

Working Towards Environmentally Friendly Production Sites: Improving Green Production Lines

All of Yokogawa's production lines are undergoing the environmental impact evaluations implemented by the YMF Kofu factory as they individually work to make Green Production Line improvements aimed at reducing environmental burdens.

Green Production Line Improvement Guidelines

The Green Production Line Improvement Guidelines established in March 2002 serve to promote production line improvements with the aim of reducing environmental burdens.

They are now being implemented as part of Yokogawa's production site improvement activities, together with the New Yokogawa Productivity System (NYPS) which has been implemented since 1981 to increase corporate management efficiency by eliminating waste and excess. This improvement evaluation is based on certain quantitative criteria determined separately for each evaluation parameter. Examples of such parameters include energy conservation rate, resource conservation rate, and toxic substance reduction rate. In the case of energy conservation, an improvement of 6% or more is evaluated as AAA, while 3% to less than 6% is AA and below 3% is A.

Improvement Efforts at YMF Kofu Factory

In order to build environmentally friendly production lines following the basic principal of eliminating excess and waste (e.g., thoroughgoing efforts to avoid any energy or resource consumption that does not contribute to production), the Yokogawa Group focuses on both reducing environmental burdens and lowering costs. At production sites, we implement improvement activities by selecting themes according to the environmental burdens related to each line.

Manufacturing Department I, working under the theme of energy conservation, achieved an energy savings of 32 MWh per year by modifying the flow of materials through production process improvements. This was done without adding any new equipment in a mass production system. Manufacturing Departments II and IV focused on reducing ethanol, a chemical substance. In the cleaning step in which products are cleaned prior to shipping, they switched from ethanol to water and achieved an overall ethanol reduction of 147 liters per year.

Manufacturing Department III tackled the challenge of completely eliminating isopropyl alcohol, a toxic chemical used by people in affixing their name stamps or seals, and achieved their goal.

Manufacturing Department V, working to reduce waste products by prolonging the usability of water in painting booths, achieved a reduction of 11 tons per year as a result of adjusting the pH value of the booth water and other modifications.

Manufacturing Department VI achieved their goal of completely eliminating dichloromethane, a toxic substance, by developing an alternative cleaning process.



YMF Kofu factory

Reducing CO₂ Emissions: The Most Important Issue for Environmental Management

The Yokogawa Group aims to make its factories world leaders in energy conservation through the development of production lines with reduced environmental burdens and improvements to facilities and production methods.

Reducing CO₂ Emissions

Yokogawa believes the most important issue for expanding environmental management is to reduce emissions of CO₂, a cause of global warming, through sparing and efficient use of resources, materials, and energy in production.

The Yokogawa Group continues to work to conserve energy as an important part of its recycling-based management practices. For example, the installation and utilization of EconoPilot at the main office/factory and the YMF Kofu factory is helping us conserve energy.

In fiscal year 2003, the Yokogawa Group's CO₂ emissions on a unit sales basis were 13.2t-CO₂ per hundred million yen, representing a 44% decrease since fiscal 1990.

All of the companies in the Yokogawa Group will continue to take a proactive approach to energy conservation, and will strive to contribute to achieving the goals established in the Kyoto Accord.

Yokogawa's Newest Factory Improved Energy Efficiency

Yokogawa Electric China Co., Ltd. (YCS), which has been operating since October 2003, is the most recent addition to the Yokogawa Group's overseas production plants. As a member of the Yokogawa Group, YCS seeks to operate as a green company contributing to the Chinese society, and has initiated environmental activities aimed at promoting environmental protection policies in Suzhou.

The YCS plant was designed to be an environmentally

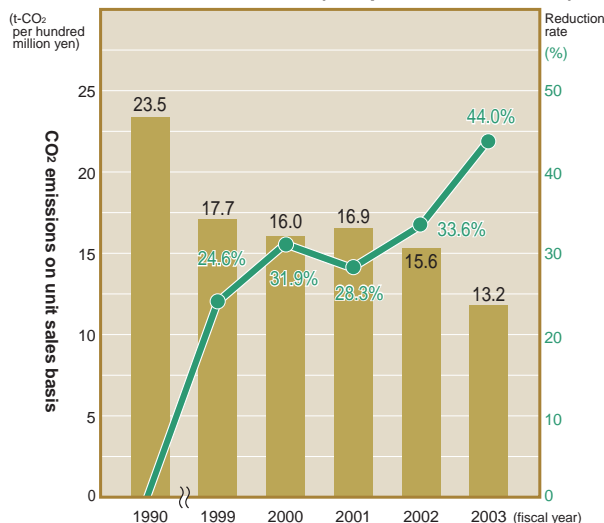
friendly operation right from the start. During the construction phase, various energy-saving facilities, toxic substance-reducing facilities, and other environmentally friendly facilities were installed, utilizing environmental protection technologies developed in Japan.

