YOSHIMINE

# WASTE HEAT RECOVERY BOILER

YOSHIMINE CO., LTD

## ~For a Preface~

Yoshimine Co., Ltd has been manufacturing and supplied a great number of boilers burning fuels ranging from liquid or gaseous fuels such as “C” heavy oil, light oil, LPG etc. to solid fuels such as wood chip, bagasse, palm fiber & shell etc.

Waste heat boilers of all kinds, which are manufactured based on Yoshimine’s manufacturing technology, and experience, have been highly appreciated among various fields of industry.

After oil shock, people began to review energy saving as permanent problem, and the waste heat boilers have drawn much attention, for they can recycle high temperature exhaust gas, which is discharged from the industrial process or the incinerators, and generate steam or hot water, in addition these waste heat boilers have been recently appreciated as the global environmental protection merchandise.

These waste gases often contain a large amount of dust, corrosiveness or explosive dangerous component, besides, often clog the gas duct by its strong tenacity. For this reason, waste heat boilers cannot be designed uniformly, but Yoshimine is confident to choose and recommend the adequate type of boiler to each customer according to our skill and experience developed for many years.

Yoshimine put on display a series of the natural circulation boiler and forced circulation boiler, which attempt to recover drastically the exhaust heat rather than for the waste heat, for the demand of co-generating system including gas turbine and diesel engine have been increasing recently. Moreover, Yoshimine is trying to make the total heat balance efficient now, employing the additional burning method.

## ~LINE-UP of Yoshimine waste heat boilers~

Yoshimine waste heat boilers are divided into the following types in compliance with characteristics and quantity of gas.

| TYPE | Characteristics and quantity of waste gas |
|---|---|
| **WA** | High temperature and with large dust content |
| **WAD** | High temperature and with large dust content |
| **WB** | With small dust content |
| **WD** | With larger dust content than type WB |
| **WEF** | Forced circulation boiler of finned tube style |
| **WBF** | Natural circulation boiler of finned tube style |

# ~Yoshimine waste heat recovery boiler~

We have already manufactured and delivered various kinds of our waste heat boilers, and its number has reached about 100. Our waste heat boilers can meet the demand and requirement of customer, and we can sell them with confidence.

## Feature

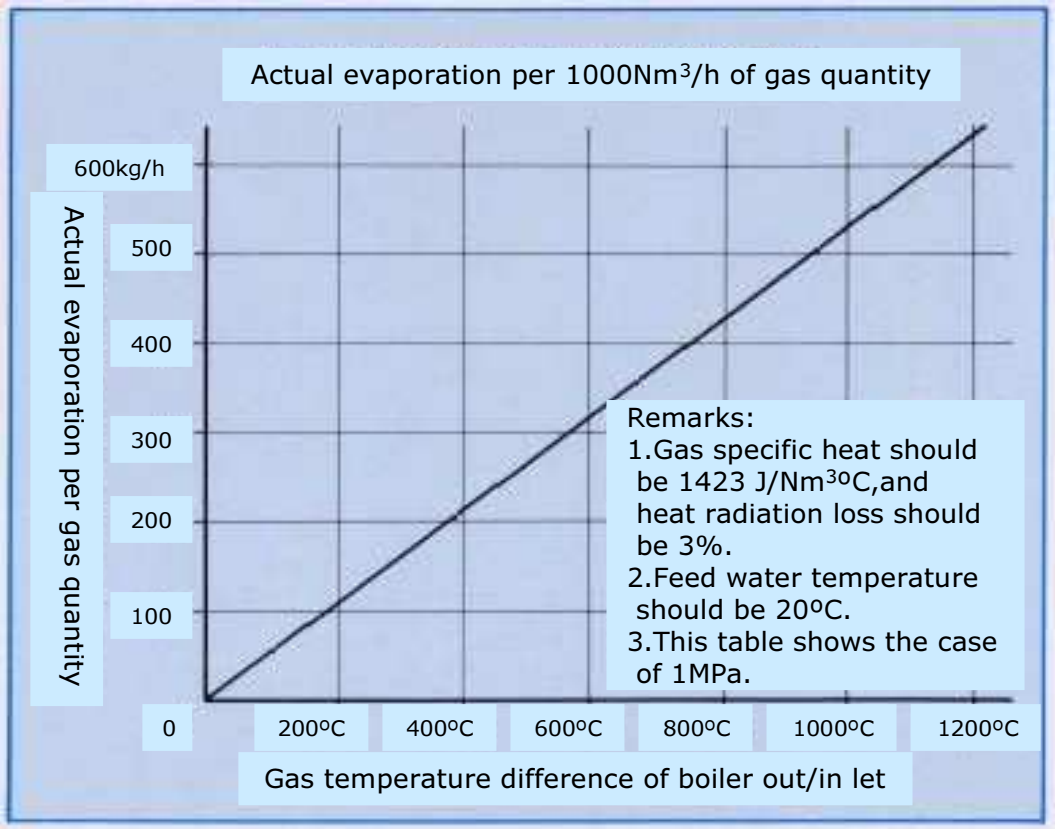
1. Possible to run without decreasing its efficiency for a long period, as its heating surface can keep off dirt.

