PRODUCT GUIDE

High-Temperature Plate and Tubular Heat Exchangers

Munters

Des Champs Products

Introduction

Pioneering Advanced Technology for Industrial Energy Conservation

Founded in 1974 with the invention of the Z-Duct plate air-to-air heat exchanger, Munters - Des Champs Products has led the industry in the design, engineering, and manufacture of air-to-air energy saving systems, industrial heat exchangers, packaged make-up air, and dehumidification systems. The company quickly earned a reputation for innovation by manufacturing a unique, efficient heat exchanger for the F-14 fighter plane. This aluminum plate heat exchanger proved to be cost effective and found a ready market in the private sector. Eighteen patents and a host of new products later, Munters offers virtually all types of air-to-air heat exchangers and energy recovery systems including equipment durable enough to withstand the effects of high temperatures and rugged operating environments. These industrial heat exchangers are able to perform under harsh conditions in temperatures as high as 2000°F with special construction.

Munters understands the customer's needs and offers engineered solutions to meet specific requirements. Our line of industrial heat exchangers includes the Thermo-Z plate heat exchanger and the Thermo-T tubular heat exchanger. Custom designs may include multiple airflow configurations and variable spacings to achieve the desired heat exchanger effectiveness and pressure differentials while maintaining specific size.

Thermo-Z™

The Munters Thermo-Z plate heat exchanger recovers heat from energy-consuming processes up to 1400°F. Thermo-Z is typically constructed of heavy gauge alloy stainless steel, providing a smooth, continuous path for minimum air resistance. Heat transfer plates are completely seam-welded to prevent cross-contamination, and optional expansion joints enable flange-to-flange ductwork installation without the need to compensate for thermal expansion. Custom designs are offered, with effectiveness values up to 85%.

Thermo-T™

The Munters Thermo-T tubular heat exchanger recovers heat from energy-consuming processes at temperatures up to 1800°F. Heat transfer tubes are fully welded to the tube sheets, ensuring minimum cross-contamination. Integral expansion joints make the Thermo-T ideal for high-temperature applications. Single and multi-pass models are available with effectiveness values up to 80%.

Product Testing

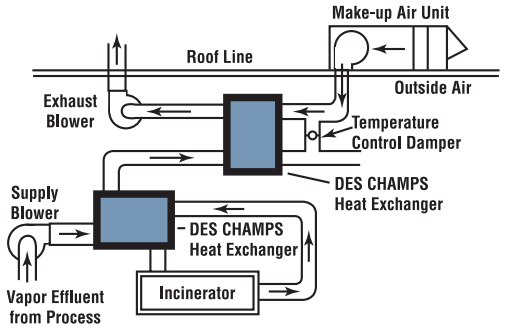
Munters - Des Champs Products utilizes modern testing instruments and procedures to ensure a high quality product. All heat exchangers are fully pressure-tested for leaks and inspected for structural integrity.

Research and Development

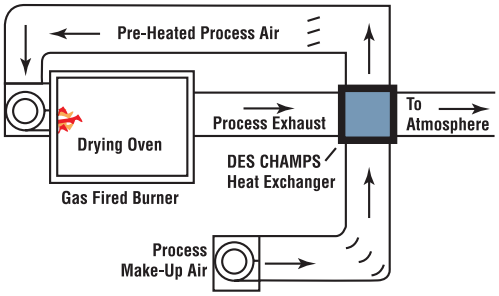
Research and Development is the core of Munters - Des Champs Products and the source of all our products. Listening to and working closely with our customers has made us the first to bring to market new products to address new applications. Munters is committed to providing custom engineered solutions to challenging problems.

