

Chugai Ro

*Recuperator &
Air-Gas Heater*

レキュペレータ **熱交換器** & 空気・ガスヒータ

中外炉工業株式会社

地球のために。お客様のために。 熱技術の中外炉だからできる

For the Earth and Our Customers

Chugai Ro can provide recuperators as a leader in the thermal

地球温暖化対策と
燃料コストの削減を
同時に実現。

Contribute to prevention of global warming
and reduction in fuel consumption.

産業界全体に地球温暖化対策が求められているいま、工業炉においてもCO₂などの温室効果ガスの削減は最重要課題です。当社では、いままで培ってきた工業炉のノウハウを活かし、炉から発生する廃熱を燃焼用空気、燃料ガスの予熱として有効利用することで燃料消費量および排出ガス量の削減を図り、地球温暖化の緩和を実現する熱交換器（レキュペレータ）を新たに開発しました。CO₂だけでなくダイオキシンの削減にも効果を発揮し、大気汚染の防止にも貢献します。チャンネル型、シェル&チューブ型、輻射式二重円筒型、輻射式ケージ型、プレート型といった多様なタイプをラインナップしていますので、さまざまな設備環境に合わせて導入していただけます。

There are many efforts for cost reduction by energy saving and environmental protection throughout the whole industry. In case of furnace, effective utilizations of restricted resources and reduction in emission of greenhouse (such as CO₂) / harmful gases are the most important issues to contribute global environmental protection. As a leader of thermal technology fields, Chugai Ro can supply state of the art heat exchangers (recuperators) based on our expertise of furnace design. Chugai Ro's recuperator can reduce amount of fuel consumption and exhaust gas, and consequently contribute energy saving and global warming prevention, effectively using of exhaust gas generated from furnaces to preheat combustion air and fuel gas. Furthermore, it is also contributable for reduction of DXN(Dioxin) as environmental protection equipment. We can provide suitable design of recuperator in accordance to the customer's request, since there are various types in our lineup such as the channel type, shell & tube type, radiation method double cylinder type, radiation method cage type and plate type.

レキュペレータがあります。

technology field.

CO₂排出量削減
Reduction of
CO₂ emissions

**ダイオキシンなど
有害物質削減**

Reduction of toxic substances
such as dioxins

*Recuperator &
Air-Gas Heater*

燃料コスト低減
Reduction in fuel consumption

低カロリー燃料適用
Application of low-calorie fuel

生産量アップ
Increase
in production quantity





Channel type recuperator

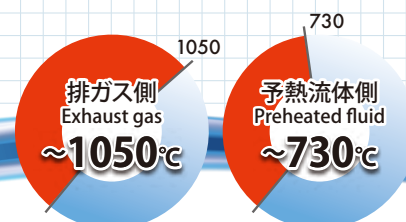
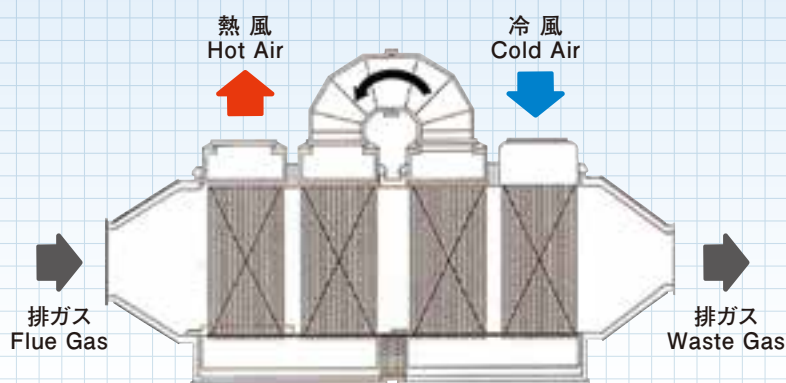
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チャンネル型レキュペレータ

