JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
MINISTRY OF THE ECONOMY
THE REPUBLIC OF POLAND

THE STUDY ON RESTRUCTURING PLAN OF ENTERPRISES CONTROLLED BY THE STATE IN THE REPUBLIC OF POLAND

FINAL REPORT

MARCH 1997

SYES CO.,LTD.

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PREFACE

In response to a request from the Government of the Republic of Poland, the government of Japan decided to conduct a development study on Restructuring Plan of Enterprises controlled by the State, and entrusted the study to the Japan International Cooperation Agency(JICA).

JICA sent to Poland a study team headed by Mr. Watanabe, SYES Co., Ltd and constituted by members of SYES Co., Ltd and International Development Center of Japan, from August 1996 to December 1996.

The team held discussions with the officials concerned of the Government of Poland and conducted a field study at the study area. After its return to Japan, the team conducted further studies and compiled the results in this report.

I hope that this report will contribute to the furtherance of the restructuring of Polish companies contorolled by the State and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to all those who paticipated in this study project for their close cooperation they extended to the team.

March, 1997

Kimio Fujita
President
Japan International Cooperation Agency

March 1997

Mr. Kimio Fujita
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Fujita,

Letter of Transmittal

We are pleased to submit to you the final report on the Study on the Restructuring Plan of Enterprises Controlled by the State in the Republic of Poland.

The study team has conducted this study starting July 1996 through March 1997 under the contract with JICA. The study team has made recommendations to the Polish government and enterprises controlled by the state in Poland based on our experiences obtained during the restructuring program for PZL-Mielec Engines Co. which was chosen as a model enterprise.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of International Trade and Industry. We also wish to express our deep gratitude to the Ministry of the Economy, PZL-Mielec Engines Co., and relevant organizations in Poland, the Embassy of Japan in Poland and JICA Austria office, for their assistance and advice.

Very truly yours,

Akira Watanabe

Akira Watanabe
Team Leader
Study Team for The Study on the Restructuring plan
of Enterprises Controlled by the State in the Republic of Poland
SYES Co., Ltd.

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Part 1

Achievements and Recommendations

1 Introduction

1 Introduction

1. 1 Background of the Study

At the 2nd East-West Industry and Trade Ministers Meeting, held in April 1993, Japan declared that for the sake of providing support for privatization of state enterprises of Eastern European countries it would undertake restructuring studies (enterprise diagnosis and preparation of restructuring plans) with respect to representative state enterprises of main sectors of industry as model enterprises. Furthermore, at the 3rd such meeting, held in May 1994, Japan promised support for preparation of comprehensive restructuring plans for model enterprises selected for promotion of enterprise reform.
Under this circumstance, the Japan International Cooperation Agency(JICA) and the Ministry of Industry and Trade (the Ministry of the Economy as of after January 1997) and the PZL-Mielec Engines Co. (hereafter referred to as "Mielec Engines Co., or the Company)" undertook the study on restructuring plan of enterprises controlled by the state in the Republic of Poland. The Minutes of the Study was signed in March 26,1996. The Japanese study team was formed in July 1996 to conduct this study.

1. 2 Purpose of the Study

The purpose of the study is to provide suggestions for contributing to promotion of restructuring of a Polish state owned enterprises, Mielec Engines Co. which has been selected as the model enterprise directly covered by the study. The Polish Government is to take the necessary steps for applying the suggestions made concerning the model enterprise to state enterprises in general that are of a similar nature and that have the same kinds of problems.
One of the reasons for selection of Mielec Engines Co. as the model enterprise is that the area in which it is located (the Mielec area) is a "structural recession" area with a high rate of unemployment that has resulted from reorganization, after collapse of the Soviet Union. The area was a sole center of Polish aeronautical industry which employed some 20,000 workers before the present reforms were initiated.
The Polish Government has designated that area as a special economic development zone and is making efforts for its vitalization.

1. 3 Achievement of the Study

The study was focused on the following basic policies.

(1) Improvement of the plant line, as a breakthrough for the restructuring plan. (Bottom-up innovation)
(2) Technology transfer for the development of the new diesel engine, as a key factor for the restructuring plan. (Technological innovation for the Company's core product)
(3) Instruction on the formulation of the mid- and long term business plans and joint formulation by newly organizing a committee. (Top-down innovation)
(4) Proposing of restructuring plans for other state-owned enterprises and advicing for the government based on the experience obtained from the study on the model company.

Next four major achievements are summarized as follows:

1. 3. 1 Company-wide reform of attitudes and thinking through the improvement activities on the production lines

Instead of relying solely on technical guidance and technology transfer, the people involved in the work on the lines have been able to carry out improvements themselves and achieve positive results through these activities.
Achievements are summarized as follows:

(1) Two small improvement circle[1] teams were organized.
(2) The study team instructed groups with Kaizen[2] (improvement), problem-solving and QC methods[3] through OJT (On the Job Training).
(3) Both two groups innovated the existing production systems.
(4) The Preventive Maintenance was introduced for the first time for the Company,.
(5) The groups achieved immediate improvements of productivity by reducing the shortage of in-process inventory parts at the final assembly line and lowering the rate of machinery trouble by 50%.

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[1] The original term for this kind of team is names the QC Circle. It is a small group to perform voluntarily quality control activities within the same workshop. This small group carries on continuously as a part of company-wide quality control activities, self-development and mutual-development, control and development within the workshop, utilizing quality control techniques with all the members participating.

[2] There are two method of the productivity improvement.; the technical innovation and Kaizen. The technical innovation is carried out by introducing new technologies and new facility investment which is planned, studied and implemented by engineering specialist. The degree of improvement is great but it is conducted not often.
Kaizen on the other hand is implemented by continuous improvement by circle teams of several kind, namely purely plant workers or engineering specialist. The cost of Kaizen is much lesser than the innovation and its output is great due to its continuation.

[3] There are 7 tools for TQM. (Parato Diagram, Cause-and-Effect Diagram, Histogram, Control Chart, Check Sheet, Scatter diagram and Management by Classification)

(6) Output of the improvement activities were presented at the *Productivity Seminar.*

Among production lines with problems to be solved which were found as a result of the plant auditing, the engine machining and assembly lines were selected as model lines.
The improvement activities started with simple themes. However, a very basic change in the production method, i.e. reduction of the number of engines on the production line by 50%, was made on the basis of the enthusiastic support of all those involved. Since the plant people had never thought of that before, it took a great deal of courage and resolution for them to undertake it. Furthermore, it was demonstrated that productivity can be substantially raised by introduction of maintenance activities that hitherto had not been considered. It was found that the method can be applied to other state enterprises of different manufacturing industries in Poland.
The leaders of the team who organized such improvement activities have made it very clear that they are firmly resolved not to go back to the old ways of doing things.

The top managers and all employees appreciate that the activities triggered reform in attitudes and thinking throughout the company. In that way the study team and the people at Mielec Engines Co. have been able to make a major break through in the task of restructuring the enterprise.
At the outstart of the study, the team was not at all confident that the people on the lines would themselves form circle teams and undertake improvement activities on the basis of our suggestions. It took three weeks until such activities on the lines were formally accepted by the Company. At first, the labor unions had their doubts about the study team's restructuring plans, but once they came to understand the aim of such restructuring, they assumed a cooperative attitude. It is almost certain that, the activities could not materialized without understanding and cooperation of the labour unions.

The positive results of the team activities were announced at the productivity seminar which was chaired by the company president and held at Mielec Engines Co. on December 3 1996. Unlike the usual case in seminars, the recipients of guidance instead of those providing the guidance played the main role. Many guests were invited to the seminar, including representatives of the Ministry of Industry and Trade, the Japanese Embassy, related universities, the parent company and the press. Both the audience, i.e. company employees, and the guests were very much impressed.

The major significance of the above-mentioned activities can be said to lie in the following two points:

(1) The first step toward enhancement of the international competitiveness of state enterprises in the present market economy is improvement of the quality of present products and productivity regarding them. The activities in question are based on that

basic consideration.

(2) Reform of the attitude and thinking of employees has been accomplished as a result of their experiencing the positive effects of such improvements. The team will present proposals for continuation of making of improvements so as to lead to development of a company-wide movement of "self-restructuring."

1. 3. 2 Formulation of a Restructuring Plan and Mid- and Long-Term Plans

Proposal presentation of a restructuring plan was the main theme of the study and was meant to lead to reform and improvements concerning top management in response to improvement activities on the plant lines, and therefore the present study is characterized by the following three points:

(1) Formulation of mid- and long-term plans (3-year plans and 5-year plans)
For the following reasons, the study team considered that the mid- and long-term plans should be formulated as the basis for management of the company:

① The mid- and long- term plans are basic necessities for the strategic business planning.
② Such plans help the Company adapts to changes of environmental factors.
③ Such plans provide future visions and goals for the company.
④ Such plans may enhance new product development.
⑤ Such plans add greater challenge to the Company's financial strategy.

The study team presented the Company a plan which up to now has had only annual plans, with a concrete draft plan, affected the stance of the Company for their positive participation in the formulation of the restructuring plan. At the final stage of the Study, the Company formulated a draft plan of its own.

(2) Features of the proposed planning method
The presented restructuring plan aims at a market priority strategy. Furthermore, the studies and diagnosis concerning restructuring are from an external environment viewpoint which is tailored to Polish enviroment as opposed to general company diagnoses, in which the viewpoint is an internal viewpoint.
The method is that of obtaining the "key success factor" (KSF)[4], i.e. the possibility of winning in market competition from the external environment, the market competitiveness of the company's products, the company's adaptation capacity, etc. and setting the allocation of company resources and the departmental goals within the company and formulating the action plans for implementation of such KSF.

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[4] KSF is the factor which are most critical for a particular product and / or services in the market. KSF may relate to product function and cost according to the stage of life cycle of products.

(3) Financial Planning

The premise for financial planning is that of using cash flow[5] as an assessment measure, introducing borrowing, which has been avoided up to now, and undertaking became clear that they had not had mid- and long-term plans before not for abstract reasons but simply because they did not have the specific necessary techniques and know-how. active leading In the present case the company's own proposal, consisting primarily of immediate joining of the Mielec special economic zone scheme and allocation of the funds results from the various tax exemptions obtained thereby, has emerged, and the company is making a switchover to an active financial policy.

The Company is expected to be approved to join the Area by maintaining six monthes 15% increase of revenue in 1996 fiscal year over the revenue in1995.

The study team presented three scenarios in terms of simulation data, and a restructuring committee was established, resulting in lively discussion on the basis of which Mielec Engines Co. has selected Scenario 1, the most active alternative of the three, as the basis for its own restructuring plan. And the Company has explicitly indicated that it will set goals for the different departments within the company on the basis thereof.

The study team undertook risk analysis and investment effectiveness evaluation concerning Scenario 1 of the three scenarios proposed by it for presentation to the company and is of the opinion that in view of the considerable flexibility and possibilities of the goals of Scenario 1 there is high probability of achievement of the plan by the year 2001.

Still to be undertaken, however, are a study of the feasibility of achieving the goals and construction of a management system. Five state enterprises in the motor vehicle field in Poland and Hungary were visited for case studies to be used as a basis for objective evaluation of the above-mentioned restructuring plan. Many of those enterprises have undertaken restructuring on the basis of their own resources and efforts and therefore served as references for the study team's proposal on the basis of which it has been possible to verify its validity.

The restructuring planning techniques will be presented at the business management seminar which is planned to be held on March 3 1997 so as make it possible for other state owned enterprises in Poland to benefit from such experience.

In summary, following outputs are obtained:

① The Company started the restructuring committee meeting to study the mid- and long term plan of their own.

② The study team transferred a planning methodology to meet Company' needs.

③ The Company turned to take the challenging financial strategy.

④ Some problem areas in marketing, product, planning, investment planning and cost control etc. are clarified for improvement

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[5] Cash flow is defined as the following formula.
Cash flow = net profit + depreciation - dividend and profit bonus for employees

1. 3. 3 Technology Transfer Concerning Engine Design

In this study emphasis has been placed on technology transfer concerning specialized design technology. The study team has placed development of a new engine for meeting the EURO-3[6], new European exhaust gas standards, as the main theme of the restructuring plan. At the time of the second field study, Mielec Engines Co.'s top management and the development department assumed an active posture regarding development of such a new engine.
In response to that, the study team undertook detailed transfer of technology and know-how regarding structure, design standards, testing standards, etc. through on-the-job training.

The following were undertaken for that purpose:

(1) Design measures were studied by dismantling competitor engines by the tear-down method[7] for comparison with the company's parts and the design review[8] method.

(2) Technology transfer concerning cases of engine design by Japan's main diesel engine manufacturers, the technology for meeting future exhaust gas standards, the latest technology papers published in leading countries, etc. was undertaken in the form of seminars and design reviews.

(3) The study team twice invited Professor Zabrocki of the Krakow Institute of Technology, one of the leading figures of Poland's Internal Combustion Engine Society, to the company, and visits were also made to that university for the purpose of receiving guidance from him and the staff. The company has already had a close relationship with that university for many years in the context of which it has received guidance from it and is working hard for continuation of promotion of such cooperation between industry and the academic world. In addition, it has also requested cooperation of Professor Lejda of the Rzeszow Institute of Technology.

Ordinarily such technology transfer regarding specialized technology is accomplished by enlisting the services of several renowned research consulting companies in Europe , but, nevertheless, the technology transfer accomplished by the study team has received high evaluation by the additional side as having been of great help in practical terms.
Improvement of development management technology is another important task that the company is faced with, and much is expected of its present efforts for acquisition of ISO 9001 certification. However, its development department has been late in starting the necessary work for that purpose, and therefore the study team has made proposals for making institutional improvements for the purpose of solving the problems that have caused such delay.

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[6] European engine exhaust gas emission control regulations under proposal which is expected to be effective in 1999 or 2000. Since they require stringent reduction of Nox and PM, they affect engine designs significantly.

[7] It is a tool of the Value Analysis. Products of its own and of competitor's are disassembled to compare and analyze design features in pursuit of finding design change proposals for cost reduction.

[8] It is a method of the system engineering to review a package of design drawings, technical specifications and other documentations of the product by expertise of different and relevant fields as invited at the design review meeting. Design review are conducted several times at different stage of the product development processes.

1. 3. 4 Proposals to Polish State Enterprises and Industries in General and the Polish Government

Another special feature of the study is its comprehensive scope of view. Three approaches have been in formulating proposals.

① Macroscopic study

A study team's specialist, primarily in Warsaw, undertook activities to study centering on macroeconomics, privatization, industrial policy, the motor vehicle industry sector, regional industrial development and economic conditions in the Mielec zone, etc.

② Microscopic study

In addition, the study team analyzed various information based on Mielec Engines Co.'s experience in promotion of restructuring and information collected in visits to government agencies, other enterprises, banks, and universities and on the basis thereof, made proposals applicable to Polish state enterprises in general and to Polish government agencies. To broaden its perspectives, the study team also visited other European international aid organizations in UK, Germany, EU, and Hungary.

③ Domestic study

Japanese experience in industrial policies such as enhancement of facility investment, R&D, export, and special functions of government are studied and compared with corresponding features in Poland to formulate recommendations.

As a result, proposals are focused on the following:

(1) For state-owned enterprises

① Restructuring efforts to improve and innovate the corporate management, marketing, technological competitiveness of product, productivity, and manufacturing engineering.

② Formulating mid- and long-term plan and the future vision.

③ Minimum but continued investment for modernization of products and production facilities.

④ Utilization of existing benefit provided by the government

⑤ Not relying on any kind of artificial price mechanism. (For example, devaluation of the Polish currency exchange rate for exporting)

(2) For government

① Exhibit of leadership at the national level

It is recommended that government undertakes and promotes programs to enhance vitalization of corporation management and entrepreneurship.

Establishment of a national-level award such as the President's award, or the Baldrige Award in the US is recommended. The Baldrige award was promoted by a Public Law which mentions foreign competition as the major rationale. No other business prize or development in managing theory can match its impact. There are similar in Brazil and Japan.

② Formulation of the grand plan and its strategy for the industry sectors, using this proposal for the automotive industry as an example,
The recommendation is applied forwards the promotion of the whole industry rather than direct support for individual companies.
Proposed issues for government review are :

a. The structure of automotive industry, in particular enhancing automotive parts and engine industries.
b. Infrastructures such as highway construction[9] and urban traffic.
c. Transportation and distribution of goods
d. Energy
e. Environment assessment
f. Globalization, overseas marketing and trade

The strategic positioning and the role of Polish automotive industry in Central Europe and its Eastern market including CIS, is the most crucial issue.
In this regard, the study team has asked the Polish government to collect and analyze more information and statistical data to facilitate the formulation of future plans by Polish enterprises as well as foreign investors.