Some of the major environmentally friendly features of the YCS plant are listed below.

- 1) Use of city gas, which imposes a smaller environmental burden, instead of fuel oil as an energy source
- 2) Installation of an environmental monitoring system which enables environmental management and energy conservation
- 3) Installation of an inverter system which optimizes air intake and exhaust
- 4) Installation of loop piping and compressor unit control system
- 5) Soil pollution countermeasures and installation of a state of the art wastewater treatment system

These efficiency improvements and leading technologies, combined with awareness training for employees, have enabled YCS to achieve much greater reductions in energy consumption than at conventional overseas factories.

CO₂ Emissions on Unit Sales Basis and Reduction Rates (compared to fiscal 1990)



Yokogawa Electric China Co., Ltd. (YCS)

Preventing Toxic Emissions with Proprietary Technology and Standards

The Yokogawa Group uses proprietary technologies and independently developed guidelines to prevent polluting chemical substances from entering the natural environment.

Powder Coating with Zero VOC*1 Emissions

Powder coating is a technology which has been the subject of interest for more than ten years because it provides excellent paint coat quality without emitting air-polluting VOCs. Recent advances in paints and application equipment have made powder coating feasible even for small products and small-lot production. Therefore, at the YMF Kofu factory, electrostatic painting equipment was installed to enable powder coating coincident with the beginning of mass production of the DPharp EJX differential pressure transmitter. With this application method, a paint coat of uniform thickness is formed over the entire EJX unit, which has a complex shape. The coat is very strong and high-quality, with excellent weather durability and chemical resistance. The EJX painting process based on this technology produces zero emissions of VOCs into the atmosphere and has no waste products, permitting annual reductions of 12.7% for toluene use and 34.0% for xylene use. In economic terms, this has enabled cost reductions of approximately 5 million yen per year.

Terminology

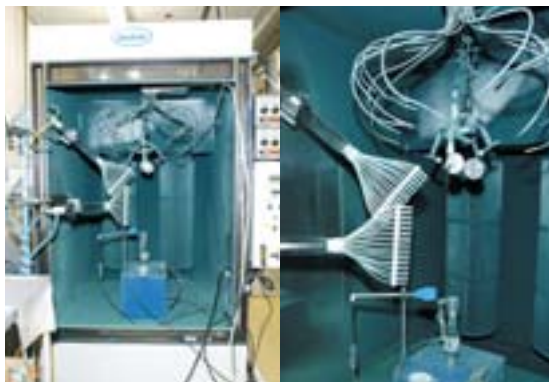
***1 VOC:** An abbreviation for Volatile Organic Compounds. VOCs are believed to be harmful if they enter the body through the lungs, skin, eyes, or other openings after being released into the air.

Standard Installation Guidelines for Toxic Fluid Waste/Waste Water Facilities

Waste fluids containing toxic chemicals could harm the ecosystem or the human living environment if released. In an effort to minimize such hazards, the Yokogawa Group has installed diaphragm filtering systems and other equipment at its main sites in Japan. This equipment generates only a small amount of sludge and does not require coagulants or flocculants.

As part of these efforts, in fiscal year 2003 Yokogawa established the Standard Installation Guidelines for Toxic Fluid Waste/Waste Water Facilities. These guidelines contain various stipulations, such as prohibiting direct burial in the ground and structures that cannot be visually checked, and prohibiting drain pipes to plated tanks. These guidelines are applied to the following facilities, which are installed by the Yokogawa Group.

