Annex III: Enterprise Diagnosis Program

1 Program Outline

The enterprise diagnosis program was conducted with the following objectives:

1) To conduct diagnostic study and guidance for selected enterprises in the electric and electronics industry and the supporting industries, with respect to their production management techniques and engineering technologies such as plastic molding and metalworking, in order to find the way to improve their competitiveness and assist them in their efforts to upgrade the current levels of technology.
2) To transfer expertise on diagnosis and guidance to the Jordanian counterpart.

The process of the diagnosis program was as follows:

Opening seminar

The opening seminar was primarily designed to make presentation of the entire process of the study and its general outline to the Jordanian counterparts and discuss the approach, methodology and procedure. At the same time, it served as an opportunity to promote understanding of the potential participants, concerning objectives, plans and expected outcomes of the "enterprise survey" and the "diagnostic study", encouraging active participation in the process.

Enterprise survey

The survey was conducted, jointly with the marketing group and industrial design development group, to identify the current state of individual enterprises in terms of production management and engineering technology (mainly plastic molding and metalworking), and major issues facing them related to the strengthening of competitiveness, and to confirm their willingness to participate in the diagnostic study.

Selection of sample enterprises for the survey

34 enterprises were selected from the list of 57 enterprises, which was provided by MIT, in the electric and electronics industry and the related supporting engineering industries. The survey was conducted to all of the 34 enterprises.

Survey items

The primary purpose of the enterprise survey was to identify issues facing individual

enterprises in various aspects of operation and management and to collect vital data and information regarding their current state, which is useful for analysis of the industrial structure, target markets and corporate profiles including the size of establishment and partnering with foreign companies. In particular, focus were be placed on the issues related to quality, cost and delivery as pointed out in transaction between domestic enterprises, the current state of subcontracting relationship, competitive conditions and the market needs arising there from. However, the subcontracting was found not common in Jordan.

The survey covered the following:

1. Product mixes, target markets and users, and tie-up with foreign partners
2. Sources of raw materials and parts, and major issues related to procurement therefrom
3. Characteristics of target markets (or users) and major issues faced in market penetration efforts
4. Nature and level of technology used and production equipment
5. Organization and method of production management
6. Management policy, and awareness about the importance of product development and marketing

Selection of model enterprises

During the enterprise survey, the Study Team explained the objective and contents of the diagnosis program, and distributed the application form. There were 10 applicants for the program, and all the applicants were accepted.

Diagnosis

The diagnostic study was originally designed to analyze the current state of the selected enterprises in terms of their capability in the fields of “marketing,” “industrial design,” “technology” and “management” and provide consultation and guidance as required. However, because of the following, the diagnosis was focused on production management and production technology.

1) No company has engaged on product design and development
2) Reluctance of the participants of disclosing financial statements and data on production costs
3) Though many companies requested to make diagnosis on “marketing”. However, the “marketing” they meant was introduction of markets and customers, which is out of the study scope.

Implementation procedures

1) Bring home the model enterprises the nature and intent of the study, request for necessary preparatory work, and obtain general profiles of the model enterprises (a half day)
2) Diagnosis (2 days)
3) Presentation of the results and guidance (a half day) (During the Second Filed Work period)
4) Follow-up diagnosis (Follow-up of the recommendations, and additional guidance, it required. During the Third Filed Work period) (a half day)
5) Summary of diagnosis method and recommendations
   - Finalization of the corporate diagnosis manual
   - Compilation of diagnostic results into a database

Diagnosis and guidance

Figures A3-1 through 6 show the examples of the recommendations given to the individual firms in the Enterprise Diagnosis Program. These recommendations were summarized in II-2 “Present status and issues of enterprise management”.

Follow-up diagnosis

The follow-up diagnosis was made to 9 companies of the total 10, which received the first diagnosis. Another one company has stopped operation due to the high product inventory at that time.

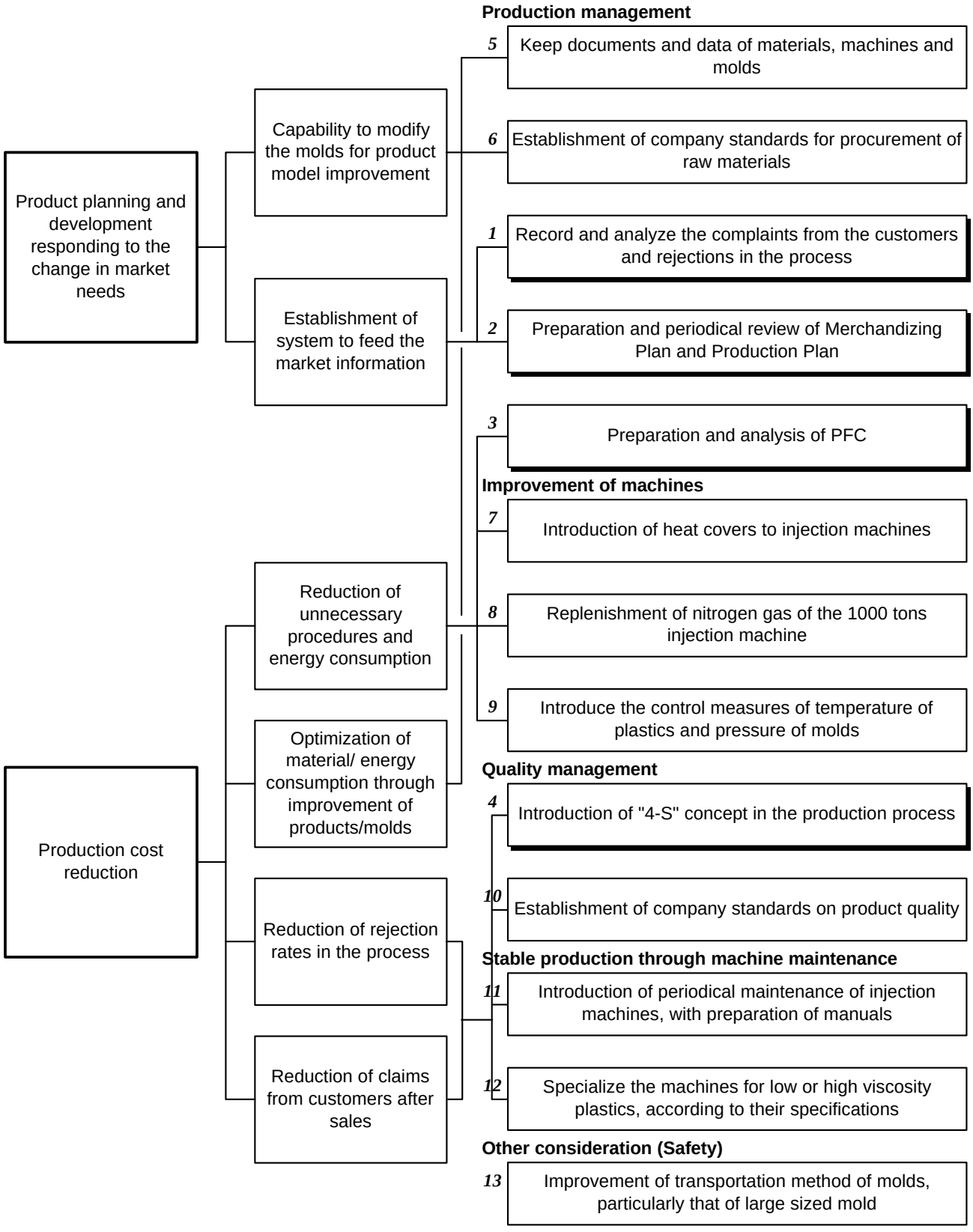
The status of implementation of the recommendations by the nine companies, at the time of follow-up diagnosis were as follows:

- Under implementation of the recommendations which require a significant investment; 2 companies
- Applying the recommendations related to those, which will not require significant investment, such as streamlining of the factory layout, improvement of working method, and compiling of work records and drawings, etc.; 5 companies
- No progress; 2 companies

The last two companies, which showed no progress, are those which have serious problems on their products, and their operation was almost stopped at that time. In most of the companies, there observed a lack of staff to lead or support the undertaking of these recommendations.

Most of these participated companies have expressed their desire for the continued undertaking of the similar programs.

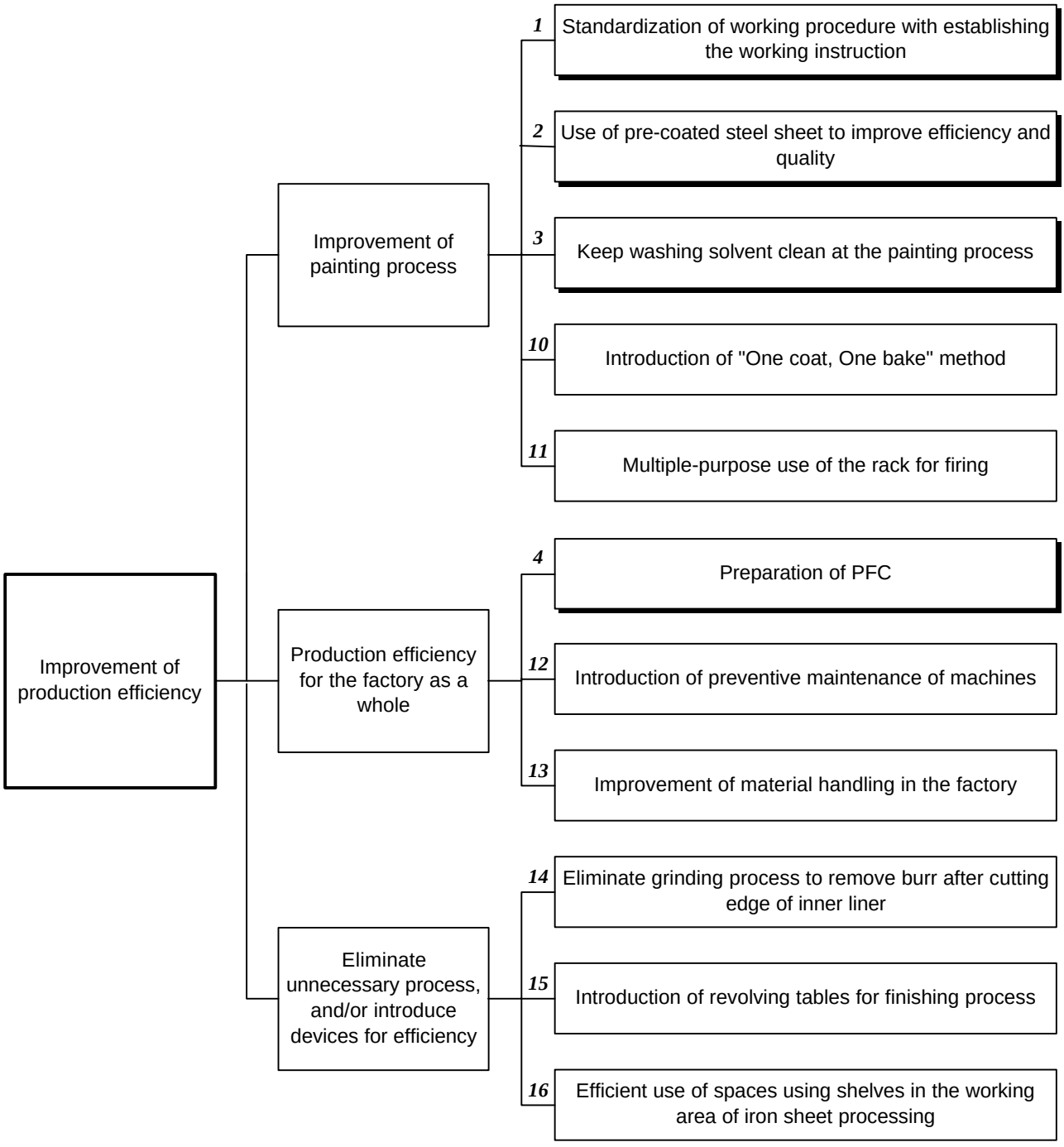
Figure A3-1 Summary of Recommendations (1)



Subsector: Plastic molding

Recommendations for immediate actions

Figure A3-2 Summary of Recommendations (2)



Subsector: Home appliance manufacturing Recommendations for immediate actions

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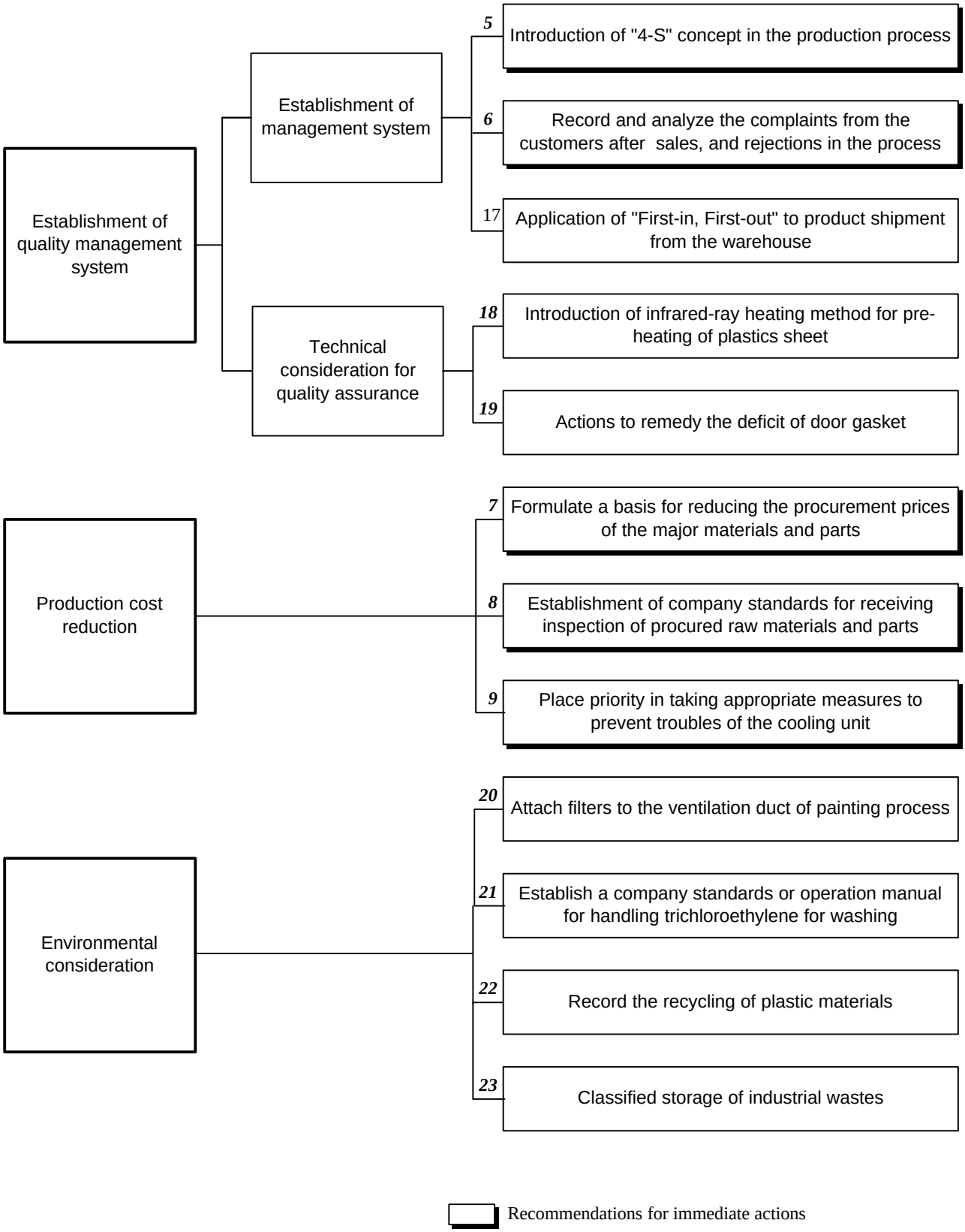
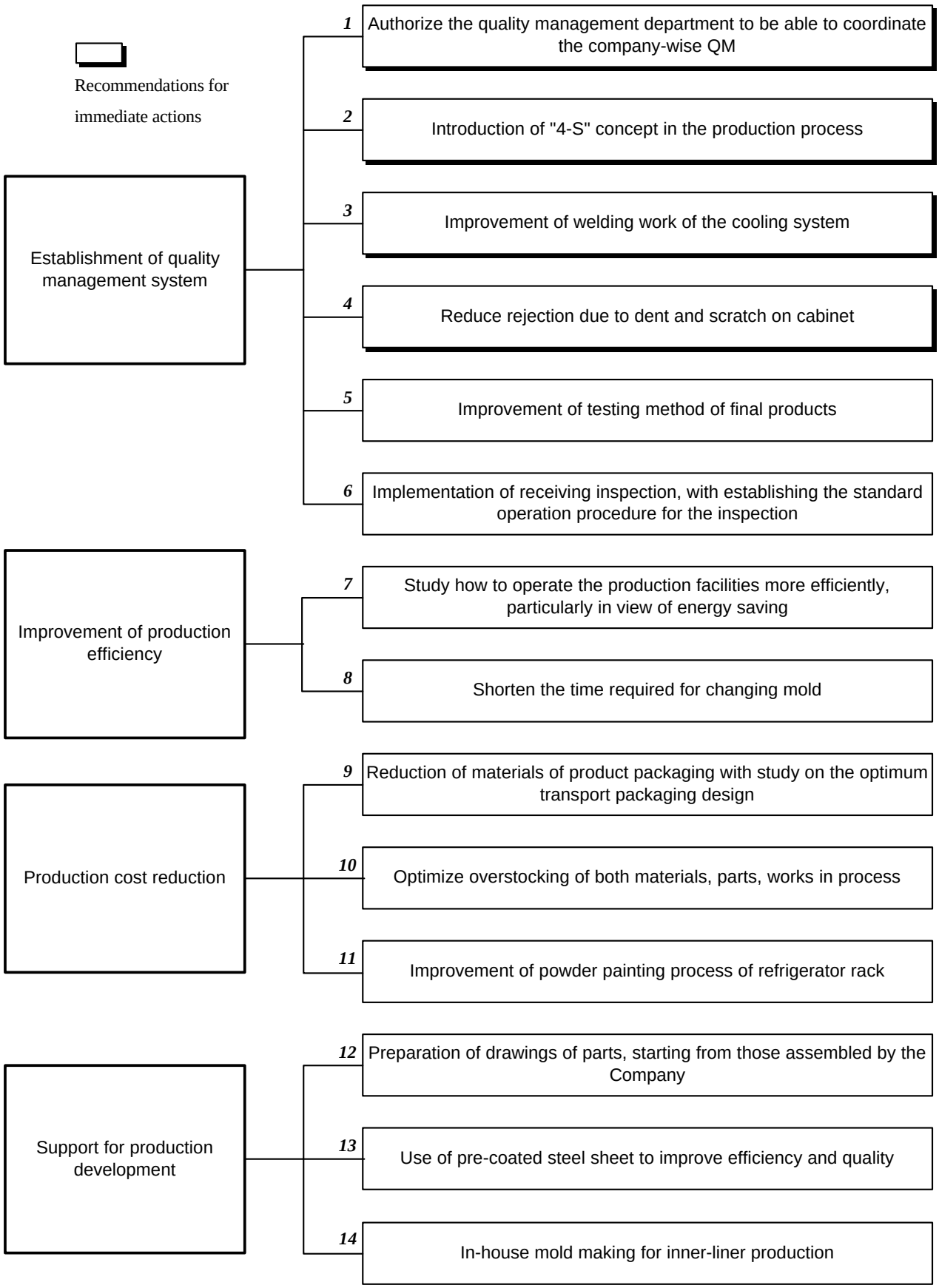

