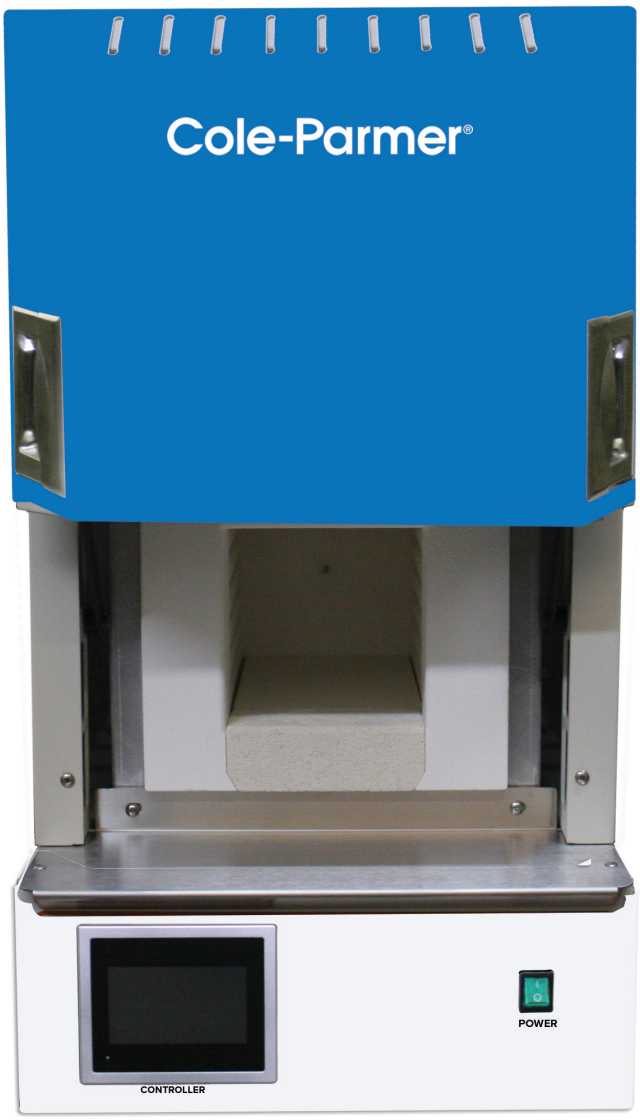
Cole-Parmer®
an antylia scientific company



Operating Manual

Box Furnace

Item Number: 33900-31

coleparmer.com

Contents

1. Furnace Specifications

Furnace Type:	Box Furnace
Item Number:	33900-31
Serial Number:	
Maximum Temperature:	1200 °C
Heater Type:	Vacuum Form
Incoming Power:	

Volts:	240
Amps:	14.0
Watts:	3360
Phase:	1
Hertz:	50/60

2. Inspection and Damaged Instructions

Inspection

Upon receipt of your new furnace, inspect for visible exterior damage. Note and describe any damage found on the freight bill and file a claim with the carrier.

Once unpacked, carefully inspect for concealed loss or damage on the unit itself, both the interior and exterior. If necessary, the carrier will arrange for official inspection to substantiate your claim.

Verify that all of the equipment shown on the packing slip is included with the unit. Carefully check all packing materials.

Return Shipment

Save the shipping box/crate until you are sure all is well. If for any reason you must return the unit, first contact our Sales Department at +1.847.549.7600. Please have the unit's serial number and model number available when you call (located on the rating plate). Note: all returns must have a Return Authorization Number.

3. Assembly

The furnace will arrive pre-assembled, however, some assembly may be required prior to start-up.

NOTE: These furnaces are heavy and care should be taken to use lifting devices which are sufficiently rated for these loads. Doors, handles and knobs are not adequate for lifting or stabilization. The unit should be completely restrained to prevent tipping during lifting and transport.

For larger furnaces, some parts such as doors, door tracks, car bottom tracks, elevator lifts, blower motors, and conveyors may have been disassembled from the furnace to accommodate shipping. Before proceeding with installation, review all drawings and diagrams included in this manual.

1. Refer to designs, making sure all furnace stands, control boxes, terminal boxes, doors, etc. are in place and secure. If not, locate the appropriate parts that are included in the shipment and follow the furnace design drawings in order to complete the assembly.
2. Locate the thermocouple hold and carefully pull out the alignment pin. Carefully slide thermocouple into the hole, do not force.

If any questions arise concerning assembly of the furnace, please contact Cole-Parmer at +1.847.549.7600.