The team considers that for the study as a whole, the goals set forth in the inception report have been satisfactorily attained as per the above description, the following having been the factors that made it possible:

(1) The active posture and leadership of the president of the model enterprise.
- Throughout the period of the study he, as the counterpart of the study team leader, set aside about two hours every other day for interviews with him.
- He did not fail to attend any of the main reporting sessions and committee meetings for the purposes of the study and give instructions to the company employees at them.
- At the main conferences and particularly at the sessions of the steering committee in the Ministry of Industry and Trade, too, he committed the company to implement all of the study team's proposals and afterward did in fact do so.
- He furnished information concerning the company's management plans and financial situation that can be considered to be classified as confidential.

(2) Cooperation by all of the company's staff.
- In spite of the fact that they were busy with their regular duties, the counterparts of the seven members of the study team and all of the other employees at all levels of the company, which has a total staff of about seven hundred, received the study team and provided full cooperation with it.
- The study team was fully satisfied with all of the conveniences furnished it by the

[9] In five-year financial period ,i.e. from 1995 till the end of 1999, Poland is to receive a total of over ECU 1bn from this fund for infrastructure improvements. The first tranche of this loan, expected for 1996, is for ECU 65km, and will be allocated for transport infrastructure(including construction of the A-4 motorway).

company, including office facilities, transportation, communications, meals, etc.

(3) Cooperation by the company's labor unions.
At first the labor unions were very wary in view of the fact that the purpose of the study was restructuring, but as the study progressed, they received assurance that the purpose of restructuring was not labor intensification or reduction of personnel strength but rather vitalization based on respect of the people on the line as human beings and fully cooperated with the study.
Although the company has two different labor unions, it is one of the companies in Poland with the best labor-management relations, and that, too, was an extremely favorable condition for the study.

(4) Cooperation by the steering committee and the Japanese Embassy
- Participation from Warsaw in the productivity seminar at Mielec by the chairman of the steering committee of the present project and by the representatives of the Japanese embassy and their words of encouragement on that occasion helped to boost the morale of the company president and employees.
- The steering committee provided the study team with full cooperation in its survey visits to government offices and other state enterprises and banks, etc.

(5) The restructuring activities of the company itself.
The fact that the study team has not had to start from scratch but rather has been able to follow upon the restructuring efforts of the company itself since it was established in 1993 by breakup of the original enterprise.

(6) Setting of goals regarding restructuring.
The goals have been set not so much in terms of raising of productivity as in terms of strengthening of corporate competitiveness as the determining factor for survival in a market economy, and they are to be achieved not by downsizing but rather with retention of the present employees on the basis of the future goal of doubling turnover.
That is why the labor unions have been able to cooperate. Furthermore, although raising of productivity has not been the direct goal, in actual fact the improvements made on the production lines have served the purpose of rationalization with respect to productivity.

(7) Placing greatest importance on the actual production lines.
The idea of placing greatest importance on the actual production lines and respecting the human dignity of workers that is such an important part of the "culture" of Japan's production industry has been a big factor in the favorable reception of the study team by everyone at the company. It was also necessary, however, for the study team to understand and respect the strong degree of European individualism, rationalism and personal pride of Polish managers.

1.4 Remaining Tasks

(1) State of Progress

Table 1.4.1 summarizes the progress made with respect to the above three items in the two parts of the present study in Poland, which lasted 40 days and 30 days, respectively, in PDCA (Plan, Do, Check, Action) terms. Implementation (Do) of the improvements on the production lines has been completed, and it is in the "Check" stage, but the other two items are still in the "Plan" stage.

In principle, ongoing promotion of the project has been left in the hands of Mielec Engines Co. itself to be furthered on the basis of its own efforts.

If the present plans for acquisition of ISO 9001 certification are steadily implemented, that will serve as solid grounds or addressing the above-mentioned task. However, in general corporate tie-ups and other similar forms are necessary for effective acquisition of management know-how and control know-how, short-term technology transfer being of only limited effectiveness. Although the company what has been accomplished so far, suitable follow-up is also essential in order for the present study to bear real fruit. That being the case, the Polish side has expressed the desire for follow-up after the present study winds up with the Draft Final Report presentation in February and reflection in the Final Report as a result thereof.

Technology transfer with respect to the tasks "policy control," "Quality Functional Development" and "product planning and development process" has been accomplished by productivity and marketing seminars and other means, but there is a limit to the effectiveness of guidance in the form of seminars, it being necessary "to do and show" and "to have do and show" when it comes to concrete practical tasks. Policy control is the essence of Japanese-style TQM, but even in Japan in actual practice it takes 1-2 years for full implementation.

	State of progress				Remaining tasks
	P	D	C	A	
Improvements on the production lines	○	○	△	X	- Promotion of maintenance activities - Implementation of policy control - Horizontal development
Restructuring planning	○	△	X	X	- Total demand survey for sales projection - Improvement of accuracy of calculation of necessary plant and equipment investment - Construction and implementation of product development process - Establishment of permanent promotion system - Complete implementation of ISO 9001 requirements
Product development	○	△	X	X	- Carrying out of design reviews - Preparation of development study document - Implementation of Quality Functional Development - Implementation of concurrent engineering - Strengthening of research and development system

Table 1-4-1

Since adequate market data and analysis thereof are particularly necessary for implementation of restructuring plans, the stage of verification by the company itself has not yet been reached. That being the case, breakdown into implementation plans has also not yet been completed. Such things are now to be carried forward by Mielec Engines Co. by its own efforts. For that purpose proposals will be made for early reflection of the ISO 9001 system in the company's practical work and development of the necessary management and control arrangements.

(2) Strategic Business Planning for Mielec Engines Co.

The objective of the restructuring plan for the Company is to reform its corporate culture and reinforce its competence to become a major supplier of the diesel engines in the Central market by its own effort. However, in order to attain this goal and privatization,

simple practice of the restructuring plan is not sufficient enough. The strategic corporate plannning which consists of the marketing, product planning and strategic alliance must be studied even at the moment. The study team has discussed some topics of this subject with top management, yet no specific proposals have been raised from the team. In particular, the time has come to start to study the strategic alliance or potential investors, After the restructuring committee was organized, the company executive staffs seem to be active for studying this theme.

1.5 Structure of the Report

The report consists of three parts.
The Part-1 is about the study team's recommendations to the Mielec Engines Co., the Polish automotive industry and the government.
Chapter 2 brings forward issues of this study by reviewing environmental factors surrounding the model company.
Chapter 3 deals with the state of implementation of plant improvement activities, and Chapter 5 the restructuring plans which has been proposed to Mielec Engines Co. is explained as the main theme of the present study. They are considered in comparison with other state owned enterprises. Recommendations for the Company's business strategies are set forth in Chapter 6. In Chapter 7 proposals are made to Polish industry and the Polish Government, with the focus on the motor vehicle industry as a typical industrial sector to which Mielec Engines Co. belongs. Chapter 8 has been complied for reference purposes. It analyzes and presents the study team's experience as regards how it went about its work, how it communicated and other aspects of its work process in technical guidance and technology transfer in Poland, a country with a different culture, different customs and a different way of thinking than Japan, in order to be able to accomplish the output of the study as described in the preceding chapters.
Part-2 is about findings which the study team has obtained during first and second field surveys on the Mielec Engines Co. and on the macro observation of the environment around Mielec Engines Co. and Polish macro economy.
The information collected in the surveys of present conditions and seminar materials are given in the Part-3 as appendices.

2 The Environment Surrounding the Model Company : Mielec Engines Co.

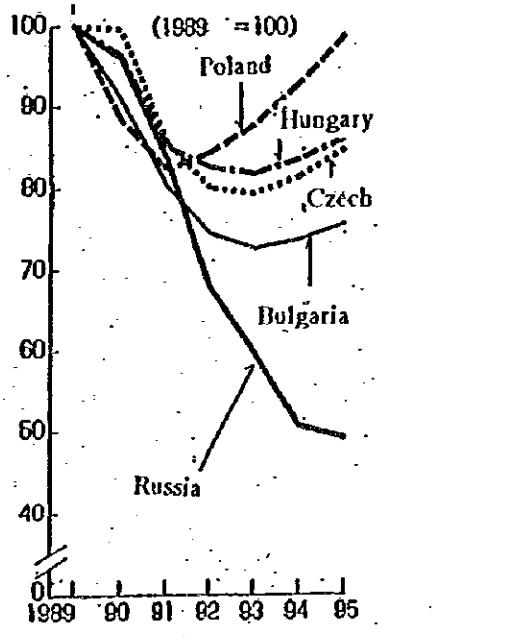
2 The Environment Surrounding the Model Company: Mielec Engines Co.

2. 1 Economic Environment Surrounding Poland

Poland is the first economy in post-communist Europe to have surpassed the level of GDP reached at the time of the fall of the communism in 1989. Poland is placed at the head of the recovery process, ahead of the Czech Republic, Slovakia and Hungary.
According to a recent study, Polish companies hold best fours among top best earning companies in central Europe. (Fig. 2-1-1, 2-1-2)

Poland has entered into the OECD, while entry into the membership of European Unions in 2002 is in progress.

Fig. 2-1-1 Poland

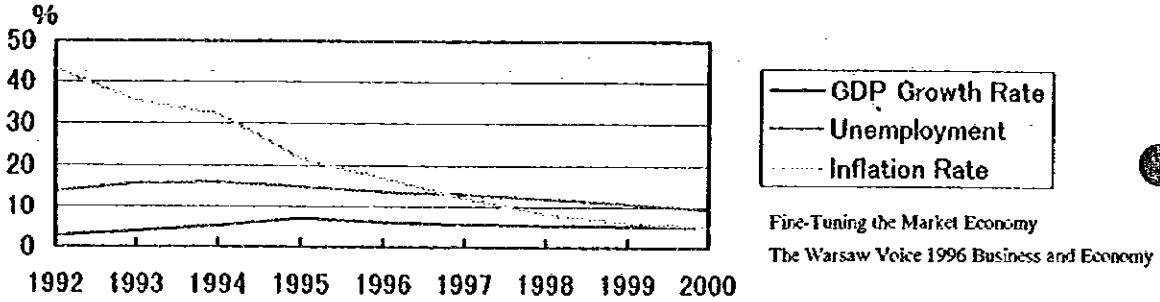


Source: A.Masuda, Nikkei Shinbunn,July,1996

Fig. 2-1-2 GDP Trend

Macroeconomic trend in Poland will bring GDP growth in 1996. The economic vision for 2000 is prospected to be favorable as shown in Fig.2-1-3.

The GDSP growth rates have maintained positive figures of 7.0 % in 1995 and forecasted to be 6.0% in 1996. It is prospected that it will be able to maintain 5.0 - 5.4% growth for the remaining years of the 20th century. Whether Polish economy might maintain the good growth or not depends on factors of export growth, the reform of the industrial structure, the privatization of state-owned enterprises and continuous introduction of foreign direct investment. However, it can be assessed that the Polish economy has the potential of realizing the GDP growth of more than 5% until the turn of the century and expand its size of economy 28%-30% bigger than the present one.



Fine-Tuning the Market Economy
The Warsaw Voice 1996 Business and Economy

Fig. 2-1-3 Macroeconomics Index

Since the beginning of 1996, the defficit in Poland's foreign trade has been growing steadily, a tendency which is arousing concern.

The fact that imports exceed export is not in itself a reason for concern. This attests to the continuing positive business climate in Poland, which is stimulating demand for imported products, especially supply and investment goods. From the point of view of development prospects this can be considered a positive phenomenon. However, what should be arouse concern is the steady decline in the rate of growth exports.

It is estimated that the rate of growth of imports in the whole of 1996 will reach 20-22% and that of exports 18-10%. However, despite the slowdown, the rate of growth or export is still high and typical of the best development countries. The liberalization of trade within the World Trade Organization as well as Poland's relations with the European Union and the Central European Free Trade organization (CEFTA) have helped prevent the decline in the rate of growth of Polish exports from becoming too rapid.

According to the data by Polish Agency for Foreign Investment, the foreign direct investment in Poland amounted to US$4 2.1 billion in 1995 and it has already reached to the figure in the first half of 1996, as compared to US$ 4.3 billion over the whole 1988-94 period. This is the reflection of the recent intensification of merger and acquisition by European and American large enterprises.

The privatization of state-owned enterprises will be further proceeded through the National Investment Fund's Program (Mass Privatization Program) in addition to the systems of privatization through Capital Privatization and Direct Privatization. The combination of these privatization methods will prepare the way for the privatization of big state-owned enterprises and those of financial sector and, by the year 2001, the private sector will amount 80-85% of GDP which is now about 60%.
As an example, Daewoo purchased 13% stock shares of Andoria from the 13th NIF (Yamaichi UK) in December 1996.

2. 2 Polish Automotive Industry and Market

2. 2. 1 Current Polish automotive industry overview

The Polish automotive industry, like other advanced automotive industry in the world has its own three basic industry structure, the basic R&D, assembling and parts industries of the self-sufficiency and self-completion. This industry feature is rather different from Asian NIES countries. However the problem is the lack of the world class technology, lower productivity and old production facilities.

Poland has the full-set automotive industry as follows:
(1) Motor car industry
(2) Truck industry
(3) Tractor industry
(4) Automotive engine industry
(5) Automotive mechanical units and components industry
(6) Automotive electrical-electronics units and components industry
(7) Automotive plastic-rubber equipment and upholstery industry
(8) Automotive overhaul industry

The industry structure looks as follows.

Polish automotive sector

State enterprises	50
Individual state treasury companies	12
Private companies	58
Polish	41
Foreign	6
Joint venture	11

Number of employees in the industry are 96 thousand.
Today Poland has 340 components makers , 260 of them are devoted to the auto industry.

Number of registered automobiles in Poland are:

Passenger cars	6,760,000
Vans	685,000
Lorries(Trucks)	550,000
Buses	85,800

According to GUS statistical data, passenger car production was 338,000 units in 1995, which represents a 34.5% increase over the year before. The figure for 1996 up to September is 329,000 units, for a 19.2% increase over the same period of the previous year.
In Poland, its automotive domestic demand has been prospected to be doubled according to several studies. Fig.2-2-1 shows the past and projected output of cars in Poland reported in recent Wall Street Journal.

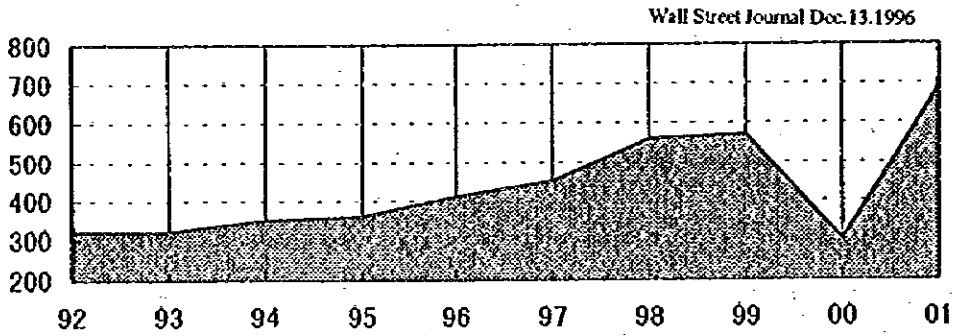


Fig. 2-2-1 Past and projected output of cars (x 1000)

2. 2. 2 Polish automobile industry in the Central Europe

Next Fig 2-2-2, 2-2-3 are good indications that the Poland is leading in the automotive industry in the Central Europe at present.

