at the shop. Excluding column shell. Installed cost.

Correlation Data:

C_o = $ 4500

S_o = 1000 (tray stack height,ft) (tray diam)$^{1.65}$

n = 0.88

L+M Factor = 2.0 (assumed)

Range : 20 to 60000

Error : 50%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
Material						
c/s	1.0		01			
copper	1.15		02			
304 s/s	2.5		03			
316 s/s	2.7		04			
monel	9.9		05			
Type						
Sieve tray	1.0			01		
Turbogrid	1.0			02		

Coding Data (Continued):

COSMOD Reference Number: 164

Correction For	Factor	e	f	g	h	i
Type (continued)						
Valve	1.4			03		
Trough	1.4			04		
Bubble cap	2.8			05		
Tray Spacing						
24"	1.0				01	
18"	1.4				02	
12"	2.2				03	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Liquid Contacting)

COSMOD Reference Number: 165

Description of Equipment:

Tray Distillation Column Units, c/s, 1 to 10 atmosphere pressure, above ambient temperature, including tower, trays, foundation, piping, instrumentation and auxiliaries such as pumps, reboilers, condensers, accumulators, indirect engineering, overheads and startup.
Installed cost.

Correlation Data:

C_o = $ 1000000

S_o = 4000 (No. of plates) $(10^6 \text{lb/yr feed})^{0.65}$

n = 1.0

L+M Factor = 2.0 (assumed)

Range : 300 to 30000

Error : 26%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
Pressure						
50 to 100 mm Hg.	4.0		01			
350 to 400	1.7		02			
760	1.0		03			
7600	1.0		04			
Design program to specify			99			
Material						
c/s	1.0			01		

Coding Data (Continued):

COSMOD Reference Number: 165

Correction For	Factor	e	f	g	h	i
Material (continued)						
410 s/s	1.5			02		
316 s/s	1.7			03		
Other Factors						
No offsites	1.0				01	
Including offsites usual on established site	1.35				02	
Including offsites, grass roots, based on c/s only	2.0				03	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Liquid Contacting)

COSMOD Reference Number: 166

Description of Equipment:

Chemical stoneware Raschig Rings, for tower packing.

FOB cost.

Correlation Data:

C_o = \$ 1

S_o = 1.0 ft^3 (packing volume)

n = 1.0

L+M Factor = 1.2 (assumed)

Range : (Not limited. Use negative code as shown below)

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		-0		00	00	00
Size of Packing						
1/2 inch	21.75		01			
5/8	21.75		02			
3/4	14.55		03			
1	8.48		04			
1 1/2	6.38		05			
2	6.00		06			
3	5.25		07			
4	3.75		08			
6	3.08		09			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Liquid Contacting)

COSMOD Reference Number: 167

Description of Equipment:

Chemical Stoneware Cross Partition rings for tower packing.

FOB cost.

Correlation Data:

C_o = $ 1

S_o = 1 ft^3 (packing volume)

n = 1.0

L+M Factor = 1.2 (assumed)

Range : (Not limited. Use negative code as shown below)

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		-0		00	00	00
Size of Packing						
3 inch	3.90		01			
4	4.24		02			
6	2.70		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Liquid Contacting)

COSMOD Reference Number: 173

Description of Equipment:

Acid brick lining for vessels.

FOB cost.

Correlation Data:

C_o = $ 1

S_o = 1 ft^2 (lining area)

n = 1.0

L+M Factor = 1.4 (assumed)

Range : (Not limited. Use negative code as shown below)

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		-0		00	00	00
Lining Thickness						
3 inches	3.10		01			
4	4.90		02			
6	6.85		03			
9	9.00		04			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Furnaces (Refractory Lining)

COSMOD Reference Number: 174

Description of Equipment:

Fire-brick lining for furnaces.

FOB cost.

Correlation Data:

C_o = $ 1

S_o = 1 ft^2 (lining area)

n = 1.0

L+M Factor = 1.4 (Assumed)

Range : (Not limited. Use negative code as shown below)

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		-0		00	00	00
Thickness of Bricks						
4.5 inches	5.90		01			
9	8.35		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid systems)

COSMOD Reference Number: 175

Description of Equipment:

Grit Chamber, controlled velocity to separate greater than 65 mesh sand. Including grit collection, washing, engineering and contractor overheads. Installed cost.

Correlation Data:

C_o =	\$ 24000
S_o =	10^4 m^3/d (maximum capacity)
n =	0.6
L+M Factor =	2.0 (assumed)
Range :	10^3 to 10^6 m^3/d
Error :	20%

Coding Data:

$\underline{X.XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid System)

COSMOD Reference Number: 176

Description of Equipment:

Same as equipment with COSMOD Ref. No. 175, but cost correlated to surface area. Installed cost.

Correlation Data:

C_o =	\$ 19000
S_o =	300 m^2
n =	0.37
L+M Factor =	2.0 (assumed)
Range :	50 to 1500 m^2
Error :	40%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i

(Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 177

Description of Equipment:

Air supply system for aerated grit chamber. Including swing header, diffusers, air lift pump, winch and blowers. Excluding grit chamber and piping to grit chamber.

FOB cost.

Correlation Data:

C_o = $ 4500

S_o = 50000 m^3/d (Grit chamber capacity, Peak flow)

n = 0.49

L+M Factor = 2.0 (assumed)

Range : 30000 to 90000 m^3/d

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid System)

COSMOD Reference Number: 178

Description of Equipment:

Complete pretreatment unit for wastewater. Including bar screen, grit chamber, overflow and bypass chamber, and Parshall flume. Concrete construction. Excluding financing, engineering and contingencies. Installed cost.

Correlation Data:

C_o = $ 37000

S_o = 10^4 m^3/d (Capacity)

n = 0.61

L+M Factor = 2.0 (assumed)

Range : 10^2 to 10^6 m^3/d

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Engineering and Contingencies						
Not included	1.0		01			
Included	1.35		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 179

Description of Equipment:

Clarifier/Thickener. Single compartment, concrete. Including 10' walls, overflow wier-launder, without central rake. Excluding excavation, site preparation, piping, feed launder, tunnels and overflow pump. Installed cost.

Correlation Data:

C_o = $ 51000

S_o = 100 m^2 (horizontal cross-sectional area)

n = 0.38

L+M Factor = 2.0 (assumed)

Range : 80 to 2000 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 180

Description of Equipment:

Same as equipment with COSMOD Ref. No. 179, but with central rake mechanism and motor of c/s. For continuous operation of rake at 25 ft/min. Installed cost.

Correlation Data:

C_o =	\$ 14000	\$ 135000
S_o =	40 m^2	1000 m^2
n =	0.36	0.78
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	10 to 80 m^2	80 to 10000 m^2
Error :		

Note: Units of size: Horizontal cross-sectional area, m^2.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separations (Liquid-Solid Systems)

COSMOD Reference Number: 181

Description of Equipment:

Same as equipment with COSMOD Ref. No. 180, but cost correlated to total capacity. Installed cost.

Correlation Data:

C_o = \$ 750000

S_o = 10^4 m^3/d

n = 0.69

L+M Factor = 2.0 (assumed)

Range : 100 to 7000 m^3/d

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 182

Description of Equipment:

Mechanism only for single compartment clarifier/thickener. Including surface skimmers, drive, access platform, centre shaft, bridge, rake and scraping arm, handrail. Excluding inlet piping, overflow launder and tax. FOB cost.

Correlation Data:

C_o = $ 11500

S_o = 100 m^2 (horizontal cross-sectional area)

n = 0.59

L+M Factor = 2.0 (assumed)

Range : 45 to 4000 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 183

Description of Equipment:

Reactor-clarifier central reaction zone.

Including normal site preparation. Excluding excavation, piping, feed launder, tunnels, pumps, chemical feed equipment, electrical and instruments.

Installed cost.

Correlation Data:

C_o =	\$ 62000	\$ 75000
S_o =	100 m^2	1000 m^2
n =	0.33	0.53
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	10 to 290 m^2	290 to 3000 m^2
Error :		

Note: Units of size: Horizontal cross-sectional area, m^2.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 185

Description of Equipment:

API oil-water separator. Excluding contingencies, engineering, administration of the contract and land costs.

Installed cost.

Correlation Data:

C_o = $ 63000

S_o = $10^3 m^3/d$ (influent flow)

n = 0.59

L+M Factor = 2.0 (assumed)

Range : 100 to 800 m^3/d

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Contingencies, etc.						
As above	1.0		01			
Including items excluded above	1.35		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 193

Description of Equipment:

Electrostatic precipitator, for non-corrosive gas, minimum cost construction. Including collecting plates, transformer, mechanical rectifier. Excluding foundations and supports.

FOB cost.

Correlation Data:

C_o =	\$ 23000	\$ 115000
S_o =	10^4 ft^3/min at 100^{o}F	2×10^5 ft^3/min at 100^{o}F
n =	0.39	0.81
L+M Factor =	1.7	1.7 (assumed)
Range :	10^3 to 8×10^4 ft^3/min	8×10^4 to 10^6 ft^3/min
Error :	40%	40%

Note: Units of size: Inlet gas capacity, ft^3/min at 100^{o}F

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Service Variation						
None	1.0		01			
Fly ash service	2.0		02			
Blast furnace	2.0		03			
Acid service	12.0		04			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 192

Description of Equipment:

Multicyclones, dry, c/s. Excluding fans, ductwork, instrumentation.

FOB cost.

Correlation Data:

C_o = $ 2000

S_o = 10^4 std.ft^3/min (Inlet gas capacity)

n = 0.66

L+M Factor = 2.0 (assumed)

Range : 10^3 to 1.5×10^5 std.ft^3/min

Error : 30%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 191

Description of Equipment:

Cyclones, dry, c/s, high efficiency.

Excluding fans, duct work, instrumentation.

FOB cost.

Correlation Data:

C_o = $ 3000

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.56

L+M Factor = 1.69

Range : 10^3 to 8×10^4 std.ft^3/min

Error : 30%

Coding Data:

X.XX XX XX XX
e f g h i (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Efficiency						
High efficiency	1.0		01			
Low efficiency	0.4		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 189

Description of Equipment:

Dissolved air flotation unit for sludge thickening purposes. Including polymer addition. Excluding building, land and contingencies. Installed cost.

Correlation Data:

C_o =	\$ 60000	\$ 150000
S_o =	100 m^3/d	1000 m^3/d
n =	0.28	0.47
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	30 to 380 m^3/d	380 to 3000 m^3/d
Error :		

Note: Units of size: Throughput flow to flotation unit, m^3/d.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 188

Description of Equipment:

Dissolved air flotation unit for clarification purposes. Excluding building, polymer addition, land and contingencies.
Installed cost.

Correlation Data:

C_o = $ 26000

S_o = 10^3 m^3/d (throughput flow to flotation unit)

n = 0.47

L+M Factor = 2.0 (assumed)

Range : 200 to 10^4 m^3/d

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 187

Description of Equipment:

All c/s equipment needed for a working dissolved air flotation unit. Excluding flotation tank. FOB cost.

Correlation Data:

C_o = $ 55000

S_o = 100 m^2 (surface area)

n = 0.61

L+M Factor = 2.0 (assumed)

Range : 50 to 400 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Items						
None	1.0		01			
Including polymer addition facilities and building	2.1		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Liquid-Solid Systems)

COSMOD Reference Number: 186

Description of Equipment:

Dissolved air flotation unit. Shop fabricated c/s package unit, including pumps, motors, internal piping. Excluding tax, concrete pad, influent and effluent lines, building, installation materials and labour, contractor's fees, land, polymer addition equipment. FOB cost.

Correlation Data:

C_o = $ 25000

S_o = 100 m^2 (surface area)

n = 0.59

L+M Factor = 2.0 (assumed)

Range : 5 to 100 m^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Equipt.						
As above	1.0		01			
Including polymer addition equipment. (chemical feed system, air compressor, polymer mix tank and control panel)	1.4		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 194

Description of Equipment:

Electrostatic precipitator, total module for windbox sintering plant or power plant. Installed cost.

Correlation Data:

C_o = $ 600000

S_o = $10^5 ft^3/min$ (inlet gas capacity at 100^oF)

n = 0.78

L+M Factor = 2.0 (assumed)

Range : $2x10^4$ to $8x10^5$ ft^3/min

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Service Variation						
None	1.0		01			
Scarfing plant	0.8		02			
New open hearth plant	1.4		03			
Added to existing open hearth plant	1.9		04			
Blast furnace	2.6		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 195

Description of Equipment:

Wet cyclone or centrifugal scrubber, c/s, including housing and spray locations. Excluding fan.

FOB cost.

Correlation Data:

C_o = $ 4000

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.72

L+M Factor = 2.0 (assumed)

Range : 500 to 10^5 std.ft^3/min

Error : 50%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
316 s/s	1.6		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 196

Description of Equipment:

Venturi-jet type, low energy, c/s scrubber, excluding fan.

FOB cost.

Correlation Data:

C_o = $ 5000

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.50

L+M Factor = 2.0 (assumed)

Range : 10^3 to 10^5 std.ft^3/min

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
s/s	1.7		02			
Type						
Low energy	1.0			01		
High energy	2.0			02		
Submerged jet	0.7			03		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 197

Description of Equipment:

Wet impingement baffle type scrubber, c/s, excluding fan.

FOB cost.

Correlation Data:

C_o = $ 4500

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.68

L+M Factor = 2.0 (assumed)

Range : 10^3 to 7×10^4 std.ft^3/min

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
s/s	1.65		02			
Type						
As above	1.0			01		
Peabody type for acid	35.0			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 198

Description of Equipment:

Gravity spray, light duty, c/s scrubber.

FOB cost.

Correlation Data:

C_o = $ 3100

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.70

L+M Factor = 2.0 (assumed)

Range : $5x10^2$ to $5x10^5$ std.ft^3/min

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Duty						
Light	1.0		01			
Heavy	3.0		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 199

Description of Equipment:

Packed column wet scrubber, polyester fiberglass, including packing. Excluding fans, duct work and instrumentation.

FOB cost.

Correlation Data:

C_o =	\$ 3500	\$ 8300
S_o =	$2x10^3$ std.ft^3/min	10^4 std.ft^3/min
n =	0.39	0.68
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	10^3 to $4x10^3$ std.ft^3/min	$4x10^3$ to $3x10^4$
Error :		

Note: Units of size: Inlet gas capacity, ft^3/min.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 200

Description of Equipment:

Generalised wet collecter.

FOB cost.

Correlation Data:

C_o = $ 3000

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.70

L+M Factor = 2.0 (assumed)

Range : 10^3 to 10^5 std.ft^3/min

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 201

Description of Equipment:

Generalised wet scrubber, for metallurgical application.

Installed cost.

Correlation Data:

C_o = \$ 700000

S_o = 10^5 std.ft^3/min (inlet gas capacity)

n = 0.83

L+M Factor = 2.0 (assumed)

Range : 2.5×10^4 to 2×10^5 std.ft^3/min

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 202

Description of Equipment:

Dynamic wet-dry separator, including hopper. Excluding settler, motor and drive. FOB cost.

Correlation Data:

C_o =	\$ 3200	\$ 7800
S_o =	10^4 std.ft^3/min	3×10^4 std.ft^3/min
n =	0.61	1.0
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	10^3 to 1.8×10^4	1.8×10^4 to 6×10^4
Error :	40%	

Note: Units of size: Inlet gas capacity, std.ft^3/min.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Equipt.						
None	1.0		01			
Including settler	1.3		02			
Including settler and motor	1.7		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 203

Description of Equipment:

Dry louvered impingement collector, c/s, parallel louvers with a minimum pressure drop. Including hopper.

FOB cost.

Correlation Data:

C_o = \$ 3200

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.39

L+M Factor = 2.0 (assumed)

Range : 5×10^3 to 3×10^4 std.ft^3/min

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Louver Type						
Parallel	1.0		01			
Centrifugal	1.7		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 204

Description of Equipment:

Bag filter, intermittent shaker type, c/s, light duty. Including electric motors for shakers. Excluding fans, ductwork and instrumentation. FOB cost.

Correlation Data:

C_o =	\$ 5000
S_o =	10^4 std.ft^3/min (inlet gas capacity)
n =	0.79
L+M Factor =	2.0 (assumed)
Range :	10^3 to 5×10^4 std.ft^3/min
Error :	50%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
s/s	1.6		02			
Duty						
Light	1.0			01		
Heavy	3.0			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 205

Description of Equipment:

Bag filter, continuous, reverse jet type, c/s, low temperature. Excluding air compressor and jet mechanism.

FOB cost.

Correlation Data:

C_o = \$ 6400

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.71

L+M Factor = 2.0 (assumed)

Range : $5x10^3$ to $6x10^4$ std.ft^3/min

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Temperature						
Low	1.0		01			
High	1.3		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 206

Description of Equipment:

Bag filter unit, for metallurgical open hearth, sinter windbox or sintering materials handling. Excluding waste heat boiler and fans. Installed cost.

Correlation Data:

C_o = $ 360000

S_o = 2×10^5 m^3/h (inlet gas capacity)

n = 0.92

L+M Factor = 2.0 (assumed)

Range : 7×10^4 to 10^6 m^3/h

Error : 20%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Service						
As described above	1.0		01			
For tar-fired furnace	1.6		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Separation (Gas-Solid)

COSMOD Reference Number: 207

Description of Equipment:

Mist eliminators, standard glass fibers, stainless steel construction, medium pressure drop, fine drops. Including gaskets, cap screws, washer and polygon frame. Excluding vessel or tank. FOB cost.

Correlation Data:

C_o = \$ 12000

S_o = 10^4 std.ft^3/min (inlet gas capacity)

n = 0.72

L+M Factor = 2.0 (assumed)

Range : 8×10^3 to 2×10^5 std.ft^3/min

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Service						
Medium pressure drop and fine drops	1.0		01			
Low pressure drop and coarse drops	0.6		02			
High pressure drop, high efficiency and fine drops	4.0		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 208

Description of Equipment:

Spray driers, c/s, inlet temperature 150°C. Including furnace, instrumentation, dust collectors, atomizer, spray machine, fans and motors. Excluding foundations.

FOB cost.

Correlation Data:

C_o = $ 150000

S_o = 5000 lb/h (capacity, water evaporation rate)

n = 0.71

L+M Factor = 2.0

Range : 250 to 20000 lb/h

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
s/s	2.0		02			
Inlet Temperature						
150 °C	1.0			01		
100	1.25			02		
250	o.62			03		
550	0.35			04		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 209

Description of Equipment:

Transported bed dryer, c/s, inlet temperature approximately 650°C. Including dust collectors, motors, cage mill or pulverizer.

FOB cost.

Correlation Data:

C_o =	$ 40000
S_o =	1000 lb/h (water evaporation rate)
n =	0.42
L+M Factor =	2.0 (assumed)
Range :	600 to 20000 lb/h
Error :	30%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
s/s	2.0		02			
Additional Equipt.						
With size reduction equipment	1.0			01		
Without	0.85			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 210

Description of Equipment:

Fluidized bed dryer, c/s, direct fired. Auxiliaries included. Excluding supporting structure.

FOB cost.

Correlation Data:

C_o = $ 45000

S_o = 10 (bed dia,ft) (fluidizing velocity,ft/s)$^{0.35}$

n = 0.73

L+M Factor = 2.0 (assumed)

Range : 3 to 26

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 211

Description of Equipment:

Drum dryer, atmospheric pressure, (Flaker), c/s. Including dip feed pan, doctor knife assembly, rotary steam/water joints, end scrapers, side conveyors. Excluding drive, motor and fume hood. FOB cost.

Correlation Data:

C_o = $ 22000

S_o = 100 ft^2 (total drum surface area)

n = 0.52

L+M Factor = 1.65

Range : 10 to 400 ft^2

Error : 40%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 212

Description of Equipment:

Drum dryer, vacuum. c/s.

FOB cost.

Correlation Data:

C_o = $ 74000

S_o = 100 ft^2 (total drum surface area)

n = 0.70

L+M Factor = 2.0 (assumed)

Range : 10 to 150 ft^2

Error : 30%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
Material						
c/s	1.0		01			
chrome plated	1.2		02			
Additional Equipt.						
None	1.0			01		
Incl. motor, drive	1.1			02		
Drums						
Single	1.0				01	
Double or twin	1.0				02	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 213

Description of Equipment:

Cone or vacuum tumble dryer, jacketed, s/s inside. Including butterfly valve, stand, drive, bleed, guard, vacuum equipment and motors. FOB cost.

Correlation Data:

C_o = $ 9200

S_o = 10 ft^3 (working capacity)

n = 0.5

L+M Factor = 2.0 (assumed)

Range : 1 to 300 ft^3

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
As above	1.0		01			
Glass lined	2.0		02			
s/s clad	0.8		03			
Equipment						
As above	1.0			01		
Dryer only	0.5			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 214

Description of Equipment:

Turbo dryers, c/s, packaged, field erected outside. Including TEFC motors, insulation, variable speed drive. Excluding internal or external heaters.

Delivered cost.

Correlation Data:

C_o =	$ 26000	$ 60000	$ 230000
S_o =	300 ft^2	2000 ft^2	10000 ft^2
n =	0.64	0.66	1.03
L+M Factor =	2.0	2.0	2.0 (all assumed)
Range :	200 to 400	400 to 6000	6000 to 20000 ft^2
Error :			

Note; Units of size: Net drying area, ft^2.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Equipt.						
As above	1.0		01			
Internal heater	1.3		02			
External heater	1.2		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 215

Description of Equipment:

Tray or truck dryers, insulated aluminum panel construction, steel frame, atmospheric pressure, steam heat. Including steamheating coils, fan, motor and instrumentation. Excluding trays and trucks. FOB cost.

Correlation Data:

C_o = $ 4000

S_o = 100 ft^2 (tray area)

n = 0.37

L+M Factor = 1.75

Range : 20 to 1500 ft^2

Error :

Coding Data:

X.XX XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s frame	1.0		01			
s/s frame	2.0		02			
Trays						
Excluding trays	1.0			01		
Including s/s trays	1.1			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 216

Description of Equipment:

Vacuum shelf dryer, c/s. Including vacuum tight box and shelves. Excluding vacuum equipment and trays.

FOB cost.

Correlation Data:

C_o = $ 5100

S_o = 100 ft^2 (tray area)

n = 0.56

L+M Factor = 2.0 (assumed)

Range: 15 to 100 ft^2

Error :

Coding Data:

X.XX XX XX XX
e f g h i (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.o		01			
s/s	2.2		02			
Vacuum Equipment						
Excluded	1.0			01		
Included	1.9			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 217

Description of Equipment:

Pan dryer, cast iron. Including auxiliaries. Excluding motor and drive. FOB cost.

Correlation Data:

C_o =	$ 5800
S_o =	100 US gal (holding capacity)
n =	0.32
L+M Factor =	2.0 (assumed)
Range :	50 to 300 US gal
Error :	20%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
Material						
cast iron	1.0		01			
c/s	1.0		02			
304 s/s clad	1.25		03			
304 s/s alloy	1.7		04			
316 s/s clad	1.6		05			
316 s/s alloy	2.0		06			
nickel	2.4		07			

Coding Data (Continued):

COSMOD Reference Number: 217

Correction For	Factor	e	f	g	h	i
Pressure						
vacuum	1.0			01		
atmospheric	0.8			02		
Motor						
excluded	1.0				01	
included	1.3				02	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 218

Description of Equipment:

Tunnel dryer, insulated aluminum panels, s/s conveying apron. Including heating coils, fans, motors, drives and instrumentation. FOB cost.

Correlation Data:

C_o = $ 62000

S_o = 400 ft^2 (exposed conveying surface)

n = 0.94

L+M Factor = 2.0 (assumed)

Range : 150 to 1000 ft^2

Error : 10%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 219

Description of Equipment:

Rotary dryer, atmospheric, c/s, hot air, indirect fired or 'indirect-direct' fired. Including motors, drives, cyclones and heating equipment. FOB cost.

Correlation Data:

C_o = $ 28000

S_o = 400 ft^2 (peripheral surface area)

n = 1.0

L+M Factor = 2.0 (assumed)

Range : 100 to 2000 ft^2

Error : 40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	o0	00
Material						
c/s	1.0		01			
s/s	3.0		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 220

Description of Equipment:

Rotary dryer, atmospheric, c/s, hot air, direct. Including induced draft fan, stack, cyclone, oil burner, solids feeder, instrumentation. FOB cost.

Correlation Data:

C_o = $ 18000

S_o = 400 ft^2 (peripheral surface area)

n = 0.88

L+M Factor = 2.0 (assumed)

Range : 100 to 4000 ft^2

Error : 30%

Coding Data:

X.XX XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
c/s	1.0		01			
s/s	3.0		02			
Heat Media						
Hot air	1.0			1.0		
Flue gas	1.7			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 221

Description of Equipment:

Rotary dryer, atmospheric, direct fired kiln or incinerator or roaster, solid waste disposal at 4500 BTU/lb.
Installed cost.

Correlation Data:

C_o = $ 150000

S_o = 100 short tons/d (waste feed)

n = 0.84

L+M Factor = 2.0 (assumed)

Range : 40 to 600 short tons/d

Error : 40%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 222

Description of Equipment:

Roto-Louvre, atmospheric, c/s.

Including heater or steam coil, dust collection, fans, motors, drives and controls.

FOB cost.

Correlation Data:

C_o = $ 35000

S_o = 200 ft^2 (peripheral surface area)

n = 0.62

L+M Factor = 2.0 (assumed)

Range : 50 to 1000 ft^2

Error : 10%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 223

Description of Equipment:

Rotary dryer, atmospheric, steam tube, c/s. Including motor, drive, intake, hopper, discharge, hood stack and rain hood.