4. Control Environmental Conditions

Normal Operating Conditions:

1. Ambient temperature: 0 to 50 °C
2. Rate of change in temperature: 10 °C/h or less
3. Ambient humidity: 20–90% RH (no condensation allowed)
4. Altitude: 2000 m or less above sea level

Maximum Effects from Operating Conditions

1. Temperature effects:
   - 1.1 Thermocouple, DC mV and DC V input: +/- 2u V/°C or +/- 0.02% of F.S./°C, whichever is larger
   - 1.2 Resistance temperature detector: +/- 0.05 °C/°C
   - 1.3 Analog output: +/- 0.05% of F.S./°C
2. Effect from fluctuation of power supply voltage (within rated voltage range)
   - 2.1 Analog input: +/- 0.2u V/V or +/- 0.002% of F.S./V, whichever is larger
   - 2.2 Analog output: +/- 0.05% of F.S./V

Transportation and Storage Conditions

1. Temperature: -25 to 70 °C
2. Humidity: 5 to 95% RH (no condensation allowed)

5. Installation and Power Connection

After the above assembly procedures have been completed, the furnace is ready for connection to incoming power as follows:

1. Open the furnace and remove the protective packing covering the heating elements.
2. Consult an electrical professional and the NEC (National Electric Code) specifications to select wire size to adequately carry the line amperage shown in section **1. Furnace Specifications**. Connect electrical service to a fused power source disconnect. Such disconnect device shall be marked as a disconnect device for the furnace.
3. For over-current protection device selection, please refer to amperage shown on the furnace rating plate.

NOTE: Be sure to check all external strain relief fittings for tightness. See Torque Recommendation for Strain Relief Fittings chart below:

TORQUE RECOMMENDATIONS FOR STRAIN RELIEF FITTINGS
(Torque in Inch Pounds – in lb (Newton Meters – Nm)

	Metal Strain Relief Fittings		Plastic Strain Relief Fittings	
	Dome Nuts	**Thread and Lock Nuts**	**Dome Nuts**	**Thread and Lock Nuts**
PG 7, M12 x 1.5	36.9 (4.17)	55.3 (6.25)	14.4 (1.62)	22.1 (2.50)
PG 9, PG 11, M16, PG 13.5, ⅜" NPT, ½" NPT, M16 x 1.5, M20 x 1.5	36.9 (4.17)	55.3 (6.25)	22.1 (2.50)	33.2 (3.75)
PG 16, ½" NPT-E	44.2 (5.00)	66.4 (7.50)	29.5 (3.33)	44.2 (5.00)
PG 21, PG 29, PG 36, PG 42, PG 48, ¾" NPT, 1" NPT, 1¼" NPT, 1½" NPT, M25 x 1.5, M32 x 1.5, M40 x 1.5, M50 x 1.5, M63 x 1.5	59.0 (6.67)	88.5 (10.00)	44.2 (5.00)	66.4 (7.50)

NOTE: The valves shown above are for reference only.

NOTE: Nylon strain relief fittings installed in a threaded connection and exposed to elevated temperature should be retained with a sealant such as Locktite® to avoid a loose connection when temperature fluctuates.

6. Operational Safety

Safe operation of your new furnace is mandatory. As manufacturer of your furnace, we at Cole-Parmer have adhered to all known safety standards and strongly suggest you install your furnace in accordance with national electric and fire protection codes. Do not exceed the electrical and temperature rating printed on the furnace rating plate.

It is important to pay particular attention to those regulations that are applicable to the specific governing operations entities including, but not limited to, legislated and accredited national and local industry standards and the type of facility in which the furnace will be employed, including zoning requirements, local building codes, and local electrical codes.

Symbols Used on the Equipment


Caution: risk of electric shock


Caution: hot surface


Caution: refer to accompanying documents

The potential for electric shock is always present when electrically operated equipment is in use. The following suggestions are recommended for your protection:

1. Before beginning service/maintenance procedures on your furnace, the power source must be locked out and tagged out per OSHA (Occupational Safety and Health Administration) regulations.
2. Ensure the furnace is properly grounded and electrically protected. Grounding lugs and ground wires have been installed prior to shipment. The ground wire will terminate within the external terminal box and is visible to the installer/operator. If unsure of the grounding status of the equipment, consult the NEC (national Electric Code) or a licensed professional.
3. If electrically conductive material is to be heat treated, the operator must be protected from becoming a conductor to the ground. To avoid electric shock, observe the following operating practices:
    a. Wear insulated gloves specific to the task that guard against electric shock if the operator will be in contact with an electric current.
    b. When using any metallic instrument to introduce items into the furnace, ensure the handle is properly insulated and the instrument is adequately grounded.
    c. Install rubber mats in front of and behind the equipment to protect the operator.


