3.4 Suggestions for Betterment

3.4.1 Suggestions for Betterment of O&M

1) Kim Lien WWTP, Truc Bach WWTP, North Thang Long WWTP

Goal 1 "Maintaining Better Discharge Quality"

(1) Improvement of the operation manual

At present, WWTP operators are referring to the O&M manual provided by the contractor without updating. It is recommended to improve the O&M manual including a risk management manual (contingency plan) for water quality by compiling the 5-year experience of WWTP operation and the latest technologies. To achieve this strategy, it is suggested to take the following 4 actions:

- understanding the treatment process and system
- improving the operation manual with water quality data
- providing countermeasures for pollution load fluctuation
- improving the risk management manual for water quality

Skilled operators' input is effective for update of the O&M manual.

(2) Measurement of the process condition for controlling discharged water quality

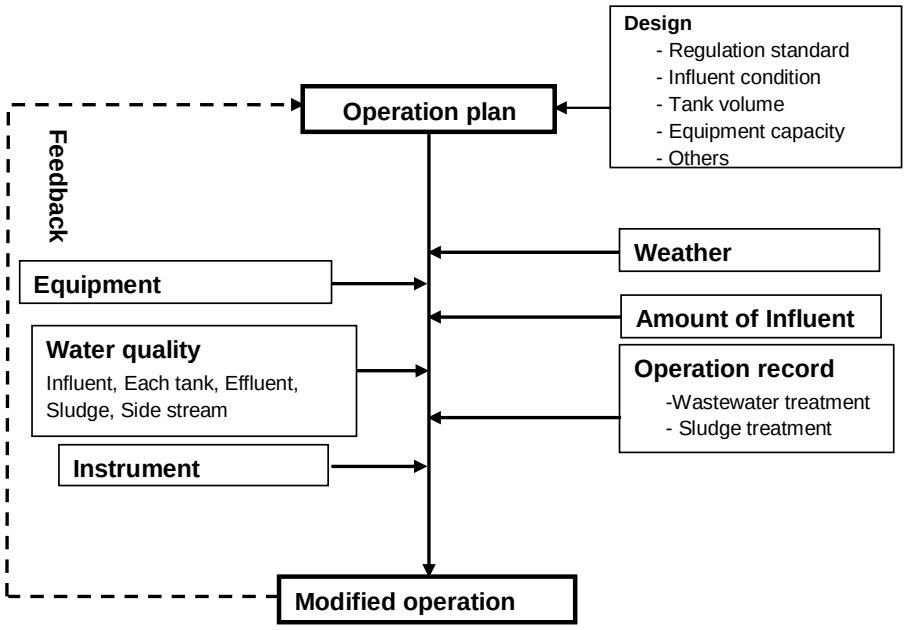
In order to secure the high treatment efficiency in the future, it is recommended to monitor the treatment process by using instrumentation because Kim Lien and Truc Bach WWTPs have the advanced treatment process.

Table 3.4.1 and Table 3.4.2 show the proposed parameters to be monitored in the treatment process and instruments required for checking those parameters. By gathering a variety of process data, the plant operation can be improved through PDCA cycle. The details are shown in Figure 3.4.1.

Table 3.4.1 Proposed parameters to be monitored in the treatment process

	pH	DO	ORP	NH4-N	NO2-N	NO3-N	PO4-P
Primary settling tank inflow	○						
Primary settling tank outflow	○			○		○	○
Anaerobic tank	○		◎		(○)	◎	◎
Anoxic tank	◎		○	◎	(○)	◎	
Oxic tank	◎	◎		◎	(○)	◎	◎
Final settling tank outflow	○	○				○	○

Source: JICA team



Source: JICA team

Figure 3.4.1 Operation procedure

Table 3.4.2 Instruments required for monitoring parameters in treatment process

- pH meter
- Dissolved Oxygen meter
- Oxidation and Reduction Potential meter (already installed)
- Simplified instruments for NH4-N, No2-N, NO3-N and PO4-P

Note: portable types are recommended Source: JICA team

(3) Change of the operational condition for successful removal of phosphorus and nitrogen in Kim Lien and Truc Bach WWTP

a. Bypassing the primary settling tank

- To supply a greater amount of organic matter to the reaction tank, the primary settling tank should be by-passed.

b. Increasing MLSS concentration

- To promote de-nitrification stably, MLSS concentration should be increased to around 3000mg/L or more over.
- MLSS concentration cannot be increased rapidly because de-nitrification is a biochemical behavior and the microorganisms cannot respond in a short time.
- A change of water quality has to be ardently pursued through experiment.

- Sludge treatment, especially the dehydrator, should be operated with care so as not to influence the return water.

(4) Reduction of MLSS concentration in North Thang Long WWTP

According to the results of the JICA team's survey, current average MLSS was 2,760 mg/L in North Thang Long WWTP which is higher than the recommendable MLSS of 1,500 - 2,000mg/L. In addition, influent BOD is lower considerably than design value. Taking into account the abovementioned conditions, MLSS in this plant should be controlled below 1,500 mg/L MLSS.

By reducing MLSS concentration, the following advantages are expected.

i) Saving power for aeration (Aerator time shall be shorten for reducing MLSS)

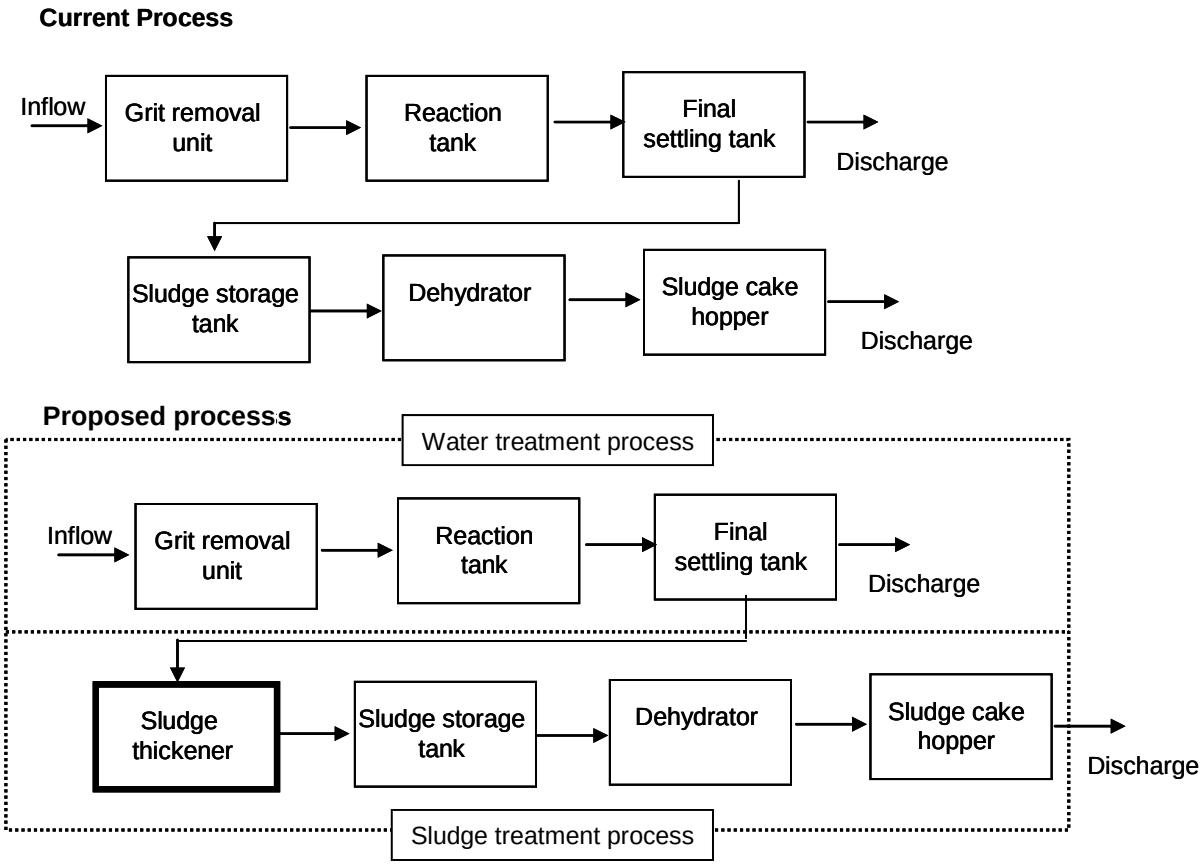
ii) Removal rate of T-P rises by shortening Solid Retention Time (SRT).

(5) Use of primary settling tanks as sludge thickening tanks in North Thang Long WWTP

There is no sludge thickening facility in the North Thang Long WWTP. Excess sludge to the dehydrator is only conveyed from the Final Settling Tank. On the other hand, the Primary Settling Tanks are not used now because influent BOD is lower than design value. For effecting utilization of the facilities, it is recommended to use the Primary Settling Tank as the Sludge Thickener. The proposed sludge treatment process using the Primary Settling Tank is shown in Figure 3.4.2. This operation has merits as mentioned below;

In the sewage treatment process, MLSS concentration in the reaction tank can be regulated properly.

In the sludge treatment process, SS concentration of sludge supplied to the dehydrator will be 2 - 3% which is higher than the present operation. As a result, sludge feeding volume to the dehydrator will be decreased. This effect can contribute to reduction of coagulant, saving power for the dehydrator and reduction of moisture content of sludge cake.



Source: JICA team

Figure 3.4.2 Current process and proposed process

Goal 2 "Reduction of O&M Cost"

(1) Improvement of the maintenance manual

Good maintenance activities can save equipment maintenance cost. Good maintenance activities can be achieved based on good maintenance manuals.

Appropriate maintenance prolongs equipment lifetime and consequently contributes to a reduction of O&M cost. Therefore, the improvement of O&M manuals including a maintenance plan, equipment manuals, and recording sheets is very important.

The maintenance plan will set down the scope of inspection for daily, monthly, 6 monthly, yearly and long-term maintenance items. An example of a maintenance plan is shown in Table 3.4.3.

Table 3.4.3 Example of maintenance plan table

Name	Daily	Monthly	6 months	Yearly	Long-term
Inlet pump	Noise	Current, Insulation resistance, Discharge pressure		Lift-up checking	
Blower	Noise, Smell	Current, Discharge pressure	Insulation resistance		Overhaul maintenance
Sludge pump	Noise, Smell, Gland-packing	Current, Discharge pressure	Insulation resistance		Overhaul maintenance
Scraper	Noise, Smell	Current	Insulation resistance		Overhaul maintenance

Source: JICA team

Implemented checking results should be recorded. For recording, equipment sheets are very helpful. An example of the equipment sheets is shown in Table 3.4.4.

Table 3.4.4 Image of equipment sheets

Tag No / Name	KBW1A / Aeration Blower A							Picture				
Installed year	Sep 2005											
Installed place	Blower Room											
Specification	30kW											
Oil / Grease No												
Bearing No												
Drawing No												
Measurement results (every month) in 2009												
Items	1	2	3	4	5	6	7	8	9	10	11	12
Current(A)	35	35	36	35	35	35	35	35	35	35	35	35
Discharge Pressure (MPa)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Insulation Resistance (M ohm)	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞

Source: JICA team

(2) Introduction of computerized equipment data-base system

A computerized data base system that records equipment history such as installation, check, repair and renewal will be effective to maintain equipments. Merits of the computerized data base system are as follows;

i. Proper management of O&M information (O&M history for buildings and equipment)

ii. Accumulation of maintenance information such as check and repair

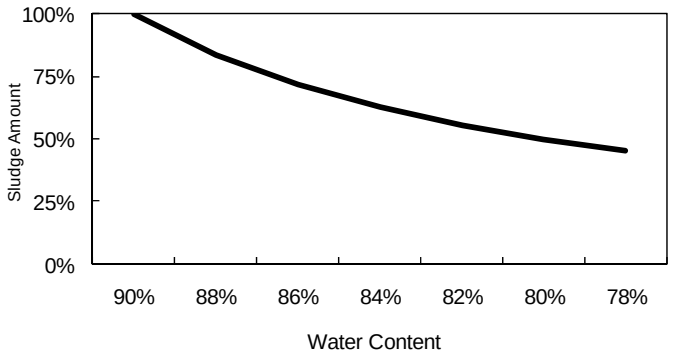
iii. Efficient management of maintenance schedule
iv. Application to making a middle-long term maintenance plan, an asset management plan, etc.

(3) Reduction of the coagulant purchase cost

i. Proper coagulant dosage can reduce the cost of coagulant purchased. Proper coagulant dosage should be examined regularly.
ii. Dosage of coagulant for phosphorus removal can be reduced by using complete biological phosphorus removal.

(4) Reduction of sludge disposal cost with decreasing water content

Control of water content in sludge is very effective for cost saving by reducing sludge amount because decreasing sludge amount leads to a transportation cost saving. Figure 3.4.3 shows the relationship between sludge amount and water content. If water content is decreased from 90 % to 86 %, the sludge amount will be reduced from 100 % to 75%. The current condition is 86% water content in the sludge in Hanoi. However, we believe water content can be decreased to around 80%. For achieving 80% water content, chemical tests with a dehydrator will be needed.



Source: JICA team

Figure 3.4.3 Relationship between sludge amount and water content

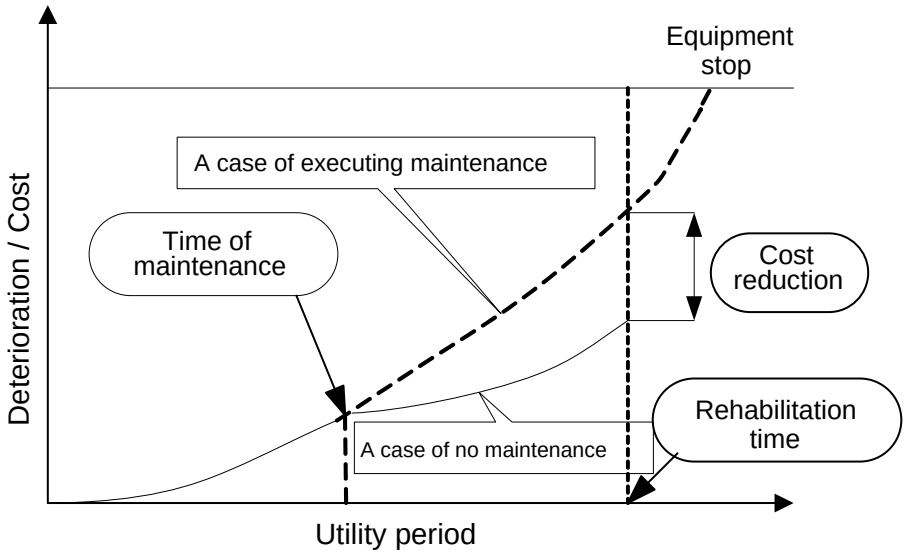
(5) Preference of local made equipment

Currently most of the pieces of equipment installed in the WWTPs are imported. When the existing equipment is replaced, it is recommended to use local made equipment as much as possible for easy repair and maintenance.

(6) Management of equipment lifetime

WWTPs in Hanoi have been operated for five years. Presently, deterioration of equipment is not significance. In the years ahead, need for replacement or overhaul of equipment must increase. Needless to say, the replacement of equipment shall be

postponed as long as possible for budget saving. Quality of maintenance work including prolongation of the equipment lifetime is very essential. (Refer to Figure 3.4.4)



Source: JICA team

Figure 3.4.4 Cost reduction through preventive maintenance

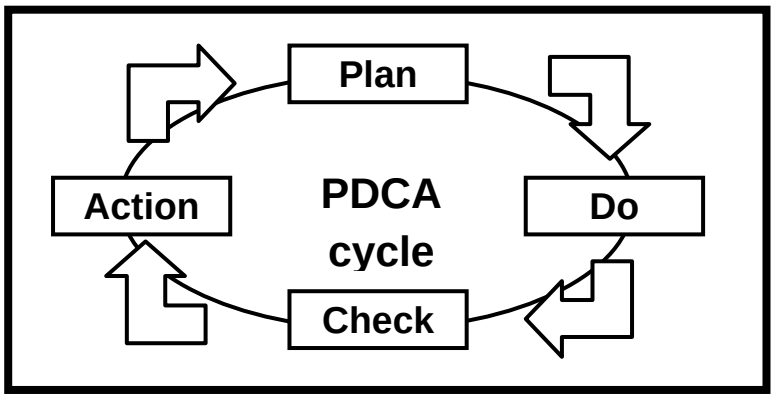
(7) O&M with PDCA cycle

Based on the investigation of equipment, there may be concern that large scale repair or replacement of most equipment will be required within 5 years if the O&M plan is kept as it is now. To keeping the equipment functioning properly longer, the O&M manual, as a basis of O&M works, should be improved. The most realistic idea for improving the O&M manual is to perform a remedial rewrite based on lessons learned at the site works, which is called PDCA cycle management. PDCA stands for Plan, Do, Check and Action. PDCA (plan–do–check–act) is an iterative four-step problem solving process typically used in business process improvement.

PLAN Establish the objectives and processes necessary for ensuring target quality of treated sewage and prolongation of equipment lifetime in accordance with the expected output by setting indicators for checking water quality and equipment status.
DO Implement the new processes based on the PLAN.

CHECK Measure the new processes and compare the indicators against the expected results to ascertain any differences.
ACT Analyze the differences to determine their causes. Each will be part of either one or more of the P-D-C-A steps. Determine how to improve.

These activities are called PDCA cycle as shown in Figure 3.4.5. A good PDCA cycle can improve O&M skills.



Source: JICA team

Figure 3.4.5 Image of PDCA cycle

2) Yen So PS

Goal 1 "Maintaining Better Operation"

In the Yen So PS, pumps are operated manually. To prevent human error, auto operation is recommendable. By using a SCADA system in Yen So PS, it would be easy to improve the present manual operation system with an automatic one. For automated operation, turning the pumps on and off would be controlled by the water level of the drainage channel.

Then, the operators will check the status of the pumps through the SCADA monitor. When a warning signal appears or unforeseeable situation arises, the operator shall inform his authority and take proper actions in accordance with the contingency plan. This is an easier and safer option for the operation of Yen So PS.

Goal 2 "Reduction of O&M Cost"

Currently, there is a lot of garbage in the sewers. This causes pump damage. The garbage is mixture of street trash entering from drainage inlets and garbage dumped

into drains and sewers by the inhabitants. For preventing pump trouble due to the garbage, a public campaign to stop disposal of garbage into drains and sewers is required. Reduction of garbage will contribute to cost saving of pump operation due to less repair work.

Source: JICA team

Figure 3.4.6 Garbage in the To Lich River

3.4.2 Suggestions for Betterment of Facilities

1) Kim Lien WWTP

(1) Repairing of pressure gauges and manometers

Almost every pressure gauge and manometer is malfunctioning already. For numerical grasping of equipment condition, pressure gauges and manometers are important equipment. Therefore, repair and/or replacement of pressure gauges and manometers will lead to good O&M.

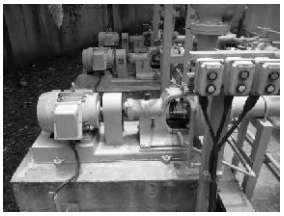
Source: JICA team

Figure 3.4.7 Pressure gauge

(2) Equipment number tags

There are no number tags on the equipment even in the control panels. This situation invites human error, for example, wrong operation.

Printing number tags for the equipment is the countermeasure.



Source: JICA team

Figure 3.4.8 Return sludge pump

(3) Maintenance space

A lot of chemical bags are found around the generator. This causes inconvenience in the operation. Chemical bags should be put in order for better maintenance activities.

Source: JICA team

Figure 3.4.9 Generator room

(4) Dehydrator maintenance stage

There is no maintenance stage around the dehydrator. This situation makes it dangerous for operators to check equipment conditions. To improve this situation, a contractor should be hired to install one.

Source: JICA team

Figure 3.4.10 Dehydrator

(5) Blower room

Current blower room temperature is very high because air infiltration is not sufficient. This situation will invite blower damage. Sufficient air infiltration is needed for prolonging the blower life time.

Source: JICA team

Figure 3.4.11 Blower room

(6) Power cable for submergible

The power cable is installed directly through the structure. This situation makes replacement work very hard. Installing pull boxes is one of the countermeasures.

Source: JICA team

Figure 3.4.12 Power cable

(7) Pipe colors

Only one color is painted on the pipes. This situation is the same as in Truc Bach WWTP and North Thang Long WWTP. In Japan, different colors are painted on the pipes depending on the purpose. To prevent mistakes, painting different colors depending on the purpose is a good countermeasure.

Source: JICA team

Figure 3.4.13 Pipe color

(8) Pipe flow direction

There are no marks for flow direction. To understand the WWTP process, flow direction marks are needed. An example is shown in Figure 3.4.14.

Source: JICA team

Figure 3.4.14 Flow direction

(9) Operation time counter

For grasping equipment operation time, installing operation time counters is very useful. However, a huge outlay will be needed to install them for all the equipment. Therefore, it is recommended, as one of good countermeasures to maintain better

O&M, to install them for the main equipment (for example, lift pump, blowers and dehydrator).

2) Truc Bach WWTP

(1) Pit covers

Pit covers are deeply rusted. These pit covers are very dangerous because an operator could fall into the pit. Immediate replacement is necessary. Changing the material is a good countermeasure, for example, employing FRP pit covers is recommendable.

Source: JICA team

Figure 3.4.15 Rust pit cover

(2) Pipe colors

Only one color is painted on the pipes. This situation is the same as in Kim Lien WWTP and North Thang Long WWTP. In Japan, different colors are painted on the pipes depending on the purpose. To prevent mistakes, painting different colors depending on the purpose is a good countermeasure. Figure 3.4.13 is to be referred to as a reference.

(3) Operation time counters

For grasping equipment operation time, installing operation time counters is very useful. However, a huge outlay will be needed to install them for all the equipment. Therefore, it is recommended, as one of good countermeasures to maintain better O&M, to install them for the main equipment (for example, lift pump, blowers and dehydrator).

(4) Dehydrator maintenance stage

There is no maintenance stage around the dehydrator. This situation makes it dangerous for operators to check equipment conditions. To improve this situation, a contractor should be hired to install one.

3) North Thang Long WWTP

(1) FST scraper

The FST scraper's guide roller abrades away easily as mentioned before. There are two recommendable countermeasures; one is changing the guide roller

Source: JICA team

Figure 3.4.16 FST scraper

material and the other is installing the guide rail on the bottom of the tank. However, it is very expensive to improve. Informing the contractor is also necessary.

(2) Sludge cake hopper

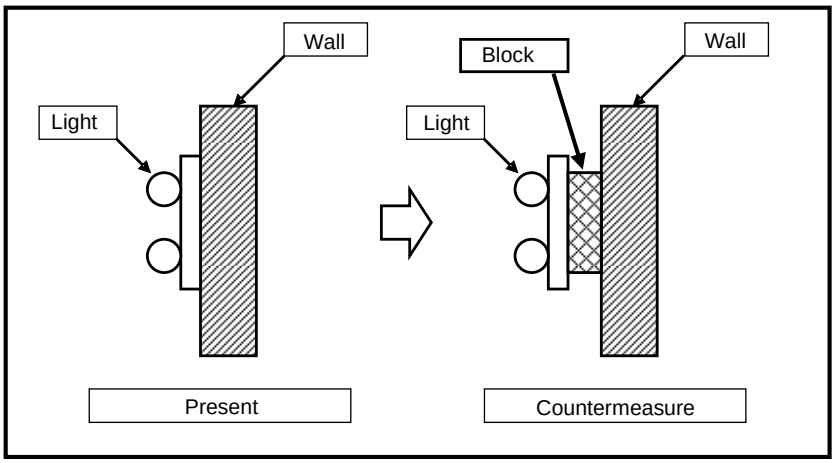
Currently, transportation trucks cannot get under the hopper. Thus, sludge cake is spread under the hopper. For improving this situation, adoption of a container as shown in Figure 3.4.17 could be one of countermeasures.

Source: JICA team

Figure 3.4.17 Container

(3) Tunnel lighting unit

Currently, water is leaking onto the lighting circuit. This is a very dangerous situation as mentioned before. Our suggested countermeasure is lifting the lighting unit from the wall as in Figure 3.4.18.



Source: JICA team

Figure 3.4.18 Countermeasure for lighting unit

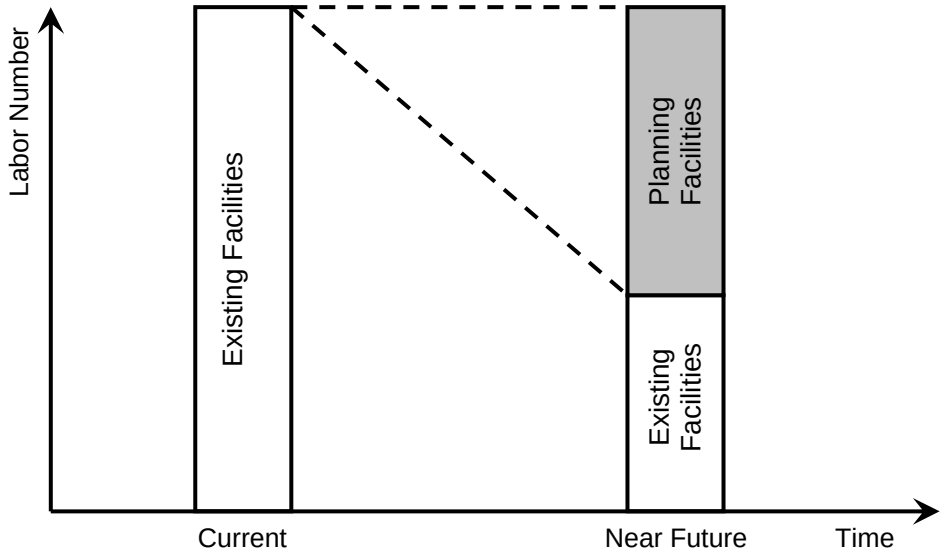
3.5 Integrated Control System (ICS)

3.5.1 Occasion for Introduction of ICS

Many WWTPs and PSs are planned, under procurement or under construction in Hanoi city and will start operation in the near future.

If the O&M plan is kept as it is, a much greater additional budget will be needed in proportion to the number of facilities. Hence it is required to rationalize the O&M plan for cost reduction.

For cost reduction, an integrated control system (ICS) is a promising option because it will reduce the number of people in the workforce. The redundant workforce in the existing facilities can be shifted to the new facilities. In particular, the night shift workforce could be reduced by adopting an ICS. Image of labor shift is shown in Figure 3.5.1.



Source: JICA team

Figure 3.5.1 Image of labor shift

3.5.2 Review of Existing Facilities for Introduction of ICS

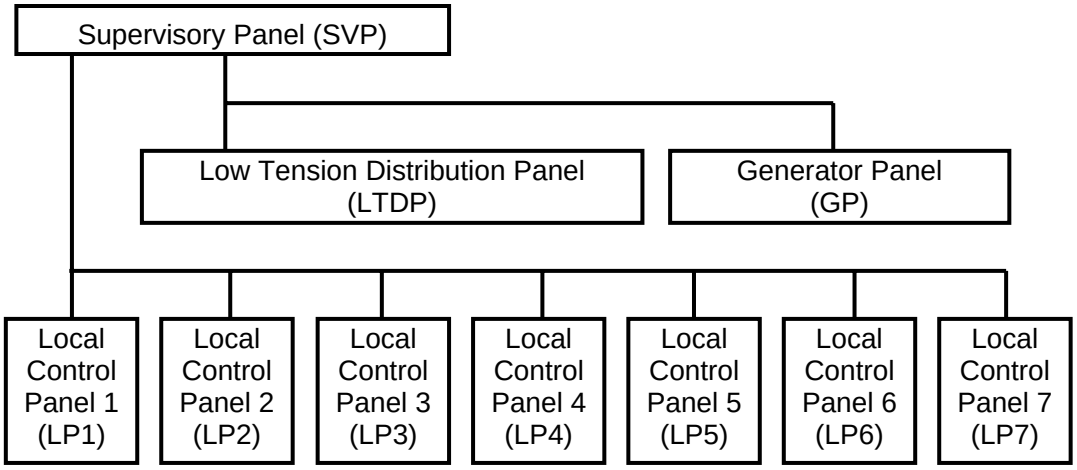
For introduction of ICS, the following existing facilities were investigated:

(1) Kim Lien WWTP
(2) Kim Lien Relay PS
(3) Truc Bach WWTP
(4) North Thang Long WWTP
(5) Yen So PS

(1) Kim Lien WWTP

No computerized monitoring systems are installed in Kim Lien WWTP. PLCs are also not installed. For adoption of ICS, PLC is necessary equipment. Figure 3.5.2 shows the current system diagram of Kim Lien WWTP.

Currently, the Low Tension Distribution Panel (LTDP), Generator Panel (GP) and all Local Control Panels (LP) are connected to the Supervisory Panel (SVP) by wire and they can grasp the whole facility's status on the SVP. Information of panel troubles is shown only on the SVP.



Source: JICA team

Figure 3.5.2 Current system diagram of Kim Lien WWTP

For considering the PLC, the current Kim Lien WWTP I/O points were investigated. Table 3.5.1 shows current DI/O, AI/O and PI points for each panel.

Table 3.5.1 Current Kim Lien WWTP I/O points

Panel No	DI	DO	AI	AO	PI
LP1	26	21	0	0	0
LP2	84	67	0	0	0
LP3	17	10	0	0	0
LP4	20	10	0	0	0
LP5	11	7	0	0	0
LP6	17	13	0	0	0
LP7	6	2	0	0	0
LP-KDH1	16	10	0	0	0
SVP	115	50	6	0	3
Other	1	0	2	0	0
Total	313	190	8	0	3

Source: JICA team

(2) Kim Lien Relay PS

For Kim Lien Relay PS, there are some panels that are tied in with each other. Only the alarm lamp that is installed in front of the pump house will light when some trouble occurs. Then, a guard can recognize that there is a problem and subsequently can take actions for trouble shooting. Of course, a detailed trouble signal will light up in the front of panel.

However, none of Kim Lien WWTP's operators can recognize any of the troubles that occur in Kim Lien Relay Pumping Station. Table 3.5.2 shows I/O points in the current Kim Lien Relay PS.

Source: JICA team

Figure 3.5.3 Kim Lien Relay PS control panels

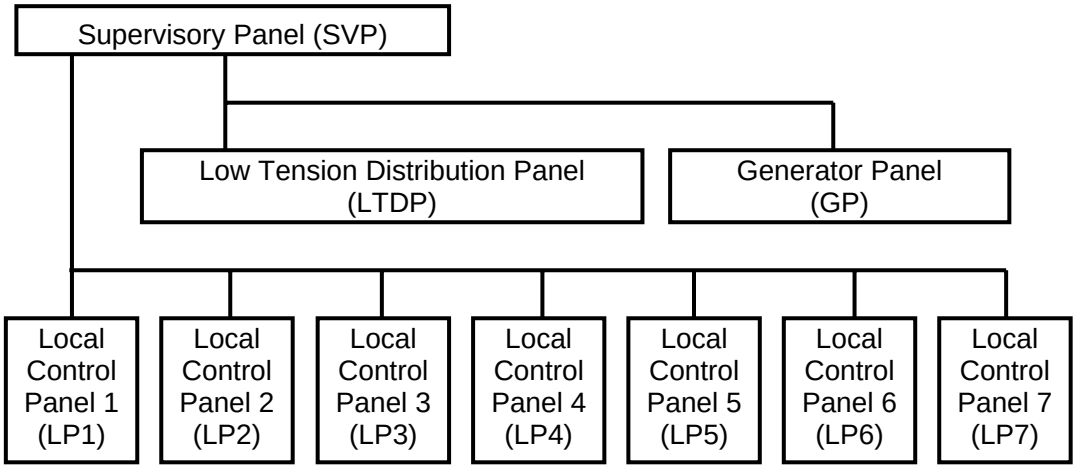
Table 3.5.2 Current Kim Lien Relay PS I/O points

Panel No	DI	DO	AI	AO	PI
LPDT-PS	21	10	0	0	0
Total	21	10	0	0	0

Source: JICA team

(3) Truc Bach WWTP

No computerized monitoring systems or PLCs are installed in Truc Bach WWTP either, the same as at Kim Lien WWTP. Figure 3.5.4 shows the current system diagram of Truc Bach WWTP and Table 3.5.3 shows the current Truc Bach WWTP I/O Points.



Source: JICA team

Figure 3.5.4 Current system diagram of Truc Bach WWTP

Table 3.5.3 Current Truc Bach WWTP I/O points

Panel No	DI	DO	AI	AO	PI
LP1	36	27	0	0	0
LP2	61	39	0	0	0
LP3	29	19	0	0	0
LP4	25	13	0	0	0
LP5	9	5	0	0	0
LP6	15	11	0	0	0
LP7	6	2	0	0	0
LP-KDH1	15	9	0	0	0
SVP	73	2	6	0	3
Other	1	0	2	0	0
Total	270	127	8	0	3

Source: JICA team

(4) North Thang Long WWTP

A computerized monitoring system is already installed. This system has monitoring and logging data functions.

Source: JICA team

Figure 3.5.5 North Thang Long WWTP monitoring system

Table 3.5.4 Current North Thang Long WWTP I/O points

Panel No	DI	DO	AI	AO	PI
GCP	51	38	0	0	0
LPP1,2,3	33	23	0	0	0
PSP	27	25	0	0	0
AFSSP	57	46	0	0	0
SAP1,2,3,4	47	36	0	0	0
CMBP	9	7	0	0	0
RAS & WAS	21	17	0	0	0
WSSP	24	15	0	0	0
FWP	25	15	0	0	0
Cake Hopper	8	7	0	0	0
STP1,2	29	4	0	0	0
DWP	6	9	0	0	0
DP	28	6	0	0	0
DCP	29	18	0	0	0
SVP	47	44	10	0	6
P4,5	112	2	0	0	20
Total	553	312	10	0	26

Source: JICA team

(5) Yen So PS

A computed monitoring system is already installed. This system also has the same monitoring and logging data functions as the North Thang Long WWTP.

Source: JICA team

Figure 3.5.6 Yen So PS monitoring system

Table 3.5.5 Current Yen So PS I/O points

Panel No	DI	DO	AI	AO	PI
O.Pump in control room	72	11	0	0	0
E.Pump in control room	204	12	0	0	0
6kV No.1	23	5	0	0	0
6kV No.2	20	5	0	0	0
22kV No.1	6	9	0	0	0
22kV No.2	5	4	0	0	0
LV SG	30	16	0	0	0
O.Pump in Pump room	113	8	0	0	0
E.Pump in Pump room	183	27	0	0	0
Vacuum Pump	11	2	0	0	0
Grit panel	16	2	0	0	0
Conveyor Control Panel	12	2	0	0	0
Level Signals	0	0	4	0	0
Total	695	103	4	0	0

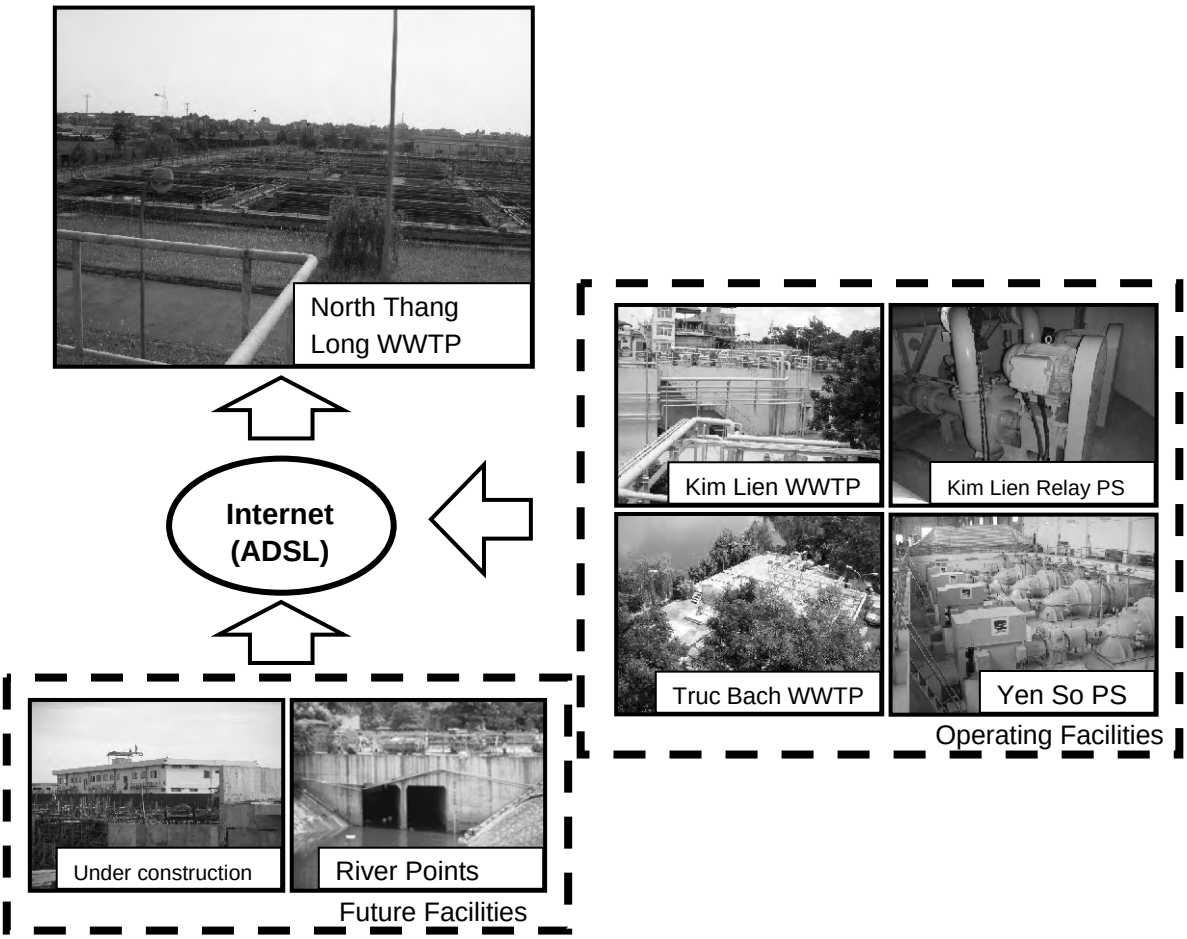
Source: JICA team

3.5.3 Design of ICS (Planning)

It is suggested that introduction of ICS should be proceeded step by step. As step 1, ICS should be installed in the existing facilities. As step 2, the same ICS should be installed in 27 pumping stations, 16 river points for real time level checking and planning facilities.

ICS has the following functions.

- Monitoring and checking of the status of all other facilities in North Thang Long WWTP
- Total management of all logging data via internet
- Monitoring other WWTPs, other PSs, river status and rain fall condition



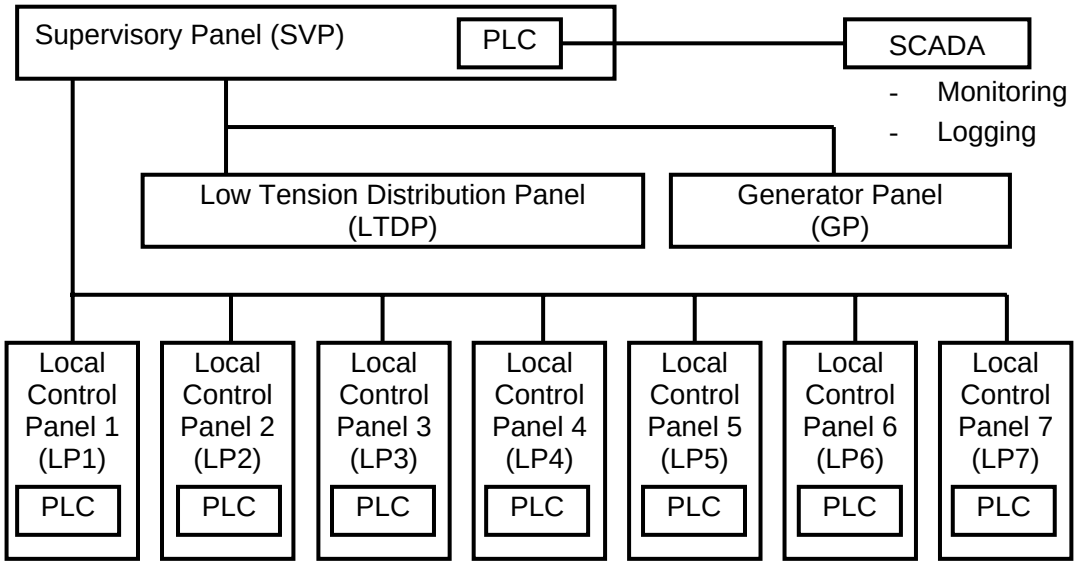
Source: JICA team

Figure 3.5.7 Outline of integrated control system

(1) Kim Lien WWTP

The design of ICS for Kim Lien WWTP calls for installing PLC in all panels first. Then, PLC and SCADA should be connected with each other. It is suggested that PLC should be installed when panels are replaced because not all the panels have enough space for installing PLC. A planned detail system diagram is shown in Figure 3.5.8.

Table 3.5.6 shows the suggested PLC I/O points for Kim Lien WWTP.



Source: JICA team

Figure 3.5.8 Planned system diagram for Kim Lien WWTP

Table 3.5.6 Planned PLC I/O points for Kim Lien WWTP

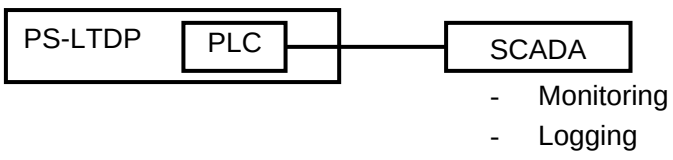
Panel No	DI	DO	AI	AO	PI
LP1	61	40	0	0	0
LP2	114	92	0	0	0
LP3	21	16	0	0	0
LP4	30	20	0	0	0
LP5	15	12	0	0	0
LP6	32	24	0	0	0
LP7	3	4	0	0	0
SVP	9	0	9	0	6
Total	285	208	9	0	6

Source: JICA team

(2) Kim Lien Relay PS

PLC is also to be installed in Kim Lien Relay PS. However, the system here can be much simpler than Kim Lien WWTP as shown in Figure 3.5.9.

And planned PLC I/O points are shown in Table 3.5.7.



Source: JICA team

Figure 3.5.9 Planned system diagram for Kim Lien Relay PS

Table 3.5.7 Planned PLC I/O points for Kim Lien Relay PS

Panel No	DI	DO	AI	AO	PI
PS-LTDP	37	20	0	0	0
Total	37	20	0	0	0

Source: JICA team

(3) Truc Bach WWTP

For Truc Bach WWTP, the planned system diagram is the same as Kim Lien WWTP. Figure 3.5.8 is the planned system diagram as a reference. Table 3.5.8 shows PLC I/O points for Truc Bach WWTP.

Table 3.5.8 Planned PLC I/O points for Truc Bach WWTP

Panel No	DI	DO	AI	AO	PI
LP1	81	52	0	0	0
LP2	107	88	0	0	0
LP3	45	32	0	0	0
LP4	39	28	0	0	0
LP5	15	8	0	0	0
LP6	26	20	0	0	0
LP7	3	4	0	0	0
SVP	9	0	9	0	6
Total	325	232	9	0	6

Source: JICA team

(4) North Thang Long WWTP

A SCADA system is already installed in North Thang Long WWTP. KVM unit should be installed for a new ICS. The new ICS will be able to access the existing SCADA with KVM. This method can reduce the introduction cost.

(5) Yen So PS

Yen So PS also has an independent SCADA system. For connection to the planned new system, it will be necessary to distribute all signals by wire.

Table 3.5.9 shows PLC I/O points for new ICS.

Table 3.5.9 Planned PLC I/O points for Yen So PS

Panel No	DI	DO	AI	AO	PI
Monitoring I/O Panel	32	0	4	0	0
Total	32	0	4	0	0

Source: JICA team

3.5.4 Rough Cost for Introduction of ICS

For Step 1, introduction cost will be approximately 24 billion VND. (Table 3.5.10)

And, for Step 2, introduction cost will be approximately 115 billion VND. (Table 3.5.11) This cost includes 27 pumping stations and 16 river points only. Repair cost is not included. Also, ICS introduction cost for on-going and planned WWTPs is not included because the cost is presumed to be included in the construction cost.

Table 3.5.10 Introduction cost of ICS for Step 1

(Unit: Mil. VND)

No	Facility name	panel	ICS	flow meter	work	overhead	Sub Total
1	North Thang Long WWTP	0	1,197	0	78	71	1,345
2	Kim Lien WWTP	1,782	4,083	443	145	714	7,168
3	Kim Lien Relay PS	213	3,166	0	86	183	3,648
4	Truc Bach WWTP	1,795	4,120	443	118	720	7,198
5	Yen So PS	279	4,120	0	51	229	4,679
	Total	4,069	16,686	887	478	1,917	24,037

Source: JICA team

Table 3.5.11 Introduction cost of ICS for Step 2

(Unit: Mil. VND)

No	Facility name	Number	Cost	
			Unit	Sum
1	PS	27	3,745	101,106
2	River Point	16	851	13,617
	Total	46		114,723

Source: JICA team

Chapter 4 Efficient Management and O & M with PPP

4.1 PPP on Sewerage and Drainage Works

4.1.1 History of PPP and PPP Models

1) History of PPP

In the 1960`s and 1970`s economic development periods, Social Overhead Capital (SOC) works such as highways, and facilities for water-supply and wastewater treatment, electricity, industrial parks, airports, and harbors were promoted as national works under the objective of infrastructure improvement aiming at economic growth to be achieved with such infrastructures. However, in the 1980`s, public investment for SOC decreased with economic stabilization etc.. And, this caused the decay of the infrastructure. In the beginning of the 1990`s, PPP aroused interest for improvement of infrastructure under the limited government finance in many countries. PPP projects were implemented from the middle of the 1990`s.