2. Various optimum kinds of type are arranged in compliance with the nature of waste gas.

3. Easy to run and maintain

4. Possible to endure the heat gain fluctuation

5. Installation area is small.



# TYPE WA

## ~Merit~

1. Applicable for such higher temperature waste gas as from the municipal waste incinerator, which have large gas volume, large dust content.

2. Possible to run continuously for a long time. Even if the clinkers stick to water screen, it can remove the clinker naturally, and that, the boiler performance may not decline.

3. Possible to install at both top and back of the incinerator.

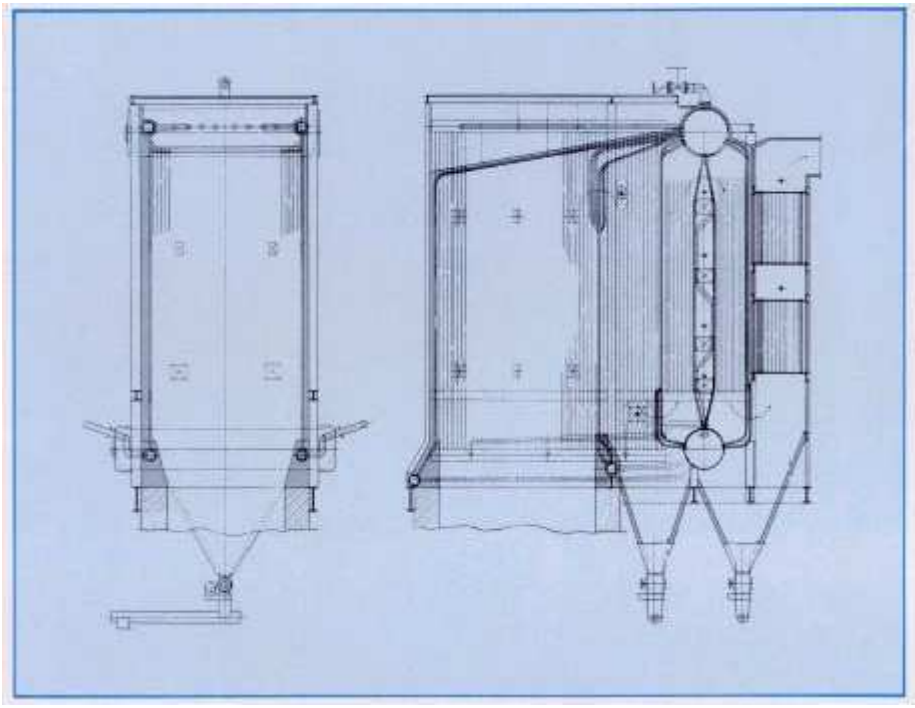
4. The gas temperature at boiler outlet is stable, even if the load fluctuation is caused, as its resistance against the draft is small.

