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CONSULTING ENGINEERS

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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

ACTING AS EXECUTING AGENT FOR THE UNITED NATIONS DEVELOPMENT PROGRAMME

FEASIBILITY STUDY FOR A PLASTIC APPLIANCES EXTRUSION DEMONSTRATION UNIT IN THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

UNIDO PROJECT DP/BUR/80/015

FINAL REPORT

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APRIL 1987

74

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INDEX

1. EXECUTIVE SUMMARY

The Socialist Republic of the Union of Burma is giving high priority in raising the standard of living of its population. An ambitious program hereinafter referred to as IDWSSD (1) is underway with the aim to provide safe water to all inhabitants of the UNION by year 2000.

Within IDWSSD program the use of plastic pipes and other plastic appliances is of topic importance. In fact extruded plastic pipes can replace in large extent the galvanized iron, and other materials because less expensive, lighter and therefore easier to transport and to lay.

The possibility of producing in Burma the large quantity of plastic pipes and other plastic appliances needed to fulfill the IDWSSD program have been studied by an UNIDO assisted Project Office established in 1984 under the control of the industrial Planning Department of the Ministry of no.1 Industry.
It was decided to proceed with the feasibility study for the establishment of a "demonstration unit" that should include:

- plastic pipes extrusion line (s)
- injection moulding machine (s)
- a well equipped quality control and testing laboratory.

This demonstration unit should be the first step toward the establishment of a number of plastic pipes factories to fulfill the 100% of the Country needs and its main goals should be:

A - to produce a wide range of plastic pipes, in size and characteristics, to fit various applications and therefore test the market.

B - to prove that plastic pipes can be used in most of the applications for water supply under the prevailing conditions in the country.

(1) I.D.W.S.S.D: International drinking water supply and sanitation decade

C - to identify the characteristics (size, material, thickness, etc) of the most widely used pipes so that the future production plants can be optimized (with consequent savings).

D - to train a core of production and maintenance engineers/technicians that will be very useful in case large scale production will be later attained by establishing other units

E - to provide, by means of a very well equipped laboratory, a careful quality control of the output to be sure that it meets with international quality standards. The laboratory can be also important for the following additional tasks:

- to test types of pipes not considered in the original production mix (for instance to meet with requirements for new applications, to modify thickness of walls to meet with local operating conditions etc). This would increase the flexibility of the demonstration unit and equip it better for its preparatory and experimental tasks

- to carry out quality control tests on both raw material and finished products of other plastic industries in Burma

- to train laboratory personnel for other plastic industries already operating in the country or which may be established in the future.

It has been stated that one of the targets of the demonstration unit is to test the market; that is to identify the kind of applications plastic pipes are suitable to specify required characteristics must be identified in order to select the equipment to be installed in the demonstration unit. Therefore a comprehensive market/applications survey has been carried out by the team.

From this study it appears that the forecast demand for plastic pipes for water supply and sanitation program in the decade 1991-2000 is in the range of:

4,600 tons/year (low projection)
5,500 tons/year (high projection)

subdivided as follows:

	HDPE (tons/year)	PVC (tons/year)
Rural Water Supply	1,400 (1) or 2,214 (2)	90
Urban Water Supply	135	2,677
Private Sector	105	45
Public Buildings	62	86
Environmental & Sanitation	19	19
Irrigation		25
TOTAL	1,721 (1) or 2,535 (2)	2,942

Total Plastic Pipes Demand: 4,663 tons/year (low)
5,477 tons/year (high)

(1) Note: (1) Low projection - (2) High projection

Only one factory (the plastic factory n.2) is presently involved in plastic pipes production in Burma. The production capacity is in the range of 200-250 tons/year uPVC water supply pipes. Its equipment are obsolete and it can only satisfy a minor portion of the present and future demand.

At present all plastic pipes needed for IDWSSD, irrigation, sanitation and for other public schemes are imported either by the executing agency or directly by the donors (UNICEF, etc).
It is obvious that only the establishment of several pipes factories (scattered in the country in order to decrease the transport costs) can satisfy the large quantity of pipes and other appliances needed.

The market survey has also indicated that the pipes should be made in both High Density Polyethylene and unplasticized Polyvinyl Chloride which are the two most commonly used raw material for this kind of applications.

The pipes types that should be produced are shown in the following table.

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PIPE MANUFACTURING PROGRAM AND WALL THICKNESS (*)

	UPVC PIPES			HDPE PIPES			
0 OUTER DIAM. mm	** N.P. 6 bars *** BC 4.8 bars	N.P. 10 bars BC 8 bars	N.P. 16 bars BC 12.8 bars	N.P. 6 BC 3.9 bars	N.P. 10 BC 6.5 bars	N.P. 16 BC 10.4 bars	0 OUTER DIAM. mm
20	-	-	1.5	-	2.0	2.8	20
25	-	-	1.9	-	2.3	3.5	25
32	-	-	2.4	-	3.0	4.5	32
40	-	2.0	3.0	2.3	3.7	5.6	40
50	-	2.4	3.7	2.9	4.6	6.9	50
63	-	3.0	4.7	3.6	5.8	-	63
90	2.7	4.3	6.7	5.1	8.2	-	90
110	3.2	5.3	8.2	-	-	-	110
125	3.7	6.0	-	-	-	-	125
160	4.7	7.7	-	-	-	-	160
250	7.3	-	-	-	-	-	250

NOTES: * The wall thickness shown in above table corresponds to the minimum. Many factors such as centering, longitudinal, wave effects, raw material and blending characteristics, operator skill, extruder performance and accuracy, suggest to increase the real wall thickness by 10% as average.

** NP indicates nominal pressure at 20°C

*** BC equivalent: Burmese pressure class at 30°C

The new demonstration unit should therefore be equipped with two pipes extrusion lines namely:
- extrusion line for uPVC
- extrusion line for HDPE

The two lines must have limited production capacity due to the aim of the unit but at the same time must comply with the following criteria:

- flexible enough to produce a wide range of pipe sizes so that the widest range of applications may be tested

- close enough to the size of the extruders that may be purchased in the future, should other factories be implemented in Burma in order to train the personnel and prepare them to face the "phenomenology" related to the operation of this type of equipment.

Bearing this in mind the following two extrusion lines are proposed:

uPVC line: twin screw extruder with 90mm screw diameter with a production capacity ranging from 100 Kg/h to 300 Kg/h in relation with pipe diameters and wall thicknesses. Theoretical output capacity with production mix considered is 1,343 tons/year. Actual output 940 tons/year

HDPE line: single screw extruder, 90mm diameter, having theoretical output capacity of 672 tons/year and an actual output of 470 tons/year

The above stated outputs will be attained when the demonstration unit will be at full production and therefore the actual output has been assumed to grow by steps as follows:

first year:	uPVC 50% of max output	= 470 tons
	HDPE 70% of max output	= 329 tons
		779 tons
second year:	uPVC 75% of max output	= 705 tons
	HDPE 90% of max output	= 423 tons
		1,128 tons
third year & following	uPVC 100% of max output	= 940 tons
	HDPE 100% of max output	= 470 tons
		1,410 tons

Part of the uPVC will be processed to produce tube wells casings for which the market survey has shown a large demand. The unit has been equipped with the equipments necessary to produce them.
Besides, the new demonstration unit will also be equipped with an injection moulding machine suitable to produce latrine pans and relevant appliances needed for the sanitation programs. The demand for this appliance in the next decade is in the range of 300,000 sets/year; the injection moulding machine can produce up to 50% of this requirement without being saturated.

The extra production capacity will be used to produce part of the most commonly used uPVC fittings (unlike uPVC, HDPE pipes do not need fittings but can be welded).

This proposal, if accepted, would considerably increase the capacity of the demonstration unit to supply complete packages (pipes plus fittings) for a number of applications, improving, therefore, the action of market testing that is one of its major objectives.

Raw materials

All the raw materials have to be imported and this could hamper the activity of the plant considering the "shortage" of foreign currency that the Country is facing. On the other hand donors have shown their willingness in supplying raw materials instead than finished product once the unit is in operation and this fact would contribute to overcome the difficulty. It is suggested that relevant arrangements be made as soon as the decision to implement the project is taken. While the HDPE extrusion and injection moulding will use pellets as raw material, it is proposed that the raw materials for uPVC, (PVC suspension and additives) be bought separately and mixed in the unit. The operation is simple but savings are high. In addition the fact that the "dry blend" locally prepared increases the capacity of the new demonstration unit in terms of flexibility to adapt output characteristics to a wide range of application. The raw materials can be purchased on the basis of international tenders (a list of world producers is provided in the report) and contracts foreseeing partial deliveries could be signed in order to obtain better terms.

Site, facilities and utilities

The new unit can be established at the site of the Plastic Factory N. 3, at Hmbawi. The factory belongs to the Pharmaceutical Corporation, Ministry of N. 1 Industry, and its site is considered the most adequate for several reasons:

- The Ministry of N. 1 Industry has established an important industrial development area at Hmbawi. Two factories have been already built and are operational. A housing scheme for the workers is under construction with all necessary infrastructures.

- The Plastic Factory N. 3 is expanding the facilities and a new group of buildings is presently under construction and will be finished by 1987.
  The buildings are perfectly suitable for the new demonstration unit and therefore a portion of their area can be used; the area needed (approx. 60%) fits very well with the factory's own development programs.

- There is a vocational training center at Hmbawi, in operation since 1985. A part of the personnel of the factory can therefore be recruited within the area.

- The site is connected to Rangoon by a two lane paved road.

- A railroad is nearby and the construction of a junction to the industrial area is planned.

- The production in Factory N. 3 has a common technological ground with the demonstration unit with reciprocal synergy and benefits.

- Administrative and social services are already available.

The only constraints is originated by the low capacity of the electric power transmission line connecting the factory to the network (33KV). The increase in installed power due to the equipment for the new unit requires the replacement of the line with a more powerful one, 3 miles long. It does not represent a major problem and the relevant cost has been considered while evaluating the fixed capital investment requirements.

<u>Personnel</u>

The unit will have a total manpower of 54 persons (22 direct and 32 indirect). Extrusion of uPVC should be carried out as much as possible on a continuous basis (three shifts). The injection moulding machine is also scheduled on three shifts.
The HDPE line works in two shifts while the laboratory carries tests only during normal hours.

Implementation schedule

Eighteen/twenty one months from the moment a decision to proceed with the implementation are needed to carry on: purchase, delivery, installation and start up of the unit.

It is suggested that three contracts be signed:

- with a foreign manufacturer for the supply of the production equipment and ancillary components;

- with a foreign manufacturer for the supply of the laboratory equipment;

- with a local contractor (construction corporation or equivalent) for the supply of utilities and some minor modifications needed to the buildings.

Financial and economic evaluation

At this point the team decided to carry out the financial analysis without taking into consideration the Country's system to calculate taxes and selling prices because it would have introduced a number of peculiar elements that could have jeopardize a correct evaluation of the project. The main aim being to ascertain the intrinsic profitability of the project. The following assumptions have been made:

- All costs have been calculated as per actual local conditions (personnel, freight, custom duty, etc).

- All imported raw materials have been considered at present international prices.

- Selling prices have been established taking into account the cost of imported equivalent items, with the assumptions that local products must be competitive.

- Profit taxes have not been introduced in the basic calculation but only in one of the alternate hypothesis (50% of gross profit).

- The foreign component (equipment, services etc.) will be purchased on the basis of a commercial loan on "consensus" terms. (Buyer's or suppliers credit).

- The equity will include a cash component as well as the allocation of the nearly finished buildings (at construction cost).

- Depreciation rates has been assumed as per Pharmaceutical Corporation standards.

- The imported production equipment have been considered duty free.

- All calculations are at constant prices.

The major results of the financial analysis carried out by using the COMFAR program are summarized in the attached table.

COMFAR 2.0 UNIDO

BURMA PLASTIC DEMONSTRATION UNIT
30 APR.1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	3757.91	68.174 % foreign
current assets:	0.00	0.000 % foreign
total assets:	3757.91	68.174 % foreign

Source of funds during construction phase

equity & grants:	2400.10	0.000 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4282.00	43.949 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1607.27	2152.93	2482.90
depreciation :	264.41	264.41	264.41
interest :	150.55	145.18	123.67
production costs	2022.23	2562.51	2870.97
thereof foreign	86.29 %	87.59 %	88.11 %
total sales :	2148.45	2948.25	3572.40
gross income :	126.22	385.74	701.43
net income :	126.22	385.74	701.43
cash balance :	3.80	239.41	582.74
net cashflow :	154.35	653.43	975.25

Net Present Value at: 10.00 % = 3372.17
Internal Rate of Return on total investment: 22.45 %
Equity paid versus Net income flow (IRR%): 21.94 %
Net Worth versus Net Cash Return (IRR%): 21.00 %

Index of Schedules produced by COMFAR

Total initial investment
Total investment during production
Total production costs
Working capital requirements
Cashflow tables
Projected balance sheet
Net income statement
Source of finance

The results of the analysis show that the demonstration unit itself is profitable. Besides it has an extremely high importance in the development of industry and as social impact.
The sensitivity analysis shows that the project is sharply affected by changes in the cost of raw materials.

The break even point is reached at 34.7% of the total output.

A number of national profitability analysis have also been carried out after price adjustment.
The Net National Value added is over 9,000,000 $ consisting of 650,000 $ wages plus 8,500,000 $ social surplus.
The project has also passed the absolute efficiency test. The present value of the net foreign exchange effect is in excess of 7.7 Million $.

Conclusions and Recommendations

- The fulfillment of the IDWSSD programs requires a large amount of plastic pipes and appliances and therefore the development of a local industry suitable to produce those items becomes a must.

- To better formulate the strategy for the development of the plastic pipes industry in the country a demonstration unit should be established.

- Such a unit could be established at Hmbawi, within the Plastic Factory N. 3.

- It is anticipated that the operation of the plant should not present problems from the technology point of view.
  The experience of other plastic factories has shown that personnel can be recruited and trained without major difficulties.

- Problems could arise for the procurement of raw materials that have to be imported. Arrangements with donors should be made.

- This feasibility study indicated that the demonstration unit is self sufficient.

- The implementation of the project is therefore recommended.

2. PROJECT BACKGROUND AND HISTORY

The Socialist Republic of the Union of Burma is giving high priority to raising the standard of living of its population. Plans are being designed and implemented to improve the economic and social growth of the population with special consideration given to rural areas.
Health is one of the important subsectors of the social sector.
Great efforts are being made to implement a country wide social infrastructure program. In this context safe drinking water and sanitation are considered as pre-requisites to health. In fact most of the virulent diseases in Burma are water born and are a prime factor in infant mortality in rural areas.

During the First and Second four-year plans, water supply and sanitation works were carried out mainly by using very limited local resources. With the Third Four year Plan more consideration was given to the activity and sizeable foreign assistance has been secured in this field. Equipment consisting of drilling rigs, pumps, engines, casings and pipes worth approximately 30 Million US $, was received as grant aid. A twenty million US $ loan was obtained to cover the foreign exchange component of Rangoon Water Supply Project.
Over 2000 villages were equipped with deep tube wells providing safe drinking water.Though achievement of third four year plan has been impressive there is still a large part of the population not served by potable water and without adequate sanitation. It was proposed that approx. 13,500 major villages (for the total of 65,000) be included in the program for the period of the Fourth and Fifth Four year plan (82-86 and 86-90).

By reaching this target drinking water and sanitation would be provided to 50% of the Country's population by 1990. This would mean an increase in coverage of 250% in comparison with the present situation.
In January 1980, Research Policy Direction Board of the Socialist Republic of the Union of Burma had formed a National Committee to deal with water Resources and Utilization. After thoroughly considering the strategy for the International Drinking Water Supply and Sanitation Decade. (IDWSSD) Program, the above mentioned National Committee set-up a Technical Committee for IDWSSD to formulate the details of the proposed strategy and draw-up tactics for achieving the objectives of IDWSSD.

A National Meeting on the Strategy and detailed planning for the International Drinking Water Supply and Sanitation Decade was held in Rangoon from 6 to 11 January 1982. Technical Committee for IDWSSD prepared a Country Report for the IDWSSD and it was submitted to the meeting giving information on the Constraints in the implementation of the water supply and sanitation.
Development projects in Burma are greatly hamrered by the lack of drilling equipment, pumping units, piping (steel and plastic) and cement.
According to the studies carried out in 1980-1981, to overcome these shortages and at the same time to reduce the requirements of foreign exchange by 50% (from the estimates US $ 120 million to approximately US $ 60 million) the establishment of a number of production units was proposed, namely:

- Four Plastic Appliances (Pipes, fittings, latrine pans) extrusion plants, each with a capacity of 5 tons per day of 1/2" to 8" pipes, conveniently located in focal points of areas of demand in order to reduce transportation costs.

- One plastic pellets manufacturing plant with a capacity of approximately 20,000 tons/year.

- Welded steel pipe plant for pipes of various sizes.

- Several mini-cement plants using appropriate technology based on fatty husks and limestone, with a combined capacity of more than 100 tons per day.

The cooperation of UNDP was requested to carry out the feasibility studies for the above projects.
Relevant project document was finalized, approved and signed in May 1984.
A Project Director from the Industrial Planning Department and four Project Managers were selected and a Project Office established under the control of the Industrial Planning Department of the Ministry of no. 1 Industry.
UNIDO was appointed Executing Agency and an UNIDO Chief Technical adviser joined the Project Team in 1984.
During 1985 and early 1986 three experts cooperated with the Water Supply Materials Production Units Project Office in carrying out preliminary assessment of the market, of the type of equipment that could be installed etc.
On the basis of these studies it was decided to study first the establishment of an extrusion demonstration unit and relevant quality control laboratory that could produce plastic pipes and accessories for various water supply applications to test the market, to train an adequate number of operators and, at the same time, to become a source of reference for the whole Burmese plastics processing industry.

Baldo & C. was invited by UNIDO to submit a proposal for the feasibility study of such demonstration unit and signed the contract on October 15, 1986.
Baldo & C. fielded the fact finding team on November 22-
The team left Burma on December 10, 1986

3. MARKET AND PLANT CAPACITY

This part of the study includes the following main topics:

- Demand and market
- Sales forecast for the proposed plant
- Production program
- Identification of plant production capacity

3.1 DEMAND AND MARKET

The following paragraphs provides data and evaluations on:

- users of plastic pipes and appliances
- analysis of past and present demand
- evaluation of future demand
- ways to satisfy present needs (local production, imports

3.1.1 Users of plastic pipes and appliances

The following major consumers have been identified:

- Rural Water Supply Division Agriculture Mechanization Department, Ministry of Agriculture and forests: it is engaged in projects to provide water supply to villages by means of tubewells or piped inter village system. It is the main agency for the implementation of the IDWSSD program.

- Environmental Sanitation Division, Ministry of Health: in charge of sanitation programs in rural area, institutional water supply program (to schools, hospitals etc).

- Irrigation Department, Ministry of Agriculture and forests: water supply for irrigation.

- Trade Corporation, Ministry of Trade: sales of pipes and appliances to private sector.

- Ministry of Home and Religious Affairs: urban water supply and distribution.

All the above were contacted by the team and information gathered on their past and present requirements of plastic pipes and appliances for sanitation programs as well as on their consumption forecast.

3.1.2 Analysis of past and present demand

Three items have been taken into consideration, namely:

- PVC pipes
- H.D.P.E. pipes
- latrine pans

3.1.2.1 uPVC pipes

The demand for years 1980-81 through 1985-86 inclusive is summarized in table 3.1

TABLE 3.1

"SUMMARY OF ACTUAL CONSUMPTION OF P.V.C. PIPES (YEAR/DEPARMENT)"

(1980 - 1986)

FISCAL YEAR	DEPARTMENT (1000 kg)						YEAR TOTAL
	C.C.	E.S.D.	R.W.S.D	T.C.	G.A.D.	I.D.	
1980-81	58.5**	-	10*	30.9	2.0	-	104.4
1981-82	112.5**	-	20*	84.4	-	-	217.3
1982-83	76.8**	20	20*	39.5	-	-	156.3
1983-84	89.0**	20	20*	59.5	-	40	228.5
1984-85	94.1**	20	25*	63.6		40	242.7
1985-86	105.1**	20	25*	60.6		40	250.7

SOURCE: Official data from various Government Department

C.C. = Construction Corporation
E.S.D = Environmental Sanitation Division
R.W.S.D. = Rural Water and Sanitation Division
T.C. = Trade Corporation (Construction and Electrical Stores)
G.A.D. = General Affairs Dept. Ministry of home and religious affairs
I.D. = Irrigation Department

NOTES: *) R.W.S.D figures have been distributed among the various years by the consultant

**) Indicate actual C.C. budgeted requirements. Due to lack of funds to import pipes, C.C. evaluates the portion that has been satisfied as 20% of the real demand.

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The details pertinent to each of the above major consumers are given hereinafter.:

- Construction Corporation (C.C.)

C.C. uses U P.V.C. pipes both for water distribution and for tube-well casings. Most of the pipes used are NP 10 class. The following table shows last years requirements, whereas 1986/87 indicates the planned requirements during that year.

TABLE 3.2 (A)

Construction Corporation - Consumption of uPVC in length meters by size diameters

FISCAL YEAR Ø inch.	82/83 mt	83/84 mt	84/85 mt	85/86 mt	86/87 mt
1/2"	4,880	6,100	4,986	8,376	6,720
3/4"	30,500	33,550	35,132	43,898	33,673
1"	27,450	33,550	36,065	40,357	29,419
1 1/4"	15,250	18,300	18,931	25,564	18,187
1 1/2"	18,300	19,825	24,827	21,796	19,138
2"	18,300	21,350	21,043	22,803	18,553
2 1/2"	4,575	6,100	4,277	6,655	3,522
3"	915	915	2,406	1,448	1,065
4"	610	457	305	503	153
TOTAL	120,780	140,147	147,972	171,400	130,428

TABLE 3.2 (B)

Construction Corporation Consumption (Kg weight) for uPVC pipes by size diameter

FISCAL YEAR Ø Inch	82/83 Kg	83/84 Kg	84/85 Kg	85/86 Kg	86/87 Kg
1/2"	1,043	1,304	1,066	1,791	1,437
3/4"	8,443	9,287	9,725	12,152	9,321
1"	11,933	14,584	15,678	17,544	12,792
1 1/4"	9,494	11,393	11,768	15,916	11,323
1 1/2"	14,045	15,215	19,054	16,728	14,688
2"	20,482	23,896	23,553	25,523	20,766
2 1/2"	7,379	9,839	6,899	10,734	5,682
3"	1,956	1,956	5,146	3,098	2,276
4"	2,042	1,531	1,21	1,685	510
TOTAL	76,817	89,005	94,1[illegible]7	105,171	78,795

The previous figures are the foreseen quantities according to plans. Construction Corporation estimates that because of lack of pipes and funds the portion supplied does not exceed 20%.
Priority has been given so far to Galvanized iron (G.I) pipes, whose demand in the last few years is shown in the following table 3.3

TABLE 3.3

Construction Corporation Demand (in length meter for Galvanized Iron pipes

FISCAL YEAR Ø inch	82/83 mt	83/84 mt	84/85 mt	85/86 mt	86/87 mt
1/2"	7,625	7,320	8,763	8,094	8,207
3/4"	33,550	35,075	39,592	44,270	44,625
1"	39,650	42,700	40,821	45,597	48,016
1 1/4"	18,300	21,350	21,010	25,208	34,355
1 1/2"	30,500	33,550	30,972	34,084	40,046
2"	36,600	35,075	38,956	36,316	43,922
2 1/2"	9,150	50,675	10,168	10,574	11,663
3"	6,645	9,150	11,193	9,915	8,894
4"	7,625	9,150	9,722	7,896	7,332
6"	1,830	2,135	2,250	2,059	2,483

Again these figures are the actual planned requirements while only an average of 40% has been satisfied.
So far uPVC has been mainly used for internal plumbing systems. The design criteria for new schemes is changing towards the use of more and more HDPE and uPVC for distribution, while the mains are still specified to be made of galvanized iron.

- Environmental Sanitation Division

The major application of uPVC pipes is for water distribution from tanks, rainwater reservoirs etc. to community buildings like schools, hospitals etc. In the last four fiscal years 1982/83 through 1985/86 inclusive, there has been an average yearly consumption of 40,000 meters uPVC pipes with diameters ranging from 3/4" to 2" and a total weight of approximately 20 tons.

- Rural Water and Sanitation Division

RWSD consumption of uPVC pipes has been quite limited and has been mainly used as tube well casing with 2,3 and 4" diameters. HDPE pipes are preferred for water distribution. uPVC pipes used in the last five years, throughout 1985/86, are the following:

TABLE 3.4

Use of uPVC pipes by RWSD
Weight (Kg)

(1982/1983 to 1986/1987)

DIAMETER	uPVC 1982-1983 Kg
2"	13,780
3"	37,982
4"	58,051
6"	- (*)
TOTAL	109,813

- (*) only black steel is used

- Trade Corporation

The Trade Corporation satisfies the demand for plastic pipes from the Construction and Electrical stores located in various towns all over the Country. Presently the uPVC water pipes are produced by the Number 2, Plastic Factory.

The detail of sales in the last three years is shown in the table hereafter:

TABLE 3.5

Trade Corporation uPVC pipes sales (in meters length)

FISCAL YEAR 0 inch	1983/84 mt	1984/85 mt	1985/86 mt
1/2 "	15,250	13,725	24,961
3/4 "	64,050	59,475	68,277
1 "	48,037	31,644	32,798
1 1/4 "	9,145	10,980	9,955
1 1/2 "	2,285	41,175	6,066
2 "	9,150	18,300	10,079
TOTAL	147,917	175,299	152,136

TABLE 3.6

Trade Corporation uPVC pipes (in weight) sales

FISCAL YEAR Ø inch	1983/84 Weight/kg	1984/85 Weight/kg	1985/86 Weight/kg
1/2 "	3,261	2,935	5,338
3/4 "	17,730	16,463	18,900
1 "	28,882	13,756	14,257
1 1/4 "	5,693	6,835	6,198
1 1/2 "	1,754	3,160	4,656
2 "	10,241	20,482	11,280
TOTAL	59,561	63,631	60,629

The Trade Corporation claims that sales are at least 20 times lower than the actual demand which cannot be satisfied for lack of production. PVC pipes are generally used by customers to assure the connection from the water mains to the house and for internal plumbing/distribution.

The Trade Corporation sales data show another additional 600,000 mt/year of galvanized iron with diameters ranging from 1/2 " to 2 ", out of which approximately 30% are used for water supply. This quantity is equivalent to approximately 512,000 Kg of uPVC pipes (considering an average of 0,420 Kg/mt) whereas the later may advantageously replace G.I. being lighter and three times less expensive.

- Irrigation Department

I.D. uses uPVC pipes for both tube-well casings and screens (4,6 and 8" diameter) and for water distribution, mainly in the underground water irrigation schemes, the first of which is due to start-up in 1988 and the second is in planning stage.

The scheme will use an average of 25,000 Kg/year uPVC pipes for tube well casings and screens plus piping for distribution.

3.1.2.2 H.D.P.E. pipes

HDPE pipes are used for both rural and urban water supply. Their use is increasing due to the advantages HDPE pipes offer due to the fewer joints needed or when supply can to be made in long coils.

HDPE pipes are imported by donor agencies, mainly, UNICEF, the agency whose projects better underline the HDPE advantages. The following table 3.7 shows the imports of HDPE pipes by UNICEF.

TABLE 3.7

Imports of HDPE pipes by UNICEF

DESCRIPTION SPECIFICATION Diameters Pipes	1981		1982		1983		1984 MT= metric tons	
	Qty (Meter)	Qty (MT)	Qty (Meter)	Qty (MT)	Qty (Meter)	Qty (MT)	Qty (Meter)	Qty (MT)
32 mm (classIV) ISI 4984/72	5000	1.0	-	-	-	-	-	-
50 mm (class V) ISI 4984/72	5000	3.3	-	-	-	-	-	-
90 mm (6kg/cm2) DIN8074/75	7000	9.7	-	-	-	-	12000	16.7
90 mm (10kg/cm2) "	1500	3.2	-	-	-	-	425	0.9
110 mm (6kg/cm2) "	2360	4.9	-	-	-	-	-	-
110 mm (10kg/cm2) "	1850	5.8	-	-	-	-	700	2.2
140 mm (6kg/cm2) "	2835	9.5	-	-	-	-	-	-
140 mm (10kg/cm2) "	5655	28.9	-	-	-	-	-	-
20 mm (6kg/cm2) ISI4984/72	-	-	-	-	5000	5.8	-	-
20 mm (10kg/cm2) "	8500	1.0	-	-	-	-	-	-
32 mm (6kg/cm2) "	20600	4.1	-	-	116100	22.8	13000	2.5
50 mm (6kg/cm2) "	1600	0.7	-	-	50000	22.0	29000	12.9
63 mm (6kg/cm2) "	500	0.3	-	-	25000	17.2	-	-
63 mm (10kg/cm2) "	400	0.4	-	-	-	-	-	-
TOTALS (TONS)		72.8		-		67.8		35.2

SOURCE : UNICEF

In 1986 UNICEF requirements for HDPE pipes have been evaluated to be in the range of 100 km of pipes corresponding to nearly 80 -100 tons. Future annual need is assumed to remain at the same level (and this figure is considered conservative by UNICEF).

Other major donors are ADAB, the Australian Development Assistance Bureau, Netherlands, Japan and the Asian Development Bank.

No official statistics have been collected on the use of HDPE by other donors/lending agencies. Taking into consideration that at present several schemes are underway to provide water supply to nearly 1.9 Million inhabitants (see following table 3.8) the demand should be quite relevant. More accurate forecast estimations are given in the following paragraphs.

TABLE 3.8

Water supply projects Just completed or underway using HDPE pipes

DESCRIPTION	YEARS	POPULATIONS SERVED	DONOR LENDER
Gravity flow systems in hilly areas of Chin, Shan, Karen and Mon	1982-1986	35 Villages (30,000 inhabit. approx.)	UNICEF
Dry zone (350 x 240 Km)	Start 1986	50 Villages (50,000 inhabit. approx)	ADAB & UNICEF
Mandalay Water Supply	85/86/87	619,537 (1990)	ADB
Taung Zin Piped Water Supply Scheme (66-mile surface)	March 87 untreated water March 88 treated water	130,914 (1990) (103 Villages)	ADAB
Nine towns	Completion 1988	553,012 (1990)	JAPAN
Pyinmana		63,088	
Yamethin		28,853	
Pyawbwe		40,056	
Thazi		22,925	
Shwebo		64,006	
Monywa		120,572	
Pakkoku		85,688	
Yenangyaung		84,972	
Taungdwingyi		42,852	

TABLE 3.8 (Cont.)

DESCRIPTION	YEARS	POPULATIONS SERVED	DONOR LENDER
Seven Schemes	1986	37,476 (1990)	Netherland
Myotha		11,678	
Ywathit		4,069	
Shwedathazi		6,830	
Patosan		2,260	
Magylsaute		3,728	
Nabemyint		5,772	
Myaing		3,139	
Rural Water Supply, Nort West of Pegu Division	Started 1986	Unknown 530 new wells, 320 rehabilitated	W. Germany
Five Towns	1986: tenders invited	493,607 (1990)	ADB with UNDP
Meiktila		107,989	
Moulmein		253,749	
Pagan		5,359	
Sandoway		15,842	
Taungggyi		110,668	

3.1.2.3 Latrine pans

Latrine pans are installed by the Environmental and Sanitation Division of the Ministry of Health as a part of an intensive sanitation program financed by UNICEF.

Latrine pans are made of Polyethylene and are purchased from Malaysia through international tender.
Each pan is supplied complete with 1 meter long 3" diameter plastic pipe (now Polyethylene but could be uPVC) The purchase price is 10.7 Malaysian Ringit (approximately 4.2 US Dollar FOB port). In the last four years 530,000 latrines have been installed and 650,000 new installations are planned for the next four years.
In Rural areas, population coverage was 17% in 1980/81 and grew to 26% in 1985/86.

3.1.3 Forecast demand for plastic pipes and latrine pans

The forecast demand for plastic pipes and appliances have been separately estimated for each of the following end applications:

- rural water supply (I.D.W.S.S.D. program)
- urban water supply (I.D.W.S.S.D. program)
- private housing and institutional water supply program;
- sanitation program
- irrigation schemes

3.1.3.1 Rural water supply needs

In the rural areas various types of schemes are being implemented at different levels. The priority target level is to provide a tank or stand pipe in each village (average population 500 - 1,000) making clean, potable water available.

A second level will be to increase the number of collection points in each village in order to reduce the distances over which water must be carried.

At third level piped water is to be provided to each permanent dwelling within the village.

The implementation of the second level is very limited (less than 5%) while the implementation of the projects for the third level should be planned only for next decade and beyond. Forecast demand in terms of plastic pipes are described in the following paragraphs according to the area configuration.

3.1.3.1.1 Hilly areas

Hilly areas are mainly located in Kachin, Kayah, Karen, Chin, Mon, Rakhine and Shan States.
The most common water supply system in these areas is the "Gravity flow System".

Each system serves a number of villages for a total of 2 - 3,000 inhabitants (1). Each system consists of a deep tube well and an average of 12 Km of network.

HDPE pipes are mostly used in the NP6 and NP10 classes and in the size range up to 90 mm.

NOTES: (1) UNICEF - RWSD gives a smaller figure of 1,000 inhabitants for each scheme. The UNICEF figure has been taken into consideration because more conservative.

The population living in the Hilly areas reaches approximately 8 million. While the IOWSS program target is to provide all of them with drinkable water, it is estimated that only 50% of them, corresponding to 4 million, will be reached, the others being spread in areas hard to reach and/or with very low density.

Therefore IOWSSO program in Hilly areas should consist in 1,300 gravity water supply systems or 1,300 deep wells and 15,600 km of pipes in order to serve the 4 million inhabitants.

In order to translate the above forecast in weight we made the following assumptions:

. each scheme serves 3,000 inhabitants
. the scheme consists of one deep well and 12 Km of pipes
. the deep well is 60 m deep and uses 2" NP10 uPVC casing and 4" uPVC NP10 .
. a weight of 2.48 Kg per meter length of casing has been considered.
. the average size of pipes in the scheme corresponds to the 40 mm HDPE pipe in the NP6 and NP10 classes. Their weight being respectively 0,283 and 0,434 kg/m we may consider 0,358 kg/m as average weight.

The IPOWSSO demand for the 13 year program (1987-1990) becomes as follows:

. for deep well 1,300 x 60 mt x 2.48 kg/m 193 tons or 14.8 uPVC tons/year;
. for the net-work 1,300 x 12,000 m x 0,358 kg/m 5,590 tons equivalent to 430 HDPE tons/year.

3.1.3.1.2 Dry Zone

This large area is located in Center Burma, including parts of Mandalay, Sagaing and Magwe Divisions. Presently approximately 9.5 Million inhabitants live in the rural Dry Zone. As already mentioned, only 29% or 2.7 million are served with safe drinkable water (March 1986) (1).
RWSD target is to reach a coverage of 35% of population (2) by 1990.

NOTE (1) : Source: UNICEF, 1986
(2) : Source: RWSD, 1986

Three schemes may be configured for the water supply:

A. Single village scheme: deep tube-well with powered pump for each village..

B. Gravity scheme: tube well with water supply by gravity pipe ducts to neighboring villages within 5 Km radius for a total of 1,000 - 1,500 inhabitants and 12 km of pipes per scheme.

C. Pressure scheme: tube-well for a number of villages, usually 3 to 4, with water supplied in pressure pipeducts.
In this case, the population served by one well is estimated to be approximately 4,000 inhabitants for 20 kms of pipeducts.

In some cases schemes use water from a river, properly treated, and pumped to a number of villages. Tube-wells are however preferred because treatment is rarely needed and engineering costs are lower.
From an economical stand point schemes which can provide water to more than one village (schemes B and C) are preferred to the single village scheme (scheme A). This is technically possible when the water flowing from the tube well exceeds 5,000 gallons/hour. In future RWSD has the intention to standardize the gravity flow (scheme B) by mainly using HDPE for piping and uPVC for the tube-well casings (usually with diameters of 4" or lower).

The following table 3.9 shows the RWSD target within the IDDWSSD program up to 1990 in the dry zone.

TABLE 3.9

DESCRIPTION	NUMBER	POPULATION SERVED Conservative Fig.
Deep tube wells:		
. Sagain Division	425	425,000
. Mandalay Division	425	425,000
. Magwe Division	350	350,000
Gravity Flow systems:		
. Magwe Division	8	8,000
. Sagain Division	7	7,000
Village Group piped Water Supply System:		
. Sagaing Division	9	36,000
. Mandalay Division	9	36,000
. Magwe Division	10	40,000
Population to be served by these schemes		1,327,000
Dry Area population already served (1986)		2,700,000 +
Total Dry Area population by 1990		4,027,000

Assuming a 2% annual increase in the population, by 1990 the population in this area should reach 11 million and should exceed 13 Million in the year 2000.
From 1990 on still 7 million are to be served. Pipe demand may vary according to two extreme assumptions:

. All links are of gravity type (scheme B)
7,000,000 : 1,500 = 4,666 systems x 12,000 m of each x 0,358 kg/m corresponding to 20,045 tons over 10 years or 2,004 tons/year.

. All links are of Pressure Type (scheme C)
7,000,000 : 4,000 = 1,750 systems x 20,000 x 0,358 = 12,530 tons over ten years or 1,253 tons/year.

If all the 7,000,000 inhabitants are served, at the first target level, we may have an average of the two assumptions above that is 1,628 tons/year (HIGH VALUE).

The "LOW VALUE" has been calculated considering that 50% of the population will still be served by systems foreseeing a single tube well per village. (This system requires no or very small amount of plastic pipe). Therefore the requirements fall to half, that is 814 tons.

In the second level, the target is to increase the number of collection points in each village. Although the need may vary from village to village, as a first approximation we have assumed 0.32 kg of plastic pipes per head. This figure has been taken based on the average existing in one known village (Zaungdawkan) in which the population of 763 inhabitants have been provided with eight valved stand pipes (1).

To be conservative, and considering that in the year 2000, 30% of the 13 Million population, will reach the second level, we have an additional 13 Million x 0,32 kg/person x 30% = 1,250 tons over the 10 years or 125 tons a year.

uPVC pipes are used as casing in those tube wells having 6" and 4" diameter and lower. It is hard to guess the right number of schemes which may vary from 1,750 in the Pressure (Scheme C) configuration to 4,666 in the gravity (Scheme B) configuration. Again to be conservative we have forecasted to drill 2000 tube wells over the 10 years, each having 250 feet average depth. The corresponding uPVC requirements are 597 tons over ten years or 59.7 tons a year.

(1) Source: Market support Study for Plastic Appliances Extrusion Plant, by the R.W. King, April 1986.

3.1.3.1.3 Other Divisions of Rural Water Supply

RWSD program in areas other than the dry zone and hilly states, is mainly concentrated in the rural parts of the Rangoon, Pegu and Irrawadoly Divisions. The RWSD program for 1987 - 1990 in these Divisions is as follows:

TABLE 3.10

DESCRIPTION	NUMBER OF TUBE WELL/ SYSTEMS	POPULATION SERVED
Deep tube wells:		
. Rangoon Division	140	140,000
. Pegu Division	770	770,000
. Irraweddy Division	400	400,000
Shallow handpump Tubewells		
. Rangoon Division	750	168,750
. Pegu Division	1,500	337,500
. Irrawaddy Division	1,500	337,500
Rehabilitation of Deep Tubewells		
. Rangoon Division	74	74,000
. Pegu Division	1,236	1,236,000
. Irraweddy Division	400	400,000
Village group water supply		
. Rangoon Division	4	16,000
. Pegu Division	4	16,000
. Irrawaddy Division	4	16,000
TOTAL POPULATION SERVED		3,911,500

According to the 1983 census, the rural population in the three above considered divisions was 8,572,000. By assuming an annual increase of 2% it should reach nearly 9,800,000 by 1990 (1). A considerable part of the population in these areas is already supplied with safe water, therefore it is estimated that in the decade 1990 - 2000 only upgrading of the network will be needed with more stand pipes installed in each village and main buildings connected.

To be on the conservative side it has been estimated that 50% of the rural population will have several water access points within the village. For this purpose another 0.32 Kg/person of HDPE pipes is needed for a total of 1,568 tons HDPE pipes needed in 10 years or 156 tons/year.

Additional wells will also be needed and PVC casings will be installed.
It has been considered that 10 percent of the number of tube wells foreseen yearly in the program 1987-1990 will be needed every year in the decade 1991-2000.

- 33 deep tube well with 4" casing, 75 meter deep	=	10 Tons
- 93 shallow tube well with 2" casing, 30 meter deep	=	5 Tons
		15 Tons/year

(1) Source: Baldo & C. Assumptions.

3.1.3.1.4 Forecast of total demand for rural water supply.

TABLE 3.11 - YEAR DEMAND 1990 - 2000 (in quantity)

	ALTERNATE A (High)	ALTERNATE B (Low)
Hilly areas	430 Tons HDPE	430 Tons HDPE
Dry area 1°level	1,628 Tons HDPE	814 Tons HDPE
Dry area 2°level	125 Tons HDPE	125 Tons HDPE
Other divisions	156 Tons HDPE	156 Tons HDPE
	-----------	----------
	2,339	1,525
uPVC Casings	89.5 Tons uPVC	89.5 Tons uPVC

3.1.3.2 Urban Water Supply

Out of the 35,308,000 total population, 8,466,000 inhabitants live in the urban areas. (1)
Only a small portion of this urban population has easy access to safe water. The most recent estimate (2) shows that only 33% of the urban population has available water at least at a walking distance of not more than 100 - 150 meters. The portion of the population having inner plumbing is even smaller and does not exceed 10 - 14% of the urban population (2).
The target by the year 2000 is to bring all urban population to have direct access to one stand pipe at a walking distance.
It is also planned (3) that by 2000 - 2005, approximately 50% of households will be connected to mains.
The demand has been forecasted based on the requirements resulting from the supply of 5 towns.
Detailed design of these schemes have now been completed and the figures may be considered quite representative if taken as average.
The following table shows, for each town, the length by diameter size of pipes to be installed.

(1) Source: 1983 Census
(2) Source: Urban Water Supply and Sanitation Division, Housing Dept. Ministry of Construction and General Affair Dept. of Ministry of Home and Religious affairs.
(3) Source: Urban water supply and Sanitation Division, Housing Dept, Ministry of Construction.

TABLE 3.12 - LENGTH OF INSTALLED PIPES BY SIDE DIAMETER
IN THE DIFFERENT URBAN WATER SUPPLY PROJECT SCHEMES

TOWNS	n° INHABITANTS	LENGTH (1,000 MTS) FOR VARIOUS DIAMETERS (mm)																	
		900	800	750	600	500	400	350	300	250	200	150	100	80	63	50	37	32	25	20
Mandalay	532,000	1.3	8.2	-	10.9	-	10	-	14	8.6	34.2	87.8	136	0.1	70.4	-	-	52	295	320
Mudon	39,700	-	-	-	-	-	0.5	-	3	1.3	3	5.9	9.7	0.9	-	-	-	3	12	45
Bassein	144,000	-	-	-	-	0.45	-	1.19	3.6	6.2	5.46	1435	2775	36.7	3.5	3	5	8.5	20.5	110
Myingyan	77,000	-	-	-	-	-	0.45	-	0.15	2.15	3.1	18.8	4.25	3915	3	2	3.5	4.2	10.7	52
Sagaing	49,000	-	-	-	-	-	0.22	1.55	3.06	2.6	7.78	8.13	14.4	12.6	2	3	4	7.1	9	36

Should above schemes be implemented in Western Europe or America, the criteria of choosing the pipe material would be as follows:

- diameters 300 mm and above: galvanized Iron/Cement etc.
- diameters from 80 to 250 mm : PVC
- diameters from 20 to 63 mm : HDPE and PVC (we have considered 70% each for our calculations HDPE and 30% uPVC for our calculation).

Assuming NP10 as the average class of all pipes, the total weight of the plastic pipes needed to supply water to the 875,000 urban population of the 5 towns considered is:

uPVC	2,220 tons
HDPE	160 tons
	2,380 tons

= 2.72 Kg/per capita (including house connection).

By the year 2000 it may be assumed that also in Burma the urban population will increase to become 30% of the total instead of the present 24%. The trend was confirmed by various Burmese bodies (Housing Dept., G.A.D.).
Assuming a 2% annual increase, the population in the year 2000 will be 49.5 Million (from 35.3 Million from 1983 Census) out of which 14.8 Million will live in urban areas.
As stated previously only 33% of the present urban population is supplied with safe water at a walking distance that is 3 Million inhabitants approximately. Therefore according to plans 50% of the remaining 12 Million should have direct connections to the main (1), the other 50% will be at walking distance.

The corresponding pipe demand for single house connections is 6,000,000 x 2.72 Kg = 16,320 tons over a 13 years period = 1,250 tons/year to be divided into:

1,170 tons/year PVC
80 tons/year HDPE

(1) Source: From a Study of Sir Alexander Gibbs and partners for the Town of Sagain and estimates of the House Department and Baldo & C.

The balance of 50% of the urban population not yet supplied will still not have house connection by the year 2000. Still the goal remains to provide them with safe water at the maximum walking distance of 10[illegible] - 150 mts. For this part of the population the per capita amount of plastic pipe considered is 1.82 Kg (2).

Therefore an additional:

6,000,000 x 1.82 Kg = 10,920 tons : 13 years = 840 tons/year to be splitted in:

785 tons/year uPVC
55 tons/year HDPE

In addition internal plumbing should be considered for houses having a water connection.

(2) Source: At Mandalay, a rough estimate of the quantity of plastic pipes per head of total population for house connection and plumbing was made from figures provided by the responsible engineers as 0.9 Kg. (Market Support Study for Plastic Appliances Extrusion by Mr. R.W. King, 1986).

The 6 Million urban inhabitants connected to mains at an average of 5 persons per household bring the total of such households to 1.2 Million. Each will have an average of 18 meters PVC pipe (2), with average weight 0.435 Kg/mt that is 7.83 Kg/household for a total of 9,396 tons PVC to be installed in 13 years or 722 tons/years.

The total yearly needs for water supply in urban areas in the period 1990 - 2000 is therefore estimated as follows:

- For population directly connected to mains	1,250 tons/year
- For inner plumbing of above	1,722 tons/year
- For population at walking distance	840 tons/year

TOTAL ANNUAL NEED	2,812 tons/year

to be splitted into:

2,677 tons/year uPVC
135 tons /year HOPE

(1) Source: Sir Alexander Gibbs and partners study on behalf of the House Department.

(2) Source: House dept. and Baldo & C. estimates.

3.1.3.3 Private Sector and Institutional Water Supply Program

The Ministry of Trade retails to the public through the Construction and electrical stores.

The present amount of PVC pipes sold through this channel is 60 tons/year but this volume could be considerably increased (1) if enough material is available. The lack of product soared the price on the black market at 3 to 5 times higher than the Trade Corporation selling prices. (1)

To be conservative a forecasted sale of 150 tons/year PVC/HDPE pipes has been considered, also taking in consideration the fact that at least 50% of the consumption of G.I. pipes used for water distribution presently sold by the Trade Corporation could be replaced by PVC/HDPE pipes.

G.I. pipes if replaced with plastic pipes correspond to an equivalent of 512 tons PVC/HDPE pipes. Considering that only 30% are used for water supply and that only a portion of 50% is replaced, the demand for G.I. pipes replacement is 77 tons/year.

The 150 tons/year may be splitted into 70% HDPE and 30% PVC which is the distribution average of European consumption for small diameters, that is 105 tons HDPE and 45 tons uPVC.

- The Construction Corporation on its side estimates to have a need of 200,000 meters/year of water supply lines and internal plumbing for public buildings with diameters ranging from 1/2" and 6".
  These lines can use plastic pipes with a ratio 50% for HDPE pipes and 50% for uPVC.

  An average weight of 0.62 Kg/mt has been considered (that is the average weight of the plastic pipes used or planned to be used by Construction Corporation in years 1984/85, 1985/86 and 1986/87. Forecast demand of the Construction Corporation is therefore 124 Tons/year splitted into:

  62 tons/year HDPE
  62 tons/year PVC.

(1) Source: Ministry of Trade, Trade Corporation

- The Environmental Sanitation Division is planning to use an average of 60,000 meters plastic pipe/year and 18,000 meters galvanized iron. (1)

  At present only uPVC pipes are requested. Considering the applications of this Division we deem however that since HDPE pipes production will be available the demand will be splitted equally between HDPE and uPVC.
  Forecast demand of Environmental Sanitation Division is 38 Tons/year splitted into/

  19 tons/year PVC
  19 tons/year HDPE

  In addition the Construction Corporation has a need of approximately 6,000 to 10,000 meters/year of PVC casings for deep wheel, average diameter 4". (2).
  To be conservative the amount needed would be:

  6,000 m . 3.98 Kg = 23.8 tons

(1) Source: Environmental Sanitation Division, Ministry of Health, conversation with Baldo & C. Team.

(2) Source: Construction Corporation

3.1.3.4 Sanitation Program

This program plans to install 650,000 latrines in the next four years in houses and to equip 600 primary schools with 8 latrines pans each.
The total yearly consumption of latrine pans up to 1990 will therefore be 163,700 units.

At that time the rural population covered by the sanitation program will be 37 - 38% of the total: 15.5 Million approximately (1). The target is to reach a 100% coverage by the year 2000. By that year the rural population still to be provided with the sanitation program will be 18.8 Million (2). Considering that the average household has 6 components and the number of households to be equipped with latrine systems is slightly over 3.1 Million. The program being implemented over 10 years, an annual demand of 300,000 latrines is estimated.