CAUTION: If this equipment is used in a manner other than described in this manual, protection provided but the equipment may be compromised or impaired. To preclude hazard and minimize risk, follow all instructions and operate within the design limits noted on the rating plate.

Do not use components or materials not specifically designed for this equipment. Failure to comply with this precaution could result in damage to the equipment used or the furnace and may create an overheat situation. Also, do not use anything other than OEM exact replacement parts. Not using OEM replacement parts could cause faulty instrumentation readings, inoperative equipment, or a temperature overshoot.

Avoid combustible product which generate toxic or hazardous vapor or fumes. Work should be done in a properly vented environment.

Observe the following precautions:

- Never stand in front of an open hot furnace
- Wear protective eyewear
- Wear protective gloves
- Use tongs to insert and remove furnace load
- Do not allow the load to touch the furnace walls

WARNING: Do not use combustible gases directly in this furnace. Process gases must always be contained in a separate tube.

Modification of equipment for use other than that for which it is explicitly designed for could cause severe injury or death. Any customer after market retrofit violates the warranty.

Do not modify or disconnect any safety features provided. Disconnection of the units safety features could allow the unit to become overheated and start on fire, causing personal injury or death, product and property damage.

Periodically disconnect power from the equipment and allow it to cool completely. Once cool, inspect for loose or broken heaters and for worn wire coils on the inside of the heated chamber. Heaters may have to be replaced if damage is severe. Avoid contact with any exposed heater coils/elements. Do not touch elements with bare hands or oily gloves. Contact Cole-Parmer if unsure of the safety of the heating elements in the conditions you have observed.

Only qualified electrical professionals should remove the upper and lower terminal covers of the terminal boxes. Keep all guards (guide-tabs, backstops, upper and lower terminal covers) provided with the equipment in place while the furnace is in operation. Observe all safety labels.

If questions arise concerning the operation of your furnace, contact Cole-Parmer at +1.847.549.7600 or email at sales@coleparmer.com.

7. Furnace Start Up Procedure

Follow your company's lock-out/tag-out procedures before beginning any work on the heaters or heated chamber of your furnace.

The following procedures should be performed by a trained electrical professional due to potential hazard.

Check to ensure that the thermocouple is securely mounted and undamaged. Check the thermocouple wiring connections.

CAUTION! Failure to check thermocouple wiring connection before initial start up could result in damage to the furnace.

Drying Out Procedure

1. It is imperative that the furnace is allowed to vent the moisture out of the furnace. For a box furnace, before the initial heat up, make sure the door is cracked open, and the terminal box covers are removed. For split tube furnaces make sure that either the tube is slightly open or that the vestibules are open for venting. Solid tubes must have an open vestibule end.
2. Heat furnace slowly up to 300 °F. This will dry the moisture out of the refractory lining.
3. Maintain the furnace at 300 °F for four to six hours or till all smoke/steam has subsided.
4. Ramp the furnace up to 600 °F and hold this temperature until all steam/smoke has dissipated.
5. If the furnace is still steaming after 600 °F, repeat this step 4 at 900 °F.
6. Be sure to turn off the power prior to reattaching terminal box covers to prevent accidental shortage and potential for electrical shock.
7. After reattaching the terminal box covers and closing the door, continue furnace heat up to normal operating temperature.
8. If steaming appears at any time during run up, do not increase temperature until steaming stops.

Be careful when moving the furnace once the furnace has reached normal operating temperatures. The insulation becomes brittle and could possibly crack or break apart. With prolonged use, hairline cracks can develop in the insulation material. These minor cracks will not affect the furnace's performance.

Shut Down Instructions

Open main circuit breaker or disconnect switch (Note: the incoming side of the main circuit breaker still has voltage, even after main device is open). If the furnace is equipped with a blower, do not shut the blower off until the furnace is cool.

8. Preventive Maintenance

CAUTION: Maintenance should only be performed by trained personnel.

WARNING: Prior to performing maintenance to the furnace or the controls, the main power must be disconnected. Prior to maintaining this equipment, read the applicable MSDS at the back of the manual.

General Furnace Maintenance

1. Inspect and verify all electrical connections for tightness. Due to thermal expansion during the heat- up/cool-down cycles electrical connection may become loosened.
2. Inspect the heating elements. Do not allow build up of foreign material on the element. Oil should be cleaned off of any part of the furnace prior to heating. Use caution not to displace the heating elements as the wire may be brittle and break easily.
3. If furnace has a door, verify that the door safety switch is operating and cutting the power to the heaters once the door is opened.
4. If your furnace is equipped with a blower motor, or has moving parts, lubricate grease fittings as required.
5. Check all hardware fasteners to ensure that they are tight.
6. Inspect the tip of the thermocouple for excessive heat deterioration.

