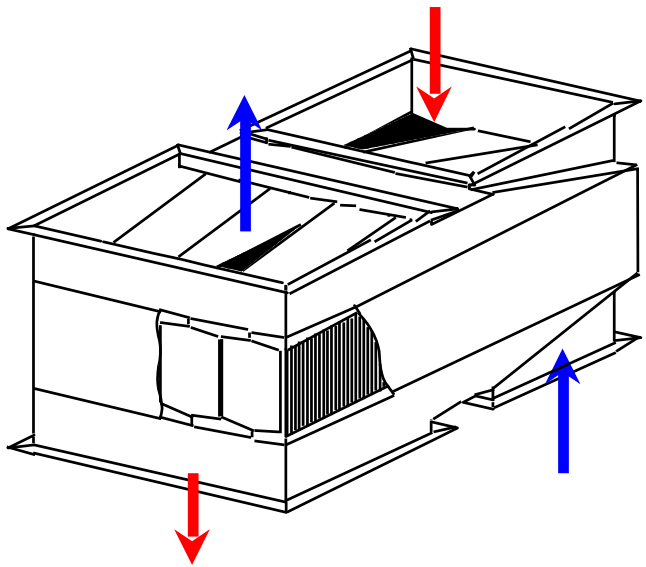
System REKULUVO®



Air Preheater for industrial application

BD Heat Recovery Division, Inc.

REKULUVO - Principle

The REKULUVO Air preheater is a plate type heat exchanger for atmospheric pressure range.

- It works as per the counter flow system
- The REKULUVO is completely leak free.
- The REKULUVO is completely welded.
- The REKULUVO has a modular construction.

REKULUVO - Development

- The REKULUVO was developed to provide the highest efficiency in the most compact space.
- The REKULUVO has to combine simple construction with zero leakage for strong environmental application.

REKULUVO - Applications

- **CFB Boiler**

  The REKULUVO is used in atmospherical circulated fluidized bed boiler as a compact alternative for tubular APH.

- **Pulp and Paper**

  The REKULUVO is used as an APH in the pulp & paper industry.

- **Petrochemical**

  The REKULUVO is used in the largest methanol and ammonia plant in the world.

REKULUVO - technical specification

Medium	Air, Flue gas relative humidity up to 100 % dust load up to approx.. 100 g/m³ pollutants such as sulfur, chloride, etc. Temperature below the dew point
Mass flow:	25.000 to 5.500.000 lbs../hr
Temperature:	Up to to 1050 °F
Design pressure:	150 inches WC
Efficiency:	up to 90 %
Material:	Carbon steel, Corten, stainless steel enameled carbon steel

Features of the REKULUVO

Regenerative

- High density of the heating surface
  - compact construction
- Counter-flow system
  - high efficiency
  - vertical gas channels
  - easy cleaning
- Easy replacement of the heating surface
- Easy access

Recuperative

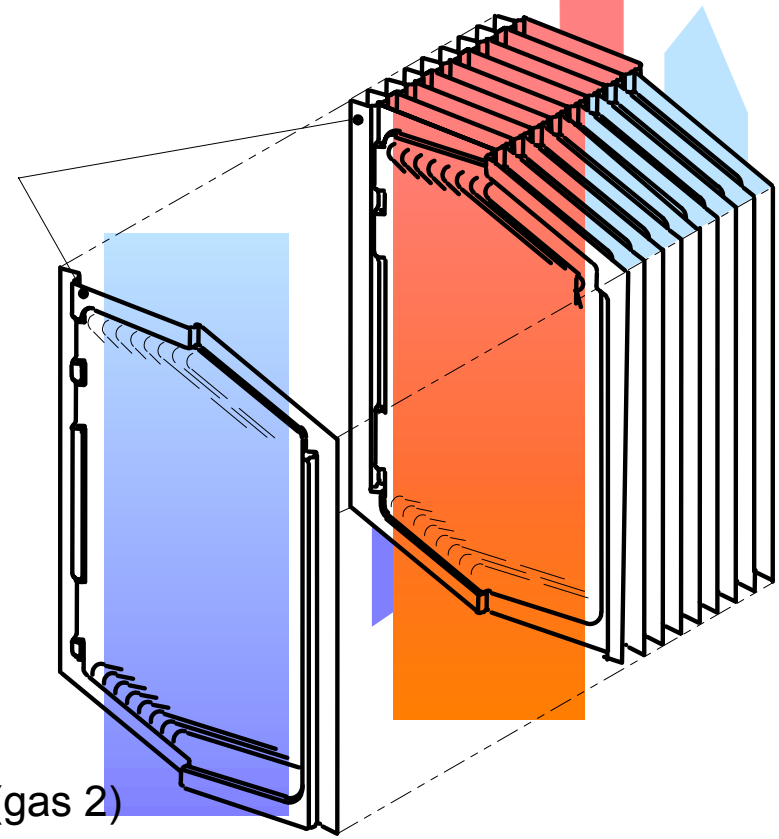
- Leakage free
  - no increase of the gas volume
  - no pollutants are transferred
- Static system
  - simple construction
  - high reliability
  - easy maintenance
  - low noise level
- no electrical instrumentation and control systems

The innovative REKULUVO® combines all these system advantages

Principle of counter flow plate

Inlet flow channels (gas 1)

