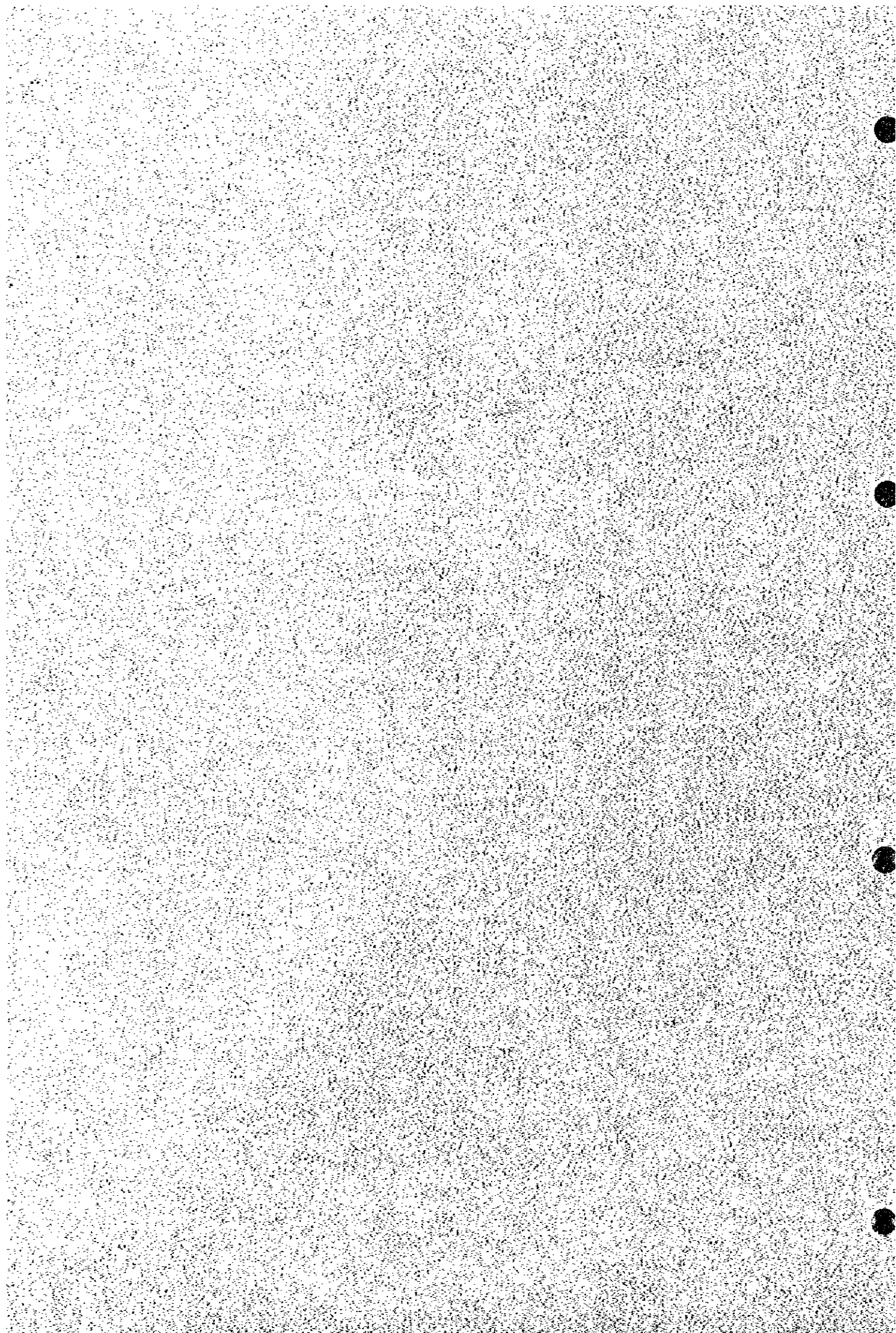


1 2 Outline of Mielec Engines Co.



12 Outline of Mielec Engines Co.

12.1 Corporate Management

12.1.1 History and Relations with the Parent Company

It is a basic Company's opinion that a new restructuring plan can not be formulated without considering Company's historical background and the relation with the parent company. The study team considers next two points:

Firstly, the Company's continuing effort of its own restructuring plan must be appreciated.

Secondly, the study team has to understand some restrictions from the parent company which may affect its future plan.

WSK PZL-Mielec, the current stockholding company of the Mielec Engines Co. started the first production of military aircrafts in 1939. Since then more than 110,000 aircrafts of different kinds have been produced. After the collapse of the USSR, this giant group once employed 20,000 people was disintegrated into small specialized companies.

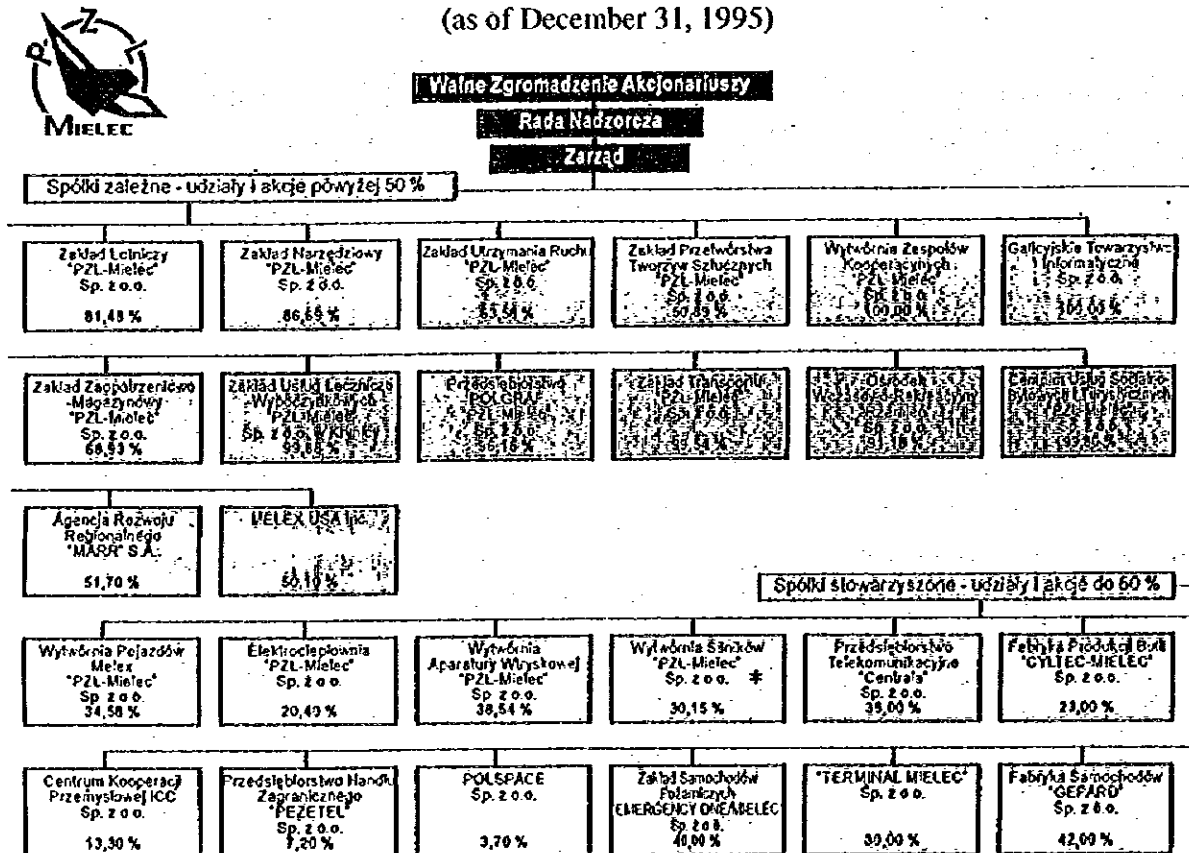
The Mielec group is proud of its skilled labor resources, accumulated high technologies, a good employer / labor relation and the aircraft industry. The Special Economic Zone Euro-Park Mielec was established in 1995 in order to invite investors. As the greatest and the only one aircraft industry of Poland, Mielec will prosper due to the growth of this industry and will attract investors into the special economic zone. Also the diesel engine industry for trucks, busses and other applications is another promising business for the 21st century. Mielec Engines Co. is one of a few domestic engine manufacturers with a long history. The Company has its own competence to develop sophisticated new engines and has advantages of outside academic resources in Poland and European parts manufacturers.

In 1993 the Mielec Engines Co. was separated from WSK PZL-Mielec. As a production unit of diesel engines, the Company once contributed 40% of the total sales with only 18% of the total number of employees for the WSK PZL-Mielec. Mielec Engines Co. succeeded all patents, product design drawings and manufacturing know-how of the Leyland engine from the parent company. Because of this good performance, the Company was attractive for stock holders. However, there were some negative legacies from the parent company as over-capacity production facilities and shranked export market as a result of a fall of Comecon. The basic corporate management systems necessary as an independent company to be competitive in the market economy such as marketing, finance and accounting, R&D and corporate planning & management had to be developed from the inception of the Company.

Following its own restructuring effort, the Company brought about remarkable results. No doubt disintegration of the WSK PZL-Mielec to small companies survived the original huge group to respond quickly to the collapse of the Comecon system. The drawback of this disintegration seems to make the business unit rather small scale. Business management indicators show that Mielec Company's financing operation is sound and stable, but its business scale per employee is rather small which causes low productivity. Even comparing with 29 Polish automotive parts manufacturers, the Company ranked at lower position in terms of the amount of sales (based on the 1993 data).

The subsidiary companies of the joint stock holding company, Transport Equipment Corporation PZL-Mielec, are classified into two groups, namely 14 companies of more than 50% share holding and 11 of less than 50% (as of 12/31/1995). Some companies are successful but not all of them. The Company belongs to the second group of less ownership by the parents company, but 0.25% of its fixed asset must be paid for the holding company annually. For Mielec Engines Co. it is not negligible. At the end of September 1996, one of the stock holders, the Industry Development Agency transferred 8.8% share to the bank DKB in Lublin, thus the bank holds 48.8% share. This could be a step toward the privatization of the Company.

Fig.12-1-1 Structure of WSK PZL-Mielec group.
(as of December 31, 1995)



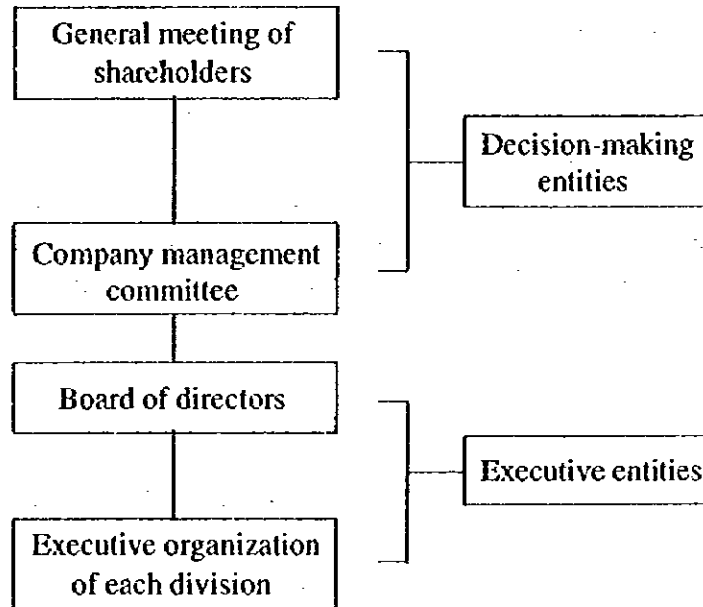
Remarks: (1) Percentage indicate shares owned by WSK PZL-Mielec S.A.
(2) Asterisk shows Mielec Engines Co.

12.1.2 Company Organization

12.1.2.1 Management Organization

The organization of Mielec Engines' company management is indicated below:

Fig. 12-1-2 Structure of Management Organization



At the top of the Company's management organization stands the general meeting of shareholders. Its main shareholders are its holding company, PZL-Mielec S.A. (21.35%), the Lublin Savings and Credit Bank (48.80%) and the Industrial Development Agency (18.88%). Besides that, it has 36 small shareholders (10.97%). Recently in November, 1996, the Industrial Development Agency (IDA) sold its shares of 8.8% to the Lublin Savings and Credit Bank. The bank represents 48.80% of the total shares, or near a majority share.

The Management Committee consists of seven members appointed by the general meeting of shareholders, three representing the Lublin Savings and Credit Bank, another one IDA, and also two from the labor unions (employees). Mielec Engines' company president is also one of the members. Its authority includes approval of large investments in excess of 1 million PLN and setting limits for loans from banks (presently 1.5 million PLN).

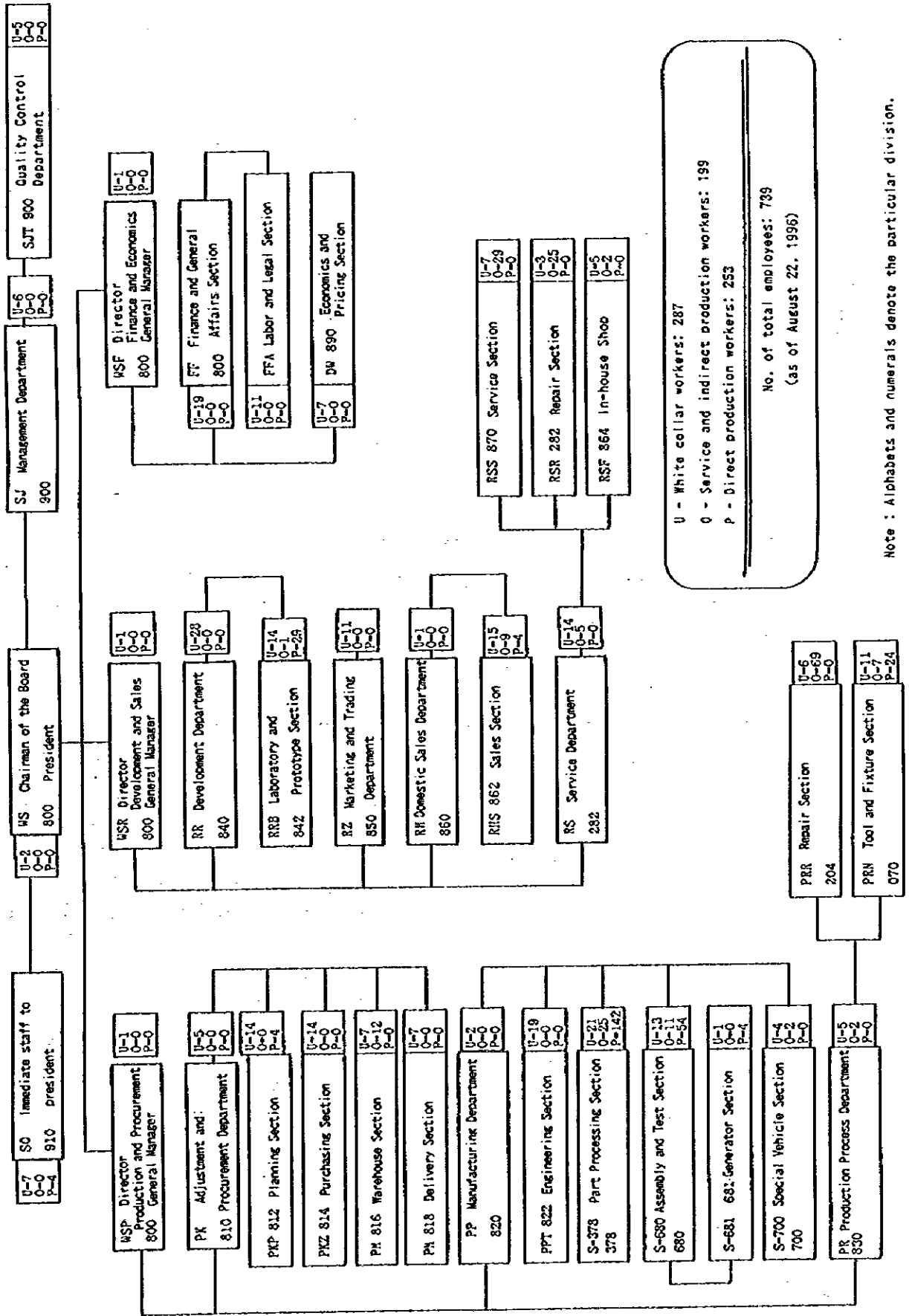
The board of directors is an executive organ of the Company's management. Mielec Engines' present president serves as the chairman and there are three other directors, one in charge of finances and accounting, another in charge of marketing and development and a third in charge of production. The board meets regularly once a month.

12.1.2.2 Executive Organization

Fig. 12-1-3 shows the organization of the company's executive divisions. The total strength of this organization stood at 739 persons as of August 1996, the breakdown by division being: 20 in the division "president and staff directly under him," 38 in the department "finance and accounting" (including the director in charge of those matters), 199 in the department "product development and marketing" (same as the above) and 482 in the division "production and procurement" (same as the above). The finance and accounting division and the marketing and development division were newly established after the Company became separate and independent. Those are fields in which the Company was in a hurry to adapt to a market economy, and they are still in the process of becoming more efficient.

In 1995, the company's board came to a conclusion to restructure its organization in order to strengthen the competitiveness of their products and services in the market by establishing a Quality Management System. Fig. 12-1-4 summarizes the company's philosophy and policies for implementing the system.

Fig. 12-1-3. Organization of the Company



U - White collar workers: 287
 0 - Service and indirect production workers: 199
 P - Direct production workers: 253

No. of total employees: 739
 (as of August 22, 1996)

Note: Alphabets and numerals denote the particular division.

Fig. 12-1-4 Philosophy and Policies for Quality Management

- **Corporate Philosophy:** "The Company will provide products and services which may satisfy the customer, aiming to improve the quality and productivity in view of 21st century. The Company can ensure success if it provides good products and services which satisfy the customer."

- **Policies and urgent issues the Company face for implementing the Quality Management include:**
 - to provide products and services which may satisfy the customer and may, in turn, lead the Company grow to and gain more profit, and
 - to increase in taking orders for the Company to develop itself to be competitive continually in the future.

- **For achieving the goals, the Corporate Management encourages employees individually and also in groups:**
 - to solve problems by reducing defects and promoting the improvement of quality and production processes, by arranging incentives in a way so that the efforts by individuals may link to the growth of the Company and consequently to the increase in compensation for those who participate.
 - respond to customer needs and provide new products, recognizing that customers buy only the products and services they want.
 - to improve the function, reliability and durability of the company's products, placing importance on preservation of the natural environment in the process of product development.
 - to cooperate with the suppliers to be a permanent member of the Company, specifically those who would supply quality parts and components for the Company in the future.
 - to achieve targeted quality goals in the course of production processes.
 - to confirm that the end-users of the company's products are provided with long-term service after they purchase.
 - to establish a quality standards and its management system, PN/EN-29001 (ISO-9001) in the Company.
 - to make an effort to improve products to meet the requirement for preserving the natural environment after the company's products have been used.

In Mielec

Jan Studnicki
President

The present organization was developed in 1995 on the basis of the opinion of a Swedish consultant. They say that Volvo's organization served as a reference. The main points in putting the organization together were integration of marketing and development of new products, new establishment of a quality control and assurance organization and the strengthening of management of information, including computer systems. Furthermore, in the previous organizational setup the sales division was also in charge of procurement, but that resulted in too high of stocks of materials (which increased to enough for 3 months). That lesson prompted them to undertake functional reorganization along the present lines. In any case, the direction taken in making the company's organization more efficient has been one of change from an organization centering on duties to an organization centering on functions, and that orientation is very clear now. What is important is how the organization is used, it being necessary to strengthen horizontal organization that is not apparent in the formal organizational setup.