Establishment of quality management system
Establishment of management system
Technical consideration for quality assurance
5
Introduction of "4-S" concept in the production process
6
Record and analyze the complaints from the customers after sales, and rejections in the process
17
Application of "First-in, First-out" to product shipment from the warehouse
18
Introduction of infrared-ray heating method for pre-heating of plastics sheet
19
Actions to remedy the deficit of door gasket
Production cost reduction
7
Formulate a basis for reducing the procurement prices of the major materials and parts
8
Establishment of company standards for receiving inspection of procured raw materials and parts
9
Place priority in taking appropriate measures to prevent troubles of the cooling unit
Environmental consideration
20
Attach filters to the ventilation duct of painting process
21
Establish a company standards or operation manual for handling trichloroethylene for washing
22
Record the recycling of plastic materials
23
Classified storage of industrial wastes
Recommendations for immediate actions

Figure A3-3 Summary of Recommendations (3)



Subsector: Home appliance manufacturing

Figure A3-4 Summary of Recommendations (4)

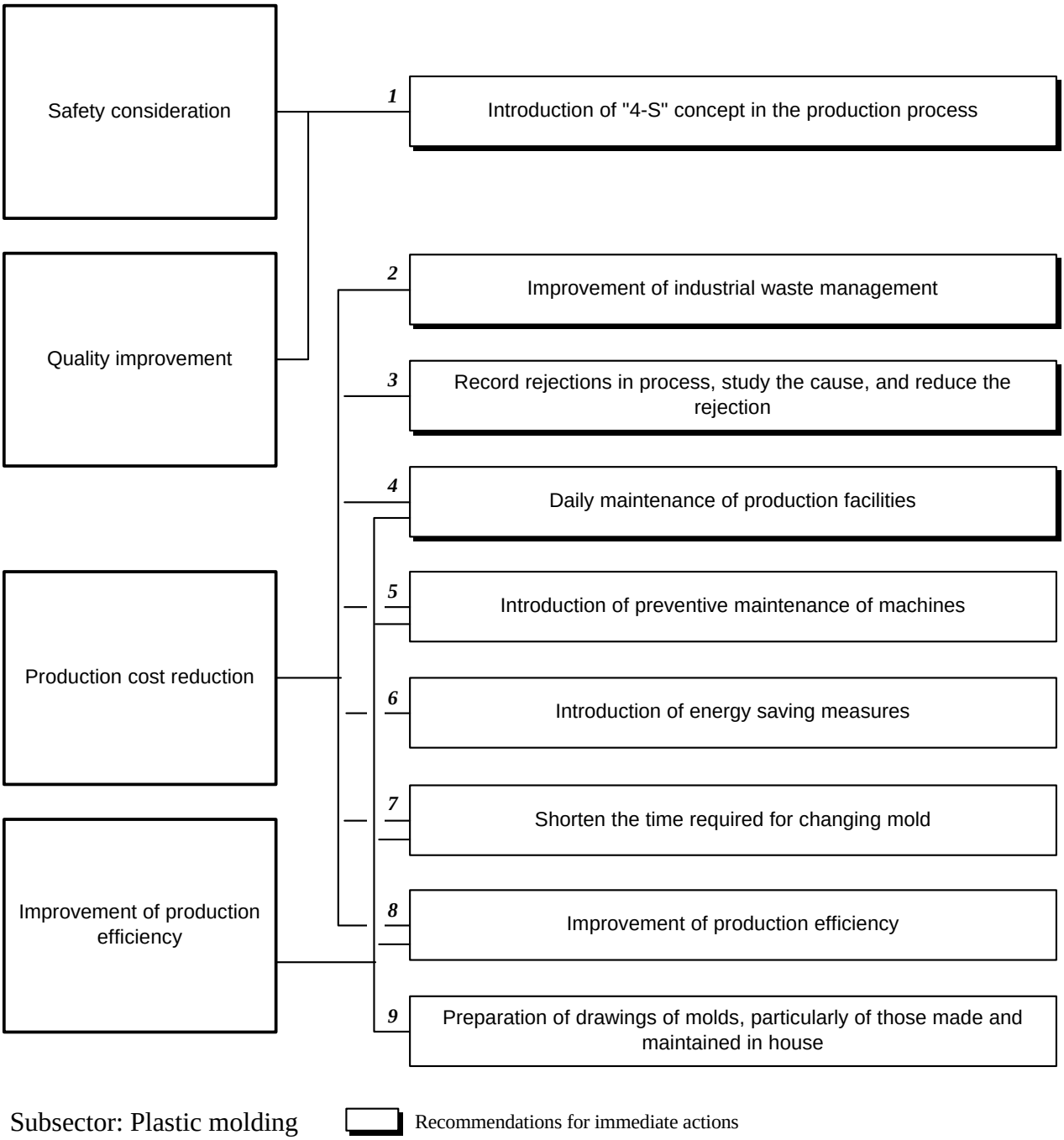
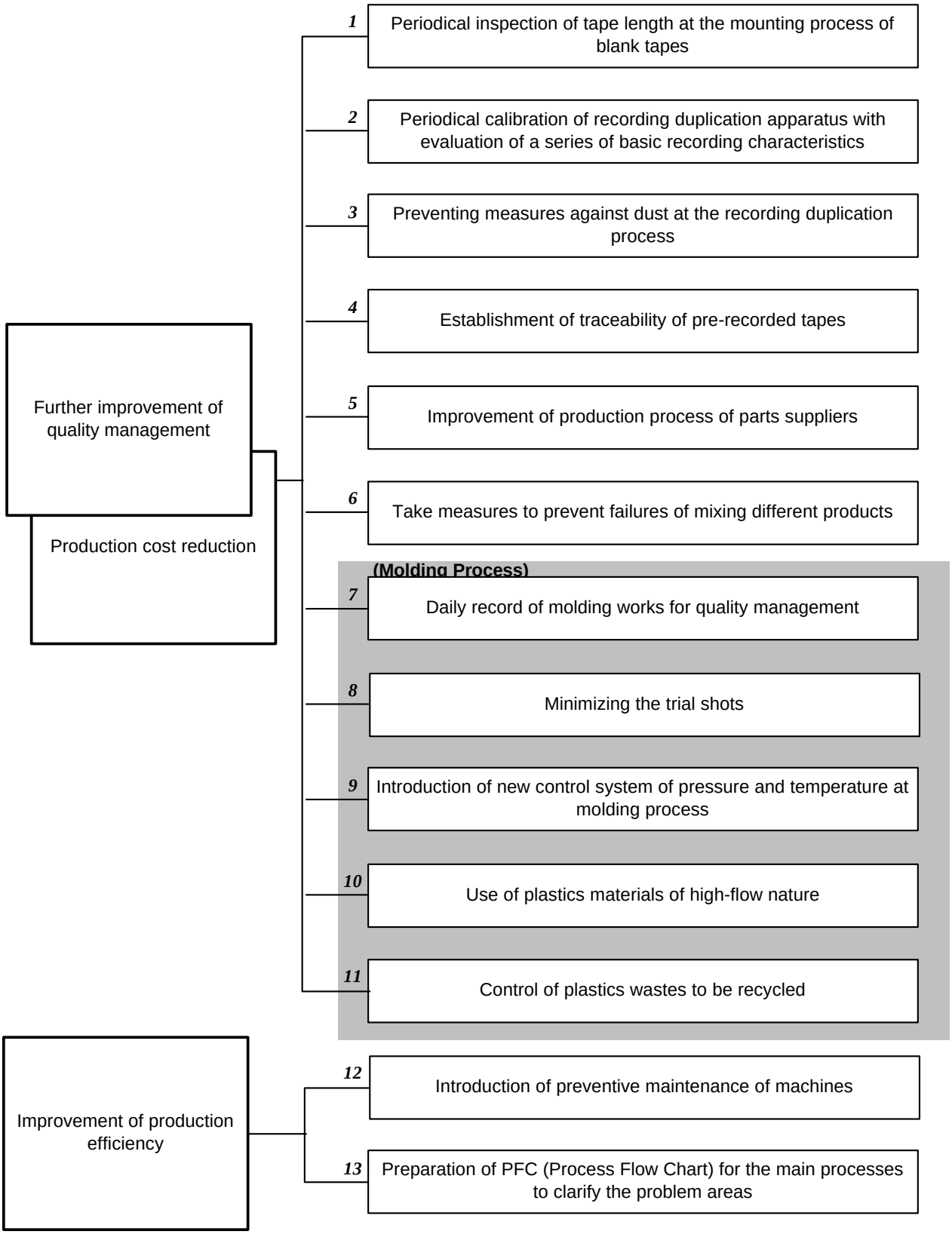
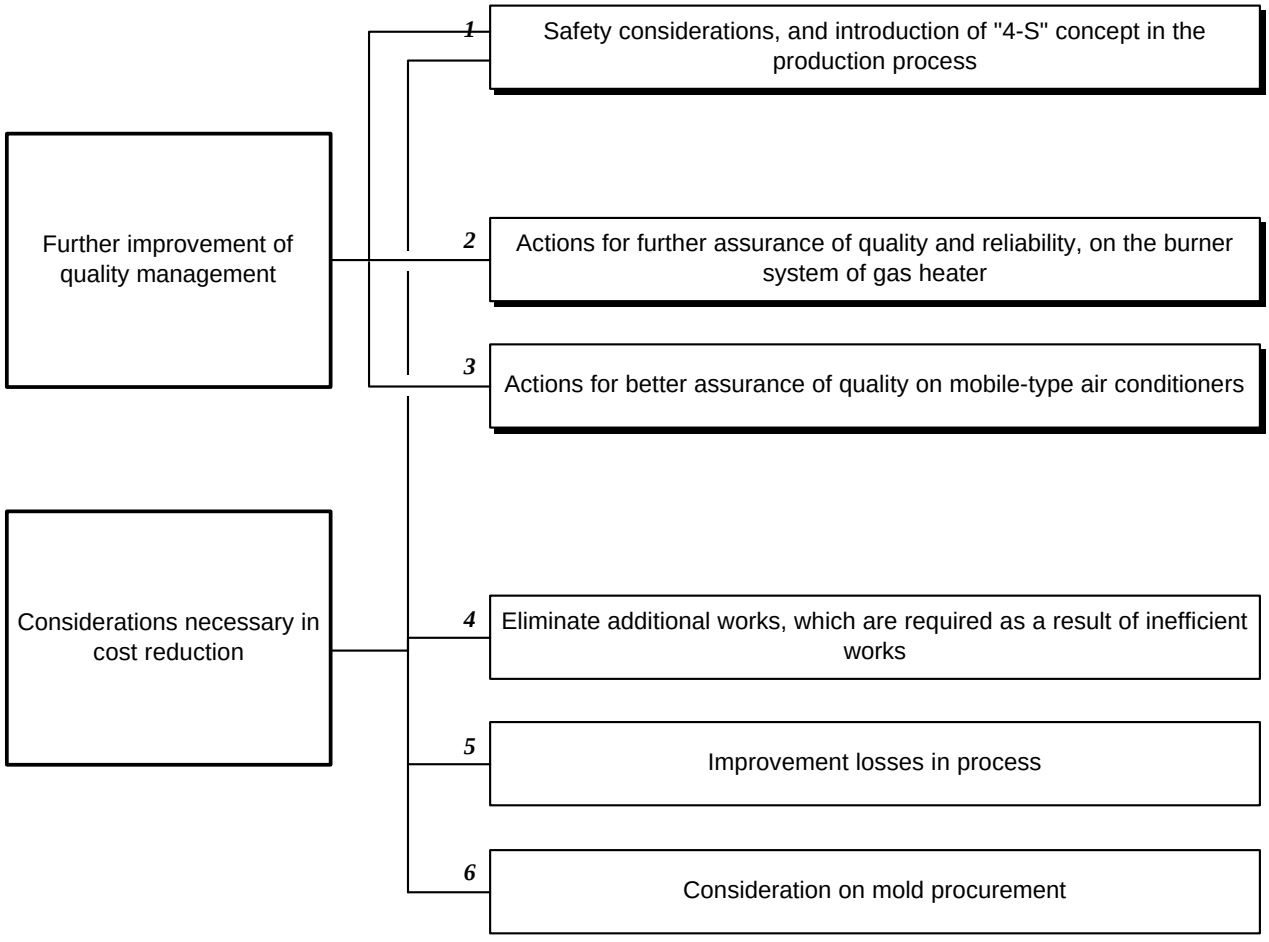


Figure A3-5 Summary of Recommendations (5)



Subsector: Plastic product manufacturing

Figure A3-6 Summary of Recommendations (6)



Subsector: Home appliance manufacturing

Recommendations for immediate actions

2 Implementation Manual for the Brief Enterprise Diagnosis

2.1 Opening Session of the Diagnosis

The brief diagnosis will be limited in its coverage because of the time limitation. Thus, the brief diagnosis is necessary to be concentrated on an important issues. The opening session of the diagnosis should be used for this aim, identifying the major problems they are facing, or the themes they want to tackle, by clarifying the following:

1) the problems, which, they think, they are facing
2) the issues, which they do not realize, but are obvious from their data or their operation situation

In order to confirm the problems which they are facing, the Diagnosis Team should request the management or a key staff of the company to attended the opening session, and explain their view not only of the major concerned issues, but also of the company mission, outline of the company, and the management goal, etc.

The next step for the Diagnosis Team is to identify the problems, which they are facing, but they do not understand it clearly. The best way to identify such problems is to obtain the data and information on the complaints from the consumers after sales. The rejection or defectives in the manufacturing process will also provide the useful information. The rejection or defective products at the end of manufacturing process will be insufficient in this case. The rejection in the process, which might be returned to the process for remedy, should be studied.

A sample program at the beginning of the diagnosis is shown in Table A3-1.

For further analysis, the analysis of manufacturing costs, particularly that of major cost components will provide an important information. However, most of the companies will be reluctant to disclose the manufacturing cost data, in the case of brief diagnosis.

2.2 Check Items for the Diagnosis

The check items for the diagnosis should be prepared according to the result of clarification of major issues in the opening session. The check sheet should be used for confirmation of the present status for evaluation. Tables A3-2 and A3-3 show the examples of the check sheet with evaluation criteria for production management and plastic molding.

In finalizing the recommendations, the Diagnosis Team should take into account the various limiting factors to make the recommendations practical, such as time available for diagnosis, investment ability, and staff for improvement work, etc.