General Control Cabinet Maintenance

1. Verify that all electrical connections are tight.
2. If applicable, clean the cabinet cooling fan filter.
3. Check all cabinet to furnace interconnection wiring.
4. If applicable, check to ensure that all signal lamps light.
5. If applicable, check to ensure that all alarms sound.

9. Thermocouple

A thermocouple is used to measure the voltage that is generated as the temperature increases. It provides an input signal for the control system that monitors the temperature of the heated chamber.

At high temperatures, the elements within the thermocouple may undergo some oxidation or corrosion causing the signals to be read incorrectly by the control system.

To monitor temperature, If possible, the tip of the thermocouple must be inside the heated chamber at least 1/8 deep. Also, the thermocouple tip must not be blocked or shielded by items being heat treated.

If the control system indicates that a thermocouple is no longer functioning, it is important to replace the malfunctioning thermocouple with the same type model thermocouple that was originally provided with the furnace. Replacement extension wires and connectors must also be compatible with the thermocouple and the controller. If your system has a Eurotherm controller a failed thermocouple will be indicated by SBR on the display and for a Yokogawa controller it will indicate B.OUT. Refer to the replacement parts list to determine the type of thermocouple required.

For optimal performance the thermocouple should be replaced one a year. In some cases a more frequent replacement schedule may be required.

NOTE: Polarity of the thermocouple extension wires is the OPPOSITE of the polarity of typical electrical wiring. The red leg is always negative for thermocouples while the black leg is always positive.

10. Ceramic Fiber Insulation Safety

Please keep in mind that your Cole-Parmer furnace is completely safe when used for its intended purpose and with the precautions listed herein. The following information is to make you aware of the potential health effects of the ceramic and insulation components incorporated into your furnace.

Cole-Parmer manufactures a broad range of high temperature furnace systems. These systems incorporate various ceramic materials. Airborne particulates produced in the handling of these materials should be considered nuisance dust. Always wear a dust mask and safety glasses to avoid such irritation due to inhalation of, or eye contact with, this or any other ceramic dust.

Chronic Effect – there has been no increased incidence of respiratory disease in the Refractory Ceramic Fiber Coalitions studies examining occupationally exposed workers. In their animal testing, long-term laboratory exposure to doses hundreds of times higher than normal occupational exposures has produced fibrosis, lung cancer, and mesothelioma in rats or hamsters. The fibers used in those studies were specially sized to maximize rodent reparability. Please refer to the Refractory Ceramic Fiber Coalitions website at www.rcfc.net for up-to-date information.

The recommended handling procedures for these ceramic materials are outlined on the following page as well as in the Cole-Parmer MSDS (Material Safety Data Sheets) at the end of this manual. Please make sure this information is available to all personnel who may be operating, handling or repairing this furnace.

As always, if you have any questions or concerns, please feel free to contact Cole-Parmer at +1.847.549.7600 or email at sales@coleparmer.com.

Recommended Safe Handling Procedures for Ceramic Fiber Products

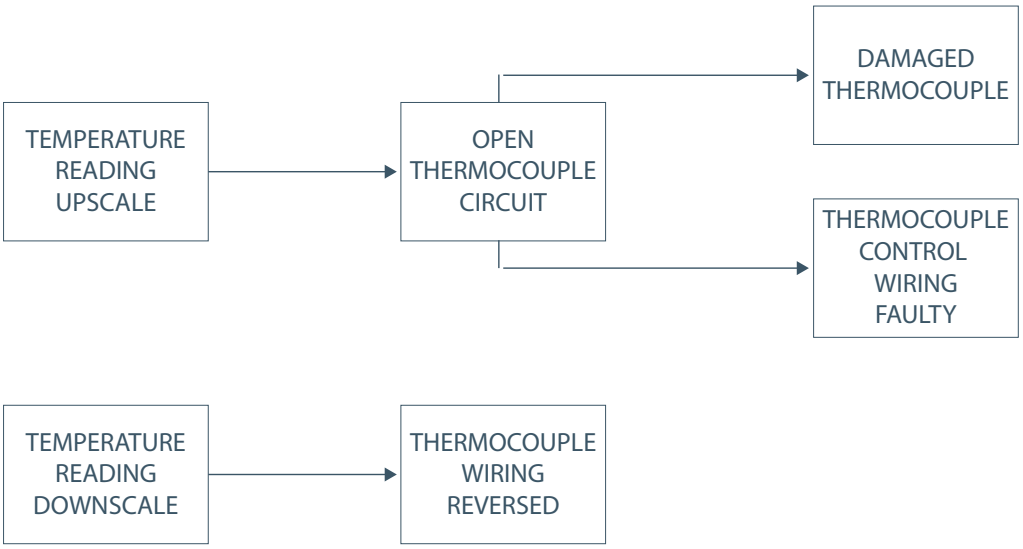
1. Minimize presence of airborne fiber at all times by avoiding applications of pressurized air from air canisters or pneumatic systems to any fibers that have already been heated.
2. Wear an appropriate NIOSH or MSHA-approved high efficiency air purifying respirator mask when handling any ceramic fiber products.
3. Wear long-sleeved, loose-fitting clothing when handling ceramic fiber products. Use protective coveralls over clothing. Do not wear contact lenses and always wear safety glasses. Do not allow employees to take soiled clothing, or any clothing in which fibers have become embedded from the facility where the furnace is employed to his/her dwelling. Have employees store, maintain and wash work clothing on site separately from other clothing. Rinse washing machine thoroughly after washing clothing worn when handling ceramic fibers.
4. Wear eye protection (safety glasses or goggles) and protective gloves at all times.
5. Wash exposed skin areas gently with soap and cold water immediately after handling ceramic fiber product.
6. Particular care should be taken when working with “used” material which has been in service at elevated temperatures (greater than 1600 °F). Such products may undergo partial conversion to cristobalite, a form of crystalline silica that can cause respiratory disease.

