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## Design Aimed at Recycle for Printer and FAX / MFP

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### Abstract

*Recycle design is Okidata's effort for global environmental conservation. The concept of our recycle design is based on three considerations: 1) the design of equipment, 2) design to improve resource problems which are caused by using equipment, and 3) the direct and indirect influence of using equipment on the environment. We express the standard of design for these three considerations with a quantitative index as much as possible, so that the development process can include a process to evaluate the quality of design by an objective index.*

## 1. Introduction

It has been a while since the serious influence of global environmental protection on the survival of the human race has been recognized. Practicing global environmental protection in business activities, however, has various difficulties, even if the importance of this influence can be conceptually understood. In such a situation, Okidata has been adopting the philosophy "Design gentle to the environment" from the day the company was founded. A concrete example of this philosophy is the adoption of our original "ink ribbon reinking system" for ink ribbons, which are consumables for impact printers. We have been using reinking type ink ribbons for a long time, implementing the reduction of waste materials.

We also introduced the "Toner recycle system", which repeatedly uses toner without disposing of it, to the printing process of electrophotographic type non-impact printers. In this system, the waste of consumables due to end of life is minimized by separating the EP cartridge and toner cartridge. We have also been decreasing absolute quantities of materials used for the equipment main unit, by thoroughly pursuing equipment downsizing.

Now, with the establishment of ISO 14001, we are making a fresh start to intensify activities for the global environmental protection that we have been promoting.

## 2. What is design aimed at recycle?

Recycle is defined as

1. reusing used units and components for the same or another product,
2. reusing material of equipment to be disassembled or disposed of for material of the same or another product

Design aimed at recycle at Okidata is based on this definition of recycling, and includes the wider sense of actions that are gentle to the global environment in such design operation concepts as resource saving, energy saving and office environment conservation. The quality of these actions is evaluated by a quantitative index specified by Okidata, so that the actions that we take will be constantly improved in promoting design activities.

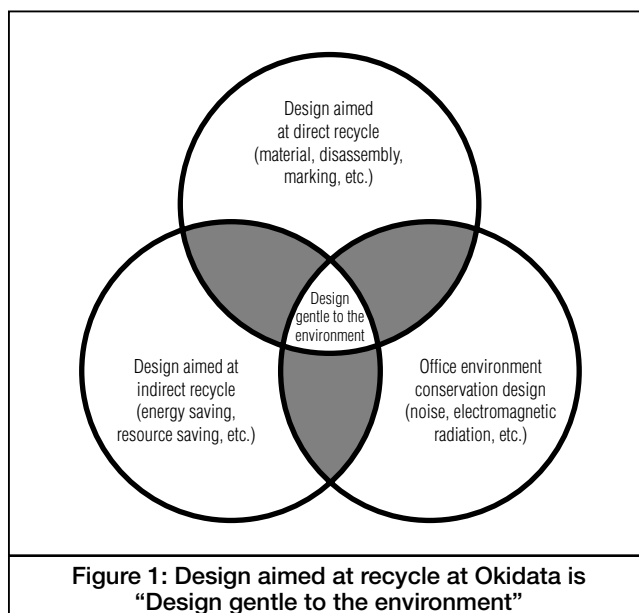


Figure 1: Design aimed at recycle at Okidata is "Design gentle to the environment"

Figure 1 shows the concept of Okidata's design aimed at recycle.

The terms "direct recycle" and "indirect recycle" used in Figure 1 are coined phrases that have the following meanings.

Direct recycle relates to equipment itself, such as material, structure and marking, which is what recycling normally refers to. Indirect recycle relates to energy saving and resource saving, which is somewhat different from recycling in the original sense. Indirect recycle concerns resources to be consumed by using equipment.

Office environment conservation relates to the direct influence of equipment operation on the area where the equipment is used.

Design aimed at recycle at Okidata is to implement "Design gentle to the environment" pinpointing factors that require improvements from these three aspects, and by setting specifications for the respective factors.

## 3. Actual design aimed at recycle

### 3.1 Design aimed at direct recycle

The three factors of design aimed at direct recycle are mate-

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rials, consumables and disassembly / disposal. These three factors correlate with each other, as shown in Figure 2.

Material design concerns the design specifications of materials to be used to manufacture equipment. Structure and processing method design concerns specifications on matters which should be considered in design to handle various problems that may occur at disassembly and disposal. Consumable design concerns specifications of conditions for the design of consumables required for the use of equipment.

Specifications on design aimed at direct recycle demands actual action for these three key factors. The quality of design aimed at direct recycle is objectively judged by a quantitative index called the “possible recycle rate”.

### 3.1.1 Considerations in design for materials to be used

The following restrictions are imposed for materials to be used for equipment.