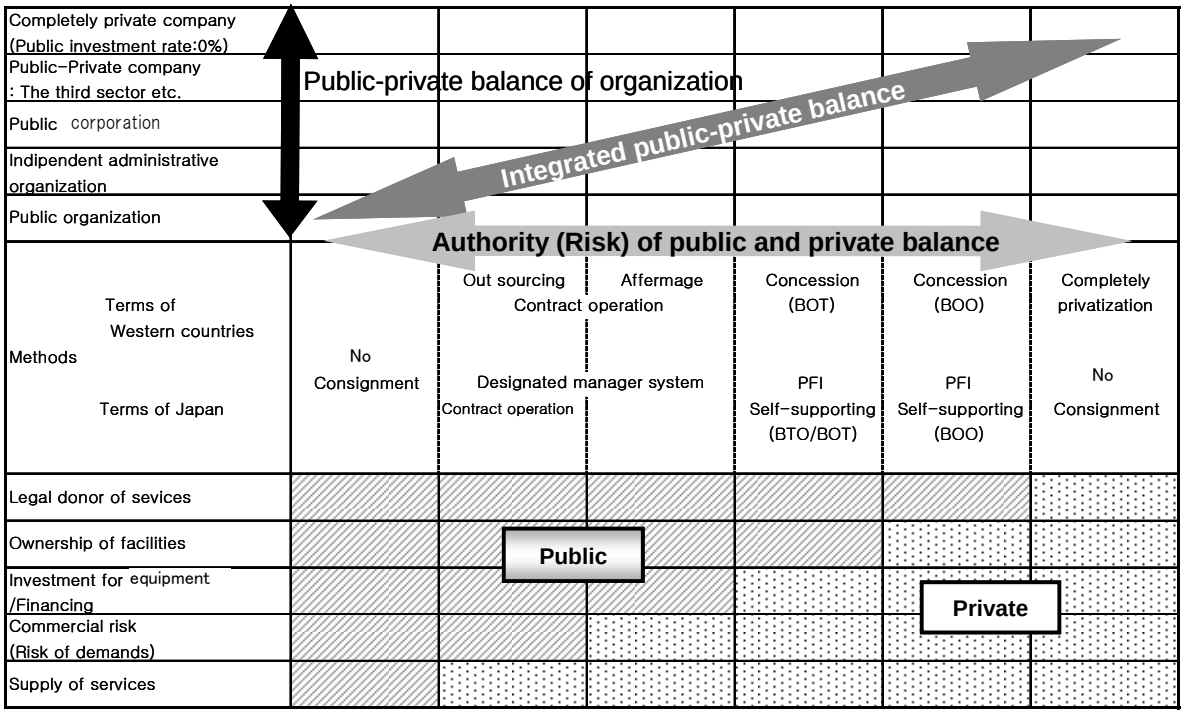
PPP is a contract between a public sector institution or municipality and a private party, in which the private party assumes substantial financial, technical and operational risk in the design, financing, building and operation of a project.

Traditionally, private sector participation has been limited to separate contracts for planning, design or construction on a fee for service basis – based on the public agency’s specifications. Expanding the private sector role allows the public agencies to tap technical, management and financial resources from the private sector in new ways to achieve certain public agency objectives; such as greater cost and schedule certainty, supplementing in-house staff, innovative technology applications, specialized expertise or access to private capital. The private partner can expand its business opportunities in return for assuming the new or expanded responsibilities and risks. PPP provides benefits by allocating the responsibilities to the party – either public or private – that is best positioned to control the activity that will produce the desired result. With PPP, this is accomplished by specifying the roles, risks and rewards contractually, so as to provide incentives for maximum performance and the flexibility necessary to achieve the desired results.

2) PPP models

The PPP models vary from short-term simple management contracts (with or without investment requirements) to the long-term and very complex Build-Operate-Transfer (BOT) form, to divestiture. These models vary mainly by ownership of capital assets, responsibility for investment, assumption of risks, and duration of contract.

The PPP models can be classified into four broad categories in order of generally (but not always) increased involvement and assumption of risks by the private sector. The four broad categories of participation are supply and management contracts, lease or affermage, concessions and private ownership of assets. Figure 4.1.1 shows the types of PPP and the roles of public and private sectors in each type.



Source: Development Bank of Japan Inc., 2005

Figure 4.1.1 The types of PPP and the roles of public and private sectors in each type

(1) Management contracts

A management contract is a contractual arrangement for the management of a part or whole of a public enterprise by the private sector. Management contracts allow private sector skills to be brought into service in design and delivery, operational control, labor management and equipment procurement. However, the public sector retains the ownership of the facility and equipment. The private sector is provided specified responsibilities concerning a service and is generally not asked to assume commercial risk. The private contractor is paid a fee to manage and operate services. Normally, payment of such fees is performance-based. Usually, the contract period is

short, typically three to five years. But longer periods may be adopted for large and complex operational facilities such as a port or airport.

- ***Supply or service contract***

  Supply of equipment, raw materials, energy and power, and labor are typical examples of supply or service contracts. A private concessionaire can enter into a number of supply or service contracts with other entities/ providers for the supply of equipment, materials, power and energy, and labor. Non-core activities of an organization (public or private) such as catering, cleaning, medical, luggage handling, security, and transport services for staff can be undertaken by private sector service providers. Such an arrangement is also known as outsourcing. Some forms of licensing or operating agreement are used if the private sector is to provide services directly to users of the infrastructure facility. Examples of such an arrangement include catering services for passengers on railway systems (the Indian Railways, for example). The main purpose of such licensing is to ensure the supply of the relevant service at the desired level of quantity and quality.

- ***Maintenance management***

  Assets maintenance contracts are very popular with transport operators. Sometimes equipment vendors/suppliers can also be engaged for the maintenance of assets procured from them.

- ***Operational management***

  Management contracts of major transport facilities such as a port or airport may be useful when local manpower or expertise in running the facility is limited or when inaugurating a new operation. Management contracts are also quite common in the transport sector for providing some of the non-transport elements of transport operations such as the ticketing system of public transport and reservation systems. Operational management of urban transport services can also be contracted out to the private sector.

  In the simplest type of contract, the private operator is paid a fixed fee for performing managerial tasks. More complex contracts may offer greater incentives for efficiency improvement by defining performance targets, and the fee is based in part on their fulfillment.

(2) Lease or Affermage

In this category of arrangement an operator (the leaseholder) is responsible for operating and maintaining the infrastructure facilities and services, but generally the operator is not required to make any large investment. However, this model is often applied in combination with other models such as build-rehabilitate –operate –transfer, and in such case, the contract period is generally much longer and the private sector is required to make a significant level of investment.

The arrangements in lease and affermage are very similar and the difference is in a technical aspect. Under a lease arrangement, the operator retains revenue collected from customers or users of the facility and makes a specified lease fee payment to the contracting authority. Under an affermage arrangement, the operator and the contracting authority share revenue from customers or users. In the lease or affermage types of arrangements, the operator takes lease of both infrastructure and equipment from the government for an agreed period of time. Generally, the government maintains the responsibility for investment and thus bears investment risks. The operational risks are transferred to the operator. However, as part of the lease, some assets may be transferred on a permanent basis for a period which extends over the economic life of the assets. Fixed facilities and land are leased out for a longer period than for mobile assets. Land to be developed by the leaseholder is usually transferred for a period of 15-30 years.

It may be noted here that if the assets transferred to the private sector under a lease agreement are constrained in their use to a specific function or service, the value of assets is dependent upon the revenue potential of that function or service. If assets are transferred to the private sector without restrictions of use, the asset value is associated with the optimum use of the assets and the revenues that they can generate.

(3) Concessions

In this form of PPP, a government defines and grants specific rights to an entity (usually a private company) to build and operate a facility for a fixed period of time. The government may retain the ultimate ownership of the facility and/or right to supply the services. In concessions, payments can take place both ways: a concessionaire pays to the government for the concession rights and the government may also pay to the concessionaire to meet certain specific conditions in the agreement.

Usually such payments by the government may be necessary to make projects commercially viable and/or reduce the level of commercial risk taken by the private sector, particularly in the initial years of a PPP program in a country where the private sector may not have enough confidence in undertaking such a commercial venture. Typical concession periods range between 5 to 50 years. It may be noted that in a concession model of PPP, a special purpose vehicle (SPV) may not always be necessary.

Concessions may be awarded to a concessionaire under two types of contractual arrangements such as a franchise or BOT type of contracts.

- ***Franchise***

  Under a franchise arrangement the concessionaire provides services that are fully specified by the franchising authority. The private sector carries commercial risks

and may be required to make investments. This form of private sector participation is historically popular in providing urban bus or rail services. Franchise can be used for routes or groups of routes over a contiguous area.

- ***Build-Operate-Transfer (BOT)***

  In a BOT (and its other variants, namely, Build-Transfer-Operate (BTO), Build-Rehabilitate-Operate-Transfer (BROT), Build-Lease-Transfer (BLT)) type of arrangement, the concessionaire undertakes investments and operates the facility for a fixed period of time after which the ownership reverts back to the public sector. In this type of arrangement, operating and investment risks can be substantially transferred to the concessionaire. However, in a BOT type of model the government has explicit and implicit contingent liabilities that may arise due to loan guarantees provided and default of a sub-sovereign government and public or private entity on non-guaranteed loans. By retaining ultimate ownership, the government controls policy and can allocate risks to those parties best suited to bear them or remove them.

  In a BOT concession, the concessionaire may often be required to establish a special purpose vehicle (SPV) for implementing and operating the project. The SPV may be formed as a joint venture company with equity participation from multiple private sector parties and the public sector. In addition to equity participation, the government may also provide capital grants or other financial incentives to a BOT project. BOT is a common form of PPP in all sectors in Asian countries. A large number of BOT port and road projects have been implemented in the region.

  Under a BROT type of arrangement, a private developer builds an add-on to an existing facility or completes a partially built facility and rehabilitates the existing assets, then operates and maintains the facility at its own risk for the contract period. BROT is a popular form of PPP in the water sector.

  A key distinction between a franchise and BOT type of concession is that, in a franchise the authority is in the lead in specifying the level of service and is prepared to make payments for doing so, whilst in the BOT type, the authority imposes a few basic requirements and may have no direct financial responsibility.

(4) Private ownership of assets

In this form of participation, the private sector remains responsible for design, construction and operation of an infrastructure facility and in some cases the public sector may relinquish the right of ownership of assets to the private sector.

It is argued that by aggregating design, construction and operation of infrastructure services into one contract, important benefits could be achieved through creation of synergies. As the same entity builds and operates the services, and is only paid for the

successful supply of services at a pre-defined standard, it has no incentive to reduce the quality or quantity of services. Compared with the traditional public sector procurement model, where design, construction and operation aspects are usually separated, this form of contractual agreement reduces the risks of cost overruns during the design and construction phases or of choosing an inefficient technology, since the operator's future earnings depend on controlling costs. The public sector's main advantages lie in the relief from bearing the costs of design and construction, the transfer of certain risks to the private sector and the promise of better project design, construction and operation.

- ***Build-Own-Operate***

  In the Build-Own-Operate (BOO) type and its other variants such as Design-Build-Finance-Operate, the private sector builds, owns and operates a facility, and sells the product or service to its users or beneficiaries. This is the most common form of private participation in the power sector in many countries. For a BOO power project, a government (or a power distribution company) may or may not have a long-term power purchase agreement (commonly known as off-take agreement) at an agreed price from the project operator.

  In many respects, licensing may be considered as a variant of the BOO model of private participation. The government grants a license to private undertakings to provide services such as fixed line and mobile telephony, Internet service, television and radio broadcast, public transport, and catering services on the railways. However, licensing may also be considered as a form of "concession" with private ownership of assets. Licensing allows competitive pressure in the market by allowing multiple operators, such as in mobile telephony, to provide competing services.

  There are two types of licensing: quantity licensing and quality licensing. By setting limits through quantity licensing, the government is able to moderate competition between service providers and adjust supply between one area and another. Quality licensing however, does not place any restriction on the number of providers or the amount of service produced but specifies the quality of service that needs to be provided. The government may get a fee and a small share of the revenue earned by the private sector under the licensing arrangement.

- ***Private Finance Initiative***

  In the Private Finance Initiative (PFI) model, the private sector, similar to the BOO model, builds, owns and operates a facility. However, the public sector (unlike the users in a BOO model) purchases the services from the private sector through a long-term agreement. PFI projects, therefore, bear direct financial obligations to the government in any event. In addition, explicit and implicit contingent liabilities may also arise due to loan guarantees provided to lenders and default of a public or

private entity on non-guaranteed loans.

In the PFI model, asset ownership at the end of the contract period may or may not be transferred to the public sector. The PFI model also has many variants.

The annuity model for financing of national highways in India is an example of the PFI model. Under this arrangement a selected private bidder is awarded a contract to develop a section of the highway and to maintain it over the whole contract period. The private bidder is compensated with fixed semi-annual payments for his investments in the project. In this approach the concessionaire does not need to bear the commercial risks involved with project operation.

Apart from building economic infrastructure, the PFI model has been used also for developing social infrastructure such as school and hospital buildings, which do not generate direct “revenues”.

− ***Divestiture***

This third type of privatization is clear from its name. In this form, a private entity buys an equity stake in a state-owned enterprise. However, the private stake may or may not imply private management of the enterprise. True privatization, however, involves a transfer of deed of title from the public sector to a private undertaking. This may be done either through outright sale or through public floatation of shares of a previously corporate state enterprise.

Full divestiture of existing infrastructure assets is not very common. However, there are many examples of partial divestiture.

4.1.2 Current State of PPP on Sewerage and Drainage Works in Other Countries

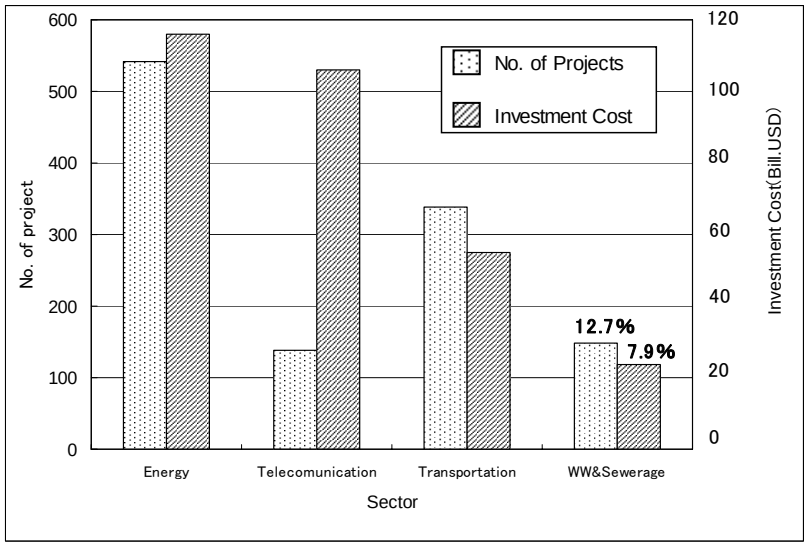
1) PPP in Asian developing countries

PPP projects in Asian developing countries have declined since 1997 due to the currency crisis. This situation seems to be improving recently.

During 1999 to 2005, 148 numbers of water supply and sewerage projects were implemented in Asia under a PPP scheme which accounts for 12.7 % of the total number of PPP projects implemented in Asia. The investment cost for the water supply and sewerage projects (148 Nos.) was around 25.7 billion USD which is 7.9% of the total investment cost of PPP projects implemented in Asia. Still, number of projects and amount of investment are less in this sector than other sectors implemented under PPP (Figure 4.1.2).

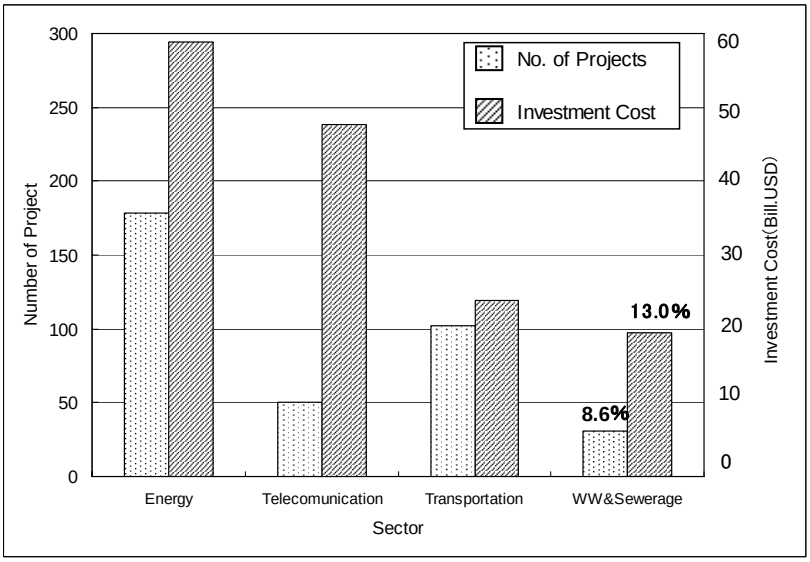
As for regional and sector bases, a significant number of projects have been seen in East Asia (mainly in China) during the period 1990-2005. Meanwhile, projects with larger investment scale are seen in Southeast Asia (Indonesia, the Philippines, Malaysia,

Vietnam and Thailand). Investment for energy and transportation sectors is the largest scale, and telecommunication sector project scales are also relatively high in Southeast Asia (Figure 4.1.3). The sewerage sector accounts for 8.6% of the total number of projects, and 13.0% (equivalent to 19.4 billion USD) of the total investment costs.



Source: World Bank

Figure 4.1.2 PPP projects in Asia (1999-2005)



Source: World Bank

Figure 4.1.3 PPP projects in Southeast Asia (1999-2005)

2) Current state and future of private investment works in China

(1) Current state

a. Introduction

- PPP was introduced to build power plants using the capital of Hong Kong in the

1980's.

After execution of the Reform-Openness policy in 1978, private investment for infrastructure was permitted by the government. The first project involving private investment was the diesel power plant in Posan city implemented by BOO in 1984. Afterwards, Daya Bay nuclear power plant of Kwangtong province and Guang-Shen Shajiao power plant of Seonjeon province by BOT methods followed. All of the private companies involved in these projects were from Hong Kong. Investment rates were 90%, 25%, and 50%, respectively, by joint ventures with Chinese companies.

- Bounds of private investment expanded to roads, highways, harbors, bridges, waterworks, communication, airports, and railways in the 1990's.

  Because infrastructure was recognized as a basic industry, the projects were constructed and operated by national enterprise. However, due to the loss through inefficient management of national enterprises and the lack of government finance for investment and limitations of management, the Chinese government decided that some of the failed businesses should be privatized and put into commercial use. In the case of new businesses, the Chinese government made progress vigorously using private investment works.

- To activate BOT using foreign investment, the Chinese government published a BOT Circular (Circular of the Ministry of Foreign Trade and Economic Cooperation Absorption of Foreign Investment by Means of BOT) and executed three pilot projects.

  The "Chengdu sixth water supply B plant" and "Laibin B power plant" have been put into operation, but the "Zangxa power plant" has not been put into operation yet because of a delay in collecting investment funds. Laibin B power plant project, which is to build and operate a 720MW thermal power plant by international competitive tender bid, started in 1997. The contract period is 18 years, which will expire in 2015. Private investment rate is 100%, and the entire investment fund is 600 million USD.

  Chengdu sixth water supply B plant project aimed at 460,000m^3/day capacity started in 1999 under an international competitive tender. The contract period is 18 years and will expire in 2017. Private investment rate is 100% and the entire investment fund is 108 million USD.

- China is ranked 1st in the number of private investments among developing countries, and 2nd in the amount of private investment during the years of 1990 to 2007.

Table 4.1.1 Accumulated amount of private investment in developing countries (1990-2007)

Country	Number of private investments	Amount of private investment (million USD)
Brazil	326	196,240
China	782	99,626
India	306	96,130
Mexico	176	86,126
Argentina	193	78,420

Source: World Bank

b. Characteristics

Private investments have been executed by forming joint ventures with Chinese companies which are mainly owned by the government directly or indirectly.

Foreign investors can invest alone in the field of water supply and sewerage.

CJV (Contractual or Co-Operative Joint Venture) method, in which the contractual condition is defined in contract documents, has been adopted in most of the projects. In general, foreign investors supply funds, technology, and Chinese partners supply land, labor, power, etc.

c. Departmental trend

- Amount of investment (1990-2007) was
  - Traffic : 42.45 billion USD
  - Energy : 35.55 billion USD
  - Communication : 14.52 billion USD
  - Water supply & Sewerage : 7.11 billion USD. (See Fig. 4.1.4)
- Amount of investment per project was
  - Traffic : 203.1 million USD
  - Energy : 106.4 million USD
  - Communication : 3.63 billion USD
  - Water supply & Sewerage : 30.3 million USD (See Fig. 4.1.5)

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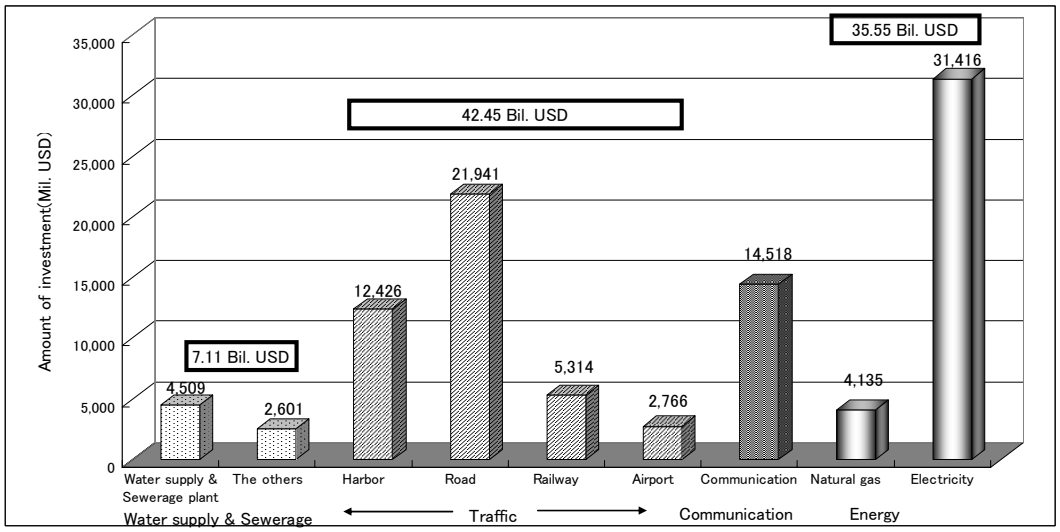
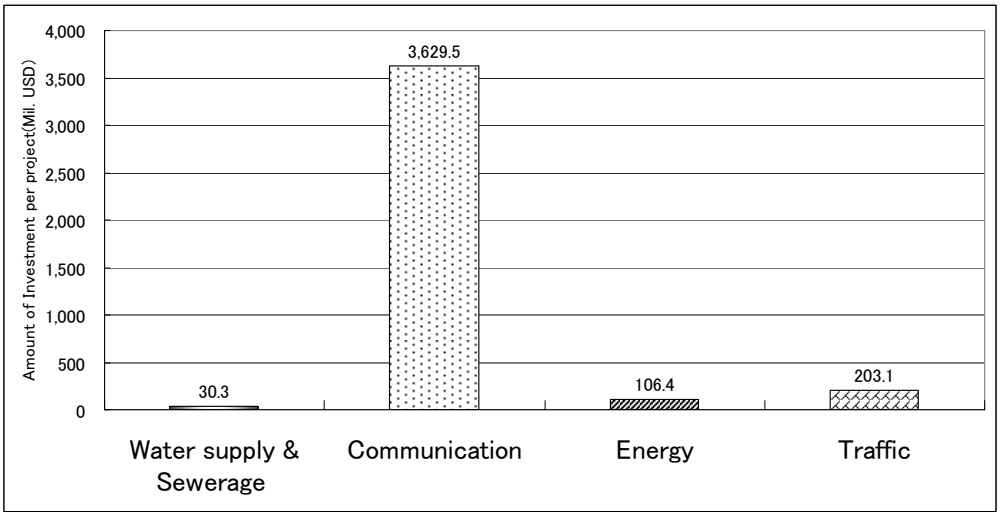


Source: World Bank

Figure 4.1.4 Departmental accumulated amount of private investment (1990-2007)



Source: World Bank

Figure 4.1.5 Departmental amount of private investment per project (1990-2007)

d. Trend of Investment methods

- Accumulated number of projects employing the BOT method is 446, and this makes up 56% of the total during the period from 1990 to 2007.
- Departmental trend of investment methods

  Traffic & Energy : BOT method was leveraged mostly.

  Communication : Divestiture

  Water supply & Sewerage : ROT (Rehabilitate- Operate- Transfer) method

was used for brownfield projects mainly. (See Tables 4.1.2 and 4.1.3)

Table 4.1.2 Departmental accumulated amount of private investment (1990-2007)

Unit: million USD

Field	Investment methods	Investment forms	Amount of investment
Energy	Concession	BROT	343
		ROT	738
	Divestiture	Tradition of all equity	167
		Tradition of partial equity	6,897
	Greenfield project	BOT	23,914
		BOO	2,892
		Merchant	600
Communication	Divestiture	Tradition of partial equity	14,518
Traffic	Concession	BROT	2,662
		ROT	3,786
	Divestiture	Tradition of all equity	181
		Tradition of partial equity	10,324
	Greenfield project	BOT	25,483
		Merchant	12
	Lease/Contract operation	Lease	1
Water supply & Sewerage	Concession	BROT	777
		ROT	3,051
	Divestiture	Tradition of all equity	1
		Tradition of partial equity	191
	Greenfield project	BOT	2,430
		BOO	117
	Lease/Contract operation	Lease	510
		Contract operation	33

Source: World Bank

Table 4.1.3 Methods of private investment by World Bank

Investment forms	Obligation of private investor	Remarks
Contract operation	- O&M service provision - Receiving O&M fee from government - Generally, Contract period is 3-5 years.	
Lease	- Taking benefit through management of business - Paying lease fee to government	
Concession	- Management of project and investment financing - Ownership of assets is in government. - Contract period is over 25 years. - ROT(Rehabilitate-Operate-Transfer), RLT (Rehabilitate-Lease-Transfer), BROT(Build-Rehabilitate-Operate- Transfer)	Renewal Project (Brownfield Project)
BLT (Build-Lease-Transfer)	- After construction by private entity, government leases it and pays lease-fee to investor. - After contract period, ownership is transferred to government.	New Development Project (Greenfield Project)
BOT (Build-Operate-transfer)	- After construction by private entity, private investor operates and manages the facility. - Private investor covers costs and reaps benefits through management of the facility. - After contract period, ownership is transferred to government.	
BOO (Build-Own-Operate)	- After construction by private entity, private investor possesses the facility and operates it.	
Merchant	- Private investor establishes and manages operation in the market without profit guarantee from the government.	
Rental	- Government rents facility from private investor. - Government guarantees profit of private investors with short term purchase contract.	
Divestiture	- Management and Purchasing of fund in project - Private investor owns proprietary of assets.	

Source: World Bank, `Water and Sanitation Toolkit, 2006, The World Bank and PPIAF, `Methodology`

(2) Future of private investment works in China

a. Increase in the amount of investment for the infrastructure

The Chinese government has planned to invest 586 billion USD up to 2010 for houses of low income people, infrastructure in the agricultural community, water supply, electricity, traffic, environmental protection, etc. considering the decrease

of economic development rate.

Table 4.1.4 Chinese economic development rate

Year	2004	2005	2006	2007	2008	2009
Rate (%)	10.1	10.4	11.6	11.9	6.8	8.7

Source: JICA team

b. Increase in the investment to the infrastructure

According to ADB reports, 132 billion USD should be necessary for development of infrastructure, which consists of 87.6 billion USD for investment, and 44.4 billion USD for O&M. (See Table 4.1.5)

On the other hand, the Chinese government has planned to invest 543 billion USD for infrastructure during 2006-2010.

Table 4.1.5 Future amount of investment to the infrastructure and rate to GDP

Item	Future amount of expenditure (Million USD)			Rate to GDP (%)		
	Investment	O&M	Sub total	Investment	O&M	Sub total
Electricity	51,688	20,739	72,407	2.7	1.1	3.8
Telecom	11,735	8,232	19,967	0.6	0.4	1.0
Roads	19,345	7,424	26,769	1.0	0.4	1.4
Rails	963	1,258	2,221	0.1	0.1	0.1
Water	2,097	4,090	6,187	0.1	0.2	0.3
Sewerage	1,830	2,644	4,474	0.1	0.1	0.2
Total	87,637	44,387	132,025	4.6	2.3	6.9

Source : Tito Yepes, Expenditure on Infrastructure in East Asia Region, 2006-2010

3) Privatization of water supply and sewerage works in Manila

(1) Privatization of water supply and sewerage works in Manila metro area

a. Outline of water supply and sewerage works in Manila metro area before privatization

The Manila metro area was constituted of 12 cities and 5 towns and its population was 10 million people (Census of 2000), of which 13% lived in the central district of Manila. The population increased seriously and the outskirts of the city were also urbanized. Thus supply of safe water became necessary.

The MWSS (Metropolitan Waterworks and Sewerage System) was established in 1982 for water supply not only to Manila but also to 6 cities near Manila, 31 local

governments and 2 regions. (The total area was 3 times that of Manila city.)

Before privatization, the number of accounts connecting to distribution pipes was 825,000 Nos., 24 hour a day water supply was achieved at 50% of the connections and the rest had a daily 12 hour water supply. Unaccounted connections arising from stealing water and leaked water reached over 50%. Unserviced area represented over 1/3 of the whole area. Population connected to sewers was about 7-8%.

b. Privatization of water supply and sewerage works in Manila metro area

In 1994, the Philippines Ministry of Finance announced the 'Study of improvement in field of water works' and established the goals as follows;

- Integration of managing the water resources
- Improving of water supply system of water supply servers
- Reforming of unaccounted for water such as leaked water, illegal connections and inaccurate meters
- Countermeasures for loss of groundwater and management of riversides
- Fund procurement for development of water resources and water supply projects
- Water distributing system and improvement of tariff

In 1995, the Water Crisis Act was established by the Philippines government. This act became the legal foundation for PPP by MWSS and was defined as follows:

- Water supply and sewerage works must be contracted in a form of BOT.
- It is necessary to reorganize MWSS.
- Stealing water is a criminal violation.

In December of 1995, privatization of the public corporation for water supply and sewerage was approved. And, IFC (International Finance Corporation) of World Bank groups was elected as the adviser.

Preparation of bidding was carried out under the lead of IFC. Concession type was adopted without divestiture.

The essential points of the privatization were defined as follows;

- Water supply and sewerage works would be contracted in a form of BOT.
- Water supply would be served to all the residents of the planned supply area within 10 years.
- During the first 10 years, it would not be allowed to increase tariff.
- New water supply works would be started for the poverty group which occupies 33% of the planned area.
- Supplying of water which fulfills WHO standards and domestic regulations would be started within 3 years.
- Unaccounted for water would be decreased to 32% from 56%.

- A sewerage maintenance rate of 80% would be achieved within 25 years.
- 7.5 billion USD would be invested for water supply and sewerage works during 25 years.
- Income taxes of 4 billion USD would be paid to the government for 25 years.

As a result of bidding, MWCI (Manila Water Company, Inc.) and MWSI (Maynilad Water Services, Inc.) were selected as concessionaires and started services in the east commercial area and the west area, respectively, in 1997. MWCI and MWSI assumed the obligation to pay 1.2 billion USD as a concession fee during the contract period of 25 years. That concession fee has been paid for which MWSS has been burdened with foreign currency debts.

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(2) Accomplishment review of MWCI and MWSI

The grade of service was improved dramatically as described below;

a. Population served by piped water, rate of water supply provision increased by 30% over 5 years.
b. Water quality satisfied the requirements in the standard.
c. Water supply time increased from 17 hours to 21 hours on an average and 24 hour water supply area exceeded 80%.
d. Rate of connection to sewers increased from less than 1%/year to 2.7%/year in the east area. (See Table 4.1.6)

Table 4.1.6 Comparison with MWSS and private contractors (MWCI, MWSI)

Service index	MWSS(1992-1996)	Private contractors(1997-2001)
Population served by piped water	Increased by 5 % over 5 years	Increased by 30 % over 5 years
Number of connections	Increased by 4.5 % over 5 years	Increased by 30 % over 5 years
Fitness of water quality	90 %	99 %
Time of water supply on average	17 hours/day	21 hours/day
Unaccounted for water	61%	57%
Increase rate of connection to sewers	Less than 1 %/year	2.7%/year
Number of staff per 1,000 connections	9.8 persons	4.1 persons

Source: JICA team

4) PPP in Indonesia

The National Committee for the Acceleration of Infrastructure Provision was established for developing an infrastructure development strategy, and to coordinate and implement programs in Indonesia. The Committee consists of the Departments of Economic Coordination (chairman), Development and Planning, Internal Affairs, Finance, Energy, Public Works, Transportation, Information and Communication, and the Government Administration Cabinet. The target sectors are sea ports, airports, highways, bridges, irrigation systems, water supply and sewerage facilities, telecommunication systems, power supply and oil and gas.

Investment project cost in Greenfield Projects (34 projects) was 17.5 billion USD in 1990-2005. This is about 8.8% of the whole Greenfield Project PPP in Asia (199.1 billion USD for 732 projects). Energy and telecommunication sectors occupied the majority (Tables 4.1.7 and 4.1.8). As for all the projects in 1990-2005, Indonesia undertook 68 projects that were equivalent to 32.6 billion USD, while all of Asia initiated 1,166 projects (300.8 billion USD).

In the water supply and sewerage sectors, four Greenfield Projects were undertaken. Meanwhile, there are three concession projects with investment of 160 million USD, 830 million USD and 990 million USD respectively.

Ticokol Water Purification Plant is a concession type (ROT) project operated by TKCM. Water supply in Jakarta, operated by Ondeo group, has raised issues on water price escalation of more than 30% every year.

Table 4.1.7 Number of PPP projects in Indonesia (1990-2005)

Category	Greenfield Project	Concession	Divestiture	Management & Lease	Total
Energy	19	―	2	1	22
Communication	8	6	3	―	17
Transportation	3	19	―	―	22
Water supply/Sewerage	4	3	―	―	7
Total	34	28	5	1	68

Source: PPP Database, World Bank

Table 4.1.8 PPP projects by cost in Indonesia (1990-2005)

(Unit: Million USD)

Category	Greenfield Project	Concession	Divestiture	Management & Lease	Total
Energy	12,063	–	487	–	12,549
Communication	5,126	4,830	6,891	–	16,846
Transportation	164	2,073	–	–	2,237
Water Supply/ Sewerage	160	832	–	–	992
Total	17,512	7,735	7,377	–	32,624

Source: PPP Database, World Bank

4.1.3 Consideration to introduce PPP for Sewerage and Drainage Works

PPP contributes to sewerage services in terms of retaining or upgrading service performance and cost reduction through O&M expertise, procurement network, and skills in professional service providers. As sewerage business lacks marketability, it is important to develop an institutional system in order to upgrade public service quality through appropriate municipal intervention and “market” & “competition”. Water supply and sewerage service is achieved through proper risk demarcation between public and private as follows:

1) Financial availability concerning project progress

One of the risks in construction phases of PPP is land acquisition for intake and securing of water resources in the water supply sector, and approval of effluent discharging in the sewerage sector. In PPP contracts, responsibilities or penalties in case of delay in progress should be clearly mentioned.

Considering project progress, on the other hand, fund arrangement on the government side should be carefully managed.

2) Project cost hike

Since project cost is easily affected by unpredictable price escalation and site-related conditions, penalties and/or responsibility of both the parties shall be made clear in the following aspects:

(1) Price escalation

Price escalation shall be stipulated as payment of both parties based on general project contract. Excess risks levied to the contractor affect public service prices in PPP projects. Escalation procedure based on accomplishments needs to be defined.

(2) Unpredictable conditions

Lack of on-site survey related to house-connections, for example, may cause unpredictable delays or costs. Since the above-mentioned risks may be attributed to both parties, risk sharing shall be stipulated.

3) Suspension of project

Suspension of the project could be caused due to either natural disaster or defects of the private sector side. The risks should be defined in terms of demarcation and exemption in accordance with risk background. The operator should scrutinize whether risk insurance is applicable or not.

4) Value for money

Because cost for PPP works should be paid by the citizens finally, implementation of PPP works must be conducted in view of value for money. For the value for money, improvement of the purchasing structure is essential to promote participation of private sectors which have appropriate ability under the condition of competition. And, structural improvement and strengthening of public organization which can manage PPP systems efficiently is important.

5) Efficiency of equipment and performance monitoring

Responsibility related to deteriorated functions should be focused on in the case of rehabilitation projects (ROT) in the risk analysis. It is the operator's task to execute surveys and analysis of functions of the existing equipment and facilities to determine required repairs to be done by the public sector in the pre-construction stage. The public sector should also carry out inspections on those functions to ensure that O&M is executed properly by the designated operator.

6) Tariff policy

In the PPP works in the 1990's, tariff level and tariff structure were big issues.

These issues must be resolved not only by the private sector but also the tariff policy of the government. Main policy for tariff mainly consists of the following;

a. Beneficiaries-pay principle

b. Affordability

c. Tariff system with charges and subsidy rate (from wealthy/commercial to lower-income).

Work costs must be reflected in the tariff policy with beneficiaries-pay principle in the private sector. And, by the tariff policy with beneficiaries-pay principle, service level should be improved. But, in developing countries, tariff or service charges for lower - income groups need to be determined by affordability, not by cost. The government

needs to make up for the difference between tariff and cost as a subsidy.

7) Improvement of laws

Laws to be put in place are requirements for private investors. To establish laws connected to the tax system and intellectual property rights for competition policy and for promotion of investment is necessary. In general, PPP works are conducted under a long-term contract between a public organization and the private sectors. Change in the socioeconomic conditions or the political scene and shift in policy are possible during a long-term contract period. But, private sectors invest under the condition that contractual terms will not change during the contract period. Therefore, it is necessary to improve the following in the public sector considering characteristics of PPP works.

- Improvement of required laws, regulations and standardized contract documents
- Simplification of acquisition for permission and authorization
- Strengthening of control framework to conduct works efficiently

8) Appropriate allocation of risks

To assure continual accomplishment of PPP works, risk allocation between public and private sectors in a private sector emergency is very important. Risk allocation does not mean imposition and sharing of the risk. The principle of risk allocation is that the sector that can respond to the risk bears it. Therefore, in the risk allocation of the public and private sectors, the government should bear political risk and the private sector should bear commercial risk.

The private sector should essentially bear the risk, because the private sector has responsibility in implementation of a project during the contract period. But, if the public sector does not share the risk within the reasonable bounds such as political risk which the private sector can not bear, PPP works can not be conducted.

(1) Concept of risk allocation

Risk allocation between the public and private sectors should be set up in contractual terms on a case-by-case basis. The general concept of risk allocation is described in Table 4.1.9.

Table 4.1.9 Concept of risk allocation between public and private sectors

Classification	Risk of public sector	Risk of private sector
Government risk	- Change of laws and policy Cancellation or change of contract Change of design or standards Change of tax system - Appearance of competitive facility	Public sector should essentially bear the risk. But, if change of policy or laws concern all projects and companies in the country, it is desirable that the private sector bear some risk.
Commercial risk	Public sector should essentially bear the risk. But, if any of the following risks exceeds a limited amount, it is desirable that the public sector share the risk. - Demand deficiency - Price increase - Exchange rate fluctuation	- License(Contract) failure - Fund procurement - Completion of construction - Demand deficiency - Exchange rate fluctuation - Price increase - Rising interest rate etc.
Other risk	The party to bear the risk is defined by individual contact conditions. - Site acquisition - Opposition of community residents - Force majeure - Wars, state of emergency	

Source: JICA team

4.2 Current State and Issues of Sewerage and Drainage Works in Hanoi

4.2.1 Organization for O & M of Facilities in Hanoi

HSDC is an operation and maintenance (O&M) company of sewerage and drainage facilities owned by the HPC. HSDC is categorized as a One-Member Limited Liability Company from the legal stand point referring to Decree no.88/2007/ND-CP. HSDC has two subsidiary companies, the Wastewater Treatment Enterprise (WTE) and Urban Drainage Enterprise (UDE). HSDC sewerage budget is managed by the Department of Construction (DOC) of HPC as a contractual employer.

Currently, there are about 1,690 employees in HSDC. But, employees of HSDC will be increased after construction of the on-going and planned WWTPs. (Table 4.2.1)

Table 4.2.1 On-going and Planned WWTPs in Hanoi

WWTP / Item	On-going and Planned Treatment Plants			
	Bay Mau	Yen So	Yen Xa	Phu Do
Capacity(m^3/day)	14,000	200,000	270,000	84,000
Treatment Method	Conventional Activated Sludge	Nitrification Activated Sludge	Nitrification Activated Sludge	Nitrification Activated Sludge
Progress	Under Procurement	Under Construction	Planned (F/S drafted)	Planned (F/S drafted)
Financial Source	Yen Loan	Private BT Method	Yen Loan (Candidate)	Yen Loan (Candidate)
O&M body[1)]	Not decided yet			

1) O&M for Yen So WWTP will be transferred to HPC(DOC) after one year operation by the private contractor.

Source: JICA team

4.2.2 Wastewater Tariff and Income from Environmental Protection Charges for Wastewater in Hanoi

Sewerage charge setup is stipulated in Decree no.88/2007/ND-CP, and 10% of the water supply charge is planned to be collected as a sewerage charge, but it has not yet been carried out. Instead, currently 10% of water supply charge has been collected as the environmental protection charge for wastewater and has funded sewerage and drainage works. The water supply charge system is classified into household, commercial, and industrial divisions: while a fixed amount system is applied to commercial and industrial divisions, household division is further classified into 2 charge rates as shown in the Table 4.2.2.

In 2009, the total income from environmental protection charges for wastewater was about 43,500 million VND (Table 4.2.3, Figure 4.2.1) which is increasing every year.

Table 4.2.2 Sewerage charge system in Hanoi

Category	Rate
Water Supply	
○ Domestic	
- unmetered	VND 30,000/month
- metered users	VND 2,800/m3 : up to 16m3
	VND 3,500/m3 : 17-20m3
	VND 5,000/m3 : 21-35m3
	VND 7,500/m3 : more than 36m3
○ Industry	VND 4,500/m3
○ Commercial & Service	VND 7,500/m3
○ State agencies	VND 4,000/m3
Sewerage	
○ Environmental Protection Fee	10% of Water Supply Charge

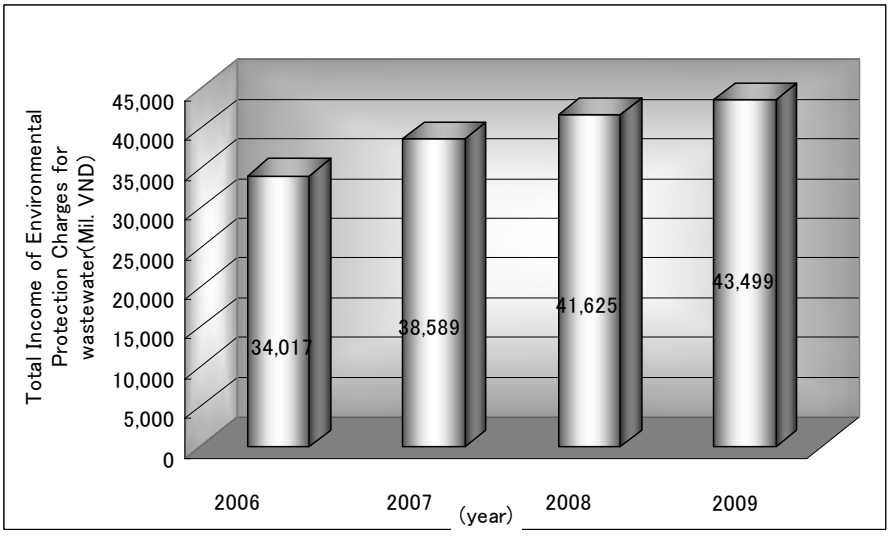
Source: JICA team

Table 4.2.3 Total income from environmental protection charges for wastewater

(Unit:1,000VND)

No.	Year	Wastewater Charge	Paid to State Budget	Retained at Water Co.
1. Hanoi Water Corporation				
	2005	26,943,482	24,549,130	2,394,352
	2006	31,616,104	29,086,809	2,529,295
	2007	35,709,619	32,852,850	2,856,769
	2008	38,437,879	35,362,776	3,075,103
	2009	39,538,451	36,375,335	3,163,116
2. Hanoi Water Company 2				
	2006	2,400,555	2,208,511	192,044
	2007	2,879,408	2,649,055	230,353
	2008	3,187,237	2,932,258	254,979
	2009	3,960,070	3,643,264	316,806

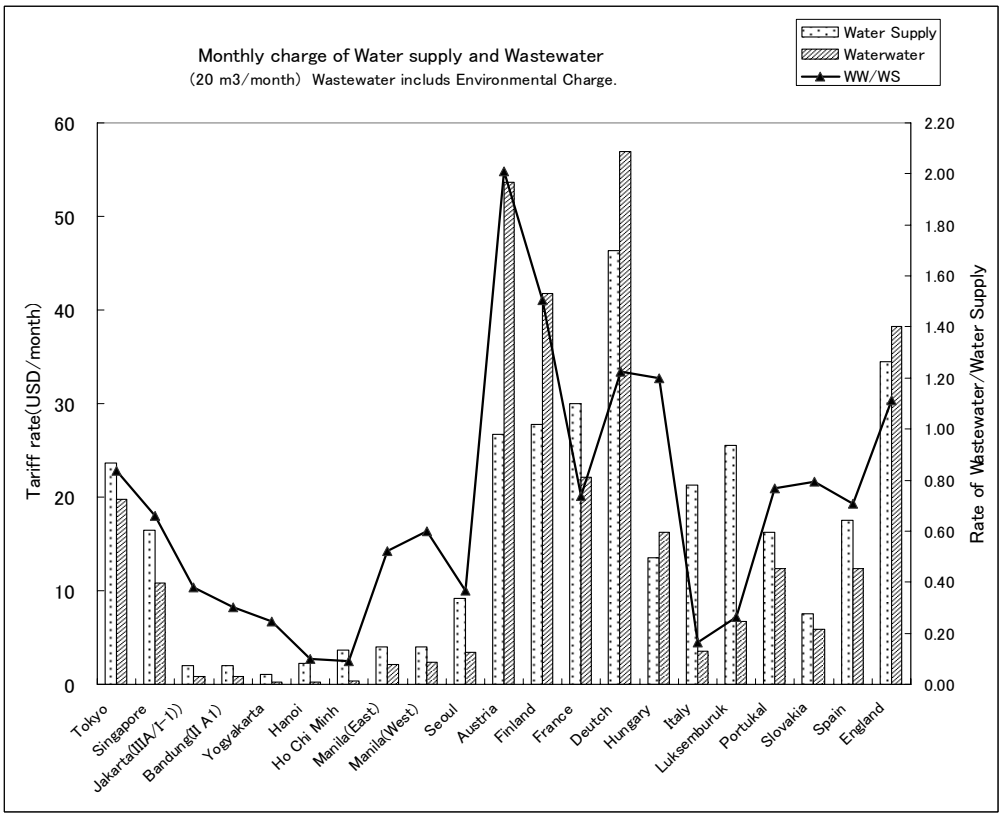
Source: HSDC



Source: HSDC

Figure 4.2.1 Total income from environmental protection charges for wastewater

Wastewater tariff rate of Hanoi is around 0.34 USD/20m3 (1 USD = 17,500 VND) , which is lower than in Indonesia or the Philippines (Refer to Figure 4.2.2). Rate of wastewater charge to water supply charge is also low at 10%.