- 1) Surface treatment facilities (facilities for plating, printed circuit board manufacture, painting booths, and chemical conversion treatments, as well as other independent facilities)
- 2) Facilities for removing toxic fluid waste and the like (wastewater treatment and exhaust gas cleaning (scrubbers), as well as other organic fluid waste removal facilities)
- 3) Storage tanks for toxic fluid chemicals and fluid waste (various chemical tanks, various fluid waste tanks, and tanker truck chemical injection equipment)
- 4) Indoor and outdoor fluid chemical piping facilities (pipes between buildings adjacent removal facilities, fluid waste storage tanks, and various fluid chemical tanks)
- 5) Other issues (issues related to the factory interior and exterior when installing disposal facilities)



Powder Coating Facility Based on Electrostatic Painting



Wastewater Facility Installed in Factory

Establishment and Promotion of Self-directed Soil Study Management Standard

In addition to complying with laws and regulations, the Yokogawa Group has established a self-directed Soil Study Management Standard. Yokogawa follows this standard in conducting soil studies at Japanese production sites that have been closed as a result of operations streamlining.

Soil Studies Done in Conjunction with Streamlining of Japanese Production Sites

In fiscal year 2003, as a result of the reorganization of the Yokogawa Group's Japanese production system, production was consolidated at four sites-the YMF Komine factory, YMF Kofu factory, YMF Ome factory, and YMF Komagane factory. Yokogawa is currently conducting soil studies at all of the factories that were closed in conjunction with this consolidation (some studies are in the planning stage).

In February 2003, the Soil Contamination Control Law was enacted. Three Yokogawa Group factories-YMF Matsukawa, YMF Mie, and YMF Koriyama-were using designated equipment for designated toxic substances as specified by this law. In accordance with the Soil Contamination Control Law, soil contamination at these three factories is being studied. In addition, Yokogawa is also conducting soil studies based on the law's stipulations at other factories which are not covered by the law.

Soil Purification at Former Site of YMF Moroyama Factory

A study of the soil at the former site of the YMF Moroyama factory in May 2002 showed soil and groundwater concentrations that exceeded the environmental standard maximums. At a briefing held

immediately after the study, we officially apologized to those living in the vicinity of the site, and reported on the situation. This pollution resulted from trichloroethylene which was used in cleaning parts at the YMF Moroyama factory from 1960 to 1983. Initially, a maximum trichloroethylene concentration of 83 mg per liter-well in excess of the environmental standard maximum value of 0.03 mg per liter, was detected in the soil. Subsequently, we implemented pollution diffusion prevention measures in both the soil and the groundwater, and used a pump purifier system to continue purifying the groundwater. By the end of fiscal 2003, the trichloroethylene concentration in the untreated water from a pump well had fallen to a level below 1 mg per liter. Now, in an effort to accelerate the purification process, Yokogawa is spraying iron powder into the soil and mixing it in to improve the soil.



Entire Pump Purifier System

Yokogawa Group Soil Studies

Location	Type of study	Pollutants covered by study	Study status	Completion report submitted to PRTR office?
YMF Ashikaga factory	Self-directed study	Type 1 designated toxic substances (11), Type 2 designated toxic substances (9), dioxin, oil	Within level allowed by standard	Yes
YMF Daian factory	Self-directed study		Within level allowed by standard	Yes
YMF Sakaigawa factory	Self-directed study		Within level allowed by standard	Yes
Yokogawa Electric Hachioji factory	Self-directed study		Trichloroethylene level exceeded maximum value of standard. Purification implemented.	Yes
YMF Koriyama factory	Soil Contamination Control Law		A secondary study showed tetrachloroethylene and 1-1-dichloroethane exceeded the maximum values of the standard inside the site. Purification implemented in 2004.	-
YMF Haramachi factory	Self-directed study		Detailed study of Type 1 and Type 2 substances in progress	-
YMF Moroyama factory	Self-directed study (before enactment of Soil Contamination Control Law)		Soil improvements implemented (spraying and mixing in iron powder); iron colloid will be injected in the future	-
Ando Electric Kosai site	Soil Contamination Control Law		Within level allowed by standard	Yes
YMF Matsukawa factory	Soil Contamination Control Law		Implemented in fiscal 2004	
YMF Mie factory	Soil Contamination Control Law	Implemented in fiscal 2004		

Reducing Chemical Emissions through Careful Management and Monitoring

The Yokogawa Group has established an Environmental-Burden Chemical Substance Standard for managing chemical substances. This standard classifies chemical substances as prohibited, carefully controlled, or subject to reduction.

Chemical Substance Management System

The Yokogawa Group has established Environmental-Burden Chemical Substance Standards, a self-directed set of standards covering all chemical substances used directly and indirectly in the group's operations. Chemical substances are classified into three groups—prohibited substances (9), carefully controlled substances (12), and substances which are subject to reduction (37).