## ~Purpose~

For the municipal waste incinerator, or the waste gas with large dust content

### ~Applicable Range~

| | |
|---|---|
| Gas temperature at inlet | More than 700ºC |
| Dust characteristic | Larger sticky dust |
| Incineration volume for municipal waste | More than 120 ton/24 hour |



# TYPE WAD

## ~Merit~

1. Applicable for such higher temperature waste gas as from the industrial waste incinerator, which have large gas volume, large dust content.

2. Possible to run continuously for a long time. Even if the clinkers stick to water screen, it can remove the clinker naturally, and that, the boiler performance may not decline.

3. Possible to install at both top and back of the incinerator.

4. The gas temperature at boiler outlet is stable, even if the load fluctuation is caused, as its resistance against the draft is small.

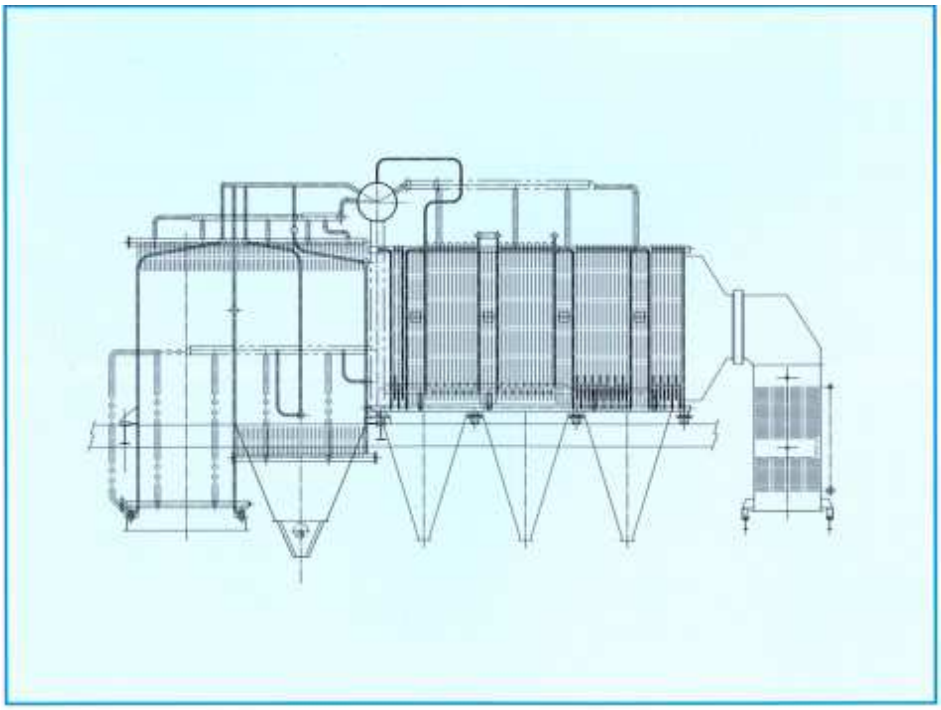
5. Superheater can be equipped flexibly, and it can be designed for 4MPa and 400deg.C.

## ~Purpose~

For the industrial waste incinerator, or the waste gas with large dust content

### ~Applicable Range~

| | |
|---|---|
| Gas temperature at inlet | More than 700℃ |
| Dust characteristic | Larger sticky dust |
| Incineration volume for industrial waste | More than 120 ton/24 hour |