In addition, each latrine pan is complete with a 1 mt long pipe, 3" diameter, 3 mm thick, made in HDPE, LDPE or uPVC. The consumption is in the range of 120 tons/year in the next four years, up to 1990. In the following ten years it will soar to approximately 220 tons/year.

3.1.3.5 Irrigation Schemes

The use of plastic (mainly PVC) is related to the ground water irrigation schemes.
The first will be completed in 1988 and a second is under preparation.
Decision on implementation of other projects will be taken once the first scheme is in operation.
Assuming that the decision is positive we anticipate a forecast demand of 25 tons/year uPVC pipes and tube well casings.

3.1.3.6 Total Demand Forecast

The following table 3.13 summarizes the demand forecast for plastic pipes for the period 1990 - 2000.

(1) Source: Environmental & Sanitation program, Ministry of Health, Conversation with Baldo & C. Team.

(2) Source: Baldo & C. estimate.

TABLE 3.13

Forecast Demand for Plastic Pipes 1990 - 2000

	HDPE (tons/year)	PVC (tons/year)
Rural Water Supply	1,400 (1) or 2,214 (2)	90
Urban Water Supply	135	2,677
Private Sector	105	45
Public Buildings	62	86
Environmental & Sanitation	19	19
Irrigation		25
TOTAL	1,721 (1) or 2,535 (2)	2,942

Total Plastic Pipes Demand: 4,663 tons/year (low)
5,477 tons/year (high)

(*1) Note: (1) Low projection - (2) High projection

3.1.3.7 Ways to satisfy present needs

Three plastic processing factories are presently operating in Burma, the No. 1 and No. 2 located in Rangoon and the No. 3 located at Hmwabi. All three factories belong to the Ministry of No. 1 Industry through the Pharmaceutical Industries Corporation.

At present only the No. 2 factory is involved in pipe production (only PVC) with the following output:

1980 - 81	202 tons
1981 - 82	213 tons
1982 - 83	188 tons
1983 - 84	177 tons
1984 - 85	175 tons
1985 - 86	105 tons
1986 - 87 (planned)	85 tons

The decrease in production is due to inefficiency of existing extruders which have been utilized for more than 25 years and due to the difficulty encountered in purchasing spare parts for those machines.

Output of No. 2 factory is sold through the Trade Corporation selling points and is not used by IDWSSD programs. Even operating at full capacity the factory could supply not more than 5% of the annual forecast needs of PVC pipes.

Notes on the No. 2 Factory are provided in Annexe 1. All plastic pipes needed for IDWSSD irrigation, sanitation and for other public schemes are imported either by the executing agencies or directly by the donors (UNICEF, etc.).

3.2 PRODUCTION PROGRAM AND SALES FORECAST

The market survey has shown that the forecast demand in the decade 1990 - 2000 will be in the range of 4,600 - 5,400 tons plastic pipes per year if the IDWSSD program is attained.

uPVC pipe demand will be approximately 2,800 tons/year while HDPE pipe demand will be in the range 1,700 - 2,500 tons/year. In addition a large number of latrine pans will be needed for the sanitation programs.

Ministry of N°. 1 Industry has decided to study the construction of a pilot unit for the production of plastic pipes and other appliances whose output will mainly be used to test the plastic pipes for the various applications under the prevailing conditions in Burma.

Therefore the scope of the project is not to satisfy 100% forecast demand of plastic pipes and other plastic appliances; it should be flexible and provide a wide range of appliances and pipes with different characteristics to match the major part of applications related to water supply and distribution.

The following items have therefore been taken into consideration for production in the new demonstration unit:

- plastic pipes for water distribution
- plastic casing for tube wells
- PVC fittings and cement sealant for PVC pipes
- latrine pans and related accessories

3.2.1 Plastic pipes for water distribution

Two kinds of materials have been considered for use by the new demonstration unit for the production of plastic pipes, namely:

- unplasticised polyvinyl Chloride (uPVC)
- high density polyethylene (HDPE)

Both are the most used plastic materials for the production of pressure pipes for water adduction. They are already used for the pipes produced (uPVC only) and imported in Burma.

Plastics have covered a leading share of the pressure pipe market especially in the range of small diameters.

The reasons for the above statement are found basically in the characteristics of plastic materials which offer many advantages if compared to more traditional ones, namely:

. Lighter weight: for the same length, diameter size and pressure class the plastic pipes are lighter. The advantages are easier handling, savings in transport and lifting means, quicker installation and erection.

. Flexibility: plastic pipe flexibility is of great advantage when laying pipes in irregular routings or beds or under yielding or sinking earth conditions. Here again we have savings in earthworks, reinforcements and casings for foundations otherwise needed.

. Low losses: The smoother inner surface of plastic pipes offers less resistance to flow and reduces losses. Also turbulence is relatively lower with fewer incrustations due to precipitations along time.

. Better resistance to overpressures and water hammer due to the propagation of the phenomena and due to partial absorption by the elasticity of plastic material. Advantages are less accidents and less need to replace damaged parts.

. Chemical stability and corrosion proof: plastic materials have a great chemical stability and do not react with most fluids including acids and salts present in the earth. The low electric resistivity do not allow corrosion or stray currents.

. Longer cuts: plastic pipes are available in 6 m long cuts for rigid type while HDPE with diameter up to 125 mm can be supplied in coils. The advantages are less fittings, less couplings, quicker installation, less leakages and savings in maintenance costs.

Plastic pipes also have critical factors which require attention in the design namely:

. Resistance to heat and to sun light: plastics are sensitive to these two agents. uPVC should not exceed 60°C average temperature and HDPE do not tolerate 80 - 100°C. Plastic pipe lasts longer if protected from heat and direct sun light, both causing quicker aging and shorter life span, and derated mechanical characteristics.

. Low shock resistance: uPVC in particular should be protected during transport and laying to avoid damage.

. Easy deformation: plastic pipes offer low resistance to external pressure and are easily deformed under vertical forces. Care should be taken when filling and compacting trenches.

The major application for pipes foreseen in Burma is in pressure ducts for water supply.

Until few years ago this application was jeopardized by asbestos cement at least for size diameter above 110 mm. At present and for sizes up to 140 - 160 mm, and provided some care is taken in the design and installation, plastic pipes are widely used in pressure ducts.

The trend nowadays goes towards the use of uPVC pipes of sizes up to 250 mm diameter and more precisely up to 315.

For cold water distribution within houses uPVC threaded pipes, in the size range (in inches) from 1/2" to 2", are normally used.

However the trend is gradually changing, at least in Europe, towards the metric system, from 20 mm to 63 mm outer diameter, with slick ends and cement sealed couplings. While pipe pressure classes are 10 and 16 bars the fittings used for cold water distribution are available in one pressure class of 16 Bars while

Taking into consideration above facts we propose the following production program:

TABLE - 3.14 PIPE MANUFACTURING PROGRAM AND WALL THICKNESS (*)

Ø OUTER DIAM. mm	UPVC PIPES			HDPE PIPES			Ø OUTER DIAM. mm
	** N.P. 6 bars	N.P. 10 bars	N.P. 16 bars	N.P. 6	N.P. 10	N.P. 16	
	*** BC 4.8 bars	BC 8 bars	BC 12.8 bars	BC 3.9 bars	BC 6.5 bars	BC 10.4 bars	
	**** UB 4 BARS	UB 6 BARS	UB10 BARS	UB 2.5 BARS	UB 4 BARS	UB 6 BARS	
20	-	-	1.5	-	2.0	2.8	20
25	-	-	1.9	-	2.3	3.5	25
32	-	-	2.4	-	3.0	4.5	32
40	-	2.0	3.0	2.3	3.7	5.6	40
50	-	2.4	3.7	2.9	4.6	6.9	50
63	-	3.0	4.7	3.6	5.8	-	63
90	2.7	4.3	6.7	5.1	8.2	-	90
110	3.2	5.3	8.2	-	-	-	110
125	3.7	6.0	-	-	-	-	125
160	4.7	7.7	-	-	-	-	160
250	7.3	-	-	-	-	-	250

NOTES: * The wall thickness shown in above table corresponds to the minimum. Many factors such as centering, longitudinal, wave effects, raw material and blending characteristics, operator skill, extruder performance and accuracy, suggest to increase the real wall thickness by 10% as average.

** NP indicates nominal pressure at 20°C

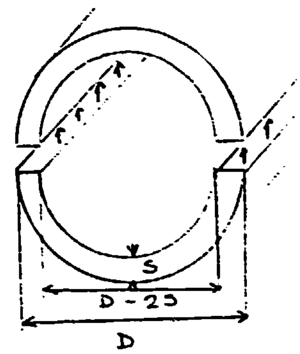
*** BC equivalent: Burmese pressure class at 30°C

**** UB equivalent: UPPER BURMA pressure class at 40°C (accordigly to DIN 8062 x uPVC and UNI 7611, British standard not applicable)

3.2.1.1 Pressure Class of Plastic Pipes

This is fundamental in understanding the meaning of Pressure Class of the plastic pipes related to their wall thickness. The relation is given by the Mariotte formula applicable to all types of pipes with thin walls, regardless of the material they are made of:

$$S = \frac{PD}{2(\sigma + P)}$$



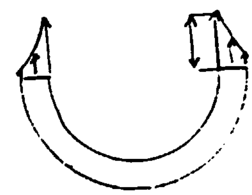
where

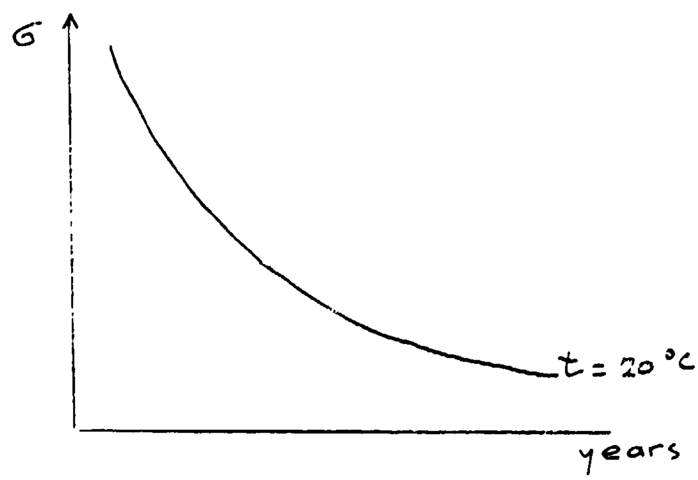
S = wall thickness in mm
P = Pressure class in Kg/cm^2
D = Outer diameter in mm
= Maximum bearing capacity in Kg/cm^2

The wall thickness of the plastic pipes is not negligible and as a result the distribution of the pressure along the wall cannot be considered constant. The Mariotte formula is changed and at first approximation it has been simplified to

$$S = \frac{P * D}{2\sigma + P}$$

The maximum bearing capacity of 100 and 50 kg/cm^2 respectively for uPVC and HDPE are extrapolated values at 20 °C temperature and 50 years life span. The experimental graph called Creep at constant temperature (isotherm) may be represented by a hyperbolic curb.





The assumption made (which is still to be verified in the few next years) is that the plastic pipes may last longer if submitted to low pressure or be torn out in a shorter time if pressure or temperature are high.

A pipe rated 10 Bars nominal pressure at 50 years and 20°C can stand only one hour at 42 Bars, 20°C or at 17 Bars, 60°C. At 60°C, 10 Bars, it can stand 1000 hours.

As a result and to keep the life span at 50 years, the nominal pressure of the plastic pipes installed under hot environmental conditions should be derated, or instead, their wall thickness increased.

Let us suppose to have in Burma an HDPE plastic pipe submitted to the following conditions: pipe is not protected against sun heat, the duct is filled and is under 10 Bars pressure, water is not flowing. Very quickly the temperature of the pipe may reach 25/30°C above the environmental temperature of 45°C. At these conditions, the pipe will stand only few years before being torn out.

These conditions are severe and likely hard to verify. If a water duct was laid down in Burma, it should be protected from direct sun heat, and it would surely transport water which brings down the temperature.

In any case the temperature has been calculated for "derated" classes considering a temperature of 30°C for Burma (compared with 20°C for applications in Europe and America).

In the above table the BC values are the pressure classes that would replace the commonly used ones.

In future the new demonstration unit, that will also be equipped with a test laboratory, may modify these classes, and may produce and test pipes with different wall thickness, to better fit local requirements.

3.2.1.2 Standards to be used

It is suggested that the ISO standards be introduced. This is also the will of the Ministry of No. 1 Industry (1) and the opinion of other consultants (2) and of Baldo & C. Team.

(1) Source: Market Support Study in Plastic Appliances extrusion plant by Mr. R.W. King, April 1986
(2) Source: Report on plastic testing laboratory for the plastic appliances extrusion demonstration unit, Mr. Jan Brzeeinski, November 1986.

The trend worldwide is in fact to adopt the ISO standards or to revise accordingly the national standards.

The ISO standards for plastics in general (ISO/TC 61) and for pipes and fittings (ISO/TC 138) are based on the continuous development reached by the members applying these standards. They overule on the national ones only once a mutual agreement is reached among them.

Each year the range of subjects covered by ISO standards increases.
However, these ISO standards are not yet and will never be a complete package. They generally lag behind the national standards. It is, therefore necessary to consider in addition to ISO standards some national standards, to form a closed and complete system for practical use.
Apparently, the most suitable for this purpose seem to be the British Standards (BS).

There are several reasons leading to this choice among other national standards, namely:

(a) In the past Burma adopted BS in the field of water supply systems, pipes, pipework, etc.

(b) The U.K. is the country, where the use of uPVC and HDPE - pipes for water supply has been well-known for decades and the British experience in this field is extremely wide.

(c) Foreign agencies supplying pipes to Burma frequently follow BS standards.

Therefore, this consultant recommends that this unit and its Plastic Testing Laboratory adopt the metric system of ISO standards for uPVC - and HDPE - pipes and fittings as the principal system of standards. These standards shall be completed whenever the need rises by the relevant BS standards (1). In very few cases BS and ISO standards do not foresee the proper pipe diameter.
To make more complete the commercial range offered by the plan standards DIN 8062 for PVC and DIN 8074 for HDPE are suggested.

(1) The same recommendation has been also expressed by Mr. Jan Brzenzski in his November 1986 report.
Baldo & C. Team fully endorses this statement.

3.2.1.3 Production capacity for plastic pipes

The plastic pipe production will consist of two extrusion lines:
- extrusion line for uPVC
- extrusion line for HDPE

It has been stated previously that the aim of this demonstration unit is not to satisfy total demand of plastic pipe but to produce a wide range of plastic pipes for water transportation in order to test the market and, at the same time, to train a core of highly experienced production and testing engineers that will then be valuable at the time when a large scale plastic pipes extrusion industry will be established in Burma.

This goal has been kept in mind while selecting the most appropriate production capabilities of the machinery.

In fact this plant should have the following features:

- flexible enough to produce a wide range of diameters and sizes so that the widest range of applications may be tested;

- small but not too much because extruders which are too small (for instance 100 - 200 tons/year output) have different mechanical limits and problems than a medium to small one such as the one selected (See note).

- similar enough to the extruders that may be purchased in future when the plastic pipe industry will develop and large scale production will be required to fulfill all IDWSSD's goals.
  This allows personnel to be well trained and prepared to face "phenomenology" typical of the operation of this type of equipment.

<u>uPVC EXTRUSION LINE</u>

A typical extruder that fulfills the requirements indicated above has a 90 mm screw diameter.

Such extrusion line has at a linear speed of 8 to 10 m/mm, a production capacity ranging from 100 Kg/h to 300 Kg/h, varying with diameter and with wall thickness.

NOTE: In fact the "power" that can be transmitted to the plastic material is proportional to the cubic of the diameter of the extruder screw core: small size extruder means small screw diameter and therefore less productivity and, what is more important, less flexibility (limitation in the sizes of pipes etc.);

Outputs for the different diameters are (Pressure class PN10).

1/2 "	diameter pipe (20 mm)	: 100 Kg/h
3/4 "	diameter pipe (25 mm)	: 127 Kg/h
1"	diameter pipe (32 mm)	: 150 Kg/h
1 1/4"	diameter pipe (40 mm)	: 177 Kg/h
1 1/2"	diameter pipe (50 mm)	: 264 Kg/h
2 "	diameter pipe (63 mm)	: 300 Kg/h
above 2" diameter pipes		: 300 Kg/h

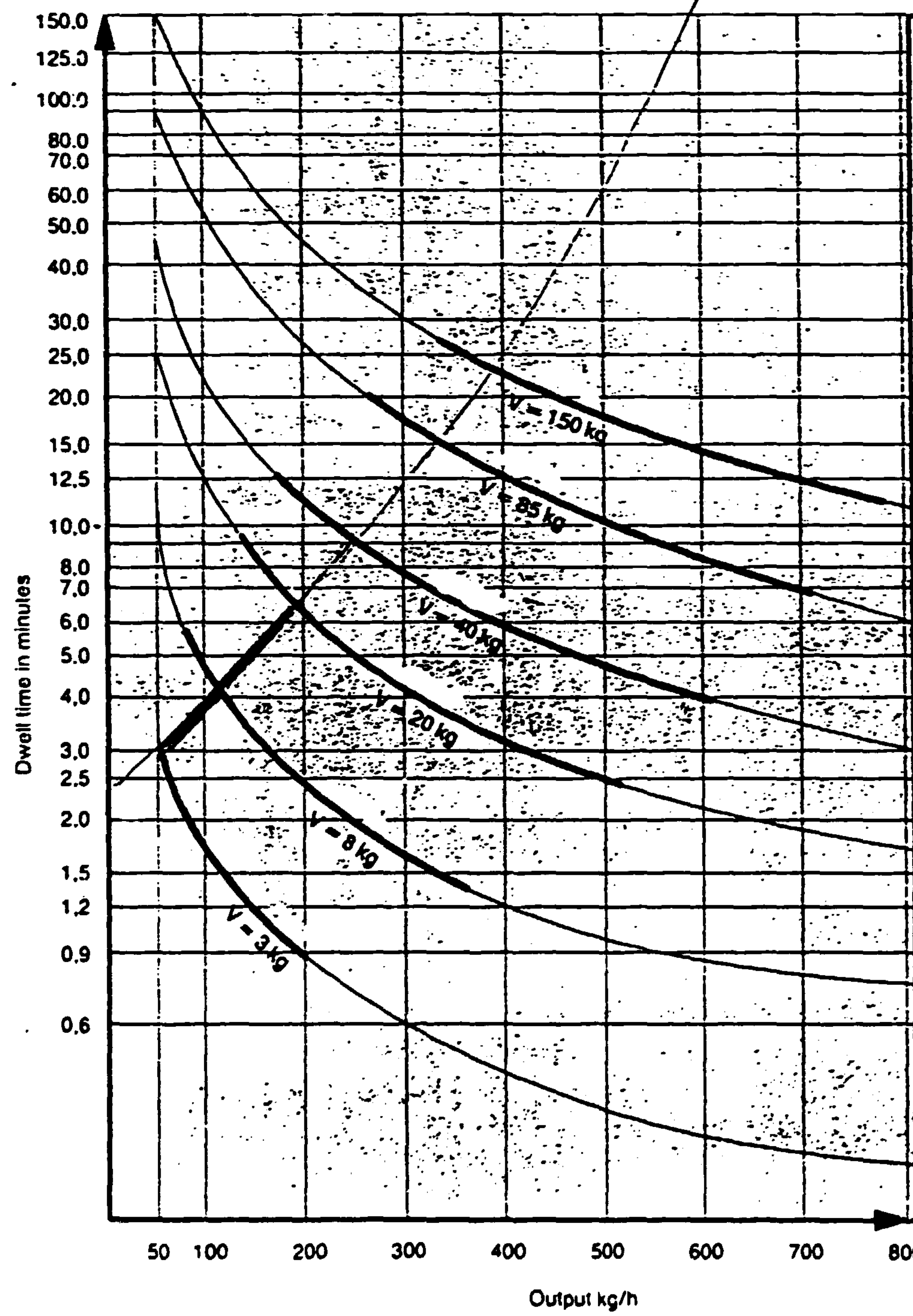
The output capacity of the extruder is therefore directly related to the production mix, as also shown in the graph of table 3.12 .

It has been seen in the the market survey chapter that main uPVC applications are in the large diameter range.

This is also the trend in the international market where uPVC pipes with diameter above 2" (63 mm) account for 80% or more of the total production (in weight).

Another cross checking confirming above statement is possible: uPVC pipe forecast requirements from various departments for the year 1987-88 as reflected, in a tentative planning for IDWSSD program, (table 3.15), shows that pipes having a larger diameter than 2" (63 mm) account for 77% of the total, perfectly in accordance with the international average.

Dwell Time – Output – Range



Pipe Heads

DIN 8062
Wall thickness

Pressure classes 2	3	4	5	mm
12.4	18.4			630
11.0	16.4	26.7		560
9.8	14.6	23.9		500
8.9	13.2	21.5		450
7.9	11.2	19.1	29.7	400
7.0	10.4	16.9	26.3	355
[illegible]	[illegible]	[illegible]	[illegible]	315
[illegible]	[illegible]	[illegible]	[illegible]	280
4.9	7.3	[illegible]	[illegible]	250
4.5	6.6	10.8	16.7	225
4.0	5.9	9.6	14.9	200
3.6	5.3	8.6	13.4	180
3.2	4.7	7.7	11.9	160
2.8	4.1	6.7	10.4	140
2.5	3.7	6.0	9.3	125
2.2	3.2	5.3	8.2	110
1.8	2.7	4.3	6.7	90
1.8	2.2	3.6	5.6	75
	1.9	3.0	4.7	63
	1.8	2.4	3.7	50
	1.8	1.9	3.0	40
		1.8	2.4	32
		1.5	1.9	25
			1.5	20
			1.2	16
			1.0	12
			1.0	10

V . . . Material volume of pipe heads in kg PVC

next larger size pipe head is to be used for higher out puts than listed in the diagram

TABLE 3.15
PVC PIPES REQUIREMENTS FROM VARIOUS DEPARTMENTS
FOR THE YEAR 1987 - 1988

DESCRIPTION		DEPARTMENTS							TOTAL TONNAGE PER YEAR
		CC	HD	ESD	RWSD	TC	GAD	ID	
PVC PIPES	1/2"	0.1	5.0	0.7	-	4.7	0.3	0.9	11.7
" "	3/4"	1.3	10.0	4.2	-	11.4	0.4	1.7	29.0
" "	1"	2.0	35.0	10.5	-	23.6	0.7	0.8	72.6
" "	1/4"	1.5	27.0	13.3	-	11.6	0.8	6.6	60.8
" "	1 1/2"	3.3	38.0	17.7	-	5.5	2.2	11.1	77.0
" "	2"	3.0	45.0	25.4	192.5	15.9	-	19.2	301.0
" "	2 1/2"	3.6	-	-	-	-	-	-	3.6
" "	3"	2.6	-	15.1	174.7	-	-	-	192.4
" "	4"	4.8	-	-	314.4	-	-	-	319.2
" "	5"	-	-	-	-	-	-	-	-
" "	6"	4.8	-	-	-	-	-	-	4.8
" "	7"	-	-	-	-	-	-	-	-
" "	8"	7.0	-	-	-	-	-	-	7.0
		34.0	160.0	85.9	681.6	72.7	4.4	40.3	1079.9

SOURCE : Official demand data from various Gouvernemnt departments.

- Working days have been assumed to be 240 days/year (1)

- Working hours: uPVC extrusion process is by definition a continuous process and it should always work on 3 shifts.
  Working on one or two shifts means a considerable decrease in productivity: at the end of shift the extruder heads must be disassembled and thoroughly cleaned, at start up, time is spent to heat the extruder before production is resumed, the relevant scrap produced etc.).

  Therefore it is definitely suggested for the uPVC extrusion line to operate on 3 shifts.

  For diameters larger than 63 mm, out of the 24 hours/day we have assumed only 21.5 available hours/day, the balance is used for changes of the head. For diameters lower than 63 mm. the available time is slightly higher to 22 hours/day.(2)

- Theoretical annual output capacity.

  Assuming the ratio of pipes larger than 63 mm towards smaller ones to be 80% to 20% the deriving theoretical output capacity is as follows:

  - For diameters 63 mm or larger: 300 kg/h . 21.5 h . 240 days . 0.80 = 1,238 Tons.

  - For smaller diameters: 100 kg/h . 22 h . 240 days . 0.20 = 105 Tons.

  Total theoretical output 1,343 tons.

(1) Source : Ministry of N° 1 Industry
(2) Source : Baldo & C. estimates from actual operating data in similar plants.

- Actual annual uPVC output

  A plant efficiency of 0.70 for maintenance, failures, black-outs etc. (1) brings the Actual Output to:

  Total actual uPVC output : 940 tons/year.

HOPE EXTRUSION LINE

Considerations are similar to the ones previously indicated for uPVC extruder. The extruder that better fits with the requirements has a single screw with 90 mm diameter. Theoretical outputs for the various diameters (pressure class PN10) are as follows:.

diameter 20 mm at speed 15 mt/min	108 Kg/h
diameter 25 mm at speed 15 mt/min	153 Kg/h
diameter 32 mm at speed 14 mt/min	235 Kg/h
diameter larger than 32 mm	250 Kg/h

Application forecast uses 50% of weight in pipes with 32 mm or lower, the remaining 50% in larger ones (2). Therefore we have assumed that 50% of the time the extruder will have an output of 250 Kg/h and 60% at 150 Kg/hour.

- Working days

- Working hours: HOPE extrusion is more flexible than for PVC as far as "continuity" is concerned. In fact extruder can stop operation without the need of removing the head and cleaning it. It could therefore operate on two shifts. Three shifts could be attained if needed. On a two shift basis we considered 14 hours available production time to take into consideration the starting up operations, the changes of production etc.

- Theoretical annual output capacity

  . for pipes 40 mm or larger 250 Kg/h x 14 h x 240 days x 0.5 = 420 Tons;
  . for pipes less than 40 mm 150 Kg/h x 14 h x 240 days x 0.5 = 252 Tons.

  Total theoretical output : 672 Tons

(1) Source: Baldo & C. estimates from actual productivity information from similar plants in Europe where average productivity is 75 - 80%. The lower value considered for Burma takes into account the more frequent changes of production (for various applications) the blackouts, and is considered conservative.
(2) Source: Baldo & C. evaluation

- Actual annual output capacity

  Considering an efficiency of the plant of 0.70, then:

  Total actual HDPE output: 470 tons/year.

The above stated outputs will be attained when the demonstration unit will be at full production.

During the first years the personnel has to be trained, and several trials to be carried out. Considerable time has to be spent in experiments and in testing with the cooperation of involved IDWSSD executing agencies to get the production approved.

3.2.1.4 Production capacity during first years:

Therefore the actual output has been assumed to grow by step as follows (1):

First year:	PVC	50% of max output	=	470 Tons
	HDPE	70% of max output	=	329 Tons
				799 Tons
Second year:	PVC	75% of max output	=	705 Tons
	HDPE	90% of max output	=	423 Tons
				1,128 Tons
Third year & following:	PVC	100% of max output	=	940 Tons
	HDPE	100% of max output	=	470 Tons
				1,410 Tons

(1) Source: Baldo & C. estimates. The difference between productivity for PVC and HDPE is based on our experience in similar plants in Europe.

3.2.1.5 Selling prices for plastic pipes

uPVC

- The present international prices for pressure pipes made of uPVC is in the range of 1.30 - 1.38 us $/kg FOB port.
- The Construction Corporation imports uPVC pipes for water at an average price of 1.40 US $/ kg FOB port.
- The Trade Corporation sells PVC pipes at an average of 2.34 $/kg. This price is however multiplied by three or four on the black market due to lack of product.
- Freight charges
  . from Europe to Rangoon 240 $/ton or /cu.m
  . from Korea to Rangoon 150-170 $ or /cu.m
  . from Japan to Rangoon 120 - 140 or /cu.m
  . from Singapore to Rangoon 80 $/ton or /cu.m
  . from Thailand to Rangoon 110 $/ton or /cu.m
  Average: 150 $/ton or /cu. m

For pipes applicable unit rates are fixed per cu.m. The average cost per ton may reach 3 to 4 times the above cost due to the low density volume.
Assuming an average value of 150 $/cu.m the unit charge per Kg is 150*3 = 450 $/ton = 0.45 US/$/kg.

The cost per kg of a uPVC pipe, delivered CIF Rangoon, and customs cleared is the following:

- average int. price	1.34 US $/kg
- freight	0.45 US $/kg
	1.75 US $/kg
Custom duty : 20% on CIF price	0.35 US $/kg
	2.10 US $/kg

International executing agencies importing pipes directly and other appliances are customs duty exempted. It is worth to mention that international Agencies, as already practiced in several other countries, are generally ready to pay up to 15% more for locally produced pipes (1).

For calculation's sake we have fixed the selling price of uPVC pipes at 1.8 US $/kg, equivalent to 13.05 Kiats (2).

(1) Source: Statement of UNICEF officials to Baldo & C. Team.

(2) Source: Ratio 1 US $ = 7.25 Kiats (Source: Ministry of No. 1 Industry).

At this price level uPVC pipes, particularly large diameters ones, are extremely competitive against Galvanized Iron pipes.

The price difference is quickly shown in the following comparison (1):

Diameter (")	G.I. (K/mt)	PVC (K/mt)
1/2	3.32	1.85
3/4	4.7	2.08
1	5.56	3.16
1 1/4	8.30	3.85
1 1/2	10.46	5.15
2	13.20	8.01

<u>HDPE</u>

- The present international average price for HDPE pipes is the range of 1.85 $/Kg FOB port delivered.

- UNICEF is importing HDPE pipes at an average price of 1.82 $/kg FOB port (but prices are old).

- The transport cost is lower than the cost for uPVC because HDPE pipes are usually, (up to 110 mm diameter pipe), shipped in coils .

  In the case of HDPE to convert the freight charges per cu. m in unit rates per kg, it should be more than doubled, that is approx. 0.3 $/kg.

The build up of cost for HDPE pipes in Burma will therefore be:

- international price	1.85 US $ /kg
- freight	0.3
	2.15
- customs duty 20%	0.43
	2.58

Executing agencies and donors do not pay customs duty but are ready to pay premium for locally produced pipes (up to 15%).

For calculation's sake a price of 2.25 $/kg HDPE, equivalent to 16.31 K/kg has been fixed. This price should presumably encourage the use of a material not yet well known in Burma, the advantages of which are quite interesting.

(1) Source: data provided by Construction Corporation.

3.2.1.6 Sales Revenues for plastic pipes

PVC : price 1.8 $/kg (13.05 k/kg)
HDPE : price 2.25 $/kg (16.31 K/kg)

First year	: 429 tons PVC (1)	772,000 $
	329 tons HDPE (2)	740,250 $
		total	1,512,250 $
Second year	655 tons PVC (1)	1,179,000 $
	423 tons HDPE (2)	951,750 $
		total	2,130,750 $
Third year & following	881 tons PVC (1)	1,585,800 $
	470 tons HDPE (2)	1,057,500 $
		total	2,643,300 $

3.2.1.7 Distribution system and selling channels

As far as Burma market is concerned, the following selling channels have been identified:

- Agencies involved in IDWSSD and sanitation programs
- Construction corporation for its construction program
- Trade corporation for retail distribution

Pipes are delivered ex-works and transportation is organized by the buyer or by the commercial department of the Pharmaceutical Corporation,(Ministry of No. 1 Industry Agency with responsibility of the plastics processing industry).

(1) A part of the pipe production will be used to produce PVC tube well casings and screens.

(2) Only HDPE pressure pipes have been considered

3.2.2. Plastic casing for tube wells

It has been seen that the trend is toward the use of uPVC to produce casings and screens for tube wells to replace heavier and more expensive galvanized iron.

The following table no. 3.16 shows the most commonly used diameters for well casings and the equivalent type of pipe produced by the new demonstration unit as well as the relevant weight.

TABLE 3.16

TUBE CASING SIZE (inches)	PROPOSED PIPE SIZE AND PRESSURE CLASS (mm)	WEIGHT Kg/mt
2	63 - Special, 7 mm thickness	1.90
4	110, PN16	3.98
6	160, PN10	5.50
8	250, PN6	8.42
10	-	
12	-	

3.2.2.1 Production program for plastic casings

To calculate the production mix the following considerations have been made:

- The total amount of uPVC casings needed every year for IDWSS programs is approximately 90 Tons for the period 1991-2000.

- Total amount of uPVC casings needed every year for the irrigation programs is 25 Tons/year should the underground water schemes be duplicated in future.

- Total amount of uPVC casings for the Construction Corporation is in the range of 24 tons/year.

- The new demonstration unit can produce uPVC casings up to the equivalent of 8" diameter.

- The uPVC casings and screens for tube wells are produced from normal uPVC pipes by using socketing, threading and sleeving machines that have been foreseen for this demonstration unit.

- The range of application that can be covered by the well casings produced in the plant are estimated to be at least 85% of the total (tube wells with casing of 10 or 12 inch diameter are relatively few in number.

- The installed equipment can easily satisfy the required demand of casings.

- The new demonstration unit has been sized to produce uPVC casings covering 50% of the forecast annual demand (taking into consideration that galvanized iron will still be used for several schemes).

  The output will therefore be 59 Tons/year.

The uPVC pipes produced can be simply stored and threaded and/or sleeved according to needs and according to specifications.

The production of uPVC casings will start the first year of operation of the plant and will be the following.

First year	:	70% = 41.3 Tons - 3% to take into account training of personnel, scrap etc. = 40 Tons
Second year	:	85% = 50 Tons
Third year & following	:	100% = 59 Tons

3.2.2.2 Selling price for uPVC Tube well casing

The uPVC casings are presently imported at the following prices.

TABLE 3.17

DIAMETER (inches)	PRICE FOB (1) ($/mt)	PRICE/Kg for equivalent FOB sizes in mm ($/Kg)
4	4.8	1.21
6	9.5	1.72
8	14.3	1.63

The price of the 4" casings and screens is not in line with both the international market and the import price of casings of other diameters. We deem anyway that these figures may be increased by approximately 50%. Still they were taken for calculation purposes to stay on the conservative side.

(1) Source: Construction Corporation and UNICEF - Values have been increased by 35% to take into account present value of US Dollar.

The CIF imported prices, customs cleared are:

FOB Price	1.70 $/Kg
freight	0.45 $/Kg

Customs duty 20%	2.15 $/Kg
	0.43 $/Kg

.	2.58 $/Kg

The executing agencies would not pay customs duty. They are prepared to pay a premium in favor of local products as high as 15% above the CIF value.

Therefore an average price of 2.4 $/Kg has been taken into consideration.

3.2.2.3 Annual Sales revenues for uPVC tube well casings

First year	: 40 Tons	. 2.4 $/Kg	=	96,000 $
Second year	: 50 Tons	. 2.4 $/Kg	=	120,000 $
Third and following year:	59 Tons	. 2.4 $/Kg	=	141,600 $

3.2.3 Lat Pans and related accessories

A latrine set presently used in the widespread sanitation program under execution by the Environmental Sanitation Division of the Ministry of Health, consists of (see enclosed drawing):

- 1 latrine pan made of HDPE, weight 730 grs
- 1 elbow, HDPE
- 1 meter long extruded pipe, 3" diameter, 3 mm wall thickness.

3.2.3.1 Production program

The latrine pans are produced by injection moulding (see paragraph 6.2.1.3 for technology selection). In the next four years 650,000 new units will be installed (165,000 units per year) while the annual demand for the decade 1991 - 2000 is on the order of 300,000 units/year.

The mould size and the weight of the item to be produce requires the use of quite a large injection moulding machine.

The machine time for the moulding of one pan is 60 seconds approximately. The latrine pan weights 750 g of HDPE injection grade, including feedheads.

To produce 150,000 latrine pans/year the machine has to work at least 2,500 hours/year.
A factor of 0.90 has been taken into consideration on the basis of previous working experience in similar plants to consider mould changes, maintenance, defective production etc. Therefore the actual production hours devoted to the latrine pan production becomes 2,750.
The first year's production program is foreseen as follows:

First year	:	70%	=	105,000 sets
Second year	:	90%	=	135,000 sets
Third and following year:		100%	=	150,000 sets

The 1 mt long pipe that is an integral part of the latrine set could be extruded on the same HDPE extruder from low density Polyethylene or from High Density Polyethylene or elsewise it could be made by uPVC.

It is suggested that uPVC be used for the following reasons:

- PVC and scrap PVC from pipe extrusion which cannot be used again for pressure pipes may be used for this kind of pipe with cost savings.

- uPVC is suited for this application, the only limitation is that large quantities of boiling water should not be poured into the latrine.

- It can be extruded in the No. 2 Plastic Factory where old but still suitable extrusion lines are available. The factory also belongs to the Pharmaceutical Corporation and cooperation can be smooth.

The weight of 1 mt uPVC pipes, 80 mm (3") diameter and 3 mm thick is 1.05 kg.
The amount of pipes needed according to the production program is:

First year	:	70 %	105,000 meters	110 Tons
Second year	:	90%	135,000 meters	142 Tons
Third year and following	:	100%	150,000 meters	157 Tons.

Elbows will be produced by injection moulding. Elbows may be different in shape depending on the application.

They will be produced on the same injection moulding machine by using a three pattern mould. Fourty seconds per shot have been considered and therefore a total of 555 hours will be needed. This figure has been increased to 700 hours to take into consideration the relatively more difficult operations if compared to those for pan moulding.

3.2.3.2 Selling price

The sets now used are imported from Malaysia at the prices of 10.7 Malaysian Riuggit corresponding to 4.18 US $. The present import cost is:

Purchasing price FOB	4.18 US $
Freight for pan	0.07 US $
freight for pipe (1) and elbow	0.21 US $
	4.46 US $

The program is sponsored by International agencies therefore no customs duty has to be paid. Considering also that the above mentioned financing agencies (mainly UNICEF) are ready to pay a premium of up to 15% for local products the selling ex-works factory price can be set at between 4.5 and 5 US $/set. To be conservative a price of 4.5 US $/set is chosen.

3.2.3.3 Revenues

Revenues originated by latrine pan sets sale are:

First year	:	472,500 US $
Second year	:	607,500 US $
Third year	:	675,000 US $

3.2.4 <u>uPVC fittings</u>

Unlike HDPE, uPVC pipe networks need fittings produced by injection molding.

On the other hand, the "new demonstration unit" should provide a "comprehensive package" to the customer to better test the market and to improve the chances of increasing the use of plastic materials among customers.

The following types have been considered essential for local production because they are the most commonly used.

(1) Source : Freight considered from Singapore. Elbow accounts for 1/4 of pipe

TABLE 3.18

TYPE OF FITTING	DIAMETER (mm)	WEIGHT (Kg)
DOUBLE SOCKETED ELBOW	20	0.018
" " "	25	0.032
TEES SOCKETED AT THREE ENDS	25	0.044
" " " "	32	0.068

For all the above pressure class is NP 16

These fittings can be produced by the same injection moulding machine used to produce latrine pans whose production capacity is not yet saturated. (1)

The number of theoretical hours still available is 2,300 h Considering that the productivity of the injection moulding machine on a four pattern mould (as the one foreseen for the fittings) is about 25 seconds per shot, the maximum theoretical production in the 2,300 hours available would be 53.6 tons. A factor of 0.7 has been considered because the size of the pieces is smaller and there may be more problems of maintenance, corrosion of moulds, higher viscosity of uPVC etc.

Actual production becomes 37.5 tons. The demand for fittings of different shapes or in larger quantity will be satisfied with conventional fittings, until mould making will be possible and a new moulding machine purchased.

3.2.4.1 Production program

First year	:	60%	22.5 Tons
Second year	:	80%	30 Tons
Third year and following	:	100%	37.5 Tons

(1) Latrine pan production 2750 hours + latrine fittings 700 h = 3,450 h out of 240 x 24 = 5,760 hours theoretical maximum working hours.

3.2.4.2 Selling price

The international price of uPVC fittings of the size produced in the new demonstration unit is in the range of 2.7 $/kg.
Its price in Burma would be:

Import price FOB	2.7 $/kg
freight	0.15 $/kg

	2.85 $/kg

Comparison with presently used fitting prices is difficult because most of the fittings used are made of galvanized iron that are much more expensive. An average price of 3 $/kg has been considered to be conservative.

3.2.4.3 Revenues

First year	:	22.5 Tons . 3 $/kg =	67,500 $
Second year	:	30 Tons . 3 $/kg =	90,000 $
Third year	:	37.5 Tons . 3$/kg =	112,500 $

3.2.5 Total revenues for the unit

TABLE - 3.19

PRODUCT/YEAR	1st/year $	2nd/year $	3rd & following $
PIPES	1,512,250 $	2,130,750 $	2,643,300 $
TUBE WELL CASING	96,000 $	120,000 $	141,000 $
LATRINE PANS	462,500 $	607,500 $	675,000 $
PVC FITTINGS	67,500 $	90,000 $	112,500 $
TOTAL ($)	2,148,250 $	2,948,250 $	3,571,800 $

4. MATERIALS AND INPUTS

4.1 QUALITATIVE SPECIFICATIONS OF FEEDSTOCK RESINS AND OTHER MATERIALS.

4.1.1 PVC for pipe extrusion

PVC suspension type, K value 65 - 70 used for pipes extrusion should have the following average properties:

TABLE - 4.1

PROPERTY	UNIT	VALUE	STANDARD USED
K value		65-70	DIN 53726
Viscosity index	cu.cm/gr.	116	DIN 53726 ISO 174
Density, apparent	gr/cu.cm	0.56	DIN 53468 ISO 60
Sulphate ashes	%	≤0.1	DIN 53568,T2ISO12708
Volatile comp.	%	≤0.3	DIN 53198 ISO 1269
Max granulometry	μm	300	
Most frequent granulometry	μm	100	
Chlorine content	%	52	DIN 53474 ISO 1158
Vicat softening temp.	°C	82	DIN 53460 ISO 306

4.1.2 High Density Polyethylene for extrusion

HDPE used for pipe extrusion should be HDPE in pellets extrusion grade, black, and have the following major properties.

TABLE - 4.2

PROPERTY	UNIT	VALUE	STANDARD USED
Density	gr/cu.cm	0.954	DIN 534479
Specific Viscosity	dl/gr	4	ISO/R 1191
Melt index MFI190/	g/10 min	0.3	DIN 53735
Tensile stress at yield	N/sq.mm	24	DIN53455 ISO/R527
Tensile Stress at breack	N/sq.mm	35	" "
Percentation elongation at break	%	>800	" "
Ball indentation hardness	N/sq.mm	37	DIN 53456E
Cristallytes melting point	°C	127-131	
Linear thermal expansion coefficient between 20 & 90°C	K -1	2.10 -4	DIN 52328
Thermal conductivity at 20°C	Kcal/m.h.grd	0.37	
Volume resistivity	Ω cm	$>10^{18}$	DIN 53482
Surface resistance	Ω	$>10^{13}$	
Dielectric strength	KV/cm	800	

4.1.3 High Density Polyethylene for injection moulding

It should be HDPE injection grade, white and have characteristics equal or similar to the following ones:

TABLE - 4.3

PROPERTY	UNIT	VALUE	STANDARD USED
Viscosity Number J	cm3/g	360	ISO/R 1191
Average Molecular weight	-	157,000	Solution Viscosity
Melt Flow Index	-	-	ISO/R 1133
MFI 190/2	g/10 min	0.1	Procedure 4
MFI 190/5	g/10 min	0.45	Procedure 5
Melting Range	°C	127-131	Polarization microscope
Density at 23°C (Bulk factor)	g/cm3	0.957**	ISO/R1183
Tensile Stress at Yield	N/mm2	24	ISO/R 527
Tensile Stress at Break	N/mm2	20	Speed D Test
Percentage Elongat. at break	%	600	specimen acc. to figure 1
Ball indentation Hardness	N/mm2	43	ISO 2039 (H358/30)
Modulus of elasticity	N/mm2	1200	ISO 178
Shear Modulus (Torsion pendulum test)	N/mm2	600	ISO/R537 Method A
Vicat Softening Temperature			ISO 306
(VST/A/50)	°C	124	
(VST/B/50)	°C	74	

To be continued

TABLE - 4.3 (Cont.)

PROPERTY	UNIT	VALUE	STANDARD USED
Deflection temp. under load	°C °C	44 75	ISO 75 Method A Method B
Thermal conductivity	W/mK	0.42	-
Coefficient of Thermal Expansion	K-1	2x10-4	-
Specific Heat	kJ/kgK	1.7	-
Water Absorption	mg/4d	2	ISO/R 62 Test specimen, 50 x 50 x 3 mm
Stress Cracking Resistance	h	>1000	-
Volume Resistivity	Ω cm.	$>10^{18}$	IEC Publ.93
Surface Resistance	Ω	$>10^{14}$	IEC Publ.93
Relative Permittivity 50 Hz	-	2.5	IEC Publ. 250
Dissipation factor 50 Hz	-	>5x10-4	IEC Publ. 250
Dielectric Strength	kV/mm	70	IEC Publ. 243
Tracking index	KC	>600	IEC Publ. 112

** Density without addition of carbon black

4.1.4 PVC for injection moulding

PVC suspension type, K value 55 - 60

4.1.5 Additives

Additives are needed for PVC extrusion and moulding processes. By additives we mean stabilizers, pigment and fillers.

PVC polymers cannot be processed without stabilizers.

During processing, they prevent damage due to oxidation and the HCl exhaled. During use they improve pipe standing to heat and light.

For the production of uPVC pipes, one pack lead stabilizer is suggested. It is easily available from different sources.

A typical composition of this kind of lead stabilizer includes:

	phr (parts per hundreds resins)
- Lead phosphite or phosphite sulfate	3-5
- Lead stereate	up to 1.5
- UV absorber	0.2 - 0.5

- The filler is usually calcium carbonate, finely groundored or chemically obtained. It prevents the formation of scale during the extrusion.
- Pigment is added to provide the required color to pipes.

As far as the filler is concerned, the use of one pack lead stabilizer is suggested instead that the mixing of the various ingredients above mentioned for the following main reasons:

- one pack lead stabilizers are available easily on the international market and its price is only 5-7% higher than the purchase of the single ingredients;
- purchasing storing and handling of a single component (the one pack stab.) is easier than for several ingredients;

- the mixing of the ingredients should take place under severe safety control because of the use of lead that is extremely harmful for the operators (the main producers of one pack stabilizers have completely computer controlled automatic weighting and mixing systems to produce the stabilizer in granules and not under powder form, to decrease possible contamination during its use.

In any case, if deemed necessary, the new demonstration unit can produce the stabilizer within the plant by using the following equipment:

- high accuracy scale
- containers
- slow speed mixer, completely dust proof

The estimated investment is in the range of 15-20,000 US$

4.2 CONSUMPTION COEFFICIENTS

4.2.1 uPVC Pipes

The weight per meter of uPVC pipe according to pressure class is provided in the following table 4.4

TABLE 4.4 UPVC PRESSURE PIPE WITH CEMENT SEALED SOCKET - WEIGHT/METER

OUTER DIAM. mm	PN6			PN10			PN16		
	THICKNESS mm	INNER DIAM.	WEIGHT Kg/m	THICKNESS mm	INNER DIAM.	WEIGHT Kg/m	THICKNESS mm	INNER DIAM.	WEIGHT Kg/m
20									
25				1.6	21.8	0.190	1.9	21.2	0.217
32				1.6	28.8	0.267	2.4	27.2	0.343
40	1.8	36.4	0.338	2.0	36.0	0.370	3.0	34.0	0.542
50	1.8	46.4	0.428	2.4	45.2	0.549	3.7	42.6	0.820
63	1.9	59.2	0.568	3.0	57.0	0.865	4.7	53.6	1.305
90	2.7	84.6	1.164	4.3	81.4	1.758	6.7	76.6	2.641
110	3.2	103.6	1.662	5.3	99.4	2.637	8.2	93.6	3.980
125	3.7	117.6	2.158	6.0	113.0	3.384	9.3	106.4	5.096
160	4.7	150.6	3.455	7.7	144.6	5.500	11.9	136.2	8.279
250	7.3	235.4	8.422	11.9	226.2	13.335			

The uPVC blend for extrusion has the following composition (amount needed to make 1 TON of mixture).

- PVC suspension	950 Kg
- One pack lead stabilizer	28 Kg
- Pigment	2.8 Kg
- Calcium carbonate	19 Kg

To produce 1 ton of uPVC pipes the above quantities of raw materials should be increased by 7% due to cast off in production.
The composition becomes:

- PVC suspension	1,021 Kg
- One pack lead stabilizer	30.1 Kg
- Pigment	3 Kg
- Calcium carbonate	20.4 Kg

The 7% cast off production is splitted as follows:

2% is thrown away as waste (from head cleaning etc).
5% is scrap that can be used again for conduits or exhaust pipe and other non-pressure pipe applications.

(1) Data obtained from actual operation in similar plants.

