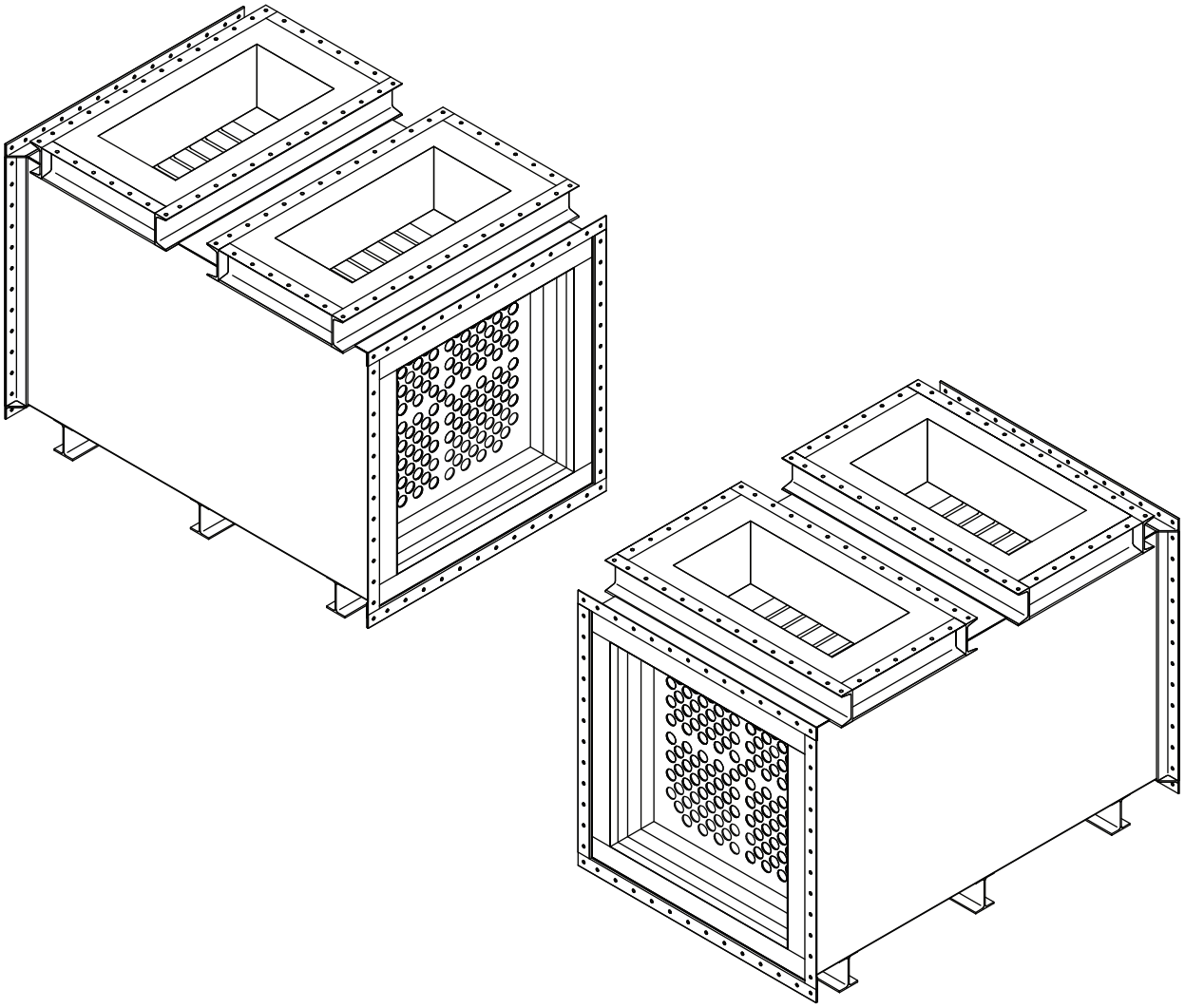
Installation Guide 545
3/20/2015

Exothermics Tubular Heat Recuperators



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EXOTHERMICS
World Class Heat Exchangers

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Disclaimer Notice

In accordance with the manufacturer's policy of continual product improvement, the product presented in this brochure is subject to change without notice or obligation.

The material in this manual is believed adequate for the intended use of the product. If the product is used for purposes other than those specified herein, confirmation of validity and suitability must be obtained. Eclipse warrants that the product itself does not infringe upon any United States patents. No further warranty is expressed or implied.

Liability & Warranty

We have made every effort to make this manual as accurate and complete as possible. Should you find errors or omissions, please bring them to our attention so that we may correct them. In this way we hope to improve our product documentation for the benefit of our customers. Please send your corrections and comments to our Technical Documentation Specialist.