Typical Installations

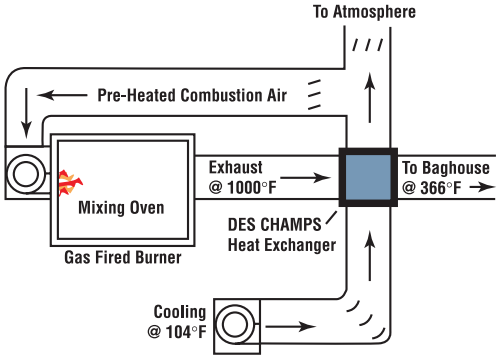
Catalytic & Thermal Oxidizer Heat Recovery 1st & 2nd Stage



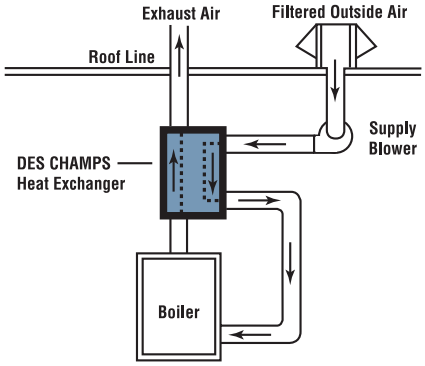
Transfer Process Exhaust to Process Make-up Air



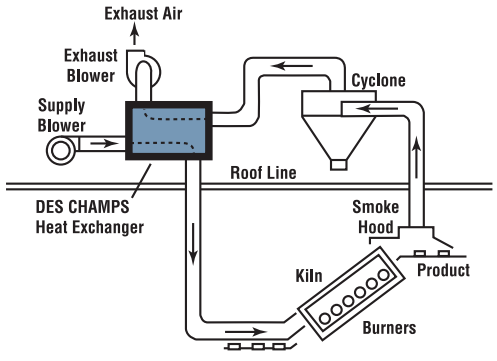
Cooling Process Air Prior to Bag House



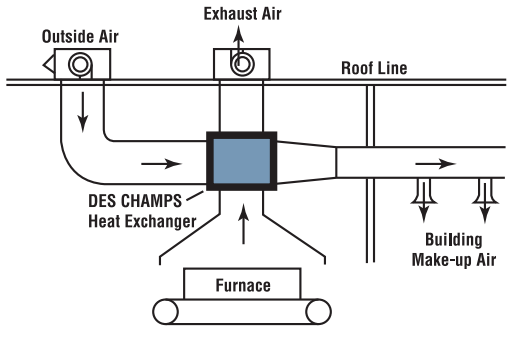
Transfer Process Exhaust to Process Make-up Air



Rotary Kiln



Waste Process Heat to Plant Make-up Air



Thermo-Z™

High-Temperature Plate Heat Exchangers

Thermo-Z

The Thermo-Z plate heat exchanger is designed to recover heat from energy consuming processes up to 1400°F. Energy can be recovered and returned as process make-up air, used to preheat combustion air, or used for plant or office heating.

Thermo-Z offers fully adjustable plate thickness and plate spacing. Combine this with the unmatched flexibility in materials of construction and flow patterns, and Thermo-Z is the obvious choice for your high temperature heat recovery application.

To meet unique performance or configuration requirements, multiple flow patterns are available. For harsh environments, the Thermo-Z can be integrated with a tubular heat exchanger (Thermo-T) to provide the ultimate in effectiveness, reliability and value.

Construction

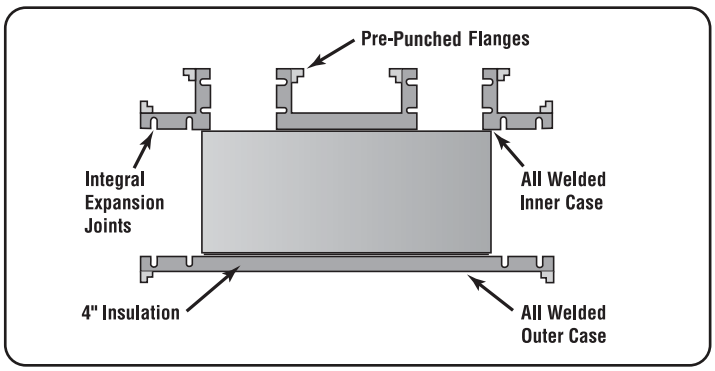
The Thermo-Z heat exchanger is designed and constructed for an industrial environment. Proper material selection is crucial to the life of a heat exchanger. Typically, Thermo-Z is constructed with heavy gauge 304L, 316L, or 309S stainless steel plates that provide a smooth, continuous path for minimum air resistance. These materials provide superior performance in high temperature or corrosive environments. Optional materials are available to meet specific needs.