Therefore the following quantity of raw materials is needed to produce the uPVC pipes foreseen by the production program:

First Year :	470 Tons PVC pipes require:	
	480	Tons PVC K68
	14 15	Tons stabilizer
	1.41	Tons Pigment
	9.59	Tons Calcium Carbonate
Second year:	705 Tons PVC pipes require:	
	720	Tons PVC K68
	21.22	Tons stabilizer
	2.21	Tons pigment
	14.38	Tons Calcium Carbonate
Third year & following:	960	Tons PVC K68
	28.3	Tons Stabilizer
	2.83	Tons pigment
	19.18	Tons Calcium Carbonate

4.2.2 HDPE pipes

The weight per meter of HDPE pipes according to pressure class is provided in the following table 4.5

TABLE 4.5
HDPE PRESSURE PIPE - WEIGHT/METER

OUTER DIAMETER	PN6		PN10		PN16	
	THICKNESS mm	WEIGHT Kg/m	THICKNESS mm	WEIGHT Kg/m	THICKNESS mm	WEIGHT Kg/m
20	--	--	1.9	0.107	2.8	0.151
25	1.6	0.117	2.3	0.164	3.5	0.236
32	1.9	0.179	3.0	0.273	4.5	0.388
40	2.3	0.272	3.7	0.421	5.6	0.604
50	2.9	0.428	4.6	0.654	6.9	0.932
63	3.5	0.670	5.8	1.040	8.7	1.480
90	5.1	1.357	8.2	2.102	12.4	3.016

HDPE pellets being the raw material and no additives being required, the production of 1 TON HDPE pipe requires the use of 1.02 Tons HDPE granules.
The 2% difference (1) is due to scrap that cannot be ground and used again. Therefore the following quantity of raw material is needed to produce the HDPE pipes foreseen by the production program:

<u>First year</u> : 329 tons of HDPE pipes require:

335.6 tons pellets

<u>Second year</u> : 423 tons of HDPE pipes require:

431.5 tons pellets

<u>Third year & following</u> : 470 tons of HDPE pipes require:

479.4 tons pellets

4.2.3 <u>Latrine pans and accessories</u>

Both latrine pan and elbow are injection molded. The material used in this case is HDPE pellets, injection grade. One latrine pan set requires:

- latrine pan	730 grs
- elbow	300 grs

	1,030 grs

The actual amount of pellets needed for the production of each set is 1,040 considering 1% as thrown away waste. (1)

Therefore, the following amount of material is needed to produce latrine pans foreseen by the production program:

First year	:	105,000 sets = 109.2 tons HDPE pellets
Second year	:	135,000 sets = 140.4 tons HDPE pellets
Third year	:	150,000 sets = 156 tons HDPE pellets

(1) Data obtained from actual operation in Similar plants

4.2.4 PVC Fittings

PVC fittings are produced by injection moulding; the preparation of 1 ton blend for PVC fitting production requires the following raw materials:

PVC suspension	954.2 Kg
One pack lead stabilizer	42.9 Kg
Pigment	2.86 Kg

An increase of 2% for thrown away waste should be considered.

Therefore the following amount aw material is needed to produce the PVC fittings foreseen by the production program:

First year : The production of 22.5 tons PVC fittings requires:

21.9 tons PVC K55
0. 985 tons Stabilizer
0.0.65 tons Pigment

Second year : The production of 30 fittings requires:

29.2 tons PVC K55
1.3 tons Stabilizer
0.087 tons Pigment

Third year and following: The production of 37.5 tons fittings requires:

36.5 tons PVC K55
1.64 tons Stabilizer
0.11 tons pigment

4.2.5 Factory Supplies

No significant factory supplies needed but lubricants, packing materials and marking tapes. In addition chemicals for laboratory are needed.

4.2.6 Total requirements for raw materials

TABLE - 4.6

	1st OPER. YEAR (Tons)	2nd OPER. YEAR (Tons)	3rd OPER. YEAR (Tons)
PVC suspension for extrusion K68	490	720	960
PVC suspension for injection K55	21.9	29.2	36.52
One lead pack stabilizer	15.13	22.52	29.94
Calcium Carbonate	9.59	14.38	19.18
Pigment	1.47	2.21	2.94
HDPE extrusion grade	335.6	431.5	479.4
HDPE injection grade	109.2	140.4	156

4.3 SOURCE OF SUPPLY

Raw materials and other supplies can be available from several potential suppliers; some, but few, are listed below.

HDPE pellets

- BXL British Cellophane Ltd. - Twickenham Mddx. - G.B.
- Cabot Corporation, Boston, Mass - U.S.
- Shell International Petroleum Co. Ltd - London SE1 7NA G.B.
- Pennekamp+Huesker KG - 4426 Vreden - DE
- Chemplex Co. - Rolling Meadows, Ill - U.S.
- Plast Labor SA - 1630 Bulle - CH
- Ondelwald-Chemie GMBH - 6901 Schönau - DE
- A & E Schmeing - Kirchhundem - Würdinghausen - DE
- Deutsche Kapillar - Plastik GmbH & Co. - KG, 3563 Dautphetal, DE
- Dr. F. Diehl & Co. - 7758 Daisendorf, DE
- Arco Chemical Co. Pittsburgh, PA, US
- Egeplast, Werner Strumann GmbH & Co., 4407 Emsdetten/W. DE
- Solvay & Cie, 1050 Bruxelles, BE
- Monmouth Plastics Inc. Asbury Park, NY 07712, U.S.
- Enichem Polimeri, S.p.A., Milano IT
- N.V. Erta, 8880 Tielt, BE
- Wilson-Fiberfil International Evansville, IN 47732, US
- Tenneco Chemicals Inc. Piscataway, NJ 08854 US
- Fina SA International, Polymer Dept. 1040 Brussels, BE
- Soltex Polymer Corp. - Houston, TX 77027, US
- Haka, Gossau SG, CH
- Allied Fibers & Plastics Corporation Morristown, NJ 07960 - US
- Kemijska Industria Pancevo („HIP'') RO Petrohemija - 26000 Pancevo - YU
- Mitsui Petrochemical Industries Ltd. Tokyo, JP
- Gulf Oil Co. Houston, TX 77001, US
- Nissan Chemical Industries, Ltd. Tokyo, JP
- Courtaulds Acetate Ltd. Spondon, Derby, G.B
- Hoechst AG - 6230 Frankfurt/M.80, DE
- Igoplast Faigle AG, 9434 AU, CH
- Exxon Chemical Co.- Houston TX 77001, US
- Chemapol, Prag 10, CS
- Phillips, Petroleum Chemical & Co. Overijse, BE
- J.T. Ryerson & Son Inc. Chicago, IL 60608 - US
- Rhône-Poulenc Polymeres - Courbevoie, FR
- Oy Nokia AB - Helsinki, Lapinlahdenkatu, FI
- Mitsubishi Chemical Industries, Ltd. Tokyo, JP
- Paraisten Kalkki Oy 21600 Parainen, FI
- USI Chemicals - New York, NY 10016, US
- Porvair P.L.C. King's Lynn, GB
- Polypenco GmbH - 50 Bergisch-Gladbach, DE

- Röchling Haren KG Haren/Ems 1, DE
- BP Chemicals International Ltd. London SW1WOSU, GB
- E.I. Du Pont de Nemours & Co. Wilmington, DE 19898 US
- Showa Denko K.K. Tokyo, JP
- Soltex Polymer, Houston, TX 77027, US
- LNP Corp. Malvern, PA 19355, US
- The Nisseki Plastic Chemical Co. Ltd. Tokyo, JP
- Sumitomo Chemical Co. Ltd. Tokyo, JP
- Asahi Chemical Industry Co. Tokyo, JP
- Arco/Polymer, Inc. Philadelphia, PA, US
- Est G. Convert, 01100 Oyonnax, FR
- Polypenco GmbH 5070 Bergisch Gladbach, DE
- Spiratex Comp. Dearborn, MI 48124, US
- Asho-Upo Oy, Nastola, FI
- Van Leer Plastics Inc., Woburn 01888, US
- Winzen International Inc. Minneapolis, MN 55420 US

PVC SUSPENSION

- Abu-plast GmbH, Rödental, DE
- Airex A.G. 5643 Sins, CH
- La Celle-Saint Cloud, FR
- Rhône-Poulenc-Films, La Cellophane Paris Cedex 08, FR
- Ross & Roberts, Inc. Stradford, CT 06497, US
- Dynamit Nobel AG - 5210 Troisdorf, DE
- J.H. Benecke GmbH - 3000 Hannover 1, DE
- Solvay & Cie, 1050 Bruxelles, BE
- Draka-Plast GmbH - 1000 Berlin 51, DE
- Antonios Drakopoulos S.A. Athen, Griechenland
- Shell International Petroleum Co. Ltd London SE17NA GB
- Cryovac Div. W.R. Grace & Co. Duncan, SC 29334, US
- ICI Ltd. Welwyn Garden City, Herts. AL71HD, GB
- VEB Eilenburg Chemie-Werk 7280 Eilenburg, DD
- Röhm GmbH, 6100 Darmstadt, DE
- TBA Industrial Products Ltd. Rochdale, Lancs., GB
- Durette-Kunststoff GmbH & Co. KG 5160 Düren, DE
- Ernst Frölich GmbH - 3360 Osterode am Hartz, DE
- PCUK, 92400 Courbevoie, FR
- Ethyl Corp. Polymer Div. Baton Ronge, LA 70808 US
- Montedison S.p.A. 20121 Milano, IT
- Everlight A/S, Skaevinge, DK
- Alfred Schwartz GmbH & Co. 5063 Overath-Untereschbach, DE.
- Gurit-Worbla AG - 3063 Ittigen-Bern, CH
- Mitsubishi Plastic Industries Ltd. - Tokyo, JP
- Hoechst, AG - 6230 Frankfurt/M 80, DE
- Jugovinil -58212 Kastel Sucurac, YU
- Sonobat S.A., Battice, BE
- Pantasote, Inc. Passaic, NJ07055, US
- Union Carbide Corp. Danbury, CT 06817, US
- Kureha Chemical Industry Co. Ltd., Tokyo, JP
- Sondex AB, Malmö, SE
- Kunststoffwerk Voerde, 5823 Ennepetal 14, DE
- BASF Aktiengesellschaft 6700 Ludwigshafen, DE
- Uniroyal Inc. , New York, NY 10020, US

- Tenneco Chemicals, Nixon, NJ, US
- Nordchem S.P.A. 33035 Martignacco, Udine, IT
- Klöckner Pentaplast GmbH - 5430 Montabaur, DE
- Permali Gloucester Ltd., Gloucester, GB
- Hermann Wendt 6500 Mainz 25, DE
- Polva-Nederland NV 1600 AA Enkhuizen, NL
- Enichem Polimeri S.p.A., Milano - IT
- Rieber & Son A/S Nostegaden, Dänemark
- Röhrig & Co. Hannover 91, DE
- Chem. Kombinat, Borzesti, RO
- C.F. Roser GmbH, Stuttgart 30, DE
- Great American Chemical Co. - Fitchburg MA01420 US
- Karl Dickel & Co. 4100 Duisburg, DE
- Rias a.s., Oslo 7, NO
- UCB N.V. Division Sidac Films, Ghent 9000, BE
- Symalit AG, 5600 Luzenburg 1, CH
- Takiron Chemical Ltd., Osaka, JP
- Tehalit Kunststoffwerk GmbH 6751 Heltersberg, DE
- Tettovil SA, 3432 Lützelflüh, CH
- Rhovyl SA, Tronville en Barrois, FR
- Dynamit Nobel, AG 5210 Troisdorf, DE
- Asko-Upo Oy, Nastola, FI
- DSM, Heerlen, NL
- Chemische Werke Hüls AG 4370 Marl, DE
- Griffine Maréchal, 75008 Paris, FR
- Emil Keller AG 9220 Bischofszell/TG, CH
- Wacker-Chemie GmbH 8000 München 22, DE
- Plastic Coatings, Ltd. Melourne, Australien
- Gurit-Worbla AG 3063 Ittigen-Bern, CH
- Zell-Metall GmbH, 5710 Kaprun, AT

<u>Additives</u>

- One lead pack stabilizers

  - Akzo Chemie, Holland
  - Barlöcher, West Germany
  - Chemson Geselschaft für Polymer Additive, W. Germany
  - American Cyanamid, USA
  - Haagen, Holland

* Pigments

  - Holland Color, Holland
  - Bayer, West Germany
  - MONTEDISON, Italy

4.4 RAW MATERIAL PRICES

4.4.1 PVC

PVC suspension with K value 65-70 has to be imported.

The following are the FOB import prices in US $ paid in the past by the Plastic Industry (1).

TABLE - 4.7

YEAR	MIN ($)		MAX ($)	AVERAGE ($)
1977-78	520		633	576
1978-79	500	-	540	520
1979-80		640		640
1980-81	564		882	723
1981-82	480		583	531
1982-83	491		529	510
1983-84		480		480
1984-85	564		619	591
1985-86		577		577

The present international price (2) FOB North European port is 600 - 630 $/Ton to be increased by 10% because of the moderate order lots. The freight charge to CIF Rangoon is 240 $/ton.

Lower freight charges may be obtained if the supplier is in Asia. Experience shows however that European products are in several cases competitive or, at least at the same level of prices as the ones from South East Asia or Far East Asia.

(1) Source: Foreign Procurement Section: Pharmaceutical Industries Corporation.

(2) February 1987

Therefore the following purchasing price has been calculated for ONE TON of PVC.

FOB price	693.0 $	
Freight CIF	240.0 $	
Import Duty (20%)	186.0 $	
(1) Inland Transport	48.2 $	(350 Kiats/Ton)
(2) Handling (loading unloading)	2.7 $	(20 Kiats/Ton)

	1,170.0 $	

4.4.2 <u>High Density Polyethylene, extrusion grade</u>

There is no record of import of HDPE extrusion grade in Burma in the past.

The present international price of HDPE for pipe extrusion is in the range of 700 - 750 $/ton FOB to be increased by 10% approx. to take into account the relatively low batch orders.

Therefore the following purchase price has been calculated for one TON of HDPE, extrusion grade:

FOB price	825.8 $
Freight to CIF	240.0 $
Import duty	213.0 $
Inland Transport	48.2 $
Handling (loading unloading)	2.7 $

	1,329.7 $

4.4.3 <u>High density Polyethylene, injection grade</u>

TABLE - 4.8

YEAR	MIN	MAX	AVERAGE
1980-81	1,075	1,330	1,202
1981-82	960	1,365	1,162
1982-83	779	1,111	945
1983-84	787		787
1984-85	826	901	863
1985-86	653		653

(1) Source: Household Products Division, Pharmaceutical Industries Corporation. Inland transport figure is inclusive of clearance fee, port charges etc.

(2) Plastic factory n. 2

Present international price is in the range of 600 - 650 US $ FOB to be increased by 10%. The following purchasing price has been calculated for ONE TON of HDPE injection grade.

FOB price	715.0 $
Freight to CIF	240.0 $
Import duty	191.0 $
Inland transport	48.2 $
Handling (loading & unloading)	2.7 $

	1,196.9 $

4.4.4 <u>Additives and other supplies</u>

The following prices per Ton have been calculated on the basis of present international prices.

- <u>One pack lead stabilizer</u>

FOB price	2,700.0 $
Freight to CIF	240.0 $
Custom duty	588.0 $
Freight to factory	48.2 $
Handling	2.7 $

	3,579.0 $/TON

- <u>Pigment</u>

FOB price	1,900.0 $
Freight to CIF	240.0 $
Custom duty	428.0 $
Freight to factory	48.2 $
Handling	2.7 $

	2,619.0 $/TON

- <u>Calcium Carbonate</u>

FOB price	60.0 $
Freight to CIF	240.0 $
Custom duty	60.0 $
Freight to factory	48.2 $
Handling	2.7 $

	411.0 $/TON (1)

(1) the freight is very high for a relatively low value additive. Other sources other than Europe can be found and, if nearer, the high charges will decrease with consequent slight decrease of the production costs. Calcium Carbonate must be finely grinded, max concentration is Gauss curve between 10 and 15 microns.

- PVC pipes for latrine sets

These pipes can be produced in Factory N° 2 by using the PVC cast off by the new demonstration unit.
The Pharmaceutical Corporation controls all plastic factories and envisages, to transfer most of the production equipment from N° 2 plastic factory to the same site where the new demonstration unit will be located.

N° 2 Factory has two PVC extrusion lines perfectly suitable for the production of the pipe in headline, eventually adding a third working shift.

Latrine pipes have 80 mm diameter, 3 mm wall thickness and are cut in 1 m length. Their weight is 1.05 Kg/mt.

Plastic Factory N° 2 selling price for pressure pipes is in the range of 1.5 $/Kg. (1)

The quantity of scrap re-used after grinding to produce these pipes is as follows:

First year	23 tons out of 110 tons required
Second year	34 tons out of 141 tons required
Third year	46 tons out of 157 tons required

Considering the above ratios the purchase price (or transfer price) from Factory N° 2 of 1 mt long pipe is reduced proportionally as follows:

First year	1.2 $
Second Year	1.14 $
Third year	1.06 $

4.5 SUPPLY PROGRAM OF THE RAW MATERIALS, PROCESS MATERIALS AND SUPPLIES

4.5.1 Supply program

The survey of the plastic processing industry in Burma has shown that in average, six to eight months elapse from the moment the need arise (spare parts, raw materials etc), and, the very moment the required material/part is delivered to the factory (2).

(1) Note: The present selling price for PVC pipes 3" from the Plastic Factory N°.2 is 10.98 K/Kg or 1.52 $.

(2) Source: Visit to Plastic Factory N. 1
To obtain the maximum profitability from batch orders and at the same time to reduce stocks it is suggested that contracts for the supply of annual need to be tendered specifying for scheduled partial shipments (at least 4 shipments/year).

4.5.2 Raw material store

Assuming to have one month's rotating reserve plus additional incoming delivery covering 3 months, the raw material store should be sized to suit 4 months stock plus the necessary manoeuvring area for the fork-lift.

Resins are supplied in one ton pallet 1 x 1,2 m which may be piled in columns of three.

The net area required for a pick of 4 months stock pile of resins (500 tons approx.) is:

500 :(3 x 1,2 sq.m) = 166 sq. m

Considering other 150 sq.m for 20 tons of pigments, stabilizers, other additives, and spares the total net surface would be in the range of 330 sq.m

We considered a pathway of 30 x 3 meters for manoeuvring and handling.

The total storage area for raw materials is approx. 420 sq.m in the size range of the building for raw materials available at Hmawby.

4.6 SPECIFICATION OF QUALITY AND CONSUMPTION FIGURES FOR UTILITIES

Utility specifications are described in paragraph 6. Hereunder we detail the consumption needs.

4.6.1 Electric power consumption

PVC extrusion line

. Mixer: 40 kW x 4,029 h/year (1) = 161,160 kWh/year

(1) Considering batches of 100 Kg/each and blend time of 20 minutes. The theoretical output of PVC extruder 1,343/year is reduced by 10% to consider maintenance gives a total of 12,087 batches a year times 20 minutes equals 4,029 h/year.

. extruder (1):	105kw x 20 h x 240 gg	= 504,000 kwh/y
. socketing sleeving & threading machine:	10kw x 20 h x 240 gg	= 48,000 kwh/y
. uPVC grinder:	32kw x 5 h x 240 gg	= 38,000 kwh/y
		751,560 kwh/y

This is the total power consumption by PVC line. It corresponds to a consumption of approx. 800 kwh/TON of pipe produced.

<u>HDPE extrusion line</u>

. extruder (2)	105 kw x 13 h x 240 h	= 327,600 kwh/y
. grinder	15 kw x 3 h x 240 h	= 10 800 kwh/y
. drying hopper	10 kw x 13 h x 240 h	= 31,200 kwh/y
		369,600 kwh/y

The electric energy required per ton of HD[illegible] amounts to 790 kwh approximately.

<u>Injection moulding machine</u>

75 kw x 22 h x 240 days = 396,000 kwh

<u>Utilities and general purpose</u>

		h	days	
. water chiller :	50 kw x	24 x	240	= 288,000 kwh/y
. air compressor:	15 kw x	24 x	240	= 86,400 kwh/y
. water system pump :	10 kw x	24 x	240	= 57,600 kwh/y
. maintenance shop:	17.5 kw x	8 x	240:2	= 16,800 kwh/y
. laboratory:	5 kw x	8 x	240:2	= 4,800 kwh/y
. lighting:	15 kw x	16 x	240	= 57,600 kwh/y
. miscellaneous:				= 8,800 kwh/y
				520,000 kwh/y

(1) The 3 shifts are average effective 22 h/day taking into consideration changes of production, less 10% for maintenance black-outs etc. brings to 20/h day actual operation.)

(2) 13 hours/day actual operation taking into account maintenance, blacks-outs etc.

Total electric energy annual consumption

PVC line	751,560 kwh/y
HDPE line	369,600 kwh/y
Injection moulding	396,000 kwh/y
Utilities	520,000 kwh/y
	2,037,160 kwh/y
Rounded to:	2,000,000 kwh

4.6.2 Compressed air

A limited amount of compressed air is needed by the two extruders and the mixer for operation. Latrine pans and elbows molds have hydraulic movements. Compressed air is also distributed in various parts of the plant, namely in the laboratory area.

4.6.3 Cooling water

Water is supplied by a tube well. The analysis of the available water at Hmbawi plant shows that it is suitable for the purpose.
The chillers work in a closed loop system. Only make up water is needed.

4.7 EVALUATION OF THE COST OF MATERIAL AND INPUTS

The following costs have been taken into consideration: all prices are for material and input delivered at factory:

PVC suspension	1,170 $/ton	
One pack lead stabilizer	3,579 $/ton	
Pigment	2,619 $/ton	
Calcium Carbonate	411 $/ton	
HDPE, extrusion grade	1,329 $/ton	
HDPE, injection grade	1,132 $/ton	
Electric energy	1-200 kwh	0.29K (0.04 $)
	201-2000kwh	0.24k (0.033$)
	2001 and above	0.19k (0.026$)

The build up of direct production costs taking into account cost of materials and inputs is as follows.

4.7.1 uPVC pipes

- 1 Ton uPVC pipes:

1,021 Kg PVC suspension	x 1,170 $/ton	=	1194.50
30.1 Kg stabilizer	x 3,579 $/ton	=	107.70
3 Kg pigment	x 2,619 $/ton	=	7.85
20.4 Kg Calcium carbonate	x 411 $/ton	=	8.38
800 kwh x 0.026 $/kwh		=	20.80
			1339.00 $/T

4.7.2 uPVC tube well casings and screens

Nearly the same material and input cost as PVC pipes. In fact the only additional operation (sleeving etc.) requires only a very limited amount of energy.

4.7.3 HDPE pipes

- 1 Ton HDPE pipe:

1.020 Kg HDPE pellets	x 1,329 $/ton	= 1,355.60
790 kwh x 0.026 $		= 20.54

		1376.00 $

4.7.4 Latrine pans and accessories

- 1 set:

1.040 kg Hdpe pellets	x 1,196.9 $/ton	= 1.245
1 mt long PVC pipe		= 1.060
(1) 1.7 kwh x 0.026 $		= 0.055

		2.36 $

4.7.5 uPVC fittings

- 1 ton uPVC fittings:

973.7 Kg PVC	x 1,170 $/ton	= 1,139.23
43.77 Kg stabilizer	x 3,579 $	= 156.65
2.91 Kg pigment	x 2,619 $	= 7.62
(2) 3,950 kwh	x 0,026 $	= 102.00

		1405.50 $/ton

(1) See paragraph 3.2.3, a total of 3,450 hours needed to produce latrine pans and fittings

(2) See paragraph 3.2.4 -, a total of 2,300 theoretical hours needed to produce uPVC fittings. Actual operating hours are approximately 90% of the above.

5. LOCATION AND SITE

Three alternatives locations have been considered for the new demonstration unit:

- the no. 1 Plastic Factory in Rangoon
- the no. 2 Plastic Factory in Rangoon
- the no. 3 Plastic Factory at Hmbawi

Both the factories N° 1 and N° 2 are located in Rangoon in densely populated areas. The government policy is not to encourage the establishment of new industrial facilities in residential areas. In addition they are often facing acute shortage of energy and any new unit would have the same problem.

Factory N° 2 is the oldest among the existing units and is tightly surrounded by residential quarters. The relevant premises and equipment are falling apart. Working conditions are not suitable for a demonstration unit. Officials plans to move from Factory N° 2 to Factory N° 3 all the remaining equipment suitable for production.

Factory N° 1, is in better condition. The surrounding area may be suitable for expansion of production. The location is in an industrial estate located in the neighborhood of Rangoon. Roads and communications are easy and in good conditions. Factory N° 1 produces laminated plastic linings and sheets.

Factory N° 3 is located 50 miles away from Rangoon along the Rangoon-Prome highway. The site is located in a new industrial estate within a relocation scheme. The Factory N° 3 produces plastic appliances from injection moulding machines and is destined to receive those production lines still in good conditions from Factory N° 2.
Factory N° 3 was considered the most adequate one for the establishment of the new demonstration unit for several reasons:

- The no. 1 Ministry of Industry has established an important industrial development area at Hmbawi. Two factories have been already built and are operating. A Housing Scheme for the workers is under construction with all necessary infrastructures. No. 3 Plastic Factory is among the operating factories.

- The factory is expanding the facilities and a new group of buildings is presently under construction and will be finished within 1987. These buildings are perfectly suited for the new demonstration unit and therefore a portion of their area can be used for the unit; the area needed fits very well with the factory's own development programs.

- The site is connected to Rangoon by a two lane paved road, suitable for heavy traffic.
- A railroad is nearby and the construction of a junction to the industrial area is planned.
- The production in Factory N° 3 has with the demonstration unit a common technological ground with reciprocal benefits.

6. PROJECT ENGINEERING

6.1 SCOPE OF THE PROJECT

The new demonstration unit will have the following main targets:

- produce plastic pipes and other appliances in various sizes and typology so that market can be adequately tested in a variety of applications and under different operating conditions;

- train a core of engineers and specialists that will then be used to develop the plastic pipes industry into mass production;

- became a center of reference for the existing and future pipes production industry (and other plastics processing too) taking advantage of the very well equipped testing laboratory, the only one existing in the Country.

The new unit will have the following major departments:

- uPVC extrusion line with an output of approximately 940 tons of which 59 tons will be then processed into tube-well casings (over a total forecast demand, in the decade 1990 - 2000, of approximately 2,900 - 3,000 tons PVC pipes per year).

- HDPE pipes with output of approximately 470 tons (over a total forecast demand, in the decade 1990-2000) of approx. 1,700 - 2,500 tons per year.

- HDPE/PVC injection moulding machine for the production of:

  . 150,000 latrine sets over an yearly forecast demand of 300,000;
  . 37.5 tons PVC fittings (actual requirements different to predict but in the range of 150 - 200 tons/year).

- Quality control and testing laboratory: very well equipped and suitable to carry out also identification of most appropriate specifications and characteristics according to prevailing conditions/application etc.

- Workshop: the plastic factory N. 3 has already a mechanical workshop but it is not adequately equipped for the needs of the new demonstration unit. In fact the two new machine tools proposed, beside providing training/technical assistance, should enable the workshop to produce spare parts to be used in the production lines,and other parts to test new sizes and new fitting shapes etc. This will increase the flexibility of the unit and improve the suitability of the plastic materials for the IDWSSD programs in Burma.

The new demonstration unit will be established within the Plastic Factory N. 3 and will therefore take advantage of existing infrastructures/facilities (social services building, offices, etc.).

6.2 TECHNOLOGY AND EQUIPMENT

6.2.1 Selection and description of optimum technologies

The following points have been taken into consideration in selecting the most appropriate technology:

- The plant is a "Pilot Plant" or "Demonstration Unit". Its purpose is to give Burma as much self reliance as possible in adapting the production, once it is set up, and once market response is duly verified. In the long run the plant should be the ground on which to build up and grow all the Plastic Industry in Burma.

- The quality of the products of the new unit must comply with the international standards. Extruding uPVC directly from dry blend gives the unit a control on the quality of the output. The laboratory has the necessary equipment to assure quality control on raw material and additives as well as on finished products. The unit may also develop, if it is the case, new formulas better suited to Burma's conditions.

- Production Range Flexibility: the unit has the capability of satisfying the demand of the market in terms of applications. Particular attention is given to reducing investment costs but in the meantime keeping to the unit full capability and self reliance in order to expand the production range, to modify it or more simply to meet operations and maintenance problems in Burma.

- Technology: technology and Technological features of the plant were chosen taking into consideration the local conditions under which the equipment will operate: cost and skill of manpower, availability of spare parts, self reliance, product development etc.

  Some devices were not purposely recommended on the ground that their technical added value is not justified by the cost burden and operating complexity.

  For each single machine and piece of equipment all these justifications are described in detail.

- Equipment and utilities must be suitable with local operating conditions (tropicalization, dust proof, etc). Components and single elements must comply to unified standards to hold investments and operating costs as low as possible.

- Working hours: 240 days a year, 2 shifts/day, 8 hours a shift. In certain cases, shifts were increased to three for technological reasons (UPVC extrusion) or to optimize a machine (moulding).

6.2.1.1 uPVC Extruding Line

a) Dry Blend

The use of dry blend mixtures to feed uPVC extruders is recommended for the following reasons:

- as a quality assurance measure as the formulation may be kept constant. Also a better quality control on incoming raw materials and additives may be done;

- for cost convenience: at constant selling price the supply of PVC resins and additives separately, instead of ready made PVC pellets, leaves a higher added value margin;

- for operating advantages: as dry blends are prepared in bulk, sampling and testing costs are reduced.

To prepare the dry blends, the plant is equipped with a 200 lt capacity high - speed heated mixer. We do not recommend an in-built vacuum drier device because it introduces frequent maintenance of filters and pumps without bringing appreciable advantages: when the mix is cooled outside, it regains lost humidity, and it needs to be dried again in the extruders.

Basically, dry blends is made by mixing together different products in the desired proportions. The equipment to be used in the area should be specified to work in very dusty conditions. Safety measures taken and instructions should also be given to the workers.

Some of the powders and additives may contain lead. For this reason it is advisable, though relatively more expensive, to use ready-made single-pack additives to reduce hazards due to frequent lead handling.

Equipment for preparing dry blends:

. high speed mixer 200 lt capacity
. weighing equipment: one for PVC powder and one for the additives
. containers and intermediate stocking area

b) PVC extruder

The uPVC extruder is recommended to meet the following specifications:

- Counter Rotating parallel twin screw type which can be fed with pellets if needed. The extruder screw design should be suitable for operation with dry blends prepared a few days before being extruded.

- Vacuum drying is foreseen directly in the plasticization barrel. The size and power of vacuum pumps and filters should be suitable to extrude blends prepared even a few days before.

- All parts in contact with uPVC should be in stainless steel or other Chlorine-proof material.

- Electrical equipment should be tropicalised.

- The main values to keep under control are :

  i) the speed of the screws and of the feeder
  ii) temperature to be measured at different points of the barrel, along the mix and in the screws;
  iii) absorbed amperage by the extruder motor drive

- Some extruder manufacturers propose to regulate screw temperature through an oil circulating exchange heater device.
  The solution offers good temperature control but requires frequent and expensive maintenance.
  We suggest systems that assure a better transfer of heat from the screw tips backward. One of these solutions is to have screws of increased size diameter with axial holes. This type of screws can assure better heat exchange and avoid localized overheating.

- Some manufacturers propose conical shaped screws. The technical advantages are not justified by the increased complexity. Moreover machining the screws in case of maintenance, requires advanced skills and higher precision tools.

- It is suggested to start up extruder with a D.C. motor drive instead of mechanical gear box. This choice assures smooth and trouble free increase of speed up to cruise speed. Motors should be dust proof and tropicalized.

- Heads should be easily removable for cleaning. The core and the shape of the outer die should be designed to avoid local stagnations and overheating.

- Calibration unit should be made of stainless steel or bronze and should be provided with micro-holes and microsleeves.
  Along the calibration tunnel and all around it, nozzles are regularly located to spray cooling water. Full immersion type calibration unit is not recommended.
  Min. length of calibration tunnel is 5 m
  The calibration unit should have a slight slope to avoid water from flowing back from inside the pipe, to the extruder head.
  The calibration unit should be fitted with a full set of calibration sleeves covering the whole range.

- Cooling tunnel: the cooling tunnel is divided into separate chambers.
  The frame is made of stainless steel. Internally a set of spraying nozzles are evenly distributed to assure an uniform cooling of the pipe.
  Each chamber should be 2.5 m long for a total length of more than 5 m.

c) Marker

The marker should be located before the haul off. Marking frequency is regulated by a time sequence through revolving device. Printing is done by heat transfer from tape.

The label should indicate:
- nominal diameter
- pressure class
- production period (optional)

d) Haul-off machine

It should have low specific pressure, and should be fitted with rubber pads. The machine should be driven with a d.c. thyristor controlled motor.
It would be better if the commands of the haul off machine were placed close to the extruder head and at direct reach from the feeder and the screw speed commands.

e) Cutting unit

The cutting unit is a simple rotating saw, better if combined with a milling contour edger. The cutting unit is placed over a sliding rail to be able to move while cutting at the same speed and in the same direction as the pipe. Clamping the pipe before cutting and at release should be done very smoothly to avoid repercussions on the calibration.

A mobile end switch placed along the tilting table, activates the cutting unit.

f) Tilting table and Bar collector

A simple tilting table six meters long is foreseen at the end of the extruding line. The switch commanding the cutting machine is positioned on the tilting table and may be regulated to cut pipes to the different size. Pipes are removed from the bar collector and taken to a storing area.

g) Socketing equipment

Different automatic socketing equipment is commonly available.
In the socketed region, according to Mariotte law, the wall thickness of the extruded pipe should be increased according and in proportion to the increase in the diameters.

To do this, wall thickness may be modified directly on the socketing machine by an additional axial pressure before socketing. This method is very delicate and requires an optimum control on temperatures.

Another process is to slow down in a sequence mode the haul off allowing an increase of the wall thickness in the region where the pipe is to be socketed.

The rubber ring is another weak element in the socketing system if not properly manufactured or well fixed.

Finally automatic socketing equipment requires a complete set of molds to cover each size diameter and each pressure class.

For all the above reasons automatic socketing equipment and the use of rubber rings is not recommended. Instead a semiautomatic socketing unit and cement sealed couplings are suggested.

In this case, the socketing unit consists of a thermo-regulated pipe heater and one mould for each size diameter, disregarding of its pressure class. The pipes are mould shaped manually.
Should this socketing solution be adopted we recommend including one milling pipe edger in the cutting unit

h) Pipe threading machine

Pipe threading machine is requested to customize uPVC pipes to be used as screens and casings for tube wells. Pipes may be threaded on both ends (in the inner part of the socketed area and in the outer part of the opposite end). A simple, hand operated unit is suggested.

i) Pipe sleeving machine

This machine is used to produce the sleeves on the tube well casings. A simple hand operated machine is sufficient.

j) Cement Sealant Preparation Unit

This unit is linked with the choice of the socketing system. Sealant cement may be purchased abroad or simply produced in Burma.

The preparation unit consists of

- weighing equipment
- cladded self heated mixer 150 lt capacity

Normal safety and hygienic measures have to be taken due to the presence of solvents and equipment should comply with explosion proof standards.
Tin cans of different sizes with tight covers are required.
It may be useful to mention two formulas develcped by the Baldo team technical consultant which proved to have excellent characteristics. The ingredients for 100 kg sealant are as follows:

	Formula A	Formula 3
Tetrahydrofurane (THF)	40	40
Cyclohexanone	20	25
Trichlorethylen	20	20
Dimetilformammide (DMFA)	5	-
PVC suspension k 65	15	15
	--------	-------
	100 kg	100 kg

k) Handling and Storing uPVC pipes

The uPVC pipe once cut to length may be stored in piles outside the production building. Piles should be simply covered to protect them from direct sun light.
Piles should not exceed 1.5 m - 2 m height to avoid permanent ovalisation of pipes at the lower levels.

6.2.1.2 HDPE Extruding Line

a) HDPE Extruder

The extruder is of the single screw type with spiral head. Size capacity has been limited up to 90 mm diameter pipe. Larger HDPE pipes may be extruded, if needed, by the twin-screw extruder foreseen for uPVC may extrude large HDPE pipes. Accurate cleaning not only of the extruder itself, but of all the lines downward, is compulsory.

The extruder is fed with ready colored pellets as PE powder is not normally available, unless for very special applications. The pigments are in enough quantity to assure adequate opacity and to increase the pipe's resistance to aging under direct sun radiation. It is not recommended to pour additional pigments directly into the extruder.

We have not specified vacuum forming unit in the extruder barrel, as drying HDPE pellets is not normally done if the supplier complies with specifications.

Instead, a separate drying hopper allows drying those lots not complying with specifications. It may be also used to dry PE colorless pellets destined to latrine pan production.

The two spiral heads sufficient for covering the whole suggested range, are suitable for all polioleifines (LDPE, HDPE, PP and PB).

In the spiral type head the coupling and welding of flow layers are favored. Also the localized stagnation areas that may appear do not affect the final quality when using the same type and the same color of polioleifines.

Emphasis should be given to the measuring and control equipment. As a matter of fact, the HDPE single screw extruding line is more sensitive to variations due to many factors (temperature and flow of cooling water, vacuum in the calibration unit, surface conditions of calibration sleeves) that may affect the external appearance of the pipe as well as the wall thickness tolerance.

It is advisable to recall that HDPE pipes cannot be threaded. HDPE pipe elements are butt-welded together. End fittings are tight or clamped.

- A DC motor drive instead of gear box is suggested for the start up. This choice was made to assure a smooth and progressive increase of the speed, up to cruising speed. Motors should also in this case be protected to work in a dusty and tropical environment.

  Elements of the motor, the drive and speed regulating devices should be standardized as much as possible with uPVC extruder elements to favor spare part interchangeability and maintenance.

- Calibration units should have two distinct vacuum zones, separately regulated. They should be made of stainless steel or bronze and should be provided with microholes and microsleeves.
  Along the calibration tunnel and all around the sleeves nozzles are evenly located to spray cooling water. Immersion type calibration unit is not recommended.

  Min. length of calibration tunnel is 5 m

  The calibration unit should have a slight slope to avoid water from flowing back from inside the pipe, to the extruder head.
  The calibration unit should be fitted with a full set of calibration sleeves covering the whole range.

- Cooling unit: the cooling tunnel is divided into separate chambers.
  The frame is made of stainless steel. Internally a set of spraying nozzles are evenly distributed to assure an uniform cooling of the pipe.
  Each chamber should be 2.5 m long for a total length of more than 5 m.

b) Marker

The marker should be located before the haul-off. Marking frequency is regulated by a time sequence through a revolving device. Printing is done by heat transfer from tape.

The label should indicate:

- nominal diameter
- pressure class
- production period (optional)
- for wound up pipes indication of progressive length milestones

c) Haul - off machine

The Haul-off machine should have more pads than in the case of uPVC to allow a larger contact area with HDPE pipe without increasing the specific pressure which may procure deformation.

If multiple pad hauling is not possible, the deformation due to a two pad hauling machine should be perpendicular to the direction of the ovalization which always occurs when the pipe is wound up around the coil.

d) Cutting Unit

The cutting unit may be the same as the one used for the uPVC extruding line even though milling edger may be redundant. The unit is activated through a length presetting manual device. Signalling and safety measures should be foreseen.

e) Twin wheel coiler

A twin wheel coiler was suggested to allow switching from one coil to the other without interrupting the flow.
Normally 20, 25 and 32 mm pipes are produced in 200 m long coils, the 40, 50 and 63 mm in 100 m long coils.
It is possible to wind up to 125 mm size diameter. The inner diameter of the coil corresponds to 24 times the nominal pipe diameter.

f) Drying hopper

It was suggested a stand alone, self heated hopper to dry all HDPE lots, both for injection moulding and pipe extruder, in case the humidity contents are higher than specifications requirements for good workability.
The size capacity corresponds to a 2 hour production of the extruder at maximum rate that is 500 kg

g) Butt welding unit

HDPE portable Butt welders suitable for pipes up to 90 mm size diameter and 9 mm wall thickness.

Pipe edges are first milled and clamped to each side of the sliding table. The edges are heated uniformly, then brought together with a slight pressure and left to cool down.

Portable units have been foreseen to be able to carry on welding directly on site.

6.2.1.3 Injection Moulding of Latrine Pans

a) Latrine Pans

Latrine pans may be obtained also by thermoforming from HDPE sheet. Technology is simple, though related equipment has low efficiency, and the number of cast off pieces is high.

Quality of final product is also poor. But major objection to this technology is that HDPE sheets should be imported, or, otherwise a complete sheet extrusion line should have been foreseen. Investment costs are definitely higher than a simple injection moulding machine including molds.

Someone may object to the above statement on the ground that the same extruding line used for HDPE pipes, if modified, may produce sheets. As a matter of fact from a 90 mm diameter extruded pipe with a blade positioned just outside extruding head hot sheets may be obtained.

To do this, the extruder should work in low temperature condition with consequent low output (90 kg/hour corresponding to two latrines per minute). The extruded pipe once cut is smoothly and gradually brought to sheet, cut to the size, and quickly vacuum stretched until final shape is obtained.
The sequence requires high team coordination. Other finishings and manual operations are still to be done: cutting of dead bottom, flanging the upper part, trimming edges.
Latrine pans obtained by thermoforming have approximately the same weight as those obtained from injection moulding, but have thinner wall thickness close to the discharge outlet section.

In light of the number of pans to be produced and taking into account the number of rejected pieces, the higher labor cost, the lower efficiency and the poorer quality thermoforming may introduce, the advantages of a technology based on injection moulding prevail.

Now injection moulding technology should be worked out on three shift working basis. As a consequence, and, even if taking into account start up and maintenance, the molding machine, to produce the latrine pans would be kept busy only half of the available time .

The shape of latrine pan requires approximately a 3,5 ton weighing mould (app. dimensions 1000 : 1200 mm high, 600 : 650 mm wide and 650 : 700 mm long). The clamping force of the machine is dictated by the projection area of the latrine on the closing plane (500 x 280 = 140,000 mm^2) multiplied by 300 Bars (security pressure) equals to 420 tons.
Nevertheless due to the dimensions of the mould a machine in the range of 600-700 tons will be used.

The mould sees the latrine up side down. The mould has two sliding walls one to free the upper spigot the second to extract the piece automatically. (The latter device offers the advantage of linking the productivity to the machine and increases safety). In the light of the high number of pieces, the size of the mould should not be reduced too much. It is also recommend to increase design complexity considering the lack of maintenance means.

The commands of the machine should be electromechanical instead of static electronics to ease and simplify maintenance, even if this may increase the price. Thermoregulating elements and other components should be as much as possible unified to the standards and to the vendors adopted in the other lines.

Rubber pads should be foreseen under the moulding press stands to avoid transmission of vibrations to other sections within the main building, and to affect some laboratory equipment.

All around the moulding machine it would be advisable to create a small trench to collect oil leakages that cannot be avoided in the injection moulding process. Another solution is to isolate the area around the moulding machine by creating a small bay with simple steel sheets and hold oil from spreading around.

b) HDPE pipes fittings

HDPE pipes present particular price competitiveness in those schemes where laying is done with few requirements of fittings or in those where variations of routing and land shape may be easily overcome by the HDPE flexibility. Considering the applications foreseen in Burma investments in moldings for HDPE fittings are not justified.

Another main feature of HDPE pipe is that the different pieces may be easily butt welded. Special units of simple construction, handling and operation are available for this purpose.

Butt welding may be done on site while laying pipeline. It was recommended to equip demonstration unit with a certain number of these, to train the installers and to encourage HDPE pipe diffusion.

Among these welding units, some are designed to cut and weld angular sections ranging from 0:45° degrees (to produce elbows up to 90°. Tees may be also obtained in the same way).

Should the need occur for special HDPE fittings, they may be produced in the workshop facility by cutting and composing different sections.

c) uPVC pipe fittings

In light of Burma's market requirements, uPVC pipe fittings may be divided in two groups:

- Small diameters (Diam. 20, 25 and 32 mm)

  For this range threaded type and cement sealed type fittings can be found. It was decided not to produce threaded pipes on the grounds that the wall thickness had to be increased to stand the threading much more than the need dictated by the pressure and Mariotte law. Increasing wall thickness means also higher prices, prices which are not compensated by installation and operation costs.
  Consequently no threaded fitting moldings are foreseen, but only cement sealed socketed ones.

  Another concern was that the number of molds necessary to cover the full range is high and very expensive (investment & depreciation). Besides this would reduce the self reliability of the demonstration unit, and, therefore contradict one of the basic design commitments undertaken.

  To overcome the problem, it was recommended to supply molds for a limited number of fittings covering the most commonly used ones.
  All fittings comply to one class pressure only NP 16.

On the other hand it has been suggested to equip the workshop with precision machine tools and to train personnel in the making of fittings molds starting from detailed drawings which may be obtained internationally.
The making of single molds first will increase the range of fittings that can be produced and will permit to train personnel.
In the supply molds for the following fittings were included:

- 20 mm elbow socketed at both ends
- 25 mm " " " " "
- 25 mm tees socketed at the 3 ends
- 32 mm " " " " "

In the future should the demand turn to favor threaded pipes in spite of high costs, it will be easy for the technicians (in the meantime being well trained) to increase wall thickness to stand threading. The technology of directly molded threaded fittings (with rotating/reciprocating round insert on moving male) may be justified only for very large quantities and only after a few years of design and production of simple molds.

In the bibliography a series of recommended books titles related to the mould design is listed.

- <u>Large diameters</u> (Diam. 63 to 160 mm)

  Large diameters long radius curves may be obtained by thermoforming pipes. The technology is easy and, in many countries, is done by the contractor while laying the pipes directly on site.
  The pipes are filled with sand, heated evenly and slowly in the bending area and then brought gradually to final shape.
  Hot air welding is not recommended because of surface oxidation that reduces the pressure rating of the pipe. Cement sealant can be used for pipe joining in the bell and not for the construction of complicated design joints.

6.2.1.4 Waste grinders

Two separate grinders respectively for HDPE and for uPVC scraps, are foreseen to reprocess cast off material.
The units are water-cooled type.
The choice of two separate machines is due to avoid pollution between the two materials, always occurring even after cleaning of grinding rooms.
More details are given in the technical data sheet.

6.2.1.5 Cement sealant production unit

Assuming that a one mm thick layer will be spread over all the socketed overlapping area, according to evaluations from the production mix, the demand of sealant, which also takes into account the high level of waste during laying operations, should be in the range of 4 to 5 tons/year.
The preparation of the cement sealant can be carried out by adding an autoclave that is described in the equipment data sheet 3.3 herewith attached. Its cost is in the range of 10,000 US $. A lack of suitable cans or containers in the Country has been noticed anyway and this could delay the installation of the equipment until this problem is solved. It is also advisable to explore the possibility of cooperating with one of the plants belonging to the Pharmaceutical Corporation where the necessary equipment can probably be available.

6.2.1.6 Utilities

a) Electric power (ref. to the single line diagram N.)

- Presently a 33 kV/750 kw is feeding the N° 3 Plastic Industry at HMWABI.
  This line is not sufficient to satisfy the need of the foreseen expansion.
  A new single line 33 kV/1500 kw is required from the junction, approximately 3 miles away.
- Still the single feeding line may be subject to frequent voltage variations. These variations may affect the final quality of the finished pipes. The unit will be complete with a voltage stabilizer that will reduce variations from ± 20% as input to ± 5% at output.
- A new outdoor distribution substation is needed. The substation consists of:
  - two step down transformers 33 kV/11kV/0.4kw, 750 kw
  - one incoming feeder
  - two transformer feeders
  - the outgoing line feeders
- Considering the structures characteristic of the production building, an overhead 400 Volts distribution system was recommended. One single feeding point should be foreseen for each piece of equipment.
  Equipment supplier is responsible until the connecting terminals of his control board unit.
- Lighting should have a separate feeding line. Lighting intensity is 200 Lux measured at 1 m height. In the Laboratory lighting intensity shall be 400 lux.

It is suggested to have a diesel engine, 200 KVA.

The set should be switched on manually. In case of blackout the genset is used to keep on uPVC extrusion and to avoid frequent disassembling of the extruder head (blackouts longer than 20 minutes cause polymerization of the uPVC in the extruder with consequent need of careful cleaning and time wasted to start again production).

b) Water (Ref. to water network diagram N. 5)

A submersed pump takes the water from a tube well present within the unit boundary and sends it to a water pool having 32 m3 capacity.
The pool close to the water chillers and its capacity corresponds to the quantity of water flowing in one hour in the cooling closed loop system. Water flows back in the pool through a siphon gate with dual purposes of separating oil and solid particles before returning in the pool. The gate should be cleaned from time to time.

A water sample taken from a well close to the future site has given the following composition:

REPORT OF WATER ANALYSIS (1)

- Appearance:	Turbid
- True color:	Pt. Co. Scale 9 Units
- Smell:	Nil
- Sediment:	Slight
- Sulfate:	Trace
- Nitrates N.:	0.50
- Nitrites N.:	0.001
- Ignition:	Slight charring
- Total solid:	240.0
- Chloride:	8.0
- Total Hardness:	78.0
- Permanent hardness:	13.0
- Saline ammonia:	0.004
- Albuminoid ammonia:	0.004
- Iron:	11.60 ppm
- Manganese:	5.80 ppm
- Copper:	Nil
- Zinc:	0.70 ppm
- Oxygen absorbed from permanganate at 37 °C for 3 hours:	0.33 ppm
- Total alkalinity as CaCO3	101.0 ppm
- pH:	6.9

(1) Source: Tube-well, Plastic factory, Hmawbi.

No treatment, neither softeners are needed.
A close loop water cooling system keeps water at constant temperature. It was preferred to have two chillers instead of one to have more flexibility when not working at full load, and to increase the system reliability.
The size of water chillers was estimated considering the following heat rates in the production cycle (1).

* uPVC extrusion line 175 kCal/kg x 300 kg/h = 52,500 kCal/h
* HDPE extrusion line 300 kCal/kg x 250 kg/h = 75,000 kCal/h
* injection moulding machine: 25,000 Kcal/h

The rounded figure brings to a total of 160,000 kCal/h or 2 units of 80,000 kCal/h each.

c) Compressed air (ref. to diagram N. 6)

Compressed air system consists of a compressor 5 m3/h at Np 6 bar located in one of the utility rooms and of relevant m3 reservoir and distribution network. Filters and drainage valves should be foreseen in the proper locations.

The distribution as for power, water and air should be overhead type.

6.2.1.7 Laboratory

Due to the features required by the "demonstration unit", the importance of a well equipped quality control and testing laboratory is emphasized.
It will have the following main tasks:

- systematic quality control on both incoming raw materials and finished products;

- testing of new or modified product (new shapes of fittings, new size of pipes, changes for new applications etc.);

- draw specifications for new raw materials and their testing.