FOB cost.

Correlation Data:

C_o = $ 18000

S_o = 1000 ft^2 (total heating area)

n = 0.75

L+M Factor = 2.0 (assumed)

Range :

Error : 30%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Materials						
c/s	1.0		01			
304 s/s shell and flights	1.85		02			
316 s/s shell and flights	1.25		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Dryers

COSMOD Reference Number: 224

Description of Equipment:

Rotary vacuum dryer, horizontal type, c/s, jacketted, indirect heat. Including motor, drive, fan, vacuum pump, receiver and condenser. FOB cost.

Correlation Data:

C_o = $ 23000

S_o = 100 ft^2 (heating surface peripheral area)

n = 0.49

L+M Factor = 1.74

Range : 20 to 1000 ft^2

Error : 30%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
c/s	1.0		01			
304 s/s clad	1.25		02			
316 s/s clad	1.60		03			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Screens (Solid-Solid Separation)

COSMOD Reference Number: 225

Description of Equipment:

Continuous screens, mechanically vibrated, single deck construction, open housing, simple construction, fixed elevation, c/s. Including frame, pulley and eccentric. Excluding screen deck cloth, bottom hopper and controls.

FOB cost.

Correlation Data:

C_o =	\$ 1200	\$ 3400
S_o =	5 ft^2	50 ft^2
n =	0.30	0.62
L+M Factor =	1.32	1.32 (assumed)
Range :	2.5 to 15 ft^2	15 to 75 ft^2
Error :		

Note: Units of size: Single deck screening area, ft^2.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				00
No. of Decks						
Single deck	1.0		01			
Double deck	1.3		02			
Triple deck	1.4		03			
Design Variation						
None	1.0			01		
With bottom hopper	1.10			02		
Totally enclosed	1.25			03		

Coding Data (Continued):

COSMOD Reference Number: 225

Correction For	Factor	e	f	g	h	i
Construction						
Simple	1.0				01	
Adjustable slope and motion	1.3				02	

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Screens (Solid-Solid Separation)

COSMOD Reference Number: 227

Description of Equipment:

Continuous screen, mechanically vibrated, single deck, open, simple, fixed elevation, c/s, for heavy duty primary screening. Including screen and motor.

Delivered cost.

Correlation Data:

C_o = $ 17000

S_o = 100 ft^2 (single deck screening area)

n = 0.99

L+M Factor = 2.0 (assumed)

Range : 90 to 150 ft^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
No. of Decks						
Single deck	1.0		01			
Double deck	1.2		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Screens (Solid-Solid Separation)

COSMOD Reference Number: 228

Description of Equipment:

Same as equipment with COSMOD Ref. No. 227, but for standard duty secondary screening. Delivered cost.

Correlation Data:

C_o =	\$ 3500	\$ 6300
S_o =	50 ft^2	80 ft^2
n =	0.62	0.81
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	15 to 70 ft^2	70 to 90 ft^2
Error :		

Note: Units of size: Single deck screening area, ft^2.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
No. of Decks						
Single deck	1.0		01			
Double deck	1.2		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Screens (Solid-Solid Separation)

COSMOD Reference Number: 229

Description of Equipment:

Same as equipment with COSMOD Ref. No. 227, but for standard duty, fines screening. Delivered cost.

Correlation Data:

C_o = $ 5500

S_o = 50 ft^2 (single deck screening area)

n = 0.90

L+M Factor = 2.0 (assumed)

Range : 30 to 90 ft^2

Error : 20%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
No. of Decks						
Single deck	1.0		01			
Double deck	1.2		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Screens (Solid-Solid Separation)

COSMOD Reference Number: 230

Description of Equipment:

Screens, rapped at 45^{o} to horizontal, including pneumatic rapper and controls. Delivered cost.

Correlation Data:

C_o = $ 5000

S_o = 10 ft^2 (area)

n = 0.18

L+M Factor = 2.0 (assumed)

Range : 6 to 18 ft^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Flotation Unit (Solid-Solid Separation)

COSMOD Reference Number: 231

Description of Equipment:

Induced draft type flotation unit, c/s. Excluding feed connection and discharge boxes, motors, blowers and launder.

Delivered cost.

Correlation Data:

C_o =	$ 1600	$ 3600
S_o =	40 ft^3	200 ft^3 (liquid capacity)
n =	0.37	0.74
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	20 to 100 ft^3	100 to 300 ft^3
Error :		

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Items						
None	1.0		01			
All connection boxes	1.1		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Hydraulics Based (Solid-Solid Separation)

COSMOD Reference Number: 232

Description of Equipment:

Jigs, including drive, motor and ragging.

Delivered cost.

Correlation Data:

C_o =	$ 2500	$ 8600
S_o =	100 Mg/d	1000 Mg/d
n =	0.17	1.56
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	40 to 350 Mg/d	700 to 1400 Mg/d
Error :		

Note: Units of size: Solids capacity, Mg/d.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Hydraulics Based (Solid-Solid Separation)

COSMOD Reference Number: 233

Description of Equipment:

Separation tables, including motor, rubber top and liners.

Delivered cost.

Correlation Data:

C_o = $ 2300

S_o = 50 ft^2 (deck or table area)

n = 0.35

L+M Factor = 2.0 (assumed)

Range : 25 to 90 ft^2

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Hydraulics Based (Solid-Solid Separation)

COSMOD Reference Number: 234

Description of Equipment:

Rake classifiers, including motor drive.

Delivered cost.

Correlation Data:

C_o = $ 13500

S_o = 7 (tank width,ft) (tank length,ft)$^{0.2}$

n = 1.8

L+M Factor = 2.0 (assumed)

Range : 4.5 to 12

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Hydraulics Based (Solid-Solid Separation)

COSMOD Reference Number: 235

Description of Equipment:

Spiral classifiers, including drive.

Delivered cost.

Correlation Data:

C_o = $ 12500

S_o = 50 inches (spiral diameter)

n = 1.53

L+M Factor = 2.0 (assumed)

Range : 25 to 75 inches

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Hydraulics Based (Solid-Solid Separation)

COSMOD Reference Number: 236

Description of Equipment:

Humphrey spiral Gravity Concentrator, c/s, approximately 2' diameter spiral with 5 turns. Including distribution and collection manifolds and supports. Delivered cost.

Correlation Data:

C_o = $ 60000

S_o = 100 Mg/h (capacity)

n = 1.0

L+M Factor = 2.0 (assumed)

Range : 1.3 to 2500 Mg/h

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Hydraulics Based (Solid-Solid Separation)

COSMOD Reference Number: 237

Description of Equipment:

Same as equipment with COSMOD Ref. No. 236, but made of fibreglass. Delivered cost.

Correlation Data:

C_o = $ 55000

S_o = 100 Mg/d (capacity)

n = 0.87

L+M Factor = 2.0 (assumed)

Range : 1.3 to 2500 Mg/d

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Hydraulics Based (Solid-Solid Separation)

COSMOD Reference Number: 238

Description of Equipment:

Air classifier, cyclone system.

Including blowers, lines and all auxiliaries.

Delivered cost.

Correlation Data:

C_o =	$ 7900	$ 13800	$ 54000
S_o =	0.3 Mg/h	3 Mg/h	30 Mg/h
n =	0.06	0.42	0.82
L+M Factor =	2.0	2.0	2.0 (all assumed)
Range :	0.09 to 0.9	0.9 to 9	9 to 70 Mg/d
Error :			

Note: Units of size: Solids capacity, Mg/h

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Hydraulics Based (Solid-Solid Separation)

COSMOD Reference Number: 239

Description of Equipment:

Wet classifier, hydrocyclone system at 65% passes through 200 mesh. Delivered cost.

Correlation Data:

C_o =	$ 1250	$ 5000
S_o =	10 Mg/h	100 Mg/h
n =	0.45	1.0
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	7.5 to 38 Mg/h	38 to 380 Mg/h
Error :		

Note: Units of size: Dry solids capacity, Mg/h.

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Heavy Media Circuit (Solid-Solid Separation)

COSMOD Reference Number: 240

Description of Equipment:

Heavy Media Circuit. Complete plant. Including heavy media separators, screens, densifiers, magnetic separators, hoppers, sumps, launders, motors, controls.

Delivered cost.

Correlation Data:

C_o = $ 110000

S_o = 100 Mg/h (capacity)

n = 0.18

L+M Factor = 2.0 (assumed)

Range : 25 to 200 Mg/h

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separators (Solid-Solid)

COSMOD Reference Number: 241

Description of Equipment:

Dry drum, 2' diameter. Including drive, drip-proof motor. Excluding chute, duties and tax.

FOB cost.

Correlation Data:

C_o = $ 5200

S_o = 4 ft (drum width)

n = 0.75

L+M Factor = 2.0 (assumed)

Range : 2.5 to 5.5 ft

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separators (Solid-Solid)

COSMOD Reference Number: 242

Description of Equipment:

Dry drum, 530 Gauss. Including TEFC motor and chute. Excluding tax and duties. FOB cost.

Correlation Data:

C_o =	\$ 1700	\$ 3500
S_o =	1 (drum width, ft)	(diam. ft)$^{1.25}$
n =	0.26	0.66
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.6 to 1.7	1.7 to 10
Error :		

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
530 Gauss	1.0		01			
400	0.92		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separators (Solid-Solid)

COSMOD Reference Number: 243

Description of Equipment:

Wet drum, 500 Gauss finisher.
Including s/s wear shell and drive. Excluding motor.
Delivered cost.

Correlation Data:

C_o = $ 8000

S_o = 7 ft (drum width)

n = 1.0

L+M Factor = 2.0 (assumed)

Range : 3 to 10 ft

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Design Variation						
500 Gauss finisher	1.0		01			
700 Gauss finisher	1.23		02			
750-800 Gauss rougher	1.55		03			
880 Gauss cobber	1.70		04			
Wear Shell Material						
s/s	1.0			01		
ceramic	1.1			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separator (Solid-Solid)

COSMOD Reference Number: 244

Description of Equipment:

Pulley, tramp metal removal, 1000 Gauss at 1". Excluding surface lagging, drive, motor.

FOB cost.

Correlation Data:

C_o = $ 1600

S_o = 4 (width,ft)(diam.,ft)$^{1.65}$

n = 0.86

L+M Factor = 2.0 (assumed)

Range : 0.8 to 12

Error : 20%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
1000 Gauss	1.0		01			
1400	1.2		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separators (Solid-Solid)

COSMOD Reference Number: 245

Description of Equipment:

Pulley, mineral processing (ore cobbing), 1500 Gauss at 1". Excluding surface lagging, drive, motor.

FOB cost.

Correlation Data:

C_o = $ 2100

S_o = 4 (width,ft) (diam.,ft)$^{1.5}$

n = 0.82

L+M Factor = 2.0 (assumed)

Range : 1 to 20

Error : 30%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separators (Solid-Solid)

COSMOD Reference Number: 246

Description of Equipment:

Plate, single gap, magnet only.

FOB cost.

Correlation Data:

C_o = $ 320

S_o = 30 inches (width)

n = 1.02

L+M Factor = 2.0 (assumed)

Range : 6 to 50 inches

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
Single gap	1.0		01			
Double gap suspended						
2" from conveyor	1.7		02			
3" from conveyor	2.5		03			
4" from conveyor	3.0		04			
5" from conveyor	3.2		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separators (Solid-Solid)

COSMOD Reference Number: 247

Description of Equipment:

Grate, 2 banks of c/s, magnetic tubes in drawer.

FOB cost.

Correlation Data:

C_o = $ 500

S_o = 10 inches (tube length)

n = 1.13

L+M Factor = 2.0 (assumed)

Range : 6 to 25 inches

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

$e\ f\ g\ h\ i$

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separators (Solid-Solid)

COSMOD Reference Number: 248

Description of Equipment:

Same as equipment with COSMOD Ref. No. 247, but with 4 banks of c/s magnetic tubes. FOB cost.

Correlation Data:

C_o = $ 2000

S_o = 10 inches (tube length)

n = 0.94

L+M Factor = 2.0 (assumed)

Range : 6 to 15 inches

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Materials						
c/s	1.0		01			
s/s	1.4		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separators (Solid-Solid)

COSMOD Reference Number: 249

Description of Equipment:

Rectangular, suspended, lift type.

24" width. Including clearing bar.

FOB cost.

Correlation Data:

C_o = $ 2200

S_o = 24 inches (length)

n = 1.53

L+M Factor = 2.0 (assumed)

Range : 18 to 48 inches

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
24" width	1.0		01			
16"	0.72		02			
30"	1.25		03			
54"	2.0		04			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separator (Solid-Solid)

COSMOD Reference Number: 250

Description of Equipment:

In-line belted magnetic separator, including belt, magnet, drive and motor. FOB cost.

Correlation Data:

C_o = $ 4600

S_o = 30 inches (belt width)

n = 1.40

L+M Factor = 2.0 (assumed)

Range : 20 to 48 inches

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
As described above	1.0		01			
Cross belted	1.42		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Magnetic Separator (Solid-Solid)

COSMOD Reference Number: 251

Description of Equipment:

High intensity, alternating polarity, 30" diameter drum, including motor, starter, housing and drive.

FOB cost.

Correlation Data:

C_o = $ 8800

S_o = 30 inches (drum width)

n = 0.27

L+M Factor = 2.0 (assumed)

Range : 12 to 72 inches

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electromagnetic Separators (Solid-Solid)

COSMOD Reference Number: 252

Description of Equipment:

Rectangular, suspended, lift type.
Including transformer oil, ring and sling, DC disconnect switch. Excluding rectifier.
FOB cost.

Correlation Data:

C_o = $ 3500

S_o = 5 kW (power)

n = 1.0

L+M Factor = 2.0 (assumed)

Range : 2 to 12 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
Belted, incl. belt, head and tail pulley, frame, drive, motor, in-line	1.85		02			
Cross-belted	1.87		03			
No variation	1.0		01			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electromagnetic Separators (Solid-Solid)

COSMOD Reference Number: 253

Description of Equipment:

Induced roll, dry, 2 7/16" diameter rotor, 16000 Gauss. Including base, drive, starter, rectifier. Excluding air valve, controls, transformers. Delivered cost.

Correlation Data:

C_o = $ 8000

S_o = 3000 lb/h (nominal capacity)

n = 0.58

L+M Factor = 2.0 (assumed)

Range : 1500 to 23000 lb/h

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Additional Equipment						
None	1.0		01			
Incl. air valve and transformer	1.08		02			
Design Variation						
16000 Gauss	1.0			01		
18000	1.16			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electromagnetic Separators (Solid-Solid)

COSMOD Reference Number: 254

Description of Equipment:

Induced roll, dry, 4 to 30" diameter rotors, 150 lb/h/linear inch. Including motor, drives, starters, housing, control panels. FOB cost.

Correlation Data:

C_o = $ 8000

S_o = 0.9 kW (power)

n = 0.7

L+M Factor = 2.0 (assumed)

Range : 0.5 to 4 kW

Error : 40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
150 lb/h/linear inch	1.0		01			
300	1.65		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electromagnetic Separators (Solid-Solid)

COSMOD Reference Number: 255

Description of Equipment:

Induced roll, wet. Including motor, drive, starter, rotating separation zones, waterproof magnetic coils.

Delivered cost.

Correlation Data:

C_o = $ 19000

S_o = 10^4 lb/h (nominal capacity)

n = 0.68

L+M Factor = 2.0 (assumed)

Range : 4000 to 32000 lb/h

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Equipment						
None	1.0		01			
Including rectifier and variable speed drive	1.2		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Electromagnetic Separator (Solid-Solid)

COSMOD Reference Number: 256

Description of Equipment:

High intensity, alternating polarity, 30" diameter drum. Including motor, starter, housing, drives, control panel. Excluding rectifiers. FOB cost.

Correlation Data:

C_o =	$ 10000
S_o =	30 inches (drum width)
n =	0.46
L+M Factor =	2.0 (assumed)
Range :	12 to 72 inches
Error :	30%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Equipment						
None	1.0		01			
Drum only	0.6		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: **Electrostatic Separators**

COSMOD Reference Number: 258

Description of Equipment:

Electrostatic separators, including motor, drive and switches. Excluding rectifier, transformers, air valve controls.
Delivered cost.

Correlation Data:

C_o = $ 4500

S_o = 10^4 (See note below for units)

n = 0.58

L+M Factor = 2.0 (assumed)

Range : 9×10^3 to 3×10^5

Error : 20%

Note: Units of size: (rotor diam,in)$^{0.65}$(nom. capacity,lb/h)

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Equipment						
None	1.0		01			
Including rectifier, transformers and air valve controls	1.25		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Air Drying-Dehydration

COSMOD Reference Number: 259

Description of Equipment:

Solid absorbent drying unit with pressure regeneration. Including swing bed, regeneration facilities, automatic controls, pre and after filters, dual system, activated alumina or silica gel. 790 kPa. FOB cost.

Correlation Data:

C_o = $ 6300

S_o = 10^3 Nm^3/h

n = 0.6

L+M Factor = 1.72

Range : 10 to 10000 Nm^3/h

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
Pressure regen.	1.0		01			
Thermal regen.	1.3		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Fans (Gas Transportation)

COSMOD Reference Number: 261

Description of Equipment:

Centrifugal, radial bladed, 2.5 kPa.

Excluding motor, starter, gearing.

Delivered cost.

Correlation Data:

C_o =	$ 2000
S_o =	10 Nm^3/s (inlet capacity)
n =	0.78
L+M Factor =	2.0 (assumed)
Range :	2 to 100 Nm^3/s
Error :	40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Design Variation						
As described above	1.0		01			
Backward bladed	1.2		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Fans (Gas Transportation)

COSMOD Reference Number: 262

Description of Equipment:

Same as equipment with COSMOD Ref. No. 261, but including TEFC motor and starter.
Excluding tax.
Delivered cost.

Correlation Data:

C_o = $ 3500

S_o = 10 Nm^3/s (inlet capacity)

n = 0.93

L+M Factor = 2.0 (assumed)

Range : 2 to 50 Nm^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Fans (Gas Transportation)

COSMOD Reference Number: 263

Description of Equipment:

Vane-axial, 0.5 kPa. Including dripproof motor. Excluding tax. FOB cost.

Correlation Data:

C_o = $ 620

S_o = 1 Nm^3/s (inlet capacity)

n = 0.36

L+M Factor = 2.0 (assumed)

Range : 0.5 to 10 Nm^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Fans (Gas Transportation)

COSMOD Reference Number: 264

Description of Equipment:

Propeller, including motor housing.

Excluding tax.

FOB cost.

Correlation Data:

C_o =	\$ 170	\$ 580
S_o =	1 Nm^3/s	10 Nm^3/s
n =	0.58	0.36
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.5 to 6 Nm^3/s	6 to 50 Nm^3/s
Error :		

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Fans (Gas Transportation)

COSMOD Reference Number: 265

Description of Equipment:

Fan unit, air conditioning package, including two fans, chiller, integral piping, heat exchangers, filter. Excluding ductwork, refrigeration and cooling tower circuits, offsites, overheads, building. Installed cost.

Correlation Data:

C_o = $ 6000

S_o = 3 Nm^3/s (inlet capacity)

n = 0.67

L+M Factor = 2.0 (assumed)

Range : 0.8 to 8 Nm^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Fans (Gas Transportation)

COSMOD Reference Number: 266

Description of Equipment:

Same as equipment with COSMOD Ref. No. 265, but delivered and field erected cost.

Correlation Data:

C_o = $ 95000

S_o = 30 Nm^3/s (inlet capacity)

n = 0.90

L+M Factor = 2.0 (assumed)

Range : 15 to 120 Nm^3/s

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Basis of Cost						
Delivered and field erected	1.0		01			
Delivered materials only	0.65		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Blowers (Gas Transportation)

COSMOD Reference Number: 267

Description of Equipment:

Centrifugal, 28 kPa. Excluding tax and motor.

Delivered cost.

Correlation Data:

C_o = $ 60000

S_o = 30 Nm^3/s

n = 0.61

L+M Factor = 1.6 (assumed)

Range : o.2 to 70 Nm^3/s

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Pressure (for range)						
28 kPa	1.0		01			
7 0.05 to 5	0.3		02			
14 0.05 to 5	0.45		03			
50 to 70 0.5 to 20	1.75		04			
140 to 200 1.0 to 20	4.5		05			
Additional Equipment						
None	1.0			01		
Incl. drive, motor	1.6			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Blowers (Gas Transportation)

COSMOD Reference Number: 268

Description of Equipment:

Rotary lobe, 70 kPa, single stage, excluding motor and tax.

Delivered cost.

Correlation Data:

C_o =	$ 5500
S_o =	0.4 Nm^3/s
n =	0.73
L+M Factor =	2.0 (assumed)
Range :	0.05 to 1 Nm^3/s
Error :	40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
No. of Stages						
Single	1.0		01			
Two stages	2.7		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Blowers (Gas Transportation)

COSMOD Reference Number: 269

Description of Equipment:

Same as equipment with COSMOD Ref. No. 268, but including dripproof motor. FOB cost.

Correlation Data:

C_o = $ 3200

S_o = 30 kW (drive)

n = 0.55

L+M Factor = 2.0 (assumed)

Range : 4 to 60 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
No. of Stages						
Single	1.0		01			
Two	2.7		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Blowers (Gas Transportation)

COSMOD Reference Number: 270

Description of Equipment:

Rotary sliding vane, 275 kPa.

Including lubricator, coupling, base. Excluding drive, tax.

Delivered cost.

Correlation Data:

C_o = $ 3700

S_o = 0.1 Nm^3/s (inlet capacity)

n = 0.40

L+M Factor = 2.0 (assumed)

Range : 0.01 to 0.4 Nm^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 271

Description of Equipment:

Centrifugal, less than 7000 kPa.
Including open dripproof induction motor, starter, baseplate and necessary gearing, lube system.
Delivered cost.

Correlation Data:

C_o =	\$ 170000	\$ 1300000
S_o =	10^3 kW (drive)	10^4 kW (drive)
n =	0.90	0.71
L+M Factor =	2.2 (assumed)	2.2 (assumed)
Range :	2 to 4000 kW	8000 to 25000 kW
Error :		

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 272

Description of Equipment:

Same as equipment with COSMOD Ref. No. 271, but cost correlated to inlet capacity at 700 kPa exit pressure.
Delivered cost.

Correlation Data:

C_o = $ 95000

S_o = 3 Nm^3/s

n = 0.58

L+M Factor = 2.0 (assumed)

Range : 0.4 to 10.0 Nm^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 273

Description of Equipment:

Compressor, cast steel, less than 7000 kPa. Excluding motor and auxiliaries. FOB cost.

Correlation Data:

C_o = $ 110000

S_o = 10^3 kW (drive)

n = 0.53

L+M Factor = 2.0 (assumed)

Range : 500 to 4000 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Exit Pressure						
Less than 7000 kPa	1.0		01			
1.7 MPa	o.8		02			
6.9	1.0		03			
14.0	1.15		04			
34.0	1.43		05			
48.0	1.51		06			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 277

Description of Equipment:

Axial compressor, 15-stage, including steam turbine drive (5500 kPa steam), base plate, lubrication.
Delivered cost.

Correlation Data:

C_o = $ 2300000

S_o = 100 Nm^3/s (capacity)

n = 0.91

L+M Factor = 2.0 (assumed)

Range : 30 to 300 Nm^3/s

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 278

Description of Equipment:

Same as equipment with COSMOD Ref. No. 277, but cost correlated to drive power. Delivered cost.

Correlation Data:

C_o = $ 2700000

S_o = 10^4 kW (drive)

n = 1.33

L+M Factor = 2.0 (assumed)

Range : 4000 to 20000 kW

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 279

Description of Equipment:

Helical screw, including dripproof motor, starter, lubricating system and some controls. FOB cost.

Correlation Data:

C_o = $ 60000

S_o = 300 kW (drive)

n = 0.77

L+M Factor = 2.0 (assumed)

Range : 100 to 600 kW

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 281

Description of Equipment:

Reciprocating, less than 7000 kPa.
Including driver (open dripproof electric motor), gears, aftercooler, lubricating system.
FOB cost.

Correlation Data:

C_o = $ 23000

S_o = 100 kW (drive)

n = 0.79

L+M Factor = 2.2

Range : 1 to 10000 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Pressure						
7 MPa	1.0		01			
17	1.25		02			
34	1.5		03			
41	1.6		04			
48	1.68		05			
55	1.78		06			
62	1.86		07			
69	1.95		08			

Coding Data (Continued):

COSMOD Reference Number: 281

Correction For	Factor	e	f	g	h	i
Drive						
Electric motor	1.0			01		
Steam turbine	1.4			02		
Gas engine	2.8			03		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 282

Description of Equipment:

Same as equipment with COSMOD Ref. No. 281, but excluding motor drive. FOB cost.

Correlation Data:

C_o =	$ 8000
S_o =	100 kW (drive)
n =	1.04
L+M Factor =	2.0 (assumed)
Range :	10 to 100 kW
Error :	

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 283

Description of Equipment:

Single stage, approximately 860 kPa (double acting for greater than 0.2 Nm^3/s). Including open dripproof motor, gears, lubricating system, filters.

Delivered cost.

Correlation Data:

C_o = $ 8000

S_o = 0.1 Nm^3/s (inlet air capacity)

n = 0.77

L+M Factor = 2.0 (assumed)

Range : 0.002 to 5 Nm^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Compressors (Gas Transportation)

COSMOD Reference Number: 284

Description of Equipment:

Same as equipment with COSMOD Ref. No. 283, but having two stages and approximately 3500 kPa pressure.

Delivered cost.