The heat transfer plates are completely seam welded to ensure against cross-contamination. Spacing is achieved with raised and depressed truncated conical dimples, providing uniform plate pitch. The height of these dimples can be varied at the time of manufacture to establish the desired plate spacing necessary to meet exact performance requirements.

The inner casing is constructed of the same material as the heat transfer matrix. It is welded to the matrix at certain peripheral locations to assure an air-tight seal.

Optional Expansion Joints With Welded Outer Casing

Thermal stress is another major factor in high-temperature heat exchanger design. At high temperatures, Munters' integral expansion joints allow the heat exchanger matrix to expand without causing excessive stress.



The outer casing remains cool because of the layer of high-temperature insulation. Therefore, it will not expand as a result of process temperature changes. The internal casing is secured to the cold outer casing by means of integral thermal expansion joints. These joints allow the inner matrix/casing assembly to move freely without undue forces being imposed on it by the rigid, cool external casing. The heat exchanger (with its cold flanges) can be installed flange-to-flange to the ductwork without the need to compensate for the thermal expansion of the heat exchanger.

Features and Benefits

- Standard operation to 1400°F
- Effectiveness to 85%
- Pressure differentials to 28" W.C. standard
- Fully-welded construction
- Near zero cross-contamination
- Custom designs
- Variable plate spacing
- Integration with Thermo-T
- More cost effective than shell and tube heat exchangers

Applications

- Oxidizers
- Ovens
- Dryers
- Furnaces
- Solid Waste Recovery
- Annealing Operations
- Solvent Recovery
- Anywhere hot air is wasted

Standard and Custom Engineered Construction

Standard Construction

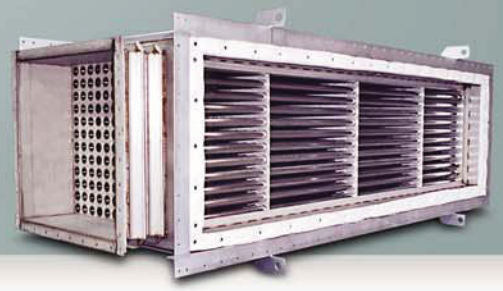
- All-welded heat transfer matrix (standard 0.030 inches thick)
- Standard 0.5-inch plate spacing
- All-welded casing (minimum 0.105 inches thick)
- 2" x 2" x 1/4" pre-punched flange connections
- Highly effective counterflow pattern
- Ready to be field installed and insulated

Custom Construction

- Broad selection of materials
- Insulated double-wall construction with integral thermal expansion joints
- Seven airflow patterns
- Designed to meet user requirements
- Complete systems
- Matrix cleaning options

Thermo-T™

High Temperature Shell & Tube Heat Exchanger



Thermo-T

The Thermo-T tubular heat exchanger is designed to recover heat from energy consuming processes up to 2000°F. Energy can be recovered and returned as process make-up air, used to preheat combustion air, or used for plant or office heating.

Thermo-T offers fully adjustable tube size and tube spacing. Combine this with the unmatched flexibility in materials of construction and flow patterns, and Thermo-T is the obvious choice for your high temperature heat recovery application.

To meet unique performance or configuration requirements, both single and multi-pass models are available. The Thermo-T can be integrated with a plate heat exchanger (Thermo-Z) to provide the ultimate in effectiveness, reliability and value.

Construction

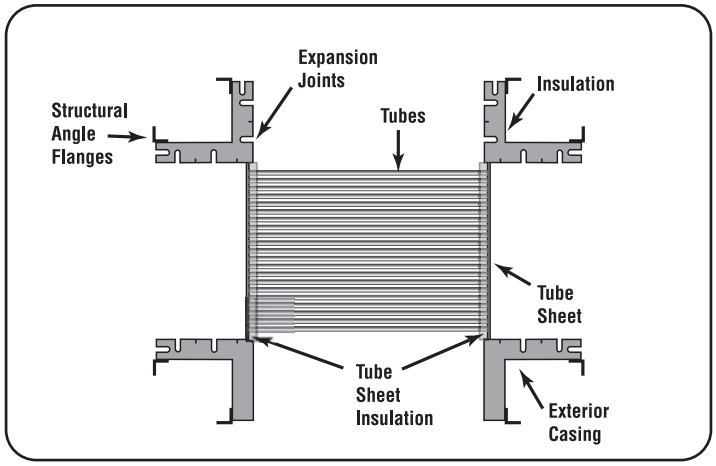
The Thermo-T heat exchanger is designed and constructed for an industrial environment. Proper material selection is crucial to the life of a heat exchanger. Typically, Thermo-T is constructed with 304L, 316L, or 309S stainless steel tubes and tube sheets. These materials provide superior performance in high temperature or corrosive environments. Optional materials are available to meet specific needs.