チャンネル型レキュペレータの伝熱メカニズムは熱源・予熱側共に対流伝熱です。多数の鋼製チューブからなる伝熱ユニットを複数組み合わせた軽量でコンパクトなレキュペレータで、保守が容易。各種工業炉の水平煙道内に組み込み、通常はチューブの外側に排ガスを、チューブ内側に被加熱流体の空気又は燃料ガスを流し、予熱します。



Channel type recuperator is a lightweight and compact structure composed of many heat transfer unit made by multiple steel tubes. Representative application is an industrial furnace. Channel type recuperator for them is installed in the flue of industrial furnace to preheat air and/or fuel gas. Exhaust gas flows through outer of tubes and pre-heated fluid (gas/air) flows through inner of tubes and heat transfer is gaining by convection mechanism.



温度条件

Application range of temperature

特長

- コンパクトで安価
- 排ガス温度の適用範囲が広い
- 温度効率が低い(最高85%)
- 排ガス側圧力損失が少ない
- 保守性が高い(取り外しが容易)

Features

- Inexpensive price and compact size
- Applicable to a wide range of temperatures of exhaust gas
- High temperature efficiency (Max 85%)
- Less pressure loss of exhaust gas flow
- High maintainability (Easy replacement)

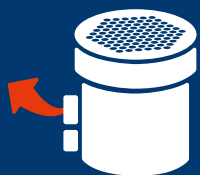
仕様 specification

用途

- 鉄鋼加熱炉
- 熱処理炉
- 塵芥焼却炉
- 非鉄溶解炉
- 炭化炉
- 各種工業用

Application

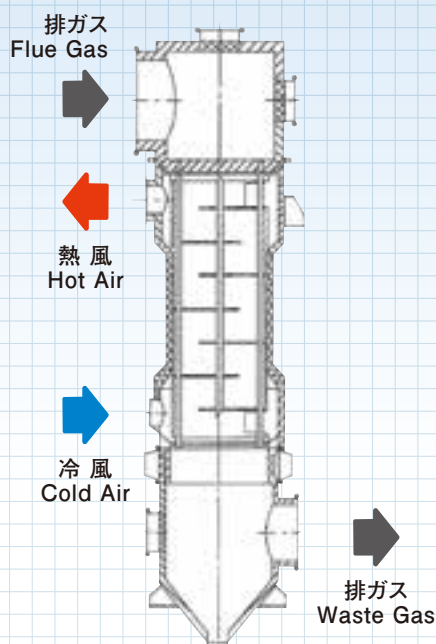
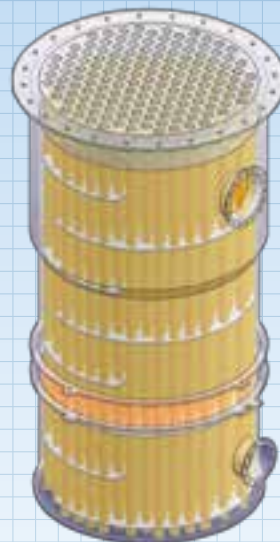
- Steel reheating furnace
- Heat treatment furnace/oven
- Incinerator
- Non-ferrous melting furnace
- Coking furnace
- Other industrial furnaces



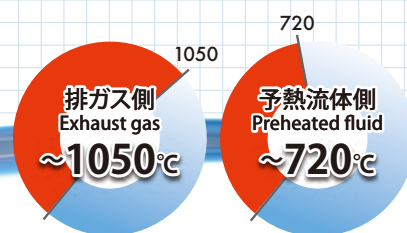
Shell & tube type recuperator

シェル&チューブ型レキュペレータ

シェル&チューブ型レキュペレータの伝熱メカニズムは熱源・予熱側共に対流伝熱です。多数の鋼製チューブを組み合わせた伝熱チューブ群と胴（シェル）、ベローズから構成されたコンパクトなレキュペレータで、各種工業炉の煙道上に自立も可能です。通常は伝熱チューブ内に排ガスを、胴内に被予熱側流体を流し予熱します（その逆も可能です）。また、横置き設置も可能です。



Shell & tube type recuperator is a compact structure composed of heat transfer tubes made by multiple steel tubes, bellows and body (shell). Generally, exhaust gas flows through inside of heat transfer tube and heated fluid flows through inside of body (opposite way is also possible) and the heat transfer mechanism is gaining by convection. This type of recuperator can be installed in the flue gas ducts of various types of industrial furnaces in self-supporting.