Recently, the company's management considered separating out a section which is responsible for the production designing of engines in the current development department under the control of the director of development and marketing, to a department under the director responsible to production and procurement. Basic problems are identified primarily in the lack of a functional linkage between the above two departments, product development and production. A detailed discussion and recommendation will be made in a later section.

Besides the formal organizational change, the Company plans to introduce a "cost center" concept in the current on-going organization from the beginning of 1997. Eight cost centers will be responsible to the costs incurred and their individual performance will be measured by comparing actual costs with budgeted costs for a specified period of time. The implementation of cost accounting systems which begins operation also in January the same year, is expected to support the facilitation of the centers.

Table 12-1-1 gives a breakdown of personnel strength by education. Those with a university degree or higher account for 11.2%, and those with a secondary school education represent 34.6%, those two categories totalling a high 45.8%. Actually, three quarters of the remaining staff have completed 8 years of compulsory education and 2 additional years of vocational education. The higher education level of employees would be an apparent asset of Mielec Engines Co.

With regard to the total 739 employees, of which direct production workers represent 34.2%, and white collar workers make up 38.8%. The remaining 26.9% represents service and indirect production workers such as those of maintenance. The fact that an overwhelming majority (65.8%) of the total is employed in nonproduction areas indicates room for utilization of human resources in a more productive way. Company management makes up an excessive amount at least 20% of the total. The reduction of employees or restructuring plans are, in fact, not scheduled at the moment. Management knows it needs to maintain employees at the current level as a prerequisite for operation of the Company under the current socio-economic environment particularly in this unemployment-ridden Mielec region.

Table 12-1-1 Employee Classification for Educational Background

Educational background	Male	Female	Total	Ratio %
Compulsory education (8 years)	83	25	108	
	83	25	108	14.6
Professional education (8 + 2 years)	233	59	292	
	233	59	292	39.6
Intermediate technology (8 + 4)	146	24	170	
Intermediate economics (8 + 4)	1	34	35	
Intermediate general (8 + 4)	6	15	21	
Intermediate others (8 + 4)	7	14	21	
Intermediate general + technology (8 + 4 + 2)	2	0	2	
Intermediate general + economics (8 + 4 + 2)	1	2	3	
Intermediate general + others (8 + 4 + 2)	0	2	2	
Intermediate profession (8 + 4)	0	1	1	
	163	92	255	34.6
Higher technology = 3 years in a technological college (8 + 4 + 3)	42	2	44	
Higher economics = 3 years in a economics college (8 + 4 + 3)	2	2	4	
Higher technology = 5 years in a technological college (8 + 4 + 5)	21	1	22	
Higher economics = 5 years in a economics college (8 + 4 + 5)	1	8	9	
Other higher education	2	2	4	
	68	15	83	11.2
	547	191	738	100.0

12.1.3 Summary of the Company's Operation

This section describes characteristics concerning the operational trends of Mielec Engines Co. and the content of its operations. An analysis from the view point of financial management will come later in the section on financial and cost management (12.1.5 below).

12.1.3.1 Operational Trends

Table 12-1-2 summarizes the trends of operational results of Mielec Engines Co.

Table 12-1-2 Recent Development of Turnover and Related Items

	1993 (9 months)	1994	1995	1996 (Estimated)
Turnover (thousands of PLN)	15,592	28,958	40,697	49,634
Rate of increase (%)	-	85.7	40.5	22.0
Operational profit (%) (For reference)	8.5	6.9	4.6	3.1
Rate of inflation (%)	37.6	29.5	21.6	17.0

The company's turnover in 1995 was PLN 40.7 million, 40.5% up from the year before, which was considerably more than inflation. As for 1996, turnover is estimated to be at about the same level as in 1995 after adjustment for inflation, and the rate of profit, which has been declining, is expected to fall still lower. The main reasons were sluggish growth in orders from truck and bus manufacturers against a background of stagnant total demand and decline in price competitiveness in the export market (Eastern Europe, Middle and Near East, India, etc.), although a substantial recovery in sales has been achieved since autumn.

Looking at the company's structure of income and costs, the trend in 1996 is one of stagnation, including leveling off of rise in variable costs (See Table 12-1-3). In particular, in 1995 variable costs rose sharply owing to the synergistic effect of no reduction in staff strength and increase in production. Treatment of employees was also improved, including wage increases, and as a result, labor cost has risen to 50.3% of processing gain.

**Table 12-1-3 Structure and Development of Income and Costs
(in terms of percentage)**

	1993	1994	1995	1996 (Estimated)
Variable costs* (1)	50.2	46.2	53.0	49.3
Fixed costs (2)	41.1	46.5	41.2	47.4
Profit** (3)	8.7	7.3	5.8	3.3
Turnover (1+2+3)	100.0	100.0	100.0	100.0
Break-even point	82.5	86.4	87.7	92.5
Labor cost as % of processing gain***	40.9	44.2	49.5	50.3

* Only the cost of materials, energy and product purchases has been included in "variable costs" so as to get an overall picture of developments based on a uniform standard. The percentage of 1996 is an estimation based on the result during January-June period.

** Profit from operations, which can be considered to be similar to the ordinary profit discussed in the following section, 12.1.5, has been taken for "profit".

*** Turnover minus variable costs

The breakdown of overall turnover 1996 is expected to be: engines, 53.3%; generators, 9.2%; ambulances, 2.8%; and parts machining, repair services and others, 34.7%. As for future development of turnover, engines will continue to be the mainstay, but sales are expected to increase in the fields of generators and ambulances. More discussions will be made in the later sections.

12.1.3.2 Characteristics of Operations

Table 12-1-4 gives the main operational indicators of Mielec Engines Co.

First of all, it should be pointed out that although the ratios concerning safety are extremely high, the indicators concerning productivity are extremely low. For example, the ratio of net worth to total capital is very high, but turnover per employee or value added per employee is lower than 10% of smaller enterprises in Japan. The rate of fixed assets, particularly the rate of machinery installation, which has a great deal to do with productivity, is extremely low, reflecting use of old equipment.

Table 12-1-4 Management Indicators
(in terms of PLN)

	1993 (9 months)	1994	1995
I Productivity			
1 Value added per employee (Gross)	6,963.3	12,845.6	16,396.3
2 Employee' income	4,405.1	9,507.7	13,057.4
3 Tangible fixed assets per employee	9,276.4	10,187.9	11,093.9
4 Production facilities per employee	950.7	1,624.6	1,358.0
5 Net sales per employee	21,655.0	39,997.0	56,133.8
6 Value added ratio, %	32.2	32.1	29.2
II Profitability and Stability			
1 Operating capital profit ratio, %	7.2	10.4	8.8
2 Operating capital turnover ratio, times/yr	0.85	1.51	1.91
3 Operating profit to sales ratio, %	8.5	6.9	4.6
4 Return on equity (ROE), %	9.6	13.6	13.5
5 Return on total capital (ROC), %	7.2	10.8	11.3
6 Break-even point ratio, %	82.5	86.4	87.7
7 Stockholder's equity ratio, %	74.7	81.8	76.8
III Growth (Company totals)			
1 Net sales, %	NA	185.7	140.5
2 Number of employees, %	NA	100.6	100.1
3 Value added, %	NA	185.5	127.8
4 Operating profit, %	NA	150.6	93.9
5 Cash flow, %	NA	127.9	122.8
Ref. Inflation rate, %	135.3	132.2	121.9

As for turnover rate, which is an indicator of capital efficiency, the inventory turnover rate is a problem. Table 12-1-5 gives a comparison of levels for different types of inventories.

Table 12-1-5 Inventory Levels for Different Types of Inventories
(months in stock)

	Mielec Engines Co.	Industrial machinery manufacturing*	Transportation machinery manufacturing*
Raw materials & purchased parts	1.17	0.13	0.13
Stocks of work in process	0.83	1.10	0.13
Product inventories	0.56	0.78	0.12
Totals	2.56	2.01	0.38

Source: Operational Analysis of Main Enterprises, 1995, Bank of Japan.

Apart from the fact that in general smaller enterprises, most of which are subcontractors, have relatively small inventories, it is very clear here that the company's raw material and parts inventory levels are extremely high. Even considering differences between Poland and Japan in practices regarding transactions and other factors, there appears to be plenty of room here for reduction of inventory levels for higher efficiency.

Table 12-1-6 gives the cost structure of Mielec Engines Co. compared to that of the industry. Again the smaller percentage figure indicates a lower level of capital investment on production facilities. On the other hand, a relatively high performance of the Company is also shown with its profit level. According to the statistics of the Central Statistical Agency, in 1995 an enterprise has a bank loan for approximately 50% of its total liabilities on average in the industry, automotive and transportation equipment, with the burden of a net 2.9% and 4.0% financial cost, respectively, out of its total revenue. On the contrary, Mielec Engines Co. operates with a minimal loan, 6% of its liabilities total, and gains net income on financial revenue and costs. The financial strength of the Company is reflected positively on its higher profitability.

Table 12-1-6 Comparison of Cost Structure, 1995
Mielec Engines Co. and Polish Industries
(in terms of percentage)

	Mielec Engines	Industries:	
	Co.	Automotive	Transport eqmnt
Materials and energies	59.1	70.0	53.2
Outside services	NA*	6.0	12.0
Taxes	1.6	1.0	1.9
Wages	16.7	9.9	18.2
Social imposts	9.2	5.1	9.1
Depreciation	1.5	5.4	3.5
Other costs	11.9	2.6	2.1
Totals	100.0	100.0	100.0
Reference:			
Gross profit**	5.8	-0.7	-0.5

* Included in the item "other costs".

** Profit before deduction of income tax.

As regards accounts receivable turnover, turnover of total operating assets and other turnover indicators, in Poland comparatively early cash settlement (about half a month after delivery) is customary, but more important than that, it is necessary to pay attention to recent changes such as delays in settlement by the company's main transaction partners.

12.1.4 Personnel Management, Wage System, Personnel Development

12.1.4.1 Personnel Management

In hiring personnel, the Company has evaluated applicants by job category on the basis of education and experience, classifying them by grades, according to which the wage level also varies.

However, since Mielec Engines Co. became separate and independent in April 1993 the figure for new hiring and leaving and retiring personnel has been only about 80 persons, and even now such matters are continuing to be dealt with case-by-case on the basis of requests from the individual divisions.

Wage and personnel management based on such job categories is the main part of it. Since movement by employees from one category to another is generally difficult not even considering special job type qualification requirements such as welder work safety regulations, personnel flexibility is extremely low.

Regarding division of labor in job positions, basically a division is made between nonworkers and workers, nonworkers being classified into high-level (department heads), medium-level (section heads) and low-level managers (subsection chiefs and foremen) as well as high-level essential workers (such as staff attached directly to the president) and then ordinary employees and workers being classified by job category. At the request of the Central Statistics Bureau there is also classification into direct workers, indirect workers, enterprise management personnel, technical personnel, economic personnel and general affairs personnel, etc., but that is purely for the authorities, the last figure of the 4-digit classification being used for internal treatment of such external classification.

Personnel evaluation is accomplished on the basis of evaluation sheets based on verbal evaluation. That tends to result in one-sided evaluation and other factors detrimental to fair evaluations. The evaluation sheet made out by the direct superior are signed by the labor union and the organizational head in question as well as the superior himself (as confirmation). It would appear that they ensure fairness by using such an open system. A few examples of evaluation forms used in Japanese companies are attached at the end of this report.

12.1.4.2 Wage System and Management

Each person's wage or salary is determined on the basis of a wage table with a breakdown by the job categories and job positions as per 12.1.4.1 above, with a further breakdown into 22 steps (monthly salary) linked to job categories in the case of nonworker employees and 12 steps (hourly wage) in the case of worker employees. The difference in wages within a category (wage level spread) is less than two times in the case of workers and low-step nonworkers, but for higher-level nonworker employees it is 2-3 times.

There is no big difference between Japan and Poland regarding differences in remuneration between a department head and general employees as far as basic wage or salary (before taxes) according to job position goes (See Table 12-1-7). If one also takes into account, however, bonuses (15-20% of basic pay) and overtime pay (less than 10%) of general employees, the difference is reduced by 20-30%, and then the difference between the top and the bottom is less than in Japan.

Table 12-1-7 Difference in Pay According to Job Position

Japan *	Between office department chief and employees		2.6 times
	Between technical department chief and employees		2.1 times
Mielec Engines Co.	Bureau Chief	1,836(a)	2.3 times
	Employees	800(b)	(a/b)
	Employees (including bonus and overtime)	1,000(c)	1.8 times (a/c)

* Data furnished by: National Personnel Authority (Japan) (1995 survey).

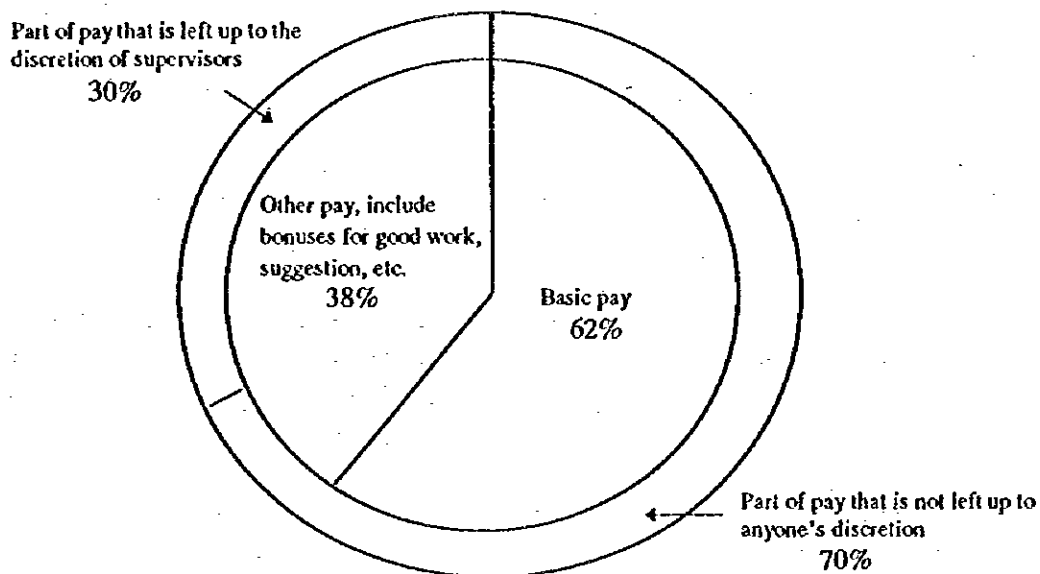
It is estimated that basic pay (that part of pay based on job category and job position as per 12.1.4.1 above) is about 62% of total pay. The remaining 38% consists of seven additional allowances or bonuses (See Fig. 12-1-5).

Fig. 12-1-5 Structure of Basic Pay and Other Pay

	Percentage	Description
1. Basic pay	62%	Determined according to wage table, production workers being paid by the hour and office workers by the month
2. Pay other than basic pay	38%	
(1) That paid every month:		
- Bonuses for good work	16%	Paid from bonus pool fund at the discretion of department and other chiefs
- Allowance for working in unhealthy environment	2%	Paid in steps according to degree of unhealthiness of environment
- Overtime pay and extra pay for work on holidays and at night	4%	50% extra up to 2 hours of overtime, after which it becomes 100% extra. Work on holidays is paid 100% extra, and night work is paid 30% extra.
- Seniority pay	5%	1% extra every year above the minimum wage decided by the government (The present minimum wage is 350 PLN/month), starting from 5th year in service: 5% the 1st year, 6% the 2nd year, 7% the 3rd year, and so forth. Same for both workers and managers.
(2) That paid from time to time (% as converted to monthly basis)		
- Bonuses	2%	Bonuses paid for ideas and goodwork
- Profit sharing	8%	Sharing of profit after taxes by employees
- Bonuses for long service	1%	Paid every 5 years starting from 20 years of service: 2 months' amount at 20 years, 3 months' amount at 25years, etc.

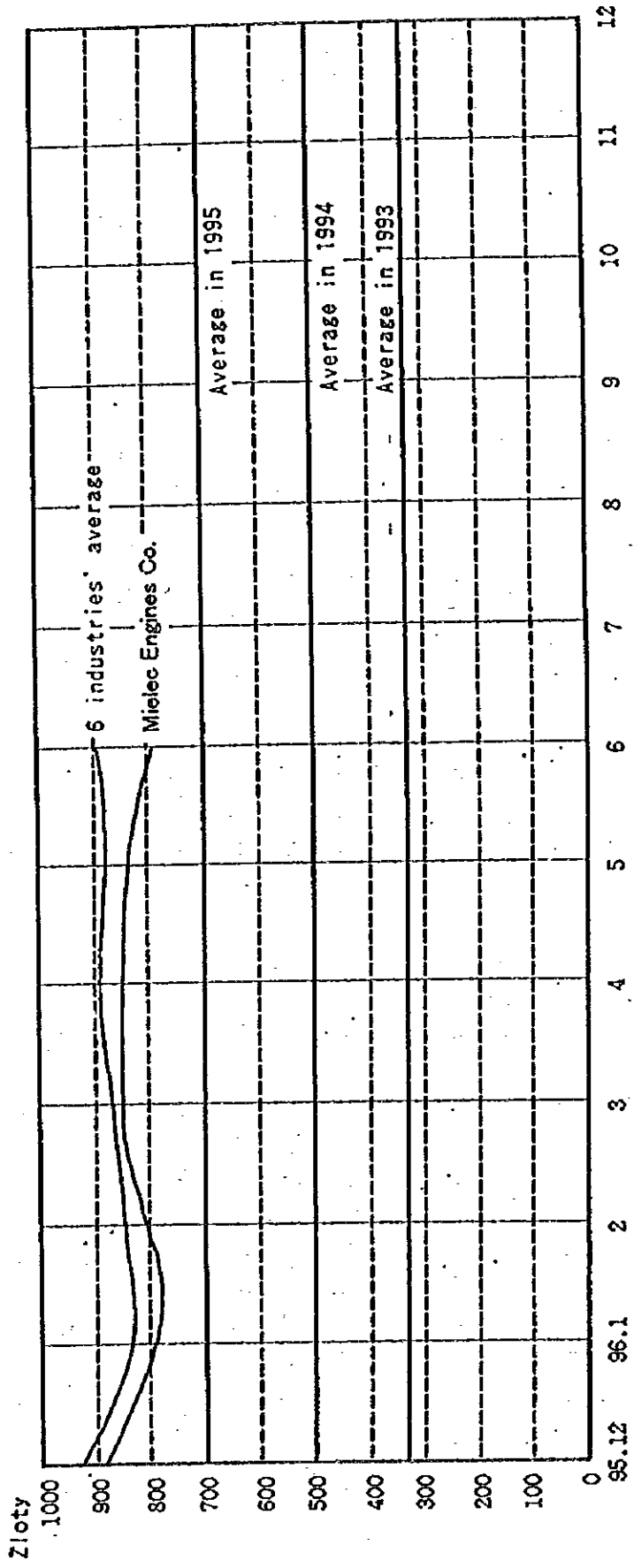
Looking at pay as the base for employer contributions by enterprise units, one see that, as in the case of the Company, if total pay is set as "100", an amount equivalent to "55" is charged and paid into the national treasury as social security contributions ("48" out of the "55"), etc. In other words, that part is charged enterprises as employer contributions. Of the total amount of pay not including social security contributions, etc., the part that can be managed, i.e. that can be decided at the discretion of the section or other chief is 30% (See Fig. 12-1-6). Needless to say not all of the part that can be managed is subject to free discretion, but they do have the power to exercise considerable authority, and there is no doubt but that middle management's subordinate evaluation technique and leadership is the focus of personnel management and development.