Source: JICA team

Figure 4.2.2 Monthly charge for water supply and wastewater

4.2.3 Current and Future O & M Cost for Wastewater Treatment in Hanoi

In 2008, O&M cost for wastewater treatment was about 10.9 billion VND. But, in 2009, because operation of the North Thang Long WWTP was started, the cost increased to 26.7 billion VND. (See Table 4.2.4, Figure 4.2.3) Ratio of sewerage treatment cost to annual turnover of HSDC was changed from 5.5% to 6.9%. The average treatment cost for wastewater was 4,831 VND/m3 in 2008, and it increased to 7,968 VND /m3 in 2009. The design capacity of North Thang Long WWTP is 42,000m3/day, but treatment amount was only about 4,000m3/day in 2009 as shown in Table 4.2.6. It is considered that this situation caused the abrupt increase in the average treatment cost. Increasing load to the North Thang Long WWTP is necessary to reduce the average treatment cost.

Table 4.2.4 Annual turnover and sewerage treatment cost of HSDC

No.	Item \ Year	2005	2006	2007	2008	2009
1	**Annual turnover**	**105,663,644,496**	**123,561,308,228**	**138,775,260,414**	**198,197,412,403**	**401,608,914,102**
2	**Average income (vnd/person/month)**					
	Number of employees	2,000	2,000	1,982	2,100	2,873
	Average salary (vnd/person/month)	1,906,158	2,550,759	3,294,549	3,688,830	4,738,573
	Average income (vnd/person/month)	2,136,481	2,832,968	3,617,709	3,964,917	5,003,289
3	**Sewerage treatment costs**		**7,896,745,808**	**9,561,018,744**	**10,933,495,821**	**26,756,058,597**

Note: 1. Annual turnover: This is annual turnover of HSDC (income) from all business and service fields.

2. Sewerage treatment costs: This is actually operation and maintenance cost including labor cost for sewerage treatment. We all understand HSDC is not collecting sewerage treatment fee. Annually, they calculate necessary cost for operation and maintenance of sewerage system and requesting Hanoi People's Committee to allocate budget.

Source: HSDC

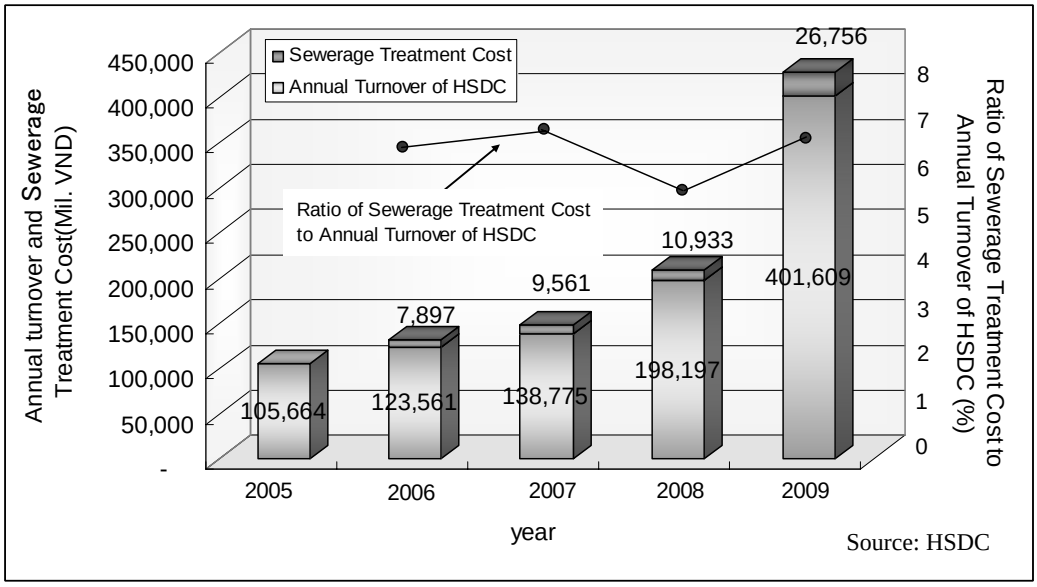


Figure 4.2.3 Annual turnover, sewerage treatment cost of HSDC and ratio of sewerage treatment cost to annual turnover of HSDC

Table 4.2.5 Annual turnover and sewerage treatment cost of HSDC

Year	WWTP	Design capacity (m^3/day)	Real treatment amount		Average treatment cost (VND/m^3)
			(m^3/day)	(m^3/year)	
2008	Kim Lien	3,700	3,700	1,350,000	4,831
	Truc Bach	2,500	2,500	912,500	
	Total	**6,200**	**6,200**	**2,263,000**	
2009	Kim Lien	3,700	3,700	1,350,000	7,968
	Truc Bach	2,500	2,500	912,500	
	North Thang Long	42,000	4,000	1,095,000	
	Total	**48,200**	**10,200**	**3,358,000**	

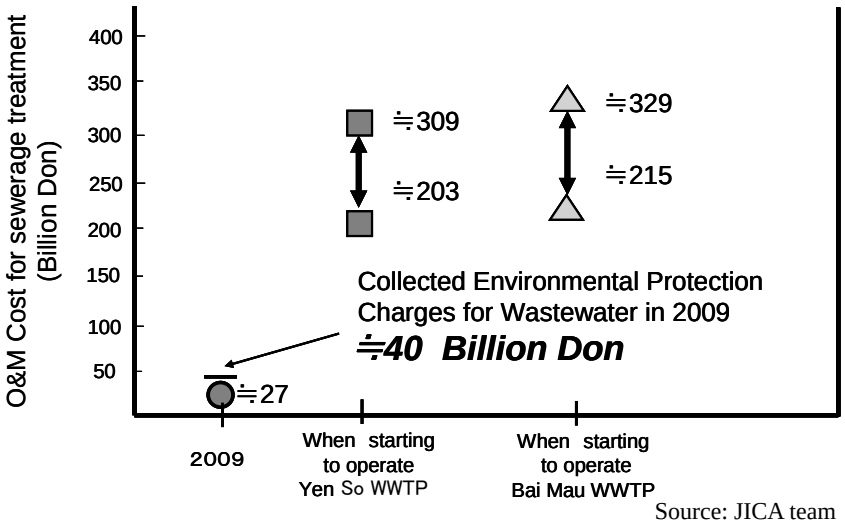
Source: JICA team

Table 4.2.6 Future of O & M cost for wastewater treatment in 2013
(When operation of Yen So and Bay Mau WWTPs is started)

Year	WWTP	Design capacity	Real treatment amount (m^3/day)	Real treatment amount (m^3/year)	Total treatment cost (Bil. VND)	Average treatment cost
2009	Kim Lien	3,700	3,700	1,350,000	26.8	7,968
	Truc Bach	2,500	2,500	912,500		
	North Thang Long	42,000	4,000	1,095,000		
	Total	**48,200**	**10,200**	**3,358,000**		
2013	Kim Lien	3,700	3,700	1,350,000	26.8	7,968
	Truc Bach	2,500	2,500	912,500		
	North Thang Long	42,000	4,000	1,095,000		
	Yen So	200,000	200,000	73,000,000	Upper[1] 282.1	3,865
					Lower[2] 176.3	2,416
	Bay Mau	14,000	14,000	5,110,000	Upper[1] 19.7	3,865
					Lower[2] 12.3	2,416
	Total	**262,200**	**224,200**	**81,468,000**	Upper 328.6	4,034
					Lower 215.4	2,644

Note : 1) 80% of average treatment cost of 2008 Source : JICA team
2) 50% of average treatment cost of 2008

When operation of Yen So WWTP and Bay Mau WWTP is started, the O&M cost would be increased to 8 to 10 times of the present. Therefore, the current sewerage tariff (environmental protection charges) will be in shortfall for the sewerage works.
Preliminary research by JICA evaluated that 10% of the water supply charge was not enough to pay for the sewerage works.



Source: JICA team

Figure 4.2.4 Future of O&M cost for wastewater treatment

4.2.4 Issues and Solutions for Sewerage and Drainage Works in Hanoi

1) Expansion of organization and shortage of engineers

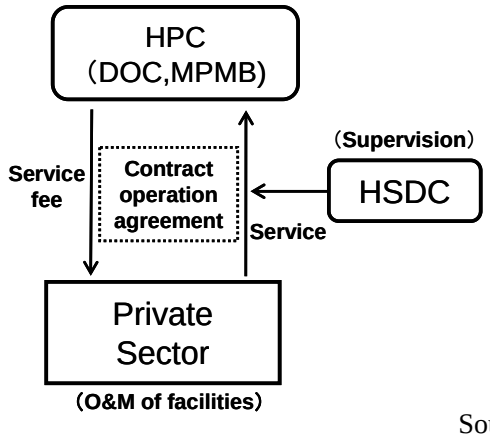
If constructions of WWTPs that are under construction/procurement or planned are completed, more than 400 engineers and support staff would be necessary to operate and maintain them. It seems very difficult to organize and keep up a big organization like HSDC and, timely employment of skilled engineers will also be difficult.

In many countries such as Japan, national governments or local governments have reduced public organizations to improve efficiency and reduce the cost for O&M of WWTPs. In countries advanced in the field of sewerage works, a large portion of the existing WWTPs have been operated and maintained by private companies based on contracts.

Generally, sewerage works are broken down into the parts described in Table 4.2.7. Those parts can be classified into works of the public or private sector considering legal responsibilities and efficiencies. For improvement of the sewerage works of Hanoi, it is necessary to introduce effective sewerage works considering public and private roles. In the O&M of the existing WWTPs, it is good to adopt private contract operation for improving efficiency and saving cost since the private sector's originality and ingenuity in the technical approach can reduce the cost.

In this case, HSDC (not including WTE) would be considered as an organization to supervise the service of the private sector as shown in Figure 4.2.5. It would also be considered as an organization to research technology for O&M of facilities.

But, in O&M of drainage works, it is good to operate drainage facilities with HSDC as it is because of the consequence of their responsibility.



Source: JICA team

Figure 4.2.5 A scheme of supervision for contract by HSDC

Table 4.2.7 Classification of sewerage works (a part of the works)

Affairs of Sewarage Works (a part of works)		
Financial Affairs		Subsidy from General Account
		Sharing Charge of Relevant Municipalities
		Governmental Subsidies
		Public Enterprise Bonds
General Affairs		Regulations, Payments, Budget, Accounting, etc.
		Safe-keeping of Official Seal
		Receipt and Shipment of Documents
	Budget Implementation	Procurement Planning of Utilities (Fuels, Chemicals, Consumables)
		Design and Supervision of Utility Order
		Implementation Planning of Utility Procurement
		Capital Expenditure and Public Works Contracts
		Consignment Contracts beyond the Scope
		Revenue Expenditure or Works Contracts within the Scope
		Consignment Contracts within the Scope
	Charge Adjustment	Research of User, Adjustment of Charge (Including Approval of Usage amout)
		Collection of Charge, Research of Accrued Charge
	Beneficiary Charge	Imposition of Beneficiary Charge
		Collection of Beneficiary Charge
	Property Management	Management of Property and Equipment
	Notice of Inception in Service	Notice and Inspection of Inception in Service, Designation of Urban Sewer
Affairs of Construction and Management		Improvement Planning of Sewarage System
		Improvement Planning of Drainage System
	Relay Pumping Stations	Improvement Planning of Construction, Reconstruction, and Renewal
		Design Supervision of Construction, Reconstruction, and Renewal
		Implementation Planning of Construction, Reconstruction, and Renewal
		Implementation of Construction, Reconstruction, and Renewal
		Improvement Planning of Repair and Maintenance
		Design Supervision of Repair and Maintenance
		Implementation Planning Repair and Maintenance
		Implementation of Repair and Maintenance
	Pipe lines	Improvement Planning of Construction, Reconstruction, and Renewal
		Design Supervision of Construction, Reconstruction, and Renewal
		Implementation Planning of Construction, Reconstruction, and Renewal

Source: JICA team

2) Shortage of funds to cover O&M cost and construction cost for new facilities

As already noted in 4.2.3, sewerage charges as environmental protection charges will be in shortfall to cover the O&M cost of the WWTPs and construction cost for new facilities.

Therefore, it is necessary to review the following issues;

- Review of sewerage tariff
- Introduction of efficient construction methods for new facilities with PPP

4.3 Suggestions for Issues of Sewerage and Drainage Works in Hanoi

4.3.1 Review of Tariff for Shortage of Funds to cover Sewage Treatment Cost

1) Review of fundamental point of view for tariff in sewerage work

For the implementation of sewerage improvement and appropriate O&M, it is necessary that the national government, local governments and users bear the expense for sewerage works. Therefore, it is necessary to make a rule for appropriate expense responsibility for sewerage drainage works in Hanoi.

Fundamentally, rainwater drainage must be covered as a public expense and wastewater treatment must be covered as a private expense. In the expense for rainwater, capital charges and O&M cost have to be covered as a public expense. But, in the expense for wastewater, capital charges and O&M expenses are presumed in many countries as follows;

(1) Capital charges

Capital cost without subsidy of the government is incorporated into the tariff. The tariff does not include expenses that must be covered as a public expense. But, if the tariff is too high, it is necessary to limit the capital charges against the tariff from time to time.

(2) O&M expense

O&M expense has to be borne by the tariff basically. But, the following have to be paid by the public sector wholly or partially;

- Expense for treatment of infiltration and inflow
- Expense for 3rd treatment

2) Review of income and expenditures for sewerage works

To set up appropriate sewerage tariff, it is important to review the accurate income and expenditures of the sewerage works, by which the current financial condition of sewerage works can also be made clear. Therefore, reviewing accurate income and expenditures should be done first.

In general, income and expenditures of sewerage works are classified into revenue income/expenditures and capital income/expenditures (for details, see Tables 4.3.1 and 4.3.2). Revenue income/expenditures mean income/expenditures of management such

as O&M, etc. for sewerage facilities. Capital income/expenditures means public enterprise bonds, subsidies, construction and repairing costs and redemption funds.

Sewage treatment cost is evaluated as the sum of O&M cost, depreciation cost and borrowing interest.

Table 4.3.1 Contents of revenue income/expenditures

Revenue Income/Expenditures	
Income	**Expenditures**
1. Operating Income	1. Operating Cost
- Sewerage Tariff	- O&M Cost
- Burden Charges from Other Accounts	- Depreciation Cost
2. Nonoperating Income	2. Nonoperating Cost
- Subsidy from Other Accounts	- Interest of Bonds for Construction
- Others	

Source: JICA team

Table 4.3.2 Contents of capital income/expenditures

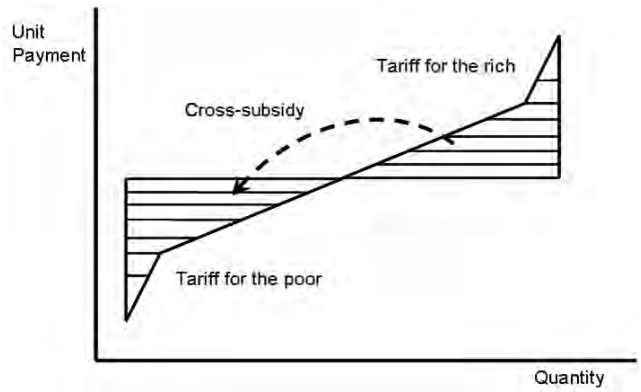
Capital Income/Expenditures	
Income	**Expenditures**
1. Public Enterprise Bonds	1. Construction/Repairing Cost
2. Investments from Other Accounts	2. Purchase Cost for Fixed Assets (Cars, Apparatus etc.)
3. Subsidy from Main Government	
4. Burden Charge etc.	3. Redemption Funds for Public Enterprise Bonds

Source: JICA team

3) Review of introducing cross-subsidy system

Many cities in developing countries have been adopting a cross-subsidy system from the wealthy class and commercial scale utility customers to lower income classes as shown in Figure 4.3.1.

In Hanoi, tariff rates of households are progressive and the commercial rate is equivalent to a large



Source ; Edited from Sohail,2004
Cross-subsidy/increasing block tariff structure

Figure 4.3.1 Cross subsidy concept

household user. In order to resolve the shortage of funds to cover sewerage treatment cost, related organizations should think about the wastewater tariff system combining metered/non-metered, progressive and subsidy rates (from wealthy/commercial to lower income).

4) Survey of household expenditures and willingness to pay

Affordability and willingness to pay are very important factors in reviewing appropriate sewerage tariff. The draft project appraisal manual of the World Bank states that the benchmark for the public sanitation sector is 1% of the consumable household income.

According to the report of the study on sewerage operation and maintenance know- how transfer (June, 2009), which was conducted in Hanoi by JICA, the wastewater tariff (as the environmental tax) was set at 0.3% of the monthly expenses. In line with this, if additional expense of 0.7% of monthly expense is allocated to the wastewater tariff, the benchmark of the World Bank is satisfied.

Present public awareness regarding the sewerage works is quite low. However, some of the sample households expressed higher willingness to pay at 0.6-0.8% of the monthly expenses. (Figures 4.3.2 and 4.3.3) Hence, the public sector should promote public awareness activities for sustainable sewerage works.

However, since the number of samples was small in that survey, (see Tables 4.3.3 and 4.3.4), it is necessary to survey more samples to achieve an accurate review.

Table 4.3.3 Outline of monthly household expenditures survey

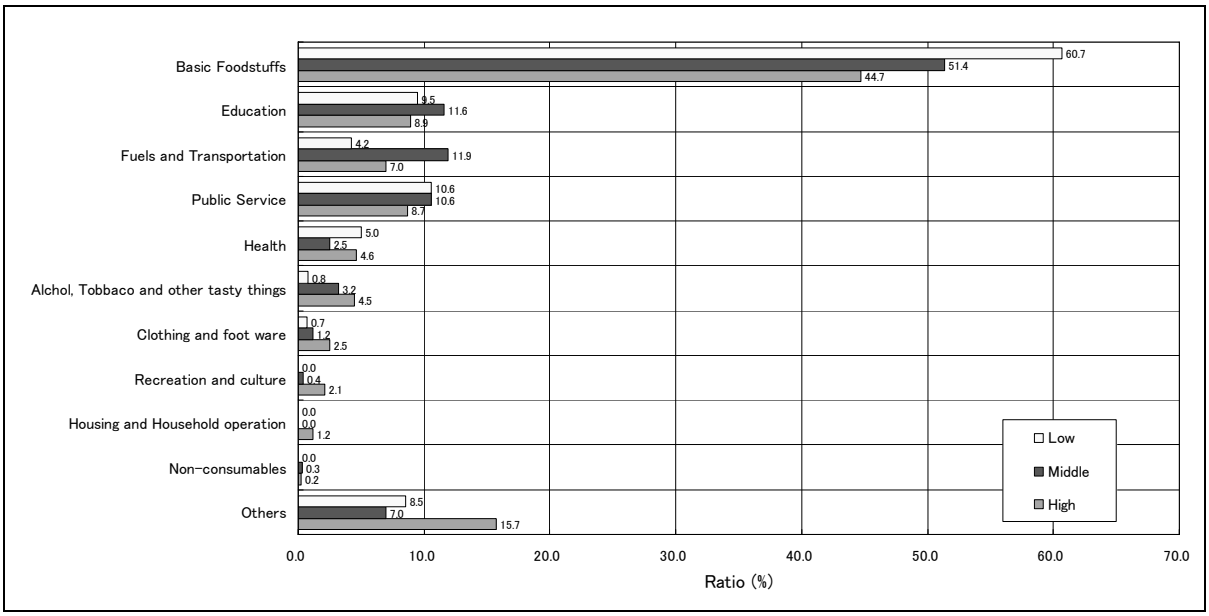
City Name	Hanoi
Survey Period	2 March ~ 6 March, 2009 (5 days)
Survey Area	Tan Mai Ward, Hoang Mai District
Survey Method	Social Survey Expert: 1 Assistant Surveyor: 1 Interview to each sample household
No. of Samples	15
Effective Answers	15 (100%)

Source: Study on sewerage operation and maintenance know- how transfer (June, 2009), JICA

Table 4.3.4 Categorization of income group

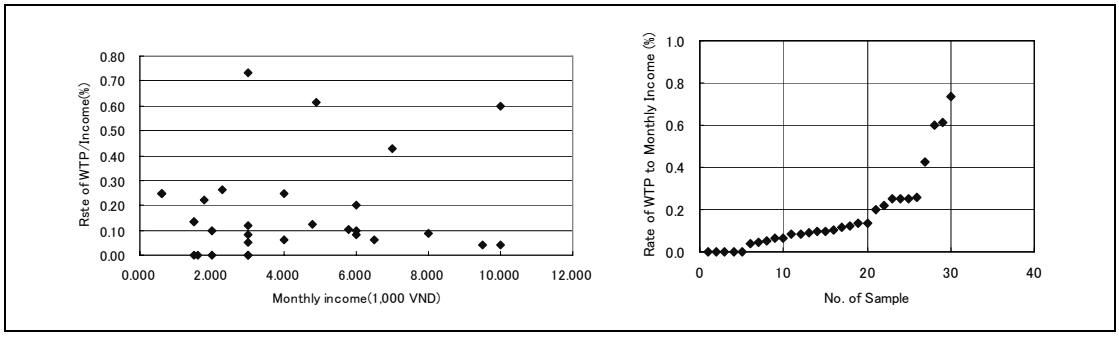
Income Level	Monthly Household Income	Ratio (Survey in Hanoi, 2008)
Low (L)	2millionVND or less	28%
Middle (M)	2million VND ~ 5million VND	38%
High (H)	5million VND or more	34%

Source: Study on sewerage operation and maintenance know- how transfer (June, 2009), JICA



Source: Study on sewerage operation and maintenance know- how transfer (June, 2009), JICA

Figure 4.3.2 Monthly household expenditure structure



Source: Study on sewerage operation and maintenance know- how transfer (June, 2009), JICA

Figure 4.3.3 Willingness to pay wastewater tariff

4.3.2 Suggestions for Sewerage and Drainage Works with PPP in Hanoi

1) Current state of PPP regarding sewerage and drainage works in Hanoi

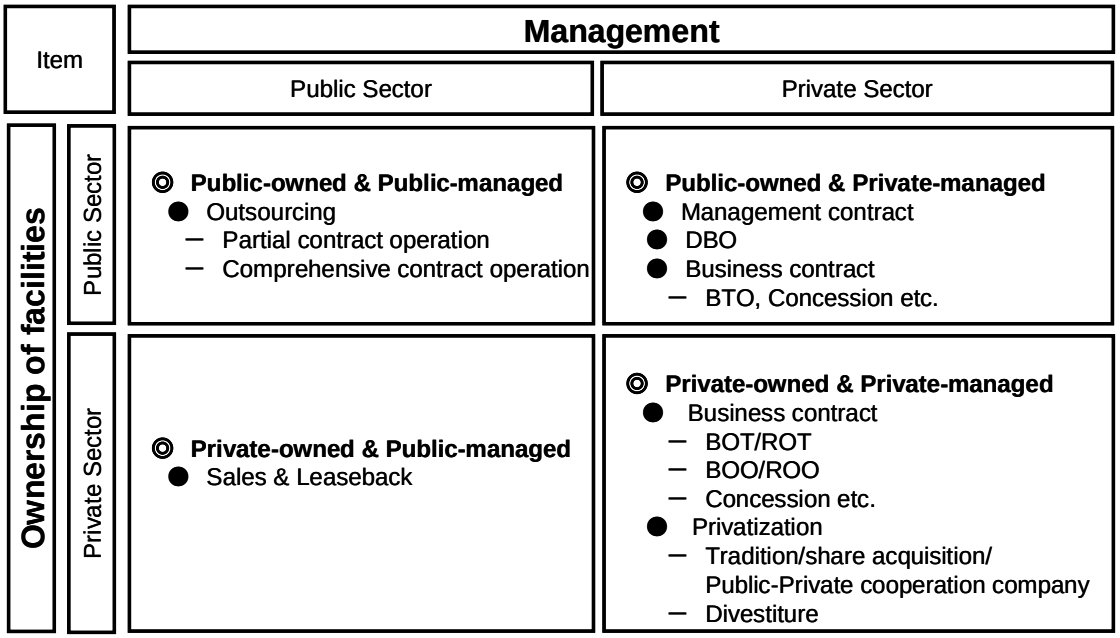
So far sewerage works have been a sort of typical public service that is owned and managed by the public sector. But, in large cities, it is very difficult to construct and to operate sewerage facilities only by public sector entities. Therefore, the private sector has to be involved in it as a part of O&M of facilities.

Recently, Europe and the United States, which already have sewerage systems, introduced applying private funding to construction and renewal of sewerage facilities and O&M by the private sector. However, there are still fewer sewerage systems than

water supply systems that are handled in this manner. Figure 4.3.4 describes the classification of sewerage work by type of ownership and managing sectors. Currently, sewerage works in Hanoi city are "Public-owned and Public -managed". Taking into account new construction, expansion and O&M of sewerage systems scheduled in the near future, it is recommendable for Hanoi to study involvement of the private sector in ownership and management of sewerage works.

There are various types of private sector creative involvement in the sewerage works.

Figure 4.3.4 shows a transitional model between public work and private work. In this figure, current sewerage works of Hanoi city are located in the outsourcing stage of public owned and public managed. By adopting the competitive circumstance, the private sector's participation can make the sewerage works more effective technically and financially for O&M of facilities and construction of new facilities.



Source: JICA team

Figure 4.3.4 Classification of sewerage works according to ownership and management of facilities

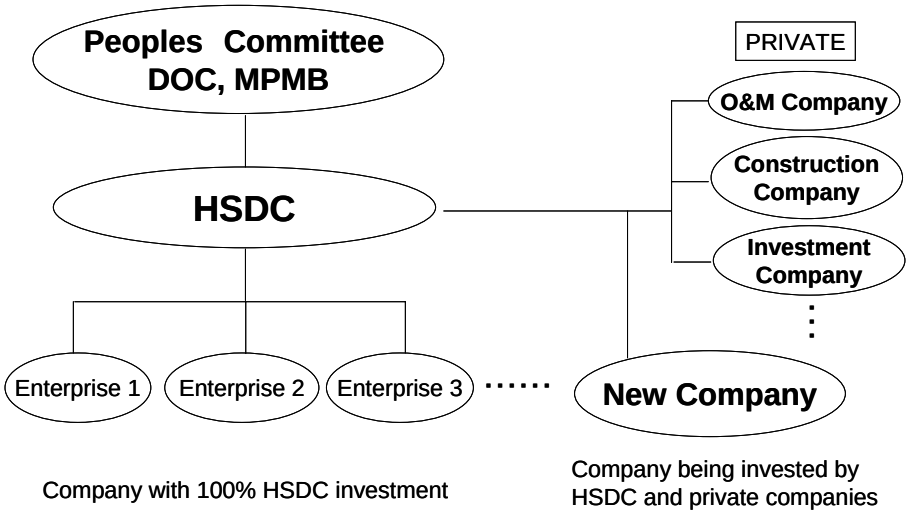
2) Suggestion of new work model with PPP for existing facilities

Hanoi city is contracting the O&M of the existing sewerage facilities with HSDC. Current HSDC's performance is a workable level as a public company. However, it may need to consider the effectiveness of contracting out of O&M work to their subsidiary company.

Taking into account successful cases of privatizing the public companies as the world trend, it may be desirable to privatize WTE (Water Treatment Enterprise) which is HSDC's subsidiary company in charge of O&M of HSDC's sewerage works.

As mentioned in 4.2.3, if the operation of Yen So and Bay Mau WWTPs, which are categorized as the existing facilities but still under construction and under procurement respectively, is started, the financial situation for sewerage works in Hanoi will become worse. Therefore, in order to achieve the efficient management for sewerage works, HPC will contract the O&M works of these facilities to the privatized WTE.

The following is a scheme considering public good to privatize WTE by public and private investment. A new O&M company will be constituted by HSDC and private companies such as a private O&M company, construction company, consulting firm, etc. (Figure 4.3.5)



Source: JICA team

Figure 4.3.5 Outline of WTE privatization scheme

(1) Objectives of WTE privatization

The objectives of WTE privatization are described below;

a. Reduction of O&M cost

Involvement of the private sector in public works may possibly reduce the costs. For example in the U.K., the National Audit Office announced that there were 15 cases of privatized public-works in 2000 that made a reduction of total project costs of about 20%. Reasons for the reduction of the project costs are listed below;

- Reduction of fixed costs

  Appropriate personnel arrangements and efficient facility management can reduce O&M costs due to reducing fixed costs such as labor cost.

- Reduction of variable costs by private efforts

  Private sector's originality and ingenuity in technical approach can reduce the variable costs. Latest technologies such as automatic control and energy-saving contribute to cut O&M costs. Private sector's efficient operation can minimize the costs for consumables such as chemicals and electricity.

- Selection of O&M companies in competitive circumstances

If the principle of competition can work, the contract costs of O&M work could be reduced.

b. Control of O&M cost from abrupt price fluctuations

In the case of long-term O&M contracts, the owner's range of responsibility for abrupt price fluctuations is fixed. Hence the owner can control the impacts of price fluctuation to the O&M charge system particularly in periods of violent fluctuations in prices.

c. Improvement of service quality

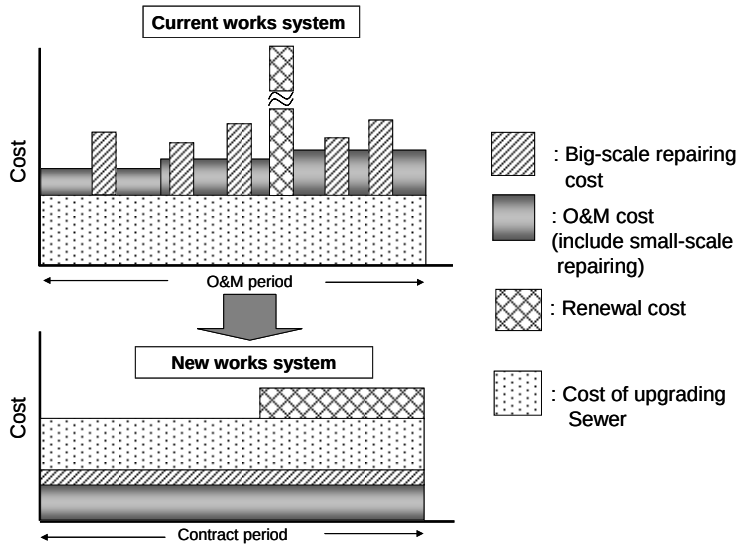
By specifying the service quality of the private sector in the contract, the service quality, such as treated water quality & customer service, is guaranteed.

d. Equalization of project costs

The private sector is, in general, obligated for comprehensive O&M work including the day-to-day operation and maintenance, repair work and sometimes renewal work too. Hence, the owner does not need to prepare such occasional costs and can equalize his expenses for the service. Appropriate repair and renewal works can prolong the lifetime of the facilities. Figure 4.3.6 describes the image of equalization of project costs.

e. Promotion of new facility investment

By equalizing the cost of repair and renewal and reducing the total project cost, Hanoi city can reduce the expenditures for O&M and invest in new facilities.



Source: JICA team

Figure 4.3.6 Image of equalization of project costs

(2) Points to be considered

In order to enhance the involvement of the private sector in O&M work, the following points should be considered;

a. Fairness of contract operation fee

In order to ensure the fairness of O&M cost, third-party organizations such as consulting firms may be appropriate to estimate O&M cost.

b. Service quality

It is necessary to ensure service quality by including a penalty system in contracts because private companies to be entrusted may pursue profit and decrease service quality.

And in order to guard against a situation in which a private company couldn't manage the O&M works for any reason, it is also necessary to set up a system such as insurance that doesn’t place responsibility on the service buyer.

c. Public awareness of privatization of sewerage works

In order to avoid creation of a sense of discomfort in the public for privatization of sewerage works, it is important for the public sector to advertise about the economic effectiveness and public supervision of the privatization of the sewerage works.

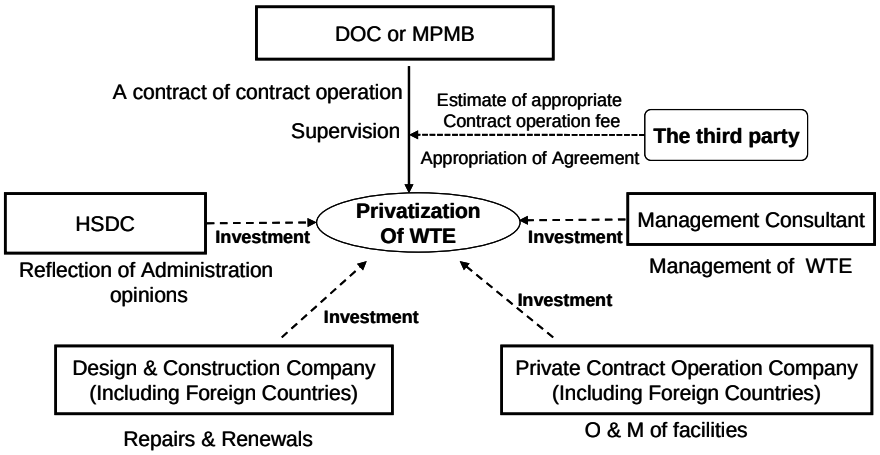
(3) Detailed privatization scheme for WTE

In this scheme, organizations such as DOC or MPMB should supervise the O&M performance of the privatized WTE. (Figure 4.3.7) However, legal issues and efficiency still need to be discussed and, if necessary, an independent third party should evaluate O&M costs and prepare an O&M contract.

Advantages of this scheme are that public opinions can be easily reflected because of HPC’s capital contribution and it can prevent the following issues;

- Decrease of service quality by pursuing profit
- Abrupt high rise of O&M cost

However, unnecessary intervention by relevant public organizations into management of a privatized WTE may bring about management difficulties and cause increase of the cost. Therefore, the control of intervention by relevant public organizations would be important.



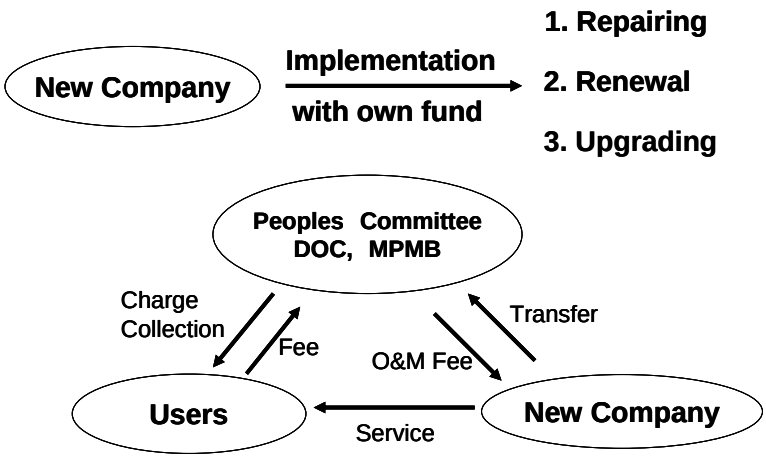
Source: JICA team

Figure 4.3.7 Detailed privatization scheme for WTE

(4) Implementation method of new work model

In this scheme, a new company implements repair and renewal of the existing facilities and upgrading of the sewers with its own funds. After repairing and renewal of the existing facilities and upgrading of the sewers with its own funds, the facilities will be transferred to HPC. Then HPC (DOC or MPMB) will pay a fee for these works in installments during the contract period. By payments in installments, responsibility for repairing and renewal of the existing facilities and upgrading of the sewers will be reduced, and repairing and renewal of the existing facilities and upgrading of the sewers will be performed at an early date and on a timely basis.

Figure 4.3.8 shows the implementation method of this scheme.



Source: JICA team

Figure 4.3.8 Implementation methods of new work model with WTE privatization

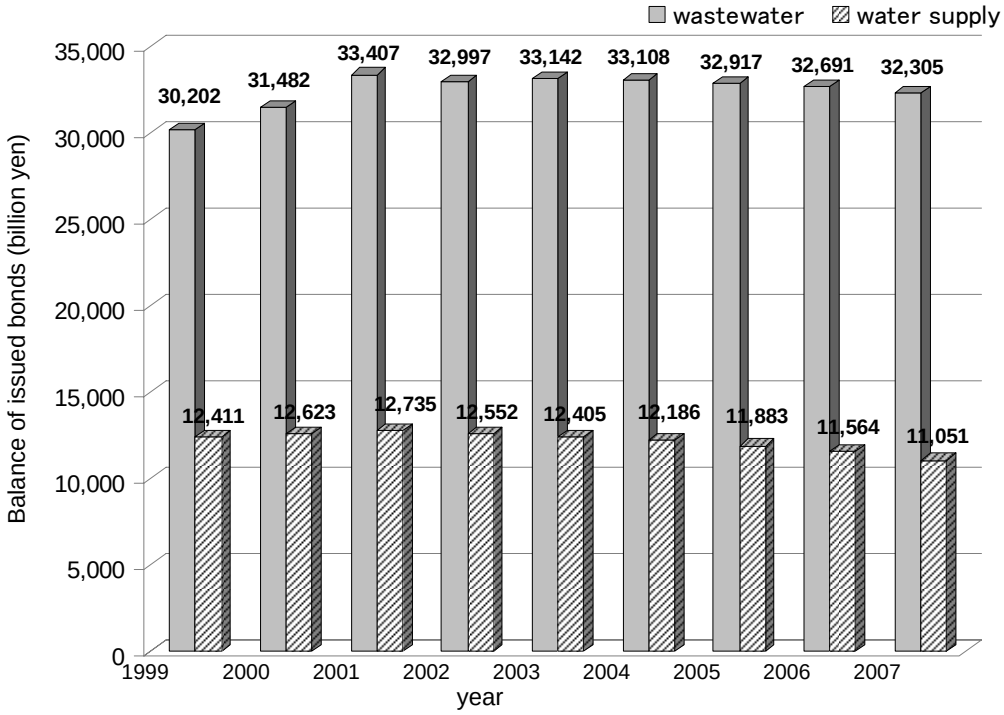
3) New works models with PPP for new facilities

(1) Suggestion of introducing Design-Build-Operate (DBO) method and Design - Build-Finance-Operate (DBFO) method for new facilities

Number of staff and O&M costs increase according to increase in the size of the sewerage works. It is easier for small cities than large cities to construct and manage the sewerage facilities by themselves. In fact, larger city governments are used to having financial difficulties in large initial investments of sewerage developments as well as O&M costs. As a result, many of the large city governments are facing difficulty in securing funds for repayment of huge debts and costs of O&M.

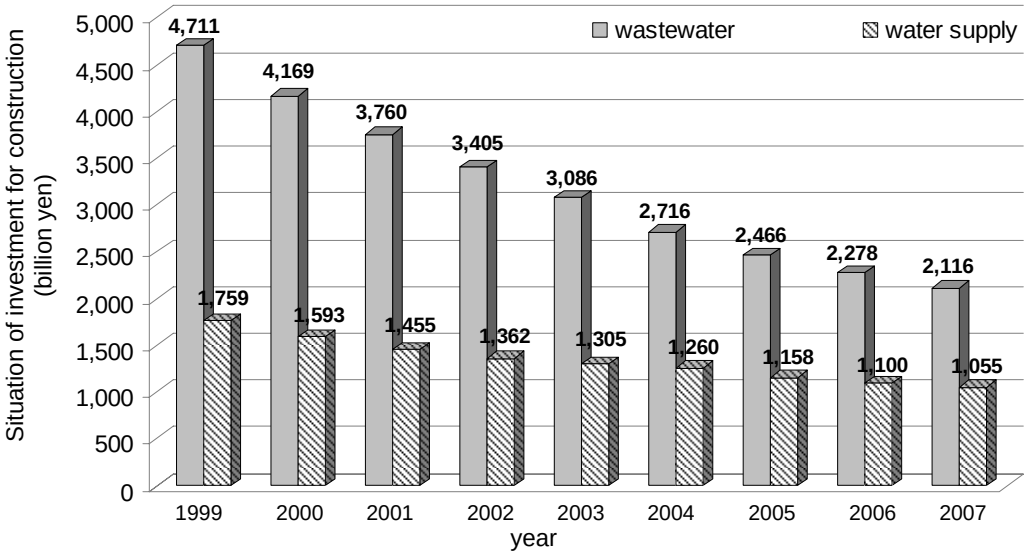
In Japan, enormous debts are still left and that leads to a decrease in the amount of investment for new and renewal construction as shown in Figures 4.3.9 and 4.3.10.

When Hanoi city plans to expand the sewage facilities, a vast amount of funds and a large scale management organization will be required. For this reason, it is essential to introduce efficient and economical facilities in which O&M is taken into consideration in design and construction. In order to reflect findings in O&M work to the design and construction of the new facility, a DBO method in which Design, Build and Operation are ordered as one package contract or DBFO method which adds Financing to DBO will be needed.



Source: Report of public enterprises in 2008, Ministry of Internal Affairs and Communications of Japan

Figure 4.3.9 Situation of Japanese public enterprise debts on sewerage and water supply works

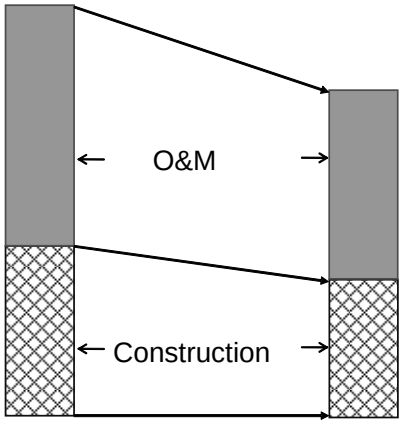


Source: Report of public enterprises in 2008, Ministry of Internal Affairs and Communications of Japan

Figure 4.3.10 Changes of construction investment on sewerage and water supply works

With DBO and DBFO methods, construction costs can decrease because private companies are keen to reduce their costs to as small as possible in design, construction and O&M by their originality and creativeness. For instance their design must consider good function with minimum O&M costs. DBFO method can solve the shortage of public investment by infusing private funds and can promote expanding new facilities by adopting progressive payments over the contract period.

Figure 4.3.11 illustrates the image of reducing total project cost with DBO and DBFO.



A case of different order A case of DBO or DBFO order

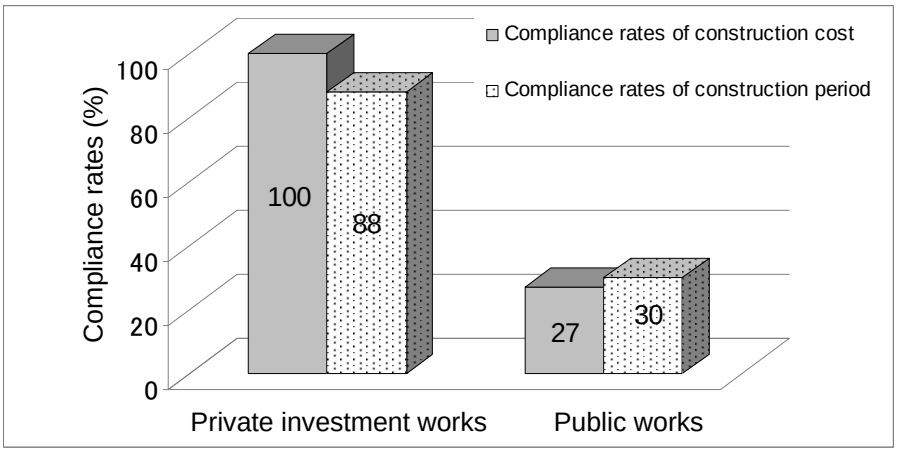
Source: JICA team

Figure 4.3.11 Image of reducing total project cost with DBO and DBFO

Advantages of DBO and DBFO are as follows;

- Reducing construction cost by inventiveness of private companies.
- Reducing O&M cost by considering O&M in design and construction.
- Avoiding over-specification in design by reflecting O&M skill to economize O&M by the DBO/DBFO contractor.
- Avoiding prolonged construction period and total project cost because any excess costs are the risk of the contractor
- Improving service quality by using the inventiveness of private companies.
- Contributing to making profit and to promoting well-being of citizens by constructing incidental facilities and welfare facilities
- Establishing long-bond market managed by private funds, providing various investment opportunities for pension funds and insurance companies, and stimulating the economy by investing surplus funds in public investment
- Providing stable investment opportunity for surplus funds

Public-works implemented by the private sector in 2000 including 15 cases of privately introduced projects decreased the project costs by about 20% compared with projects implemented directly by the government according to the National Audit Office of the United Kingdom (U.K.). In addition, the compliance rates of construction cost and period with DBFO method are better than those of ordinary financed projects as shown in Figure 4.3.12.



Source: England HM Treasury, Sep.2002

Figure 4.3.12 Comparison of the compliance rates of construction cost and period

It is beneficial to introduce PPP such as DBO & DBFO methods for new sewerage facilities in Hanoi to reduce construction and O&M costs. Introducing DBO & DBFO methods will be helpful in resolving the finance shortage in Hanoi.

(2) The comparison between DBO and DBFO

Ordinary implementation structures of DBO and DBFO are described in Figure 4.3.13.

The DBFO method basically needs joint participation of design companies, construction companies, O&M companies and financial investors from the phase of project development to the phase of establishment of the private-owned corporation.

However, financial investors do almost nothing in regards to the projects from the phase of project development to the phase of stipulating contract conditions in the implementation contracts. So there is an issue that other participants have to take the initiative and run risks that financial investors have to take, and, as a result, there occurs an issue of expensive total project costs by passing on risk avoidance costs to total project costs.

But, for the public sector, DBFO method makes it possible to resolve initial cost shortage and expand projects timely. Indeed, many profitable projects are implemented with the DBFO method.

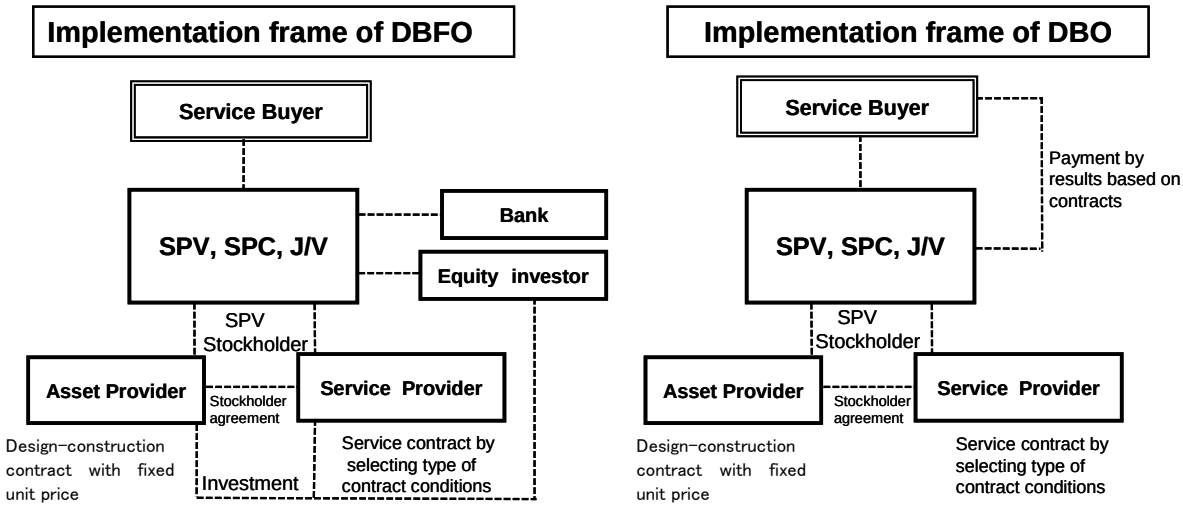
The DBO method doesn't include infusion from private funds and manages the project with service charges from the service buyer.