温度条件

Application range of temperature

特長

- ダストを多量に含む排ガスラインに使用可能（ダストの自浄作用を引き出すため）
- ダスト除去装置と併用可能（ショットクリーニング装置）
- コンパクト
- 煙道・煙突と兼用可能

Features

- Applicable to exhaust gas with high contaminated dust (because of leading to dust self-purifying action)
- Applicable with dust removal equipment (shot cleaning equipment)
- Compact size
- Useable as part of stack and flue

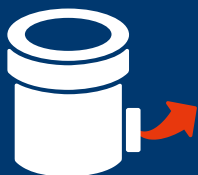
仕様 specification

用途

- 汚泥焼却炉
- キューボラ用APH
- 熱処理炉
- 焼成炉
- 鉄鋼加熱炉
- 各種工業用

Application

- Environmental incinerator
- Hot blast cupola
- Heat treatment furnace
- Kiln
- Steel reheating furnace
- Other industrial furnaces



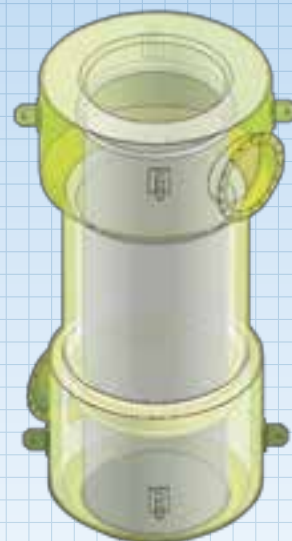
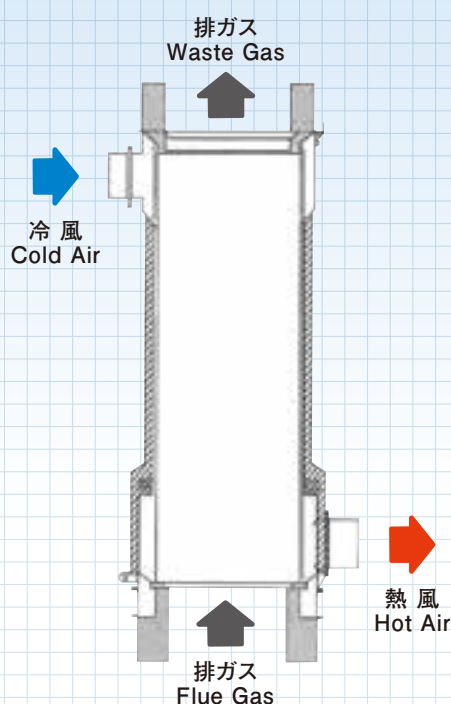
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Chugai Ro

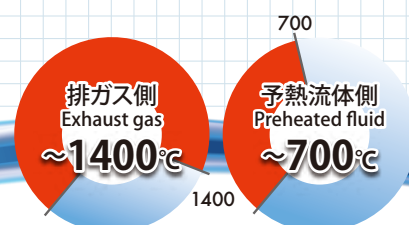
Radiation method double cylinder type recuperator

輻射式二重円筒型レキュペレータ

輻射式二重円筒型レキュペレータの伝熱メカニズムは熱源側はガス輻射、予熱側は対流伝熱です。二重の鋼製円筒から構成された非常にシンプルなレキュペレータであり、その構造上熱的負荷変動に対して高強度を誇ります。各種工業炉の煙道上に自立も可能で、通常は内筒内側に排ガスを、内筒と外筒の隙間に被加熱流体の空気又は燃料ガスを流し予熱します。



Radiation type recuperator is very simple structure composed of double cylinders made of steel. Generally, exhaust gas flows through inner cylinder and pre-heated fluid (air/gas) flows through clearance between inner and outer cylinder (opposite way is also possible) and the heat transfer mechanism is gaining by radiation and convection. This type of recuperator shows high performance under heavy thermal load and can be in the flue gas ducts of various types of industrial furnaces in self-supporting.