11. Replacement Parts

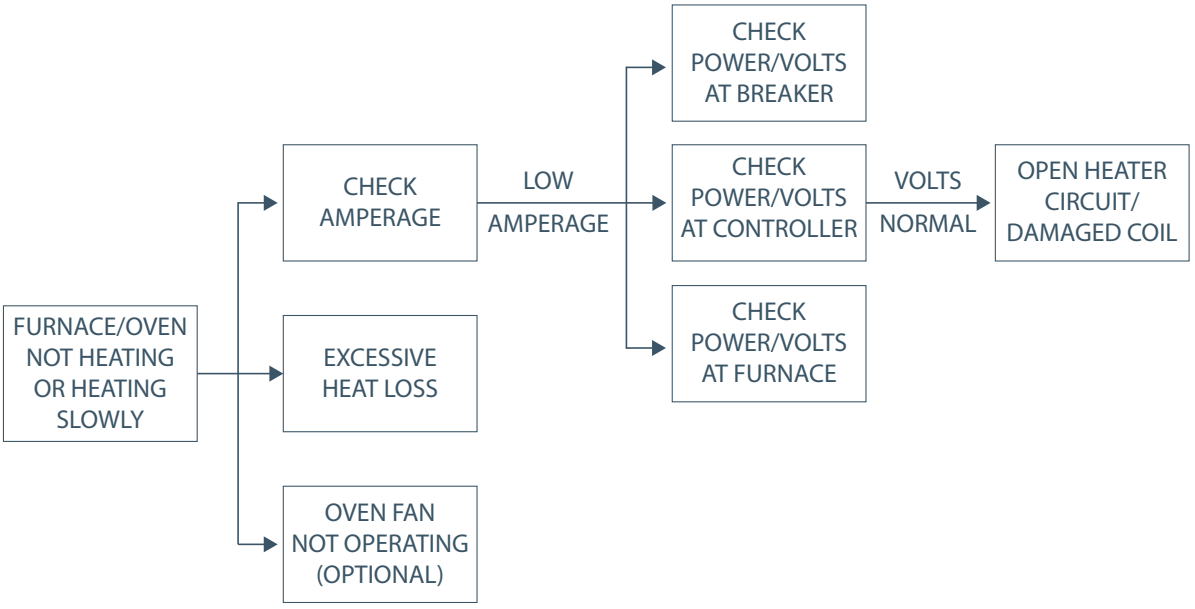
Description	Quantity Included	Item Number
XSB_8-8-9_INT240V	1/furnace	99
XSB_1TC	1/furnace	98

12. Furnace Troubleshooting – Trouble Shooting for Furnace/Oven Problems

Thermocouple Problems



Heater Problems



13. MSDS

Material Safety Data Sheet

MSDS No. 1 **Effective Date: 03/19/2013**

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Trade Names: ***Fibercraft***

Product Group: REFRACTORY CERAMIC FIBER PRODUCT

Chemical Name: VITROUS ALUMINOSILICATE FIBER

Synonym(s): RCF, ceramic fiber, synthetic vitreous fiber (SVF), man-made vitreous fiber (MMVF), man-made mineral fiber (MMMF)

Manufacturer/Supplier: **Thermcraft, Inc.**
3950 Overdale road
Winston-Salem, N.C. 27107
336-784-4800

Product Stewardship Information Hotline
1-800-322-2293 (Monday - Friday 8:00 a.m. - 4:30 p.m. EST)

