

Environmental Report 2003



Yanmar Co., Ltd.

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Editorial Notes

- Reference was made to the Environment Agency's guidelines on environmental reports in drawing up this document.
- The contents of this report are primarily based on activities in the 2002 business year (March 21, 2002 to March 20, 2003). They also include some activities of related companies, past activities etc.
- Yanmar Diesel Engine Co., Ltd. was restructured as Yanmar Co., Ltd. in July, 2002. Many company systems were revised at this time. This report, in dealing with the 2002 business year, refers in some places to the former structures.
- The term Shiga Zone is used in this report to refer to the small engine factories (at Nagahama, Biwa, Yamamoto and Kinomoto) and the precision equipment factories (at Omori and Nagahara) based in and around Shiga Prefecture. Amagasaki Zone refers to the production facilities for large engines based in and around Amagasaki City, Hyogo Prefecture (Amagasaki and Tsukaguchi).

Greetings

Our company has striven ever since it was founded in 1912 to develop and supply highly energy-efficient and superbly cost-effective engines and the work implements that they power. Making the very most efficient use of energy resources and raising the productivity of both food production and industry, it has been our consistent purpose to create more plentiful lifestyles for all.

In the process, we have developed businesses that are deeply rooted in food production, in the earth and the oceans, taking co-existence with nature as our motto from the very start. Ahead of others in this industry, we have promoted clean engine emissions, low noise & low vibration products and sophisticated environment-friendly technologies.

In our own business operations, too, we have long sought to reduce the environmental load in every process of manufacturing, distribution, etc. aiming for beautiful harmony with the global environment.

The 21st century is being called the Century of the Environment. Environmental preservation is being promoted in all aspects of governmental policy in many countries around the world, as well as in corporate and individual activities. We know that the environmental load imposed by corporate activities is not slight, with respect not only to the manufacture of products but also to their uses. We have been promoting environmental conservation activities at all stages of our business operations from development and production to sales, disposal, recycling, etc.

This is the 2nd year of our Second Five Year Environmental Conservation Plan. Under Yanmar's recently revised Global Environmental Charter, we have reinforced the activities of the environmental committees of our group companies with the aim of improving environmental management groupwide. Environmental management of the whole Yanmar group has only just been initiated and numerous tasks remain. We firmly believe that the improvement of environment conservation and efficiency through the development of environmental technologies, rationalization of production and distribution processes, etc. will strengthen our corporate foundations directly. All Yanmar group companies and employees perform their daily work with this environment awareness in mind.

Environmental preservation continues to be one of the important management pillars of the Yanmar Group. We will continue to improve our environment management and contribute our bit to creation of the sustainable energy-saving and recycling society.

We have reviewed our environmental activities for 2002 for explanation to our users, customers and friends. We are also determined to ensure the transparency of our corporate activities through the active disclosure of corporate information. We trust in the continued support and assistance of you all.



Tatehito Yamaoka
President

About Yanmar

Yanmar Diesel Engine Co., Ltd. became Yanmar Co., Ltd. on July 1st, 2002 to serve as the holding company of the Yanmar group.



Trade Name: Yanmar Co., Ltd.

Head Office: 1-32 Chayamachi, Kita-ku, Osaka City

Founded: March 1912

Capital: 5.2 billion yen

Chairman: Tadao Yamaoka

President: Takehito Yamaoka

Turnover: 196 billion yen (Fiscal 2002)

Employees: 3,054 (Mar.2003)

Our Products

With energy conversion technologies at the core, we research, develop, manufacture, sell and maintain hardware and software for use on the land and sea and in other living spaces.



Energy

- Generation, Cogeneration
- Air Conditioning,
Gas Heat Pumps
- Micro-cogeneration



Industry

- Industrial Engines
- Construction Machinery
/Industrial Products



Environmental Protection

- Environmental Equipment
- Distribution
(Cool Containers)
- Living Equipment



Marine

- Marine Products
- Fish Farming
- Large Marine Products



Agriculture

- Farm Machinery
- Farm Facilities
- Hobby Farming Machinery
- Unmanned Helicopters

I. Environmental Management Systems

1. Yanmar's Global Environmental Pledge (Revised 2002 Edition)

Yanmar Co., Ltd. has long tackled environmental problems in its daily business activities on the basis of the company's corporate philosophy of seeking beautiful harmony between plentiful human lifestyles and the needs of the global environment.

Global warming, acid rain, waste and other problems all continue to pose serious threats to the global environment and society demands that countermeasures be taken.

Yanmar Diesel Engine Co., Ltd. made its Environmental Pledge in 1995, and earned ISO environmental certification for all of its production plants in 1998. Much environmental work has already been done. Now, with the reinforcement of management structures across the Yanmar group, the Environmental Pledge has been revised as the pledge of the whole group, with the aim of furthering environmental management group-wide.

This pledge today serves as the environmental constitution for improving environmental management throughout the Yanmar group. The group is united in its efforts to promote environmental protection activities at every place of business.

Corporate Philosophy

We the Yanmar Group seek through creative technologies and human warmth to give the world new worth and enrich the lives of people everywhere in beautiful harmony with the global environment.

Environmental Philosophy

The Yanmar Group aims through building a harmonious relationship between the group's development and global environmental protection to contribute to the sustainable development of society.

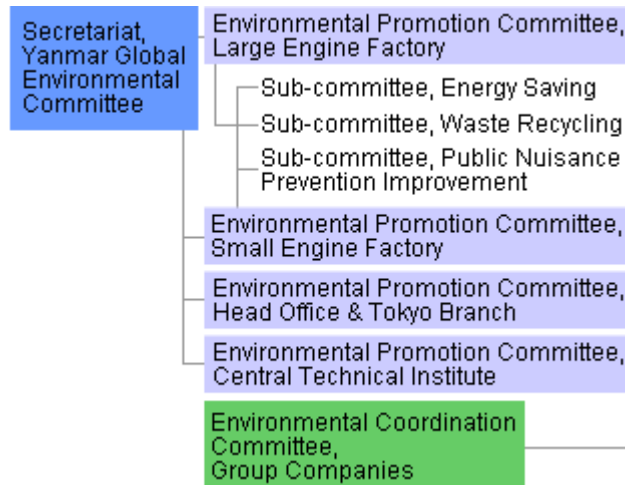
Action Guidelines

1. We position environmental preservation as one of the most important management objectives of the Yanmar Group for the purpose of group-wide environment management.
2. We strictly observe the laws of all countries and the ordinances and regulations of all districts where we conduct production activities and when necessary establish voluntary environmental regulation in order to achieve higher levels of environmental preservation.
3. The Yanmar Group Global Environment Committee establishes the environmental promotion guidelines and disseminates them throughout the group for the overall promotion of environment preservation by the group.
4. We actively disseminate environmental preservation information internally and externally to deepen the understanding of group companies and partners for cooperation in the promotion of efficient environmental preservation activities.
5. We promote effective measures systematically and on a continuous basis in the following four environmental fields:
 - Establishing technologies that contribute to environmental preservation and products and services that decrease environmental load.
 - Reducing environmental load in each stage of business operations.
 - Tying up and cooperating with external parties to contribute to local communities and disseminate environmental information.
 - Raising environmental awareness among employees, internal environmental education, lifestyle innovation, etc.

2. Implementation Structures

An Environmental Committee is established in each business division with the participation of top management, having the role of establishing environmental management founded on clearly stated responsibilities and rights. An Environmental Promotion Committee and sub-committees by category are further established in each business division and at each site to promote and realize tangible environmental protection activities. Here, we describe the example of the organizational structure of the Environmental Committee of Yanmar Co., Ltd, at the heart of the group. The Environmental Promotion Committee coordinates promotion at each site and oversees the smooth overall implementation of promotion activities.

Yanmar Global Environmental Committee Organization



The Yanmar Group Environmental Committee was also established in April 2002 with the participation of top executives from the group's companies. It is working to implement group-wide policy with clearly stated lines of responsibility and rights. At each group company, too, an Environmental Committee has been established to promote and implement environmental protection under the responsibility of top management.



Environmental Coordination Committee

Yanmar Group Global Environmental Committee Organization



Yanmar Group Environmental

3. Certification of the Environmental Management System

Our company's environmental management system is implemented for accreditation under the international ISO 14001 standard in the course of promoting full, defect-free environmental protection activities.