# TYPE WB

## ~Merit~

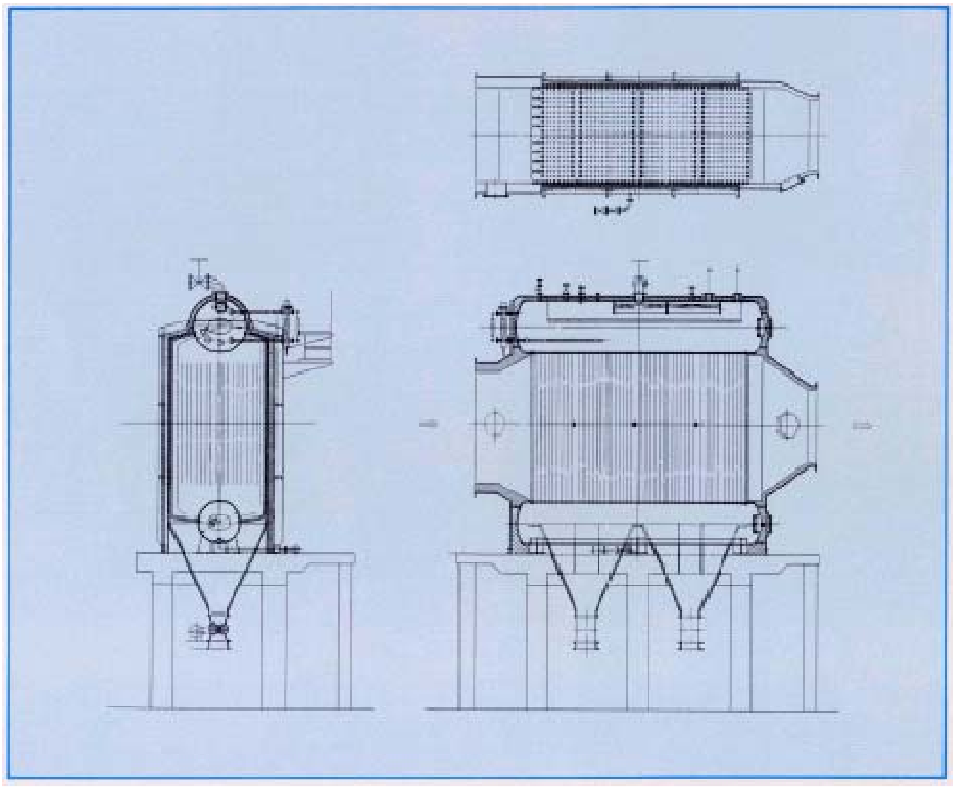
1. Suitable for the waste gas with smaller dust content
2. Compact structure with good heat absorption, for the gas flows at higher speed, and at right angle to the water tube
3. Possible to separate the dust clearly, and easy to clean up and inspect
4. Slag screen is installed at the side of inlet gas in order to suit for making use of the high temperature gas.

## ~Purpose~

For the waste gas with small dust content (in common)

### ~Applicable Range~

| | |
|---|---|
| Gas temperature at inlet | More than 1000℃~350℃ |
| Dust characteristic | Soft and its viscosity is small. |



# TYPE WD

## ~Merit~

**1.** Suitable for the waste heat gas with larger dust content

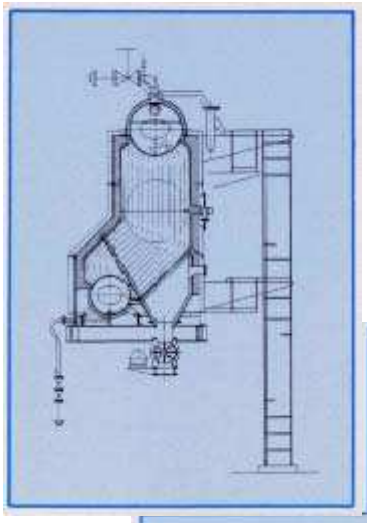
**2.** Double shell style with each one upper and lower drum is applicable to the small gas volume. Triple shell style with one upper drum and two lower drums is applicable to the large gas volume.

**3.** The dust separated and fallen while the waste gas is flowing through the boiler is collected on the bottom hopper, and the rotary valve discharges them outside even during its operation.