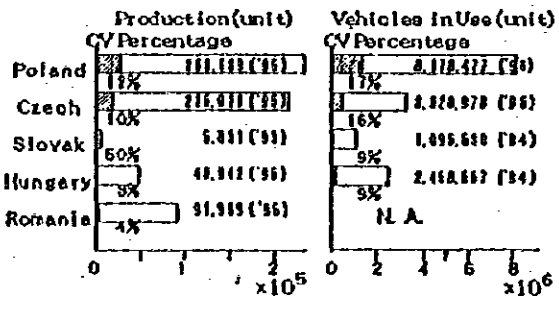


Fig. 2-2-2 Auto statistics in Central & Eastern Europe

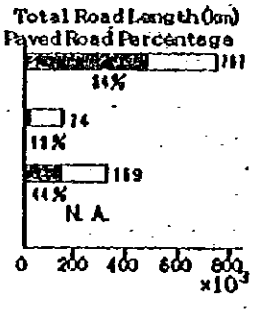
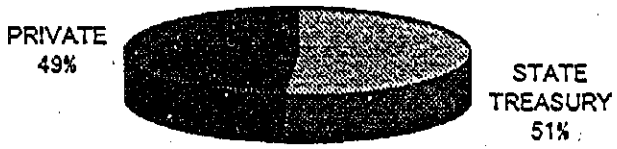


Fig. 2-2-3 Comparison of road conditions

AUTOMOTIVE INDUSTRY IN POLAND

Fig.2-2-4 OWNERSHIP STRUCTURE (A)



OWNERSHIP STRUCTURE (B)

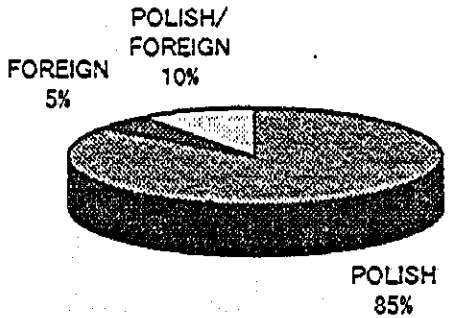


Fig.2-2-5 EMPLOYMENT

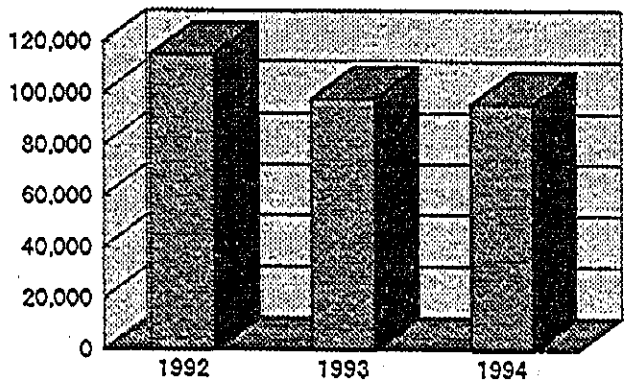
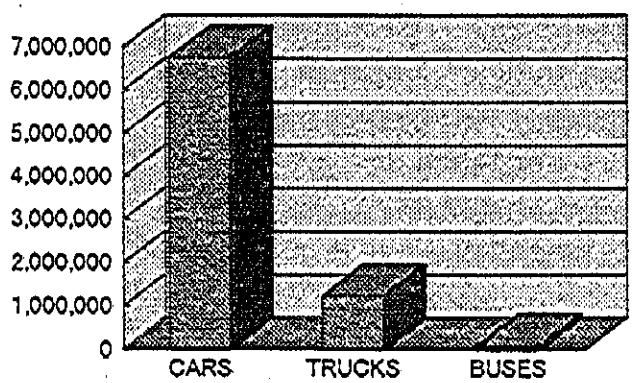


Fig.2-2-6 MOTOR VEHICLES CURRENTLY OPERATING IN POLAND



Source: Polish Agency for Foreign Investment,1996

Since current Poland is in the process of joining the EC in 2002, Poland is directing to the Western Europe's market which is matured and saturated. Yet Poland could be a supplier of entry level cars and automotive parts to the Western Europe. However, the future potential market would be found in the Polish domestic market, the Central Europe and the CIS(Commonwealth of the Independent States) which could be the last automotive markets where future high growth rate is expected as other markets like China and India. (Table 2-2-1, 2-2-2)

Fig. 2-2-4, 2-2-5, 2-2-6 show major data on the Polish automotive industry.

(UNIT:1,000)

	1993	1994	1995	1996	Average Growth 1993~1996
World	33,015	34,803	36,467	38,521	16.7
Central Europe (includes CIS)	1,186	1,316	1,472	1,630	37.4
Czechoslovakia	133	159	191	238	79
North America	9,550	10,136	10,134	10,423	9.14
Asia ,Oceania	3,015	3,390	3,753	4,052	34.4
Central/South America	1,843	1,861	1,930	2,053	11.4
East Europe	11,324	11,656	12,459	13,369	18
Germany	3,063	3,001	3,128	3,310	8

Source DRI/Mac growhill,World Automotive forecast 1993

Table 2-2-1 World auto sales past and projected

(UNIT:$1,000)

	1993	1994	1995	1996	1997	1998	1999	2000	Average Growth 1993~2000
Czechoslov	133	159	191	238	289	315	355	375	182%
Bulgaria	15	25	41	53	63	79	90	98	—
Hungary	50	68	101	17	15	165	175	191	282%
Poland	224	237	264	294	329	375	421	455	103%
Rumania	40	50	63	69	87	94	101	108	170%
Yugoslavia	104	157	202	219	232	237	242	250	140%
Sub total	566	696	862	1,000	1,155	1,265	1,384	1,477	160%
CIS	620	620	610	630	650	660	700	720	16%
Grand Total	1,186	1,316	1,472	1,630	1,805	1,925	2,084	2,197	85%

Source : DRI

Table 2-2-2 Central European auto sales past and projected volume

In recent days, Poland is said to be a greatest automotive production center in the whole Europe. It could draw production from Western Europe. This idea is based on a recent increase in foreign direct investment for the Polish automotive industry. In addition Poland can supply well durable and high quality products to meet market sales in the West European countries with lower cost than EU products and with the comparable cost with Asian and Latin American products.

2. 2. 3 Foreign investors

During past year, Fiat and rivals from the U.S. and Asia have announced they will invest over $ 3 billion in Polish car production by the end of the decade. Over $750 million more has gone into vehicle-component manufacturing. Fiat Auto Poland, the top car-maker in Poland, produces only some parts and subassemblies and its major work goes to external auto-parts makers. FAP is trying to strengthen its contractors including Teksid Poland(aluminum and iron castings), Gilardini Poland (exhaust systems and mirrors) and Magnetti Marelli Poland and also encouraging other contracted domestic auto-parts makers for joint venture with foreign parts makers.
This year, the Fiat's Tychy plant factory will produce 200,000 super compact Cinquecento "city cars," 75% of which will be exported to Western Europe.The coperation with Fiat started in 1921 and it is a good example of a long term cooperation between Poland and a foreign partner. Waewoo plans to introduce modernized technologies into main factories in Lubullin,Warsszawa and Andoria and other 13 auto parts factories. It is estimated that Daewoo will take Fiat's first place in future.
Fig 2-2-7 shows major foreign investor's plants.

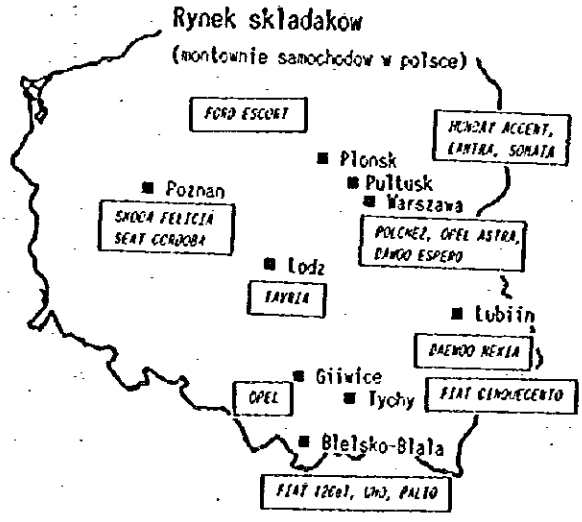


Fig. 2-2-7 Foreign Investor's Plants

2. 2. 4 Passenger cars

According to the estimates provided by the Research Bureau of the Sejm, by the year 2000 the total registered passenger cars will be 10 million and by the year 2010 - 15 million.
The Central Statistical Office states that the average number of residents per automobile is 5.7 . In Japan the figure is 3.5, yet the Polish figure is higher in the rest of many countries.
Table 2-2-3 shows major car manufacturers. Research carried out by the Penter Market and Opinion Research Institute shows that over half of Polish families have an automobiles, and 2% of them have two. This rather high propagation is due to imported used cars.

Name of makers	Unit	Share (%)
Fiat (Dmestic)	106,547	40.3
FSO Polonez (Dmestic)	68,993	26.1
Fiat (Import + CKD)	27,541	10.4
Opel (Import +SKD)	12,460	4.7
Ford (Import +SKD)	8,046	3.0
Renault (Import)	8,018	3.0
Peugeot (Import +SKD)	4,001	1.5
Skoda (Import + SKD)	3,855	1.5
VW/Audi (Import)	3,789	1.4
Daewoo (Import)	3,593	1.4
Others	17,036	1.4
Total	263,879	100.0

Table 2-2-3: Top10 Markers of Car Sales in Poland (1995)

2.2.5 Truck and bus of medium and heavy duty

Since Zasada group holds stocks of Jelcz and Autosan, 100% of Polish truck and bus companies are invested by foreign companies.
Table 2-2-4 show Polish truck bus companies. One industrial vehicle company is added because it is a customer of the Mielec Engines Co.

Company	Products	Installed engines	Mielec's share	Competitors
Star SA	Small, medium capacity trucks, Special military cross country vehicles	Scania		
Jelcz Automotive Works	Trucks, Truck tractors, Buses	Man, Detroit Diesel, M.Benz	35%	Styr, Star
Scania-Kapena	SAAB trucks, Low-deck bus, coaches	Scania, SAAB		
Autosan	Coaches, City buses, Low-deck buses	M Benz	15%	Andoria, Renault, Cummins
Volvo-Poland	Truck-tractors, coaches	Volvo		
The Factory of City Transport	City buses	DAF		
Huta Stalowa Wola	Industrial Vehicles			Cummiins, Caterpillar

Table 2-2-4

Table 2-2-5 shows sales volume of Mielec engines for domestic truck and bus makers.
Fig. 2-2-8 indicates the bus production in Poland.
Fig. 2-2-9 shows truck & tractor sales in Poland

	Customer	1993	1994	1995	1996
Engine	Jelcz	619	695	737	559
	Sanok	72	59	112	95
	Fadroma Wroc	71	67	92	12
	Stalowa Wola	213	218	178	134
	Inni odbiorcy	504	257	145	164
	Total	1479	1296	1264	964
Bus	Sanok	72	59	112	95
	Jelcz	217	223	239	162
	Total	289	282	351	257
HD Truck	Jelcz	80	263	382	397
Geneset	Large(WS)			30	
	Small(Deutz)			3	
	Total			33	

Table 2-2-5 Sales Volume of Mielec Engines Co.'s Products

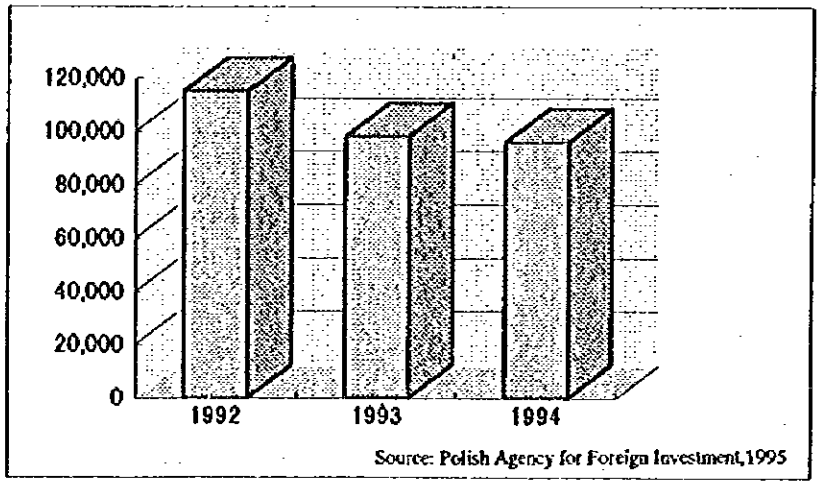
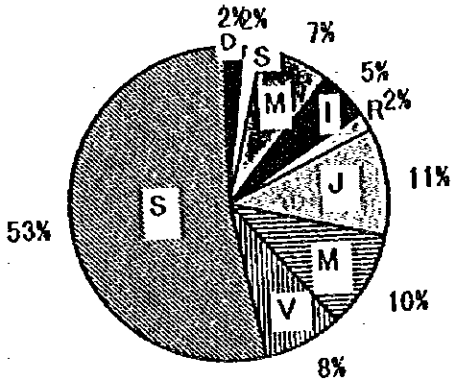


Fig. 2-2-8 Bus Production Poland

In the forthcoming five years, an additional 50,000 trucks (lorries),(7,000) buses will be needed.(From the report of PAIZ 1994)

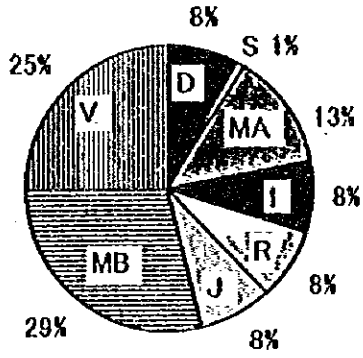
Truck Sales

1994

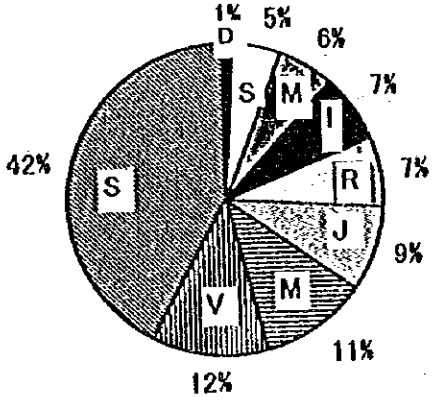


Tractor Sales

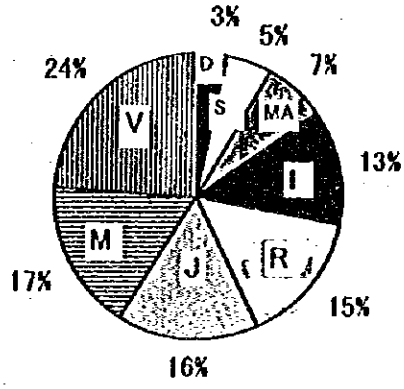
1994



1995



1995



DAF	D
Scania	S
MAN	MA
Iveco	I
Renault	R
Jelcz	J
Mercedes	M
Volvo	V
Star	S

Fig. 2-2-9

* Courtesy of Mielec Engines Co.

2. 2. 6 Diesel engines

Diesel engine production is in growing and Europe and Asian shares are higher than rest of region. (Fig.2-2-10)As far as the automotive and industrial engine production are concerned, it is mostly concentrated to the West Europe and Japan. (Fig. 2-2-11)
Among these volume, share in heavy duty diesel engines is small. Yet engines of around 10 liter are principal size among heavy duty class,
Also the world diesel engine manufacturers are limited in numbers. They are:

Japan: Suzuki, Hino, Mitsubishi, Nissan Diesel

Europe: Mercedes Benz, Deutz, Man, IVECO, Volvo, Scania, Leyland base; Mielec, DAF

US: Cummins, Catapiller, Detroit Diesel

China:

Other Industrial diesel engine manufacturers: Komatsu, Yammer, Perkins

Problems of diesel engine industry are:
Global over production capacity
Sales saturation in advanced industrial countries (Fig. 2-2-12)
Challenge to environment regulation countermeasures, High cost R&D
Most of heavy duty truck manufacturers equip engines of their own made.
There are no diesel engine manufacturers which exclusively make truck/bus engines.
In the US and in the Europe, trucks are assembled with different make of engines, power trains and axles according to customer's choice. This kind is not exists in Japan.