It must be understood that Eclipse's liability for its product, whether due to breach of warranty, negligence, strict liability, or otherwise is limited to the furnishing of replacement parts and Eclipse will not be liable for any other injury, loss, damage or expenses, whether direct or consequential, including but not limited to loss of use, income, or damage to material arising in connection with the sale, installation, use of, inability to use, or the repair or replacement of Eclipse's products.

Any operation expressly prohibited in this manual, any adjustment, or assembly procedures not recommended or authorized in these instructions shall void the warranty.

Document Conventions

There are several special symbols in this document. You must know their meaning and importance.

The explanation of these symbols follows below. Please read it thoroughly.

How To Get Help

If you need help, contact your local Eclipse representative. You can also contact Exothermics at:

5040 Enterprise Blvd.
Toledo, Ohio 43612 U.S.A.
Phone: 419-729-9726
Fax: 419-729-9705
http://www.eclipsenet.com

Please have the information on the product label available when contacting the factory so we may better serve you.

⚠	This is the safety alert symbol. It is used to alert you to potential personal injurt hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.
⚠ **DANGER**	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **WARNING**	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **CAUTION**	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Is used to address practices not related to personal injury.
NOTE	Indicates an important part of text. Read thoroughly.

Customer Information

Customer name _____

Address _____

City _____ State _____ Zip code _____

Phone _____ Fax _____

Equipment _____

Performance Estimate No. _____

Product Information - Startup Record

Model number _____

Serial number _____

Start-Up Date _____

Exhaust Volume _____ Pressure Drop _____ (” w.c.)

Exhaust Temperature (Inlet) _____ (Outlet) _____

Supply Volume _____ Pressure Drop _____ (” w.c.)

Supply Temperature (Inlet) _____ (Outlet) _____

Table of Contents

Safety

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Important notices which help provide safe operation will be found in this section. To avoid personal injury and damage to the property or facility, the following warnings must be observed. All involved personnel should read this entire manual carefully before attempting to start or operate this system. If any part of the information in this manual is not understood, contact Exothermics before continuing.

Safety Warnings

⚠ WARNING

- **The duct sections are likely to have HOT surfaces. Always wear the appropriate protective equipment when approaching the heat exchanger.**
- **Exothermics products are designed to minimize the use of materials that contain crystalline silica. Examples of these chemicals are: respirable crystalline silica from bricks, cement or other masonry products and respirable refractory ceramic fibers from insulating blankets, boards, or gaskets. Despite these efforts, dust created by sanding, sawing, grinding, cutting and other construction activities could release crystalline silica. Crystalline silica is known to cause cancer, and health risks from the exposure to these chemicals vary depending on the frequency and length of exposure to these chemicals. To reduce the risk, limit exposure to these chemicals, work in a well-ventilated area and wear approved personal protective safety equipment for these chemicals.**

NOTICE

- **This manual provides information regarding the use of these heat exchangers for their specific design purpose. Do not deviate from any instructions or application limits described herein without written approval from Exothermics.**

Operator Training

The best safety precaution is an alert and trained operator. Train new operators thoroughly and have them demonstrate an adequate understanding of the equipment and its operation. A regular retraining schedule should be administered to ensure operators maintain a high degree of proficiency. Contact Exothermics for any needed site-specific training.

Installation 3

Receipt of Heat Recuperator

The heat recuperator should be inspected immediately for any evidence of damage received in transit. If shipping damage has occurred, a claim should be filed immediately with the shipping company. Notify Exothermics, Inc. at (419) 729-9726.

Installation

The heat recuperator may be installed indoors or outdoors without the need for additional painting or protection.

Exothermics manufactures three different recuperator designs: uninsulated, externally insulated, and internally insulated; each design has it's own installation requirements.

Uninsulated Recuperator

All exterior surfaces have the potential to reach elevated temperatures, therefore, personal protection must be considered when installing this unit. Because all flange connections are considered HOT connections, provisions for expansion are required. Field insulation of the entire system is recommended.

Externally Insulated Recuperator

These units are typically insulated with 4 to 6 inches (102 to 152 mm) of insulation to all external surfaces except the flange connections. The flange connections and immediate surrounding surfaces, therefore, have the potential to reach elevated temperatures. Personal protection must be considered when installing this unit. Because the flange connections are considered HOT connections, provisions for expansion are required. Field insulation of the flanges and surrounding surfaces should be considered.

Internally Insulated Recuperator

These units are typically pre-insulated with 4 to 6 inches (102 to 152 mm) of fiber modular insulation. The flange connections are considered cold connections. Mating connections must also be cold flanges. External insulation is not recommended.