A Special Purpose Vehicle (SPV) or Special Purpose Company (SPC), which is a project implementing body concludes implementation contracts with the service buyer and receives payment based on performance result.

The DBO method is evaluated to be a more flexible method in modifying implementation contracts with the service buyer and making negotiation smoother than the DBFO method, due to the negotiations without the demands of financial investors.

The DBO method is more cost efficient than the DBFO method because, in DBFO, equity investment and loans from financial investors that are intended to produce income from capital may increase financial costs compared with the use of public funds.

Moreover, DBFO usually adopts project finance that uses the cash flow of the works for repaying the debt. And also, it requires not only funds to cover financing costs but also various fees. As financing costs and various fees in project finance are fixed amounts notwithstanding the scale of the project, it is desirable to adopt the DBFO method in large scale projects. On the other hand, the financing costs of the DBFO method account for a considerable percentage in total costs of small scale projects.



Reference：Palmer,K.,"Contract Issues and Financing in PPP/PFI-Do We Need the F' in DBFO Projects"? Prepared for the IPPR Commission on Public Private Partnerships, 2000, 13-15p.

Figure 4.3.13 Implementation structures of DBO and DBFO

(3) Comparison among DBFO methods and suggestion of BTL as the DBFO method

DBFO methods are implemented in many countries with various methods.

Common methods are as follows.

- BOT (Build-Operate-Transfer) Private companies build facilities with their own funds first. After construction, they operate the facilities and collect service charges from end users during the contract period. When the contract period is over, the facilities are transferred to the service purchasing party.
- BTO (Build-Transfer-Operate) Private companies build facilities with their own funds. After construction, facilities are transferred to the service purchasing party and the private companies are granted the management right of the facilities. Then the private companies operate the facilities and collect service charges from end users during the contract period.
- BOO (Build-Owned-Operate) Private companies build and own facilities with their own funds. And they operate the facilities and collect service charges from end users.
- BTL (Build-Transfer-Lease) Private companies build facilities with their own funds and transfer them to the service purchasing party. The private companies are granted the management right but they lease the right to the

service purchasing party. The private companies collect lease charges.

Table 4.3.5 shows the comparison of each method.

Table 4.3.5 Comparison between BTO and BTL

BOT, BTO, BOO	Execution Form	BTL
Facilities which could recover investment through fees such as roads and harbors etc.	**Features of object facilities**	Facilities which could not recover investment through fees such as facilities for education and welfare etc.
Fees from users	**Recovery of Investment**	Lease fees from government
High （Change of benefit rate by demand）	**Risk** **(for private sector)**	Low (Securing of benefit rate by government）

Source: JICA team

So far, most DBFO projects have been implemented with BOT or BTO because profitable projects have been selected, such as Electricity and Transportation.

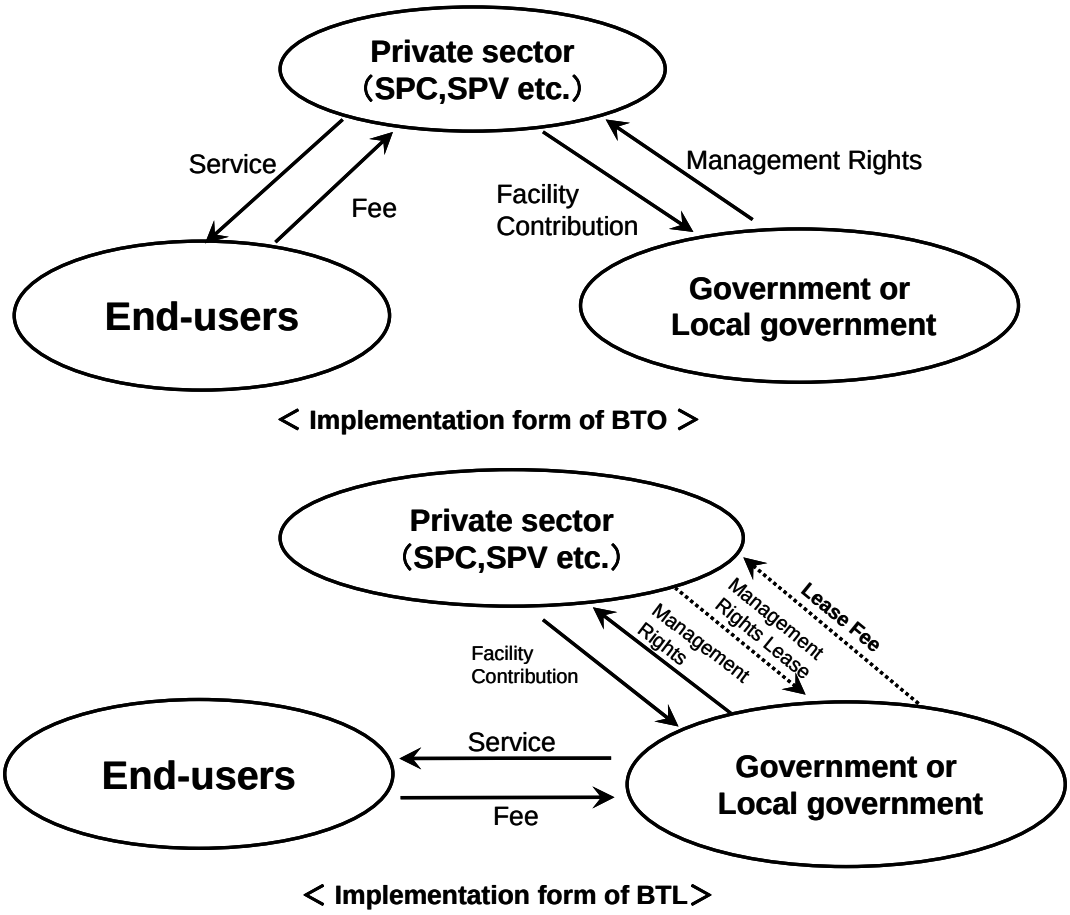
However, facilities for education, culture and welfare including sewerage facilities are not profitable, therefore total project costs are returned through national and local government's lease fees, not by usage charges. This system decreases the risk of project investors and provides stable investment opportunities.

Fundamental differences between BTO and BTL are, as illustrated in Figure 4.3.14, service provider and payment recipient:

In BTO, private companies provide service to end users and collect service charges for repayment of total project costs.

On the other hand, in BTL, private companies collect lease fees from the national or local government for the repayment of total project costs.

If HPC wants private investment for construction and operation of new sewerage facilities, it is believed that introducing BTL would be efficient. The private sector can not recover the investment of the construction and operation of new sewerage facilities by collecting sewerage charges from users, however, the private sector can invest easily under the guarantee of payment for the investment from the national or local government.



Source: JICA team

Figure 4.3.14 Implementation forms of BTO and BTL

BTL can produce the following benefits:

- To construct facilities in a short period while the national or local government has a long period of time in which to secure sufficient budget.
- To reduce financial burden by sharing the expenditure over a long period of time.
- To receive benefits at an early date by achieving early implementation. Delay of the project increases total costs because of the rise of land compensation, price fluctuation, etc.

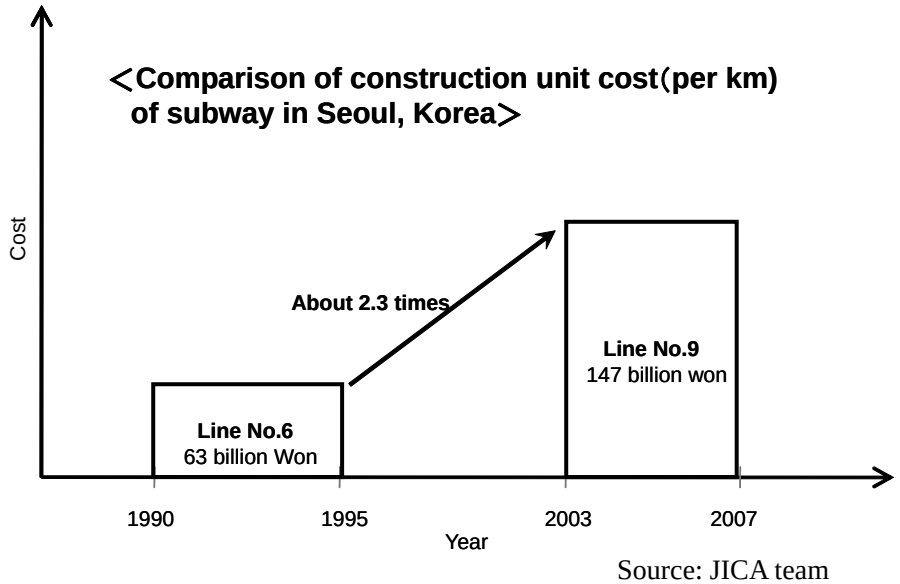
  Figure 4.3.15 shows the comparison of unit construction costs of subways in Seoul City, Korea. There is a remarkable difference between unit construction costs in the 1990's and 2000's. If the construction is delayed, unit construction cost gets more expensive.
- To shift national or local public finance to that of developed countries which utilize not only public funds but also private funds.

In the U.K., Private Finance Initiative (PFI) has already been introduced and has been implemented in Public-works since 1992. Most PFI projects have been implemented with the DBFO method. In this method, private companies implement all of the

projects and the government pays facility usage charges. So it is very similar to the BTL method.

A total of 16 years have passed since PFI started, and there are totally about GBP 60 billion of private investment and about 600 facilities providing their services, such as hospitals, schools, transportation, environment and national defense.

In Japan, the government established the Act on Promotion of Private Finance Initiative (PFI law) in 1999 for public-sector financial reform. According to the PFI Promotion Office of the Cabinet Office, 366 projects have been progressed, and of these projects, 237 projects were providing services at the end of 2009.



Source: JICA team

Figure 4.3.15 Comparison of unit construction cost of subways in Seoul City, Korea

4) General method for introducing BTL

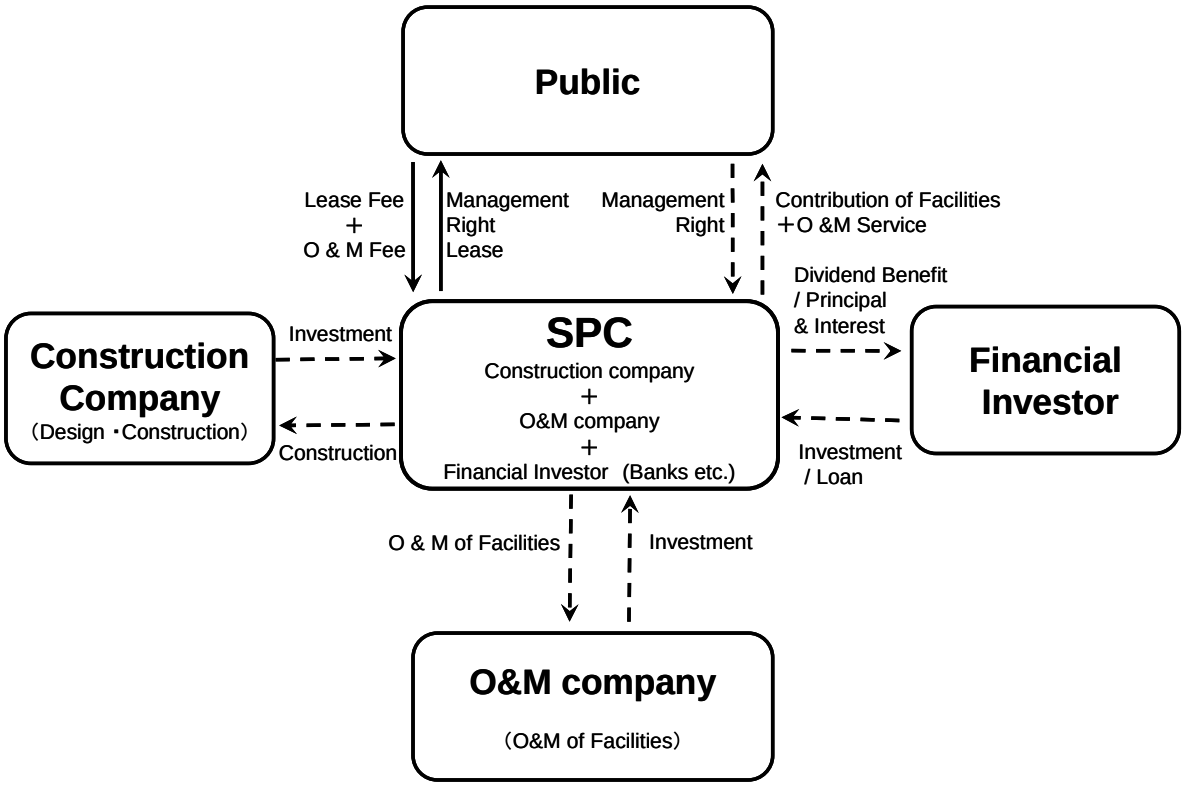
In the BTL method, private companies are to design, finance, construct and manage facilities, and they establish a Special Purpose Company (SPC) that includes financial investors, construction companies, O&M companies, etc. (as shown in Figure 4.3.16).

The repayment of private investment includes the following concerns.

a. Benefit rate

The facility lease charge shall be established based on a benefit rate which has a long-term investment premium (α) on the interest rate of national and local debts and the premium is to be set by bidding.

Generally, long term receivables don't earn excessive profits because their benefit rate is higher than short-term receivables. So, the premium is set at an appropriate rate for long-term investments and is a compensation for the risk of managing with a limited budget.



Source: JICA team

Figure 4.3.16 Structure of BTL method

b. Management budget is dependant on results

It is essential to include a Penalty system into the contracts in order to maintain service quality so that unless the annual result comes up to the contract levels, the management budget would be decreased.

For example, in the case of schools in the U.K., management budget is adjusted or decreased by evaluating levels of services such as air-conditioning, lights, water supply, repair time, etc.

As for wastewater treatment plants, treated water quality, repair and renewal are evaluation criteria in order to adjust management budget.

c. Profit from profitable works

If there are incident profitable works such as event halls, sports facilities, parking lots, etc., they would ease the financial burden on the government budget by improving usage efficiency of facilities as long as they were not permitted to interrupt the function of the facilities.

d. Profits from them are deducted in estimating facility-lease-charge.

It is a good way to obligate to construct incident profitable facilities in order to ease financial burden on the government.

5) Items to be studied for introducing BTL methods

Figures 4.3.17 and 4.3.18 show the general work flow for implementation of DBFO such as BTL. It is necessary to study some items that follow in order to introduce the DBFO method efficiently for new works.

a. Scale of project

The government should properly formulate the BTL project in order to manage financial demand.

It is necessary to invest in financial works and BTL works separately through analyzing financial plans and unit costs.

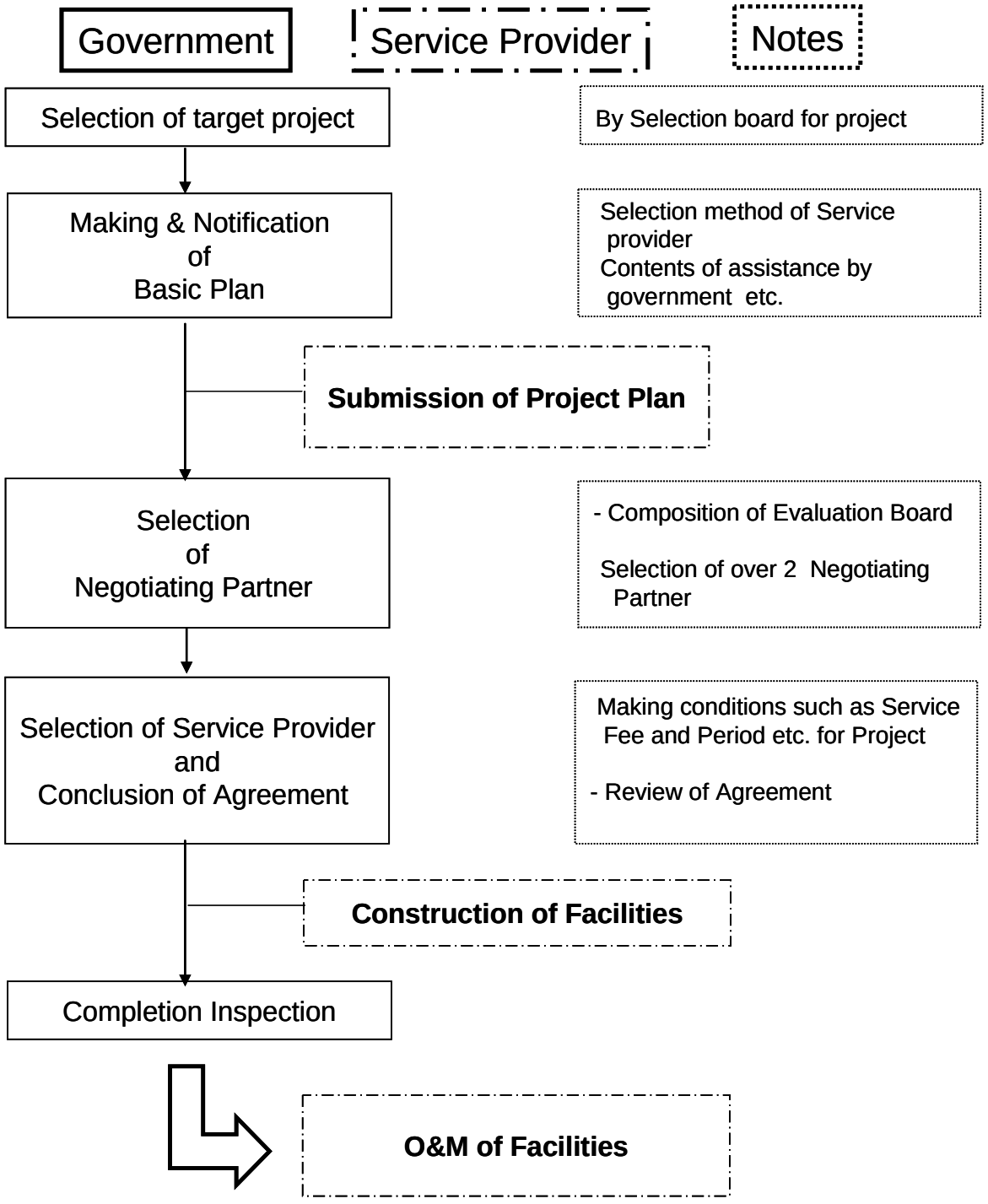
b. Project selection

It is necessary to consider a scheme that can develop legal systems which prevent excessive investment, select projects rigidly and review them.

Although BTL projects are constructed early, projects which take time for financing should be selected, and profitable projects are to be considered for implementation by the BTO method.

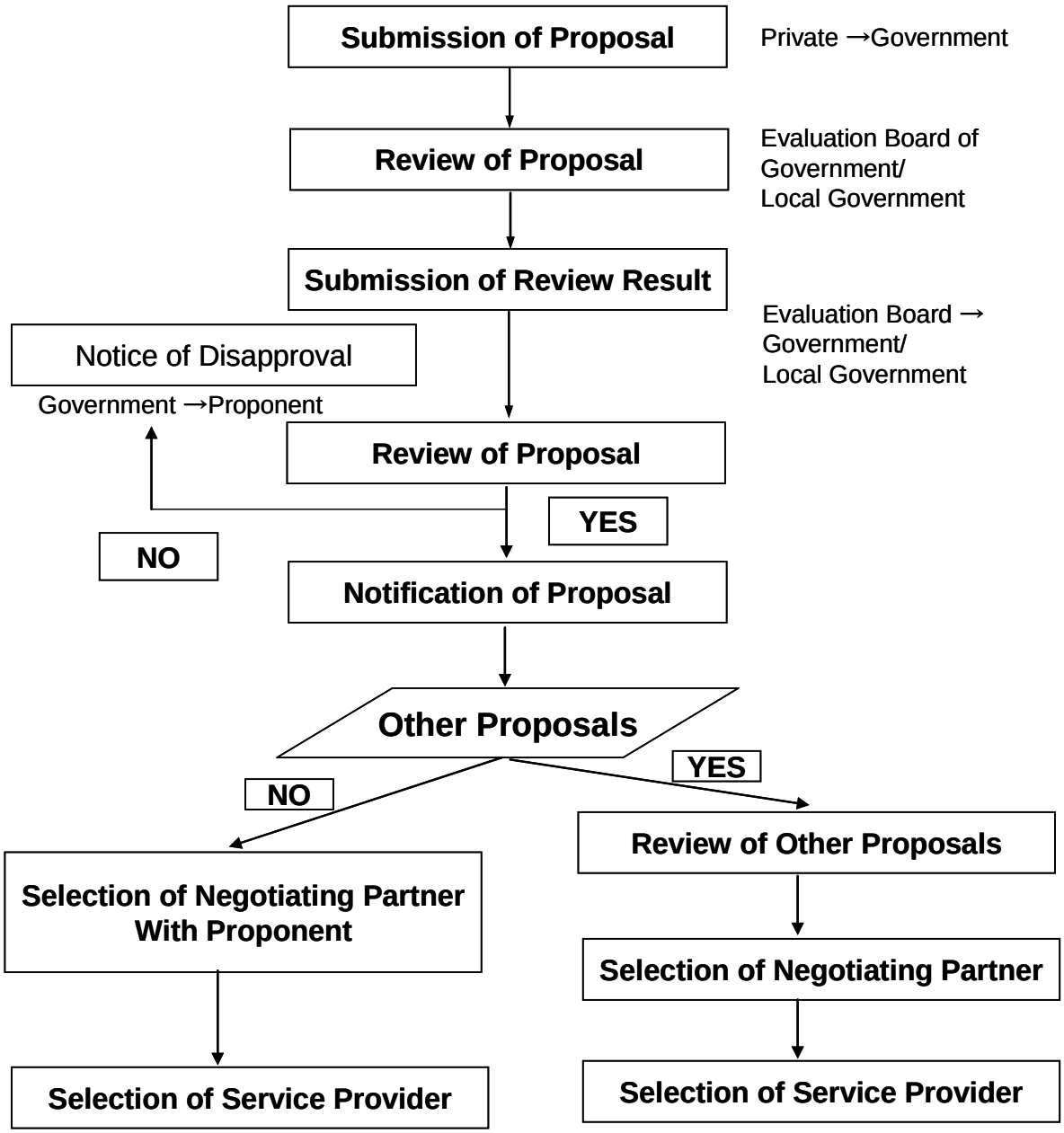
c. Formulation of investment rules

It is necessary to formulate a clear and secure investment plan and review it.



Source: JICA team

Figure 4.3.17 General work flow of DBFO for government ordered projects



Source: JICA team

Figure 4.3.18 General work flow of DBFO for the projects proposed by the private sector

4.3.3 Suggestions for a Road Map for introducing PPP on Sewerage and Drainage Works in Hanoi

1) Suggestions for a road map for reviewing new sewerage tariffs

Table 4.3.6 shows the schedule for review of appropriate new tariffs. About 8 months will be necessary to study and review new tariffs. Conducting a hearing is necessary to implement the new tariffs. It is suggested that the new tariff system should be started in 2013 when operation of Yen So WWTP will start, because a shortage of funds to cover O&M cost through the sewerage tariff will occur. The work items and schedule including the hearing for implementation of new tariffs are described in Table 4.3.7.

Table 4.3.6 Schedule for review of appropriate new tariffs

No.	Item \ Schedule	2011											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Review of fundamental point of view for tariff			⇨	⇨	⇨							
2	Review of income and expenditure for sewerage works			⇨	⇨	⇨							
3	Research of Cross-Subsidy System			⇨	⇨	⇨							
4	Survey of Household Expenditure			⇨	⇨	⇨	⇨						
5	Surrvey of Willingness to Pay			⇨	⇨	⇨	⇨						
6	Review of Appropriate Tariff							⇨	⇨	⇨	⇨		
7	Submission of Appropriate Tariff to HPC										▼		

Source: JICA team

Table 4.3.7 Schedule for implementation of appropriate new tariffs

No.	Item \ Schedule	2011	2012	2013	2014
1	Review of New Appropriate Tariff	⇨			
2	Conducting the Hearing	⇨			
3	Final Review & Determination of New Tariff by HPC		⇨		
4	Approval of New Tariff by Peoples Committee		⇨		
5	Official Announcement for New Tariff		⇨		
6	Implementatation of New Tariff		▼		

Source: JICA team

2) Suggestions for a road map for reviewing new works model for existing facilities

Table 4.3.8 shows the review schedule for a new work model for the existing facilities. About 9 months will be necessary to study and review the new works model. It is suggested that a new joint company should be established by the end of 2012, and it is also suggested that Yen So WWTP should be operated efficiently by a new joint company. The work steps and schedule for implementation of the new work model are described in Table 4.3.9.

Table 4.3.8 Schedule for review of new work model for existing facilities

No.	Item \ Schedule	2011											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Review of Model Works												
1.1	Selection of Model Works												
1.2	Review of Outline Cost of Works												
1.3	Estimation of Efficiency												
2	Review of Legal & Financial Issues												
2.1	Review of Consistency with Existing Regulation												
2.2	Review of Needs for New Regulation												
2.3	Review of Funding & Investment												
3	Review of Adequate Works Scheme												
3.1	Review of Appropriate Structure of New Company												
3.2	Prepare Contract Forms and Tender Documents												
4	Submission of Adequate Works Scheme to HPC												

Source: JICA team

Table 4.3.9 Schedule for implementation of new work model for existing facilities

No.	Schedule / Item	2011		2012	
		Jan - Jun	Jul - Dec	Jan - Jun	Jul - Dec
1	Review of Adequate Works Scheme				
2	Final Review & Determination of New Works Model by HPC				
3	Establishment of New Joint Company				
4	Contract of New Works Model				
5	Start of O&M by New Joint Company				

Source: JICA team

3) Suggestions for a road map for reviewing new works model for new planned facilities

Table 4.3.10 shows the review schedule for a new work model for newly planned facilities. About 10 months will be necessary to study and review the new works model. It is suggested that Yen Xa WWTP should be constructed by the new works model with the DBO or DBFO method. The work steps and schedule for implementation of the new work model are described in Table 4.3.11.

Table 4.3.10 Schedule for review of new work model for newly planned facilities

No.	Schedule / Item	2011											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Review of Detail Works Frame of DBO & DBFO												
2	Review of Legal & Financial Issues												
2.1	Review of Consistency with New PPP Regulation												
2.2	Review of Consistency with Other Vietnamese regulation												
2.3	Review of New Regulation Needs												
2.4	Review of Appropriate Profit of Private Provider in DBFO												
3	Effectiveness Analysis of DBO & DBFO with Model Works												
3.1	Selection of Model Works												
3.2	Review of Outline Cost of Model Works												
3.3	Review of VFM for Model Works												
3.4	Risk Analysis												
4	Prepare Contract Forms and Tender Documents												
5	Submission of Adequate DBO,DBFO Scheme to HPC												

Source: JICA team

Table 4.3.11 Schedule for implementation of new work model

No.	Schedule / Item	2011	2012	2013	2014
1	Review of Adequate Works Scheme	⇨			
2	Final Review & Determination of New Works Model by HPC		⇨		
3	Approval of New Works Model by HPC		⇨		
4	Selection of DBO, DBFO Model Works		⇨		
5	Public offering of DBO, DBFO Model Works		⇨		
6	Selection of Service Provider		⇨		
7	Contract with Selected Service Provider			⇨	
8	Implementation of Model Works with DBO(DBFO)			⇨	⇨

Source: JICA team

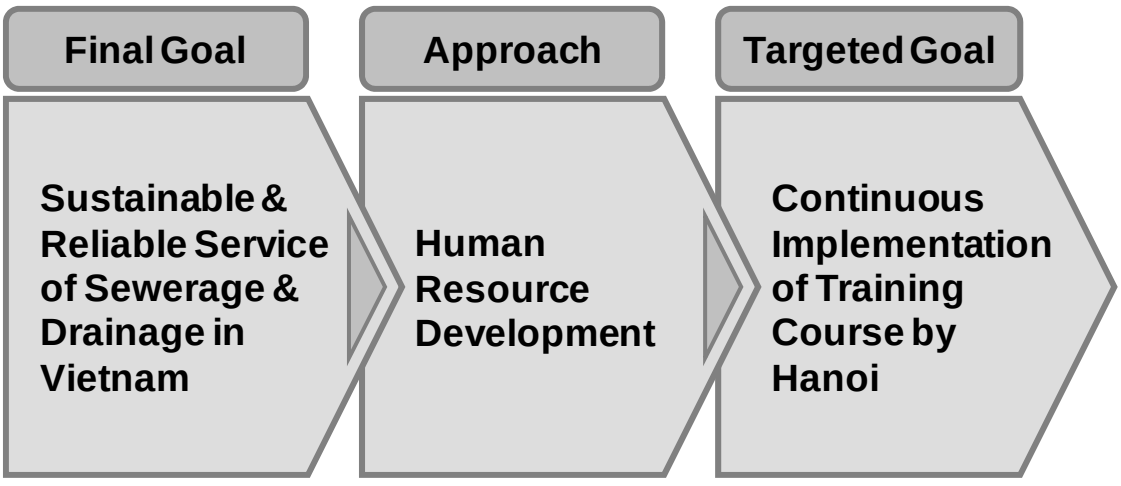
Chapter 5 Technical Transfer Program to Other Cities

5.1 Necessity of Technical Transfer Program to Other Cities

According to the rapid economic growth and urbanization, many cities in Vietnam are planning to develop new sewerage systems in the near future. It is essential for those cities to reserve skilled staff for the operation and maintenance (O&M) of the sewerage systems in order to provide sustainable and reliable service.

For sustainable and reliable service, one of the approaches is the capacity development of O&M staff. As Hanoi is advancing in the sewerage service operation ahead of the other cities in Vietnam, it has been requested that Hanoi transfer their skills to the other cities. For this purpose, JICA and the Hanoi Sewerage and Drainage Company (HSDC) carried out a technical transfer program to the other cities on a trial basis under this study.

Through this study, the JICA study team assisted HSDC's technical transfer courses for O&M of the sewerage facilities to the other cities by inviting 16 cities to send representatives to learn about the program, materials, staff, arrangements, etc. This section summarizes the JICA study team's review and advice regarding the technical transfer program.



Source: JICA team

Figure 5.1.1 Goal image of technical transfer to other cities

5.2 Framework of Technical Transfer Program

5.2.1 Schedule

The training course was named the "TECHNICAL TRANSFER PROGRAM TO OTHER CITIES FOR OPERATION & MAINTENANCE IN THE SEWERAGE FACILITIES". It took place three times during the study time. The first course was held in July, and the second and third were in September. Each course lasted 5 days.

Table 5.2.1 Course schedule

	Schedule
1st course	From the 12th to 16th of July
2nd course	From the 6th to 10th of September
3rd course	From the 13th to 17th of September

Source: JICA team

5.2.2 Trainers

Before the first training course, HSDC selected four of their experienced engineers as trainers. Their specialties were Sewerage Management, Water Quality, Electronics, and Mechanics. Taking into consideration their areas of specialties, each trainer took charge of one or two classes.

Table 5.2.2 Trainers' List

Trainers' Name	Current Occupation	Assigned Class
Mr. Tran Cong Tuyen	Deputy Head of Water Environment Engineering Department	Introduction of Sewerage Works, Piping Systems
Ms. Tran Minh Hien	Head of Water Environment Laboratory	Water Quality, Sludge Treatment
Mr. Nguyen Hong Phong	Vice Director of Water Treatment Enterprise, Facilities and Equipment Manager	Electrical Equipment & Maintenance
Mr. Dang Dinh Quy	Sewerage Treatment Operation Team Leader	Mechanical Equipment & Maintenance

Source: JICA team

5.2.3 Trainees

For the OJT of technical transfer, HSDC and JICA invited 35 trainees from 16 cities, who work at companies in charge of sewerage and drainage service in their cities. Their ages ranged between 24 and 52 years old, and their specialties were a variety of Civil, Environmental, Electrical, Irrigation, Forestry, etc. A total of 34 trainees were male and 1 trainee was female. (Refer to Appendix 4)

Figure 5.2.1 Trainers of HSDC

Figure 5.2.2 Trainees (Third Course)

Table 5.2.3 City, number and company of trainees

	City	Number	Company
1st Course	Danang	4	Drainage & Waste Water Treatment Plant
	Hai Phong	2	Sewerage & Drainage Company
	Thanh Hoa	2	Environmental & Urban Works Company
	Son La	2	Urban Environment State-owned Limited Company
2nd Course	Nam Dinh	2	Urban & Environment Company
	Thai Nguyen	2	Urban & Facility Company
	Hai Duong	2	Urban Facility Management Company
	Ha Nam	2	Urban Facility & Environment Company
	Lang Son	2	Water Supply & Drainage Company
3rd Course	HCMC	2	Urban Drainage & Sewerage Limited Company 1 member
	Hue	2	Environment & Urban Facilities Limited Company
	Binh Duong	3	Environmental Drainage & Sewerage Ltd Company 1 member
	Vinh Phuc	2	Environmental Improvement Investment PMB
	Son Tay	2	Urban Facility & Environment Company
	Bac Giang	2	Urban Facilities Management Joint-Stock Company
	Ninh Binh	2	Urban Facilities Management Joint-Stock Company
Total		35	

Source: JICA team

5.2.4 Program

This technical transfer program was set up as a basic course aiming at improvement of trainee's fundamental understanding about the sewerage works. Table 5.2.4 shows the program of the training course. The program consisted of two types, one was desktop training, and another was on-site training.

Table 5.2.4 Training course program

	1st Day	2nd Day	3rd Day	4th Day	5th Day
AM	Opening Ceremony	On-Site @Truc Bach WWTP	On-Site @Kim Lien WWTP	On-Site @North Thang Long WWTP	Piping System
PM	Intro of Sewerage Works	Electrical Equipment & Maintenance	Mechanical Equipment & Maintenance	Water Quality& Sludge Treatment	Closing Ceremony

Source: JICA team

Since the trainers did not have adequate capacity to conduct the technical transfer courses, the study team executed a model for them at the first training course. Based on the study team's role model, the trainers played the part of lecturers at the second and third courses.

The venue of desktop training was at HSDC's assembly hall. In addition to the textbook that the study team prepared (refer to Appendix 5), trainers developed PowerPoint materials for their classes.

On-site training was held at three Waste Water Treatment Plants in Hanoi. The director of each WWTP explained the outline of the facility, and had a question and answer session.

In addition to the training, HSDC held opening and closing ceremonies in each course. At the closing ceremonies, trainees were awarded certificates of course completion.

After finishing all the courses, trainers were also awarded certificates of course completion as a trainer.

Figure 5.2.3 Opening ceremony

Figure 5.2.4 Desktop training

Figure 5.2.5 On-site training

Figure 5.2.6 Closing ceremony

5.2.5 Costs

Table 5.2.5 shows the cost breakdown of each training course. In this study, the cost of the venue is not counted, because the study team obtained the HSDC's assembly hall free of charge. The difference of each total cost mainly depends on transportation. For example, at the second course, all the trainees were from cities neighboring Hanoi, thus the total cost was cheaper than the others. Without taking transportation expense into account, average cost per capita is about VND 3,000,000 or 30 USD. Assuming 1 USD equals VND 20,000, the average cost per capita is about VND 3,600,000 or 180 USD. For the subsequent courses, it is estimated that the cost was about VND 3,600,000 per trainee except for the costs of venue and transportation, based on the actual expenditure for the training courses implemented under this study.

Table 5.2.5 Cost for training courses

Item	Currency	1st course (10 trainees)	2nd course (10 trainees)	3rd course (15 trainees)
Transportation	VND	11,673,000	1,210,000	20,416,000
Hotel Fee	VND	15,510,000	16,500,000	28,300,000
Photocopy	VND	7,469,000	3,810,000	7,312,500
Lunch Fee	VND	2,100,000	1,800,000	1,140,000
Allowance for Trainers	VND	500,000	1,000,000	1,000,000
Allowance for Trainees	VND	4,200,000	4,200,000	6,300,000
Bus Rental	USD	190.2	312.2	419.5
Total Cost	VND	41,452,000	28,520,000	64,468,500
	USD	190.2	312.2	419.5
Total Cost Without Transportation	VND	29,779,000	27,310,000	44,052,500
	USD	190.2	312.2	419.5
Average Cost per capita Without Transportation	VND	2,977,900	2,731,000	2,936,833
	USD	19.0	31.2	28.0

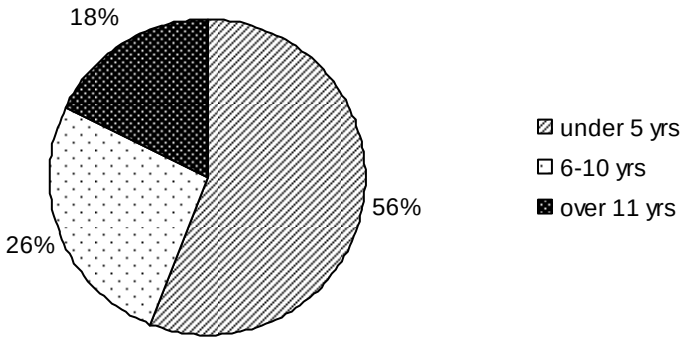
Source: JICA team

5.3 Analysis of Trainees' Questionnaires on Technical Transfer Program

During the training courses, the study team gave a questionnaire survey to the trainees after each lecture every day. The questionnaire data quoted in 2) and 3) is only from the second and third courses. Because the study team played the role of trainers at the first course, the data of the first course should be separated. (Refer to Appendix 6)

5.3.1 Backgrounds

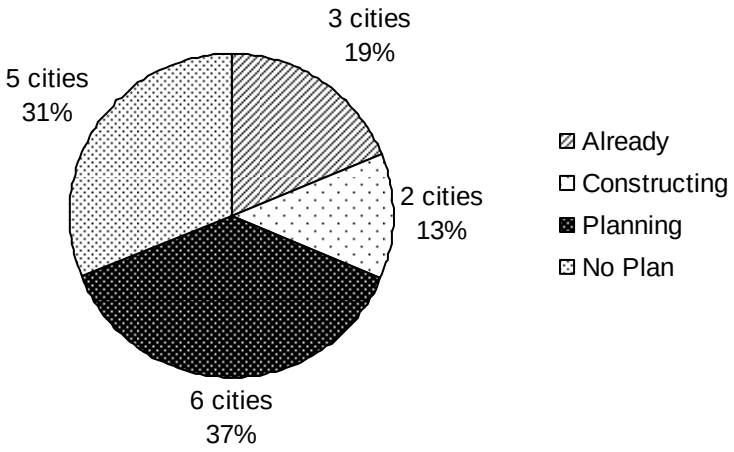
First of all, we were able to learn of their wide variety of background experience. Figure 5.3.1 shows the trainees' work experience at the company in charge of sewerage and drainage service. Over 50 % of them have had less than 5-years experience. A total of 18%, that is, 6 of them have had over 11-years experience. In terms of work experience, beginners and experts were mingled together at a string of courses.



Source: JICA Team

Figure 5.3.1 Trainees' experience in sewerage and drainage

Among the 16 cities invited to send participants to the course, three cities have already introduced WWTP, two are going to be in service soon, and the remaining five cities do not have even a plan for WWTP. Among 35 trainees, 16 trainees had never seen a WWTP until the on-site training. Needless to say, the trainees having WWTP in their cities found it easier to follow the technical transfer program than those who do not have a WWTP. From the efficiency point of view, each training course is recommended to unify the level of trainees based upon the purpose of the course and their knowledge and skill. Otherwise it is very difficult to cover all the levels in the course.



Source: JICA team

Figure 5.3.2 Introduction of WWTP into cities

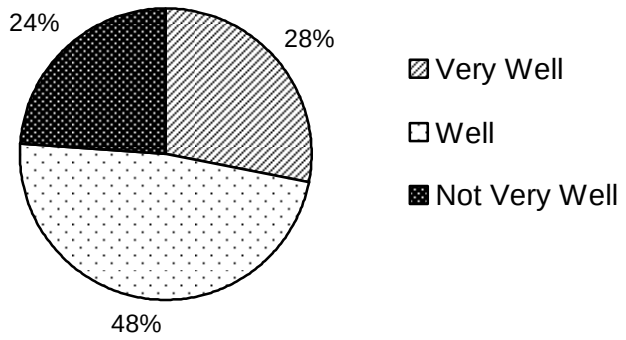
Table 5.3.1 Current standings of introducing WWTP in each city

	City	Introduction of WWTP	In-Service-Year	Capacity (m3/day)
1st Course	Danang	Already	2007	70,000
	Hai Phong	Planned	2014	40,000
	Thanh Hoa	No Plan	-	-
	Son La	Planned	2015	-
2nd Course	Nam Dinh	No Plan	-	-
	Thai Nguyen	No Plan	-	-
	Hai Duong	Constructing	2011	-
	Ha Nam	Constructing	2012	5,000
	Lang Son	No Plan	-	-
3rd Course	HCMC	Already	2006	30,000+141,000
	Hue	Planned	2020	-
	Binh Duong	Planned	2014	70,600
	Vinh Phuc	Planned	2015	5,000
	Son Tay	Planning	-	-
	Bac Giang	Already	2010	10,000
	Ninh Binh	No Plan	-	-

Source: JICA team

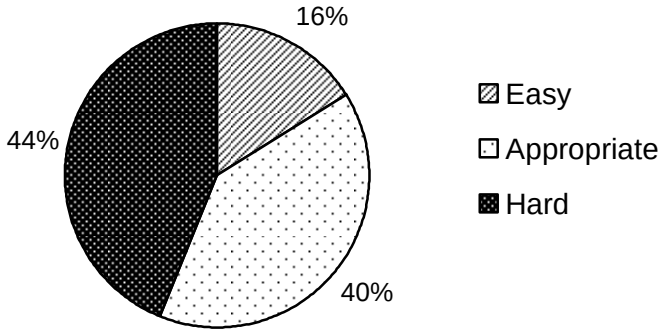
5.3.2 Understandings

As shown in Figures 5.3.3 and 5.3.4, three fourths of the trainees understood the contents of the course “well” or “very well”. However, at the same time, 44% of them thought of the course was “Hard”. In particular, all the trainees at the second course answered that this course was “Hard” to follow. This is understandable because no one at the second course was familiar with wastewater engineering or WWTPs, besides 6 out of 10 trainees never planned a sewerage system in their cities. According to the above results, the efficiencies of the program are influenced by the trainee’s knowledge and experience with sewerage; in other words, the technical training program should have several grades according to the trainees' ability.



Source: JICA team

Figure 5.3.3 Trainees' understanding (2nd and 3rd courses)



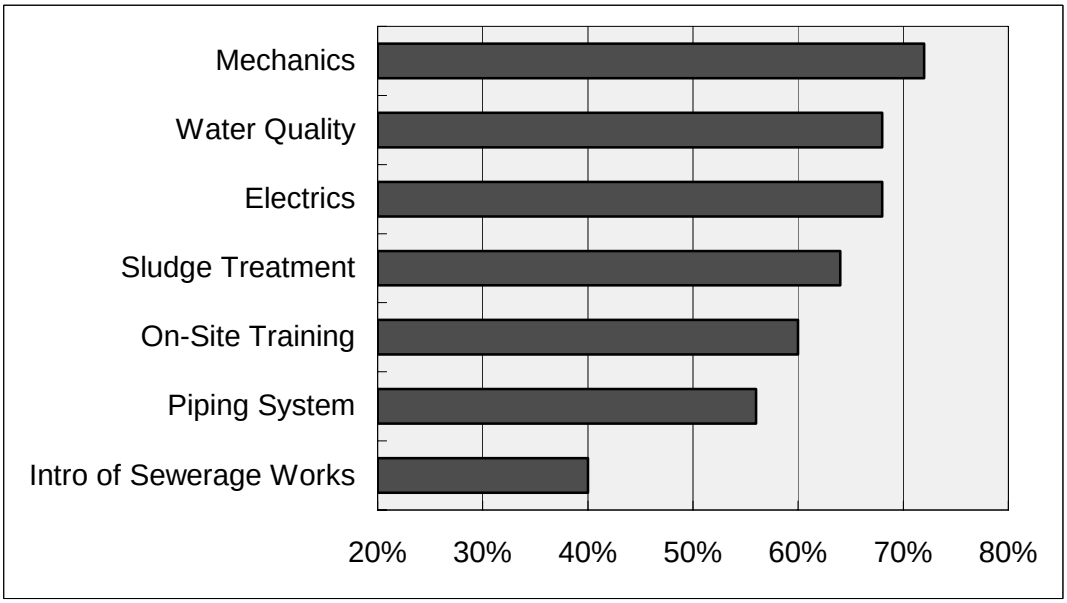
Source: JICA team

Figure 5.3.4 Level of the course (2nd and 3rd courses)

5.3.3 Interests

Figure 5.3.5 shows the trainees' interests in the technical training program. Regardless of their understanding, the trainees mainly had interests regarding mechanics, water quality, and electronics, which are directly relating to their current jobs.

In contrast, piping systems and introduction of sewerage works were not in their interest because these topics are general and theoretical, and not directly related to their jobs. In addition, this might be affected by a lack of trainer's skill for making the course attractive for trainees.



Source: JICA Team

Figure 5.3.5 Topics of interest for trainees (2nd and 3rd courses)

It is necessary to hold practical classes, which are directly linked with their current jobs. But at the same time, it is also needed to provide wastewater engineering theory to make their knowledge complete. The training courses should maintain a balance between practical and theoretical.

5.3.4 Suggestions from Trainees

Through the answers in the questionnaires, the trainees frankly commented regarding their impressions about the technical transfer courses. Their suggestions are mixture of positive impressions and negative impressions. For simplifying, the suggestions are categorized into three parts as follows;

(1) Clearness

- ✓ Topics should be concentrated in the O&M of the sewerage facilities as the purpose of these training courses.
- ✓ The topics of the lectures were not clear because the trainees did not have in-depth understanding about the sewerage treatment procedures.

(2) Curriculum

- ✓ Training for management and operation should be separated for easy focus.
- ✓ The time was too short, not enough time to discuss further issues.
- ✓ Training course should be longer and more organized.

(3) Ingenuity

- ✓ It would be more interesting if there were more images, data, and solutions relating to current issues of Hanoi and other cities in Vietnam.
- ✓ Handouts should be delivered to trainees before every lecture.

This technical transfer program was prepared at a basic level to provide fundamental knowledge of the sewerage works to the unskilled O&M staff. Contrary to the aim of the course, the interests of trainees leaned to the topics relating to their jobs. However, in order to operate the sewerage systems properly, persons concerned shall, once at least, pass through the basic course because basic knowledge of sewerage works would improve their capabilities in the O&M works. The courses beyond than the basic level may require a more specified program to suit for a specified purpose.

5.4 Analysis of Trainers' Questionnaires and Interviews on Technical Transfer Program

Concerning the trainers, the study team conducted not only a questionnaire survey but also interviews with them. Here is the summary of the survey. (Refer to Appendix 7)

5.4.1 A Sense of Accomplishment

All the trainers had a sense of accomplishment after all the courses were completed according to the questionnaire. All of them replied "Mostly I have done well", against the question "Do you think you have done well as a trainer?" This is a welcome reply without concern for the results.