Source: Internal Combustion Engine,1987

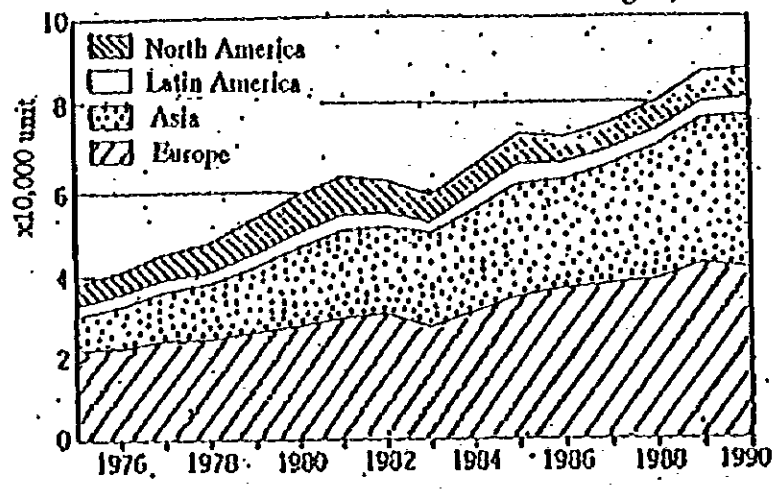


Fig. 2-2-10World Diesel Engine Production

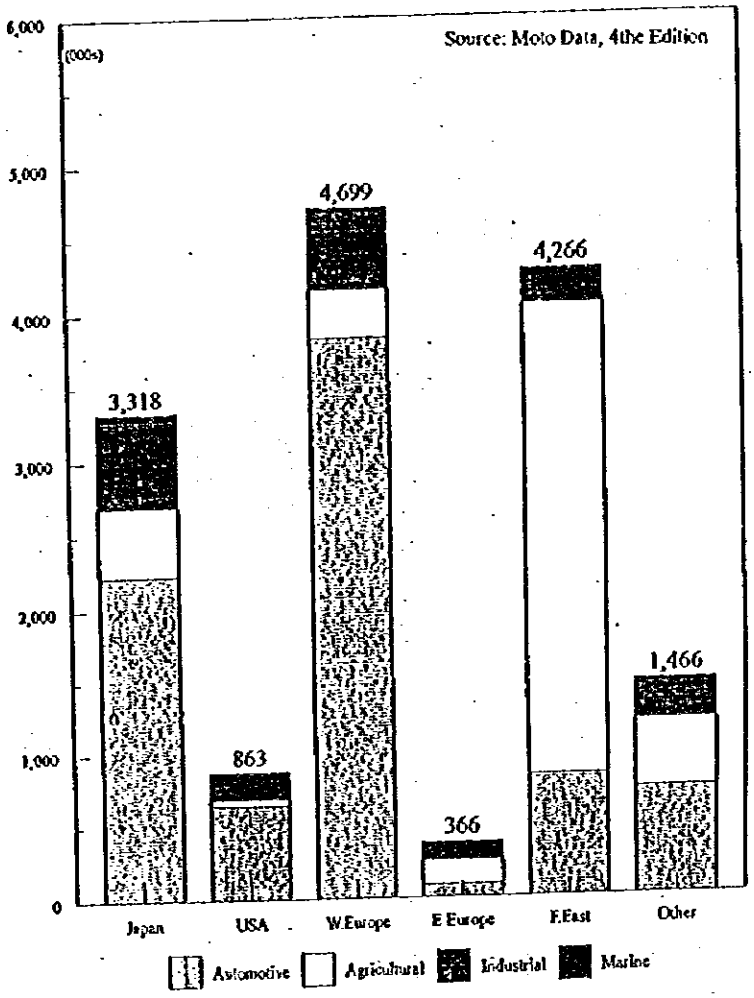


Fig. 2-2-11 1994 Diesel Engine Production by Application

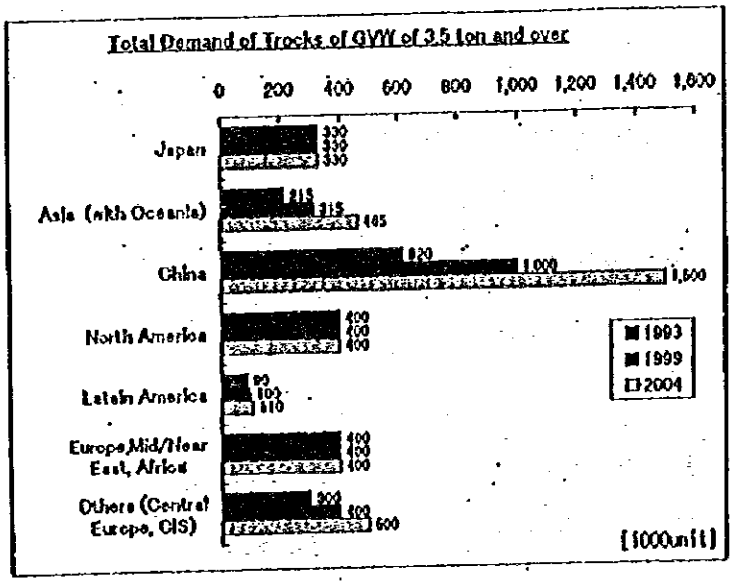


Fig. 2-2-12

2. 3 Euro-Park Mielec

2. 3. 1 Euro-Park Mielec

Euro-Park Mielec started it operation in early 1996. By the end of September 1996, twelve economic entities were granted permits to conduct activities in the zone. It is expected that by the end of 1997 investors will create 8000 work places. This number is likely to increase 1,3000 by the year 2000. On the basis of permits granted so far, the value of investments launched in the zone is estimated at over PLN 80 million. The first two investors listed in August 1996 will reach some 56M. Currently there are eight enterprises operating in the Euro-Park Mielec Special Economic Zone.
At the moment there are other two zones; the Katowice and the Suwalki Special Economic Zones. 6 or 7 successive special economic zones have been drafted.
Mielec Engines Co. will get tax exemption benefit by joining the Euro-Park. The plan will be discussed in Chapter 5 as an important condition for the restructuring plan.

2. 3. 2 PZL-Mielec Group

The WSK PZL-Mielec Co. the transportation equipment company is the parent company from which the PZL-Mielec Engines Co. was separated in April 1994.
WSK PZL-Mielec 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 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.
However, there were some negative legacies from the parent company as over-capacity production facilities and shrinked export market as a result of a fall of COMECON..
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 PZL-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 term of the amount of sales. (Based on the 1993 date)
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 WSK PZL-Mielec planned to transfer 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.
Even though there are some companies related to the automotive industry in the group like an Injection pump manufacturer, any distinguished advantage for the Company obtained from the group is not known to the study team.
Appendix 7, 8 show a structure and activities of the WSK PZL-Mielec group.

2. 4 Environment Around Mielec Engines Co.

The expected high growth of the Polish automotive industry will be a favorable factor for the Mielec Engines. However, there are several difficult problems to be solved

(1) Entry of foreign competitors
Membership for Poland in the EU may allow stronger competitors from the West to the Polish market.
There are too many competitors to the Mielec Engines Co. Liaz of Czeck, Man of Germany and DAF of Holland have plans to assemble their trucks in Poland.
It must be noted that there exsist in Poland is no 100 % Polish breed automakers except for Mielec Engines Co. There are only two automotive diesel manufacturers in Poland; Mielec Engines Co. and Andoria. However, Daewoo has purchased andoria's stock and will be the 75% shareholder in future.

(2) Market competitiveness of its business and products
Even though the Company's products such as the 11 liter diesel engine has had advantages in low cost and quick delivery to customers, probably within several years, the Company will lose these merits. Despite of the newly developed Euro-2 engine which will be put in the market this year, the Company's competitor's product performance, quality and product variance will exceed the Company's products. Reducing import tariff or complete exemption in 2002 will decrease the price advantage of the Company.

(3) Lowered export price competitiveness
Due to Polish currency exchange rate, profitability of export business is decreased. This tendency will be intensified when Poland joints the EU.

(4) Euro-3 emission control requirement
Euro-3 engine development is a heavy financial burden for the Company. Also R&D capability is serious problem to be solved.

(5) Concentrated stock holder
In September 1996, Bank of Lublin increased its stock share in the Mielec Engines Co. up to 48.8%.

(6) Domestic restructuring of the automotive industry
Zasada group is investing to the domestic bus and truck manufacturers. However the Zasada group is the best customers of the Company as well as a potential investor.
Jelcz as a start ,purchased 100% of the Mielec engines but the share is declining; in 1993, 81% and in October 1996, 68%. Even though, there are several advantages for the Mielec engines, Zasada is replacing them by Mercedes Benz engines.

(7) The domestic automotive parts industry is also exposed to severe competition from foreign

companies.

The production technology and productivity in the domestic automotive part industry are in behind of the world standards. Thus the Company purchased major engine components from Western European companies. The Mielec injection pump manufacturer which is a family company of the Mielec Engines Co. is no exception.

3 Plant Productivity Improvement Activities

3 Plant Productivity Improvement Activities

3.1 Production Management and Equipment Management

During the second study I gave advise to ensure that the results aimed at by Mielec Engines' production enhancement and improvement team are attained and that it will be possible to apply those results throughout the company. In the process of doing so, I handled items for which new technology transfer has become necessary as urgent proposal matters. The following is a summary of all that.

3.1.1 Production Control Activities

First of all, the layout of the cylinder block line is indicated in Fig. 3-1-1. As indicated in it, the cylinder blocks undergo 47 machining processes on lines A --> B --> C to become products that are sent to the engine assembly plant. The goals set by the improvement team with respect to those cylinder lines are the following three items:

(1) 50% reduction of the present in-process quantity of cylinder blocks from 60 a day to 30 a day.
(2) Reduction of present cylinder block line equipment downtime by 25%.
(3) Reduction of present cylinder block line machining time by 5%.

All three items were implemented during the period of my stay there, and they were able to attain the goals. The main points of the activities are described next.

3.1.1.1 Activities for 50% Reduction of In-Process Quantity

Fig. 3-1-2 shows the state of product in-process quantity on the cylinder block lines. The main reason for that figure of 60 cylinder blocks in process at a time was fear of delay in delivery because of frequent equipment trouble. The extent of such equipment trouble is indicated in Table 3-1-1 in terms of monthly achievement. As can be seen from that table, the monthly average number of times that trouble occurs is 12, and the monthly average time of duration of such incidents is 41 hours. That means that on the average trouble occurs once every two days, with an average downtime of 3.5 hours each time. That makes a trouble rate of 22.1%, and it is no wonder that that causes those on the production lines a great deal of worry. The reason for such a high rate is that they do only breakdown maintenance. During my stay there I therefore had them implement preventive maintenance, with regular shutdowns for detection and repair of anomalies before the trouble occurs. Fig. 3-1-3 gives a comparison of such breakdown maintenance and preventive maintenance. Regular shutdowns were implemented three times between Saturday, November 23, and Saturday, December 7, 1996. As for cylinder block production, machining time was measured by a time study, and a change was made to production of ten cylinder blocks each on lines A, B and C. It was confirmed that with ten cylinder blocks per line, that easily fit in with the amount of work time each day. The production that was

established is indicated in Fig. 3-1-4. Needless to say, the arrangement was such as to make it possible for all thirteen workers to help out, a change being made to work in two teams. As a result the in-process volume became 30 cylinder blocks a day. In other words, the improvement goal was attained.

3.1.1.2 Activities for 25% Reduction of Equipment Downtime

As explained in Fig. 3-1-3, the regular shutdown method was implemented starting Nov. 23, 1996, and zero equipment trouble was attain in the 2 week period up to December 7, 1996.The goal was sufficiently attained by that, but if identification of reasons for trouble are not sought in order to be able to establish countermeasures and make improvements, trouble will once again not be reduced. Thus, utilizing the process capacity analysis indicated in Table 3-1-2 for analysis, one sees that trouble is conspicuous for the equipment with provisional equipment numbers 22, 4, 9 and 6, and one notices that the trouble very often concerns bearings and packings. Now they are engaged in promotion of countermeasures at Mielec Engines. Fig. 3-1-5 gives a breakdown of the trouble by speciality, hydraulic and pneumatic accounting for 36%, and mechanical for 28%. Since that involves a high percentage of common parts and apparatus with comparatively high repetition, better results can be expected with future implementation of modificative maintenance.

3.1.1.3 Activities for 5% Reduction of Machining Time

Since all of the machining times before improvement were not measured, it is not clear whether or not there was a 5% reduction in the figures. The worker organization of 2 workers x 6 teams + 1 group leader was changed to two teams:7 workers x 1 team + 1 group leader and 4 worker x 1 team + 1 group leader, and it was made possible for all of the workers to help out when necessary. Therefore on-line inspection time was reduced. I am sure that it was possible to attain a time savings of at least 5%.

The team improvement activities thus attained very good results. Besides that, the "5S" campaign was also actively implemented, resulting in a much better work zone environment, including painting of machinery bodies, and in better discipline, too. The difference can be seen from the photographs by the comparison of the situation in Figures 3-1-6 and 3-1-7. During the second study period the content of the advice given was put in the form of a record for the sake of smooth development of improvement team activities, that record being indicated in Attached Papers 1-4 (which see).

3.1.2 Equipment Management Activities

It was recognized that equipment management was necessary for promotion of cylinder block line improvement, and implementation thereof was judged to be one of the most important tasks. Therefore I was in constant contact with the head of the maintenance department and those involved below him, giving various advice in pursuit of introduction and thorough

application of preventive maintenance. Since all of the details are to be found in the materials of the production improvement (productive maintenance) seminar held on December 3, 1996, only a summary is given here. I placed emphasis on innovating the attitudes of the senior staff of the maintenance department. Therefore I showed the maintenance development process in Japan as per Fig. 3-1-8 and explained it to them by picking up specific examples in Mielec Engines, thereby helping them understand. The second step, preventive maintenance, will now be implemented, but in the near future there will no doubt be implementation of productive maintenance. Next, as indicated in Fig. 3-1-9, four functions will be necessary for implementation of productive maintenance, i.e. repair, inspection & planning, maintenance & plant engineering and coordination & control. Furthermore, the 3 working gears must be balanced (Wr ≡ Wi ≡ Wm+p).Unfortunately, however, presently Mielec Engines has only the function Wr. There is no such maintenance system or even an idea thereof. Therefore I have asked them to build a maintenance system keeping those four functions constantly in mind as the picture of working gears. Furthermore, I have told them that for the sake of productive maintenance it is necessary that the maintenance personnel account for at least 20% of all employees as indicated in Fig. 3-1-10. Presently at Mielec P/A is a little less than 5%, and A/B is under 2%. At that rate it is impossible to reduce equipment trouble and product defects. However, in improvement of the cylinder block lines this time there has been progress such as to be able to accomplish "5S" with 13 operators. They should be put together with the personnel to make the mother group larger. That way, the P/A figure will increase, and that will lead to total productive maintenance.
And I encouraged them not to give up hope. Fig. 3-1-11 indicates what must be done as a minimum at Mielec Engines for that purpose. That was explained in the production improvement seminar, and Mr. R. Sierak (production department director) fully understands it, and therefore I repeatedly explained to Mr. M. Szyputa (maintenance department chief) that it is necessary to actively build such a system. At the last meeting with them, they assured us that they fully understood and that they would carry it out, but carrying out maintenance is really something quite difficult. Japan has a history of forty years of such efforts, but Mielec Engine will just be starting out on that road. The study team this time planted the buds of maintenance in the field, but it will be necessary to water them, fertilize them and from time to time loosen the soil and replant them. The need for support from Japan is a matter of time. I believe that that is the same for all companies in Poland, not just Mielec Engines.
It might be added that during the second study stay I accomplished many items of technology transfer. Attached sheets 5-10 indicate the record, information and state of progress thereof. Attached sheet 11 indicates my last words to the senior management of Mielec Engines on

3.1.3 Improvement of Production Management

1) The Matters Transferred by the First Batch Survey Team :
As I mentioned above, the results of fact-finding survey at the plants on Aug. 21 showed that Mielec Engines. had various problems in the aspects of production management. Thus, hereby I would like to explain what technology was transferred to whom and by what kind of methods, with concrete instances :

- On Aug. 22, Thursday, a meeting with Mr. R. SIERAK and Mr. A. LASINSKI. Based on the materials mentioned on the attached sheet No.12, we explained and discussed on the methods to investigate and examine the production site of Mielec Engines. in detail. The team proposed to select two model lines and achieve cost-cutting by improving them. The Company. side immediately objected to the proposal, saying that how the team considered about excess workers if it would rationalize the lines and that the Company. did not agree with dismissal of workers, etc. The team explained that it did not mean that, but wished to focus on practice routine maintenance or 3S, and reduction in 3M. The company side accepted the proposal. As results, the team asked the Company side to give it an opportunity to explain to the personnels concerned on the site and union leaders about its activities and purports as a survey team. And that was agreed by the company side. two to three days after the meeting, the company side told the team that Mr. R. SIERAK had already conveyed to managers and foremans about the meeting for explanation and asked the team when it would hold it. Since the team considered that it could give them more appropriate advises if it would organize the meeting after it had grasped whole organization and duties of the Company and its real circumstances. The team decided to postpone the meeting. And the team finally judged that it could understand actual state of the firm during Aug. 22 to Sept. 4, then we decided to address examination in detail.

- On Sept. 4, Wednesday, a meeting with Mr. J. MADRY and Mr. R. SIERAK. After the team's explanation on its aims of survey and examination and selection of 2 model lines, etc., it could get acceptance on the matter by them. At this meeting, Mr. J. MADRY requested the team to teach them know-how of working by team since they were not used to do that. The content of the meeting and circumstances were mentioned on the attached sheet 13 and 14.

- On Sept. 10, Tuesday, the team held meeting for intermediate report for the management of Mielec Engines. All members of survey team joined the meeting and explained development of the investigation and examination and problems for the management. The content of this meeting should be referred to the attached sheet 14.

- On Sept. 11, Wednesday, the team organized training session for the members of model groups. It explained 9 members of 2 teams about the purpose of team organizing, etc. and they agreed with that. The content of the training should be referred to the attached sheet 15.

- On Sept. 12 and 13, the team held discussions by team, and decided subjects and goals for improvement (main and sub). The teams started their activities under the leaders respectively. The content of the discussion should be referred to the attached sheet 16.

- On Sept. 12, 13 and 16, the team analyzed and sorted out the results of time study for the processes of machining. The content should be referred to the attached sheet 17.

- On Sept. 16 and 17, a discussion with Mr. M. SZYPUTA of Maintenance Depatment, Mr. W. MOL and other 2 members. The team attempted to transfer various technologies through this discussion. All those attempted will be implemented by the second batch survey team. The content of the discussion should be referred to the attached sheet 18.