Rigging

When rigging the recuperator for handling by crane, extreme care should be used to avoid damage to the recuperator. The heat recuperator is NOT equipped with lifting lugs. To minimize external loading on the heat recuperator, a lifting frame should be fabricated from a minimum of 8 inch (203 mm) channel, the same width and length as the heat recuperator casing. Lifting slings may then be attached to the lifting frame. Chains should be avoided as they may cause external damage. The slings may then be attached to the I beam supports on the underside of the heat recuperator. The slings should be vertical, so that no side loads are transmitted to the heat recuperator casing or supports. Some units may have external packaging, plywood covers, or external supports. This packaging should not be removed until the unit is set into place.

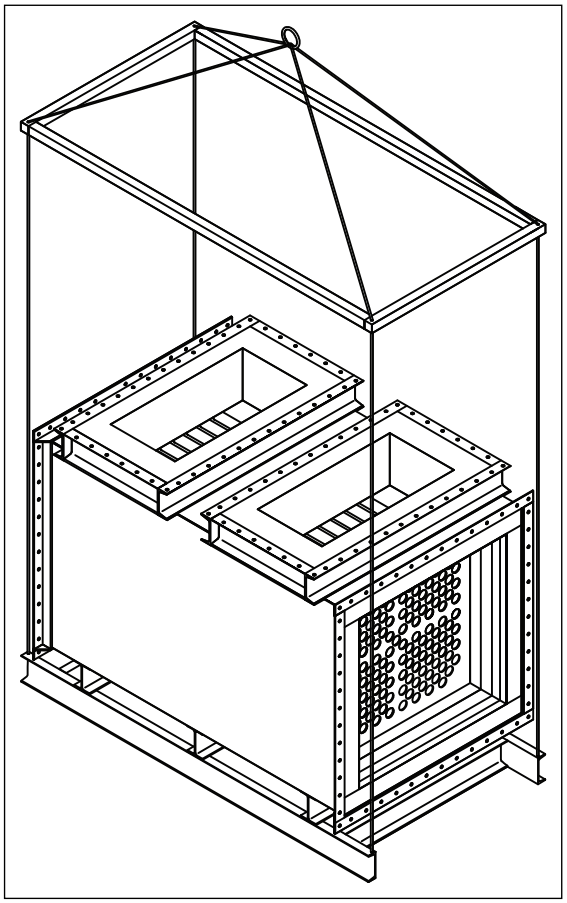

Figure 3.1.

Thermal Expansion

High temperature installations require appropriate allowance for thermal expansion. The heat recuperator is equipped with internal expansion joints to provide for internal thermal expansion. At high temperatures, however, considerable linear thermal expansion may occur in duct work and interconnecting transitions. Insufficient allowance for expansion may result in catastrophic damage to the heat recuperator. It is strongly recommended that all duct work connections to the heat recuperator contain flexible connections or bellow type expansion joints.

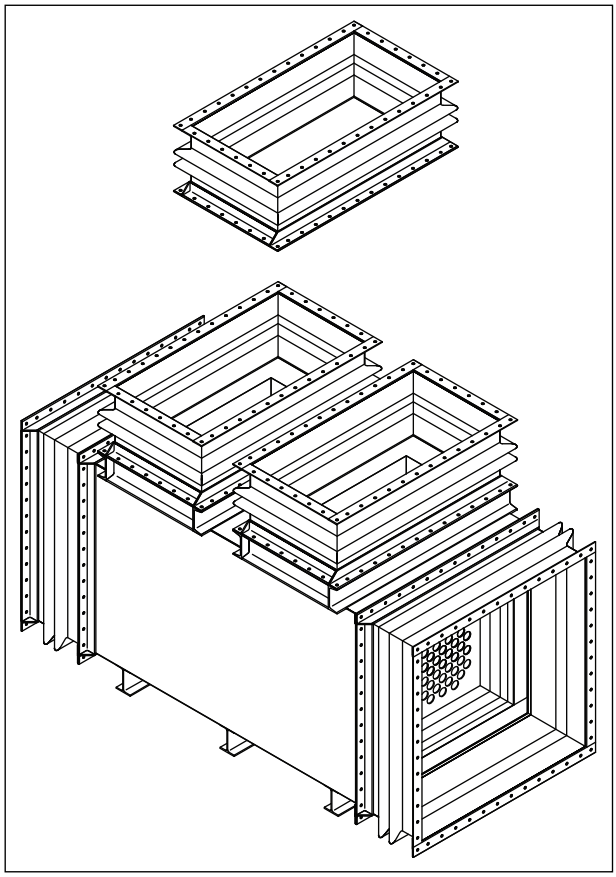

Figure 3.2.