In order to comply with the Pollutant Release and Transfer Register law (PRTR law^{*1}), which was enacted in April 2001, in 2000 Yokogawa established a chemical substance management system to centrally manage all chemical substances. Yokogawa has been using this system since fiscal year 2001, and has also made improvements to its chemical substance registration inspection system. Using this system, it is possible to view chemical substance MSDS (chemical substance safety data sheet) information as well as PRTR-related information over the Internet at any work location.

***1 PRTR law:** Abbreviation for Pollutant Release and Transfer Register. This law was established to prevent environmental pollution by chemical substances and to encourage self-directed improvements to chemical substance management by chemical substance-handling enterprises, through an understanding of the emissions of toxic chemical substances into the environment. Under the PRTR system, chemical substances throughout the company are managed through disclosure of emissions data and other information.

Substances Covered by PRTR

The following table presents Yokogawa's usage amounts of the substances designated for reporting by the PRTR law (usage amounts of 1 ton or more). These are figures for the consolidated Yokogawa operating companies in Japan. For further details, please visit Yokogawa's website.

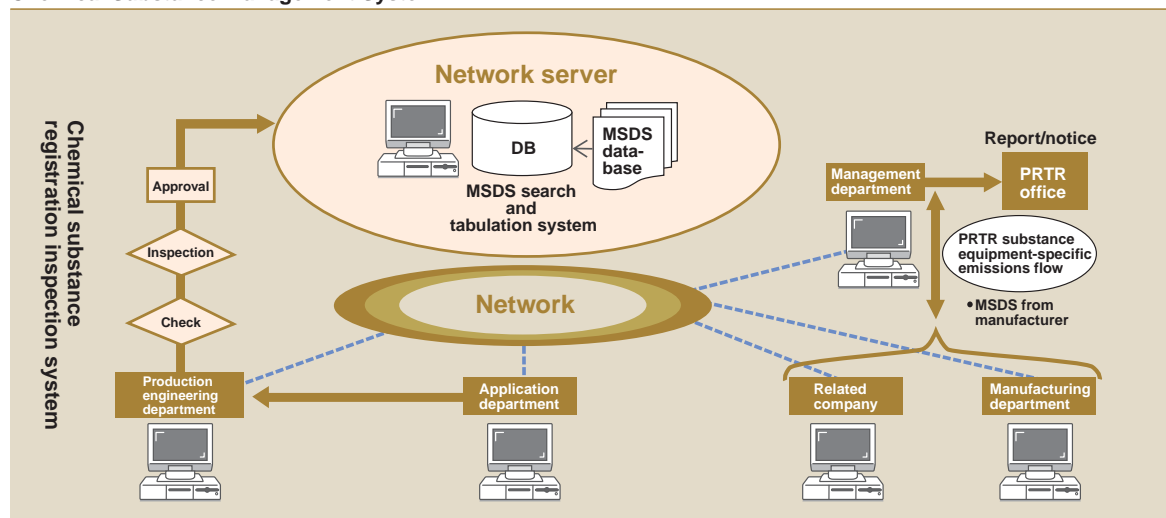
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<http://www.yokogawa.co.jp/Environment/>

Fiscal 2003 PRTR Data (1 ton or more)

Factory	Substance	Amount (kg)
YMF Komine factory	Xylene	4,042
	Toluene	1,372
YMF Kofu factory	Xylene	3,507
	Toluene	3,283
	Diethoxyethyl acetate	1,581
YMF Ome factory	Formaldehyde	13,800
	Water-soluble copper salts	23,700
YMF Komagane factory	Xylene	1,897
	Hydrogen fluoride and water-soluble salts thereof	2,383
	Xylene	1,960

Chemical Substance Management System



Toxic Substance Reduction Practices Gain the Recognition of Customers

The Yokogawa Group has taken a proactive approach to reducing its use of toxic substances. In recognition of its efforts, in fiscal year 2003 Yokogawa was awarded a Green Partner designation by Sony Corporation. Yokogawa also introduced lead-free soldering technology to its commercial production operations.

Gaining Customer Recognition

In 2003, the Waste Electrical and Electronic Equipment (WEEE), and the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directives were put into effect in Europe. These directives are aimed at improving product collections, recycling, and waste disposal and treatment.