Fig. 12-1-6 Pay Structure



The company's pay level is a little lower than, but near to, the nationwide average (average for 6 industrial sectors). Before the Company became separate and independent in 1993, that level was 50-55% because of deficits in all divisions, but after the turn for the better in 1994 they started raising it to the present level at the end of that year. That average, published by the Central Statistics Bureau on the basis of actual wages and salaries paid, is for the six sectors "energy" (including oil refining), "machinery", "construction", "mining", "iron and steel manufacturing" and "light industry". As indicated in Fig. 12-1-7, since the company's pay level has become quite divergent from that average for six industrial sectors, its employees were scheduled to get a pay raise in October.

Fig. 12-1-7 Transition of Average Pay



Actually the bonus system for ideas, etc. is not being used very much. The bonuses that are being paid amount to less than 2% of total pay, and only 15-20 persons receive such bonuses in an average month in the entire company. Suggestion applications are in principle made by the employees in the particular work area, and the bonuses for ideas concerning particular work, activities and mental labor are in most cases granted on the basis of evaluation by their superiors. Such suggestions are not treated together with proposals in activities for raising of productivity and quality control activities. It would appear that the background for that is reaction against the movement for increase of production and material and other savings under the Communist regime in the past.

In those days the results of efficiency improvement activities by workers were converted to money according to provisions stipulated by law, the amount of savings of materials, etc. being paid in bonuses. Savings were recognized with respect to materials, time and number of man-hours, and everyone was eager to make suggestions, with the result that quality and product reliability declined. What is more, there were many cases in which the attainment of goals which the suggestions were supposed to ensure were not attained. Considering that historical background, it would appear to be necessary to implement improvement activity in a manner based on proper planning.

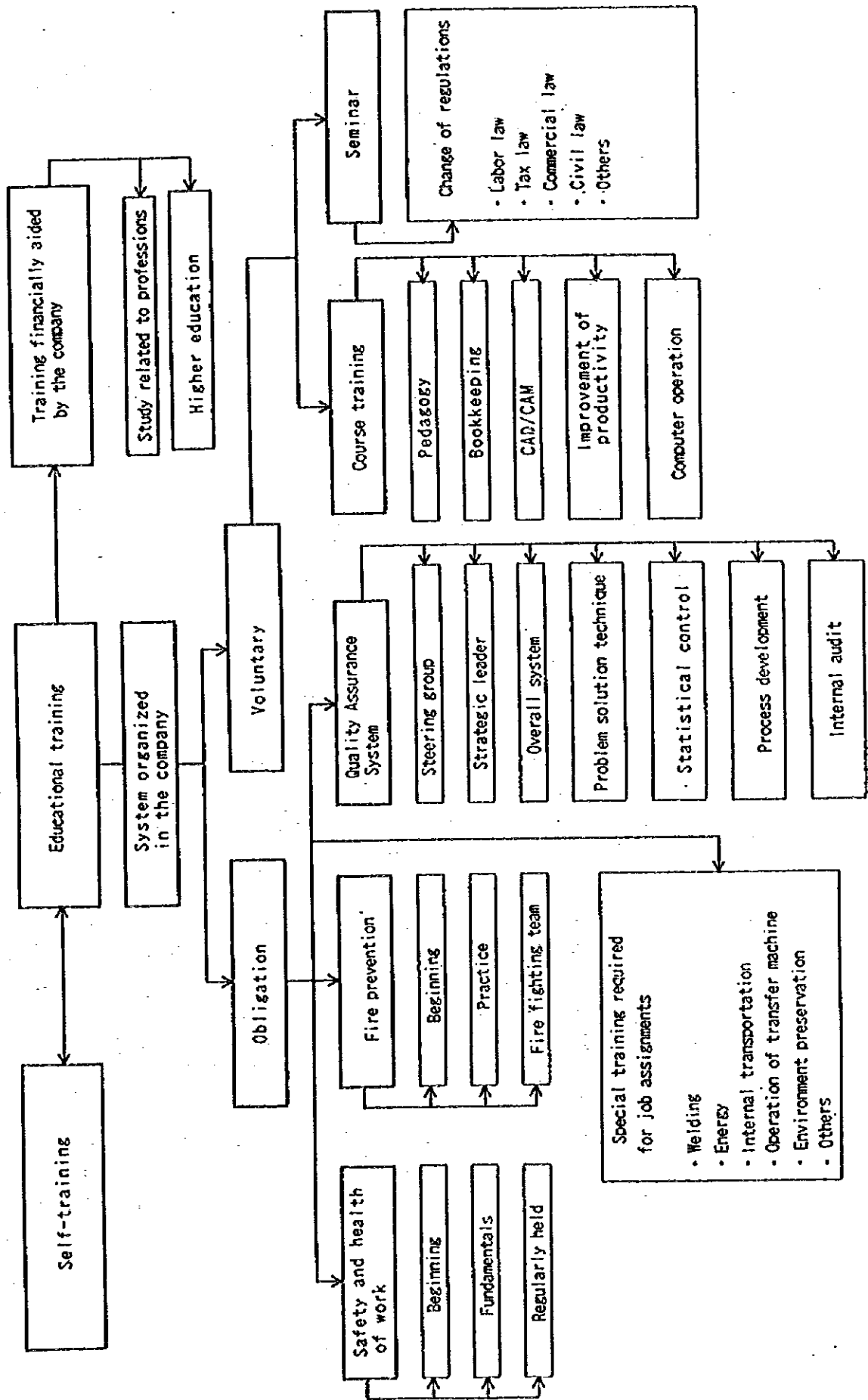
It should be added that the employee pay that we have discussed so far has been pay before taxes, the rate of taxation being 21-45% according to three levels of taxable income. The rate of taxation with respect to total pay is estimated to be 20-30%, which is very heavy taxation on low-income groups.

12.1.4.3 Training and Education System

Fig. 12-1-8 shows the training and education system of Mielec Engines Co.

The system consists of two parts. One is the program established by the Company in terms of the job position system. It concerns training regarding job safety, hygiene, fire prevention, etc. The other is a program concerning systemized quality insurance for acquisition of the ISO 9001 certification. It consists of courses concerning individual problems and holding of and participation in seminars made necessary by the amendment of laws and other circumstances. In addition to that, there are also subsidies for further training outside and education applied for by individual employees, including vocation training, night courses, etc. It is quite clear that a key importance of such training and educational activities is placed on those in the program concerning acquisition of the ISO certification.

Fig. 12-1-8 Education and Training System



12.1.5 Financial and Cost Management

12.1.5.1 Financial Management

Regarding the financial situation of Mielec Engines Co., first of all it should be noted that its cash flow has become considerably smaller. If its cash flow in 1995 is put at "100", the figures, after revision for inflation for recent years, are as indicated in the following table, the decline in 1996 being particularly pronounced as a reflection of bad times in the industrial branch in question.

Table 12-1-8 Comparison of Cash Flow for Different Recent Years

	1993 *	1994	1995	1996 **
Cash flow (PLN 1000)	1,211.3	1,549.1	1,887.7	1,143.0
Index (1995 = "100")	101	100	100	50
Rate of inflation (%)	37.6	29.5	21.6	7.0

* Unrevised actual figures at closing of books at end of 9-month period.

** Based on estimated figures at closing of books at end of 12-month period.

In particular, recently its balance of accounts receivable has been tending upward because of reasons such as payment arrears by its main clients, and that is weighing heavily on its cash flow. Urgently necessary over the short run are reduction of raw material and semifinished product inventories and earlier recovery of accounts receivable, but the most important thing is to strengthen its cash flow over the mid-term in future.

Plant and equipment investment is scheduled to be 917,800 PLN in 1996. In addition, it plans to call for 575,600 PLN in equipment leases and 360,000 PLN in machinery overhauling. The plant and equipment investment is within the scope of being possible to cover it with the current cash flow although it is in excess of the amount of depreciation made. Considering the above mentioned spending and also 1,437,600 PLN to be invested in research and development, the company is in a difficult situation in regards to procurement of funds. In particular, bank loans are hard to come by, and, in addition, as explained in the preceding section, a strict loan limit has been set, which makes the situation even more difficult. At the time of the survey the annual interest on bank loans was 20-odd percent. The fact that a high interest rate of 48% is charged for lateness in paying that and accounts receivable also indicates how difficult its cash flow situation is.

12.1.5.2 Accounting Management

The Company has been improving its cost accounting systems in connection with computer systems. An estimated cost of each type products (let us call it "standard cost") was established solidly under the old regime and is now maintained with computers since January, 1996. The database is reviewed by quarterly with material costs and wages primarily. On the other hand, regarding actual cost, it is difficult to make a comparison in a way in which it corresponds to such standard cost. Likewise, it has become possible to total the actual costs for each type of engines, for example, corresponding to the cost items included in the standard, but comparison and analysis are not yet possible. Only this year have sales and costs started to be classified separately into large and small generators and reported on that basis. Table 12-1-9 indicates the analysis which may be made utilizing available cost data by product at this moment.

Table 12-1-9 Sales and Profit Analysis by Product
(in terms of percentage)

	1995		1996 (Jan-Jun)	
	Sales*	Profit**	Sales*	Profit**
Engines	67.0	15.3	59.6	19.2
Small generators***	NA	NA	2.2	4.7
Large generators****	NA	NA	6.3	8.8
Parts	19.0	28.3	21.2	14.6
Services	9.5	39.8	8.6	34.0
Export of parts	2.2	8.2	2.0	14.2
Export of engines	2.3	8.4	0.1	4.5
Totals	100.0	100.0	100.0	100.0

* Not include sales which derives from the purchase of finished products.

** Sales subtracted by costs incurred and indirect costs allocated.

*** Marketed after 1996.

**** Included in 'engines' in 1995.

In any event, the Table illustrates a larger contribution of parts processing and repair services areas in profit making compared to the engine business. It should be noted, however, that those parts and service businesses are generated by engine production. The engine business is, therefore, is the core of the company's operation.

In Mielec Engine's accounting system (which is based on the Polish accounting system) the treatment is different than the Japanese method, the two methods not strictly coinciding. However, in order to proceed with the analysis, it is necessary to make a few comments concerning definitions of account headings for comparison and concerning differences.

- (1) The following is a comparison between the company's method and the Japanese method regarding method of calculating profit/loss.

Fig. 12-1-9 Methods of Calculation of Profit/Loss Statement

Mielec Engines Co. (Poland)		Japan	
I	Sales	I	Sales
II	Sales cost	II	Cost of goods sold
	Operating profit		Gross profit on sales
III	Activity earnings *	III	Administrative and sales costs
			Operating profit
IV	Activity loss *	IV	Nonoperating earnings (incl. interest)
	Operating activity earnings		
V	Financial earnings	V	Nonoperating expenses (incl. interest)
VI	Financial expenditures		
	Operating activity profit		Ordinary profit
VII	Extraordinary profit	VI	Extraordinary profit
VIII	Extraordinary loss	VII	Extraordinary loss
	Total profit		Net profit before tax
	Income tax		Reserves for income tax
	Net profit		Net profit

* Profit and loss from government subsidies, sale of fixed assets, etc.

The company's accounting system is one that lumps manufacturing cost and overhead together in sales cost without considering overhead apart, but there is no difference between the two methods as regards calculation of operating profit. However, in calculation of profit/loss from disposal of fixed assets the operating activity profit based on the Polish method and the ordinary profit based on the Japanese method do not coincide.

It might be added that in the present situation calculation of manufacturing cost may not be impossible in terms of practical handling, but nevertheless it is difficult.

- (2) The differences of the balance sheet of Polish and Japanese methods are illustrated in the following.

Fig. 12-1-10 Comparison of Method of Calculation of Balance Sheet

Mielec Engines Co. (Poland)		Japan	
<u>Assets</u>		<u>Assets</u>	
I	Fixed assets	I	Current assets
	1. Intangible fixed assets		1. Cash on hand and in banks
	2. Tangible fixed assets		2. Notes and accounts receivable
	3. Financial fixed assets		3. Inventories
II	Current assets		4. Other current assets
	1. Inventories	II	Fixed assets
	2. Notes and accounts receivable		1. Tangible fixed assets
	3. Short-term securities		2. Intangible fixed assets
	4. Cash on hand and in banks		3. Other fixed assets
III	Closing of books at end of period		
	Total assets		Total assets
<u>Net worth and liabilities</u>		<u>Liabilities and net worth</u>	
I	Net worth	Liabilities:	
	Basic funds (capital), etc.	I	Short-term liabilities
	including change in funds	II	Long-term liabilities
	based on revaluation of	Stockowners' equity:	
	assets	I	Paid-in capital
II	Reserves, etc.	II	Capital reserves
III	Long-term liabilities	III	Profit reserves
IV	Short-term liabilities	IV	Other unappropriated profit
V	Closing of accounts during		
	period (earnings received		
	in advance, etc.)		
	Total net worth and liabilities		Total liabilities and net worth

In the order of arrangement, the order of asset liquidity is opposite, and in the case of liabilities and net worth in Poland, net worth comes first, followed by long-term liabilities and then short-term liabilities. Regarding treatment of small account headings, including closing of some accounts during the period and treatment of reserves, since they are no big problem from the standpoint of proceeding with analysis of the Company, it has not been deemed necessary to delve into them at this time.

(3) Below are indicated some accounting treatment methods of Mielec Engines Co. (Poland) that should be borne in mind in connection with some important items in proceeding with analysis of the Company:

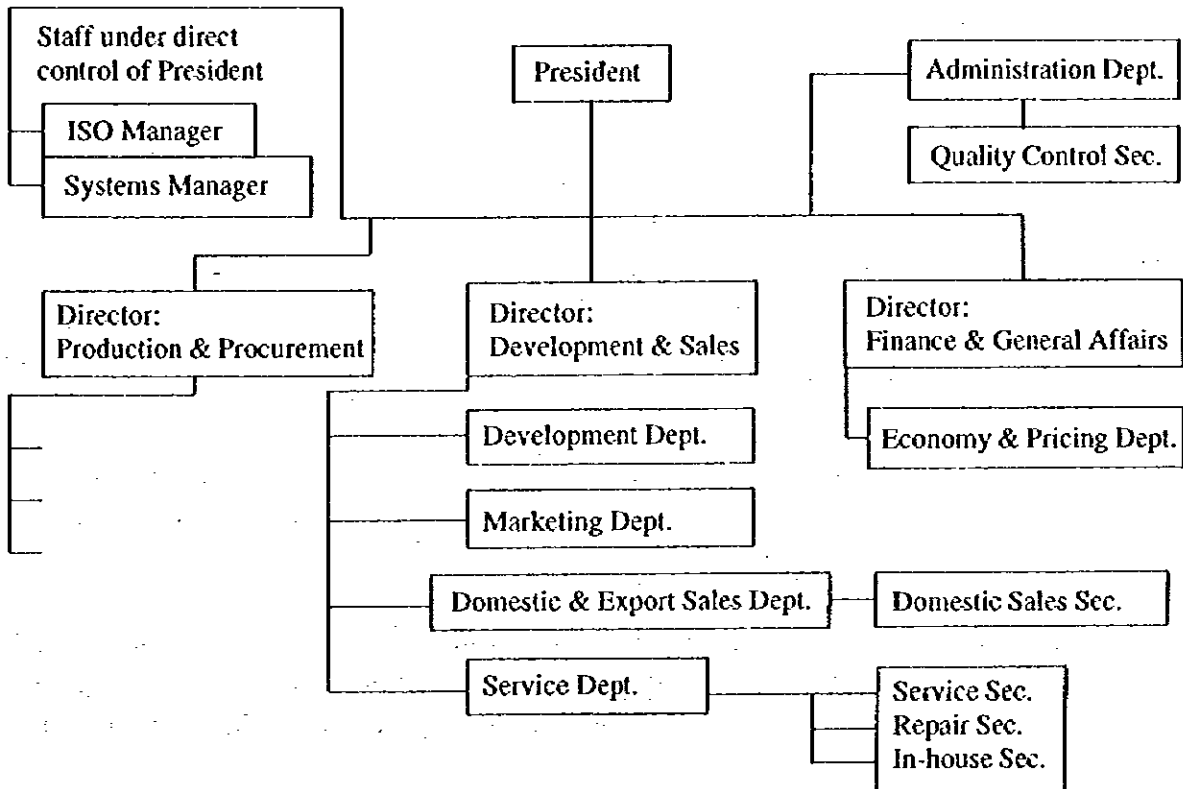
- 1) Regarding depreciation, residual book value is put at zero, and straight-line method is used.**
- 2) Treatment of inventories is based on the "first in, first out" (FIFO) method.**
- 3) Revaluation of assets is accomplished on the basis of rules stipulated by law. Change in capital due to revaluation is indicated in the item "net worth".**
- 4) Corporate tax is 40% of profit before taxes.**
- 5) It is not customary to use promissory notes for settlement of accounts receivable and payment accounts. Usually settlement is made in cash by way of bank accounts about two weeks after delivery of merchandise or provision of services.**

12.1.6. Marketing Function and Product Structure

12.1.6.1. Organization and Responsibilities

Figure 12-1-11 below shows the organization chart of the marketing-related divisions of Mielec Engines (hereinafter referred to as the "Company").

Fig. 12-1-11 Organization Chart of Marketing-Related Divisions

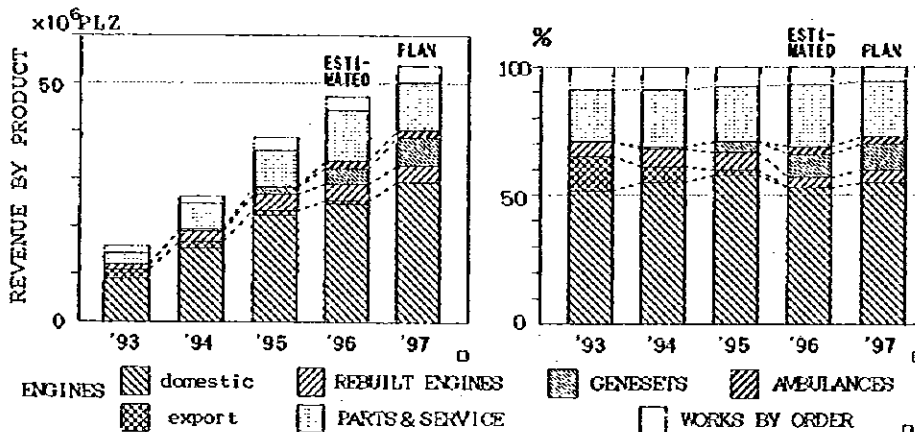


The Marketing Dept. was launched in 1995 with the former export sales group as its core members. Due to the reorganization, which took place in November 1996, the export/import function was separated and placed under the control of the Sales Dept. The division, which currently consists of 8 members headed by the General Manager, is mainly handling the promotion of new products as well as proposing new business ideas based on the information collected about customers and competitors.

The Dept., based on this year's company policies, is promoting all of the Company's products, with a particular emphasis on the newly introduced ones, small and medium-sized generators, and ambulances, as well as collecting information about customers and competitors and proposing new business ideas. With the support of new business partners (Electrim S.A., Fiat Polska, etc.), the Company's sales is increasing, except for ambulances which were recently introduced to the market, with the Geneset enjoying the highest growth rate in 1995 (Fig. 12-1-12), which compares the export sales of engines during the early years of the Company (Fig. 12-1-13).