The support structure for the heat recuperator should provide allowance for external thermal expansion. The recommended attachment method provides only one fixed point at some location on the recuperator. Any other support points should be allowed to “float”. This may be accomplished with anti-friction skids, wheels, treads, or another approved method. Failure to follow these steps may result in damage to the heat recuperator.

Upon startup, it is recommended that the installer measure the amount of heat recuperator movement, and place permanent marks on the supporting structure so the thermal expansion can be monitored as a regular maintenance item.

It is strongly recommended that the system be checked for thermal expansion during startup. The system should be checked to make sure that all rollers and expansion joints are moving freely. In addition, the thermal expansion should be measured and compared to the predicted thermal expansion for the system. Also, it is recommended that permanent marks be placed on the support structure so thermal expansion can be monitored as part of a regular maintenance/inspection program.

After startup, the following measurements should be made:

HOT Side:

1. Hot Side Entering Temperature and Static Pressure
2. Hot Side Exiting Temperature and Static Pressure
3. Hot Side Air Volume

COLD Side:

1. Cold Side Entering Temperature and Static Pressure
2. Cold Side Exiting Temperature and Static Pressure
3. Cold Side Air Volume

These measurements should be recorded and referred to when establishing a preventative maintenance schedule.

Duct work

The insulated tubular heat recuperator is designed to be used with internally insulated duct work. All flange connections are to be “cold flanged”. It is recommended that the duct work insulation be installed so there is adequate compression between the duct work insulation and the heat recuperator insulation. Alternatively, insulation may be packed in the transition between the duct work insulation and the heat recuperator insulation. This is required to protect the carbon steel flanges and casing from excessive heat due to gaps in the insulation. Duct work should be equipped with inspection ports or access doors for periodic inspection of the heat recuperator.

The efficiency of the heat recuperator may be adversely affected by poor airflow distribution. For maximum performance, Exothermics recommends that proper consideration be given to transitions and/or elbows to assure uniform airflow distribution entering and exiting the heat recuperator. If possible, transition should have a 30° or less included angle. Where space limitations prevent the use of these transitions, it is recommended that turning vanes or perforated plates be used.

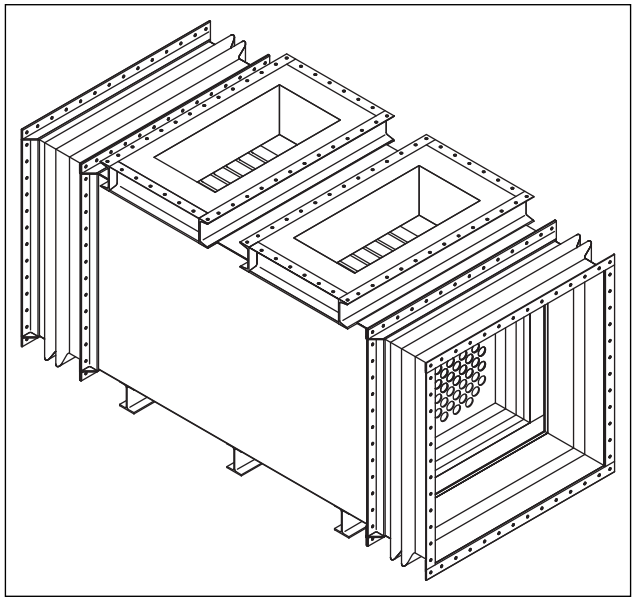

Figure 3.4.

Flange Details and Gaskets

For maximum performance and safety, all flange connections should be gasketed. A gasket material appropriate to the operating conditions should be used. Recommended material is a woven, high temperature fiber tape. Connections should be made with 3/8 inch (9.5 mm) diameter stainless steel nuts and bolts. All fasteners should be coated with a high temperature, anti-seize compound before assembly.

Operation and Startup

Startup should be conducted by qualified personnel in a systematic manner. Prior to startup, all connections should be tested for tightness. Flanged connections should be inspected for leaks. Typically the refractories used in construction do not require a bake-out or curing schedule.

Startup personnel should monitor the system closely for correct operation of temperature controls, high limit cutoffs, and differential pressure switches prior to release to operating personnel. It is strongly recommended that operating personnel be familiarized with the operating limits of the heat recuperator before use.

Temperature Control

A ramping type temperature control is required. The maximum rate of heat-up or cool down is 25°F (14°C) per minute. Exceeding this rate may cause damage to the heat recuperator due to excessive thermal stress. An approved high temperature limit control should be installed in the hot gas inlet airstream. Control and high limit thermocouples should be placed in the center of the hot gas inlet duct. All thermocouples should be calibrated and checked for proper operation before startup. Excessive thermal cycling should be avoided.