The Yokogawa supplies communications-related instruments and semiconductor elements to Sony Corporation. In July 2003, the YMF Kofu factory and YMF Komagane factory were designated as Green Partners under the Green Partner Environmental Quality Recognition System, which is promoted by Sony. In addition, two factories which produce OEM power supplies in China were also recognized. This recognition system is an independent system run by Sony for recognizing suppliers who establish a flow management system (put nothing in, take nothing out). The environmental management practices of suppliers are evaluated by site visits to determine whether recognition should be given. The Green Partner Environmental Quality Recognition is renewed every two years.

Efforts to Eliminate Chrome and Halogen

Hexavalent chromium, which is used in underlayer treatments to prevent coatings from rusting, is a toxic chemical. In addition, flame-retardant polybrominated diphenyl ethers (PBDE) and polybrominated biphenyls (PBB) are designated as prohibited substances in the aforementioned RoHS directive. In light of these conditions, the Environmentally Friendly Materials Selection Standards list materials that are free of toxic substances.

Yokogawa's aim is to eliminate hexavalent chromium use by July 2006. Yokogawa is also working to reduce its use of halogen-based flame retardants, listing recommended halogen-free plastic molded materials, examples of halogen-free printed circuit boards, and their general performance specifications.

INTERVIEW

Creating a lead-free design for the Xancia™ next-generation controller

Takahiro Mori,
Dept. I of Manufacturing Engineering Div.,
Sourcing & Manufacturing Business HQ

In fiscal year 2003 Yokogawa completed the development of its lead-free soldering technology and applied it to the Xancia™. It took four years to establish this technology, counting from 1999 when we began searching for new soldering materials and evaluating their characteristics. The evaluations considered the types of soldering temperature conditions required for all types of mountings and a wide variety of electronic components. We also considered what the solder's reliability would be, and what the equipment requirements would be. All of these considerations were incorporated into individual experiments. Now that we have used lead-free technology in the Xancia™, I feel like all our hard work has paid off. Going forward, I would like to help establish a production system that will make it possible to rapidly transition Yokogawa products to lead-free production.



[picture: Approved for IPV6 Ready Logo]



Xancia™



Working Towards Zero Emissions with the Goal of Recycling-based Management

The Yokogawa Group strives to reduce waste products and promote reuse and recycling with the goal of zero emissions. In fiscal year 2003 Yokogawa achieved zero emissions at four sites, including the main office/factory.

The Challenge of Zero Emissions

The production processes for manufacturing measuring and control instruments consist of numerous steps and consume a variety of raw materials and forms of energy. Therefore, environmental problems such as air, water, and soil pollution and waste treatment cannot be avoided.

The Yokogawa Group, through all of its operations, strives to minimize its impact on the environment, through effective use of resources and other measures. Yokogawa's zero emissions practices are based specifically on efficiently using resources and energy; minimizing external discharge; and appropriate treatment and processing. Yokogawa defines zero emissions as reclaiming and reusing 99% or more of the total amount of waste generated. Through its proactive resource conservation and reuse initiatives, Yokogawa strives to reduce waste products.

In fiscal year 2003, Yokogawa achieved zero emissions at its main office/factory, the YMF Komine factory, the YMF Matsukawa factory, and Kokusai Chart Corp.

Results for Fiscal Year 2003

In fiscal year 2003 the waste product reduction rate (unit sales basis) for the Yokogawa Group was 86.4%, compared to fiscal 1995. Specific initiatives include those described below. Going forward, Yokogawa will continue its proactive approach with the goal of increasing the number of factories that achieve zero emissions.

Resource Recycling

Yokogawa first conducted a detailed analysis of waste product treatment and carefully sorted materials after they had been broken down. Next, we increased our metal collection efforts, and instead of discarding plastics, we sought to convert them for solid fuel or gasification furnace treatment.

Glass materials are ground for recycling into road-base materials and other materials.

Yokogawa Group's Definition of Zero Emissions

Zero emissions means to recycle 99% or more of the total amount of waste generated.