温度条件

Application range of temperature

特長

- 高温排ガスでも使用可能 (～1400℃)
- 負荷変動に強い
- ダストを多量に含む排ガスに使用可能
- 排ガス側圧力損失がほとんど無い
- 構造が堅固でシンプル
- 煙道・煙突と兼用可能

Features

- Applicable to high temperature exhaust gas: Up to 1400℃
- Applicable to a wide range of thermal loads
- Useable for exhaust gas including high contaminated dust
- Extra less pressure loss of exhaust gas flue
- Simple and solid structure
- Useable as part of stack and flue

仕様

specification

用途

- 硝子溶解炉
- 鍛造加熱炉
- 灰溶解炉
- ガス化溶解炉
- 汚泥焼却炉・熔融炉
- 非鉄溶解炉

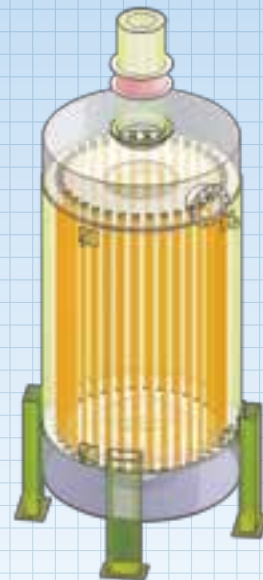
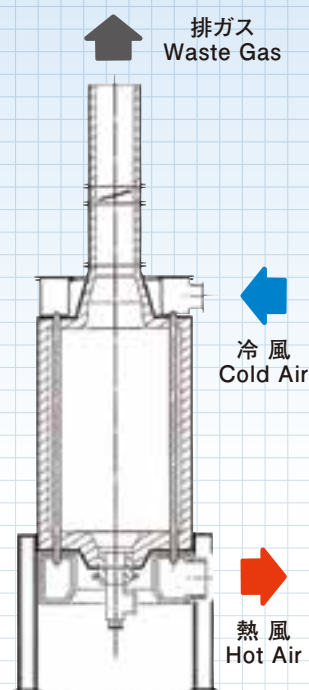
Application

- Glass melting furnace
- Forged steel reheating furnace
- Ash melting furnace
- Gasification melting furnace
- Environmental incinerator
- Non-ferrous melting furnace

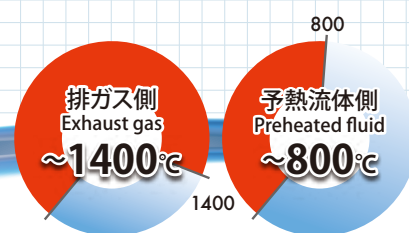
04 Radiation method cage type recuperator

輻射式ケージ型レキュペレータ

輻射式ケージ型レキュペレータの伝熱メカニズムは熱源側はガス輻射、予熱側は対流伝熱です。通常の輻射型レキュペレータ内筒の代わりに、伝熱面は鳥かご状に配置された伝熱チューブを用いたレキュペレータです。スタートアップ用ヒータとしても利用可能です。その場合は燃焼室が不要で直接レキュペレータの中で燃焼（自燃）出来るため、非常にコンパクトな設計が可能となり設備費の低減が可能です。各種工業炉の煙道上に自立も可能で、通常はチューブの外側に排ガスを、チューブ内側に被加熱流体の空気又は燃料ガスを流し予熱します。



Cage type recuperator is one of the radiation type recuperator where steel tubes are used as heat transfer instead of inner cylindrical steel. Exhaust gas flows through outside of heat transfer tube and pre-heated fluid (air/gas) flows through inside of tube, and the heat transfer is gaining by radiation and convection. This type of recuperators can be installed in the flue gas ducts of various types of industrial furnaces in self-supporting and applied as start-up heaters. In case of using start-up heater, the structure can be simple design (no need combustion chamber) and consequently inexpensive price.