2.3 Tool for the Diagnosis

Use of the following analysis tools may be useful for the diagnosis. Particularly, if there are too many issues to make the recommendations easy to undertake, use of these tools will help clarify the typical issues. If the Diagnosis Team can make the company staff analyze their problems by themselves during the diagnosis, then, they will be able to utilize the tools even after completing the diagnosis.

- PFC (Process Flow Chart)

  Figure A3-7 shows the example of the PFC. The chart can help understand the operational status of production through the movement of materials. It indicates the characteristics of production operation, showing the moving processes of materials starting from the warehouse to the completed products. The chart can be used for improvement of procedures and establishment of production management materials.
- Quality Characteristic Diagram

  Figure A3-8 shows the example. This chart will be useful for the qualitative analysis of the relationship between the quality characteristic and affecting factors on it. It can be used for clarifying the cause of defectives, and establishing the measures against it.
- ABC Analysis (ABC Curve)

  Items requiring special control or management are classified according to priority set on the basis of a specific measure (value, volume, etc.). Those given of the highest priority are classified into category A, those with the second highest priority category B, and so on. Resource allocation is made according to the priority assigned. Items can be selected in any form. For instance, when cost reduction is a major issue, ABC analysis helps the production engineer to decide as to which cost factor he should focus on (e.g., labor, raw material and energy). Or a quality problem can be analyzed by identifying and classifying its causes according to the level of importance, thereby to allow corrective measures to be taken in an efficient and effective manner. Also, inventory management is an area where ABC analysis contributes greatly.

2.4 Important Points in Brief Enterprise Diagnosis

It is very important to have the owner or the manager who is responsible for management of the evaluated company at the meeting with the evaluation team. By knowing the owner's or the manager's expectation for corporate diagnosis and setting evaluation items accordingly, the evaluation team can provide technical guidance that meets the company's needs.

Also, the meeting should be attended by production managers and engineers. They should understand the nature and intent of evaluation and are expected communicate them to workers. Their understanding is essential in executing corrective actions according to evaluation and recommendations.

Most SMEs are limited in human resource and lacks the ability to put recommendations into practice. In fact, it is often the case that the manager understands the need for improvement but does not have resources to execute it. To ensure the effective use of limited resources, therefore, it is imperative to make recommendations by specifying priority.

Table A3-1 Agenda for Orientation and Outline Survey Session

1. Orientation to the program (*10 min.*) *Briefing by Diagnosis Team*
   1)Objective and scope
   2)Procedure
   3)Important notice
2. Company profile and management policy (*20min.*) *Briefing by Management*
   1)Management mission
   2)Products and markets
   3)Major concerns to improve/strengthen the efficiency and/or competitiveness of your company (in the order of importance), *together with your targets*
   Examples: Sales promotion, Product development/improvement, Cost reduction, Improvement of production efficiency, Improvement of product quality, Reduction of stock (materials, intermediates, and products), Ensuring the operation/investment fund, etc.
   4)Management target/plan for short, medium and long-term
   (Examples: Target/Plan of revenue, sales, profit, export, investment, etc.)
3. Outline of the company organization and operation (*60min.*)
   Briefing by Management or Company Staff
   - Performance of production, sales and change in product inventory with figures in the past two years.
   - Organization of your company (including organizations for ad-hoc objectives), using an organization chart
   - Plant layout, using the layout drawing
   - Organizations in charge of various production management
   - Data on complaints received from customers on your products after sales
   - Data on rejection rates of products in the production process
   - Outline of cost compositions of your products
4. Plant visit (*20min*.)
5. Discussions, and confirmation of the diagnosis schedule (*10min*.)

Table A3-2 Check Sheet on Plastic Molding (1/2)

Category	Items	Check points
I. Production design	1.1 Required specifications	• Functions and performances • Dimensional accuracy (initial accuracy, allowable aging distortion etc.) • Mechanical conditions (max. load, static/dynamic conditions, allowable distortion, wearing condition etc.) • Environmental conditions (temperature and humidity, atmospheric gas, solvent, UV rays etc.) • Special specifications (electrical conductivity, heat release property, magnetic property, transparency, color tone etc.) • Applied standards (domestic/international), safety (flame-resisting, EMI shield properties etc.)
	1.2 Form design	• Thickness • Geometry • Boss and rib • Weld line • Flow analysis • Stress concentration and corner radius • Mold construction • Draft angle • Insert
	1.3 Strength design	• Strength variation caused by the temperature • Characteristics variation caused by the humidity change • Oil and chemical resistance • Distortion and rupture (creep, stress relaxation etc.) due to aging • Safety factor • Structure strength analysis
	1.4 Selection of materials	• Crystalline/Amorphous material (thermoplastic resin, only) • Pot life of the material (thermosetting resin, only) • Filler • Additive • Post-shrinkage and residual strain • Creep, stress relaxation, fatigue, TG, environmental effects
II. Molding machine	2.1 Stability and responsibility	• Injection speed/pressure, screw position • Measuring accuracy, mixing property, temperature control • Rigidity of die plate/bar, clamp force • Nozzle • Cushion quantity • Driving unit • Mold opening/closing and ejector mechanism
	2.2 Reproducibility	• Control unit • Dispersion of molded product
	2.3 Environment and safety	• Oil leakage, noise and machine safety

Table A3-2 Check Sheet on Plastic Molding (2/2)

Category	Items	Check points
III. Molding conditions	3.1 Temperature control	· Resin temperature · Metal mold temperature · Room temperature
	3.2 Pressure control	· Injection pressure · Pressure in the mold
	3.3 Injection speed control	· Injection speed
	3.4 Peripheries	· Material dryer · Mold temperature controller
IV. Die	4.1 Die assembler and die design	· Machining accuracy and assembly accuracy · Estimation of molding contraction rate · Geometry, dimension and number of the runners and gates · Material flow analysis · Heating/cooling (arrangement of heating/cooling piping) · Cooling analysis · Mold separation, draft angle · Ejection · Gas release path
	4.2 Rigidity and durability	· Service life and economy · Distortion of moving/fixed side plate · Mold material
V. Post-finishing, fabrication and assembly	5.1 Distortion, migration and mutual solubility	· Annealing, coating, hot stamping, adhesion and ultrasonic welding · Assembly, stress and migration
VI. Accuracy measurement	6.1 Measuring method	· Contact pressure, measuring load · Measuring jig · Reference plane for measurement · Distortion due to the self-weight and/or by assembly · Measuring environment · Measuring point of time
	6.2 Measuring instrument	· Accuracy of instrument · Measuring chamber · Geometrical errors and securing the accuracy of measuring instrument
	6.3 Measurement control	· Securing the accuracy of measuring instrument · Human error · Sampling
VII. Quality inspection	7.1 Initial performance	· Material, dimensional accuracy and strength · Residual stress (strain) and migration characteristics
	7.2 Durability	· Heat (Heat resistance, thermal shock and inflammability) · Destructive life test and emergency test

Table A3-3 Check Sheet on Production Management (1/2)

Items	Check points
1 Level of cleanness, Workshop adjustment	• How are the placed materials, parts and products placed on the floor • Are there useless or indistinct thing in workshops • Distinction of normal and abnormal products, machines • How is the cleanness in workshops
2 Production process and Flow	• How are the flow of workers, materials and parts with speed and smoothness • Tact speed, Tact balance • Are there frequent machine troubles • How is the PFC (Process Flow Chart) management • Notice board, destination board and indications for production, materials and parts supplying
3 Operation status	• Operation rates of each machine • Total capacity utilization rate • Frequency of machine stops and their causes
4 Product quality	• QC on production flow line. Inspection process and QC dates • Level of quality demand for products from customers, clients • Arrangement for ISO9000
5 Stock	• Level of stock amount with products, purchase materials parts • What country do they purchase from; How long does it take • How to communicate with suppliers, workshop and customers
6 Transportation and Material Handling	• Administration of transportation among the workshop or factory; transportation of products • Packaging (container, loading, materials etc) • Transportation route, distance, and method • Joint transformation among different parts / processes
7 Facility, Equipment and System	• How to be the newest machine type or not • How to be the control of machines and process • Operational status, machine troubles and stops • Automatic level of machine, equipment and assembling • Notice signals, indication systems; machine maintenance, it's procedure, process and section roles, responsibility
8 Die, Jig and Process	• Section or company of die, jig production • Procedure, process of die, jig maintenance and suggest on purchase • Die exchange process, setting up time, yield of materials in working process

Table A3-3 Check Sheet on Production Management (2/2)

Items	Check points
9 Environment, Safety and Health	• Control of energy and resources with natural resources • Recycling of materials and parts • Pollutants into environment including air, water and land • Safety and health for employees, some people
10 Management system	• Cost account • Production • Purchase • Education and training • Information systems

Figure A3-7 Process Flow Chart (1/3)

Applied Product Name:	Gas heater, Model-xxx
Part Code No. and Name:	Cabinet, xxx-xxx
Name of Process Flow:	Metal cabinet line

Company Name:

Symbol of main process

Stock | Transfer | Receive | Operate | Inspection | Operate with inspection | Receive with inspection

Date Issued:		
Date Revised:		
Approved by	Checked by	Checked by
28, June '00		

Sequence No.	Process flow: Part name, material name used	Process flow: Symbol of main process	Individual process: Process No.	Individual process: Name of process	Individual process: Work details	Facilities used: Machine, molds and dies, measuring instruments, etc.	Method of control: Procedure, instructions, standard etc. if any	Method of control: Quality control: Control item inspection, etc.	Method of control: Quality control: Standard, sampling, etc.	Method of control: Quality control: Recording method	Method of control: Person in charge: Operator ○trained	Method of control: Person in charge: Responsible person	Remarks
1	Cold roll sheet t=1, 2			Materials transfer	Take out and put them on cart	By hand	-	-			In charge of warehouse	Warehouse manager	
					Carry to metal press factory	By cart	-	-			In charge of carriage	Machine process supervisor	
2			1	Introduction inspection	To look for abnormality on materials	By eyes	Inspection instructions	No scratch, No dent, No remarkable corrosion	All metal sheets	○	○ Machine operator I	Same as above	ISO9002 requirement
			2	Press machine operation	Outside cutting, Cut right corner	Press machine I, Die I	Operation instructions	No remarkable burr	One per one day lot	○	○ Same as above	Same as above	ISO9002 requirement
			3		Outside cutting, Cut left corner	Press machine II, Die II	Operation instructions	No remarkable burr	One per one day lot	○	○ Same as above	Same as above	ISO9002 requirement
			4	Drilling operation	Make holes	Drilling machine I	Operation instructions	No burr	One per one day lot	○	○ Machine operator II	Same as above	ISO9002 requirement
			5	Bending with inspection	Bend as cabinet forming	Press machine II, Die II, Caliper	Operation instructions	No scratch, No dent, Dimensions check	One per one day lot	○	○ Same as above	Same as above	ISO9002 requirement

Figure A3-7 Process Flow Chart (2/3)

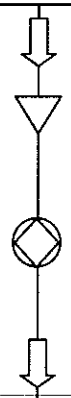
Sequence No.	Process flow: Part name, material name used	Process flow: Symbol of main process	Individual process: Process No.	Individual process: Name of process	Individual process: Work details	Facilities used: Machine, molds and dies, measuring instruments, etc.	Method of control: Procedure, instructions, standard etc. if any	Method of control: Quality control: Control item inspection, etc.	Method of control: Quality control: Standard, sampling, etc.	Method of control: Quality control: Recording method	Method of control: Person in charge: Operator ○trained	Method of control: Person in charge: Responsible person	Remarks
3				Transfer		Pallet with carrier	-				In charge of carriage	Same as above	
				Temporally stock		Pallet	-	Pile not so high			Same as above	Same as above	
				Surface treatment before painting	Put on hunger, remove oil, make oxidization, wash by water	Surface treatment system conveyer, dipping tanks for pre-treatment, by batch process operation	20sec. washing, 180sec. oxidization, 20sec. washing	No uneven oxidized surface	All		Painting operator I	Paint, process supervisor	
				Transfer		Pallet with carrier	-						
4				Painting	Put on hunger, Powder painting	Electro-static powder machine system (automatic)	Operation instructions	Check of automatic controller			Painting operator I	Paint, process supervisor	
5				Transfer	Automatic transfer	Conveyer of painting system	-	-			Painting operator II	Same as above	
			1	Arrangements	Take out from hunger, put work in order on a rack	Rack	-	-					
			2	Heating	Carry rack with work into heat chamber	Heat chamber	180degree C, 30min.	-			Same as above	Same as above	
			3	Cooling	Take out rack and leave the room	Rack	More than 2 hours	-			Same as above	Same as above	
			4	Inspection	To look for abnormality on materials	By eyes	Inspection instructions	No uneven painting, No painting spot	All		Same as above	Same as above	

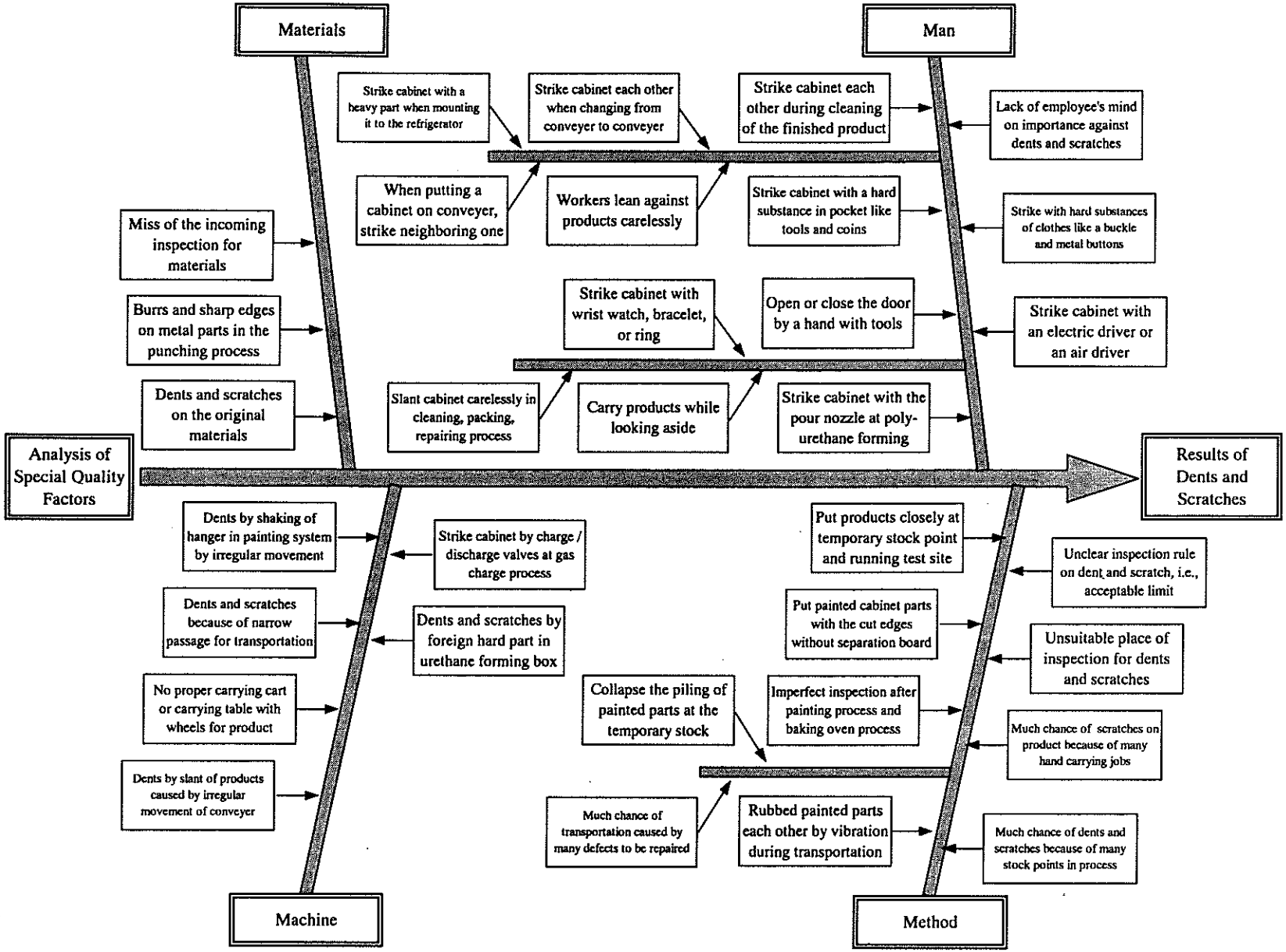
Figure A3-7 Process Flow Chart (3/3)

Sequence No.	Process flow: Part name, material name used	Process flow: Symbol of main process	Individual process: Process No.	Individual process: Name of process	Individual process: Work details	Facilities used: Machine, molds and dies, measuring instruments, etc.	Method of control: Procedure, instructions, standard etc. if any	Method of control: Quality control: Control item inspection, etc.	Method of control: Quality control: Standard, sampling, etc.	Method of control: Quality control: Recording method	Method of control: Person in charge: Operator ○trained	Method of control: Person in charge: Responsible person	Remarks
6	Handles, Screws			Transfer	Transfer to assembling room	By rack							
			1	Assembling	Insert 2 handles into holes of cabinet and fix them with screws	Working table, Air screw driver	Operation instructions	Check air pressure of air screw driver			Assembler	Same as above	
			2	Inspection of complete cabinet	Confirm every holes for fixing parts	Working table, △1 Inspection gauge for holes	Inspection instructions	Confirm diameter, all within spec.	One per every 100pcs.	○	○ QC engineer		ISO9002 requirement
			3	Temporary stock	Put cabinet of pallet	Pallet	-	Not pile up			Assembler	Same as above	
	To final product assembly												

History of revisions: Mark	Revised date	Reasons and explanations	Revised by	Checked date
△1	28, June, '00	Add an inspection gauge		
△2				
△3				
△4				

History of revisions: Mark	Revised date	Reasons and explanations	Revised by	Checked date
△5				
△6				
△7				
△8				

Figure A3-8 Quality Characteristic Diagram



3 Samples of Diagnosis and Guidance

During the diagnosis program, the Study Team prepared a diagnosis report for each participating company, and made the technical guidance according to the report. The following section contains all the recommendations in an order presented in Table A3-4, as a reference material for the diagnosis to be conducted in the future.