1. Single component material is used for molding materials
2. Rate of using recycled material is increased according to the following target by the year 2000

1997	1998	1999	2000
20%	50%	75%	100%
Ratio of using material mixing 20% of recycle materials			

3. Toxic substances must not be used
4. Materials used are marked
5. Types of materials to be used for equipment are decreased according to the following targets by the year 2000

1997	1998	1999	2000
18 types	14 types	10 types	7 types

6. Specifications similar to the specifications on materials to be used for equipment are applied to packaging materials  
Specifically, 1) recyclable materials are used, 2) each material can be sorted, 3) materials are marked, and 4) environmental conservation in processing and in final disposal is thoroughly investigated and a specific action plan is established based on the investigation result.

### 3.1.2 Consideration in design for structure and processing method

1. The following restrictions are imposed on the processing methods to be used for equipment production.

The number of locations that require coating, plating, painting, printing, labeling, insertion of screws, caulking, riveting and welding is decreased according to the following targets by the year 2000.

1997	1998	1999	2000
5%	15%	30%	35% (Note 1)
—	5%	10%	15% (Note 2)

(Note 1) For non-impact printers and FAX / MFP

(Note 2) For impact printers

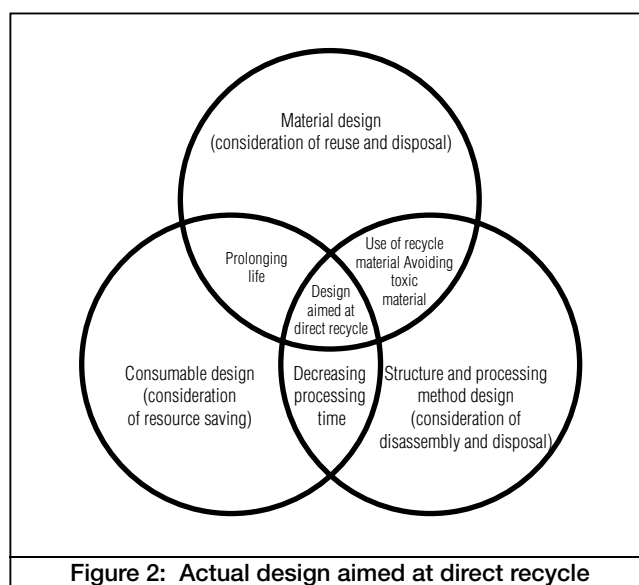


Figure 2: Actual design aimed at direct recycle

2. Consideration in design for parts to be used  
The number of screws and parts is decreased according to the following targets by the year 2000.

1997	1998	1999	2000
1%	2%	5%	10%

3. Consideration in design for tools used during disassembly  
Okidata’s equipment must be designed such that no special tools are necessary at disassembly. Also the number of tools used during disassembly is decreased according to the following targets by the year 2000.

1997	1998	1999	2000
5 units	5 units	4 units	4 units

### 3.1.3 Consideration in design for consumables

1. Consideration in design for prolonging life of consumables  
We have been making great efforts to decrease consumables, and will execute design activities that will continue this reduction at an annual rate of 2%.

Consumables must be reduced both from the hardware side and software side.

At the software side, double sided printing and multiple page printing are some of the possible measures, and at the hardware side, prolonging consumable materials, downsizing consumables and systematic improvements must be considered.

2. Consideration for use of recycled consumables  
Recycled consumables are increasing (e.g. recycled paper). These consumables have some shortcomings in performance compared with new products (e.g. images are blurred). Okidata’s equipment must be designed to eliminate these shortcomings.

For example, Okidata’s equipment must increase the number of recycled paper brands for which equipment performance is completely assured. The targets by the

year 2000 are as follows.

1997	1998	1999	2000
—	2 types	3 types	4 types

### 3.1.4 Quantitative evaluation of design aimed at direct recycle

We use an index called the “possible recycle rate” as the quantitative evaluation index for the quality of design aimed at recycle.

The possible recycle rate is the recycle rate set at the design stage of a product. Unlike an actual recycle rate, this rate is the result when the total weight of units or parts specified as follows by the weight of the product.

1. Units or parts designed assuming reuse
2. Units or parts that can be disassembled from the product within 5 minutes, and where materials can be sorted and identified.

The flow chart in Figure 3 shows the calculation procedure of a possible recycle rate. When the flow results in “X”, the product is regarded as recycle impossible.

Target values of a possible recycle rate, which we should implement by the year 2000, are as follows.

1997	1998	1999	2000
46%	61%	63%	65%

These values of a possible recycle rate are checked at each stage of a design review, which is integrated into our development process. If the result is unacceptable, then a design change is required.

### 3.2 Design aimed at indirect recycle

Figure 4 shows the three factors of design aimed at indirect recycle.

Design for energy saving relates to the reduction of energy consumption when the equipment is used.

Design for easy repair and exchange relates to the exchange of consumables or repair at failure.