温度条件

Application range of temperature

特長

- 高温排ガスでも使用可能（～1400℃）
- 負荷変動に強い
- ダストを含む排ガスに使用可能
- 排ガス側圧力損失がほとんど無い
- 被加熱側流体の圧力が高くても使用可能
- メンテナンス性が高い（チューブの交換が容易）
- 煙道・煙突と兼用可能

Features

- Applicable to high temperature exhaust gas: Up to 1400℃
- Applicable to a wide range of thermal loads
- Useable for exhaust gas including high contaminated dust
- Extra less pressure loss of exhaust gas flue
- Useable for high pressure heated fluid
- High maintainability (Easy replacement of the tubes)
- Useable as part of stack and flue

仕様

specification

用途

- アルミ溶解炉
- 鍛造加熱炉
- 灰溶解炉
- ガス化溶解炉
- 汚泥焼却炉・溶解炉
- 化学プラント・その他

Application

- Aluminum melting furnace
- Forged steel reheating furnace
- Ash melting furnace
- Gasification melting furnace
- Environmental incinerator
- Chemical plant and others

その他取扱商品

当社では下記商品も取り扱っております。
We can supply the following products.



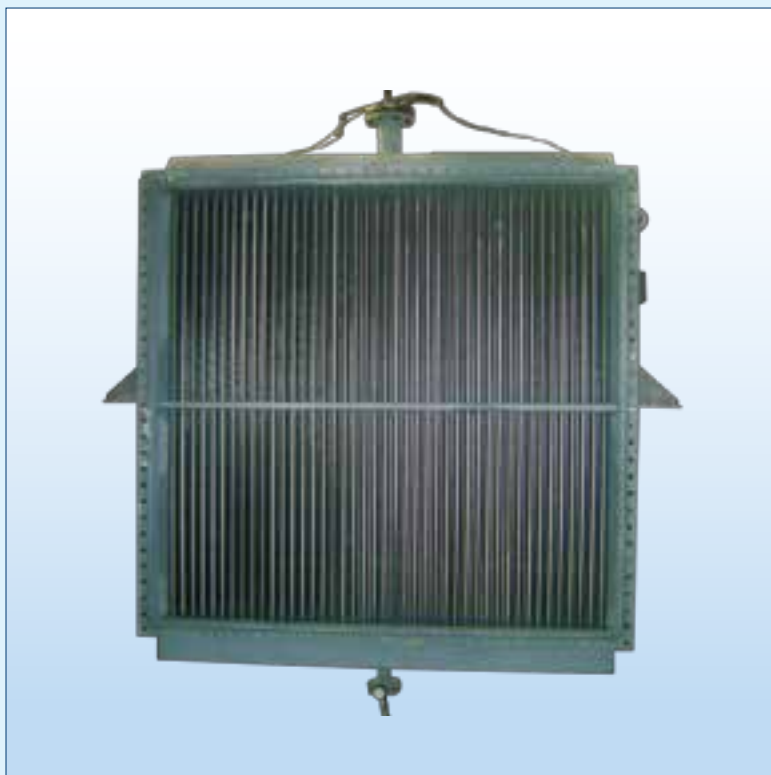
Plate type recuperator

プレート型レキュペレータ



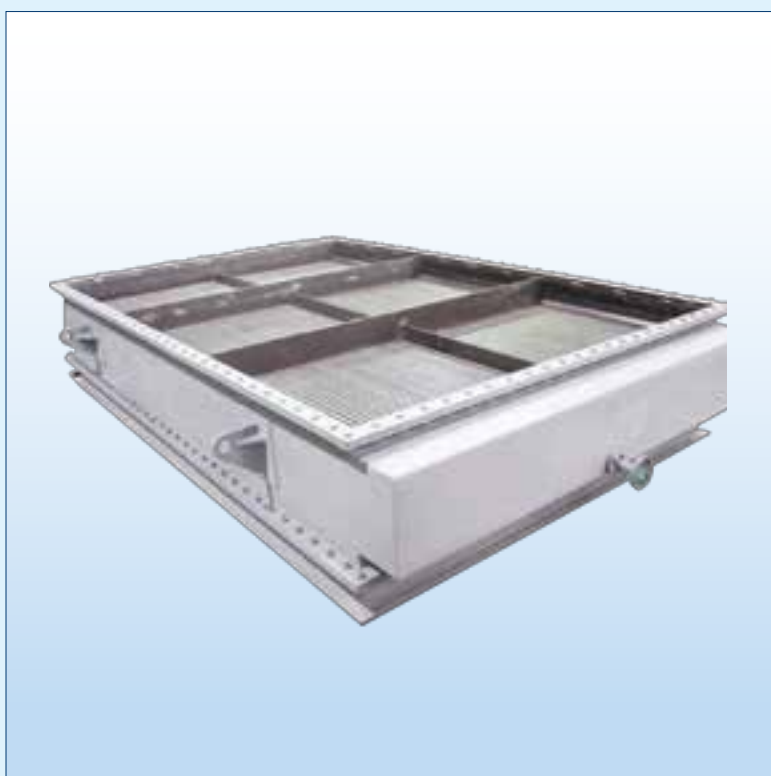
Air fin cooler

エアフィンクーラー



Finned tube type heat exchanger (steam&gas)

フィンチューブ式熱交換器 (蒸気・ガス)



Bare tube type heat exchanger (steam&gas)

ベアチューブ式熱交換器 (蒸気・ガス)

	 01 チャンネル型 レキュペレータ	 02 シェル&チューブ型 レキュペレータ	 03 輻射式二重円筒型 レキュペレータ	 04 輻射式ケージ型 レキュペレータ	その他取扱商品 プレート型 レキュペレータ