Table A3-4 System of Recommendations (1/2)

Category 1		Category 2		Category 3		Pages
101	Production control	10101	Maintenance of environment for safe operation	1010101	4S	1
		10102	Operation analysis	1010201	Quality confirmation	6
				1010202	Operation instructions	7
				1010203	Replacement of molds and dies	8
				1010204	Heat exchanger	8
				1010205	Reduction of losses	9
				1010206	Improvement of productivity	9
		10103	Process control	1010301	Process control chart	11
				1010302	Reduction of losses	11
				1010303	Production system	14
		10104	Measures for defects in market	1010401	Improvement for product defectives	18
		10105	Inventory control	1010501	Inventory check	22
				1010502	ABC analysis	23
				1010503	First-in first-out	24
		10106	Quality control/ system	1010601	ABC analysis	25
				1010602	Method of quality confirmation	25
				1010603	Analysis of defectives	27
				1010604	Traceability	32
				1010605	Compliance with standards	29
				1010606	Utilization of drawings and technical data	30
				1010607	Incoming inspection	31
				1010608	Countermeasures against mixture of different parts	33
				1010609	Improvement for operation	33
				1010610	Disposal	35
				1010611	Record of defects in process	36
				1010612	Endurance test	37
		10107	Facilities control	1010701	Energy saving	39
				1010702	Periodical preservation	40
				1010703	Apparatus for recording	42
		10108	Environmental preservation	1010801	Trichloroethylene	44
				1010802	Recycled use of materials	44
				1010803	Wastes	45
		10109	Material handling analysis	1010901	Crane for replacement of molds and dies	46
				1010902	Layout of facilities	46
		10110	Improvement for product quality	1011001	Dents and scratches	48
				1011002	Door gasket of refrigerator	49

Table A3-4 System of Recommendations (2/2)

Category 1		Category 2		Category 3		Pages
101	Production control	10111	Materials procurement	1011101	Standardization for materials procurement	50
		10112	Cost analysis	1011201	ABC analysis	51
				1011202	Improvement for packaging	51
				1011203	Material change	52
		10113	Improvement of facilities	1011301	Maintenance of technical data	54
		10114	Production planning	1011401	Computerization	56
				1011402	PSI meeting	58
				1011403	Standardization for products	58
102	Plastic molding engineering	10201	Molding system	1020101	Molding machine	60
		10202	Improvement for product quality	1020201	Nitrogen gas	61
				1020202	Method of temperature control	61
				1020203	Plastic materials	62
				1020204	Recorded data	62
		10203	Foaming molding	1020301	Inner liner of refrigerator	64
		10204	Vacuum molding	1020401	Improvement for pre-heating	65
		10205	Introduction of new materials	1020501	High-flow plastic materials	65
		10206	Precision molding	1020601	New control technology	65
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3.1 Recommendations on production control

(1) Maintenance of environment for safe operation

1) 4-S (1)

Theme:

Safety considerations

Recommendation:

There are many points to be improved in view of ensuring working safety. The following recommendations emphasize the working safety, however, they will not only be related to the safety, but also be useful in view of reduction of loss, improvement of production efficiency and quality management.

1) Improvement of punch press machines which use foot switch.
2) Use of safety glasses for spot welding works, and drilling works on ladders.
3) Use of gloves for enamel painting works.
4) Wearing of safety shoes by machine operators.
5) Strengthen of the staging at the chemical treatment shop.
6) Cleaning of metal chips at the assembling line of ladders (the chips make the floor slippery).
7) Reconsideration of space layout for bending works of ladders.
8) Improvement of unstable working desk for boring and screw tightening works of ladders. (We can point out many other points to be improved on the spot at the factory, during the diagnosis reporting.)

The introduction of "4-S" concept will contribute greatly for the above improvement, and it will be the starting point of improving the production efficiency and implementing the quality management, at the same time. The "4-S" consists of 4 important actions, the first character of which begin with "S" in Japanese, namely (1) Putting things in order, (2) Straighten things up, (3) Keeping things and spaces clean, and (4) Cleaning the space time to time.

At present, completed products, half-finished goods, and materials are kept in the process without distinct identifications. Some of them are rejected goods, while others are good for processing or shipping.

One of the method to improve the above is to draw white line on the floor of the factory, and put the materials in order in the area surrounded by the line, while indicating

clearly that the area is the space for keeping the specific materials/goods indicated. Use of boxes or bags with different color for keeping rejected products/materials is another way to improve.

Expected effects:

Introduction of "4-S" concept will not only help implementing safety operation, but also contribute to the improved quality management. It will be also useful for efficient production management, enabling quick decision making on the cause of rejection with accurate information on the rejected goods, which become available with separating wastes and rejected goods from goods for production.

2) 4-S (2)

Theme:

Introduction of "4-S" concept particularly in the assembling process.

Recommendation:

At present, completed products, half-finished goods, and materials are kept in the process without distinct identifications. Some of them are rejected goods, while others are good for processing or shipping. This will make the visual management of raw materials, parts, and products difficult, resulting the problems happening in the process hard to realized. One of the method to improve such situation is to draw white line on the floor of the factory, and put the rejected parts and materials in the area surrounded by the line, while indicating clearly that the area is the space for keeping the rejected parts and materials.

The introduction of "4-S" concept is the starting point of improving the production efficiency and implementing the quality management. The "4-S" consists of 4 important actions, the first character of which begin with "S" in Japanese, namely (1) Putting things in order, (2) Straighten things up, (3) Keeping things and spaces clean, and (4) Cleaning the space time to time.

It is also recommended to attach a control slip to each good. The slip should indicate clearly such descriptions as the classification of rejected or not, the date when the stock is put, and number of goods in the lot, etc. Introduction of "4-S" concept will not only help preventing confusion, and contribute to the improved quality management. It will be also useful for efficient production management, enabling quick decision making on the cause of rejection with accurate information on the rejected goods, which become available with separating them from goods for production.

3) 4-S (3)

Theme:

Introduction of "4-S" concept in the production process.

Recommendation:

The introduction of "4-S" concept is the starting point of improving the production efficiency and implementing the quality management. The "4-S" consists of 4 important actions, the first character of which begin with "S" in Japanese, namely (1) Putting things in order, (2) Straighten things up, (3) Keeping things and spaces clean, and (4) Cleaning the space time to time.

Expected effects:

At present, completed products, half-finished goods, and materials are kept in the process without distinct identifications. Some of them are rejected goods, while others are good for processing or shipping. This will tend to cause confusion among the workers, resulting in failure in quality management. Introduction of "4-S" concept will help preventing such confusion and contribute to the improved quality management, and efficient production management.

4) 4-S (4)

Theme:

Introduction of "4-S" concept in the production process.

Recommendation:

The introduction of "4-S" concept is the starting point of improving the production efficiency and implementing the quality management. The "4-S" consists of 4 important actions, the first character of which begin with "S" in Japanese, namely (1) Putting things in order, (2) Straighten things up, (3) Keeping things and spaces clean, and (4) Cleaning the space time to time.

At present, completed products, half-finished goods, and materials are kept in the process without distinct identifications. Some of them are rejected goods, while others are good for processing or shipping. This will tend to cause confusion among the workers, and there is a fear to assemble the rejected parts into a product. One of the method to avoid such fear is to draw white line on the floor of the factory, and put the rejected parts

and materials in the area surrounded by the line, while indicating clearly that the area is the space for keeping the rejected parts and materials.

It is also recommended to attach a control slip to each good. The slip should indicate clearly such descriptions as the classification of rejected or not, the date when the stock is put, and number of goods in the lot, etc.

Expected effects:

Introduction of "4-S" concept will not only help preventing such confusion, and contribute to the improved quality management. It will be also useful for efficient production management, enabling quick decision making on the cause of rejection with accurate information on the rejected goods, which become available with separating them from goods for production.

5) 4-S (5)

Theme:

Introduction of "4-S" concept in the production process.

Recommendation:

Safety consideration seems to be an urgent requirement for the Company. We can point out many points to be improved in view of safety. Some of the examples are;

1) Cigarette stubs are scattered at the doorway to the factory. With oil stains and combustible plastics wastes seen in the place, it will easily catch fire. Smoking areas should be clearly defined at suitable places, and let employees to observe the smoking areas.
2) Plastics raw materials are scattered on the heaters of molding machines. Some of them are already burned black. It is recommended to keep clean it time to time, or fix a cover on the heater.
3) Spilled oil is seen at many spots in the factory. It makes floor slippery and goods easy to catch fire.
4) Scattered plastics bags at passages will also lead to people slip and fell. The staff in charge of a machine should also be responsible to keep the surrounding space clean with disposing wastes and put materials in order.
   (We can point out many other points to be improved on the spot at the factory, during the diagnosis reporting.)

The introduction of "4-S" concept will contribute greatly for the above improvement,

and it will be the starting point of improving the production efficiency and implementing the quality management, at the same time. The "4-S" consists of 4 important actions, the first character of which begin with "S" in Japanese, namely (1) Putting things in order, (2) Straighten things up, (3) Keeping things and spaces clean, and (4) Cleaning the space time to time.

At present, completed products, half-finished goods, and materials are kept in the process without distinct identifications. Some of them are rejected goods, while others are good for processing or shipping.

One of the method to improve the above is to draw white line on the floor of the factory, and put the materials in order in the area surrounded by the line, while indicating clearly that the area is the space for keeping the specific materials/goods indicated. Use of boxes or bags with different color for keeping rejected products/materials is another way to improve.

There will be many other way to improve the situation.

Expected effects:

Introduction of "4-S" concept will not only help implementing safety operation, but also contribute to the improved quality management. It will be also useful for efficient production management, enabling quick decision making on the cause of rejection with accurate information on the rejected goods, which become available with separating wastes and rejected goods from goods for production.

(2) Operation analysis

1) Quality confirmation

Theme:

Actions for further assurance of quality and reliability, on the burner system of gas heater, which was converted to in-house manufacturing.

Situation:

Theme: Productivity improvement of own process following supply 100% good part to next manufacturing process.

Explanation of situation for actual problem:

The important point for better productivity and keeping good quality is giving half made good quality product to next manufacturing process. For that purpose manufacturing procedure must be standardized eliminating adjustment or modification work procedure. Using suitable fixtures and good tools assures stable and good quality whoever may work.

Recommendation:

The burner system is the main functional parts of the gas heater, and thus, assurance of function and safety is essential. The following are recommended to avoid the possible deficit in the future:

1) Preparation of engineering drawings of the parts. The drawings should include such important descriptions relating to production such as specifications, tolerance, notice on production, and allowance on appearance, etc.
2) Confirm the conformity of parts manufactured with the drawings, sampling periodically.
3) Conduct the firing test, burning condition test, and extinguishing test, repeatedly, record the results, and confirm that the function of those manufactured in-house is equal or better than the imported ones.

Expected effects:

The preparation of engineering drawings is the basis for improvement and development efforts. The drawings will provide basic information to decide the quality, production efficiency, and contribute to production loss reduction, and quality

improvement.

2) Operation instructions (1)

Theme:

Actions for better assurance of quality on mobile-type air conditioners.

Recommendation:

In order to assure the quality and performance of the new strategic products of mobile-type air conditioners, following are recommended for the cooling unit:

1) To prevent air dusts and water from entering into such parts as compressors, coolers, condensers, and capillary tubes, when stocked, attach rubber caps for inlets and outlets of these parts. Remove the caps just before brazing, and finish brazing in a short time.
2) To avoid the risk of loss of the sub-assembled cooling unit, particularly due to damage on compressor by gas leakage or poor cooling capacity, intensive care should be taken for the process of brazing and the following processes. In the processes of forming vacuum and charging gas, designed standards should be followed exactly. Further, it is recommended to establish an operation manual and standards for these processes in consultation withparts supplier.
3) Measure and record the cooling capacity of the unit periodically, with C.O.P. (Coefficient of Performance), which can be calculated with Enthalpy and motor input.

Expected effects:

The above procedures are essential to assure quality both in-process, and in market.

3) Operation instructions (2)

Recommendation:

To upgrade the production capacity of the process, it would be useful to standardize the working procedure with establishing the working instruction.

Expected effects:

Improvement of production capacity and efficiency.

4) Replacement of molds and dies (1)

Theme:

Shorten the time required for changing mold.

Recommendation:

At present some of the molds require as long as almost one-working day for setting. It is recommended to establish the more efficient method of mold exchange, for instances, with the following:

1) Prepare attachment metal fittings, bolts and nuts exclusively use for a specific molds setting.
2) Invent a device to tighten the metal fittings, and bolts and nuts easily.

Expected effects:

Improvement of production efficiency.

5) Replacement of molds and dies (2)

Theme:

Shorten the time required for changing mold.

Recommendation:

At present some of the molds more than 800 tons require as long as 6 hours for setting. It is recommended to establish the more efficient method of mold exchange. One of the recommendable method is to prepare the setting independently from the machine and set it to the machine after the preparation. In this case, the following are required:

1) Standardize the height and size of mold to be set using jigs and application tools, and use clamps exclusively for each mold, and
2) Prepare the mold according to the above standard, separately from the machine.
3) Convert the attachment method of cooling hose to those of one-touch operation.

Expected effects:

Improvement of production efficiency with reducing the loss time for production.

6) Heat exchanger

Theme:

Improvement of working method at heat exchanger assembling process.

Recommendation:

The works to expand copper pipes manually, and the works to setup the enclosures at the top and bottom, are those which are the burden for the workers. Other works of cutting materials are mostly operated using machines and can be completed in a short time. The works, however, seem to be the cause of defective parts, and form a bottleneck of the process. It is recommended to make the work study on these works to identify the possible improvement, including use of machines and devising of jigs.

This defects of aluminum fins in this process seem to be an indirect cause of deform of the fins seen during the material handling in the following process.

7) Reduction of losses (1)

Theme:

Examine and take actions to eliminate unnecessary processes.

Recommendation:

One of the unnecessary process identified is a grinding process to remove burr after cutting the edge of inner liner at sharing. If the cutting of edge is completed within the cutting process, you can eliminate the burr removing process.

Expected effects:

Increase in production efficiency and reduction of costs.

8) Reduction of losses (2)

Theme:

Introduction of revolving tables for finishing process.

Recommendation:

Expected effects: The revolving table will make the finishing work easier, and you can even reduce the number of workers from the current three to two if you introduce the revolving table.

9) Improvement of productivity (1)

Theme:

Improvement of quality of parts supplied to the assembling process, to reduce the fluctuation of required working time at assembling process, and assure the production quality.

Explanation of problem situation:

Important items taken into consideration for productivity improvement and good quality control is to supply 100% reliable semi finished product for following manufacturing process.

Suitable fixtures and tools must be prepared for that so as to be able to do uniform work even if another worker changed his job.

Recommendation:

Clarify the required specifications of parts, preparing drawings which indicate tolerance, and produce and inspect the parts based on the drawings. During the diagnosis, we found a case where the poor quality of parts makes the assembling work unstable in time and quality. It is the process to integrate the metal pole plate into a plastics body. The worker uses a hammer to beat the plate to fix it to the plastics body. This is because of significant variation in shape and size of the metal, and causes a fluctuation in required assembling time. Further, it might cause the crack at the plastics body.

10) Improvement of productivity (2)

Theme:

Reduce working burden of workers by devising jigs, fixtures, and tools.

Explanation of problem situation:

De-burring process of plastic parts manufacturing is inevitable.

Not only suitable tools for workers but also safety protection tools like masks and spectacles are necessary in essential.

Recommendation:

At the final stage of plastics parts manufacturing process, before being supplied to the assembling process, burr is removed. The work done in this process seems to be nuisance and burden for workers. If the fixture is devised and tools are modified, the work burden can be reduced and the production efficiency can be increased.