- train a core of laboratory technicians that will be then employed when new pipes production factories will be built;

- carry out quality control on both raw materials and finished products for the other plastic factories in Burma.

The Baldo & C. team shares and endorses the conclusions of the report prepared by the Jan Brzazinski and titled: "Report and Terms of Reference on Plastic Testing Laboratory for the Plastic Appliances Extrusion Demonstration Unit in the Socialist Republic of the Union of Burma" (Project DP/BUR/80/015).
A list of the laboratory equipment that will be installed in the above referenced report is in Annexe 3. Three window type air conditioners have also been included.

6.2.1.8 <u>Workshop</u>

A maintenance workshop is presently available at the Plastic Factory N° 3 but it is deemed not to be suitable to the needs of the new demonstration unit. This workshop should namely:

- assure maintenance to all production equipment
- manufacture of molds for PVC fittings
- manufacture of extruder new applications under different conditions.

The last two objectives may seem too ambitious but the consultant deems that they are feasible in the short to medium period.
In fact, opportunity was given to see items and even injection molding machines produced in the workshops of the existing plastic factories. In spite of the lack of suitable machinery, raw material and appropriate design, the results were judged to be satisfying.
When the workshop will have adequate machine tools and the personnel is equipped with specific training and appropriate parts design will start to produce simple items and will become step by step self reliable for the manufacture of several types of molds and extruder heads, increasing the flexibility of the new demonstration unit.
The existing workshop at Plastic Factory N. 3 has enough room to locate the additional equipment.
It is proposed that the following additional equipment be purchased:

- Milling unit
- Lathe

the specifications for the equipment are provided in the equipment data sheets.
These machines, in cooperation with the presently installed ones (drilling machines etc.) will equip the workshop to fulfil the major maintenance needs.

6.2.2 SPECIFICATIONS OF MAJOR PLANT EQUIPMENT

Based upon Par. 6.2.1 "Selection and description of Optimum Technologies" technical data sheets containing the main characteristics, (type, size, capacity) features and specifications deemed to be important have been prepared.

On the top left side of the data sheet appears a reference number, the same identifying the machine over plant lay-out (drawing N. 8-163-003)

The specifications and features contained in these sheets show the functional requirements and conditions the equipment should comply with. Purposely the characteristics, features and specifications were given within a floating range or as a minimum value. Prices are in the average of the quotations received.

In drawing up the technical data sheet attention was given to favor equipment standardization at the detriment of minor differentiations. (For instance: cutting units, markers).
An effort in standardizing elements and major components of the equipment has been generally recommended, namely for thermoregulating units and for the electronic boards of the DC motors.

LAY-OUT REF. 1.1.1	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: WEIGHING UNITS

MAIN CHARACTERISTICS:

Precision wheighing machine spring type: scale 0/5 Kg precision 1g (for additives and pigments, stabilizers, etc)

- Wheighing machine: manual type scale 0/50 kg, precision 10g (for resins

UTILITY NEEDS:

QUANTITY:
two (2)

MAIN SUPPLIERS:

LAY-OUT REF. 1.1.2	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HIGH SPEED MIXER

MAIN CHARACTERISTICS:

HEATHER:

1) Type: self heating high speed mixer - manually loaded.
2) Internal free volume = 200 lt minimum (batch load 100-120 Kg/each)
3) impeller peripherical speed: at least 25 mt/sec
4) tank lining and impeller: stainless steel
5) temperature and time commandes: local
6) impeller drive: double speed AC motor 18/36 Kw minimum
7) temperature control: automatic control with manual setting
8) Emptying tap: pneumatic controlled

9) COOLER

Type: water cooled jacket stainless steel lined
internal free volume: 500 lt (two batch allowed) minimum
low speed, stainless steel impeller internally cooled
dust proof coupling between heather and cooler
impeller drive: single speed AC Motor 4 Kw
pneumatic emptying tap, automatic thermocontrolled (manual setting)
manually unloaded

Recommendations
spare parts: additional impeller for heather
all electrical equipment must be dust proof and tropicalized

electromechanicel type control suggested instead of microprocessors

UTILITY NEEDS:
1) Power X 40 Kw
2) Air X 0.5 cu/h

QUANTITY: 1

MAIN SUPPLIERS:
CACCIA (IT) - BATTAGION (IT) - DIOSNA (FRG)
- PAPPEMEYER (FRG) - MTI (FRG) - AND MANY OTHERS

LAY-OUT REF. 1.1.3	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: uPVC EXTRUDER

MAIN CHARACTERISTICS:

1) Type: twin screw parallel counterrotating
2) Sense of screw rotation: divaricating upwards
5) Length of plastification unit: at least 20 diameters
6) Maximum periferical screw speed: 9 mt/min
7) Installed power: 40 Kw minimum DC drive thyristor total controlled
3) Outer screw diameter: 85 mm minimum
4) Interaxis of rotation: 70 mm minimum
8) Number of thermocontrolled heating points on the barrel: 6 zones minimum (temperature minimum range 100:250°C)
9) Number of thermocontrolled cooling points on the barrel:at least 2 zones (temp. min. range 100-250°C)
10) Maximum output at sigma 100 gelation level: 300 Kg/lt (at back pressure of 50-250 bar)
11) Vacuum degassing on the barrel: at least 3 kW water ring pump with filtering system
12) Height of extrusion axes from the ground: 1000 - 1100 mm

Other features:
screw geometry adapted for: dry blend UPVC - pressure pipe
dosing feeder hopper: DC drive thyristor controlled, 2KW minimum
control board: positioned close to the head outlet. Screw speed, dosing feeder speed and linear haul-off speed indicators and commands at easy reach for manouvering while looking at he extruded pipe.

Special features:
tropicalized isolation
dust proof isolation

UTILITY NEEDS:
1) Power X 105 Kw
2) Air X 1 cu.mt/h
3) Water X 11cu.mt/h

QUANTITY: 1

MAIN SUPPLIERS:
AMUT (IT) - BANDERA (IT) - BATTENFELD (D) BAUSANO (IT- CINCINNATI (A)- REIFENHAUSER (D) - WEBER (D) - KRAUSSMAFFEI (A) - MAPLAN (A) - NOUVELLE-MAPRE (L) - OESWAG (A) - ESDE (D) - BAKER PERKINS (G.B.) - FAIREX (F) - BERSTORFF (D) - DE ROLLEPAAL (N) - AXON (S)

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LAY-OUT	EQUIPMENT DATA SHEET:
REF. 1.1.4	EQUIPMENT DESCRIPTION: uPVC EXTRUSION TOOLS

MAIN CHARACTERISTICS:

HEADS

1) easy disassembling spider type for uPVC pressure pipes sigma 100 Kg/cm2
2) material: stainless steel or internally nickel plated
3) design: internal geometries must not allow dead zones of the melt flow
4) maximum pressure drop: (at the maximum speed of 10 mt/min or at the maximum output of 300 Kg/h) not higher than 250 Bar; with sigma 100 gelation level
5) thermocontrolled in each zone
6) tools for the production of uPVC pipes according to ISO R 161 standards (for thickness allowed range according to DIN 8062 or UNI 7441 or BS equivalent):
   diam. 20 x 1,5 mm
   diam. 25 x 1,9 mm
   diam. 32 x [illegible]4 mm
   diam. 40 x 2,0 mm and diam. 40 x 3,0 mm
   diam. 50 x 2,4 mm and diam. 50 x 3,7 mm
   diam. 63 x 3,0 mm and diam. 63 x 4,7 mm
   diam. 90 x 2,7 mm and diam. 90 x 4,3 mm and diam. 90 x 6,7 mm
   diam.110 x 3,2 mm and diam.110 x 5,3 mm and diam. 110 x 8,2 mm
   diam.125 x 3,7 mm and diam.125 x 6,0 mm
   diam.160 x 4,7 mm and diam.160 x 7,7 mm
   diam.250 x 7,3
   diam. 80 x 3 mm (for Latrine pans) not ISO standard

CALIBRATORS

7) inox or bronze tubular shaped with microholes and microsleeves, prolounged with connecting bars to hold set of sizing rings
8) should be suitable to vacuum calibration when installed in the unit described at 1.1.5
9) dimensions: ouside diameter 20, 25, 32, 40, 50, 63, 90, 110, 125, 160 250 and 80 mm (not ISO standard)

UTILITY NEEDS:

MAIN SUPPLIERS:

Same as ref 113

LAY-OUT REF. 1.1.5	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: uPVC CALIBRATING UNIT

MAIN CHARACTERISTICS:

Type: water spraying not at full immersion

1) diameter range: 20 - 250 mm
2) minimum length of the vacuum tank: 5000 mm
3) maximum vacuum required: 700 torr (70 cm Hg)
4) installed power: at least 5 Kw vacuum water ring pump
5) spraying nozzles: not clogging type up to 1 mm diameter impurity in cooling water
6) water filtering set: twin (by-pass system) with manometer and cloth sieves at the inlets
7) longitudinal translation electrical powered: speeds 0,2-0,5 mt/min
8) tank body: stainless steel
9) tank water temperature and level: local controls
10) positionning: on rail bolted on the floor
11) axes height from the ground: 1000 - 1100 mm

Special features:
tropicalized
dust proof

UTILITY NEEDS:

1) Power)
2) Air (see 1.1.3
3) Water)

MAIN SUPPLIERS:

Same as ref.1.1.3

LAY-OUT REF. 1.1.6	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: uPVC COOLING UNITS

MAIN CHARACTERISTICS:

Type: water spraying
1) diameter range: 20 - 250 mm outside diameters
2) length required: enough to assure the complete cooling of the proposed range of pipes (diameters + thickness + speed) whith water at 16°C
3) water filtering set: twin by-pass system with manometer and cloth sieves at the inlets
4) spray nozzles: not clogging type up to 1 mm diameter impurity in cooling water
5) installed power: water circulating pumps at least 1 KW for each meter length
6) tank water temperature local controlled
7) pipe axes height: 1000 - 1100mm
8) translation: manual on floor rails
9) tank body: stainless steel

Special features:
tropicalized
dust proof

UTILITY NEEDS:
1) Power (
2) Air) See 1.1.3
3) Water (

MAIN SUPPLIERS:

Same as ref. 1.1.3

LAY-OUT REF. 1.1.7	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: MARKERS

MAIN CHARACTERISTICS:

Type: continuously rotating, hot printing with interchangeable writing inserts, coloured tape marking,

Writing inserts: individually or together enabling to have the following labels:

NAME OF PRODUCER
OUTER DIAMETER (mm)
PRESSURE (bars)
LENGHT OF THE COIL (mt)
PERIOD OF PRODUCTION (month-year)

distance stop between marks on the pipe: 1000 +/- 1 mm

thermoregulation of printing marker with proportional controller

height of printing: 1010 to 1225 mm from ground levels
stand: individual or bolted on the haul-off frame (inlet side)

UTILITY NEEDS:
1) Power)
2) Air (see 1.1.3
3) Water)

QUANTITY:
1 (ONE)

MAIN SUPPLIERS:

Same as ref. 1.1.3 plus:
SICA (I) - ELMEPLA (I) - GATTO (U.S.A.) - YORKSHIRE (U.K.) - WAVIN (H)
UPO (S) - MAUNY (F)

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LAY-OUT REF. 1.1.8	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: uPVC HAUL OFF

MAIN CHARACTERISTICS:

Type: caterpillar, rubber pads, multiple belted

Diameter range: 20/250 mm

Speed range: 0,2/10 mt/min

Minimum length of contact : 1500 mm

Pneumatic controlled clamping force: 0,05-5 Kg/cm2 on the rubber pads

Maximum pulling force: 4000 Kg

Number of belts: at least 2 for pipes up to 50 mm OD included
at least 3 for pipes up to 90 mm OD included
at least 4 for pipes up to 250mm OD included

Installed power: DC drive thyristhor total controlled 1 Kw minimum

Speed control: remote with high sensibility potentiometer

Mechanical control: quick opening of the belts, quiet closing

Rubber pads hardness: 60 - 80 shore A

Height of pipe axes from the floor = 1000 - 1100 mm

Special features:
tropicalized
dust proof

UTILITY NEEDS:
1) Power (
2) Air) see 1.1.3
3) Water (

MAIN SUPPLIERS:

Same as ref. 1.1.7

LAY-OUT REF. 1.1.9	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: CUTTING MODULE

MAIN CHARACTERISTICS:

Type: rotating saw with vertical movement. The module should be able to shuttle while cutting, at the same extrusion speed.

Saw cutting blade: air transparent type to reduce calibration problems during cutting

Pipe range: diam. 20 - 250, maximum thickness 9mm

Cutting scraps: separate collector

Installed power: 2 Kw minimum AC drive

Pneumatic clamping on the moving pipe

Pipe axes height from the ground: 1000 - 1100 mm

Special features:
tropicalized
dust proof

UTILITY NEEDS:
1) Power X)
2) Air X (see 1.1.3
3) Water (

MAIN SUPPLIERS:

Same as ref.1.1.7

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LAY-OUT	EQUIPMENT DATA SHEET:
REF. 1.1.10	EQUIPMENT DESCRIPTION: TILTING TABLE

MAIN CHARACTERISTICS:

Length: 6000 - 6500 mm

Height: 1000 - 1100 mm above floor

Pipe collector: by gravity, allowing capacity for a minimum of 5 pipes diam. 250mm

Diameter range: 20-250 mm outside diameter

Electrical switch of tilt: positionned from 100 to 300 mm after cut switch

Pneumatic tilting

UTILITY NEEDS:
1) Power X (
2) Air X) see 1.1.3
3) Water (

MAIN SUPPLIERS:

Same as ref.1.1.3

LAY-OUT REF. 1.1.11	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: SOCKETING MACHINE AND SOCKETING MOULD

MAIN CHARACTERISTICS:

Semi-automatic belling station:

- heating desk with thermo-controlled plastic softening oven (temperature control 50 - 150°C; with a minimum of 3 working stations)

- forming unit with clamps and pneumatic movement of socketing head, internal sizing plain socket for sealant coupling, cooling device; with a minimum of 3 working stations

- belling tools: accordingly to ISO R 161 standard as internal sizing (tolerance for pipe diameters: 20, 25, 32, 40, 50, 63, 90, 110, 125, 160, 250 according to DIN 8062 or UNI 7441

- half thickness belling tools (for tube well casing and screews to be threaded): diameter 110, 160, 250

UTILITY NEEDS:
1) Power 5 Kw

QUANTITY: 1

MAIN SUPPLIERS:

Same as 1.1.7

LAY-OUT REF. 1.1.12	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: THREADING MACHINE

MAIN CHARACTERISTICS:

Type: electrical driver, manual controlled axial movement of threader (inner or outer) reversible rotation

Range of diameter: 40 : 250 mm OD

Threading tools: inner and outer, square pitch, average diameters 110, 160, 250

Clamping moulds: diameters 110, 160, 250

UTILITY NEEDS:
1) Power 3 Kw

QUANTITY: 1

MAIN SUPPLIERS:

Many (the same for G.I. pipes)

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LAY-OUT REF. 1.1.13	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: SLEEVING MACHINE

MAIN CHARACTERISTICS:

Type: multiple packed circular saw blade, at least 3 radially pivotting arms, automatic translation of the pipe, after every sleeving cycle.

Blade thickness: 0,5-1 mm

Blade diameter: 100-150 ouside diameter

Distance between each packed blade: 5-10mm

Required free/closed area ratio: 10% on the pipe outside surface

Pipe range: 110 - 250 mm outside diameter

Scraps and powder from blades: separate collector

Special features:
tropicalized

UTILITY NEEDS:
1) Power 2 Kw
2) Air X

QUANTITY: 1

MAIN SUPPLIERS:

ELMEPLA (I) - UPO (S) - FRANKISCHE (D) - HEGLER (D)

LAY-OUT REF. 1.1.14	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: uPVC WASTE GRINDER

MAIN CHARACTERISTICS:

Type: heavy construction rotating blade grinder, for UPVC pipes 250x9 mm max

Hopper: low noise, lateral pipe feeding
Rotating blades: minimum n.3
Fixed blades: n.2
Rotor minimum width: 500 mm
Rotor minimum diameter: 400 mm
Water circulating cooled grinding room
Screen holes: 10 mm diameter, capacity: 250 Kg/h
Scrap collecting stainless steel under tank
Complete electrical cabinet with security switches

Special features:
tropicalized
dust proof

UTILITY NEEDS:
1) Power 32 Kw
2) Water 0.5 cu.m/h

QUANTITY: 1

MAIN SUPPLIERS:

CUMBERLAND (U.K.) - MECCANOPLASTICA (I) - TRIA (I) - and many others -

LAY-OUT REF. 1.2.1	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE DRYING HOPPER

MAIN CHARACTERISTICS:

Type: hot air dryer for non hygroscopic granules, stand alone structure

Internal volume: 500 lt minimum

Max temperature: 150°C (working temperature at 90°C for HDPE)

Heating power: 13 KW minimum

Fan motor power: about 2 KW

UTILITY NEEDS:
1) Power 15 Kw

QUANTITY: 1

MAIN SUPPLIERS:

PIOVAN (I) - FRIGOMECCANICA (I) - CHURCHILL (GB)

LAY-OUT REF. 1.2.2	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE SINGLE SCREW EXTRUDER

MAIN CHARACTERISTICS:

Type: single screw, constant pitch.
Barrel length: L/D ratio at least 30
Screw diameter: 85mm minimum
Number of thermo-controlled heating points on the barrel: 8 zones minimum (temp. 100 - 250°C)
Number of thermo-controlled air cooled zones on the barrel: minimum the last 4 zones
Maximum output: (at maximum melt temperature and pressure of 220°C and 200 bar) 250 Kg/hour
Installed power: 60 Kw minimum - DC drive thyristor total controlled

Other features:
screw geometry for HDPE pellets, pressure pipe production
control board: positioned close to the head outlet. Screw speed and linear haul-off speed indicators and commands at easy reach for manouvering while looking at the pipe between the die and the caliber.

Special features:
electrical cabinet complete with security switch
tropical isolation
dust proof

UTILITY NEEDS:
1) Power 105 Kw
2) Air 0.5 cu.m/h
3) Water 11 cu.m/h

QUANTITY: 1

MAIN SUPPLIERS:

As per item 1.1.3

LAY-OUT REF. 1.2.3	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE EXTRUSION TOOLS

MAIN CHARACTERISTICS:

HEADS:

Type: Helical shcpe
- high flow, low back-pressure, for HDPE pressure pipe
- material: stainless steel or carbon steel internally chromium plated
- maximum pressure drop: not higher than 200 bar at melt temperature not higher than 220°C, at the maximum linear speed of 15 mt/min or at maximum output of 250 Kg/hr
- thermo-controlled in each zone
- tools for the production of HDPE pipes according to ISO R 161 standards (wall thicknesses according to DIN 8074 or UNI 7611 or BS equivalent tolerances range):
  diam. 20 x 2 and diam. 20 x 2,8
  diam. 25 x 2,3 and diam. 25 x 3,5
  diam. 32 x 3,0 and diam. 32 x 4,5
  diam. 40 x 2,3; 40 x 3,7 and 40 x 5,6
  diam. 50 x 2,9; 50 x 4,6 and 50 x 6,9
  diam. 63 x 3,6 and 63 x 5,8
  diam. 90 x 5,1 and 90 x 8,2

CALIBRATORS

- inox or bronze tubular shaped with microholes and microsleeves, prolonged with connecting bars holding set up sizing rings
- suitable to double vacuum calibration when installed in the unit described at ref. 1.2.4
- dimensions: outside diameters (tolerances as in DIN 8074 or UNI 7611): diam. 20, 25, 32, 40, 50, 63, 90

UTILITY NEEDS:
1) Power (
2) Air) see 1.1.2
3) Water (

MAIN SUPPLIERS:

As per 1.1.3

LAY-OUT REF. 1.2.4	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE CALIBRATING UNIT

MAIN CHARACTERISTICS:

Type: water spraying, not fully immersed, with two separate vacuum zones

1) diameter range: 20 - 90 mm outer diameters or wider
2) minimum lenght of each vacuum tank: 2000 mm
3) maximum vacuum required: 700 torr (70 cm Hg) in each room, separate control
4) installed power: at least 3 Kw water ring vacuum pumps for each zone
5) spraying nozzles: not clogging type up to 1mm diameter suspension in cooling water
6) water filtering set: twin with by-pass system with filters at the general inlet
7) electrical powered longitudinal translation: speed 0,2 - 0,5 mt/min
8) positionning on rails bolted on the floor
9) tank body: stainless steel
10) tank water temperature and level local controlled
11) pipe axis height: 1000 - 1100 mm from the floor

Special features:
dust proof
tropicalized

UTILITY NEEDS:
1) Power X (
2) Air) see 1.2.2
3) Water X (

MAIN SUPPLIERS:

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LAY-OUT REF. 1.2.5	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE COOLING UNITS

MAIN CHARACTERISTICS:

Type: water spraying
1) diamater range: 20 - 90 mm outer diameter or wider
2) lenght required: assuring the complete cooling of the proposed range of pipes (diameters, thickness, speed) with water at 16°C
3) water filtering set: twin (by-pass system) with manometer with filters at the general inlet
4) spray nozzles: not clogging type up to 1mm diameter impurity in cooling water
5) installed power: water circulating pumps at least 1 Kw for each meter lenght
6) tank water temperature local controlled
7) pipe axis height: 1000 - 1100 mm
8) translation: manual on floor rails

Special features:
tropicalized
dust proof

UTILITY NEEDS:
1) Power (
2) Air) see 1.1.2
3) Water (

MAIN SUPPLIERS:

LAY-OUT REF. 1.2.6	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: MARKERS

MAIN CHARACTERISTICS:

Type: continuously rotating, hot printing with interchangeable writing inserts, coloured tape marking, foreseen for progressive bench markers of the coiled pipe.

Writing inserts individually or together anabling to have the following labels:

NAME OF PRODUCER
OUTER DIAMETER (mm)
PRESSURE (bars)
LENGHT OF THE COIL (mt)
PERIOD OF PRODUCTION (month-year)

Distance step between marks on the pipe: 1000 +/-

Thermoregulation of printing marker with proportional controller

Height of printing: 1010 to 1225 mm from ground level

Stand: individual or bolted on the haul-off frame (inlet side)

UTILITY NEEDS:
1) Power X 2 Kw
2) Air X 0.5 cu.mt/h

QUANTITY: 1

MAIN SUPPLIERS:

See item 1.1.7

LAY-OUT REF. 1.2.7	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE HAUL OFF

MAIN CHARACTERISTICS:

Type: caterpillar, multiple belted with rubber pads
Diameter range: 20 - 90 mm OD
Speed range: 0,5 - 15 mt/min
Maximum pulling force = 3000 Kg
Minimum lengths of contact = 1500 mm
Pneumatic controlled clamping force: 0,05 - 4 Kg/cm2 on the rubber pads
Rubber pads hardness: 50 - 70 shore A
Number of belts: at least 2 for pipes up to 50mm OD included
Number of belts: at least 3 for pipes up to 90mm OD included
Installed power: DC drive, thyrister total controlled 1 Kw min
Speed control: remote with high sensibility potentiometer
Mechanical control: quick opening, quiet pneumatic closing
Heigh of pipe axes from the floor: 1000 - 1100 mm

UTILITY NEEDS:
1) Power X (
2) Air X) see 1.1.2
3) Water (

MAIN SUPPLIERS:

See item 1.1.2

LAY-OUT REF. 1.2.8	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: CUTTING UNIT

MAIN CHARACTERISTICS:

Type: rotating saw with vertical movement. The unit should be able to translate; while cuitting, at the same extrusion speed.

Saw cutting blade: air transparent tipe to minimize calibration problems during cutting

Pipe range: diam. 20 - 250 maximum thickness 9mm

Cutting scraps: separate collector

Installed power: 2 Kw minimum AC drive

Pneumatic clamping on the moving pipe

Pipe axes heigth from the ground: 1000 : 1100mm

Special features:
tropicalized
dust proof

UTILITY NEEDS:
1) Power X (
2) Air X) see 1.1.2
3) Water (

MAIN SUPPLIERS:

See item 1.1.2

LAY-OUT REF. 1.2.9	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: TWIN WHEELED COILS

MAIN CHARACTERISTICS:

Type: side by side positioned coiling reels

Minimum range of inner diameter of pipe coil: 480mm : 2160 mm

Maximum outer diameter of pipe coil: 2800 mm

Minimum range of width of each pipe coil: 300 : 1000 mm

Electromechanical clutch drive at constant adjustable torque

Installed power: at least 3 kw

Maximum speed: 15 mt/min

Easy strip linking of the wounded coil by hand

Easy removing of linked wounded coil by hand forklift

Working selection of: coiling reels in use left, right, both

UTILITY NEEDS:
1) Power (
2) Air) see 1.1.2
3) Water (

MAIN SUPPLIERS:

See item 1.1.2

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LAY-OUT REF. 1.2.10	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE WASTE GRINDER

MAIN CHARACTERISTICS:

Type: heavy construction, rotating blade grinder, for HDPE pipes diam. 90 x 9 mm max
Hopper: low noise, with lateral pipe feeding
Rotating blades: minimum n.3
FIxed blades: n.2
Rotor minimum width: 400mm
Rotor minimum diameter: 300mm
Water circulating cooled grinding room
Screen holes: 8mm diameter
Installed power: 15 Kw minimum
Capacity: 150 Kg/h
Complete electrical control cabinet, with security switches
scrap collecting under tank.

Special features:
tropicalized
dust proof

UTILITY NEEDS:
1) Power X 15 Kw
2) Water X 0.3 cu.m/h

QUANTITY: 1

MAIN SUPPLIERS:

CUMBERLAND (U.K.) - MECCANOPLASTICA (I) - TRIA (I) - and several other

LAY-OUT REF. 1.2.11	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE PIPES BUTT WELDING EQUIPMENT

MAIN CHARACTERISTICS:

Type: portable HDPE pipe butt welding machine for pipe range 20 : 90mm (maximum wall thickness 9mm)

Complete with: hand or electrical powered front milling of the two pipes surfaces to be welded
- twin tables holding clamps (one fixed, the other hand movable)
- heating thermo-controlled plate (antiadhesive surface) at 190 : 210°C
- spring operated loading device with locking under load
- easy reading load scale
- thermo-chromic wax pencils set

UTILITY NEEDS:
1) Power X

MAIN SUPPLIERS:

LAY-OUT REF. 1.2.12	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: HDPE PIPES TEE AND BENDS BUTT WELDING EQUIPMENT

MAIN CHARACTERISTICS:

Type: portable HDPE pipe butt welding machine for pipe range 20-90mm (maximum wall thickness 9mm).
These units in addition to the butt welders described in ref. 1.2.11 may cut and weld HDPE pipes in angular sections at 30°; 45°; 60° and 90° degrees.

UTILITY NEEDS:

MAIN SUPPLIERS:

LAY-OUT REF. 1.3.1	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: INJECTION MOULDING MACHINE

MAIN CHARACTERISTICS:

1) Horizontal clearance between colum: at least 10mm more than maximum width of latrine pans mould (ref.1.3.2) with shiding section upwards

2) minimum 420 tons clamping force

3) minimum shot capacity

4) mechanical mouvements (locking knee)

5) mould thickness allowed range 400 : 800mm minimum

6) security switches on gates, automatic opening

7) extraction device on moving plate

8) electromechanical control cabinet with sequence of cycle (relais type, not microprocessor)

9) thermocontrollers: electronics Fee-cost type, PID function minimum 96 x 96 front dimension
HDPE plasticating screw with valve + UPVC dry blend screw
security control on lubrification, filters, water and oil
water flow control for mould cooling

OTHER FEATURES:
- tropicalized
- dust proof protection

UTILITY NEEDS:

MAIN SUPPLIERS:

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LAY-OUT REF. 1.3.2	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: LATRINE PAN MOULD.

MAIN CHARACTERISTICS:

- Moulded piece as described in drawing without number of 2.2.84 of Environmental Sanitation Division Dept. of Health (at point A1, A2, A3, A4)
- thickness of the pan: minimum 3mm
- material of piece: HDPE
- weight of pan including running feeders about 800 gr
- material of mould: alloy steel (Nichel Chronium)
- type: simple and rugged construction, hydraulic movement of upper sliding wall
- extraction of piece: automatic with third plate
- sealing frame around piece: at least 100mm each
- runners: cold type, manual cutting of feeding runner
- easy cleaning of water cooling holes and system

UTILITY NEEDS:

MAIN SUPPLIERS:

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LAY-OUT REF.1.3.3	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: MOULD FOR PVC FITTINGS

MAIN CHARACTERISTICS:

Type: 4 places with interchangeable insert, central solid feed head for moulding uPVC

4 hydraulic moving castles disposed at 90°, suitable to mount different round male for obtaining bends or tee

total length of stroke of every castle = 80 mm

insert for obtaining 90° elbow double socketed diam. 20
insert for obtaining 90° elbow double socketed diam. 25
insert for obtaining 90° tee triple socketed diam. 25
insert for obtaining 90° tee triple socketed diam. 32

thicknesses: sufficient to outstand 16 Bar working pressure

material of mould: alloy steel internally nickel plated

easy cleaning of cooling water holes

UTILITY NEEDS:

MAIN SUPPLIERS:

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LAY-OUT REF. 1.3.4	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: MOULD FOR LATRINE PANS FITTINGS

MAIN CHARACTERISTICS:

Type: 3 places for 3 different shape bends (90°; 135° and 45°) central solid feed head (not hot runners filling) for HDPE

Only 3 hydraulic moving male castles, each with two round male.

Bends suitable to connection to latrine pan (according to drawing...) with plain socket and sealing bond.

One of the two male used in every bend must be holed for air passing while extracting for not making internal vacuum.

Outer diameter, as inner in the socket = 80 mm

Thickness = 3 mm

Material of mould : alloy steel

Easy cleaning of cooling water holes.

UTILITY NEEDS:

MAIN SUPPLIERS:

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CONSULTING ENGINEERS

LAY-OUT REF. 3.1	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: MILLING UNIT

MAIN CHARACTERISTICS:

Milling unit:

- size of the table working surface:
- number of T slots
  . separate motors for spindle and feeds min. 1100 x 300 mm
  . spindle motor should be above 5 HP
  . feeds motor above 2 HP
- spindle ISO 40 or ISO 50 (better the second one)
- range of speeds from 30 to 1500 rpm
- number of speeds 12
- number of feeds 18
- the milling unit should be supplied with both universal and vertical milling attachment and two full set of tools.
- skid mounted refrigerating fluid

Other features:
- tropicalized drive and electrical cabling
- ISO testing procedure before shipping

UTILITY NEEDS:

MAIN SUPPLIERS:

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CONSULTING ENGINEERS

LAY-OUT REF. 3.2	EQUIPMENT DATA SHEET: EQUIPMENT DESCRIPTION: LATHE

MAIN CHARACTERISTICS:

Lathe:

- max turning capacity mm 2000 x mm 250
- power of electric motor above 10 HP
- spindle cam lock 8"
- Pitches: metric, whitworth module, diametral
- skid mounted refrigerating fluid

Other features:
- tropicalized drive and electrical cataling
- ISO testing procedure before shipping

UTILITY NEEDS:

MAIN SUPPLIERS:

baldo & C. s.a.
CONSULTING ENGINEERS

LAY-OUT REF. 3.3	EQUIPMENT DATA SHEET: Lay-out EQUIPMENT DESCRIPTION: autoclave

MAIN CHARACTERISTICS:

Type	:	vertical stirrer, for high visous liquid
Capacity	:	150 lt
Cap	:	air-tight, manual opening and loading
Heating	:	circulating oil max 130 °C
Emptying	:	gravity manual 2" teflon seals bottom ball valve
Electrics	:	explosion proof equipment, for stirrer drive, timer and oil thermoregulator

Other features:

- gas suction fan
- tin cans set with tight covers of 0.5 and 1 kg capacity for cement storage

UTILITY NEEDS:
1) Power x 10 kw
2) Water x 0.2 cu.m/h

AREA NEEDS:

PRICE F.O.B.:

MAIN SUPPLIERS:

many chemical equipment makers

6.2.3 Summary of main production equipment and major ancillary and service plant

6.2.3.1 Production Equipment (a)	ESTIMATED F.O.B. PRICE IN US $
A) ONE COMPLETE uPVC TWIN SCREW COUNTER ROTATING LINE including extrusion tools, calibrating and cooling units, haul off, cutting unit, tilting table.	310,000
B) ONE COMPLETE HDPE SINGLE SCREW EXTRUSION LINE, together with relevant tools, cooling and calibrating units, haul off, cutting unit and twin wheeled coil	340,000
Weighing unit	4,000
High speed mixer for dry blends	77,000
2 MARKERS one for each line	24,000
SOCKETING MACHINE (uPCV)	28,000
THREADING MACHINE (uPVC) tube well casings	33,000
SLEEVING MACHINE (uPVC) tube well screens	40,000
uPVC WASTE GRINDER	33,000
HDPE WASTE GRINDER	25,000
HDPE SELF DRYING HOPPER	15,000
FRONT BUTT WELDING (HDPE) (3 UNITS)	9,000
FRONT 1 ANGULAR BUTT WELDING (2 CIRCUITS)	6,000
ONE INJECTION MOULDING MACHINE	230,000
MOULD for latrine pans	45,000
MOULD for latrine pans fittings	20,000
MOULD for uPVC pipe fittings	25,000
SPARE PARTS	70,000

TOTAL PRODUCTION EQUIPMENT (a)	1,329,000

6.2.3.2 Laboratory (referred to as Production Equipment (b) in Comfar)

A) PHYSICAL AND PHYSIOCHEMICAL TESTS

- Set of polyolefin density columns
- Direct reading density balance
- Apparent powder density funnel
- Shaker for compacted PVC resins
- Digital precision balance 0 : 200 g ± 0.0001 g
- Balance plates 0 : 200 g ± with set of weights
- Spinning balance 500 g
- Spinning balance 30 kg
- Micrometers, Slide calibers (2+2)
- Polarization microscope
- Stop watches (2)
- Viscometers (2)
- Thermostatic bath transparent glass firmware
- pH - meter with glass electrodes
- Stirrer (variable speed) with set of glass agitators.
- Magnetic stirrer with heated plate

TOTAL OF PHYSICAL AND CHEMICAL TESTING EQUIP 18,000

B) HARDNESS AND MECHANICAL TEST EQUIPMENT

- Rockwell hardness tester for plastic
- Shore A and shore D durometers (3)
- Impact tester, analogical read out (Izod/Charpy type)
- Tensile testing machine up to 30 kN, printed read out
- Stress cracking apparatus
- Short and long term burst pressure tester
- Falling weight impact tester
- Elmendorf tear testing apparatus
- Equipment for mechanical tests specimen preparation: moulding, puncher, rotating saw, contour cut milling machine, press und notching machine the latter for the impact tester saples.

TOTAL HARDNESS AND
MECHANICAL TEST EQUIP. 157,000 US $

C) THERMAL PROPERTIES TESTS EQUIPMENT

- Melt flow index
- Heat distorsion
- Vicat softening point
- Melt point measurement with polarized light
- Oven 25 - 300° centigrade

TOTAL FOR THERMAL PROPERTIES
TESTS EQ. 26,000 US $

D) GLASSWARE, REACTORS, AND CHEMICAL CONSUMERS (Lump sum) and other auxiliary equipment — 19,000

TOTAL LABORATORY EQUIPMENT (b) — 220,000 US $

6.2.3.3 Utilities and ancillaries

	Foreign U.S. $	Local U.S. $
A) POWER		
. Overhead transmission line		65,000
. Electrical distribution substation and stabilizer		135,000
. Power distribution		15,000
. Light distribution		11,000
TOTAL POWER	--	226,000
B) WATER		
. Well drilling	--	7,000
. water tank, and distribution	--	11,000
. Water chillers	60,000	--
TOTAL WATER	60,000	18,000
C) AIR		
. Compressor and . Distribution	--	6,000
D) MAINTENANCE WORKSHOP		
. Milling machine	30,000	--
. Lathe	27,000	--
TOTAL	57,000	
E) DIESEL EMERGENCY UNIT	50,000	--
F) ANCILLARIES		
. Fork lift 3.5 tons	35,000	--
. Pickup (2)	--	30,000
TOTAL	35,000	30,000
G) SPARE PARTS FOR GENERAL MAINTENANCE	10,000	10,000
TOTAL UTILITIES AND ANCILLARIES	212,000	290,000

The above figures have been modified as shown below to take into consideration all the components (transport, erection, etc) as well as:
3% increase for inflation before equipment are purchased
10% contingencies

Description	Foreign origin $	Local origin $
uPVC line	600,000	-
HDPE line	460,000	-
Injection moulding	360,000	-
Ancillaries	100,000	35,000
Laboratory equip.	250,000	-
Utilities	124,000	280,000
Spare parts	95,000	10,000
Transport	165,000	35,000
Erection/commissioning	60,000	55,000
Plant design & eng.	56,000	20,000
Civil works		731,000
	2,270,000	1,166,000

TOTAL 3,436,000 $

6.2.4 Civil Works

6.2.4.1 Site location

The site is located in the Hmwaby industrial estate area, close to Hmbawi village along Rangoon/Mandalay main road.
The road is in good conditions and at present is being furtherly enlarged.
Main roads and locations have been reproduced on a map (see map BURMA/1).

6.2.4.2 Site description

A general lay-out of Hmbawy industrial area is shown in the attached drawing N. BURMA/2
The suggested production building herein is clearly indicated.The production and raw material buildings have been already constructed. The new production will have no effect on the size of the administration Bldg and of the maintenance workshop.

6.2.4.3 Civil works

As previously stated the main buildings are ready. Drawings representing lay-out (N.BURMA/3), and typical are annexed to this report.

According to the officials of Factory N° 3, the total cost of the Buildings are as follows:

Production Bld	4,500,000 Kiats
& Raw material and ports warehouse, roads, etc.	2,500,000 Kiats

The available area is much beyond the effective need. The necessary area is as follows:

- 60% of production Bldg
- Raw material warehouse (finished products are stored in the outside yard under a simple shed).

In the investment costs only this occupied portion will be considered.

In the production Bldg a steel framework for hanging on a false ceiling is foreseen. False ceiling is not recommended. Instead it is suggested to use this framework to install water and air pipes and cable trays for utility distribution. This solution leaves the area free and flexible for future modification in the lay-out. It also makes it easier to install the utilities and reduces costs.
The given cost estimates for the distribution of the utilities have been made using this configuration.

Internal roads are not modified and are included in the lump sum price of the buildings.

In addition some minor changes are proposed and are shown in the lay-out as:

- removing of a partition wall to better install laboratory equipment
- increase the dimensions of the transformer room and of the compressor room.

6.2.5 Estimate & allowance of spare parts & consumable

6.2.5.1 Spare parts

The offers received at this stage were budgetary lump sum quotations. Even if some of them mentioned and quoted the spare parts the figures are not comparable as far as the scope covered by these spare parts may differ.

It was proceeded assuming a 5% allowance on total investments to cover purchase of spare parts for two years normal operation. These do not include pieces subject to be reconditioned frequently (impellers) for

which it was requested to supply two. One to operate while the second is in maintenance.
In the final tender documents we suggest to ask for unit price quotations of spare parts considering two categories:

a) Spare parts for two years of normal operation at 2 or 3 shifts as the case may be. (Included in the bid price).

b) Additional recommended spare parts which is a list of pieces, the manufacturer suggests, according to his experience, to account for the distance separating the problems of mixing new orders etc.These pieces are not included in the bid price, but are to be considered as options to take before awarding contract and sometimes even after.

6.2.5.2 **Consumable hardware and tools**

Process technology of plastic extrusion and injection cause little wear and tear to hardware and tools. Only some reconditioning of linings and maintenance on components may be required. (1)
Consumable tools for the milling and lathe machines have irrelevant impact.

6.2.6 Foreign technical assistance

It is suggested that technical assistance be provided by 2 foreign experts during the first two years of operation of the new demonstration unit, namely:

- One expert in plastic pipes production as well as in injection moulding.
  He should have spent at least 10 years in a production unit and be acquainted with actual production problems, maintenance, workshop operation etc.

- One expert in plastic appliance quality control and testing laboratories with at least 10 years experience.

Note: (1) uPVC pressure pipe extruders with counterrotating screws running at no more than 9 mt/mins of peripherical screws
speed, have a screws working life of about 20.000 : 25.000 hours/at 3 shift production, 7 days a week, without interruptions). Frequent start up and shut down reduces T.B.O. (time between overwhole) not only on the crews but also of the barrel and heads.

7. PLANT ORGANIZATION AND OVERHEAD COSTS

The new demonstration unit will be located in the Plastic Factory N. 3 where most of the infrastructures, facilities and services are already available. It is recommended that the new unit be organized as a division of the existing factory from the administrative point of view. This will also decrease overheads and administrative expenses.

8. MANPOWER

8.1 GENERAL

Manpower requirements have been established taking into account the following considerations:

8.1.1 The production unit will be located within the boundary of an existing and operating plastic industry. The present industry is manned and staffed and we deem that expanding production will increase only direct and indirect labour involved in the new production lines while it should not effect other indirect services. Purchase in large quantities of some new raw materials do not justify any increase in the purchase dept. Besides, Purchase and Selling in Burma are done according to rigid and consolidated plans directly at Corporate level, if not at higher levels.

8.1.2 Presently the plant has a total manpower of 70 persons divided in 52 direct and 18 indirect workers (ratio indirect/direct 1:3).

8.1.3 Extrusion of uPVC should be carried out as much as possible on a continuous basis. The injection moulding machine in order to satisfy the production output is also scheduled on three shifts. The HDPE line works in two shifts. Laboratory and indirect staff work only during normal hours.

8.1.4 Wages and salaries in Burma have a wide classification range. The Administration Dept. and Accounting Dept. have provided the following table:

TABLE C.1 - WAGES AND SALARIES (INCLUDING BENEFITS AND SOCIAL SECURITY CONTRIBUTION)
All Values in Kiats - 1 $ = 7.25 K

	DESIGNATION	PAY SCALE	SPECIAL	S.S.b. CONTRIBUTION
1.	General Mgr.	1400/1300	130/120	7.80
2.	Deputy General Mgr.	1000-50-1200	110	7.80
3.	Assistant Factory Mgr.	800-40-1000	100	7.80
4.	Deputy Assistant Mgr.	500-30-800	90	7.80
5.	Head of Division	450-25-700	90	7.80
6.	Technician Grade 10/Superintendent	400-20-520	90	7.80
7.	Technician Grade 9	360-20-480	85	7.80
8.	Technician Grade 8	320-15-440	85	7.80
9.	Branch Clerk	300-15-420	85	7.80
10.	Technician Grade 7	260-15-380	80	7.80
11.	Technician Grade 6	210-15-330	80	7.80
12.	Upper Division Clerk	185-15-305	80	7.80
13.	Technician Grade 5	160-10-230	80	7.80
14.	Technician Grade 4	150-10-220	75	7.80
15.	Lower Division Clerk Technician Grade 3	130-10-200	75	5.80
16.	Technician Grade 2	125-5-150	70	4.50
17.	Technician Grade 1	110-3-125	70	3.25
18.	Apprentice and Office Helper	100-2-110	70	3.25

SOURCE: Administration Department and Accounting Department, Pharmaceutical Industries Corporation

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For investment purposes it was considered a reduced number among the categories listed hereabove: level 1, level 4, level 6, level 8, level 11, and level 17.

Category as in pharmaceutical Industries Corporation list	Corresponding to positions in the following organization chart
Top Manager (Level 1)	General Manager
Manager (Level 4)	. Production & Planning Mgr. . Laboratory Mgr.
Superintendent (Level 6)	. HDPE Manager . uPVC Manager . Moulding Manager
Technicians & Quality Control (Level 8)	. General Maintenance . Tools & mould maintenance . Quality control . Technical Bureau . Lab. Technicians . Chief Blenders . Clerks
Skilled Workers & Clerks, drivers (Level 11)	. The remaining except helpers.
Helpers (Level 17)	. Helpers

8.2 ORGANIZATION CHART

GENERAL MANAGEMENT OFFICE

General Mgr.	1 * 1 shift	= 1
Clercks	3 *	= 3
Drivers	1 * 2	= 2
Office Helper	1 * 1	= 1

PRODUCTION

Manager	1 * 1 shift	= 1

LABORATORY

Manager	1 * 1 Shift	= 1

INDIRECT LABOUR

Grinders	1 * 1 shift	= 1
Tooling	1 * 2	= 2
Technical Bur.	1 * 1	= 1
Quality Control	1 * 1	= 1
Gen. Maintenance	2 * 1	= 2
Moulds Maint.ce	1 * 1	= 1
Forklift driver	1 * 3	= 3
Helpers	2 * 3	= 6
Threading *	1 * 2	= 2
TOTAL INDIRECT LABOUR		19

HDPE LINE

1 Head	* 2 Shifts
1 Operator	* 2 Shifts
TOTAL DIRECT	4

INJECTION MOULDING

1 Manager	* 3 Shifts
1 Assist	* 3
TOTAL DIRECT	6

UPVC LINE

1 Head	* 3 shifts
1 Chief blender	* 3 shifts
1 Assist. blender	* 3 shifts
1 Cutting/handl.	* 3 shifts
TOTAL DIRECT	12

LABORATORY

Technicians	1 * 3 shift	= 3
Helper	1 * 1 shift	= 1
TOTAL LABORATORY		4

TOTAL DIRECT WORKERS 22
INDIRECT WORKERS 32

* Threading personnel considered indirect because also employed on other activities

8.3 TOTAL LABOUR COSTS

	NUMBER (A)	SHIFT (B)	TOTAL (AxB)	MONTHLY SALARY IN KIATS	S.S. CONTRIB. IN KIATS	DIRECT COSTS WAGE (Kiats)	DIRECT COSTS S.S. (Kiats)	INDIRECT COSTS WAGE (Kiats)	INDIRECT COSTS S.S. (Kiats)
General Manager	1	1	1	1,530	7.80	-	-	18,360	93.6
Production Manager	1	1	1	890	7.80	-	-	10,680	93.6
Laboratory Manager	1	1	1	890	7.80	-	-	10,680	93.6
HDPE Manager (direct)	1	2	2			14,640	187.2		
uPVC Manager (direct)	1	3	3	610	7.80	21,960	280.2		
Moulding Manager (Dir)	1	3	3			21,960	280.2		
Quality Control	1	1	1			-	-	6,420	93.6
Technical Office	1	1	1			-	-	6,420	93.6
Lab. Technicians	3	3	1			-	-	19,260	280.8
Chief Blender (direct)	1	3	3	535	7.80	19,260	280.8	-	-
General Maintenance	2	1	2			-	-	12,840	187.2
Tools & Mould Maintenance	1	1	1			-	-	6,420	93.6
Clerks	3	1	3			-	-	19,260	280.8
Grinder Operators	1	1	1			-	-	4,920	93.6
Tooling	1	2	2			-	-	9,840	187.2
Forklift Driver	1	3	3			-	-	14,760	280.8
Coiler (direct)	1	2	2	410	7.80	9,840	187.2	-	-
Assist. moulding (direct)	1	3	3			14,760	280.8	-	-
Thread/Sleeve	1	2	2			9,840	187.2	-	-
Assist. Blender (direct)	1	3	3			14,760	280.8	-	-
Socketing & Cutting (Dir)	1	3	3			14,760	280.8	-	-
Drivers	1	2	2			-	-	9,840	187.2
Helpers	2	3	6	195	3.25	-	-	14,040	2.34
Helpers	2	1	2	195	3.25	-	-	4,680	78
			54			141,780	2,246.4	168,420	2,371.2

8.4 LABOUR COSTS DIVIDED IN DIRECT AND INDIRECT COSTS

8.4.1 Annual Direct Labour Costs

- uPVC line

		Annual Salary	S.S
Managers	(3)	21,960 kiats	280.8 kiats
Chief Blenders	(3)	19,260 kiats	280.8 kiats
Blender	(3)	14,760 kiats	280.8 kiats
Cut. & Socket	(3)	14,760 kiats	280.8 kiats
Total	(12)	70,740 kiats	1,123.2 kiats

- HDPE line

Managers	(2)	14,640 kiats	187.2 kiats
Coiler	(2)	9,840 kiats	187.2 kiats
Total	(4)	24,480 kiats	374.4 kiats

- Moulding

Managers	(3)	21,960 kiats	280.8 kiats
Assistant	(3)	14,760 kiat	280.8 kiats
Total	(6)	36,720 kiats	561.6 kiats

Total Annual direct labour costs is 141,780 kiats for wages and 2,246.4 kiats as social security.

Total direct labour: 22 units

8.4.2 Annual Indirect Labour costs

Total Annual indirect labour costs is 168,420 kiats for wages and 2,371.2 kiats for social security.

Total indirect labour: 32 units

8.5 PRE-PRODUCTION STAFF

For the purpose of assessing labour costs during pre-production stage (*) the following was assumed:

a) The General Manager is appointed in the early days of project implementation. The cost is:

- Salary . 18 months x 1,530 = 27,540 kiats
- S. Security : 18 x 7.80 = 140.4 kiats

b) The technicians to be trained abroad are the following:

- Labs manager
- Production manager who will be in charge mainly of uPVC blends and extrusion aspects.
- Another technician for HDPE extrusion, moulds and moulding.
- Maintenance engineer

In the cost we included a period of training abroad ranging from 3 to 5 months according to the specialization. Training will take place during the last 5 - 6 months before start up.
The following costs have been considered:

- Salaries and social securities: 14,480.40 Kiats
- Training costs : 80,000 US $

c) The General Manager during pre-production is expected to be assisted by two persons, at superintendent level. The provisions considered for this are the following:

- Salary : 18 x 610 x 2 = 21,960 kiats
- S. Security : 18 x 2 x 7.85 = 282.6 kiats

d) All the remaining superintendents and above, for a total of six persons should be made available 6 months before start up.
In this way, they may contribute to the erection of equipment and familiarize themselves with the machines.