Correlation Data:

C_o = $ 13000

S_o = 0.1 Nm^3/s (inlet air capacity)

n = 0.53

L+M Factor = 2.0 (assumed)

Range : 0.03 to 0.2 Nm^3/s

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0		00	00	00
No. of Stages						
Two	1.0		01			
Three	1.7		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 285

Description of Equipment:

Steam ejector systems. Single stage, 6.7 to 40 kPa pressure, 700 kPa steam. Ejector only. FOB cost.

Correlation Data:

C_o = \$ 600

S_o = 10 $kg.h^{-1}.kPa^{-1}$(abs) (ejector capacity)

n = 0.45

L+M Factor = 2.0 (assumed)

Range : 0.015 to 750

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 286

Description of Equipment:

Steam ejectors, two stage, barometric condenser. 1.3 to 13 kPa pressure, 700 kPa steam, 29°C water (maximum temperature), including ejectors, barometric condenser and interconnecting piping. FOB cost.

Correlation Data:

C_o = $ 2700

S_o = 10 $kg.h^{-1}.kPa^{-1}$ (abs) (ejector capacity)

n = 0.39

L+M Factor = 2.0 (assumed)

Range : 0.7 to 20

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 287

Description of Equipment:

Multistage, barometric inter condensers. 0.07 to 27 kPa (absolute). 700 kPa steam, 29°C maximum water temperature. Including ejectors, cast iron barometric condensers and interconnecting piping. FOB cost.

Correlation Data:

C_o = $ 3600

S_o = 10 $kg.h^{-1}.kPa^{-1}$ (abs) (ejector capacity)

n = 0.24

L+M Factor = 2.0 (assumed)

Range : 0.8 to 80

Error :

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
cast iron	1.0		01			
c/s	1.3		02			
s/s	2.0		03			
hastelloy	3.0		04			
Condenser Type						
Barometric	1.0			01		
Surface	1.25			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 288

Description of Equipment:

Horizontal, 1800 rpm, 50 ft. head, cast iron, radial flow. Including impeller, mechanical seal, baseplate, coupling. Excluding motor, duties, sales tax.

FOB cost.

Correlation Data:

C_o =	$ 750	$ 2000
S_o =	10 kW (power)	100 kW (power)
n =	0.26	0.43
L+M Factor =	2.0	2.0
Range :	0.2 to 16 kW	16 to 400 kW
Error :	+200 -30	+100 -50

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i

(Select values from data below)

Correction For	Factor	e	f	g	h	i
		0				
Suction Pressure						
150 psi	1.0		01			
500	1.6		02			
1000	2.0		03			
Design program to specify			99			
Material						
cast iron	1.0			01		
c/s	1.3			02		

Coding Data (Continued):

COSMOD Reference Number: 288

Correction For	Factor	e	f	g	h	i
Material (cont.)						
bronze	1.5			03		
316 s/s alloy	1.9			04		
316 s/s clad	1.4			05		
titanium	9.5			06		
graphite	1.3			07		
304 s/s alloy	1.9			08		
nickel	3.0			09		
monel	3.0			10		
Alloy 20, Worthite or Carpenter 20	1.9			11		
Hastalloy C	2.8			12		
Type						
As described	1.0				01	
Self priming	1.5				02	
Heavy duty	1.1				03	
Closed impeller	1.15				04	
Number of Stages						
one	1.0					01
two	1.3					02
three	1.4					03
four	1.5					04
five	1.7					05

Coding Data (Continued):

COSMOD Reference Number: 288

Correction For	Factor	e	f	g	h	i
Number of Stages (continued)						
six	1.9					06

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 289

Description of Equipment:

Same as equipment with COSMOD Ref. No. 288, but with cost correlated to capacity. FOB cost.

Correlation Data:

C_o =	\$ 1200
S_o =	0.5 m^3/min
n =	0.34
L+M Factor =	2.0 (assumed)
Range :	0.05 to 30 m^3/min
Error :	

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
Select factors from sheet for equipment with COSMOD Ref. No. 288						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 290

Description of Equipment:

Same as equipment with COSMOD Ref. No. 288, but with cost correlated to capacity and head.

FOB cost.

Correlation Data:

C_o = $ 1300

S_o = 10 $(m^3/s)(m)^{0.5}$

n = 0.34

L+M Factor = 2.0 (assumed)

Range : 1 to 300 $(m^3/s)(m)^{0.5}$

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select factors from sheet for equipment with COSMOD Ref. No. 288						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 291

Description of Equipment:

Same as equipment with COSMOD Ref. No. 288, but with cost correlated to functions of capacity and head.

FOB cost.

Correlation Data:

C_o = \$ 1900

S_o = 5000 $(m^3/s)^{0.6}(m)^{2.5}$

n = 0.34

L+M Factor = 2.0 (assumed)

Range : 1000 to 30000 $(m^3/s)^{0.6}(m)^{2.5}$

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select factors from sheet for equipment with COSMOD Ref. No. 288						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 292

Description of Equipment:

Centrifugal pump, including impeller, mechanical seal, baseplate, coupling, TEFC motor.
Excluding duties and sales tax.
FOB cost.

Correlation Data:

C_o =	$ 920	$ 2800
S_o =	10 kW	100 kW
n =	0.39	0.58
L+M Factor =	2.4	2.4 (assumed)
Range :	1 to 23 kW	23 to 250 kW
Error :		

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0			00	00
Suction Pressure						
150 psi	1.0		01			
500	1.5		02			
1000	1.9		03			
Design program to specify			99			
Material						
Cast iron	1.0			01		
c/s	1.3			02		

Coding Data (Continued):

COSMOD Reference Number: 292

Correction For	Factor	e	f	g	h	i
Material (cont.)						
bronze	1.28			03		
316 s/s alloy	1.93			04		
316 s/s clad	1.45			05		
titanium	9.0			06		
nickel	3.5			07		
monel	3.2			08		
Alloy 20	2.3			09		
Hastalloy C	2.95			10		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 294

Description of Equipment:

Same as equipment with COSMOD Ref. No. 292, but with cost correlated to capacity.

FOB cost.

Correlation Data:

C_o = \$ 1600

S_o = 1 m^3/min

n = 0.59

L+M Factor = 2.4 (assumed)

Range : 0.04 to 30 m^3/min

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
Select factors from sheet for equipment with COSMOD Ref. No. 292						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 295

Description of Equipment:

Heavy duty, non-clog, cast iron centrifugal pump. 1800 rpm. Including baseplate, coupling and seal. Excluding motor. FOB cost.

Correlation Data:

C_o =	$ 1050	$ 2500
S_o =	10 kW	40 kW
n =	0.11	1.10
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.8 to 19 kW	19 to 150 kW
Error :	30%	50%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 296

Description of Equipment:

Vertical, in-line, cast iron centrifugal pump. Including baseplate, coupling and TEFC motor.

FOB cost.

Correlation Data:

C_o =	$ 700	$ 1750
S_o =	3 kW	30 kW
n =	0.28	0.58
L+M Factor =	1.27	1.27 (assumed)
Range :	0.5 to 11 kW	11 to 60 kW
Error :	50%	50%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Pressure						
150 psi	1.0		01			
500	1.48		02			
1000	1.92		03			
Material						
cast iron	1.0			01		
cast steel	1.28			02		
clad s/s	1.3			03		
s/s	1.64			04		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 297

Description of Equipment:

Horizontal, cast iron, mixed flow centrifugal pump. Including impeller, mechanical seal, baseplate, coupling, TEFC motor. Excluding sales tax. FOB cost.

Correlation Data:

C_o =	\$ 25000
S_o =	100 m^3/min
n =	0.85
L+M Factor =	2.0 (assumed)
Range :	4 to 700 m^3/min
Error :	50%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 298

Description of Equipment:

Axial flow centrifugal pump, steel. Including impeller, coupling, TEFC motor. Excluding sales tax, duties. FOB cost.

Correlation Data:

C_o =	$ 17500	$ 33000
S_o =	10 m^3/min	100 m^3/min
n =	0.03	0.65
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	4 to 40 m^3/min	40 to 1000 m^3/min
Error :	50%	50%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Centrifugal Pumps

COSMOD Reference Number: 299

Description of Equipment:

Peripheral flow (turbine), steel. Including impeller, mechanical seal, baseplate, TEFC motor. Excluding sales tax, duties. FOB cost.

Correlation Data:

C_o = $ 1400

S_o = 10 kW

n = 0.48

L+M Factor = 2.0 (assumed)

Range : 1 to 500 kW

Error : 40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
steel	1.0		01			
cast iron	0.7		02			
bronze fitted	0.65		03			
all bronze	1.0		04			
s/s (pump only)	2.0		05			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 300

Description of Equipment:

Reciprocating piston or plunger, cast iron, 150 psig suction pressure, 150 to 300 rpm with exit pressure less than 1000 psig. Including base plate and gears. Excluding motor. FOB cost.

Correlation Data:

C_o =	$ 1500
S_o =	10 kW
n =	0.52
L+M Factor =	2.0 (assumed)
Range :	1 to 70 kW
Error :	40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0				
Material						
cast iron	1.0		01			
c/s	1.55		02			
s/s	2.10		03			
Suction Pressure						
150 psig	1.0			01		
500	1.2			02		
1000	2.10			03		
Design program to specify				99		

Coding Data (Continued):

COSMOD Reference Number: 300

Correction For	Factor	e	f	g	h	i
Exit Pressure						
1000 psig	1.0				01	
10000	2.5				02	
Drive						
electric motor	1.0					01
steam turbine	0.17					02

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 301

Description of Equipment:

Reciprocating piston or plunger, cast iron, 305 m head. Including TEFC electric motor drive.

FOB cost.

Correlation Data:

C_o = \$ 5200

S_o = 0.1 m^3/min

n = 0.58

L+M Factor = 2.4

Range : 0.02 to 2 m^3/min

Error :

Coding Data:

X.XX XX XX XX
e f g h i (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
cast iron	1.0		01			
c/s	1.55		02			
s/s	2.10		03			
bronze	1.25		04			
Suction Pressure						
150 psig	1.0			01		
500	1.2			02		
1000	1.4			03		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 302

Description of Equipment:

Reciprocating piston metering pumps or chemical injection pumps. 316 s/s. Including drive, baseplate and TEFC motor.

FOB cost.

Correlation Data:

C_o =	$ 1800
S_o =	1 kW
n =	0.85
L+M Factor =	1.58
Range :	0.3 to 3.0 kW
Error :	60%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
s/s 316	1.0		01			
cast steel	0.64		02			
cast iron	0.5		03			
Pressure						
150 psig	1.0			01		
500	1.37			02		
1000	1.79			03		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 304

Description of Equipment:

Diaphragm metering pump, s/s, PTFE diaphragm, including TEFC motor. FOB cost.

Correlation Data:

C_o =	$ 2300
S_o =	1 kW
n =	0.67
L+M Factor =	2.0 (assumed)
Range :	0.1 to 3.0 kW
Error :	70%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 305

Description of Equipment:

Same as equipment with COSMOD Ref. No. 304, but with cost correlated to capacity. FOB cost.

Correlation Data:

C_o = $ 1000

S_o = 0.001 m^3/s

n = 0.54

L+M Factor = 2.0 (assumed)

Range : 0.0001 to 0.02 m^3/s

Error : 100%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 306

Description of Equipment:

Diaphragm pumps, large capacity, 5 m head, including motor. FOB cost.

Correlation Data:

C_o = \$ 1600

S_o = 0.4 m^3/s

n = 0.46

L+M Factor = 2.0 (assumed)

Range : 0.06 to 2.0 m^3/s

Error : 20%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 307

Description of Equipment:

Rotary gear, cast iron, including gear reducer, baseplate and open dripproof motor. FOB cost.

Correlation Data:

C_o =	\$ 920
S_o =	1 m^3/min
n =	0.43
L+M Factor =	2.0 (assumed)
Range :	0.04 to 4.0 m^3/min
Error :	20%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0			00	00
Material						
cast iron	1.0		01			
316 s/s	2.40		02			
glass lined	3.60		03			
bronze	1.40		04			
Additional Eqpt.						
None	1.0			01		
pump only	0.3			02		

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 308

Description of Equipment:

Rotary Moyno pump, cast iron, including pump, baseplate, V-belt drive, belt gaurd. Excluding motor. FOB cost.

Correlation Data:

C_o =	\$ 700	\$ 2500
S_o =	0.1 m^3/min	1.0 m^3/min
n =	0.5	0.6
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.04 to 0.35	0.35 to 1.50
Error :	10%	10%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Eqpt.						
None	1.0		01			
TEFC motor	1.2		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 309

Description of Equipment:

Rotary sliding-vane cast iron pump.

Including pump, gear box or coupling, baseplate.

Excluding motor.

FOB cost.

Correlation Data:

C_o = \$ 1800

S_o = 1 m^3/min

n = 0.75

L+M Factor = 2.0 (assumed)

Range : 0.03 to 3.0 m^3/min

Error : 40%

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Eqpt.						
None	1.0		01			
motor	1.7		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 310

Description of Equipment:

Same as equipment with COSMOD Ref. No. 309, but with cost correlated to power.

FOB cost.

Correlation Data:

C_o =	$ 170	$ 500
S_o =	1 kW	10 kW
n =	0.14	1.04
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.7 to 4.0 kW	4.0 to 70 kW
Error :	50%	50%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Eqpt.						
None	1.0		01			
motor	1.7		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Positive Displacement Pumps

COSMOD Reference Number: 311

Description of Equipment:

Double helical screw, cast iron, with discharge pressure of 500 to 2000 psig. Including baseplate, coupling, guard. Excluding motor. FOB cost.

Correlation Data:

C_o =	$ 1200	$ 4500
S_o =	20 kW	150 kW
n =	0.45	1.73
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	20 to 100 kW	100 to 150 kW
Error :		

Coding Data:

$\underset{e}{X}.\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Material						
cast iron	1.0		01			
ductile iron	1.3		02			
cast steel	1.52		03			
316 s/s	2.5		04			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pump House

COSMOD Reference Number: 312

Description of Equipment:

Booster pumping stations, including pumps, drives, building contractors' fees, and standby units. Excluding engineering, contingencies, intakes. Installed cost.

Correlation Data:

C_o = $ 51000

S_o = 100 kW

n = 0.67

L+M Factor = 2.0 (assumed)

Range : 10 to 10000 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pump House

COSMOD Reference Number: 313

Description of Equipment:

For raw domestic sewage. Including normal earthwork, pumping station, structures, pumps, drives, controls, integral piping, screens, wet well. Excluding unusual foundations, piping, rock excavation, dewatering soil, heating, ventillating, wiring of pump house. Installed cost.

Correlation Data:

C_o =	$ 25000	$ 70000	$ 400000
S_o =	0.01 m^3/s	0.1 m^3/s	1.0 m^3/s
n =	0.37	0.70	0.85
L+M Factor =	2.0 (assumed)	2.0 (assumed)	2.0 (assumed)
Range :	0.01 to 0.05	0.05 to 0.4	0.4 to 20.0
Error :			

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Jobsite Material						
Not included	1.0		01			
FOB cost of jobsite material only	0.5		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pump House

COSMOD Reference Number: 314

Description of Equipment:

Same as equipment with COSMOD Ref. No. 313, but with cost correlated to power. Installed cost.

Correlation Data:

C_o = $ 60000

S_o = 40 kW

n = 0.33

L+M Factor = 2.0 (assumed)

Range : 15 to 80 kW

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
Select code from sheet for equipment with COSMOD Ref. No. 313						

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pump House

COSMOD Reference Number: 315

Description of Equipment:

For sludge from the primary settler in wastewater treatment, and providing reliable, continuous operation with two or three pumps running. The capacity is for two pumps, the cost is for three. Including normal earthwork, station integral piping. Excluding heating, ventillating and wiring of pump house. Installed cost.

Correlation Data:

C_o =	\$ 45000	\$ 155000
S_o =	0.01 m^3/s	0.1 m^3/s
n =	0.39	0.61
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.002 to 0.18	0.18 to 0.40
Error :		

Coding Data:

$\underset{e}{X.}\underset{f}{XX}\ \underset{g}{XX}\ \underset{h}{XX}\ \underset{i}{XX}$ (Select values from data below)

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pump House

COSMOD Reference Number: 316

Description of Equipment:

For recirculating or intermediate pumping in the activated sludge process for wastewater treatment.
Pump and drive only.
Installed cost.

Correlation Data:

C_o = $ 8000

S_o = 0.1 m^3/s

n = 0.61

L+M Factor = 2.0 (assumed)

Range : 0.03 to 0.5 m^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Pump House

COSMOD Reference Number: 317

Description of Equipment:

Same as equipment with COSMOD Ref. No. 316, but with station included. Deep wet well excluded.

Installed cost.

Correlation Data:

C_o =	$ 40000	$ 78000	$ 118000
S_o =	0.1 m^3/s	0.3 m^3/s	1.0 m^3/s
n =	0.42	0.65	0.87
L+M Factor =	2.0 (assumed)	2.0 (assumed)	2.0 (assumed)
Range :	0.02 to 0.10	0.10 to 0.75	0.75 to 15
Error :			

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$
e f g h i

(Select values from data below)

Correction For	Factor	e	f	g	h	i
		0		00	00	00
Additional Eqpt.						
None	1.0		01			
Including heating, ventillating and wiring	1.3		02			

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 318

Description of Equipment:

Rotary vane vacuum pump, 85 to 95 kPa (vacuum). Including dripproof motor, baseplate, gearing and reservoir.

FOB cost.

Correlation Data:

C_o = $ 2800

S_o = 10 m^3/min (free air displacement)

n = 0.38

L+M Factor = 2.0 (assumed)

Range : 0.2 to 100 m^3/min

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 319

Description of Equipment:

Reciprocating vacuum pump, cast iron.
Including TEFC motor, baseplate and belt drive.
FOB cost.

Correlation Data:

C_o = $ 1600

S_o = 1 $kg.h^{-1}.kPa^{-1}$ (abs) (capacity)

n = 0.66

L+M Factor = 2.0 (assumed)

Range : 0.1 to 80

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 320

Description of Equipment:

Reciprocating vacuum pump, cast iron, 84 kPa (abs). Including baseplate and V-belt drive. Excluding motor.

FOB cost.

Correlation Data:

C_o = $ 3500

S_o = 0.1 m^3/s (inlet capacity)

n = 0.69

L+M Factor = 2.0 (assumed)

Range : 0.003 to 1.2 m^3/s

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 321

Description of Equipment:

Same as equipment with COSMOD Ref. No. 320, but cost correlated to drive power. FOB cost.

Correlation Data:

C_o = $ 3300

S_o = 10 kW (drive power)

n = 0.88

L+M Factor = 2.0 (assumed)

Range : 4 to 80 kW

Error :

Coding Data:

X.XX XX XX XX (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 322

Description of Equipment:

Rotary Piston oil-sealed vacuum pump, 0.013 Pa pressure. Including open dripproof motor, belt guard, drive.

FOB cost.

Correlation Data:

C_o = $ 1250

S_o = 1 m^3/min (free air displacement)

n = 0.55

L+M Factor = 2.0 (assumed)

Range : 0.02 to 100 m^3/min

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 323

Description of Equipment:

Rotary Liquid-Piston, vacuum pump, 85 to 95 kPa. Excluding drive. FOB cost.

Correlation Data:

C_o = \$ 13000

S_o = 100 m^3/min (actual free air displacement)

n = 0.73

L+M Factor = 2.0 (assumed)

Range : 5 to 300 m^3/min

Error :

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment

COSMOD Reference Number: 324

Description of Equipment:

Generalised vacuum pump, including TEFC motor, baseplate and belt drive.
FOB cost.

Correlation Data:

C_o = $ 6200

S_o = 10 $kg.h^{-1}.kPa^{-1}$ (abs) (capacity)

n = 0.64

L+M Factor = 2.0 (assumed)

Range : 0.01 to 500

Error : 30%

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		00	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Vacuum Equipment (Gas Transportation)

COSMOD Reference Number: 325

Description of Equipment:

Vacuum oil diffusion pump. Complete unit.

FOB cost.

Correlation Data:

C_o =	\$ 360	\$ 1700
S_o =	10 m^3/min	300 m^3/min
n =	0.22	0.89
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	0.4 to 95 m^3/min	95 to 10^3 m^3/min
Error :		

Note: Units of size: Actual free air displacement, m^3/min.

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)

e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

EQUIPMENT DATA AND CODING SHEET

Type of Equipment: Chlorine Feed System

COSMOD Reference Number: 326

Description of Equipment:

Chlorine feed systems for water and waste water treatment. Including chlorine feeding and handling equipment, scales, evaporators, structure, housing and inside storage space for chlorine. Excluding storage tanks and chlorination contact vessel.

Correlation Data:

C_o =	$ 21000	$ 57000
S_o =	30 $kg.day^{-1}$	300 $kg.day^{-1}$
n =	0.32	0.48
L+M Factor =	2.0 (assumed)	2.0 (assumed)
Range :	5 to 65	65 to 4000
Error :		

Note: Units of size: Average dosage rate, $kg.day^{-1}$

Coding Data:

$\underline{X}.\underline{XX}\ \underline{XX}\ \underline{XX}\ \underline{XX}$ (Select values from data below)
e f g h i

Correction For	Factor	e	f	g	h	i
		0	00	00	00	00

APPENDIX D

COSMOD's equipment data file is listed here. COSMOD uses this file to access cost correlation and other data on nearly 300 different equipment.

Information on how these data are organised begin on p. D-73 of this Appendix.

LISTING OF DATA ON FILE

RECORD NO.	1	LENGTH OF RECORD	65
	1.0000	2.0000	2000.0000
	1.0000	100.0000	.7100
	40.0000	1.1500	0.0000
	1.0000	2.0000	3.0000
	9.0000	1.0000	1.1500
	1.5200	1.5500	2.5000
	150.0000	300.0000	400.0000
	1000.0000	3000.0000	4000.0000
	1.0000	1.2000	1.3500
	1.7000	2.8000	2.4000
	9.0000	2.4000	8.5000
	4.0000	13.0000	-5.0000
	1.3500	.3000	1.2500
RECORD NO.	2	LENGTH OF RECORD	20
	1.0000	.0300	.3000
	.1000	1.0000	.5800
	0.0000	1.0000	0.0000
	6.0000	7.0000	0.0000
RECORD NO.	3	LENGTH OF RECORD	20
	1.0000	.7000	70.0000
	10.0000	1.0000	.6900
	0.0000	1.1500	0.0000
	1.0000	2.0000	0.0000
RECORD NO.	4	LENGTH OF RECORD	20
	1.0000	2.0000	70.0000

1.0000	8000.0000
2.3000	40.0000
0.0000	5.0000
4.0000	5.0000
1.2500	1.4500
2.8000	3.1000
600.0000	800.0000
5000.0000	-17.0000
1.3000	1.5000
2.0000	3.0000
3.0000	2.8000
.9500	.8700
0.0000	0.0000

1.0000	380.0000
1.8000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	4000.0000
2.2000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	1900.0000

1.0000	10.0000	.5000
15.0000	1.1500	0.0000
1.0000	2.0000	0.0000

RECORD NO. 5 LENGTH OF RECORD 20

1.0000	10.0000	40.0000
1.0000	10.0000	.3400
0.0000	1.1500	0.0000
1.0000	2.0000	0.0000

RECORD NO. 6 LENGTH OF RECORD 30

2.0000	10.0000	120.0000
1.0000	2900.0000	1.0000
2.0000	20.0000	20.0000
0.0000	30000.0000	30.0000
2.0000	20.0000	20.0000
0.0000	2.0000	1.0000

RECORD NO. 7 LENGTH OF RECORD 30

2.0000	70.0000	300.0000
1.0000	5000.0000	1.0000
2.0000	20.0000	20.0000
0.0000	14000.0000	5.0000
2.0000	20.0000	20.0000
0.0000	2.0000	1.0000

RECORD NO. 8 LENGTH OF RECORD 35

1.0000	20.0000	2000.0000
2.8000	100.0000	.8000
30.0000	1.0000	0.0000
1.0000	7.0000	3.0000
1.0000	1.0500	1.1000
250.0000	500.0000	1000.0000

2.0000	15.0000
0.0000	2.0000
0.0000	0.0000
1.0000	3400.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1000.0000	1.0000
10.0000	.6000
1.1500	0.0000
10.0000	.9700
1.1500	0.0000
2.0000	0.0000
1000.0000	1.0000
100.0000	.5700
1.1500	0.0000
100.0000	.7800
1.1500	0.0000
2.0000	0.0000
1.0000	26000.0000
1.5800	30.0000
0.0000	4.0000
4.0000	4.0000
1.1500	150.0000
-5.0000	1.0000

1.0800	1.5000	2.8500

RECORD NO. 9 LENGTH OF RECORD 20

1.0000	30.0000	200.0000
1.0000	100.0000	.7800
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 10 LENGTH OF RECORD 40

2.0000	.5000	2.5000
1.0000	55.0000	1.0000
2.0000	0.0000	0.0000
0.0000	160.0000	5.0000
2.0000	0.0000	0.0000
0.0000	4.0000	1.0000
5.0000	-2.0000	1.0000
1.0000	2.8000	0.0000

RECORD NO. 11 LENGTH OF RECORD 20

1.0000	4.0000	25.0000
.9300	10.0000	1.0000
20.0000	1.1500	0.0000
1.0000	2.0000	0.0000