**4.** The water tubes have been latticed, and can restrain dust-sticking to minimum, and are easy clean up and inspect.

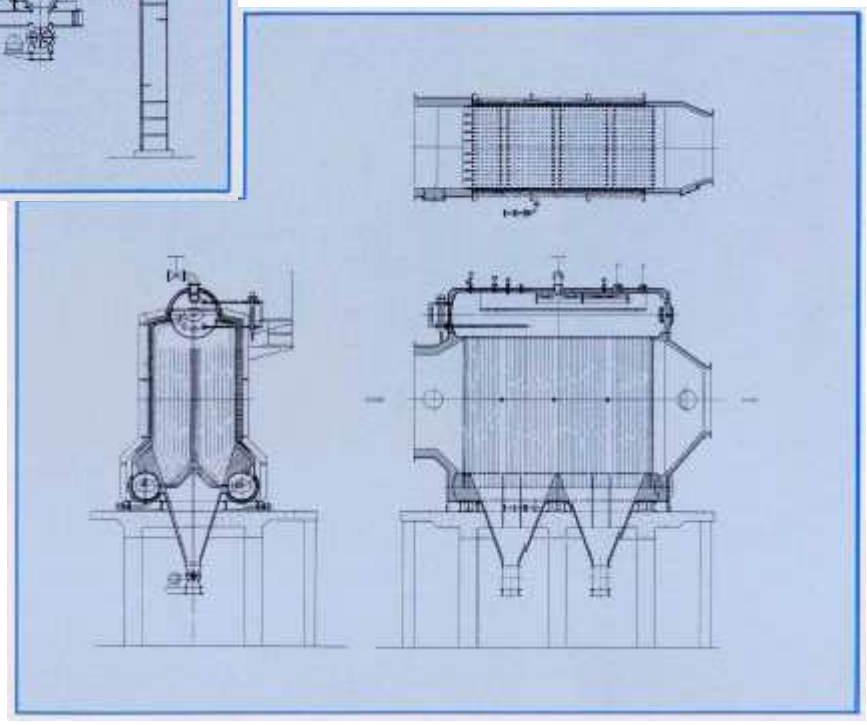
## ~Purpose~

For wide range of waste gas with large dust content



## ~Applicable Range~

| | |
|---|---|
| Gas temperature at inlet | More than 1000℃~350℃ |
| Dust characteristic | Large dust content |
| | Viscosity is small. |



# TYPE WEF

## ~Merit~

1. Applicable for large capacity of lower temperature waste gas with small dust content

2. Compact structure, which employs the heat transfer tube of finned tube type, for the heating surface becomes larger.

3. Installation space is smaller, as it is the compact structure.

4. Boiler water circulation is of the forced circulation type, which is performed by the circulation pump, and it may increase electric power a little.

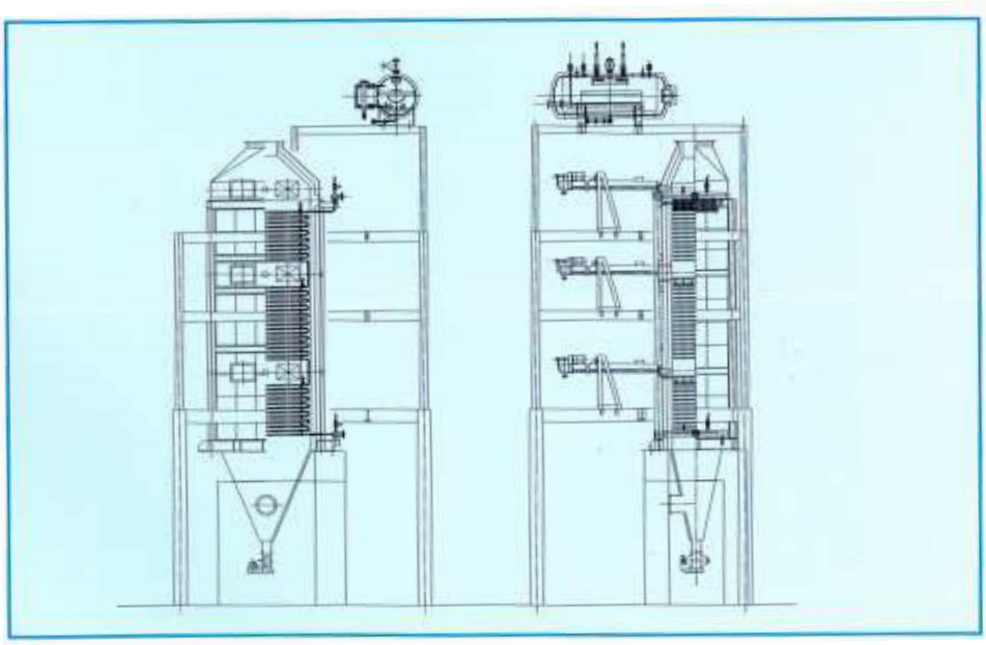
5. Possible to increase the boiler steam generation by employing the additional burning method