Counter-flow plates

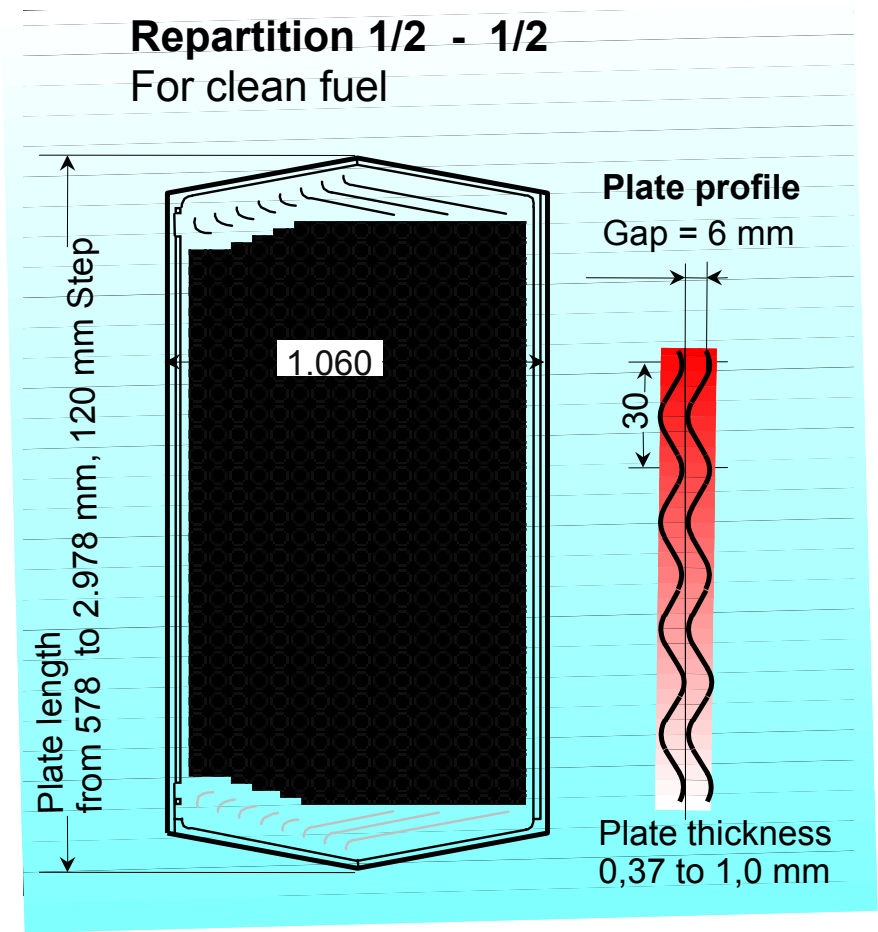


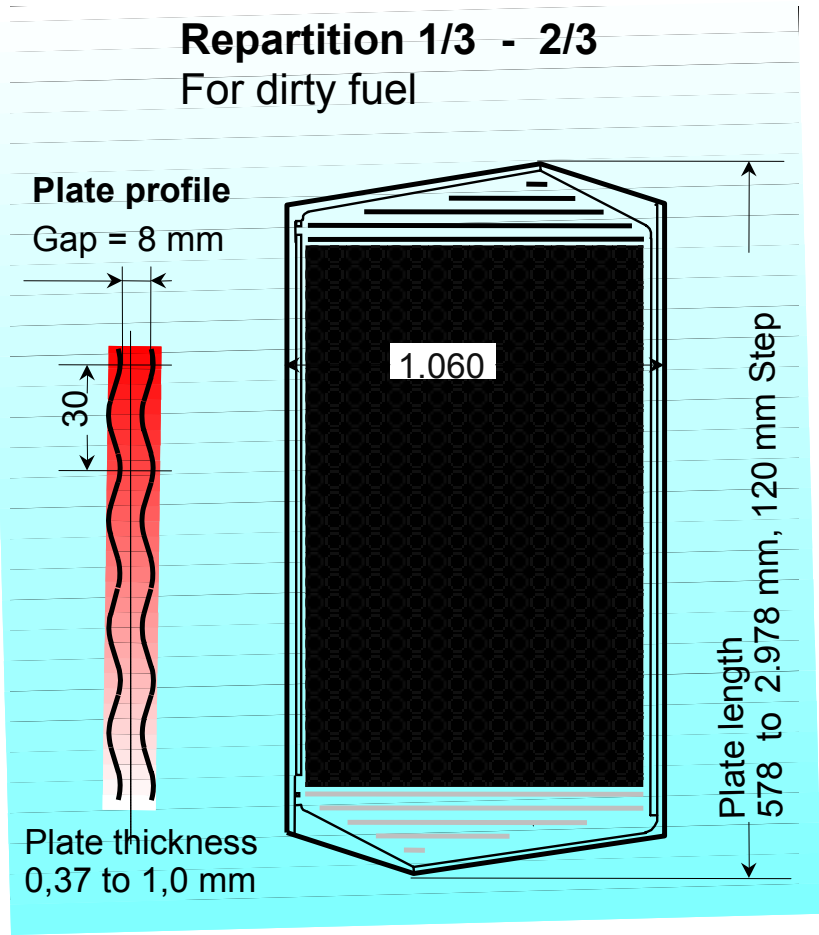
Material:

Carbon steel
enameled steel
Stainless steel
Nickel-Chrome alloy

Inlet flow channels (gas 2)