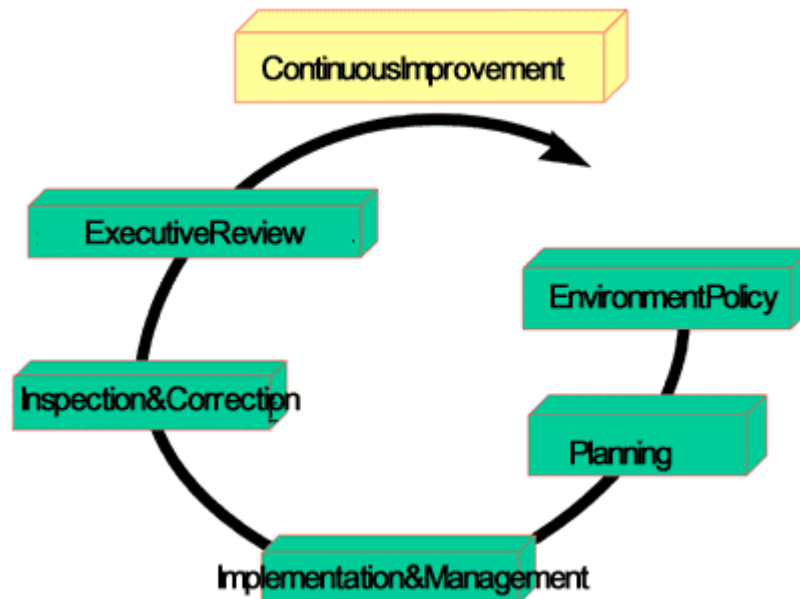
What is ISO 14001?

This is the standard for environmental management laid down by the International Standard Organization (ISO).

How is a Company Certified?

Certification is performed by a third party organ, which inspects to see whether the standards have been satisfied.

=Continuous Improvement Under ISO14001=



ISO Certification by Site

Large Power Products Operation Division (Amagasaki and Tsukaguchi Plants) Amagasaki Zone

- Certified: June, 1997
- Certification No.: 770250 Issuer: LRQA

Power System Operations Division (Nagahama, Biwa, Yamamoto, Omori, Nagahara, and Kinomoto (tractor) plants) Shiga Zone

- Certified: March, 1998
- Certification No.: JQA-E-90134 Issuer: JQA

Certification of Group Companies

Yanmar Agricultural Machinery Manufacturing Co.,Ltd.

- Certified: March 1999
- Certification No: 4002304 Issuer: LRQA

Kanzaki Kogyukoki (Itami, Amagasaki and Ibuki Plants)

- Certified: March, 1999
- Certification No.: 772501 Issuer: LRQA

Seirei (Okayama, Kochi and Fukuoka Plants)

- Certified: December, 1998
- Certification No.: JQA-EM0277 (Okayama) Issuer: JQA
- Certification No.: JQA-EM0262 (Kochi) Issuer: JQA
- Certification No.: JQA-EM0281 (Fukuoka) Issuer: JQA

Matsue Diesel Co.,Ltd

- Certified: Aug, 2003
- Certification No.: JBC-4002315 Issuer: LRQA

4. Auditing the Environmental Management System

Sites certified under ISO 14001 make their environmental policy public and perform regular audits to confirm that it is being pursued continuously.



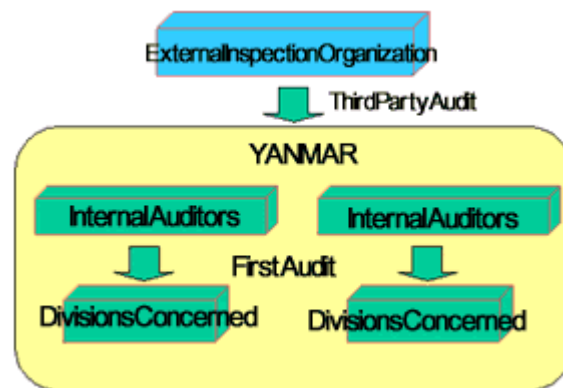
The Environmental Policy displayed in the Shiga Zone



The Environmental Policy displayed in the Amagasaki Zone

Audits are conducted both internally, to establish whether the environmental management systems are functioning effectively, and, on the basis of the results, by external third party audit according to the ISO 14001 requirements.

=Environmental Inspection System=



Results of the Environmental Audit

We conduct an internal audit once a year of all divisions throughout the company. The results are reported to the general manager of the business division for use in the environmental control review.

We also receive a surveillance and certificate renewal audit by a third party certification organization.

In 2002, we were instructed to improve three items, and complied satisfactorily with those requests. Other requests were made regarding 24 items, and we enhanced our environment control system accordingly.

II. Environmental Products

Let us introduce some of our new environmental products released in 2002 and older products with much improved environmental features, including energy-saving performance, low noise & low vibration, pollution-free features and recycling capabilities, that far outstrip conventional products. We also include some comments from personnel who helped develop the products.

1.The TNV Series of Multi-purpose Vertical Diesel Engines

The Yanmar TNV Series is a power source for agricultural, construction and other industrial machinery. It features high output, durability and reliability and provides clean exhaust performance that can clear all the major exhaust regulations of the world.

1-1.TNV Series Lineup

The TNV series is the successor to our small industrial TNE diesel engines, which have long been favored by many users. The TNV series now covers 0.6 - 3.3 liters displacement and 10~64kW output, complying with a wide range of applications with low noise and low fuel consumption, too.



ECO diesel, TNV

1-2.Environment-Friendly Performance

1)Clean & Low Fuel Consumption

The displacement of the up to 1.3 liter NV1 series has been boosted ahead of conventional models. Use of the swirl combustion chamber and Yanmar's unique new ML fuel oil injection pump ensures ultra-clean exhaust performance and complies with major exhaust regulations. The NV2 and NV3 series in the displacement range of 1.3~3.3 liters inherit the same direct injection system and employ Yanmar's own new high pressure MP fuel oil injection pump and the new combustion chamber. These bring remarkably low fuel consumption and clean exhaust performance. The NV3 series uses a 4-valve structure. All TNV series engines comply with the exhaust regulations of each county.

2)Low Noise

Noise as well as exhaust regulations are getting stricter. We have been reducing engine noise to relieve the pressure on driven machines. The NV1 series, in particular, has a wholly new structural design that helps to reduce noise over the whole service range. In the NV2 and NV3 series, too, the noise has been reduced substantially.



ML FO injection pump



MP FO injection pump



Four-valve structure

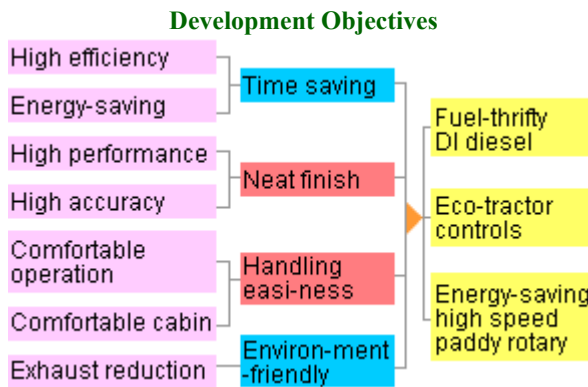
2. ECO Tractor (EF300 Series)

- 1)The new EF300 series of ECO tractors was born through the thoroughgoing pursuit of basic tractor performance, amenity and environmental-friendliness.
- 2)The tractor is equipped with the new TNV Eco-diesel engine, which achieves both high power and environmental performance, (complying with Japan's special vehicle exhaust gas regulations of Oct. 2003).
- 3)A pleasant new cabin and two new rotaries with higher efficiency.



Ryuichi Miyazaki, Tractor Development

This year we improved and released the 24~38PS EF300 series of Eco Tractors. We are proud of achieving the basic target concepts for tractors: energy-saving, clean exhaust, low noise and low vibrations.



Eco tractor EF300

[Eco Tractor]

The Eco-tractor, equipped with the electronic governor eco-diesel engine and energy-saving, highly efficient rotary, slashes fuel consumption by about 30% and reduces CO₂ emissions, too.

The Eco-tractor has been highly acclaimed for its energy-saving features ever since its release, and was awarded the Energy-saving Equipment Prize by the Energy Saving Center Foundation, Japan in 1998. The annual improvements include ease of handling, extra amenity, etc.

3. Ultra Low Noise Portable Generator, AG Series

The portable AG generator series excels on construction sites in urban areas and at night. The series features voltage regulation within 1% and speed regulation within 5% and is suitable for computer and all other loads, such as large capacity starting motors. The compact design for truck loading platform dimensions permits loading and unloading on small trucks - a feature only available from Yanmar.

Environment-Friendly Generator

1)Equipment to Comply with Exhaust Gas Regulations

The AG series generators already comply with the Tier II regulations of the Ministry of Land and Transport, Japan for NO_x, HC and other exhaust emissions to be applied from September 2005. The combustion performance, with its low fuel consumption, also achieves a massive reduction of CO₂ emissions.