RECORD NO. 12 LENGTH OF RECORD 35

2.0000	2.0000	5.0000
1.0000	750.0000	3.3000
2.0000	0.0000	0.0000
0.0000	2200.0000	14.0000
2.0000	50.0000	50.0000
0.0000	3.0000	1.0000
-2.0000	1.0000	1.2500

```
 3.2000          0.0000


 1.0000       1600.0000
 2.0000          0.0000
 0.0000          2.0000
 0.0000          0.0000


10.0000          1.0000
 1.0000           .3700
 1.1500          0.0000
 1.0000          1.0700
 1.1500          0.0000
 2.0000          4.0000
 4.4000         -2.0000
 0.0000          0.0000


 1.0000        400.0000
 2.0000         20.0000
 0.0000          2.0000
 0.0000          0.0000


35.0000          1.0000
 1.0000           .6100
 1.1500          0.0000
 1.0000           .8200
 1.1500          0.0000
 2.0000          4.0000
 0.0000          0.0000
```

RECORD NO. 13 LENGTH OF RECORD 35

1.0000	.3000	25.0000
2.0000	1.0000	.1400
20.0000	1.1500	0.0000
1.0000	2.0000	3.0000
1.0000	1.1000	1.2500
1000.0000	-5.0000	1.0000
2.1000	2.5000	0.0000

RECORD NO. 14 LENGTH OF RECORD 35

1.0000	5.0000	200.0000
20.0000	1.0000	.6700
100.0000	1.1500	0.0000
1.0000	2.0000	3.0000
1.0000	1.1000	1.2500
1000.0000	-5.0000	1.0000
2.1000	2.5000	0.0000

RECORD NO. 15 LENGTH OF RECORD 25

1.0000	10.0000	600.0000
1.0000	100.0000	.6500
20.0000	1.1500	0.0000
1.0000	2.0000	4.0000
1.1000	0.0000	0.0000

RECORD NO. 16 LENGTH OF RECORD 45

3.0000	4.0000	20.0000
1.0000	1.0000	1.0000
10.0000	.2700	2.0000
1.1500	0.0000	0.0000
10.0000	.4800	2.0000
1.1500	0.0000	0.0000

1.0000	400.0000
2.0000	20.0000
0.0000	4.0000
5.0000	3.0000
150.0000	900.0000
2.6500	5.5000
0.0000	0.0000

1.0000	3400.0000
1.6000	100.0000
0.0000	4.0000
5.0000	3.0000
150.0000	900.0000
2.6500	5.5000
0.0000	0.0000

1.0000	15000.0000
2.0000	20.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

40.0000	100.0000
1400.0000	.9300
0.0000	0.0000
2200.0000	2.8800
0.0000	0.0000
3700.0000	6.5000

10.0000	.7200	2.0000
1.1500	0.0000	0.0000
2.0000	0.0000	0.0000

RECORD NO. 17 LENGTH OF RECORD 45

3.0000	5.0000	10.0000
1.0000	1.0000	1.0000
10.0000	.5100	2.0000
1.1500	0.0000	0.0000
10.0000	.7500	2.0000
1.1500	0.0000	0.0000
10.0000	.5300	2.0000
1.1500	0.0000	0.0000
2.0000	0.0000	0.0000

RECORD NO. 18 LENGTH OF RECORD 35

2.0000	.2500	.7500
1.0000	120.0000	.5000
2.0000	0.0000	0.0000
0.0000	470.0000	3.0000
2.0000	0.0000	0.0000
0.0000	3.0000	1.0000
-2.0000	1.0000	1.0000

RECORD NO. 19 LENGTH OF RECORD 30

2.0000	.1000	1.3000
1.0000	80.0000	.3000
2.0000	30.0000	30.0000
0.0000	700.0000	5.0000
2.0000	0.0000	0.0000
0.0000	2.0000	1.0000

0.0000	0.0000
2.0000	1.0000
0.0000	0.0000
70.0000	100.0000
2400.0000	.6500
0.0000	0.0000
6300.0000	2.8000
0.0000	0.0000
13500.0000	7.9000
0.0000	0.0000
2.0000	1.0000
0.0000	0.0000
6.0000	1.0000
1.0000	.4300
1.1500	0.0000
1.0000	.8300
1.1500	0.0000
2.0000	4.0000
0.0000	0.0000
12.0000	1.0000
1.0000	.2500
1.0000	0.0000
1.0000	1.3300
1.0000	0.0000
7.0000	0.0000

RECORD NO. 20 LENGTH OF RECORD 30

2.0000	3.0000	25.0000
1.0000	1400.0000	2.0000
2.0000	0.0000	0.0000
0.0000	3300.0000	5.0000
2.0000	0.0000	0.0000
0.0000	2.0000	1.0000

RECORD NO. 21 LENGTH OF RECORD 20

1.0000	10.0000	200.0000
50.0000	1.0000	.8700
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 22 LENGTH OF RECORD 20

1.0000	1.0000	20.0000
6.5000	1.0000	.7000
0.0000	1.0000	0.0000
1.0000	7.0000	0.0000

RECORD NO. 23 LENGTH OF RECORD 25

1.0000	.1000	30.0000
2.8000	1.0000	.7000
0.0000	1.0000	0.0000
1.0000	7.0000	4.0000
2.3000	3.5000	0.0000

RECORD NO. 24 LENGTH OF RECORD 20

1.0000	1.5000	70.0000
.9300	10.0000	.8200
0.0000	1.0000	0.0000
1.0000	7.0000	0.0000

150.0000	1.0000
10.0000	.5800
1.0000	0.0000
10.0000	1.0400
1.0000	0.0000
7.0000	0.0000
1.0000	700.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	1700.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	290.0000
2.0000	0.0000
0.0000	3.0000
-3.0000	1.0000
0.0000	0.0000
1.0000	1400.0800
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

RECORD NO. 25 LENGTH OF RECORD 30

2.0000	1.0000	7.5000
1.0000	7500.0000	.3000
2.0000	0.0000	0.0000
0.0000	11000.0000	1.0000
2.0000	40.0000	40.0000
0.0000	2.0000	1.0000

RECORD NO. 26 LENGTH OF RECORD 30

2.0000	100.0000	1300.0000
1.0000	4500.0000	5.0000
2.0000	0.0000	0.0000
0.0000	19000.0000	40.0000
2.0000	0.0000	0.0000
0.0000	2.0000	1.0000

RECORD NO. 27 LENGTH OF RECORD 30

2.0000	70.0000	1000.0000
1.0000	55000.0000	3.0000
2.0000	0.0000	0.0000
0.0000	130000.0000	15.0000
2.0000	0.0000	0.0000
0.0000	2.0000	1.0000

RECORD NO. 28 LENGTH OF RECORD 25

1.0000	.2000	40.0000
2.0000	1.0000	.6000
40.0000	1.1500	0.0000
9.0000	2.0000	4.0000
1.5000	2.0000	0.0000

RECORD NO. 29 LENGTH OF RECORD 25

40.0000	1.0000
10.0000	.1300
1.0000	0.0000
10.0000	.7800
1.0000	0.0000
7.0000	0.0000

10000.0000	1.0000
100.0000	.3400
1.1500	0.0000
100.0000	1.0000
1.1500	0.0000
2.0000	0.0000

10000.0000	1.0000
100.0000	.4200
1.0000	0.0000
100.0000	1.0000
1.0000	0.0000
7.0000	0.0000

1.0000	2800.0000
2.0000	40.0000
0.0000	3.0000
-3.0000	1.0000
0.0000	0.0000

1.0000	.1000	2.5000
1.0000	1.0000	1.3700
30.0000	1.1500	0.0000
10.0000	2.0000	4.0000
1.5000	2.0000	0.0000

RECORD NO. 30 LENGTH OF RECORD 25

1.0000	.6000	20.0000
5.0000	1.0000	.4300
0.0000	1.0000	0.0000
6.0000	7.0000	5.0000
2.7000	0.0000	0.0000

RECORD NO. 31 LENGTH OF RECORD 20

1.0000	1.2000	12.0000
5.0000	1.0000	.5000
0.0000	1.0000	0.0000
6.0000	7.0000	0.0000

RECORD NO. 32 LENGTH OF RECORD 20

1.0000	2.0000	10.0000
5.0000	1.0000	.7500
0.0000	1.0000	0.0000
6.0000	7.0000	0.0000

RECORD NO. 33 LENGTH OF RECORD 40

1.0000	10000.0000	400000.0000
12.0000	1000.0000	.7500
40.0000	1.1500	0.0000
8.0000	2.0000	3.0000
4.0000	1.0000	1.1000
500.0000	1000.0000	2000.0000
1.0000	1.3500	1.7500

1.0000	4600.0000
2.0000	30.0000
0.0000	3.0000
-3.0000	1.0000
0.0000	0.0000

1.0000	4000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	7000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	22000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	54000.0000
1.5000	40.0000
0.0000	5.0000
11.0000	12.0000
1.2500	1.6000
3000.0000	-5.0000
2.3000	2.0000

-3.0000	1.0000	1.1000

RECORD NO.	34	LENGTH OF RECORD	20
	1.0000	15000.0000	110000.0000
	12.0000	1000.0000	.7900
	0.0000	1.5000	0.0000
	8.0000	13.0000	0.0000

RECORD NO.	35	LENGTH OF RECORD	20
	1.0000	15000.0000	250000.0000
	12.0000	1000.0000	.7900
	0.0000	1.5000	0.0000
	8.0000	13.0000	0.0000

RECORD NO.	36	LENGTH OF RECORD	35
	1.0000	500.0000	100000.0000
	3.0000	1000.0000	.7400
	0.0000	1.0000	0.0000
	8.0000	7.0000	3.0000
	1.0000	1.1500	1.2000
	1500.0000	-3.0000	1.0000
	0.0000	0.0000	0.0000

RECORD NO.	37	LENGTH OF RECORD	20
	1.0000	3.0000	6.0000
	5.0000	1.0000	1.5500
	0.0000	1.5000	0.0000
	10.0000	13.0000	0.0000

RECORD NO.	38	LENGTH OF RECORD	20
	1.0000	100.0000	30000.0000
	1.0000	1000.0000	.5900

```
    1.3500          0.0000

    1.0000     115000.0000
    2.0000          0.0000
    0.0000          2.0000
    0.0000          0.0000

    1.0000     260000.0000
    2.0000          0.0000
    0.0000          2.0000
    0.0000          0.0000

    1.0000      40000.0000
    1.6500          0.0000
    0.0000          4.0000
    4.0000          3.0000
  500.0000       1000.0000
    1.4500          1.5000
    0.0000          0.0000

    1.0000     250000.0000
    2.0000          0.0000
    0.0000          2.0000
    0.0000          0.0000

    1.0000     750000.0000
    2.0000          0.0000
```

0.0000	1.5000	0.0000
15.0000	13.0000	0.0000

RECORD NO. 39 LENGTH OF RECORD 35

2.0000	180.0000	600.0000
1.0000	270000.0000	.2300
2.0000	0.0000	0.0000
0.0000	680000.0000	1.0000
2.0000	0.0000	0.0000
0.0000	3.0000	15.0000
-2.0000	1.0000	.8000

RECORD NO. 40 LENGTH OF RECORD 30

2.0000	150.0000	500.0000
1.0000	200.0000	.2000
2.0000	0.0000	0.0000
0.0000	400.0000	1.0000
2.0000	0.0000	0.0000
0.0000	2.0000	8.0000

RECORD NO. 41 LENGTH OF RECORD 20

1.0000	300.0000	1500.0000
1.0000	1000.0000	.2600
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 42 LENGTH OF RECORD 20

1.0000	150.0000	500.0000
.2000	1000.0000	.5700
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 43 LENGTH OF RECORD 20

0.0000	2.0000
0.0000	0.0000

4000.0000	1.0000
1000.0000	.5300
1.5000	0.0000
1000.0000	.7800
1.5000	0.0000
13.0000	5.0000
0.0000	0.0000

3000.0000	1.0000
1000.0000	.1600
1.0000	0.0000
1000.0000	.8500
1.0000	0.0000
7.0000	0.0000

1.0000	1000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	300.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	180000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	2100.0000
1.3600	80.0000
0.0000	4.0000
19.0000	4.0000
1.3000	900.0000
-4.0000	1.0000
0.0000	0.0000
1.0000	10000.0000
1.8000	30.0000
0.0000	2.0000
0.0000	0.0000
1.0000	1000.0000
1.8000	0.0000
0.0000	2.0000
0.0000	0.0000
200.0000	1.0000
1.0000	0.0000
1.0000	0.0000
1.0000	.7700
1.0000	0.0000

1.0000	60.0000	100.0000
1.0000	100.0000	.9800
0.0000	1.0000	0.0000
16.0000	7.0000	0.0000

RECORD NO. 44 LENGTH OF RECORD 35

1.0000	50.0000	200000.0000
1.0000	100.0000	1.1000
80.0000	1.0000	0.0000
17.0000	7.0000	18.0000
1.3000	1.5000	1.0800
1200.0000	1800.0000	3600.0000
.7000	.9000	1.1500

RECORD NO. 45 LENGTH OF RECORD 20

1.0000	1000.0000	500000.0000
2.0000	100.0000	.8100
30.0000	1.5000	0.0000
17.0000	13.0000	0.0000

RECORD NO. 46 LENGTH OF RECORD 20

1.0000	10.0000	200.0000
70.0000	1.0000	.9300
0.0000	1.0000	0.0000
17.0000	7.0000	0.0000

RECORD NO. 47 LENGTH OF RECORD 30

2.0000	10.0000	25.0000
1.0000	3700.0000	10.0000
1.8000	0.0000	0.0000
0.0000	5800.0000	70.0000
1.8000	0.0000	0.0000

0.0000	2.0000	17.0000

RECORD NO. 48 LENGTH OF RECORD 30

1.0000	2000.0000	4500.0000
3.0000	1000.0000	.5500
0.0000	1.5000	0.0000
17.0000	13.0000	18.0000
1.2500	1.0000	200.0000
0.0000	0.0000	0.0000

RECORD NO. 49 LENGTH OF RECORD 30

1.0000	700.0000	10000.0000
3.0000	1000.0000	.8100
0.0000	1.1500	0.0000
17.0000	2.0000	18.0000
1.1000	1.0000	514.0000
0.0000	0.0000	0.0000

RECORD NO. 50 LENGTH OF RECORD 20

1.0000	500.0000	10000.0000
3.0000	1000.0000	.9600
0.0000	1.1500	0.0000
17.0000	2.0000	0.0000

RECORD NO. 51 LENGTH OF RECORD 20

1.0000	7.0000	100.0000
20.0000	1.0000	1.0000
0.0000	1.0000	0.0000
17.0000	7.0000	0.0000

RECORD NO. 52 LENGTH OF RECORD 20

1.0000	1.0000	8.0000
3.0000	1.0000	.2600

7.0000	0.0000
1.0000	120000.0000
1.8000	0.0000
0.0000	3.0000
3.0000	1.7000
500.0000	700.0000
0.0000	0.0000
1.0000	33000.0000
1.8000	0.0000
0.0000	3.0000
3.0000	1.2500
900.0000	1200.0000
0.0000	0.0000
1.0000	48000.0000
1.8000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	1100.0000
1.8000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	45.0000
1.8000	50.0000

50.0000	1.0000	0.0000
17.0000	7.0000	0.0000

RECORD NO. 53 LENGTH OF RECORD 20

1.0000	10.0000	2000.0000
1.0000	100.0000	1.0000
80.0000	1.0000	0.0000
17.0000	7.0000	0.0000

RECORD NO. 54 LENGTH OF RECORD 30

2.0000	.5000	2.5000
1.0000	200.0000	1.0000
1.8000	0.0000	0.0000
0.0000	510.0000	10.0000
1.8000	0.0000	0.0000
0.0000	2.0000	17.0000

RECORD NO. 55 LENGTH OF RECORD 20

1.0000	5.0000	25.0000
10.0000	1.0000	.7900
0.0000	1.5000	0.0000
17.0000	13.0000	0.0000

RECORD NO. 56 LENGTH OF RECORD 20

1.0000	.5000	10.0000
2.0000	1.0000	63.0000
50.0000	1.0000	0.0000
20.0000	7.0000	0.0000

RECORD NO. 57 LENGTH OF RECORD 20

1.0000	30.0000	7000.0000
400.0000	1.0000	.8200

0.0000	2.0000
0.0000	0.0000
1.0000	700.0000
1.0000	80.0000
0.0000	2.0000
0.0000	0.0000
25.0000	1.0000
1.0000	.2000
1.0000	0.0000
1.0000	.5300
1.0000	0.0000
7.0000	0.0000
1.0000	3500.0000
1.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	1000.0000
1.0000	50.0000
0.0000	2.0000
0.0000	0.0000
1.0000	50000.0000
1.0000	70.0000

0.0000	2.0000
0.0000	0.0000

1.0000	11000.0000
1.8000	0.0000
0.0000	5.0000
21.0000	5.0000
1.5000	1.6000
2000.0000	5.0000
1.0500	1.1000
350.0000	400.0000
0.0000	0.0000

1.0000	100000.0000
1.8000	0.0000
0.0000	5.0000
21.0000	5.0000
1.5000	1.6000
2000.0000	5.0000
1.0500	1.1000
350.0000	400.0000
0.0000	0.0000

1.0000	160000.0000
1.8000	0.0000
0.0000	5.0000
21.0000	5.0000
1.5000	1.6000
2000.0000	5.0000
1.0500	1.1000

70.0000	1.0000	0.0000
17.0000	7.0000	0.0000

RECORD NO. 58 LENGTH OF RECORD 45

1.0000	10.0000	4000.0000
400.0000	1.0000	.5100
0.0000	1.0000	0.0000
17.0000	7.0000	3.0000
4.0000	1.0000	1.2200
300.0000	600.0000	800.0000
1.0800	.9700	1.0000
100.0000	200.0000	300.0000
-2.0000	1.0000	1.8500

RECORD NO. 59 LENGTH OF RECORD 45

1.0000	1000.0000	20000.0000
4000.0000	1.0000	.4600
0.0000	1.0000	0.0000
17.0000	7.0000	3.0000
4.0000	1.0000	1.2200
300.0000	600.0000	800.0000
1.0800	.9700	1.0000
100.0000	200.0000	300.0000
-2.0000	1.0000	1.8500

RECORD NO. 60 LENGTH OF RECORD 45

1.0000	2000.0000	20000.0000
4000.0000	1.0000	.3500
0.0000	1.0000	0.0000
17.0000	7.0000	3.0000
4.0000	1.0000	1.2200
300.0000	600.0000	800.0000
1.0800	.9700	1.0000

100.0000	200.0000	300.0000
-2.0000	1.0000	1.8500

RECORD NO. 61 LENGTH OF RECORD 20

1.0000	1000.0000	30000.0000
5.0000	1000.0000	.8000
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 62 LENGTH OF RECORD 20

1.0000	650.0000	15000.0000
5.0000	1000.0000	.5500
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 63 LENGTH OF RECORD 35

1.0000	3000.0000	50000.0000
10.0000	1000.0000	.7300
20.0000	1.0000	0.0000
8.0000	7.0000	3.0000
1.0000	1.0000	1.3000
250.0000	850.0000	2400.0000
1.2500	0.0000	0.0000

RECORD NO. 64 LENGTH OF RECORD 30

2.0000	4.0000	150.0000
1.0000	580.0000	40.0000
1.8000	0.0000	0.0000
0.0000	3600.0000	500.0000
1.8000	0.0000	0.0000
0.0000	2.0000	22.0000

350.0000	400.0000
0.0000	0.0000
1.0000	250000.0000
1.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	520000.0000
1.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	600000.0000
1.0000	20.0000
0.0000	4.0000
5.0000	4.0000
1.5000	125.0000
-2.0000	1.0000
0.0000	0.0000
2000.0000	1.0000
1.0000	.4500
1.0000	0.0000
1.0000	.7500
1.0000	0.0000
7.0000	0.0000

RECORD NO. 65 LENGTH OF RECORD 30

2.0000	4.0000	250.0000
1.0000	260.0000	40.0000
1.8000	0.0000	0.0000
0.0000	2400.0000	500.0000
1.8000	0.0000	0.0000
0.0000	2.0000	22.0000

RECORD NO. 66 LENGTH OF RECORD 20

1.0000	2.0000	30.0000
10.0000	1.0000	.8800
0.0000	1.0000	0.0000
17.0000	7.0000	0.0000

RECORD NO. 67 LENGTH OF RECORD 20

1.0000	2.0000	10.0000
10.0000	1.0000	.2100
0.0000	1.0000	0.0000
17.0000	7.0000	0.0000

RECORD NO. 68 LENGTH OF RECORD 30

2.0000	1.5000	15.0000
1.0000	840.0000	5.0000
1.8000	0.0000	0.0000
0.0000	2800.0000	30.0000
1.8000	0.0000	0.0000
0.0000	2.0000	8.0000

RECORD NO. 69 LENGTH OF RECORD 25

1.0000	10.0000	80.0000
30.0000	1.0000	.5100
0.0000	1.0000	0.0000
8.0000	7.0000	5.0000

1200.0000	1.0000
1.0000	.5400
1.0000	0.0000
1.0000	1.9000
1.0000	0.0000
7.0000	0.0000

1.0000	140.0000
1.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	55.0000
1.0000	0.0000
0.0000	2.0000
0.0000	0.0000

500.0000	1.0000
1.0000	.7500
1.0000	0.0000
1.0000	.4600
1.0000	0.0000
7.0000	0.0000

1.0000	5500.0000
1.0000	0.0000
0.0000	3.0000
-3.0000	1.0000

1.1000	1.6400	0.0000

RECORD NO. 70 LENGTH OF RECORD 0

RECORD NO. 71 LENGTH OF RECORD 0

RECORD NO. 72 LENGTH OF RECORD 0

RECORD NO. 73 LENGTH OF RECORD 0

RECORD NO. 74 LENGTH OF RECORD 0

RECORD NO. 75 LENGTH OF RECORD 55

1.0000	100.0000	80000.0000
1.0000	1000.0000	.6200
0.0000	1.0000	0.0000
23.0000	7.0000	3.0000
9.0000	1.0000	1.1500
1.6000	1.7000	1.9000
150.0000	200.0000	300.0000
700.0000	800.0000	900.0000
1.0000	4.0000	2.2500
6.3000	3.9000	-3.0000
1.3000	0.0000	0.0000

RECORD NO. 76 LENGTH OF RECORD 65

2.0000	100.0000	2000.0000
1.0000	600.0000	1.0000
2.2000	0.0000	0.0000
0.0000	3300.0000	10.0000
2.2000	0.0000	0.0000
0.0000	5.0000	24.0000

0.0000	0.0000
1.0000	1900.0000
2.2000	0.0000
0.0000	5.0000
4.0000	5.0000
1.2500	1.4500
2.3000	2.5000
500.0000	600.0000
1000.0000	-7.0000
8.0000	4.2500
1.0000	.8000
0.0000	0.0000
100000.0000	1.0000
1000.0000	.5700
1.0000	0.0000
1000.0000	.7900
1.0000	0.0000
7.0000	3.0000

1.0000	1.1500
1.7000	1.9000
200.0000	300.0000
800.0000	900.0000
4.0000	2.2500
3.9000	-3.0000
0.0000	0.0000

1.0000	11000.0000
2.2000	0.0000
0.0000	5.0000
4.0000	5.0000
1.2500	1.4500
2.3000	2.5000
500.0000	600.0000
1000.0000	-7.0000
8.0000	4.2500
1.0000	.8000
0.0000	0.0000

1.0000	4800.0000
3.0000	50.0000
0.0000	5.0000
4.0000	5.0000
1.2500	1.4000
2.0000	2.4000
300.0000	400.0000
800.0000	900.0000
2.7500	2.5000

4.0000	5.0000	9.0000
1.2500	1.4500	1.6000
2.3000	2.5000	150.0000
500.0000	600.0000	700.0000
1000.0000	-7.0000	1.0000
8.0000	4.2500	6.3000
1.0000	.8000	1.3000

RECORD NO. 77 LENGTH OF RECORD 55

1.0000	12.0000	100.0000
3.0000	1.0000	.8400
0.0000	1.0000	0.0000
25.0000	7.0000	3.0000
9.0000	1.0000	1.1500
1.6000	1.7000	1.9000
150.0000	200.0000	300.0000
700.0000	800.0000	900.0000
1.0000	4.0000	2.2500
6.3000	3.9000	-3.0000
1.3000	0.0000	0.0000

RECORD NO. 78 LENGTH OF RECORD 0

RECORD NO. 79 LENGTH OF RECORD 65

1.0000	8.0000	350.0000
100.0000	1.0000	.8100
50.0000	1.0000	0.0000
25.0000	7.0000	3.0000
10.0000	1.0000	1.2800
1.5000	1.6500	1.9000
2.6000	150.0000	200.0000
500.0000	600.0000	700.0000
1000.0000	-15.0000	1.0000

3.6500	2.2500	3.2500
1.6000	8.2000	6.5000
4.2500	8.2000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 80 LENGTH OF RECORD 75

2.0000	10.0000	2500.0000
1.0000	600.0000	.1000
3.0000	40.0000	40.0000
0.0000	12000.0000	10.0000
3.0000	40.0000	40.0000
0.0000	5.0000	23.0000
4.0000	5.0000	10.0000
1.2500	1.4000	1.5000
2.0000	2.4000	2.6000
300.0000	400.0000	500.0000
800.0000	900.0000	1000.0000
2.7500	2.5000	3.6500
2.1000	2.3000	1.6000
4.0000	7.9000	4.2500
1.0000	1.6000	0.0000

RECORD NO. 81 LENGTH OF RECORD 65

1.0000	100.0000	300000.0000
10.0000	1000.0000	.7000
0.0000	1.0000	0.0000
24.0000	7.0000	3.0000
10.0000	1.0000	1.2000
1.5000	1.6500	1.9000
2.6000	150.0000	200.0000
500.0000	600.0000	700.0000
1000.0000	-15.0000	1.0000