Heat exchanger plate for REKULUVO®



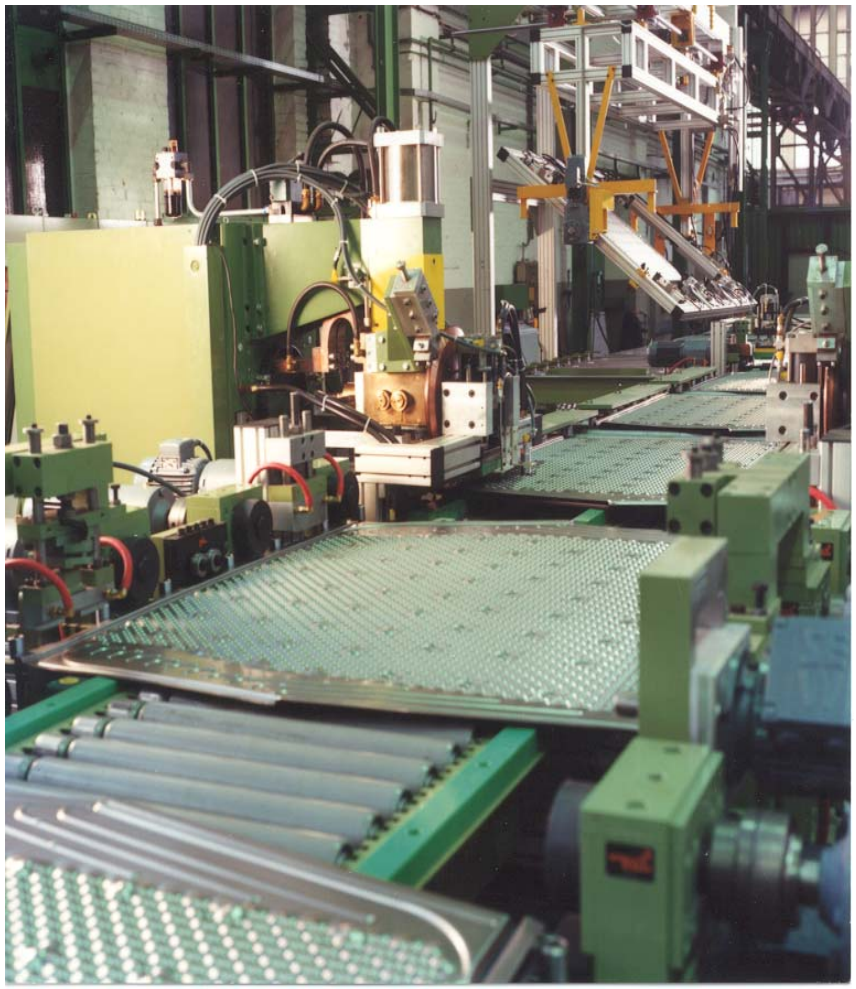


Standard design

BD Heat Recovery Division, Inc.

Standard Plate

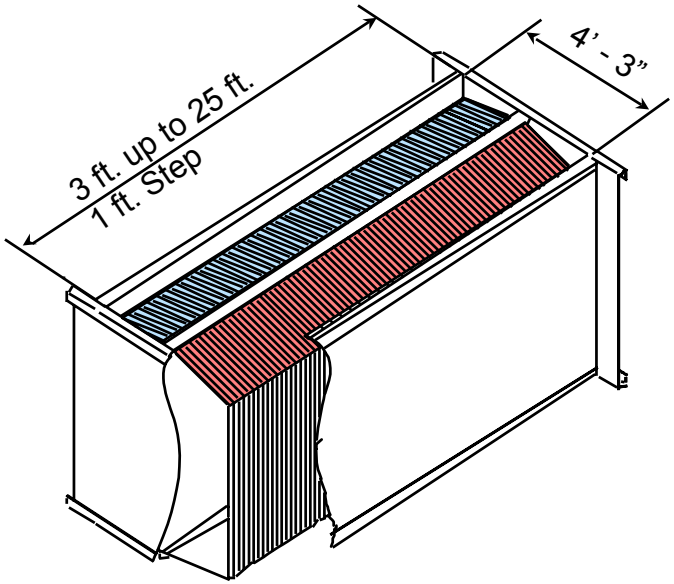
During Manufacture



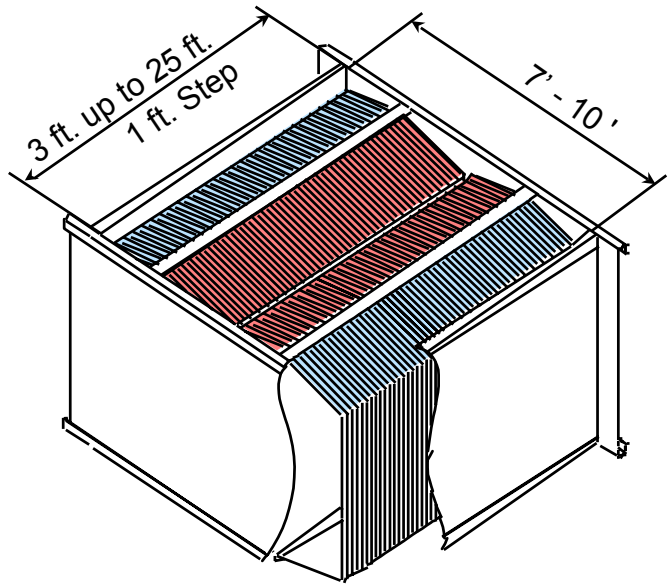
Boxberg Plate

Standard container REKUGAVO®/REKULUVO®

Casing with <u>one</u> plate packs lane



Casing with <u>two</u> plate packs lanes



Min. overall height: 3' - 9" with Plate height 578 mm
Max. overall height: 11' - 6" with Plate height 2.978 mm
Height Step: 5"
Container weight: approx.. 1 t to max. 37 t

Plate Packs Assembled in Module

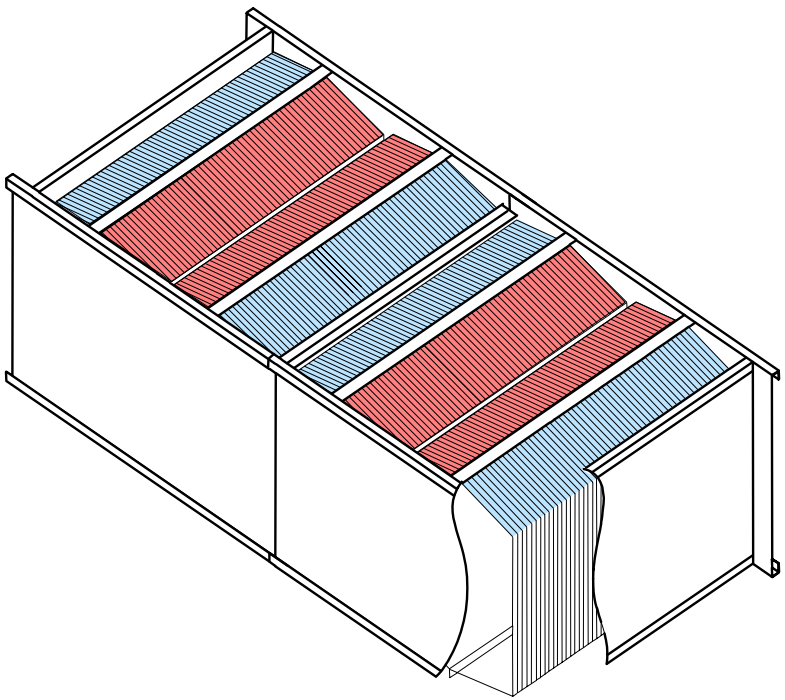
The standard containers are combined together to form units of any size