CHEMTREC Assist: CHEMTREC will provide assistance for chemical emergencies.
Call 1-800-424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	% BY WEIGHT
Refractories, Fibers, Aluminosilicate	142844-00-6	100

(See Section 8 “Exposure Controls / Personal Protection” for exposure guidelines)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

WARNING!
POSSIBLE CANCER HAZARD BY INHALATION.
(See Section 11 for more information)

CHRONIC EFFECT

There has been no increased incidence of respiratory disease in studies examining occupationally exposed workers. In animal studies, long-term laboratory exposure to doses hundreds of times higher than normal occupational exposures has produced fibrosis, lung cancer, and mesothelioma in rats or hamsters. The fibers used in those studies were specially sized to maximize rodent respirability.

OTHER POTENTIAL EFFECTS

TARGET ORGANS:
Respiratory Tract (nose & throat), Eyes, Skin

RESPIRATORY TRACT (nose & throat) IRRITATION:
If inhaled in sufficient quantity, may cause temporary, mild mechanical irritation to respiratory tract. Symptoms may include scratchiness of the nose or throat, cough or chest discomfort.

EYE IRRITATION:

May cause temporary, mild mechanical irritation. Fibers may be abrasive; prolonged contact may cause damage to the outer surface of the eye.

SKIN IRRITATION:

May cause temporary, mild mechanical irritation. Exposure may also result in inflammation, rash or itching.

GASTROINTESTINAL IRRITATION:

Unlikely route of exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

Pre-existing medical conditions, including dermatitis, asthma or chronic lung disease may be aggravated by exposure; individuals who have a history of allergies may experience greater amounts of skin and respiratory irritation.

HAZARD CLASSIFICATION

Although studies, involving occupationally exposed workers, have not identified any increased incidence of respiratory disease, results from animal testing have been used as the basis for hazard classification. In each of the following cases, the conclusions are qualitative only and do not rest upon any quantitative analysis suggesting that the hazard actually may occur at current occupational exposure levels.

In October 2001, the **International Agency for Research on Cancer (IARC)** confirmed that Group 2b (possible human carcinogen) remains the appropriate IARC classification for RCF.

The Seventh Annual Report on Carcinogens (1994), prepared by the **National Toxicology Program (NTP)**, classified respirable RCF as “reasonably anticipated” to be a carcinogen.

The **American Conference of Governmental Industrial Hygienists (ACGIH)** has classified RCF as “A2-Suspected Human Carcinogen.”

The **Commission of The European Communities (DG XI)** has classified RCF as a substance that should be regarded as if it is carcinogenic to man.

The **State of California**, pursuant to Proposition 65, The Safe Drinking Water and Toxic Enforcement Act of 1986, has listed “ceramic fibers (airborne fibers of respirable size)” as a chemical known to the State of California to cause cancer.

The **Canadian Environmental Protection Agency (CEPA)** has classified RCF as “probably carcinogenic” (Group 2).

The **Canadian Workplace Hazardous Materials Information System (WHMIS)** – RCF is classified as Class D2A – Materials Causing Other Toxic Effects

The **Hazardous Materials Identification System (HMIS)** – Health 1* Flammability 0 Reactivity 0 Personal Protection Index: X (Employer Determined)
(* denotes potential for chronic effects)

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4. FIRST AID MEASURES

FIRST AID PROCEDURES

RESPIRATORY TRACT (nose & throat) IRRITATION:
If respiratory tract irritation develops, move the person to a dust free location. Get medical attention if the irritation continues. See Section 8 for additional measures to reduce or eliminate exposure.

EYE IRRITATION:
If eyes become irritated, flush immediately with large amounts of lukewarm water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

SKIN IRRITATION:
If skin becomes irritated, remove soiled clothing. Do not rub or scratch exposed skin. Wash area of contact thoroughly with soap and water. Using a skin cream or lotion after washing may be helpful.

GASTROINTESTINAL IRRITATION:
If gastrointestinal tract irritation develops, move the person to a dust free environment.

NOTES TO PHYSICIANS:
Skin and respiratory effects are the result of temporary, mild mechanical irritation; fiber exposure does not result in allergic manifestations.

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5. FIRE FIGHTING MEASURES

NFPA Codes: **Flammability: 0** **Health: 1** **Reactivity: 0** **Special: 0**

NFPA Unusual Hazards:	None
Flammable Properties:	None
Flash Point:	None
Hazardous Decomposition Products:	None
Unusual Fire and Explosion Hazard:	None
Extinguishing Media:	Use extinguishing media suitable for type of surrounding fire.