2)Ultra Low Noise Generator

The dual-stage muffler, dual structure door, foldable duct structure, etc., muffle the exhaust and discharge air noise. The AG series became the quietest in the industry at 53dBA (51dBA for 50Hz) as against the average noise level for conventional models of ≤ 63dBA for 60Hz, measured at 7m in 4 directions.



Tadao Yabe, Development Div, Construction Machinery

53dBA is the noise level of general offices, restaurants, cafeteria, etc. where ordinary conversations can be heard. To measure the noise of the AG series, it is necessary to take the measurement at a quieter place with a noise level of about 40~45dBA. We used the parking area of our plant during the holidays and at night. The birdsong and cicadas, however, still upset the results. I found their noise so frustrating during that time!



AG-SS series

4. Biomass Waste Gas Power Generation System

[Outline of the System]

The basis system consists of the gasification furnace and power generation system. In the gasification furnace, wooden materials, (sawdust, chips, etc.), garbage, animal waste and other biomass are thermally decomposed to produce low calorific combustible gas for the dual fuel engine power generation system developed by Yanmar to supply both power and heat.

[Environment-Friendly Features]

- Use of Unutilized Resources
Use of biomass and other new energy sources.
- Carbon Neutral
Biomass derives from plant photosynthesis, which fixes CO₂. The use of biomass energy does not increase CO₂ levels.
- Dioxin-free
The temperature in the gasification furnace exceeds 800° C. Dioxins decompose and are not produced.
- Small Scale, Decentralized Treatment
Compatible also with small scale, decentralized treatment of 1 to several tons of biomass per daily.
- Production of ash is very low at 1~several % of the raw biomass.
- The engine generator features high overall efficiency.



Yanmar's display at Lake Biwa Environmental Business Fair , 2002

5. Sludge Reduction System

Under the present sludge treatment system, surplus sludge collected by vacuum trucks is transported to the local raw sewage treatment facility for drying, incineration and eventual landfill. It raises concern for both land and air pollution.

Yanmar's sludge reduction system, with its use of impact waves, cavitation etc., crushes the sludge from the sewage facility, turns it into substrates and returns it to the biological treatment tank. This system reduces the production of sludge and can slash sludge treatment costs by about 75%.

The system features a very simple structure and produces cavitation by force, making productive use of an old enemy in fluid dynamics.

The basic research for this system was conducted jointly with the Industrial Technology Center of Shiga Prefecture. The verification tests for practical use were conducted at a rural sewage facility.



It's good for the water environment.

Haruki Nikai, Environmental Plant Engineering



Sludge reduction system

6. Membrane Separation Activated Sludge Treatment System for Outside the Tank

A higher level of water environment preservation has been demanded in recent years. Regulations to control waste discharges into rivers, seas, lakes and swamps are getting stricter year by year with the partial addition of gross volume limits in addition to the conventional density controls. Yanmar has responded by developing Membrane Separation Activated Sludge Treatment outside the tank. The system features, better water quality, easy installation in existing waste water treatment facilities, and easy maintenance and control.

What sets this system wholly apart from conventional membrane separation activated sludge treatment is that the membrane module can be installed outside the aeration tank, instead of inside.

Thanks to this feature, in addition to the easy maintenance, the volume of the chemical liquid used to clean the membrane can be slashed. The number of membrane modules, too, can be reduced, and the design is more flexible with the membrane modules installed outside the tank. This system can be applied to all types of waste water treatment, including those for domestic and industrial waste, sewage treatment leakage and water-front amenity water. In addition, this system can be used as a provisional unit for processing drainage during reinforcement of drainage facilities in farming areas.

The SS-free membrane-processed water can be used as neutral water for flushing toilets, etc.



Hideki Takahashi, Environmental Plant Engineering

This system introduces overseas technologies, but it is Japan's first. It's going to be used widely in the future.



7. Purified Seawater Supply Equipment (UPF Series)

Filtration and ultra-violet sterilization unit to supply clean seawater for seafood

The seawater used in fish markets must be sterilized appropriately for both the quality and cleanliness of the product.

Yanmar has been engaged with the sea and fishing for many years. Allowing for the scale and cost needs of local fish markets, we developed purified seawater supply equipment for use with seawater filtration and ultra-violet sterilization devices in a compact unit. The unit has high economic performance and is easy to install, operate and maintain. When used as a core system, it can be applied to produce cool seawater or seawater ice.



Hideo Yakushiji, Environmental Plant Engineering

We developed this system for the supply of safe and fresh seafood.



8. High Efficiency GHP F Series

[Outline of Product]

The GHP is a commercial air conditioner operated on natural gas. While ordinary electric air conditioners are driven by electric motors, the GHP is driven by a gas engine for air cooling and heating. The effective use of the engine's exhaust heat achieves very high thermal efficiency.



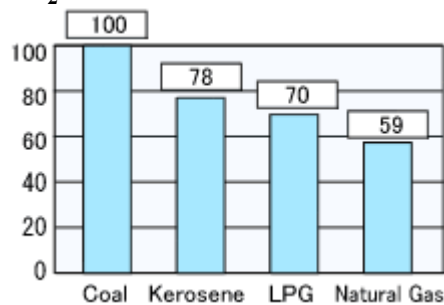
YNZP560F (20HP)

[Environmental Performance]

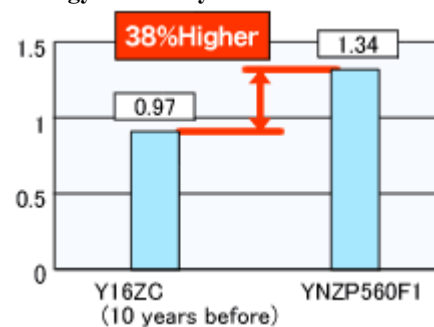
CO₂ emissions are one of the major causes of global warming. Natural gas produces the least CO₂ emission of any fossil fuel. If the CO₂ emissions of coal are 100, those of natural gas are only about 59, a reduction of 40%

The highly efficient GHP F series is 38% more thermally efficient than the GHPs of 10 years ago. The F series air conditioner features low gas consumption, clean exhaust and great economy.

CO₂ Emissions



Energy Efficiency



9. High Efficiency Gas Cogeneration Equipment (EP350G)

[Outline of Product]

Gas cogeneration equipment is captive power generation equipment where the engine is operated on natural gas to produce electric power and heat. Gas cogeneration is especially economical because electric power, itself cheaper than the commercial supply, can be supplied together with heat. The recently developed EP350G combines the lean burn mirror cycle gas engine with a highly efficient generator. The power generation efficiency of the equipment is truly world class.



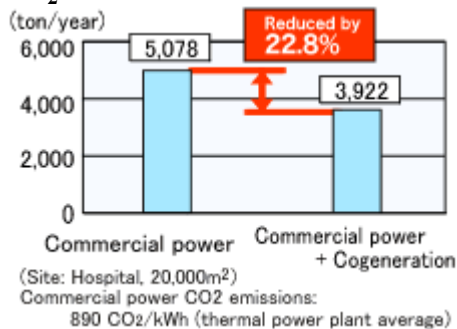
EP350G

[Environmental Performance]

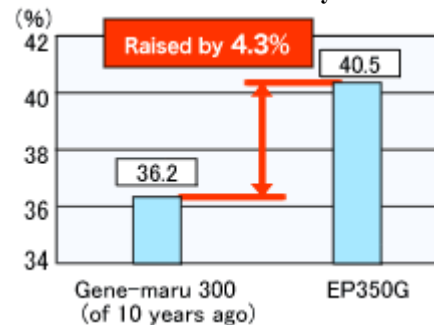
The highly efficient GHP F series has 43% better power generation efficiency than the GHP's of 10 years ago, with lower CO₂ emissions, too.

The energy utilization ratio of the cogeneration system for electric power and heat is $\geq 70\%$. This reduces CO₂ emissions by 22.8% compared with commercial power only. The noise of the co-generation system, 70dB(A), is among the lowest in the industry.

CO₂ Emissions



Power Generation Efficiency



10. New 12ft Cool Container

Modal shifts have occurred with the transfer from road to energy-saving and low pollution road and water transport, and the integration of all three. Efficiency has risen, costs have come down, and a further acceleration of the changes is expected following the new speed regulations introduced for large trucks in Japan in September 2003. Yanmar's cool containers have a big role to play. The newest model uses HFC refrigerant and gives even better performance.