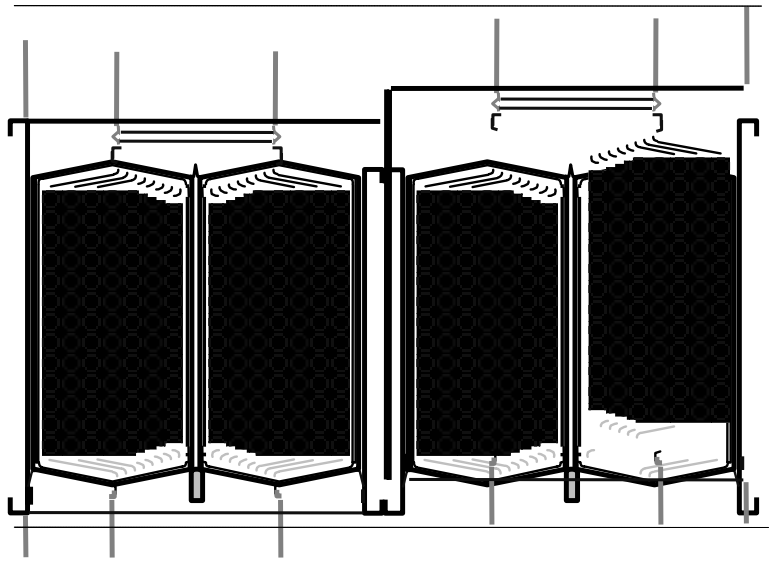
The system of standard modules is suitable for volume flows of approximately:

25.000 to 5,500,000 lbs../hr

with a space requirement of approx..:

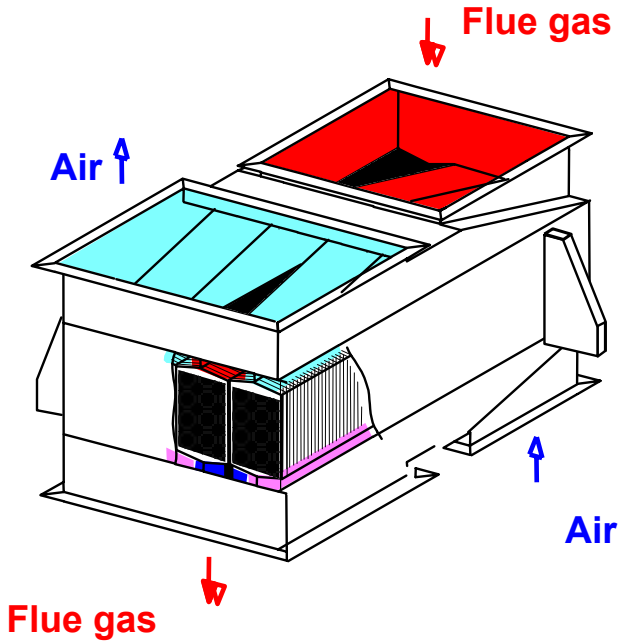
10 ft^2 to 4000 ft^2



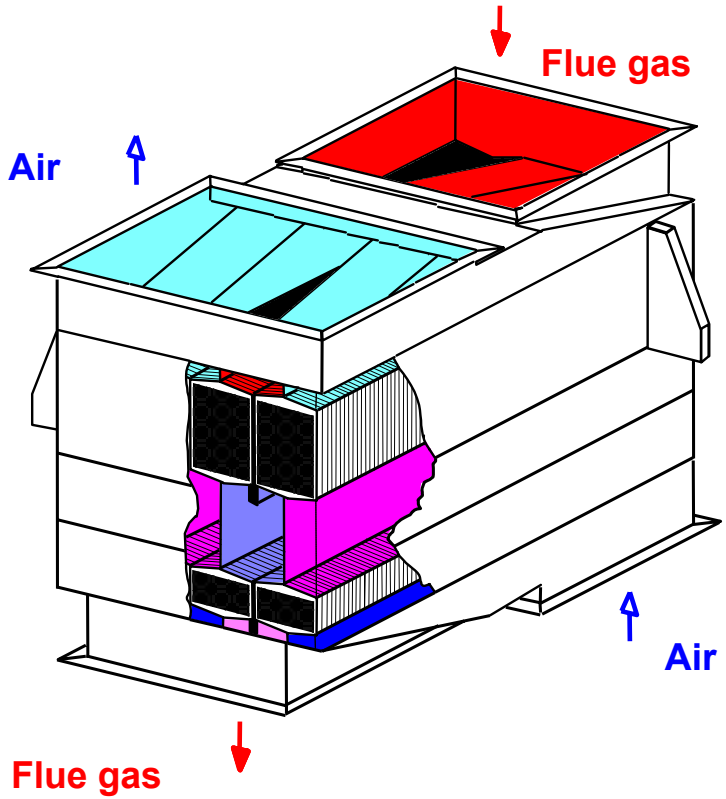


Heat exchanger REKUGAVO® /REKULUVO®

with <u>one</u> stage



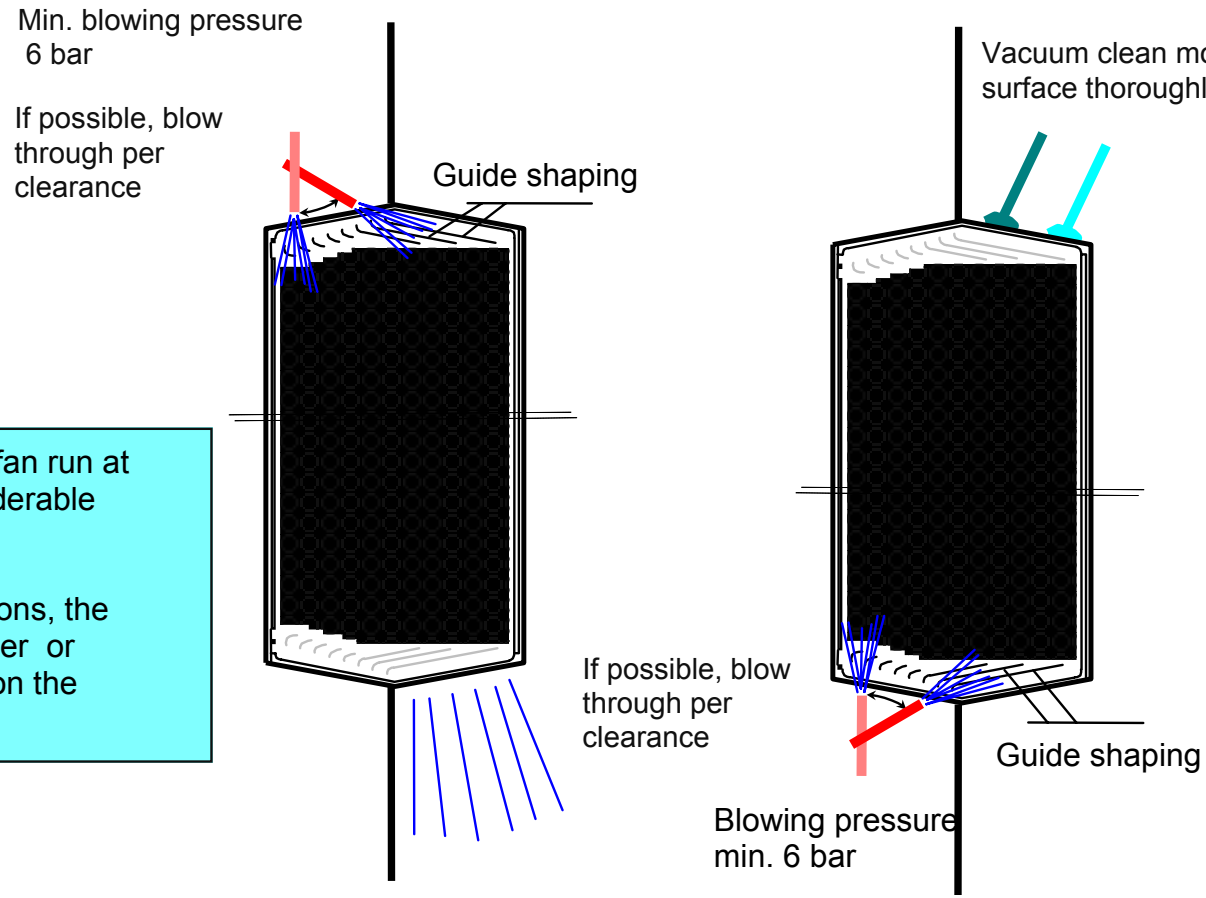
with <u>two</u> stages



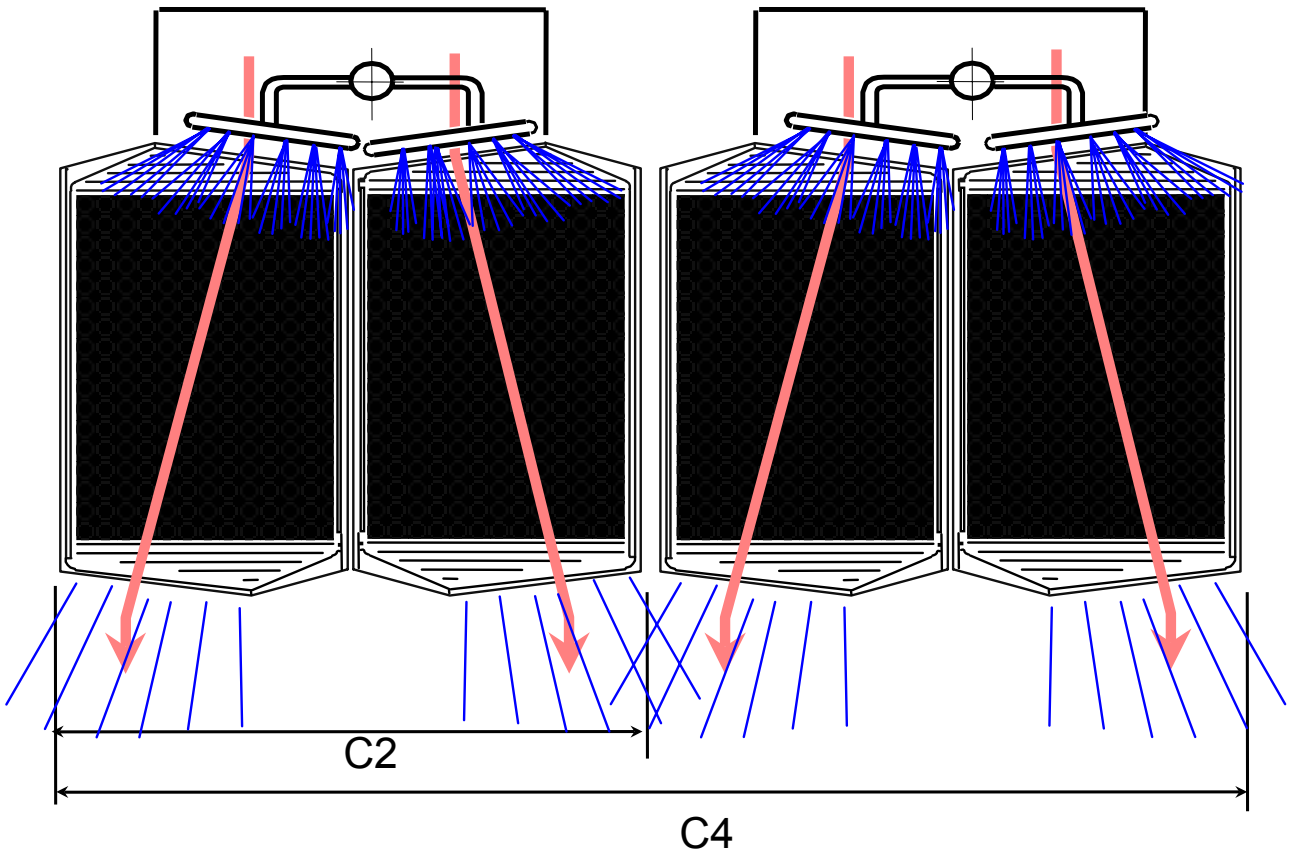
Typical Distribution Hood

Manuel cleaning concept

- It is of advantage to let the main fan run at low speed. this results in a considerable reduction in dust generalization.
- If there are heavy dirt accumulations, the system can be washed using water or high-pressure water, depending on the kind of contamination.