Fig. 12-1-12 Change in Product Sales

Fig. 12-1-13 Change in Percentage of Sales by Products



Product planning, which is an important marketing function for the manufacturing company, is lead by the Development Dept. Traditionally, the Company first introduces new products on a trial basis to see the market's response and then develops final specifications. As for engine products, the Company's design function could process efficiently, since the Company, as a sub-supplier, simply needs to modify detailed specifications of base products according to the OEMs needs. Large-, medium-, and small-sized Geneset products have been introduced to the market in that order. As the products, especially the medium and small ones, have been launched only recently, the design staff are joining the promotional activities of the Marketing Division to grasp customers' response.

As for ambulance business, the Marketing Dept., following the completion of the first model, lead the promotional activities by listening to users' responses and opinions. Then, the Task Team headed by the Director in charge of production modified and refined the model in preparation for tender.

The Sales Dept. is in charge of inputting information necessary for production scheduling based on the production schedule of its OEM customers as well as accepting individual customer's orders. 3- and 2-month production forecasts as well as firm requirements for next month are sent to the Production Control Dept. and reported to the Administration/Finance Division at the end of each month. Next year's production plan is made based on the OEM data aggregated in August. Sales figures, along with other business and administrative data, are added up every 10th day and first and third month.

The Dept. is also in charge of managing product warehouse and delivery and processing of sales slips. Since November this year, the Dept. has been handling domestic sales and purchasing, which it took over from the Marketing Dept..

Pricing, business negotiations, and aggregation of sales results are handled by the Economy & Pricing Dept. under the Director in charge of finance and general affairs.

The Quality Control Department under the direct control of President handles customer information and OEM claims. Service claims and breakage as well as the sales of repair parts are attended to by the Service Dept., which also accepts and handles certain field claims for OEM. Quality problems attributable to OEM design process are conveyed to the Development Dept., which directly deals with certain claims and other design-related problems handled by other departments.

In-house audit of quality issues are done by the ISO Manager group, which is under the direct control of President. According to the present company rules, Manager of each function has the responsibility and authority to decide whether or not to conduct quality action. Final reporting is not concerned with action of the claim and satisfaction of the customers but with statistics of the products of the Company.

As described above, the marketing functions are handled and shared by several departments of the Company. The current marketing staff is insufficient in order for the Company to be able to develop effective marketing strategies from the standpoint of customer satisfaction and organize activities of related departments accordingly. It seems that most of the managers and employees think marketing is a synonym for sales promotion.

12.1.6.2 Product Composition and Marketing of Mielec Engines

The Company is not implementing any company-wide product planning, which should form a basis of marketing activities of the manufacturing company. Although production is the revenue source of all manufacturing firms, in order to fully utilize the production capacity on a long-term basis, it is imperative that the Company realizes the best product mix from the planning phase through product development stage before planning on individual products. Thus, we analyzed the present status of the marketing activities of the Company, especially its product planning process, as follows:

(1) Control of Product Mix

The Company's products consist of diesel engines, generators and related products, and ambulance cars, details of which are described in a separate chapter titled "Development-Related Report," and which are summarized in the table below:

Table 12-1-10 Outline of Company's Product Line

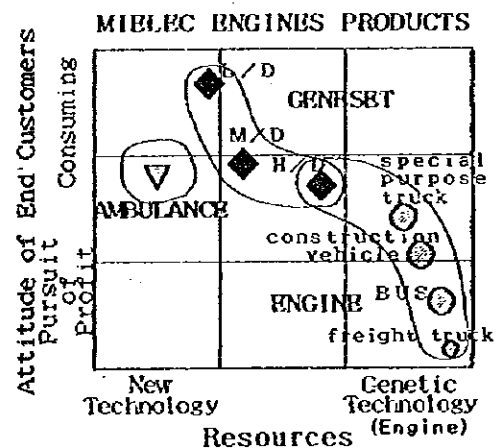
Keys (Company's position): (E) End product supplier, (S) Sub-supplier

Product	Line name (no. of items)	Final products in the market & marketing		Internal system
Engine	11 ltr. diesel (12)	capital goods	(S) Repeat sale to OEM customers	- Base structure for design, production, & services is in place.
			(S) Spot order taking from OEM customers (S) Spot order taking from other customers (S) Order taking through tender (E) Service parts for end users	- Produced based on standard spec. or customized designs.
Geneset	85-150kVA (12)	consumption goods	(E) Sales to order for end users or (S) installation contractors	- Using Mielec engines. - Assembled in the prototype-shop. - Produced based on standard spec. or customized designs.
	85-150kVA (12)	capital or consumption goods	(E) Sales to order for end users	- Using purchased engines (diesel or gasoline). - Assembled in the prototype-shop.
	85-150kVA (38)		(B) Sales to stock for dealers	- Production to stock based on standard spec..
Ambulance	Cosea body ambulance (Fiat GE Peugeot GE Peugeot DE Peugeot 4WD)	public goods	(E) Sales to public/private organizations through tenders (Purchasers are different from users.), or (E) Sales to orders from institutions or individuals.	- Base vehicles, bodies, interior trims purchased from outside vendors. standard nursing & medical equipment installed. - Base cars, bodies, interior trims purchased from outside vendors. standard nursing & medical equipment installed. Equipment & layout can be customized according to specific requirements.

Each of the three types of products listed above have and require different customers and operating procedures, and thus should be considered as three separate businesses (Fig. 12-1-14). The survey failed to identify the exact reason why the Company chose this particular product mix. Dealing with products other than engines, whether to replace the main product line or to diversify the business by supplementing the main products, should be done with careful planning so that the Company can effectively develop advanced technologies in different fields. Even the Company is taking a wait-and-see attitude, a mid-term to long-term decision making plan needs to be worked out.

Fig. 12-1-14 Positioning of Products

Having different customer groups would require balanced care among each group and make business operations more complicated. On the other hand, however, having three product lines may produce a synergy effect. Producing and selling final products can give the Company an opportunity to have a direct contact with the market, which may benefit the engine business. Marketing activities for each product line are as follows:



(2) Engines

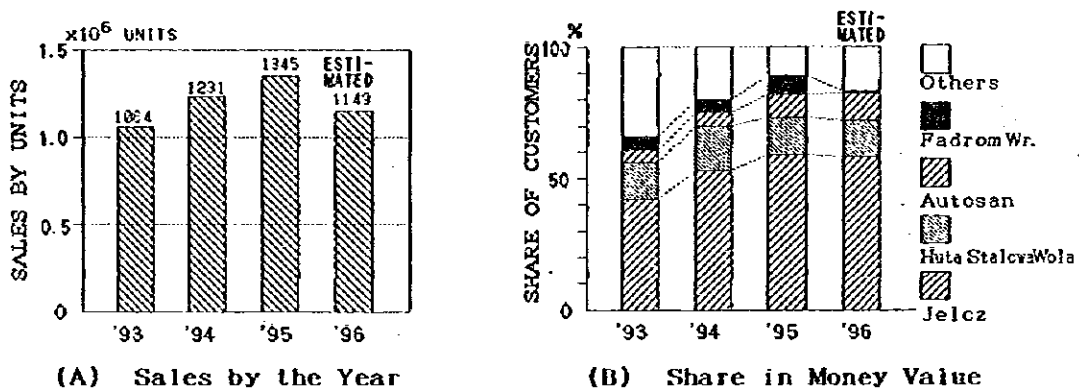
As shown in Fig. 12-1-12, engine sales have been declining since the establishment of the Company in 1993. Currently, main customers consist of OEM customers listed below. The sales shares were derived from the "Prezeds tawienie Firmy" of the Company as of August 1996.

Customer	Share	Customer's product	Competitor
JZS Jeletz S.A.	35%	buses, trucks	Mercedes Benz, Styr, Star
Huta Stalowa Wola S.A.	20%	industrial, construction vehicles	Cummins, Caterpillar
Auto San S.A.	15%	buses	Andoria, MB, Renault, Cummins
Others	30%		

OEM sales figures include those of service parts. Sales of other products include sales to spot orders from domestic and overseas customers and sales through tenders as well as direct sales of service parts to individual users of the end products. In addition to the above, the Company produces a small number of Geneset engines.

Changes in engine sales for OEMs to date are shown in the figures below:

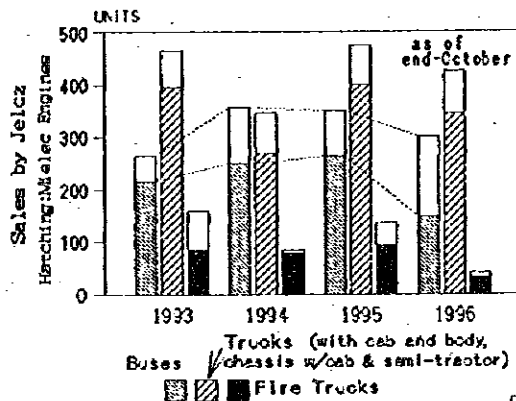
Fig. 12-1-15 Sales of Engines



Jeletz, the Company's biggest customer, used to use Mielec engines in 100% of its vehicles. However, since Jeletz implemented a restructuring program in 1989, it has begun using other products, which gradually took up the shares of Mielec-engine mounted cars. Mielec is losing its shares particularly in the long-distance transportation equipment segment, as is the case with Autosan. In 1996, a steep drop of the share in bus was observed. The Company's share in Jeletz dropped from 81% in 1993 to 68% as of October 1996. Now, Jeletz uses both Mielec and Mercedes-Benz engines in the same segments (Figure 12-1-H). The Mercedes-Benz engine has the Euro 2 exhaust emission control and used with automatic transmissions.

Fig. 12-1-16 Mielec Engine Share in Jeletz Products

Huta Stalowa Wola (HSW), which deals with construction vehicles, indicated that its customers began realizing that their business might benefit more from using highly advanced engines made by such companies as Cummins and Caterpillar.



a. Product Planning for Engines

Product planning of the Company is a realization of customers' complaints and suggestions. It concerns only the Design Dept., not the whole Company. The Company is not in the position to discuss its mid- to long-term strategies. One of the reasons for this is that although Poland is shifting itself to market economy, the Company still has a monopoly on the domestic engine market, which clearly explains why it continued to make profit without major product improvement or cost reduction efforts. The Company's reluctance to make mid-term and long-term plans also prevented it from taking proper measures under the crisis.

Development of Euro 2 engines was no exception. It started without much understanding of the Company's position in the market or analysis of its strength against competitors. The Company was not even aware of which vehicles its OEM customers would mount these engines on. The Company should have at least understood that the truck market was divided into two segments as described in Chapter 10 and decided which segment it should aim for before starting the design work. Strategy development jointly with OEM customers based on the product concept should enable the Company to accurately project the market share (sales volume) of the products.

The Company's potential lies in the realization of Euro 2 engines and aggressive planning, and effective methods and processes to be implemented in the future. In light of the above, the study team transferred various other techniques including product portfolio as a part of suggestions for restructuring. The lead time the Company has established for production to order is only for a small portion of its entire business, and its appropriateness will have to be tested at the peak of full-scale production.

b. Promotion Strategy

While the new regulations are about to take effect, the Company has yet to proceed with a full-scale promotion campaign for its Euro 2 engines. The market's response at the Poznan Show in 1995 was extremely cold as the prototypes exhibited at the show were a far cry from completed products. HSW, on the other hand, conducted large scale service training for Cummins products in August in preparation for the introduction of new Euro 2 engines scheduled in January next year. Jelcz has been preparing vehicles for Mielec engines for the last 1.5 years, but it was lamenting that they did not even have instruction manuals.

Generally, development of automobiles and construction vehicles would require three or more years of lead time. Thus, it is a common practice that a sub-supplier should start soliciting at the commencement of product development in order not to lose business opportunities.

To further the move, it would be necessary to work with the customers from the research and development stage based on the product mix plan. Star S.A.* * and Deawoo**, with which the Company has no direct business, have been adopting such joint development process.

* Based on interviews at Star S.A.

** Information obtained from interviews at Jelcz. Although it is not currently adopting this process, it is interested in it.

In order for the Company to adopt such a system, everyday efforts are essential. As a sub-supplier, it would be appropriate to appoint a contact person for each OEM customer, who would make regular contact with the customer to confirm their level of satisfaction with the products and services, and make necessary arrangements, and to establish certain in-house procedures to solve problems when they arise. Although the Sales Manager, following the examples of outside vendors of the Company, makes a monthly visit to each OEM customer, the Company is not in a position to implement such a system and benefit from it.

In other words, under the current system, which gives each Manager in charge full power to make decisions with regard to product development planning and measures against defects, it would be very difficult to launch a full-scale promotion campaign. In order to secure business in advance in a middle- to long-range product development program, the Company should be able to make corporate decisions at the management review, and make a company-wide effort to achieve the goal of the program.

c) Pricing Strategy

There are three approaches that the Company can take as a sub-supplier: 1) setting a target price in the product planning phase, 2) price renegotiation according to the changes of economic conditions each year, and 3) submitting price quotation when applying for a tender. Among the three, item 1) is the most important strategy. In observing the Company's operation, we noticed several things, which are outlined in the following paragraphs.

1) Target price in product planning phase

The Company seems to be of the opinion that they have the cost competitiveness based on the comparison of their prices with those of competitors listed in catalogues and other materials. Price calculation is made by adding up the in-house cost. The Company has been satisfied with low depreciation cost and has lost certain reinvestment opportunities. Although it is not possible to compare and verify specific cost information, cost of engines with the same horse-power produced by Japanese auto motive manufacturers is not so much different than that of Mielec products, at least not two to three times greater as the Company claims.

It is said that the market decides the price. In case of the Company as a sub-supplier, its pricing strategy can never go beyond the the strategy of the OEM, as the latter is what the end users take into account. That is another reason why the Company needs to discuss and agree on which engine types to supply with the required cost prior to the commencement of development work with the OEMs. As stated in paragraph b) above, the goal can only be achieved through the company-wide efforts.

2) Annual price negotiation

As one of the recommendations for corporate restructuring, the Study Team suggested 3% annual cost reduction. The Company and the Study Team discussed whether the 3% reduction should be for every year or for the whole year, and agreed on implementing what the team had originally suggested. Results of the first and second survey verified that each OEM was requesting its component suppliers the cost reduction as much as 3% as a condition to do business with them. This means that in order for the component suppliers to secure business on a continual basis, they have to make more rationalization efforts than the OEMs, which corresponds to the dynamics in the Japanese auto industry. In other words, as a result of close business relationship, component makers will be transferred technology for design and manufacture of products by OEMs, which will enable them to expand their customer bases.

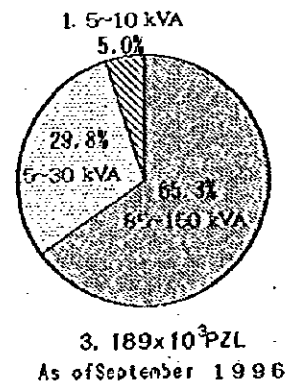
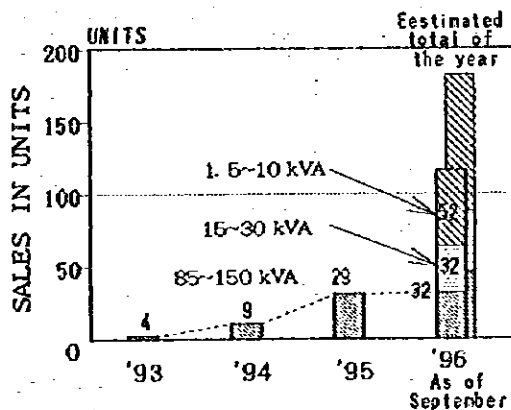
3) Pricing for tender application

Based on the cost structure established through 1) and 2) above, the Company should enjoy either high-pricing or low-pricing strategy depending on the competition.

(3) Genesets (engine generators)

The Geneset series have been one of the most promising product lines of the Company since it became an independent firm in 1993. The Company started out with 95-150kVA generators using its own engines. In 1995, it added 15-30kVA class generators using purchased engines. Then, the Company adopted 1.5-8kVA and 5.2-10kVA class this year. As described in Section 12.1.6.1, the sales of these products are increasing (See Fig. 12-1-17 and -18).

Fig. 12-1-17 Sales of Geneset Fig. 12-1-18 Sales percentage of each Geneset class



a. Product Planning

According to the information collected from personnel concerned, the initial intention to introduce the Geneset was to increase the sales of the Company's main product line (i.e., engines). As Polish regulations require certain types of buildings to be installed with emergency generators, the Company developed the product line for emergency uses. As electricity charges are relatively low in Poland, the Company cannot expect to sell a lot of generators for ordinary use. They installed a manual switch for general purpose in some generators. Until the market response became clearly identifiable, they decided not to start a full-scale production, but instead to assemble a small number of units in the prototype shop in the R & D building.

The volume was not so high as the Company expected at the beginning. The Company studied the moves of foreign makers entering the Polish market and listened to the field opinions, and decided to promote small-size generators for outdoor events and camping.

Table 12-1-11 compares the product composition of Mielec and that of Honda, the Company's biggest competitor in the small generator segment. It is quite apparent that Honda has significantly more extensive product lines and varieties that appeal to consumers and offers generators that have much more attractive appearances. Honda dealers told us that they were confident about the quality and reliability of Honda products and expected increased demand for them comparable to that for Mielec generators.

Table 12-1-11 Comparison of product lines with Honda

Mielec Engine	Portable	gasoline		●	●●●●	●●●●●
		diesel			●●●●	●●●●●
	Stationary	gasoline		●	●●●●	●●●●●
		diesel			●●●●	●●●●●●
Power generating capacity			1k VA	1~2k VA	2~5k VA	5 ~ 10k VA
Honda	Stationary	open type	●●●			
		semi-open		●●●●●●●● ●●●●●●●● ●●●●●●●● ●	●●●●●●●● ●●●●●●●● ●●●●	
		trunk type				
	Portable	2-wheel				●●●●●●●
		4-wheel		●	●	

* The Company's stationary type is mounted on pipe frames with handles

** Honda's semi-open type is also mounted on pipe frames. Open type comes with a mount base.

The strength of the Company is that it offers a complete set of diesel-engine generators along with a complete set of petroleum-engine generators.

Stimulated by the promotion activities of new products, sales of large-sized generators are also increasing (Fig. 12-1-17) and making a great contribution to the Company's profitability (Fig. 12-1-18). The original objectives of the Company was achieved as a result of full-line product strategy. New series of large-sized generators using newly developed Euro 2 engines are expected to be launched. Another series using bio-gas engines were introduced to the market on a trial basis successfully.

b. Promotional Activities

The Company has been conducting a promotion campaign mainly for new product lines. Now the Company needs to analyze how the promotional activities took effect on the sales increase of large generators and utilize the results for future marketing activities.

Establishment of business tie-up with Electrim through the introduction of new products was a significant move for the Company.

Sales of such products as Geneset depend on the mobility of sales people as an extension of the Company's work force, who are also important information sources of the market. It would be helpful to organize regular events that would strengthen ties between the Company and its sales representatives.

Corporate identity issues need to be resolved, too. Using the "Mielec Diesel" logo on the gasoline-engine Geneset and ambulance cars is confusing to the consumers.

(4) Ambulances

This year, the Company launched the ambulance project, which had been contemplated since the Company's establishment. The project has been extremely successful due to the following factors:

- 1) Selection of appropriate base vehicles and business partners (Fiat and Peugeot)
- 2) Refinement of products based on user survey (a model car was tried by paramedics and hospitals)
- 3) Effective promotion and advertisement to establish the Company's presence

The Company won the Rzeszow new product competition at the Katwice Trade Show held in September. The project was carried out by a task team under the control of the Director in charge of production.