The relevant cost is: 6 x 610 x 6 = 21,960
6 x 6 x 7.80 = 280.88

e) It was also considered important, to include in the pre-production team the people in charge of maintenance.

The relevant cost is: 3 x 535 x 6 = 9,360
3 x 7.80x 6 = 140.4

(*) Note: Pre-production stage covers 18 months.

9. IMPLEMENTATION SCHEDULE

The proposed implementation schedule is provided in the following table.
The following suggestions can be made on the type of contracts:

3 different contracts can be signed:

- with a foreign manufacturer for the supply of the production equipment and ancillary items;
- with a foreign manufacturer for the supply of the laboratory equipment:
- with a local contractor (Construction Corporation or equivalent) for the supply of utilities.

Assistance can be provided by UNIDO to supervise the preparation of the specifications and tender documents.

TABLE 9.1 PLASTIC APPLIANCES EXTRUSION DEMONSTRATION UNIT - BURMA

		Stato
1	START OF PROJECT	C
2	PREP. OF TENDER DOCS	C
3	OFF.SUBMITTALS	C
4	CONTARCTS AWARD	C
5	DESIGN&ENG SUPPLY	
6	MANUFACTURING EQ.	C
7	DES&ENG CIV+UTIL	
8	CIVIL WORKS	
9	UTILITIES DELIVERY	
10	UTILITIES INSTALL	P
11	SHOP TESTS	PC
12	EQUIPMENT DELIVERY	PC
13	EQUIP.INSTALL	PC
14	TRIAL RUN	C
15	COMMISIONING	C
16	START PRODUCTION	C

Periods: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

10. FINANCIAL AND ECONOMIC EVALUATION

10.1 FINANCIAL EVALUATION

In this paragraph the financial evaluation, carried out by using the COMFAR program is offered together with some economic evaluations.

Taking into consideration the peculiar conditions under which prices and taxes are calculated in Burma, the financial study has been carried out with the goal of checking the intrinsic profitability of the project and therefore assuming that:

A. All costs have been calculated as per actual local conditions (personnel, freight, custom duty etc.)

B. Selling prices have been established taking into account the cost of imported equivalent items with the assumption that local products must be competitive.

C. No profit taxes have been assumed in the basis alternative.
Profit taxes assumed to be 50% of gross profit have been considered in alternate Hypothesis No. 8.

D. The foreign component will be purchased on the basis of a commercial loan on "Consensus" terms.

E. The equity will include a cash component as well as the allocation of the nearly finished buildings (and other civil works).

F. Depreciation rates per standard rules of the Pharmaceutical Corporation, Ministry of No 1 Industry.

G. The imported production equipment have been considered duty free (but an alternative has considered the payment of 15% custom duty plus 30% turn over tax).

H. Fixed capital investment

The following notes also apply (see input tables).

TABLE 10.1 - FIXED CAPITAL INVESTMENT

DESCRIPTION	FOREIGN ORIGIN $	LOCAL ORIGIN $
uPVC line	600,000	-
HDPE linE	460,000	-
Injection Moulding	360,000	-
Ancillaries	100,000	35,000
Laboratory Equipment	250,000	-
Utilities	124,000	280,000
Spare Parts	95,000	10,000
Transport	165,000	35,000
Erection/Commissioning	60,000	55,000
Plant design & engin.	56,000	20,000
Civil Works		731,000
	2,270,000	1,166,000
TOTAL	3,436,000 $	

I. Preproduction expenses

	Foreign ($)	Local ($)
Pre-production expenses	115,000	30,000

J. Depreciation rate

TABLE 10.2 - DEPRECIATION RATE

DESCRIPTION	TERMS YEARS	RATE OF DEPRECIATION (%)
Machinery and tools	15	6.67
Factory or Process Bldg.	40	2.5
Ancillary Building	33	3.03
Administration Building	20	5
Others	33	3.03
Office furniture and equipment	15	6.67
Vehicles (Office Car, Factory cars)	5	20
Road and Railways	50	2

K. Raw material cost

The unit price of the foreign origin raw material that has been used in the COMFAR (column L 65) is the following:

Product A:	uPVC pipes	1.23 $
Product B:	HDPE pipes	1.33 $
Product C:	Latrine pans sets	1.20 $
Product D:	uPVC fittings	1.30 $
Product E:	tube well casings	1.23 $

These values are referred to all foreign origin raw materials used for the production of that specific product (i.e. PVC suspension, stabilizer, pigment etc.) in the right proportion according to the mix.

SOURCE: Ministry of N. 1 Industry, Industrial Planning

Foreign production cots, beside raw materials and specifically allocated spare parts are:

- Spare parts for utilities and general — 4,000 $/year
- Foreign technical assistance — 110,000 (1) $/year (firts 2 years)

Local cost not allocated to specific products include:

- Energy (line L.85) for utilities etc. — 12,270 $
- Factory overhead (line L.87) — 35,000 $
- Cost for sales and distribution not considered because in charge to the Pharmaceutical Corporation and not to the unit.

(1) Note: 2 experts x 55,000 $/year each.

10.1.1 INPUT DATA FOR THE FINANCIAL EVALUATION

Tabi BURMA : Text Variables

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Project Name:	BURMA PLASTIC DEMONSTRATION UNIT
Date:	30 APR.1987
Name of Alternative:	DP/BUR/80/015 Contract 86/97
Accounting currency:	1000 US dollars
Name of Product (A):	uPVC PIPES
Name of Product (B):	HDPE PIPES
Name of Product (C):	LATRINE PANS SETS
Name of Product (D):	uPVC FITTINGS
Name of Product (E):	TUBEWELL CASINGS

Tabi BURMA : General Variables

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Multiplier to compute foreign into accounting currency:	1.000
Multiplier to compute local into accounting currency:	1.000
Construction phase: 2 year(s), planned half-yearly	
Interest rate for computation of future values in % p.a.:	8.000
Percent rate for CF-Discounting:	10.000

Equity - O: not specified

Equity - P: not specified

Subsidies : not specified

Loan A: first disbursement in period 1
Amortization: constant principal
lasting for 7 year(s)
paying half-yearly rates
Period of grace: 2 year(s)
Interests payable: 8.0 % for year 1 through 7

Loan B: not specified

Loan C: not specified

Overdraft: not specified

Tobi BURMA : Source of finance - local funds

Equity - O: first disbursement in year 1

Equity - P: not specified

Subsidies : not specified

Loan A: not specified

Loan B: not specified

Loan C: not specified

Overdraft: not specified

Tabi BURMA : Subtable **Initial Fixed Investment - foreign**

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Deprec- %	Type of de	Scrap - %	Depreciati	Amount- P1	Amount- P2	Amount- P3
L 1 Land........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 2 Site preparation and developme	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 3 Structures and civil (a)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 4 Structures and civil (b)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 5 Incorporated fixed assets,-(a)	6.67	1.00	0.00	15.00	0.00	56.00	0.00
L 6 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 7 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 8 Plant machinery and equipm-(a)	6.67	1.00	10.00	15.00	0.00	303.00	454.00
L 9 Plant machinery and equipm-(b)	6.67	1.00	20.00	15.00	0.00	0.00	50.00
L 10 Auxiliary and service faciliti	3.03	1.00	0.00	33.00	0.00	44.00	44.00
L 11 Pre-production expenditures...	20.00	1.00	0.00	5.00	0.00	0.00	20.00
L 12 Inventory, working capital....	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable **Initial Fixed Investment - local**

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Deprec- %	Type of de	Scrap - %	Depreciati	Amount- P1	Amount- P2	Amount- P3
L 13 Land........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 14 Site preparation and developme	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 15 Structures and civil (a)......	2.50	1.00	50.00	40.00	0.00	717.00	14.00
L 16 Structures and civil (b)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 17 Incorporated fixed assets,-(a)	6.67	1.00	0.00	15.00	0.00	20.00	20.00
L 18 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 19 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 20 Plant machinery and equipm-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 21 Plant machinery and equipm-(b)	20.00	1.00	0.00	5.00	0.00	0.00	35.00
L 22 Auxiliary and service faciliti	8.33	1.00	0.00	12.00	0.00	0.00	145.00
L 23 Pre-production expenditures...	20.00	1.00	0.00	5.00	0.00	5.00	10.00
L 24 Inventory, working capital....	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Tabl BURMA : Subtable Initial Fixed Investment - foreign

8	9	10	11	12	13	14	15	16	17
Amount- P4	Amount- P5	Amount- P6	Amount- P7	Amount- P8	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
758.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
136.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabl BURMA : Subtable Initial Fixed Investment - local

8	9	10	11	12	13	14	15	16	17
Amount- P4	Amount- P5	Amount- P6	Amount- P7	Amount- P8	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
145.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Current Fixed Investment - foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Deprec-n %	Depreciati	Scrap - %	Depreciati	Amount- Y1	Amount- Y2	Amount- Y3
L 25 Land........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 26 Site preparation and developme	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 27 Structures and civil (a)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 28 Structures and civil (b)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 29 Incorporated fixed assets,-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 30 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 31 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 32 Plant machinery and equipm-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 33 Plant machinery and equipm-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 34 Auxiliary and service faciliti	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 35 Pre-production expenditures...	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 36 Inventory, working capital....	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Current Fixed Investment - local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Deprec-n %	Depreciati	Scrap - %	Depreciati	Amount- Y1	Amount- Y2	Amount- Y3
L 37 Land........................	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 38 Site preparation and developme	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 39 Structures and civil (a)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 40 Structures and civil (b)......	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 41 Incorporated fixed assets,-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 42 Incorporated fixed assets,-(b)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 43 Incorporated fixed assets,-(c)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 44 Plant machinery and equipm-(a)	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 45 Plant machinery and equipm-(b)	20.00	1.00	0.00	5.00	0.00	0.00	0.00
L 46 Auxiliary and service faciliti	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 47 Pre-production expenditures...	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L 48 Inventory, working capital....	0.00	1.00	0.00	0.00	0.00	0.00	0.00

Tobi BURMA : Subtable Current Fixed Investment - foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

8	9	10	11	12	13	14	15	16	17
Amount- Y4	Amount- Y5	Amount- Y6	Amount- Y7	Amount- Y8	Amount- Y9	Amount-Y10	Amount-Y11	Amount-Y12	Amount-Y13
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tobi BURMA : Subtable Current Fixed Investment - local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

8	9	10	11	12	13	14	15	16	17
Amount- Y4	Amount- Y5	Amount- Y6	Amount- Y7	Amount- Y8	Amount- Y9	Amount-Y10	Amount-Y11	Amount-Y12	Amount-Y13
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	35.00	0.00	0.00	0.00	0.00	35.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Production Costs - foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Inflator %	Adjust- Y1	Adjust- Y2	Adjust- Y3	Adjust- Y4	Adjust- Y5	Adjust- Y6
L 52 Raw material, annual cost (a).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 53 Raw material, annual cost (b).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 54 Utilities, annual cost.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 55 Energy, annual cost..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 56 Labour (direct), annual cost..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 57 Maintenance, annual cost......	0.00	0.00	0.00	0.00	0.00	0.00	[illegible]
L 58 Spares, annual cost..........	0.00	4.00	4.00	4.00	4.00	4.00	4.00
L 59 Factory overheads, annual cost	0.00	110.00	110.00	0.00	0.00	0.00	0.00
L 60 Administration, labour cost...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 61 Administration, non-labour cos	0.00	0.00	0.00	[illegible]	0.00	0.00	0.00
L 62 Marketing, labour cost........	0.00	0.00	0.00	[illegible]	0.00	0.00	0.00
L 63 Marketing, non-labour cost....	0.00	0.00	0.00	[illegible]	0.00	0.00	0.00

Tabi BURMA : Subtable Standard Production Costs - foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Quanti- A	Variat- A	Quanti- B	Variat- B	Quanti- C	Variat- C	Quanti- D
L 64 Raw material (a).............	947.00	100.00	479.40	100.00	156.00	100.00	38.25
	Product A	Not used	Product B	Not used	Product C	Not used	Product D
L 65 Raw material, unit price (a)..	1.23	0.00	1.33	0.00	1.20	0.00	1.30
	Quanti- A	Variat- A	Quanti- B	Variat- B	Quanti- C	Variat- C	Quanti- D
L 66 Raw material (b).............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Product A	Not used	Product B	Not used	Product C	Not used	Product D
L 67 Raw material, unit price (b)..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Standa- A	Variat- A	Standa- B	Variat- B	Standa- C	Variat- C	Standa- D
L 68 Utilities, annual cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 69 Energy, annual cost...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 70 Labour (direct), annual cost..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 71 Maintenance, annual cost......	10.00	100.00	5.00	100.00	10.00	100.00	5.00
L 72 Spares, annual cost...........	18.00	100.00	18.00	100.00	10.00	100.00	8.00
L 73 Factory overheads, annual cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 74 Administration, labour cost...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 75 Administration, non-labour cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 76 Marketing, labour cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 77 Marketing, non-labour cost....	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Foreig- A	Foreig- B	Foreig- C	Foreig- D	Foreig- E	Foreig- F	Local - A
L 78 % of annual depreciation costs	35.00	30.00	20.00	10.00	5.00	0.00	35.00

Tabi BURMA : Subtable Production Costs - local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Inflator %	Adjust- Y1	Adjust- Y2	Adjust- Y3	Adjust- Y4	Adjust- Y5	Adjust- Y6
L 82 Raw material, annual cost (a).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 83 Raw material, annual cost (b).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 84 Utilities, annual cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 85 Energy, annual cost...........	0.00	12.27	12.27	12.27	12.27	12.27	12.27
L 86 Labour (direct), annual cost..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 87 Maintenance, annual cost......	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 88 Spares, annual cost...........	0.00	10.00	10.00	10.00	10.00	10.00	10.00
L 89 Factory overheads, annual cost	0.00	35.00	35.00	35.00	35.00	35.00	35.00
L 90 Administration, labour cost...	0.00	6.60	6.60	6.60	6.60	6.60	6.60
L 91 Administration, non-labour cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 92 Marketing, labour cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tobi BURMA : Subtable Production Costs - foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

8	9	10	11	12	13	14	15	16	17
Adjust- Y7	Adjust- Y8	Adjust- Y9	Adjust-Y10	Adjust-Y11	Adjust-Y12	Adjust-Y13	Adjust-Y14	Adjust-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tobi BURMA : Subtable Standard Production Costs - foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

8	9	10	11	12	13	14	15	16	17
Variat- D	Quanti- E	Variat- E	Quanti- F	Variat- F	Not used	Not used	Not used	Not used	Not used
100.00	63.40	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Product E	Not used	Product F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variat- D	Quanti- E	Variat- E	Quanti- F	Variat- F	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Product E	Not used	Product F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variat- D	Standa- E	Variat- E	Standa- F	Variat- F	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	2.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Local - B	Local - C	Local - D	Local - E	Local - F	Not used	Not used	Not used	Not used	Not used
30.00	20.00	10.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00

Tobi BURMA : Subtable Production Costs - local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

8	9	10	11	12	13	14	15	16	17
Adjust- Y7	Adjust- Y8	Adjust- Y9	Adjust-Y10	Adjust-Y11	Adjust-Y12	Adjust-Y13	Adjust-Y14	Adjust-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	12.27	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	0.00
35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	0.00
6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

L 93 Marketing, non-labour cost....	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabl BURMA : Subtable Standard Production Costs - local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Quanti- A	Variat- A	Quanti- B	Variat- B	Quanti- C	Variat- C	Quanti- D
L 94 Raw material (a).............	0.00	0.00	0.00	0.00	159.00	100.00	0.00
	Product A	Not used	Product B	Not used	Product C	Not used	Product D
L 95 Raw material, unit price (a)..	0.00	0.00	0.00	0.00	1.00	0.00	0.00
	Quanti- A	Variat- A	Quanti- B	Variat- B	Quanti- C	Variat- C	Quanti- D
L 96 Raw material (b).............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Product A	Not used	Product B	Not used	Product C	Not used	Product D
L 97 Raw material, unit price (b)..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Standa- A	Variat- A	Standa- B	Variat- B	Standa- C	Variat- C	Standa- D
L 98 Utilities, annual cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 99 Energy, annual cost...........	18.33	100.00	9.65	100.00	6.60	100.00	3.85
L 100 Labour (direct), annual cost..	6.00	0.00	3.50	0.00	3.00	0.00	2.40
L 101 Maintenance, annual cost......	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 102 Spares, annual cost...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 103 Factory overheads, annual cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 104 Administration, labour cost...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 105 Administration, non-labour cos	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 106 Marketing, labour cost........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 107 Marketing, non-labour cost....	0.00	0.00	0.00	0.00	0.00	0.00	0.00

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Standard Production Costs - local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

8	9	10	11	12	13	14	15	16	17
Variat- D	Quanti- E	Variat- E	Quanti- F	Variat- F	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Product E	Not used	Product F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variat- D	Quanti- E	Variat- E	Quanti- F	Variat- F	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Product E	Not used	Product F	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Variat- D	Standa- E	Variat- E	Standa- F	Variat- F	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100.00	1.30	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tobi BURMA : Subtable **Production Program and Sales - foreign**

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 110 Yearly production, export - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 111 Unit price, export product A.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 112 Sales tax, export product A..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 113 Other direct variable cost- A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 114 Direct non-variable cost, - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 115 Labour included in direct - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 116 Yearly production, export - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 117 Unit price, export product B.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 118 Sales tax, export product B..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 119 Other direct variable cost- B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 120 Direct non-variable cost, - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 121 Labour included in direct - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 122 Yearly production, export - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 123 Unit price, export product C.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 124 Sales tax, export product C..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 125 Other direct variable cost- C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 126 Direct non-variable cost, - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 127 Labour included in direct - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 128 Yearly production, export - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 129 Unit price, export product D.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 130 Sales tax, export product D..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 131 Other direct variable cost- D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 132 Direct non-variable cost, - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 133 Labour included in direct - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 134 Yearly production, export - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 135 Unit price, export product E.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 136 Sales tax, export product E..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 137 Other direct variable cost- E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 138 Direct non-variable cost, - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 139 Labour included in direct - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Not used	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 140 Yearly production, export - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 141 Unit price, export product F.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 142 Sales tax, export product F..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 143 Other direct variable cost- F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 144 Direct non-variable cost, - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 145 Labour included in direct - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Production Program and Sales - foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

8	9	10	11	12	13	14	15	16	17
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Production Program and Sales - local

Col	1	2	3	4	5	6	7
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 146 Yearly production, local p- A	881.00	429.00	655.00	881.00	881.00	881.00	881.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 147 Unit price, local product A..	0.00	1.80	1.80	1.80	1.80	1.80	1.80
L 148 Sales tax, local product A...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 149 Other direct variable cost- A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 150 Direct non-variable cost, - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 151 Labour included in direct - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 152 Yearly production, local p- B	470.00	329.00	423.00	470.00	470.00	470.00	470.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 153 Unit price, local product B..	0.00	2.25	2.25	2.25	2.25	2.25	2.25
L 154 Sales tax, local product B...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 155 Other direct variable cost- B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 156 Direct non-variable cost, - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 157 Labour included in direct - B	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 158 Yearly production, local p- C	150.00	105.00	135.00	150.00	150.00	150.00	150.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 159 Unit price, local product C..	0.00	4.50	4.50	4.50	4.50	4.50	4.50
L 160 Sales tax, local product C...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 161 Other direct variable cost- C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 162 Direct non-variable cost, - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 163 Labour included in direct - C	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 164 Yearly production, local p- D	37.50	22.50	30.00	37.50	37.50	37.50	37.50
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 165 Unit price, local product D..	0.00	3.00	3.00	3.00	3.00	3.00	3.00
L 166 Sales tax, local product D...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 167 Other direct variable cost- D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 168 Direct non-variable cost, - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 169 Labour included in direct - D	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 170 Yearly production, local p- E	59.00	40.00	50.00	59.00	59.00	59.00	59.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 171 Unit price, local product E..	0.00	2.40	2.40	2.40	2.40	2.40	2.40
L 172 Sales tax, local product E...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 173 Other direct variable cost- E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 174 Direct non-variable cost, - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 175 Labour included in direct - E	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Reference	Quanti- Y1	Quanti- Y2	Quanti- Y3	Quanti- Y4	Quanti- Y5	Quanti- Y6
L 176 Yearly production, local p- F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Inflat- %	1st year	2nd year	3rd year	4th year	5th year	6th year
L 177 Unit price, local product F..	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 178 Sales tax, local product F...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 179 Other direct variable cost- F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 180 Direct non-variable cost, - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 181 Labour included in direct - F	0.00	0.00	0.00	0.00	0.00	0.00	0.00

8	9	10	11	12	13	14	15	16	17
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
881.00	881.00	881.00	881.00	881.00	881.00	881.00	881.00	881.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
470.00	470.00	470.00	470.00	470.00	470.00	470.00	470.00	470.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	59.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Quanti- Y7	Quanti- Y8	Quanti- Y9	Quanti-Y10	Quanti-Y11	Quanti-Y12	Quanti-Y13	Quanti-Y14	Quanti-Y15	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7th year	8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Working Capital Requirements - £/1

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Covera- F	Covera- L	Covera- F	Covera- L	Not used	Not used	Not used
L 182 Accounts receivable C1/C2; cos	1.00	7.00	1.00	30.00	1.00	1.00	1.00
	Covera- F	Covera- L	not used	not used	Not used	Not used	Not used
L 183 Inventory, raw material (a)...	90.00	30.00	0.00	0.00	0.00	0.00	0.00
L 184 Inventory, raw material (b)...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 185 Inventory, utilities..........	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L 186 Inventory, energy.............	1.00	1.00	1.00	1.00	1.00	1.00	1.00
L 187 Inventory, spare parts........	365.00	180.00	1.00	1.00	1.00	1.00	1.00
L 188 Inventory, work-in-progress...	1.00	7.00	1.00	1.00	1.00	1.00	1.00
L 189 Inventory, finished products..	1.00	15.00	1.00	1.00	1.00	1.00	1.00
L 190 Accounts payable..............	1.00	7.00	1.00	1.00	1.00	1.00	1.00

Tobi BURMA : Subtable Working Capital Requirements - £/1

8	9	10	11	12	13	14	15	16	17
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used
1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used
1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabl BURMA : Subtable **Source of Finance - foreign**

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	1st disbu	2nd disbu	3rd disbu	4th disbu	5th disbu	6th disbu	7th disbu
L 191 Equity-O (ordinary shares)...	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 192 Equity-P (preference shares).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 193 Subsidies, grants............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 194 Loan A, foreign (AF)..........	500.00	600.00	781.90	0.00	0.00	0.00	0.00
L 195 Loan B, foreign (BF)..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 196 Loan C, foreign (CF)..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 197 Overdraft during production...	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabl BURMA : Subtable **Source of Finance - local**

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	1st disbu	2nd disbu	3rd disbu	4th disbu	5th disbu	6th disbu	7th disbu
L 198 Equity-O (ordinary shares)...	1200.00	400.00	400.00	400.10	0.00	0.00	0.00
L 199 Equity-P (preference shares).	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 200 Subsidies, grants............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 201 Loan A, local (AL)............	0.00	0.00	0.00	0.00	0.00	.00	0.00
L 202 Loan B, local (BL)............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 203 Loan C, local (CL)............	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 204 Overdraft during production...	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tobi BURMA : Subtable Source of Finance - foreign

8	9	10	11	12	13	14	15	16	17
8th disbu	9th disbu	10th disbu	11th disbu	12th disbu	13th disbu	14th disbu	15th disbu	16th disbu	17th disbu
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tobi BURMA : Subtable Source of Finance - local

8	9	10	11	12	13	14	15	16	17
8th disbu	9th disbu	10th disbu	11th disbu	12th disbu	13th disbu	14th disbu	15th disbu	16th disbu	17th disbu
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Income, Tax, Cashflow

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7
	Variab- ?	Yearly- %	Tax ho-(y)	Years loss	Tax credit	Differ- F	Differ- L
L 205 Income tax....................	0.00	0.00	0.00	1.00	0.00	0.00	0.00
	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
L 206 Investment allowance (deducted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 207 Depreciation allowance (initia	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 208 Adjustment of income tax......	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 209 Tax rate in % (if defined var	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 210 Profit distributed Equity--FF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 211 Profit distributed Equity--FL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 212 Profit distributed Equity--OF)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 213 Profit distributed Equity--OL)	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabi BURMA : Subtable Income, Tax, Cashflow

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

8	9	10	11	12	13	14	15	16	17
Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8th year	9th year	10th year	11th year	12th year	13th year	14th year	15th year	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

10.1.2 CONFAR SCHEDULES

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

BURMA PLASTIC DEMONSTRATION UNIT
30 APR.1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	3757.91	68.174 % foreign
current assets:	0.00	0.000 % foreign
total assets:	3757.91	68.174 % foreign

Source of funds during construction phase

equity & grants:	2400.10	0.000 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4282.00	43.949 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1607.27	2152.93	2482.90
depreciation :	264.41	264.41	264.41
interest :	150.55	145.18	123.67
production costs	2022.23	2562.51	2870.97
thereof foreign	86.29 %	87.59 %	88.11 %
total sales :	2148.45	2948.25	3572.40
gross income :	126.22	385.74	701.43
net income :	126.22	385.74	701.43
cash balance :	3.80	239.41	582.74
net cashflow :	154.35	653.43	975.25

Net Present Value at: 10.00 % = 3372.17
Internal Rate of Return on total investment: 22.46 %
Equity paid versus Net income flow (IRR%): 21.94 %
Net Worth versus Net Cash Return (IRR%): 21.00 %

Index of Schedules produced by COMFAR

Total initial investment
Total investment during production
Total production costs
Working capital requirements
Cashflow tables
Projected balance sheet
Net income statement
Source of finance

COMFAR 2.0 UNIDO

Total Initial Investment in 1000 US dollars

Year	1987.1	1987.2	1988.1	1988.2
Fixed investment costs				
Land, site preparation, development	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	717.00	14.00	0.00
Auxiliary and service facilities	0.00	44.00	189.00	281.00
Incorporated fixed assets	0.00	76.00	20.00	295.00
Plant machinery and equipment	0.00	303.00	539.00	958.00
Total fixed investment costs	0.00	1140.00	762.00	1534.00
Pre-production capital expenditures	10.00	37.00	89.64	185.28
Net working capital	0.00	0.00	0.00	0.00
Total initial investment costs	10.00	1177.00	851.64	1719.28
Of it foreign, in %	100.00	36.96	73.70	86.62

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Total Current Investment in 1000 US dollars

Year	1989	1990	1991	1992-93	1994
Fixed investment costs					
Land, site preparation, development	0.00	0.00	0.00	0.00	0.00
Buildings and civil works	0.00	0.00	0.00	0.00	0.00
Auxiliary and service facilities	0.00	0.00	0.00	0.00	0.00
Incorporated fixed assets	0.00	0.00	0.00	0.00	0.00
Plant, machinery and equipment	0.00	0.00	0.00	0.00	35.00
Total fixed investment costs	0.00	0.00	0.00	0.00	35.00
Preproduction capitals expenditures.	0.00	0.00	0.00	0.00	0.00
Working capital	386.82	141.89	114.25	0.00	0.00
Total current investment costs	386.82	141.89	114.25	0.00	35.00
Of it foreign, %	91.44	96.36	97.58	0.00	0.00

BURMA PLASTIC DEMONSTRATION UNIT — 30 APR.1987

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Total Current Investment in 1000 US dollars

Year	1995-98	1999
Fixed investment costs		
Land, site preparation, development	0.00	0.00
Buildings and civil works	0.00	0.00
Auxiliary and service facilities	0.00	0.00
Incorporated fixed assets	0.00	0.00
Plant, machinery and equipment	0.00	35.00
Total fixed investment costs	0.00	35.00
Preproduction capitals expenditures.	0.00	0.00
Working capital	0.00	0.00
Total current investment costs	0.00	35.00
Of it foreign, %	0.00	0.00

BURMA PLASTIC DEMONSTRATION UNIT — 30 APR.1987

COMFAR ©
2.0 UNIDO

Total Production Costs in 1000 US dollars

Year	1989	1990	1991	1992	1993
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00
Raw material 1	1337.12	1855.11	2273.40	2273.40	2273.40
Other raw materials	0.00	0.00	0.00	0.00	0.00
Utilities	0.00	0.00	0.00	0.00	0.00
Energy	35.76	44.70	52.00	52.00	52.00
Labour, direct	15.90	15.90	15.90	15.90	15.90
Repair, maintenance	18.37	24.93	30.00	30.00	30.00
Spares	48.52	60.68	70.00	70.00	70.00
Factory overheads	145.00	145.00	35.00	35.00	35.00
Factory costs	1600.67	2146.33	2476.30	2476.30	2476.30
Administrative overheads	6.60	6.60	6.60	6.60	6.60
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Depreciation	264.41	264.41	264.41	264.41	264.41
Financial costs	150.55	145.18	123.67	102.16	80.65
Total production costs	2022.23	2562.51	2870.97	2849.47	2827.96
Costs per unit (single product)	0.00	0.00	0.00	0.00	0.00
Of it foreign, %	86.29	87.59	88.11	88.02	87.93
Of it variable,%	69.90	76.45	83.56	84.20	84.84
Total labour	22.50	22.50	22.50	22.50	22.50

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Total Production Costs in 1000 US dollars

Year	1994	1995-99	2000	2001	2002
% of nom. capacity (single product).	0.00	0.00	0.00	0.00	0.00
Raw material 1	2273.40	2273.40	2273.40	2273.40	2273.40
Other raw materials	0.00	0.00	0.00	0.00	0.00
Utilities	0.00	0.00	0.00	0.00	0.00
Energy	52.00	52.00	52.00	52.00	52.00
Labour, direct	15.90	15.90	15.90	15.90	15.90
Repair, maintenance	30.00	30.00	30.00	30.00	30.00
Spares	70.00	70.00	70.00	70.00	70.00
Factory overheads	35.00	35.00	35.00	35.00	35.00
Factory costs	2476.30	2476.30	2476.30	2476.30	2476.30
Administrative overheads	6.60	6.60	6.60	6.60	6.60
Indir. costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Direct costs, sales and distribution	0.00	0.00	0.00	0.00	0.00
Depreciation	193.03	200.03	199.93	159.31	107.98
Financial costs	0.00	0.00	0.00	0.00	0.00
Total production costs	2675.92	2682.92	2682.82	2642.21	2590.88
Costs per unit (single product) .	0.00	0.00	0.00	0.00	0.00
Of it foreign, %	87.73	87.50	87.50	88.22	87.99
Of it variable, %	89.66	89.42	89.43	90.80	92.60
Total labour	22.50	22.50	22.50	22.50	22.50

COMFAR 2.0 UNIDO

Total Production Costs in 1000 US dollars

Year	2003
% of nom. capacity (single product).	0.00
Raw material 1	2273.40
Other raw materials	0.00
Utilities	0.00
Energy	52.00
Labour, direct	15.90
Repair, maintenance	30.00
Spares	70.00
Factory overheads	35.00
Factory costs	2476.30
Administrative overheads	6.60
Indir. costs, sales and distribution	0.00
Direct costs, sales and distribution	0.00
Depreciation	57.94
Financial costs	0.00
Total production costs	2540.84
Costs per unit (single product)	0.00
Of it foreign, %	87.76
Of it variable,%	94.42
Total labour	22.50

Net Working Capital in 1000 US dollars

Year	mdc	coto	1989	1990	1991	1992-2003
Coverage	mdc	coto				
Current assets &						
Accounts receivable	2	214.2	8.04	10.24	11.54	11.54
Inventory and materials	86	4.2	315.73	439.93	541.85	541.85
Energy	1	360.0	0.10	0.12	0.14	0.14
Spares	338	1.1	44.06	56.38	65.83	65.83
Work in progress	2	216.0	7.91	10.11	11.41	11.41
Finished products	3	139.0	12.81	15.91	17.73	17.73
Cash in hand	13	28.6	6.09	6.14	5.88	5.88
Total current assets			394.74	538.83	654.38	654.38
Current liabilities and						
Accounts payable	2	216.0	7.91	10.11	11.41	11.41
Net working capital			386.82	528.72	642.97	642.97
Increase in working capital			386.82	141.89	114.25	0.00
Net working capital, local			33.11	38.28	41.04	41.04
Net working capital, foreign			353.71	490.44	601.93	601.93

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

COMFAR 2.0 UNIDO

Source of Finance, construction in 1000 US dollars

Year	1987.1	1987.2	1988.1	1988.2
Equity, ordinary ..	1200.00	400.00	400.00	400.10
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	500.00	600.00	781.90	0.00
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan	500.00	600.00	781.90	0.00
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft	0.00	0.00	0.00	0.00
Total funds	1700.00	1000.00	1181.90	400.10

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Source of Finance, production in 1000 US dollars

Year	1989	1990	1991	1992-96
Equity, ordinary ..	0.00	0.00	0.00	0.00
Equity, preference.	0.00	0.00	0.00	0.00
Subsidies, grants .	0.00	0.00	0.00	0.00
Loan A, foreign .	0.00	-268.84	-268.84	-268.84
Loan B, foreign..	0.00	0.00	0.00	0.00
Loan C, foreign .	0.00	0.00	0.00	0.00
Loan A, local....	0.00	0.00	0.00	0.00
Loan B, local....	0.00	0.00	0.00	0.00
Loan C, local....	0.00	0.00	0.00	0.00
Total loan	0.00	-268.84	-268.84	-268.84
Current liabilities	7.91	2.19	1.30	0.00
Bank overdraft	0.00	0.00	0.00	0.00
Total funds	7.91	-266.65	-267.54	-268.84

Cashflow Tables, construction in 1000 US dollars

Year	1987.1	1987.2	1988.1	1988.2
Total cash inflow . .	1700.00	1000.00	1181.90	400.10
Financial resources .	1700.00	1000.00	1181.90	400.10
Sales, net of tax . .	0.00	0.00	0.00	0.00
Total cash outflow . .	10.00	1177.00	851.64	1719.28
Total assets	0.00	1145.00	792.00	1644.00
Operating costs . . .	0.00	0.00	0.00	0.00
Cost of finance . . .	10.00	32.00	59.64	75.28
Repayment	0.00	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00
Surplus (deficit) .	1690.00	-177.00	330.26	-1319.18
Cumulated cash balance	1690.00	1513.00	1843.26	524.09
Inflow, local	1200.00	400.00	400.00	400.10
Outflow, local	0.00	742.00	224.00	230.00
Surplus (deficit) .	1200.00	-342.00	176.00	170.10
Inflow, foreign . . .	500.00	600.00	781.90	0.00
Outflow, foreign . . .	10.00	435.00	627.64	1489.28
Surplus (deficit) .	490.00	165.00	154.26	-1489.28
Net cashflow	0.00	-1145.00	-792.00	-1644.00
Cumulated net cashflow	0.00	-1145.00	-1937.00	-3581.00

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Cashflow tables, production in 1000 US dollars

Year	1989	1990	1991	1992	1993	1994
Total cash inflow . .	2156.36	2950.44	3573.70	3572.40	3572.40	3572.40
Financial resources .	7.91	2.19	1.30	0.00	0.00	0.00
Sales, net of tax . .	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40
Total cash outflow . .	2152.56	2711.03	2990.96	2853.90	2832.39	2786.74
Total assets	394.74	144.09	115.55	0.00	0.00	35.00
Operating costs . . .	1607.27	2152.93	2482.90	2482.90	2482.90	2482.90
Cost of finance . . .	150.55	145.18	123.67	102.16	80.65	0.00
Repayment	0.00	268.84	268.84	268.84	268.84	268.84
Corporate tax . . .	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit) .	3.80	239.41	582.74	718.50	740.01	785.66
Cumulated cash balance	527.89	767.30	1350.04	2068.54	2808.54	3594.20
Inflow, local	2152.49	2949.04	3572.85	3572.40	3572.40	3572.40
Outflow, local	251.72	261.26	281.71	278.50	278.50	313.50
Surplus (deficit) .	1900.78	2687.78	3291.14	3293.90	3293.90	3258.90
Inflow, foreign . . .	3.87	1.40	0.85	0.00	0.00	0.00
Outflow, foreign . . .	1900.85	2449.77	2709.25	2575.41	2553.90	2473.25
Surplus (deficit) .	-1896.98	-2448.37	-2708.40	-2575.41	-2553.90	-2473.25
Net cashflow	154.35	653.43	975.25	1089.50	1089.50	1054.50
Cumulated net cashflow	-3426.65	-2773.22	-1797.97	-708.47	381.03	1435.54

Cashflow tables, production in 1000 US dollars

Year	1995	1996	1997	1998	1999	2000
Total cash inflow	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40
Financial resources	0.00	0.00	0.00	0.00	0.00	0.00
Sales, net of tax	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40
Total cash outflow	2751.74	2751.74	2482.90	2482.90	2517.90	2482.90
Total assets	0.00	0.00	0.00	0.00	35.00	0.00
Operating costs	2482.90	2482.90	2482.90	2482.90	2482.90	2482.90
Cost of finance	0.00	0.00	0.00	0.00	0.00	0.00
Repayment	268.84	268.84	0.00	0.00	0.00	0.00
Corporate tax	0.00	0.00	0.00	0.00	0.00	0.00
Dividends paid	0.00	0.00	0.00	0.00	0.00	0.00
Surplus (deficit)	820.66	820.66	1089.50	1089.50	1054.50	1089.50
Cumulated cash balance	4414.86	5235.52	6325.02	7414.52	8469.02	9558.52
Inflow, local	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40
Outflow, local	278.50	278.50	278.50	278.50	313.50	278.50
Surplus (deficit)	3293.90	3293.90	3293.90	3293.90	3258.90	3293.90
Inflow, foreign	0.00	0.00	0.00	0.00	0.00	0.00
Outflow, foreign	2473.25	2473.25	2204.40	2204.40	2204.40	2204.40
Surplus (deficit)	-2473.25	-2473.25	-2204.40	-2204.40	-2204.40	-2204.40
Net cashflow	1089.50	1089.50	1089.50	1089.50	1054.50	1089.50
Cumulated net cashflow	2525.04	3614.54	4704.04	5793.54	6848.04	7937.54

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Cashflow tables, production in 1000 US dollars

Year	2001	2002	2003
Total cash inflow . .	3572.40	3572.40	3572.40
Financial resources .	0.00	0.00	0.00
Sales, net of tax . .	3572.40	3572.40	3572.40
Total cash outflow . .	2482.90	2482.90	2482.90
Total assets	0.00	0.00	0.00
Operating costs . . .	2482.90	2482.90	2482.90
Cost of finance . . .	0.00	0.00	0.00
Repayment	0.00	0.00	0.00
Corporate tax . . .	0.00	0.00	0.00
Dividends paid . . .	0.00	0.00	0.00
Surplus (deficit) .	1089.50	1089.50	1089.50
Cumulated cash balance	10648.02	11737.52	12827.02
Inflow, local	3572.40	3572.40	3572.40
Outflow, local	278.50	278.50	278.50
Surplus (deficit) .	3293.90	3293.90	3293.90
Inflow, foreign . . .	0.00	0.00	0.00
Outflow, foreign . . .	2204.40	2204.40	2204.40
Surplus (deficit) .	-2204.40	-2204.40	-2204.40
Net cashflow	1089.50	1089.50	1089.50
Cumulated net cashflow	9027.04	10116.54	11206.04

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Cashflow Discounting:

a) Equity paid versus Net income flow:
Net present value .... 2602.89 at 10.00 %
Internal Rate of Return (IRRE1) .. 21.94 %
b) Net Worth versus Net cash return:
Net present value .... 2808.45 at 10.00 %
Internal Rate of Return (IRRE2) .. 21.00 %
c) Internal Rate of Return on total investment:
Net present value .... 3372.17 at 10.00 %
Internal Rate of Return (IRR) .. 22.45 %
Net Worth = Equity paid plus reserves

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US dollars

Year	1989	1990	1991	1992	1993
Total sales, incl. sales tax	2148.45	2948.25	3572.40	3572.40	3572.40
Less: variable costs, incl. sales tax.	1413.50	1959.16	2399.13	2399.13	2399.13
Variable margin	734.95	989.09	1173.27	1173.27	1173.27
As % of total sales	34.21	33.55	32.84	32.84	32.84
Non-variable costs, incl. depreciation	458.18	458.18	348.18	348.12	348.18
Operational margin	276.77	530.92	825.09	825.09	825.09
As % of total sales	12.88	18.01	23.10	23.10	23.10
Cost of finance	150.55	145.18	123.67	102.16	80.65
Gross profit	126.22	385.74	701.43	722.93	744.44
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	126.22	385.74	701.43	722.93	744.45
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	126.22	385.74	701.43	722.93	744.44
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	126.22	385.74	701.43	722.93	744.44
Accumulated undistributed profit	126.22	511.96	1213.38	1936.32	2680.76
Gross profit, % of total sales	5.87	13.08	19.63	20.24	20.84
Net profit, % of total sales	5.87	13.08	19.63	20.24	20.84
ROE, Net profit, % of equity	5.26	16.07	29.22	30.12	31.02
ROI, Net profit+interest, % of invest.	6.98	12.92	19.53	19.53	19.53

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US dollars

Year	1994	1995	1996	1997	1998
Total sales, incl. sales tax	3572.40	3572.40	3572.40	3572.40	3572.40
Less: variable costs, incl. sales tax.	2399.13	2399.13	2399.13	2399.13	2399.13
Variable margin	1173.27	1173.27	1173.27	1173.27	1173.27
As % of total sales	32.84	32.84	32.84	32.84	32.84
Non-variable costs, incl. depreciation	276.79	283.79	283.79	283.79	283.79
Operational margin	896.48	889.48	889.48	889.48	889.48
As % of total sales	25.09	24.90	24.90	24.90	24.90
Cost of finance	0.00	0.00	0.00	0.00	0.00
Gross profit	896.48	889.48	889.48	889.48	889.48
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	896.48	889.48	889.48	889.48	889.48
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	896.48	889.48	889.48	889.48	889.48
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	896.48	889.48	889.48	889.48	889.48
Accumulated undistributed profit	3577.23	4466.71	5356.19	6245.66	7135.14
Gross profit, % of total sales	25.09	24.90	24.90	24.90	24.90
Net profit, % of total sales	25.09	24.90	24.90	24.90	24.90
ROE, Net profit, % of equity	37.35	37.06	37.06	37.06	37.06
ROI, Net profit+interest, % of invest.	21.05	20.88	20.88	20.88	20.88

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Net Income Statement in 1000 US dollars

Year	1999	2000	2001	2002	2003
Total sales, incl. sales tax	3572.40	3572.40	3572.40	3572.40	3572.40
Less: variable costs, incl. sales tax.	2399.13	2399.13	2399.13	2399.13	2399.13
Variable margin	1173.27	1173.27	1173.27	1173.27	1173.27
As % of total sales	32.84	32.84	32.84	32.84	32.84
Non-variable costs, incl. depreciation	283.79	283.69	243.08	191.75	141.71
Operational margin	889.48	889.58	930.19	981.52	1031.56
As % of total sales	24.90	24.90	26.04	27.48	28.88
Cost of finance	0.00	0.00	0.00	0.00	0.00
Gross profit	889.48	889.58	930.19	981.52	1031.56
Allowances	0.00	0.00	0.00	0.00	0.00
Taxable profit	889.48	889.58	930.19	981.52	1031.56
Tax	0.00	0.00	0.00	0.00	0.00
Net profit	889.48	889.58	930.19	981.52	1031.56
Dividends paid	0.00	0.00	0.00	0.00	0.00
Undistributed profit	889.48	889.58	930.19	981.52	1031.56
Accumulated undistributed profit	8024.62	8914.19	9844.39	10825.91	11857.47
Gross profit, % of total sales	24.90	24.90	26.04	27.48	28.88
Net profit, % of total sales	24.90	24.90	26.04	27.48	28.88
ROE, Net profit, % of equity	37.06	37.06	38.76	40.90	42.98
ROI, Net profit+interest, % of invest.	20.71	20.72	21.66	22.86	24.02

Projected Balance Sheets, construction in 1000 US dollars

Year	1987.1	1987.2	1988.1	1988.2
Total assets	1700.00	2700.00	3881.90	4282.00
Fixed assets, net of depreciation	0.00	10.00	1187.00	2038.64
Construction in progress	10.00	1177.00	851.64	1719.28
Current assets	0.00	0.00	0.00	0.00
Cash, bank	0.00	0.00	0.00	0.00
Cash surplus, finance available	1690.00	1513.00	1843.26	524.09
Loss carried forward	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00
Total liabilities	1700.00	2700.00	3881.90	4282.00
Equity capital	1200.00	1600.00	2000.00	2400.10
Reserves, retained profit	0.00	0.00	0.00	0.00
Profit	0.00	0.00	0.00	0.00
Long and medium term debt	500.00	1100.00	1881.90	1881.90
Current liabilities	0.00	0.00	0.00	0.00
Bank overdraft, finance required	0.00	0.00	0.00	0.00
Total debt	500.00	1100.00	1881.90	1881.90
Equity, % of liabilities	70.59	59.26	51.52	56.05

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US dollars

Year	1989	1990	1991	1992	1993
Total assets	4416.13	4535.22	4969.11	5423.20	5898.80
Fixed assets, net of depreciation	3493.51	3229.10	2964.69	2700.28	2435.88
Construction in progress	0.00	0.00	0.00	0.00	0.00
Current assets	388.65	532.68	648.50	648.50	648.50
Cash, bank	6.09	6.14	5.88	5.88	5.88
Cash surplus, finance available	527.89	767.30	1350.04	2068.54	2808.54
Loss carried forward	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00
Total liabilities	4416.13	4535.22	4969.11	5423.20	5898.80
Equity capital	2400.10	2400.10	2400.10	2400.10	2400.10
Reserves, retained profit	0.00	126.22	511.96	1213.38	1936.32
Profit	126.22	385.74	701.43	722.93	744.44
Long and medium term debt	1881.90	1613.06	1344.21	1075.37	806.53
Current liabilities	7.91	10.11	11.41	11.41	11.41
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00
Total debt	1889.81	1623.16	1355.62	1086.78	817.94
Equity, % of liabilities	54.35	52.92	48.30	44.26	40.69

BURMA PLASTIC DEMONSTRATION UNIT — 30 APR.1987

COMFAR 2.0 UNIDO

Projected Balance Sheets, Production in 1000 US dollars

Year	1994	1995	1996	1997	1998
Total assets	6526.43	7147.06	7767.70	8657.17	9546.65
Fixed assets, net of depreciation	2242.85	2077.83	1877.80	1677.78	1477.75
Construction in progress	35.00	0.00	0.00	0.00	0.00
Current assets	648.50	648.50	648.50	648.50	648.50
Cash, bank	5.88	5.88	5.88	5.88	5.88
Cash surplus, finance available	3594.20	4414.86	5235.52	6325.02	7414.52
Loss carried forward	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00
Total liabilities	6526.43	7147.06	7767.70	8657.17	9546.65
Equity capital	2400.10	2400.10	2400.10	2400.10	2400.10
Reserves, retained profit	2680.76	3577.23	4466.71	5356.19	6245.66
Profit	896.48	889.48	889.48	889.48	889.48
Long and medium term debt	537.69	268.84	-0.00	-0.00	-0.00
Current liabilities	11.41	11.41	11.41	11.41	11.41
Bank overdraft, finance required	0.00	0.00	0.00	0.00	0.00
Total debt	549.10	280.25	11.41	11.41	11.41
Equity, % of liabilities	36.78	33.58	30.90	27.72	25.14

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COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Projected Balance Sheets, Production in 1000 US dollars

Year	1999	2000	2001	2002	2003
Total assets	10436.13	11325.70	12255.90	13237.42	14268.98
Fixed assets, net of depreciation	1277.73	1112.80	953.49	845.51	787.57
Construction in progress	35.00	0.00	0.00	0.00	0.00
Current assets	648.50	648.50	648.50	648.50	648.50
Cash, bank	5.88	5.88	5.88	5.88	5.88
Cash surplus, finance available	8469.02	9553.52	10648.03	11737.53	12827.03
Loss carried forward	0.00	0.00	0.00	0.00	0.00
Loss	0.00	0.00	0.00	0.00	0.00
Total liabilities	10436.13	11325.70	12255.90	13237.42	14268.98
Equity capital	2400.10	2400.10	2400.10	2400.10	2400.10
Reserves, retained profit	7135.14	8024.62	8914.19	9844.39	10825.91
Profit	889.48	889.58	930.19	981.52	1031.56
Long and medium term debt	-0.00	-0.00	-0.00	-0.00	-0.00
Current liabilities	11.41	11.41	11.41	11.41	11.41
Bank overdraft, finance required.	0.00	0.00	0.00	0.00	0.00
Total debt	11.41	11.41	11.41	11.41	11.41
Equity, % of liabilities	23.00	21.19	19.58	18.13	16.82

10.2 ALTERNATES AND SENSITIVITY ANALYSIS

The following seven pages show the COMFAR summary sheets for the following alternatives.