On Line Cleaning - Rake Type Sootblowers

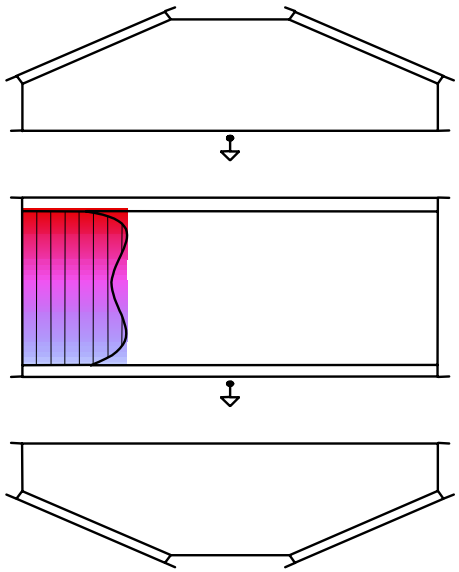


Erection Sequence

Upper Hood

Container

Lower Hood



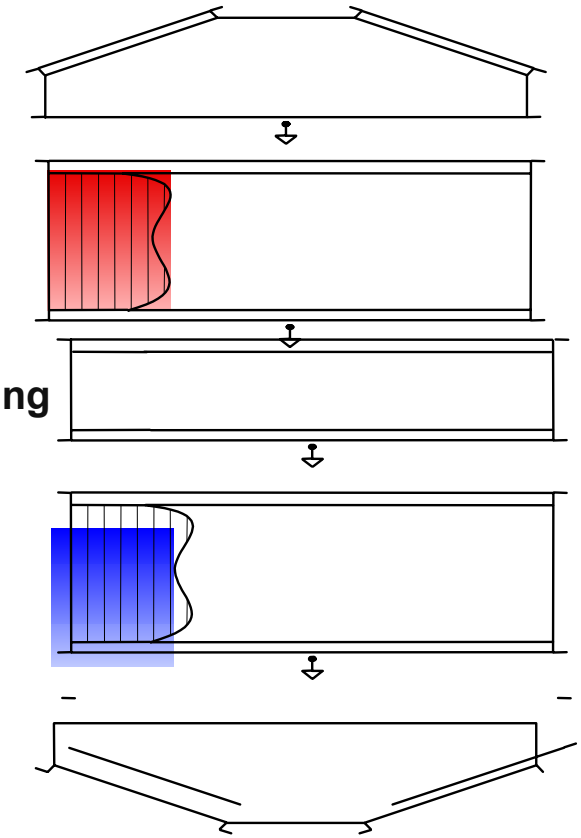
Upper Hood

Container

Intermediate casing

Container

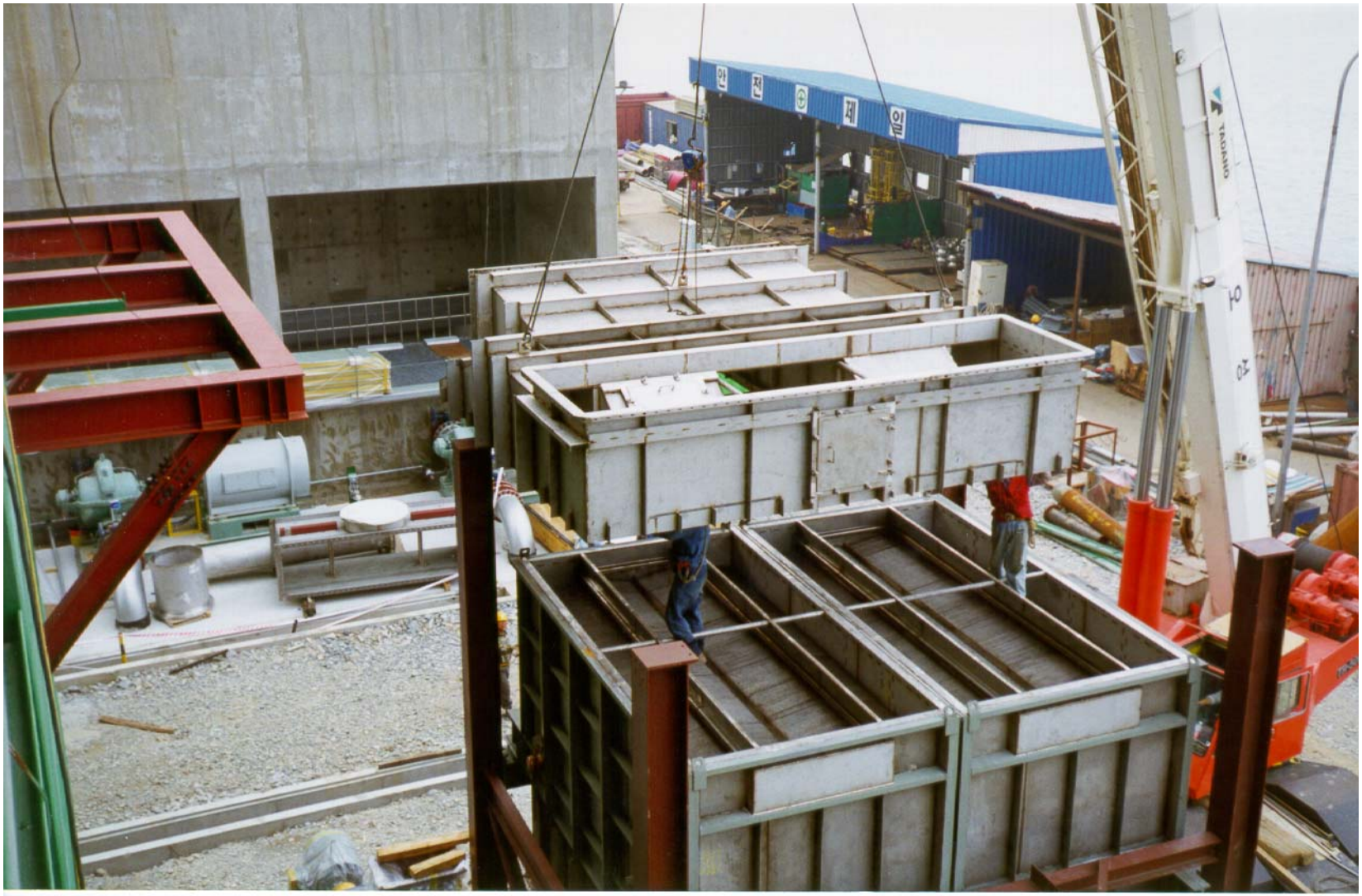
Lower Hood



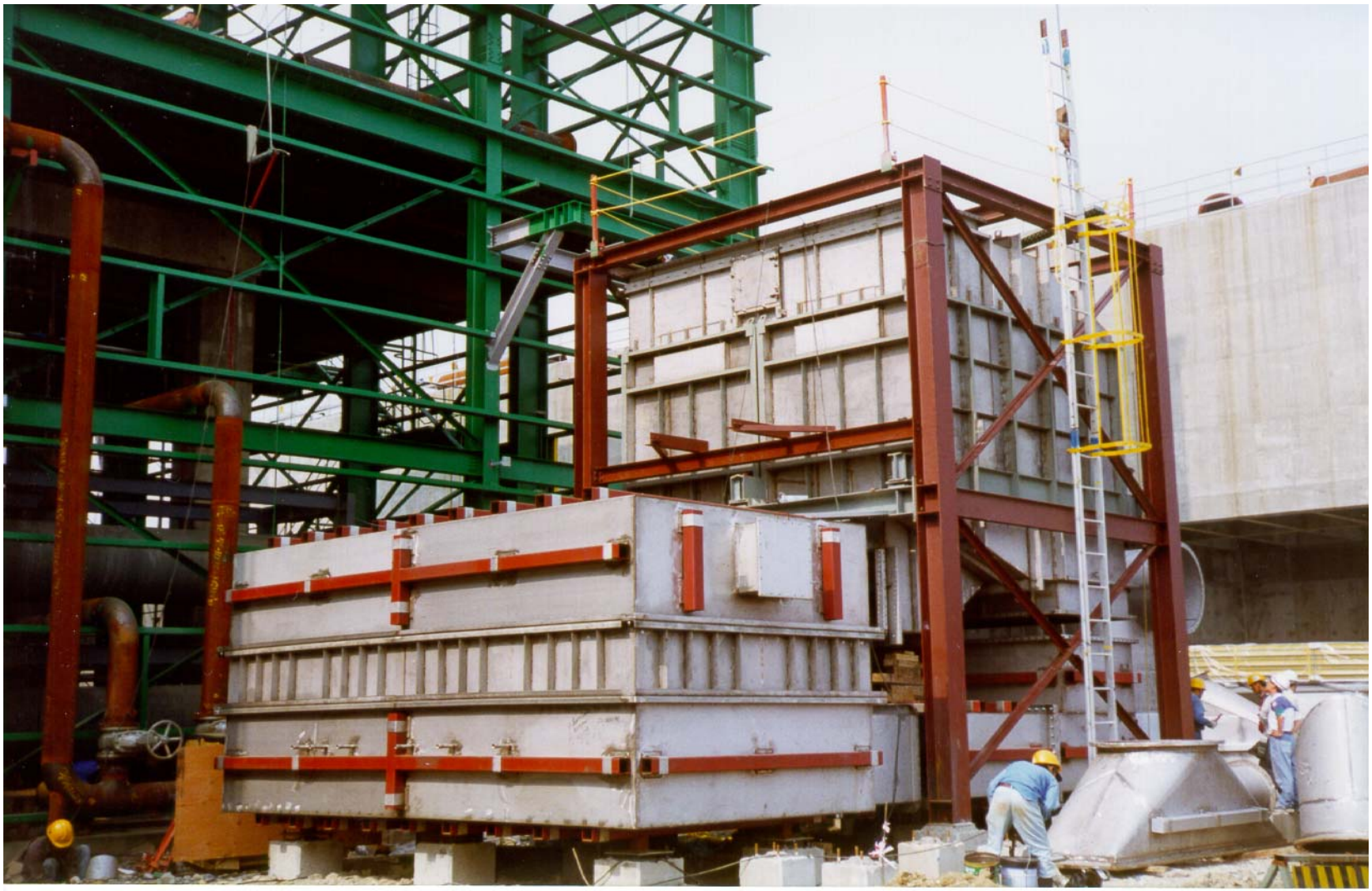
Bottom Hood Lowered into Position

Modules Placed in Position

Top Hood Lowered into Position

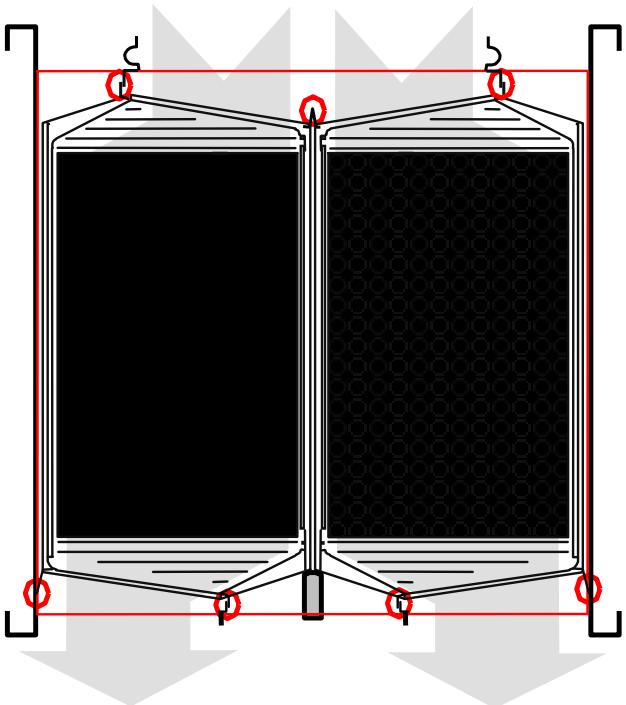


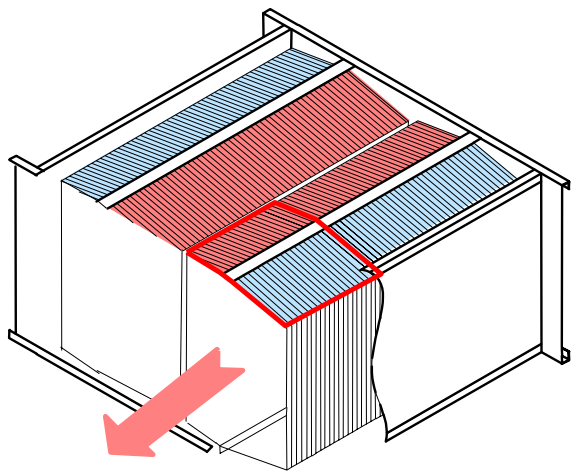
Completed Catalytic Incineration System



Replacement of modules

- Cut off front wall at the market point.
- Attach supporting beams.
- Lift, spot-weld and fix expansion joint.
- Cut-off lower central seal and angles.
- Cut-off upper seal between the module
- Grind open transverse seam on top and bottom of module.
- Push module cart below module, pump up hydraulic cylinder by approx.. 10 mm and push out cart with module.





REKULUVO-Reference list for chemical application

- **Methanol Plant**
  - → CMC, Trinidad 1500 tpd
  - → M4, Trinidad 1650 tpd
  - → Methanex II, Chile 2500 tpd
  - → Methanex III, Chile 3000 tpd
  - → Iran Kharg, Iran
  - → GNFC, Gujarat, India 600 tpd

- **Olefin Plant:**
  - → Wesseling, Oven 17

- **Ammonia plant**
  - → ABU QIR III 1250 tpd