## ~Purpose~

Gas turbine with large capacity, Diesel engine, Co-generation boiler

### ~Applicable Range~

| | |
|---|---|
| Gas temperature at inlet | Less than 1000℃<br>(with additional burning method) |
| Dust amount | Less than 0.5 g/Nm$^3$ |
| Waste gas volume | No limitation |



# TYPE WBF

## ~Merit~

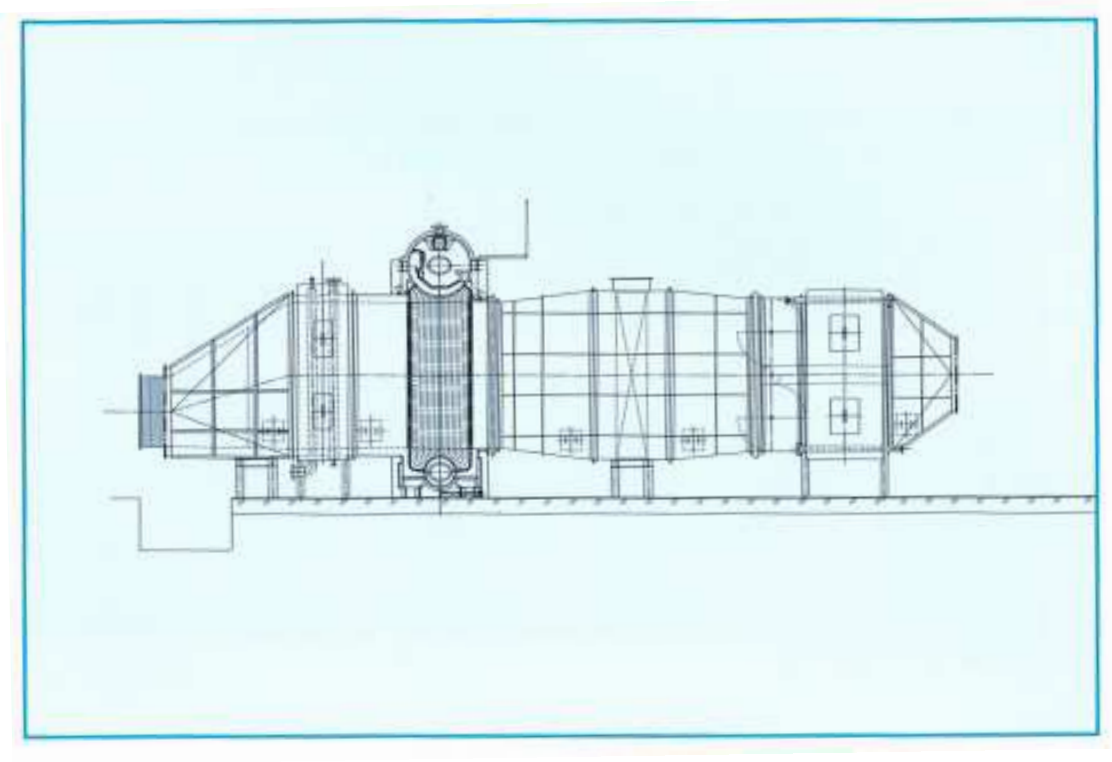
1. Possible to obtain good heat absorption, for the water tubes are zigzag arranged and the gas flows in a single pass at high speed.
2. Compact structure employing the heat transfer tube of finned tube type
3. Boiler water circulation pump is not required, as the boiler is of natural circulation type.
4. Easy to install, for it is the shop assembled packaged boiler.