- On Sept. 18 to 20, the team advised to Mr. R. LATO how to proceed the work during absence of the team because of returning to Japan, especially, how to conduct time study, organizing of teams with 13 members. It also gave him advice to wash rollers of the roller tables for transportation of blocks by washing oil during scheduled suspension of the assembly lines from Oct. 16 to Nov. 15. As a matter of course, they were very enthusiastic to implement them. Lastly, the team handed them "How to Organize Brain Storming", translated in Polish. The material should be referred to the attached sheet 19.

- On Sept. 20, Friday, the team explained Mr. R. SIERAK, its counterpart, on three examples of improvement for assembly line for cylinder block and was given his authorization. The three instances will be implemented by the second batch survey team and may bring successful results. The contents of the proposal should be referred to the attached sheet 20.

- On Sept. 2, Monday, the team visited a foundry (PZL-RZESZOW S.A.) for observation and survey with members of the Mielec Engines. At the time, the counterpart, Mr. R. SIERAK asked the team how its impression for Mr. S. DZIK, president of the foundry, was, and he requested me to write and translate it into Polish by all means. The team handed it to him. The document is shown on the attached sheet 21.

I outlined above on all of technology transfer achieved in the first investigation. And I consider that we could complete almost all of items we had expected and planed.

2) The Matters Planed to Be Transferred by the Second Batch Team. :
The Second batch team will positively support achievement of goals established by the Productivity Improvement Team (cylinder block line), i.e. :

(a) to examine manufacturing system to reduce the amount of works in the processes up to 50 % , to practice trial for 2 days to take up various problems in order to determine standard time and manufacturing system. As a matter of course, it also includes decision of the method to settle the problems and preparation to practice of these measures.

(b) to introduce preventive maintenance system in order to reduce failure time up to 25 % and to support it positively in order to operate the system actually. The Procedure for this should be referred to the attached sheet 22, "Steps for Implementation of PM into the Company", 23, "Basic Cycles of Maintenance activities", and No.24, "Examples for Practice of Modificative Maintenance". In order to make sure to implement the PM, the second batch team will set the day for periodical repair in the production planning and will transfer this method by implementing this shutdown once on Saturday.

(c) to change all the on-line inspection to off-line one in order to reduce process machining time up to 5%. The current system, 6 groups with 13 personnels should be reorganized to 2 to 3 groups to use workers more effectively and examination should be done to make the personnel concentrate in inspection and checking.

(d) to examine to shorten time for replacement of tools and jigs and extend their life.

- In order to implement above (a) to (d) and to achieve the goals, the team will advice so that the line and the staff can work as one(* quick response to take measures to analyze defectives and wrong process, pinpoint the causes, preparation of documents, etc. * examination of system to enable thorough acceptance and delivery control in order to achieve no delay of acceptance or stockout). Following steps can be targeted. :

3.1.4 Mielec Engine Co. Conditions for Improvements

Replies from Mielec Engine Co. as of February 28, 1997

(1) From Mr. E. Cabaj:

- There is continuous line production of ten cylinder blocks per day.
- Incidence of equipment troubles within the 47 processes of the cylinder block production line was 5.8% in the four months between November 1996 and February 1997. In the twenty months between February 1995 and September 1996 in the previous survey, there was a 22.1% equipment trouble rate. Through the adoption of preventative maintenance (P.M.), troubles were reduced by one quarter.
- The cylinder block production line is, of course, more attractive than other industrial machinery parts workplaces.
- Since January 1997, cost calculations have been done in section units that have been turned into cost centers. The result being the possibility of production costs reductions.

(2) From Mr. M. Szypula

- Modificative Maintenance (M.M.) system has been developed with the arrival of the Maintenance Engineer, Mr A. Zavaski in January 1997.
- The inspector , Mr. A. Yagoda is continuously in charge, handling spot checks and planning.
- Regular shutdowns are conducted on Saturdays. At this time, preventative repairs are done with repair parts on operating parts and spot checks on tools and exchanges to the 3S line are conducted.
- An established and popular production maintenance committee" was organized in January 1997. With two stewards and many members of the commitee, the chairperson Mr. R. Sierak analyzed the results of the cylinder block line, and is working to introduce these processes to other areas and conduct further examinations.

Upon leaving the Mielec Engine Co. on December 11th, 1996, looking back on all the advise, I felt that matters were conducted to perfection. It was a short 40 days, but I am sure the country and companies have finally started to get serious. I must give my heartfelt regards to all related management and production staff.

Steps for implementation practice of improvement :

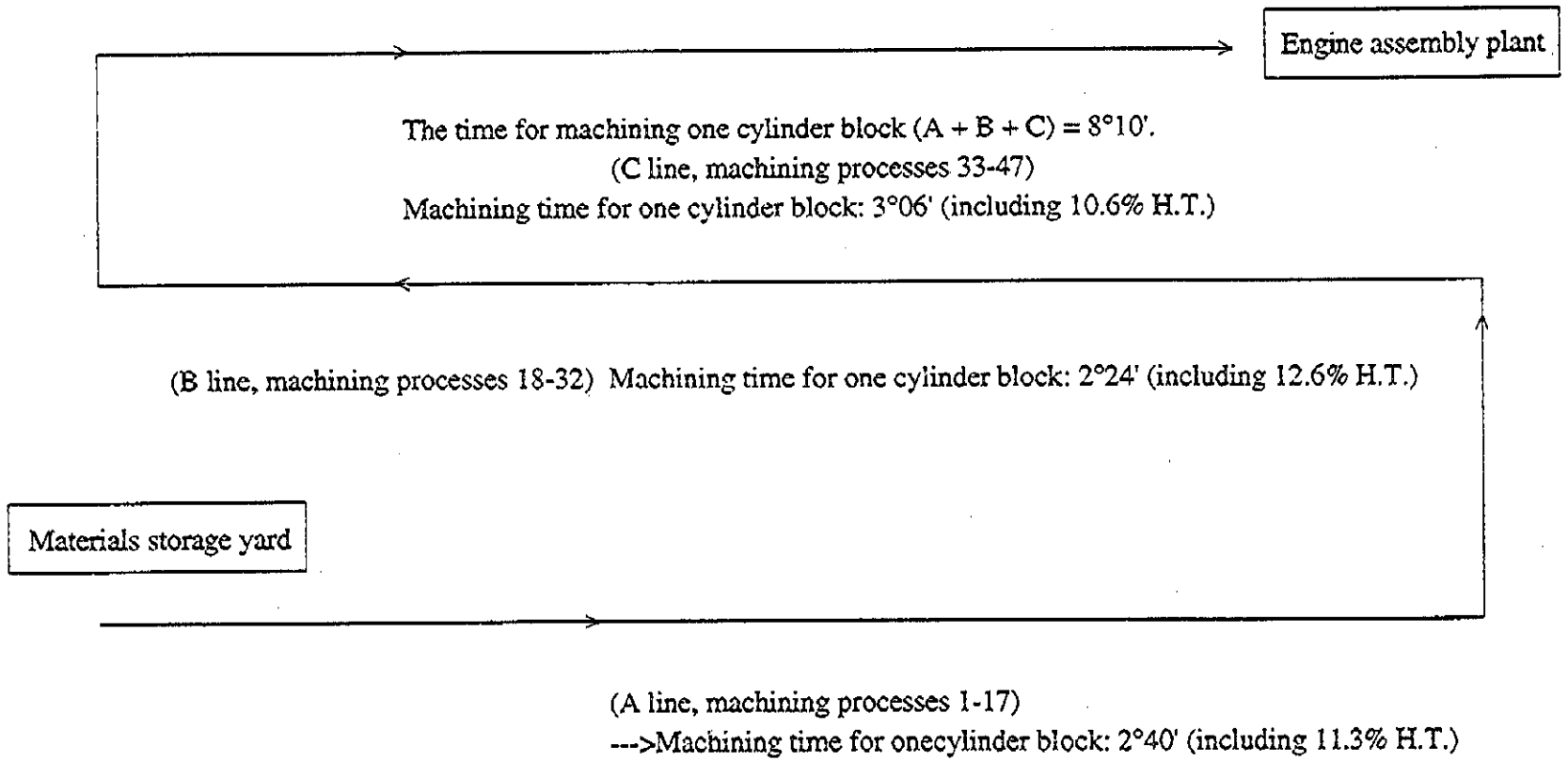
①	continuous process for machining of cylinder block :	50 processes, including 44 machining.
②	processing completion time for one piece of cylinder block (including approximately 30 min. for inspection and transportation).:	7 hours and 1 min.
③	time required to process 10 pieces of cylinder blocks in a day :	8 hours and 6 min..
④	suspended time of lines due to breakdown of machinery (5 to 10 %) :	40 min.
④	time required to manufacture 10 pieces under current system (③+4) :,	8 hours and 46 min.
	assuming actual working hours as 7 hours and 25 min. (including rest time, 35 min.) :	+ 1 hour and 21 min.
⑥	Implementation of periodical repair for reduction of breakdown time of machineries, the regular shutdown implemented once on	40 min. to 0,
	Saturday on the work :	+ 41 min.
⑦	change on-line inspection at machining to off-line one :	30 min. to 0, +11 min.
⑧	application of 3S for working area, promotion of clean-up and will to work	+ 6 min.
	(3S for lines will be implemented during Oct. 16 to Nov. 15) :	
⑨	other reductions due to practice of implementation :.	6 min to 0

(e) In the dispatched duration, the second batch team will hold "Production Improvement Seminar" and it will make efforts to examine ways to propagate and spread the ideas and methods improved by team activities to all over the company.

3) Proposal for restructuring :

In order to examine, review and support 2 methods, i.e. (A) Introduction of productive maintenance into the M.E. (the guideline for popularization should be referred to the attached sheet 25) and (B) systematization of for production process which enables assembly of engines of 10 pieces in a day with proposal of restructuring (production management) for the company, the team will make efforts as much as possible. Attached sheet 26.

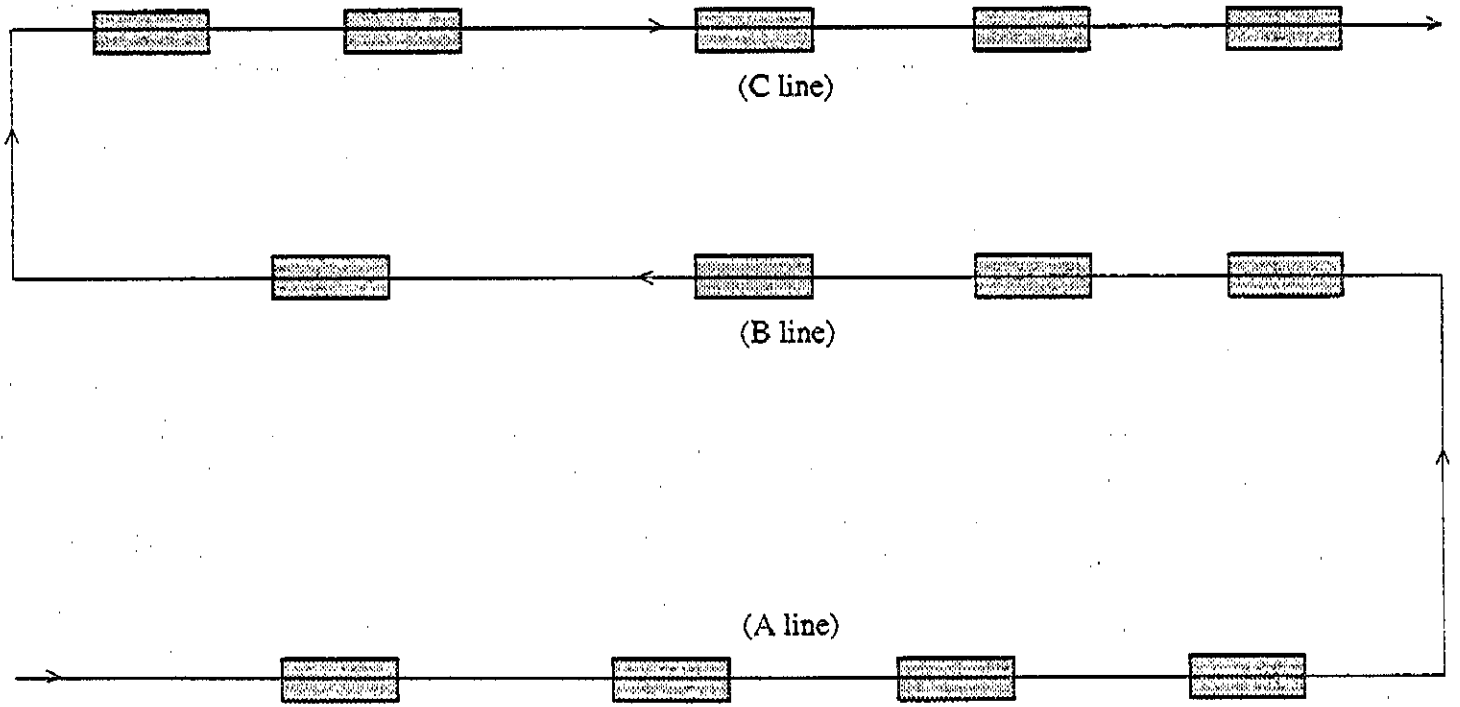
Fig. 3-1-1 Equipment Layout of Cylinder Block Machining Lines



N.B.: • Transfer between machining processes is by roller conveyor (manual). The total conveyor length is about 350 m.
• Thirteen workers, organized into 2 teams, man the cylinder block machining lines.

Fig. 3-1-2 In-Process Volume of Cylinder Block Lines (Present State)

• The machining equipment of the lines has only breakdown maintenance.



N.B.: • The in-process volume of the cylinder block lines is 60 cylinder blocks a day.
• The daily planned volume of production is eight cylinder blocks.
• The defect rate (due to defective castings) is 10-30%.
• The worker organization consists of six teams (2 persons x 6 teams + 1 group leader).

Table 3-1-1 Monthly Trouble Record of Cylinder Block Lines
(February, 1995, to September, 1996)

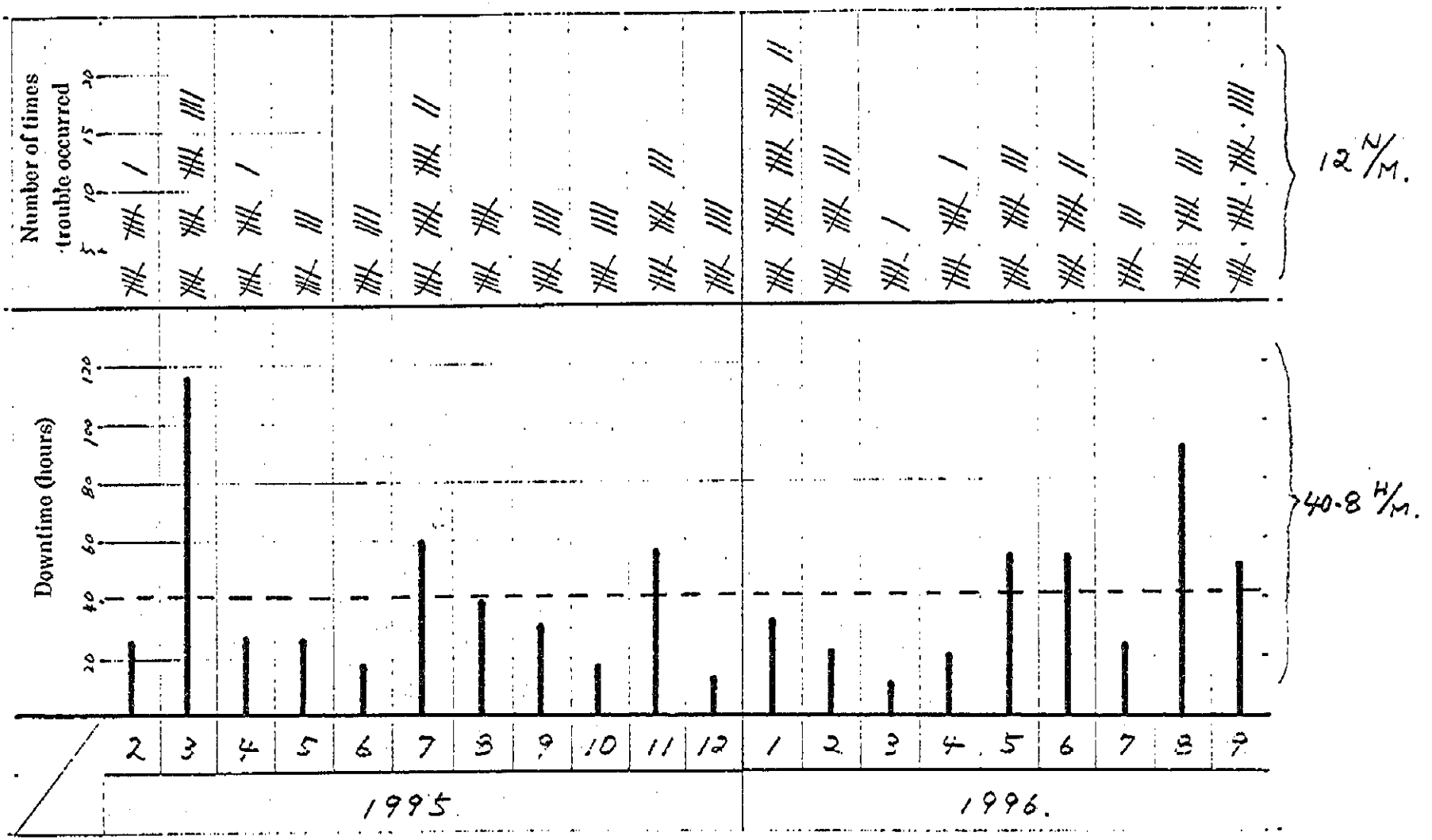
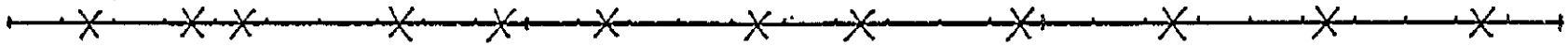