  - → Porto Maghera 600 tpd
  - → Suez 1250 tpd

REKULUVO for drying process

Erection phase of Cerestar plant / Commissioning in Jan. 1996

- **BHKW Cerestar:**
  - Flue gas flow — 154,000 pph
  - air flow — 200,000 pph
- **Temperatures:**
  - Flue gas inlet — 625 °F
  - Flue gas outlet — 187 °F
  - Air inlet — 104 °F
  - Air outlet — 482 °F
- **Thermal duty:**
  - REKULUVO — 18.4 x 10^6 Btu/hr
- **Pressure drop:**
  - Total — 8 inches WG
- **Dimension:**
  - Width, depth, height — (18 x 18.5 x 37.75)ft
  - Exchange surface — 61,330 ft²
  - Total weight — 88 tons

REKULUVO for Methanol Plant

Erection phase for CMC Methanol plant in 1992

- **CMC Methanol II:**
  - Flue gas flow 650,000 pph
  - air flow 620,000 m³/h i.N.f.
- **Temperatures:**
  - Flue gas inlet 788 °F
  - Flue gas outlet 266 °F
  - air inlet 79 °F
  - air outlet 716 °F
- **Duty:**
  - REKULUVO 93.2×10^6 Btu/hr.
- **Pressure drop**
  - total 14 inches WG
- **dimensions:**
  - Width, depth, height (31 x 42.5 x 39) ft
  - Exchange surface 189,350 ft²
  - Total weight 330 tons

REKULUVO for Methanol Plant

Erection phase for Methanex, train II Methanol plant in 1996

- **Methanex II:**
  - Flue gas flow 1,312,000 pph/hr.
  - air flow 1,248,000 pph/hr.
- **Temperatures:**
  - Flue gas inlet 780 °F