2.1000	2.3000
4.0000	7.9000
1.0000	1.6000
0.0000	0.0000
28000.0000	1.0000
1000.0000	.5300
1.0000	0.0000
1000.0000	.8900
1.0000	0.0000
7.0000	3.0000
1.0000	1.2000
1.6500	1.9000
150.0000	200.0000
600.0000	700.0000
-15.0000	1.0000
2.2500	3.2500
8.2000	6.5000
8.2000	-2.0000
0.0000	0.0000
1.0000	4700.0000
3.0000	0.0000
0.0000	5.0000
4.0000	5.0000
1.2500	1.4000
2.0000	2.4000
300.0000	400.0000
800.0000	900.0000
2.7500	2.5000

3.6500	2.2500	3.2500
1.6000	8.2000	6.5000
4.2500	8.2000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 82 LENGTH OF RECORD 0

RECORD NO. 83 LENGTH OF RECORD 0

RECORD NO. 84 LENGTH OF RECORD 0

RECORD NO. 85 LENGTH OF RECORD 0

RECORD NO. 86 LENGTH OF RECORD 0

RECORD NO. 87 LENGTH OF RECORD 30

1.0000	40.0000	1500.0000
100.0000	1.0000	.7000
40.0000	1.5000	0.0000
26.0000	13.0000	3.0000
1.1000	1.2000	1.3000
50.0000	75.0000	100.0000

RECORD NO. 88 LENGTH OF RECORD 20

1.0000	1200.0000	5000.0000
3.7800	1000.0000	.7300
0.0000	1.5000	0.0000
26.0000	13.0000	0.0000

RECORD NO. 89 LENGTH OF RECORD 20

1.0000	8000.0000	50000.0000
3.0000	10000.0000	.7300
0.0000	1.5000	0.0000

2.1000	2.3000
4.0000	7.9000
1.0000	1.6000
0.0000	0.0000

1.0000	28000.0000
1.6500	50.0000
0.0000	3.0000
5.0000	1.0000
1.6000	30.0000
200.0000	0.0000

1.0000	90000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	450000.0000
2.0000	0.0000
0.0000	2.0000

26.0000	13.0000	0.0000

RECORD NO. 90 LENGTH OF RECORD 20

1.0000	13000.0000	100000.0000
3.0000	10000.0000	.5800
0.0000	1.5000	0.0000
26.0000	13.0000	0.0000

RECORD NO. 91 LENGTH OF RECORD 35

1.0000	100.0000	40000.0000
1.0000	1000.0000	.5700
0.0000	1.0000	0.0000
23.0000	7.0000	4.0000
1.0000	2.8000	2.8000
6.8000	7.9000	6.6000
.5000	0.0000	0.0000

RECORD NO. 92 LENGTH OF RECORD 35

1.0000	400.0000	20000.0000
3.0000	1000.0000	.9300
0.0000	1.0000	0.0000
27.0000	7.0000	4.0000
1.0000	2.8000	2.8000
6.8000	7.9000	6.6000
.5000	0.0000	0.0000

RECORD NO. 93 LENGTH OF RECORD 45

1.0000	100.0000	20000.0000
1.0000	1000.0000	.3000
20.0000	1.0000	0.0000
23.0000	7.0000	4.0000
1.0000	1.4000	1.5000

0.0000	0.0000
1.0000	1400000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	1400.0000
2.0000	0.0000
0.0000	4.0000
5.0000	-8.0000
3.0000	4.4000
-2.0000	1.0000
0.0000	0.0000
1.0000	1800.0000
2.0000	0.0000
0.0000	4.0000
5.0000	-8.0000
3.0000	4.4000
-2.0000	1.0000
0.0000	0.0000
1.0000	1000.0000
1.5000	20.0000
0.0000	4.0000
5.0000	-16.0000
1.5000	4.3000

.5000	3.0000	1.5000
5.8000	3.0000	5.9000
3.0000	-2.0000	1.0000
0.0000	0.0000	0.0000

RECORD NO. 94 LENGTH OF RECORD 45

1.0000	400.0000	20000.0000
3.0000	1000.0000	.5100
0.0000	1.0000	0.0000
27.0000	7.0000	4.0000
1.0000	1.4000	1.5000
.5000	3.0000	1.5000
5.8000	3.0000	5.9000
3.0000	-2.0000	1.0000
0.0000	0.0000	0.0000

RECORD NO. 95 LENGTH OF RECORD 25

1.0000	70.0000	1500.0000
1.0000	1000.0000	.5700
40.0000	1.0000	0.0000
23.0000	7.0000	4.0000
1.5000	0.0000	0.0000

RECORD NO. 96 LENGTH OF RECORD 25

1.0000	1.0000	200.0000
1.0000	10.0000	.5000
0.0000	1.0000	0.0000
23.0000	7.0000	4.0000
1.9000	0.0000	0.0000

RECORD NO. 97 LENGTH OF RECORD 30

1.0000	1000.0000	650000.0000
1.0000	10000.0000	.3200

```
 3.0000          2.5000
 3.0000          5.1000
 1.2000          0.0000
 0.0000          0.0000


 1.0000       2200.0000
 1.5000          0.0000
 0.0000          4.0000
 5.0000        -15.0000
 1.5000          4.3000
 3.0000          2.5000
 3.0000          5.1000
 1.2000          0.0000
 0.0000          0.0000


 1.0000       4500.0000
 2.0000         40.0000
 0.0000          3.0000
-2.0000          1.0000
 0.0000          0.0000


 1.0000       3700.0000
 2.0000          0.0000
 0.0000          3.0000
-2.0000          1.0000
 0.0000          0.0000


 1.0000       6200.0000
 1.5500          0.0000
```

0.0000	1.0000	0.0000
23.0000	7.0000	4.0000
1.4000	1.5000	1.5000
0.0000	0.0000	0.0000

RECORD NO. 98 LENGTH OF RECORD 30

1.0000	30000.0000	3000000.0000
1.0000	1000000.0000	.5800
0.0000	1.5000	0.0000
23.0000	28.0000	4.0000
1.5000	1.6000	3.2000
5.8000	5.1000	0.0000

RECORD NO. 99 LENGTH OF RECORD 30

1.0000	250000.0000	3000000.0000
1.0000	1000000.0000	.6300
0.0000	1.5000	0.0000
23.0000	28.0000	5.0000
1.0000	.8500	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 100 LENGTH OF RECORD 40

2.0000	4000.0000	25000.0000
1.0000	35000.0000	10.0000
2.0000	0.0000	0.0000
0.0000	160000.0000	100.0000
2.0000	0.0000	0.0000
0.0000	2.0000	29.0000
0.0000	0.0000	0.0000
0.0000	0.0000	0.0000

RECORD NO. 101 LENGTH OF RECORD 20

0.0000	3.0000
-5.0000	1.0000
4.3000	0.0000
0.0000	0.0000

1.0000	70000.0000
2.0000	0.0000
0.0000	3.0000
-8.0000	1.0000
3.5000	5.9000
0.0000	0.0000

1.0000	88000.0000
2.0000	0.0000
0.0000	4.0000
5.0000	-2.0000
1.0000	1.3000
0.0000	0.0000

300000.0000	1.0000
1000.0000	.4500
1.5000	0.0000
1000.0000	.7900
1.5000	0.0000
13.0000	0.0000
0.0000	0.0000
0.0000	0.0000

1.0000	100000.0000	100000000.0000
.2200	1000000.0000	.7900
0.0000	1.5000	0.0000
30.0000	13.0000	0.0000

RECORD NO. 102 LENGTH OF RECORD 0

RECORD NO. 103 LENGTH OF RECORD 20

1.0000	10000.0000	100000000.0000
1.0000	1000000.0000	.7800
0.0000	1.5000	0.0000
30.0000	13.0000	0.0000

RECORD NO. 104 LENGTH OF RECORD 25

1.0000	3000.0000	1000000.0000
100000.0000	1.0000	.7700
0.0000	1.5000	0.0000
29.0000	13.0000	0.0000
0.0000	0.0000	0.0000

RECORD NO. 105 LENGTH OF RECORD 30

1.0000	1000.0000	1000000.0000
100000.0000	1.0000	.6300
0.0000	1.5000	0.0000
23.0000	13.0000	5.0000
1.0000	17.0000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 106 LENGTH OF RECORD 25

1.0000	70000.0000	70000000.0000
100000.0000	1.0000	.5100
0.0000	1.5000	0.0000
23.0000	13.0000	5.0000

1.0000	160000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	54000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	120000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
0.0000	0.0000

1.0000	32000.0000
2.0000	0.0000
0.0000	4.0000
5.0000	-2.0000
1.0000	1.2500
0.0000	0.0000

1.0000	19000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000

1.2500	0.0000	0.0000

RECORD NO. 107 LENGTH OF RECORD 20

1.0000	100000.0000	200000000.0000
1000000.0000	1.0000	.6700
40.0000	1.5000	0.0000
23.0000	13.0000	0.0000

RECORD NO. 108 LENGTH OF RECORD 0

RECORD NO. 109 LENGTH OF RECORD 0

RECORD NO. 110 LENGTH OF RECORD 0

RECORD NO. 111 LENGTH OF RECORD 20

1.0000	1000.0000	1000000.0000
10000.0000	1.0000	.6000
0.0000	1.5000	0.0000
26.0000	13.0000	0.0000

RECORD NO. 112 LENGTH OF RECORD 20

1.0000	20.0000	10000.0000
1000.0000	1.0000	.5600
0.0000	1.5000	0.0000
26.0000	13.0000	0.0000

RECORD NO. 113 LENGTH OF RECORD 20

1.0000	100000.0000	10000000.0000
1.0000	1000000.0000	.8200
0.0000	1.5000	0.0000
23.0000	13.0000	0.0000

0.0000	0.0000

1.0000	90000.0000
2.0000	40.0000
0.0000	2.0000
0.0000	0.0000

1.0000	26000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	92000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	420000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

RECORD NO. 114 LENGTH OF RECORD 30

2.0000	28.0000	987.0000
1.0000	37000.0000	283.0000
2.0000	0.0000	0.0000
0.0000	480000.0000	85000.0000
2.0000	0.0000	0.0000
0.0000	2.0000	26.0000

RECORD NO. 115 LENGTH OF RECORD 30

1.0000	.2500	7.5000
2.0000	1.0000	.5800
30.0000	1.0000	0.0000
17.0000	7.0000	4.0000
1.0000	1.1200	1.1700
-2.0000	1.0000	1.2000

RECORD NO. 116 LENGTH OF RECORD 25

1.0000	1.0000	30.0000
5.0000	1.0000	.5200
40.0000	1.0000	0.0000
17.0000	7.0000	4.0000
1.1200	1.1700	1.3600

RECORD NO. 117 LENGTH OF RECORD 25

1.0000	1.0000	50.0000
5.0000	1.0000	.5700
40.0000	1.0000	0.0000
17.0000	7.0000	4.0000
1.1200	1.1700	1.3600

RECORD NO. 118 LENGTH OF RECORD 30

2.0000	1.0000	9.0000
1.0000	920.0000	2.0000

140000.0000	1.0000
1.0000	.4100
1.5000	0.0000
1.0000	.9700
1.5000	0.0000
13.0000	0.0000

1.0000	600.0000
2.0000	30.0000
0.0000	4.0000
5.0000	-5.0000
1.3600	1.3700
0.0000	0.0000

1.0000	1100.0000
1.6200	40.0000
0.0000	3.0000
-5.0000	1.0000
1.3700	0.0000

1.0000	1800.0000
1.6200	40.0000
0.0000	3.0000
-5.0000	1.0000
1.3700	0.0000

30.0000	1.0000
1.0000	.1900

2.0000	0.0000	0.0000
0.0000	1550.0000	10.0000
2.0000	0.0000	0.0000
0.0000	2.0000	17.0000

RECORD NO. 119 LENGTH OF RECORD 25

1.0000	2.0000	30.0000
10.0000	1.0000	.4500
50.0000	1.0000	0.0000
17.0000	7.0000	4.0000
1.1300	1.1700	1.3600

RECORD NO. 120 LENGTH OF RECORD 25

1.0000	2.0000	200.0000
10.0000	1.0000	.5600
20.0000	1.0000	0.0000
17.0000	7.0000	4.0000
1.1500	1.1700	1.3600

RECORD NO. 121 LENGTH OF RECORD 30

2.0000	400.0000	7500.0000
1.0000	46000.0000	4.0000
2.0000	0.0000	0.0000
0.0000	250000.0000	30.0000
2.0000	0.0000	0.0000
0.0000	2.0000	32.0000

RECORD NO. 122 LENGTH OF RECORD 20

1.0000	200000.0000	4000000.0000
1.0000	1000000.0000	.0000
0.0000	1.5000	0.0000
23.0000	13.0000	0.0000

1.0000	0.0000
1.0000	.4800
1.0000	0.0000
7.0000	0.0000
1.0000	2100.0000
1.6700	50.0000
0.0000	3.0000
-5.0000	1.0000
1.4000	0.0000
1.0000	3200.0000
2.0000	20.0000
0.0000	3.0000
-5.0000	1.0000
1.3700	0.0000
50000.0000	1.0000
1000.0000	.6600
1.5000	0.0000
1000.0000	.9300
1.5000	0.0000
13.0000	0.0000
1.0000	280000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

RECORD NO. 123 LENGTH OF RECORD 20

1.0000	1.0000	200.0000
20.0000	1.0000	.5500
0.0000	1.0000	0.0000
17.0000	7.0000	0.0000

RECORD NO. 124 LENGTH OF RECORD 25

1.0000	1.0000	3.0000
2.0000	1.0000	.4100
0.0000	1.0000	0.0000
17.0000	7.0000	4.0000
1.1400	1.1800	1.5400

RECORD NO. 125 LENGTH OF RECORD 0

RECORD NO. 126 LENGTH OF RECORD 0

RECORD NO. 127 LENGTH OF RECORD 25

1.0000	500.0000	10000.0000
2.0000	1000.0000	.6800
0.0000	1.1500	0.0000
23.0000	2.0000	4.0000
1.2700	2.3500	2.4000

RECORD NO. 128 LENGTH OF RECORD 25

1.0000	30.0000	150.0000
70.0000	1.0000	.5500
0.0000	1.0000	0.0000
33.0000	7.0000	4.0000
2.0000	0.0000	0.0000

RECORD NO. 129 LENGTH OF RECORD 20

1.0000	8500.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	1350.0000
2.0000	0.0000
0.0000	3.0000
-5.0000	1.0000
1.4000	0.0000

1.0000	30000.0000
1.6000	0.0000
0.0000	3.0000
-4.0000	1.0000
0.0000	0.0000

1.0000	5500.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	70.0000	600.0000
100.0000	1.0000	.7900
0.0000	1.0000	0.0000
33.0000	7.0000	0.0000

RECORD NO. 130 LENGTH OF RECORD 0

RECORD NO. 131 LENGTH OF RECORD 25

1.0000	10.0000	1000.0000
100.0000	1.0000	.5300
0.0000	1.0000	0.0000
34.0000	7.0000	4.0000
1.0000	.7500	3.0000

RECORD NO. 132 LENGTH OF RECORD 30

1.0000	10.0000	10000.0000
100.0000	1.0000	.6200
100.0000	1.0000	0.0000
34.0000	7.0000	4.0000
1.0000	1.2000	1.1000
1.0000	.7000	0.0000

RECORD NO. 133 LENGTH OF RECORD 30

1.0000	200.0000	1200.0000
1000.0000	1.0000	.5700
30.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.0000	1.2000	1.1000
1.0000	.7000	0.0000

RECORD NO. 134 LENGTH OF RECORD 25

1.0000	100000.0000	100000000.0000

1.0000	6500.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	85000.0000
1.7500	0.0000
0.0000	3.0000
-4.0000	1.0000
0.0000	0.0000

1.0000	130000.0000
1.7500	100.0000
0.0000	4.0000
5.0000	-3.0000
-3.0000	1.0000
0.0000	0.0000

1.0000	90000.0000
1.7500	30.0000
0.0000	4.0000
5.0000	-3.0000
-3.0000	1.0000
0.0000	0.0000

1.0000	62000.0000

1.0000	1000000.0000	.6200
60.0000	1.5000	0.0000
30.0000	13.0000	5.0000
3.0000	0.0000	0.0000

RECORD NO. 135 LENGTH OF RECORD 30

2.0000	.7000	42.0000
1.0000	10000.0000	7.5000
1.5700	40.0000	40.0000
0.0000	85000.0000	75.0000
1.5700	0.0000	0.0000
0.0000	2.0000	8.0000

RECORD NO. 136 LENGTH OF RECORD 45

3.0000	.5000	30.0000
1.0000	-1.0000	1.0000
1.0000	.5800	2.0000
1.0000	0.0000	0.0000
0.0000	0.0000	0.0000
0.0000	0.0000	0.0000
1.0000	1.1100	2.0000
1.0000	0.0000	0.0000
7.0000	0.0000	0.0000

RECORD NO. 137 LENGTH OF RECORD 20

1.0000	.2000	1.9000
1.0000	1.0000	1.2800
0.0000	1.0000	0.0000
1.0000	7.0000	0.0800

RECORD NO. 138 LENGTH OF RECORD 30

2.0000	1.0000	70.0000
1.0000	9000.0000	1.0000

2.0000	60.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000
280.0000	1.0000
1.0000	.6500
1.0000	0.0000
1.0000	.8100
1.0000	0.0000
7.0000	0.0000
350.0000	1000.0000
14000.0000	10.0000
0.0000	0.0000
0.0000	0.0000
0.0000	0.0000
100000.0000	350.0000
0.0000	0.0000
2.0000	35.0000
0.0000	0.0000
1.0000	70000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
750.0000	1.0000
10.0000	.5000

1.5700	50.0000	50.0000
0.0000	90000.0000	1.0000
1.5700	40.0000	40.0000
0.0000	2.0000	8.0000

RECORD NO. 139 LENGTH OF RECORD 20

1.0000	150.0000	4000.0000
1.0000	1000.0000	.9200
0.0000	1.0000	0.0000
35.0000	7.0000	0.0000

RECORD NO. 140 LENGTH OF RECORD 20

1.0000	.5000	1.3000
1.0000	1.0000	.9500
0.0000	1.0000	0.0000
1.0000	7.0000	0.0000

RECORD NO. 141 LENGTH OF RECORD 20

1.0000	20.0000	2000.0000
100.0000	1.0000	.9200
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 142 LENGTH OF RECORD 20

1.0000	25.0000	1000.0000
1.0000	100.0000	.6400
100.0000	1.0000	0.0000
35.0000	7.0000	0.0000

RECORD NO. 143 LENGTH OF RECORD 20

1.0000	.6000	2.1000
1.0000	1.0000	1.8000

1.0000	0.0000
100.0000	1.1900
1.0000	0.0000
7.0000	0.0000

1.0000	310000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	160000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	50000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	35000.0000
1.5780	100.0000
0.0000	2.0000
0.0000	0.0000

1.0000	33000.0000
2.0000	0.0000

0.0000	1.0000	0.0000
10.0000	7.0000	0.0000

RECORD NO. 144 LENGTH OF RECORD 20

1.0000	1.0000	100.0000
10.0000	1.0000	.6500
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 145 LENGTH OF RECORD 20

1.0000	.5000	15.0000
1.0000	1.0000	.9400
60.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 146 LENGTH OF RECORD 20

1.0000	.7500	200.0000
10.0000	1.0000	.6100
60.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 147 LENGTH OF RECORD 20

1.0000	1.0000	60.0000
10.0000	1.0000	.6100
100.0000	1.0000	0.0000
35.0000	7.0000	0.0000

RECORD NO. 148 LENGTH OF RECORD 20

1.0000	3.0000	30.0000
10.0000	1.0000	.5900
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

0.0000 2.0000
0.0000 0.0000

1.0000 2500.0000
2.0000 0.0000
0.0000 2.0000
0.0000 0.0000

1.0000 2600.0000
2.0000 60.0000
0.0000 2.0000
0.0000 0.0000

1.0000 8500.0000
2.0000 60.0000
0.0000 2.0000
0.0000 0.0000

1.0000 9400.0000
2.0000 100.0000
0.0000 2.0000
0.0000 0.0000

1.0000 2300.0000
2.0000 0.0000
0.0000 2.0000
0.0000 0.0000

RECORD NO. 149	LENGTH OF RECORD 20	
1.0000	8.0000	150.0000
100.0000	1.0000	.5200
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000
RECORD NO. 150	LENGTH OF RECORD 20	
1.0000	3.0000	25.0000
7.5000	1.0000	.6100
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000
RECORD NO. 151	LENGTH OF RECORD 20	
1.0000	1.1000	4.0000
2.0000	1.0000	1.4100
0.0000	1.0000	0.0000
1.0000	7.0000	0.0000
RECORD NO. 152	LENGTH OF RECORD 0	
RECORD NO. 153	LENGTH OF RECORD 0	
RECORD NO. 154	LENGTH OF RECORD 0	
RECORD NO. 155	LENGTH OF RECORD 25	
1.0000	20.0000	200.0000
50.0000	1.0000	.5000
0.0000	1.0000	0.0000
33.0000	7.0000	5.0000
.3000	0.0000	8.0000
RECORD NO. 156	LENGTH OF RECORD 30	

1.0000	60000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	6500.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	300000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	10000.0000
1.9000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	200.0000	5000.0000
1.0000	1000.0000	.7500
40.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.0000	1.0000	1.0000
1.0000	.3500	1.0000

RECORD NO. 157 LENGTH OF RECORD 25

1.0000	100.0000	9000.0000
5.0000	100.0000	.4700
30.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.0000	0.0000	0.0000

RECORD NO. 158 LENGTH OF RECORD 25

1.0000	100.0000	6000.0000
5.0000	100.0000	.5500
60.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.0000	2.0000	0.0000

RECORD NO. 159 LENGTH OF RECORD 20

1.0000	10000.0000	70000.0000
300.0000	100.0000	.7000
0.0000	1.0000	0.0000
33.0000	7.0000	0.0000

RECORD NO. 160 LENGTH OF RECORD 30

1.0000	10.0000	100000.0000
1000.0000	1.0000	.6800
70.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.0000	2.0000	3.0000

1.0000	65000.0000
1.9000	40.0000
0.0000	4.0000
5.0000	-4.0000
1.5000	-3.0000
0.0000	0.0000

1.0000	20000.0000
1.9000	30.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	21000.0000
1.9000	60.0000
0.0000	3.0000
-3.0000	1.0000
0.0000	0.0000

1.0000	550000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	23000.0000
2.0000	70.0000
0.0000	4.0000
5.0000	-5.0000
3.5000	10.0000

-2.0000	1.0000	.8500

RECORD NO. 161 LENGTH OF RECORD 40

2.0000	1.0000	18.0000
1.0000	10000.0000	5.0000
2.0000	30.0000	30.0000
0.0000	45000.0000	100.0000
2.0000	30.0000	30.0000
0.0000	4.0000	33.0000
5.0000	-2.0000	1.0000
1.0000	1.5000	0.0000

RECORD NO. 162 LENGTH OF RECORD 20

1.0000	50.0000	1000.0000
100.0000	1.0000	.4000
0.0000	1.0000	0.0000
23.0000	7.0000	0.0000

RECORD NO. 163 LENGTH OF RECORD 35

1.0000	3.0000	15.0000
10.0000	1.0000	2.0000
30.0000	1.1500	0.0000
36.0000	2.0000	4.0000
1.0000	1.1500	2.5000
-5.0000	1.0000	1.0000
2.8000	0.0000	0.0000

0.0000	0.0000
250.0000	1.0000
1.0000	.3600
1.0000	0.0000
1.0000	.6200
1.0000	0.0000
7.0000	4.0000
.9000	-2.0000
0.0000	0.0000
1.0000	16000.0000
1.7500	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	600.0000
2.0000	30.0000
0.0000	4.0000
5.0000	-5.0000
2.7000	9.9000
1.4000	1.4000
0.0000	0.0000

LISTING OF DATA ON FILE

RECORD NO. 164	LENGTH OF RECORD 40	
1.0000	20.0000	60000.0000
1000.0000	1.0000	.8800
50.0000	1.0800	0.0000
37.0000	7.0000	4.0000
-5.0000	1.0000	1.1500
9.9000	-5.0000	1.0000
1.4000	2.8000	-3.0000
2.2000	0.0000	0.0000
RECORD NO. 165	LENGTH OF RECORD 40	
1.0000	300.0000	30000.0000
4000.0000	1.0000	1.0000
0.0000	1.5000	0.0000
38.0000	13.0000	39.0000
4.0000	4.0000	1.7000
100.0000	400.0000	760.0000
1.0000	1.5000	1.7000
1.3500	2.0000	0.0000
RECORD NO. 166	LENGTH OF RECORD 30	
1.0000	.5000	6.0000
1.0000	1.0000	1.0000
0.0000	1.0000	0.0000
29.0000	7.0000	64.0000
21.7500	14.5500	8.4800
5.2500	3.7500	3.0000
RECORD NO. 167	LENGTH OF RECORD 25	

1.0000	4500.0000
2.0000	50.0000
0.0000	5.0000
5.0000	3.0000
2.5000	2.7000
1.0000	1.4000
1.0000	1.4000
0.0000	0.0000

1.0000	1000000.0000
2.0000	0.0000
0.0000	5.0000
4.0000	5.0000
1.0000	1.0000
7500.0000	-3.0000
-3.0000	1.0000
0.0000	0.0000

1.0000	1.0000
1.2000	0.0000
0.0000	3.0000
-9.0000	21.7500
6.3800	6.0000
0.0000	0.0000

1.0000	3.0000	6.0000
1.0000	1.0000	1.0000
0.0000	1.0000	0.0000
29.0000	7.0000	64.0000
4.2400	2.7000	0.0000