The tubes are fully welded to the tube sheet to provide a double layer of protection against cross-contamination. The tube size and spacing are fully adjustable at the time of manufacture to meet exact performance requirements.

The inner casing is constructed of the same material as the heat transfer matrix. It is welded to the matrix at certain peripheral locations to assure an air-tight seal.

Optional Expansion Joints With Welded Outer Casing

Thermal stress is another major factor in high-temperature heat exchanger design. At high temperatures, Munters' integral expansion joints allow the tube/sheet assembly to expand without causing excessive stress.



The outer casing remains cool because of the layer of high-temperature insulation. Therefore, it will not expand as a result of process temperature changes. The internal casing is secured to the cold outer casing by means of integral thermal expansion joints. These joints allow the inner matrix/casing assembly to move freely without undue forces being imposed on it by the rigid, cool external casing. The heat exchanger (with its cold flanges) can be installed flange-to-flange to the ductwork without the need to compensate for the thermal expansion of the heat exchanger.

Features and Benefits

- Standard operation to 1800°F; higher temperature construction available
- Effectiveness to 80%
- Pressure differentials to 28" W.C. standard
- Fully-welded construction
- Near zero cross-contamination
- Custom designs
- Variable tube size and spacing
- Integration with Thermo-Z
- Ideal for high pressure applications

Applications

- Oxidizers
- Ovens
- Dryers
- Furnaces
- Solid Waste Recovery
- Annealing Operations
- Solvent Recovery
- Particulate-laden exhausts
- Anywhere hot air is wasted

Standard and Custom Engineered Construction

Standard Construction

- Fully welded tube bundle (.065 inch avg wall thickness)
- 1/4" thick tube sheet
- Tubes fully welded to tube sheet.
- All-welded casing (minimum 0.105 inches thick)
- 2" x 2" x 1/4" pre-punched flange connections
- Highly effective counterflow pattern
- Ready to be field installed and insulated

Custom Construction

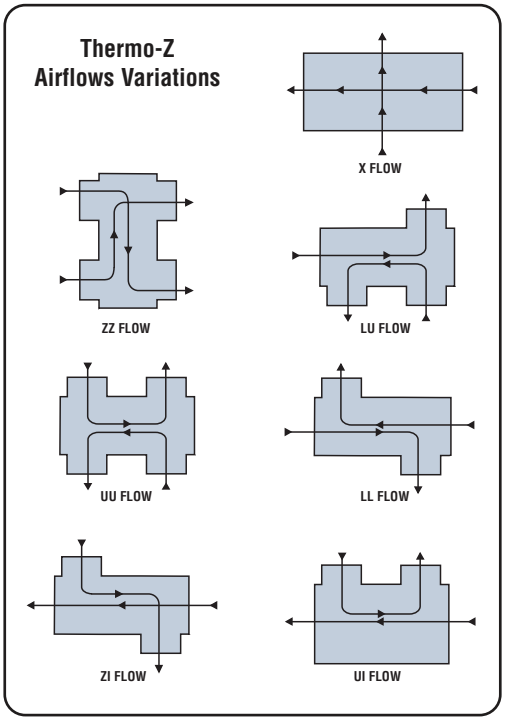
- Broad selection of materials
- Insulated double-wall construction with integral thermal expansion joints
- Single & multi-pass units
- Designed to meet user requirements
- Complete systems
- Tube bundle cleaning options
- High pressure construction