[Product Features]

- 1)R404A (HFC refrigerant) is a chlorine-free, alternative to CFC's that is harmless to the ozone layer.
- 2)A fully-opening side door raises the loading and unloading efficiency ¥. The storage capacity is 16m³ and the service temperature range -25°C~+25°C.
- 3)Control and fuel supply from either of two sides.
- 4)Remote monitoring of location and functions by a GPS system. Customers, too, can check the temperature and other data on the Internet.
- 5)To ensure hygiene during transport, the container is equipped with the ozone making equipment for sterilization, deodorization and maintaining freshness. The temperature data can be checked on a liquid crystal panel, and printed out, too, on the printer housed in the panel.



(Comments by Development Staff)
Yosuke Takahashi, Distribution Equipment

The control equipment and software were reviewed from scratch. Development tests were repeated on the top-notch remote monitoring system. The container's capacity was raised by reducing the thickness of the door insulation. Careful research optimized the thermal flow inside the container.

III. Environmental Protection Activities

1. Medium-term Environmental Protection Plan

Yanmar implemented its first medium-term plan for the promotion of environmental activities from fiscal 1995 to 2000. The second plan is running from fiscal 2001 to 2005. The goals for fiscal 2005, compared with fiscal 2000, are shown below.

Goals of the Second Medium-term Environmental Plan

Category	Sub-category	Controlled Item	Mid-term Goal
Product System	Product Cleanliness	Average NOx Emission Volume	Cut of at least 15% on average for combined annual engine production of each division
		Average CO ₂ Emission Volume	Control of average CO ₂ , total CO ₂ and total NOx emission for combined annual engine production of each division
Business Operations	Energy Saving	Energy Use	Cut of energy used in production of at least 3.5% as a percentage of the entire company's sales turnover
		CO ₂ Emission Volume	Cut of CO ₂ emission during production of at least 3.5% as a percentage of the entire company's sales turnover
	Other Resource Saving and Recycling	Water Use	Reduction of at least 10% as a percentage of the entire company's sales turnover
		Waste Processing	Reduction of at least 10% as a percentage of the entire company's sales turnover
	Control of Dangerous Materials	Quantity Handled (total)	Reduction of at least 10% of chemicals covered by PRTR handled (used) annually by the whole company (2001 fiscal year as base)
Pollution Prevention	Extra Provisions	With regard to legal regulations for preventing pollution, extra provisions of at least 15% for the whole company	
Local Society	Local Society	Community Activities	No numerical objectives
Public Relations	Public Relations	PR Activities	No numerical objectives

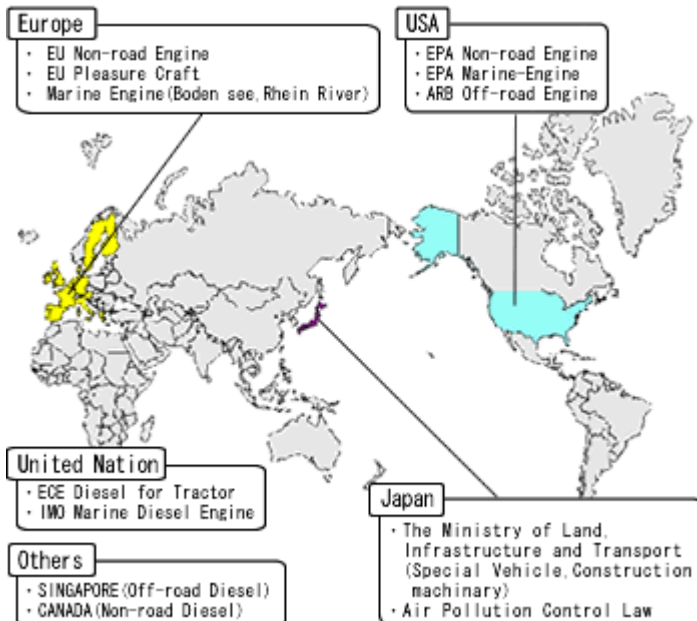
Note: Except where noted, fiscal 2000 is the base year, and 2005 the target year

2. Developing Environmental Products

2-1 Meeting Global Emissions Requirements

Regulatory authorities around the world have set various regulations with the purpose of cleaning the atmosphere, and the mandatory values get stricter by the year. The reduction of exhaust emissions, especially in the diesel sector, has long been an important theme of our company, and our constant efforts to find ever better solutions are continuing in the same vein.

Non-road Engine Exhaust Emission Regulation around the World



Measuring particulate matter in dilution tunnel

2-2 Fuel-efficient Engines

Wide-ranging research and Yanmar's own knowhow and technologies are used with great effect in combustion and other improvements that enhance to the fullest the high thermal efficiency and fuel economy of the diesel engine.



Experiment to improve combustion

2-3 Low Noise and Vibrations

The reduction of noise and vibration emissions is an important environmental theme for the engine maker. Work is progressing on reducing all such emissions.



Experiment for reducing noise and vibrations

2-4 Efficient Implements and Systems

Studies are also advancing on more efficient agricultural implements, giving thought to the entire product life cycle from manufacture and use to beyond, adopting the technologies that place the lightest burden on the environment. The representative product is the Eco-Tractor, which uses an electronically governed direct injection engine and power-saving rotary.



Field test



PTO performance test

The demand for energy-saving, high efficiency air conditioning systems also continues to rise. Responding to these needs, research is advancing on coolant cycle and control technologies.



Thermal efficiency test for GHP

2-5 Planning for Recycling

We are striving from the development stage to provide products that are safe and non-burdensome to recycle, with the aim of reducing waste when the products are finally discarded at the end of their working life. Features for ease of disassembly and recycling and environmental-friendliness are targeted in development, with clear targets for improvement in each category and for each product as a whole.

Example Targets

Target Type	Tractors	Combines	Planters	Notes
Recycling Rate (%)	85	85	75	Rate for items that can be and already are being recycled (batteries, tires, catalytic metals)
Recycling Capability (%)	98	98	90	Rate of parts that can be recycled at the end of the product's working life as a ratio of all parts (resin bumpers, rubber products, etc.)

3. Environmental Protection in Business Activities

Business activities necessarily produce an environmental burden in the forms of emissions of greenhouse gases and pollutants and the consumption of natural resources. Our company constantly gauges this environmental burden and endeavors to reduce it wherever possible.

The environmental burden increases proportionately to the scale of production, so we also present figures for unit production volume.

3-1 Energy Saving (Preventing Global Warming)

The fuel, electric power etc. used in the course of production is being reduced in a planned manner in order to prevent global warming. In the current fiscal year, inverter control is being applied to all electric drive devices in order to use electric power more efficiently. Other energy-saving contributions include the use of our own supplementary auxiliary power generation for cooling in summer in order to reduce consumption peaks. Other measures include the improvement of heat exchanger efficiency.



Inverter-controlled water pump



Captive power generation for air conditioning



Improvement of heat exchanger efficiency

The company's annual energy usage for the current fiscal year is shown in terms of crude oil. CO₂ emission is also described in terms of carbon conversion. Increment and reduction ratios are in comparison to the figures for 2000.

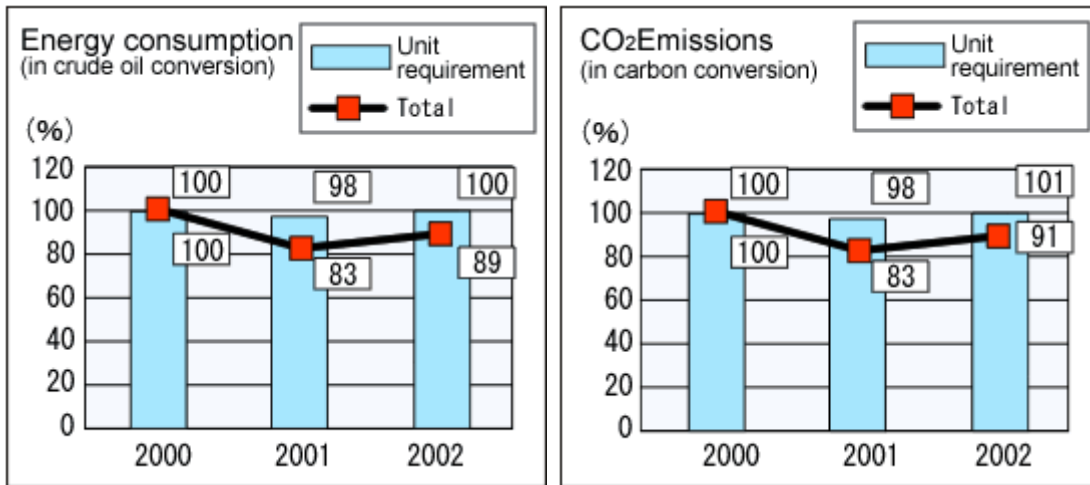
Year/Site	Energy unit requirement (Crude Oil kl/¥100mil.)			CO ₂ Emission unit requirement (t-C)/¥100mil.)		
	Whole Company	Shiga Zone	Amagasaki Zone	Whole Company	Shiga Zone	Amagasaki Zone
Fiscal 2000	30.6	36.4	18.8	15.4	18.0	10.3
Fiscal 2001	29.8	36.4	18.7	15.1	18.0	10.2
Fiscal 2002	30.4	36.6	18.8	15.6	18.2	10.9
Increment/Reduction, 2001(%)	-2.0	0.0	-1.0	-2.0	0.0	-1.0
Increment/Reduction, 2002(%)	0.0	1.0	0.0	1.0	1.0	7.0