5.4.2 Trainers' Difficulties

Judging from the questionnaire and interviews, trainers felt that there were the following difficulties;

- The first one is their lack of training ability since this was their first experience to be a trainer. They need to improve qualities of presentation, materials, manners of speech, and questions and answers.
- The second one is limitations of their knowledge about the sewerage facilities. Because the trainers only know about the facilities in Hanoi, it is difficult for them to cope with different facilities in other cities such as HCMC or Danang.

- The third one is preparation for their lectures regarding topics outside of their specialties. They understood the needs for further preparation, but they could not spare enough time to prepare because of their daily jobs.

5.4.3 Trainees' Interests

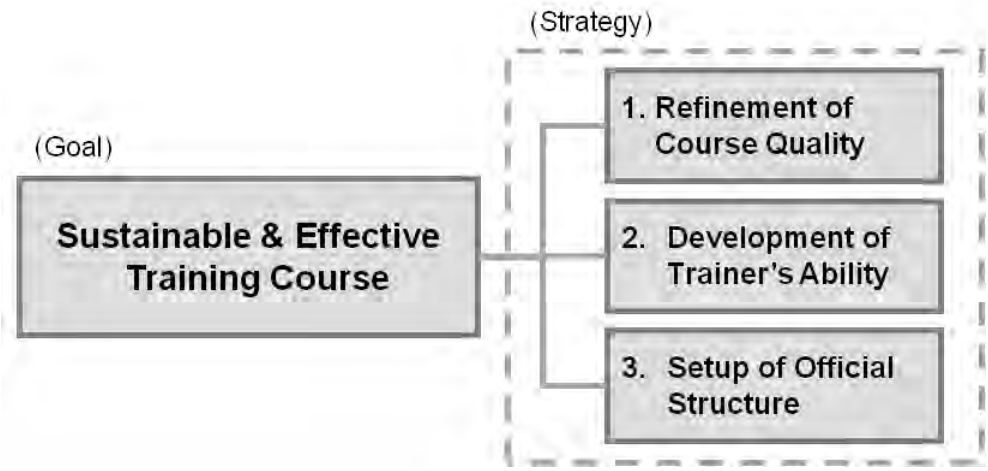
According to the trainers, trainees' major interests focus only on matters closely linked with their jobs. However, meeting trainees' demands is not always important, and the trainees' understanding of the purpose and level of the courses are more essential.

5.4.4 Will to Continue as a Trainer

According to the interviews, all the trainers were willing to continue as trainers for the following training courses. To change the trainers in every course would bring inefficiency in terms of fostering or enhancing trainers' abilities. It might be necessary to give them a firm commitment of HSDC's support to make them motivated as trainers.

5.5 Advice for Sustainable & Effective Technical Transfer Programs

On the basis of analysis of the questionnaire, the study team advises to adopt following strategies in order to implement sustainable and effective training courses.



Source: JICA team

Figure 5.5.1 Image of goal and strategies

5.5.1 Refinement of Course Quality and Development of Trainer's Capacity

The quality of the technical transfer courses is composed of various factors such as comprehensibility, practicability, affordability, etc. Levels of such factors will be depending upon the purpose of the course. The courses conducted under this study were targeted at a basic level, and most of the contents were referred to only within HSDC's current jobs. Hence the quality improvement or extension of the courses shall accompany the HSDC trainers' break-through into advanced fields. For HSDC trainers' break-through over current capacity, it is recommendable to commence from trail runs under JICA assistance. As for the advanced courses, training materials used by the Japanese organization can be a prototype for Vietnam.

5.5.2 Setup of Official Structure

Not only the trainers' efforts, but also the support of Hanoi City or the State is also needed for sustainable training courses. If the training courses are established as an institution by Hanoi City or the State, there would be many advantages in terms of budget, facilities, workforce, and so on.

Required budget covers transportation, accommodation, and per-diem for trainees, remuneration for trainers and coordination staff, set-up of lecture places, training materials, on-site training costs, certificates, etc. Based on the courses conducted under this study VND 3,600,000 per trainee was spent omitting the costs of lecture place set-up and transportation.

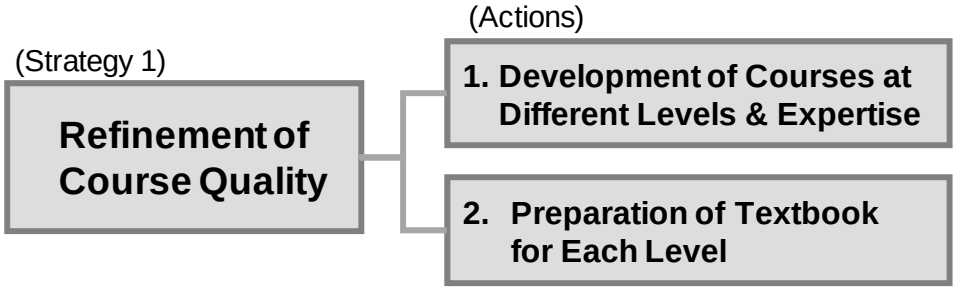
Required facilities are places for the lectures, training materials, presentation equipment, materials for practice such as water quality tests, mechanical & electrical instruments for inspection, safety goods for on-site training, etc.

In addition, coordination staff is required for total arrangement of the course and control of budget.

5.6 Technical Transfer to Other Provinces

There are three strategies to adopt for the implementation of sustainable and effective technical transfer programs. The strategies are 1) Refinement of Course Quality, 2) Development of Trainers' Ability, and 3) Setup of Official Structure. Here the study team suggests actions to be taken along with each strategy.

5.6.1 Actions for Refinement of Course Quality

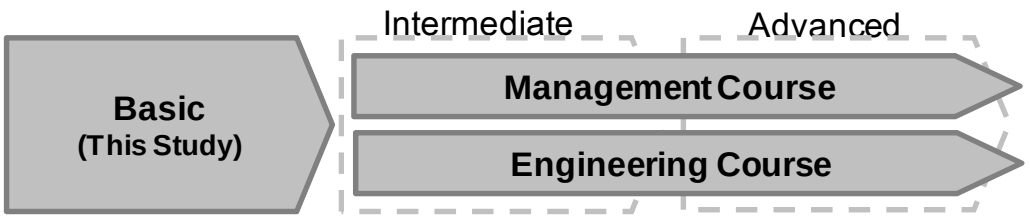


Source: JICA team

Figure 5.6.1 Actions for refinement of course quality

1) Developing courses at different levels

Since trainers tried to cover various levels of trainees, the topics of the courses in this study became unclear. To make the topics specific, it is effective to develop courses by levels and expertise of trainee like Figure 5.6.2. If the courses in this study are regarded as “Basic”, it will be fine to be general. However, for “Intermediate” and “Advanced” courses, it would be better to separate the trainees by expertise like “Management” and “Engineering”. The higher the level becomes, the more specific the topics should be.



Source: JICA team

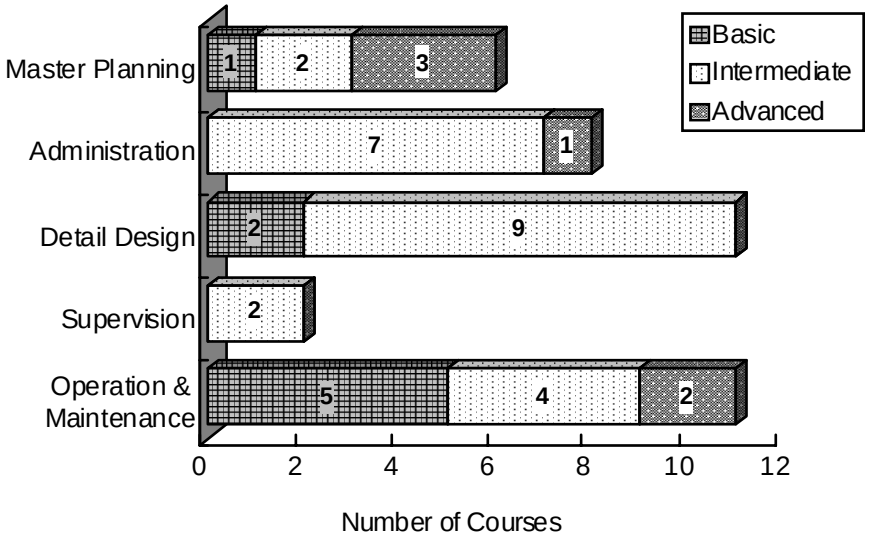
Figure 5.6.2 Image of course development

For example, the Japanese training system is managed by the Japan Sewage Works Agency (JSWA) which has been established through local governments' funds to

support the local governments in engineering and management. The courses of JSWA are prepared by level and expertise of participating trainees.

As well as the JWSA courses, subsequent training courses also need to set some criteria to classify the trainees. When inviting the trainees, it should be clarified to trainees the purpose of the course and eligibility for participation along with the criteria such as experience and qualification. By doing this, the levels of trainees will be unified to some degree, and the courses will be more effective and efficient.

Figure 5.6.3 shows the plan of JSWA's training courses in 2010.



Source: Website of Japan Sewage Works Agency

Figure 5.6.3 Training courses of Japan Sewage Works Agency (2010)

2) Preparation of textbooks for each level

Needless to say, it is necessary to prepare the textbooks in accordance with development of the courses by level and expertise. As well as the contents of the course, the textbooks also need to improve step by step.

5.6.2 Actions for Development of Trainer's Ability

Source: JICA team

Figure 5.6.4 Actions for development of trainer's ability

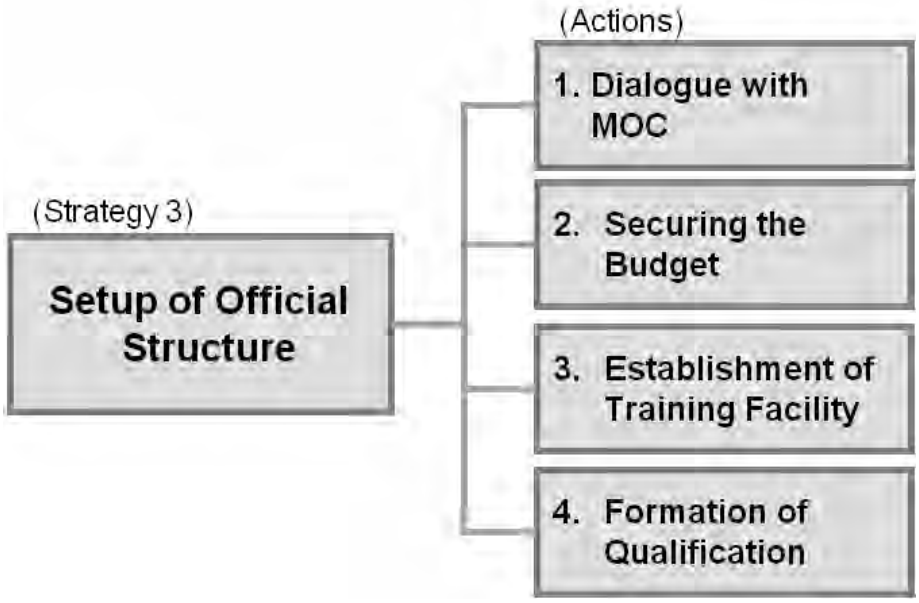
1) Development of training skill

This study was the first time for HSDC staff to train other people. In order to increase efficiency of the courses, the trainers should take coaching classes to their increase their skill, particularly presentation skill. A university or academic institution for business consultants may be helpful for HSDC trainers to improve presentation manner, question and answer, time keeping, and making attractive handout materials.

2) Enhancement of expertise

HSDC trainers' expertise of the sewerage system is limited to those topics found within the facilities in Hanoi. In order to cover other types of sewerage systems in other cities in the courses, they have to learn other treatment methods. Additionally they have to deepen their present expertise. There are two approaches to enhance their expertise. One is to send them to a foreign company or an organization where they can learn cutting-edge knowledge of sewerage works. Another is to hire a foreign consultant who has enough knowledge and experience to train the trainers as a model for the trainers.

5.6.3 Actions for Setup of Official Structure



Source: JICA team

Figure 5.6.5 Actions for setup of official structure

1) Dialogue with MOC on overall policy and framework

Before thinking about the official support for the sustainable training course, it would be necessary for Hanoi City to dialogue with Ministry of Construction (MOC) on the overall policy and framework of training for sewerage works. Especially the role of HSDC is to be discussed. It is suggested that Hanoi City should obtain JICA adviser's support for the policy-making on this issue.

2) Securing the budget

Budget for the courses is one of the most important matters for the continuous implementation of the training courses. Based on the training courses in this JICA study, the cost of the training course was about VND 3,600,000 per trainee except for transportation and venue cost. Taking into account continuity of the training courses, it is unrealistic to always expect the government subsidy or ODA funds for the training courses. One of the solutions is to build up the structure to collect the training fee from the trainee's company. The contents of the courses shall be worth the fee.

3) Training center

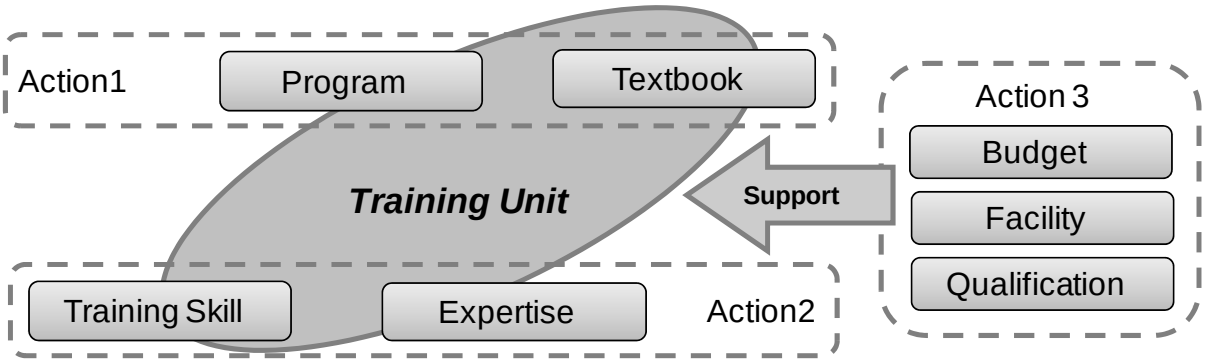
When the training courses are held regularly, a training center, permanently set up for the training course, will be required.

4) Formation of qualification

In order to bring many trainees into the course, it will be effective to issue the certificates of O&M training linked with the trainees' authorized qualification. The organization to authorize the certificate is assumed to be either Hanoi City or MOC. By making the qualification prestigious, it might be easier to collect the training fee from the trainees.

5.6.4 Establishment of Training Unit

In order to carry out the actions above, it would be productive to create a training unit. This unit will generate the synergetic effects on action 1 and 2 because improvement of course quality and development of trainer's ability have something to do with each other. Action 3 will help the activity of the training unit through official support. Figure 5.6.6 shows the image of the relationship between the various actions.



Source: JICA team

Figure 5.6.6 Image of training unit

For instance in Japan, the Japan Sewage Works Agency (JSWA) is the core organization of the training unit in Japan. As well as implementation of training courses, the functions of JSWA are "technical support", "supervision of planning, design, and construction enforcement", and "research and technology development". JSWA might be one of references for future Vietnam system to improve the sewerage skills.

5.6.5 Benefits of Training Courses

Promising benefits of the training courses are as follows.

1) Benefits for HSDC

Implementation of the training courses will contribute to improvement of HSDC trainers' skills in their own jobs and also with standardization of O&M works. In

addition, the quality of O&M will be improved through the discussions with O&M staff of other cities during the training courses.

2) Benefits for the entire State

Mutual support between cities in aspects of engineering and management are supposed to be of benefit for the entire State by accumulating expertise through the training courses such as sewerage planning, construction, O&M and management. Moreover, it enables the promotion of public awareness of sewerage services and public concern about the environment. As a symbol of water environment improvement of Vietnam, it is recommendable to establish a training center with function of O&M skill improvement for operators and enhance environmental education to the public.

APPENDICES

Appendix 1 Diagnosis Results

1) Kim Lien WWTP Mechanical Instrument Check Sheet

2) Kim Lien Relay Pumping Station Mechanical Instrument Check Sheet

3) Kim Lien WWTP Electric/Control Instrument Check Sheet

4) Truc Bach WWTP Mechanical Instrument Check Sheet

5) Truc Bach WWTP Electric/Control Instrument Check Sheet

6) North Thang Long WWTP Mechanical Instrument Check Sheet

7) North Thang Long WWTP Electric/Control Instrument Check Sheet

Mechanical Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
1	GRIT AND SCREENING REMOVAL FACILITY	KGC1A	GC Inlet Gate	B	L O	G	N	N	N	N			15					
2	GRIT AND SCREENING REMOVAL FACILITY	KGC1B	GC Inlet Gate	B	L O	G	N	N	N	N			15					
3	GRIT AND SCREENING REMOVAL FACILITY	KGC2A	GC Coarse Screen	B	L O	G	N	N	N	N			15					rake deformation grease run down for chain
4	GRIT AND SCREENING REMOVAL FACILITY	KGC2B	GC Coarse Screen	B	L O	G	N	N	N	N			15					rake deformation grease run down for chain
5	GRIT AND SCREENING REMOVAL FACILITY	KGC3A	GC Fine Screen	A	L O	G	N	N	N	N	G	G	15			39		0.4kW
6	GRIT AND SCREENING REMOVAL FACILITY	KGC3B	GC Fine Screen	A	L O	G	N	N	N	N	G	G	15	0.7		37		0.4kW
7	GRIT AND SCREENING REMOVAL FACILITY	KGC4A	Grit pump	A	S O	N		N	N	N	G		15	5.8	0.05			3.7kW dischage hose pipe damaged
8	GRIT AND SCREENING REMOVAL FACILITY	KGC4B	Grit pump	A	S O	N		N	N	N	G		15		×			3.7kW discharge pressure gauge broken
9	GRIT AND SCREENING REMOVAL FACILITY	KGC5	Grit Separator	B	L O	N		N	N	N	G	N	15	0.9		40		
10	GRIT AND SCREENING REMOVAL FACILITY	KGC6	GC lifting Equipment for pumps	C	L O			N	N	N			20					rust hook, rust chain
11	GRIT AND SCREENING REMOVAL FACILITY	KGC7A	GC Screenings Bin	C	L O			G	N	N			15					
12	GRIT AND SCREENING REMOVAL FACILITY	KGC7B	GC Screenings Bin	C	L O			G	N	N			15					

Mechanical Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
13	GRIT AND SCREENING REMOVAL FACILITY	KGC7C	GC Screenings Bin	C	L O			G	N	N			15					
14	GRIT AND SCREENING REMOVAL FACILITY	KGC8A	Grit Bin	C	L O			N	N	N			15					rust
15	GRIT AND SCREENING REMOVAL FACILITY	KGC8B	Grit Bin	C	L O			N	N	N			15					rust
16	EQUALIZATION TANK	KET1A	ET Inlet Gate	B	L O	G	N	N	N	N			15					
17	EQUALIZATION TANK	KET1B	ET Inlet Gate	B	L O	G	N	N	N	N			15					
18	EQUALIZATION TANK	KET2A	ET Outlet Gate	B	L O	G	N	N	N	N			15					
19	EQUALIZATION TANK	KET2B	ET Outlet Gate	B	L O	G	N	N	N	N			15					
20	EQUALIZATION TANK	KET3A	ET Agitator	A	S O	G		N	N	N	N		10	4.8				rust chain stopper
21	EQUALIZATION TANK	KET3B	ET Agitator	A	S O	G		N	N	N	N		10	4.7				rust chain stopper
22	EQUALIZATION TANK	KET4A	ET Transfer pump	A	S O	G		N	N	N	N		15	11.2	0.17			7.5kW
23	EQUALIZATION TANK	KET4B	ET Transfer pump	A	S O			N	N	N			15					7.5kW
24	EQUALIZATION TANK	KET4C	ET Transfer pump	A	S O	G		N	N	N	N		15	11.3	0.15			7.5kW

Mechanical Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
25	EQUALIZATION TANK	KET5	ET lifting Equipment for pumps	C	L O			N	N	N			20					rust hook, rust chain
26	PRIMARY SETTLING TANK	KPS1	PST Sludge Scraper	A	L O	N	N	N	N	N	B	B	15	0.8		53		0.4kW noise (moter opposite load side)
27	PRIMARY SETTLING TANK	KPS2A	PST Sludge pump	A	L O	G		N	N	N	G	N	15		0.07	34		0.75kW rust around gland-packing, deteriorated
28	PRIMARY SETTLING TANK	KPS2B	PST Sludge pump	A	L O	G		N	N	N	G	N	15		0.06	35		0.75kW rust around gland-packing, deteriorated
29	PRIMARY SETTLING TANK	KPS3	PST Scum pump	A	S O			N	N	N			15					0.75kW
30	PRIMARY SETTLING TANK	KPS4	PST Scum Box	C	L O			N	N	G			15					box broken partly
31	PRIMARY SETTLING TANK	KRT1	Reactor Fine Screen	B	L O	G	N	N	N	N	G	G	15	0.7		50		0.4kW
32	REACTOR	KRT3A	Anaerobic Mixer	A	S O								15	5.4				2.2kW pit cover fixed (open impossibly)
33	REACTOR	KRT3B	Anaerobic Mixer	A	S O	G		G	N	N	G		15	5.6				2.2kW
34	REACTOR	KRT4A	Anoxic Mixer	A	S O	G		G	N	N	G		15	9.7				3.7kW
35	REACTOR	KRT4B	Anoxic Mixer	A	S O	G		G	N	N	G		15	9.4				3.7kW
36	REACTOR	KRT5A	Aeration Aerator	A	S O								15	12.9				7.5kW pit cover fixed (open impossibly)

Mechanical Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
37	REACTOR	KRT5B	Aeration Aerator	A	S O								15	12.7				7.5kW pit cover fixed (open impossibly)
38	REACTOR	KRT6	Carrier	C														
39	REACTOR	KRT7A	Aeration Tank Screen	B	S O			G	G	G			15					
40	REACTOR	KRT7B	Aeration Tank Screen	B	S O			G	G	G			15					
41	REACTOR	KRT8A	Recirculation pump	A	S O			G	N	N	G		15	8.9	0.04			5.5kW pit cover fixed (open impossibly)
42	REACTOR	KRT8B	Recirculation pump	A	S O			G	N	N	G		15	9.1	0.04			5.5kW pit cover fixed (open impossibly)
43	REACTOR	KRT9A	Lifting Equipment for Mixer	C	L O			N	N	N			20					
44	REACTOR	KRT10	Lifting Equipment for pumps	C	L O			N	N	N			20					
45	REACTOR	KRT12A	Overflow Weir	C														pit cover fixed (open impossibly)
46	REACTOR	KRT12B	Overflow Weir	C														pit cover fixed (open impossibly)
47	REACTOR	KRT13A	Screenings Bin	C	L O			G	N	N			15					
48	REACTOR	KRT13B	Screenings Bin	C	L O			G	N	N			15					

Mechanical Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
49	FINAL SETTLING TANK	KRT14	Coagulant Storage Tank	B	L I			G	G	G			15					
50	FINAL SETTLING TANK	KRT15A	Coagulant Dosing pump	B	L I	G	N	N	N	N	G	G	15			40		0.2kW
51	FINAL SETTLING TANK	KRT15B	Coagulant Dosing pump	B	L I	G	N	N	N	N	G	G	15			40		0.2kW
52	FINAL SETTLING TANK	KFS1A	FST Sludge Scraper	A	L O	G	N	N	N	N	G	N	15	0.7		55		0.4kW
53	FINAL SETTLING TANK	KFS1B	FST Sludge Scraper	A	L O	G	N	N	N	N	G	N	15	0.7		55		0.4kW
54	FINAL SETTLING TANK	KFS2A	Return Sludge pump	A	L O		N	N	N	N		N	15					3.7kW gland packing replacement is necessary
55	FINAL SETTLING TANK	KFS2B	Return Sludge pump	A	L O	G	N	N	N	N	G	N	15	5.2	0.12	46		3.7kW
56	FINAL SETTLING TANK	KFS2C	Return Sludge pump	A	L O	G	N	N	N	N	G	N	15	5.3	0.1	47		3.7kW
57	FINAL SETTLING TANK	KFS3	FST scum pump	A	S O			N	N	N			15					0.75kW
58	FINAL SETTLING TANK	KFS4A	WAS Control Valve	B	L O	G		G	N	N	G	G	15					0.2kW
59	FINAL SETTLING TANK	KFS4B	WAS Control Valve	B	L O	G		G	N	N	G	G	15					0.2kW
60	DISINFECTION TANK	KCT1	NaOC l Storage Tank	C	L I			G	G	G			10					

Mechanical Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
61	DISINFECTION TANK	KCT2A	NaOC l Dosing p ump	B	L I	G	N	N	N	N	G	G	15			42		0.2kW
62	DISINFECTION TANK	KCT2B	NaOC l Dosing p ump	B	L I	G	N	N	N	N	G	G	15			42		0.2kW
63	SLUDGE THICKENER	KST1	Thickened sludge scraper	A	L O	G		G	N	N	G	G	15			48		0.4kW
64	SLUDGE THICKENER	KST2A	Thickened sludge pump	A	L I	G		N	N	N	N	G	15		0.08	49		0.75kW rust gland packing partly
65	SLUDGE TREATMENT	KDH1	Dehydrator	A	L I	G	N	N	N	N	G	N	15	2.7				0.75kW
66	SLUDGE TREATMENT	KDH2	Coagulator	A	L I	G	N	N	N	N	G	G	15					1.5kW
67	SLUDGE TREATMENT	KDH3	Sluge Cake Hopper	B	L I	G	N	N	N	N	G	G	15					1.5kW×2
68	SLUDGE TREATMENT	KDH4	Polymer Tank	B	L I			G	N	N			15					
69	SLUDGE TREATMENT	KDH5	Polymer Tank Agitator	C	L I			N	N	N	G	G	15					1.5kW
70	SLUDGE TREATMENT	KDH6	Polymer Feeder	B	L I			N	N	N			15					
71	SLUDGE TREATMENT	KDH7A	Polymer Dosing pump	B	L I	G		N	N	N	G	G	15	1.0				0.75kW
72	SLUDGE TREATMENT	KDH8A	Sluge Feeding pump	A	L I	G		G	N	N	G	G	15	1.9	0.35	38		2.2kW

Mechanical Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
73	SLUDGE TREATMENT	KDH9	Dehydrator room drainage pump	A	S I			N	N	N			10					0.75kW
74	SLUDGE TREATMENT	KDH11	Booster pump	B	L I	G		G	N	N	G	G	15	1.6	0.38			1.5kW
75	SLUDGE TREATMENT	KDH12	BackWash Valve	C	L I			G	N	N			15					0.1kW
76	FILTRATE RETURN PUMP	KFP1A	Filtrate Return pump	B	S O	G		N	N	N	G			2.8				1.5kW
77	FILTRATE RETURN PUMP	KFP1B	Filtrate Return pump	B	S O	G		N	N	N	G			2.9	0.6			1.5kW
78	FILTRATE RETURN PUMP	KFP2	Scum Screen	C														
79	BLOWER	KBW1A	Aeration Blower	S	L I	G	N	N	N	N	N	N	20	35	0.092	74	○	22kW Vibration checking: refer other sheet
80	BLOWER	KBW1B	Aeration Blower	S	L I	G	N	N	N	N	N	N	20	43	0.068	42	○	22kW Vibration checking: refer other sheet
81	BLOWER	KBW1C	Aeration Blower	S	L I	G	N	N	N	N	N	N	20	40	0.083	40	○	22kW Vibration checking: refer other sheet
82	WATER SUPPLY UNIT	KWS1A	Recyle Water pump	B	S O			G	N	N			15					3.7kW
83	WATER SUPPLY UNIT	KWS1B	Recyle Water pump	B	S O	G		G	N	N	G		15		0.23			3.7kW
84	WATER SUPPLY UNIT	KWS2A	Recyle Water strainer	B	L O			N	N	N			20					

Mechanical Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
85	WATER SUPPLY UNIT	KWS2B	Recyle Water strainer	B	L O			N	N	N			20					
86	WATER SUPPLY UNIT	KWS3	Potabie Water Supply Unit	B	L I			N	N	N			15					
87	WATER SUPPLY UNIT	KWS3	Potabie Water Supply pump	B	L I			N	N	N		N	15					1.5kW
88	WATER SUPPLY UNIT	KWS3	Potabie Water Supply pump	B	L I			N	N	N		N	15					1.5kW
89	WATER SUPPLY UNIT	KWS4	Potabie Water Tank	B	L O			N	N	N			15					
90	DEODORIZION SYSTEM	KDS1	Deodorizer with activated carbon & accessories	B	L O			N	N	N			10		×			manometer malfunction
91	DEODORIZION SYSTEM	KDS2	Odor Extraction Fan	A	L I	G	N	N	N	N	G	N	10			58		5.5kW
92	DEODORIZION SYSTEM	KDS3	Eliminator	C	L I			G	G	G								routine checking of the inside is necessary
93	DEODORIZION SYSTEM	KDS4	Lifting Equipment for Deodorizer	C	L O			N	N	N			20					
94	EMERGENCY POWER SUPPLY SYSTEM	KEP1	Generator	B	L I			G	G	G			15					75kVA
95	EMERGENCY POWER SUPPLY SYSTEM	KEP2	Oil Tank	B	L O			N	N	G			15					700ℓ
96	EMERGENCY POWER SUPPLY SYSTEM	KEP3	Oil pump	A									15					0.2kW

Mechanical Instrument Check Sheet

Facility Name : Kim Lien Relay Pumping Station

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
1	PUMPING STATION	KLP1A	Transfer pump	S	LI	G	N	G	N	N	G	G	15	36	×	54		22kW discharge pressure gauge broken
2	PUMPING STATION	KLP1B	Transfer pump	S	LI		N	G	N	N		G	15					22kW
3	PUMPING STATION	KLP1C	Transfer pump	S	LI		N	G	N	N		G	15					22kW
4	PUMPING STATION	KLP2	Drainage pump	A	S I			N	N	N			10					0.75kW
5	PUMPING STATION		Inlet Screen	C	S I			N	N	N			15					danger to be fallen down
6	EMERGENCY POWER SUPPLY SYSTEM	KLP3	Generator	B	LI			G	G				15					120kVA Generator maintenance door locked
7	EMERGENCY POWER SUPPLY SYSTEM	KLP7	Deodorizer for pump Station	B	L I	G	N	N	N	N	G	N	15					manometer maintenance is necessary
8	EMERGENCY POWER SUPPLY SYSTEM	KLP8	Eliminator for pump Station	B	L I			G	G	G								periodic cleaning up is necessary

Electric/Control Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
1	Electric instrument	LP-1	Local Control Panel	A	O	N	G	G	G	N									no maintenance space on back side
2	Electric instrument	LP-2	Local Control Panel	A	O	N	G	G	G	N									
3	Electric instrument	LP-3	Local Control Panel	A	O	N	G	G	G	N									
4	Electric instrument	LP-4	Local Control Panel	A	I	N	G	G	G	N									
5	Electric instrument	LP-5	Local Control Panel	A	O	G	G	G	G										
6	Electric instrument	LP-6	Local Control Panel	A	I	G	G	G	G	N	G								
7	Electric instrument	LP-7	Local Control Panel	A	I	G	G	G	G	N									
8	Electric instrument	SVP	Supervisory Panel	S	I	N	G	G	G		G			220	29.4	87			a lot of dust in the panel
9	Electric instrument		Emergency Generator	A	I	X	X	X	X	X	X								No space for maitenance (chemical bags)
10	Electric instrument	LTDP	L/T Distribution Panel	S	I	N	G	G	G		G			392	29.6	131			a lot of dust in the panel
11	Electric instrument	LP-KDH1	DRPP-1500 Control Panel	A	I	B	G	G	G										rust mark in the panel
12	Electric instrument	PS-LTDP	Low Tension Distribution Panel	A	I	G	G	G	N/B	G	G								black cable core color by Hydrogen Sulphide(H_2S)

Electric/Control Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
13	Electric instrument	KLP3	Monitroing Control Panel (Generator)	A	I	G	G	G	G	G	G								
14	Control Instrument	K-LS1	Kim Lien PS Level (float level switch)	A	I	B	B	B	N										worry of short failure (becase of condensation)
15	Control Instrument	K-LS2	Equalization Tank Level (float level switch)	A	O	G	G	G	G										name plate is unreadable by much paiting
16	Control Instrument	K-LS3	PST Scum Pit Level (float level switch)	A	O	N	B	X	N										cover is firmly fixed by much painting
17	Control Instrument	K-LS4A	Reactor Level (float level switch)	A	O	G	G	G	G										
18	Control Instrument	K-LS4B	Reactor Level (float level switch)	A	O	G	G	G	G										
19	Control Instrument	K-LS5	FST Scum Pit Level (float level switch)	A	O	N	N	G	G										cable cover is broken
20	Control Instrument	K-LS6	NaClO Storage Tank Level (electrode level switch)	A	I	N	N	X	N										couldn't open the box connector has rust a little
21	Control Instrument	K-LS7	Sludge Reservoir Level (float level switch)	A	O	N	N	G	N										name plate is unreadable by much paiting
22	Control Instrument	K-LS8	Polymer Tank Level (electrode level switch)	A	I	N	N	N	N										no terminal cover
23	Control Instrument	K-LS9	Dehydrator Room Drainage Tank Level(float LS)	A	I	N	N	X	X										couldn't reach the connector box
24	Control Instrument	K-LS10	Filtrate Return Pit Level (float level switch)	A	O	N	N	X	X										couldn't open the connector box by much painting

Electric/Control Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
25	Control Instrument	K-LS11	Recycle Water Pit Level (float level switch)	A	O	N	N	X	N										
26	Control Instrument	K-LS12	Coagurant Storage Tank Level (electrode LS)	A	I	N	N	X	N										couldn't open the connector box
27	Control Instrument	K-LIA1	Equalization Tank Level (ultrasonic level sensor)	A	O	G	G		G		G								
28	Control Instrument	K-FI1	Grit Chamber Air Flow (manometer)	A	O	B	B				B								almost broken, rust a lot, water leak
29	Control Instrument	K-FI3A	Recirculation Pump Flow (magnetic flow meter)	A	O	G	G	X	G		G								
30	Control Instrument	K-FI3B	Recirculation Pump Flow (magnetic flow meter)	A	O	G	G	X	G		G								
31	Control Instrument	K-FI4	Effluent Flow (堰式流量計 weir flow meter?)	A	O	G	G				G								
32	Control Instrument	K-FI5A	Reactor Air Flow (manometer)	A	O	B	B				B								almost broken, rust a lot
33	Control Instrument	K-FI5B	Reactor Air Flow (manometer)	A	O	B	B				B								almost broken, rust a lot
34	Control Instrument	K-FIQR4	ET Transfer Pump Flow (magnetic flow meter)	A	O	N	N	X	N		G								
35	Control Instrument	K-FIQ1	PST Sludge Flow (magnetic flow meter)	A	O	N	N	X	N		G								
36	Control Instrument	K-FIQ2	WAS Flow (magnetic flow meter)	A	O	N	N	X	N		G								

Electric/Control Instrument Check Sheet

Facility Name : Kim Lien WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
37	Control Instrument	K-DOI1A	Reactor DO	A	O	G	G	X	N		G								
38	Control Instrument	K-DOI1B	Reactor DO	A	O	G	G	X	N		G								

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
1	PUMP STATION	TBP1A	TB Transfer pump	A	SO	G		G	N	N	G		15	8.9				5.5kW
2	PUMP STATION	TBP1B	TB Transfer pump	A	SO	N		G	B	N	N		15	8.8	×			5.5kW lack of guide rail
3	PUMP STATION	TBP1C	TB Transfer pump	A	SO			G	N	N			15					5.5kW
4	PUMP STATION	TBP2	LIfting Equipment	C	LO								20					
5	PUMP STATION	TBP3A	Screenings Bucket	C	LO								15					
6	PUMP STATION	TBP3B	Screenings Bucket	C	LO								15					
7	GRIT AND SCREENING REMOVAL FACILITY	TGC1A	GC Inlet gate	B		G	N	N	N	N			15					
8	GRIT AND SCREENING REMOVAL FACILITY	TGC1B	GC Inlet gate	B		G	N	N	N	N			15					
9	GRIT AND SCREENING REMOVAL FACILITY	TGC2A	GC Coarse Screen	B		G	N	G	N	N			15					chain grease run down
10	GRIT AND SCREENING REMOVAL FACILITY	TGC2B	GC Coarse Screen	B		G	N	G	N	N			15					chain grease run down
11	GRIT AND SCREENING REMOVAL FACILITY	TGC3A	GC Fine Screen	A			N	G	N	N		G	15					0.2kW chain grease run down
12	GRIT AND SCREENING REMOVAL FACILITY	TGC3B	GC Fine Screen	A		G	N	G	N	N	G	G	15	0.7		55		0.2kW rake deformation, chain grease run down

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
13	GRIT AND SCREENING REMOVAL FACILITY	TGC4A	Grit Pump	A	SO			B	N	N			15					3.7kW rust ladder (pit), rust pit cover
14	GRIT AND SCREENING REMOVAL FACILITY	TGC4B	Grit Pump	A	SO	G		B	N	N	G		15	5.8				3.7kW rust ladder (pit), rust pit cover
15	GRIT AND SCREENING REMOVAL FACILITY	TGC5	Grit Separator	B	LO	G	N	N	N	N	G	N	15	0.9				2.2kW rust shaft
16	GRIT AND SCREENING REMOVAL FACILITY	TGC6	GC LIfting Equipment for pumps	C	LO			N	N	N			20					
17	GRIT AND SCREENING REMOVAL FACILITY	TGC7A	GC Screenings Bin	C	LO			G	N	N			15					
18	GRIT AND SCREENING REMOVAL FACILITY	TGC7B	GC Screenings Bin	C	LO			G	N	N			15					
19	GRIT AND SCREENING REMOVAL FACILITY	TGC7C	GC Screenings Bin	C	LO													
20	GRIT AND SCREENING REMOVAL FACILITY	TGC8A	Grit Bin	C	LO			N	N	N			15					
21	GRIT AND SCREENING REMOVAL FACILITY	TGC8B	Grit Bin	C	LO			N	N	N			15					
22	EQUALIZAITON TANK	TET1A	ET Inlet gate	B	LO	G	N	N	N	N			15					
23	EQUALIZAITON TANK	TET1B	ET Inlet gate	B	LO	G	N	N	N	N			15					
24	EQUALIZAITON TANK	TET2A	ET Outlet gate	B	LO	G	N	N	N	N			15					

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
25	EQUALIZAITON TANK	TET2B	ET Outlet gate	B	LO	G	N	N	N	N			15					
26	EQUALIZAITON TANK	TET3A	ET Agitator	A	SO	G		G	N	N			10	4.9				2kW
27	EQUALIZAITON TANK	TET3B	ET Agitator	A	SO	G		G	N	N			10	5				2kW
28	EQUALIZAITON TANK	TET4A	ET Transfer pump	A	SO	G		G	N	N	G		15	6.6	×			3.7kW
29	EQUALIZAITON TANK	TET4B	ET Transfer pump	A	SO	G		G	N	N	G		15	7	×			3.7kW
30	EQUALIZAITON TANK	TET4C	ET Transfer pump	A	SO													couldn't find out this equipment
31	EQUALIZAITON TANK	TET5	ET LIfting Equipment for pumps	C	LO			N	N	N			20					
32	PRIMARY SETTLNG TANK	TPS1	PTS Sludge Scraper	A	LO	G	N	N	N	N	G	N	15	0.77		62		0.2kW rust pit cover
33	PRIMARY SETTLNG TANK	TPS2A	PTS Sludge Pump	A	LO			N	N	N			15					0.75kW
34	PRIMARY SETTLNG TANK	TPS2B	PTS Sludge Pump	A	LO	G	N	N	N	N	G	G	15		×	40		0.75kW discharge pressure gauge broken
35	PRIMARY SETTLNG TANK	TPS3	PTS Scum Pump	A	SO			N	N	N			15					
36	PRIMARY SETTLNG TANK		Scum Box	C														

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
37	REACTOR	TRT1	Reactor Fine Screen	A	LO	G	N	N	N	N	G	G	15	0.75		55		0.2kW
38	REACTOR	TRT3A	Anaerobic Mixer	A	SO	G		N	N	N	G		15	3.5				1.5kW
39	REACTOR	TRT3B	Anaerobic Mixer	A	SO	G		N	N	N	G		15	3.4				1.5kW
40	REACTOR	TRT4A	Anoxic Mixer	A	SO	G		N	N	N	G		15	5.8				2.2kW
41	REACTOR	TRT4B	Anoxic Mixer	A	SO	G		N	N	N	G		15	5.7				2.2kW
42	REACTOR	TRT5A	Aeration Aerator	A	SO			N					15	9.3				5.5kW pit cover not opened
43	REACTOR	TRT5B	Aeration Aerator	A	SO			N					15	8.4				5.5kW pit cover not opened
44	REACTOR	TRT7A	Aeration Tank Screen	C	SO			N	N	N			15					rust
45	REACTOR	TRT7B	Aeration Tank Screen	C	SO			N	N	N			15					rust
46	REACTOR	TRT8A	Recirculation Pump	A	SO			N	N	N	G		15	8.9	0.07			5.5kW rust pipe
47	REACTOR	TRT8B	Recirculation Pump	A	SO			N	N	N	G		15	8.8	0.07			5.5kW rust pipe
48	REACTOR	TRT9A	LIfting Equipment for Mixer	C	LO			G	G	G			20					

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
49	REACTOR	TRT9B	LIfting Equipment for Mixer	C	LO													
50	REACTOR	TRT10	LIfting Equipment for pumps	C	LO			N	N	N			20					
51	REACTOR	TRT12A	Over Flow Weir	B														
52	REACTOR	TRT12B	Over Flow Weir	B														
53	REACTOR	TRT13A	Reactor Screenings Bin	B	LO			G	G	G			15					
54	REACTOR	TRT13B	Reactor Screenings Bin	B	LO			G	G	G			15					
55	FINAL SETTLING TANK	TRT14	Coagulant Storage Tank	B	LI			G	G	G			15					
56	FINAL SETTLING TANK	TRT15A	Coagulant Dosing pump	B	LI	G		G	N	N	G	G	15	0.35		42		0.2kW
57	FINAL SETTLING TANK	TRT15B	Coagulant Dosing pump	B	LI			G	N	N		G	15					0.2kW
58	FINAL SETTLING TANK	TFS1A	FST sludge Scraper	A	LO	G	N	N	N	N	G	N	15	0.84		56		0.4kW worry of oil seal damaged
59	FINAL SETTLING TANK	TFS1B	FST sludge Scraper	A	LO	G	N	N	N	N	G	N	15	0.79		59		0.4kW
60	FINAL SETTLING TANK	TFS2A	Return sludge pump	A	LO	G		G	N	N	G		15	3.6				2.2kW

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
61	FINAL SETTLING TANK	TFS2B	Return sludge pump	A	LO	G		G	N	N	G		15	3.7				2.2kW
62	FINAL SETTLING TANK	TFS2C	Return sludge pump	A	LO													2.2kW
63	FINAL SETTLING TANK	TFS3	FST scum pump	A	SO			G	N	N			15					0.75kW
64	FINAL SETTLING TANK	TFS4A	WAS Control Valve	B	LO	G		G	N	N	G	G	15					0.2kW
65	FINAL SETTLING TANK	TFS4B	WAS Control Valve	B	LO	G		G	N	N	G	G	15					0.2kW
66	FINAL SETTLING TANK	TFS5	scum Box	C														
67	DISINFECTION TANK	TCT1	NaClO Storage Tank	C				G	N	N			10					2.0 m^3
68	DISINFECTION TANK	TCT2A	NaClO Dosing pump	B		G		G	N	N	G	G	15	0.32		41		0.2kW
69	DISINFECTION TANK	TCT2B	NaClO Dosing pump	B				G	N	N		G	15					0.2kW
70	SLUDGE THICKENER	TST1	Thickened Sludge Scraper	A	LO	N	N	N	N	N	N	N	15	0.4		47		0.4kW
71	SLUDGE THICKENER	TST2	Thickened Sludge pump	A	LI			N	N	N		G	15					0.75kW rust around gland packing
72	SLUDGE TREATMENT	TDH1	Dehydrator	A	LI	G	N	N	N	N	G	G	15	0.7		35		0.75kW

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
73	SLUDGE TREATMENT	TDH2	Coagurator	A	LI	G	N	N	N	N	G	G	15	1.1		36		0.75kW
74	SLUDGE TREATMENT	TDH3	Sludge Cake Hopper	A	LI			N	N	N		G	15					1.5kW×2 5.2㎥
75	SLUDGE TREATMENT	TDH4	Polymer tank	B	LI			N	N	N			15					
76	SLUDGE TREATMENT	TDH5	Polymer tank agitator	C	LI			N	N	N			15					1.5kW
77	SLUDGE TREATMENT	TDH6	Polymer feeder	B	LI			G	G	G			15					
78	SLUDGE TREATMENT	TDH7	Polymer dosing pump	B	LI	G		N	N	N	G	G	15	1		35		0.75kW
79	SLUDGE TREATMENT	TDH8	Sluge feeding pump	A	LI	N		N	N	N	N	G	15	3.1		34		1.5kW
80	SLUDGE TREATMENT	TDH9	Dehydrator room drainage pump	A	LS			N	N	N			10					0.2kW
81	SLUDGE TREATMENT	TDH11	Booster pump	B	LI	G		N	N	N	G	G	15	1.9				1.5kW
82	SLUDGE TREATMENT	TDH12	Backwash Valve	B	LI			G	N	N		G	15					0.1kW
83	FILTRATE RETURN PUMP	TFP1A	Filtrate Return pump	B	SO			N	N	N			15					0.75kW
84	FILTRATE RETURN PUMP	TFP1B	Filtrate Return pump	B	SO			N	N	N			15					0.75kW

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
85	FILTRATE RETURN PUMP	TFP2	Scum Screen	B														
86	BLOWER	TBW1A	Aeration Blower	S	LI	N	N	N	B	N	N	N	20	23	×	97	○	15kW much noise in duty time Vibration checking: refer other sheet
87	BLOWER	TBW1B	Aeration Blower	S	LI	N	N	N	N	N	N	N	20	23	×	92	○	15kW Vibration checking: refer other sheet
88	BLOWER	TBW1C	Aeration Blower	S	LI	N	N	N	N	N	N	N	20	22	×	60	○	15kW Vibration checking: refer other sheet
89	WATER SUPPLY UNIT	TWS1A	Recycle Water pump	B	SO			G	N	N			15					3.7kW
90	WATER SUPPLY UNIT	TWS1B	Recycle Water pump	B	SO	G		G	N	N	G		15	4.7	×			3.7kW discharge pressure gauge broken
91	WATER SUPPLY UNIT	TWS2A	Recycle Water Strainer	C	LO			N	N	N			20					
92	WATER SUPPLY UNIT	TWS2B	Recycle Water Strainer	C	LO			N	N	N			20					
93	WATER SUPPLY UNIT	TWS3	Potable Water Supply Unit	B		G		N	N	N	G	G	15	1.7				3.0kW
94	WATER SUPPLY UNIT	TWS4	Potable Water Tank	C				G	G	G			15					
95	DEODORIZING SYSTEM	TDS1	Deodorizer with Activated Carbon & Accessories	C				G	N	N			10					
96	DEODORIZING SYSTEM	TDS2	Odor Extraction Fan	A		G	N	N	N	N	G	G	10	5.9		71		3.7kW