(3) Process control

1) Process control chart

Theme:

Preparation of PFC (Process Flow Chart) for the processes to clarify the problem areas in the production processes.

Recommendation:

Starting from the simple but major production process, we recommend to prepare the PFC. The sample PFC was prepared for a pipe processing process of the cloth dryer manufacturing.

Expected effects:

The PFC will help identifying the problem areas in the process, and analyzing the improvement directions, contributing to assurance of product quality, and accumulation of technical know-how to your company.

2) Reduction of losses

Theme:

Eliminate additional works, which are required because of inefficient works.

Explanation of problem situation:

In Jordan most electric appliances manufacturers import such material as steel sheets, plastics and functional parts like electric accessories. That results in not only high cost, long lead time in addition to inflexible production system but also a large among of material stock, work in process with big product inventory, we are afraid of. That will become heavy burden of interest pay.

If localizing production is possible in stead of import, synchronized production will be easy including affiliated companies.

Furthermore, cost reduction, in other words value add in the factory will be achieved when they are able to be manufactured in the factory including design.

Recommendation:

For the reduction of costs, it is recommended to eliminate the works, which are not necessary if the works are conducted properly. There are many unnecessary works, and some of examples are:

1) Works to make metal sheets flat using a hammer, after pressing. The work can be eliminated with improving the press mold.
2) Works to remove remains using nippers after boring and bending of ladder. It can be avoided with fixing the die and puncher completely, and readjustment of clearance.
3) Boring process using a hand drill at assembling process of ladders. It can be eliminated if it is processed using a pluriaxial boring machine.
4) Use of hammers for fitting at ladder assembling process. This is because of both wooden jig, which is worn, and burr of parts to be fixed. The work hours can be reduced by renewal of the wooden jig and reduction of burr of the parts.

3) Reduction of losses (2)

Theme:

Improvement of losses in process.

Recommendation:

Despite the fact that significant rejections and losses have been improved applying the quality management system of ISO standard, still there are rooms of further improvement. The rejections and losses are the important teacher for accumulation of technological know-how. The remedy actions should be taken only after analysis of the real cause of the troubles. Also important is the record of troubles, even if it is solved. Otherwise, the remedy actions of the troublewill be applied only to this specific case, and not be used for the similar possible troubles.

Some of the examples of rejections and losses to be improved are:

1) Deficit at porcelain coating (ceramic coating) process, due to surface scratching: The troubles are reportedly solved already. However, there is no record of the cause and remedy actions taken. The scratch in the oven may be caused by inappropriate hungers, or inappropriate air pressure of air compressor, etc.
2) Burr at injection machines: The volume of rejection due to burr is observed as much as that of products passed. The production has been continued without any remedy actions against the burr. The possible cause may be (1) higher temperature of mold because of the operation without chiller of the mold, (2) excessively high injection pressure, and (3) inappropriate parting lines of mold, etc.
3) Detachment of welded parts after painting: The rejected parts are seen at the assembly process. This loss is particularly serious because the part is rejected at the

final stage of manufacturing. All the preceding processes become in vain.

4) Reduction of losses (3)

Theme:

Reduction of production loss.

Subject matter:

It occurs frequently the burr and poor molding at the molding process of thermosetting resin. In this process significant burr and defect in molding are observed. This is because of omission of process to make resin in tablet making process, or conversion to a new molding method such as injection molding of thermosetting resin, or introduction of full-automated transfer molding machine, etc.

Expected effects:

Reduction of production loss contributes to reduce production cost and improve production efficiency.

Recommendation:

If the Company takes appropriate remedy actions on the reduction of production losses, not only a significant cost reduction but also improvement of production efficiency can be expected. The remedy actions should be undertaken after analyzing the causes and recording the contents of troubles and causes. Otherwise, the remedy action will not be applied to the possible troubles of the similar nature in the future.

Some of the examples of losses caused by defect observed through the diagnosis are:

1) Water leakage from the pulsator and welding spot of washing tubs. The estimated causes of defect include inappropriate joint of pulsator, poor welding at the bottom of washing tub, or detachment of welding spot caused by high temperature at the enamel treatment process, etc. The defect rate is estimated as high as 5% of the production.
2) Frequent occurrence of burr and poor molding at the molding process of thermosetting resin. In this process significant burr and defect in molding are observed. This is because of omission of process to make resins in tablet before pre-heating of resins. In order to improve this problem, it is recommended the use of the tablet making process, or conversion to a new molding method such as injection molding of thermosetting resins, or introduction of full automated transfer molding machine, etc.

3) Defect at enamel treatment process. There observed as much as 10% of defect in the process. Some of them are because of scratch on the surface, but other causes are not analyzed yet. Sine the process is one of the critical technology for the products exposed to heat, the intensive analysis of the causes is essential.

5) Reduction of losses (4)

Theme:

Improvement of production efficiency.

Explanation of problem situation:

When workers operate using equipment or facilities, both machines and workers must operate fully and effectively for resulting into maximum output. When they use popular conventional machines, workers must operate fully. On the contrary, machines must work fully for the case of using precious ones. To diminish or reduce direct worker's idle time of this case, some additional work should be charged during machine automatic operation.

Recommendation:

Although the Company has applied various measures to improve production efficiency, but still there is a room to improve production efficiency. These include:

1) Improvement of mold to minimize the occurrence of burr. It will enable to reduce a worker, making a worker to handle two machines.
2) Assign an additional job to an operator of injection machines. One cycle of the 800 tons injection work takes 60 seconds, and the operators have wasted their time until the next shot.

Expected effects:

Increase in production efficiency and reduction of costs.

6) Production system (1)

Theme:

Improvement of working methods of assembling process for increased working efficiency.

Explanation of problem situation:

Assembly work within the horizontal space of both hands swing, each reverse is applicable for small electric instruments assembling effectively. Different from conveyer system one worker covers whole assembly process from start to final assembly complete.

Through these, workers feel satisfaction and responsibility for their assembling products.

To extend this system effectively, mark workers initials on the corners of the instruments and trace the reliability in the market after sales.

As this is quite incentive system, managers should hear worker's opinion carefully prior to start.

Recommendation:

The shortcoming of assembling process using belt conveyer is the loss time caused by unskilled work and imbalanced working time among the works on the line. The Personal Shop System, which is adopted by the Company, is a method increasingly given more credit as a method to overcome such problems, particularly for assembling of small quantity but variety of products. The process has an advantage for the case with working conditions that a worker handles less than 20 kinds of parts using less than 3 jigs, finishing it within 3 minutes. Most of the products assembled in AEI are applicable to this method.

Under the current situation of high operation rate, and for future consideration, we recommend to improve this method further. It will enable to increase working efficiency, and in addition, avoid unnecessary defects.

1) The layout of parts stock points should be reexamined so that the workers can reach all the necessary parts with one hand.
2) Space of the working desk should be left free except for a product model they are assembling, and other minimum requirements for the assembling.
3) Improve the layout of jigs and tools to be convenient for the assembling.
4) Assembling should be completed by a worker, without dividing the assembling of a product into more than one worker.
5) Make counting the numbers assembled easy using a tray, on which the worker puts the assembled products in order. Or, use a counter for the worker to push it every time he (she) assembles one product.
6) Further improve the skill of workers, using a working instruction. The working instruction should be made model by model using illustration, and let workers read it every day before starting their works. It should be applied also to those who have skills already.

7) Supervisors should analyze the contents of rejected parts in the box designated to put them, and identify the cause of defect.
8) Review and readjust the assignment of workers by model analyzing their skill levels.
9) Separate the final inspection process from the packaging/boxing process.

7) Production system (2)

Theme:

Improvement of production efficiency with conversion of current batch system to assembly line system at the product assembling process.

Explanation of problem situation:

In Jordan job shop production system seems to more popular rather than line assembly system. Because production quantity from the market demand is rather small. On the other hand when large order comes from the market, it becomes of high operation rate.

To prevent this, most makers usually prepare relatively large amount of products inventory or work in process that will results in pressure of large interest pay. Thinking of this situation, it seems to be recommendable that advanced companies adopt line type assembly production.

Through this process, simplified operation work, rationalization of M/H and minimum inventory can be archived. Furthermore such improvement as working efficiency up, short lead time and reducing set up time will be accomplished as a result.

But some preparation are necessary for this before start. As an example, starting from simplified standardization of design specification as well as time and motion study for work operation are necessary.

Therefore this kind of method is to be recommended for potential companies.

8) Production system (3)

Theme:

Improvement of plastics product design

Subject matter:

In future it is necessary introducing of in-house plastics molding to make the product, especially mini split type design improvement easy. However, again, careful study on the above is recommended. It may be better to start small plastics parts, example electric box.

Expected effects:

Introduction of in-house plastics molding to make the products should not only contribute reduction of production cost, but also developing product design engineering.

Recommendation:

In the current system, the workers move along the roller conveyer line and assemble the parts into the product. If this system is converted to assembly line system using moving conveyer, the production efficiency is expected to be improved. Namely,

1) The workers will stay unmoved and assemble the parts to the products, which are transferred with the conveyer to the workers' position.
2) All the necessary parts are put in a space next to the workers to enable them to reach the parts without moving.
3) The time required for each worker to complete one unit will be scheduled to be the same.

The system can be applied to the controller box assembling if the result is found effective for improvement of production efficiency. The controller box assembling line should be connected to the product assembly line so that both assembling works can be synchronized, reducing material handling works as much as possible.

At the same time, draw white lines on the floor, indicating clearly the space designated to put parts, products, rejects, and parts for assembling. It will definitely contribute to the increased production efficiency.

(4) Measures for defects in market

1) Improvement for product defectives (1)

Overview:

In some enterprises in Jordan, each of them has generally a quality assurance section and seems to manage not to send defective products into the market. However, the section does actually not function for manufacturing good products in process as a whole by means of prompt and proper improvement. That is to say, the actual situation of product quality in the market is not convey to the engineering section and the manufacturing section but the remedy of defective products returned from the market is conducted in the factory without the collected information of analyzed factors in defective and also the operation concerned in process is not aware of the problems. Besides, although the top management says that there are only limited information about product defectives in the market, much of repairing work actually happens in the manufacturing process.

The recommendations after the diagnosis are expressed on the necessary flow of information inside company and on the role of quality assurance section in order to reduce the reoccurrence of defectives in the market and the manufacturing process.

1) Proper incoming inspection system of supplied parts from subcontractors
2) Request of improvement to be reported the situation of defects of supplied parts in the incoming inspection and manufacturing process to the supplier.

Theme:

Record and analyze the claims from the customers after sales, and rejections in

Recommendation:

These are one of the most valuable data and information to improve management. The following is recommended:

1) Record the number and contents of claims from the customers after sales.
2) Record the rejections in the production process.
3) Analyze the cause of the above claims and rejections, classifying the causes into the parts, and production processes.
4) Report the analysis results to those responsible for the cause, and make them discussion about the measures to be taken.
5) Report the results to the General Manager for their decision.

An sample form for the record and reporting is attached (Attachment 1).

Expected effects:

The data on the claims and rejections is not available, and the quantitative effect is difficult to estimate at present. However, the claims will be approximately 12%, according to the rough estimate by the staff 12% claims are not small enough. These claims cost a lot, and further, deteriorate the reputation of the brand in the market. The above procedure will help reduce the claims and rejections, and definitely reduce the production costs.

2) Improvement for product defectives (2)

Theme:

Authorize the quality management department to be able to collect all the data related to quality problems, analyze the problems, and coordinate the actions for remedy and prevention of recurrence, together with establishment of reporting system of all the quality problems to the quality management department.

Recommendation:

1) "Rework Order" sheet, which is issued by the Service Department when they receive the complaints from the customers, requesting remedy work at the factory, is currently sent to Production Department alone. The sheet together with the "Service Request/ Job" sheet should be sent to the Quality Management Department also.
2) Report the rejections in the production process from Production Department to the Quality Management Department.
3) The Quality Management Department should analyze the cause of the above troubles and rejections, classifying the causes into the parts, and production processes.
4) Report the analysis results to those responsible for the cause, and make them discussion about the measures to be taken.
5) Report the results to the Top Management for their decision.
6) The responsible department should report the proposed measures they will take, to the Quality Management Department.
7) The Quality Management Department should monitor the actions to be taken by the department responsible for actions for remedy.

Also important is that the Quality Management Department masters the skill to use

Statistical Quality Control Method for their analysis.

Expected effects: The claims cost a lot, and further, damage the brand image in the market. With establishment of quality management system, particularly the system which is designed to prevent the recurrence of the same type of the trouble, you can decrease the occurrence of all types of troubles.

3) Improvement for product defectives (3)

Theme:

Further improvement of quality management.

Recommendation:

The Team could not trace each record of their production activities, and remedy/improvement actions following the cause analysis, since the production line has completely stopped.

The quality management system itself seem organized quite well with ISO 9002 certification. Further, it indicates that the Company can do their production activities also in a planned and organized manner. We hope that the Company will continue their efforts to make most of this capability in their future development, targeting technology base development.

Particularly important is the serious analysis of causes of complaints from customers after sales, and reflection of it on the production activities. It will form the basis of technological know-how of the Company, and be one of the most valuable resource of the Company.

4) Improvement for product defectives (4)

Theme:

Record and analyze the complaints from the customers after sales, and rejections in the production process.

Recommendation:

The data thus obtained will be one of the most valuable data and information to improve management. The following is recommended:

1) Record the number and contents of complaints from the customers after sales.

2) Record the rejections in the production process.
3) Analyze the cause of the above troubles and rejections, classifying the causes into the parts, and production processes.
4) Report the analysis results to those responsible for the cause, and make them discussion about the measures to be taken.
5) Report the results to the Management for their decision.

Expected effects:

The claims costs a lot, and further, damage the brand image in the market. The above procedure will help reduce the complaints, and definitely reduce the production costs, with improvement and establishment of quality management system.

5) Improvement for product defectives (5)

Theme:

Place priority in taking appropriate measures to prevent troubles of the cooling unit.

Recommendation:

It is recommended to establish a system for those who are engaged in sales or service after sales, to build up the capability to define the cause of trouble correctly, as the first step.

Also important is to establish the appropriate countermeasures for the major troubles, and let all the relevant staff to know the fact, as soon as it is reported.

Expected effects:

Enable to establish good reputation of consumers on your brand, and reduce the costs incurred from the trouble. The costs is estimated to have been significantly big.

(5) Inventory control

1) Inventory check

Theme:

Optimize overstocking of both materials, parts and works in process.

Explanation of problem situation:

Many factories in Jordan manufacture their products and parts without using their drawings. Therefore judge criteria of acceptable or not acceptable at inspection of quality control is unstable.

That will results in unstable quality, low productivity and actual high cost. Authorized drawings are the base of good quality, high productivity and reasonable cost.

We must prepare drawings as the base of manufacturing first of all. About 70 to 80% of cost, quality & productivity are decided by drawings.

Recommendation:

Set targets of inventory levels for the major materials, parts and works in progress, as a first step, and reduce the inventory to the target levels. The following process is recommended:

1) Select some materials, parts, work in progress, in view of their total values to be handled.
2) Set the target level of inventory, taking into account the production level and lead time for procurement/production.
3) Take inventory periodically, checking the computer outputs and actual number of stock.
4) Stock the materials, parts or works in process, which are not actively used, separately from others for special attention.
5) Extend the above to the other materials, parts, and works in process.

Major factors to be taken into consideration in setting the target level of inventory will be the following, though it varies depending on the company situation:

- Minimum size of procurement lot, which is acceptable in terms of the procurement price/cost.
- Allowance of lead time after placing a procurement order until when the materials and parts can be used in the process, including.
  - Allowance for probable delay.

- Lead time for suppliers after receiving the order to start production.
- Reliability on supplier's quality assurance.

- Timing of placing order.
- Volume of works in process with consideration on rejection rates.
- Possible stop of production of the product model within the coming 6 months.

Expected effects:

Effective not only for reducing the existing stock to the target level, but also useful for preventing from the useless and wasteful procurement.

2) ABC analysis

Theme:

Actions for reduction of unnecessary stock of works in process.

Explanation of problem situation:

Sales amount of seasonal commodities has a tendency of fluctuating following climate conditions. Tender business also requests suppliers short delivery in general.

To cover these problems, following countermeasures have to be taken as to production,

1) Parts oriented inventory production.
2) To shorten lead time. For example, replacing import to local or manufacturing in plant.
3) Standardization, common specification or common usage of long lead time parts and material.

Recommendation:

For the purpose of reduction of unnecessary stock in process, appropriate production planning is necessary. In order to perform the adequate production planning, and reduce the unnecessary stocks, following actions will be useful.

(1) Make an inventory on products, parts, works in process and raw materials, and define the unnecessary stocks.

You can start with the stocks related to the major products in terms of size of aggregate value. ABC analysis will help identify the major products.

(2) Develop a system to control requirement of parts, and materials.