The gross energy use and CO₂ emissions are shown below:

Year/Site	Energy Unit (Crude Oil kl)			CO ₂ Emission Unit (t-C)		
	Whole Company	Shiga Zone	Amagasaki Zone	Whole Company	Shiga Zone	Amagasaki Zone
Fiscal 2000	36,590	29,160	7,430	18,485	14,417	4,068
Fiscal 2001	30,352	23,302	7,052	15,403	11,533	3,849
Fiscal 2002	32,732	25,686	7,046	16,835	12,737	4,098
Increment/Reduction, 2001(%)	-17.0	-20.1	-5.1	-16.7	-20.0	-5.4
Increment/Reduction, 2002(%)	-10.5	-11.9	-5.2	-8.9	-11.7	0.7

At the Amagasaki Division, the reduction was 5.2% in crude oil terms. The CO₂ emissions, were higher than in 2001 due to the increased use of heavy fuel oils. We shall continue to promote the energy-saving activities and CO₂ reduction through the use of gas fuels, etc.

The changes of energy use and CO₂ emissions from the reference year, 2000, are as follows:



The total energy consumption and CO₂ emissions in 2002 were both less than the levels of 2000 but more than in 2001, mostly due to higher production. There was almost no improvement to either on the unit basis.

Energy saving in equipment investment that does not fluctuate with changes in production volume will also be promoted in addition to conventional energy-saving activities.

3-2 Resource Saving and Re-cycling (Waste Reduction)

A good example of re-cycling this year is the introduction of equipment that solidifies the polishing powder produced in the machining process, for use in re-cycling. A device that recovers and recycles the mold releasing agent for aluminum die-casting has also been introduced.



Compression and recycling equipment for polishing powder



Recovery and recycling equipment for mold releasing agent

Our annual consumption of water was 56.2 tons. We aim to reduce this through the use of underground water, prevention of water leakage, etc.

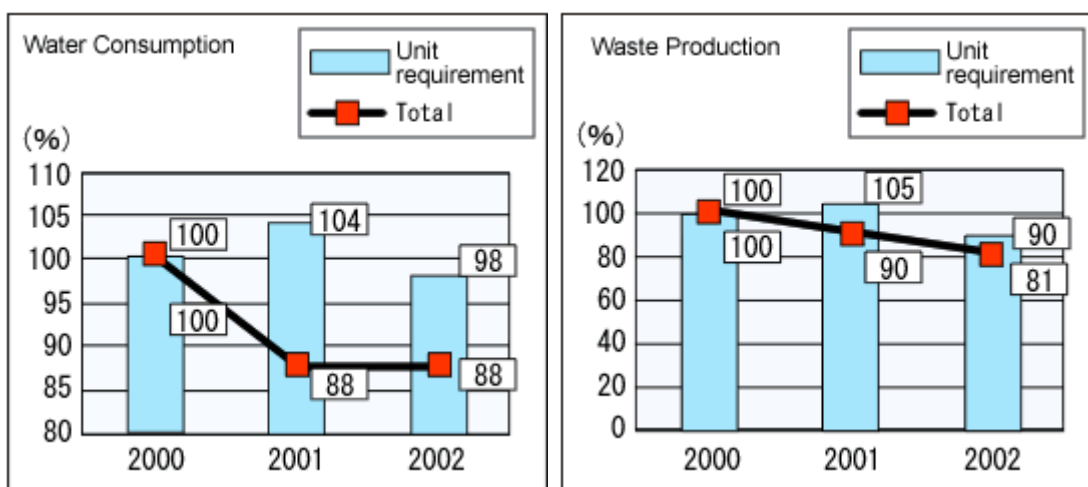
The figures for water and industrial waste are shown below:

Year/Site	Unit Requirement Cost of Water (ton/¥100 million)			Unit Requirement Cost of Waste (ton/¥100 million)		
	Whole Company	Shiga Zone	Amagasaki Zone	Whole Company	Shiga Zone	Amagasaki Zone
Fiscal 2000	535.2	311.2	989.9	3.2	4.1	1.36
Fiscal 2001	557.5	281.3	1027.1	3.37	4.54	1.37
Fiscal 2002	522.8	253.2	1026.7	2.88	3.76	1.23
Increment/Reduction, 2001(%)	4.1	-9.6	3.8	5.3	10.7	0.7
Increment/Reduction, 2002(%)	-2.3	-18.6	3.7	-10.0	-8.2	-9.6

The total water consumption and waste volumes are shown below:

Year/Site	Water Consumption (ton)			Waste Production (ton)		
	Whole Company	Shiga Zone	Amagasaki Zone	Whole Company	Shiga Zone	Amagasaki Zone
Fiscal 2000	640,596	249,596	391,000	3,825	3,286	539
Fiscal 2001	567,515	180,294	387,221	3,431	2,913	518
Fiscal 2002	562,508	177,508	385,000	3,099	2,635	464
Increment/Reduction, 2001(%)	-11.4	-27.6	-1.0	-10.3	-11.3	-3.9
Increment/Reduction, 2002(%)	-12.2	-28.9	-1.5	-19.0	-19.8	-13.9

Changes are represented in the diagrams below where the figures for 2000 equal 100:



With respect to the water, there have been reductions in both the overall consumption and unit requirement cost figures, but an increase in the unit requirement volume was observed in the Amagasaki Division because no underground water was used there.

The reduction of waste made good progress with respect to both the total volume and the unit requirement cost. This was due mainly to the increased use of recycled polishing powder, grease & oils, etc. We shall continue to promote waste reduction, fuller re-cycling and lower treatment costs in this field.

3-3 Controlling Dangerous Materials (Chemical Management)

All chemical materials used in the factories are checked and supervised on a daily basis as shown below during purchase, use and disposal, in accordance with the PRTR Law.

PRTR Law Controlled Chemicals, Amagasaki					
Apr.-Sep., 2002					
品名	製造元	用途	取得数量	消費数量	廃棄数量
1	日本化学工業	有機溶剤	100	100	0
2	日本化学工業	有機溶剤	100	100	0
3	日本化学工業	有機溶剤	100	100	0
4	日本化学工業	有機溶剤	100	100	0
5	日本化学工業	有機溶剤	100	100	0
6	日本化学工業	有機溶剤	100	100	0
7	日本化学工業	有機溶剤	100	100	0
8	日本化学工業	有機溶剤	100	100	0
9	日本化学工業	有機溶剤	100	100	0
10	日本化学工業	有機溶剤	100	100	0

Chemical Control Data

Chemicals Covered by the PRTR Law (Results for fiscal 2002) Figures above law's levels highlighted

No.	Names of Chemicals / Site	Regulation No.	Nagahama	Biwa	Yamamoto	Omori	Nagahara	Kinomoto	Amagasaki	Tsukaguchi	Total
1	Zinc	1	0	0	0	7	34	1,573	0	0	1,613
2	2-aminoethanol	16	1,521	234	232	7	0	0	0	0	1,995
3	Straight chain alkyl Benzenesulfonic acid & its salt	24	6	0	0	1	0	0	0	0	7
4	Bisphenol A Epoxy resins	30	2	0	4	0	0	3	0	0	10
5	Ethyl benzene	40	6,042	8,958	358	8	0	6,558	980	245	23,150
6	Ethylene glycol	43	829	0	0	0	0	31,095	0	0	31,924
7	Ethylene glycol mono ethyl acetate	44	0	0	0	0	0	0	0	350	350
8	Xylene	63	9,727	54,041	1,547	56	70	10,463	10,422	5,311	91,638
9	Sexivalent chrome	69	27	0	1	0	0	149	106	57	340
10	Chlorodifluoromethane	85	8	0	0	0	0	0	0	0	8
11	Ethylene glycol mono ethyl ether	101	0	0	0	0	0	0	0	68	68
12	2-diethyl aminoethanol	109	0	0	13	0	0	0	0	0	13
13	1,3, 5-trimethylbenzene	224	288	2,507	9	9	40	410	263	153	3,678
14	Toluene	227	9,477	25,633	2,697	96	4	8,453	8,326	6,695	61,381
15	Lead	230	22	0	4	0	0	717	432	4	1,179
16	Nickel	231	0	0	0	0	0	20	0	0	20
17	Nickel compounds	232	0	0	0	0	0	143	0	0	143
18	hydrazine	253	0	0	0	0	0	114	0	0	114
19	Phthalic acid di-N-butyl	270	22	7	7	2	1	1	0	0	39
20	Fluoridation hydrogen & its water soluble salt	283	0	0	54	0	0	0	0	0	54
21	Benzene	299	250	15	158	2	0	0	0	0	425
22	Polyoxyethylene=alkylphenylether	307	382	111	0	0	0	0	0	0	493
23	Polyoxyethylene=nonylphenylether	309	32	3	1	139	176	111	0	0	461
24	Manganese	311	0	0	0	0	0	214	0	0	214
Total			28,635	91,508	5,085	328	324	60,023	20,530	12,884	219,317