Mechanical Instrument Check Sheet

FaciLIty Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful LIfe (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
97	DEODORIZING SYSTEM	TDS3	ELIminator	C				G	G	G								
98	DEODORIZING SYSTEM	TDS4	LIfting Equipment for Deodorizer	C				G	G	G			20					
99	EMERGENCY POWER SUPPLY SYSTEM	TEP1	Generator	B	LI			G	N	N			15					75kVA
100	EMERGENCY POWER SUPPLY SYSTEM	TEP2	Oil Tank	C				N	N	N			15					
101	EMERGENCY POWER SUPPLY SYSTEM	TEP3	Oil pump	B														0.2kW

Electric/Control Instrument Check Sheet

Facility Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
1	Electric Instrument	LP-1	Local Control Panel	A	O	N	N	G	G	N									No maintenance space (no stage on back side of the panel)
2	Electric Instrument	LP-2	Local Control Panel	A	O	N	N	G	G	N									lack of maintenance space (planting on back side of the panel)
3	Electric Instrument	LP-3	Local Control Panel	A	O	N/B	N	G	G	N									bottom of the panel rusts deeply
4	Electric Instrument	LP-4	Local Control Panel	A	I	N	N/B	G	G	N									
5	Electric Instrument	LP-5	Local Control Panel	A	O	N/B	N/B	G	G	N									side of the panel door rust deeply, panel door and stage are touched
6	Electric Instrument	LP-6	Local Control Panel	S	I	G	G	G	G	N	G			392	49.4	24.2			tough location (room temp is very high)
7	Electric Instrument	LP-7	Local Control Panel	A	I	G	G	G	G	N									the breaker is cut when it isn't operated (good point)
8	Electric Instrument	LP-TDH1	DRPP-1000 Control Panel	A	I	N	N	G	G										
9	Electric Instrument	LTDP	L/T Distribution Panel	S	I	G	G	G	G	N	G			392	30	79.5			
10	Electric Instrument	SVP	Supervisory Panel	S	I	G	G	G	G	N	G			397	28.2	1.5			
11	Electric Instrument	TEP1	Emergency Generator Monitoring Control Panel	A	I	N	G	G	G		G								
12	Control Instrument	T-LS1	Truc Bach Influent Pump Pit Level (float SW ×4)	A	O	N	N	G	N										

Electric/Control Instrument Check Sheet

Facility Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
13	Control Instrument	T-LS2	Equalization Tank Level (float SW ×6)	A	O	N	N	G	N										
14	Control Instrument	T-LS3	PST Scum Pit Level (float SW ×4)	A	O	N	N	G	N										
15	Control Instrument	T-LS4A	Reactor Level (float SW ×2)	A	O	N	N/B	G	N										tag plate is rust and unreadable
16	Control Instrument	T-LS4B	Reactor Level (float SW ×2)	A	O	N	N/B	G	N										tag plate is rust and unreadable
17	Control Instrument	T-LS5	FST Scum Pit Level (float SW ×4)	A	O	N	N	G	N										
18	Control Instrument	T-LS6	NaClO Storage Tank Level (electrode SW ×4)	A	I	G	G	G/B	N										no terminal cover
19	Control Instrument	T-LS7	Sludge Reservoir Level (float SW ×4)	A	I	N	N	G	N										
20	Control Instrument	T-LS8	Polymer Tank Level (electrode SW ×4)	A	I	N	N	G	N										connector is rust a little bit
21	Control Instrument	T-LS9	Dehydrator Room Drainage Tank Level (float SW ×)	A	I	G	G	G	N										blower room is very high temperature
22	Control Instrument	T-LS10	Filtrate Return Pit Level (?)	A	O	N	N/B	X	N										couldn't open the terminal box cover
23	Control Instrument	T-LS11	Recycle Water Pit Level (float SW ×2)	A	O	N	N	G	N										
24	Control Instrument	T-LS12	Coagurant Storage Tank Level	A	I	G	G	G	N										

Electric/Control Instrument Check Sheet

Facility Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
25	Control Instrument	T-LS13	Effuluent Pump Pit Level? (?)	A	O	N	N	X	B										terminal box cover fixed, cable connector almost drops off
26	Control Instrument	T-LIA1	Equalization Tank Level (ultrasonic)	A	O	N	N/B	X	N		N/B								Error Code E040
27	Control Instrument	T-FI1	Grit Chamber Air Flow (manometer)	A	O	N/B	N/B				B								terminal box is broken
28	Control Instrument	T-FI3A	Recirculation Pump Flow (magnetic flow meter)	A	O	N	N	X	N		G								
29	Control Instrument	T-FI3B	Recirculation Pump Flow (magnetic flow meter)	A	O	N	N	X	N		G								
30	Control Instrument	T-FI4	Effluent Flow (堰式流量計)	A	O	N/B	N				G								rust casing
31	Control Instrument	T-FI5A	Reactor Air Flow (manometer)	A	O	N	B				B								broken
32	Control Instrument	T-FI5B	Reactor Air Flow (manometer)	A	O	N	B				B								broken
33	Control Instrument	T-FIQR1	ET Transfer Pump Flow (magnetic flow meter)	A	O	N	N	X	N		G								
34	Control Instrument	T-FIQ1	PST Sludge Flow (magnetic flow meter)	A	O	N	N	X	N		G								
35	Control Instrument	T-FIQ2	WAS Flow (magnetic flow meter)	A	O	N	N	X	N		G								
36	Control Instrument	T-DOIR1A	Reactor DO	A	O	N	N	X	N		G								

Electric/Control Instrument Check Sheet

Facility Name : Truc Bach WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
37	Control Instrument	T-DOIR1B	Reactor DO	A	O	N	N	X	N		G								

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
1	Grit Chamber facility	M1-01	Inflo gate	A	L O			G	N	N		G	15					0.75kW
2	Grit Chamber facility	M1-02	GC Inflo gate	B	L I	G		G	G	N			15					
3	Grit Chamber facility	M1-02	GC Inflo gate	B	L I	G		G	G	N			15					
4	Grit Chamber facility	M1-02	GC Inflo gate	B	L I	G		G	G	N			15					
5	Grit Chamber facility	M1-03	GC Coarse screen	C	L I			G	G	G			15					screen pitch : 100mm
6	Grit Chamber facility	M1-03	GC Coarse screen	C	L I								15					screen pitch : 100mm
7	Grit Chamber facility	M1-03	GC Coarse screen	C	L I								15					screen pitch : 100mm
8	Grit Chamber facility	M1-04A	Grit pump	A	S I	G		G	N	N	G		15		0.035			3.7kW
9	Grit Chamber facility	M1-04B	Grit pump	A	S I	G		G	N	N	G		15	7.1	0.03			3.7kW
10	Grit Chamber facility	M1-04C	Grit pump	A	S I			G	N	N			15					3.7kW
11	Grit Chamber facility	M1-04D	Grit pump	A	S I			G	N	N			15					3.7kW
12	Grit Chamber facility	M1-04E	Grit pump	A	S I			G	N	N			15					3.7kW

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
13	Grit Chamber facility	M1-04F	Grit pump	A	S I			G	N	N			15					3.7kW
14	Grit Chamber facility	M1-04G	Grit pump	A	S I			G	N	N			15					3.7kW
15	Grit Chamber facility	M1-04H	Grit pump	A	S I			G	N	N			15					3.7kW
16	Grit Chamber facility	M1-04I	Grit pump	A	S I			G	N	N			15					3.7kW
17	Grit Chamber facility	M1-05	Grit separator	B	L I	G		G	N	N	G	G	15	1.27		37		0.25kW
18	Grit Chamber facility	M1-06	Grit container	C	L I			G	G	G			15					
19	Grit Chamber facility	M1-06	Grit container	C	L I			G	G	G			15					
20	Grit Chamber facility	M1-07A	Fine screen	A	L I			G	N	N		G	15					0.75kW
21	Grit Chamber facility	M1-07B	Fine screen	A	L I			G	N	N		G	15					0.75kW
22	Grit Chamber facility	M1-07C	Fine screen	A	L I			G	N	N		G	15					0.75kW
23	Grit Chamber facility	M1-08	Fine screenings conveyor	B	L I			G	N	N	N	G	15					2.2kW Noise (worry of screw damaged)
24	Grit Chamber facility	M1-09	Screenings container	C	L I			G	G	G			15					

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
25	Grit Chamber facility	M1-09	Screenings container	C	L I			G	G	G			15					
26	Grit Chamber facility	M1-09	Screenings container	C	L I			G	G	G			15					
27	Grit Chamber facility	M1-09	Screenings container	C	L I			G	G	G			15					
31	Grit Chamber facility	M1-11	Grit pump hoist	C	L I			G	G	G		G	20					
32	Grit Chamber facility	M1-12	Container hoist	C	L I			G	G	G		G	20					1.17kW、0.2kW
33	Lift pump facility	M2-01A	Lift pump（1）	S	L I			G	N	N		G	15					75kW
34	Lift pump facility	M2-01B	Lift pump（1）	S	L I			G	N	N		G	15					75kW
35	Lift pump facility	M2-02A	Lift pump（2）	S	L I	G		G	N	N	G	G	15	53	0.046	33		75kW（variable speed）
36	Lift pump facility	M2-02B	Lift pump（2）	S	L I			G	N	N		G	15					75kW（variable speed）
37	Lift pump facility	M2-03A	Discharge valve	B	L I			G	N	N		G	15					1.5kW
38	Lift pump facility	M2-03B	Discharge valve	B	L I			G	N	N		G	15					1.5kW
39	Lift pump facility	M2-03C	Discharge valve	B	L I			G	N	N		G	15					1.5kW

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
40	Lift pump facility	M2-03D	Discharge valve	B	L I			G	N	N		G	15					1.5kW
41	Lift pump facility	M2-04	Drainage pump	A	S I			N	N	N		N	10					2.2kW
42	Lift pump facility	M2-05	Lift pump hoist	C	L I			G	G	G		G	20					2.5kW、0.75kW
43	Wateer Treatment Facility	M3-01	PST Inflow gate	B	L O	G		G	N	N			15					
44	Wateer Treatment Facility	M3-01	PST Inflow gate	B	L O	G		G	N	N			15					
45	Wateer Treatment Facility	M3-01	PST Inflow gate	B	L O	G		G	N	N			15					
46	Wateer Treatment Facility	M3-01	PST Inflow gate	B	L O	G		G	N	N			15					
47	Wateer Treatment Facility	M3-01	PST Inflow gate	B	L O	G		G	N	N			15					
48	Wateer Treatment Facility	M3-01	PST Inflow gate	B	L O	G		G	N	N			15					
49	Wateer Treatment Facility	M3-02	PST sludge scraper	A	L O			N	N	N			15					0.25kW
50	Wateer Treatment Facility	M3-02	PST sludge scraper	A	L O			N	N	N			15					0.25kW
51	Water Treatment Facility	M3-02	PST sludge scraper	A	L O			N	N	N			15					0.25kW

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
52	Wateer Treatment Facility	M3-02	PST sludge scraper	A	L O			N	N	N			15					0.25kW
53	Wateer Treatment Facility	M3-02	PST sludge scraper	A	L O			N	N	N			15					0.25kW
54	Wateer Treatment Facility	M3-02	PST sludge scraper	A	L O			N	N	N			15					0.25kW
55	Wateer Treatment Facility	A	No.1 PST scum skimmer	B	L O			N	N	N			15					0.12kW
56	Wateer Treatment Facility	B	No.2 PST scum skimmer	B	L O			N	N	N			15					0.12kW
57	Wateer Treatment Facility	C	No.3 PST scum skimmer	B	L O			N	N	N			15					0.12kW
58	Wateer Treatment Facility	D	No.4 PST scum skimmer	B	L O			N	N	N			15					0.12kW
59	Wateer Treatment Facility	E	No.5 PST scum skimmer	B	L O			N	N	N			15					0.12kW
60	Wateer Treatment Facility	F	No.6 PST scum skimmer	B	L O			N	N	N			15					0.12kW
61	Wateer Treatment Facility	M3-03A	Primary sludge valve	B	L I			G	N	N			15					0.75kW
62	Wateer Treatment Facility	M3-03B	Primary sludge valve	B	L I			G	N	N			15					0.75kW
63	Wateer Treatment Facility	M3-03C	Primary sludge valve	B	L I			G	N	N			15					0.75kW

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
64	Wateer Treatment Facility	M3-03D	Primary sludge valve	B	L I			G	N	N			15					0.75kW
65	Wateer Treatment Facility	M3-03E	Primary sludge valve	B	L I			G	N	N			15					0.75kW
66	Wateer Treatment Facility	M3-03F	Primary sludge valve	B	L I			G	N	N			15					0.75kW
67	Wateer Treatment Facility	M3-04A	Primary sludge pump	A	L I		N	B	N	N		G	15					5.5kW shaft is rust around gland packing
68	Wateer Treatment Facility	M3-04B	Primary sludge pump	A	L I		N	B	N	N		G	15					5.5kW shaft is rust around gland packing
69	Wateer Treatment Facility	M3-05	PST bypass gate	B	L O	G		G	N	N			15					
70	Wateer Treatment Facility	M3-06A	Reactor Inflow weir	B	L O	G		G	N	N			15					
71	Wateer Treatment Facility	M3-06B	Reactor Inflow weir	B	L O	G		G	N	N			15					
72	Wateer Treatment Facility	M3-06C	Reactor Inflow weir	B	L O	G		G	N	N			15					
73	Wateer Treatment Facility	M3-06D	Reactor Inflow weir	B	L O	G		G	N	N			15					
74	Wateer Treatment Facility	M3-06E	Reactor Inflow weir	B	L O	G		G	N	N			15					
75	Wateer Treatment Facility	M3-06F	Reactor Inflow weir	B	L O	G		G	N	N			15					

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
76	Wateer Treatment Facility	M3-07A	RAS flow control weir	B	L O	G		G	N	N			15					
77	Wateer Treatment Facility	M3-07B	RAS flow control weir	B	L O	G		G	N	N			15					
78	Wateer Treatment Facility	M3-07C	RAS flow control weir	B	L O	G		G	N	N			15					
79	Wateer Treatment Facility	M3-07D	RAS flow control weir	B	L O	G		G	N	N			15					
80	Wateer Treatment Facility	M3-07E	RAS flow control weir	B	L O	G		G	N	N			15					
81	Wateer Treatment Facility	M3-07F	RAS flow control weir	B	L O	G		G	N	N			15					
82	Wateer Treatment Facility	M3-08A	Anaerobic tank mixer	A	L O	G	N	N	N	N	N	N	15	9.7		84		4kW motor is heated
83	Wateer Treatment Facility	M3-08B	Anaerobic tank mixer	A	L O			N	N	N		N	15					4kW
84	Wateer Treatment Facility	M3-08C	Anaerobic tank mixer	A	L O			N	N	N		N	15					4kW
85	Wateer Treatment Facility	M3-08D	Anaerobic tank mixer	A	L O			N	N	N		N	15					4kW
86	Wateer Treatment Facility	M3-08E	Anaerobic tank mixer	A	L O			N	N	N		N	15					4kW
87	Wateer Treatment Facility	M3-08F	Anaerobic tank mixer	A	L O			N	N	N		N	15					4kW

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
88	Wateer Treatment Facility	M3-09A	Surface aerator	S	L O	G		N	N	N	N	G	15	57		47	○	37kW Vibration checking: refer other sheet
89	Wateer Treatment Facility	M3-09G	Surface aerator	S	L O	G		N	N	N	N	G	15	55		49	○	37kW Vibration checking: refer other sheet
90	Wateer Treatment Facility	M3-09B	Surface aerator	S	L O			N	N	N		G	15					37kW
91	Wateer Treatment Facility	M3-09H	Surface aerator	S	L O			N	N	N		G	15					37kW
92	Wateer Treatment Facility	M3-09C	Surface aerator	S	L O			N	N	N		G	15					37kW
93	Wateer Treatment Facility	M3-09 I	Surface aerator	S	L O			N	N	N		G	15					37kW
94	Wateer Treatment Facility	M3-09D	Surface aerator	S	L O			N	N	N		G	15					37kW
95	Wateer Treatment Facility	M3-09J	Surface aerator	S	L O			N	N	N		G	15					37kW
96	Wateer Treatment Facility	M3-09E	Surface aerator	S	L O			N	N	N		G	15					37kW
97	Wateer Treatment Facility	M3-09K	Surface aerator	S	L O			N	N	N		G	15					37kW
98	Wateer Treatment Facility	M3-09F	Surface aerator	S	L O			N	N	N		G	15					37kW
99	Wateer Treatment Facility	M3-09L	Surface aerator	S	L O			N	N	N		G	15					37kW

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
100	Wateer Treatment Facility	M3-10A	Channel mixing blower	S	L I	G	N	N	N	N	N	G	20	21	×	48	○	15kW Vibration checking: refer other sheet
101	Wateer Treatment Facility	M3-10B	Channel mixing blower	S	L I	G	N	N	N	N	N	G	20	20	0.078	62	○	15kW Vibration checking: refer other sheet
102	Wateer Treatment Facility		Gas filter	C	L I			G	G	G								
103	Wateer Treatment Facility	M3-11	Blower hoist	C	L I			G	G	G			20					
104	Wateer Treatment Facility	M3-12A	FST Inflow valve	B	L I			G	G	G			15					
105	Wateer Treatment Facility	M3-12B	FST Inflow valve	B	L I			G	G	G			15					
106	Wateer Treatment Facility	M3-12C	FST Inflow valve	B	L I			G	G	G			15					
107	Wateer Treatment Facility	M3-12D	FST Inflow valve	B	L I			G	G	G			15					
108	Wateer Treatment Facility	M3-12E	FST Inflow valve	B	L I			G	G	G			15					
109	Wateer Treatment Facility	M3-12F	FST Inflow valve	B	L I			G	G	G			15					
110	Wateer Treatment Facility	M3-13A	FST sludge scraper	A	L O			N	N	N			15					0.25kW Gear box grease trickle out
111	Wateer Treatment Facility	M3-13B	FST sludge scraper	A	L O	G	N	N	N	N	G	G	15	0.4		46		0.25kW

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
112	Wateer Treatment Facility	M3-13C	FST sludge scraper	A	L O	G	B	N	N	N	G	G	15	0.4		47		0.25kW Gear box grease trickle out
113	Wateer Treatment Facility	M3-13D	FST sludge scraper	A	L O			N	N	N			15					0.25kW
114	Wateer Treatment Facility	M3-13E	FST sludge scraper	A	L O			N	N	N			15					0.25kW
115	Wateer Treatment Facility	M3-13F	FST sludge scraper	A	L O			N	N	N			15					0.25kW
116	Wateer Treatment Facility	A	FST scum skimmer	B	L O			N	N	N			15					0.12kW
117	Wateer Treatment Facility	B	FST scum skimmer	B	L O	N	N	N	N	N	G	G	15	0.27		43		0.12kW
118	Wateer Treatment Facility	C	FST scum skimmer	B	L O	N	B	N	N	N	G	G	15	0.27		45		0.12kW Gear box grease trickle out
119	Wateer Treatment Facility	D	FST scum skimmer	B	L O			N	N	N			15					0.12kW
120	Wateer Treatment Facility	E	FST scum skimmer	B	L O			N	N	N			15					0.12kW
121	Wateer Treatment Facility	F	FST scum skimmer	B	L O		N	N	N	N			15					0.12kW
122	Wateer Treatment Facility	M3-14A	RAS pump	A	L I		N	N	N	N		G	15					18.5kW
123	Wateer Treatment Facility	M3-14B	RAS pump	A	L I	G	N	N	N	N	G	G	15	25	0.136	40		18.5kW adjusting gland packing is necessary

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
124	Wateer Treatment Facility	M3-14C	RAS pump	A	L I		N	N	N	N		G	15					18.5kW
125	Wateer Treatment Facility	M3-14D	RAS pump	A	L I		N	N	N	N		G	15					18.5kW
126	Wateer Treatment Facility	M3-15	WAS extraction valve	B	L I			G	N	N		G	15					0.16kW
127	Wateer Treatment Facility	M3-15	WAS extraction valve	B	L I			G	N	N		G	15					0.16kW
128	Wateer Treatment Facility	M3-16	Drainage pump	A	S I			N	N	N		N	10					2.2kW
129	Wateer Treatment Facility	M3-16	Drainage pump	A	S I			N	N	N		N	10					2.2kW
130	Wateer Treatment Facility	M3-16	Drainage pump	A	S I			N	N	N		N	10					2.2kW
131	Wateer Treatment Facility	M3-16	Drainage pump	A	S I			N	N	N		N	10					2.2kW
132	Wateer Treatment Facility	M3-16	Drainage pump	A	S I			N	N	N		N	10					2.2kW
140	Disinfection Facility	M4-01	Disinfection tank inflow gate	B	L O	G		G	N	N			15					
141	Disinfection Facility	M4-02	Disinfection tank bypass gate	B	L O	G		G	N	N			15					
142	Disinfection Facility	M4-03	NaClO storage tank	B	L I			G	G	G			10					

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
143	Disinfection Facility	M4-04A	NaClO dosing pump	B	L I	G		N	N	N	G	G	15	0.7		47		0.4kW
144	Disinfection Facility	M4-04B	NaClO dosing pump	B	L I			G	N	N		G	15					0.4kW
145	Disinfection Facility	M4-06	NaClO storage tank for well water	B	L I			G	G	G			10					
146	Disinfection Facility	M4-05A	NaClO dosing pump for well water	B	L I			G	N	N			15					
147	Disinfection Facility	M4-05B	NaClO dosing pump for well water	B	L I			G	N	N			15					
148	Water supply facility	M5-01A	Spray pump	B	L I			N	N	N			15					5.5kW
149	Water supply facility	M5-01B	Spray pump	B	L I			N	N	N			15					5.5kW
150	Water supply facility	M5-02	Auto-strainer for Spray pump	B	L I			G	G	G		G	20					0.2kW
151	Water supply facility	M5-03A	Sand filter supply pump	B	L I			N	N	N		G	15					1.5kW
152	Water supply facility	M5-03B	Sand filter supply pump	B	L I			N	N	N		G	15					1.5kW
153	Water supply facility	M5-04	Auto-strainer for sand filter	B	L I			G	G	G		G	20					0.2kW
154	Water supply facility	M5-05	Sand filter	B	L O			N	N	N			15					

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
155	Water supply facility	M5-06A	Air compressor for sand filter	B	L I			G	N	N		G	15					7.5kW
156	Water supply facility	M5-06B	Air compressor for sand filter	B	L I			G	N	N		G	15					7.5kW
157	Water supply facility	M5-08	water supply unit for wastewater treatment facility	B	L I			G	N	N		G	15					
158	Water supply facility	M5-09	water supply unit for wastewater treatment facility	B	L I			G	N	N		G	15					
159	Water supply facility	M5-10A	Belt washing pump	B	L I			G	N	N		G	15					3kW
160	Water supply facility	M5-10B	Belt washing pump	B	L I			G	N	N		G	15					3kW
161	Water supply facility	M5-11	Sand filter supply pump from deep well	B	L O			N	N	N			15					5.5kW
162	Water supply facility	M5-12	Sand filter for domestic water	B	L I			N	N	N			15					leakage
163	Water supply facility	M5-13A	Water supply unit for domestic use	B	L I			G	N	N		G	15					0.75kW
164	Water supply facility	M5-14A	Drainage pump	A	S I			G	N	N		G	10					2.2kW
165	Water supply facility	M5-14B	Drainage pump	A	S I			G	N	N		G	10					2.2kW
166	Sludge treatment facility	M6-01	Mixed sludge mixer	A	S I								10					5.0kW

Mechanical Instrument Check Sheet

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Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
167	Sludge treatment facility	M6-02A	Mixed sludge pump	A	L I			G	N	N		G	15					7.5kW
168	Sludge treatment facility	M6-02B	Mixed sludge pump	A	L I			G	N	N		G	15					7.5kW
169	Sludge treatment facility	M6-03A	sludge dewaterer	A	L I			N	N	N		G	15					1.3kW
170	Sludge treatment facility	M6-03B	sludge dewaterer	A	L I			N	N	N		G	15					1.3kW
171	Sludge treatment facility		Flocculator	A	L I			G	N	N		G	15					
172	Sludge treatment facility	M6-04	Cake conveyor（1）	A	L I			G	N	N		G	15					4kW
173	Sludge treatment facility	M6-05	Cake conveyor（2）	A	L I								15					4kW
174	Sludge treatment facility		No.2-2 Cake conveyor	A	L I								15					1.5kW
175	Sludge treatment facility	M6-06	Cake hopper	B	L I								15					3kW
176	Sludge treatment facility	M6-07	Automatic polymer make-up unit	B	L I			G	N	N		G	15					1.68kW
177	Sludge treatment facility		polymer feeder	B	L I			G	N	N			15					
178	Sludge treatment facility	M6-08A	polymer dosing pump	B	L I			G	N	N		G	15					1.1kW

Mechanical Instrument Check Sheet

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Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
179	Sludge treatment facility	M6-08B	polymer dosing pump	B	L I			G	N	N		G	15					1.1kW
180	Sludge treatment facility	M6-09	FeCl3 storage tank	B	L I			G	G	G			15					
181	Sludge treatment facility	M6-10A	FeCl3 dosing pump	B	L I	G		G	N	N	G	G	15					0.4kW
182	Sludge treatment facility	M6-10B	FeCl3 dosing pump	B	L I			G	N	N		G	15					0.4kW
183	Sludge treatment facility	M6-11A	FeCl3 dosing pump for well water	B	L I			G	N	N			15					0.016kW
184	Sludge treatment facility	M6-11B	FeCl3 dosing pump for well water	B	L I			G	N	N			15					0.016kW
185	Sludge treatment facility	M6-12A	Air compressor for sludge treatment facility	B	L I		N	G	N	N		G	15					1.5kW
186	Sludge treatment facility	M6-12B	Air compressor for sludge treatment facility	B	L I		N	G	N	N		G	15					1.5kW
187	Sludge treatment facility	M6-13	Air dryer	B	L I			G	N	N			10					0.22kW
188	Sludge treatment facility	M6-14A	Filtrate pump	B	L I			N	N	N		G	15					11kW
189	Sludge treatment facility	M6-14B	Filtrate pump	B	L I	G		N	N	N	G	G	15	16	0.03	46		11kW
190	Sludge treatment facility	M6-15A	Drainage pump	A	S I			N	N	N			10					2.2kW

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
191	Sludge treatment facility	M6-15B	Drainage pump	A	S I			N	N	N			10					2.2kW
192	Sludge treatment facility	M6-16A	Sludge dewateret hoist	C	L I			G	G	G			20					2.5kW、0.4kW
193	Sludge treatment facility	M6-16B	Sludge dewateret hoist	C	L I			G	G	G			20					2.5kW、0.4kW
194	Sludge treatment facility	M6-17	Maintenance hoist	C	L I			G	G	G			20					
195	Sludge treatment facility	M6-18	FeCl3 storage tank for well water	B	L I			N	N	N			15					
197	Sludge treatment facility	M7-02A	Drainage pump	A	S I			N	N	N			10					2.2kW
198	Sludge treatment facility	M7-02B	Drainage pump	A	S I								10					2.2kW checking impossible (sludge cake spread)
199	Sludge treatment facility	M7-03	Maintenance hoist	C	L I								20					
201	Deodorization facility	M8-01	NaClO storage tank	B	L I			G	N	N			15					
202	Deodorization facility	M8-02A	NaClO dosing pump	B	L I			G	N	N			15					0.022kW
203	Deodorization facility	M8-02B	NaClO dosing pump	B	L I			G	N	N			15					0.022kW
204	Deodorization facility	M8-03	NaOH storage tank	B	L I			G	N	N			15					leakage

Mechanical Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check (all) & Measurement (all)	L Landed	W Work	Number: Year	C Current(A)	G Good
A Physical Check (all) & Measurement (C,P,T only)	S Submerged	O/G Oil & Grease Check		P Pressure(MPa)(with Press. gauge only)	N Normal
B Physical Check (all)	I Inside	S/P Stain & Painting		T Temperature(℃)	B Bad
C Physical Check (S/P,D,A only)	O Outside	D Damage		V Vibration (main equipment only)	X Couldn't check
		A Abrasion			
		V/N Vibration & Noise			
		M Motor (with motor only)			

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M				Remark
						W	O/G	S/P	D	A	V/N	M		C	P	T	V	
205	Deodorization facility	M8-04A	NaOH dosing pump	B	L I			G	N	N			15					0.017kW
206	Deodorization facility	M8-04B	NaOH dosing pump	B	L I			G	N	N			15					0.017kW
207	Deodorization facility	M8-05A	Circulating pump	B	L O			N	N	N			15					1.5kW
208	Deodorization facility	M8-05B	Circulating pump	B	L O			N	N	N			15					1.5kW
209	Deodorization facility	M8-06	Mist separator	C	L O			G	N	N								
210	Deodorization facility	M8-07	Deodorization fan	A	L O	G		N	N	N	G	N	10	4.7		45		4kW
211	Deodorization facility	M8-08	Chemical scrubber	C	L O			G	N	N			10					
212	Generator Room facility	M9-01	Oil supply pump	A	L I			G	N	N			15					3.7kW
213	Generator Room facility	M9-02	Service tank	B	L I			G	G	G			15					
214	Generator Room facility	M9-03	Emergency Generator	B	L I			G	N	N			15					

Electric/Control Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
1	Electric instrument	SVP	Supervisory Panel	S	I	N	N	G	G	N/B	G			238	30.2	54.7			No fan cover
2	Electric instrument	LVIP	Low Voltage Incoming Panel	S	I	N	N	G	N	N	G			X	29.7	60			Leakage relay is making
3	Electric instrument	CSP	Changeover Switch Panel	S	I	N	N	N	N	N				X	30.2	770			
4	Electric instrument	LVDP	Low Voltage Distribution Panel	S	I	N	N	N	N	N				X	29.7	600			
5	Electric instrument	GP		S	X	X	X	X	X	X	X								
6	Electric instrument	DB-BP4		A	X	X	X	X	X	X	X								
7	Electric instrument	DB-BP5		A	X	X	X	X	X	X	X								
8	Electric instrument	PSSP	Primary Sludge Scraper Panel	A	O	N/B	N/B	X	X	X									Panel inside is rust, Door is keeping on opening in rainfalling
9	Electric instrument	AFSSP	Anaerobic & Final Sludge Scraper Panel	A	O	B	B	X	X	X									inside of the panel is rust
10	Electric instrument	SAP-1	Surface Airation Panel-1	A	O	N/B	N	N	N	N									head of the panel is rust
11	Electric instrument	SAP-2	Surface Airation Panel-2	A	O	N	N	N	N	N									

Electric/Control Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
12	Electric instrument	SAP-3	Surface Airation Panel-3	A	O	N	N	N	N	N									
13	Electric instrument	SAP-4	Surface Airation Panel-4	A	O	N/B	N	N	N	N									Panel head is rust
14	Electric instrument	CMBP	Channel Mixing Blower Panel	A	I	N	N	N	N		G								
15	Electric instrument	DP	Deodorization Panel	A	O	N/B	N/B	X	X	X	G								Door locked, Panel inside has rust mark
16	Electric instrument	GCP	Grit Chamber Panel	A	I	N	N	N	N										Bus bar is changing a color slightly
17	Electric instrument	BCP		A	X	X	X	X	X	X	X								
18	Electric instrument	LPP	Lift Pump Panel 1-3	A	I	N	N	X	X	N	G								Door locked
19	Electric instrument	PSP	Primary Sludge Panel	A	I	N	N	N	N										
20	Electric instrument	RWP	RAS & WAS Panel	A	I	N	N	N	N		G								
21	Electric instrument	WSSP	Water Supply System Panel	A	I	N	N	N	N		G								No ELB, No ELR
22	Electric instrument	FWP	Filter Water Panel	A	I	N	N	N	N		G								PLC installed
23	Electric instrument	STP-1	Sludge Treatment Panel -1	A	I	N	N	N/B	N		G								Lack of terminal cover partly

Electric/Control Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
24	Electric instrument	STP-2	Sludge Treatment Panel -2	A	I	N	N	B	N										Rust terminal
25	Electric instrument	DWP	Dewaterer Panel	A	I	N	N	X	X										Door locked
26	Electric instrument		Cake Hopper Control Panel	A	I	N	B	X	X	X									Spread sludge cake under the hopper
27	Electric instrument		Deodorization Control Panel	A	O	N	N	X	X	X	G								Door locked
28	Electric instrument		Charger No.1 Cubicle	A	I	N	N	X	X		G		2004						Door locked
29	Electric instrument		Charger No.2 Cubicle	A	I	N	N	X	X		G		2004						Door locked
30	Control Instrument	LCA1	Grit Chamber Level (electorode ×4)	A	I	N	N	G	G										
31	Control Instrument	LCA2-1	Pump Well Level (electorode×6)	A	I	N	N	G	G										
32	Control Instrument	LCA2-2	Pump Well Level (electorode×6)	A	I	N	N	G/B	G										No terminal cover
33	Control Instrument	LICA3	Pump Well Level (ultrasonic)	A	I	N	N	G	G										
34	Control Instrument	LCA4	Secondary Effluent Tank Level	A	O	N	N	G	G										
35	Control Instrument	LCA5	Filtered Water Tank Level (electorode)	A	O	N	N	G	G										

Electric/Control Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
36	Control Instrument	LCA6	Mixed Sludge Storage Tank Level (float ×5)	A	I	N	N	G	G										
37	Control Instrument	LICA7	Mixed Sludge Storage Tank Level (ultrasonic)	A	I	N	N	G	G		G								
38	Control Instrument	LCA8	Filtrate Tank Level (float ×4)	A	I	N	N	G	G										Pipes are installed just upon the terminal box
39	Control Instrument	LCA9	NaClO Storage Tank Level	A	I	N	N	G	N										Hard to maintain (not enough space)
40	Control Instrument	LCA10	FeCl3 Storage Tank Level	A	I	N	N	G	N										
41	Control Instrument	LCA11	Polymar Tank Level (float ×3)	A	I	X	X	X	X										No terminal box (very hard to replace)
42	Control Instrument	LCA12	NaClO Storage Tank Level (float ×4)	A	I	N	N		G										No Tag Number
43	Control Instrument	LCA13	NaOH Storage Tank Level (float ×4)	A	I	N	N		G										No Tag Number
44	Control Instrument	LC14	Deep Well Level	A	X	X	X	X	X										Couldn't find out
45	Control Instrument	LCA15	Water Supply Unit Tank Level	A	I	N	N	B	B										Rust terminal
46	Control Instrument	LCA16	NaClO Storage Tank Level for Well Water (electorode)	A	I	N	N	B	N										Rust terminal
47	Control Instrument	LCA17	FeCl3 Storage Tank Level for Well Water (electorode)	A	I	N	N	G	N/B										

Electric/Control Instrument Check Sheet

Facility Name : North Thang Long WWTP

Check Rank (C/R)	Placement (P)	Physical Check (P/C)	Useful Life (L)	Measurement (M)	Result
S Physical Check & Measurement A Physical Check X Taking photo only	I Inside O Outside	S/P Stain & Painting D Damage T Terminal C Cable F Filter I Indicate	Number: Year	V Voltage (V) (main breaker only) T Temperature(℃) (main breaker only) L Leak Current (mA) (main breaker only)	G Good N Normal B Bad X Couldn't check

No	Category	Tag No.	Instrument Name	C/R	P	P/C							L	M					Remark
						S/P	D	T	C	F	I			V	T	L			
48	Control Instrument	LCA18	Chemical Scrubber Level	A	O	X	X	X	X										Impossible maintenance (a lot of pipes around)
49	Control Instrument	DOI-1	Reactor DO	A	O	N	N	X	N		G								Hard to maintain (not enough space)
50	Control Instrument	DOI-2	Reactor DO	A	O	N	N	X	N		G								Hard to maintain (not enough space)
51	Control Instrument	FIQ1	Pump Well Flow (magnetic flow meter)	A	I	N	N	X	X		G								
52	Control Instrument	FIQ2-1	FST RAS Flow (magnetic)	A	I	N	N	X	X		G								
53	Control Instrument	FIQ2-2	FST RAS Flow (magnetic)	A	I	N	N	X	X		G								
54	Control Instrument	FIQ3	PST Sludge Flow (magnetic)	A	I	N	N	X	X		G								
55	Control Instrument	FIQ4	FST WAS Flow (magnetic)	A	I	N	N	X	X		G								Hard to maintain (lack of maintenance stage)
56	Control Instrument	FIQ5	Effluent Flow (堰式)	A	O	N/B	N	X	X		B								No Tag plate
57	Control Instrument	pHI-1	NaOH Storage Tank pH	A															
58	Control Instrument	RS-1	No.1 Lifting Pump Rotation Speed	A	X	X	X	X	X		X								Door locked
59	Control Instrument	RS-2	No.2 Lifting Pump Rotation Speed	A	X	X	X	X	X		X								Door locked

Appendix 2 Vibration Measuring Results

1) Kim Lien WWTP Aeration Blower (KBW1A) Vibration Measuring Result

2) Kim Lien WWTP Aeration Blower (KBW1B) Vibration Measuring Result

3) Kim Lien WWTP Aeration Blower (KBW1C) Vibration Measuring Result

4) Truc Bach WWTP Aeration Blower (TBW1A) Vibration Measuring Result

5) Truc Bach WWTP TBW1B Aeration Blower (TBW1B) Vibration Measuring Result

6) Truc Bach WWTP TBW1C Aeration Blower (TBW1C) Vibration Measuring Result

7) North Thang Long WWTP Surface Aerator (M3-9A) Vibration Measuring Result

8) North Thang Long WWTP Channel Mixing Blower (M3-10A) Vibration Measuring Result

9) North Thang Long WWTP Channel Mixing Blower (M3-10B) Vibration Measuring Result

drawing date: 29 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1A Aeration Blower				
measurement part	Motor (Opposite Load Side)				
ID code	111	Direction of measurement	Vertical	Group No.	111
Output	30.0 kW	Rotational speed	1477 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:28

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.731	Good
ACC(OA) [G]	1.00	4.00	0.372	Good
ACC(PEAK) [G]	3.00	12.00	0.986	Good
VEL [cm/s]	0.40	1.00	0.372	Good
DISP [μm]	30	100	20.1	Good

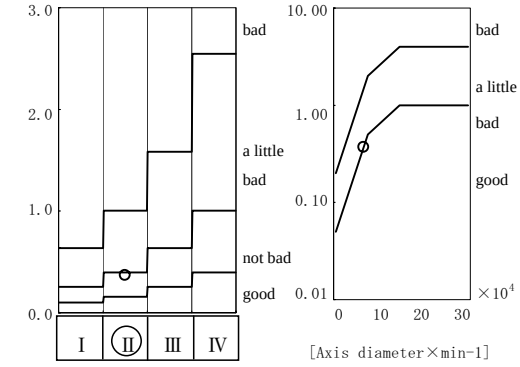
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:28

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.41	1.64	0.372	Good
VEL [cm/s]	0.40	1.00	0.372	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



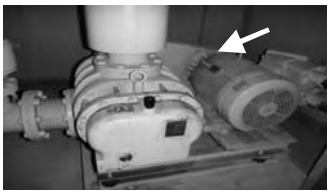
【Comment】

drawing date: 29 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1A Aeration Blower				
measurement part	Motor (Load Side)				
ID code	112	Direction of measurement	Vertical	Group No.	112
Output	30.0 kW	Rotational speed	1477 min-1	Axis diameter	60 mm



【 Relative value Judgment 】 recorded time: 13 May 2010 12:29

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.523	Good
ACC(OA) [G]	1.00	4.00	0.256	Good
ACC(PEAK) [G]	3.00	12.00	0.709	Good
VEL [cm/s]	0.40	1.00	0.314	Good
DISP [μm]	30	100	31.3	Attention

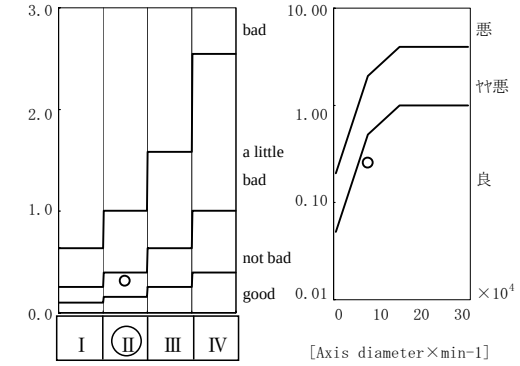
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:29

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.54	2.16	0.256	Good
VEL [cm/s]	0.40	1.00	0.314	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 29 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1A Aeration Blower				
measurement part	Blower Inside (Load Side)				
ID code	113	Direction of measurement	Vertical	Group No.	113
Output	30.0 kW	Rotational speed	1244 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:30

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.910	Attention
ACC(OA) [G]	1.00	4.00	1.065	Attention
ACC(PEAK) [G]	3.00	12.00	3.596	Attention
VEL [cm/s]	0.40	1.00	0.684	Attention
DISP [μm]	30	100	72.2	Attention

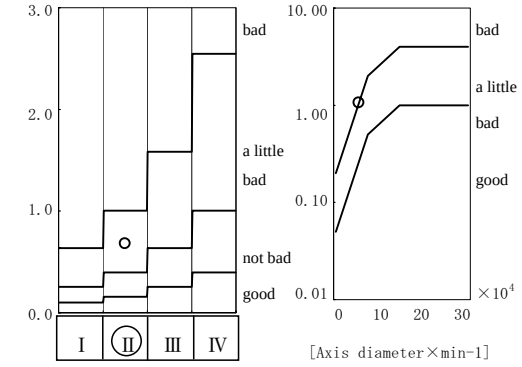
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:30

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.12	1.065	little bad
VEL [cm/s]	0.40	1.00	0.684	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 29 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1A Aeration Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	115	Direction of measurement	Vertical	Group No.	115
Output	30.0 kW	Rotational speed	1244 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:31

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.391	Attention
ACC(OA) [G]	1.00	4.00	0.646	Good
ACC(PEAK) [G]	3.00	12.00	2.775	Good
VEL [cm/s]	0.40	1.00	0.440	Attention
DISP [μm]	30	100	34.0	Attention

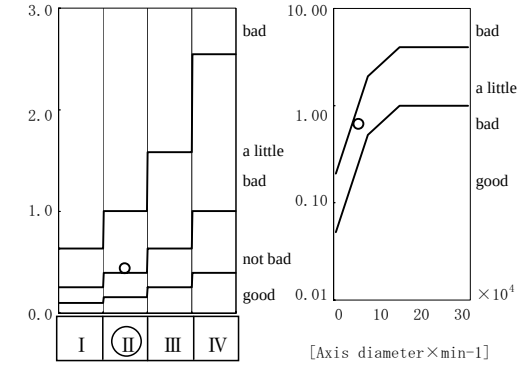
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:31

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.12	0.646	little bad
VEL [cm/s]	0.40	1.00	0.440	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 29 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1A Aeration Blower				
measurement part	Blower Outside (Load Side)				
ID code	114	Direction of measurement	Vertical	Group No.	114
Output	30.0 kW	Rotational speed	1244 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:31

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	2.116	Attention
ACC(OA) [G]	1.00	4.00	0.850	Good
ACC(PEAK) [G]	3.00	12.00	2.970	Good
VEL [cm/s]	0.40	1.00	0.714	Attention
DISP [μm]	30	100	66.5	Attention

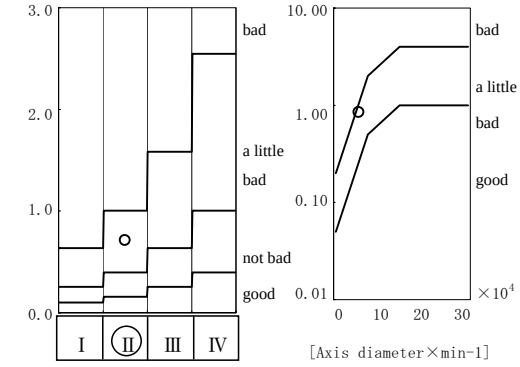
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:31

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.12	0.850	little bad
VEL [cm/s]	0.40	1.00	0.714	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 29 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1A Aeration Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	116	Direction of measurement	Vertical	Group No.	116
Output	30.0 kW	Rotational speed	1244 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:32

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.479	Attention
ACC(OA) [G]	1.00	4.00	0.703	Good
ACC(PEAK) [G]	3.00	12.00	2.369	Good
VEL [cm/s]	0.40	1.00	0.467	Attention
DISP [μm]	30	100	25.1	Good

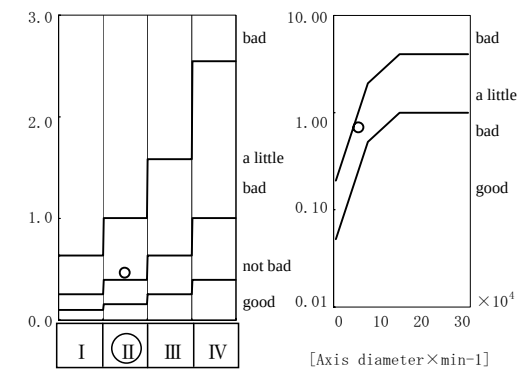
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:32

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.12	0.703	little bad
VEL [cm/s]	0.40	1.00	0.467	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 15 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1B Aeration Blower				
measurement part	Moter (Opposite Load Side)				
ID code	121	Direction of measurement	Vertical	Group No.	111
Output	30.0 kW	Rotational speed	1477 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:45

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.891	Good
ACC(OA) [G]	1.00	4.00	0.538	Good
ACC(PEAK) [G]	3.00	12.00	1.535	Good
VEL [cm/s]	0.40	1.00	0.425	Attention
DISP [μm]	30	100	20.8	Good

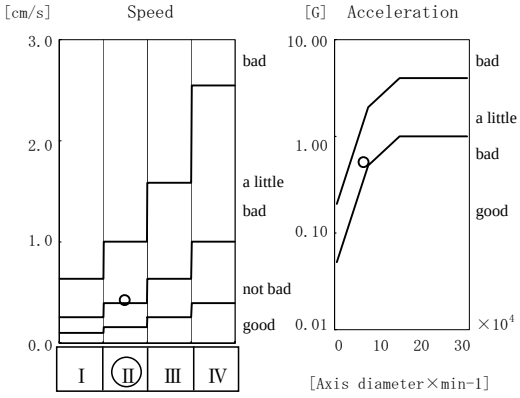
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:45

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.41	1.64	0.538	little bad
VEL [cm/s]	0.40	1.00	0.425	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