We recommend to develop a control system of parts and materials, starting with the following:

1) Preparation of drawings, including that of parts, sub-assembling structure, and assembling structure. The drawing should include important descriptions relating to the parts, sub-assembles, and assembles, such as tolerance, specifications of surface, specifications of materials to be used, thickness, etc. When a new model is designed, use the drawing of existing model as much as possible, and update it adding the changes. In this way, you can standardize the parts and raw materials.
2) Development of Bill of Materials. Develop the bill of materials, which stated required component parts in quantity, on the basis of the above drawings. The bill should be developed both in structural form and summarized form. It can be used in production planning indicating the required parts in quantity.
3) Develop the Bill of Material in the form of computer database. It can be used for procurement, receiving inspection, inventory control, and others, and thus, form the information system on production management.

3) First-in first-out

Theme:

Application of "First-in, First-out" to product shipment from the warehouse.

Explanation of problem situation:

When it comes into effective utilization of factory space, such idea as using special shelves is important for stocking of non-urgent matters like old molds and service parts, placing them in order as any one who needs them can easily understand their proper location.

In warehouse three dimensional stock is essential but we must take care of total stock height in addition to easy in and out operation from the point of safety.

Recommendation:

Products should be stored and shipped in the order of product lot number in the warehouse. With shipping the products, which came early, first, you can trace the cause easier, in case of trouble.

Expected effects: Make the trouble handling easier, in addition to make the inventory control easier.

(6) Quality control/ system

1) ABC analysis

Overview:

As shown the characteristics in statistical analysis of quality control, many cases of defectives are usually caused by a few causes in various kinds of causes. For example, the method to be reduced many defectives is applied to the case of countermeasures based on the few causes. That is so called ABC analysis. That method is not adopted for measures to quality problems but it is proposed that the company is to apply to incoming inspection of parts for the first.

1) Method of ABC analysis, that is, the effective method with a few countermeasures classified A class.
2) Improvement of production efficiency by limiting item of main parts in incoming inspection and supplying lots of good parts to the manufacturing process.

Theme:

Implementation of receiving inspection, with establishing the standard operation procedure for the inspection.

Recommendation:

Firstly, select parts and materials to be categorized in "Class A", applying ABC analysis, and apply the receiving inspection for the parts and materials, thus selected.

At the same time, establish the company standards for the receiving inspection of the above parts and raw materials, as a starting point.

The company standards should include procedure, check points, acceptable level of major materials and parts procured.

For the major parts and raw materials you should ask the suppliers to provide with a certificate that shows the result of lot sampling tests.

Expected effects:

It is estimated that the significant portion of poor product quality has come from the deficiency of procured parts and raw materials. Focusing your major concern on these parts and materials, as the first step action for cost reduction, you can expect the reduction of poor product quality.

2) Method of quality confirmation (1)

Overview:

To make confirmation of functions and the performance on the product acceptable or not, the ordinary way of measurement is to use the related measuring instruments. However, as the measurement is not always done with the same manner of user of the product, it is not actually proper method. If the measuring instrument is out of precision caused by any cases, it will not be helpful for the quality assurance of the product. For example, the truly reliable measurement for 60 minutes long recording cassette tape should be confirmed the correct length by the tape running as fast as its speed when the user hears the sound. The apparatus for tape winding in the factory runs with very rapid speed for measuring the tape length. It is possible to confirm easily the measurement in the apparatus correct or not by using a standard tape cassette, which is calibrated in the same condition as the manner of user. It is quite wrong that, they say, the measurement by machine is always correct. So, instruments used for manufacturing consumer products should be confirmed correlation with the actual way of users. The problem is a quality control without the basic understandings such a way of thinking that the products are made for consumers or made for the convenience of the maker.

1) The fundamental quality control shall be based on the confirmation of products in conditions of the actual use for consumer.
2) The instruments shall be calibrated by the way of confirmation with the actual use, when measuring functions and the performance.

Theme:

Periodical inspection of tape length at the mounting process of blank tapes.

Recommendation:

Introduction of periodical sampling inspection of tape length is recommended at the mounting process of blank tapes. The inspection is to confirm whether the length of tapes mounted is precisely equal to those programmed. The length is necessary to be checked under the same conditions as the consumers play the tapes.

3) Method of quality confirmation (2)

Theme:

Periodical calibration of recording duplication apparatus with evaluation of a series of basic recording characteristics.

Recommendation:

The recording characteristics can be affected by the change in frictional resistance, which is caused by abrasion of recording head, and tape driving mechanism. Therefore, it is necessary to make a periodical check of sound quality, sound volume, and output characteristics, sampling the products, for the purpose of system calibration at the recording duplication process.

The evaluation should be conducted to confirm a series of basic characteristics such as frequency, dynamic range-linearity, and wow-flatter, etc., with electric signals through playback, using a standard tape for evaluation.

4) Analysis of defectives

Overview:

The company diagnosed not pick up problems on deterioration of production efficiency due to the separation processof defective products in manufacturing and evaluates workers by quantity of completed products in the definite working time. Therefore, many defective parts separated during the intermediate finishing and the last process are not confirmed the quality. It is calculated that the cost of disposed materials in the current process are cheaper than personal expenses for the analysis of the cause and countermeasures to improve. However, it is not considered that the company loses the reputation, because many examples proved that there were defective products in the market after many defectives happened in the manufacturing process.

The recommendation is expressed that the method of analysis on defective parts are shown and that the product reliability and the productivity can be improved.

1) Example of damaged parts caused by improper operations of workers.
2) Example of dimensional defects of parts caused by poor maintenance of the mold.
3) Example of defective assembled products caused by no limit setting of the rotation torque for tools.

Theme:

Analyze the causes of rejection in process and take appropriate remedy measures.

Recommendation:

The rejection in process will increase the lost working time, and lost parts and raw materials. The remedy measures, which might be costly, would be compensated by the reduction of costs. In view of quality management, again, analysis of rejection is important. The current concept of quality assurance, which tries to avoid shipment of

defective goods, should be converted to the concept of quality management to reduce the production of defective goods. The quality assurance through severe inspection still has a risk of shipping defective goods, unless the rejection in process is reduced. A sample of cause analysis of malfunctioned outlet socket with switch, analyzed by the Team during the diagnosis is given below.

Cause Analysis of malfunctioned outlet socket with switch

Object: 7 Samples of malfunctioned switch

Description of defects:

(a) Switch unmovable
(b) Switch moves slightly
(c) No clicking
(d) Switch moves loosely

Causes of defects:

(a) Contacting point of the switch is out of the designed position.
(b) The same as (a).

In addition, (1) the hole of plastics case is damaged by inappropriate fastening of tap screw, (2) insufficient fastening of the tap screw, or (3) mis-filling of plastics tip into the hole.

(c) Nylon rod is broken.
(d) Not identified definitely, but estimated that (1) insufficient fastening of tap screw, (2) insufficiently short size of spring attached to the nylon rod, or (3) big burr at the switch, or insufficient height.

Measures to be taken (or cause analysis):

- Insufficient height of the switch due to the insufficiently short eject pin of the mold for the switch
- Need to identify the cause of broken nylon rod with life test, or chemical response test (whether it is caused by strength given in the working process, or brittleness caused by chemical reaction of grease)
- Standardize the optimum torque of air driver, and check the torque periodically. Also check the abrasion of driver tip or pit, and replace it if necessary. The current torque seems to be wrong to damage the screw head.
- Insufficient removal work of burr.
- Reduction of variation of length of coil spring.
- Use of limit samples for the sensuous inspection switch movement

5) Compliance with standards

Overview:

The manufacturing company shall secure and maintain the safety level of its own standard as well as its level of other requirements in the market on the finished products. And, the parts and the materials composed the products in compliance with other safety standards shall be used by the manufacturing company so that it may get reliance. Unsafe products shall not be definitely trusted in the market if it is used only cheep parts and materials without thinking quality. This point shall be taken attention to the product when manufacturer intends to reduce the cost.

1) The good product is made with the selected level of the standard.
2) It is desirable that the materials and the process control are also complied with the related standards.

Theme:

Establishment of company standards on product quality beside relying on such public standards as ASTM, DIN, BIS, and ISO, etc.

Situation:

Theme: Establishment of company inspection standards on product quality besides relying on such public standards as ASTM, DIN and ISO, etc.

Subject matter:

At the present, the quality inspections for plastics products demanded public standard from the customer are promoted. The public standard define the minimum requirement for the quality. Further, the establishment of company standards on the quality will be necessary to help maintaining the quality requirement specific to the products.

Expected effects:

The establishment of independent company standard will help maintaining the quality on production process.

Recommendation:

Expected effects: The public standards define the minimum requirement for the quality. The establishment of company standards on the quality will help maintaining the quality requirement specific to the products.

6) Utilization of drawings and technical data

Overview:

In general, there are very few enterprises which are referring to the drawings of products or the technical data for the manufacturing in the actual working place. They usually rely on their experience and perception in the process.

Products and the parts have dimensions with the tolerable range needed and notes for the process. So, the machine for the process is set up without any reference but set up by using parts made at past. It is doubtful whether the product is made according to the designed specifications or not.

On the after hand, there are enterprises using a product in intermediate finishing instead of the inspection jig for the quality confirmation at the manufacturing process of the parts, but it is not a correct method of inspection when considering the accumulated errors with the combinations of the related parts.

The recommendation is expressed what is needed after arrangements of drawings and technical data at the working place of manufacturing.

Theme:

Preparation of drawings of parts, starting from those assembled by the Company.

Situation:

Theme: Production plan & its periodic review based on market situation reflecting them to the status of inventory, work in process, material and parts.

Explanation of problem situation:

Few companies in Jordan make market situation reflect quickly to production schedule and inventory especially for mass production cases. This is because they must import many materials and parts from outside countries with long lead time and information net work has not populated. Periodic and elaborate monthly review of market is essentially important at this situation.

Recommendation:

The drawings should include such important descriptions relating to production such as specifications, tolerance, notice on production, and allowance on appearance, etc.

Expected effects:

The preparation of engineering drawings is the basis for improvement and development efforts. The drawings will provide basic information to decide the product price, quality, production efficiency, and contribute to production reduction, and quality improvement.

7) Incoming inspection (1)

Overview:

There are many cases of defective parts found and separated to reject or corrected to use in the manufacturing process.

Many defectives happened in the product assembling process are not counted and the causes are not analyzed, and then they are disposed or recycled to use. Those parts are sill adopted in the products without sending claim the parts manufacturing section inside same company or the subcontractor. The company is not modifying against the production efficiency and the deterioration of product quality level due to the defective parts.

The recommendations after the diagnosis are expressed that the enterprise has to convey the proper information of results of incoming inspection to the subcontractor in order to reduce defective parts found in the manufacturing process.

1) A proper incoming inspection of parts produced by the subcontractor shall be performed.
2) Request of improvement by reporting to the subcontractor the conditions of defects found at the incoming inspection or the product assembly process

Theme:

Reduction of losses caused by defective procured parts.

Recommendation:

The Company has suffered losses from defective procured parts, like motors for washing machines which are defective with over current at start, and ceramic heaters. Ideally, the procured parts should be no defect when receiving. Even if a certain level of defect may be accepted, 5% of defect rate seems to be too high to rely on the supplier for these critical parts supply. In addition to taking the appropriate countermeasures against the damage caused by the defect, we recommend to take necessary actions for the suppliers to ship no defective parts.

If the defective parts are assembled into the products, the Company will also be

damaged seriously.

8) Incoming inspection (2)

Theme:

Establishment of company standards for receiving inspection of procured raw materials and parts.

Recommendation:

The company standards should include;

1) Procedure, check points, acceptable level of major materials and parts procured.
2) Numbering and indicating method of the procured lots.

At least the receiving inspection should be established for the products procured from the local suppliers, as the first step.

Expected effects:

To avoid useless or costly procurement. Further, for maintaining the product quality, the raw material quality is necessary to be standardized.

9) Incoming inspection

Theme:

Improvement of production process of parts suppliers.

Recommendation:

Some of the rejections at the automatic cassette mounting process has derived from mixture of defective parts in the parts procured. We recommend to request the suppliers to improve their production process to assure their quality, showing the rejection data and samples.

10) Traceability

Overview:

There are companies which do not completely made practice of the traceability in what required in ISO9000s quality system (that is to say, after problems happen in products, it is possible to trace the products through the system of traceability how they were produced under the conditions of (H5W). Unfortunately, in case that the serious problems happen, it is possible that the enterprise is fail to continue to exist in the future unless the

traceability is considered in products.

The recommendation is proposed that products shall be put a registered control marking and that the recording in connection with the manufacturing process shall be kept.

Theme:

Establishment of traceability of pre-recorded tapes.

Recommendation:

Registered number control should be marked on the cassette, cover print, or cassette case. This is to respond to possible complaints from the market after sales, establishing traceability of shipped products.

11) Countermeasures against mixture of different parts

Overview:

Similar models of the products are sometimes delivered mistakenly without distinction from the models of ordered products or similar parts are assembled in the product or separated parts as defectives are assembled as good ones.

Those actions used to happen in manufacturers. There are many enterprises where can fully distinguish good quality products from all in the actual working place of manufacturing, even if the enterprises understand the requirements of ISO9000s.

The recommendation is written that the company should be sure to distinguish the placement of things and boxes for the stock of parts.

Theme:

Take measures to prevent failures of mixing different products.

Recommendation:

The current instruction is not sufficient to prevent from mixing of different products. Following measures will help avoid mixing.

1) Assign a stocking space of similar products in places not close to each other.
2) Shapes and colors of the boxes for stocking should be made different clearly for the similar products.

12) Improvement for operation

Overview:

Recommendation is written that the company should study well about the possible improvement in product manufacturing operation to maintain the quality as there are many points to be taken attention to the improvement of operation process. The products composed by the metal enclosure and used by connection with electric power line should be conducted the insulation test between the enclosure and the power cord at the final stage of production. Besides, it is necessary for operators to pay attention to fingerprints on the stainless steel panel especially wearing gloves during manufacturing process, because the fingerprints are easily remained on the stainless panel of the products and consumers may feel no good on them as soon as they receive the product first.

1) To produce safety products,
2) To give manufacturers heart to consumer products,
3) To determine what to be good or not at the inspection process by using the limit samples,
4) To try to use a specific characteristic factor chart to investigate the cause of dents and scratches on the product during production.

Theme:

Further improvement of quality management.

Recommendation:

The basic concept we will recommend in the following is that the Company should convert its concept of quality management from the current concept of "quality through intensive inspection in process", to "quality through reduction of defective or substandard parts and works in process".

Under the current quality management concept, the defective parts and products are put in the box, which is marked "Hold". The staff of quality control will inspect the products and parts later and decide finally to be rejected or passed. This undertaking can avoid the use of deficit parts in the production. However, it does not necessarily lead to analysis of causes and improvement of the process which has produced the defect.

Under the new concept of quality management, all the parts supplied to the assembling process will be the parts already cleared the quality standard. The current quality management methods, which heavily depend on workers, entrusting the decision of reject or pass to their personal sense, will be converted to those using objective standards and tools.

Some of the points, we identified during the diagnosis, to be improved are:

1) At the end of the production process of washing machine and gas oven, conduct the insulation test (or dielectric strength test) of metal closure, which has contacts with the power supply line. It will ensure the insulation of enclosure from the power line. This is applicable to washing machine and gas oven.
2) Use air driver at the torque, which is standardized in advance, when fasten the screws and nuts. The torque of air driver should be checked and adjusted to the standardized torque periodically. For the important fastening points, torque wrench or torque driver should be used.
3) Reduce dents and scratches of cabinets and panels, analyzing the cause of them. The analysis should be undertaken in an organized manner in every sections related to the process. The Specific Characteristic Factor Chart is a tool useful to identify the causes (a sample is attached).
4) Undertake life test (or endurance test) of products under the possible severest conditions, with sampling the products. The test will enable the Company to ensure the quality assurance of their products, showing the limitation of product durability and critical points for possible defect.
5) Use limit samples for visual inspections. The limit samples should be provided at the process for the worker to be able to check the product against it. The limit samples will be particularly useful for the visual inspections of screen prints, painted parts, and dents and scratches, etc.
6) Maximum number of packaged products allowed to be piled at stock, should be decided in advance with the piling and transportation tests, and clearly printed on the packaging material. The maximum number allowed should be limited within the number, which will not cause any damages to the products and packaging. The marking indicating top and bottom should also be shown on the packaging to prevent the products from being piled upside down.
7) Remedy work of defective parts should be done by the supplying process or suppliers, instead of making it in assembling process. The incomplete remedy work will result in assembling of defective parts into the product. An example of such a remedy work seen is the burr removal work of plastics pulley. The remaining burr of the pulley will shorten the life of timing belt significantly.
8) Install boxes in the assembly process to keep rejected parts. It will help preventing rejected parts from mixing in the parts acceptable.

13) Disposal

Overview:

It is unsuitable to put disorderly waste materials from the manufacturing process at the place of operation or at outside near the building. The big amount of useless and waste materials come from the process, and the disposal without complete control proves that the losses happened in the production are not grasped clearly because many rejected defectives in the process are included in that waste materials.