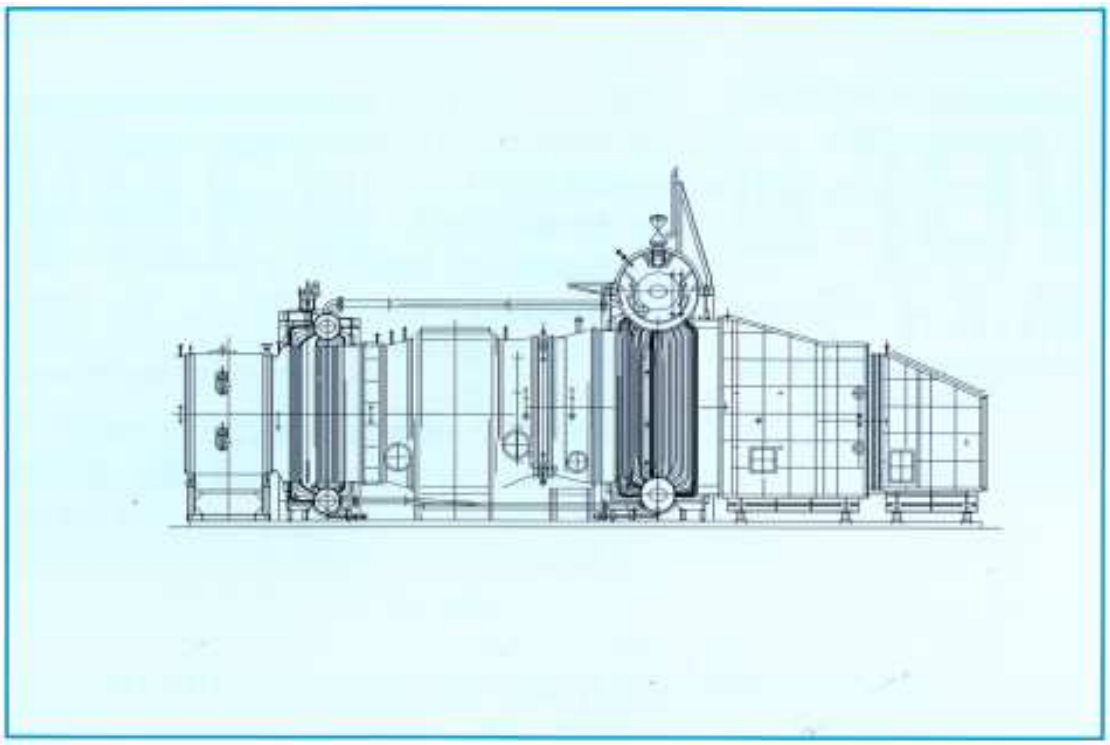
## ~Purpose~

Gas turbine with large capacity, Diesel engine, Co-generation boiler

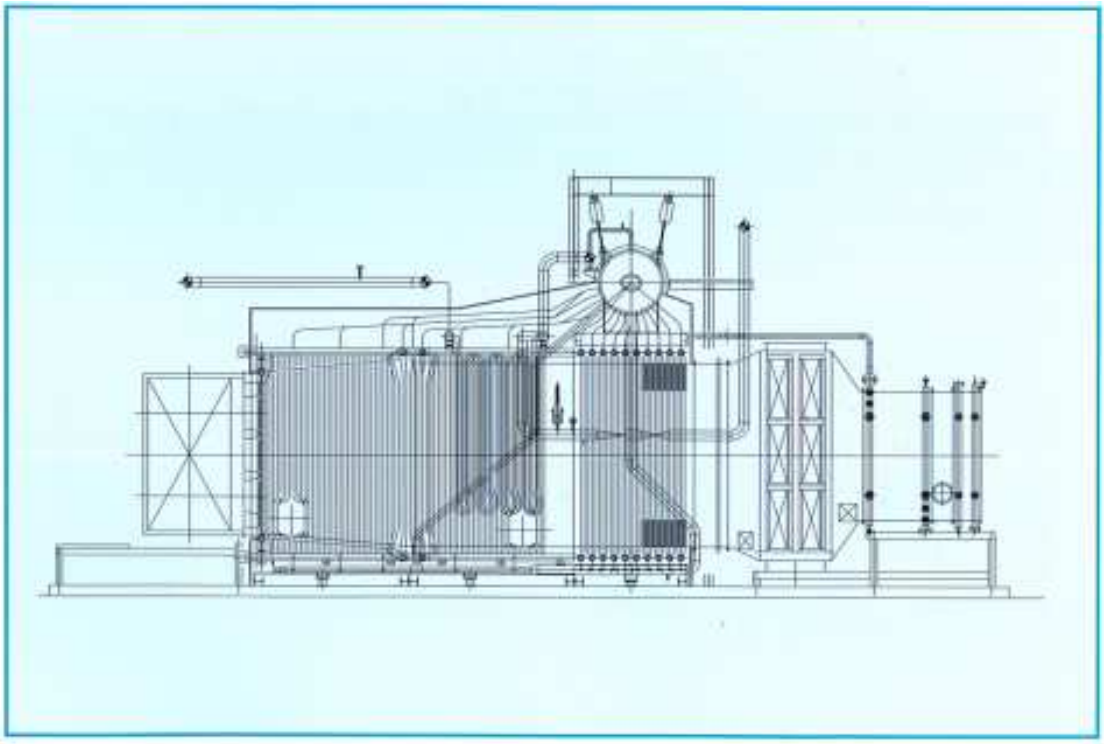
### ~Applicable Range~

| | |
|---|---|
| Gas temperature at inlet | Less than 1000℃<br>(with additional burning method) |
| Evaporation | Less than 20 ton/h |
| Dust content | Less than about 0.2 g/Nm$^3$<br>Without abrasion |





WBF type equipped supplemental duct burner unit



WBF type equipped exhaust afterburner unit

# ~For Inquiries of Yoshimine waste heat boilers~

Please include the following matters in your inquiries of Yoshimine waste heat boilers.

1. Generative resource of waste gas

2. Purpose of using steam

3. Nature of waste gas

| | |
|---|---|
| Volume | $Nm^3/h$ or kg/h |
| Component | Vol% |
| Temperature | °C<br>(at inlet or preferable discharging gas temperature) |
| Pressure at inlet | Pa |
| Dust content | $g/Nm^3$<br>(Including the dust particle size) |
| Existence of dust adhesion | |
| Existence of gas volume fluctuation, and its ratio | |

4. Waste heat boiler

| | |
|---|---|
| Installation place | Indoor / Outdoor |
| Maximum allowable working pressure | MPa |
| Working pressure | MPa |
| Required evaporation | Kg/h |
| Steam temperature | °C |
| Feed water temperature | °C |
| Allowable draft loss | Pa |
| Existence of burner equipment | |

# ~For Inquiries of Yoshimine waste heat boilers~

## 5. Utilities

| | | | |
|---|---|---|---|
| Voltage | | V | Hz |
| Raw water | Water quality | | |
| | Temperature | | ºC |
| For control system | Air sources | Pressure | MPa |
| | Power sources | | V |
| The specification of fuels for supplemental burner | | | |

## 6. Others

| |
|---|
| The drawings of installation place and its neighborhood |
| Treating method and discharging equipment of dust |
| Required regulation value for exhaust gas |
| Specified maker or its type |
| Other requirements |