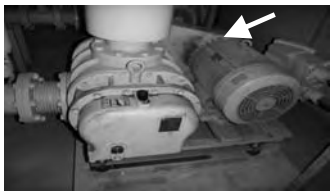
【Comment】

drawing date: 15 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1B Aeration Blower				
measurement part	Moter (Load Side)				
ID code	122	Direction of measurement	Vertical	Group No.	112
Output	30.0 kW	Rotational speed	1477 min-1	Axis diameter	60 mm



【 Relative value Judgment 】 recorded time: 13 May 2010 12:46

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.625	Good
ACC(OA) [G]	1.00	4.00	0.222	Good
ACC(PEAK) [G]	3.00	12.00	0.673	Good
VEL [cm/s]	0.40	1.00	0.545	Attention
DISP [μm]	30	100	65.1	Attention

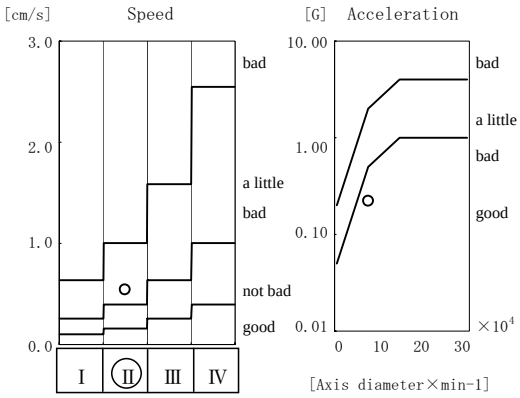
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:46

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.54	2.16	0.222	Good
VEL [cm/s]	0.40	1.00	0.545	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 15 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1B Aeration Blower				
measurement part	Blower Inside (Load Side)				
ID code	123	Direction of measurement	Vertical	Group No.	113
Output	30.0 kW	Rotational speed	1240 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:48

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	3.203	Attention
ACC(OA) [G]	1.00	4.00	1.248	Attention
ACC(PEAK) [G]	3.00	12.00	4.811	Attention
VEL [cm/s]	0.40	1.00	0.759	Attention
DISP [μm]	30	100	55.7	Attention

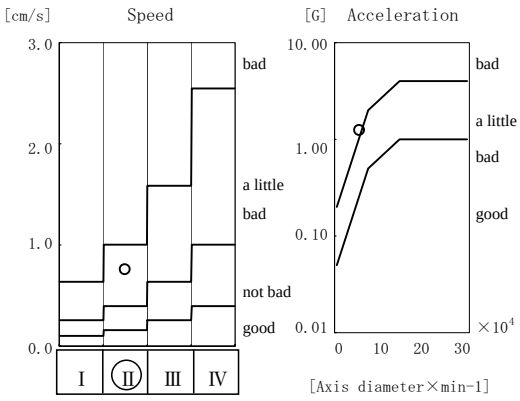
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:48

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.11	1.248	Bad
VEL [cm/s]	0.40	1.00	0.759	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 15 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1B Aeration Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	125	Direction of measurement	Vertical	Group No.	115
Output	30.0 kW	Rotational speed	1240 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:49

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.994	Attention
ACC(OA) [G]	1.00	4.00	0.876	Good
ACC(PEAK) [G]	3.00	12.00	3.355	Attention
VEL [cm/s]	0.40	1.00	0.643	Attention
DISP [μm]	30	100	36.4	Attention

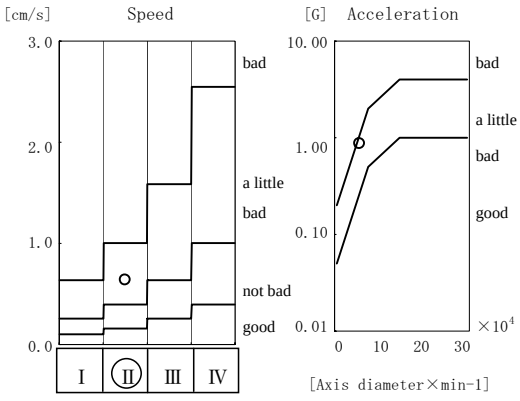
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:49

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.11	0.876	little bad
VEL [cm/s]	0.40	1.00	0.643	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 15 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1B Aeration Blower				
measurement part	Blower Outside (Load Side)				
ID code	124	Direction of measurement	Vertical	Group No.	114
Output	30.0 kW	Rotational speed	1240 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:48

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	3.698	Attention
ACC(OA) [G]	1.00	4.00	1.374	Attention
ACC(PEAK) [G]	3.00	12.00	4.516	Attention
VEL [cm/s]	0.40	1.00	1.006	Danger
DISP [μm]	30	100	54.7	Attention

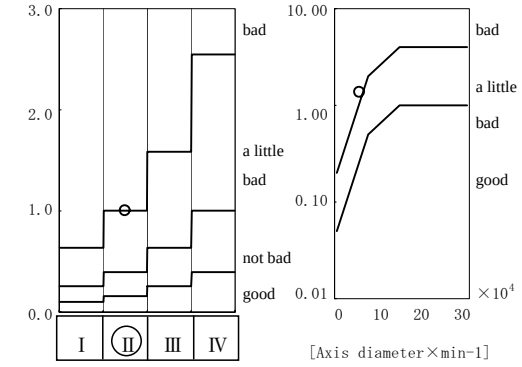
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:48

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.11	1.374	Bad
VEL [cm/s]	0.40	1.00	1.006	Bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1B Aeration Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	126	Direction of measurement	Vertical	Group No.	116
Output	30.0 kW	Rotational speed	1240 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 12:50

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	2.437	Attention
ACC(OA) [G]	1.00	4.00	1.071	Attention
ACC(PEAK) [G]	3.00	12.00	3.485	Attention
VEL [cm/s]	0.40	1.00	0.609	Attention
DISP [μm]	30	100	26.6	Good

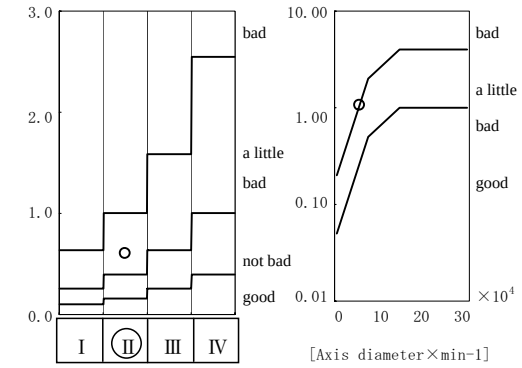
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:50

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.11	1.071	little bad
VEL [cm/s]	0.40	1.00	0.609	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



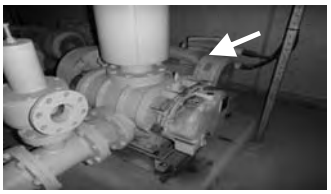
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1C Aeration Blower				
measurement part	Moter (Opposite Load Side)				
ID code	131	Direction of measurement	Vertical	Group No.	111
Output	30.0 kW	Rotational speed	1482 min-1	Axis diameter	50 mm



【 Relative value Judgment 】 recorded time: 13 May 2010 12:59

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.298	Good
ACC(OA) [G]	1.00	4.00	0.149	Good
ACC(PEAK) [G]	3.00	12.00	0.364	Good
VEL [cm/s]	0.40	1.00	0.297	Good
DISP [μm]	30	100	18.1	Good

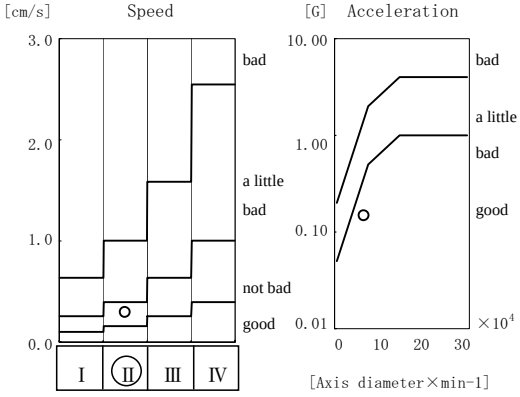
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:59

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.41	1.65	0.149	Good
VEL [cm/s]	0.40	1.00	0.297	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



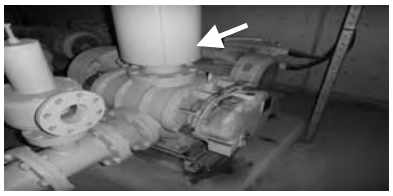
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1C Aeration Blower				
measurement part	Moter (Load Side)				
ID code	132	Direction of measurement	Vertical	Group No.	112
Output	30.0 kW	Rotational speed	1482 min-1	Axis diameter	60 mm



【 Relative value Judgment 】 recorded time: 13 May 2010 12:59

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.236	Good
ACC(OA) [G]	1.00	4.00	0.078	Good
ACC(PEAK) [G]	3.00	12.00	0.199	Good
VEL [cm/s]	0.40	1.00	0.383	Good
DISP [μm]	30	100	49.9	Attention

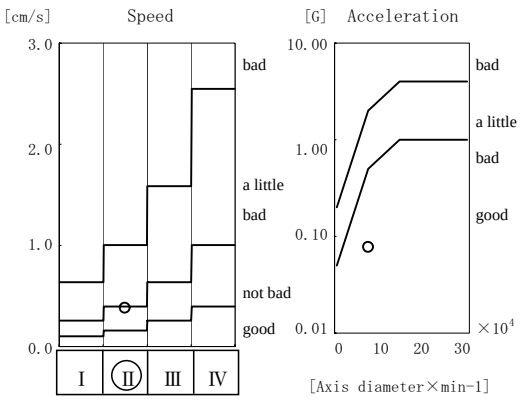
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 12:59

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.54	2.17	0.078	Good
VEL [cm/s]	0.40	1.00	0.383	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1C Aeration Blower				
measurement part	Blower Inside (Load Side)				
ID code	133	Direction of measurement	Vertical	Group No.	113
Output	30.0 kW	Rotational speed	1247 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 13:01

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.986	Good
ACC(OA) [G]	1.00	4.00	0.512	Good
ACC(PEAK) [G]	3.00	12.00	1.479	Good
VEL [cm/s]	0.40	1.00	0.484	Attention
DISP [μm]	30	100	62.8	Attention

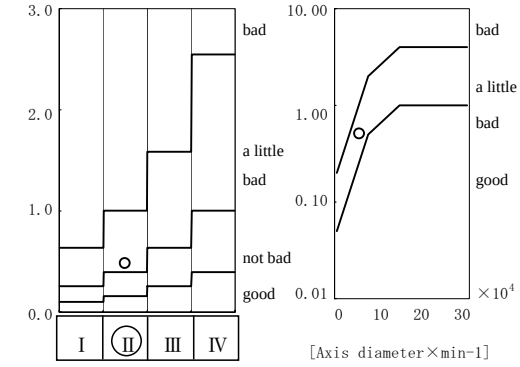
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 13:01

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.12	0.512	little bad
VEL [cm/s]	0.40	1.00	0.484	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1C Aeration Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	135	Direction of measurement	Vertical	Group No.	115
Output	30.0 kW	Rotational speed	1247 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 13:01

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.683	Good
ACC(OA) [G]	1.00	4.00	0.282	Good
ACC(PEAK) [G]	3.00	12.00	1.100	Good
VEL [cm/s]	0.40	1.00	0.361	Good
DISP [μm]	30	100	25.0	Good

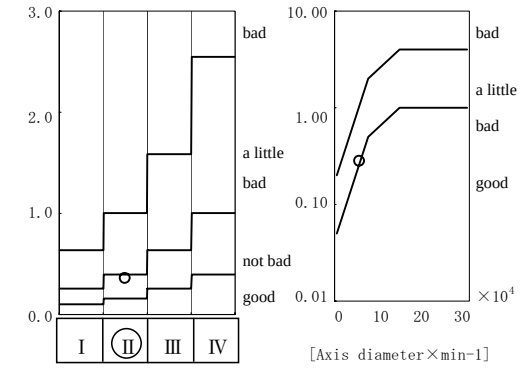
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 13:01

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.12	0.282	little bad
VEL [cm/s]	0.40	1.00	0.361	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



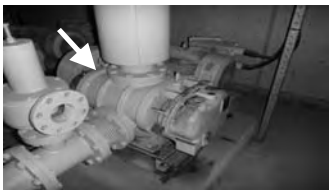
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1C Aeration Blower				
measurement part	Blower Outside (Load Side)				
ID code	134	Direction of measurement	Vertical	Group No.	114
Output	30.0 kW	Rotational speed	1247 min-1	Axis diameter	50 mm



【 Relative value Judgment 】 recorded time: 13 May 2010 13:00

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.880	Good
ACC(OA) [G]	1.00	4.00	0.344	Good
ACC(PEAK) [G]	3.00	12.00	1.094	Good
VEL [cm/s]	0.40	1.00	0.465	Attention
DISP [μm]	30	100	61.0	Attention

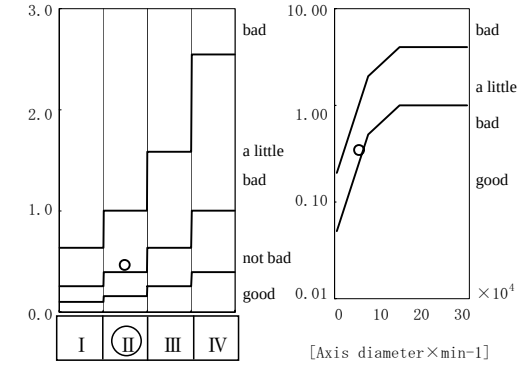
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 13:00

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.12	0.344	little bad
VEL [cm/s]	0.40	1.00	0.465	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

簡 易 診 断 報 告 書

					drawing

equipment name	Kim Lien WWTP				
machine name	KBW1C Aeration Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	136	Direction of measurement	Vertical	Group No.	116
Output	30.0 kW	Rotational speed	1247 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 13 May 2010 13:00

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.728	Good
ACC(OA) [G]	1.00	4.00	0.300	Good
ACC(PEAK) [G]	3.00	12.00	0.968	Good
VEL [cm/s]	0.40	1.00	0.259	Good
DISP [μm]	30	100	16.3	Good

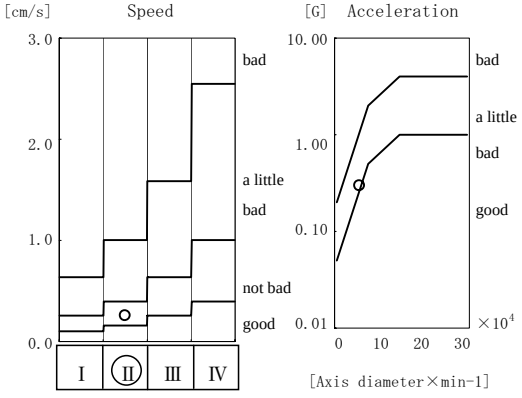
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 13 May 2010 13:00

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.28	1.12	0.300	little bad
VEL [cm/s]	0.40	1.00	0.259	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



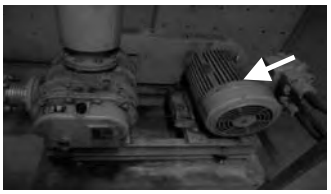
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Motor (Opposite Load Side)				
ID code	211	Direction of measurement	Vertical	Group No.	211
Output	15.0 kW	Rotational speed	1469 min-1	Axis diameter	40 mm

drawing



【 Relative value Judgment 】 recorded time: 18 May 2010 16:18

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.592	Good
ACC(OA) [G]	1.00	4.00	0.356	Good
ACC(PEAK) [G]	3.00	12.00	1.084	Good
VEL [cm/s]	0.40	1.00	0.268	Good
DISP [μm]	30	100	21.7	Good

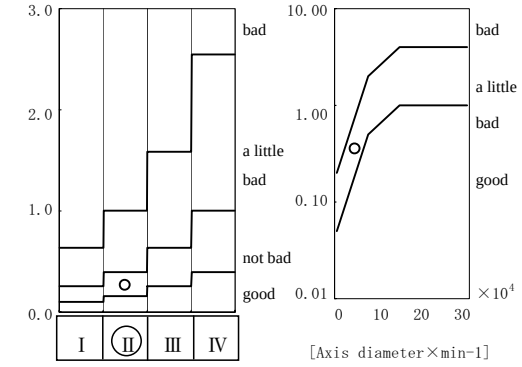
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:18

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.25	1.00	0.356	little bad
VEL [cm/s]	0.40	1.00	0.268	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



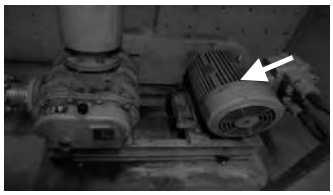
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Motor (Opposite Load Side)				
ID code	211	Direction of measurement	Vertical	Group No.	211
Output	15.0 kW	Rotational speed	1469 min-1	Axis diameter	40 mm

drawing



【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:34

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.655	Good
ACC(OA) [G]	1.00	4.00	0.491	Good
ACC(PEAK) [G]	3.00	12.00	1.253	Good
VEL [cm/s]	0.40	1.00	0.248	Good
DISP [μm]	30	100	16.9	Good

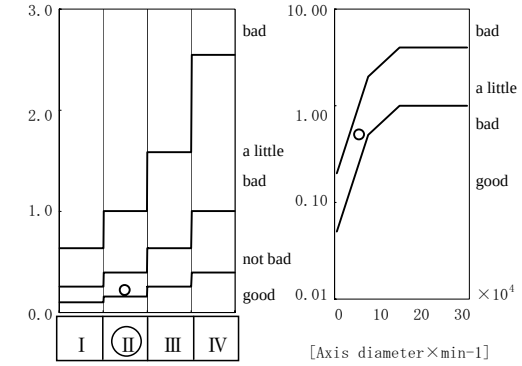
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:34

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.25	1.00	0.491	little bad
VEL [cm/s]	0.40	1.00	0.248	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



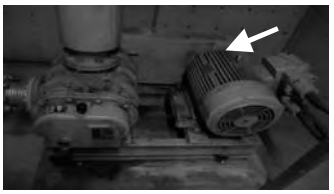
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Moter (Load Side)				
ID code	212	Direction of measurement	Vertical	Group No.	212
Output	15.0 kW	Rotational speed	1469 min-1	Axis diameter	45 mm



【 Relative value Judgment 】 recorded time: 18 May 2010 16:18

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.069	Attention
ACC(OA) [G]	1.00	4.00	0.503	Good
ACC(PEAK) [G]	3.00	12.00	1.138	Good
VEL [cm/s]	0.40	1.00	0.220	Good
DISP [μm]	30	100	15.6	Good

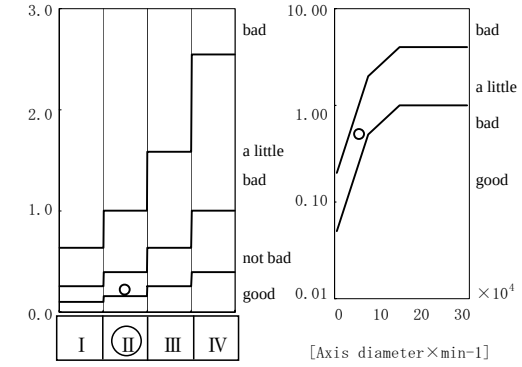
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:18

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.32	1.27	0.503	little bad
VEL [cm/s]	0.40	1.00	0.220	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



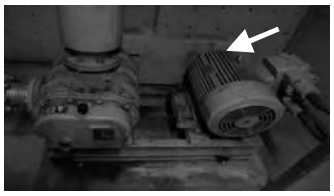
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Moter (Load Side)				
ID code	212	Direction of measurement	Vertical	Group No.	212
Output	15.0 kW	Rotational speed	1469 min-1	Axis diameter	45 mm



【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:34

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.425	Good
ACC(OA) [G]	1.00	4.00	0.173	Good
ACC(PEAK) [G]	3.00	12.00	0.554	Good
VEL [cm/s]	0.40	1.00	0.205	Good
DISP [μm]	30	100	16.4	Good

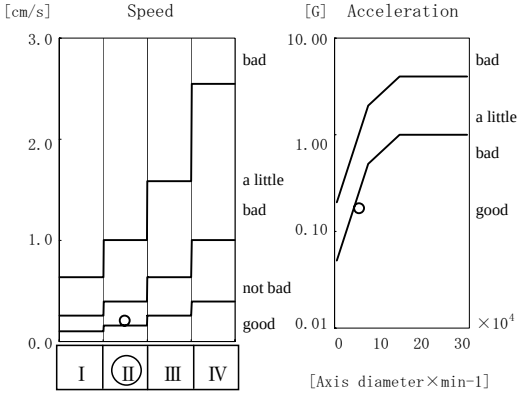
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:34

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.32	1.27	0.173	Good
VEL [cm/s]	0.40	1.00	0.205	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



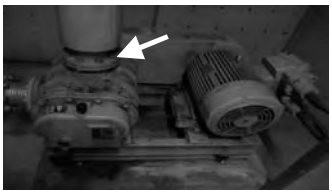
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Blower Inside (Load Side)				
ID code	213	Direction of measurement	Vertical	Group No.	213
Output	15.0 kW	Rotational speed	1518 min-1	Axis diameter	50 mm



【 Relative value Judgment 】 recorded time: 18 May 2010 16:19

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	3.890	Attention
ACC(OA) [G]	1.00	4.00	1.885	Attention
ACC(PEAK) [G]	3.00	12.00	5.622	Attention
VEL [cm/s]	0.40	1.00	0.827	Attention
DISP [μm]	30	100	75.8	Attention

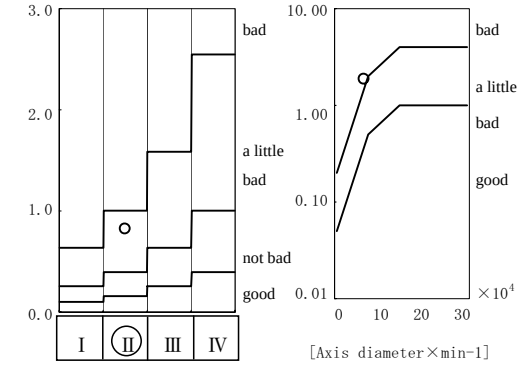
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:19

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.44	1.75	1.885	Bad
VEL [cm/s]	0.40	1.00	0.827	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



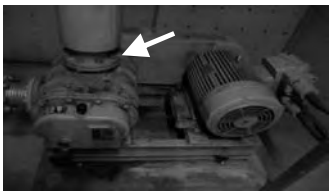
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Blower Inside (Load Side)				
ID code	213	Direction of measurement	Vertical	Group No.	213
Output	15.0 kW	Rotational speed	1518 min-1	Axis diameter	50 mm



【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:35

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	2.147	Attention
ACC(OA) [G]	1.00	4.00	1.362	Attention
ACC(PEAK) [G]	3.00	12.00	3.625	Attention
VEL [cm/s]	0.40	1.00	0.487	Attention
DISP [μm]	30	100	38.7	Attention

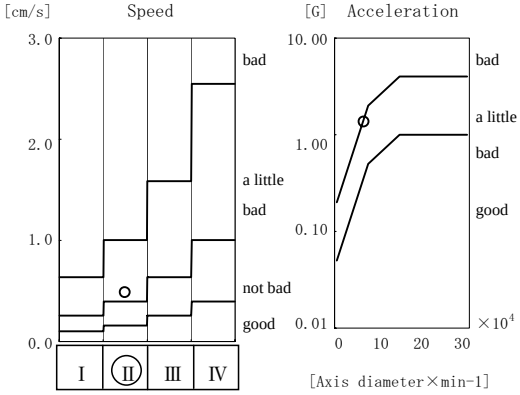
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:35

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.44	1.75	1.362	little bad
VEL [cm/s]	0.40	1.00	0.487	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



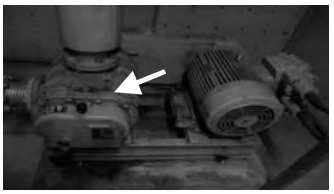
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

drawing					

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	215	Direction of measurement	Vertical	Group No.	215
Output	15.0 kW	Rotational speed	1518 min-1	Axis diameter	45 mm



【 Relative value Judgment 】 recorded time: 18 May 2010 16:20

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	2.330	Attention
ACC(OA) [G]	1.00	4.00	1.297	Attention
ACC(PEAK) [G]	3.00	12.00	3.585	Attention
VEL [cm/s]	0.40	1.00	0.495	Attention
DISP [μm]	30	100	29.1	Good

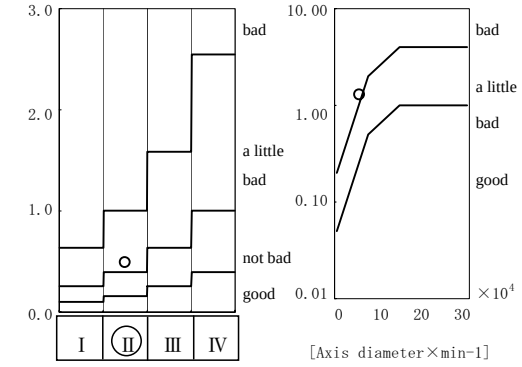
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:20

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.34	1.37	1.297	little bad
VEL [cm/s]	0.40	1.00	0.495	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



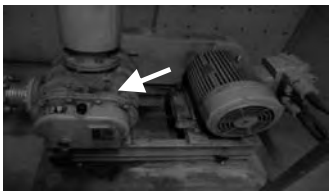
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

drawing					

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	215	Direction of measurement	Vertical	Group No.	215
Output	15.0 kW	Rotational speed	1518 min-1	Axis diameter	45 mm



【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:36

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.555	Attention
ACC(OA) [G]	1.00	4.00	0.844	Good
ACC(PEAK) [G]	3.00	12.00	2.869	Good
VEL [cm/s]	0.40	1.00	0.290	Good
DISP [μm]	30	100	22.9	Good

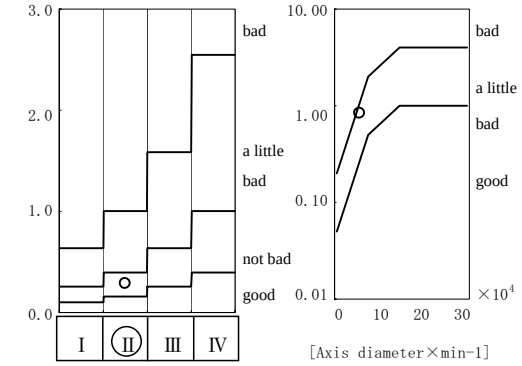
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:36

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.34	1.37	0.844	little bad
VEL [cm/s]	0.40	1.00	0.290	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Blower Outside (Load Side)				
ID code	214	Direction of measurement	Vertical	Group No.	214
Output	15.0 kW	Rotational speed	1518 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 16:20

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	3.654	Attention
ACC(OA) [G]	1.00	4.00	1.942	Attention
ACC(PEAK) [G]	3.00	12.00	5.055	Attention
VEL [cm/s]	0.40	1.00	0.789	Attention
DISP [μm]	30	100	37.2	Attention

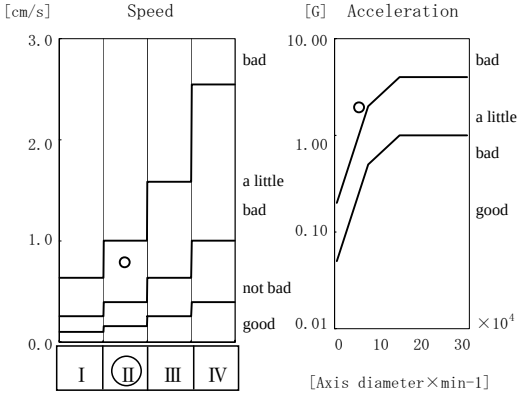
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:20

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.34	1.37	1.942	Bad
VEL [cm/s]	0.40	1.00	0.789	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Blower Outside (Load Side)				
ID code	214	Direction of measurement	Vertical	Group No.	214
Output	15.0 kW	Rotational speed	1518 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:36

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	2.741	Attention
ACC(OA) [G]	1.00	4.00	1.438	Attention
ACC(PEAK) [G]	3.00	12.00	4.092	Attention
VEL [cm/s]	0.40	1.00	0.506	Attention
DISP [μm]	30	100	38.4	Attention

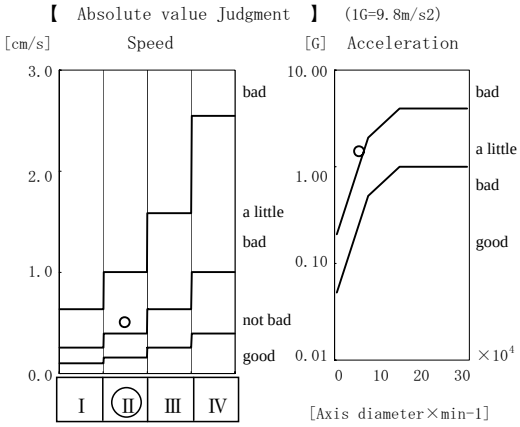
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:36

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.34	1.37	1.438	Bad
VEL [cm/s]	0.40	1.00	0.506	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

drawing					

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	216	Direction of measurement	Vertical	Group No.	216
Output	15.0 kW	Rotational speed	1518 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 16:21

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.741	Attention
ACC(OA) [G]	1.00	4.00	0.990	Good
ACC(PEAK) [G]	3.00	12.00	2.753	Good
VEL [cm/s]	0.40	1.00	0.333	Good
DISP [μm]	30	100	17.1	Good

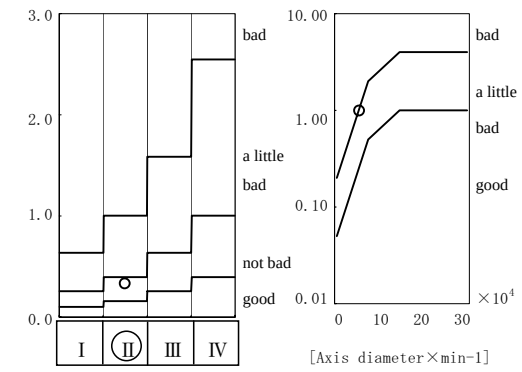
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:21

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.34	1.37	0.990	little bad
VEL [cm/s]	0.40	1.00	0.333	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

drawing					

equipment name	Truc Bach WWTP				
machine name	TBW1A Aeration Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	216	Direction of measurement	Vertical	Group No.	216
Output	15.0 kW	Rotational speed	1518 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:37

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.632	Attention
ACC(OA) [G]	1.00	4.00	1.008	Attention
ACC(PEAK) [G]	3.00	12.00	3.207	Attention
VEL [cm/s]	0.40	1.00	0.299	Good
DISP [μm]	30	100	17.5	Good

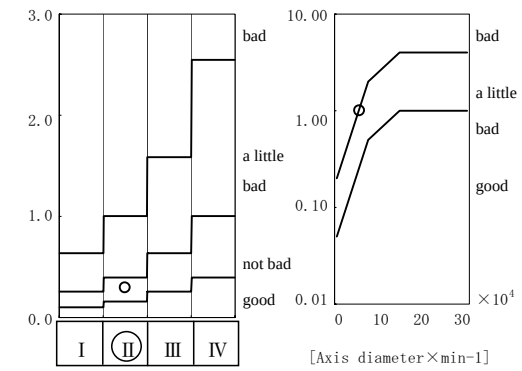
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:37

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.34	1.37	1.008	little bad
VEL [cm/s]	0.40	1.00	0.299	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



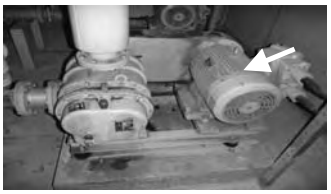
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Moter (Opposite Load Side)				
ID code	221	Direction of measurement	Vertical	Group No.	211
Output	15.0 kW	Rotational speed	1459 min-1	Axis diameter	40 mm



【 Relative value Judgment 】 recorded time: 18 May 2010 15:57

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.658	Good
ACC(OA) [G]	1.00	4.00	0.520	Good
ACC(PEAK) [G]	3.00	12.00	0.940	Good
VEL [cm/s]	0.40	1.00	0.265	Good
DISP [μm]	30	100	17.1	Good

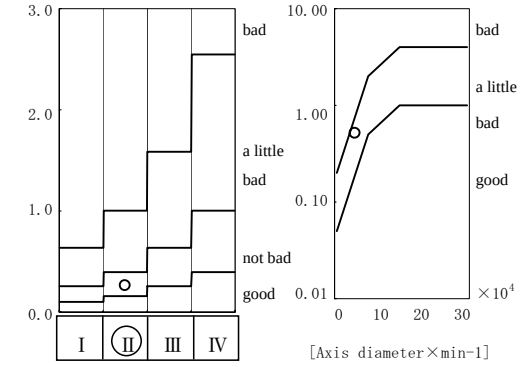
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 15:57

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.25	0.98	0.520	little bad
VEL [cm/s]	0.40	1.00	0.265	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Moter (Opposite Load Side)				
ID code	221	Direction of measurement	Vertical	Group No.	211
Output	15.0 kW	Rotational speed	1459 min-1	Axis diameter	40 mm

【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:37

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.662	Good
ACC(OA) [G]	1.00	4.00	0.432	Good
ACC(PEAK) [G]	3.00	12.00	0.910	Good
VEL [cm/s]	0.40	1.00	0.254	Good
DISP [μm]	30	100	19.8	Good

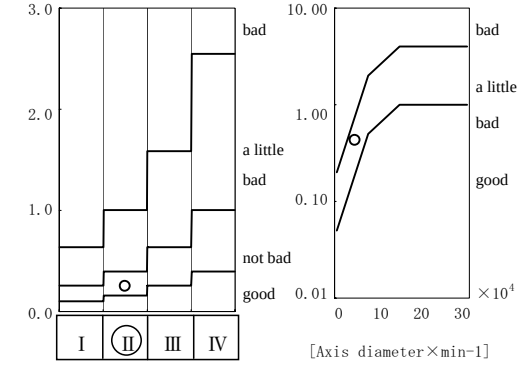
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:37

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.25	0.98	0.432	little bad
VEL [cm/s]	0.40	1.00	0.254	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

drawing					

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Motor (Load Side)				
ID code	222	Direction of measurement	Vertical	Group No.	212
Output	15.0 kW	Rotational speed	1459 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 15:58

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.993	Good
ACC(OA) [G]	1.00	4.00	0.268	Good
ACC(PEAK) [G]	3.00	12.00	0.712	Good
VEL [cm/s]	0.40	1.00	0.435	Attention
DISP [μm]	30	100	20.3	Good

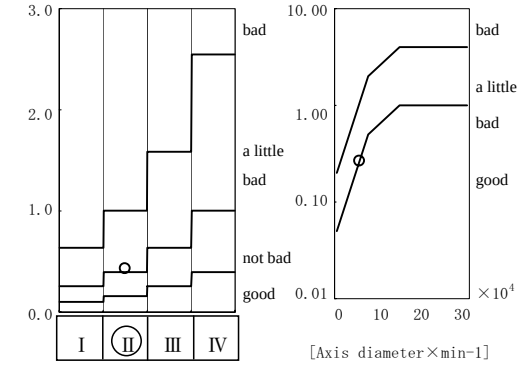
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 15:58

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.31	1.25	0.268	Good
VEL [cm/s]	0.40	1.00	0.435	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

drawing					

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Motor (Load Side)				
ID code	222	Direction of measurement	Vertical	Group No.	212
Output	15.0 kW	Rotational speed	1459 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:38

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.839	Good
ACC(OA) [G]	1.00	4.00	0.329	Good
ACC(PEAK) [G]	3.00	12.00	0.846	Good
VEL [cm/s]	0.40	1.00	0.344	Good
DISP [μm]	30	100	24.4	Good

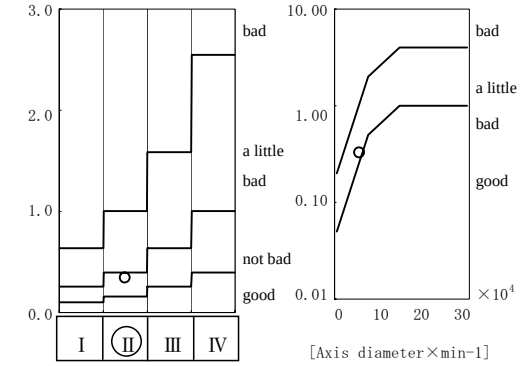
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:38

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.31	1.25	0.329	little bad
VEL [cm/s]	0.40	1.00	0.344	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



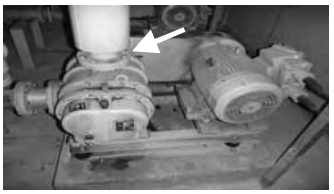
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Blower Inside (Load Side)				
ID code	223	Direction of measurement	Vertical	Group No.	213
Output	15.0 kW	Rotational speed	1542 min-1	Axis diameter	50 mm



【 Relative value Judgment 】 recorded time: 18 May 2010 15:59

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.458	Attention
ACC(OA) [G]	1.00	4.00	0.803	Good
ACC(PEAK) [G]	3.00	12.00	2.513	Good
VEL [cm/s]	0.40	1.00	0.586	Attention
DISP [μm]	30	100	52.3	Attention

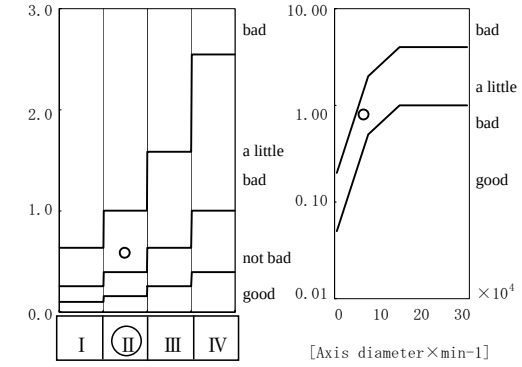
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 15:59

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.46	1.82	0.803	little bad
VEL [cm/s]	0.40	1.00	0.586	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Blower Inside (Load Side)				
ID code	223	Direction of measurement	Vertical	Group No.	213
Output	15.0 kW	Rotational speed	1542 min-1	Axis diameter	50 mm

【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:38

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	2.176	Attention
ACC(OA) [G]	1.00	4.00	0.951	Good
ACC(PEAK) [G]	3.00	12.00	2.892	Good
VEL [cm/s]	0.40	1.00	0.588	Attention
DISP [μm]	30	100	47.4	Attention

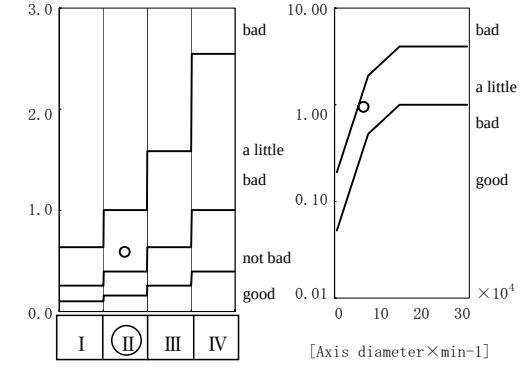
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:38

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.46	1.82	0.951	little bad
VEL [cm/s]	0.40	1.00	0.588	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



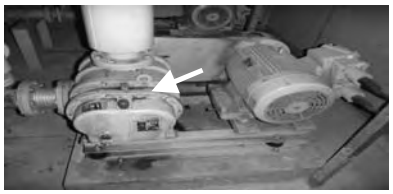
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	225	Direction of measurement	Vertical	Group No.	215
Output	15.0 kW	Rotational speed	1542 min-1	Axis diameter	45 mm



【 Relative value Judgment 】 recorded time: 18 May 2010 16:01

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.018	Attention
ACC(OA) [G]	1.00	4.00	0.603	Good
ACC(PEAK) [G]	3.00	12.00	2.304	Good
VEL [cm/s]	0.40	1.00	0.344	Good
DISP [μm]	30	100	17.2	Good

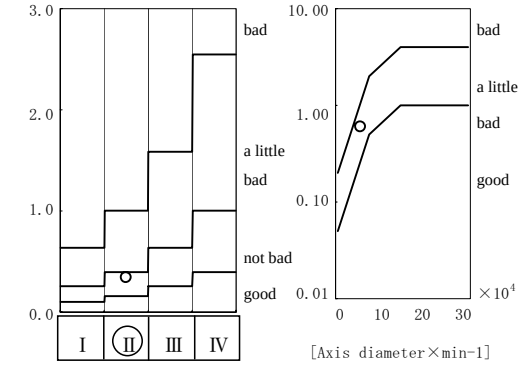
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:01

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.35	1.41	0.603	little bad
VEL [cm/s]	0.40	1.00	0.344	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



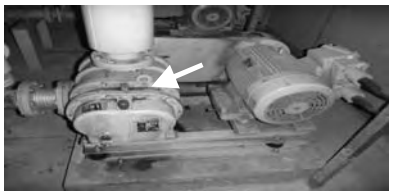
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	225	Direction of measurement	Vertical	Group No.	215
Output	15.0 kW	Rotational speed	1542 min-1	Axis diameter	45 mm



【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:39

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.137	Attention
ACC(OA) [G]	1.00	4.00	0.809	Good
ACC(PEAK) [G]	3.00	12.00	2.151	Good
VEL [cm/s]	0.40	1.00	0.442	Attention
DISP [μm]	30	100	20.0	Good

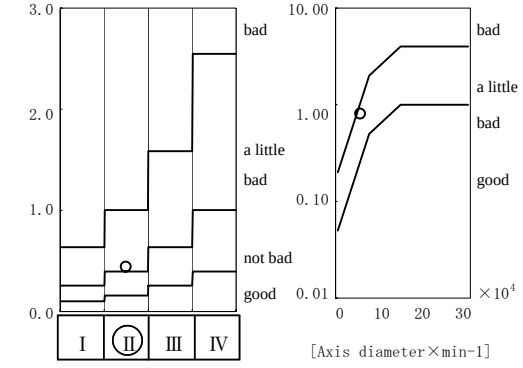
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:39

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.35	1.41	0.809	little bad
VEL [cm/s]	0.40	1.00	0.442	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Blower Outside (Load Side)				
ID code	224	Direction of measurement	Vertical	Group No.	214
Output	15.0 kW	Rotational speed	1542 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 16:00

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.924	Attention
ACC(OA) [G]	1.00	4.00	1.089	Attention
ACC(PEAK) [G]	3.00	12.00	3.273	Attention
VEL [cm/s]	0.40	1.00	0.558	Attention
DISP [μm]	30	100	52.2	Attention

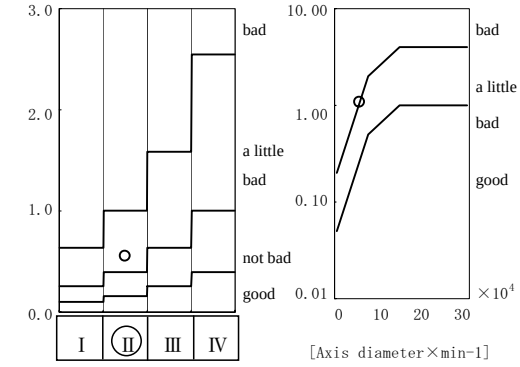
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:00

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.35	1.41	1.089	little bad
VEL [cm/s]	0.40	1.00	0.558	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Blower Outside (Load Side)				
ID code	224	Direction of measurement	Vertical	Group No.	214
Output	15.0 kW	Rotational speed	1542 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:39

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	2.093	Attention
ACC(OA) [G]	1.00	4.00	1.146	Attention
ACC(PEAK) [G]	3.00	12.00	3.055	Attention
VEL [cm/s]	0.40	1.00	0.625	Attention
DISP [μm]	30	100	51.9	Attention

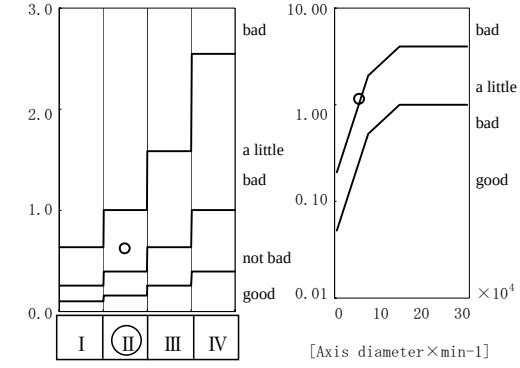
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:39

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.35	1.41	1.146	little bad
VEL [cm/s]	0.40	1.00	0.625	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	226	Direction of measurement	Vertical	Group No.	216
Output	15.0 kW	Rotational speed	1542 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 16:01

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.561	Attention
ACC(OA) [G]	1.00	4.00	0.948	Good
ACC(PEAK) [G]	3.00	12.00	2.673	Good
VEL [cm/s]	1.00	4.00	0.296	Good
DISP [μm]	30	100	17.6	Good

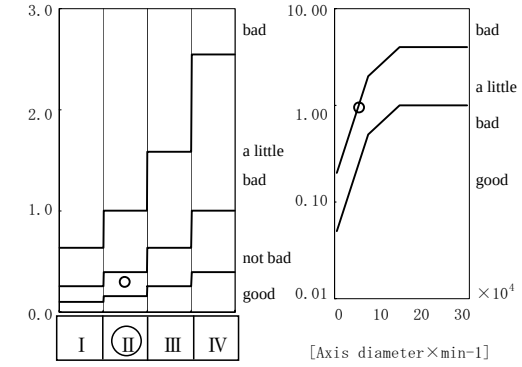
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:01

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.35	1.41	0.948	little bad
VEL [cm/s]	0.40	1.00	0.296	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1B Aeration Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	226	Direction of measurement	Vertical	Group No.	216
Output	15.0 kW	Rotational speed	1542 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 16 Jul 2010 11:39

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.661	Attention
ACC(OA) [G]	1.00	4.00	0.868	Good
ACC(PEAK) [G]	3.00	12.00	2.348	Good
VEL [cm/s]	1.00	4.00	0.402	Good
DISP [μm]	30	100	11.9	Good

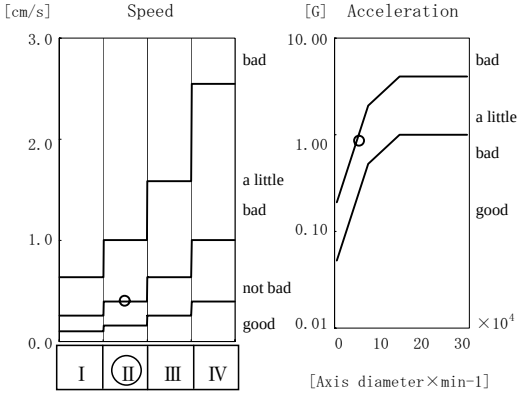
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 16 Jul 2010 11:39

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.35	1.41	0.868	little bad
VEL [cm/s]	0.40	1.00	0.402	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1C Aeration Blower				
measurement part	Moter (Opposite Load Side)				
ID code	231	Direction of measurement	Vertical	Group No.	211
Output	15.0 kW	Rotational speed	1473 min-1	Axis diameter	40 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 16:02

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.902	Good
ACC(OA) [G]	1.00	4.00	0.621	Good
ACC(PEAK) [G]	3.00	12.00	1.069	Good
VEL [cm/s]	0.40	1.00	0.274	Good
DISP [μm]	30	100	10.3	Good