Fig. 3-1-3 Maintenance Innovation and Improvement

1. Present state: breakdown maintenance
   Equipment trouble --> Stopping of production --> Repair (machining of reserve parts or procurement) --> Increase in line in-process volume -- Increase in interest



Monthly cylinder block line trouble rate: 22.1%

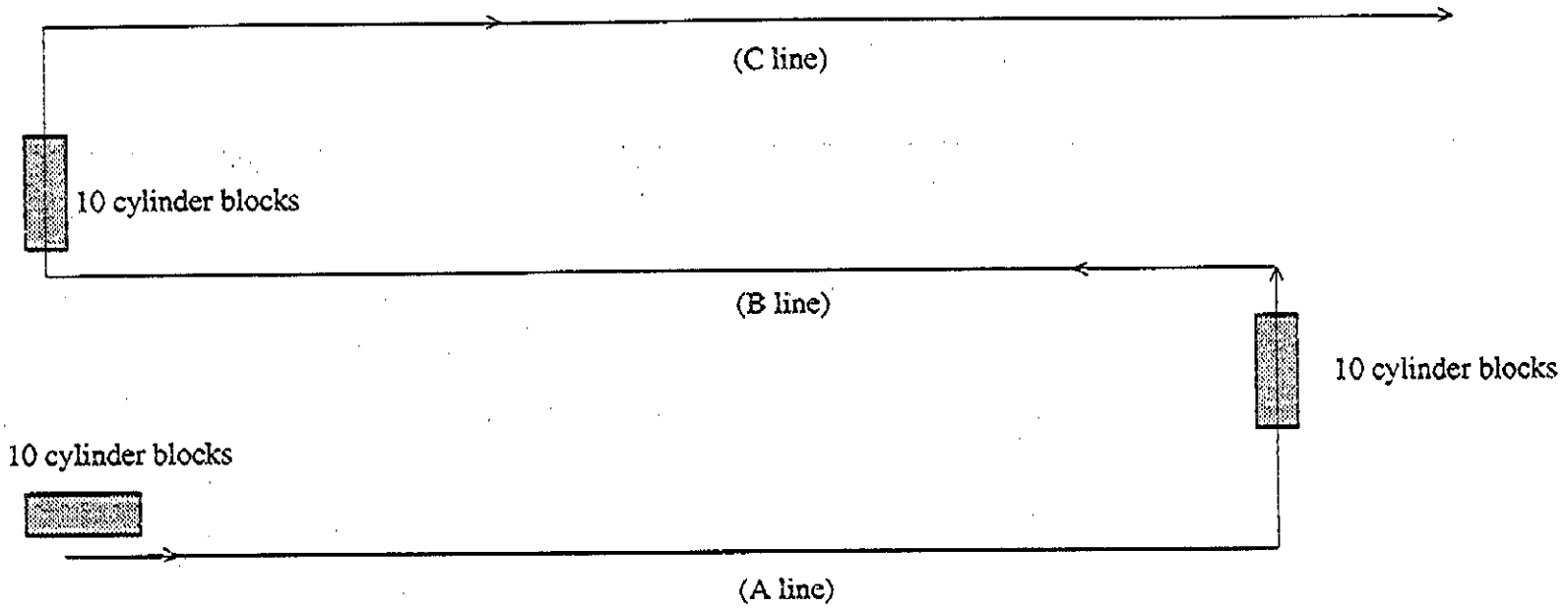
2. After improvement: preventive maintenance
   Checking of equipment --> Repair plans --> Prior procurement of reserve parts --> Regular week shutdown --> Decrease in equipment trouble

Monthly cylinder block line trouble rate: 2-0%

N.B.: Regular weekly shutdown was implemented starting Saturday, November 23, 1996. The operators accomplished 3S with respect to the cylinder block lines, and the maintenance department implemented checking, repairs and centering adjustment. The equipment trouble rate for the 2-week period of zero.

Fig. 3-1-4 Cylinder Block Line In-Process Volume (After Improvement)

• The line machine equipment with preventive maintenance based on implementation of regular shutdown



N.B.: • Cylinder block line in-process volume: 30 cylinder blocks/day
• Same planned production figures and defect rate as presently
• Change in worker organization from 6 teams to 2 teams

parting.

Table 3-1-2 Actual Downtime of Cylinder Block Line Machining Equipment
(February 1995 to September 1996)

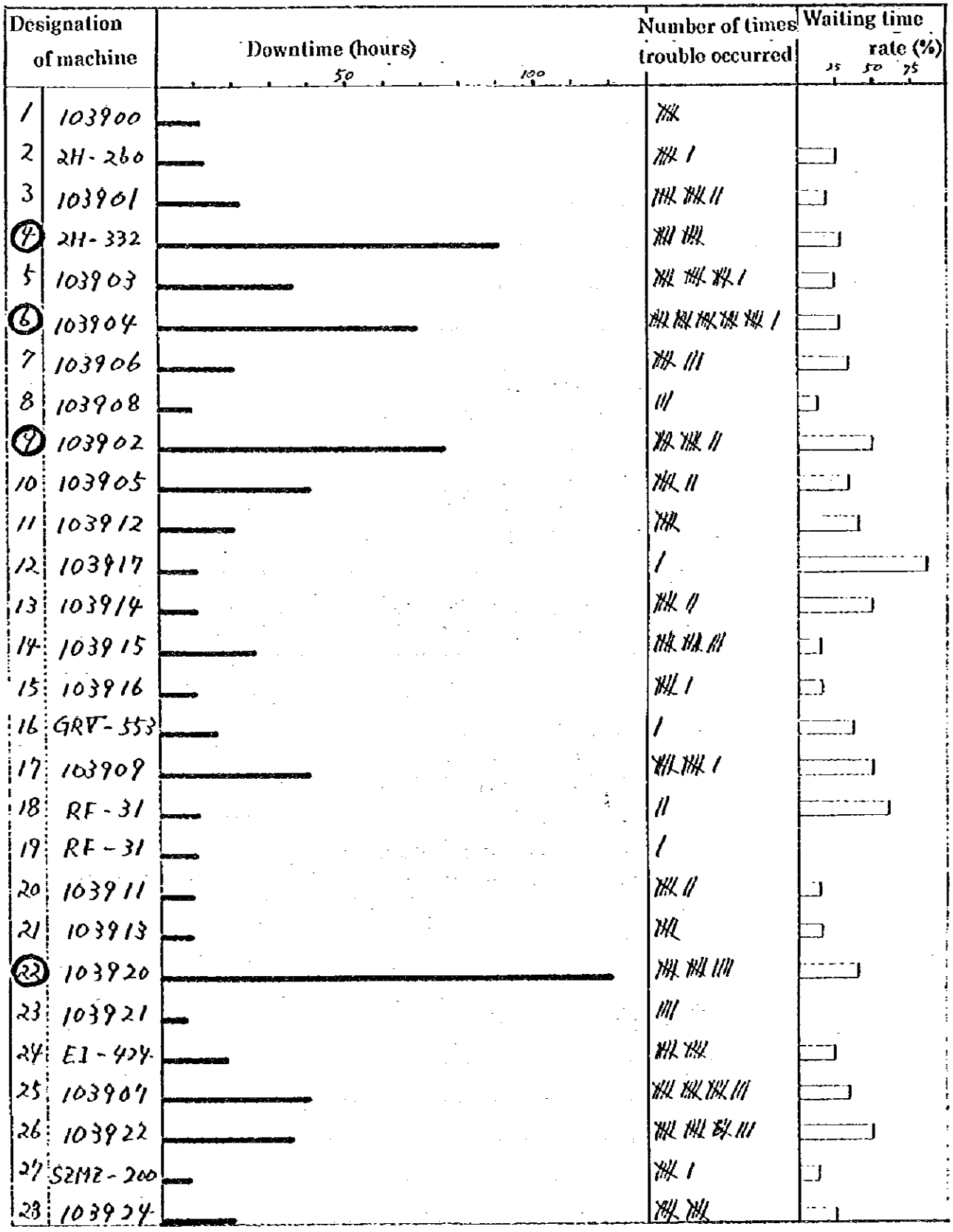


Fig. 3-1-5 Breakdown of Equipment Downtime on Cylinder Block Lines by Specialty (February 1995 to September 1996)

1/ Electrical, 24% 2/ Others, 12% 3/ Mechanical, 28%
4/ Hydraulic and pneumatic, 36% 5/ Total downtime: 817 h (100%)

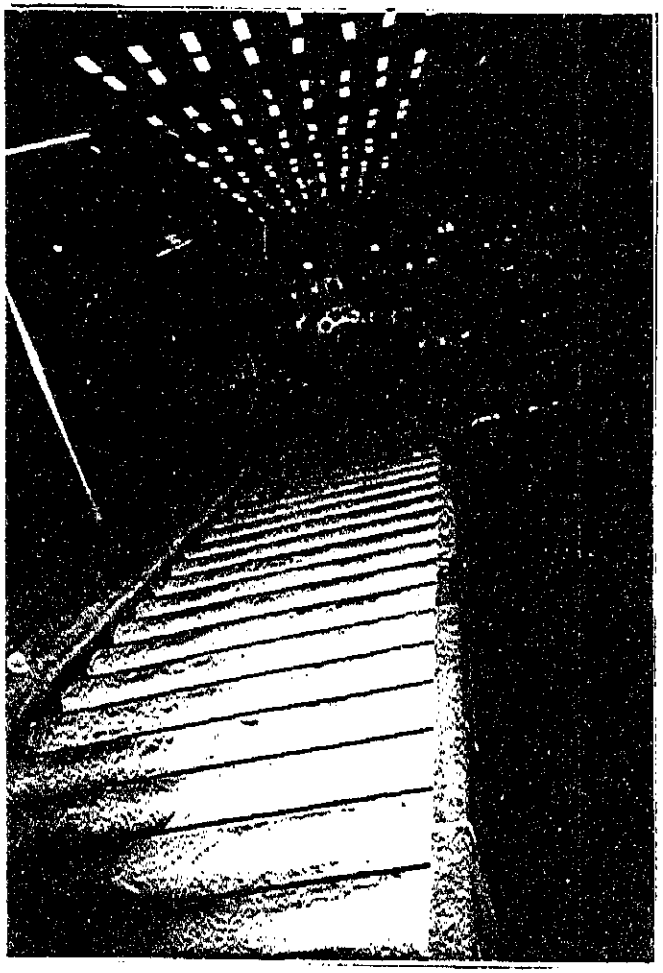
* Maintenance Characteristic (1)
  - A lot of the equipment is supplied by the same manufacturer and consists interchangeable parts and apparatus, e.g. motor, reduction gear, accumulator, etc. For instance, there are 42 accumulators that are the same. That being the case, preventive maintenance will be immediately effective.
  - But the manufacturer that supplied them has gone bankrupt and no longer exists.

* Maintenance Characteristic (2)
  - A lot of the machinery trouble is due to bearing seizure and damage, and it occurs a lot with respect to particular machines.
  - A lot of the trouble with hydraulic and pneumatic equipment is due to leakage from packings and seals. It is therefore possible to reduce trouble through extension of service life by considering the shapes and materials of the packings.

「Trouble can be reduced by analyzing the data, seeking the reasons for it with respect to particular parts and making the necessary improvements.」

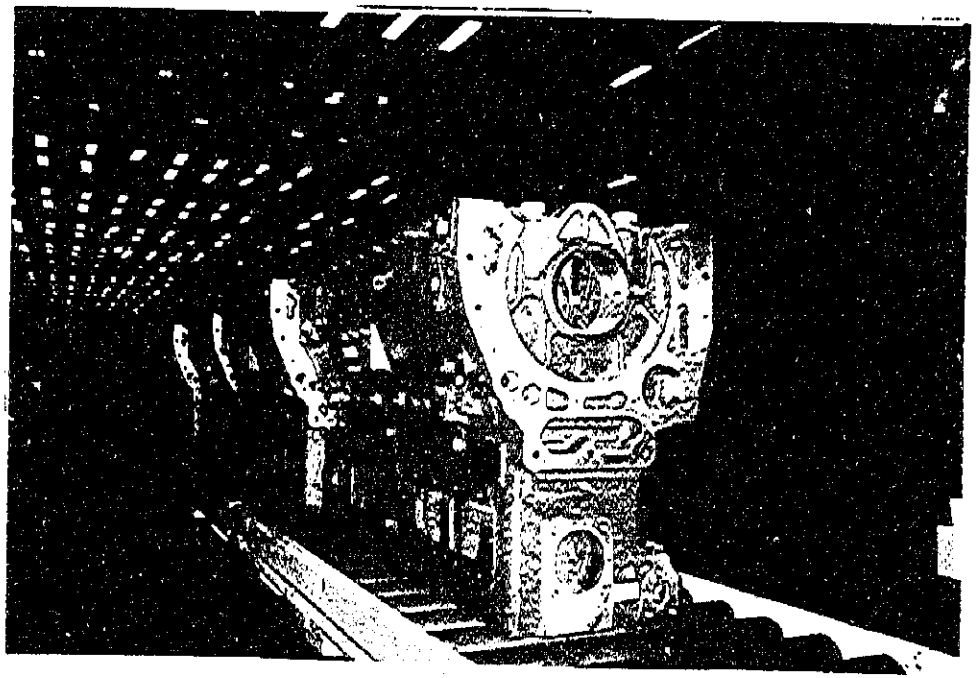
Fig. 3.1.6 State of "3S" With Respect to Cylinder Block Line Roller Conveyor

(Before improvement)



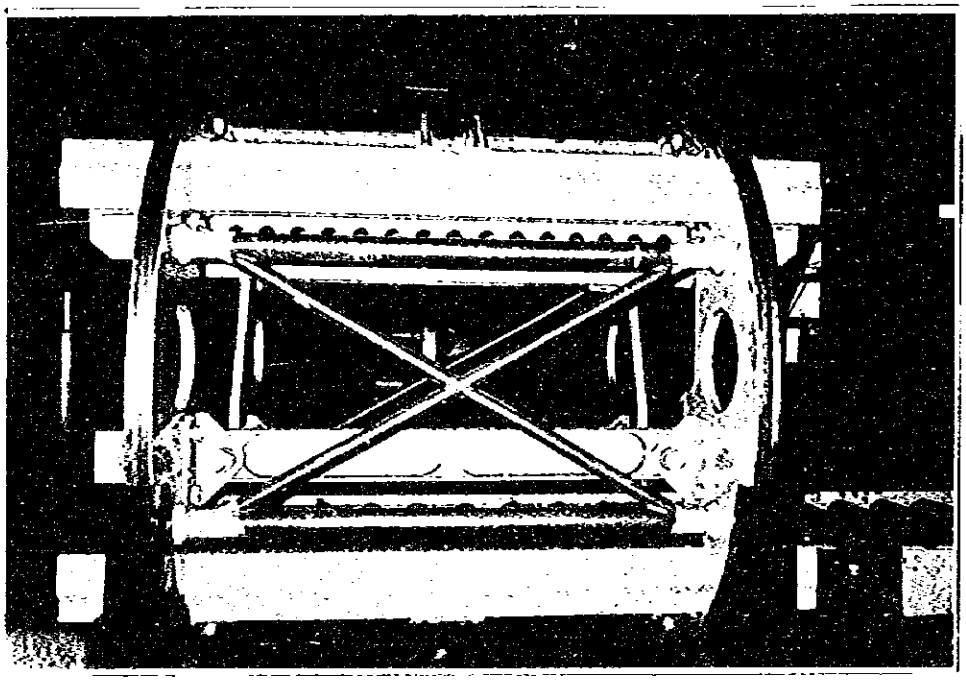
Indicates fouling of roller surface and table frame of roller conveyor and state of stock of cylinder blocks

(After improvement)



Indicates state of flow of cylinder blocks by lot, without roller surface fouling and with side cover of table frame painted yellow.