The annual consumption of chemicals regulated under the PRTR Regulation is listed above. Details of the uses of chemicals are reported to the agencies of the national or local governments in accordance with their regulations.

We will promote lower use of PRTR regulated chemicals through rationalization of the uses of the chemicals, introduction of non-polluting alternatives, etc.

Supervision of PCBs

Each plant controls and stores condensers etc. that include PCBs with great strictness and reports their status each year to their respective prefectural governors. The PCB-related laws shall continue to be observed and the control and processing of PCBs enhanced.



Stored PCB-containing condensers



Stored PCB-containing stabilizers

3-4 Environment-Friendly Distribution (Activities of Yanmar Logistics Service Co., Ltd.)

The company endeavors to reduce the load that distribution places on the environment by promoting modal shifts from truck transportation to marine transportation, etc. One example is the change from truck to JR container railway transportation for carrying engines from the Biwa Plant to the Fukuoka Plant of Seirei Industrial Company, which greatly reduced the wooden crates, CO₂ exhaust emissions and transportation costs.



Loading engines into the van



Shipping in JR containers

We regard the packing as a part of our product and try to reduce the load it places on the environment. Wooden crates and corrugated cardboard packing have been replaced by pallets for repeated use, saving wood resources. Other products chosen for low environmental load and recycling features include small items such as adhesive tape and buffer and packing materials.



Wooden crates replaced by steel pallets



Wooden crates replaced by steel pallets



We will continue to make quantitative checks and surveys of all aspects of our distribution activities and their environmental load in order to achieve further improvements.

3-5.Preventing Public Nuisance (Preserving the Community Environment)

The environment preservation data of our major plants are shown on the following pages. We continue to control the public nuisance under voluntary standards stricter than those of the environmental regulations and ordinances. Countermeasures are specified for items that exceed the voluntary standards.

Small Engine Factory

Name of Plant: Nagahama Plant
 Major Production Item: Medium and Small Engines
 Location: Sanwa-cho 7-35, Nagahama, Shiga Prefecture
 Tel. 0749-62-2001



1.Business Activities

Horizontal water-cooled engines, vertical water-cooled engines and vertical air-cooled engines for use with a wide range of agricultural machinery, construction machinery and other general industrial equipment, marine diesel engines, saildrive equipment, and metal mold products are produced by an integrated system handling everything from machining, assembly and test operation through to coating and shipping.

2.Environmental Preservation Activities

- (1) Environmental load reduction from compressors, (prevention of air leakage).
- (2) Machining oil spray reduction
- (3) Reduction of packing material waste by improved packing methods
- (4) Solidification and recycling of polishing powder.
- (5) Reduction of environmental load of products, (low fuel consumption, energy saving and exhaust gas purification)

3.Environmental Data

Water Quality (Water discharged to rivers)

Div.	Measured Item	Standard value	Voluntary value	Measured Value		
				2002		
				Max.	Min.	Average
Density Unit (mg/liter)	PH	6.0~8.5	6.2~8.2	8.1	7.2	7.7
	BOD	20.0	4.0	3.0	0.5	1.3
	COD	20.0	16.0	8.7	0.6	2.2
	SS	70.0	4.0	5.6	1.0	1.8
	oil content	5.0	4.0	0.8	0.5	0.5
	T-N	8.0	6.4	1.46	0.15	0.63
	T-P	0.8	0.64	0.26	0.04	0.15

Water Quality (Drained to sewage)

Div.	Measured Item	Standard value	Voluntary value	Max.	Min.	Average
				2002		
Density Unit (mg/liter)	PH	5~9	5.4~8.6	7.6	6.3	7.0
	BOD	600	480	32.0	0.5	4.2
	SS	600	480	16.0	1.6	5.2
	oil content	5	4	1.0	0.5	0.6
	T-N	60	48	34.50	9.84	17.73
	T-P	10	8	0.44	0.03	0.20

Air Quality (Max. Value)

Div.	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Nitrous oxides	ppm	180~250	108~150	66~110
Sulfuric oxides	Nm ³ /h	3.68~5.08	2.21~3.05	0.01~0.15
Soot particles	g/Nm ³	0.24	0.14	0.001~0.003

Noise (Max. Value)

Time of measurement	Unit	Standard value	Voluntary value	Measured Value
				2002
Morning	dB(A)	60	58	56
Day time		65	63	63
Evening		65	63	62
Night		55	53	53

A value that satisfied the legal stipulation, but exceeded our voluntary standard. SS density tended to increase during rainfall. We cleaned the drainage channels around our plant to reduce the SS density.

Small Engine Factory

Name of Plant: Biwa Plant

Major Production Item: Medium and Small Engines

Location: Kawamichi 1009-2, Biwa-cho Higashi Asai-gun, Shiga Prefecture

Tel. 0749-72-5151



1. Business Activities

Vertical water-cooled diesel engines for use with a wide range of agricultural machinery, construction machinery and other general industrial equipment are produced under an integrated system from machining, assembly, test operation through to coating and shipping. Gas engines are also assembled at the plant.

2. Environmental Preservation Activities

- (1) Environmental load reduction from compressors, (prevention of air leakage)
- (2) Reduction of standby power
- (3) Reduction in starting time of drying furnace
- (4) Oil purification for longer service life and establishment of standard for oil and grease replacement.
- (5) Solidification and recycling of polishing waste powder.
- (6) Reduction of environmental load of products, (low fuel consumption, energy saving and exhaust gas purification)

3. Environmental Data

Water Quality (Drained to sewage)

Div.	Measured Item	Standard value	Voluntary value	Measured Value		
				2002		
				Max.	Min.	Average
Density Unit (mg/liter)	PH	5~9	5.4~8	7.9	6.6	7.4
	BOD	600	480	300	5.1	50.4
	SS	600	480	110	2.2	17.2
	oil content	5	4	2.0	0.5	0.9
	T-N	60	48	58.7	14.7	34.4
	T-P	10	8	1.59	0.03	0.29

Air Quality (Max. Value)

Div.	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Nitrous oxides	ppm	180	108	44~77
Sulfuric oxides	Nm ³ /h	4.65~7.89	2.79~4.74	Less than 0.01
Soot particles	g/Nm ³	0.3	0.18	0.003

Noise (Max. Value)

Time of measurement	Unit	Standard value	Voluntary value	Measured Value
				2002
Morning	dB(A)	65	63	55
Day time		70	68	61
Evening		70	68	61
Night		60	58	55

A value that satisfied the legal stipulation, but exceeded our voluntary standard. SS density tended to increase during rainfall. We plan engineering work to raise the waste water treatment capacity.

Small Engine Factory

Name of Plant: Yamamoto Plant

Major Production Item: gasoline engines, aluminum parts

Location: Oaza Yamotomoto 3198, Kita-machi, Higashi Asai-gun, Shiga Prefecture

Tel. 0749-79-0305



1. Business Activities

Aluminum alloy parts are indispensable for engine weight reduction. The aluminum parts are cast and machined here. Air-cooled gasoline engines are also produced by an integrated system of assembly, operation and shipping.

2. Environmental Preservation Activities

- (1) Environmental load reduction from compressors, (prevention of air leakage).
- (2) Energy-saving measures for the heaters and furnace burners.
- (3) Purification of machining oil for longer service life
- (4) Solidification and recycling of polishing waste powder.
- (5) Recovery (and re-used) of mold releasing agent
- (6) Reduction of packing material waste by improving packing methods.