1. The plant operates at 50% of its capacity
2. The cost of raw materials increased (10%)
3. Selling price increase (10%)
4. Fixed capital investment increase (10%)
5. The foreign component of the fixed investment is covered by a grant.
6. The imported equipment pay 15% custom duty
7. Profit taxes,50% of gross profit, are introduced

HYP. 1 DECREASE OF OUTPUT, 50%

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BURMA PLASTIC DEMONSTRATION UNIT
03 FEB. 1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	3757.91	68.174 % foreign
current assets:	0.00	0.000 % foreign
total assets:	3757.91	68.174 % foreign

Source of funds during construction phase

equity & grants:	2400.10	0.000 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4282.00	43.949 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	829.22	1173.35	1283.33
depreciation :	264.41	264.41	264.41
interest :	150.55	145.18	123.67
production costs	1244.18	1582.93	1671.41
thereof foreign	83.21 %	85.45 %	85.53 %
total sales :	961.72	1474.13	1786.20
gross income :	-282.45	-108.81	114.79
net income :	-282.45	-108.81	114.79
cash balance :	-202.36	-203.55	53.69
net cashflow :	-51.81	210.47	446.20

Net Present Value at: 10.00 % = -284.13
Internal Rate of Return on total investment: 8.78 %
Equity paid versus Net income flow (IRR%): 2.86 %
Net Worth versus Net Cash Return (IRR%): 6.15 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance

HYP. 2 RAW MATERIAL COST INCREASE, 10%

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BURMA PLASTIC DEMONSTRATION UNIT
03 FEB. 1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	3757.91	68.174 % foreign
current assets:	0.00	0.000 % foreign
total assets:	3757.91	68.174 % foreign

Source of funds during construction phase

equity & grants:	2400.10	0.000 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4282.00	43.949 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1731.44	2326.53	2697.55
depreciation :	264.41	264.41	264.41
interest :	150.55	145.18	123.67
production costs	2146.40	2736.11	3085.62
thereof foreign	87.08 %	88.38 %	88.94 %
total sales :	2148.45	2948.25	3572.40
gross income :	2.05	212.14	486.78
net income :	2.05	212.14	486.78
cash balance :	-152.10	53.18	357.60
net cashflow :	-1.55	467.20	750.11

Net Present Value at: 10.00 % = 1961.55
Internal Rate of Return on total investment: 17.40 %
Equity paid versus Net income flow (IRR%): 15.99 %
Net Worth versus Net Cash Return (IRR%): 15.58 %

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HYP. 3 SALES REVENUES INCREASE, 10%

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BURMA PLASTIC DEMONSTRATION UNIT
03 FEB. 1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	3757.91	68.174 % foreign
current assets:	0.00	0.000 % foreign
total assets:	3757.91	68.174 % foreign

Source of funds during construction phase

equity & grants:	2400.10	0.000 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4282.00	43.949 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1607.27	2152.93	2482.90
depreciation :	264.41	264.41	264.41
interest :	150.55	145.18	123.67
production costs	2022.23	2562.51	2870.97
thereof foreign	86.29 %	87.59 %	88.11 %
total sales :	2363.29	3243.07	3929.64
gross income :	341.06	680.57	1058.67
net income :	341.06	680.57	1058.67
cash balance :	278.65	534.24	939.98
net cashflow :	369.20	948.25	1332.49

Net Present Value at: 10.00 % = 5677.78
Internal Rate of Return on total investment: 30.19 %
Equity paid versus Net income flow (IRR%): 30.83 %
Net Worth versus Net Cash Return (IRR%): 29.25 %

Index of Schedules produced by COMFAR

Total initial investment
Total investment during production
Total production costs
Working capital requirements
Cashflow tables
Projected balance sheet
Net income statement
Source of finance

HYP. 4: FIXED CAPITAL INVESTMENT INCREASE, 10%

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03 FEB. 1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	4039.41	69.327 % foreign
current assets:	0.00	0.000 % foreign
total assets:	4039.41	69.327 % foreign

Source of funds during construction phase

equity & grants:	2400.10	0.000 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4282.00	43.949 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1607.27	2152.93	2482.90
depreciation :	284.78	284.78	284.78
interest :	150.55	145.18	123.67
production costs	2042.61	2582.88	2891.35
thereof foreign	86.24 %	87.54 %	88.07 %
total sales :	2148.45	2948.25	3572.40
gross income :	105.84	365.37	681.05
net income :	105.84	365.37	681.05
cash balance :	3.80	239.41	582.74
net cashflow :	154.35	653.43	975.25

Net Present Value at: 10.00 % = 3127.72
Internal Rate of Return on total investment: 20.96 %
Equity paid versus Net income flow (IRR%): 21.38 %
Net Worth versus Net Cash Return (IRR%): 21.01 %

Index of Schedules produced by COMFAR

Total initial investment
Total investment during production
Total production costs
Working capital requirements
Cashflow tables
Projected balance sheet
Net income statement
Source of finance

HYP. 5

A GRANT IS PROVIDED TO COVER FOREIGN PORTION OF EQUIPMENT/SERVICES

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BURMA PLASTIC DEMONSTRATION UNIT
03 FEB. 1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	3581.00	66.602 % foreign
current assets:	0.00	0.000 % foreign
total assets:	3581.00	66.602 % foreign

Source of funds during construction phase

equity & grants:	3985.00	59.849 % foreign
foreign loans :	0.00	
local loans :	0.00	
total funds :	3985.00	59.849 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1607.27	2152.93	2482.90
depreciation :	229.03	229.03	229.03
interest :	0.00	0.00	0.00
production costs	1836.30	2381.95	2711.92
thereof foreign	84.90 %	86.65 %	87.42 %
total sales :	2148.46	2948.25	3572.40
gross income :	312.15	566.30	860.48
net income :	312.15	566.30	860.48
cash balance :	154.35	653.43	975.25
net cashflow :	154.35	653.43	975.25

Net Present Value at: 10.00 % = 3372.17
Internal Rate of Return on total investment: 22.45 %
Equity paid versus Net income flow (IRR%): 31.77 %
Net Worth versus Net Cash Return (IRR%): 34.40 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow tables
Total investment during production	Projected balance sheet
Total production costs	Net income statement
Working capital requirements	Source of finance

15% CUSTOM DUTY AND 30% TAX CHARGED ON IMPORTED PRODUCTION EQUIPMENT

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BURMA PLASTIC DEMONSTRATION UNIT
03 FEB. 1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	4652.96	74.296 % foreign
current assets:	0.00	0.000 % foreign
total assets:	4652.96	74.296 % foreign

Source of funds during construction phase

equity & grants:	2594.15	7.480 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4476.05	46.379 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1607.27	2152.93	2482.90
depreciation :	320.44	320.44	320.44
interest :	150.55	145.18	123.67
production costs	2078.26	2618.54	2927.00
thereof foreign	86.66 %	87.85 %	88.34 %
total sales :	2148.45	2948.25	3572.40
gross income :	70.19	329.71	645.40
net income :	70.19	329.71	645.40
cash balance :	3.80	239.41	582.74
net cashflow :	154.35	653.43	975.25

Net Present Value at: 10.00 % = 2601.21
Internal Rate of Return on total investment: 18.19 %
Equity paid versus Net income flow (IRR%): 19.21 %
Net Worth versus Net Cash Return (IRR%): 20.04 %

Index of Schedules produced by COMFAR

HYP. 7
50% PROFIT TAXES

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BURMA PLASTIC DEMONSTRATION UNIT
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2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	3757.91	68.174 % foreign
current assets:	0.00	0.000 % foreign
total assets:	3757.91	68.174 % foreign

Source of funds during construction phase

equity & grants:	2400.10	0.000 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4282.00	43.949 % foreign

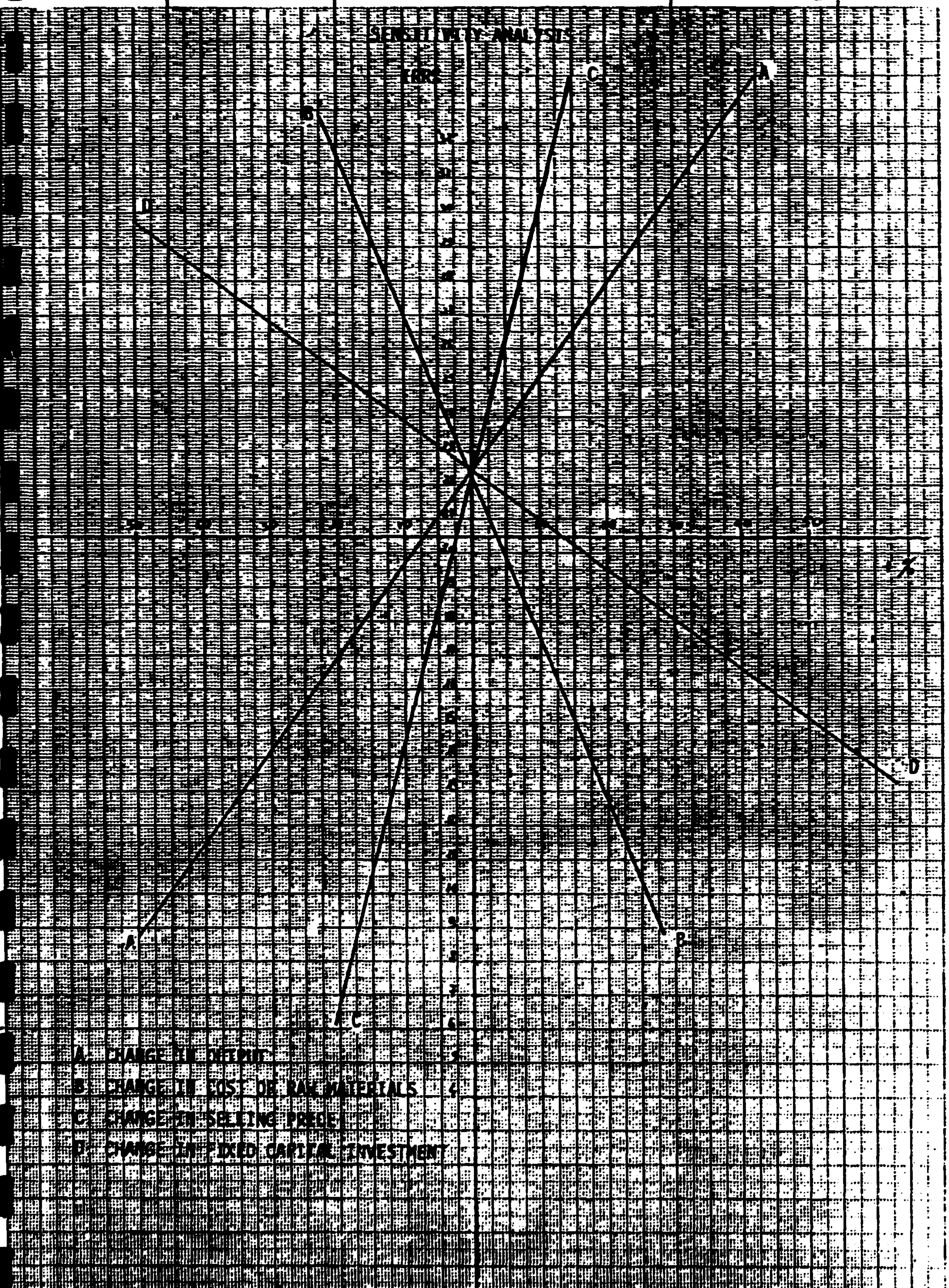
Cashflow from operations

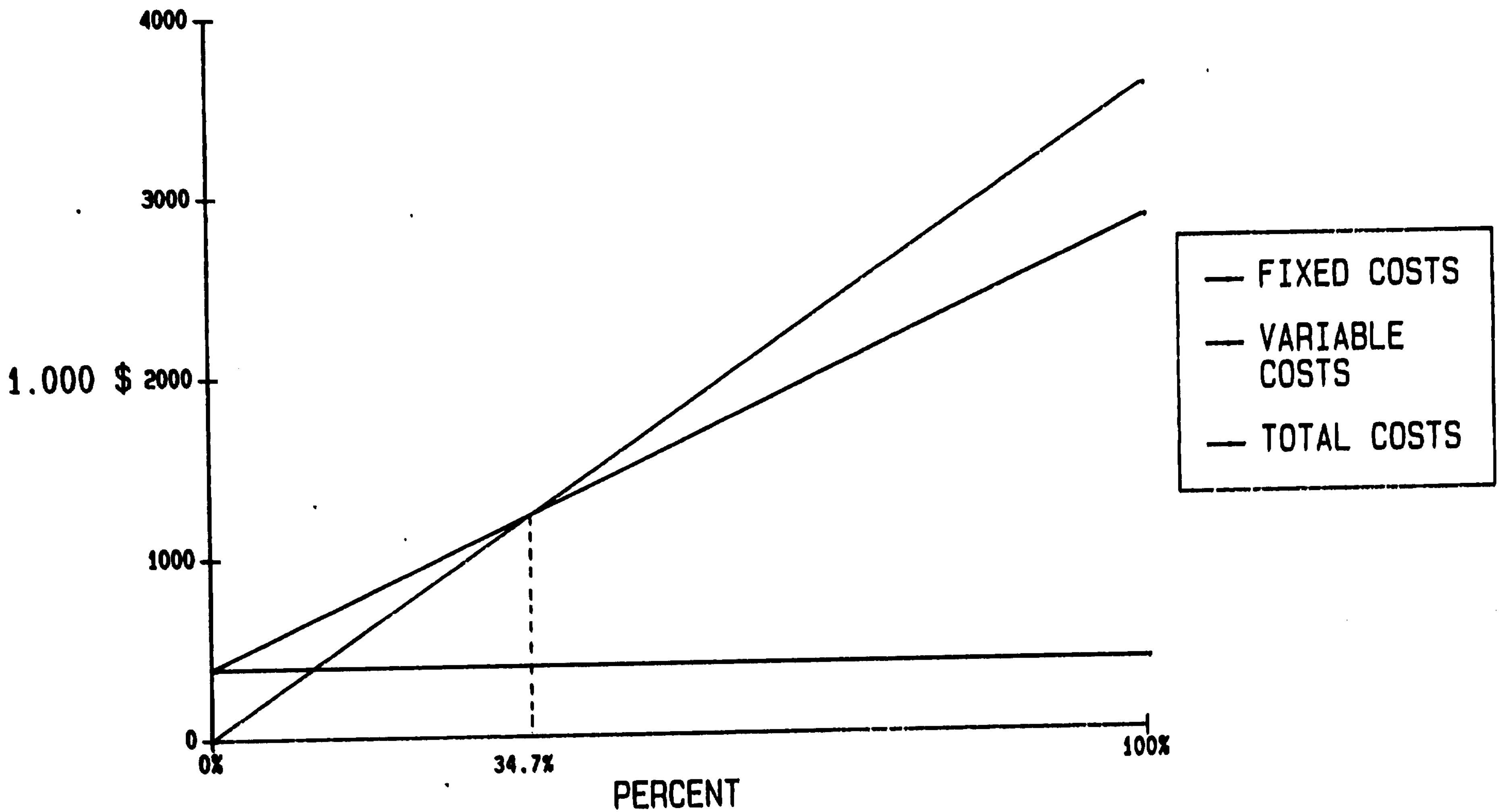
Year:	1	2	3
operating costs:	1607.27	2152.93	2482.90
depreciation :	264.41	264.41	264.41
interest :	150.55	145.18	123.67
production costs	2022.23	2562.51	2870.97
thereof foreign	86.29 %	87.59 %	88.11 %
total sales :	2148.45	2948.25	3572.40
gross income :	126.22	385.74	701.43
net income :	63.11	192.87	350.71
cash balance :	-59.31	46.54	232.03
net cashflow :	91.24	460.56	624.54

Net Present Value at: 10.00 % = 924.82
Internal Rate of Return on total investment: 13.91 %
Equity paid versus Net income flow (IRR%): 10.90 %
Net Worth versus Net Cash Return (IRR%): 11.62 %

Index of Schedules produced by COMFAR

Total initial investment
Total investment during production
Total production costs
Working capital requirements
Cashflow tables
Projected balance sheet
Net income statement
Source of finance


SENSITIVITY ANALYSIS
IRR
A
B
C
D
A. CHANGE IN OUTPUT
B. CHANGE IN COST OF RAW MATERIALS
C. CHANGE IN SELLING PRICE
D. CHANGE IN FIXED CAPITAL INVESTMENT



$$\text{BEP} = \frac{392}{3{,}572 - 2{,}442} = 34.7\%$$

10.4 NATIONAL PROFITABILITY

The following calculations have been carried out:

- Price adjustments
- Economic Internal Rate of Return calculation
- Value added
- Absolute efficiency test
- Net foreign - exchange effect

At the end considerations on the national profitability of the project and its impact in the IDWSSD programme are provided.

10.4.1 Price adjustments

In principle the outputs and inputs of an investment project should be valued at actual market prices. By actual prices are meant current and expected future prices on the domestic and relevant world markets where outputs can actually be marketed and inputs can actually be procured.

However, market prices prevailing in a country at any particular time may not represent their real social costs since they are vitally effected by the financial, economic, social and administrative policies of the Government. Therefore the existing or expected actual prices should be reviewable.
The above adjustments should be made before making an appraisal of the national profitability.
The output of the demonstration unit will be domestically marketed, but they are actually import substituting. The establishment of the new project would lead to the discontinuance of imports of the same product. Such outputs should be valued at actual c.i.f. prices since this value represents the real cost for the country. (c.i.f. price should be understood to mean that all import taxes, import duties, internal charges of transport, insurance etc. are also to be taken into consideration).

Imported inputs (investment and current material inputs) are valued at actual c.i.f. prices plus internal charges for transport, insurance etc. This is the real price paid by the country.

Therefore the sales revenues have been calculated taking into account the following c.i.f. prices:

uPVC pipes	1.75 $/kg
HDPE pipes	2.15 $/kg
Latrine pans	4.46 $/kg
PVC fittings	2.85 $/kg
Tube well casings	2.15 $/kg

Different prices for electricity are applied in Burma, some for the public and other ones for industrial purposes. For economic analysis sake the highest should be taken (in this case 100% increase, i.e. the normal fare for non industrial uses) because it reflects the actual social worth of this service.
Labor is valued in terms of actual gross salaries and wages plus fringe benefits (for instance the houses and social services that are now under construction for the No. 3 Plastic Factory).
The present labor cost has therefore been increased by 20%. On the other hand we have not considered a change in the cost of unskilled labour (its shadow price in case of unemployment is lower than the official wage guaranteed by law) because of its negligible effect on the production cost.

10.4.2 Economic Internal Rate of Return

The COMFAR has been used to calculate the economic internal rate of return, obtained by introducing the values introduces at point 10.4.1.
The summary is presented in the following page: the internal rate of return, IRR is 18.32%

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

BURMA PLASTIC DEMONSTRATION UNIT
03 FEB. 1987
DP/BUR/80/015 Contract 86/97

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: 1000 US dollars

Total initial investment during construction phase

fixed assets:	3757.91	68.174 % foreign
current assets:	0.00	0.000 % foreign
total assets:	3757.91	68.174 % foreign

Source of funds during construction phase

equity & grants:	2400.10	0.000 % foreign
foreign loans :	1881.90	
local loans :	0.00	
total funds :	4282.00	43.949 % foreign

Cashflow from operations

Year:	1	2	3
operating costs:	1652.53	2207.13	2544.39
depreciation :	264.41	264.41	264.41
interest :	150.55	145.18	123.67
production costs	2067.49	2616.71	2932.47
thereof foreign	84.40 %	85.77 %	86.27 %
total sales :	2076.53	2850.80	3454.98
gross income :	9.03	234.09	522.50
net income :	9.03	234.09	522.50
cash balance :	-117.04	87.19	403.35
net cashflow :	33.51	501.21	795.86

Net Present Value at: 10.00 % = 2203.67
Internal Rate of Return on total investment: 18.32 %
Equity paid versus Net income flow (IRR%): 16.93 %
Net Worth versus Net Cash Return (IRR%): 16.56 %

Index of Schedules produced by COMFAR

10.4.3 Value added

One of the most important index to evaluate the contribution of the project to the national economy is the Net National Value Added (NNVA).
The formula for finding the net national value added is as follows:

$$\sum_{t=0}^{n} NNVA = \sum_{t=0}^{n} O - \sum_{t=0}^{n} (MI+I+RP)$$

where:

- O = expected value of the output of the project (sales revenues).
- MI = expected value of current material inputs and services purchased from outside the project required to obtain the above output (raw materials, energy, fuel, transport, maintenance etc.)
- I = total investment
- RP = all repatriated payments in respect of this project such as royalties, wages of expatriate labor etc.

= 9,165,000 $

the figure consists of:

- wages and salaries : 651,345 $
- Social surplus : 8,513,654 $

where the social surplus expresses the earning capacity of the project. It comprises interest, dividends if any, undistributed profit, taxes if any etc.

10.4.4 Absolute efficiency test

This is one of the application of the value added criterion for evaluation of the project. This estimate will provide only a preliminary idea of the benefits of the project to the country but if the result shows positive value added, it is a good sign for proceeding further with the project. The following formula is used:

$$ES = O - (MI+D) > W$$

where

ES = absolute efficiency test of the project in terms of value added surplus over the wages on the basis of data for a normal year.

O = value of the output in a normal year

Ml = Value of normal annual current material inputs and services purchased from outside the project.

D = Expected depreciation of fixed capital in normal year.

W = Expected wages in normal year

Es = 3,454,280 - (2,495,000 + 281,000)
= 678,000 $ > 43,423 $/year

There is a surplus after meeting the wage obligations and the test has therefore a positive result.

10.4.5 Net foreign - exchange effect

First the net foreign exchange flow has been calculated (see following page table).
The total net present value (discount rate 10%) of the net foreign exchange flow is negative, being (12,546,000).
In the same table we have calculated the import-substitution effect that, on the country, gives a positive result.
From the above date, net foreign exchange flow and import-substitution effect, the total net foreign exchange effect has been calculated for each year of the life of the project. Then these values have been discounted at the rate of 10% and the present value of the net foreign exchange effect amounts to 7,722,000 $. Hence the amount of foreign exchange earned and saved by implementation of this project will be such that in spite of repaying the foreign loan, using imported material, etc. there would still be a surplus which in terms of present value would amount to approximately 7.7 Million $.
On the other hand the operation of the new demonstration unit could be hampered by the shortage of foreign currency that Burma is facing. This could reduce considerably the quantity of raw material that can be purchased. Difficulty can be overcome, as done in other Regions, by having Donor Countries and Agencies involved in IDWSSD programme providing the raw materials (or agent to by them). These donors may be supplied in this case with the pipes they need for their financed programmes at reduced price, to take into consideration the portion already paid in providing the raw materials.

TABLE 10.3

	p1	p2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FOREIGN EXCHANGE INFLOW																	
direct inflow																	
foreign equity capital	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
loans in cash	1881.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
foreign aid or grant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
goods/eq.on credit/deferred pay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
exports of goods or services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
indirect inflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL INFLOW	1881.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FOREIGN EXCHANGE OUTFLOWS																	
DIRECT																	
survey,& tech. serv.,eng.fees	56	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
import capital goods	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
import raw mat.semifinished etc..	0	0	1275	1777	2193	2193	2193	2193	2193	2193	2193	2193	2193	2193	2193	2193	2193
imported of above but loc. purc.	0	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Construction & Inst charges	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct charges on importspaid in f.c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
salaries in f.c.	0	0	96	96	0	0	0	0	0	0	0	0	0	0	0	0	0
repayment of foreign borrowing	0	0	268.84	268.84	268.84	268.84	268.84	268.84	268.84	0	0	0	0	0	0	0	0
royalty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
repatriation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INDIRECT OUTFLOW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL OUTFLOW	56	175	1644.84	2146.84	2466.84	2466.84	2466.84	2466.84	2466.84	2198	2198	2198	2198	2198	2198	2198	2198
NET FOREIGN EXCHANGE FLOW	1825.9	-175	-1644.84	-2146.84	-2466.84	-2466.84	-2466.84	-2466.84	-2466.84	-2198	-2198	-2198	-2198	-2198	-2198	-2198	-2198
TOTAL NET PRESENT VALUE	-12546.9																
IMPORT SUBST.EFFECT	0	0	2076.53	2850.8	3454.98	3454.98	3454.98	3454.98	3454.98	3454.98	3454.98	3454.98	3454.98	3454.98	3454.98	3454.98	3454.98
TOTAL NET FOREIGN EXCH.EFFECT	1825.9	-175	431.69	703.96	988.14	988.14	988.14	988.14	988.14	1256.98	1256.98	1256.98	1256.98	1256.98	1256.98	1256.98	1256.98
NET FOR.EXCH.EFFECT PRES.VALUE	7722.835																

10.4.6 Other considerations

The above calculations have shown that:

- the project will cause a net saving of 14 Million Dollars (present value 7.7 Mil. $) in foreign currency over its operating life;

- the project will generate a social surplus of over 8.5 Million $ in addition to the wages and salaries paid with a net national value added summing up to over 9 Million dollars.

In addition other benefits could be generated by the project, namely:

- the project will be of benefit to other plants of the subsector. In fact the proposed plant is equipped with a very modern quality control laboratory and can therefore become a centre of reference for many other industries;

- the project will have a training component built in for Burmese specialists in fields like plastic processing, machinery maintenance, quality control on both raw materials and finished products.
  This fact will increase available skillness and will, in turn, generate more training capabilities;

- the project will increase the self reliance for the local production of molds and other components that will be used in the plastics processing industry (other than pipes and related appliances production).

11. THE IMPACT OF THE PROJECT IMPLEMENTATION ON THE ACHIEVEMENT OF THE IDWSSD OBJECTIVES

The market survey has shown that the forecast demand in the decade 1990-2000 will be in the range of 4,600 - 5,400 tons plastic pipes per year if the IDWSSD programme is attained. In addition a large number of fittings, tube well casings will be needed as well as latrine pans for the sanitation programmes.
The scope of the implementation of the demonstration unit is not to satisfy 100% of the forecast demand of plastic pipes and appliances but mainly to produce a limited quantity of these items to test suitability of their application. In general, the implementation of the project will have the following major effects:

- Provide the IDWSSD executing agencies with a wide range of plastic pipes and other appliances to test them under various conditions in different applications (rural distribution, urban distribution, sanitation programmes etc).

- Standardize the type of materials to be used for the various applications within the IDWSSD programmes (cement/steel pipes, uPVC, HDPE pipes etc.) according to size, pressures, environmental conditions etc.

- Standardize the characteristics of the plastic pipes to be used according to the prevailing conditions for each application (size, diameter, thickness, material).

- Test and optimize the production processes that are used to produce these items.

- Test and optimize the necessary quality control procedures for both raw materials and finished products.

- Equip a core of specialists with the necessary experience to design, build and operate a number of plastic pipes/appliances production plants in order to supply the quality and quantity of plastic items needed to attain the IDWSSD goals.

12. NOTES ON PROJECT FINANCING

The implementation of the demonstration unit project can be jeopardized by the lack of foreign currency that the Socialist Republic of the Union of Burma is facing.
Therefore the possibility of grants to finance the foreign exchange component of the project should be carefully considered.

Bilateral aid could also be seek to finance the import of raw materials (mainly uPVC, HDPE pellets and additives). Donors have been active so far in providing finished products (plastic pipes, appliances etc.). Once that the demonstration unit is operating they could provide raw materials instead.
This procedure has been used by various Aid Agencies in other Countries in the past; the project implementing agency should contact potential donors as soon as the construction of the demonstration unit is decided.

ANNEXES

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A N N E X E 1
A SHORT SURVEY OF THE PLASTIC INDUSTRY IN BURMA

ANNEXE 1

A Short Survey of the Plastic Industry in Burma

Three plastic processing plants are presently operating in Burma, the No. 1,2 and 3 factories, all belonging to the Pharmaceutical Industries Corporation, Ministry of No. 1 Industry.

1. Plastic Factory No. 1

Plastic Factory No. (1), originally established by a private owner, was nationalized by the Socialist Republic of the Union of Burma in the year 1964. The Industrial Development Corporation under the Ministry of No.1 Industry took over the implementation works and the said factory was completely installed during the fiscal year 1964-65. The plant started up production in 1966.

It is located on plot No. 105 to 111, Industrial Estate, North Okkalapa, Rangoon.

The staff is 120 approximately, 69 of which are direct.

The production includes: calendered-coated leather cloth with woven or knitted backing, plasterized PVC table cloths etc.
The present production is 1.5 TON/day on two shifts.
The machinery is in general 20 years old except for the foaming units which has been purchased and installed in 1981 (Nishimura make, Japan).
In spite of age the equipment are well operating and are quite well maintained.
Maintenance is carried on with some difficulty due to lack of spare parts. Small repairs are done in the workshop of the factory while for larger ones the need of the Government Central workshop is required.
Lack of lifting equipment, makes more difficult disassembling and assembling of large rolls for the calendar.
The factory has a quality control laboratory but no controls on incoming raw materials. These are carried out in the Central Laboratory.

2. <u>Plastic Factory No. 2</u>

This factory is located at Thamaing, in the Rangoon metropolitan area. It was nationalized in 1966 and it now belongs to the Pharmaceutical Corporation of the Ministry of No. 1 Industry.

<u>Activities:</u>

Injection Moulding - bottle caps, toothbrush handles, bottle plugs.

Blow moulding - mainly bottles for pharmaceutical industries, PE honey jars.

Extrusion - Pipe
electrical conduit
wire covering

Blown polyethylene film & sheet
Bag making
Reclaiming of scrap material

<u>Breakdown by activity:</u>

Injection/blow moulding	- 30%
Pipes/conduit/wire	- 30%
PE film & bags	- 30%
Other products	- 10%

Most of the equipment is 25 years old.

The highest level of production was attained in 1962. Since then the output declined due to lack of funds to buy raw material and lack of spare parts for the injection moulding machines.

Personnel is approximately 200 out of which 65 are direct.
Plant is usually working on two shifts, 8 hours each.
The maintenance workshop is quite efficient.
Simple moulds for the injection machine are produced in spite of the fact the machine tools used are very old.

Energy supply is the main problem: 3 to 4 blackouts per week are normal with consequent heavy losses in production efficiency and output.

The factory is located in a residential area and there is no further area for expansion. Under the Government Overall plan of transferring industries from the metropolitan Rangoon area, it is planned that the machinery will be moved to Hmawbi.
No real quality control on incoming raw material nor on final product is carried out.

Main Machinery:

Extrusion pipe/conduit/cable covering

2 x Windsor (UK Origin) Twin screw corotating extruders (50mm dia.), with combined output of 100 lbs/hour. Production is from pellets.

Pipe & conduit sizing - sizing plates in water bath (no cooling).

Scrap is granulated & fed back with virgin material.

Extrusion (tubular PE film)

Reifenthauser (W. Germany Origin) single screw extruder (60 mm dia.) - approx. 25 years old.
10 home made extruders, towers , etc.
Some have manual winders some other have no winders.
PE film scrap is fed into a variety of old extruders. Extrudate is cut with scissors and dropped into water (or laid on trays). Granulated and recycled is blown in film for garbage bags.

Blow moulding:

Placo (Japanese Origin) twin head extrusion/blow moulder with automatic trim. Approx. 5 years old.
Old unidentified twin head blow moulding machine with manual clamping of moulds.
Currently being used to produce PE honey pots.

Injection moulding:

2 x Clayton Goodfellow (UK Origin) small injection moulding machines.
Approx. 10 years old.
6 x Nissei (Japanese Origin) 4 oz. injection moulding machines.
1 x Matuda vertical injection moulding machine.

Miscellaneous:

Several very old granulators and other ancillary equipment.
16 small bag sealers.

Mould maintenance and mould making

4 very old lathes
2 x Pantograph (copying machines)
Milling machine
Small vertical drill
Power saw

3. <u>Plastic Factory No. 3</u>

This is a new, modern factory, well designed and well built. It is situated on the Industrial Complex at Hmawbi, which is under the direction of the Ministry of No. 1 Industry.

The project was planned in August 1982 and construction started in December 1982.

The factory construction, power & water supply and the equipment were totally provided by Burmese funds with no foreign aids or grants.

Present activities include: extrusion/blowing of PE film; conversion of this tubular film by printing and bag making equipment; a PP cast film line is also in operation.

Equipment:

Blown film extrusion line (Battenfeld, West Germany).
Printing (LEMO, West Germany)
Bag making - a Battenfeld Company)
Cast film line (Battenfeld, West Germany)

Incoming power 33 KVA installed capacity with step down transformer. Operating power 400V/3 ph/50 Hz; machine control voltage either 110 V or 240 V.

Consumption of material (per year)

LDPE	-	400 tons
HDPE	-	100 tons
PP	-	300 tons

Material is provided either by Pharmaceutical Industries Corporation or by the Corporations requiring the product.

No quality control facilities are available at this factory.

Scrap film (other than edge trim which is automatically recycled on equipment) is bagged and sent to Plastics Factory No. (2) for recycling.

Total staff - 70

Presently running two shifts.

The total site is approx. 7.5 acres.

There are plans to bring a railway spur to this Industrial Complex from Hmwawbi.

Battenfeld (West Germany) sent original design of factory hall, but the final plans and construction were the responsibility of Construction Corporation.

Foundations, machine mounting points, machine tracks and machine installation, where all provided by Plastics Factory No. (3) and the results appear to be suitable.

A maintenance workshop is available but additional tooling machines are needed.

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A N N E X E 2
PRESENTATION AND CHARACTERISTICS OF PLASTIC PIPES

ANNEXE 2

Presentation and characteristics of Plastic pipes

1. Introduction

Plastic pipes were first used in Germany and the United States in the years preceding the second World War. These first pipes were made of polyvinyl chloride (PVC).

Since the years following the war with the revival of the base chemical industry fovoured the low cost of crude oil, the world wide production of plastic pipes has grown progressively to its present levels.
Western Europe has an annual production of about one million tons (not much lower than the U.S.) with Germany and France at the head.

The statistics show a strong majority of rigid PVC followed by high density (HDPE) and low density (LDPE) polyethylene. The use of polypropylene (PP) and other resins such as chlcrurated PVC (C-PVC) and ABS is still quite low. The application of fibreglass reinforced plastic pipes, which have a remarkable resistance but are limited by their cost of large diameters and higher pressures, is fairly low but qualitatively rather interesting.

2. Principle properties of plastic pipes

At this point, it is appropriate to introduce ISO definition of plastic materials. The ISO limits the use of this term to products which contain a high polymer as their main ingredient and that, at a certain point in their transformation into a final product, can be formed taking advantage of their fluidity.

The plastic materials we shall consider are some of the thermoplastic resins, named as such due to the fact that when exposed to heat their degree of aggregation varies considerably; they become plastic when heated and rigid when cooled. We shall limit ourselves to rigid PVC, high and low density (HDPE and LDPE) polyethylene (PP).

In addition we shall consider, even if not in depth because it is such a large field, fibreglass reinforced plastic materials.
These materials use thermosetting resins, named as such because when exposed to heat or to a catalyser they pass irreversibly from a melted [illegible] soluble state to solid and insoluble one.

The block diagram in fig. 1 illustrates the production process of the above mentioned materials in an approximative manner.

In the field of mechanical resistance and in the behaviour under loads, thermoplastic materials are very different from the more commonly used traditional materials like steel and cast iron.

A look at the stress/deformation diagram in fig. 2 makes the following properties evident: the elastic phase is reduced, with elasticity coefficients 70 times lower for PVC and 1400 times lower for HDPE than for steel; resistance to failure is lower by 10 to 30 times and irreversible elongation much higher.

The behaviour of reinforced plastic materials is very different.
They are more elastic and have a higher degree of mechanical resistance than steel, even if the elasticity coefficient is lower. This behaviour is mainly due the properties of the fibreglass which constitute the resistant part of the material while the resin functions as a filler and support.

Further properties can be gathered from the table in fig. 3

- low density
- higher electrical resistance
- low thermal conductivity (100 - 150 times lower than for steel)

in addition,

- high chemical resistance to the most aggressive liquids;
- low water absorption
- high resistance to abrasion
- smooth and waterproof surfaces

The values of the mechanical resistance do not guarantee the effective life of the pipes in use.

In fact, all plastic materials are subject to the phenomenon called creep. Creep is the constant increase in deformation when the material is subject to a constant stress even if much lower than its failure point. This phenomenon is illustrated in the deformation/time diagram for 20°C in fig. 4 on a double logarithmic scale, the curve for a certain stress and temperature approaches a straightline.

The stress/deformation relationship for a certain time period is called the creep coefficient. This coefficient is influenced by the temperature which causes it to decline rapidly. Thus, with an increase in temperature, less stress is needed to cause a given amount of elongation and, in particular, failure.

To estimate the life span of a pipe as a function of the temperature and internal pressure, we can trace some experimental curves called regression curves.

These are obtained by determining for a number of pipe samples kept at constant temperature, the wall stress due to a given internal pressure and the bursting time, and then connecting the points which represent the minimum for these pairs of values.

An example of such a curve which may be extrapolated is given in fig. 5 at 20°C and 60°C.

The knee-shaped curves shown in this graph separated the area of ductile failure which occurs when there is a high stress over a short period of time from brittle failure which occurs when there is low stress over a long period of time.

These failures are more likely to occur in PVC due to the working process; to protect against this possibility, regression curves based on longer and more in depth experimentation should be used.

Based on the regression curves it is possible to determine the average failure stress for continuous use at constant pressure for 50 years and the reduction of this stress with temperature. Selecting proper safety coefficients the allowable stress can be determined. For discontinuous use, the allowance stress can be obviously increased.

For the different thermoplastic materials, the allowable stresses at 20°C are the following:

PVC	=	10 MN/sq.m
HDPE	=	5 MN/sq.m
LDPE	=	3.2 MN/sq.m
PP	=	5 MN/sq.m

For reinforced plastic pipes creep is largely reduced and, in general, is only sensitive to loads of over 50% of the failure load.
Therefore, the failure resistance decreases much less with time, reaching reductions of 30 - 35% after 100 years.

For these types of pipes it is not so much the failure of the glass fibres which determines the failure, as the deformation to the point of failure of the interior resin layer and the separation of the fibres and the resin matrix.

In addition to burst tests. to be sure that the plastic material correspond to the exact specifications, it is important to determine the internal stresses which may have been acquired during the working process and which may affect to its resistance. In order to perform this test, the material is heated to a temperature above its softening temperature for the length of time needed to relax the acquired stresses. If this is not possible, the specimen must not exceed its original length by more than a set amount.

When PVC and PP are used for waste lines, impact testing is also required given the brittleness of these materials as a consequence of additives and of the extrusion conditions.
The basic property of thermoplastic materials, as the name implies, is softening as a function of temperature. The behaviour of PVC and polyolefines (PE and PP) is different. In fact, since these materials have a semi-crystalline structure, they undergo a slow continuous decline of stress/deformation coefficient up to the melting point of the cristallites (at around 200°c) where we pass from the solid stated to the liquiviscous state.
Instead PVC; which has a glass-like amorphous structure, undergoes rapid softening at around 80°C and only at higher temperatures (around 800°C) does it pass to the liquid state necessary for both the extrusion and moulding process.

This strong dependence of the mechanical properties on the temperature, obviously limits the field of application for all plastic materials.
Even more for PVC (useful from -20°C to 60°C) than for polyolefines (HDPE from -40°C to 80°C, PP from -20°C to 100°C).

3. Items for comparison with traditional materials

We shall list some of the advantages and disadvantages of pipes made out of plastic materials compared with those made out of traditional materials.

ADVANTAGES

Lightness: By virtue of their low specific weights (from 1.4 for PVC to 0.9 for PP), for equal diameters and working pressures, the weight of plastic pipes is always notably lower than for pipes made of traditional materials (steel, cast iron, asbestos cement, clay). This holds true for the fields of the most common applications. Another obvious advantage is ease and quickness when laying the pipes.

Flexibility: Due to the low elasticity coefficient and the creep phenomenon, plastic pipes, PE in particular, are remarkably flexible in cases where the ratio of length to diameter is great. Therefore, the pipes are appropriate for use on ocean bottom, lakes, rivers, or fairly uneven terrain.
Another advantage of flexibility is that small diameter pipes may be supplied in coils.

Reduction of "water hammer" overpressure : The low value of the elasticity coefficient, which influences the acceleration of the propagation of perturbations caused by the water hammer phenomenon, is such that the overpressure caused by water hammer in plastic pipes is notably lower, by values on the order of 10 - 20%, than for pipes made of traditional materials.

Low load losses: Plastic pipes have very smooth, non adhesive, water-repellent walls on which crusts do not form. The coefficient of roughness is therefore very low and does not increase as a function of time (we can assume e = 0.01 in the Colebrook formula).
The graph in fig. 6 is an indicative comparison of load losses in PVC pipes and those estimated for pipes of the same diameter made out of currently used steel and spheroid cast iron with an internal lining of cement (e = 0.4 and e = 0.05 respectively).
For equal load losses and flow capacity, the reduction of the inside diameter is on the order of 6 - 8% with respect to steel and 2 - 3% with respect to spheroid cast iron with a cement lining.

Resistance to chemical agents: Since plastic pipes are highly resistant to chemical attack, the corrosion phenomenon due to piped fluids including ocean water and domestic waste is practically negligible.
The chemical resistance to a good part of industrial is also excellent. However, each case must be considered

separately given the limited resistance to certain substances such as nitric acid and some organic solvents (benzyl, tryelene, chloroform).
The resistance to acids and salts present in the ground is excellent. This property combined with high electrical resistance keeps electromechanical corrosion from taking place even in the presence of stray currents.
When gas is transported, the aromatic hydrocarbon content must not exceed certain values.

DISADVANTAGES

Temperature sensitivity: Since the mechanical properties are strongly dependent on the temperature, as previously illustrated, it is necessary to carefully evaluate any heating or cooling which may occur as a result of exposure to certain environmental conditions or due to the fluids being transported.

Impact sensitivity: The low impact resistance of PVC and PP necessitates more care during transport and laying.

Danger due to crushing: For large diameter, low pressure pipes and especially for those made out of reinforced plastic where a higher degree of resistance consents reduced thickness, unbalanced external vertical loads may cause unacceptable oval deformation. In these cases more care should be exercised when back filling the trenches and the dirt should be as compact as possible so as to take advantage of its passive pressure.

Inflammability: Except for a specially treated PP, thermoplastic resins are inflammable.

4. Survey of the most commonly used plastic materials and their principle applications

RIGID PVC

The production of rigid PVC pipes generally includes three main categories:

1. Pipes for buildings (domestic and rain water waste, ventilation, telephone and electrical cables).

2. Pipe for buried waste lines (sewers).

3. Pipes for pressure lines (water networks, gas networks).

Pipes for buildings are produced in various series with diameters ranging from 32 to 600 mm and reduced thicknesses ranging from 1.2 to 9 mm. Joints are generally cement sealed.
In France, the use of a "lightened" PVC is fairly widespread in this field. The addition of an expanding product lowers the specific weight from 1.4 to 0.85. Lower mechanical resistance is compensated by using a greater wall thickness.

Pipes used for waste lines are generally produced in two series, with diameter ranging from 110 to 630 mm and thicknesses ranging from 3.2 to 15.4 mm to be used for pressures of 5 - 6 bar and trench depths of up to 6 meters.
Coupling may be done with, cement sealing, or rubber rings sockets.
The limited use of pipes with diameters of over 600 mm is mainly due to their rapidly rising cost with respect to pipes made out of asbestos cement.
The higher interest in the use of PVC for civil and industrial waste lines is its high resistance to chemical attack by the most common agents.
Pipes for pressure lines are generally produced in four thickness series calculated assuming an allowable stress of 10 MN/sq.m for nominal pressures (NP) of 4 - 6 - 10 and 16 bar.
The outside diameters are used as reference: the maximum diameters are 630 mm for NP 4 and 200 mm for NP 16.
pipe sections, available in sizes of 6 - 8 - 12 meters, may have smooth ends or be fitted with sockets.
Coupling of the smooth ended sections may be by sleeve or double socket supplied with rubber ring.
Coupling of the sections fitted with sockets may be by cement sealing or rubber ring. Flange couplings may also be used.
For small diameters in the range of 3/8" to 4" pipes with threaded ends are also available. However cement sealed and rubber ring couplings are usually preferred

to this type of coupling. In addition, for the small diameter pipes generally used in distribution networks, HDPE is used instead of PVC since it is easier to use (supplied in coils, flexible).

In water networks the use of PVC is increasing above all for mains; in the water distribution field a degree of uncertainty exists due to the greater difficulty in the connections to fittings.
These inconveniences also exist in gas distribution networks, where the use of PVC is generally permitted for pressures not exceeding 0.5 bar and for gas not containing more than 20 gr/mc of aromatic hydrocarbons. The use of PVC in this field is rather limited (The largest distributor of gas in Italy prohibits its use, preferring welded steel of spheroid cast iron with special compression joints).

High density polyethylene (HDPE)

The production of high density polyethylene pipes essentially concerns the following:

Civil and industrial waste lines
Pressure lines for water networks and industrial plants
gas lines.

Buried waste lines are normally produced with diameters ranging from 110 to 1200 mm and with thicknesses corresponding to nominal pressures ranging from 2.5 to 3.2 bar. For special applications, extruded pipes with diameters of up to 1600 mm to 3 meters, pipes with filled walls or walls lightened using the BAUKU system are built.
the BAUKU system consists in producing different types of profiles, filled of hollow, by wheel-coiling with polyfusion on a drum whose outside diameter creates the inside pipe diameter.
pipes with lightened walls are used in cases where the principle stres is caused by external crushing.
Small diameter HDPE pipes can be joined by flanges or connections made of different metallic materials or, in general, by butt welding.
This last method is done using a special device that presses the ends to be welded against a metal which has been heated to a temperature of over 200°C. The heating element is then extracted and the ends are pressed together until solidification and cooling at about 60°C.
For special fittings, socket welding is also used by pre-heating and then manually placing one of the two ends to be joined, into the other; one of the ends has a socket.
In special cases, especially for repairs, a special sleeve heated by an incorporated electrical resistance is used for the joint.

Socket couplings are used for pipes produced with the BAUKU system with welding of additional material filling in the hollows on the inside and outside of the pipe.

In Germany and Austria, HDPE pipes have been used in grandiose applications of large scale waste lines for sewers laid on the ocean floor or on lake, river, or canal floors.
In this case, laying the lines is easier because, since the lines tend to float, they can be dragged across the water and then sunk with weights.
In some cases, mobile extrusion units have been used for fabricating pipes of up to 1000 meters (without any connections) at the site.

Pressure line pipes cover a full range or applications including transport of drinking and feeding fluids. This is due to the fact that PE does not contain any prohibited additives and the carbon black used for stabilization to light respects the sanitary regulations.
Normal production adopts five series of thicknesses calculated assuming an allowable stress of 5 MN/sq.m for nominal pressures of 2.5 - 4 - 6 - 10 and 16 bar.

The outside diameters reach a maximum of:

1000 mm for NP 2.5 and 4
710 mm for NP 6
450 mm for NP 10
250 mm for NP 16

For diameters of up to 110 mm, the pipes may be supplied coils.
Joints are normally butt welded using the method already described.
For diameters of up to 110 MM, sleeves with rubber rings or clamps or compression coupling may be used.

HDPE pipes are used for branches of a large number of water networks. In city distribution networks the use of HDPE pipes is still fairly limited, although their application in areas of uneven or aggressive terrain or in the vicinity of faults appears very interesting.
Some countries have started using reticulated PE for internal equipment since it may be used at temperatures of up to 90°C and pressures of 5 bar.
PE pipes used for gas lines are not substantially different from those used for water networks except that they have better material quality for improved internal flow and the toughness.
Italy does not yet officially permit the use of PE pipes to convey methane (only welded steel may be used).
However, stricter control regulations are being prepared which should modify the provisions of the law.

In Germany and Holland there is a widespread use of HDPE pipes for natural gas distribution networks at pressures of up to 4 bar.
The use of HDPE for relining old steel, cast iron, or asbestos cement pipes for water or gas networks is growing since there is a savings of more than 50% with respect to replacement costs.
This system is also used to repair old sewer systems.

Low density polyethylene pipes

LDPE is used for relatively small diameter pipes for water networks and irrigation.
In some cases, LDPE may be more advantageous than HDPE since it is more flexible and can be laid in coils.
Coupling is by metal sleeve with ring or by pressure.

Polypropylene

PP pipes, which up to a few years ago were rarely used due to their higher cost, are presently being used more and more as they often prove to be even less expensive than HDPE pipes.
Their properties are similar to those of HDPE pipes with the advantage of greater resistance to high temperatures (up to 100°C) and to microbiological and chemical agents. Their use is of interest for waste lines where the fluids being conveyed are aggressive (they resist values of pH from 1 to 12).
A special, self-extinguishing type of PP should be noted since it is of interest in building applications where the danger of fire exists.
A special type of black PP/PE resin adds more lightness (specific weight = 0.9) and flexibility to the resistance of HDPE.
It is also used for water networks and irrigation systems.

Reinforced plastic (PAV)

There are different types of fibreglass reinforced plastic pipes depending on composition and method of fabrication.
The reinforcement which is composed of fibreglass "E" and "C" may be of two types:

- short fibres arranged in any direction or arranged mainly in the direction of force;

- long continuous wire, cloth, or laminated fibres arranged in one or more directions.

The thermosetting resins may be polyesters, polyammids, epoxies, in some layers it is even possible to use thermoplastic resins.

From a structural standpoint, the reinforced plastic pipe walls should be composed of at least three layers.

- An inside layer which is rich in resin called a liner. Its purpose is to provide waterproofing and chemical resistance to the fluids being conveyed.

- An intermediate layer with a high fibreglass content. Its main purpose is to provide mechanical resistance.

- An outside layer. Its purpose is to provide protection against the environment.

Depending on the type, the resin content may vary from 40 to 50%.
Different fabrication methods may be used: centrifugation, manual winding on a wheel-coil, filament-winding on a rigid drum, or winding by spinning on a deformable drum.
Among the pipes fabricated using the centrifugation method, HOBAS pipes have been widely used in Switzerland (and also in Southern Italy). These pipes are of medium rigidity and composed of two layers of short-fibred glass resin mixed with sand-filled resin.
The production of these pipes includes four classes of pipes not subject to pressure with diameters ranging from 400 to 2200 mm and thicknesses ranging from 5.5 to 51.7 mm, nine classes of pressure pipes for pressures of 4-6-10-16-20 and 24 bar, diameters ranging from 400 to 2200 mm and thicknesses ranging from 6.7 to 50.4 mm. The maximum diameter is 1000 mm for a pressure of 24 bar, 1200 mm for 20 bar, 1600 mm for 16 bar and 2200 mm for 10 bar.
The type of joint is a glass resin sleeve placed on a neoprene washer with a profile.