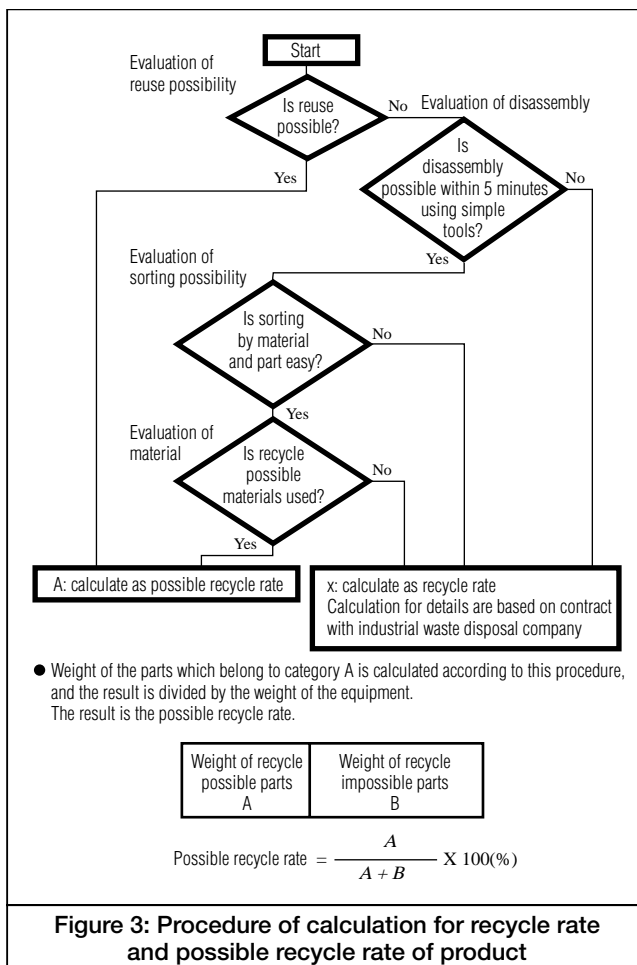
Design for upgrading relates to the design considerations that allow upgrading functions and performance without exchanging the entire product.

Specifications on design aimed at indirect recycle shows the standard of actual actions to be taken for each one of these factors.

#### 3.2.1 Design for energy saving

Along with power saving when equipment is used, considerations on power saving during standby is becoming indispensable.

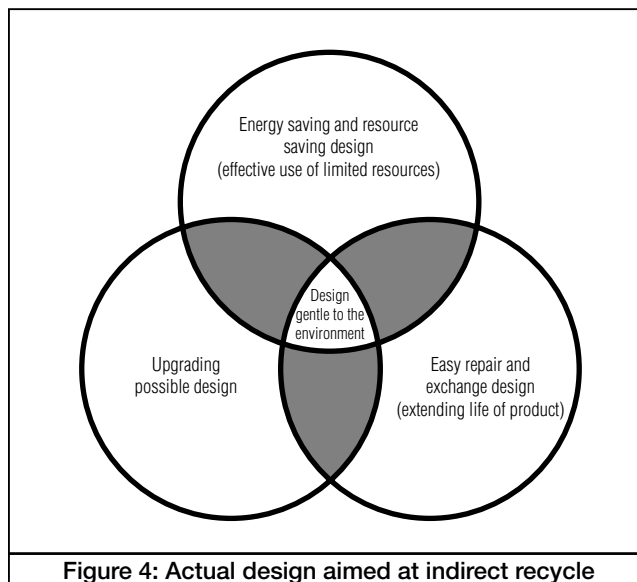
Especially for facsimile, which has its power on all the time in many cases, Okidata has released equipment for which power consumption at standby is 0.4W. We will extend this feature to printers and at the same time will further implement a decrease of power consumption during operation.



#### 3.2.2 Design for decreasing repair and exchange time

Decreasing repair and exchange time when equipment fails will substantially prolong the life of the product and will save resources as a result. For this we will:

1. design such that the time required for repair and maintenance is within 30 minutes,



2. design such that the time required for exchange of short life parts and consumable parts is within 30 minutes, and
3. prepare documents that describe the repair and maintenance operation procedures.

### 3.2.3 Design for upgrading

For resource saving, extending the life of products is also an effective means. To extend the life of a product, design must consider the possibility of upgrading a product. To make upgrading possible, we specify details in the planning stage of a product, and execute the specifications.

### 3.3 Design for office environment conservation

For office environment conservation:

1. The safety standards of each country must be completely adhered to,
2. the noise level from equipment must be decreased as follows by the year 2000,

1997	1998	1999	2000
55dB	55dB	50dB	50dB (Note 3)
—	—	—	58dB (Note 4)

(Note 3) For non-impact printers and FAX / MFP

(Note 4) For impact printers

3. toxic substances, such as ozone and styrene, must be controlled. For ozone, control measures have been systematically established. For styrene and for other toxic substances that will be added in the future, we will sequentially take control measures and will establish these measures by the year 2000.

## 4. Conclusion

This paper described design aimed at recycle, which Okidata is executing. In the future, we will organize recovery routes and methods for products designed and manufactured based on the concept "Design gentle to the environment", and promote actions for global environmental conservation at the entire company level.