Pressure Control

The maximum rated differential pressure is ____ w.c. (mbar). Differential pressure limit switches and controls are strongly recommended. System fans should be sequenced appropriately to avoid excessive operating pressure at startup.

⚠ CAUTION

- **The recommended Maximum Continuous Operating Temperature for the recuperator is:**

_____

- **The recommended Maximum Differential Pressure for the recuperator is:**

_____

⚠ CAUTION

- **25°F (14°C) per minute maximum rate of temperature change.**
- **If the recommended operating limits for the recuperator are exceeded, damage may result.**

Maintenance

The tubular recuperator is a high quality, static device with no moving parts. There are no serviceable user parts inside. Periodic visual inspection of the tubes is recommended. The use of a temperature chart recorder and a high temperature limit control is strongly recommended.

Thank you for your selection of an Exothermics, Inc. heat exchanger. If you require additional information or assistance, please contact your Exothermics representative or the home office at (419) 729-9726.

Product Warranty 3

Material and Workmanship:

Manufacturer warrants that the equipment proposed herein of their manufacture shall be free of defects in workmanship or materials for a period of one year from date of shipment. Should any failure or defect appear within one year of date of shipment, manufacturer shall upon written notification of said failure and substantiation that the equipment has been stored, installed, erected, maintained, and operated in accordance with good industry practice and in accordance with manufacturer's instructions, correct such non-conformity by repair or replacement, F.O.B. factory. This warranty does not cover labor or transportation charges for the removal, exchange, or reinstallation of the equipment.

Manufacturer shall not be responsible, nor shall allowance be made, for work done, equipment furnished, or for repairs or replacements made by the purchaser or others, either with or without purchaser's approval, unless prior written approval is made to the purchaser by the manufacturer. Any unauthorized repairs or parts will void the warranty.

Products or goods manufactured by others, supplied by Exothermics, Inc. as a part of a system, are not covered by this warranty. Exothermics, Inc., however, will give their customer the benefit of any such adjustment as it finally obtains from that respective manufacturer of that component or product.

Freight damage is specifically excluded from this warranty and is the responsibility of the purchaser and the carrier.

Damage as a result of the effect of corrosion, erosion, excessive heat, freezing, dirt, dust or foreign materials, and normal wear for that application are specifically excluded from this warranty.

Performance Warranty:

Performance figures or requirements, if any, must be addressed in the quotation. Performance warranty, if any, must be specifically covered in the quotation. Where no performance figures are specified or warranted the manufacturer assumes no responsibility for compliance or noncompliance.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXCEPT THAT OF TITLE, AND EXOTHERMICS-ECLIPSE HEREBY DISCLAIMS ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, IN FACT OR IN LAW (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE).

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Having a policy of continuous product improvement, Exothermics, Inc. reserves the right to change or alter design or specification without notice.

Appendix

Conversion Factors

Metric to English

From	To	Multiply By
actual cubic meter/h (am^3/h)	actual cubic foot/h (acfh)	35.31
normal cubic meter/h (Nm^3/h)	standard cubic foot /h (scfh)	38.04
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 9/5) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	Btu/h	3415
meter (m)	foot (ft)	3.281
millibar (mbar)	inches water column ("w.c.)	0.402
millibar (mbar)	pounds/sq in (psi)	14.5×10^{-3}
millimeter (mm)	inch (in)	3.94×10^{-2}
MJ/Nm^3	Btu/ft^3 (standard)	26.86

Metric to Metric

From	To	Multiply By
kiloPascals (kPa)	millibar (mbar)	10
meter (m)	millimeter (mm)	1000
millibar (mbar)	kiloPascals (kPa)	0.1
millimeter (mm)	meter (m)	0.001

English to Metric

From	To	Multiply By
actual cubic foot/h (acfh)	actual cubic meter/h (am^3/h)	2.832×10^{-2}
standard cubic foot /h (scfh)	normal cubic meter/h (Nm^3/h)	2.629×10^{-2}
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32) x 5/9
pound (lb)	kilogram (kg)	0.454
Btu/h	kilowatt (kW)	0.293×10^{-3}
foot (ft)	meter (m)	0.3048
inches water column ("w.c.)	millibar (mbar)	2.489
pounds/sq in (psi)	millibar (mbar)	68.95
inch (in)	millimeter (mm)	25.4
Btu/ft^3 (standard)	MJ/Nm^3	37.2×10^{-3}

Notes

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