伝熱形態	●伝熱面:チューブ ●熱源・予熱側共に対流伝熱	●伝熱面:チューブ ●熱源・予熱側共に対流伝熱	●伝熱面:内筒 (内側シリンダー) ●熱源はガス輻射・予熱側は対流伝熱	●伝熱面:チューブ ●熱源はガス輻射・予熱側は対流伝熱	●伝熱面:プレート ●熱源・予熱側共に対流伝熱
性能	●熱源側温度 ～ 1050℃ ●予熱側温度 ～ 730℃	●熱源側温度 ～ 1050℃ (管内熱源) ～ 900℃ (管外熱源) ●予熱側温度 ～ 720℃	●熱源側温度 600℃ ～ 1400℃ ●予熱側温度 ～ 700℃	●熱源側温度 600℃ ～ 1400℃ ●予熱側温度 ～ 800℃	●熱源側温度 ～ 800℃ ●予熱側温度 ～ 600℃
特長	●コンパクトで安価 ●排ガス温度の適用範囲が広い ●温度効率が高い(最高85%) ●排ガス側圧力損失が少ない ●保守性が高い(取り外しが容易)	●ダストを多量に含む排ガスラインに使用可能(ダストの自浄作用を引き出すため) ●ダスト除去装置と併用可能(ショットクリーニング装置) ●コンパクト ●煙道・煙突と兼用可能	●高温排ガスでも使用可能(～1400℃) ●負荷変動に強い ●ダストを多量に含む排ガスに使用可能 ●排ガス側圧力損失がほとんど無い ●構造が堅固でシンプル ●煙道・煙突と兼用可能	●高温排ガスでも使用可能(～1400℃) ●負荷変動に強い ●ダストを含む排ガスに使用可能 ●排ガス側圧力損失がほとんど無い ●被加熱側流体の圧力が高くても使用可能 ●メンテナンス性が高い(チューブの交換が容易) ●煙道・煙突と兼用可能	●コンパクトで安価 ●温度効率が高い(最高85%) ●保守が容易 ●ダスト除去装置と併用可能
注意点	●急熱・急冷の熱変動が多い環境へは不向き ●排ガスダストが多量な環境へは不向き ●煙道(ケーシング)が必要	●ダストが固着・融着する性状の熱源ガスには不向き ●ガス量が大量の場合は複数基必要	●600℃以下の熱源からの熱回収は不経済 ●熱源側に、CO₂・H₂Oガスが含まれていない場合は使用不可 ●ガス量が大量の場合は複数基必要	●600℃以下の熱源からの熱回収は不経済 ●熱源側に、CO₂・H₂Oガスが含まれていない場合は使用不可 ●ガス量が大量の場合は複数基必要	●他の型式に比べ、気密性が低い ●高温領域では熱歪みの懸念がある ●圧力が高い流体への適用は不向き ●急熱・急冷の熱変動が多い環境へは不向き
用途	●鉄鋼加熱炉 ●熱処理炉 ●塵芥焼却炉 ●非鉄溶解炉 ●炭化炉 ●各種工業用	●汚泥焼却炉 ●キュボラ用APH ●熱処理炉 ●焼成炉 ●鉄鋼加熱炉 ●各種工業用	●硝子溶解炉 ●鍛造加熱炉 ●灰溶融炉 ●ガス化溶融炉 ●汚泥焼却炉・溶融炉 ●非鉄溶解炉	●アルミ溶解炉 ●鍛造加熱炉 ●灰溶融炉 ●ガス化溶融炉 ●汚泥焼却炉・溶融炉 ●化学プラント・その他	●熱処理炉 ●鉄鋼加熱炉 ●各種エアヒータ