The Company, along with Mercedes, lost this year's bid for government tender (Lodz Province) to Poloneze. The total requirement this year was far fewer than the projection, ending up around 10 units or so. The Company sold only four units.

a. **Product Structure and Competitiveness**

The Company uses, as base vehicles, semi-cab-over type FWD (front wheel drive) delivery vans by Fiat and Peugeot. Although the two companies use different functional parts, they produce so-called twin models as they share the same body made by PSA, which manufactures trucks for the two companies and Citroen. The base vehicles are converted into ambulance cars by Cocea of Italy. Fiat is the top passenger car maker in Poland, holding a 40% share. Peugeot offers a wide selection of vehicles of diesel engines and 4WDs suitable for a variety of operating conditions. The Company designs interior panels and has them manufactured in Slovenia. The Company assembles interior trims, installs doors and windows, lays out and installs customized instruments, and conducts final inspection. The cost of purchased parts and materials accounts for 87% of the total cost of entire vehicles.

Stretchers and first-aid instruments are supplied by two companies, of which Vico is far more willing to support the Company's promotional activities and provide technical advice. Their experienced consultants, who teach at a paramedics training school, are available to provide support. The other company is called upon only when the Company needs sophisticated equipment to serve specific requests from customers.

- The Company's competitor in this field is Mercedes-Benz (MB), which offers two types of cars based on Sprinter 208 D KA: one is for transporting patients and is slightly smaller than Mielec cars, and the other is of large-size and carries first-aid equipment. Taking advantage of FWD, Mielec cars have higher ceilings and lower floors and roofs and thus are easier to use. Features of the ambulance cars of both companies are compared in Table 12-1-K below:
- Polonez, which won the government tender for Lodz Province, makes ambulance cars for transport with simplified first-aid equipment using high-roof "Cargo" as a base vehicle that was converted from a passenger car.

Table 12-1-12: Ambulance cars, Mielec vs. Mercedes Benz

Manufacturer	Mielec Engines			Mercedes Benz		Evaluation
Specifications and particulars of base car						
Base car model	FIAT Ducat	PEUGEOT Boxer		Sprinter 212D 208D		S: Wider selection Mielec is differentiated by gasoline engines. Diesel is option, I: MB's name value and experiences S: FIAT's service network
Engine displacement (cc) output (ps)	4cyl G 1998 122	4cyl D 2500 110	4cyl G 1581 80	5cyl D 2874 122		
Wheel base (mm) Ground clearance	2850 155			3050 180		S: FF distinctiveness E: Ground clearance S: Entry and exit I: Front seat passenger capacity
No. of persons on front seat	2			3		
Specifications of modified part						
Interior length (mm) Interior width (m) Interior height (m)	2700 1800 1860			3265 1736 1855	2525 1736 1639	E: Space Utility Efficient layout and good finish offset smaller space by 14% S: Roof height MB's weak point in transport cars
Function	For emergency aid & transport			For transport		

S: superior, I: inferior, E: equal

b. **Business Environment, Demand Projection & Pricing Strategy**

Mercedes-Benz makes the entire modification work at Sobieslaw Zasada Centrum S.A., a Polish body conversion base of its vehicles, and supplies the products directly to the customers. Both are direct competitors of the Company in the fields of sales and remodeling work. The Company's ambulance business is conducted under multi-partnership including interior trim manufacturers. The Company is not a position of integrating these partners with its strategies.

- The Company's demand projection is based on the number of ambulance cars needing replacement in Poland. At the Red Cross model car exhibition party, the Study Team had a chance confirm the Health and Welfare Ministry's plan to purchase 75 units this year. The old cars we saw in Lodz Province desperately needed replacement. The fact that Lodz Province was the only locality to conduct a tender is a clear evidence of harsh economic condition of the country. Charity organizations' plans to make their own purchase were also shelved.

The survey team projects that the demand for orthodox ambulance cars, which the Company is aiming to produce, will increase as the Polish economy recovers. The Company keeps negotiating with private hospitals and organizations.

- To receive orders for ambulance cars, suppliers usually have to estimate the cost of chassis, bodies, and installed equipment that meet specific requirements of the purchaser and win a competitive tender. The basic approach to this is to understand the purchaser's needs and budget as well as competitors' strategies. MB has a corporate culture that places an emphasis on philanthropy. The Company needs to examine and study its past experiences in tender application so that it can work out the next tender strategies effectively. Although the Company has put in its bid for ambulance cars in the past, the experience and the lessons learned through unsuccessful bid are not reflected in its business practice.

(5) **Export Market**

The Company was exporting engines, either directly or through OEM customers, under the former economic system with the government schedules. The Company directly provided services and repair parts. When these business channels were closed off, the ratio of engine sales dropped from 13% to 1% as shown in Fig. 12.1-13. Although the Company has tried to cultivate their own sales channels through a trading company, they failed miserably and further lost markets in Turkey and the United Arab Emirates. Experienced sales staff are negotiating export deals while continuing domestic marketing efforts.

a. Ukraine

Ukraine is the only country that the Company can conduct marketing without any external support. When the country became independent, all documents containing customer information were lost, and the Company set up a local office last January to provide services for users of Mielec engines. It has been approached by Kraz, their first business opportunity.

The Company competes against Cummins, Volvo, Mercedes-Benz, and Yamz of Russia for Euro 2 engines for 10-ton trucks and loaders. The Euro 2 engines will be replacing currently used Russian-made engines. As the Euro 2 engines are to be compatible with the current V-type engines, the Company needs to develop a design change for reduced engine height, and a business structure for services and consignment.

b. Syria

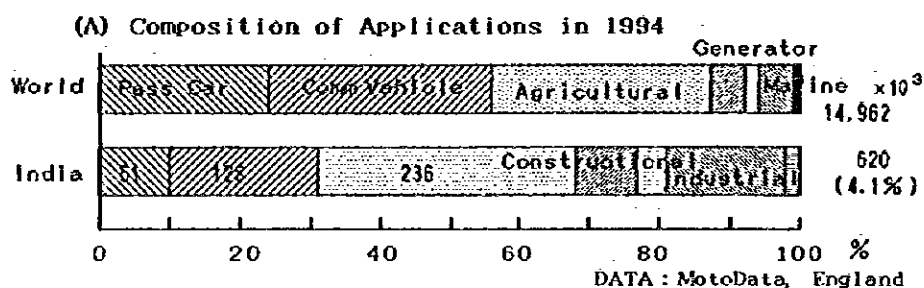
Exhibitions at trade shows in various countries by Electrim, the Company's new partner, opened up new opportunities. The Syrian government has tendered twice for Geneset, but failed both times due to the extremely tight budget of the country. Their recent offer included that of Deutz Co. of Egypt.

c. India

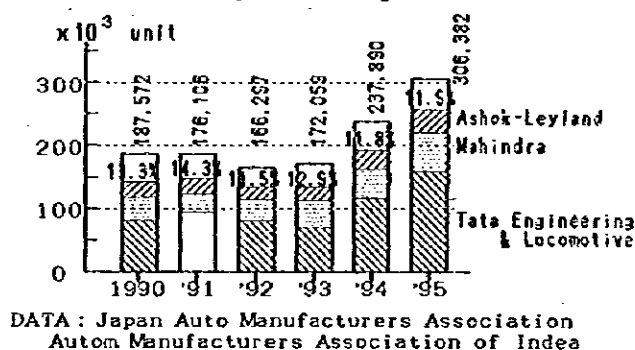
Negotiations with Ashok-Leyland over the last 18 months were finally settled. Ashok-Layland has been using Layland engines for their 8-ton trucks since 1952, but the engines became obsolete. The fourth engine sample for right-side driver seat was finally accepted. Although Mielec engines are too big and expensive for their vehicles, the Company is hoping to earn profit through the sales of service parts.

India produces a big volume of Diesel engines for truck and agricultural applications(10.3.1). Telco dominates the truck market with a share of 53% and its trucks, Tata-Benz, are widely used in Asian countries with the reasonable price. Ashok-Leyland enjoys the 2nd position with truck production volume 36,147 (12%) in 1995. The company manufactures above-mentioned engines. This business is an export of "half engine", the supply of a part of components and parts of an engine. The presence of the Company in this market with the modernized products by a step ahead seems very promising for the future strategy.

Fig. 12-1-19 Diesel Engines in India



(B) Trucks & buses Production and Share of Ashok-Leyland
Gasoline & Diesel engines



d. Romania

Mielec engines are installed in the loaders exported by HSW.

e. Bulgaria

Export is currently suspended.

f. Turkey

The customer used to use Mielec engines in their Genesets, but switched to Perkins products due to their dissatisfaction with the price of Mielec products. Annual price increase was not accepted in Turkey.

g. The United Arab Emirates

The Company was once selling 650 units of fishing boat engines, but lost the deal after many claims for salt water corrosion despite the corrective measures that the Company took in three different occasions. Compensation was paid by the brokers. The failure is attributable to insufficient prior market study.

Currently, the Company is eager to develop export market. It should first develop the export strategy, incorporating the solutions for many problems learnt from the past experiences and considering a balance with the strategy for domestic market, and execute it.

(6) Summary

In proceeding with the restructuring program, the Company is faced with a number of product-related problems that need to be solved. Through the course of the study, the survey team was able to convince the Company personnel to understand the need for careful planning and improvement efforts. In order to carry out the restructuring program effectively, the Company needs to prioritize the problems. The management is facing the challenge of making appropriate decisions and finding a balance between long-term objectives and short-term cash flow requirements under the limited resources.

Strategies for marketing, including export market, especially for product planning, should be the best suited policies for the Company, taking into account its resources and business environment, and thus, need to be fully understood and supported by all personnel concerned. The staff in charge of marketing planning should propose solutions for the Company's problems and ask the management to make decisions and then coordinate internal and external forces in order to achieve the objectives of the plans.

In light of the Company's current situation described in this chapter, measures and solutions are recommended in Chapter 6.2.

12.1.7 Information Management

12.1.7.1 Operational Data Management

Looking at the situation concerning Mielec Engines' transmission of operational data, one sees that its top management receives the data that it needs sufficiently rapidly, such as data on total sales, main financial data broken down by product and data on divergence between the company's wages and wages in general in the labor market. On the basis of such data, it is possible for top management to make comparisons with the target figures in the annual plans and make appropriate adjustments from time to time.

However, when it comes to management of different divisions within the Company, the situation is that the original information remains within the different divisions and is not analyzed and processed for use within the division and provision to other divisions in order for action to be taken. Examples of that were seen everywhere. For instance, there is no system for sorting out information on complaints and expressed wishes in marketing and sending it on to design and production technology functions. Needless to say, such information should also be reported to top management.

Furthermore, in general there is not much awareness of the advantages of cooperating in collection of data and information and sharing it. Representative of that are difficulty of getting information on actual cost incurred and the fact that although the production lines are furnished with standard cost data, it is not being used. More necessary at this stage than systemization of information systems, is promotion of understanding of the aims and goals of systemization and the advantages to be derived from it.

12.1.7.2 Computer System

The company's computer system was introduced in the autumn of 1993, after which it was partially commissioned in these areas including finance and accounting, wages and some design works. Full commissioning thereof is scheduled to take place from the beginning of 1997. But such full commissioning will not be effective unless appropriate action is taken regarding data input and utilization of the information obtained as represented with the cost accounting system. In the meantime, it might be mentioned that although development and support of both the hardware and software sides of the system has been provided on an on-going basis by the Garsia Information Union, which also became independent from the parent company (it is located in Europark, just as Mielec Engines Co.) there is no linkage with it in terms of the system.

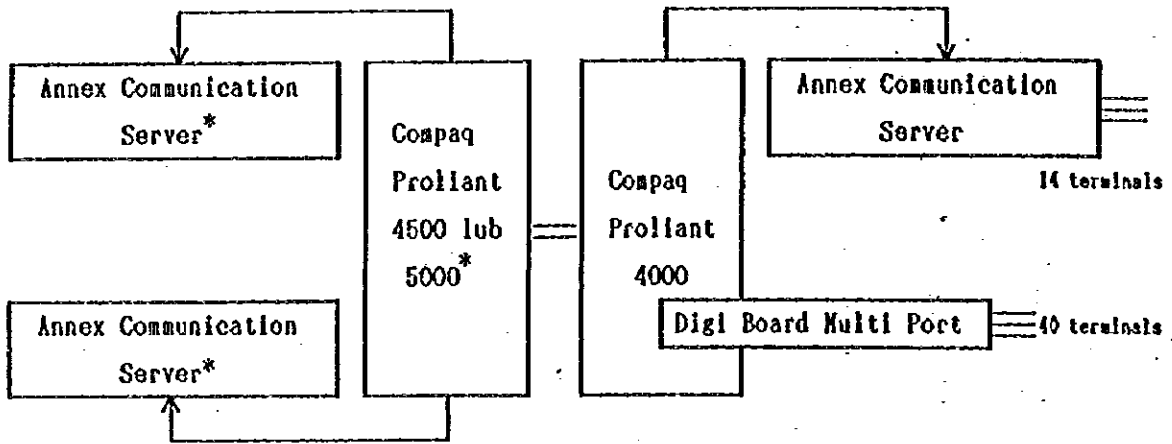
Fig. 12-1-11 shows the structure of the company's present LAN system. The hardware is a LAN based on Compaq's Proliant 4000, a server and a total of 54 terminals, with 2 more servers planned.

Fig. 12-1-12 gives a complete picture of the company's computer system by management function. It covers almost all of the main operational management divisions in terms of system configuration as follows:

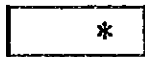
- (1) Financial and Wages Systems
 - a) General accounting
 - b) Fixed assets
 - c) Wages
 - d) Sales
 - e) Cost accounting
- (2) Production Control Systems
 - a) Production planning /ordering
 - b) Inventory
 - c) Production process
 - d) Purchasing
 - e) Parts information
 - f) Production process information
- (3) Design Management Systems

There is no problem concerning Mielec Engines' orientation of efforts aiming at sharing of information and making management more efficient by use of computers. In operating processes between divisions many reports from one division to another are observed rewritten, sorted out and computed, error is inevitably involved. A few examples include the processing between such divisions as sales, finance and production planing. There would be a plenty room for modernization avoiding duplications not only by computers but also fundamentally in the flow of information processing including manual work. Regarding system configuration, what is needed is further development of program software and introduction of package software (e.g. MRP-II) as planned as well as checking of compatibility between the large number of software programs and review of efficiency of things like handling of transactions. In particular, and this relates also to the cost accounting system, which will be the future core of strategic information, fostering of a system for mutual cooperation between divisions will be the key issue in the immediate future.

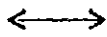
Fig.12-1-22 LAN and System Configuration



Explanation of the figure



* Equipment in planning



↔ Ethernet (Link with optical fibers)



== Fast Ethernet

System configuration

-Compaq Proliant 4000

Pentium 66 MHz

128 MB RAM

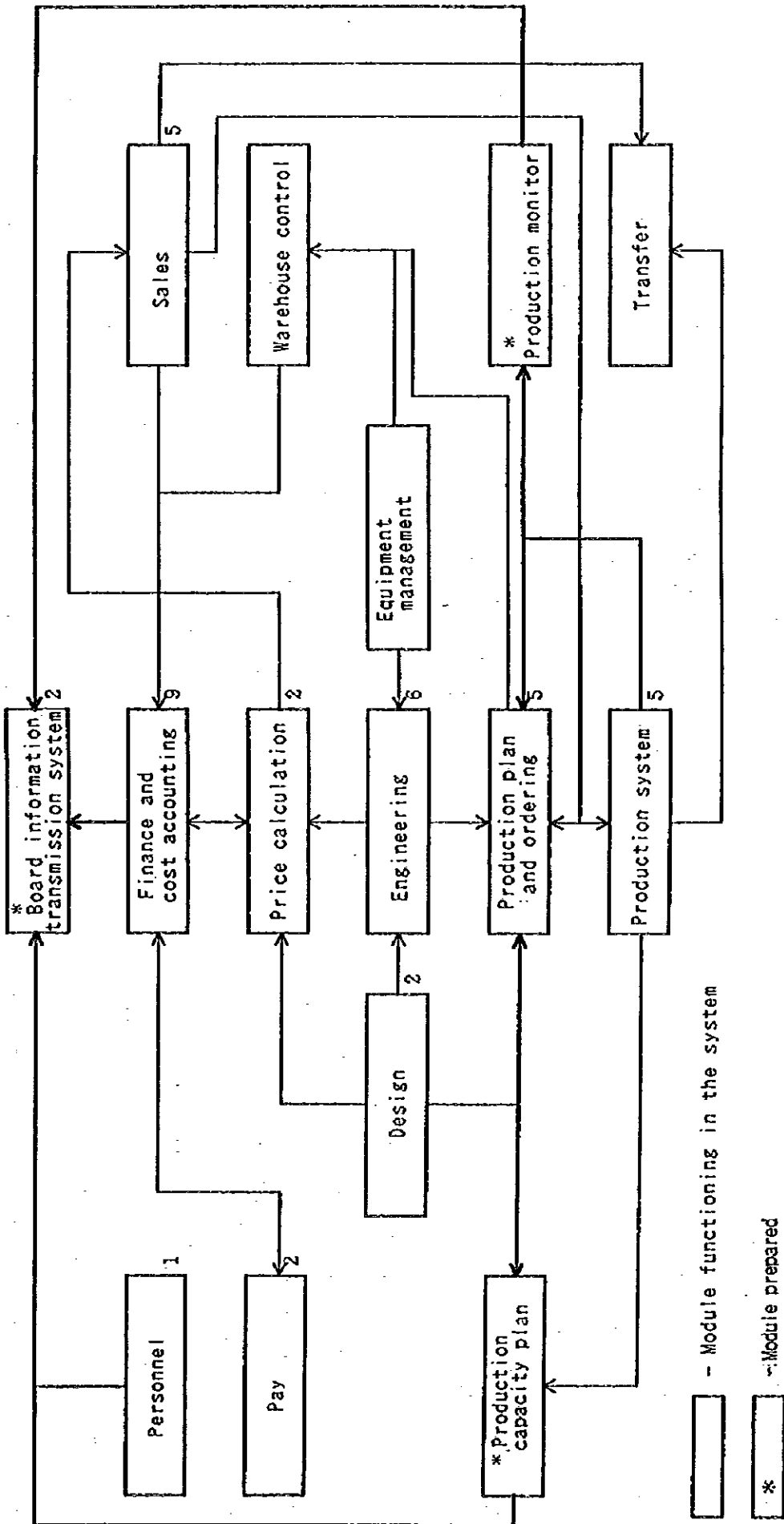
Disk Array 5x1GB/RAID 5

Streamer 1 GB

-Annex Communication Server (16-port)

-DigiBoard Multi Port(48 port)

Fig. 12-1-23 Computer Management System



Note: Figures noted on each box indicate the number of terminal computers (client personal computers) allocated.

12.1.8 Labor Relations

Mielec Engines' labor unions are of the in-house type. There are two of them, with different superstructures. One is a union under the Electrical and Mechanical Industry Labor Union, which has its roots in the old regime, and the other is a "Solidarity" labor union. Their respective memberships as of the beginning of September were 193 (26.2% of all company employees) and 176 (23.9%). Together, they represent 50.1% of the company's employees. We were told that the membership of the "Solidarity" union consisted mostly of production line workers and that the members of the union with roots in the old regime were mostly office workers. Also to be seen are cases of employees on the "Meister" level belonging to one or the other.