It is necessary to sort and count defectives in the waste materials, to designate the yard for disposal and to make factory environments clean.

Theme:

Define and indicate clearly the kind and name of industrial wastes to be stored to each space-lot outdoor for storing, and the industrial wastes should be dumped by kind to each designated space-lot thus allocated.

Recommendation:

Expected effects: Needless to say that wastes dumped in disorder outside of the factory gives a bad impression for visitors. The waste management should be considered as a part of production management. The management of wastes by kind will provide a good information with management about the poor molding operation, and thus, contribute to reduction of material loss.

14) Record of defects in process

Overview:

The waste materials happened in process are not treated as defectives in the reason why they can be recycled in this case. This means that the true quality control is not functioned in the factory. It is wrong to treat as defectives in the process by only reason of no disuse. It is very necessary to make the operation efficiency high by means of studying causes of any losses in the process. The way of thinking that good products separated with a certain ratio in the process are satisfied is a surprising mistake.

The recording system is needed for all defectives in the process and for improvement to reduce defects through the analysis of causes from the record.

Theme:

Record rejections in process, study the cause, and reduce the rejection.

Recommendation:

The actual rejections in process seem to be more than reported in a daily report on products received. For example, one or two rejections are observed per every shots in the case of injection molding, which uses a mold to produce more than one product per shot. Also in the case of blow molding of a container, many deformed products were seen in a bag for rejected products.

With recording the actual number of rejections by process, regardless of the possibility to recycle them to process, the quality management system should be reviewed to reduce the rejections. It should be followed by the analysis of causes, clear assignment of staff in charge of inspection of each molds and molding machines, reporting system of troubles, and measures to raise the awareness of employees on importance of reducing rejections.

Expected effects:

Even if the number of rejected products to have shipped to the market is small, so long as the number of recycled rejections are large, the man-hours used for the recycling work can not be disregarded. The above measures will help reduce inefficiency significantly.

15) Endurance test

Overview:

It is general that the measurement of characteristics in every functions of product is conducted to confirm the quality. However, the environment of the measurement is only under conditions of nominal temperature and humidity. That is, the measurement is not conducted under the worst conditions which can be guaranteed functions of the product and it is not confirmed as the real quality assurance. Moreover, the confirmation in long term practical use is never conducted at past. Very few companies are only studying such confirmation. The recommendation is explained concretely about the method and the significance for the test.

1) Confirmation of the characteristics by sampling base under the worst environment guaranteed the practical use of product.
2) Confirmation of the critical points in product quality by the endurance test.

Theme:

Improvement of testing method of final products.

Situation:

Theme: Quality assurance test before shipping.

Explanation of problem situation:

In general keeping good quality is assured through manufacturing good quality parts at upstream, good semi-finished product in middle stream and final assembly at downstream.

Therefore, final test before dispatching remains only confirmation of whole performance in addition to safety check. But in most Jordan companies, final test before shipping acts as selection test for quality assurance because preceding process is not stable as the skill of direct workers has not been trained well.

Furthermore quality level after selection test is not enough.

Recommendation:

The testing method of final products under the standardized temperature is necessary to be improved in the following view points:

1) Conduct the durability test under the severer temperature conditions as one of the final tests. This test will enable you to identify the critical points of your products. The product quality can be further improved and become reliable, if you take an appropriate measure to cope with the critical point of your product quality indicated in the test.
2) Improve the current testing method with using an enclosure. The current testing method makes the results inaccurate since the testing environment is the temperature of open air without control. The controlled environment temperature is required. Further, use of enclosure helps reducing the energy, with reducing the testing time.

Expected effects:

Improvement of quality as described in the above.

(7) Facilities control

1) Energy saving

Theme:

Study how to operate the production facilities more efficiently, particularly in view of energy saving.

Recommendation:

1) Select some major production facilities in terms of significance in energy consumption.
2) Set a certain target of energy saving for each selected facility.

Some examples of practicing energy saving are;

- Operation only within a limited dates and limited times.
- Operation only within a specified areas.
- Reduction of use of lighting.
- Setting a target of reduction for consumption of power, water, gas and oil, and make the target informed well to the workers, putting stickers at appropriate spots indicating the target.

For example, the facilities to prepare painting, plastics molding, and foam molding may save energy if it is operated for a short time continuously. Conversion of steel sheet to pre-coated one is also one of the way to save energy at the painting process.

Expected effects:

To reduce the costs for energy.

2) Energy saving

Theme:

Introduction of energy saving measures.

Recommendation:

With expensive power price, particularly in summer season, reduction of power consumption is one of the major tasks for the Company operating many power consuming molding machines. All of these machine are not those designed as energy-saving type. Besides converting these machines to those of energy-saving types when they will be renewed, following measures will contribute partly for the reduction of power consumption:

1) Introduction of control measures of temperature of plastics for the injection machines, and the control measures of pressure in the mold. As for the temperature control method of the plastics in injection machines, the direct censoring of plastic temperature, is recommended.
2) Introduction of heat covers to injection machines. Some of the injection molding machine are not equipped with the heat cover. The introduction of the heat cover will prevent the heat loss, reducing the consumption of power.

In addition to the production machines, energy saving measures should also be applied to auxiliary machines and facilities, which consumes power significantly, including compressors commonly used among the machines.

Also recommended is to take measure to operate the machines reducing the energy consumption. Some examples of practicing energy saving are;

- Operation only within a limited dates and limited times.
- Operation only within a specified areas.
- Reduction of use of lighting.
- Setting a target of reduction for consumption of power, water, gas and oil, and make the target informed well to the workers, putting stickers at appropriate spots indicating the target.

Expected effects:

To reduce the costs for energy.

3) Periodical preservation (1)

Theme:

Introduction of periodical maintenance of injection machines while preparing the maintenance manuals.

Subject matter:

The periodical maintenance of production machines will contribute to keep the productivity, and further to improve it. Example, 1,000 tons injection machine is not used nitrogen gas for stabilizing the mold pressure and saving energy in spite of being accessory with machine. The 1,000 tons machine should be periodical maintenance. At the same time, through the maintenance works, the maintenance manuals should be prepared and improved.

Expected effects:

It will help improve the production efficiency and cost.

Recommendation:

The periodical maintenance of production machines will contribute to keep the productivity, and further to improve it. At the same time, through the maintenance works, the maintenance manuals should be prepared and improved. It will help improve the efficiency of maintenance, but also help identifying the problem areas of the machines.

4) Periodical preservation (2)

Theme:

Introduction of preventive maintenance of machines.

Recommendation:

Introduce a preventive maintenance to avoid possible machine troubles, preparing and using performance records of machine maintenance.

The recommended introduction procedure is,

1) Record the contents of machine trouble, and renewal date of spare parts,
2) Analyze the above record after some time of record accumulation, and
3) Set preventive maintenance schedule for each machine and facility on the basis of the above analysis.

Expected effects:

The preventive maintenance will increase the cost for maintenance, but it will be more than compensated with improvement of production efficiency, and reduction of time to be spent on troubles.

5) Periodical preservation (3)

Theme:

Daily maintenance of production facilities, recording the conditions of each machine by foremen in charge of daily check of the assigned machine.

Recommendation:

There observed a various type of mal-conditions of machines and facilities in the

factory. These include leakage of oil from molding machines, trouble of a switch board, unused peripheral equipment (such as material feeders), and power cables which hung down from the ceiling, etc.

Expected effects:

The daily check will not only help prevent accidents, reduce loss of works and costs required for repair, but also contribute to accumulation of technical know-how on machine and their operation.

6) Periodical preservation (4)

Theme:

Introduction of preventive maintenance of machines.

Recommendation:

Introduce a preventive maintenance to avoid possible machine troubles, preparing and using performance records of machine maintenance.

The recommended introduction procedure is,

1) Record the troubles and repair works of machines and molds, and renewal date of spare parts (a sample recording form is attached for your reference),
2) Analyze the above record after some time (every 6 months, for example) of record accumulation,
3) Set preventive maintenance schedule for each machine and facility on the basis of the above analysis, together with procurement and stock plan of spare parts required periodically.
4) Keep the staff to be well informed and trained to stop the machine and report the management when the machine trouble happens.

Expected effects:

The preventive maintenance will increase the cost for maintenance, but it will be more than compensated with improvement of production efficiency, and reduction of time to be spent on troubles.

7) Apparatus for recording

Theme:

Preventing measures against dust at the recording duplication process.

Recommendation:

Dusts tend to stick easily to tapes and recording heads at the recording duplication process. The current measures of avoiding it with frequent blowing using compressed air, or head cleaning are not enough to avoid the dust. Following measures are required:

1) Doorway should be closed.
2) Air should be in-flowed through a dust filter.
3) Restrict the enter of people, who are not in charge of the process.
4) Shoes of persons should be changed when entering into the room.
5) The staff should wear shoes and working wears of dust free, when they are in the room.

(8) Environmental preservation

1) Trichloroethylene (1)

Theme:

Attach filters to the ventilation duct of painting process to control the exhaust emission of painting mists.

Subject matter:

The environmental consideration has increasingly become important for all the manufacturers in the recent years. Various kind of activities are recommended step by step for environmental consideration. Attach filters to the ventilation duct of painting process to control the exhaust emission of painting mists.

Recommendation:

Expected effects: Environmental protection.

2) Trichloroethylene (2)

Theme:

Establish a company standard or operation manual for handling trichloroethylene for washing.

Recommendation:

Particularly important is to let the staff to close the cap of it after work.

Expected effects:

Safety and health consideration.

3) Recycled use of materials

Theme:

Record the recycling of plastic materials.

Subject matter:

Define and indicate clearly the kind and name of industrial wastes to be stored to each space-lot outdoor for storing, and the industrial wastes should be dumped by kind of solid wastes to each designated space-lot thus allocated.

Expected effects:

Safety and environmental protection.

Recommendation:

Expected effects: Establish environmentally friendly process.

4) Wastes

Theme:

Define and indicate clearly the kind and name of industrial wastes to be stored to each space-lot outdoor for storing and the industrial wastes should be dumped by kind to each designated space-lot thus allocated.

Recommendation:

Expected effects: Safety and environmental consideration.

(9) Material handling analysis

1) Crane for replacement of molds and dies

Theme:

Improvement of transportation method of molds, particularly that of large size mold.

Explanation of problem situation:

Smooth changing work of heavy and large mold is very important from various point of view, for example minimizing set up time lose, safety for workers as well as good mold maintenance.

In general for mold over 1 tonnage weight, we had better use ceiling running crane.

Recommendation:

Conversion to use a crane, which is operated running from the ceiling, is recommended in replace of the current transportation method of using carrier.

Expected effects:

To improve the safety of the work.

2) Layout of facilities (1)

Theme:

Improvement of material handling in the factory.

Explanation of problem situation:

Material handling work as well as setting up work is necessary for factory operation. But smooth operation is desirable as they do not generate any additional value for the complete product. To shorten set up time, adjusting work must be eliminated because that work requires skillful operation.

For the case of material handling, the method of carrying work is very important. Not carrying distance but activity method is important. Parallel to this, drawing white lines clearly on the factory floor as a path for smooth carriage without any interfering semi-finished products and parts is important. For keeping this space, stereo type space usage in the factory for keeping stock parts and mold is necessary in general.

Recommendation:

Various inefficiencies are observed in transporting products, intermediates, parts and

raw materials within and among processes. Starting from the transportation method of final products in the factory, it is recommended to improve the material handling step by step. The main focus should be placed on reduction of distance, which the goods are transported, and reduction of temporary stock points within and among processes. The improvement should not be limited to tools, but also the layout of passages, and location of stock points of parts and work in process.

Expected effects:

Improve not only the production efficiency, but also product quality through reduction of possible damages caused in the process of handling.

3) Layout of facilities (2)

Theme:

Efficient use of spaces using shelves for intermediate stock of small-size metal fittings in the working area of iron sheet processing.

Explanation of problem situation:

For the case of products and purchased parts, firstly stocked product or parts must be dispatched in order. This is necessary for control of products in the market. And to proceed this properly stocking method in the warehouse must be considered.

Recommendation:

Expected effects: Efficient use of the spaces.

(10) Improvement for product quality

1) Dents and scratches

Theme:

Reduce rejection due to dent and scratch on cabinet.

Recommendation:

With the following methods, study the cause of the dent and scratch, and try the countermeasures for it:

1) Make an intensive search on probable causes.
2) Study the causes using Specific Characteristics Factor Chart (Sample is attached).
3) Raise the awareness of employees on importance of reducing rejections through, for example, the Happy Program.

Once the cause is identified, the possible countermeasures include:

- Use of cushions (of plastics foam) on the surface of the cabinet during the temporary stock.
- Improvement of jigs used for transportation among processes.
- Use of pre-coated steel sheet covered by plastics film on the surface.

Expected effects:

Rejections due to dent and scratch is observed frequently. The man-hours used for the remedy work can not be disregarded. For the painting process, the remedy works account for around 13% of their total man-hours consumed. The above measures will help reduce this kind of inefficiency significantly.

(11) Improvement for product quality

1) Door gasket of refrigerator

Overview:

Door gasket used in the refrigerator is requested the repair in many cases from customers after they use for long time. When manufacturing refrigerator, the operator sometimes adjusts the door at the plastic part of gasket by using a heating dryer in the process. This case of adjustment seems to be kept forming for long period after heating. The forming will be slightly returned to the former shape because of the plastic material. This means, the plastic door gasket will deform after using for long period. And also, the magnet action inside the plastic gasket seems to be weak and the spring action formed by shaping of the plastic material is weak especially in the model with a big door.

Theme:

Appropriate measures should be taken for remedy the deficit of door gasket.

Recommendation:

1) Strength of the magnet in the plastic door gasket should be selected to fit properly for closing door.
2) The shape of the plastic door gasket should be selected by the size of door.

Expected effects:

Reduction of complaints after service.

(12) Materials procurement

1) Standardization for materials procurement

Theme:

Establishment of company standards for procurement of raw materials.

Recommendation:

Expected effects: To avoid useless or costly procurement. Further, for maintaining the product quality, the raw material quality is necessary to be standardized.

(13) Cost analysis

1) ABC analysis

Theme:

Formulate a basis for reducing the procurement prices of the major materials and parts.

Explanation of problem situation:

In Jordan companies, most important functional parts & material are mainly imported from outside countries. It seems that agreement condition of price, delivery and quality assurance are not so favorable for purchasing sides. At present they have two supply sources in principle from the point of cost comparison competitiveness. But it is recommendable that they make an agreement with suppliers through purchasing specification which includes their requests of quality, delivery and price including epidemic clauses.

Recommendation:

For this aim, following actions should be taken;

1) Select parts and materials to be categorized in "Class A", applying ABC analysis,
2) Prepare specifications of each of the parts and materials, which are categorized in Class A in the above,
3) Make a procurement contract with suppliers, of these parts and materials using the above specifications. The contract should include clear agreement regarding the price, quality specifications, delivery conditions, and required lead time, etc.

Expected effects:

Focusing your major concern on these parts and materials, as the first step action for cost reduction.

2) Improvement for packaging

Theme:

Reduction of materials of product packaging with study on the optimum transport packaging design.

Recommendation:

The current packaging, using heat-shrink plastics, seems to be good enough for product transportation. Nevertheless, some part of packaging materials may be reduced

without worsening the protection capacity, except for the styrene foam at corners of the cabinet. It is recommended to make a study on the possibility with transportation packaging tests.

Expected effects:

Excess capacity is a source of wastes, and it is also applicable to the packaging design.

3) Material change (1)

Theme:

Use of pre-coated steel sheet to improve efficiency and quality.

Recommendation:

In using pre-coated steel sheet, modification of design to eliminate the welding process, and acquisition of skills to prevent the sheet from damage in pressing process are the prerequisites. The latter can be avoided by using the sheet covered by plastics film.

Expected effects:

Use of pre-coated steel sheet increases the material costs compared to the currently used sheet. However, taking into account the possible reduction of costs for rejection, energy and water, labor, and costs for pollution control, it will contribute to reduction of costs as a whole. At the same time, use of the pre-coated sheet increases the value of product with making colorful design possible.

4) Material change (2)

Theme:

Use of pre-coated steel sheet to improve efficiency and quality.

Recommendation:

The use of pre-coated steel sheet has begun already, but it requires the modification of design to eliminate the welding process, and acquisition of skills to prevent the sheet from damage in pressing process.

Use of the pre-coated sheets covered by plastics film is further recommended.

Expected effects:

Use of pre-coated steel sheet improves working efficiency of the painting process, which is one of the inefficient process in the factory, and at the same time increases the value of product with colorful design. Further, if you use the pre-coated sheets covered with plastics film, you can prevent the possible damages on the sheet surface caused in the pressing process, handling processes and storing. Use of the sheet covered with plastic film will increase the cost of sheet, but it reduces loss of the sheet, preventing them from possible damages.

(14) Improvement of facilities

1) Improvement for product defectives

Theme:

Preparation of drawings of molds, particularly of the blowing molds, which are made and maintained in house.