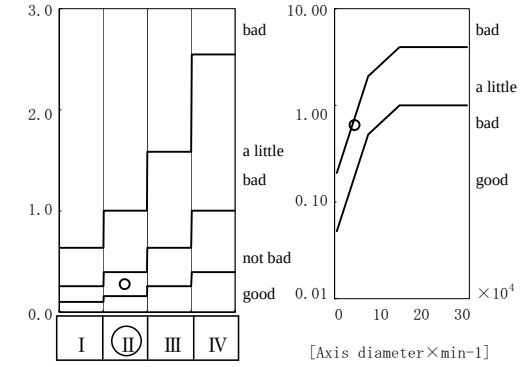
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:02

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.25	1.00	0.621	little bad
VEL [cm/s]	0.40	1.00	0.274	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1C Aeration Blower				
measurement part	Moter (Load Side)				
ID code	232	Direction of measurement	Vertical	Group No.	212
Output	15.0 kW	Rotational speed	1473 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 16:02

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.462	Good
ACC(OA) [G]	1.00	4.00	0.236	Good
ACC(PEAK) [G]	3.00	12.00	0.623	Good
VEL [cm/s]	0.40	1.00	0.244	Good
DISP [μm]	30	100	21.0	Good

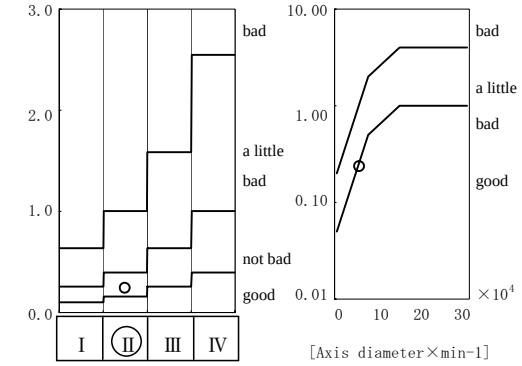
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:02

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.32	1.28	0.236	Good
VEL [cm/s]	0.40	1.00	0.244	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



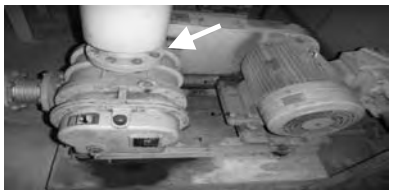
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

drawing					

equipment name	Truc Bach WWTP				
machine name	TBW1C Aeration Blower				
measurement part	Blower Inside (Load Side)				
ID code	233	Direction of measurement	Vertical	Group No.	213
Output	15.0 kW	Rotational speed	1557 min-1	Axis diameter	50 mm



【 Relative value Judgment 】 recorded time: 18 May 2010 16:03

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	3.035	Attention
ACC(OA) [G]	1.00	4.00	1.633	Attention
ACC(PEAK) [G]	3.00	12.00	3.919	Attention
VEL [cm/s]	0.40	1.00	0.488	Attention
DISP [μm]	30	100	30.3	Attention

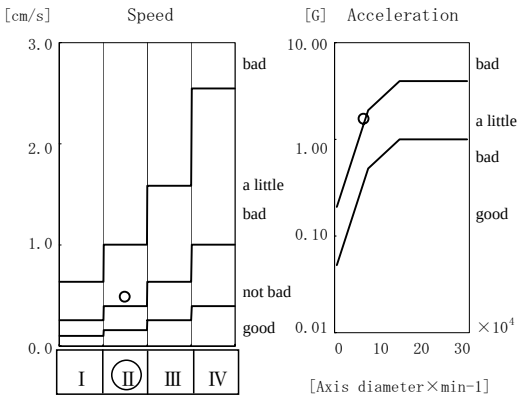
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:03

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.47	1.87	1.633	little bad
VEL [cm/s]	0.40	1.00	0.488	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



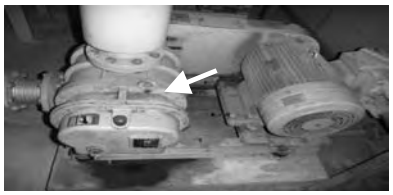
【Comment】

drawing date: 24 May 2010

Simple diagnosis report

drawing					

equipment name	Truc Bach WWTP				
machine name	TBW1C Aeration Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	235	Direction of measurement	Vertical	Group No.	215
Output	15.0 kW	Rotational speed	1557 min-1	Axis diameter	45 mm



【 Relative value Judgment 】 recorded time: 18 May 2010 16:04

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.491	Attention
ACC(OA) [G]	1.00	4.00	1.090	Attention
ACC(PEAK) [G]	3.00	12.00	3.176	Attention
VEL [cm/s]	0.40	1.00	0.223	Good
DISP [μm]	30	100	15.5	Good

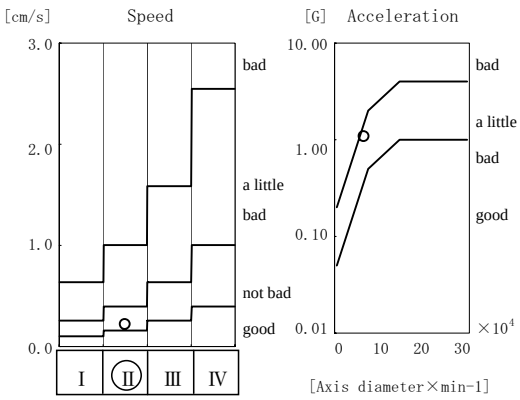
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:04

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.36	1.45	1.090	little bad
VEL [cm/s]	0.40	1.00	0.223	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1C Aeration Blower				
measurement part	Blower Outside (Load Side)				
ID code	234	Direction of measurement	Vertical	Group No.	214
Output	15.0 kW	Rotational speed	1557 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 16:04

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	3.375	Attention
ACC(OA) [G]	1.00	4.00	1.876	Attention
ACC(PEAK) [G]	3.00	12.00	4.231	Attention
VEL [cm/s]	0.40	1.00	0.552	Attention
DISP [μm]	30	100	42.6	Attention

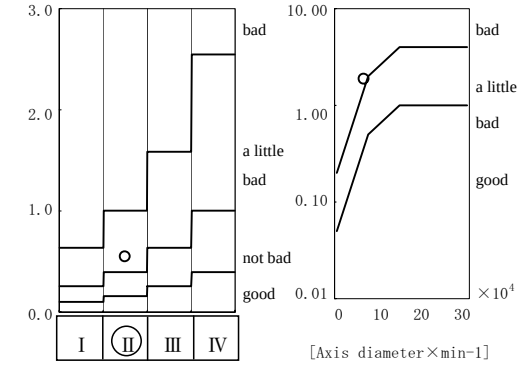
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:04

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.36	1.45	1.876	Bad
VEL [cm/s]	0.40	1.00	0.552	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 24 May 2010

Simple diagnosis report

					drawing

equipment name	Truc Bach WWTP				
machine name	TBW1C Aeration Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	236	Direction of measurement	Vertical	Group No.	216
Output	15.0 kW	Rotational speed	1557 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 18 May 2010 16:05

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.628	Attention
ACC(OA) [G]	1.00	4.00	0.996	Good
ACC(PEAK) [G]	3.00	12.00	3.319	Attention
VEL [cm/s]	0.40	1.00	0.300	Good
DISP [μm]	30	100	12.8	Good

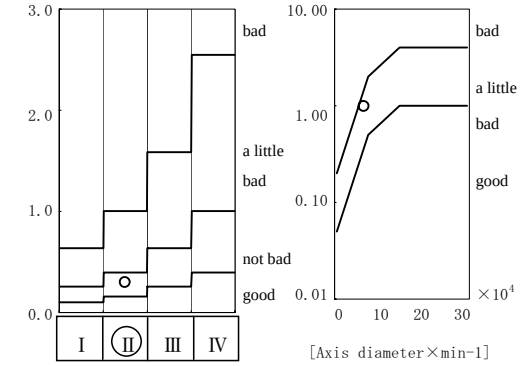
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 18 May 2010 16:05

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.36	1.45	0.996	little bad
VEL [cm/s]	0.40	1.00	0.300	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



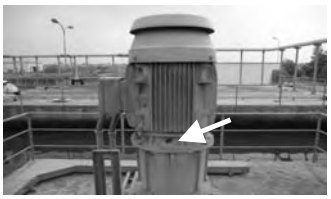
【Comment】

drawing date: 27 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-9A Surface Aerator				
measurement part	Motor (Load Side)				
ID code	352	Direction of measurement	Horizontal	Group No.	352
Output	37.0 kW	Rotational speed	1475 min-1	Axis diameter	70 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 11:40

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.310	Attention
ACC(OA) [G]	1.00	4.00	0.911	Good
ACC(PEAK) [G]	3.00	12.00	2.355	Good
VEL [cm/s]	0.40	1.00	0.248	Good
DISP [μm]	30	100	77.1	Attention

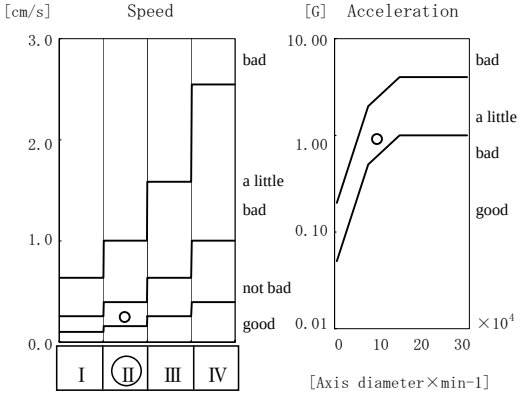
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 11:40

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.63	2.50	0.911	little bad
VEL [cm/s]	0.40	1.00	0.248	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-9A Surface Aerator				
measurement part	Motor (Load Side)				
ID code	352	Direction of measurement	Horizontal	Group No.	352
Output	37.0 kW	Rotational speed	1475 min-1	Axis diameter	70 mm

【 Relative value Judgment 】 recorded time: 14 Jul 2010 11:55

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.217	Attention
ACC(OA) [G]	1.00	4.00	0.808	Good
ACC(PEAK) [G]	3.00	12.00	2.045	Good
VEL [cm/s]	0.40	1.00	0.236	Good
DISP [μm]	30	100	43.5	Attention

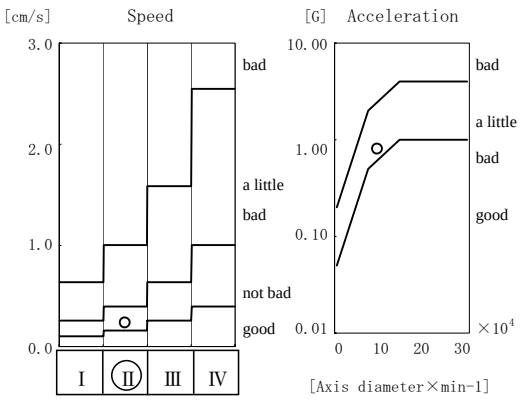
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 11:55

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.63	2.50	0.808	little bad
VEL [cm/s]	0.40	1.00	0.236	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 27 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-9A Surface Aerator				
measurement part	Motor (Opposite Load Side)				
ID code	351	Direction of measurement	H	Group No.	351
Output	37.0 kW	Rotational speed	1475 min-1	Axis diameter	70 mm

【 Relative value Judgment 】 recorded time: 27 May 2010 11:39

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.689	Attention
ACC(OA) [G]	1.00	4.00	0.897	Good
ACC(PEAK) [G]	3.00	12.00	1.964	Good
VEL [cm/s]	0.40	1.00	0.354	Good
DISP [μm]	30	100	67.1	Attention

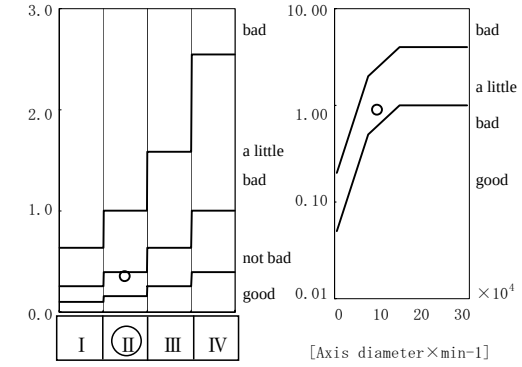
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 11:39

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.63	2.50	0.897	little bad
VEL [cm/s]	0.40	1.00	0.354	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-9A Surface Aerator				
measurement part	Motor (Opposite Load Side)				
ID code	351	Direction of measurement	Horizontal	Group No.	351
Output	37.0 kW	Rotational speed	1475 min-1	Axis diameter	70 mm

【 Relative value Judgment 】 recorded time: 14 Jul 2010 11:54

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.310	Attention
ACC(OA) [G]	1.00	4.00	0.678	Good
ACC(PEAK) [G]	3.00	12.00	1.583	Good
VEL [cm/s]	0.40	1.00	0.318	Good
DISP [μm]	30	100	61.4	Attention

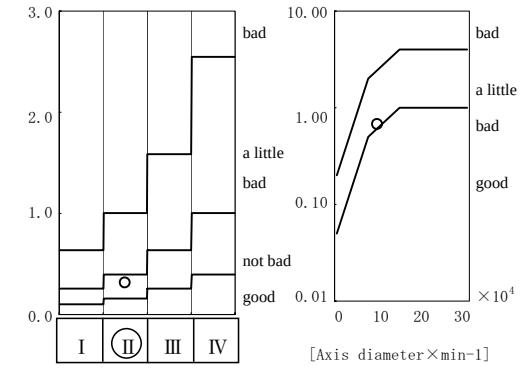
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 11:54

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.63	2.50	0.678	little bad
VEL [cm/s]	0.40	1.00	0.318	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Motor (Load Side)				
ID code	372	Direction of measurement	Vertical	Group No.	372
Output	15.0 kW	Rotational speed	1472 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 27 May 2010 16:46

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.422	Good
ACC(OA) [G]	1.00	4.00	0.148	Good
ACC(PEAK) [G]	3.00	12.00	0.403	Good
VEL [cm/s]	0.40	1.00	0.259	Good
DISP [μm]	30	100	19.0	Good

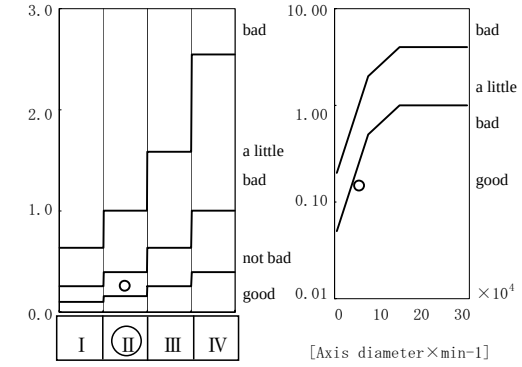
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 16:46

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.32	1.28	0.148	Good
VEL [cm/s]	0.40	1.00	0.259	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Motor (Load Side)				
ID code	372	Direction of measurement	Vertical	Group No.	372
Output	15.0 kW	Rotational speed	1472 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 14 Jul 2010 12:39

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.762	Good
ACC(OA) [G]	1.00	4.00	0.568	Good
ACC(PEAK) [G]	3.00	12.00	1.092	Good
VEL [cm/s]	0.40	1.00	0.270	Good
DISP [μm]	30	100	18.1	Good

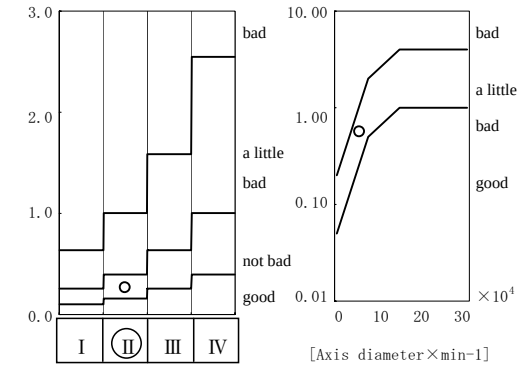
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 12:39

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.32	1.28	0.568	little bad
VEL [cm/s]	0.40	1.00	0.270	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



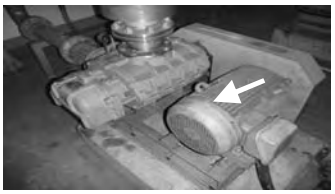
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Motor (Opposite Load Side)				
ID code	371	Direction of measurement	Vertical	Group No.	371
Output	15.0 kW	Rotational speed	1472 min-1	Axis diameter	35 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 16:44

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.595	Good
ACC(OA) [G]	1.00	4.00	0.329	Good
ACC(PEAK) [G]	3.00	12.00	0.827	Good
VEL [cm/s]	0.40	1.00	0.332	Good
DISP [μm]	30	100	19.9	Good

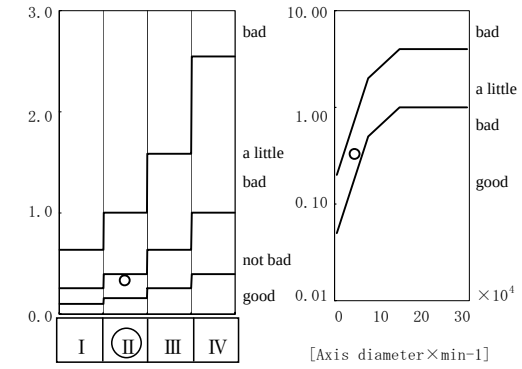
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 16:44

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.20	0.79	0.329	little bad
VEL [cm/s]	0.40	1.00	0.332	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



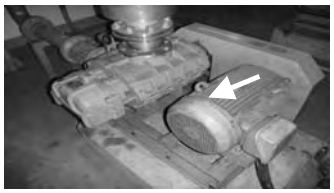
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Motor (Opposite Load Side)				
ID code	371	Direction of measurement	Vertical	Group No.	371
Output	15.0 kW	Rotational speed	1472 min-1	Axis diameter	35 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 12:39

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.289	Attention
ACC(OA) [G]	1.00	4.00	1.162	Attention
ACC(PEAK) [G]	3.00	12.00	1.709	Good
VEL [cm/s]	0.40	1.00	0.414	Attention
DISP [μm]	30	100	23.5	Good

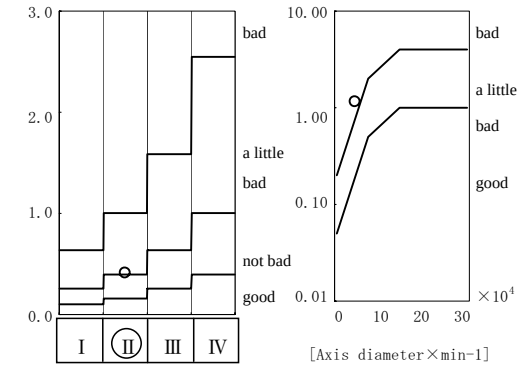
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 12:39

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.20	0.79	1.162	Bad
VEL [cm/s]	0.40	1.00	0.414	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



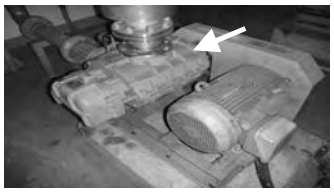
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Blower Inside (Load Side)				
ID code	373	Direction of measurement	Vertical	Group No.	373
Output	15.0 kW	Rotational speed	1913 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 16:47

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.898	Good
ACC(OA) [G]	1.00	4.00	0.472	Good
ACC(PEAK) [G]	3.00	12.00	1.282	Good
VEL [cm/s]	0.40	1.00	0.397	Good
DISP [μm]	30	100	23.2	Good

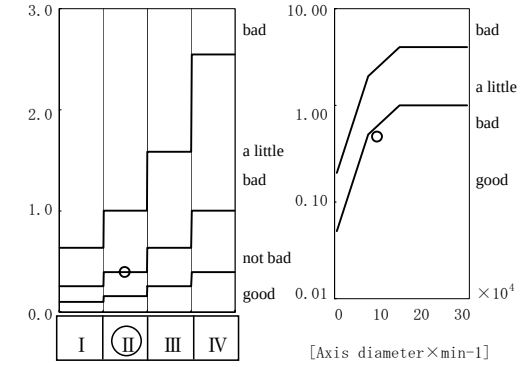
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 16:47

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.55	0.472	Good
VEL [cm/s]	0.40	1.00	0.397	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



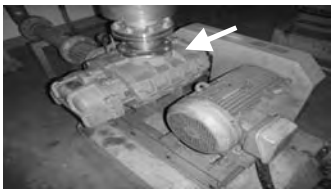
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Blower Inside (Load Side)				
ID code	373	Direction of measurement	Vertical	Group No.	373
Output	15.0 kW	Rotational speed	1913 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 12:40

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.776	Attention
ACC(OA) [G]	1.00	4.00	0.997	Good
ACC(PEAK) [G]	3.00	12.00	2.100	Good
VEL [cm/s]	0.40	1.00	0.497	Attention
DISP [μm]	30	100	28.2	Good

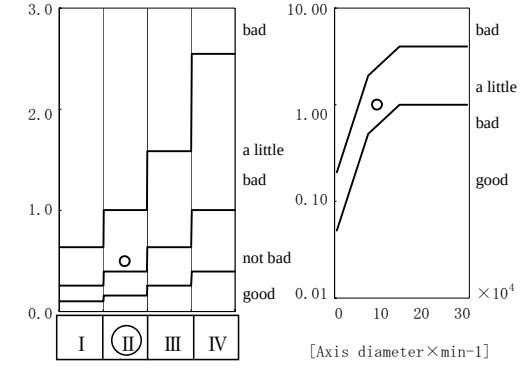
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 12:40

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.55	0.997	little bad
VEL [cm/s]	0.40	1.00	0.497	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



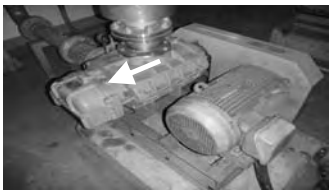
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	375	Direction of measurement	Vertical	Group No.	375
Output	15.0 kW	Rotational speed	1913 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 16:48

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.460	Good
ACC(OA) [G]	1.00	4.00	0.246	Good
ACC(PEAK) [G]	3.00	12.00	0.620	Good
VEL [cm/s]	0.40	1.00	0.252	Good
DISP [μm]	30	100	18.0	Good

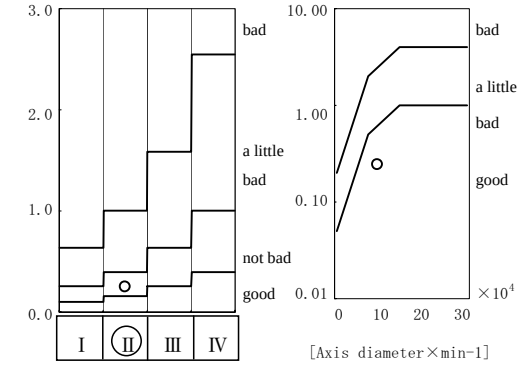
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 16:48

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.55	0.246	Good
VEL [cm/s]	0.40	1.00	0.252	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



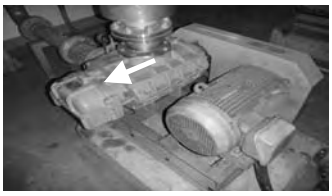
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	375	Direction of measurement	Vertical	Group No.	375
Output	15.0 kW	Rotational speed	1913 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 12:41

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.617	Good
ACC(OA) [G]	1.00	4.00	0.398	Good
ACC(PEAK) [G]	3.00	12.00	1.119	Good
VEL [cm/s]	0.40	1.00	0.273	Good
DISP [μm]	30	100	20.6	Good

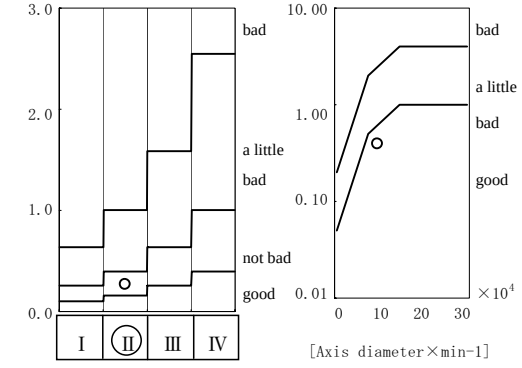
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 12:41

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.55	0.398	Good
VEL [cm/s]	0.40	1.00	0.273	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



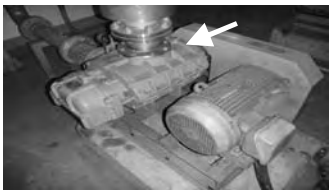
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Blower Outside (Load Side)				
ID code	374	Direction of measurement	Vertical	Group No.	374
Output	15.0 kW	Rotational speed	1913 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 16:47

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.899	Good
ACC(OA) [G]	1.00	4.00	0.513	Good
ACC(PEAK) [G]	3.00	12.00	1.352	Good
VEL [cm/s]	0.40	1.00	0.269	Good
DISP [μm]	30	100	22.9	Good

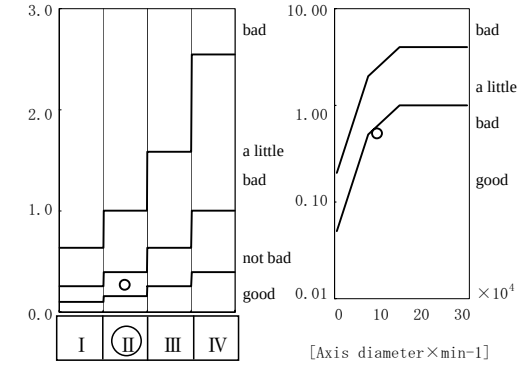
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 16:47

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.55	0.513	Good
VEL [cm/s]	0.40	1.00	0.269	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



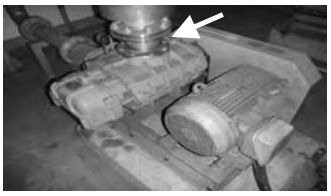
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Blower Outside (Load Side)				
ID code	374	Direction of measurement	Vertical	Group No.	374
Output	15.0 kW	Rotational speed	1913 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 12:41

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	1.693	Attention
ACC(OA) [G]	1.00	4.00	1.038	Attention
ACC(PEAK) [G]	3.00	12.00	2.083	Good
VEL [cm/s]	0.40	1.00	0.329	Good
DISP [μm]	30	100	27.5	Good

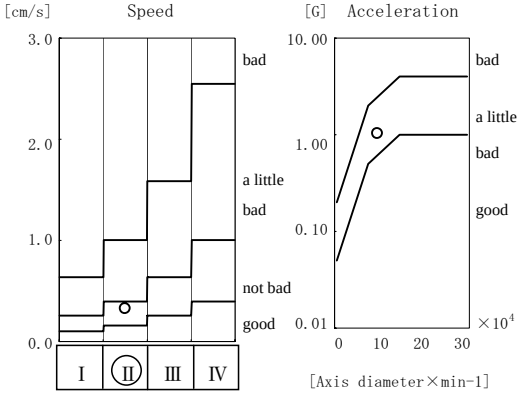
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 12:41

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.55	1.038	little bad
VEL [cm/s]	0.40	1.00	0.329	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



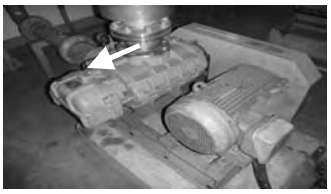
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	376	Direction of measurement	Vertical	Group No.	376
Output	15.0 kW	Rotational speed	1913 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 16:48

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.774	Good
ACC(OA) [G]	1.00	4.00	0.367	Good
ACC(PEAK) [G]	3.00	12.00	0.954	Good
VEL [cm/s]	0.40	1.00	0.244	Good
DISP [μm]	30	100	15.9	Good

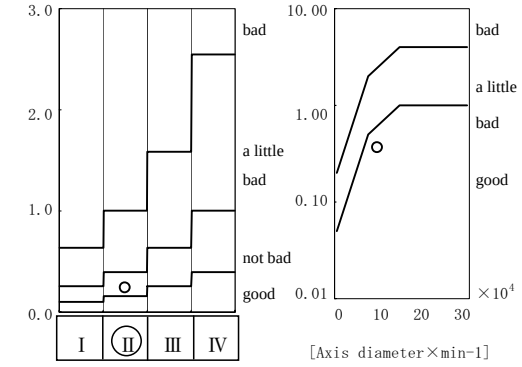
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 16:48

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.55	0.367	Good
VEL [cm/s]	0.40	1.00	0.244	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



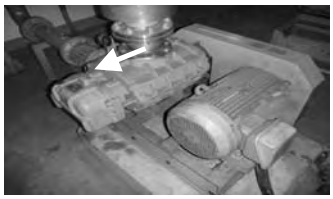
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10A Channei Mixing Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	376	Direction of measurement	Vertical	Group No.	376
Output	15.0 kW	Rotational speed	1913 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 12:42

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.568	Good
ACC(OA) [G]	1.00	4.00	0.357	Good
ACC(PEAK) [G]	3.00	12.00	0.993	Good
VEL [cm/s]	0.40	1.00	0.212	Good
DISP [μm]	30	100	17.9	Good

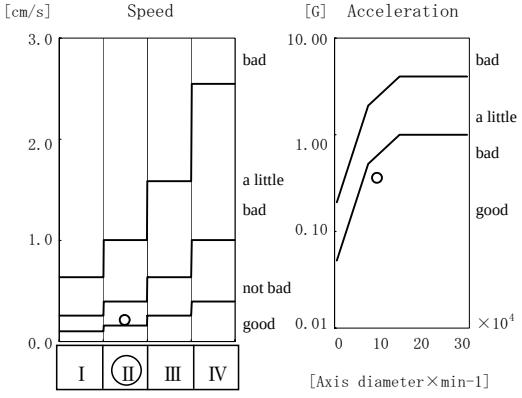
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 12:42

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.55	0.357	Good
VEL [cm/s]	0.40	1.00	0.212	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Moter (Load Side)				
ID code	382	Direction of measurement	Vertical	Group No.	372
Output	15.0 kW	Rotational speed	1473 min-1	Axis diameter	45 mm

【 Relative value Judgment 】 recorded time: 27 May 2010 11:35

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.569	Good
ACC(OA) [G]	1.00	4.00	0.335	Good
ACC(PEAK) [G]	3.00	12.00	0.872	Good
VEL [cm/s]	0.40	1.00	0.456	Attention
DISP [μm]	30	100	52.9	Attention

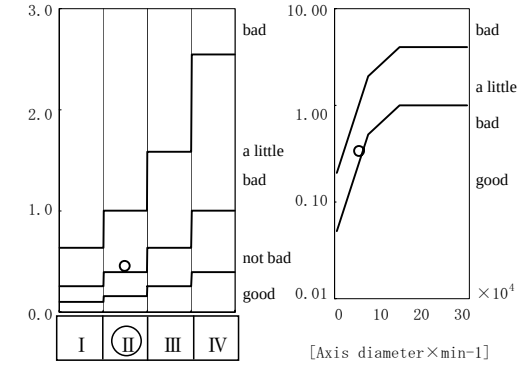
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 11:35

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.32	1.28	0.335	little bad
VEL [cm/s]	0.40	1.00	0.456	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



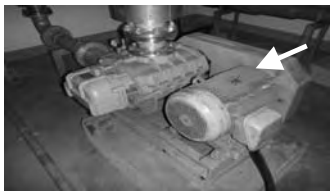
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Moter (Load Side)				
ID code	382	Direction of measurement	Vertical	Group No.	372
Output	15.0 kW	Rotational speed	1473 min-1	Axis diameter	45 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 13:02

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.639	Good
ACC(OA) [G]	1.00	4.00	0.179	Good
ACC(PEAK) [G]	3.00	12.00	0.435	Good
VEL [cm/s]	0.40	1.00	0.453	Attention
DISP [μm]	30	100	40.1	Attention

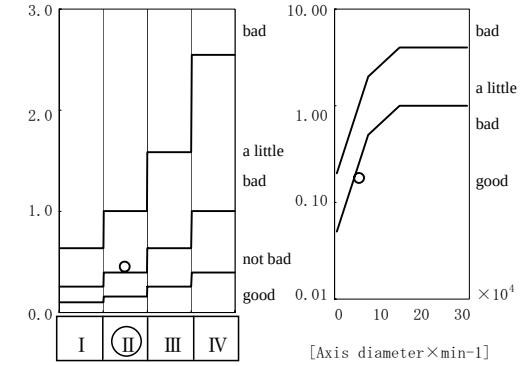
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 13:02

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.32	1.28	0.179	Good
VEL [cm/s]	0.40	1.00	0.453	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



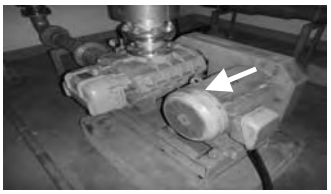
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Moter (Opposite Load Side)				
ID code	381	Direction of measurement	Vertical	Group No.	371
Output	15.0 kW	Rotational speed	1473 min-1	Axis diameter	35 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 11:34

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.873	Good
ACC(OA) [G]	1.00	4.00	0.754	Good
ACC(PEAK) [G]	3.00	12.00	1.779	Good
VEL [cm/s]	0.40	1.00	0.479	Attention
DISP [μm]	30	100	47.5	Attention

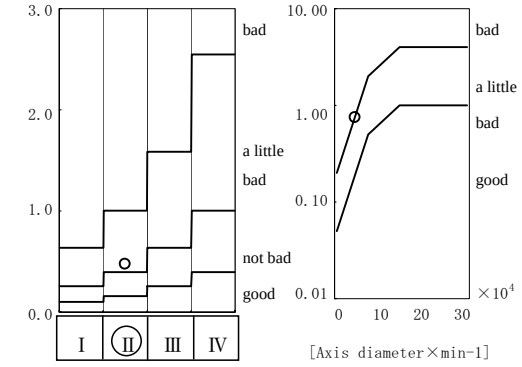
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 11:34

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.20	0.79	0.754	little bad
VEL [cm/s]	0.40	1.00	0.479	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



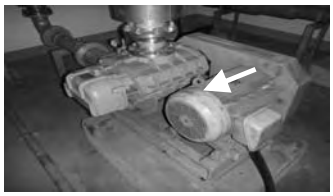
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Moter (Opposite Load Side)				
ID code	381	Direction of measurement	Vertical	Group No.	371
Output	15.0 kW	Rotational speed	1473 min-1	Axis diameter	35 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 13:01

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.629	Good
ACC(OA) [G]	1.00	4.00	0.394	Good
ACC(PEAK) [G]	3.00	12.00	1.002	Good
VEL [cm/s]	0.40	1.00	0.655	Attention
DISP [μm]	30	100	55.9	Attention

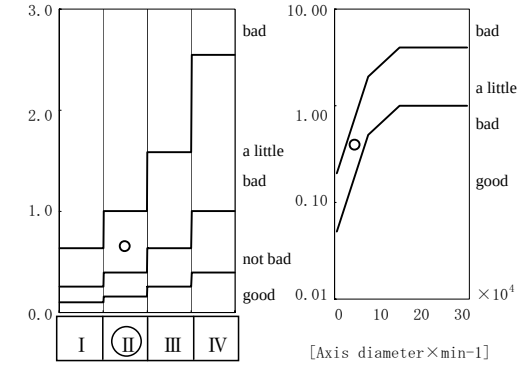
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 13:01

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.20	0.79	0.394	ﾔﾔ悪
VEL [cm/s]	0.40	1.00	0.655	ﾔﾔ悪

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



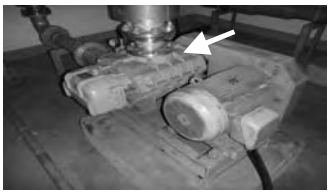
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Blower Inside (Load Side)				
ID code	383	Direction of measurement	Vertical	Group No.	373
Output	15.0 kW	Rotational speed	1920 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 11:36

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.613	Good
ACC(OA) [G]	1.00	4.00	0.425	Good
ACC(PEAK) [G]	3.00	12.00	1.254	Good
VEL [cm/s]	0.40	1.00	0.481	Attention
DISP [μm]	30	100	47.5	Attention

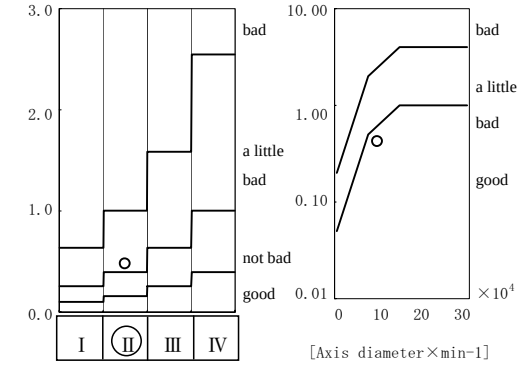
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 11:36

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.56	0.425	Good
VEL [cm/s]	0.40	1.00	0.481	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



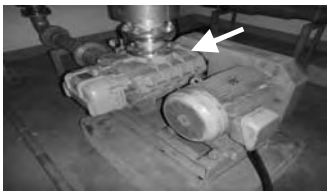
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Blower Inside (Load Side)				
ID code	383	Direction of measurement	Vertical	Group No.	373
Output	15.0 kW	Rotational speed	1920 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 13:02

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.584	Good
ACC(OA) [G]	1.00	4.00	0.371	Good
ACC(PEAK) [G]	3.00	12.00	1.173	Good
VEL [cm/s]	0.40	1.00	0.530	Attention
DISP [μm]	30	100	55.4	Attention

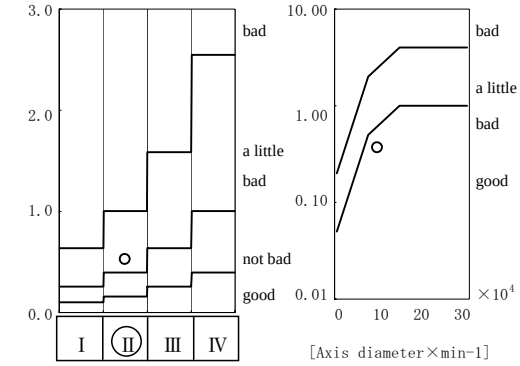
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 13:02

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.56	0.371	Good
VEL [cm/s]	0.40	1.00	0.530	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



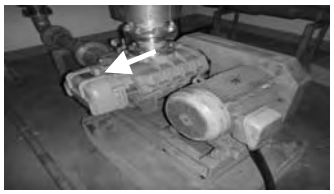
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	385	Direction of measurement	Vertical	Group No.	375
Output	15.0 kW	Rotational speed	1920 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 11:37

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.568	Good
ACC(OA) [G]	1.00	4.00	0.343	Good
ACC(PEAK) [G]	3.00	12.00	1.064	Good
VEL [cm/s]	0.40	1.00	0.464	Attention
DISP [μm]	30	100	46.2	Attention

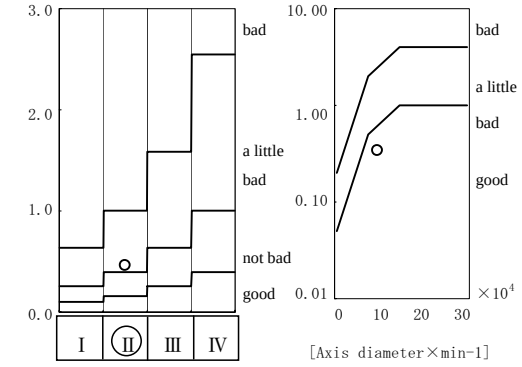
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 11:37

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.56	0.343	Good
VEL [cm/s]	0.40	1.00	0.464	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



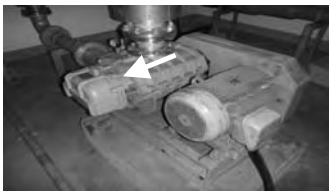
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Blower Inside (Opposite Load Side)				
ID code	385	Direction of measurement	Vertical	Group No.	375
Output	15.0 kW	Rotational speed	1920 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 13:03

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.546	Good
ACC(OA) [G]	1.00	4.00	0.362	Good
ACC(PEAK) [G]	3.00	12.00	0.836	Good
VEL [cm/s]	0.40	1.00	0.389	Good
DISP [μm]	30	100	37.9	Attention

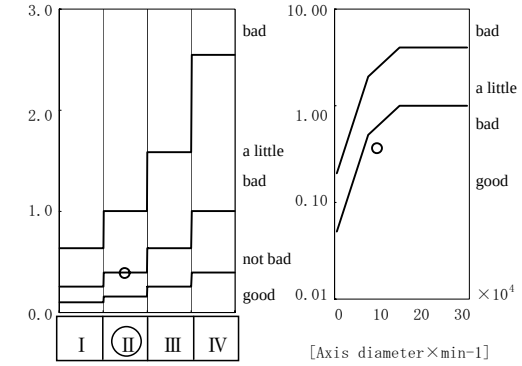
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 13:03

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.56	0.362	Good
VEL [cm/s]	0.40	1.00	0.389	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



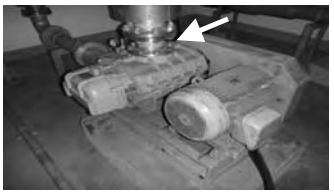
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Blower Outside (Load Side)				
ID code	384	Direction of measurement	Vertical	Group No.	374
Output	15.0 kW	Rotational speed	1920 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 11:36

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.932	Good
ACC(OA) [G]	1.00	4.00	0.598	Good
ACC(PEAK) [G]	3.00	12.00	1.661	Good
VEL [cm/s]	0.40	1.00	0.546	Attention
DISP [μm]	30	100	54.1	Attention

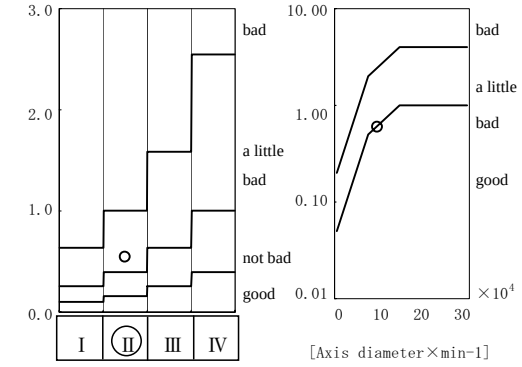
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 11:36

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.56	0.598	Good
VEL [cm/s]	0.40	1.00	0.546	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



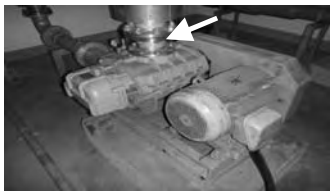
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Blower Outside (Load Side)				
ID code	384	Direction of measurement	Vertical	Group No.	374
Output	15.0 kW	Rotational speed	1920 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 13:03

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.949	Good
ACC(OA) [G]	1.00	4.00	0.601	Good
ACC(PEAK) [G]	3.00	12.00	1.523	Good
VEL [cm/s]	0.40	1.00	0.556	Attention
DISP [μm]	30	100	54.6	Attention

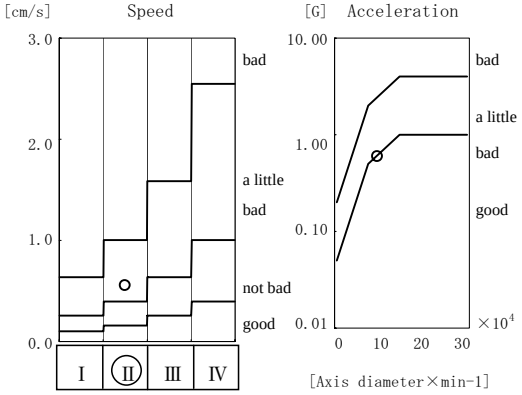
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 13:03

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.56	0.601	Good
VEL [cm/s]	0.40	1.00	0.556	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



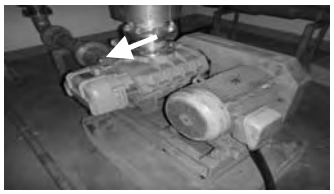
【Comment】

drawing date: 28 May 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	386	Direction of measurement	Vertical	Group No.	376
Output	15.0 kW	Rotational speed	1920 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 27 May 2010 11:37

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.567	Good
ACC(OA) [G]	1.00	4.00	0.365	Good
ACC(PEAK) [G]	3.00	12.00	1.014	Good
VEL [cm/s]	0.40	1.00	0.449	Attention
DISP [μm]	30	100	45.0	Attention

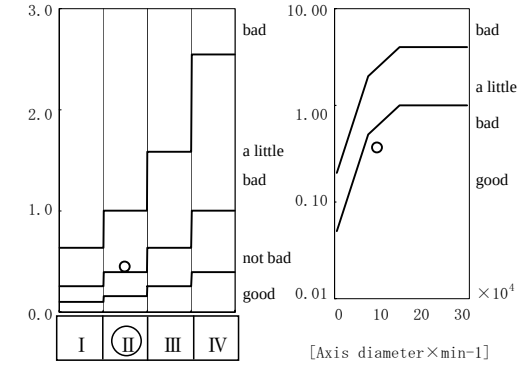
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 27 May 2010 11:37

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.56	0.365	Good
VEL [cm/s]	0.40	1.00	0.449	little bad

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



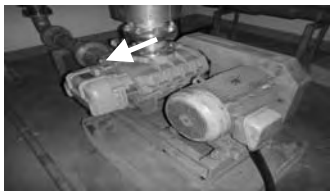
【Comment】

drawing date: 16 Jul 2010

Simple diagnosis report

					drawing

equipment name	North Thang Long WWTP				
machine name	M3-10B Channel Mixing Blower				
measurement part	Blower Outside (Opposite Load Side)				
ID code	386	Direction of measurement	Vertical	Group No.	376
Output	15.0 kW	Rotational speed	1920 min-1	Axis diameter	55 mm



【 Relative value Judgment 】 recorded time: 14 Jul 2010 13:03

Measurement Mode	Warning Level		Measurements	Judgment
	Attention	Danger		
ACC(THRU,OA) [G]	1.00	4.00	0.524	Good
ACC(OA) [G]	1.00	4.00	0.299	Good
ACC(PEAK) [G]	3.00	12.00	0.766	Good
VEL [cm/s]	0.40	1.00	0.376	Good
DISP [μm]	30	100	38.0	Attention

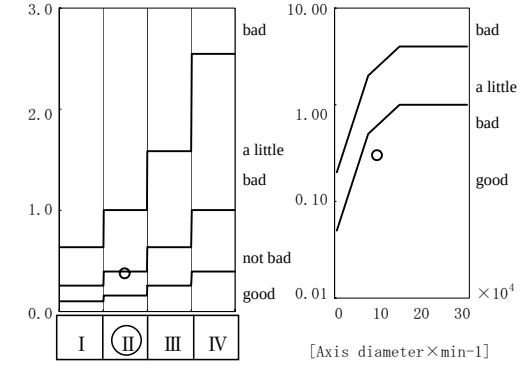
(1G=9.8m/s2)

【 Absolute value Judgment 】 recorded time: 14 Jul 2010 13:03

Measurement Mode	Warning Level		Measurements	Judgment
	little bad	Bad		
ACC(OA) [G]	0.64	2.56	0.299	Good
VEL [cm/s]	0.40	1.00	0.376	little good

(1G=9.8m/s2)

【 Absolute value Judgment 】 (1G=9.8m/s2)



【Comment】