RECORD NO. 168 LENGTH OF RECORD 0

RECORD NO. 169 LENGTH OF RECORD 0

RECORD NO. 170 LENGTH OF RECORD 0

RECORD NO. 171 LENGTH OF RECORD 0

RECORD NO. 172 LENGTH OF RECORD 0

RECORD NO. 173 LENGTH OF RECORD 25

1.0000	3.0000	9.0000
1.0000	1.0000	1.0000
0.0000	1.0000	0.0000
33.0000	7.0000	64.0000
4.9000	6.8500	9.0000

RECORD NO. 174 LENGTH OF RECORD 25

1.0000	4.5000	9.0000
1.0000	1.0000	1.0000
0.0000	1.0000	0.0000
33.0000	7.0000	64.0000
8.3500	8.0000	0.0000

RECORD NO. 175 LENGTH OF RECORD 20

1.0000	1000.0000	1000000.0000
10.0000	1000.0000	.6000

1.0000	1.0000
1.2000	0.0000
0.0000	3.0000
-3.0000	3.9000
0.0000	0.0000

1.0000	1.0000
1.4000	0.0000
0.0000	3.0000
-4.0000	3.1000
0.0000	0.0000

1.0000	1.0000
1.4000	0.0000
0.0000	3.0000
-2.0000	5.9000
0.0000	0.0000

1.0000	24000.0000
2.0000	20.0000

20.0000	1.5000	0.0000
40.0000	13.0000	0.0000

RECORD NO. 176 LENGTH OF RECORD 20

1.0000	50.0000	1500.0000
3.0000	100.0000	.3700
40.0000	1.5000	0.0000
1.0000	13.0000	0.0000

RECORD NO. 177 LENGTH OF RECORD 20

1.0000	30000.0000	90000.0000
50.0000	1000.0000	.4900
0.0000	1.0000	0.0000
30.0000	7.0000	0.0000

RECORD NO. 178 LENGTH OF RECORD 25

1.0000	100.0000	1000000.0000
10.0000	1000.0000	.6100
0.0000	1.5000	0.0000
40.0000	13.0000	5.0000
1.3500	0.0000	0.0000

RECORD NO. 179 LENGTH OF RECORD 20

1.0000	80.0000	2000.0000
1.0000	100.0000	.3800
0.0000	1.5000	0.8900
1.0000	13.0000	0.0000

RECORD NO. 180 LENGTH OF RECORD 30

2.0000	10.0000	80.0000
1.0000	14000.0000	.4000
2.0000	0.0000	0.0000

0.0000	2.0000
0.0000	0.0000
1.0000	19000.0000
2.0000	40.0000
0.0000	2.0000
0.0000	0.0000
1.0000	4500.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	37000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000
1.0000	51000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
10000.0000	1.0000
180.0000	.3600
1.5000	0.0000

0.0000	135000.0000	10.0000
2.0000	0.0000	0.0000
0.0000	2.0000	1.0000

RECORD NO. 181 LENGTH OF RECORD 20

1.0000	100.0000	7000.0000
10.0000	1000.0000	.6900
0.0000	1.5000	0.0000
40.0000	13.0000	0.0000

RECORD NO. 182 LENGTH OF RECORD 20

1.0000	45.0000	4000.0000
1.0000	100.0000	.5900
0.0000	1.0000	0.0000
1.0000	7.0000	0.0000

RECORD NO. 183 LENGTH OF RECORD 30

2.0000	10.0000	290.0000
1.0000	62000.0000	1.0000
2.0000	0.0000	0.0000
0.0000	75000.0000	10.0000
2.0000	0.0000	0.0000
0.0000	2.0000	1.0000

RECORD NO. 184 LENGTH OF RECORD 0

RECORD NO. 185 LENGTH OF RECORD 25

1.0000	100.0000	8000.0000
1.0000	1000.0000	.8400
0.0000	1.5000	0.0000
40.0000	13.0000	5.0000
1.3500	0.0000	0.0000

100.0000	.7800
1.5000	0.0000
13.0000	0.0000
1.0000	750000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	115000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
3000.0000	1.0000
100.0000	.3300
1.5000	0.0000
100.0000	.5300
1.5000	0.0000
13.0000	0.0000
1.0000	63000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

RECORD NO. 186 LENGTH OF RECORD 30

1.0000	5.0000	100.0000
1.0000	10.0000	.5900
0.0000	1.0000	0.0000
1.0000	7.0000	5.0000
1.0000	1.4000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 187 LENGTH OF RECORD 25

1.0000	50.0000	400.0000
10.0000	10.0000	.6100
0.0000	1.0000	0.0000
1.0000	7.0000	5.0000
2.1000	0.0000	0.0000

RECORD NO. 188 LENGTH OF RECORD 20

1.0000	200.0000	10000.0000
1.0000	1000.0000	.4700
0.0000	1.5000	0.0000
40.0000	13.0000	0.0000

RECORD NO. 189 LENGTH OF RECORD 30

2.0000	30.0000	380.0000
1.0000	60000.0000	.1000
2.0000	0.0000	0.0000
0.0000	150000.0000	1.0000
2.0000	0.0000	0.0000
0.0000	2.0000	40.0000

RECORD NO. 190 LENGTH OF RECORD 0

RECORD NO. 191 LENGTH OF RECORD 25

1.0000	25000.0000
1.2000	0.0000
0.0000	4.0000
5.0000	-2.0000
1.0000	1.7000
0.0000	0.0000

1.0000	55000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	26000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

3000.0000	1.0000
1000.0000	.2000
1.5000	0.0000
1000.0000	.4700
1.5000	0.0000
13.0000	0.0000

1.0000	1000.0000	80000.0000
10000.0000	1.0000	.5600
30.0000	1.0000	0.0000
32.0000	7.0000	5.0000
.4000	0.0000	0.0000

RECORD NO. 192 LENGTH OF RECORD 25

1.0000	1000.0000	150000.0000
10000.0000	1.0000	.6600
30.0000	1.0000	0.0000
32.0000	7.0000	0.0000
0.0000	0.0000	0.0000

RECORD NO. 193 LENGTH OF RECORD 40

2.0000	1000.0000	80000.0000
1.0000	23000.0000	10000.0000
1.7000	40.0000	40.0000
0.0000	115000.0000	200000.0000
1.7000	40.0000	40.0000
0.0000	3.0000	32.0000
-4.0000	1.0000	2.0000
0.0000	0.0000	0.0000

RECORD NO. 194 LENGTH OF RECORD 25

1.0000	20000.0000	800000.0000
100000.0000	1.0000	.7800
0.0000	1.5000	0.0000
32.0000	13.0000	5.0000
.8000	1.4000	1.9000

RECORD NO. 195 LENGTH OF RECORD 25

1.0000	500.0000	100000.0000
10000.0000	1.0000	.7200

1.0000	3000.0000
1.5900	30.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000
1.0000	2080.0000
2.0000	30.0000
0.0000	2.0000
0.0000	0.0000
0.0000	0.0000
1000000.0000	1.0000
1.0000	.3900
1.0000	0.0000
1.0000	.0100
1.0000	0.0000
7.0000	5.0000
2.0000	12.0000
0.0000	0.0000
1.0000	600000.0000
2.0000	0.0000
0.0000	3.0000
-5.0000	1.0000
2.5000	0.0000
1.0000	4000.0000
2.0000	50.0000

50.0000	1.0000	0.0000	0.0000	3.0000
32.0000	7.0000	4.0000	-2.0000	1.0000
1.6000	0.0000	0.0000	0.0000	0.0000

RECORD NO. 196 LENGTH OF RECORD 30

1.0000	1000.0000	100000.0000	1.0000	5000.0000
10000.0000	1.0000	.5000	2.0000	0.0000
0.0000	1.0000	0.0000	0.0000	4.0000
32.0000	7.0000	4.0000	5.0000	-2.0000
1.0000	2.0000	-3.0000	1.0000	2.0000
.7000	0.0000	0.0000	0.0000	0.0000

RECORD NO. 197 LENGTH OF RECORD 30

1.0000	1000.0000	70000.0000	1.0000	4500.0000
10000.0000	1.0000	.6800	2.0000	0.0000
0.0000	1.0000	0.0000	0.0000	4.0000
32.0000	7.0000	4.0000	5.0000	-2.0000
1.0000	1.6500	-2.0000	1.0000	35.0000
0.0000	0.0000	0.0000	0.0000	0.0000

RECORD NO. 198 LENGTH OF RECORD 25

1.0000	500.0000	500000.0000	1.0000	3100.0000
10000.0000	1.0000	.7000	2.0000	0.0000
0.0000	1.0000	0.0000	0.0000	3.0000
32.0000	7.0000	5.0000	-2.0000	1.0000
3.0000	0.0000	0.0000	0.0000	0.0000

RECORD NO. 199 LENGTH OF RECORD 30

2.0000	1000.0000	4000.0000	30000.0000	1.0000
1.0000	3500.0000	2000.0000	1.0000	.3900
2.0000	0.0000	0.0000	1.0000	0.0000
0.0000	8300.0000	10000.0000	1.0000	.6800

2.0000	0.0000	0.0000
0.0000	2.0000	32.0000

RECORD NO. 200 LENGTH OF RECORD 20

1.0000	1000.0000	100000.0000
1000.0000	1.0000	.7000
0.0000	1.0000	0.0000
32.0000	7.0000	0.0000

RECORD NO. 201 LENGTH OF RECORD 20

1.0000	25000.0000	200000.0000
100000.0000	1.0000	.8300
0.0000	1.5000	0.0000
32.0000	13.0000	0.0000

RECORD NO. 202 LENGTH OF RECORD 35

2.0000	1000.0000	18000.0000
1.0000	3200.0000	10000.0000
2.0000	40.0000	40.0000
0.0000	7800.0000	30000.0000
2.0000	0.0000	0.0000
0.0000	3.0000	32.0000
-3.0000	1.0000	1.3000

RECORD NO. 203 LENGTH OF RECORD 25

1.0000	5000.0000	30000.0000
10000.0000	1.0000	.3900
0.0000	1.0000	0.0000
32.0000	7.0000	5.0000
1.7000	0.0000	0.0000

RECORD NO. 204 LENGTH OF RECORD 30

1.0000	1000.0000	50000.0000

1.0000	0.0000
7.0000	0.0000
1.0000	3000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	700000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
60000.0000	1.0000
1.0000	.6100
1.0000	0.0000
1.0000	1.0000
1.0000	0.0000
7.0000	5.0000
1.7000	0.0000
1.0000	3200.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000
1.0000	5000.0000

10000.0000	1.0000	.7900	2.0000	50.0000
50.0000	1.0000	0.0000	0.0000	4.0000
32.0000	7.0000	4.0000	5.0000	-2.0000
1.0000	1.6000	-2.0000	1.0000	3.0000
0.0000	0.0000	0.0000	0.0000	0.0000

RECORD NO. 205 LENGTH OF RECORD 25

1.0000	5000.0000	60000.0000	1.0000	6400.0000
10000.0000	1.0000	.7100	2.0000	0.0000
0.0000	1.0000	0.0000	0.0000	3.0000
32.0000	7.0000	5.0000	-2.0000	1.0000
1.3000	0.0000	0.0000	0.0000	0.0000

RECORD NO. 206 LENGTH OF RECORD 25

1.0000	70000.0000	1000000.0000	1.0000	360000.0000
200.0000	1000.0000	.9200	2.0000	20.0000
20.0000	1.5000	0.0000	0.0000	3.0000
41.0000	13.0000	5.0000	-2.0000	1.0000
1.6000	0.0000	0.0000	0.0000	0.0000

RECORD NO. 207 LENGTH OF RECORD 25

1.0000	8000.0000	200000.0000	1.0000	12000.0000
10000.0000	1.0000	.7200	2.0000	0.0000
0.0000	1.0000	0.0000	0.0000	3.0000
32.0000	7.0000	5.0000	-3.0000	1.0000
.6000	4.0000	0.0000	0.0000	0.0000

RECORD NO. 208 LENGTH OF RECORD 30

1.0000	250.0000	20000.0000	1.0000	150000.0000
5.0000	1000.0000	.7100	2.0000	0.0000
0.0000	1.0000	0.0000	0.0000	4.0000
42.0000	7.0000	4.0000	43.0000	-2.0000

1.0000	2.0000	-4.0000
.6200	.3500	0.0000

RECORD NO. 209 LENGTH OF RECORD 30

1.0000	600.0000	20000.0000
1.0000	1000.0000	.4200
30.0000	1.0000	0.0000
42.0000	7.0000	4.0000
1.0000	2.0000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 210 LENGTH OF RECORD 20

1.0000	3.0000	26.0000
10.0000	1.0000	.7300
0.0000	1.0000	0.0000
44.0000	7.0000	0.0000

RECORD NO. 211 LENGTH OF RECORD 20

1.0000	10.0000	400.0000
100.0000	1.0000	.5200
40.0000	1.0000	0.0000
33.0000	7.0000	0.0000

RECORD NO. 212 LENGTH OF RECORD 35

1.0000	10.0000	150.0000
100.0000	1.0000	.7000
30.0000	1.0000	0.0000
33.0000	7.0000	4.0000
-2.0000	1.0000	1.2000
1.1000	-3.0000	1.0000
0.0000	0.0000	0.0000

RECORD NO. 213 LENGTH OF RECORD 30

1.0000	1.2500
0.0000	0.0000

1.0000	40000.0000
2.0000	30.0000
0.0000	4.0000
5.0000	-2.0000
1.0000	.8500
0.0000	0.0000

1.0000	45000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	22000.0000
1.6500	40.0000
0.0000	2.0000
0.0000	0.0000

1.0000	74000.0000
2.0000	30.0000
0.0000	5.0000
5.0000	5.0000
-2.0000	1.0000
1.0000	1.0000
0.0000	0.0000

1.0000	1.0000	300.0000
10.0000	1.0000	.5200
0.0000	1.0000	0.0000
29.0000	7.0000	4.0000
1.0000	2.0000	.8000
.5000	0.0000	0.0000

RECORD NO. 214 LENGTH OF RECORD 50

3.0000	200.0000	400.0000
1.0000	1.0000	1.0000
1000.0000	.6400	2.0000
1.1500	0.0000	0.0000
1000.0000	.6600	2.0000
1.1500	0.0000	0.0000
1000.0000	1.0300	2.0000
1.1500	0.0000	0.0000
2.0000	5.0000	-3.0000
1.2000	0.0000	0.0000

RECORD NO. 215 LENGTH OF RECORD 30

1.0000	20.0000	1500.0000
1.0000	100.0000	.3700
0.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.0000	2.0000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 216 LENGTH OF RECORD 30

1.0000	15.0000	1000.0000
1.0000	100.0000	.5600
0.0000	1.0000	0.0000
33.0000	7.0000	4.0000

1.0000	9200.0000
2.0000	0.0000
0.0000	4.0000
5.0000	-3.0000
-2.0000	1.0000
0.0000	0.0000

6000.0000	20000.0000
26000.0000	.3000
0.0000	0.0000
60000.0000	2.0000
0.0000	0.0000
230000.0000	10.0000
0.0000	0.0000
3.0000	33.0000
1.0000	1.3000
0.0000	0.0000

1.0000	4000.0000
1.7500	0.0000
0.0000	4.0000
5.0000	-2.0000
1.0000	1.1000
0.0000	0.0000

1.0000	5100.0000
2.0000	0.0000
0.0000	4.0000
5.0000	-2.0000

1.0000	2.2000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 217 LENGTH OF RECORD 35

1.0000	50.0000	300.0000
100.0000	1.0000	.3200
20.0000	1.0000	0.0000
23.0000	7.0000	4.0000
-7.0000	1.0000	1.0000
1.6000	2.0000	2.4000
.8000	-2.0000	1.0000

RECORD NO. 218 LENGTH OF RECORD 20

1.0000	150.0000	1000.0000
400.0000	1.0000	.9400
10.0000	1.0000	0.0000
33.0000	7.0000	0.0000

RECORD NO. 219 LENGTH OF RECORD 25

1.0000	100.0000	2000.0000
400.0000	1.0000	1.0000
40.0000	1.0000	0.0000
33.0000	7.0000	4.0000
3.0000	0.0000	0.0000

RECORD NO. 220 LENGTH OF RECORD 30

1.0000	100.0000	4000.0000
400.0000	1.0000	.8000
30.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.0000	3.0000	-2.0000
0.0000	0.0000	0.0000

1.0000	1.9000
0.0000	0.0000
1.0000	5800.0000
2.0000	20.0000
0.0000	5.0000
5.0000	5.0000
1.2500	1.7000
-2.0000	1.0000
1.3000	0.0000
1.0000	62000.0000
2.0000	10.0000
0.0000	2.0000
0.0000	0.0000
1.0000	28000.0000
2.0000	40.0000
0.0000	5.0000
-2.0000	1.0000
0.0000	0.0000
1.0000	18000.0000
2.0000	30.0000
0.0000	4.0000
5.0000	-2.0000
1.9000	1.7000
0.0000	0.0000

RECORD NO. 221	LENGTH OF RECORD 20	
1.0000	40.0000	600.0000
100.0000	1.0000	.8400
40.0000	1.5000	0.0000
34.0000	13.0000	0.0000

RECORD NO. 222	LENGTH OF RECORD 20	
1.0000	50.0000	1000.0000
200.0000	1.0000	.6200
10.0000	1.0000	0.0000
33.0000	7.0000	0.0000

RECORD NO. 223	LENGTH OF RECORD 25	
1.0000	400.0000	7000.0000
1000.0000	1.0000	.7500
30.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.8500	1.2500	0.0000

RECORD NO. 224	LENGTH OF RECORD 25	
1.0000	20.0000	1000.0000
100.0000	1.0000	.4900
30.0000	1.0000	0.0000
33.0000	7.0000	4.0000
1.2500	1.6000	0.0000

RECORD NO. 225	LENGTH OF RECORD 45	
2.0000	2.5000	15.0000
1.0000	1200.0000	5.0000
1.3200	0.0000	0.0000
0.0000	3400.0000	50.0000
1.3200	0.0000	0.0000

1.0000	150000.0000
2.0000	40.0000
0.0000	2.0000
0.0000	0.0000

1.0000	35000.0000
2.0000	10.0000
0.0000	2.0000
0.0000	0.0000

1.0000	18000.0000
2.0000	30.0000
0.0000	3.0000
-3.0000	1.0000
0.0000	0.0000

1.0000	23000.0000
1.7400	30.0000
0.0000	3.0000
-3.0000	1.0000
0.0000	0.0000

75.0000	1.0000
1.0000	.3000
1.0000	0.0000
1.0000	.6200
1.0000	0.0000

0.0000	5.0000	33.0000
5.0000	5.0000	-3.0000
1.4000	-3.0000	1.0000
-2.0000	1.0000	1.3000

RECORD NO. 226 LENGTH OF RECORD 0

RECORD NO. 227 LENGTH OF RECORD 25

1.0000	90.0000	150.0000
10.0000	10.0000	.9900
0.0000	1.1500	0.0000
33.0000	2.0000	5.0000
1.2000	0.0000	0.0000

RECORD NO. 228 LENGTH OF RECORD 35

2.0000	15.0000	70.0000
1.0000	3500.0000	5.0000
2.0000	0.0000	0.0000
0.0000	6300.0000	8.0000
2.0000	0.0000	0.0000
0.0000	3.0000	33.0000
-2.0000	1.0000	1.2000

RECORD NO. 229 LENGTH OF RECORD 25

1.0000	30.0000	90.0000
5.0000	10.0000	.9900
20.0000	1.1500	0.0000
33.0000	2.0000	5.0000
1.2000	0.0000	0.0000

RECORD NO. 230 LENGTH OF RECORD 20

1.0000	6.0000	15.0000
1.0000	10.0000	.1800

7.0000	5.0000
1.0000	1.3000
1.1000	1.2500
0.0000	0.0000

1.0000	17000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

90.0000	1.0000
10.0000	.6200
1.1500	0.0000
10.0000	.8100
1.1500	0.0000
2.0000	5.0000
0.0000	0.0000

1.0000	5500.0000
2.0000	20.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	5000.0000
2.0000	0.0000

0.0000	1.1500	0.0000
33.0000	2.0000	0.0000

RECORD NO. 231 LENGTH OF RECORD 35

2.0000	20.0000	100.0000
1.0000	1600.0000	.4000
2.0000	0.0000	0.0000
0.0000	3600.0000	2.0000
2.0000	0.0000	0.0000
0.0000	3.0000	29.0000
-2.0000	1.0000	1.1000

RECORD NO. 232 LENGTH OF RECORD 45

3.0000	40.0000	350.0000
1.0000	-1.0000	1.0000
1.0000	.1700	2.0000
1.1500	0.0000	0.0000
0.0000	0.0000	0.0000
0.0000	0.0000	0.0000
1.0000	1.5600	2.0000
1.1500	0.0000	0.0000
2.0000	0.0000	0.0000

RECORD NO. 233 LENGTH OF RECORD 20

1.0000	25.0000	90.0000
50.0000	1.0000	.3500
0.0000	1.1500	0.0000
33.0000	2.0000	0.0000

RECORD NO. 234 LENGTH OF RECORD 20

1.0000	4.5000	12.0000
7.0000	1.0000	1.0000

0.0000	2.0000
0.0000	0.0000
300.0000	1.0000
100.0000	.3700
1.1500	0.0000
100.0000	.7403
1.1500	0.0000
2.0000	5.0000
0.0000	0.0000
700.0000	1400.0000
2500.0000	100.0000
0.0000	0.0000
0.0000	0.0000
0.0000	0.0000
8600.0000	1000.0000
0.0000	0.0000
2.0000	15.0000
0.0000	0.0000
1.0000	2300.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	13500.0000
2.0000	0.0000

0.0000	1.1500	0.0000
45.0000	2.0000	0.0000

RECORD NO. 235 LENGTH OF RECORD 20

1.0000	25.0000	75.0000
50.0000	1.0000	1.5300
0.0000	1.1500	0.0000
46.0000	2.0000	0.0000

RECORD NO. 236 LENGTH OF RECORD 20

1.0000	1.3000	2500.0000
100.0000	1.0000	1.0000
0.0000	1.1500	0.0000
35.0000	2.0000	0.0000

RECORD NO. 237 LENGTH OF RECORD 20

1.0000	1.3000	2500.0000
100.0000	1.0000	.8700
0.0000	1.1500	0.0000
35.0000	2.0000	0.0000

RECORD NO. 238 LENGTH OF RECORD 49

3.0000	.8900	.9000
1.0000	1.0000	1.0000
1.0000	.0600	2.0000
1.1500	0.0000	0.0000
1.0000	.4200	2.0000
1.1500	0.0000	0.0000
1.0000	.8200	2.0000
1.1500	0.0000	0.0000
2.0000	0.0000	0.0000

RECORD NO. 239 LENGTH OF RECORD 30

0.0000	2.0000
0.0000	0.0000
1.0000	12500.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	60000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	55000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
9.0000	70.0000
7980.0000	.3000
0.0000	0.0000
13680.0000	3.0000
0.0000	0.0000
54000.0000	30.0000
0.0000	0.0000
2.0000	35.0000
0.0000	0.0000

2.0000	7.5000	38.0000
1.0000	1250.0000	10.0000
2.0000	0.0000	0.0000
0.0000	5000.0000	100.0000
2.0000	0.0000	0.0000
0.0000	2.0000	35.0000

RECORD NO. 240 LENGTH OF RECORD 20

1.0000	25.0000	200.0000
100.0000	1.0000	.1800
0.0000	1.1500	0.0000
35.0000	2.0000	0.0000

RECORD NO. 241 LENGTH OF RECORD 20

1.0000	2.5000	5.5000
4.0000	1.0000	.7500
0.0000	1.0000	0.0000
47.0000	7.0000	0.0000

RECORD NO. 242 LENGTH OF RECORD 35

2.0000	.6000	1.7000
1.0000	1700.0000	1.0000
2.0000	0.0000	0.0000
0.0000	3500.0000	5.0000
2.0000	0.0000	0.0000
0.0000	3.0000	48.0000
-2.0000	1.0000	.9200

RECORD NO. 243 LENGTH OF RECORD 30

1.0000	3.0000	10.0000
7.0000	1.0000	1.0000
0.0000	1.1500	0.0000

380.0000	1.0000
1.0000	.4500
1.1500	0.0000
1.0000	1.0000
1.1500	0.0000
2.0000	0.0000
1.0000	110000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	5280.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
10.0000	1.0000
2.0000	.2600
1.0000	0.0000
1.0000	.6600
1.0000	0.0000
7.0000	5.0000
0.0000	0.0000
1.0000	8000.0000
2.0000	0.0000
0.0000	4.0000

47.0000	2.0000	5.0000
1.0000	1.2300	1.5500
1.0000	1.1000	0.0000

RECORD NO. 244 LENGTH OF RECORD 25

1.0000	.8000	12.0000
4.0000	1.0000	.8600
20.0000	1.0000	0.0000
49.0000	7.0000	5.0000
1.2000	0.0000	0.0000

RECORD NO. 245 LENGTH OF RECORD 20

1.0000	1.0000	20.0000
4.0000	1.0000	.8200
30.0000	1.0000	0.0000
50.0000	7.0000	0.0000

RECORD NO. 246 LENGTH OF RECORD 25

1.0000	6.0000	50.0000
30.0000	1.0000	1.0200
0.0000	1.0000	0.0000
51.0000	7.0000	5.0000
1.7000	2.5000	3.0000

RECORD NO. 247 LENGTH OF RECORD 20

1.0000	6.0000	25.0000
10.0000	1.0000	1.1300
0.0000	1.0000	0.0000
51.0000	7.0000	0.0000