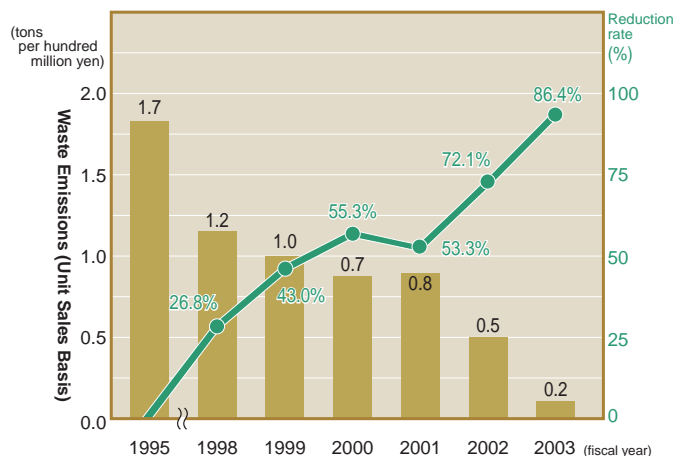
Classification	Process	Legal (Japan)	Types of waste	
Total amount of waste recycled	Recycling	General refuse	Paper, packing materials, cardboard, etc. Domestic garbage, packing materials, wood cuttings	
		Industrial waste	Metals Manufacturing debris (metal, paper, plastic, solvents, oil, etc.) Glass, concrete and other incombustibles	
		Specially controlled refuse	Toxic substances (mercury, solder debris, asbestos)	
	Chemical treatment fluid waste (volume reduction)	Industrial waste / specially controlled refuse	Wastewater detoxified by contractors (except for detoxification at Yokogawa facilities)	
	Amount of waste emissions	Refuse for incineration	General	Domestic garbage (cigarette butts, food waste, mixed papers, fallen leaves, etc.) Packing materials, debris containing wood cuttings, etc.
			Specially controlled refuse	Fats and fatty oils (waste oil, paint, ink), infectious refuse
Refuse for landfills		Industrial waste / specially controlled refuse	Debris containing metal, plastic, etc. Waste asbestos	

*The remaining 1% is waste that would pose a significant burden on the environment if recycled, or would be difficult to recycle. Examples include infectious refuse, refuse which is difficult to sanitize, asbestos, and fluorescent lights.

*Waste that can be turned into fuel, used to generate power, or recycled as incineration ash is considered part of recycled waste.

Note: Temporarily stored polychlorinated biphenyl (PCB) equipment is counted as part of waste emissions when it is detoxified.

Waste Emissions (Unit Sales Basis) and Reduction Rate (compared to fiscal 1995)



Logistics Revisions Help Significantly Reduce Environmental Burdens

The Yokogawa Group revised its distribution system as part of the consolidation of its domestic production sites in an effort to reduce exhaust gas emissions. Through this process, Yokogawa is linking improvements in distribution efficiency to improvements in operations management and global environmental protection.

Distribution Improvements

The Yokogawa Group outsources the distribution processes of its domestic production sites to an ISO14001 certified company.

Yokogawa worked jointly with the distribution company to achieve the fuel reductions shown below with the goal of creating a green logistics system.

①Energy-use reductions achieved due to establishment of new and shortest routes for regular runs between sites in conjunction with domestic factory reorganization and consolidation

②Mixed cargo transport of products being delivered domestically

In particular, the shortening of transport distances between sites implemented in conjunction with the reorganization and consolidation of domestic factories (①above), which was started in 2001, was linked to very significant reductions in energy consumption.

In fiscal year 2003 Yokogawa achieved a reduction of 79.2 tons (converted to CO₂) compared to fiscal year 2002.

Measures to Reduce Consumption of Packaging Materials

In order to reduce the amount of packaging materials consumed, Yokogawa employs a number of measures, including simplifying packages, increasing efficiency, using packageless shipping, and reusable containers.

The Yokogawa Group puts a lot of effort into developing environmentally friendly packages, which are simple in design and use less packaging material, using film cushions and pulp molds. In fiscal year 2003 the number of models shipped using film cushion packages increased by 16, for a total of 71 such products. In shipping parts between factories, Yokogawa works to reduce packaging materials through measures such as using reusable containers, in which all of the parts required for a product are set in a single box.

In 2001, Yokogawa Engineering Service Corp. began using packageless shipping for some products being picked up for repairs and calibration in the Kanto area. Now that customers have come to understand this system, packageless shipping was expanded to the Chubu and Kansai areas in fiscal year 2003.

As a result, packageless shipping for designated shipping items has increased to 54% compared to 24% when packageless shipping was used only in the Kanto area.



Truck Loading and Unloading Zone (YMF Kofu factory)



Film Cushion