Specifications and Airflow Variations

Thermo-Z™

Thermo-Z Specification

1. The unit manufacturer shall have at least 35 years of experience with high temperature air-to-air heat exchangers and combustion equipment.
2. The heat recovery equipment shall be Munters type Thermo-Z, having a model number of _____.
3. The unit shall be capable of operating with a hot side inlet temperature (T3) of _____ °F.
4. The heat exchanger heat transfer matrix shall be made with minimum 0.03" _____ plates with embossed conical dimples to maintain plate separation and enhance heat transfer.
5. All material directly in contact with the hot side gas stream shall be _____.
6. The heat transfer matrix shall be die formed with continuous seam welds to prevent gas leakage to the adjacent airstream.
7. The heat transfer matrix and inner casing shall be mechanically and thermally separated from the outer case by means of integral all-welded thermal expansion joints and 4" of high temperature thermal ceramic insulation (minimum 6 pcf density).
8. The inner casing shall be minimum 12-gauge all-welded construction and be of the same material as the heat transfer matrix.
9. No open face insulation shall be in contact with the process air stream.
10. Expansion joints shall be formed and welded metal bellows type, constructed from the same material type as the heat transfer matrix.
11. The outer casing shall be minimum 11-gauge carbon steel.
12. Flanges shall be minimum ___" x ___" x ___" structural steel with pre-punched boltholes for easy hook-up.
13. The unit shall have a structural steel baseframe with integral lifting lugs.
14. The unit shall be sandblasted to SP6 grade specification and shall be primed and painted with high temperature aluminum paint for weather protection.
15. The unit shall be rated for ____ inches W.C. maximum differential pressure at operating temperatures.
16. Airflow through the heat exchanger shall be in a counterflow pattern to ensure maximum performance.
17. Prior to shipment, each module must be pressure tested to ____ inches W.C. differential air pressure and experience no more than 0.01% leakage rate.



Thermo-T™

Thermo-T Specification

1. The unit manufacturer shall have at least 35 years of experience with high temperature air-to-air heat exchangers and combustion equipment.

2. The heat recovery equipment shall be Munters type Thermo-T, having a model designation of _____.

3. The unit shall be capable of operating with a hot side inlet temperature (T3) of _____ °F.

4. All material directly in contact with the hot side gas stream shall be _____.

5. The heat exchanger tubes shall be minimum .065" average wall thickness _____ material.

6. The tube sheet shall be 1/4" thick minimum.

7. The tubes shall be continuously seam welded to tube sheet, preventing gas leakage and cross-contamination.

8. The heat exchanger tubes, tube sheets and inner casing shall be mechanically and thermally separated from the outer case by means of integral all-welded thermal expansion joints and 4" of high temperature thermal ceramic insulation (minimum 6 pcf density).

9. The inner casing shall be minimum 12-gauge all-welded construction and be of the same material as the tube bundle.

10. No open face insulation shall be in contact with the process air stream.

11. Expansion joints shall be formed and welded metal bellows type, constructed from the same material type as the tube bundle.

12. The outer casing shall be minimum 11-gauge carbon steel.

13. Flanges shall be minimum ____" x ____" x ____" structural steel with pre-punched boltholes for easy hook-up.

14. The unit shall have a structural steel baseframe with integral lifting lugs.

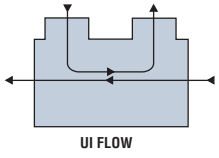
15. The unit shall be sandblasted to SP6 grade specification and primed and painted with high temperature aluminum paint for weather protection.

16. The unit shall be rated for ____ inches W.C. maximum differential pressure at operating temperatures.

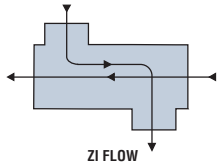
17. Airflow through the heat exchanger shall be in a counterflow pattern to ensure maximum performance.

18. Prior to shipment, each module must be pressure tested to ____ inches W.C. differential air pressure and experience no more than 0.01% leakage rate.

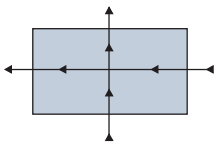
Thermo-T Airflows Variations



UI FLOW



ZI FLOW



X FLOW

Computer Analysis

Munters will supply a complete Thermodynamic Output as well as a Financial Analysis showing simple payback.