3. Environmental Data

Water Quality (Water discharged to rivers)

Div.	Measured Item	Standard value	Voluntary value	Measured Value		
				2002		
				Max.	Min.	Average
Density Unit (mg/liter)	PH	6.0~8.5	6.2~8.2	7.3	6.5	7.1
	BOD	30	24	8.9	0.5	1.5
	COD	30	24	12.0	0.5	2.9
	SS	70	56	8.8	1.0	1.5
	oil content	5	4	0.8	0.5	0.5
	T-N	12	9.6	1.26	0.35	0.60
	T-P	1.2	0.96	0.07	0.02	0.04

Air Quality (Max. Value)

Div.	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Nitrous oxides	ppm	180	108	45
Sulfuric oxides	Nm ³ /h	0.61	0.37	Less than 0.03
Soot particles	g/Nm ³	0.2	0.12	0.005

Noise (Max. Value)

Time of measurement	Unit	Standard value	Voluntary value	Measured Value
				2002
Morning	dB(A)	60	58	56
Day time		65	63	63
Evening		65	63	62
Night		55	53	53

Small Engine Factory

Name of Plant: Kinomoto Plant
 Major Production Item: Engine Parts and Tractors
 Location: Kuroda 650, Kinomoto-cho, Shiga Prefecture
 Tel. 0749-82-3325



1. Business Activities

The diesel engines produced at Biwa Plant are installed on the tractors at this Kinomoto Plant. Here, too, tractors are produced by an integrated system handling everything from machining, press, welding, resin molding, coating, assembly and test operation through to packing and shipping.
 The golf carts, (4~5 passengers, self driving electro-magnetic guided type) are also produced here under the same integrated system.

2. Environmental Preservation Activities

- (1) Environmental load reduction from compressors, (prevention of air leakage).
- (2) Reduction of starting time of drying furnace.
- (3) Reduction of paint and thinner consumption through the improvement of coating process.
- (4) Purification of oil for longer service life and establishment of oil and grease replacement standard.
- (5) Solidification and recycling of polishing waste powder.
- (6) Reduction of packing material waste by improved packing style
- (7) Reduction of environmental load of products, (low fuel consumption and recycling of resins)

3. Environmental Data

Water Quality (Water discharged to rivers)

Div.	Measured Item	Standard value	Voluntary value	Measured Value		
				2002		
				Max.	Min.	Average
Density Unit (mg/liter)	PH	6.0~8.5	6.2~8.2	7.7	6.5	7.1
	BOD	30	24	5.0	0.5	1.7
	COD	30	24	12.0	0.6	3.4
	SS	70	56	20.0	1.0	3.0
	oil content	5	4	1.5	0.5	0.54
	T-N	12	9.60	1.74	0.55	0.89
	T-P	1.2	0.96	0.09	0.03	0.05

Water Quality (Drained to sewage)

				Max.	Min.	Average
Density Unit (mg/liter)	PH	5~9	5.4~8.6	6.9	6.2	6.7
	BOD	600	480	13	2.4	4.8
	SS	600	480	5.8	1.8	3.5
	oil content	5	4	0.5	0.5	0.5
	T-N	60	48	1.58	1.03	1.27
	T-P	10	8	0.06	0.04	0.05

Air Quality (Max. Value)

Div.	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Nitrous oxides	ppm	180~250	108~150	10~42
Sulfuric oxides	Nm ³ /h	1.16~8.13	0.70~4.88	Less than 0.01
Soot particles	g/Nm ³	0.2~0.3	0.12~0.18	0.001~0.03

Noise (Max. Value)

Time of measurement	Unit	Standard value	Voluntary value	Measured Value
				2002
Morning	dB(A)	65	63	55
Day time		70	68	60
Evening		70	68	58
Night		60	58	59

Vibrations (Max.)

Time of measurement	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Day time	dB	70	56	35
Night		65	52	35

59 A value that satisfied the legal stipulation, but exceeded our voluntary standard. The noise level was reduced subsequently to 55dB(A) by improving the relevant facilities.

Precision Machinery Factory

Name of Plant: Omori Plant

Major Production Item: Fuel Injection Pump

Location: Aza Omori 354, Oaza Shigenori, Takatsuki-cho, Ika-gun, Shiga Prefecture

Tel. 0749-85-3000



1. Business Activities

The fuel injection equipment is the core part for the diesel engine. The fuel injection equipment is produced by an integrated system from machining, assembly and test operation to shipping.

2. Environmental Preservation Activities

- (1) Environmental load reduction from compressors, (prevention of air leakage).
- (2) Changing facility power to inverter system
- (3) Energy-saving for heater burners
- (4) Promotion of re-use of oil and grease
- (5) Reduction of packing material waste by improving packing methods
- (6) Solidification and recycling of waste polishing powder

3. Environmental Data

Water Quality (Water discharged to rivers)

Div.	Measured Item	Standard value	Voluntary value	Measured Value		
				2002		
				Max.	Min.	Average
Density Unit (mg/liter)	PH	6.0~8.5	6.2~8.2	7.4	6.2	7.0
	BOD	30	24	30.0	0.5	5.9
	COD	30	24	21.0	2.1	7.6
	SS	70	56	14.0	1.0	3.9
	oil content	5	4	1.0	0.5	0.5
	T-N	12	9.6	9.49	0.45	2.37
	T-P	1.2	0.96	0.22	0.02	0.09

Air Quality (Max. Value)

[The plant does not have applicable air polluting facilities]

Noise (Max. Value)

Time of measurement	Unit	Standard value	Voluntary value	Measured Value
				2002
Morning	dB(A)	50	48	44.4
Day time		55	53	50.2
Evening		50	48	47.1
Night		45	43	44.4

Vibrations (Max. Value)

Time of measurement	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Day time	dB	60	54	40
Night		55	50	43

A value that satisfied the legal stipulation, but exceeded our voluntary standard. Monitoring of the waste water treatment facility for plant operations has been strengthened.

Precision Machinery Factory

Name of Plant: Nagahara Plant

Major Production Item: Precision equipment, fuel oil injection nozzles

Location: Sho 18, Nishi-asai-machi, Ika-gun, Shiga Prefecture
Tel. 0749-89-1151



1. Business Activities

The fuel injection nozzle is a core part for diesel engines. The fuel oil injection nozzles are produced under an integrated system of machining, assembly, operation and shipping. The precision machining technologies of the plant are also used for various hydraulic devices

2. Environmental Preservation Activities

- (1) Changeover of facility power to an inverter system
- (2) Energy-conservation through decentralized air conditioning piping and use of open/close valves
- (3) LPG consumption reduction by improving the nitriding treatment.
- (4) Oil and grease consumption reduction by purification and recycling
- (5) Reduction of packing material waste by improving packing methods
- (6) Solidification and recycling of polishing waste powder.

3. Environmental Data

Water Quality (Water discharged to rivers)

Div.	Measured Item	Standard value	Voluntary value	Measured Value		
				2002		
				Max.	Min.	Average
Density Unit (mg/liter)	PH	6.0~8.5	6.2~8.2	7.4	6.8	7.1
	BOD	40.0	32.0	12.0	0.8	2.8
	COD	40.0	32.0	7.7	1.1	3.4
	SS	90.0	72.0	5.6	1.0	1.9
	oil content	5.0	4.0	0.8	0.5	0.5
	T-N	15.0	12.0	1.66	0.56	1.07
T-P	1.5	1.2	0.14	0.02	0.05	

Air Quality (Max. Value)

Div.	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Nitrous oxides	ppm	(not regulated)	(not established)	-
Sulfuric oxides	Nm ³ /h	7.62	4.57	0.02
Soot particles	g/Nm ³	(not regulated)	(not established)	-

Noise (Max. Value)

Time of measurement	Unit	Standard value	Voluntary value	Measured Value
				2002
Morning	dB(A)	60	58	49
Day time		65	63	53
Evening		65	63	53
Night		55	53	51

Large Engine Factory

Name of Plant: Amagasaki Plant
 Major Production Item: Large diesel engines, gas turbines
 Location: 1-1, Nagassu Higashi-dori 1-chome, Amagasaki
 Tel. 06-6489-8005



1. Business Activities

The plant produces large diesel engines, including marine main and auxiliary and industrial diesel engines. The plant also produces gas engines and gas turbines using an integrated production system.