	 01	 02	 03	 04	The other products
	Channel type recuperator	Shell & tube type recuperator	Radiation method double cylinder type recuperator	Radiation method cage type recuperator	Plate type recuperator
Heat Transfer Mechanism	- Heat-source fluid : convection - Preheated fluid : convection - Heat-transfer surface: multiple tubes	- Heat-source fluid : convection - Preheated fluid : convection - Heat-transfer surface: multiple tubes	- Heat-source fluid : radiation - Preheated fluid : convection - Heat-transfer surface: inner cylinder	- Heat-source fluid : radiation - Preheated fluid : convection - Heat-transfer surface: multiple tubes	- Heat-source fluid : convection - Preheated fluid : convection - Heat-transfer surface: plates
Performance	- Heat source temperature: Up to 1050°C - Preheated gas temperature: Up to 730°C	- Heat source temperature: Up to 1050°C (Inside of the tube) Up to 900°C (Outside of the tube) - Preheated gas temperature: Up to 720°C	- Heat source temperature: From 600°C to 1400°C - Preheated gas temperature: Up to 700°C	- Heat source temperature: From 600°C to 1400°C - Preheated gas temperature: Up to 800°C	- Heat source temperature: Up to 800°C - Preheated gas temperature: Up to 600°C
Features	- Inexpensive price and compact size - Applicable to a wide range of temperatures of exhaust gas - High temperature efficiency (Max 85%) - Less pressure loss of exhaust gas flow - High maintainability (Easy replacement)	- Applicable to exhaust gas with high contaminated dust (because of leading to dust self-purifying action) - Applicable with dust removal equipment (shot cleaning equipment) - Compact size - Useable as part of stack and flue	- Applicable to high temperature exhaust gas: Up to 1400°C - Applicable to a wide range of thermal loads - Useable for exhaust gas including high contaminated dust - Extra less pressure loss of exhaust gas flue - Simple and solid structure - Useable as part of stack and flue	- Applicable to high temperature exhaust gas: Up to 1400°C - Applicable to a wide range of thermal loads - Useable for exhaust gas including high contaminated dust - Extra less pressure loss of exhaust gas flue - Useable for high pressure heated fluid - High maintainability (Easy replacement of the tubes) - Useable as part of stack and flue	- Inexpensive price and compact size - High temperature efficiency (Max 85%) - High maintainability - Applicable with dust removal equipments
Cautions	- Unsuitable application under frequent thermal fluctuation environment and large amount of dust in exhaust gas fluid. - Need casings to set.	- Unsuitable in case of the heat source gas having fusion and adherence property. - Required multiple units under large volume of the fluid.	- Uneconomical way when the heat source gas temperature is less than 600°C. - Inapplicable when the heat source gas does not include CO₂ or H₂O component. - Required multiple units under large volume of the fluid.	- Uneconomical way when the heat source gas temperature is less than 600°C. - Inapplicable when the heat source gas does not include CO₂ or H₂O component. - Required multiple units under large volume of the fluid.	- Lower airtightness than other models. - Unsuitable application under high temperature/pressure fluid because of a thermal strain. - Unsuitable application under frequent thermal fluctuation environment.
Applications	- Steel reheating furnace - Heat treatment furnace/oven - Incinerator - Non-ferrous melting furnace - Coking furnace - Other industrial furnaces	- Environmental incinerator - Hot blast cupola - Heat treatment furnace - Kiln - Steel reheating furnace - Other industrial furnaces	- Glass melting furnace - Forged steel reheating furnace - Ash melting furnace - Gasification melting furnace - Environmental incinerator - Non-ferrous melting furnace	- Aluminum melting furnace - Forged steel reheating furnace - Ash melting furnace - Gasification melting furnace - Environmental incinerator - Chemical plant and others	- Heat treatment furnace - Steel reheating furnace - Air heaters