RECORD NO. 248 LENGTH OF RECORD 25

1.0000	6.0000	15.0000
10.0000	1.0000	.9400

5.0000	-4.0000
1.7000	-2.0000
0.0000	0.0000

1.0000	1500.0000
2.0000	20.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	2100.0000
2.0000	30.0000
0.0000	2.0000
0.0000	0.0000

1.0000	320.0000
2.0000	0.0000
0.0000	3.0000
-5.0000	1.0000
3.2000	0.0000

1.0000	500.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	2000.0000
2.0000	0.0000

0.0000	1.0000	0.0000
51.0000	7.0000	5.0000
1.4000	0.0000	0.0000

RECORD NO. 249 LENGTH OF RECORD 25

1.0000	18.0000	48.0000
24.0000	1.0000	1.5300
0.0000	1.0000	0.0000
51.0000	7.0000	5.0000
.7200	1.2500	2.0000

RECORD NO. 250 LENGTH OF RECORD 25

1.0000	20.0000	48.0000
30.0000	1.0000	1.4000
0.0000	1.0000	0.0000
51.0000	7.0000	5.0000
1.4200	0.0000	0.0000

RECORD NO. 251 LENGTH OF RECORD 20

1.0000	12.0000	72.0000
30.0000	1.0000	.2700
0.0000	1.0000	0.0000
51.0000	7.0000	0.0000

RECORD NO. 252 LENGTH OF RECORD 25

1.0000	2.0000	12.0000
5.0000	1.0000	1.0000
0.0000	1.0000	0.0000
8.0000	7.0000	5.0000
1.8500	1.8700	0.0000

RECORD NO. 253 LENGTH OF RECORD 30

0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000
1.0000	2200.0000
2.0000	0.0000
0.0000	3.0000
-4.0000	1.0000
0.0000	0.0000
1.0000	4600.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000
1.0000	8800.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	3500.0000
2.0000	0.0000
0.0000	3.0000
-3.0000	1.0000
0.0000	0.0000

1.0000	1500.0000	23000.0000
3.0000	1000.0000	.5800
0.0000	1.1500	0.0000
42.0000	2.0000	5.0000
1.0000	1.0800	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 254 LENGTH OF RECORD 25

1.0000	.5000	4.0000
.9000	1.0000	.7000
40.0000	1.0000	0.0000
8.0000	7.0000	5.0000
1.6500	0.0000	0.0000

RECORD NO. 255 LENGTH OF RECORD 25

1.0000	4000.0000	32000.0000
10.0000	1000.0000	.6800
0.0000	1.1500	0.0000
42.0000	2.0000	5.0000
1.2000	0.0000	0.0000

RECORD NO. 256 LENGTH OF RECORD 25

1.0000	12.0000	72.0000
30.0000	1.0000	.4600
30.0000	1.0000	0.0000
51.0000	7.0000	5.0000
.6000	0.0000	0.0000

RECORD NO. 257 LENGTH OF RECORD 0

RECORD NO. 258 LENGTH OF RECORD 25

1.0000	9000.0000	300000.0000
10000.0000	1.0000	.5800

1.0000	8000.0000
2.0000	0.0000
0.0000	4.0000
5.0000	-2.0000
1.0000	1.1600
0.0000	0.0000

1.0000	8000.0000
2.0000	40.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	19000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	10000.0000
2.0000	30.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	4500.0000
2.0000	20.0000

20.0000	1.1500	0.0000
52.0000	2.0000	5.0000
1.2500	0.0000	0.0000

RECORD NO. 259 LENGTH OF RECORD 25

1.0000	10.0000	10000.0000
1.0000	1000.0000	.6000
0.0000	1.0000	0.0000
65.0000	7.0000	5.0000
1.3000	0.0000	0.0000

RECORD NO. 260 LENGTH OF RECORD 0

RECORD NO. 261 LENGTH OF RECORD 25

1.0000	2.0000	100.0000
10.0000	1.0000	.7800
40.0000	1.1500	0.0000
53.0000	2.0000	5.0000
1.2000	0.0000	0.0000

RECORD NO. 262 LENGTH OF RECORD 20

1.0000	2.0000	50.0000
10.0000	1.0000	.9300
0.0000	1.1500	0.0000
53.0000	2.0000	0.0000

RECORD NO. 263 LENGTH OF RECORD 20

1.0000	.5000	10.0000
1.0000	1.0000	.3600
0.0000	1.0000	0.0000
53.0000	7.0000	0.0000

0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	6300.0000
1.7200	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	2000.0000
2.0000	40.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	3500.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	620.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

RECORD NO. 264 LENGTH OF RECORD 30

2.0000	.5000	6.0000
1.0000	170.0000	1.0000
2.0000	0.0000	0.0000
0.0000	580.0000	10.0000
2.0000	0.0000	0.0000
0.0000	2.0000	53.0000

RECORD NO. 265 LENGTH OF RECORD 20

1.0000	.8000	8.0000
3.0000	1.0000	.6700
0.0000	1.5000	0.0000
53.0000	13.0000	0.0000

RECORD NO. 266 LENGTH OF RECORD 25

1.0000	15.0000	120.0000
30.0000	1.0000	.9000
0.0000	1.5000	0.0000
53.0000	54.0000	5.0000
.6500	0.0000	0.0000

RECORD NO. 267 LENGTH OF RECORD 30

1.0000	.2000	70.0000
30.0000	1.0000	.6100
0.0000	1.1500	0.0000
53.0000	2.0000	3.0000
1.0000	.3000	.4500
-2.0000	1.0000	1.6000

RECORD NO. 268 LENGTH OF RECORD 25

1.0000	.0500	1.0000
.4000	1.0000	.7300
40.0000	1.1500	0.0000

50.0000	1.0000
1.0000	.5800
1.0000	0.0000
1.0000	.3600
1.0000	0.0000
7.0000	0.0000

1.0000	6000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	95000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	60000.0000
1.6000	0.0000
0.0000	4.0000
5.0000	-5.0000
1.7500	4.5000
0.0000	0.0000

1.0000	5500.0000
2.0000	40.0000
0.0000	3.0000

53.0000	2.0000	5.0000
2.7000	0.0000	0.0000

RECORD NO. 269 LENGTH OF RECORD 25

1.0000	4.0000	60.0000
30.0000	1.0000	.5500
0.0000	1.0000	0.0000
8.0000	7.0000	5.0000
2.7000	0.0000	0.0000

RECORD NO. 270 LENGTH OF RECORD 20

1.0000	.0100	.4000
.1000	1.0000	.4000
0.0000	1.1500	0.0000
53.0000	2.0000	0.0000

RECORD NO. 271 LENGTH OF RECORD 45

3.0000	2.0000	4000.0000
1.0000	-1.0000	1.0000
1.0000	.9000	2.2000
1.1500	0.0000	0.0000
0.0000	0.0000	0.0000
0.0000	0.0000	0.0000
1.0000	.7100	2.2000
1.1500	0.0000	0.0000
2.0000	0.0000	0.0000

RECORD NO. 272 LENGTH OF RECORD 20

1.0000	.4000	10.0000
3.0000	1.0000	.5800
0.0000	1.1500	0.0000
53.0000	2.0000	0.0000

-2.0000	1.0000
0.0000	0.0000
1.0000	3200.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000
1.0000	3700.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
8000.0000	25000.0000
170000.0000	1000.0000
0.0000	0.0000
0.0000	0.0000
0.0000	0.0000
1300000.0000	10000.0000
0.0000	0.0000
2.0000	8.0000
0.0000	0.0000
1.0000	95000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

```
 1.0000      110000.0000
 2.0000           0.0000
 0.0000           3.0000
-6.0000           1.0000
 1.4300           1.5100
 0.0000           0.0000


 1.0000     2300000.0000
 2.0000           0.0000
 0.0000           2.0000
 0.0000           0.0000

 1.0000     2700000.0000
 2.0000           0.0000
 0.0000           2.0000
 0.0000           0.0000

 1.0000       60000.0000
 2.0000           0.0000
 0.0000           2.0000
 0.0000           0.0000
```

RECORD NO. 273 LENGTH OF RECORD 30

1.0000	500.0000	4000.0000
1000.0000	1.0000	.5300
0.0000	1.0000	0.0000
8.0000	7.0000	55.0000
.8000	1.0000	1.1500
0.0000	0.0000	0.0000

RECORD NO. 274 LENGTH OF RECORD 0

RECORD NO. 275 LENGTH OF RECORD 0

RECORD NO. 276 LENGTH OF RECORD 0

RECORD NO. 277 LENGTH OF RECORD 20

1.0000	30.0000	300.0000
100.0000	1.0000	.9100
0.0000	1.1500	0.0000
53.0000	2.0000	0.0000

RECORD NO. 278 LENGTH OF RECORD 20

1.0000	4000.0000	20000.0000
10000.0000	1.0000	1.3300
0.0000	1.1500	0.0000
8.0000	2.0000	0.0000

RECORD NO. 279 LENGTH OF RECORD 20

1.0000	100.0000	600.0000
300.0000	1.0000	.7700
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 280 LENGTH OF RECORD 0

RECORD NO. 281 LENGTH OF RECORD 40

1.0000	1.0000	10000.0000
100.0000	1.0000	.7900
0.0000	1.0000	0.0000
8.0000	7.0000	55.0000
1.0000	1.2500	1.5000
1.7800	1.8600	1.9500
1.4000	2.8000	0.0000
0.0000	0.0000	0.0000

RECORD NO. 282 LENGTH OF RECORD 20

1.0000	10.0000	1000.0000
100.0000	1.0000	1.0400
0.0000	1.0000	0.0008
8.0000	7.0000	0.0000

RECORD NO. 283 LENGTH OF RECORD 20

1.0000	.0020	5.0000
.1000	1.0000	.7700
0.0000	1.1500	0.0000
53.0000	2.0000	0.0000

RECORD NO. 284 LENGTH OF RECORD 25

1.0000	.0300	.2000
.1000	1.0000	.5300
0.0000	1.1500	0.0000
53.0000	2.0000	5.0000
1.7000	0.0000	0.0000

RECORD NO. 285 LENGTH OF RECORD 20

1.0000	23000.0000
2.2000	0.0000
0.0000	4.0000
5.0000	-6.0000
1.6000	1.6800
-3.0000	1.0000
0.0000	0.0000
0.0000	0.0000

1.0000	8000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	8000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	13000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

1.0000	.0150	750.0000
10.0000	1.0000	.4500
0.0000	1.0000	0.0000
56.0000	7.0000	0.0000

RECORD NO. 286 LENGTH OF RECORD 20

1.0000	.7000	20.0000
10.0000	1.0000	.3900
0.0000	1.0000	0.0000
56.0000	7.0000	0.0000

RECORD NO. 287 LENGTH OF RECORD 30

1.0000	.8000	80.0000
10.0000	1.0000	.2400
0.0000	1.0000	0.0000
56.0000	7.0000	4.0000
1.0000	1.3000	2.0000
1.0000	1.2500	0.0000

RECORD NO. 288 LENGTH OF RECORD 70

2.0000	.2000	15.0000
1.0000	750.0000	10.0000
2.0000	200.0000	30.0000
0.0000	2000.0000	100.0000
2.0000	100.0000	50.0000
0.0000	6.0000	8.0000
4.0000	5.0000	5.0000
1.6000	2.0000	150.0000
-12.0000	1.0000	1.3000
1.4000	9.5000	1.3000
3.0000	1.9000	2.8000
1.5000	1.1000	1.1500
1.3000	1.4000	1.5000

1.0000	600.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	2700.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	3600.0000
2.0000	0.0000
0.0000	4.0000
5.0000	-4.0000
3.0000	-2.0000
0.0000	0.0000

400.0000	1.0000
1.0000	.2600
1.0000	0.0000
1.0000	.4300
1.0000	0.0000
7.0000	3.0000
3.0000	1.0000
500.0000	1000.0000
1.5000	1.9000
1.9000	3.0000
-4.0000	1.0000
-6.0000	1.0000
1.7000	1.9000

0.0000	0.0000	0.0000

RECORD NO. 289	LENGTH OF RECORD 55	
1.0000	.0500	30.0000
.5000	1.0000	.3400
0.0000	1.0000	0.0000
9.0000	7.0000	3.0000
5.0000	3.0000	1.0000
150.0000	500.0000	1000.0000
1.3000	1.5000	1.9000
1.3000	1.9000	3.0000
2.8000	-4.0000	1.0000
1.1500	-6.0000	1.0000
1.5000	1.7000	1.9000

RECORD NO. 290	LENGTH OF RECORD 55	
1.0000	1.0000	300.0000
10.0000	1.0000	.3400
0.0000	1.0000	0.0000
58.0000	7.0000	3.0000
5.0000	3.0000	1.0000
150.0000	500.0000	1000.0000
1.3000	1.5000	1.9000
1.3000	1.9000	3.0000
2.8000	-4.0000	1.0000
1.1500	-6.0000	1.0000
1.5000	1.7000	1.9000

RECORD NO. 291	LENGTH OF RECORD 55	
1.0000	1000.0000	30000.0000
3000.0000	1.0000	.3400
0.0000	1.0000	0.0000

0.0000	0.0000
1.0000	1200.0000
2.0000	0.0000
0.0000	6.0000
4.0000	5.0000
1.6000	2.0000
-12.0000	1.0000
1.4000	9.5000
3.0000	1.9000
1.5000	1.1000
1.3000	1.4000
0.0000	0.0000
1.0000	1300.0000
2.0000	0.0000
0.0000	6.0000
4.0000	5.0000
1.6000	2.0000
-12.0000	1.0000
1.4000	9.5000
3.0000	1.9000
1.5000	1.1000
1.3000	1.4000
0.0000	0.0000
1.0000	1900.0000
2.0000	0.0000
0.0000	6.0000

59.0000	7.0000	3.0000
5.0000	3.0000	1.0000
150.0000	500.0000	1000.0000
1.3000	1.5000	1.9000
1.3000	1.9000	3.0000
2.8000	-4.0000	1.0000
1.1500	-6.0000	1.0000
1.5000	1.7000	1.9000

RECORD NO. 292 LENGTH OF RECORD 50

2.0000	1.0000	23.0000
1.0000	920.0000	10.0000
2.4000	0.0000	0.0000
0.0000	2800.0000	100.0000
2.4000	0.0000	0.0000
0.0000	4.0000	8.0000
4.0000	3.0000	1.0000
150.0000	500.0000	1000.0000
1.3000	1.2800	1.9300
3.5000	3.2000	2.3000

RECORD NO. 293 LENGTH OF RECORD 0

RECORD NO. 294 LENGTH OF RECORD 60

1.0000	.0400	30.0000
1.0000	1.0000	.5900
0.0000	1.0000	0.0000
9.0000	7.0000	3.0000
1.0000	1.5000	1.9000
1000.0000	-10.0000	1.0000
1.9300	1.4500	9.0000
2.3000	2.9500	0.0000

4.0000	5.0000
1.6000	2.0000
-12.0000	1.0000
1.4000	9.5000
3.0000	1.9000
1.5000	1.1000
1.3000	1.4000
0.0000	0.0000

250.0000	1.0000
1.0000	.3900
1.0000	0.0000
1.0000	.5800
1.0000	0.0000
7.0000	3.0000
1.5000	1.9000
-10.0000	1.0000
1.4500	9.0000
2.9500	0.0000

1.0000	1600.0000
2.4000	0.0000
0.0000	4.0000
4.0000	3.0000
150.0000	500.0000
1.3000	1.2000
3.5000	3.2000
0.0000	0.0000

RECORD NO. 295 LENGTH OF RECORD 30

2.0000	.8000	19.0000
1.0000	1050.0000	10.0000
2.0000	30.0000	30.0000
0.0000	2500.0000	40.0000
2.0000	50.0000	50.0000
0.0000	2.0000	8.0000

RECORD NO. 296 LENGTH OF RECORD 45

2.0000	.5000	11.0000
1.0000	700.0000	3.0000
1.2700	50.0000	50.0000
0.0000	1750.0000	30.0000
1.2700	50.0000	50.0000
0.0000	4.0000	8.0000
4.0000	3.0000	1.0000
150.0000	500.0000	1000.0000
1.2800	1.3000	1.6400

RECORD NO. 297 LENGTH OF RECORD 20

1.0000	4.0000	7.0000
100.0000	1.0000	.8500
50.0000	1.0000	0.0000
9.0000	7.0000	0.0000

RECORD NO. 298 LENGTH OF RECORD 30

2.0000	4.0000	40.0000
1.0000	17500.0000	10.0000
2.0000	50.0000	50.0000
0.0000	33000.0000	100.0000
2.0000	50.0000	50.0000
0.0000	2.0000	9.0000

150.0000	1.0000
1.0000	.1100
1.0000	0.0000
1.0000	1.1000
1.0000	0.0000
7.0000	0.0000

60.0000	1.0000
1.0000	.2800
1.0000	0.0000
1.0000	.5800
1.0000	0.0000
7.0000	3.0000
1.4800	1.9200
-4.0000	1.0000
0.0000	0.0000

1.0000	25000.0000
2.0000	50.0000
0.0000	2.0000
0.0000	0.0000

1000.0000	1.0000
1.0000	.0300
1.0000	0.0000
1.0000	.6500
1.0000	0.0000
7.0000	0.0000

RECORD NO. 299 LENGTH OF RECORD 25

1.0000	1.0000	500.0000
10.0000	1.0000	.4800
40.0000	1.0000	0.0000
8.0000	7.0000	4.0000
.7000	.6500	1.0000

RECORD NO. 300 LENGTH OF RECORD 45

1.0000	1.0000	70.0000
10.0000	1.0000	.5200
40.0000	1.0000	0.0000
8.0000	7.0000	4.0000
5.0000	-3.0000	1.0000
3.0000	1.0000	1.2000
500.0000	1000.0000	2.0000
6895.0000	10000.0000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 301 LENGTH OF RECORD 30

1.0000	.0200	2.0000
.1000	1.0000	.5800
0.0000	1.0000	0.0000
9.0000	7.0000	4.0000
1.0000	1.5500	2.1000
1.0000	1.2000	1.4000

RECORD NO. 302 LENGTH OF RECORD 35

1.0000	.2000	3.0000
1.0000	1.0000	.8500
60.0000	1.0000	0.0000
8.0000	7.0000	4.0000
1.0000	.6400	.5000

1.0000	1400.0000
2.0000	40.0000
0.0000	3.0000
-5.0000	1.0000
2.0000	0.0000

1.0000	1500.0000
2.0000	40.0000
0.0000	6.0000
60.0000	61.0000
1.5500	2.1000
1.4000	150.0000
1.0000	2.5000
1.0000	.1700
0.0000	0.0000

1.0000	5200.0000
2.4000	0.0000
0.0000	4.0000
60.0000	-4.0000
1.2500	-3.0000
0.0000	0.0000

1.0000	1800.0000
1.5000	60.0000
0.0000	4.0000
3.0000	-3.0000
3.0000	1.0000

1.3700	1.7900	150.0000
0.0000	0.0000	0.0000

RECORD NO. 303 LENGTH OF RECORD 0

RECORD NO. 304 LENGTH OF RECORD 20

1.0000	.1000	3.0000
1.0000	1.0000	.6700
70.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 305 LENGTH OF RECORD 20

1.0000	.0001	.0200
.0010	1.0000	.5400
100.0000	1.0000	0.0000
6.0000	7.0000	0.0000

RECORD NO. 306 LENGTH OF RECORD 20

1.0000	.0600	2.0000
.4000	1.0000	.4600
20.0000	1.0000	0.0000
9.0000	7.0000	0.0000

RECORD NO. 307 LENGTH OF RECORD 30

1.0000	.0400	4.0000
1.0000	1.0000	.4300
20.0000	1.0000	0.0000
9.0000	7.0000	4.0000
1.0000	2.4000	3.6000
1.0000	.3000	0.0000

RECORD NO. 308 LENGTH OF RECORD 35

500.0000	1000.0000
0.0000	0.0000
1.0000	2300.0000
2.0000	70.0000
0.0000	2.0000
0.0000	0.0000
1.0000	1000.0000
2.0000	100.0000
0.0000	2.0000
0.0000	0.0000
1.0000	1600.0000
2.0000	20.0000
0.0000	2.0000
0.0000	0.0000
1.0000	920.0000
2.0000	20.0000
0.0000	4.0000
62.0000	-4.0000
1.4000	-2.0000
0.0000	0.0000

2.0000	.0400	.3500
1.0000	700.0000	.1000
2.0000	10.0000	10.0000
0.0000	2500.0000	1.0000
2.0000	10.0000	10.0000
0.0000	3.0000	9.0000
-2.0000	1.0000	1.2000

RECORD NO. 309 LENGTH OF RECORD 25

1.0000	.0300	3.0000
1.0000	1.0000	.7500
40.0000	1.0000	0.0000
9.0000	7.0000	5.0000
1.7000	0.0000	0.0000

RECORD NO. 310 LENGTH OF RECORD 35

2.0000	.7000	4.0000
1.0000	170.0000	1.0000
2.0000	50.0000	50.0000
0.0000	500.0000	10.0000
2.0000	50.0000	50.0000
0.0000	3.0000	8.0000
-2.0000	1.0000	1.7000

RECORD NO. 311 LENGTH OF RECORD 40

2.0000	20.0000	100.0000
1.0000	1200.0000	20.0000
2.0000	0.0000	0.0000
0.0000	4500.0000	150.0000
2.0000	0.0000	0.0000
0.0000	3.0000	8.0000
-4.0000	1.0000	1.3000
0.0000	0.0000	0.0000

1.5000	1.0000
1.0000	.5000
1.0000	0.0000
1.0000	.6000
1.0000	0.0000
7.0000	5.0000
0.0000	0.0000

1.0000	1500.0000
2.0000	40.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000

70.0000	1.0000
1.0000	.1400
1.0000	0.0000
1.0000	1.0400
1.0000	0.0000
7.0000	5.0000
0.0000	0.0000

150.0000	1.0000
1.0000	.4500
1.0000	0.0000
1.0000	1.7300
1.0000	0.0000
7.0000	4.0000
1.5200	2.5000
0.0000	0.0000

RECORD NO. 312	LENGTH OF RECORD 20	
1.0000	10.0000	10000.0000
100.0000	1.0000	.6700
0.0000	1.5000	0.0000
8.0000	13.0000	0.0000

RECORD NO. 313	LENGTH OF RECORD 50	
3.0000	.0100	.0500
1.0000	1.0000	1.0000
1.0000	.3700	2.0000
1.5000	0.0000	0.0000
1.0000	.7000	2.0000
1.5000	0.0000	0.0000
1.0000	.8500	2.0000
1.5000	0.0000	0.0000
13.0000	5.0000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 314	LENGTH OF RECORD 25	
1.0000	15.0000	80.0000
40.0000	1.0000	.3300
0.0000	1.5000	0.0000
8.0000	13.0000	5.0000
.5000	0.0000	0.0000

RECORD NO. 315	LENGTH OF RECORD 30	
2.0000	.0020	.1800
1.0000	45000.0000	.0100
2.0000	0.0000	0.0000
0.0000	155000.0000	.1000
2.0000	0.0000	0.0000

1.0000	51000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
.4000	20.0000
25000.0000	.0100
0.0000	0.0000
70000.0000	.1000
0.0000	0.0000
400000.0000	1.0000
0.0000	0.0000
3.0000	6.0000
1.0000	.5000
0.0000	0.0000
1.0000	60000.0000
2.0000	0.0000
0.0000	3.0000
-2.0000	1.0000
0.0000	0.0000
.4000	1.0000
1.0000	.3900
1.5000	0.0000
1.0000	.6100
1.5000	0.0000

0.0000	2.0000	6.0000

RECORD NO. 316 LENGTH OF RECORD 20

1.0000	.0300	.5000
.1000	1.0000	.6100
0.0000	1.5000	0.0000
6.0000	13.0000	0.0000

RECORD NO. 317 LENGTH OF RECORD 50

3.0000	.0200	.1000
1.0000	1.0000	1.0000
1.0000	.4200	2.0000
1.5000	0.0000	0.0000
1.0000	.6500	2.0000
1.5000	0.0000	0.0000
1.0000	.8700	2.0000
1.5000	0.0000	0.0000
13.0000	5.0000	-2.0000
0.0000	0.0000	0.0000

RECORD NO. 318 LENGTH OF RECORD 20

1.0000	.2000	100.0000
10.0000	1.0000	.3800
0.0000	1.0000	0.0000
9.0000	7.0000	0.0000

RECORD NO. 319 LENGTH OF RECORD 20

1.0000	.1000	80.0000
1.0000	1.0000	.6600
0.0000	1.0000	0.0000
56.0000	7.0000	0.0000

RECORD NO. 320 LENGTH OF RECORD 20

13.0000	0.0000
1.0000	8000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
.7500	15.0000
40000.0000	.1000
0.0000	0.0000
78000.0000	.3000
0.0000	0.0000
118000.0000	1.0000
0.0000	0.0000
3.0000	6.0000
1.0000	1.3000
0.0000	0.0000
1.0000	2800.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000
1.0000	1600.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	.0030	1.2000
.1000	1.0000	.6900
0.0000	1.0000	0.0000
6.0000	7.0000	0.0000

RECORD NO. 321 LENGTH OF RECORD 20

1.0000	4.0000	80.0000
10.0000	1.0000	.8800
0.0000	1.0000	0.0000
8.0000	7.0000	0.0000

RECORD NO. 322 LENGTH OF RECORD 20

1.0000	.0200	100.0000
1.0000	1.0000	.5500
0.0000	1.0000	0.0000
9.0000	7.0000	0.0000

RECORD NO. 323 LENGTH OF RECORD 20

1.0000	5.0000	300.0000
100.0000	1.0000	.7300
0.0000	1.0000	0.0000
9.0000	7.0000	0.0000

RECORD NO. 324 LENGTH OF RECORD 20

1.0000	.0100	500.0000
10.0000	1.0000	.6400
30.0000	1.0000	0.0000
56.0000	7.0000	0.0000

RECORD NO. 325 LENGTH OF RECORD 30

2.0000	.4000	95.0000
1.0000	360.0000	10.0000

1.0000	3500.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	3300.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	1250.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	13000.0000
2.0000	0.0000
0.0000	2.0000
0.0000	0.0000

1.0000	6200.0000
2.0000	30.0000
0.0000	2.0000
0.0000	0.0000

1000.0000	1.0000
1.0000	.2200

2.0000	0.0000	0.0000
0.0000	1700.0000	300.0000
2.0000	0.0000	0.0000
0.0000	2.0000	9.0000

RECORD NO. 326 LENGTH OF RECORD 30

2.0000	5.0000	65.0000
1.0000	21000.0000	30.0000
2.0000	0.0000	0.0000
0.0000	57000.0000	300.0000
2.0000	0.0000	0.0000
0.0000	2.0000	57.0000

1.0000	0.0000
1.0000	.8900
1.0000	0.0000
7.0000	0.0000

4000.0000	1.0000
1.0000	.3200
1.5000	0.0000
1.0000	.5600
1.5000	0.0000
13.0000	0.0000

ORGANISATION OF DATA IN THE DATA FILE

Equipment data are organised in lists in COSMOD's data file. These lists are referred to as 'records'. Each record is identified by a unique 'record number'. For a particular equipment, the COSMOD Reference Number in the Equipment Catalogue (Appendix C) and its record number in the data file (Appendix D) are the same. COSMOD uses this number to retreive cost and other data for the equipment from the data file.