Labor relations are generally good. Since the company became separate and independent in April of 1993 there have been no strikes, and it would appear that the Company has maintained its wage level at least at the general level of the Mielec region. As mentioned in the preceding section, the company's wages are at the general level in Poland and are appropriately revised in accordance with such standards as the guidelines agreed to by industry, labor and the government (Ministry of Labor), and strikes have not come to the surface, considering also welfare aspects. Besides that, the Company has continued pay its employees on time.

12.2 Products

12.2.1 Main Diesel Engines

12.2.1.1 Current Mass-Produced Engines

(1) At the Company the following two 6-cylinder types with total cubic displacement of 11 liters are being produced as massproduction engines:

- SW680 : Engine based on license from Leyland.
- SWT11 : Represents improvement of the SW680 for heavy-duty.

(2) The specifications of the SW680 and SWT11 are as follows, the structure of the SWT11 engine being indicated in Fig. 12-2-1:

DIESEL ENGINE SPECIFICATION		Table 5-2-1
Make	PZL "Mielec"	
Model number	SW680, SWT11	
Number of cylinder	6	
Bore x Stroke	127 x 146 [mm]	
Displacement	11,1 Litre	
Maximum Power	100 - 200 [kW]	
Maximum Torque	667 - 1050 [Nm]	
Compression ratio	15.8	
Combustion system	direct injection	
Specific fuel consumption	165 gt/ps/hr	
Weight	dry weight -950 kg	
Outsize size	1391 x 728 x 1127 [mm]	

Source : Mielec Engines Co.

(3) As indicated in Fig. 12-2-2, the SW680 and SWT11 diesel engines are mounted on trucks and buses and industrial-use and other vehicles.

12.2.1.2 Development of New MD111E Engine

(1) In view of the fact that the current mass-production diesel engines types SW680 and SWT have the following problems, the new MD111E engine (also known in short as the "ECO engine") has been developed in order to improve them. Its development has already been completed, the present stage being one of preparations for mass production, which is scheduled to start in January 1997.

- Clearance of the European exhaust gas controls, EURO-2.

On November 20 the testing of the new-type MD111E engine (output 305 ps, maximum torque 125 kg.m) for the Company's new-type dump truck for certifications with respect to the EURO-2 European environmental standards took place at the State Research Room of Professor Zaborcki of Krakow University in the presence of government officials. The testing was passed, and EURO-2 certification was acquired for the engine.

- Improvement of fuel consumption as follows:

Fuel consumption, g/PS/h	New MD 111E	Current SW680, SWT11
	150	165

At value for fuel consumption represents a technical level that is not inferior to that of Japanese products (see Fig. 12-2-3).

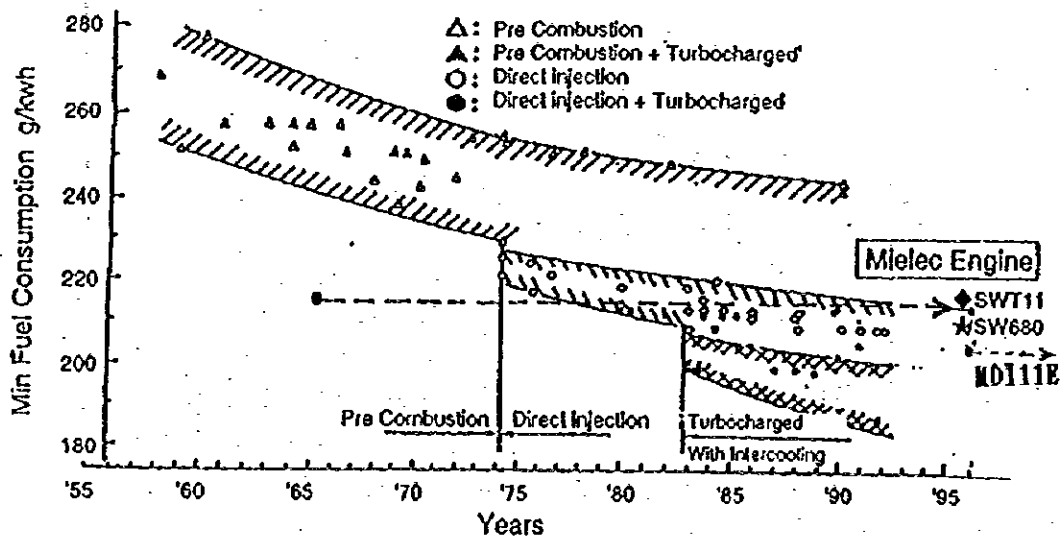


Fig. 12-2-3 Comparison of Fuel Consumption

Source : Mielec Engines Co.

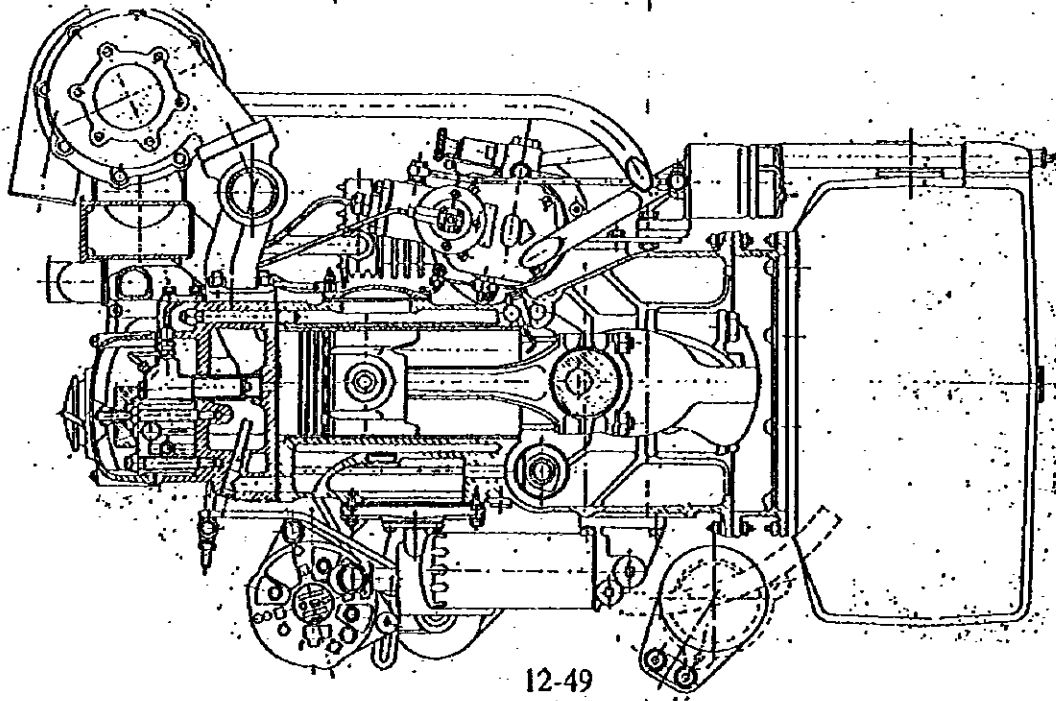
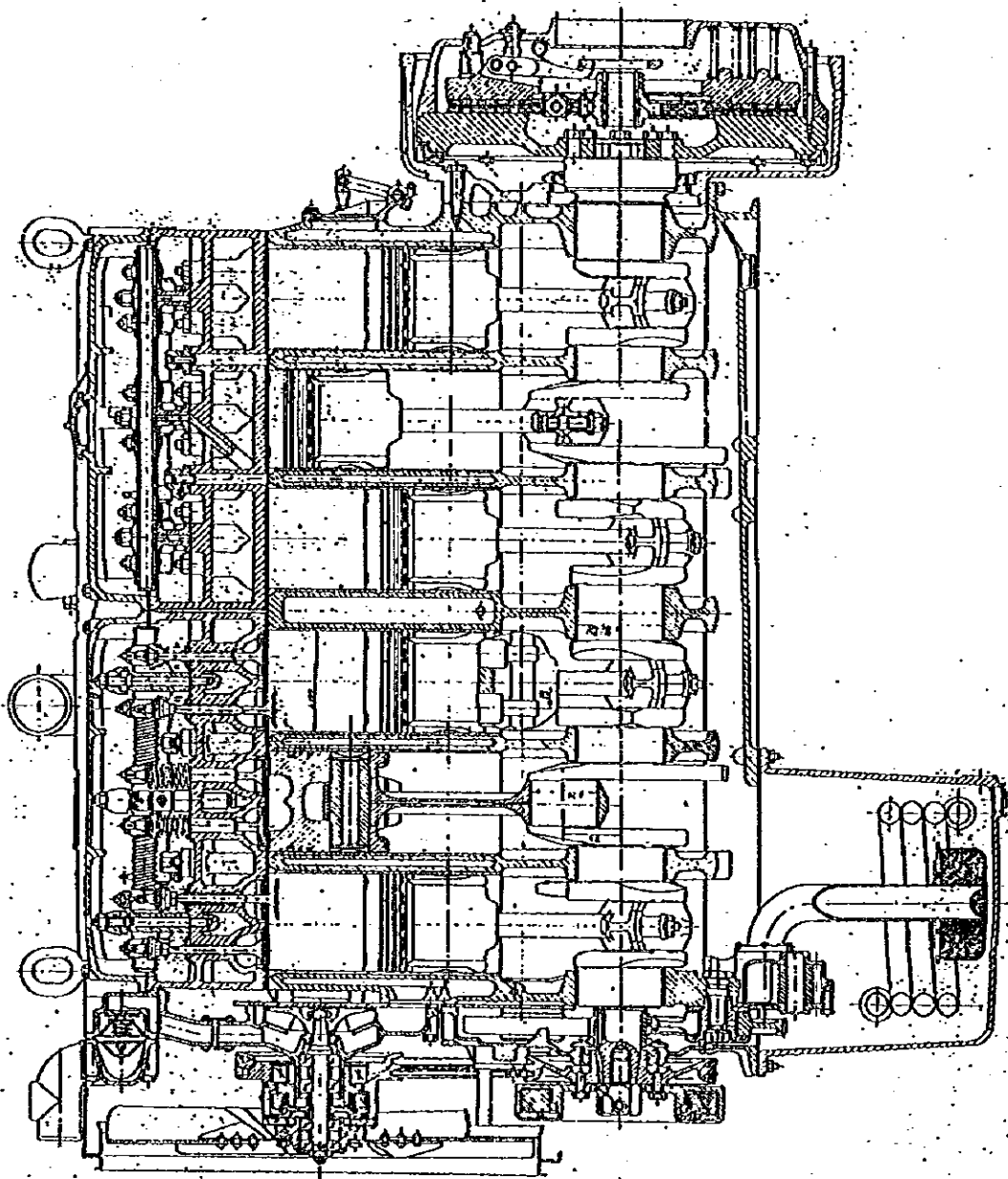
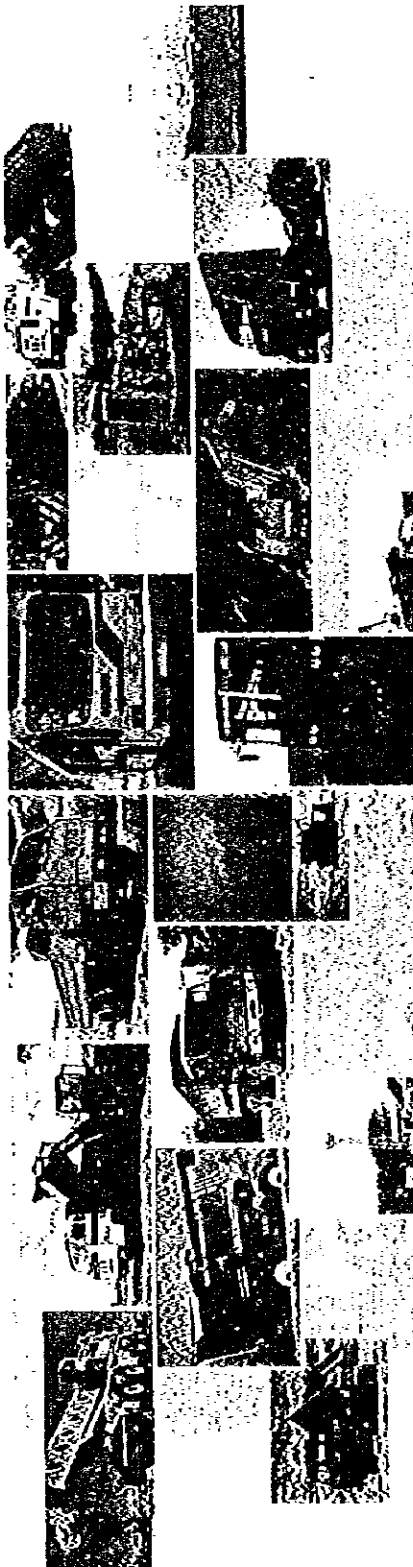
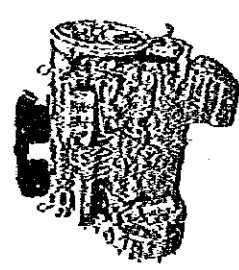


Fig. 12-2-1 SWT11 Engine
Source: Miclet Engines Co.



Rodzina silników SW680 i SWT11

to ponad 200 odmian o różnorodnym zastosowaniu. Są to:



1. Silniki wysokoprężne wolnossące pionowe
 a) do zastosowań trakcyjnych o mocy od 125 kW przy 2000 obr./min do 130 kW przy 2200 obr./min
 b) do zastosowań przemieszczających o mocy od 100 kW przy 1500 obr./min do 125 kW przy 2000 obr./min



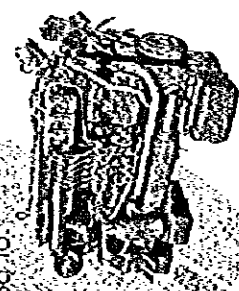
2. Silniki wysokoprężne doładowane pionowe
 do zastosowań trakcyjnych o mocy od 160 kW przy 2000 obr./min do 195 kW przy 2200 obr./min



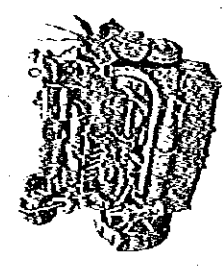
3. Silniki wysokoprężne pionowe doładowane z chłodzeniem powietrza doładowującego do zastosowań trakcyjnych i obsługujących o mocy od 200 kW przy 2000 obr./min do 235 kW przy 2200 obr./min



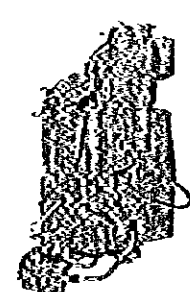
4. Silniki wysokoprężne poziome
 a) wolnossące o mocy od 125 kW przy 2000 obr./min do 135 kW przy 2200 obr./min
 b) doładowane o mocy od 150 kW przy 2000 obr./min do 200 kW przy 2200 obr./min



5. Silniki wysokoprężne pionowe doładowane do zastosowań specjalnych o mocy od 150 kW przy 2000 obr./min do 200 kW przy 2200 obr./min



6. Silniki wysokoprężne doładowane pionowe do zastosowań przemieszczających o mocy od 120 kW przy 1500 obr./min do 160 kW przy 1500 obr./min



7. Silniki wysokoprężne pionowe do zastosowań morskich
 a) wolnossące o mocy od 125 kW przy 2000 obr./min
 b) doładowane o mocy od 155 kW przy 2000 obr./min

Fig. 12-2-2 SW680 SWT11 Engines

Source : Mielec Engines Co.

(2) The competitiveness of the new MD111E engine compares as follows with engines of competitors:

○ : Superior to - : Same as △ : Inferior to

Item \ Competitor	DAF	SCANIA	VOLVO
Price	○	○	○
Quality: • Exhaust gas level	-	-	-
• Fuel consumption	-	-	-
• Reliability, durability:	△	△	△
- 1,000,000 km		-	-
- 400,000 km		○	△
• Weight, kg			

Table 12-2-2 Comparison of the competitiveness

(3) The main items of component improvement are as follows, Western European parts being used for the main components (see Fig. 12.2.4, "MD111E Engine"):

- a) Cylinder heads: The form has been changed from 1 intake port for every 2 valves to 1 for every valve.
- b) Higher pressure of fuel injection pump: The Bosch 1200 kg/cm² pump has been adopted for better combustion characteristics.
- c) Wide-range turbocharger: A Garret turbocharger has been adopted for better air feed characteristics.
- d) Exhaust manifold: A pulse manifold has been adopted for better air feed characteristics.
- e) Piston and piston ring: The 3-ring type has been adopted in order to reduce friction horsepower loss, Western European parts being used in view of the fact that pistons and piston rings are important functional parts.
- f) Crankshaft rear seal: The rear seal has been improved as a measure to cope with oil leakage.

(4) Sales Price of New MD111E Engine

The selling price of the new-type MD111E engine has not been decided, but they will probably set the selling price indicated below, which has been determined taking into account the higher output and functional improvement regarding exhaust gas level compared with the present SWT-11 engine. The profitability will be about the same as for the SW series.

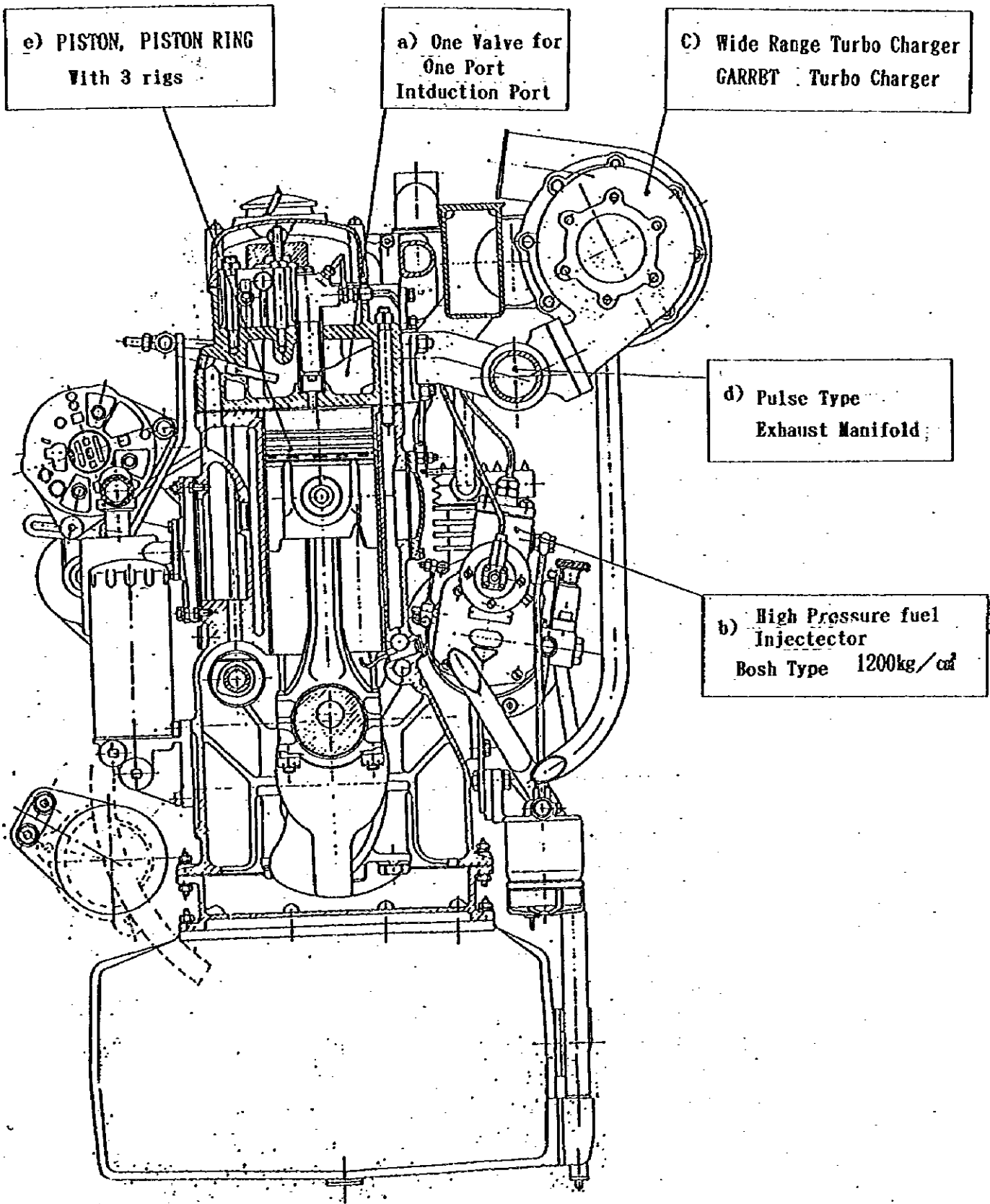
	New-type MD111E	Present SWT-11
Selling price	38,000 zloty	25,000 zloty
Real market price	36,000 zloty	22,000 zloty
Output, ps	360	305
Exhaust gas level	EURO-2	-
Selling price per ps of output, zloty/ps	105	82

Table 12-2-3 Selling Price of New-Type MD111E Engine

(5) Remaining Product Tasks

- a) 1,000,000 km reliability and durability.
- b) Production design: Change from functional design to easy-to-make design as in the case of advanced competitor products.
- c) Modernization design: Achievement of modernization design taking into account production equipment.