ご計画に際して必要なデータを記入願います。

Please fill in below blanks for your planning.

レキュペレータ型式 Recuperator type		炉の燃料 Fuel for combustion	
炉型式 Furnace type		低位発熱量 Low calorific value	
燃料消費量 Amount of fuel consumption		空燃比 Air-fuel ratio	

項目 Item	単位 Unit	設計条件 Design Condition	最大 Max	現状の運転条件 Current Operating Condition
排ガス組成 Exhaust gas composition (不明時は燃料種類から計算します) (Estimate from the kind of fuel unless otherwise specified)	Vol %			
排ガス流量 Exhaust gas flow rate	Nm ³ /h			
排ガス入口温度 Exhaust gas inlet temperature	°C			
排ガス出口温度 Exhaust gas outlet temperature	°C			
排ガス圧力 Exhaust gas pressure	mmH ₂ O			
許容排ガス圧損 Permissible pressure loss of exhaust gas	mmH ₂ O			
腐蝕性成分及び濃度 Corrosive elements and the concentration of exhaust gas	ppm			
排ガスダスト量 Exhaust gas dust amount	g/Nm ³			
被予熱物質組成 Preheated fluid composition	Vol %			
同 流量 Preheated fluid flow rate	Nm ³ /h			
同 入口温度 Preheated fluid inlet temperature	°C			
同 出口温度 Preheated fluid outlet temperature	°C			
同 圧力 Preheated fluid pressure	mmH ₂ O			
同 許容圧損 Permissible pressure loss of preheated fluid	mmH ₂ O			
腐蝕性成分及び濃度 Corrosive elements and the concentration of preheated fluid	ppm			
被予熱側ダスト量 preheated fluid dust amount	g/Nm ³			
運転状況 Operating condition	☐ 24時間連続 × 日 Continuously 24 hours day(s) ☐ 時間バッチ × 日 hour(s) by batch processing day(s)			

※上記の内、記載可能な部分の記入をお願い致します。
Please fill in the blanks as much as possible.



安全に関するご注意:ご使用の際は、取扱説明書をよくお読みの上、正しくお使いください。

SAFETY PRECAUTIONS : Read the instruction manual carefully before using the equipment.



サーモテックで未来をひらく

中外炉工業株式会社

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