Explanation of problem situation:

Self maintenance and manufacturing of simple mold and working tools in own factories are very effective for improving production engineering. The important point to remember for this case is making design drawings which inform us of all necessary dimensions as standards. Furthermore appropriate purchasing price can be estimated when mold and dies are supplied from outside companies, that will result in engineering level up in addition to cost improvement engineering level up.

Recommendation:

The drawings should include such important descriptions relating to production such as specifications, tolerance, notice on production, and allowance on appearance, etc. At the same time, equip some measuring instruments of simple type, required for checking the precision of size of molds and products according to the drawings.

Expected effects:

The preparation of engineering drawings is the basis for improvement and development efforts. The drawings will provide basic information to decide the quality, production efficiency, and contribute to production loss reduction, and quality improvement.

2) Maintenance of technical data

Theme:

Keep documents and data for the future improvement and development, including specifications of materials procured, specifications and drawings of machines and molds.

Recommendation:

When the company procures raw materials, machines and molds, we recommend to obtain the documents stating specifications and data of the goods procured. These data and information is indispensable for the future improvement and development. At

present, there is no such documents for raw materials, machines and molds, that cause the difficulty in modification.

Expected effects:

One of the most serious problems the company is facing is difficulty in respond to the change in the needs of market. The company has many machines and molds, and there are some points for the product model to be improved with some modification of molds. However, since there is no drawings of the molds, the modification is almost impossible. The above consideration will help improvement of product models in the future.

(15) Production planning

1) Computerization (1)

Theme:

Building up of product development capability in the fields of telephone set manufacturing.

Recommendation:

(1) Taking into account the world trend of this industry, prepare for the future change in business environment.

The growth of telephone market is already at the matured stage. In establishing the management strategy of the Company in this field, following tendency should be seriously considered:

1) Technology renovation has been taken place in a short period, and it will be continuously happened in the future.
2) The consumers needs and requests have been diversified conspicuously, partly due to market saturation.
3) The life cycle of products has been getting shorter and shorter.

Therefore,

- In planning the procurement of parts, scale of economy should be emphasized. In other words, the parts should be procured from the sources which produce the parts in bulk. Maximum use of materials, parts, molds commonly with the affiliated company in Egypt could be an alternative way in this direction.
- The standardization of parts and products should be intensively promoted. For this aim, the standard model should be established at first, and then, the model lines which will be introduced with adding or deducting some features to the standard model, according to the customers' tastes, should be prepared. In such way, common use of parts, molds, and production lines should be carried ahead among the various models.
- The information gathering activities should be intensified not only by a department in charge of technology, but also by all the relevant departments including marketing, procurement and technical services.
- Outsourcing is one of the key factor for the Company to survive and develop themselves in this industry. Otherwise, the Company has to have all the necessary functions and resources inside, that will cause inefficiency of the

management. The analysis of available resources within the company, and on the basis of it, the company's identity as well as the coverage of outsourcing should be studied.

- Quick actions and completion of development work and implementation of production in a short period will be the essential requirement for the development of the Company, in this industry of short life span products.

(2) Analyze the Company's resources and weakness for establishing the Company's development strategy.

In planning the future strategy of the Company, the analysis of available resources and weakness is the starting points in addition to the analysis of business environment. The radar chart attached in this report is one of the effective tool for the management diagnosis. The attached sample indicates the Company's position in the five major management field, assuming that the most excellent company in Jordan to be the best position (or 100%). We cannot make any definite diagnosis using this chart in this short time diagnosis period. We hope that the Company analyze their resources and weakness using this chart by themselves.

2) Computerization (2)

Theme:

Tap potentials of computerized control system.

Situation:

Theme: Actual application of business software for production plan and expediting.

Explanation of problem situation:

Rationalization of business through computer software usage is advancing day by day. From the total of the result through seizing of actual progressive status till application for planning, computer software application is expanding.

Not only production related activities but also sales and logistics application are becoming popular. Through structure type bill of material, systemized business system can be expected both for upstream and downstream, making routing software locate at center.

Recommendation:

The computerized control system of the Company, which was developed internally,

may be useful for development of coordination with the affiliated company, and further there could be a possibility of sales of the software, specialized in this industry or that of similar type of operation. Further development of the system, for example, to inventory control, sales administration, and customer relation management, is recommended even for the internal use alone.

3) PSI meeting

Theme:

Preparation and periodical review of Merchandising Plan and Production Plan among the managers responsible for production, sales, and inventory.

Explanation of problem situation:

The market situation change of commodities and furniture is rapid. Information feedback from the market and its quick reflect to inventory and production control is very important.

Both over inventory and opportunity loss must be avoided as a manufacturing company.

Recommendation:

Through the periodical meetings among these managers, they should analyze the problem areas and agree the tasks for improvement.

Expected effects:

The problems for sales, production, procurement and inventory have been left unsolved. The quick action will be ensured through the periodical meetings.

4) Standardization for products

Overview:

For example, the growth of telephone market is already at the matured age. In establishing g the management strategy of the company in this field, following tendency should be seriously considered:

1) Technology renovation has been take place in a short period, and it will be continuously happened in the future.
2) The consumers needs and requests have been diversified conspicuously, partly due to

market situation.

3) The life cycle of products has been getting shorter and shorter.

Theme:

Building up of product development capability in the fields of telephone set manufacturing (ex. applicable to the case of products in matured market).

Recommendation:

This is applicable to the small-scale company or the limited capital for the product development.

1) In planning the procurement of parts, scale of economy should be emphasized. In other words, the parts should be procured from the sources which produce the parts in bulk. Maximum use of materials, parts, and molds commonly with the affiliated company could be an alternative way in this direction.
2) The standardization of parts and products should be intensively promoted. For this purpose, the standard model should be established at first, and then, the model lines which will be introduced with adding or deducting some features to the standard model, according to customers' testes, should be prepared. In such way, common use of parts, molds, and production lines should be carried out among the various models.
3) The information gathering activities should be intensified not only by a department in charge of technology, but also by all the relevant departments including marketing, procurement and technical services.
4) Outsourcing is one of the key factors to service and develop themselves. Otherwise, the company has to have all the necessary functions and resources inside, that will cause inefficiency of the management. The analysis of available resources within the company, and on the basis of it, the company's identity as well as the coverage of outsourcing should be studied.
5) Quick actions and completion of development work and implementation of production in a short period will be the essential requirement for the development, in this industry of short life span products.

3.2 Recommendations on plastic molding engineering

(1) Molding system

1) Molding machine

Theme:

Reduction of processing time at the compression molding process of thermosetting resins for circuit breaker and switches.

Recommendation:

The compression molding process of thermosetting resin takes a lot of time. The molding of small parts like switches takes more than one minutes, while it takes more than 20 minutes for breaker cases. The reduction of molding time can be partly achieved by reduction of pre-heating time and curing time. Use of turn table molding system can reduce the time, and transfer molding system will not require the pre-heating time. However, the former requires the modification costs of the system, and the latter will not produce significant effect.

The best recommended method is to convert the process to injection process of thermosetting resins. This method, however, has the following problems:

1) Machinery cost is expensive.
2) Necessity to change of raw material resin to that suitable for injection molding.
3) Need to review and readjust the electrical and mechanical characteristics.

Nevertheless, the conversion to injection molding will reduce the required time by around 40 to 50%, enable to minimize the fluctuation in mass counting, and reduce the occurrence of burr with lowering the pressure, thus contributing the stable and efficient molding.

(2) Improvement for product quality

1) Nitrogen gas (1)

Theme:

Introduction of heat covers to injection machines.

Recommendation:

Expected effects: The introduction of the heat cover will prevent the heat loss, reducing the consumption of power. In the case of 1,000 tons injection machine, the required time for heating estimated to be reduced to 1.5 hours from the current 2 hours with introduction of the heat cover.

2) Nitrogen gas (2)

Theme:

Replenishment of nitrogen gas of the 1,000 tons injection machine.

Situation:

Theme: Introduction of periodical maintenance of injection machines.

Subject matter:

The periodical maintenance of production machines will contribute to keep the productivity, and further to improve it. Example, 1,000 tons injection machine is not used nitrogen gas for stabilizing the mold pressure and saving energy in spite of being accessory with machine. The 1,000 tons machine should be periodical maintenance. At the same time, through the maintenance works, the maintenance manuals should be prepared and improved.

Expected effects:

It will help improve the production efficiency and cost.

The nitrogen gas is used for stabilizing the mold pressure. The stable pressure will contribute to the stability of product quality.

3) Method of temperature control

Theme:

Introduction of control measures of temperature of plastics for the injection machines.

The control measures of pressure in the mold is also recommended.

Recommendation:

As for the temperature control of the plastics in injection machines, the method of censoring the temperature of plastics directly, is recommended.

Expected effects:

Improve the stabilization of product quality.

4) Plastic materials

Theme:

Clear criteria should be established by machine used, as to which raw material plastics should be used, low viscosity of plastics such as PP, PE and PS, or high viscosity plastics such as PC, AS and ABS.

Recommendation:

Injection machines are classified to those good for low viscosity type and high viscosity type, depending on the L/D ratio (ratio of the length of screw over the diameter of cylinder).

Expected effects:

It can reduce the poor molding with stabilizing the molding works.

5) Recorded data

Theme:

Daily record of molding works for quality management.

Recommendation:

Taking records of the daily molding works is the basis to identify the problems areas and undertake required countermeasures. The recommended recording items in molding process is given as follows:

Recommended items to be recorded

1) Data
2) Product name

3) Raw material grade name (lot no.)
4) Worker's name
5) Product number (lot no. or shift no.)
6) Defect number
7) Injection Molding Condition (pressure, temperature, die mold temp.)
8) Time till starting molding (min.)
9) Material loss (kg)

Expected effects:

The quality management on the basis of the record of performance will be useful not only for cost reduction, but also for advanced product quality.

(3) Foaming molding

1) Inner liner of refrigerator

Theme:

In-house mold making for inner-liner production.

Recommendation:

Expected effects: The in-house mold making efforts will definitely contribute to nurturing capability to improve or develop products. In addition, it will also useful in accumulating development and improvement know-how's, resulting in cost reduction and trouble solution.

(4) Vacuum molding

1) Improvement for pre-heating

Theme:

Improvement of pre-heating method of plastics sheets.

Recommendation:

Introduction of infrared-ray heating method is recommended for speedup of pre-heating process and ensuring the uniform pre-heating.

Expected effects:

Improvement of production efficiency and quality.

(5) Introduction of new materials

1) High-flow plastic materials

Theme:

Use of plastic materials of high-flow nature.

Recommendation:

The tendency of use of raw material plastics is to move to those of high-flow nature. Use of the high-flow type raw materials will contribute to energy saving and reduction of thickness of products. However, it should be noted that the use of high-flow materials requires measures to avoid deterioration of production characteristics.

(6) Precision molding

1) New control technology (1)

Theme:

Minimizing the trial shots.

Recommendation:

The current material losses for trial shots account for 20% of total material consumption (5 tons/month). Minimizing of trial shots will not only reduce the materials consumed, but also improve the loss of working time, and energy.

2) New control technology (2)

Theme:

Introduction of new control system of pressure and temperature, and molding process.

Situation:

It is necessary to introduction of new control system, example closed control system for pressure and temperature.

Expected effects:

Introduction of new control system for injection molding will improve product quality and production efficiency.

Recommendation:

For production of compact discs, new system to control pressure and temperature will be required. It will help molding of more precise and quality-stable products.

(7) Improvement of facilities

1) Recycled use of materials

Theme:

Control of plastics wastes to be recycled.

Recommendation:

For production of higher-value added products, increasing attentions will be required in controlling and avoiding the contamination of the materials. Even minute contamination will be the cause of rejection in the case of compact discs.

Some of the measures to control and avoid contamination for plastics wastes to be recycled include:

1) Control the contamination while the plastics wastes are stocked.
2) Use of facility to eliminate the minute contamination.

Expected effects: It will contribute to reduction of raw materials with enabling the use of recycled materials even in production of higher-value added products.

3.3 Recommendations on metal processing engineering

(1) Puncher and dies

1) Consideration at introduction of puncher and dies

Theme:

Consideration on mold procurement.

Recommendation:

There might be cases of efforts for cost reduction, which are made at the cost of quality deterioration. Particularly, it is recommended, in this connection, to reexamine the appropriate procurement procedure of molds, to avoid such cases, since quality and performance of molds are critical for producing quality products.

Important points are:

1) When deciding the procurement costs, and guaranteed number of shots, of molds, the following factors have to be taken into consideration:
   a) Influences of the molds on product quality.
   b) Life of mold.
   c) Required maintenance costs for whole the life span of the mold.
   d) Probable troubles of molds after warranty.
   e) Deterioration of product quality using the molds after warranty.
2) Staff in charge of mold procurement should attend the trial shot of the mold, together with staff in charge of pressing, and staff who developed the product, so that he (she) can understand the intension of the mold design, and critical points of the life of mold, and press works.
3) At the trial shot, they should evaluate the product quality by themselves, measuring the product, instead of leaving the evaluation to the mold manufacturer alone.

(2) Welding

1) Pipes for cooling system

Overview:

It is apparent that many cases of defects in the cooling system of refrigerator are caused by the work when connecting cooling pipes. But, it is not considered how to instruct the worker in charge of the welding.

The recommendations are noted as follows:

1) Analyze full actions of work by making the process flow chart.
2) Make the process standard and propose the items for improvement.
3) Display near the worker good and bad samples resulted in process and call him attention to proper work.
4) Make plan of target to reduce defectives and train the worker.

It is very sure that the welding is not conducted after the pipes are not enough to heat full range of connecting part with a burner, but it is considered that one of problems is the capability of supervisor which is suitable for making the worker keep the instructed rules. Moreover, another problem is a habit in Jordan so that engineers and superior managers may never teach the working skill to the worker directly in the manufacturing process.

Theme:

Improvement of welding work of the cooling system.

Recommendation:

Among the troubles reported from the Service Department, 13.5% is those of gas leakage, which was mainly caused by poor welding. For improvement of the process, the following is recommended:

1) Analyze the process using Process Flow Chart.
2) Formulate the standard operation procedure, including the following instructions:
   - Length of insert at the connecting part.
   - Optimum time for pre-heating of the connecting part.
   - Optimum volume of solder.
   - Length of piping to be cut, layout, and fixing method.
3) Put actual samples and/or illustrations indicating cases of poor welding, at the welding process.
4) Select some workers in charge of welding, who have relatively excellent welding skills, and make training to them to reduce the poor welding down to 10% of the current level.

Expected effects:

Reduction of troubles.

(3) Painting

1) Countermeasures against defects at painting process

Overview:

The defective ratio is very high in the painting process of metal wire netting shelf for refrigerator. The method of painting is so called "Powder flow dipping method" that is attaching paint to heated metal wire net by dipping powder paint. The handling with care in this painting process is proposed precisely. On the other hand, the introduction of a plastic mold shelf is proposed without using the metal wire netting.

Theme:

Improvement of powder painting process of refrigerator rack.

Recommendation:

Possible measures for the improvement include:

1) Uniform pre-heating of the rack before painting.
2) Keep the powder paint tank clean to avoid contamination.
3) Change of the materials of rack from current metal to plastics.

Expected effects:

The rejection or rework rate of powder painting process is as much as 15%. The above actions will contribute to the significant reduction of the production costs. The change of materials to plastics will make reduce the production cost by 30 to 40% of the current costs.

2) Improvement for operation

Overview:

"One painting one baking system" is proposed instead of "Two paintings two baking system" in order to get the necessary thickness of paint on the surface of the metal door of refrigerator. The proposed system has a merit of uplifting the production efficiency, but, the process control of the proposed painting system is different from the current system, so the detailed method is introduced.

Theme:

Introduction of efficient painting method.

Recommendation:

Conversion of current "two coat, two bake" method to "one coat, one bake" method is recommended. A guideline on steps to introduce this method is given in the material "How to do the coating process of one coat one bake"

Expected effects:

Improvement of production efficiency.

(4) Common use of facilities

1) Rack for temporary stock

Overview:

When transferring painted parts to other working place or taking them down from the cart by hands, workers may make dents and scratches on painted surface so often. And many kinds of racks and boxes and the space for temporary stock are usually needed after painting and also a cubic rack with castors is now used for the baking oven after painting. As the rack with castors is proper size to stock and transfer easily, it can be also used as a temporary stock.

The recommendation suggests that the same rack for the baking oven to use commonly for the temporary stock and to reduce times of putting on or taking down after transferring.

Theme:

Multiple-purpose use of the rack for firing, sharing with temporary stocking use.

Recommendation:

Expected effects: Reduce the number of transportation and stock points.

(5) Operation control

1) Solvent

Theme:

Keep the washing solvent clean at the painting process.

Recommendation:

Increase the frequency of cleanliness check of washing solvent, from the current every 6 months to every months. The unclean washing solvent will make the sheet dirty instead of making it clean.

Expected effects:

It will reduce the occurrence of poor painting. Further, it will make the transition to "One coat, one bake" method easy.