Technology transfer was accomplished with respect to tasks a) ~ c) above in the form of design review at the time of the second part of the local study.



12.2.2 Ambulances

(1) The Company has completed development of a new ambulance that meets the Ministry of Health's criteria for ambulances for first-aid treatment. The first such ambulance was produced as the primary prototype, and the second as the secondary prototype, the present stage being that of receipt of an order and scheduled sale of the third ambulance.

(2) The vehicle itself is the Fiat Ducato 14, made for the Fiat ambulance, and the ambulance more than meets the stipulated safety criteria.

It is equipped with automatic fixed safety belts, an BAS handle for absorption of collision shock and a valve that checks inflow of fuel.

(3) The vehicle specifications of the ambulance are as follows (see Fig. 12-2-5, "Ambulance"):

a) Vehicle dimensions: Length: 5085 mm. Width: 1990 mm. Height: 2690 mm.

- Engine: Gasoline engine (also possible to mount diesel engine if desired by the user)
- Suspension: Front-wheel: MacPherson independent type.
Back-wheel: Vertical spring type.
- Gears: Front-wheel drive, 5 gears
- Wheels: Rim: 15" 6J-H2. Radial tires: 195 70-R15C

b) First-aid treatment compartment

The new-type functional-beauty, environmental-protection interior finishing of the European standard is made of recyclable ABS plastic and makes for ease of cleaning and sterilization.

Dimensions: Length: 2700 mm. Width: 1800 mm. Height: 1860 mm.

- Side walls and ceiling: Recess and storage space above driver's seat for keeping medical apparatus.
- The floor covering consists of anti-slip carpeting for safety and reduction of noise.
- There is a small window in the wall between the first-aid treatment compartment and the driver's seat for conversation.
- The side door, which opens from the right side, has a glass window in it and is equipped with removable stairs.
- The panels of the back door can be opened 180 degrees from the left and right. That door also has a glass window and stairs.
- There is an emergency window behind the driver's seat.
- All of the windows have partial matte finishing.
- Thermal and sound wall insulation.
- The two seats on the right side are equipped with safety belts.
- The extra collapsible seats in the wall of the first-aid treatment compartment are also equipped with safety belts.

- The main stretcher, of the movable Ferno 26 type, is installed on the left side of the first-aid treatment compartment. It can be moved to the middle, depending on the available space (thereby making it possible to treat the patient from three sides).
 - The secondary stretcher, for moving a second patient, of the Ferno type, is installed on the cantilever beam at the side of the right wall (after it is pulled out for work).
 - The stretcher for lifting the patient, also of the Ferno type and collapsible, is installed next to the front wall.
 - The seat for heart-disease patients, of the Ferno type, is located at the side of the wall of the first-aid treatment compartment (making it possible to move the patient sitting upright).
 - At the left wall there is a place where it is possible to install an artificial respiration device.
 - There is a rail of the Mondura type for suspension of medical apparatus.
 - Above the driver's seat there is a place for keeping an air mat.
 - Next to first-aid treatment compartment wall and rear door is a place for placement of a medical apparatus case.
 - There is a washstand with fixtures, tank and pump.
 - Oxygen breathing apparatus, two 110 bottles (with reducer), three oxygen distribution outlets, two on the right side and one in the ceiling, all adjusted using the control panel on the left side.
 - Three 12V, 16A electrical outlets (one of which in the rear door).
 - There are four electric lights in the ceiling for the lighting of the first-aid treatment compartment. Their light is of the dispersion type (2-stage adjustment possible), it being possible to adjust them by means of the control panel on the left wall.
 - There are two halogen lamps in the middle of the ceiling (light of concentrated type).
 - A searchlight is installed on the rear door for lighting of the site of the rescue activity.
 - Inside the treatment compartment there are two 220V electrical outlets that are supplied with power from the outlet on the left-hand outside part of the front of the vehicle body, there being a blocking device that makes it impossible to start the engine when connected to an external power supply.
 - There is a 3-stage adjustable air exhaust/intake device operated by means of a control panel.
 - Three types of heating: by means of the engine cooling device, Ebersprecher independent heating and 220V electrical heating (when the vehicle is at a stop).
- Note: The above-mentioned interior equipment can be changed by agreement between the maker and the purchaser of the ambulance.

c) **Marking and Signals**

- For the light beam, use is made of a blue warning lamp, the color of which is modulated by sound signal. It is also possible for it to be directed outside.

- Two blue lamps on the rear part of the roof.
- Two flashing lamps at the front at bumper height.
- Signal lamp to indicate that the width of the vehicle body has been extended when the rear door is opened 180 degrees.
- Two direction indicator lamps installed on the rear part of the roof.
- Red and blue reflection strips on the periphery of the vehicle body.
- Marking "Ambulans" in reflected-image letters on the front part of the vehicle body.
- Mark "R" to indicate that it is a first-aid treatment ambulance.
- Cross of St. Andrzej to indicate a medical vehicle.

d) Special Equipment

- Driver's seat searchlight
- Place for installation of antenna + antenna cord + transceiver.
- Fire extinguishers in the first-aid compartment and at driver's seat.

e) Service and Guarantee

After-sales and guarantee service for the vehicle is provided by the Fiat service network. The Company is responsible for the guarantee of the first-aid treatment compartment.

MIELEC
DIESEL

WYTWÓRNA SILNIKÓW
"PZL - Mielec" Spółka z o.o.

AMBULANS REANIMACYJNY
MIELEC - DIESEL



Fig. 12-2-5 AMBULANS
Source : Mielec Engines Co.

12.2.3 Generators

(1) The Company has expanded its series from its past

- large ZG680 and ZG11 (80-150 kVA), 1500 rpm (50 Hz)
(86-180 kVA), 1800 rpm (60 Hz)

generators mounted with its own SW680 and SWT diesel engines, by adding the

- small ZG and ZG1001 (1.5-30 kVA), 3000 rpm (50 Hz)

generators mounted with ACME MOTORI SPA and DEUTZ diesel engines developed by it.

(2) As a result of the above-mentioned expansion of its product series, it now looks as follows:

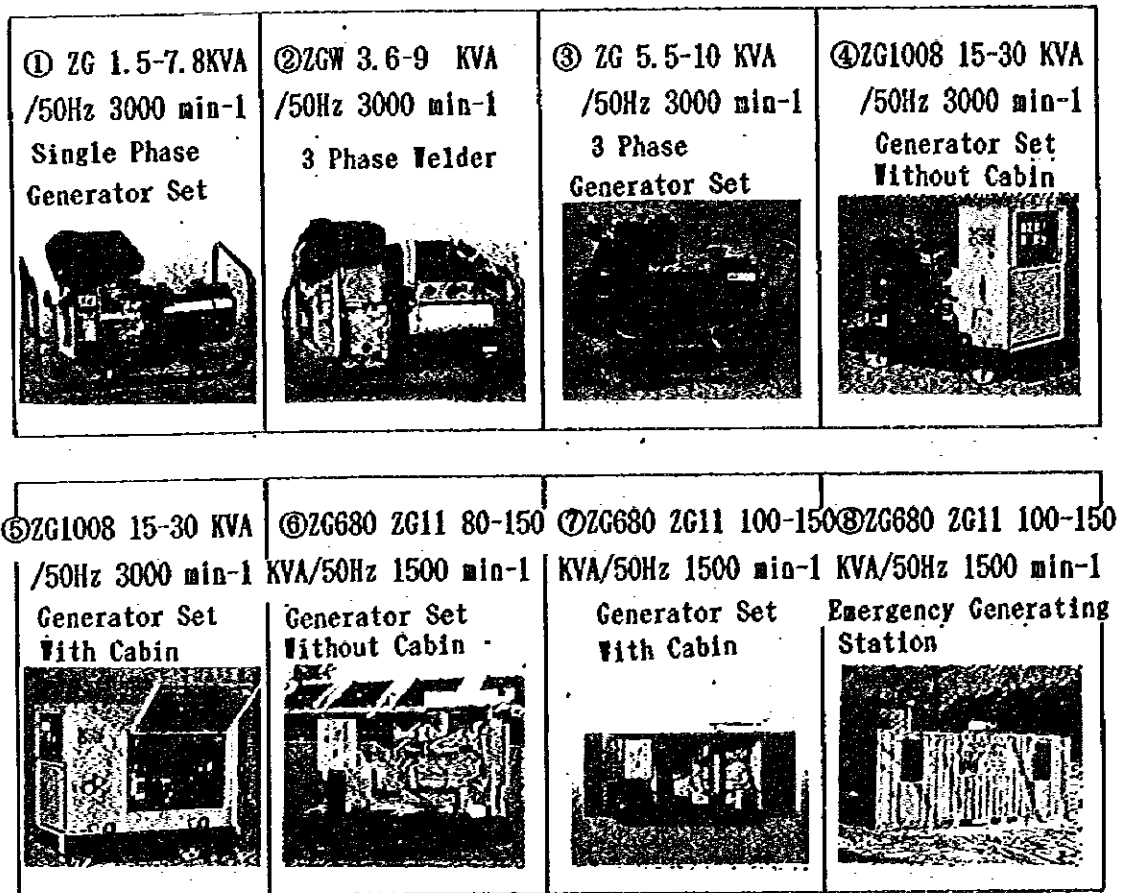


Fig. 12-2-6 Generator Series
Source : Mielec Engines Co.

(3) The generator manufacturers are EMIT, STAMFORD, MECC, ALTE and LEROY-SOMER, and use is being made of generators of the single-phase type with flange connection by bearing.

(4) It allows for the possibility of mounting the following optional devices on the generator sets:

- | | |
|---------------------------------------|---|
| 1) Generator set cabin | 5) 2-axle trailer |
| 2) Generator set container-type cabin | 6) Parallel operation device |
| 3) Soundproofed cabin | 7) Engine warming device |
| 4) 1-axle trailer | 8) Other items based on agreement with client |

(5) Uses of Generators

As emergency power supplies for hospitals, convalescence centers, social protection institutes, telecommunications facilities, railroads, border customs offices, fire stations, military installations, computers and finance centers.

As regular power supplies for exploration operations throughout the world, forestry, agricultural and livestock-raising operations, building operations, port operations, etc.

The relative weights of use as emergency power supply and use as regular power supply are 9:1.

(6) Competitiveness of Generators

In general, the competitiveness of the generators is greater the larger they are and less the smaller they are.

① ZG 1.5-7.8 kVA ② ZGW 3.6-9 kVA ③ ZG 5.5-10 kVA

○ : Superior to - : Same as △ : Inferior to

Item \ Manufacturers of competing generators	At home: KAREMA	U.K.: GENERA	Japan: HONDA	Belgium: BELP	Germany: BOSCH
Price	-	△	-	-	-
Quality: •Design	-	-	-	-	-
•Functionality	-	-	-	-	-
•Service life	-	-	△	-	-

④ ZG1008 15-30 kVA

⑤ ZG1008 15-30 kVA

Item \ Manufacturers of competing generators	Domestic		Ireland: WILSON	BK: DAWSON KEITH	USA: ATLAS COPCO
	KAREMA	ANDRY CHOW			
Price	○	-	△	△	○
Quality: •Design	○	○	-	-	-
•Functionality	○	○	-	-	-
•Service life		○	○	-	-

⑥ ZG680 ZG11 80-150kVA ⑦ ZG680 ZG11 100-150kVA ⑧ ZG680 ZG11 100-150 kVA

Item \ Manufacturers of competing generators	Domestic		
	ZMWOLA	ENERCO	WSW ANDRYCHOIS
Price	○	-	○
Quality: •Design	○	-	○
•Functionality	○	○	○
•Service life	△	○	-

Table 12-2-4 Competitiveness of Generator

12.2.4 Gas Fuel Engine

The Company has developed the MD111P2 gas fuel engine using substitute fuels other than gas oil and other petroleum fuels. Presently it is undergoing practical-use testing installed in buses. Gas fuels include natural gas, propane, butane and biogases and are used for buses, generators, etc. in urban areas.

The gas fuel engine is appropriate for limited use, i.e. in urban areas and elsewhere where environmental countermeasures are needed, because of the comparatively low PM and NOx content of its exhaust gas.

On the other hand, because of the limited quantity of gas fuel that can be carried on board due to the low density of gas fuel, the gas fuel engine is suitable for use only by urban buses with short running distances and stationary generators and for other similar purposes.

They say that the annual market demand for gas fuel engines in Poland is about 500 engines.

(1) Advantages and Disadvantages of the Gas Fuel Engine

The following table compares the gas fuel engine with the diesel engine in terms of advantages and disadvantages. (Table 12-2-5)

Item	Gas fuel engine	Diesel engine	Remarks
Price	△	○	Price about 10% higher than that of diesel engine
Fuel consumption	○	△	Fuel consumption about 10% lower than that of diesel engine
Exhaust gas components	○	△	Less PM, NOx, HC and S
Output/displacement	△	○	Smaller output per unit of displacement
Noise	○	△	3-5 dBA lower
Durability	○	△	Outstanding durability

Table12-2-5 Advantages and Disadvantages of the Gas Fuel Engine

(2) Specifications of the MD111P2 Gas Fuel Engine

The specifications of the engine for JEM LZCZ120M buses are as follows: (Table 12-2-6)

Item	MD111P2	Item	MD111P2
Type of engine	Horizontal type	Type of gas	Liquefied propane, butane
Number of cylinders-diameter x travel, mm	6-127X146	Running distance without refueling, km	About 300
Displacement, liters	11.4	Gas consumption, dm ³ /km	45-50
Output/speed, kW/rpm	128/2200	Capacity of gas container	144 dm ³ x 2 tanks
Maximum torque, Nm	715		
Fuel consumption g/kW.h	170		

(3) The JEMLZCZ120M Bus and the Gas Engine for Buses

The engine is of the horizontal type and is mounted at the rear of the JEMLZCZ120M bus. Two gas tanks are installed below at the middle of the bus (see Fig. 12-2-7 and 12-2-8 below).

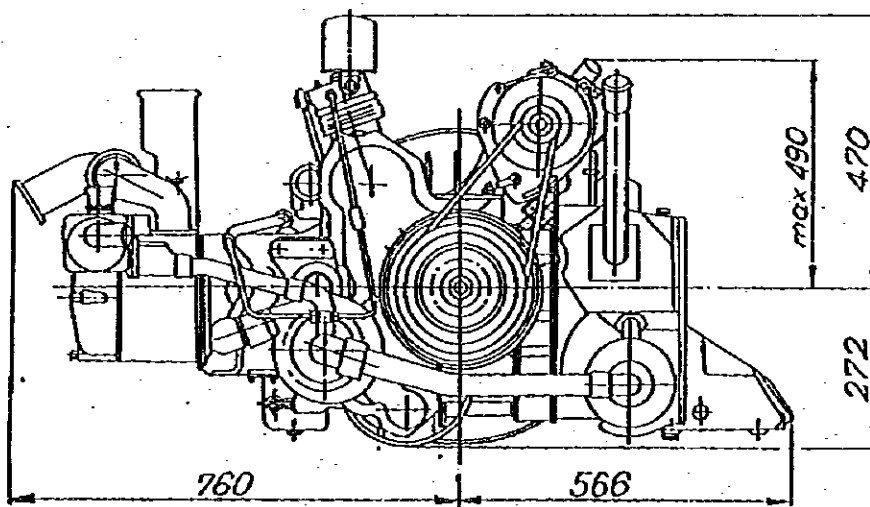


Fig. 12-2-7 The Horizontal MD111P2 Gas Source : Mielec Engines Co.

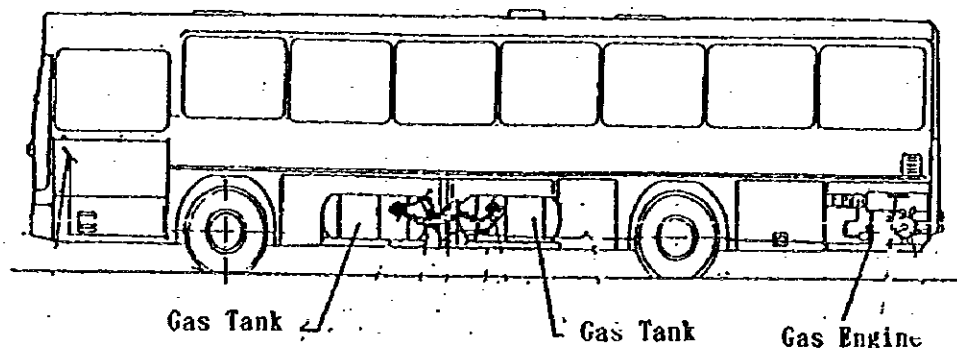


Fig. 12-2-8 The JEMLZCZ120M Bus Source : Mielec Engines Co.

(4) The MD111P2 Gas Fuel Engine

The MD111P2 gas fuel engine has been created by making the following improvements on the Company's present SWT11 engine:

a) Mounting of Sparking Plug on Cylinder Head

A sparking plug has been mounted at the combustion chamber at the bottom of cylinder head. The sparking plug is connected with the ignition coil by high-voltage wiring (see Fig. 12-2-9).