2. Environmental Preservation Activities

The plant promotes the ideal of harmonizing corporate progress with both local and global environmental preservation. Its aim to achieve this through daily activity for environmental preservation in the following fields:

- (1) Beautifying plant appearance; use of meshed fences, expansion of greenery; harmony with local community
- (2) Introduction of waste oil recycling equipment; recycling of other wastes
- (3) Industrial waste incinerator removed to end public nuisance.
- (4) Change from water load test operation to the dry load test operation to reduce water consumption
- (5) Introduction of collecting and recycling equipment for machining oil
- (6) Recovery of steam to heat cleaning liquid, for energy -conservation
- (7) Green procurement, recycling of paper, water, wooden chips, etc.

3. Environmental Data

Water Quality (Drained to sewage)

Div.	Measured Item	Standard value	Voluntary value	Measured Value		
				2002		
				Max.	Min.	Average
Density Unit (mg/liter)	Temp.	Below 40° C	Below 30° C	32	18	27
	PH	5.7~8.7	6.2~8.2	7.1	6.9	6.99
	oil content	35	10	1.75	1.00	1.11
	SS	300	10	6.25	1.25	2.66

Air Quality (Max. Value)

Div.	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Nitrous oxides	ppm	150~250	75~200	51~76
Sulfuric oxides	Nm ³ /h	2.20	2.00	0.05
Soot particles	g/Nm ³	0.15~0.30	0.03~0.08	0.001~0.003

Noise (Max. Value)

Time of measurement	Unit	Standard value	Voluntary value	Measured Value
				2002
Morning	dB(A)	70	67	57
Day time		70	67	67
Evening		70	67	57
Night		60	57	57

Vibrations(Max.)

Time of measurement	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Day time	dB	65	62	52
Night		60	57	40

A value that satisfied the legal stipulation, but exceeded our voluntary standard. We plan to raise the pit capacities to control the temperature change.

Large Engine Factory

(The Tsukaguchi Plant was re-organized as a new marine engine plant effective from July 2003.)

Name of Plant: Tsukaguchi Plant
 Major Production Item: Medium diesel engines
 Location: 3-1, Tsukaguchi Honcho 5-chome, Amagasaki
 Tel. 06-6428-3122



1. Business Activities

The plant specializes in the medium diesel engines and produces marine main and aux. engines, industrial engines, gas engines and compressors under an integrated production system.

2. Environmental Preservation Activities

The plant promotes the ideal of harmonizing corporate progress with both local and global environmental preservation. Its aim to achieve this through daily activity for environmental preservation in the following fields:

- (1) Beautifying plant appearance; use of meshed fences, expansion of greenery; harmony with local community
- (2) Air conditioner fuel switched from heavy fuel oil to city gas to prevent air pollution.
- (3) Reduction of engine exhaust noise (with silencer installation) to prevent noise and public nuisance
- (4) Energy-saving equipment for air conditioners introduced.
- (5) Oil/water separation equipment for machining oil introduced to prevent waste water emulsification.
- (6) Improvement of oil/water separation tank for test operation cooling water, etc. to prevent waste water emulsification.
- (7) Green procurement, recycling of paper, water, wooden chips, etc.

3. Environmental Data

Water Quality (Drained to sewage)

Div.	Measured Item	Standard value	Voluntary value	Measured Value		
				2002		
				Max.	Min.	Average
Density Unit (mg/liter)	PH	5.7~8.7	5.9~8.5	8.49	7.41	7.89
	BOD	300	200	9.5	1.0	3.4
	SS	300	200	5.6	1.0	4.36
	oil content	35.0	4.5	2.6	1.0	1.10
	Temp.	40° C	30° C	27.5	10.5	20.5

Air Quality (Max. Value)

Div.	Measured Item	Standard value	Voluntary value	Measured Value
				2002
Nitrous oxides	ppm	180~250	75~100	46~75
Sulfuric oxides	Nm ³ /h	0.09~0.33	0.02~0.05	0.001~0.020
Soot particles	g/Nm ³	0.3	0.01~0.10	0.001~0.002

Noise (Max. Value)

Time of measurement	Unit	Standard value	Voluntary value	Measured Value
				2002
Morning	dB(A)	70	65	60
Day time		70	65	63
Evening		70	65	65
Night		60	55	56

A value that satisfied the legal stipulation, but exceeded our voluntary standard. Noise insulation provided to compressors.

4. Other Activities

4-1 Environmental Education

Yanmar gives all employees training once a year. The range of training provided includes general environmental matters and conservation measures, technologies and ISO14001. Education related to facilities and technologies that have a major environmental impact is implemented by staff who actually work in those areas.

Area of responsibility	Content of General Education	Content of Special Education
Workers on special jobs	—	Perfection of work practices for boilers, etc.
Internal monitors	—	ISO methods for environmental monitoring
General workforce	Requirements of ISO14001 etc.	—
New recruits	Basic points of environmental problems	—

Education for special environmental qualifications is also arranged with outside educational institutions.

Numbers of Staff with Major Environmental Qualifications

Qualification/Plant	Amagasaki Zone	Shiga Zone	Total
Pollution prevention supervisor (water quality)	2	12	14
Pollution prevention supervisor (atmospheric)	3	10	13
Pollution prevention supervisor (noise)	2	7	9
Pollution prevention supervisor (vibration)	2	2	4
Special designated industrial waste supervisor	7	19	26
Energy supervisor (electric)	2	3	5
Energy supervisor (heat)	2	2	4
High pressure gas safety officer	0	5	5
Chief electrician	1	10	11
Boiler technician	0	20	20
Total	21	90	111



Internal audit

4-2 Environmental Communication

Communication is a vital activity for environmental coexistence with the local community. Yanmar takes various opportunities to provide information to the community and invites opinions and requests on its home page etc. for use in future activities.

Environmental Exhibitions

Yanmar's environmental products were displayed and presentations made to wide acclaim at the International Environmental Business Messe (Fair) in Shiga Prefecture in November, 2002. Yanmar also participated in the New Environment Exhibition in 2002 and 2003.



International Environmental Business Messe

Exhibits at the International Environmental Business Messe

ECO Diesel Engines
Bio-mass Power Generation System
Industrial waste processors
Domestic waste processors
Compression containers
Water processing etc.



New Environment Exhibition

Exhibits at the New Environment Exhibition

Industrial waste processors
Domestic waste processors
Compression containers
Odor-removal devices
Compost systems
Water processing etc.

Participation in Local Clean Up Activities

- Neighborhood road cleaning campaigns implemented twice a month around the head office
- Participation in the annual Biwa Day activities in the Biwa Zone, cleaning roads around the plants



Road cleaning in the Amagasaki Zone



Road cleaning in the Amagasaki Zone

- Neighborhood and commuting road cleaning campaigns implemented twice a year in the Amagasaki Zone

4-3 Ancillary Activities

The following independent activities are performed by administration divisions at head office, the research laboratories, branches etc.:

1. Recycling of utensils etc. (Reducing general waste)
2. Use of recycled paper, photocopying on both sides of paper, waste sorting etc. (Resource saving and recycling)
3. Control of air conditioning temperature for daytime energy-saving etc.

4-4 Environment Preservation Activities by Group Companies

Yanmar Co., Ltd. not being as a single corporation but as a whole Yanmar group including many subsidiaries and affiliates promotes environment preservation activities.

At Seirei Industry Co. Ltd., one of the Yanmar group companies, the assorted wastes carried out from each division of the head office plant are measured in weight for entry of the data on the ledger and are provisionally stored at the recycling resource storages in the premises of the plant before delivery to the recycling subcontractors. The ledger record is instrumental in controlling the waste by division on a monthly basis and this raises awareness of waste reduction in each division.



Weighing scale of wastes



Provisional waste storage

IV. More Information

Yanmar wants to inform society at large about the effects of its business operations on the environment and environmental protection activities, in order to that these may be developed arm in arm with the whole community.

Two-way communication is essential. This environmental report is Yanmar's first publication of this kind and we may not have included everything you wanted to see. Please let us know your opinions, impressions and questions so that we can improve future editions. We look forward to receiving your comments at the address shown below.

1. Inquiries about this Environmental Report

Environmental Management Department
Technical Administration Division
Yanmar Co., Ltd.
1-32 Chayamachi
Kita-ku
Osaka 530-8311
TEL: 06-6376-6402
FAX: 06-6377-0741

2. Yanmar Home Page and other Inquiries

The latest business activities of Yanmar and Yanmar group companies are described in a simple and attractive format. The Environment page introduces various other environmental activities not covered in this report.

To send inquiries via the net, please visit the site shown below.

Yanmar Home Page
<http://www.yanmar.co.jp>

Yanmar welcomes all inquiries on both environmental and other subjects via the inquiry corner on the home page.
Please feel free to contact us at any time.

**We the Yanmar Group seek through
creative technologies and human
warmth to give the world new worth
and enrich the lives of people
everywhere in beautiful harmony with
the global environment.**



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