  - Flue gas outlet 265 °F
  - air inlet 60 °F
  - air outlet 690 °F
- **Duty:**
  - REKULUVO 194.7×10^6 Btu/hr.
- **Pressure drop**
  - total 9.2 inches WG
- **dimensions:**
  - Width, depth, height (32 x 32 x 36) ft
  - Exchange surface 310,000 ft²
  - Total weight 242 tons

REKULUVO for Methanol Plant

Erection phase for Methanex, train III Methanol plant in 1998

- **Methanex III: 3,000 Tpd**
  - Flue gas flow 1,658,250 pph/hr.
  - air flow 1,563,300 pph/hr.
- **Temperatures:**
  - Flue gas inlet 970 °F
  - Flue gas outlet 310 °F
  - air inlet 60 °F
  - air outlet 855 °F
- **Duty:**
  - REKULUVO 300 x 10^6 Btu/hr.
- **Pressure drop**
  - total 15.0 inches WG
- **dimensions:**
  - Width, depth, height (32 x 32 x 36) ft
  - Exchange surface 310,000 ft²
  - Total weight 220 tons

REKULUVO for a Nitrogen plant

Erection phase for Sam Nam Plant in Korea, 1996

- **San Nam:**
  - Flue gas flow 350.000 pph/h.
  - air flow 350.000 pph/h.
- **Temperatures:**
  - hot gas inlet 720 °F
  - hot gas outlet 270 °F
  - cold gas inlet 95 °F
  - cold gas outlet 555 °F
- **Duty:**
  - REKULUVO 42.25 x 106 Btu/hr.
- **Pressure drop**
  - total 12.8 inches WG
- **Dimensions:**
  - Width, depth, height 2 x (8 x 26 x15) ft
  - Exchange surface 44,600 ft²
  - Total weight 48.5 tons