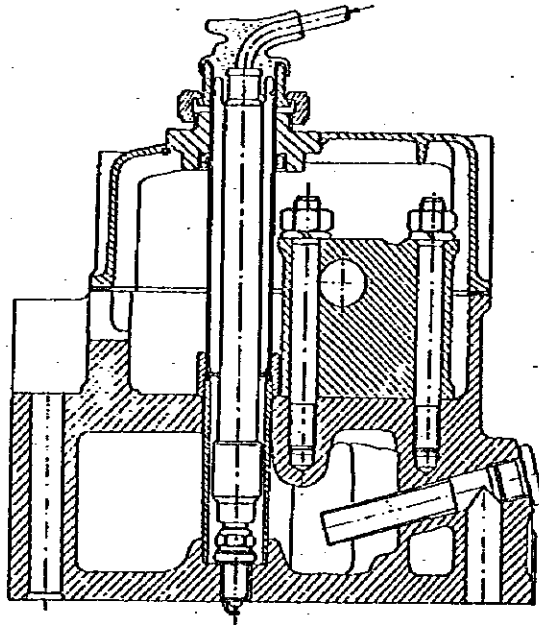


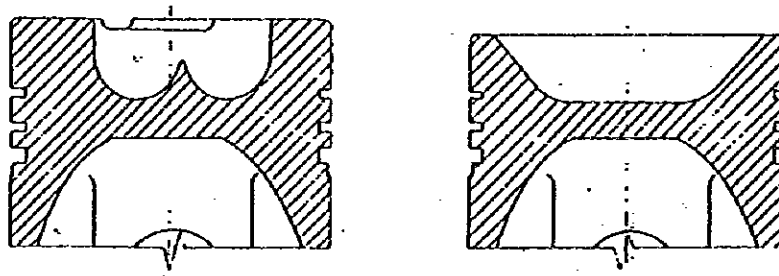
Fig. 12-2-9 Mounted Sparking Plug

Source : Mielec Engines Co.

b) Piston

The compression ratio of the LPG (Liquid Propane Gas) engine is 9, which is lower than that of the diesel engine, and the combustion chamber at the piston head is dish-shaped. Combustion noise is lower than in the case of the diesel engine because the lower piston compression ratio makes for lower maximum combustion pressure in the cylinder.

The compression ratio varies according to the type of gas used. In the case of biogas, it is about 11. For biogas, however, a desulfurization device is needed (see Fig. 12-2-10).



diesel
ε-16

LPG
ε-9

Fig. 12-2-10 Shape of Piston Head
Source : Mielec Engines Co.

c) Mixer

A mixer for obtaining the specified air/gas ratio is installed at the top of the intake manifold (see 12-2-11).

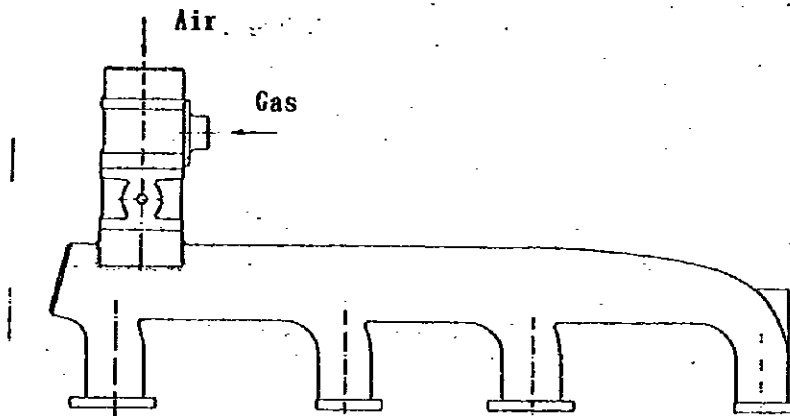


Fig. 12-2-11 Mixer
Source : Mielec Engines Co.

d) Other Improvements

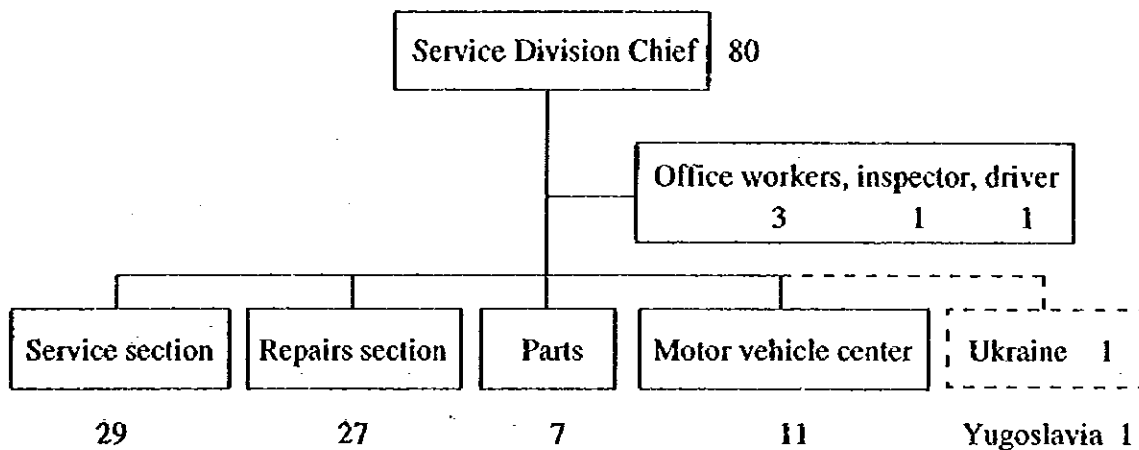
In addition, there is a throttle for control of engine speed in linkage with the driver seat acceleration pedal.

12.2.5 Service, Maintenance, Repairs, Parts Processing

About 30% of the Company's turnover is accounted for by servicing, maintenance, repairs and processing of parts. Its profitability in those areas is also high: 40-100% for servicing parts and 30% for parts processing.

(1) Service, Maintenance and Repair System

The Company's service system employs a staff of 80 persons as per the following organizational chart:



- For domestic service activities it has three bases: the Company district base, the northern district base and the western district base.
- It also sends personnel outside the country to the Ukraine and Yugoslavia for repair work.
- The period of guarantee for engines is one year or 100,000 km, and that for repaired parts is 50,000 km.
- It receives information on claims by fax and dispatches personnel within 24 hours in urgent cases and within one week when there is no great urgency.
- Recent major claim problem: There was recently the problem of burning of the cylinder head gasket of the SWT11 engine, the reason being cylinder head residual casting sand.
- As in Japan, the compensation in cases in which vehicles go out of operation is based on the "out-of-operation guarantee."
- The ratio of repairs with charges and gratuitous repairs is 3:1.
- In the past the retail stores for products of the Company Group were in "special economic zones", but it is going to establish them outside the plant because of too high expense.
- It also have service for construction equipment, providing that for the French manufacturer IKARVS as well.

(2) Parts Processing

- At the Company they do parts processing for others on a commission basis, the profitability being an extremely good 30%.
- The number of different parts is about 1,000. For instance, machining of such engine

parts as rocker arm assembly flanges is done by orders from the Company's sister company "WSW ANDORIA". (Fig.12-2-12)

It uses its idle turret lathes for machining of small bolts. It does such work as cutting from round bars, thread cutting and cutting off of ends.

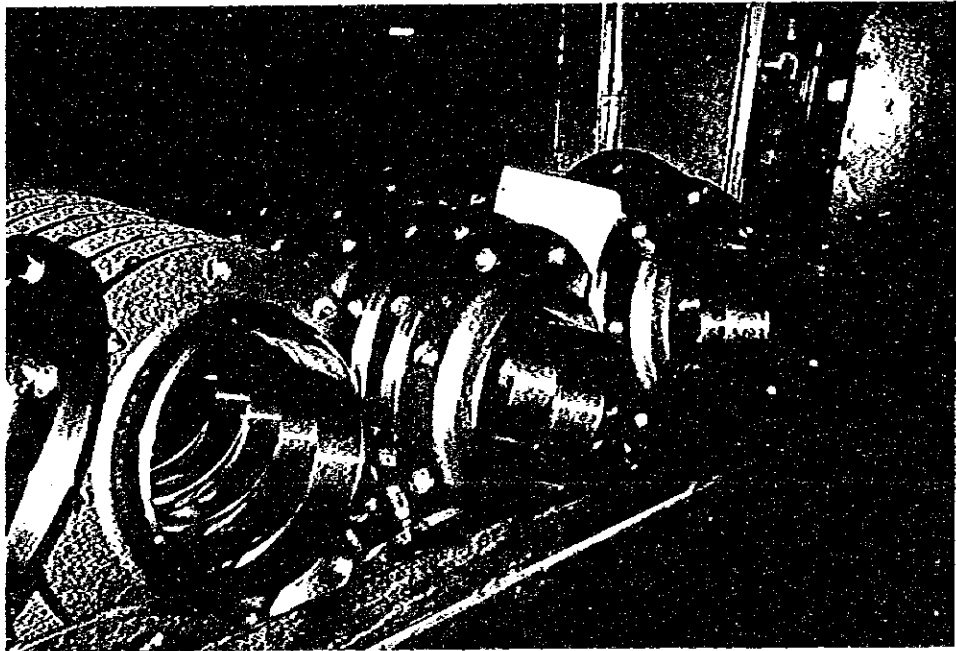
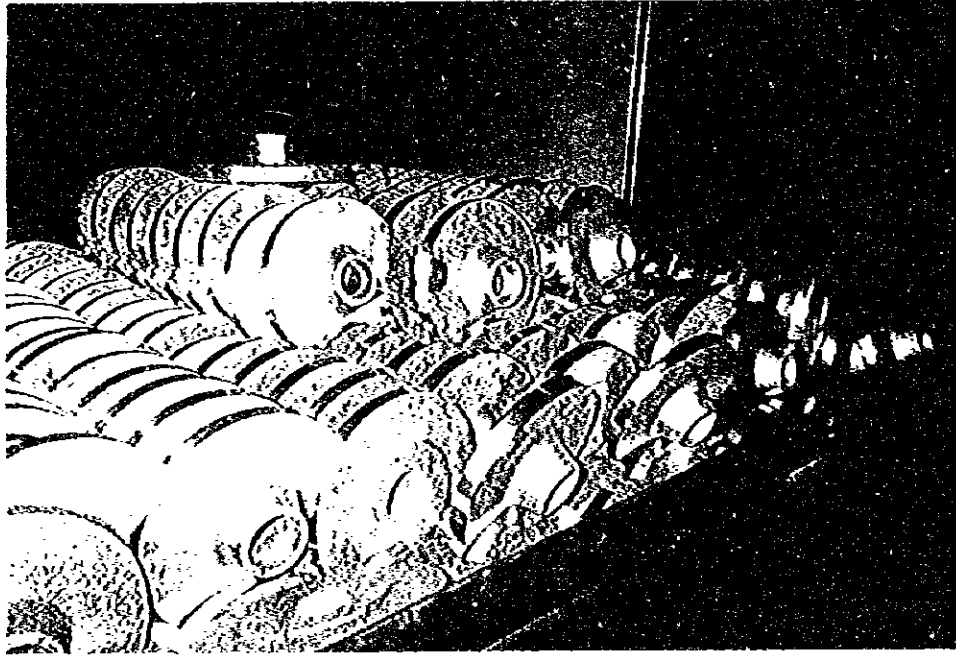


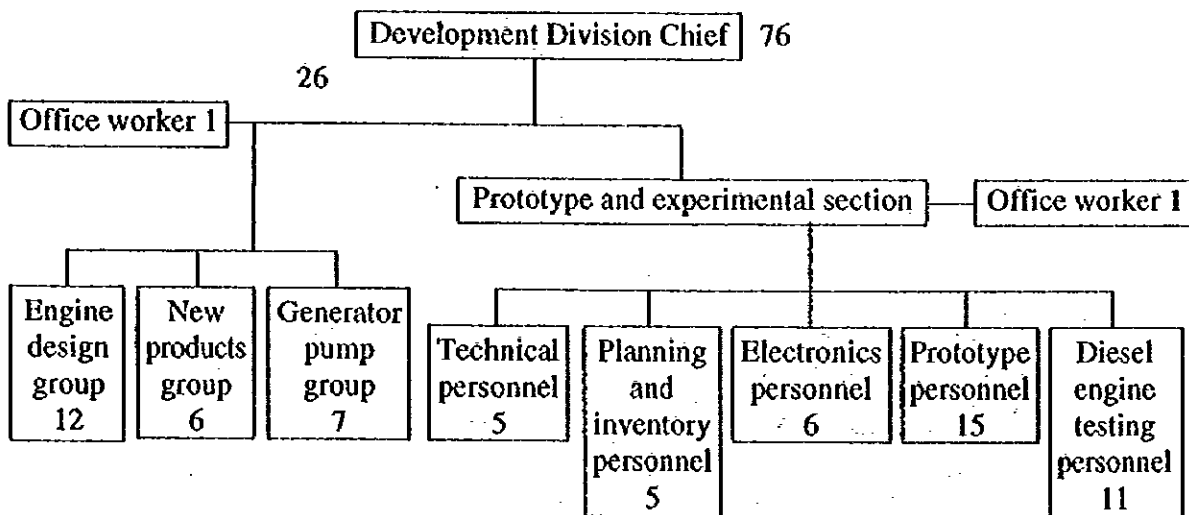
Fig. 12-2-12 Manufacture of Frange and Rocker Arm
Source : Mielec Engines Co.

12.3 RESEARCH AND DEVELOPMENT

12.3.1 Research and Development Organization and System

(1) Research and Development Organization

The Company's research and development organization consists of a staff of 76 as per the following chart:



a) Design Groups

- Engine Design Group

Of the staff of 12 in this group, 4 are project leaders. They are in charge mainly of design concepts, finding of ideas, setting of testing conditions, witnessing of testing and judging the results of testing. A parts diagram is dispensed with here.

- New Products Group

With a staff of 6 it is presently carrying out the ambulance design work.

b) Prototype and Experimental Section

- Technical personnel: From design to liaison work and preparation of tests.
- Planning and inventory personnel: Arrangements concerning internally produced and externally produced parts of prototypes and keeping of delivered parts.
- Electronics personnel: Mainly management of electronic control and electronic measurement of generators.

c) Others

The personnel of the Development Division (design, prototypes and testing) have a long average work experience of twenty years.

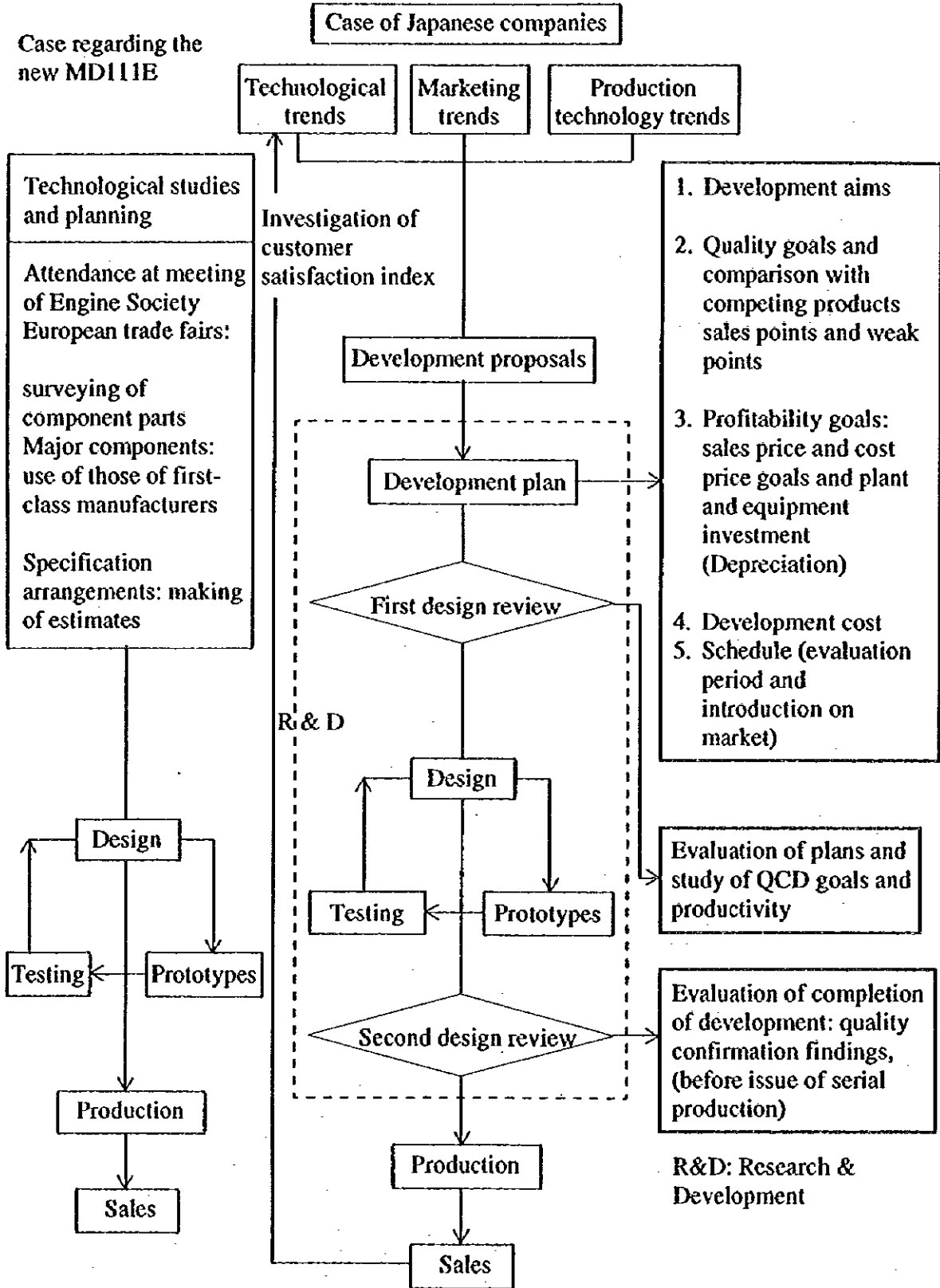
There is no separate development management (development planning and follow-up) or technology management (management of standards, patents, information, etc.) division.

(2) Development System

There is no great difference between the development system presently being implemented by the Company and that of Japanese companies.

The following is a comparison of the case of development of the new MD11E engine and the development systems implemented by Japanese companies.

Present situation of the Company



a) **Present Situation of the Company**

- . It does not carry out preparation and approval of development plans or design reviews. Development problems are handled separately, but there is no development system embracing the whole company.
- . Procedure concerning prototype expenses: Products produced externally are approved by the company official in charge, and those produced within the company are approved by the head of the development division.
- . They are slow in implementation of design management according to ISO 9001. The details concerning that are given in the section concerning state of progress regarding ISO 9001.

12.3.2 Research Facilities

(1) The Company's Research Facilities

- 1) Test cells: 8
- 2) Dynamometers: hydraulic dynamometers
- 3) Exhaust gas measurement devices
- 4) Combustion analysis devices
- 5) Vibration testing machine 6) Injection pump testing stands: 6

(2) Utilization of Research Facilities Outside the Company

- a) **Krakow Institute of Technology**
 - 1) Combustion testing device
 - 2) Air intake swell measuring device
 - 3) Piston temperature measuring device
 - 4) Cylinder internal pressure measuring device
 - 5) PM Measuring Device (Dilution tunnel type)
- b) **Aircraft Research Institute**
 - 1) Low-temperature testing room (-60°C) 2) Noise testing room
- c) **The Company Group WSK Facility**
 - 1) Material analysis 2) Chemical analysis

(3) Task: Modernisation of the Company's measurement devices and equipment (e.g. introducing electric dynamometer, etc.)

12.3.3 Outside Technical Support System

In its engine research and development work the Company's research and development division receives the following outside technical support:

(1) **Krakow Institute of Technology**

The combustion testing of the new MD111E engine was done at Krakow Institute of Technology with the following results:

- The "EURO-2" European exhaust gas controls were cleared.
- Fuel consumption was improved from 165g/PS/h to 150g/PS/h.

Prof. Zaboroski of the Krakow Institute of Technology comes to the company once a week to lead a study session. He told us that he had visited the Company about 1,200 times.

(2) **KBN (National Scientific Research Committee)**

Of the 1.7 million zloty (68 million yen) development cost of the new MD111E engine, 40%, or 680,000 zoly was provided by the KBN as support funds.

(3) **Other Support**

The Company also used the Aircraft Research Institute and the the Company Group WSK research facilities as well as having relations with Rzeszow University.