Fig. 3.1.7 Photo Indicating State of Implementation of "3S" With Respect to Cylinder Block Line Equipment Bodies



The frame of the body of the rotary tilting machine for tilting the upper and lower surfaces of the cylinder blocks for machining is painted gray, and the side ... table is painted yellow.

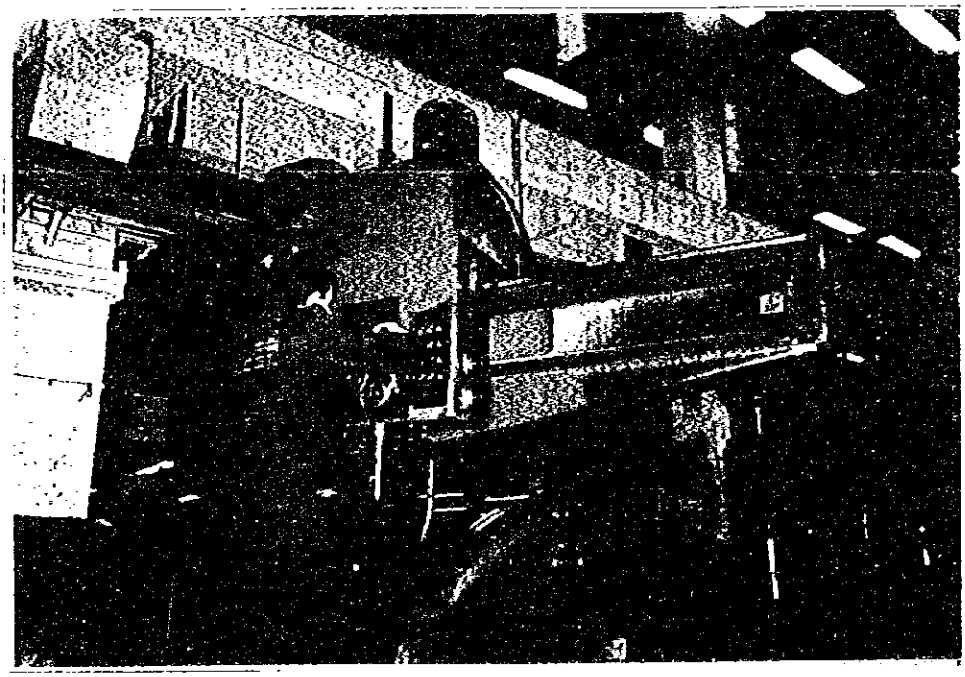
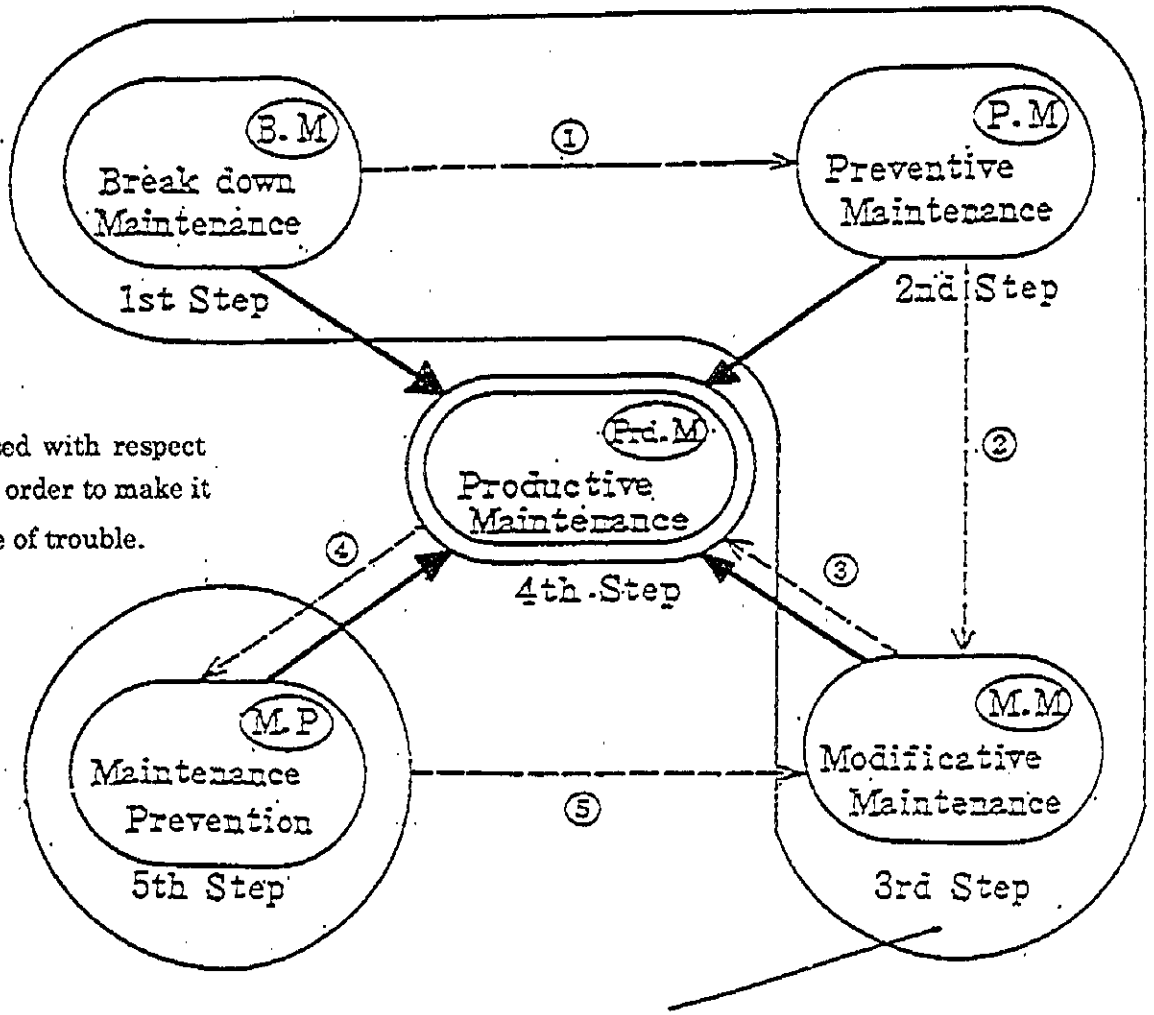


Photo showing removal of fouling of body of radial drilling machine and painting of the body by worker. All of the machining equipment of the 47 processes was painted by Christmas 1996.

Fig. 3.1.8 Maintenance Method Development Process



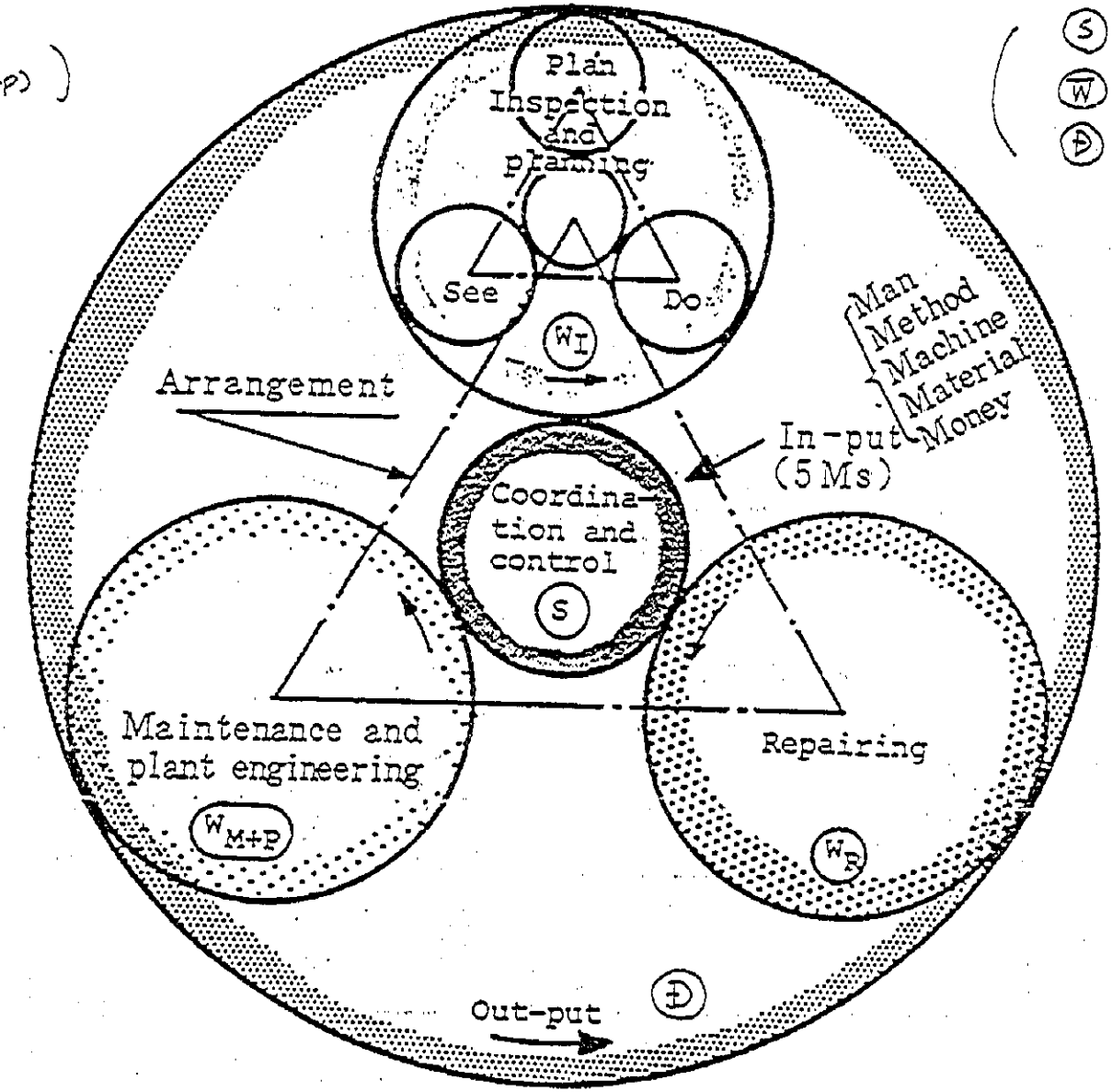
Unlike those 3 steps, the 5th step is used with respect to equipment yet to be constructed in order to make it equipment with little occurrence of trouble.

The three steps indicated here (1st, 2nd and 3rd steps) are steps used for improvement (in terms of operation) of equipment that has already been constructed and commissioned.

Fig. 3.1.9 System of Productive Maintenance

$(\overline{W_R} \equiv \overline{W_I} \equiv \overline{W_{(M+P)}})$

((S) : starting Gear.
(W) : Working Gear.
(D) : Driving Gear.)



Products, Quality, Cost, Delivery.

Fig. 3-1-9 System of Productive Maintenance

Fig. 3-1-10 Development of Maintenance Organization and Number of Maintenance Personnel

• Relationship between development of maintenance method, and maintenance organization

Maintenance method	B.M	P.M	M.M	M.P	Prd.M	T.P.M
Development sequence	1.	2.	3.	4.	5.	6.
Maintenance organization	D.M	A.M	C.M	C.M	Comb.M	Comb.M

N.B.: D.M.: Department Maintenance
A.M.: Area Maintenance
C.M.: Central Maintenance
Comb. M.: Combined Maintenance

• Basic Functions of Maintenance Organization

Maintenance Department
- Maintenance and plant engineering (W(M+P))
- Inspection and planning(WI)
- Repairing(WR)
- Coordination and control(S)

• Number of personnel for implementation of different maintenance methods

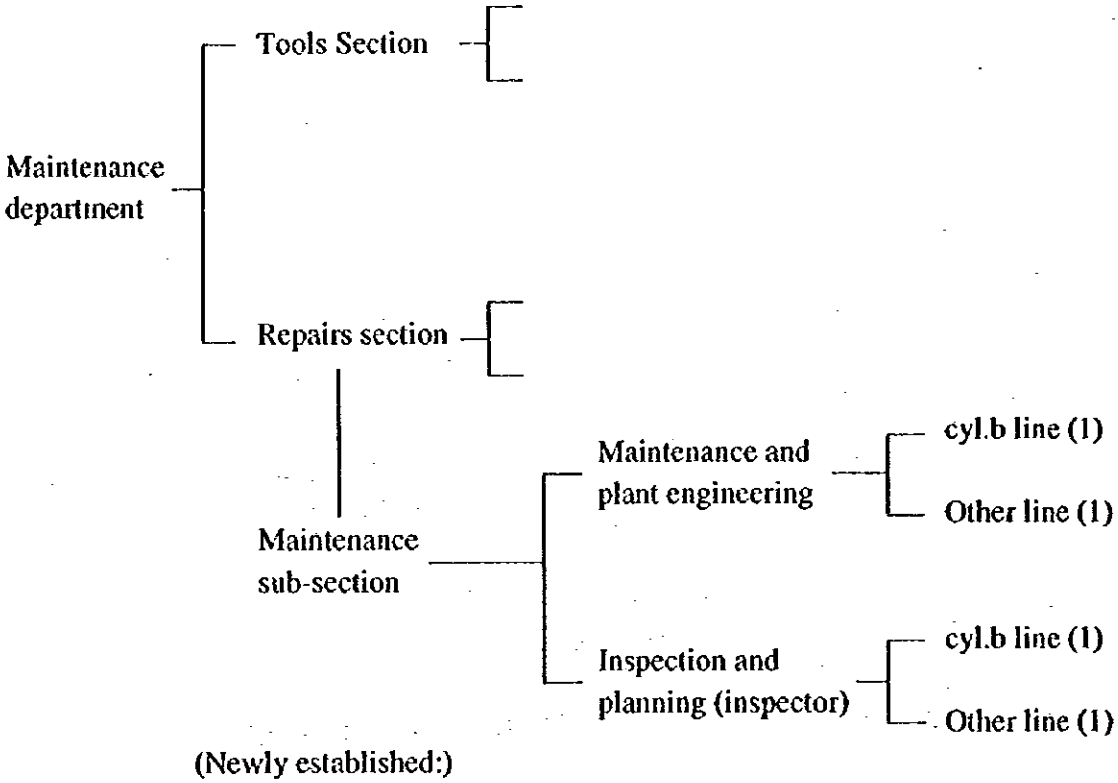
MAINTENANCE METHODES	P/A(%)	Q/B(%)
Prd.M	20-23	19-21
M.M	11-17	10-15
P.M	5-10	4-8
B.M	3<	2<

Note: A: total number of company employees
B: total number of thinking personnel in company
P: number of maintenance personnel in company

Q: number of thinking maintenance personnel in company

Fig. 3-1-11 Summary of Introduction and Through Application of Productive Maintenance

1. As indicated in the section on the system for implementation of productive maintenance, fostering of the three functions, i.e. the inspection and planning function (Wi), the maintenance and plant engineering function (Wm+p) ... and assignment of two personnel



each to The Company's maintenance department for that purpose.

2. Adoption of yardstick for determining maintenance effect and confirmation of trend.
   (a) Monthly downtime and number of incidents
   (b) Monthly number of repairs and cost thereof
   (c) Monthly number of renovations and cost thereof

3. Establishment of a committee in the company for promotion of implementation of productive maintenance throughout the company, to meet every month to study and confirm maintenance achievement and state of promotion of maintenance.
   - Chairman: Mr. R. Sierak
   - Managers: Mr. E. Cabaj and Mr. M. Szyputa

• Members: Section chiefs of production, maintenance and procurement departments
Attached Sheet 1

Agenda of Meeting (at S-378)
Discussion Meeting of Cylinder Block Line Improvement Team First Meeting
(Thursday, November 21, 9:00-10:00)

1. Confirmation of state of implementation of "3S" with respect to roller table.

2. Confirmation of state of collection breakdown data (February 1995 to September 1996). Collection of data on downtime and number of incidents has been completed for each type machining equipment, and it is now clear which machines represent bottlenecks. However, they were instructed to collect the following information as well:
   Table 1: Distinction between repair time and reserve parts waiting time
   Table 2: Preparation of ABC analysis chart.
   Table 3: Instructions on investigation of downtime and number of incidents for every month from February 1995 to September 1996
   Table 4: Instructions on how to determine distribution of downtime by speciality

3. Confirmation of main points concerning production of 10 cylinder blocks a day. Organization of support system involving all operators for the two days November 27 and 28 in order to undertake machining in minimum amount of time and confirm what process can be reached in the machining between 7:00 and 15:00 hours. O.K.