6. ACCIDENTAL RELEASE MEASURES

SPILL PROCEDURES

Minimize creating airborne dust. Dust suppressing cleaning methods such as wet sweeping or vacuuming should be used to clean the work area. If vacuuming, the vacuum must be equipped with a HEPA filter. Compressed air or dry sweeping should not be used for cleaning.

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7. HANDLING AND STORAGE

STORAGE

Store in original container in a dry area. Keep container closed when not in use.

HANDLING

Handle ceramic fiber carefully. Limit use of power tools unless in conjunction with local exhaust. Use hand tools whenever possible. Frequently clean the work area with HEPA filtered vacuum or wet sweeping to minimize the accumulation of debris. Do not use compressed air for clean-up.

EMPTY CONTAINERS

Product packaging may contain residue. Do not reuse.

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8. EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE GUIDELINES

COMPONENTS	OSHA PEL	MANUFACTURER REG
Refractories, Fibers, Aluminosilicate	None Established*	0.5 f/cc, 8-hr. TWA**

* There is no specific regulatory standard for RCF in the U.S. OSHA's "Particulate Not Otherwise Regulated (PNOR)" standard [29 CFR 1910.1000, Subpart Z, Air Contaminants] applies generally; Total Dust 15 mg/m^3; Respirable Fraction 5 mg/m^3.

** The Refractory Ceramic Fibers Coalition (RCFC) has sponsored comprehensive toxicology and epidemiology studies to identify potential RCF-related health effects (See Section 11 for more details), consulted experts familiar with fiber and particle science, conducted a thorough review of the RCF-related scientific literature, and further evaluated the data in a state-of-the-art quantitative risk assessment. Based on the efforts and in the absence of an OSHA PEL, RCFC has adopted a recommended exposure guideline, as measured under NIOSH Method 7400 B. The manufacturers' REG is intended to promote occupational health and safety through prudent exposure control an d reduction and it reflects relative technical and economic feasibility as determined by extensive industrial hygiene monitoring efforts undertaken pursuant to an agreement with the U.S. Occupational Safety and Health Administration (OSHA).

OTHER OCCUPATIONAL EXPOSURE LEVELS (OEL)

RCF-related occupational exposure limits vary internationally. Regulatory OEL examples include: Canada – 0.2 to 1.0 f/cc; Non-regulatory OEL examples include: ACGIH TLV 0.2 f/cc; RCFC REG 0.5 f/cc. The objectives and criteria underlying each of these OEL decisions also vary. The evaluation of occupational exposure limits and determining their relative applicability to the workplace is best performed, on a case-by-case basis, but a qualified Industrial Hygienist.

ENVIRONMENTAL CONDITIONS

Use environmental controls such as local exhaust ventilation, point of generation dust collection, down draft work stations, emission controlling tool designs, and materials handling equipment designed to minimize airborne fiber emissions.

PERSONAL PROTECTION EQUIPMENT

Respiratory Protection – RCF:

When engineering and/or administrative controls are insufficient to maintain workplace concentrations within the 0.5 f/cc REG, the use of appropriate respiratory protection, pursuant to the requirements of OSHA Standards 29 CFR 1910.134 and 29 CFR 1926.103, is recommended. The following information is provided as an example of appropriate respiratory protection for aluminosilicate fibers. The evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case-by-case basis, by a qualified Industrial Hygienist.

MANUFACTURER'S RESPIRATORY PROTECTION RECOMMENDATIONS WHEN HANDLING RCF PRODUCTS

Respirable Airborne Fiber Concentration (levels are 8-hr. time-weighted averages)	**Respirator Recommendation**†
Not yet determine but expected to be below	A respirator with a filter efficiency of at least 95%
5.0 f/cc based on operation	
"Reliably" less than 0.5 f/cc	Optional
0.5 f/cc to 5.0 f/cc	A single use respirator or half-face, air purifying respirator with a filter efficiency of at least 95%
5.0 f/cc to 25 f/cc	Full-face piece, air purifying respirator equipped with a NIOSH certified particulate filter cartridge with a filter efficiency of at least 95% or PAPR
Greater than 25 f/cc	PAPR with tight-fitting full face piece or a supplied air respirator in continuous flow mode
When individual workers request respiratory use protection as a matter of personal comfort least or choice where exposures are "reliably" below 0.5 f/cc	A NIOSH certified respirator, such as a single particulate respirator with a filter efficiency of 95%

†The 95% filter efficiency recommendation is based on NIOSH respirator selection logic sequence for exposure to particulates. Selection of filter efficiency (i.e. 95%, 99% or 99.9 7%) depends on how much filter leakage can be accepted. Higher filter efficiency means lower filter leakage. Other factors to consider are the NIOSH filter series N, R or P. (N) Not resistant to oil, (R) Resistant to oil and (P) oil Proof. These recommendations are not designed to limit informed choices, provided that respiratory protection decisions comply with 29 CFR 1910.134.