In the pipes produced by filament-winding, the glass fibres may be arranged in a single direction with respect to the pipe axis (generally about 55) or in more than one direction.
The market offers varied and little standardized production. In general, pipes are made only by request and their properties established from time to time depending on how they are to be used.
Large diameter pipes may be stiffened by ribbing or rippling the walls.
The joints may be socked or cement sealed or with a simple or double rubber ring washer. Another type of joint is on-site butt welding with a special band made out of glass fibres impregnated with resin.
Flanges applied to the pipe section with cement sealant may be used for connection to the controls.
The pipe sections may even be 12 to 15 meters long.
The high cost of reinforced plastic and the low level of standardization has so far limited the use of this

material in the field of waste water lines to only the large diameter lines (in the United States pipes with diameters of 5 metres have been built for the cooling circuits in thermoelectric plants and these pipes are the largest in existence) and in the field of water networks, to long mains subject to high pressures.
As already mentioned in the introduction, we deem that the excellent properties of this material, the tendency towards diminishing costs, standardization, and the compliancy of the production process to exact regulations will all contribute to increasing use of plastic materials in the upcoming years.

5. Cost considerations

A cost comparison for buried pipes has been attempted using fig. 7 and fig. 8 and by estimating the total cost of the pipe including supply, transport, and laying for the same size diameters.
The comparison was made using the cost of pipes made out of the most traditional materials: asbestos cement for waste water lines and steel for water networks.
The comparison is only an indication given the implicit difficulties in estimates of this type where not all the items for comparison can be made homogeneous and where the material costs, in addition to being subject to market oscillations, change with time, location, and the particular circumstances.
Keeping these reservations in mind, we will try nonetheless to make same general conclusions based on the graphs and all the previous considerations.
For low pressure waste lines, thermoplastic materials are decisively more competitive than traditional ones for small diameters (up to 400/500 mm). For larger diameters (up to 1500 mm) HDPE is of particular interest since its higher cost (on the order of 20% for extruded pipes used for normal underground applications) can be easily disregarded in situations where there are special laying conditions.
The interest grows if we consider BAUKU-type spun pipes since they offer a savings on the order of 30% with respect to extruded pipes.
The same considerations are true for reinforced plastic pipes with diameters ranging from 500 to 1500 mm whose use in this field appears, at present, to be the best solution both technically and economically for very large diameters (from 1500 to 3000 mm and over).
For pressure lines, the thermoplastic materials are competitive with respect to the traditional materials for diameters of up to 300/500 mm. However, the other cost factors (trenches and road repairs) bear heavily upon this advantage and render it almost negligible. The choice must, therefore, be based on other considerations according to the particular set of circumstances.
For larger diameters and the pressures normally used for water networks, the cost of PVC and, above all, HDPE becomes too high.
The use of reinforced plastic pipes with diameters ranging from 400 to 1000 mm and over and for high pressure is very interesting.
The cost is only slightly higher with respect of steel (on the order of 15-20%) but it only becomes apparent when faced with the other advantages such as laying, corrosion resistance, life, and small load losses.

6. Conclusions

At the end of this brief summary on plastic pipes, we can conclude that by making the proper choice and in conformance with the particular set of circumstances, these pipes may satisfy almost any requirement related to conveying fluids in the field of water, gas, and sewer networks.
The cost of these materials in the various technological diversifications, has become competitive with the cost of traditional materials in almost the full range of possible diameters. The further growth in the use of these materials predominantly depends upon gradually convincing technicians and on the consequent modification of the systems and the organization of work in places that are tied to the exclusive use of traditional materials.

FIG. 1

PRODUCTION DIAGRAM OF PLASTIC MATERIALS FOR PIPES

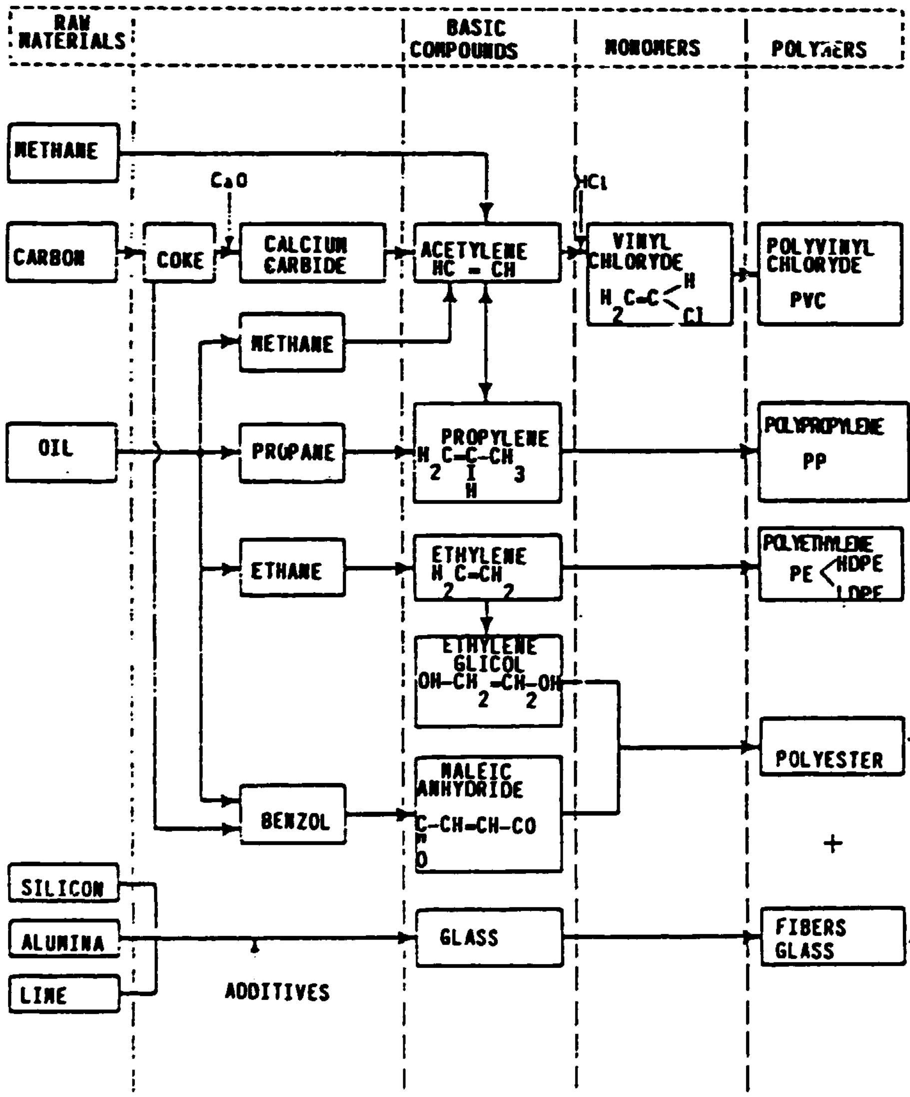
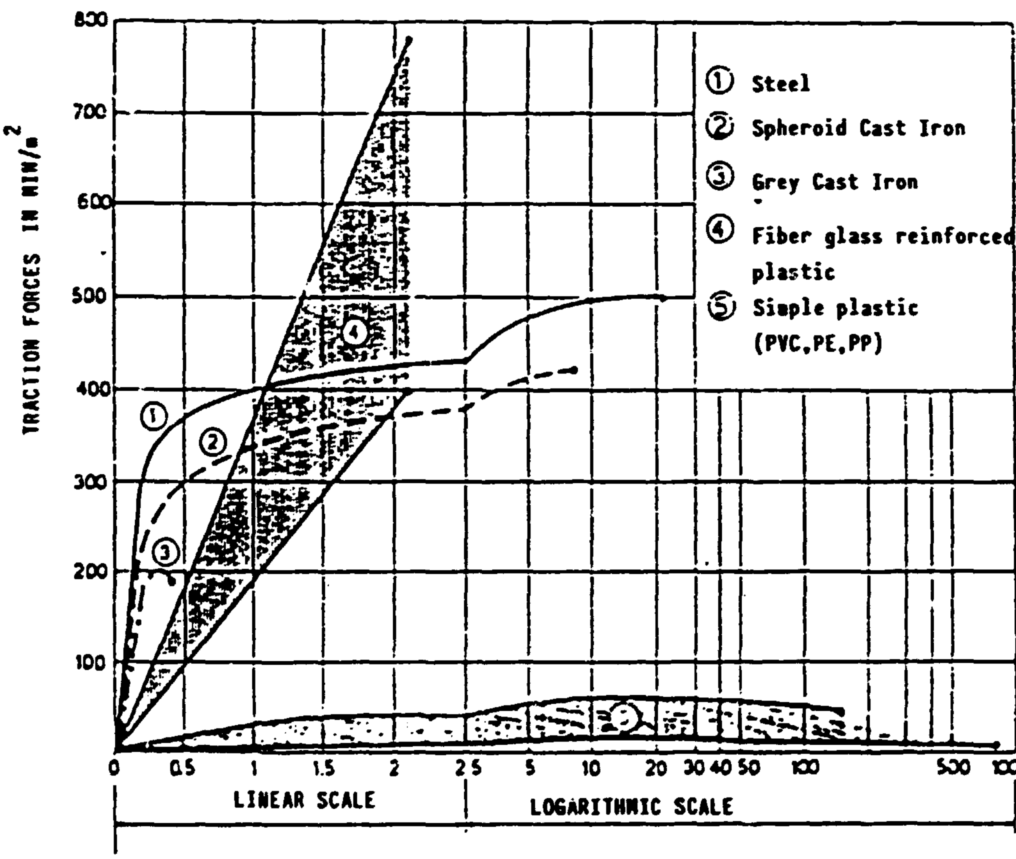


FIG. 2

COMPARISON DIAGRAM OF STRESS/DEFORMATION

UNDER INSTANTANEOUS LOAD FOR PIPE MATERIALS



DEFORMATION %

FIG. 3

PHYSICAL PROPERTIES AND CONDITIONS FOR USE

OF PLASTIC PIPE MATERIALS

PHYSICAL PROPERTIES (Indicative Values)

		STEEL	PVC	LDPE	HDPE	PP	FRP
DENSITY	t/m^3	[illegible].8	1.4	0.92	0.95	0.91	1.3–1.9
RESISTANCE TO RIPPLING	MN/m^2	280	50	14	24	35	100 ÷ 800
ELASTICITY COEFFICIENT	MN/m^2	210000	3000	200	900	1250	7000 ÷ 40000
THERMAL EXPANSION	$10^{-6}\frac{m}{m\,°C}$	11.5	70	200	120	150	10 ÷ 40
THERMAL CONDUCTIVITY	$\frac{Kcal}{m \cdot h \cdot °C}$	50	0.15	0.30	0.4	0.2	0.2–0.4
ELECTRICAL RESISTIVITY	$\mu \cdot \Omega m$	0.2	10^{10}	10^{8}	10^{10}	10^{8}	10^{6}
SOFTENING TEMPERATURE	°C		82	50	87	127	
MELTING TEMPERATURE	°C	[illegible]500		120	140	165	

CONDITIONS FOR USE

		STEEL	PVC	LDPE	HDPE	PP	FRP
MINIMUM TIME OF USE	°C		−10	−40	−40	−20	−35 ÷ −40
MAXIMUM TIME OF USE	°C		+60	+80	+80	+100	+80 ÷ +100
ALLOWABLE FORCES	MN/m^2	140	10	3.2	5	5	20 ÷ 100

FIG. 4

ELONGATION UNDER LOAD AS A FUNCTION

OF TIME AT A TEMPERATURE OF 20°C

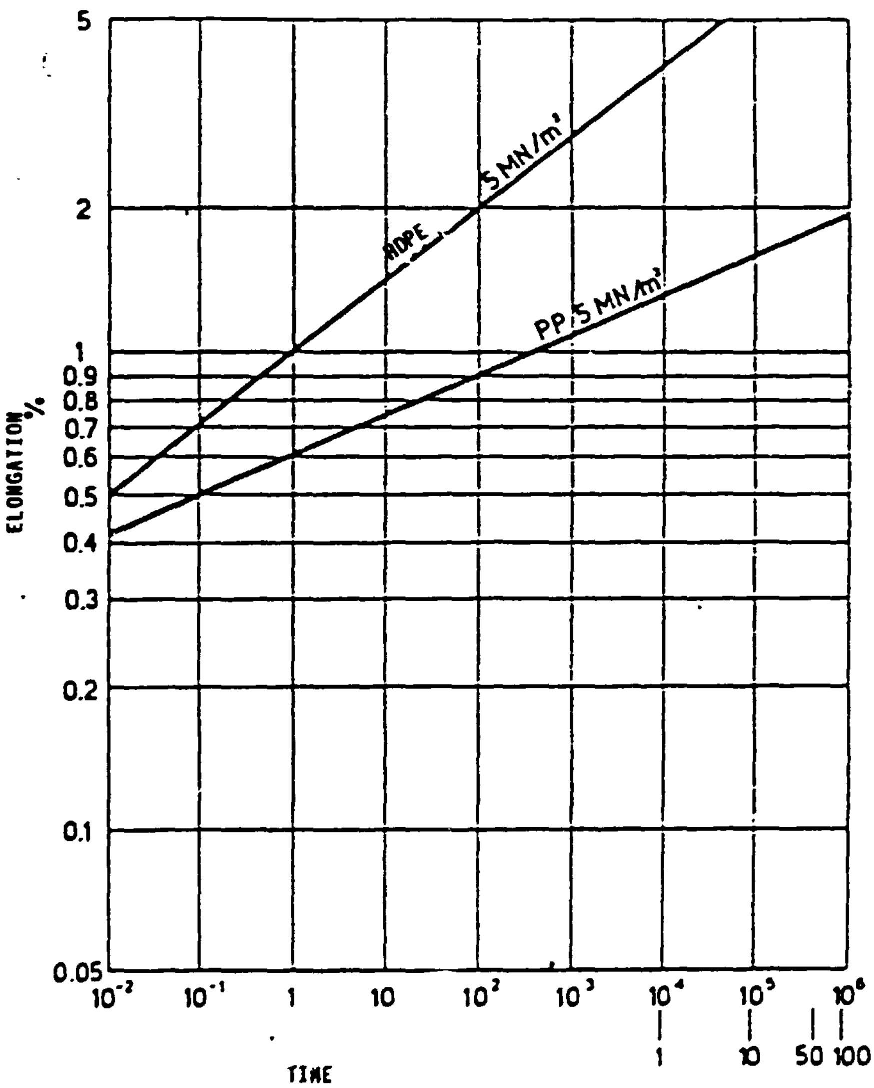


FIG. 5

FAILURE STRESS AS A FUNCTION OF TIME

OF A TEMPERATURE OF 20°C AND 60°C

FOR PLASTIC PIPE MATERIALS

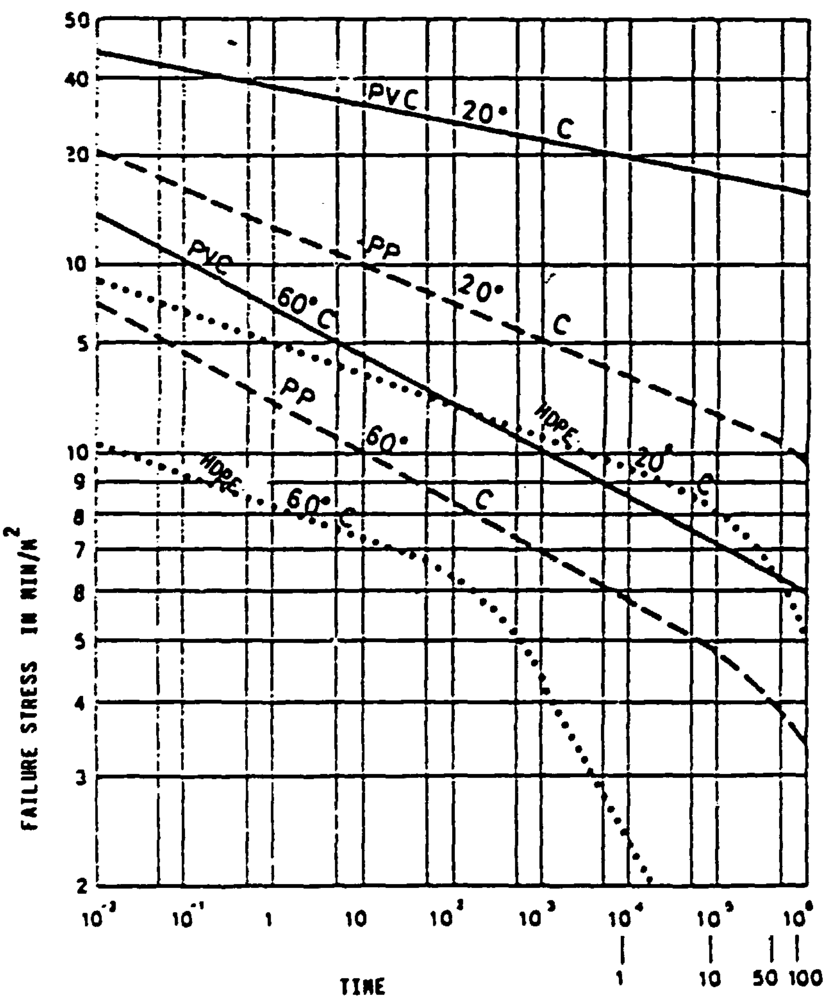
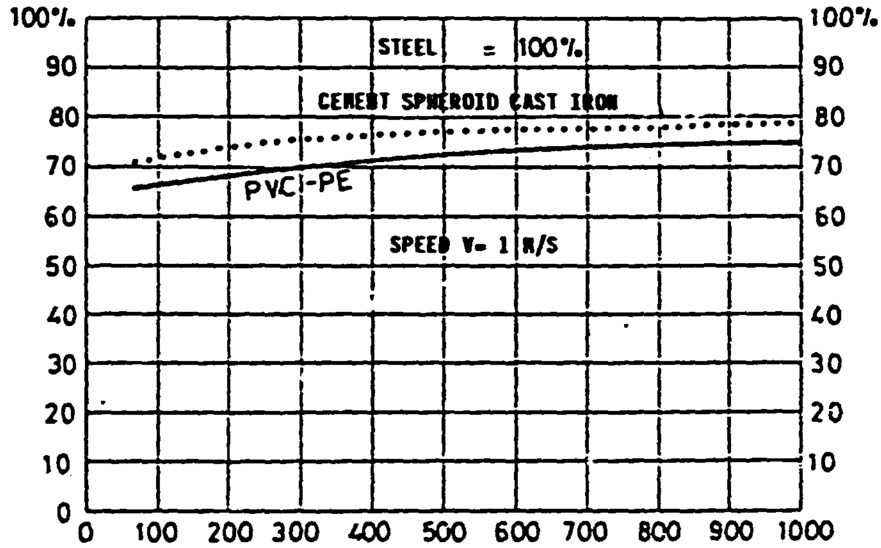


FIG. 6

LOSS OF LOAD IN PLASTIC PIPES AND
SPHEROID CAST IRON WITH CEMENT LINING PIPES
IN COMPARISON WITH AN OLD STEEL PIPE

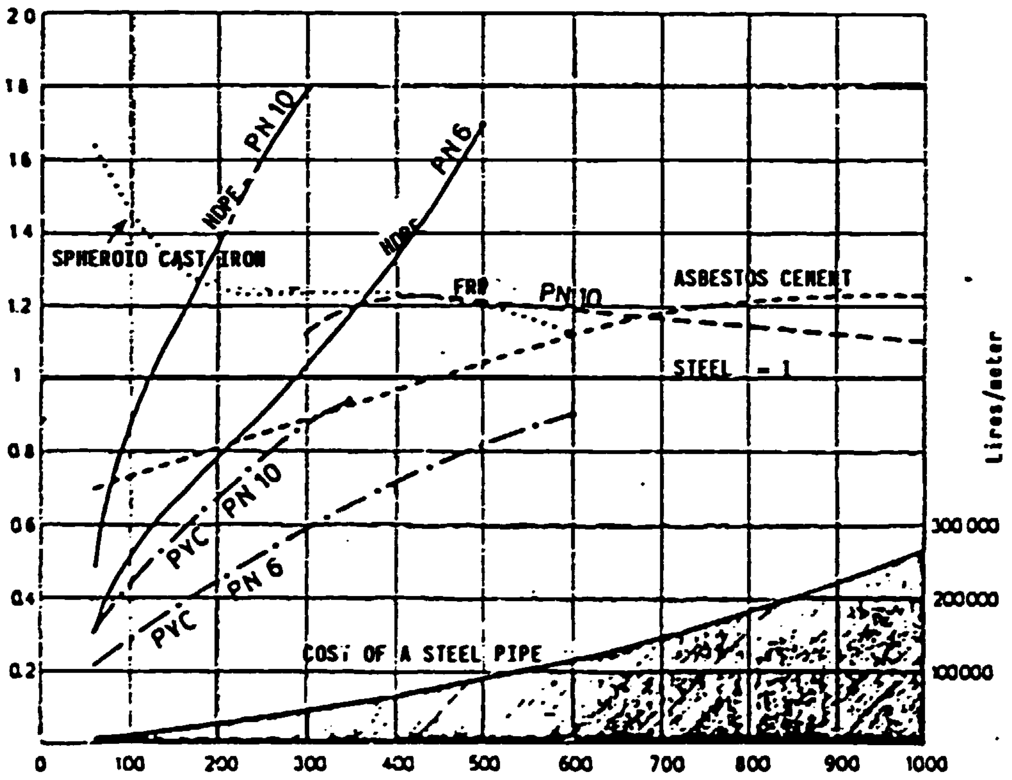


DIAMETERS IN mm

FIG. 7

RELATIVE COSTS OF PRESSURE PIPES

MADE OF PLASTIC AND TRADITION MATERIALS

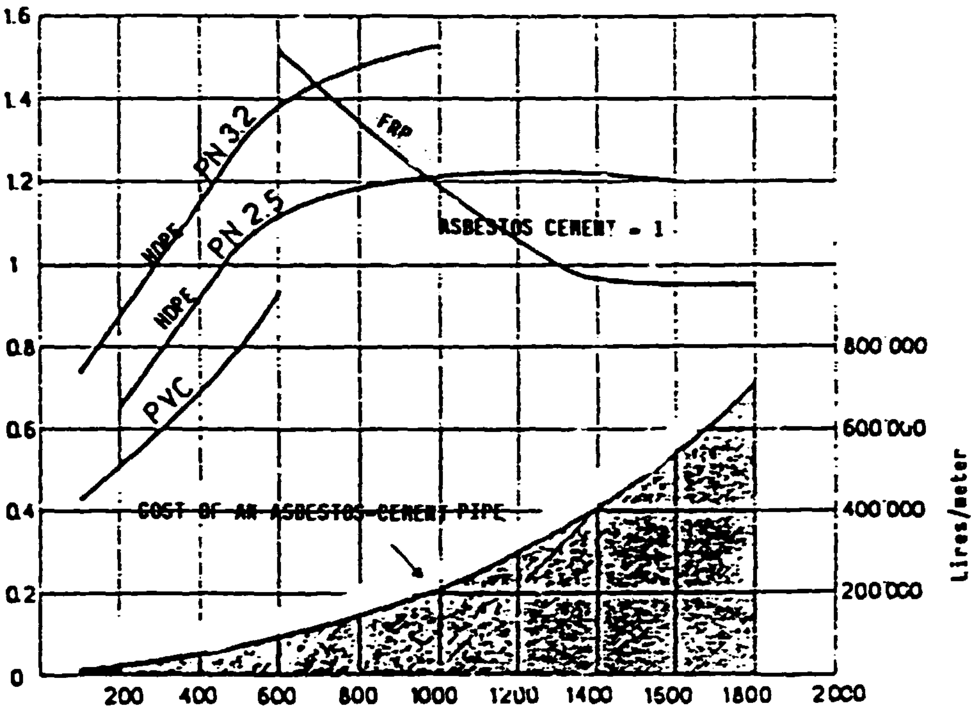


DIAMETERS IN mm

FIG. 8

RELATIVE COSTS OF PIPES WITHOUT PRESSURE

MADE OF PLASTIC AND TRADITIONAL MATERIALS



INTERNATIONAL STANDARD ISO 161/I

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Thermoplastics pipes for the transport of fluids — Nominal outside diameters and nominal pressures — Part I : Metric series

Tube en matières thermoplastiques pour le transport des fluides — Diamètres extérieurs nominaux et pressions nominales — Partie I : Série métrique

Second edition — 1978-04-01

UDC 621.643.2 : 678

Ref. No. ISO 161/I-1978 (E)

Descriptors : piping, plastic pipes, thermoplastic resins, fluids, dimensions, pressure.

Price based on 2 pages

ISO 161/I-1978 (E)

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 161/I was developed by Technical Committee ISO/TC 138, *Plastics pipes and fittings for the transport of fluids*. This second edition, containing five additional nominal outside diameters in table 1, was submitted directly to the ISO Council in accordance with clause 6.12.1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 161/I-1976), which had been approved by the member bodies of the following countries :

Austria	Israel	Spain
Belgium	Italy	Sweden
Chile	Japan	Switzerland
Czechoslovakia	Mexico	Thailand
Denmark	Norway	Turkey
Finland	Poland	United Kingdom
Germany	Portugal	U.S.A.
India	Romania	U.S.S.R.
Ireland	South Africa, Rep. of	Yugoslavia

The member bodies of the following countries had expressed disapproval of the document on technical grounds :

France
Netherlands

Thermoplastics pipes for the transport of fluids — Nominal outside diameters and nominal pressures — Part I : Metric series

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the nominal outside diameters and nominal pressures of circular section thermoplastics pipes for the transport of fluids, whatever their method of manufacture, their composition and their use.

It is intended to serve as a guide to manufacturers and users, and as a basis for specific standards for thermoplastics pipes made from a given plastics material and/or for a definite application.

Attention is also drawn to ISO 161/II.

2 REFERENCES

ISO 3, *Preferred numbers — Series of preferred numbers.*

ISO 161/II, *Thermoplastics pipes for the transport of fluids — Nominal outside diameters and nominal pressures — Part II : Inch series.*

3 NOMINAL OUTSIDE DIAMETERS

The pipes shall have one of the nominal outside diameters given in table 1.

4 TOLERANCES ON OUTSIDE DIAMETERS

The permissible deviations on the outside diameters of thermoplastics pipes shall be positive, in the form $^{+x}_{\ 0}$.

5 NOMINAL PRESSURES AND WORKING PRESSURES

5.1 The nominal pressure of a pipe is the working pressure of the pipe conveying water at a temperature of 20 °C.

5.2 The working pressure of a pipe is the maximum pressure which the pipe can sustain in continuous use.

5.3 The nominal pressures of thermoplastics pipes are given in table 2.

TABLE 1 — Nominal outside diameters

Values in millimetres

2,5	180
3	200
4	225
5	250
6	280
8	315
10	355
12	400
16	450
20	500
25	560
32	630
40	710
50	800
63	900
75	1 000
90	1 200
110	1 400
125	1 600
140	1 800
160	2 000

TABLE 2 — Nominal pressures

bar	MPa
1	0,1
2,5	0,25
4	0,4
6 (6,3)	0,6 (0,63)
10	1
16	1,6

Values in parentheses: for calculation only.

If higher or intermediate nominal pressures are required, they should be selected from the R 10 series of preferred numbers given in ISO 3.

6 CONVENTIONAL FORMULA RELATING THE INDUCED STRESS IN THE WALL OF A PIPE TO THE PRESSURE OF THE FLUID CONTAINED BY THE PIPE

It is taken conventionally that the stress induced in the wall of a pipe, the pressure of the fluid, the outside diameter and the wall thickness of the pipe are related by the following formula :

$$\sigma = \frac{p\,(d_e - e)}{2e}$$

where

σ is the induced stress;

p is the pressure of the fluid;

d_e is the outside diameter of the pipe;

e is the wall thickness of the pipe.

NOTE — The induced stress should be indicated in the same units as the fluid pressure, and the wall thickness in the same units as the outside diameter of the pipe.

INTERNATIONAL STANDARD ISO 161/II

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Thermoplastic pipes for the transport of fluids — Nominal outside diameters and nominal pressures — Part II : Inch series

Tubes en thermoplastiques pour le transport des fluides — Diamètres extérieurs nominaux et pressions nominales — Partie II : Série en inches

First edition — 1977-09-01

UDC 621.643.29 : 389.152

Ref. No. ISO 161/II-1977 (E)

Descriptors : pipes (tubes), plastic tubes, dimensions, diameters, pressure.

Price based on 2 pages

ISO 161/II-1977 (E)

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 161/II (originally ISO/DIS 330) was developed by Technical Committee ISO/TC 138, *Plastic pipes, fittings and valves for the transport of fluids*, and this edition was circulated to the member bodies in July 1973.

It was approved by the member bodies of the following countries :

Australia	Germany	Spain
Austria	Ireland	Sweden
Belgium	Israel	Switzerland
Bulgaria	Mexico	Thailand
Czechoslovakia	Netherlands	Turkey
Denmark	New Zealand	United Kingdom
Egypt, Arab Rep. of	Poland	U.S.A.
Finland	Portugal	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

France
Italy
Japan
Romania
South Africa, Rep. of

This International Standard cancels and replaces ISO Recommendation R 330-1963, of which it constitutes a technical revision.

Thermoplastic pipes for the transport of fluids — Nominal outside diameters and nominal pressures — Part II : Inch series

0 INTRODUCTION

The first part of this International Standard, ISO 161/I, shall be considered as the ISO standard for the future.

This second part provides, on a temporary basis, the metric values corresponding to dimensions based on the inch system still in use in certain countries, in order to enable them to ensure continuity in interchangeability.

The first edition of this second part was published as ISO Recommendation R 330, *Pipes of plastics materials for the transport of fluids (Outside diameters and nominal pressures) — Part II : Inch series.*

1 SCOPE AND FIELD OF APPLICATION

This International Standard deals solely with circular-section plastic pipes for the transport of fluids, whatever their method of manufacture, their composition and their use.

It is intended, as a temporary measure pending the generalization of ISO 161/I, to serve as a guide to manufacturers and users still using the inch system, and as a basis for specific standards for thermoplastic pipes made from a given plastic material and/or for a definite application.

2 REFERENCES

ISO 161/I, *Thermoplastics pipes for the transport of fluids — Thermoplastics outside diameters and nominal pressures — Part I : Metric series.*

ISO 336, *Plain end steel tubes, welded or seamless — General table of dimensions and masses per unit length.*

3 NOMINAL OUTSIDE DIAMETERS

The pipe shall have one of the nominal outside diameters given in table 1.

TABLE 1 — Nominal outside diameters

mm	(in)
10,2	(0.402)
13,5	(0.531)
17,2	(0.677)
21,3	(0.839)
26,9	(1.059)
33,7	(1.327)
42,4	(1.669)
48,3	(1.902)
60,3	(2.374)
75,3	(2.965)
88,9	(3.500)
101,6	(4.000)
114,3	(4.500)
140,3	(5.524)
168,3	(6.626)
193,7	(7.626)
219,1	(8.626)
244,5	(9.626)
273,0	(10.75)
323,9	(12.75)
355,6	(14.00)
406,4	(16.00)
457,2	(18.00)
508,0	(20.00)
558,8	(22.00)
609,6	(24.00)
660,4	(26.00)
711,2	(28.00)
762,0	(30.00)
812,8	(32.00)
863,6	(34.00)
914,4	(36.00)
1 016	(40.00)

4 TOLERANCES ON OUTSIDE DIAMETERS

The actual limits on outside diameters for each size of pipe shall be obtained by applying a tolerance appropriate to the application and material in question.

The tolerances may comprise positive and/or negative values.

5 NOMINAL PRESSURES AND WORKING PRESSURES

5.1 The nominal pressure of a pipe is the working pressure of the pipe conveying water at a temperature of 20 °C.

5.2 The working pressure of a pipe is the maximum pressure which the pipe can sustain in continuous use.

5.3 The nominal pressures of thermoplastic pipes are given in table 2.

TABLE 2 – Nominal pressures

Nominal pressure MPa	Head of water ft
0,3	(100)
0,6	(200)
0,9	(300)
1,2	(400)
1,5	(500)

If necessary, higher nominal pressures may be selected by extending the progression in 0,3 MPa steps.

6 CONVENTIONAL FORMULA RELATING THE INDUCED STRESS IN THE WALL OF A PIPE TO THE PRESSURE OF THE FLUID CONTAINED BY THE PIPE

It is taken conventionally that the stress induced in the wall of a pipe, the pressure of the fluid, the outside diameter and the wall thickness of the pipe are related by the formula

$$\sigma = \frac{p\,(d_e - e)}{2e}$$

where

σ is the induced stress, in megapascals;

p is the pressure of the fluid, in megapascals;

d_e is the outside diameter of the pipe, in millimetres;

e is the wall thickness of the pipe, in millimetres.

ANNEXE 4
CONFAR OUTPUT TABLES

Tabo BURMA : Subtable **initial fixed investment – foreign**

COMFAR 2.0 – BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	sum foreig	sum fval/f			invest- P1	invest- P2	invest- P3	invest- P4
L 1 land, site........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 2 civil A+B.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 3 equipment A+B.....	1765.00	1809.88	0.00	0.00	0.00	303.00	504.00	958.00
L 4 equipment C......	224.00	229.35	0.00	0.00	0.00	44.00	44.00	136.00
L 5 incorporate.......	281.00	285.57	0.00	0.00	0.00	56.00	0.00	225.00
L 6 pp-expenses.......	291.91	115.80	0.00	0.00	10.00	32.00	79.64	170.28
L 7 total fixed.......	2561.91	2440.60	0.00	0.00	10.00	435.00	627.64	1489.28
L 8 inventory.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 9 receivables.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 10 t o t a l.........	2561.91	2440.60	0.00	0.00	10.00	435.00	627.64	1489.28

Tabo BURMA : Subtable **initial fixed investment – local, consolidated**

COMFAR 2.0 – BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	sum local	sum fval/l	sum consol	sum fval/c	invest- P1	invest- P2	invest- P3	invest- P4
L 11 land, site........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 12 civil A+B.........	731.00	790.07	731.00	790.07	0.00	717.00	14.00	0.00
L 13 equipment A+B.....	35.00	36.40	1800.00	1846.28	0.00	303.00	539.00	958.00
L 14 equipment C......	290.00	295.80	514.00	525.15	0.00	44.00	189.00	281.00
L 15 incorporate.......	110.00	112.43	391.00	398.00	0.00	76.00	20.00	295.00
L 16 pp-expenses.......	30.00	30.81	321.91	146.61	10.00	37.00	89.64	185.28
L 17 total fixed.......	1196.00	1265.51	3757.91	3706.11	10.00	1177.00	861.64	1719.28
L 18 inventory.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 19 receivables.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 20 t o t a l.........	1196.00	1265.51	3757.91	3706.11	10.00	1177.00	861.64	1719.28

Tabo BURMA : Subtable **initial fixed investment – consolidated, foreigr**

COMFAR 2.0 – BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	grant tota	FVAL	sum nval	sum fval	sum P1	sum P2	sum P3	sum P4
L 21 sum, cons/f.......	3757.91	3889.27	2561.91	2623.76	[illegible]	435.00	627.64	1489.28
L 22 sum, local........	8.00	2.00	1196.00	1265.51		742.00	224.00	230.00

Tabo BURMA : Subtable initial fixed investment - foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
invest- P5	invest- P6	invest- P7	invest- P8	Not used	Not used	Not used	Not used	Not used	scrap valu
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	201.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	122.19
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	323.69
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	323.69

Tabo BURMA : Subtable initial fixed investm - local, consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
invest- P5	invest- P6	invest- P7	invest- P8	Not used	Not used	Not used	Not used	Not used	scrap valu
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	456.88
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	201.50
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	122.19
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	780.57
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	780.57

Tabo BURMA : Subtable initial fixed investment - consolidated, foreig

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
sum P5	sum P6	sum P7	sum P8	Not used	Not used	Not used	Not used	Not used	scrap valu
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	323.69
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	456.88

Tabo BURMA : Subtable investment during production, foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 151 land, site........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 152 civil A+B..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 153 equipmt A+B.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 154 equipment C.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 155 incorporate.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 156 pp-expenses.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 157 total fixed.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 158 in progress.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 159 inventory.........	0.00	353.25	136.68	111.75	0.00	0.00	0.00	0.00
L 160 receivables.......	0.00	3.87	1.40	0.85	0.00	0.00	0.00	0.00
L 161 cash, bank.......	0.00	0.46	0.05	-0.27	0.00	0.00	0.00	0.00
L 162 tot.current.......	0.00	357.58	138.13	112.34	0.00	0.00	0.00	0.00
L 163	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 164 total asset.......	0.00	357.58	138.13	112.34	0.00	0.00	0.00	0.00
L 165 depreciation......	0.00	201.64	201.64	201.64	201.64	201.64	143.26	143.26

Tabo BURMA : Subtable investment during production, consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 166 land, site........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 167 civil A+B..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 168 equipmt A+B.......	0.00	0.00	0.00	0.00	0.00	0.00	35.00	0.00
L 169 equipment C.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 170 incorporate.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 171 pp-expenses.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 172 total fixed.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 173 in progress.......	0.00	0.00	0.00	0.00	0.00	0.00	35.00	0.00
L 174 inventory.........	0.00	380.61	141.84	114.52	0.00	0.00	35.00	0.00
L 175 receivables.......	0.00	8.04	2.19	1.30	0.00	0.00	0.00	0.00
L 176 cash, bank........	0.00	6.09	0.05	-0.27	0.00	0.00	0.00	0.00
L 177 tot.current.......	0.00	394.74	144.09	115.55	0.00	0.00	0.00	0.00
L 178 loss c/f..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 179 total asset.......	0.00	394.74	144.09	115.55	0.00	0.00	35.00	0.00
L 180 depreciation......	0.00	264.41	264.41	264.41	264.41	264.41	193.03	200.03

Tabo BURMA : Subtable investment during production, local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 181 total fixed.......	0.00	0.00	0.00	0.00	0.00	0.00	35.00	0.00
L 182 tot.current.......	0.00	37.16	5.96	3.21	0.00	0.00	0.00	0.00

Tabo BURMA : Subtable investment during production, foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
143.26	143.26	143.26	143.26	143.16	126.58	75.37	25.39	0.00	323.69

Tabo BURMA : Subtable investment during production, consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	35.00	0.00	0.00	0.00	0.00	0.00	7.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	35.00	0.00	0.00	0.00	0.00	0.00	7.00
0.00	0.00	0.00	35.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	35.00	0.00	0.00	0.00	0.00	0.00	0.00
200.03	200.03	200.03	200.03	199.93	159.31	107.98	57.94	0.00	787.57

Tabo BURMA : Subtable investment during production, local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	35.00	0.00	0.00	0.00	0.00	0.00	7.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMA : Subtable production costs, foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 106 raw material......	0.00	1225.82	1712.01	2114.40	2114.40	2114.40	2114.40	2114.40
L 107 other RM..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 108 utilities.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 109 energy............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 110 labour............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 111 maintenance.......	0.00	18.37	24.93	30.00	30.00	30.00	30.00	30.00
L 112 spares............	0.00	38.52	50.68	60.00	60.00	60.00	60.00	60.00
L 113 factory ovh.......	0.00	110.00	110.00	0.00	0.00	0.00	0.00	0.00
L 114 sub-total.........	0.00	1392.71	1897.62	2204.40	2204.40	2204.40	2204.40	2204.40
L 115 (variable)........	0.00	1278.71	1783.62	2200.40	2200.40	2200.40	2200.40	2200.40
L 116 admin. ovh........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 117 M+distrib.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 118 operating c.......	0.00	1392.71	1897.62	2204.40	2204.40	2204.40	2204.40	2204.40
L 119 depreciation......	0.00	201.64	201.64	201.64	201.64	201.64	143.26	143.26
L 120 sub-total.........	0.00	1594.35	2099.26	2406.04	2406.04	2406.04	2347.66	2347.66
L 121 interest..........	0.00	150.55	145.18	123.67	102.16	80.65	0.00	0.00
L 122 total PCost.......	0.00	1744.90	2244.44	2529.71	2508.20	2486.69	2347.66	2347.66
L 123 (variable)........	0.00	1278.71	1783.62	2200.40	2200.40	2200.40	2200.40	2200.40
L 124 (labour)..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabc BURMA : Subtable production costs, foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used
2114.40	2114.40	2114.40	2114.40	2114.40	2114.40	2114.40	2114.40	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	0.00	0.00
60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2204.40	2204.40	2204.40	2204.40	2204.40	2204.40	2204.40	2204.40	0.00	0.00
2200.40	2200.40	2200.40	2200.40	2200.40	2200.40	2200.40	2200.40	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2204.40	2204.40	2204.40	2204.40	2204.40	2204.40	2204.40	2204.40	0.00	0.00
143.26	143.26	143.26	143.26	143.16	126.58	75.37	25.39	0.00	0.00
2347.66	2347.66	2347.66	2347.66	2347.56	2330.98	2279.77	2229.79	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2347.66	2347.66	2347.66	2347.66	2347.56	2330.98	2279.77	2229.79	0.00	0.00
2200.40	2200.40	2200.40	2200.40	2200.40	2200.40	2200.40	2200.40	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabw BURMA : Subtable **Working capital req., foreign**

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1 mdc	2 coto	3 required Y1	4 required Y2	5 required Y3	6 required Y4	7 required Y5	8 required Y6
L 1 receivables.......	1.00	360.00	3.87	5.27	6.12	6.12	6.12	6.12
L 2 raw material 1st..	90.00	4.00	306.46	428.00	528.60	528.60	528.60	528.60
L 3 raw material other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 4 utilities.........	1.00	360.00	0.00	0.00	0.00	0.00	0.00	0.00
L 5 energy............	1.00	360.00	0.00	0.00	0.00	0.00	0.00	0.00
L 6 spare-parts.......	365.00	0.99	39.06	51.38	60.83	60.83	60.83	60.83
L 7 work-in-progress..	1.00	360.00	3.87	5.27	6.12	6.12	6.12	6.12
L 8 finished products.	1.00	360.00	3.87	5.27	6.12	6.12	6.12	6.12
L 9 liabilities.......	1.00	360.00	3.87	5.27	6.12	6.12	6.12	6.12
L 10 cash in hand......	1.00	360.00	0.46	0.52	0.25	0.25	0.25	0.25
L 11 current assets....	461.00	2164.99	357.58	495.71	608.05	608.05	608.05	608.05
L 12 net work'g capital	460.00	1804.99	353.71	490.44	601.93	601.93	601.93	601.93
L 13 NWC increase......	0.00	0.00	353.71	136.73	111.49	0.00	0.00	0.00

Tabw BURMA : Subtable **Working capital req., local**

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1 mdc	2 coto	3 required Y1	4 required Y2	5 required Y3	6 required Y4	7 required Y5	8 required Y6
L 14 receivables.......	7.00	51.43	4.17	4.96	5.42	5.42	5.42	5.42
L 15 raw material 1st..	30.00	12.00	9.27	11.92	13.25	13.25	13.25	13.25
L 16 raw material other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 17 utilities.........	1.00	360.00	0.00	0.00	0.00	0.00	0.00	0.00
L 18 energy............	1.00	360.00	0.10	0.12	0.14	0.14	0.14	0.14
L 19 spare-parts.......	180.00	2.00	5.00	5.00	5.00	5.00	5.00	5.00
L 20 work-in-progress..	7.00	51.43	4.04	4.84	5.29	5.29	5.29	5.29
L 21 finished products.	15.00	24.00	8.94	10.64	11.60	11.60	11.60	11.60
L 22 liabilities.......	7.00	51.43	4.04	4.84	5.29	5.29	5.29	5.29
L 23 cash in hand......	30.00	12.00	5.63	5.63	5.63	5.63	5.63	5.63
L 24 current assets....	271.00	872.86	37.16	43.11	46.33	46.33	46.33	46.33
L 25 net work'g capital	264.00	821.43	33.11	38.28	41.04	41.04	41.04	41.04
L 26 NWC increase......	0.00	0.00	33.11	5.16	2.76	0.00	0.00	0.00

Tabw BURMA : Subtable **Working capital req., consolidated**

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1 mdc	2 coto	3 required Y1	4 required Y2	5 required Y3	6 required Y4	7 required Y5	8 required Y6
L 27 NWC,consol........	724.00	2626.42	386.82	528.72	642.97	642.97	642.97	642.97
L 28 increase consol...	0.00	0.00	386.82	141.89	114.25	0.00	0.00	0.00

Tabw BURMA : Subtable Working capital req., foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	
required Y7	required Y8	required Y9	require-Y10	require-Y11	require-Y12	require-Y13	require-Y14	require-Y15	
6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12 L	1
528.60	528.60	528.60	528.60	528.60	528.60	528.60	528.60	528.60 L	2
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	3
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	4
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	5
60.83	60.83	60.83	60.83	60.83	60.83	60.83	60.83	60.83 L	6
6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12 L	7
6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12 L	8
6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12	6.12 L	9
0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25 L	10
608.05	608.05	608.05	608.05	608.05	608.05	608.05	608.05	608.05 L	11
601.93	601.93	601.93	601.93	601.93	601.93	601.93	601.93	601.93 L	12
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	13

Tabw BURMA : Subtable Working capital req., local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	
required Y7	required Y8	required Y9	require-Y10	require-Y11	require-Y12	require-Y13	require-Y14	require-Y15	
5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42	5.42 L	14
13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25 L	15
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	17
0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14 L	18
5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00 L	19
5.29	5.29	5.29	5.29	5.29	5.29	5.29	5.29	5.29 L	20
11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.60 L	21
5.29	5.29	5.29	5.29	5.29	5.29	5.29	5.29	5.29 L	22
5.63	5.63	5.63	5.63	5.63	5.[illegible]	5.63	5.63	5.63 L	23
46.33	46.33	46.33	46.33	46.33	46.33	46.33	46.33	46.33 L	24
41.04	41.04	41.04	41.04	41.04	41.04	41.04	41.04	41.04 L	25
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	26

Tabw BURMA : Subtable Working capital req., consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	
required Y7	required Y8	required Y9	require-Y10	require-Y11	require-Y12	require-Y13	require-Y14	require-Y15	
642.97	642.97	642.97	642.97	642.97	642.97	642.97	642.97	642.97 L	27
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 L	28

Tabo BURMA : Subtable production costs, consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 126 raw material......	0.00	1337.12	1855.11	2273.40	2273.40	2273.40	2273.40	2273.40
L 127 other RM..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 128 utilities.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 129 energy............	0.00	35.76	44.70	52.00	52.00	52.00	52.00	52.00
L 130 labour............	0.00	15.90	15.90	15.90	15.90	15.90	15.90	15.90
L 131 maintenance.......	0.00	18.37	24.93	30.00	30.00	30.00	30.00	30.00
L 132 spares............	0.00	48.52	60.68	70.00	70.00	70.00	70.00	70.00
L 133 factory ovh.......	0.00	145.00	145.00	35.00	35.00	35.00	35.00	35.00
L 134 sub-total.........	0.00	1600.67	2146.33	2476.30	2476.30	2476.30	2476.30	2476.30
L 135 (variable)........	0.00	1413.50	1959.16	2399.13	2399.13	2399.13	2399.13	2399.13
L 136 admin. ovh........	0.00	6.60	6.60	6.60	6.60	6.60	6.60	6.60
L 137 M+distrib.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 138 operating c.......	0.00	1607.27	2152.93	2482.90	2482.90	2482.90	2482.90	2482.90
L 139 depreciation......	0.00	264.41	264.41	264.41	264.41	264.41	193.03	200.03
L 140 sub-total.........	0.00	1871.68	2417.33	2747.31	2747.31	2747.31	2675.92	2682.92
L 141 interest..........	176.91	150.55	145.18	123.67	102.16	80.65	0.00	0.00
L 142 total PCost.......	0.00	2022.23	2562.51	2870.97	2849.47	2827.96	2675.92	2682.92
L 143 (variable)........	0.00	1413.50	1959.16	2399.13	2399.13	2399.13	2399.13	2399.13
L 144 (labour)..........	0.00	22.50	22.50	22.50	22.50	22.50	22.50	22.50
L 145	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMA : Subtable local costs; marketing distribution foreign, co

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 146 variable..........	0.00	134.79	175.53	198.73	198.73	198.73	198.73	198.73
L 147 labour............	0.00	22.50	22.50	22.50	22.50	22.50	22.50	22.50
L 148 total PCost.......	0.00	277.33	318.07	341.27	341.27	341.27	328.27	335.26

Tabo BURMA : Subtable production costs, consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used
2273.40	2273.40	2273.40	2273.40	2273.40	2273.40	2273.40	2273.40	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	0.00	0.00
15.90	15.90	15.90	15.90	15.90	15.90	15.90	15.90	0.00	0.00
30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	0.00	0.00
70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	0.00	0.00
35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	0.00	0.00
2476.30	2476.30	2476.30	2476.30	2476.30	2476.30	2476.30	2476.30	0.00	0.00
2399.13	2399.13	2399.13	2399.13	2399.13	2399.13	2399.13	2399.13	0.00	0.00
6.60	6.60	6.60	6.60	6.60	6.60	6.60	6.60	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2482.90	2482.90	2482.90	2482.90	2482.90	2482.90	2482.90	2482.90	0.00	0.00
200.03	200.03	200.03	200.03	199.93	159.31	107.98	57.94	0.00	0.00
2682.92	2682.92	2682.92	2682.92	2682.82	2642.21	2590.88	2540.84	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2682.92	2682.92	2682.92	2682.92	2682.82	2642.21	2590.88	2540.84	0.00	0.00
2399.13	2399.13	2399.13	2399.13	2399.13	2399.13	2399.13	2399.13	0.00	0.00
22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMA : Subtable local costs; marketing distribution foreign, co