Cost and other data are organised in each record in a well defined manner, and the logic in COSMOD's cost estimating routine is based on this organisation. If records are changed in or added to the data file, this organisation scheme must be followed.

The organisation of data in each record is described below. It will be easier to follow the description if reference is made to data on any equipment in Appendix C and its record in Appendix D.

(1) Each record must be given a unique record number and its length must be specified. This is explained further in Appendix E.

(2) The first number in the list (excluding the record

number and length) indicates the number of intervals of equipment size that are specified in the list. This is followed by data on the size intervals.

(3) A cost correlation may or may not exist for a particular size interval. For this reason, data on intervals of size is followed by a 1 or -1 for each interval in respective order. A 1 indicates that a cost correlation exists in the list for that interval of size, while a -1 indicates that it does not.

(4) The next ten numbers in the list must contain the following data for the first interval of size, whether or not a correlation exists for it. (If no correlation exists, these ten numbers would be all 0.0).The data must be specified in the order shown.

(i) Base cost in $, as in column 4 in Table(2.1) or C_o in Equipment Catalogue.

(ii) Base size, column 2 in Table(2.1).

(iii) Units of size, column 3 in Table(2.1). S_o in Equipment Catalogue is (ii) x (iii).

(iv) Correlation exponent. Column 6 in Table(2.1), n in Equipment Catalogue.

(v) L+M factor. Column 8 in Table(2.1). L+M in Equipment Catalogue. (Note that this factor is used only if the user does not specify his own.)

(vi) Correlation error (+). Column 7 in Table(2.1). Error in Equipment Catalogue.

(vii) Correlation error (-). Same as above.

(viii) Factor to estimate FOB cost. 1.0 if cost basis is FOB. 1.15 if basis is 'delivered', and 1.5 if basis is 'installed' or 'field erected'.

(ix) Presently unused. Enter 0.0 .

(x) Presently unused. Enter 0.0 .

The above sequence of data must be repeated for each size interval in respective order.

(5) The next group of numbers identify alphanumeric data stored in the UNIT matrix (see COSMOD's Declaration statements) which apply to this list.

The first number in the group, say x, indicates that x of the numbers that follow identify rows of the UNIT matrix to provide information on the following in the order shown.

(i) Units of size of the equipment.

(ii) Basis of cost. (FOB, Delivered, Installed or Field Erected).

(iii) Variable for which the first correction factor is applied. (e.g. Pressure).

(iv) Variable for which the second correction factor is applied. (e.g. Material of construction).

(--) .....

(x) Variable for which the (x-2)th correction factor is applied.

Note that the information on variables for which correction factors are to be applied must be in the order shown in the Equipment Data and Coding Sheets of the Equipment Catalogue. Note also that if no correction factors are to be applied, x = 2, as the units of size and basis of cost must always be identified.

(6) When correction factors for equipment design variables, such as pressure, temperature, material of construction, etc., are to be applied, these factors are arranged in groups in the rest of the data in the record.

The first group contains all the possible correction factors that can be applied for the first design variable. The second group applies to the second design variable, and so on.

The user of COSMOD choses a factor from each group via the nine digit equipment code as described in Appendix C.

The first number in each correction factor group defines the length of the group. (i.e. the number of factors in the group).

This first number must be entered as a negative number if the user has no option but to choose a factor directly via the nine digit equipment code as described in Appendix C. If the user has the option to specify that COSMOD choose the correction factor from the group, this first number must be entered as a positive number.

When the first number in any correction factor group is positive, that group must be immediately followed by the maximum values of the variable for which each of correction factors apply. The values of the variable must be in ascending order.

The record for an equipment is complete when the last group of correction factors has been entered. The last group must be followed by at least one 0.0 data. This indicates to COSMOD that there are no more data in the list. Hence, the length of the record must be at least one greater than the length of the actual data.

The actual length of the record must be equal to the length specified at the time of creating the record. (See Appendix E). Hence, any empty data spaces must be filled in with zeroes.

APPENDIX E

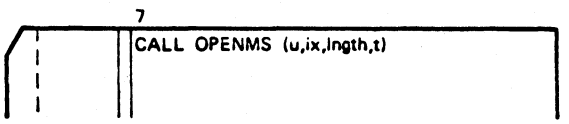
Information on creating and using Multiple Record, Random Access files at McMaster's CDC 6400 computer is filed here.

The program used for loading the data file is also listed here.

MASS STORAGE INPUT/OUTPUT III-7

Mass storage input/output subroutines allow the user to create, access, and modify multi-record files on a random basis without regard for their physical position or internal structure. A random file can reside on any mass storage device for which Record Manager word addressable file organization is defined. Each record in the file may be read or written at random without logically affecting the remaining file contents. The length and content of each record is determined by the user.

Six object time input/output subroutines control the transfer of records between central memory and mass storage. These routines employ the word addressable feature available through Record Manager (refer to Record Manager Reference Manual or 7000 SCOPE Reference Manual for details of this feature).



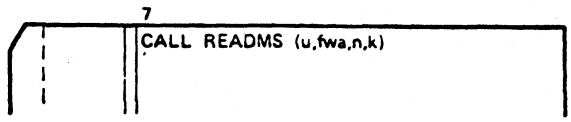
OPENMS opens the mass storage file and informs Record Manager that it is a random (word addressable) file. The array specified in the call arguments is automatically cleared to zeros. If an existing file is being reopened, the master index is read from mass storage into the index array.

u	Unit designator
ix	First word address in central memory of the array which will contain the index
lngth	Length of index
	for a number index, lngth ≥ (number of records in file) + 1
	for a name index, lngth ≥ 2*(number of records in file) + 1
t	t = 0 file is referenced through a number master index
	t = 1 file is referenced through a name master index

Example:

```
DIMENSION I(11)
CALL OPENMS (5,I,11,0)
```

Prepares for random input/output on unit 5 with an 11-word master index of the number type. If the file already exists, the master index is read into memory starting at address 1.

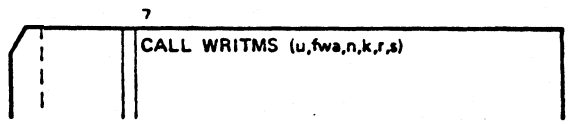


Transmits data from mass storage to central memory.

u	Unit designator
fwa	Address in central memory of first word of record
n	Number of 60-bit central memory words in the record to be transferred. ‡Record Manager may operate more efficiently if n is always a multiple of 64.
k	Number index: k = 1 ≤ k ≤ lngth - 1 Name index: k = any 60-bit quantity except ±0

Example:

```
CALL READMS (3,DATAMOR,25,2)
```



Transmits data from central memory to the selected mass storage device.

u, fwa, n, k are the same as for READMS.

r r=1 rewrite in place. Unconditional request; fata error occurs if new record length exceeds old record length.

r=-1 rewrite in place if space available, otherwise write at end of information.

r=0 no rewrite; write normally at end of information.

The default value for r is 0 (normal write). The r parameter can be omitted if the s parameter is omitted.

s s=1 write sub-index marker flag in index control word for this record.

s=0 do not write sub-index marker flag in index control word for this record.

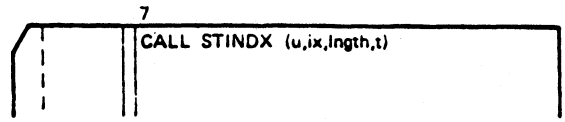
Default value is 0 if s is omitted.

The s parameter is included for future random file editing routines. Current routines do not test the flag, but the user should include this paramter in new programs when appropriate to facilitate transition to a future edit capability.

Example:

```
CALL WRITMS (3,DATA,25,6,1)
```

‡Applies only to CONTROL DATA CYBER 70/Models 72, 73, 74, CYBER 170, and 6000 Series computers.



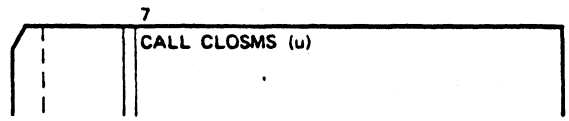
STINDX selects a different array to be used as the current index to the file. The call permits a file to be manipulated with more than one index. For example, when the user wishes to use a sub-index instead of the master index, he calls STINDX to select the sub-index as the current index. The STINDX call does not cause the sub-index to be read or written; that task must be carried out by explicit READMS or WRITMS calls. It merely updates the internal description of the current index to the file.

u, ix, lngth and t are the same as OPENMS.

Examples:

```
DIMENSION SUBIX (10)
CALL STINDX (3,SUBIX,10,0)

DIMENSION MASTER (5)
CALL STINDX (2,MASTER,5)
```



The CLOSMS call is optional since its function is identical to that performed automatically by the FORTRAN object time routine SYSTEM when the run terminates. (SYSTEM and CLOSMS both write the master index from central memory to the file, and close the file.) CLOSMS is provided so that a file can be returned to the operating system before the end of a FORTRAN run, or to preserve a file created by an experimental job that may subsequently abort, or for other special circumstances.

Example:

```
CALL CLOSMS (2)
```

ACCESSING A RANDOM FILE

Random file manipulations differ from conventional sequential file manipulations. In a sequential file, records are stored in the order in which they are written, and can normally be read back only in the same order. This can be slow and inconvenient in applications where the order of writing and retrieving records differ and, in addition, it requires a continuous awareness of the current file position and the position of the required record. To remove these limitations, a randomly-accessible file capability is provided by the mass storage input/output subroutines.

In a random file, any record may be read, written or rewritten directly, without concern for the position or structure of the file. This is possible because the file resides on a random-access rotating mass storage device that can be positioned to any portion of a file. Thus, the entire concept of file position does not apply to a

random file. The notion of rewinding a random file is, for instance, without meaning.

To permit random accessing, each record in a random file is uniquely and permanently identified by a record key. A key is an 18- or 60-bit quantity, selected by the user and included as a READMS or WRITMS call parameter. When a record is first written, the key in the WRITMS call becomes the permanent identifier for that record. The record can be retrieved later by a READMS call that includes the same key, and it can be updated by a WRITMS call with the same key.

When a random file is in active use, the record key information is kept in an array in the user's field length. The user is responsible for allocating the array space by a DIMENSION, type or similar array declaration statement, but must not attempt to manipulate the array contents. The array becomes the directory or index to the file contents. In addition to the key data, it contains the word address and length of each record in the file. The index is the logical link that enables the mass storage subroutines, in conjunction with Record Manager, to associate a user call key with the hardware address of the required record.

The index is maintained automatically by the mass storage subroutines. The user must not alter the contents of the array containing the index in any manner; to do so may result in destruction of the file contents. (In the case of a sub-index, the user must clear the array before using it as a sub-index; and read the sub-index into the array if an existing file is being reopened and manipulated. However, individual index entries should not be altered.)

Under SCOPE, when a permanent file that was created by mass storage input/output routines is to be modified, the EXTEND control card should be used to ensure that the new index is made permanent.

In response to an OPENMS call, the mass storage subroutines automatically clear the assigned index array. If an existing file is being reopened, the mass storage subroutines will locate the master index in mass storage and read it into this array. Subsequent file manipulations make new index entries or update current entries. When the file is closed, the master index is written from the array to the mass storage device. When the file is reopened, by the same job or another job, the index is again read into the index array space provided, so that file manipulation may continue.

INDEX KEY TYPES

There are two types of index key, name and number. A name key may be any 60-bit quantity except +0 or -0. A number key must be a simple positive integer, greater than 0 and less than or equal to (lngth - 1). The user selects the type of key by the (t) parameter. The key type selection is permanent. There is no way to change the key type, because of differences in the internal index structure. If the user should inadvertently attempt to reopen an existing file with an incorrect index type parameter, the job will be aborted. (This does not apply to sub-indexes chosen by STINDX calls, proper index type specification is the sole reponsibility of the user.) In addition, key types cannot be mixed within a file. Violation of this restriction may result in destruction of a file.

The choice between name and number keys is left entirely to the user. The nature of the application may clearly dictate one type or the other. However, where possible, the number key type is preferable. Job execution will be faster and less central memory space will be required. Faster execution occurs because it is not necessary to search the index for a matching key entry (as is necessary when a name key is used). Space is saved due to the smaller index array length requirement.

Example:

```
      PROGRAM MS1 (TAPE3)

C  CREATE RANDOM FILE WITH NUMBER INDEX.

      DIMENSION INDEX(11), DATA(25)
      CALL OPENMS (3,INDEX,11,0)

      DO 99 NRKEY=1,10
C               .
C               .
C  (GENERATE RECORD IN ARRAY NAMED DATA.)
C               .
C               .
 99   CALL WRITMS (3,DATA,25,NRKEY)

      STOP
      END



      PROGRAM MS2 (TAPE3)

C  MODIFY RANDOM FILE CREATED BY PROGRAM MS1.
C  NOTE LARGER INDEX BUFFER TO ACCOMMODATE TWO NEW
C  RECORDS.

      DIMENSION INDEX(13), DATA(25), DATAMOR(40)
      CALL OPENMS (3,INDEX,13,0)

C  READ 8TH RECORD FROM FILE TAPE3.
      CALL READMS (3,DATA,25,8)
C               .
C               .
C  (MODIFY ARRAY NAMED DATA.)
C               .
C               .

C  WRITE MODIFIED ARRAY AS RECORD 8 AT END OF
C  INFORMATION IN THE FILE
      CALL WRITMS (3,DATA,25,8)

C  READ 6TH RECORD.
      CALL READMS (3,DATA,25,6)
C               .
C               .
C  (MODIFY ARRAY.)
C               .
```

```
C                .

C  REWRITE MODIFIED ARRAY IN PLACE AS RECORD 6.
      CALL WRITMS (3,DATA,25,6,1)

C  READ 2ND RECORD INTO LONGER ARRAY AREA.
      CALL READMS (3,DATAMOR,25,2)
C                .
C                .
C  (ADD 15 NEW WORDS TO THE ARRAY NAMED DATAMOR.)
C                .
C                .

C  CALL FOR IN-PLACE REWRITE OF RECORD 2.  IT WILL
C  DEFAULT TO A NORMAL WRITE AT END-OF-INFORMATION
C  SINCE THE NEW RECORD IS LONGER THAN THE OLD ONE,
C  AND FILE SPACE IS THEREFORE UNAVAILABLE.
      CALL WRITMS (3,DATAMOR,40,2,-1)

C  READ THE 4TH AND 5TH RECORDS.
      CALL READMS (3,DATA,25,4)
      CALL READMS (3,DATAMOR,25,5)
C                .
C                .
C  (MODIFY THE ARRAYS NAMED DATA AND DATAMOR.)
C                .
C                .

C  WRITE THE ARRAYS TO THE FILE AS TWO NEW RECORDS.
      CALL WRITMS (3,DATA,25,11)
      CALL WRITMS (3,DATAMOR,25,12)

      STOP
      END


      PROGRAM MS3 (TAPE7)

C  CREATE A RANDOM FILE WITH NAME INDEX.

      DIMENSION INDEX(9), ARRAY(15,4)
      DATA REC1,REC2/7HRECORD1,7HRECORD2/
C                .
C                .
C  (GENERATE DATA IN ARRAY AREA.)
C                .
C                .
```

```
C  WRITE FOUR RECORDS TO THE FILE.  NOTE THAT
C  KEY NAMES ARE RECORD(N).
      CALL WRITMS (7,ARRAY(1,1),15,REC1)
      CALL WRITMS (7,ARRAY(1,2),15,REC2)
      CALL WRITMS (7,ARRAY(1,3),15,7RRECORD3)
      CALL WRITMS (7,ARRAY(1,4),15,*RECORD4*)

C  CLOSE THE FILE.

      CALL CLOSMS (7)

      STOP
      END
```

MULTI-LEVEL FILE INDEXING

When a file is opened by an OPENMS call, the mass storage routines clear the array specified as the index area, and if the call is to an existing file, locates the file index and reads it into the array. This creates the initial or master index.

The user can create additional indexes (sub-indexes) by allocating additional index array areas, preparing the area for use as described below, and calling the STINDX subroutine to indicate to the mass storage routine the location, length and type of the sub-index array. This process may be chained as many times as required, limited only by the amount of central memory space available. (Each active sub-index requires an index array area.) The mass storage routine uses the sub-index just as it uses the master index; no distinction is made.

A separate array space must be declared for each sub-index that will be in active use. Inactive sub-indexes may, of course, be stored in the random file as additional data records.

The sub-index is read from and written to the file by the standard READMS and WRITMS calls, since it is indistinguishable from any other data record. Although the master index array area is cleared by OPENMS when the file is opened, STINDX does not clear the sub-index array area. The user must clear the sub-index array to zeros. If an existing file is being manipulated and the sub-index already exists on the file, the user must read the sub-index from the file into the sub-index array by a call to READMS before STINDX is called. STINDX then informs the mass storage routine to use this sub-index as the current index. The first WRITMS to an existing file using a sub-index must be preceded by a call to STINDX to inform the mass storage routine where to place the index control word entry before the write takes place.

If the user wishes to retain the sub-index, it must be written to the file after the current index designation has been changed back to the master index, or a higher level sub-index by a call to STINDX.†

†Since the file is closed automatically at job termination, it is no longer necessary as it was under previous versions of FORTRAN Extended, for the user to reset the master index before closing the file.

INDEX TYPE

MASTER INDEX

The master index type for a given file is selected by the t parameter in the OPENMS call when the index is created. The type cannot be changed after the file is created; attempts to do so by reopening the file with the opposite type index are treated as fatal errors.

SUB-INDEX

The sub-index type can be specified independently for each sub-index. A different sub-index name/number type can be specified by including the t parameter in the STINDX call. If t is omitted, the index type remains the same as the current index. Intervening calls which omit the t parameter do not change the most recent explicit type specification. The type remains in effect until changed by another STINDX call.

STINDX cannot change the type of an index which already exists on a file. The user must ensure that the t parameter in a call to an existing index agrees with the type of the index in the file. Correct sub-index type specification is the responsibility of the user; no error message is issued.

Example:

```
      PROGRAM MS4 (TAPE2)

C  GENERATE SUBINDEXED FILE WITH NUMBER INDEX.  FOUR
C  SUBINDEXES WILL BE USED, WITH NINE DATA RECORDS
C  PER SUBINDEX, FOR A TOTAL OF 36 RECORDS.

      DIMENSION MASTER(5), SUBIX(10), RECORD(50)
      CALL OPENMS (2,MASTER,5,0)

      DO 99 MAJOR=1,4

C  CLEAR THE SUBINDEX AREA.
      DO 77 I=1,10
 77   SUBIX(I)=0

C  CHANGE THE INDEX IN CURRENT USE TO SUBIX.
      CALL STINDX (2,SUBIX,10)

C  GENERATE AND WRITE NINE RECORDS.
      DO 88 MINOR=1,9
C              .
C              .
```

```
C  WRITE A RECORD.
 88    CALL WRITMS (2,RECORD,50,MINOR)

C  CHANGE BACK TO THE MASTER INDEX.
       CALL STINDX (2,MASTER,5)

C  WRITE THE SUBINDEX TO THE FILE.
       CALL WRITMS (2,SUBIX,10,MAJOR,0,1)

 99    CONTINUE

C  READ THE 5TH RECORD INDEXED UNDER THE 2ND SUBINDEX.
       CALL READMS (2,SUBIX,10,2)
       CALL STINDX (2,SUBIX,10)
       CALL READMS (2,RECORD,50,5)
C                .
C                .
C  (MANIPULATE THE SELECTED RECORD AS DESIRED.)
C                .
C                .

       STOP
       END



       PROGRAM MS5 (INPUT,OUTPUT,TAPE9)

C  CREATE FILE WITH NAME INDEX AND TWO LEVELS OF SUBINDEX.

       DIMENSION STATE(101), COUNTY(501), CITY(501), ZIP(100)
       INTEGER STATE, COUNTY, CITY, ZIP
 10    FORMAT (A10,I10)
 11    FORMAT (I10)
 12    FORMAT (5X,8I16)

       CALL OPENMS (9,STATE,101,1)

C  READ MASTER DECK CONTAINING STATES, COUNTIES, CITIES

C  AND ZIP CODES.
       DO 99 NRSTATE-1,50
       READ 10,STATNAM, NRCNTYS

C  CLEAR THE COUNTY SUBINDEX.
       DO 21 I-1,501
 21    COUNTY(I)-0
```

```
      DO 98 NRCN=1,NRCNTYS
      READ 10, CNTYNAM, NRCITYS

C  CLEAR THE CITY SUBINDEX.
      DO 31 I=1,501
 31   CITY(I)=0

      CALL STINDX (9,CITY,501)

      DO 97 NRCY=1,NRCITYS
      READ 10, CITYNAM, NRZIP

      DO 96 NRZ=1,NRZIP
 96   READ 11,ZIP(NRZ)

 97   CALL WRITMS (9,ZIP,100,CITYNAM)

      CALL STINDX (9,COUNTY,501)
 98   CALL WRITMS (9,CITY,501,CNTYNAM)

      CALL STINDX (9,STATE,101)
 99   CALL WRITMS (9,COUNTY,501,STATNAM)

C  FILE IS GENERATED.  NOW PRINT OUT LOCAL ZIP CODES.

      CALL STINDX (9,STATE,101)
      CALL READMS (9,COUNTY,501,≠CALIFORNIA≠)
      CALL STINDX (9,COUNTY,501)
      CALL READMS (9,CITY,501,≠SANTACLARA≠)
      CALL STINDX (9,CITY,501)
      CALL READMS (9,ZIP,100,≠SUNNYVALE≠)
      PRINT 12, ZIP

      CALL STINDX (9,STATE,101)

      STOP
      END
```

```
      1                PROGRAM TST (INPUT,OUTPUT,PUNCH,CDISF=129,TAPE5=INPUT,TAPE6=OUTPUT
                      1,TAPE7=PUNCH,TAPE1=CDISF)
                       DIMENSION INDEX(448),DATA(128)
                C
      5         C
                C
                       DO 5 K=1,128
                       DATA(K) = 0.0
                     5 CONTINUE
     10                LTOT = 0
                    40 CONTINUE
                       READ(5,*) KEY,LREC
                       LTOT = LTOT + LREC
                       IF(KEY.GT.400) GO TO 30
     15                WRITE(6,100) KEY,LREC
                       READ(5,*) (DATA(I),I=1,LREC)
                       CALL OPENMS(1,INDEX,448,0)
                       CALL WRITMS(1,DATA,LREC,KEY)
                       CALL CLOSMS(1)
     20                DO 6 I = 1,LREC
                       DATA(I) = 0.0
                     6 CONTINUE
                       GO TO 40
                    30 CONTINUE
     25                WRITE(6,200) KEY,LTOT
                   100 FORMAT(10X,*READING AND FILING REC. NO.*,I4,* OF LENGTH*,I4)
                   200 FORMAT(1H0, *CODE = *,I4,* END OF FILING*,10X,I10,* DATA ON FILE*)
                       STOP
                       END
```

--ENTRY POINTS--

1438	CDISF≡	38	INPUT≡	438	OUTPUT≡	1038	PUNCH≡
1438	TAPE1≡	38	TAPE5≡	438	TAPE6≡	1038	TAPE7≡
2168	TST						

--EXTERNALS--

CLOSMS FTNRPV. INPFI. INPFR. OPENMS OUTCI. STOP. WRITMS

--STATEMENT LABELS--

.5	ID	0B	.6	ID	0B	.30	2718	.40	2268		
.100	F	3028	.200	F	3118						

--VARIABLE MAP--

CDISF≡	-		1438	ENTRY		CLOSMS	R			SUBROUTINE	
DATA	R		3638		128	FTNRPV.	-			EXTERNAL.	
I	I	U	14658			INDEX	I		5648		448
INPFI.	-			EXTERNAL.		INPFR.	-			EXTERNAL.	
INPUT≡	-		38	ENTRY		K	I	U	3628		
KEY	I		5638			LREC	I		14648		