4. Confirmation of method of implementation of machining of the cylinder blocks for the different lines, A, B and C, and request for implementation of time observation. O.K.

5. Instructions to undertake regular shutdown the first time on Saturday, December 7. O.K. Discussion with Mr. R. Sierak (production board) for arrangements.

6. Confirmation of change in team organization of workers.
   6 teams --> 2 teams

Attached Sheet 2

Minutes of Meeting (at S-378)

Discussion Meeting With Cylinder Block Line Improvement Team Second Meeting, Monday, November 25, 10:00-11:30 hours

1. Confirmation of state of sorting out of breakdown data
   Since the data showed the very high figures of an average of 12 incidents a month and 22.1% production stoppage time as the monthly average in the period from February 1995 to September 1996, it was decided to implement regular shutdown starting Saturday, November 23.

2. Consideration of method of determination of 10 cylinder blocks/day production achievement
   Collection of data separately for lines A, B and C, with entry of time observation values, number and circumstances of defects, etc. in this table.
   Also entry of general layout.

3. Consultation concerning the format and method of presentation of O.H.P. announced in seminar.

4. Discussion of items to be implemented by operator department at the time of regular shutdown:
   - elimination of fouling of machinery bodies
   - dealing with shavings inside and around the machining equipment
   - replacement and adjustment of tools
   - refilling of lubrication oil

   Keeping of repair records on those items for each type of machining equipment.

Attached Sheet 3

Minutes of Meeting (at S-378)

Arrangement Meeting With Cylinder Block Line Improvement Team Third Meeting, Friday, November 29, 10:00-11:30 hours

1. Consideration of content of improvement report (summary)
   (a) Determination and recording of percentage of cylinder block machining time represented by manual handling time.N.B.: Average value of 11.5%.
   (b) Entry of defect rate for production of 10 cylinders a day per line during the period November 19 to November 26.
   (c) Determination and entry of monthly average downtime and monthly average number of incidents in downtime investigation for the period from February 1995 to September 1996.

   N.B.: Monthly average number of incidents: 12. Monthly average downtime percentage: 22.1%. Monthly average downtime: 40 hours.

   (d) Entry of any available information on how the group members divided the work among themselves and went about resolving the problems.
   (e) Regarding means of 5% reduction of machining time, making sure to enter such things as reorganization from 6 teams to 2 teams and the support system that was adopted.

2. Matters to be considered at time of announcement
   Make sure to decide such things as who is to be the O.H.P. assistant.

Attached Sheet 4

Minutes of Meeting (at S-378)

Discussion Meeting of Cylinder Block Line Improvement Team Fourth Meeting, December 4, 13:30-14:45 hours

1. Establishment of 10 cylinder blocks/day production system.
   Since a flow of 10 cylinder blocks a day on lines A, B and C has been authorized by the company, it is to be implemented with this production plan. PKK and PKZ are to assist S-378 for the sake of getting this plan going properly. Monthly and quarterly plans are to be drafted as a basis for promotion and follow-up.

2. Record of replacement of bits and cutters
   Replacement takes place in accordance with P.P.T.'s instructions. Needless, replacement and adjustment are also to take place at the time of regular shutdown. Records are kept by the operator department.

3. Cost Center Implementation Proposal
   Monthly determination of actual production figures and costs for each section. First of all, discussion of such determination by S-378 (members of circle). Since the financial department has overall control, that is outside the province of S-378. The matter of obtaining information on cost relating to defects, yield rate, trouble, etc. was discussed, but no conclusion was reached, Mr. B. Cabaj and Mr. R. Lato agreeing to speak with Mr. R. Sierak about it.
   Note: Since Mr. R. Sierak gave his okay on December 15, starting from January 1997 cost information will be furnished S-378. That means that such consideration will start from January.

4. What is the situation regarding 20-unit production and regular shutdown on the cylinder head line? Since it is also producing replacement (repair) reserve parts, 20 units "plus alpha" will be necessary. As for "3S", they are already implementing it.

5. The repercussions of the cylinder block line are considerable on other work areas as well, and they, too, are already implementing "3S" and maintenance.

Attached Sheet 5

Discussion Meeting With Maintenance (PR)
First Meeting, November 22, 1996, 10:00-11:30 hours
Attended by: Mr. M. Szyputa, Mr. W. Mol and Mr. C. Jungiewicz

1. Discussion concerning regular shutdown
   - How advantageous is implementation of regular shutdowns?
   - Regular shutdown is necessary in the case of continuous processing lines.
   - Examples of what the operator department and the maintenance department should do during regular shutdown.
   - Explanation of main points of planning, study and implementation of repairs at time of regular shutdown (separate sheet). Entry of different jobs on flow chart, with explanations.
   - Keeping of record of repairs for reference at time of next repair.

2. Concerning need for inspection and inspectors
   - What should the qualifications of an inspector be? What kind of person is best suited to be an inspector? Should he be an engineer, a technician or a skilled worker?
   - What should be the inspector's work?
   - Will the inspection work take a full day?
   - Explanation of inspection method by five senses (separate sheet).
   - Explanation of inspection standards, check lists, routes, etc.
   - Great importance of getting information from operators.

3. Explanation of importance of maintenance engineer.
   - Explanation of differences between inspection and repair.
   - Discussion of qualifications of maintenance engineer.
   - Expression of desire to talk to Mr. R. Sierak concerning The Company's sufficiency.

4. Materials on the productivity seminary (productive maintenance)were handed out to all three of them, and it was decided to discuss the content thereof at a later date.

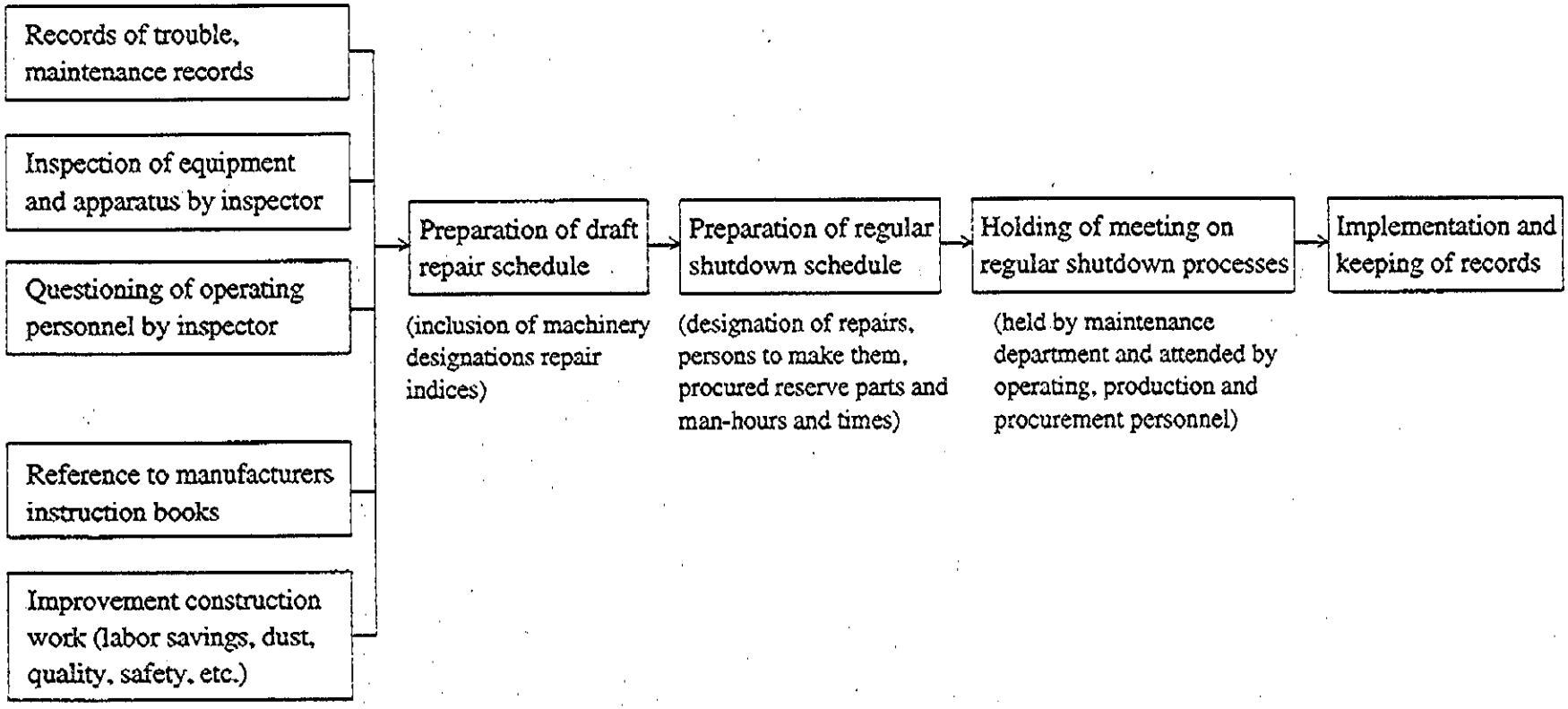
5. For the time being, I asked Mr. M. Szyputa to consider selection of one inspector.

Attached Sheet 6

Explanation to Mr. M. Szyputa and Mr. W. Mol. 10:00-12:00 hours.

Main Points Concerning Planning and Implementation of Regular Shutdown

(including repair of machining equipment, regular replacement of tools and "3S": SEIRI, SEITON, SEISOU (keeping everything in order and clean)



(modernization work on two modern plants, oil and air leakage, provision of safety enclosures and handrails)

Attached Sheet 7

Five senses for Inspection

1. Watch by Eye
   rotation, slide, oil leakage, wear, crack, oil gauge, motors.

2. Listen by Ear
   impact, rotation, slip, air leakage, looseness, corrosion.

3. Touch by Hand, Leg and Body
   vibration, temperature, roughness, crack, air leakage, dust.

4. Smell by Nose
   rot, burn-out, exhaust gas or oil.

5. Taste by Tongue
   sweet, salt, acid.

   (N.B) Daily inspection tools.
   - Listening bar
   - Hammer
   - Color tape and chalk
   - Test meter

Attached Sheet 8

Arrangement Meetings With Maintenance Department (PR)
2nd and 3rd Meetings, Nov. 26-27, 1996
Attended by Mr. Szyputa, Mr. Mol and Mr. Jonggiewicz
10:00-11:30 hours on Nov. 26 and 10:00-12:00 on Nov. 27

1. Explanation of content and discussion of productivity seminar
   The other side requested updating of the materials prepared in Japan for the seminar because of the fact that they contain old information, particularly regarding The Company's maintenance problems, number of personnel and percentages. I accepted that, and we agreed to meet again the next day. In particular, although the total staff of the maintenance department is 123, very few of them are of any use in equipment repairing, and the P/A value is only 5%.
   Regular shutdown is to be implemented starting from Saturday, November 23, and an inspector is to be selected for implementation of inspection work. Therefore the other side requested that the situation at the present time be explained to senior managers.

2. Explanation of content of revised productivity seminar text
   The revised text was in English. All of the content was explained and agreed to by both sides (see the seminar materials).

3. Discussion of regular shutdown and annual shutdown
   (a) I think that about twice a month is the right frequency for regular shutdown. Inclusion of overhaul inspection when frequency of regular shutdown is increased.
   (b) Planning of repair, dismantling and other work that takes a long time for the annual shutdown. However, it will not do if the plans are completed only two days before implementation, as happened in the summer of 1996. They should be completed three months in advance so that parts and materials can be ordered and delivered on time. The inspection and planning functions are important in that respect.
   (c) I advised them to keep full records of repairs and inspections by machinery unit in connection with implementation of repairs and overhauls.

Attached Sheet 9

Arrangement Meeting With Maintenance Department (PR)
4th Meeting, December 5, 1996, 8:30-10:00 hours
Attended by Mr. M. Szyputa, Mr. W. Mol and Mr. C. Jungiewicz

1. Explanation of three additional seminar information sheets:
   - Method of Preventive Repair
   - Task of Maintenance Engineer
   - Task of Manager

2. The Matter of a Maintenance Engineer
   They full realize the need for one, and there is a suitable candidate in the company, but he cannot be transferred to PR because of the work he is now doing. Therefore Mr. W. Mol and Mr. K. Wiacek will fill the role for the time being, and a new man will be hired early next year.

3. The Matter of Introduction and Application of Preventive Maintenance Throughout the Company
   The second line for implementation of P.M. will be the cylinder head line, followed by other equipment in the order of importance. Besides that, all that will be necessary is one more inspector.

4. The P.M. Application Committee is to meet every month. Since Mr. M. Szyputa is one of the committee's managers, he will carry out the meetings as advised by Mr. Tashiro. Needless to say, the results obtained in introduction of P.M. to the cylinder block lines will be announced and explained at the committee meetings, and on the basis of approval by the committee members P.M. will be implemented elsewhere as well in the order of the most important machinery.

5. Countermeasures Concerning the Four Equipment Items With the Most Trouble
   - As regards No. 103920 (made in U.K.), its bearings have only a short service life. The manufacturer went bankrupt and no longer exists so they are using locally produced products. The matter is now under study.
   - As for No. 2H332, No. 103904 and No. 103902, they have hydraulic system seals that have only a short service life. It is now being studied whether or not the service life can be extended through testing.

6. Maintenance of Hoisting Crane
   Polish regulations stipulate it. Mr. Bomba and Mr. Halaburda are in charge of inspection and repairs, which are being properly carried out . There is no problem regarding it.

(Cylinder block and cylinder head lines: 4, 3t hoists + 18, 0.5t hoists + 8, 0.125t hoists)

7. Apparatus and Parts With Repeated Trouble or High Repair Frequency
There is a lot of such apparatus and parts in the hydraulic and pneumatic systems. What to do about the problem is now under study. In view of the labor involved, it is intended to divide the work into lines A, B, C and D and implement regular shutdown once a week.

8. One set of information indicating the yardsticks for measurement of the maintenance effect will be furnished.

Attached Sheet 10

State of Implementation of Regular Shutdown at The Company

Mr. R. Sierak (Production Board) made the decision to implement regular shutdown every week, starting from Saturday, November 23. The following is an account of such implementation.

1. State of implementation of regular shutdown on Saturday, November 23, 1996 (1st regular shutdown)

   (1.1) Work by Operator Department

   - Mainly elimination of shavings from A line, with recovery of scale by dust collector, removal of scale from sliding parts, partial removal of fouling, etc.
   - I went around checking things, including oil gauges, instructing refilling thereof, and pointed out poor suction of dust collectors, places where dust was not properly collected, etc.

   (1.2) Work by Repair Department (total of 9 items)

   - 3 mechanical items (2 men x 4 h, 1 man x 6 h), 3 hydraulic items (1 man x 3 h, 3 men x 6 h, 3 men x 8 h) and 4 electrical items (2 men x 8 h, 3 men x 7 h, 2 men x 8 h, 3 men x 5 h). Mainly only repairs.
   - Guidance of inspector (Mr. Jagoda) concerning inspection by five senses.

2. State of implementation of regular shutdown on Saturday, November 30, 1996 (2nd regular shutdown)

   (2.1) Work by Operator Department

   - Mainly elimination of shavings from around machinery of Line C, recovery of scale by dust collector, removal of scale on sliding parts and conveyor parts and removal of fouling around machinery controls.
   - I went around checking together with those in charge, checking for air leaks and instructing that they be stopped. Seven were detected.

   (2.2) Work by Repair Department (total of 7 work items)

   - Mostly forward-looking work such as revision of machinery levels and electrical adjustments.
   - 2 mechanical items (2 men x 2 h, 2 men x 2 h), 4 hydraulic items (4 men x 2 h, 1 man x 3 h, 2 men x 4 h, 2 men x 4 h) and 1 electrical item (3 men x 6 h)
   - I went around with the inspector making checks.

3. State of implementation of regular shutdown on Saturday, December 7 (3rd regular shutdown)

(3.1) Work by Operator Department

- Mainly elimination of shavings from machinery of Line B . Defouling of machinery bodies (including motors) (using scaffolding) and painting of Line B (bodies)
- Cleaning and refilling of oil tanks
- Also implement of "3S" by all personnel with respect to cylinder head line and support of painting of cylinder block lines

(3.2) Work by Repair Department (total of 4 items)

- 4 items of repair, inspection and adjustment of mechanical equipment, electrical equipment, lubrication and hydraulic system (2 men x 8 h, 2 men x 5 h, 2 men x 12 h, 2 men x 2 h)
- Lots of cleaning and adjustment of terminals on electrical distribution boards

(Summary): The operators did the cleaning and implementation of "3S" very well. As for the repair department, their minor repair and adjustment work is increasing. I hope that the present basis can be kept up.