Munters
Des Champs Products

ZDUCT PAYBACK

225 South Magnolia Ave, Buena Vista, VA 24416
Phone: (540) 291-1111 Fax: (540) 291-3333

10/6/2008 5:27:43 PM Ver. 4.2.25
dctindustrial@munters.com

Order Name	Energy Recovery	Location	Virginia
Order Number	0	Prepared By	JLC
(Qty) Model	(1)S81CF	Unit Tag	HX-1
Representative	Munters	Engineering Firm	OEM
Altitude	1000		

INPUT DATA:

Cost of Electricity, $/kW-Hour	$0.050
Coefficient of Performance (COP) of Cooling Equipment	3
Heating Fuel Cost, $/million Btu	$10.00
Heating Fuel Conversion, %	90.0
Maximum Winter Supply Temperature, F	1000.0
Time of Operation, %	100.0
Installed Cost for Energy Recovery Equipment, dollars	$150,000
Credit for Replaced Conventional Equipment, dollars	$0
City used for Bin Data Analysis	Roanoke,VA

OUTPUT DATA:

AMB.BIN DB/WB	CONDITION HOURS	ENERGY SAVED (BTU / 1000)	HEAT RECOVERY DOLLARS SAVED	ADDED FAN HP COSTS	NET SAVINGS
102/ 75	1	11,524	$128	$1	$127
97/ 73	17	196,995	$2,189	$16	$2,173
92/ 72	92	1,071,998	$11,911	$84	$11,827
87/ 70	281	3,292,284	$36,581	$256	$36,325
82/ 68	448	5,277,653	$58,641	$409	$58,232
77/ 66	622	7,367,366	$81,860	$568	$81,292
72/ 65	892	10,622,650	$118,030	$814	$117,216
67/ 63	939	11,242,620	$124,918	$857	$124,061
62/ 58	793	9,545,445	$106,061	$724	$105,337
57/ 53	751	9,088,072	$100,979	$685	$100,293
52/ 48	707	8,600,979	$95,566	$645	$94,921
47/ 43	682	8,340,603	$92,673	$622	$92,051
42/ 38	702	8,630,238	$95,892	$641	$95,251
37/ 35	687	8,489,912	$94,332	$627	$93,705
32/ 32	563	6,993,650	$77,707	$514	$77,193
27/ 25	292	3,645,993	$40,511	$266	$40,245
22/ 20	162	2,033,172	$22,591	$148	$22,443
17/ 16	92	1,034,398	$11,493	$75	$11,418
12/ 11	25	316,969	$3,522	$23	$3,499
7/ 6	9	114,686	$1,274	$8	$1,266

Annual Energy Savings
Less Additional Fan/HP Costs
Net Annual Savings
Simple Payback (Initial Cost)/(Annual Savings)

Munters
Des Champs Products

ZDUCT Thermodynamic Performance

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(Qty) Model	(1)S81CF	Unit Tag	HX-1
Representative	Munters	Engineering Firm	OEM
Altitude	1000		

INDUSTRIAL PROCESS

Job File Designation = 10062008.zd3

UNIT INFORMATION:

Model Code Designation (Quantity)	(1)S81CF
Model Designation per Bulletin	81UI-15/15-5.6-800-304
Heat Exchanger Coating	plain
Plate Material	304 Stainless
Plate Thickness, inches	0.031
Plate Surface Area, sq. feet	13,546

COOLER AIR SIDE:

Air Inlet Temperature, T1, °F	95.0
Air Outlet Temperature, T2, °F	819.3
Air Flow at Entry Point T1, CFM	16,287.6
Air Flow at Exit Point T2, CFM	37,542.2
Air Flow, SCFM	15,000.0
Humidity Ratio, lbm.H2O/lb.Dry Air	0.0050
Pressure Drop, inches of water column	2.80

WARMER AIR SIDE:

Air Inlet Temperature, T3, °F	1000.0
Air Outlet Temperature, T4, °F	291.2
Air Flow at Entry Point T3, CFM	42,846.6
Air Flow at Exit Point T4, CFM	22,044.8
Air Flow through, SCFM	15,000.0
Humidity Ratio at T3, lbm.H2O/lb.Dry Air	0.0050
Humidity Ratio at T4, lbm.H2O/lb.Dry Air	0.0050
Pressure Drop, inches of water column	2.81

THERMAL PERFORMANCE

Water Condensed from Cooled Air, lbs/hour	0.0
Thermal Transfer Effectiveness, %	80.0
Heat Transferred, Q, btu's/hour	12,107,890

The output data from this program are derived from laboratory testing and field test results. Certified performance available.

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