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used
198.73	198.73	198.73	198.73	198.73	198.73	196.73	198.73	0.00	0.00
22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	0.00	0.00
335.26	335.26	335.26	335.26	335.26	311.22	311.11	311.05	0.00	0.00

Tabo BURMA : Subtable sales (= production programme) foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 56 A,sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 57 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 58 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 59 B,sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 60 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 61 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 62 C,sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 63 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 64 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 65 D,sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 66 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 67 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 68 E,sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 69 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 70 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 71 F,sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 72 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 73 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 74 total sales.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table BURMA : Subtable sales (= production programme) foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4014/1

Tabo BURMA : Subtable sales (= production programme) local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 77 A,sales pa........	0.00	772.20	1179.00	1585.80	1585.80	1585.80	1585.80	1585.80
L 78 -net of tax.......	0.00	772.20	1179.00	1585.80	1585.80	1585.80	1585.80	1585.80
L 79 -net dir.c........	0.00	772.20	1179.00	1585.80	1585.80	1585.80	1585.80	1585.80
L 80 B,sales pa........	0.00	740.25	951.75	1057.50	1057.50	1057.50	1057.50	1057.50
L 81 -net of tax.......	0.00	740.25	951.75	1057.50	1057.50	1057.50	1057.50	1057.50
L 82 -net dir.c........	0.00	740.25	951.75	1057.50	1057.50	1057.50	1057.50	1057.50
L 83 C,sales pa........	0.00	472.50	607.50	675.00	675.00	675.00	675.00	675.00
L 84 -net of tax.......	0.00	472.50	607.50	675.00	675.00	675.00	675.00	675.00
L 85 -net dir.c........	0.00	472.50	607.50	675.00	675.00	675.00	675.00	675.00
L 86 D,sales pa........	0.00	67.50	90.00	112.50	112.50	112.50	112.50	112.50
L 87 -net of tax.......	0.00	67.50	90.00	112.50	112.50	112.50	112.50	112.50
L 88 -net dir.c........	0.00	67.50	90.00	112.50	112.50	112.50	112.50	112.50
L 89 E,sales pa........	0.00	96.00	120.00	141.60	141.60	141.60	141.60	141.60
L 90 -net of tax.......	0.00	96.00	120.00	141.60	141.60	141.60	141.60	141.60
L 91 -net dir.c........	0.00	96.00	120.00	141.60	141.60	141.60	141.60	141.60
L 92 F,sales pa........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 93 -net of tax.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 94 -net dir.c........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 95 total sales.......	0.00	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40	3572.40
L 96 -net of tax.......	0.00	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40	3572.40
L 97 -net dir.c........	0.00	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40	3572.40

Tabo BURMA : Subtable sales (= production programme) consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
		cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 98 total sales.......	0.00	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40	3572.40
L 99 -net of tax.......	0.00	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40	3572.40
L 100 -net dir.c........	0.00	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40	3572.40
L 101 tax foreign.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 102 tax cons..........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 103 labour, fgn.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 104 labour, loc.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 105 labour,cons.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4,24/2

Tabo BURMA : Subtable sales (= production programme) local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used
1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	0.00	0.00
1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	0.00	0.00
1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	1585.80	0.00	0.00
1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	0.00	0.00
1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	0.00	0.00
1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	1057.50	0.00	0.00
675.00	675.00	675.00	675.00	675.00	675.00	675.00	675.00	0.00	0.00
675.00	675.00	675.00	675.00	675.00	675.00	675.00	675.00	0.00	0.00
675.00	675.00	675.00	675.00	675.00	675.00	675.00	675.00	0.00	0.00
112.50	112.50	112.50	112.50	112.50	112.50	112.50	112.50	0.00	0.00
112.50	112.50	112.50	112.50	112.50	112.50	112.50	112.50	0.00	0.00
112.50	112.50	112.50	112.50	112.50	112.50	112.50	112.50	0.00	0.00
141.60	141.60	141.60	141.60	141.60	141.60	141.60	141.60	0.00	0.00
141.60	141.60	141.60	141.60	141.60	141.60	141.60	141.60	0.00	0.00
141.60	141.60	141.60	141.60	141.60	141.60	141.60	141.60	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	0.00	0.00
3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	0.00	0.00
3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	0.00	0.00

Tabo BURMA : Subtable sales (= production programme) consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	Not used	Not used
3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	0.00	0.00
3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	0.00	0.00
3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMA : Subtable finance - initial investment = foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	total fund	total FVAL			funds P1	funds P2	funds P3	funds P4
L 23 equ.O, paid.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 24 equ.P, paid.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 25 subsidies.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 26 loan A paid.......	1881.90	2058.81	0.00	0.00	500.00	600.00	781.90	0.00
L 27 loan B paid.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 28 loan C paid.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 29 total loan........	1881.90	2058.81	0.00	0.00	500.00	600.00	781.90	0.00
L 30 debt A............	0.00	0.00	0.00	0.00	500.00	1100.00	1881.90	1881.90
L 31 debt B............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 32 debt C............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 33 total debt........	0.00	0.00	0.00	0.00	500.00	1100.00	1881.90	1881.90
L 34 debt/funds%.......	0.00	0.00	0.00	0.00	100.00	100.00	100.00	100.00

Tabo BURMA : Subtable finance - initial investment = local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	total fund	total FVAL	local+forg	total FVAL	funds P1	funds P2	funds P3	funds P4
L 35 equ.O paid........	2400.10	2598.58	0.00	0.00	1200.00	400.00	400.00	400.10
L 36 equ.P paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 37 subsidies.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 38 loan A paid.......	0.00	0.00	1881.90	2058.81	0.00	0.00	0.00	0.00
L 39 loan B paid.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 40 loan C paid.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 41 total loan........	2400.10	2598.58	1881.90	2058.81	1200.00	400.00	400.00	400.10
L 42 debt A............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 43 debt B............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 44 debt C............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 45 total debt........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 46 debt/funds%.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMA : Subtable finance - initial investment = consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	total fund	total FVAL			funds P1	funds P2	funds P3	funds P4
L 47 sum equity........	2400.10	2598.58	0.00	0.00	1200.00	400.00	400.00	400.10
L 48 sum loan CF.......	1881.90	2058.81	1881.90	2058.81	500.00	600.00	781.90	0.00
L 49 total funds.......	4282.00	0.00	1881.90	0.00	1700.00	1000.00	1181.90	400.10
L 50 debt/funds%.......	0.00	0.00	0.00	0.00	29.41	40.74	48.48	43.95
L 51 interest f.......	176.91	0.00	0.00	0.00	10.00	32.00	59.64	75.28
L 52 interest l.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 53 interest c.......	176.91	0.00	0.00	0.00	10.00	32.00	59.64	75.28

Tabo BURMA : Subtable finance - initial investment = foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
funds P5	funds P6	funds P7	funds P8	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMA : Subtable finance - initial investment = local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
funds P5	funds P6	funds P7	funds P8	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tabo BURMA : Subtable finance - initial investment = consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
funds P5	funds P6	funds P7	funds P8	Not used	Not used	Not used	Not used	Not used	Not used
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Tobo BURMA : Subtable funds during production, foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 185 equ.O paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 186 equ.P paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 187 balance ret.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 188 profit dist.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 189 loanA,cflow.......	1881.90	0.00	-268.84	-268.84	-268.84	-268.84	-268.84	-268.84
L 190 loanB,cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 191 loanC,cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 192 debt A............	1881.90	1881.90	1613.06	1344.21	1075.37	806.53	537.69	268.84
L 193 debt B............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 194 debt C............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 195 subsidies.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 196 net worth.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 197 total loan........	1881.90	1881.90	1613.06	1344.21	1075.37	806.53	537.69	268.84
L 198 s.term,bank.......	0.00	3.87	1.40	0.85	0.00	0.00	0.00	0.00
L 199 total funds.......	1881.90	3.87	-267.44	-267.99	-268.84	-268.84	-268.84	-268.84

Tobo BURMA : Subtable funds during production, local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 200 equ.O paid........	2400.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 201 equ.P paid........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 202 balance ret.......	0.00	390.62	650.15	965.83	987.34	1008.85	1089.50	1089.50
L 203 profit dist.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 204 loanA,cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 205 loanB,cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 206 loanC,cflow.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 207 debt A............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 208 debt B............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 209 debt C............	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 210 subsidies.........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 211 net worth.........	2400.10	390.62	650.15	965.83	987.34	1008.85	1089.50	1089.50
L 212 total loan........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 213 s.term,bank.......	0.00	4.04	0.79	0.45	0.00	0.00	0.00	0.00
L 214 total funds.......	2400.10	394.67	650.94	966.28	987.34	1008.85	1089.50	1089.50

Tobo BURMA : Subtable funds during production, consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Col	1	2	3	4	5	6	7	8
	for Calcul	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 215 equity paid.......	2400.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 216 net worth.........	2400.10	390.62	650.15	965.83	987.34	1008.85	1089.50	1089.50
L 217 long term.........	1881.90	0.00	-268.84	-268.84	-268.84	-268.84	-268.84	-268.84
L 218 short term........	0.00	7.91	2.19	1.30	0.00	0.00	0.00	0.00
L 219 total funds.......	4282.00	398.54	383.50	698.29	718.50	740.01	820.66	820.66
L 220 loan repay........	4282.00	0.00	268.84	268.84	268.84	268.84	268.84	268.84

Table BURMA : Subtable funds during production, foreign

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-268.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	1881.90
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-268.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table BURMA : Subtable funds during production, local

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	0.00	787.57
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	0.00	0.00

Table BURMA : Subtable funds during production, consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	for Calcul	for Calcul
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	0.00	0.00
-268.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
820.66	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	1089.50	0.00	0.00
268.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table BURMA : Subtable funds income, cashflows, consolidated

Col	1	2	3	4	5	6	7	8
	cflow. c/f	cashfl- Y1	cashfl- Y2	cashfl- Y3	cashfl- Y4	cashfl- Y5	cashfl- Y6	cashfl- Y7
L 221 gross profit......	0.00	126.22	385.74	701.43	722.93	744.44	896.48	889.48
L 222 foreign inc.......	0.00	-1744.90	-2244.44	-2529.71	-2508.20	-2486.69	-2347.66	-2347.66
L 223 allowances........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 224 taxable inc.......	0.00	126.22	385.74	701.43	722.93	744.44	896.48	889.48
L 225 income tax........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 226 net income........	0.00	126.22	385.74	701.43	722.93	744.44	896.48	889.48
L 227 tx/dividend.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 228 net divident......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 229 acc. income.......	0.00	126.22	511.96	1213.38	1936.32	2680.76	3577.23	4466.71
L 230 incl interest.....	0.00	276.77	807.69	1632.78	2457.87	3282.97	4179.44	5068.92
L 231 CF-out,prod.......	3581.00	1994.10	2294.82	2597.15	2482.90	2482.90	2517.90	2482.90
L 232 CF-in,prod........	0.00	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40	3572.40
L 233 net CF,prod.......	-3581.00	154.35	653.43	975.25	1089.50	1089.50	1054.50	1089.50
L 234 acc. net-CF.......	-3581.00	-3426.65	-2773.22	-1797.97	-708.47	381.03	1435.54	2525.04
L 235 equ. NPV/IRR......	0.00	2602.89	21.94	2808.45	21.00	0.00	0.00	0.00
L 236 NCF/sales %.......	0.00	7.18	22.16	27.30	30.50	30.50	29.52	30.50
L 237 NCF/invest %......	0.00	3.89	15.90	23.09	25.79	25.79	24.76	25.58
L 238 net income ROE1...	0.00	126.22	385.74	701.43	722.93	744.44	896.48	889.48
L 239 NPV, IRR..........	0.00	3372.17	22.45	0.00	0.00	0.00	0.00	0.00
L 240 netCF (ROE2)......	0.00	3.80	239.41	582.74	718.50	740.01	785.66	820.66
L 241 total CF,out......	3757.91	2144.65	2708.84	2989.66	2853.90	2832.39	2786.74	2751.74
L 242 total CF, in......	4282.00	2148.45	2948.25	3572.40	3572.40	3572.40	3572.40	3572.40
L 243 total netCF.......	524.09	3.80	239.41	582.74	718.50	740.01	785.66	820.66
L 244 acc. netCF........	524.09	527.89	767.30	1350.04	2068.54	2808.54	3594.20	4414.86
L 245 depr. allow.......	0.00	264.41	264.41	264.41	264.41	264.41	193.03	200.03
L 246 tax% if var.......	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 247 tax due...........	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L 248 acc. investm......	3581.00	3967.82	4109.72	4223.97	4223.97	4223.97	4258.97	4258.97

Tabo BURMA : Subtable funds income, cashflows, consolidated

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

9	10	11	12	13	14	15	16	17	18
cashfl- Y8	cashfl- Y9	cashfl-Y10	cashfl-Y11	cashfl-Y12	cashfl-Y13	cashfl-Y14	cashfl-Y15	salvage va	for Calcul
889.48	889.48	839.48	889.48	889.58	930.19	981.52	1031.56	0.00	0.00
-2347.66	-2347.66	-2347.66	-2347.66	-2347.56	-2330.98	-2279.77	-2229.79	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
889.48	889.48	889.48	889.48	889.58	930.19	981.52	1031.56	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
889.48	889.48	889.48	889.48	889.58	930.19	981.52	1031.56	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5356.19	6245.66	7135.14	8024.62	8914.19	9844.39	10825.91	11857.47	0.00	0.00
5958.40	6847.87	7737.35	8626.83	9516.40	10446.59	11428.12	12459.67	0.00	0.00
2482.90	2482.90	2482.90	2517.90	2482.90	2482.90	2482.90	2482.90	0.00	0.00
3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	0.00	0.00
1089.50	1089.50	1089.50	1054.50	1089.50	1089.50	1089.50	1089.50	1430.54	0.00
3614.54	4704.04	5793.54	6848.04	7937.54	9027.04	10116.54	11206.04	12636.58	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30.50	30.50	30.50	29.52	30.50	30.50	30.50	30.50	0.00	0.00
25.58	25.58	25.58	24.56	25.37	25.37	25.37	25.37	0.00	0.00
889.48	889.48	889.48	889.48	889.58	930.19	981.52	1031.56	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
820.66	1089.50	1089.50	1054.50	1089.50	1089.50	1089.50	1089.50	1430.54	0.00
2751.74	2482.90	2482.90	2517.90	2482.90	2482.90	2482.90	2482.90	0.00	0.00
3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	3572.40	0.00	0.00
820.66	1089.50	1089.50	1054.50	1089.50	1089.50	1089.50	1089.50	0.00	0.00
5235.52	6325.02	7414.52	8469.02	9558.52	10648.02	11737.52	12827.02	0.00	0.00
200.03	200.03	200.03	200.03	199.93	159.31	107.98	57.94	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4258.97	4258.97	4258.97	4293.97	4293.97	4293.97	4293.97	4293.97	0.00	0.00

baldo & c. s.r.l.
CONSULTING ENGINEERS

A N N E X E 5
COST OF PRODUCTION

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Production costs for product: uPVC PIPES, foreign

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	565.82	863.89	1161.97	1161.97	1161.97
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	4.87	7.43	10.00	10.00	10.00
spares	8.77	13.38	18.00	18.00	18.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	579.45	884.71	1189.97	1189.97	1189.97
thereof variable	579.45	884.71	1189.97	1189.97	1189.97
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	579.45	884.71	1189.97	1189.97	1189.97
total before interests	637.64	942.90	1248.16	1248.16	1248.16
interests	0.00	0.00	0.00	0.00	0.00
total production cost	637.64	942.90	1248.16	1248.16	1248.16
thereof variable	579.45	884.71	1189.97	1189.97	1189.97
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	58.19	58.19	58.19	58.19	58.19

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Production costs for product: uPVC PIPES, foreign

	Year: 6	Year: 7	Year: 8	Year: 9	Year: 10
raw material (first)	1161.97	1161.97	1161.97	1161.97	1161.97
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	10.00	10.00	10.00	10.00	10.00
spares	18.00	18.00	18.00	18.00	18.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	1189.97	1189.97	1189.97	1189.97	1189.97
thereof variable	1189.97	1189.97	1189.97	1189.97	1189.97
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	1189.97	1189.97	1189.97	1189.97	1189.97
total before interests	1240.11	1240.11	1240.11	1240.11	1240.11
interests	0.00	0.00	0.00	0.00	0.00
total production cost	1240.11	1240.11	1240.11	1240.11	1240.11
thereof variable	1189.97	1189.97	1189.97	1189.97	1189.97
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	50.14	50.14	50.14	50.14	50.14

Production costs for product: uPVC PIPES, foreign

	Year:11	Year:12	Year:13	Year:14	Year:15
raw material (first)	1161.97	1161.97	1161.97	1161.97	1161.97
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	10.00	10.00	10.00	10.00	10.00
spares	18.00	18.00	18.00	18.00	18.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	1189.97	1189.97	1189.97	1189.97	1189.97
thereof variable	1189.97	1189.97	1189.97	1189.97	1189.97
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	1189.97	1189.97	1189.97	1189.97	1189.97
total before interests	1240.11	1240.07	1234.27	1216.35	1198.85
interests	0.00	0.00	0.00	0.00	0.00
total production cost	1240.11	1240.07	1234.27	1216.35	1198.85
thereof variable	1189.97	1189.97	1189.97	1189.97	1189.97
total labour (of tot. prod. cost)	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	50.14	50.10	44.30	26.38	8.89

Production costs for product: uPVC PIPES, local

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	8.92	13.62	18.33	18.33	18.33
labour	6.00	6.00	6.00	6.00	6.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	14.92	19.62	24.33	24.33	24.33
thereof variable	8.92	13.62	18.33	18.33	18.33
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	14.92	19.62	24.33	24.33	24.33
total before interests	36.89	41.59	46.29	46.29	46.29
interests	0.00	0.00	0.00	0.00	0.00
total production cost	36.89	41.59	46.29	46.29	46.29
thereof variable	8.92	13.62	18.33	18.33	18.33
total labour (of tot. prod. cost)	6.00	6.00	6.00	6.00	6.00
depreciation borne by product	21.97	21.97	21.97	21.97	21.97

Production costs for product: uPVC PIPES, local

	Year: 6	Year: 7	Year: 8	Year: 9	Year:10
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	6.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	18.33	18.33	18.33	18.33	18.33
labour	6.00	6.00	6.00	6.00	6.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	24.33	24.33	24.33	24.33	24.33
thereof variable	18.33	18.33	18.33	18.33	18.33
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	24.33	24.33	24.33	24.33	24.33
total before interests	41.74	44.19	44.19	44.19	44.19
interests	0.00	0.00	0.00	0.00	0.00
total production cost	41.74	44.19	44.19	44.19	44.19
thereof variable	18.33	18.33	18.33	18.33	18.33
total labour (of tot. prod. cost) .	6.00	6.00	6.00	6.00	6.00
depreciation borne by product	17.42	19.87	19.87	19.87	19.87

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Production costs for product: uPVC PIPES, local

	Year:11	Year:12	Year:13	Year:14	Year:15
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	18.33	18.33	18.33	18.33	18.33
labour	6.00	6.00	6.00	6.00	6.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	24.33	24.33	24.33	24.33	24.33
thereof variable	18.33	18.33	18.33	18.33	18.33
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	24.33	24.33	24.33	24.33	24.33
total before interests	44.19	44.19	35.78	35.74	35.72
interests	0.00	0.00	0.00	0.00	0.00
total production cost	44.19	44.19	35.78	35.74	35.72
thereof variable	18.33	18.33	18.33	18.33	18.33
total labour (of tot. prod. cost) .	6.00	6.00	6.00	6.00	6.00
depreciation borne by product	19.87	19.87	11.45	11.41	11.39

Production costs for product: HDPE PIPES, foreign

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	446.32	573.84	637.60	637.60	637.60
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	3.50	4.50	5.00	5.00	5.00
spares	12.60	16.20	18.00	18.00	18.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	462.42	594.54	660.60	660.60	660.60
thereof variable	462.42	594.54	660.60	660.60	660.60
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	462.42	594.54	660.60	660.60	660.60
total before interests	512.30	644.42	710.48	710.48	710.48
interests	0.00	0.00	0.00	0.00	0.00
total production cost	512.30	644.42	710.48	710.48	710.48
thereof variable	462.42	594.54	660.60	660.60	660.60
total labour (of tot. prod. cost)	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	49.88	49.88	49.88	49.88	49.88

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Production costs for product: HDPE PIPES, foreign

	Year: 6	Year: 7	Year: 8	Year: 9	Year: 10
raw material (first)	637.60	637.60	637.60	637.60	637.60
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	5.00	5.00	5.00	5.00	5.00
spares	18.00	18.00	18.00	18.00	18.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	660.60	660.60	660.60	660.60	660.60
thereof variable	660.60	660.60	660.60	660.60	660.60
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	660.60	660.60	660.60	660.60	660.60
total before interests	703.58	703.58	703.58	703.58	703.58
interests	0.00	0.00	0.00	0.00	0.00
total production cost	703.58	703.58	703.58	703.58	703.58
thereof variable	660.60	660.60	660.60	660.60	660.60
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	42.98	42.98	42.98	42.98	42.98

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Production costs for product: HDPE PIPES, foreign

	Year:11	Year:12	Year:13	Year:14	Year:15
raw material (first)	637.60	637.60	637.60	637.60	637.60
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	5.00	5.00	5.00	5.00	5.00
spares	18.00	18.00	18.00	18.00	18.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	660.60	660.60	660.60	660.60	660.60
thereof variable	660.60	660.60	660.60	660.60	660.60
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	660.60	660.60	660.60	660.60	660.60
total before interests	703.58	703.55	698.58	683.21	668.22
interests	0.00	0.00	0.00	0.00	0.00
total production cost	703.58	703.55	698.58	683.21	668.22
thereof variable	660.60	660.60	660.60	660.60	660.60
total labour (of tot. prod. cost)	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	42.98	42.95	37.97	22.61	7.62

Production costs for product: HDPE PIPES, local

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	6.76	8.69	9.65	9.65	9.65
labour	3.50	3.50	3.50	3.50	3.50
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	10.26	12.19	13.15	13.15	13.15
thereof variable	6.76	8.69	9.65	9.65	9.65
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	10.26	12.19	13.15	13.15	13.15
total before interests	29.09	31.02	31.98	31.98	31.98
interests	0.00	0.00	0.00	0.00	0.00
total production cost	29.09	31.02	31.98	31.98	31.98
thereof variable	6.76	8.69	9.65	9.65	9.65
total labour (of tot. prod. cost) .	3.50	3.50	3.50	3.50	3.50
depreciation borne by product	18.83	18.83	18.83	18.83	18.83

Production costs for product: HDPE PIPES, local

	Year: 6	Year: 7	Year: 8	Year: 9	Year:10
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	9.65	9.65	9.65	9.65	9.65
labour	3.50	3.50	3.50	3.50	3.50
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	13.15	13.15	13.15	13.15	13.15
thereof variable	9.65	9.65	9.65	9.65	9.65
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	13.15	13.15	13.15	13.15	13.15
total before interests	28.08	30.18	30.18	30.18	30.18
interests	0.00	0.00	0.00	0.00	0.00
total production cost	28.08	30.18	30.18	30.18	30.18
thereof variable	9.65	9.65	9.65	9.65	9.65
total labour (of tot. prod. cost) .	3.50	3.50	3.50	3.50	3.50
depreciation borne by product	14.93	17.03	17.03	17.03	17.03

Production costs for product: HDPE PIPES, local

	Year:11	Year:12	Year:13	Year:14	Year:15
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	9.65	9.65	9.65	9.65	9.65
labour	3.50	3.50	3.50	3.50	3.50
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	13.15	13.15	13.15	13.15	13.15
thereof variable	9.65	9.65	9.65	9.65	9.65
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	13.15	13.15	13.15	13.15	13.15
total before interests	30.18	30.18	22.97	22.94	22.92
interests	0.00	0.00	0.00	0.00	0.00
total production cost	30.18	30.18	22.97	22.94	22.92
thereof variable	9.65	9.65	9.65	9.65	9.65
total labour (of tot. prod. cost)	3.50	3.50	3.50	3.50	3.50
depreciation borne by product	17.03	17.03	9.82	9.78	9.77

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Production costs for product: LATRINE PANS SETS, foreign

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	123.40	158.65	176.28	176.28	176.28
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	7.00	9.00	10.00	10.00	10.00
spares	7.00	9.00	10.00	10.00	10.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	137.40	176.65	196.28	196.28	196.28
thereof variable	137.40	176.65	196.28	196.28	196.28
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	137.40	176.65	196.28	196.28	196.28
total before interests	170.65	209.90	229.53	229.53	229.53
interests	0.00	0.00	0.00	0.00	0.00
total production cost	170.65	209.90	229.53	229.53	229.53
thereof variable	137.40	176.65	196.28	196.28	196.28
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	33.25	33.25	33.25	33.25	33.25

Production costs for product: LATRINE PANS SETS, foreign

	Year: 6	Year: 7	Year: 8	Year: 9	Year: 10
raw material (first)	176.28	176.28	176.28	176.28	176.28
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	10.00	10.00	10.00	10.00	10.00
spares	10.00	10.00	10.00	10.00	10.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	196.28	196.28	196.28	196.28	196.28
thereof variable	196.28	196.28	196.28	196.28	196.28
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	196.28	196.28	196.28	196.28	196.28
total before interests	224.93	224.93	224.93	224.93	224.93
interests	0.00	0.00	0.00	0.00	0.00
total production cost	224.93	224.93	224.93	224.93	224.93
thereof variable	196.28	196.28	196.28	196.28	196.28
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	28.65	28.65	28.65	28.65	28.65

Production costs for product: LATRINE PANS SETS, foreign

	Year:11	Year:12	Year:13	Year:14	Year:15
raw material (first)	176.28	176.28	176.28	176.28	176.28
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	10.00	10.00	10.00	10.00	10.00
spares	10.00	10.00	10.00	10.00	10.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	196.28	196.28	196.28	196.28	196.28
thereof variable	196.28	196.28	196.28	196.28	196.28
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	196.28	196.28	196.28	196.28	196.28
total before interests	224.93	224.91	221.60	211.35	201.36
interests	0.00	0.00	0.00	0.00	0.00
total production cost	224.93	224.91	221.60	211.35	201.36
thereof variable	196.28	196.28	196.28	196.28	196.28
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	28.65	28.63	25.32	15.07	5.08

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Production costs for product: LATRINE PANS SETS, local

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	111.30	143.10	159.00	159.00	159.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	4.62	5.94	6.60	6.60	6.60
labour	3.00	3.00	3.00	3.00	3.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	118.92	152.04	168.60	168.60	168.60
thereof variable	115.92	149.04	165.60	165.60	165.60
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	118.92	152.04	168.60	168.60	168.60
total before interests	131.47	164.59	181.15	181.15	181.15
interests	0.00	0.00	0.00	0.00	0.00
total production cost	131.47	164.59	181.15	181.15	181.15
thereof variable	115.92	149.04	165.60	165.60	165.60
total labour (of tot. prod. cost)	3.00	3.00	3.00	3.00	3.00
depreciation borne by product	12.55	12.55	12.55	12.55	12.55

Production costs for product: LATRINE PANS SETS, local

	Year: 6	Year: 7	Year: 8	Year: 9	Year: 10
raw material (first)	159.00	159.00	159.00	159.00	159.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	6.60	6.60	6.60	6.60	6.60
labour	3.00	3.00	3.00	3.00	3.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	168.60	168.60	168.60	168.60	168.60
thereof variable	165.60	165.60	165.60	165.60	165.60
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	168.60	168.60	168.60	168.60	168.60
total before interests	178.55	179.95	179.95	179.95	179.95
interests	0.00	0.00	0.00	0.00	0.00
total production cost	178.55	179.95	179.95	179.95	179.95
thereof variable	165.60	165.60	165.60	165.60	165.60
total labour (of tot. prod. cost)	3.00	3.00	3.00	3.00	3.00
depreciation borne by product	9.95	11.35	11.35	11.35	11.35

Production costs for product: LATRINE PANS SETS, local

	Year: 11	Year: 12	Year: 13	Year: 14	Year: 15
raw material (first)	159.00	159.00	159.00	159.00	159.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	6.60	6.60	6.60	6.60	6.60
labour	3.00	3.00	3.00	3.00	3.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	168.60	168.60	168.60	168.60	168.60
thereof variable	165.60	165.60	165.60	165.60	165.60
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	168.60	168.60	168.60	168.60	168.60
total before interests	179.95	179.95	175.15	175.12	175.11
interests	0.00	0.00	0.00	0.00	0.00
total production cost	179.95	179.95	175.15	175.12	175.11
thereof variable	165.60	165.60	165.60	165.60	165.60
total labour (of tot. prod. cost) .	3.00	3.00	3.00	3.00	3.00
depreciation borne by product	11.35	11.35	6.55	6.52	6.51

Production costs for product: uPVC FITTINGS, foreign

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	29.90	39.87	49.84	49.84	49.84
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	3.00	4.00	5.00	5.00	5.00
spares	4.80	6.40	8.00	8.00	8.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	37.70	50.27	62.84	62.84	62.84
thereof variable	37.70	50.27	62.84	62.84	62.84
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	37.70	50.27	62.84	62.84	62.84
total before interests	54.33	66.90	79.47	79.47	79.47
interests	0.00	0.00	0.00	0.00	0.00
total production cost	54.33	66.90	79.47	79.47	79.47
thereof variable	37.70	50.27	62.84	62.84	62.84
total labour (of tot. prod. cost)	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	16.63	16.63	16.63	16.63	16.63

COMFAR 2.0 UNIDO

Production costs for product: uPVC FITTINGS, foreign

	Year: 6	Year: 7	Year: 8	Year: 9	Year:10
raw material (first)	49.84	49.84	49.84	49.84	49.84
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	5.00	5.00	5.00	5.00	5.00
spares	8.00	8.00	8.00	8.00	8.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	62.84	62.84	62.84	62.84	62.84
thereof variable	62.84	62.84	62.84	62.84	62.84
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	62.84	62.84	62.84	62.84	62.84
total before interests	77.17	77.17	77.17	77.17	77.17
interests	0.00	0.00	0.00	0.00	0.00
total production cost	77.17	77.17	77.17	77.17	77.17
thereof variable	62.84	62.84	62.84	62.84	62.84
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	14.33	14.33	14.33	14.33	14.33

COMFAR 2.0 UNIDO

Production costs for product: uPVC FITTINGS, foreign

	Year:11	Year:12	Year:13	Year:14	Year:15
raw material (first)	49.84	49.84	49.84	49.84	49.84
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	5.00	5.00	5.00	5.00	5.00
spares	8.00	8.00	8.00	8.00	8.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	62.84	62.84	62.84	62.84	62.84
thereof variable	62.84	62.84	62.84	62.84	62.84
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	62.84	62.84	62.84	62.84	62.84
total before interests	77.17	77.16	75.50	70.38	65.38
interests	0.00	0.00	0.00	0.00	0.00
total production cost	77.17	77.16	75.50	70.38	65.38
thereof variable	62.84	62.84	62.84	62.84	62.84
total labour (of tot. prod. cost)	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	14.33	14.32	12.66	7.54	2.54

COMFAR 2.0 UNIDO

Production costs for product: uPVC FITTINGS, local

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	2.31	3.08	3.85	3.85	3.85
labour	2.40	2.40	2.40	2.40	2.40
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	4.71	5.48	6.25	6.25	6.25
thereof variable	2.31	3.08	3.85	3.85	3.85
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	4.71	5.48	6.25	6.25	6.25
total before interests	10.99	11.76	12.53	12.53	12.53
interests	0.00	0.00	0.00	0.00	0.00
total production cost	10.99	11.76	12.53	12.53	12.53
thereof variable	2.31	3.08	3.85	3.85	3.85
total labour (of tot. prod. cost) .	2.40	2.40	2.40	2.40	2.40
depreciation borne by product	6.28	6.28	6.28	6.28	6.28

Production costs for product: uPVC FITTINGS, local

	Year: 6	Year: 7	Year: 8	Year: 9	Year:10
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	3.85	3.85	3.85	3.85	3.85
labour	2.40	2.40	2.40	2.40	2.40
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	6.25	6.25	6.25	6.25	6.25
thereof variable	3.85	3.85	3.85	3.85	3.85
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	6.25	6.25	6.25	6.25	6.25
total before interests	11.23	11.93	11.93	11.93	11.93
interests	0.00	0.00	0.00	0.00	0.00
total production cost	11.23	11.93	11.93	11.93	11.93
thereof variable	3.85	3.85	3.85	3.85	3.85
total labour (of tot. prod. cost) .	2.40	2.40	2.40	2.40	2.40
depreciation borne by product	4.98	5.68	5.68	5.68	5.68

COMFAR 2.0 UNIDO

Production costs for product: uPVC FITTINGS, local

	Year: 11	Year: 12	Year: 13	Year: 14	Year: 15
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	3.85	3.85	3.85	3.85	3.85
labour	2.40	2.40	2.40	2.40	2.40
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	6.25	6.25	6.25	6.25	6.25
thereof variable	3.85	3.85	3.85	3.85	3.85
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	6.25	6.25	6.25	6.25	6.25
total before interests	11.93	11.93	9.52	9.51	9.51
interests	0.00	0.00	0.00	0.00	0.00
total production cost	11.93	11.93	9.52	9.51	9.51
thereof variable	3.85	3.85	3.85	3.85	3.85
total labour (of tot. prod. cost)	2.40	2.40	2.40	2.40	2.40
depreciation borne by product	5.68	5.68	3.27	3.26	3.26

COMFAR 2.0 UNIDO

COMFAR 2.0 - BALDO & CO. S.R.L., MILANO

Production costs for product: TUBEWELL CASINGS, foreign

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	52.74	65.93	77.79	77.79	77.79
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	1.36	1.69	2.00	2.00	2.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	54.10	67.62	79.79	79.79	79.79
thereof variable	54.10	67.62	79.79	79.79	79.79
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests	54.10	67.62	79.79	79.79	79.79
total before interests	62.41	75.93	88.10	88.10	88.10
interests	0.00	0.00	0.00	0.00	0.00
total production cost	62.41	75.93	88.10	88.10	88.10
thereof variable	54.10	67.62	79.79	79.79	79.79
total labour (of tot. prod. cost)	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	8.31	8.31	8.31	8.31	8.31

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Production costs for product: TUBEWELL CASINGS, foreign

	Year: 6	Year: 7	Year: 8	Year: 9	Year:10
raw material (first)	77.79	77.79	77.79	77.79	77.79
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	2.00	2.00	2.00	2.00	2.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	79.79	79.79	79.79	79.79	79.79
thereof variable	79.79	79.79	79.79	79.79	79.79
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	C.00
total before depr. and interests ..	79.79	79.79	79.79	79.79	79.79
total before interests	86.95	86.95	86.95	86.95	86.95
interests	0.00	0.00	0.00	0.00	0.00
total production cost	86.95	86.95	86.95	86.95	86.95
thereof variable	79.79	79.79	79.79	79.79	79.79
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	7.16	7.16	7.16	7.16	7.16

Production costs for product: TUBEBELL CASINGS, foreign

	Year:11	Year:12	Year:13	Year:14	Year:15
raw material (first)	77.79	77.79	77.79	77.79	77.79
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.00	0.00	0.00	0.00	0.00
labour	0.00	0.00	0.00	0.00	0.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	2.00	2.00	2.00	2.00	2.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	79.79	79.79	79.79	79.79	79.79
thereof variable	79.79	79.79	79.79	79.79	79.79
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.60	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	79.79	79.79	79.79	79.79	79.79
total before interests	86.95	86.95	86.12	83.56	81.06
interests	0.00	0.00	0.00	0.00	0.00
total production cost	86.95	86.95	86.12	83.56	81.06
thereof variable	79.79	79.79	79.79	79.79	79.79
total labour (of tot. prod. cost) .	0.00	0.00	0.00	0.00	0.00
depreciation borne by product	7.16	7.16	6.33	3.77	1.27

Production costs for product: TUBBELL CASINGS, local

	Year: 1	Year: 2	Year: 3	Year: 4	Year: 5
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	0.88	1.10	1.30	1.30	1.30
labour	1.00	1.00	1.00	1.00	1.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	1.88	2.10	2.30	2.30	2.30
thereof variable	0.88	1.10	1.30	1.30	1.30
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	1.88	2.10	2.30	2.30	2.30
total before interests	5.02	5.24	5.44	5.44	5.44
interests	0.00	0.00	0.00	0.00	0.00
total production cost	5.02	5.24	5.44	5.44	5.44
thereof variable	0.88	1.10	1.30	1.30	1.30
total labour (of tot. prod. cost) .	1.00	1.00	1.00	1.00	1.00
depreciation borne by product	3.14	3.14	3.14	3.14	3.14

Production costs for product: TUBEWELL CASINGS, local

	Year: 6	Year: 7	Year: 8	Year: 9	Year:10
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	1.30	1.30	1.30	1.30	1.30
labour	1.00	1.00	1.00	1.00	1.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	2.30	2.30	2.30	2.30	2.30
thereof variable	1.30	1.30	1.30	1.30	1.30
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	2.30	2.30	2.30	2.30	2.30
total before interests	4.79	5.14	5.14	5.14	5.14
interests	0.00	0.00	0.00	0.00	0.00
total production cost	4.79	5.14	5.14	5.14	5.14
thereof variable	1.30	1.30	1.30	1.30	1.30
total labour (of tot. prod. cost) .	1.00	1.00	1.00	1.00	1.00
depreciation borne by product	2.49	2.84	2.84	2.84	2.84

Production costs for product: TUBEWELL CASINGS, local

	Year: 11	Year: 12	Year: 13	Year: 14	Year: 15
raw material (first)	0.00	0.00	0.00	0.00	0.00
raw material (other)	0.00	0.00	0.00	0.00	0.00
utilities	0.00	0.00	0.00	0.00	0.00
energy	1.30	1.30	1.30	1.30	1.30
labour	1.00	1.00	1.00	1.00	1.00
maintenance	0.00	0.00	0.00	0.00	0.00
spares	0.00	0.00	0.00	0.00	0.00
factory overheads	0.00	0.00	0.00	0.00	0.00
subtotal factory costs	2.30	2.30	2.30	2.30	2.30
thereof variable	1.30	1.30	1.30	1.30	1.30
administration	0.00	0.00	0.00	0.00	0.00
marketing, distribution indirect ..	0.00	0.00	0.00	0.00	0.00
thereof labour	0.00	0.00	0.00	0.00	0.00
total before depr. and interests ..	2.30	2.30	2.30	2.30	2.30
total before interests	5.14	5.14	3.93	3.93	3.92
interests	0.00	0.00	0.00	0.00	0.00
total production cost	5.14	5.14	3.93	3.93	3.92
thereof variable	1.30	1.30	1.30	1.30	1.30
total labour (of tot. prod. cost) .	1.00	1.00	1.00	1.00	1.00
depreciation borne by product	2.84	2.84	1.64	1.63	1.63

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A N N E X E 6
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ANNEXE 7

LIST OF LABORATORY EQUIPMENT

SOURCE: Mr. Jan Brzezinski Report on
Plastic Testing Laboratory (Nov. 1986)

A. List of equipment for physical and physicochemical tests
(density, weight, dimensions, viscosity of solutions, etc.)

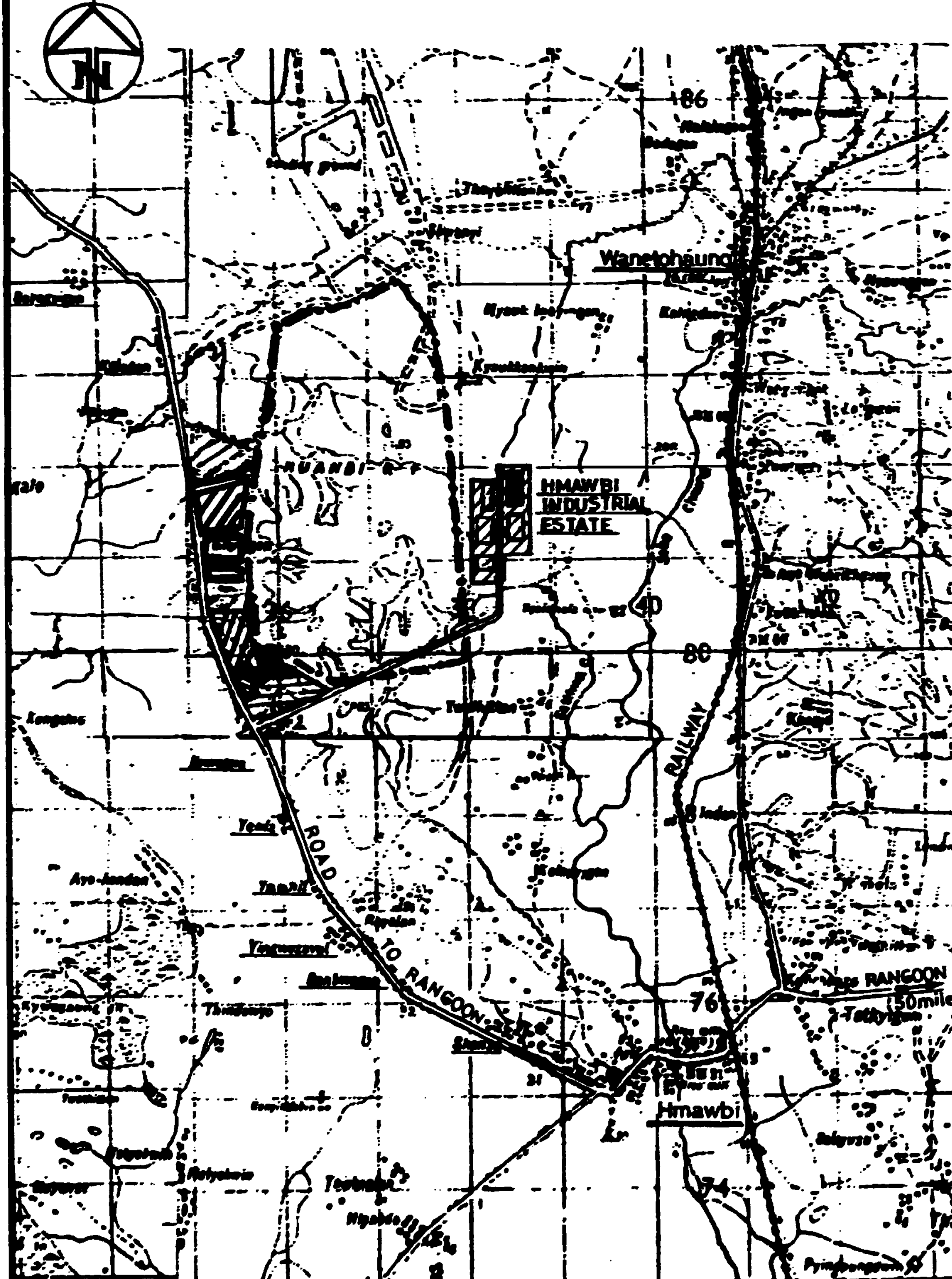
Item No.	Denomination	Suppliers	Qty.	Appr. total price, US$	Standard test methods according to Standard No.		
					ISO	BS	ASTM
A.1.	Density columns for polyolefins densities range only (0.9 - 1.0) with thermostat	Coast (6001) Davenport	1	7,000	1183	2782, Meth. 620 D	D 1505 (Vol.08.01)
A.2	Direct reading density balance by liquid displacement	Davenport	1	300	used	in many test methods;	D 792 (Vol.08.01)
A.3.	Funnel for apparent powder density	own workshop (or Davenport)	1	-	60	2782, Meth. 621 A	
A.4.	Shaking machine for compacted bulk density of PVC resins	many	1	1,000	1068	2782, Meth. 621 D	
A.5.	Automatic analytical balance, 0 - 200g, 0.0001g, with digital readout	Mettler	1	2,000	used	in many test methods;	
A.6.	Laboratory balance, 200g, 0.01g, with a set of weights	many	1	200	used	in many test methods;	
A.7.	Spring balance, 500g, 1g	many	1	100	used	in many test methods;	
A.8.	Spring balance, 30 kg, 10g	many	1	300	used	in many test methods and in the preparation of formulations	
A.9.	Micrometers, 0 - 25 mm, 0.01 mm	many (Davenport)	2	100	used	in many test methods for thickness and dimensions testing	
A.10.	Slide calipers, accy. 0.1 mm	many	2	100	3126	2782, Meth. 621 D	
A.11.	Polarization microscope	many	1	1,500	3146	2782, Meth. 123 C	D 2117 (Vol.08.02)
A.12.	Stop watches, 0.1 s, with two hands	many	2	400	used	in many test methods	
A.13.	Ubbelohde No. 1 capillary viscometers	many, Coast	2	200	174 1628	2782, Meth. 730 A	D 1601 (Vol.08.01) D 1243 (Vol.08.01)
A.14.	Thermostat bath with transparent glass walls	Davenport, Gallenkamp, Coast (1001)	1	2,000	used	in many test methods, a.o. Viscometry	
A.15.	pH-meter, laboratory type, with glass electrodes	Phillips	1	1,500	used	in many test methods	
A.16.	Abbe refractometer for sodium light	Jena	1	2,000	489	many identification & purity tests	D 542 (Vol 08.01)
A.17.	Variable speed laboratory stirrer with a set of glass agitators	many	1	300	used	in many test methods	
A.18.	Magnetic stirrer with heating plate	many	1	100	used	in many test methods	

B. List of equipment for thermal properties tests

Item No.	Denomination	Suppliers	Qty.	Appr. total price, US$	Standard test methods according to Standard No.		
					ISO	BS	ASTM
B.1.	Melt flow indexer, automatic version with special die for PVC, too	Ceast (6542) IPT, Ray Ran Davenport	1	14,000	1133, 292	2782, Meth. 720A	D 1238 (Vol.08.01)
B.2a.	Heat distortion temperature (HDT) apparatus	Ceast (6510) Davenport	1	7,000	75	2782, Meth. 102 G a.H	D 648 (Vol.08.01)
B.2b.	Vicat softening point apparatus	same app. as in B.2a.	-	-	306, 2507 (uPVC pipes)	2782, Meth. 102 D, E a.J	D 1525 (Vol.08.01)
B.3.	Melt point apparatus with polarized light system	Ceast (6185) + 6185/170)	1	2,000	1218	2782, Meth. 123	-
B.4.	Laboratory constant temperature oven with air circulation, 25 - 300°C	Gallenkamp Davenport	1	3,000	used in many test methods		

C. List of equipment for the hardness and mechanical tests

Item No.	Denomination	Suppliers	Qty.	Appr. total price US$	Standard test methods according to Stan[dards]	
					ISO	BS
C.1.	Ball indentation Rockwell hardness tester for plastics	IPT, Wallace	1	5,000	2039	2782, Meth. 365D
C.2.	Shore A and Shore D durometers	Const (3115, 3117, 7206), Wallace	3, each different	2,000	868	2782, Meth. 365A
C.3.	Pendulum impact tester Izod- and Charpy-type with analog readout, without recorder	IPT, Zwick, Const (6543) Davenport	1	7,000	Izod: 180	2782, Meth. 306A
					Charpy: 179	2782, Meth. 351A
C.4.	Tensile testing machine up to 30 kN, with constant rate of traverse and with measurement of elongations, only at ambient temperatures, with a recorder	Instron, Zwick, Davenport	1	30,000	527, types A, B	2782, Meth. 320 A,B,C
C.5.	Environmental stress cracking apparatus for polyethylenes with an ultrathermostat (same as under list of equipment, item A.14. - Const 1001	Const (6095) IPT, Davenport	1	4,500	-	-
C.6.	Short- and long-term burst pressure pipe tester (additional information - see report p. 46)	IPT, Const (6963)	1	70,000	uPVC: 1167	3505, p. 9.3 and p. 9.4.
					HDPE: 1167	3284 and 6437
C.7.	Falling weight impact tester for pipes	Const (6758) IPT, Davenport	1	3,000	3127	2782, Meth. 352 D
C.8.	Elmendorf tear testing apparatus	Const (5035) Davenport	1	1,000	6383	2782, Meth. 360 A
C.9.	Equipment for mechanical-tests specimens preparation :					
	a) moulds for compression moulding	Isoterix	1 set	5,000	527, types A & B	2782, Meth. 320 A-C
	b) punching machine with hollow punching dies	Const (605' + 8005/020)	1 + 1	2,000	same +C	same as above
	c) motorized notching machine for Charpy and Izod impact test specimens	Const (6525) IPT, Davenport	1	4,200	same as under p. C.3. above	
	d) rotating saw	many	1	500	-	-
	e) contour cut milling machine	Const (6490)	1	3,000	many standards for mechanical tests	
	f) laboratory press, 50	Davenport, Polystat (Schwabenthan)	1	30,000		
C.10	N° 3 window type air conditioners					



Project :	PLASTIC PIPES EXTRUSION DEMONSTRATION UNIT — DP/BUR/80/015	COMMESSA N° JOB N°	B-163
Title :	MAP OF HMAWBI INDUSTRIAL ESTATE SITE LOCATION	SCALA SCALE	
		DIS. N° DWG N°	B-163-001
baldo & C. CONSULTING ENGINEERS	Via Stilicone 39, 20154 MILANO Ph. N. 3102 Tlx N. 330229		

INFORMATION FOR THE USER:

SOME MAPS ARE NOT PHOTOGRAPHED DUE ITS BIG SIZE