Other Information

- Concentrations based upon an eight hour time weighted average (TWA) as determined by air samples collected and analyzed pursuant to NIOSH method 7400 (B) for airborne fibers.
- The manufacturer recommends the use of a full face piece air purifying respirator equipped with an appropriate particulate filter cartridge during furnace tear out events and the removal of used RCF to control exposures to airborne fiber and the potential presence of crystalline silica. If exposure levels are known, the respiratory protection charge provided above may be applied. Potential exposure to other airborne contaminants should be evaluated by a qualified industrial hygienist for the selection of appropriate respiratory protection and air monitoring.

Skin Protection:

Wear gloves, head coverings and full body clothing as necessary to prevent skin irritation. Washable or disposable clothing may be used. If possible, do not take unwashed clothing home. If soiled work clothing must be taken home, employers should ensure employees are thoroughly trained on the best practices to minimize non-work dust exposure (e.g., vacuum clothes before leaving the work area, wash work clothing separately, rinse washer before washing other household clothes, etc.).

Eye Protection:

Wear safety glasses with side shields or other forms of eye protection in compliance with appropriate OSHA standards to prevent eye irritation. The use of contact lenses is not recommended, unless used in conjunction with appropriate eye protection. Do not touch eyes with soiled body parts or materials. If possible, have eye-washing facilities readily available where eye irritation can occur.

9. PHYSICAL AND CHEMICAL PROPERTIES

ODOR AND APPEARANCE:	White, odorless, fibrous material
CHEMICAL FAMILY:	Vitreous Aluminosilicate Fibers
BOILING POINT:	Not Applicable
WATER SOLUBILITY (%):	Not Soluble in Water
MELTING POINT:	1760 °C (3200 °F)
SPECIFIC GRAVITY:	2.50 – 2.75
VAPOR PRESSURE:	Not Applicable
pH:	Not Applicable
VAPOR DENSITY (Air = 1):	Not Applicable
% VOLATILE:	Not Applicable
MOLECULAR FORMULA:	Not Applicable

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY:	Stable under conditions of normal use
INCOMPATIBILITY:	Soluble in hydrofluoric acid, phosphoric acid, and concentrated alkali
CONDITIONS TO AVOID:	None
HAZARDOUS DECOMPOSITION PRODUCTS:	None
HAZARDOUS POLYMERIZATION:	Not Applicable

11. TOXICOLOGICAL INFORMATION

HEALTH DATA SUMMARY

Epidemiological studies of RCF production workers have indicated no increased incidence of respiratory disease nor other significant health effects. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.

EPIDEMIOLOGY

In order to determine possible human health effects following RCF exposure, the University of Cincinnati in the United States and the Institute of Occupational Medicine (IOM) in Europe have conducted medical surveillance studies on RCF workers in U.S. and European manufacturing facilities. The University of Cincinnati study has been in progress for over 20-years, collecting data from respiratory questionnaires, lung function tests, and chest X-rays, exposure monitoring, and worker mortality.

The results of this study of RCF plant workers exposed from 1953 to the present have shown *(LeMasters et al, 2003*): No excess mortality related to all deaths, all cancers, or lung cancer No statistically significant increase in interstitial findings (fibrosis), and No mesotheliomas or increase in lung cancer The initial cross-sectional spirometry studies in the U.S. (L*eMasters et al.1998*) and Europe (*Cowie et al.2001*) revealed lung function decrements in the RCF-exposed cohort that were associated with heavier historical exposures. Subsequently, longitudinal studies have revealed no RCF exposure related decrements in lung function associated with current exposure levels.

Through 1996, pleural plaques seen on chest X-rays in 2.7% of the workers. Pleural plaques are considered a marker of exposure and not disease. The prevalence of pleural plaques has remained relatively constant over time, perhaps as a result of lower current exposure levels.

Thus, this long term epidemiology study has demonstrated an absence of interstitial fibrosis, no increased mortality risk and no decrement in lung function associated with current exposures.

TOXICOLOGY

Early animal studies of RCF effects by intraperitoneal and intrapleural injections, as well as by inhalation, resulted in mostly negative results. In an effort to eliminate any questions posed by the results of these early studies, a definitive Maximum Tolerated Dose Study (MTD) by nose only, lifetime inhalation in rats and hamsters, was designed in the 1980s. The MTD study appeared to confirm that RCF was an animal carcinogen under certain test conditions, e.g., extremely high concentrations of approximately 200 f/cc inhaled directly into the lungs.

A later review of the MTD pathology indicated that the animals' lungs were likely "overloaded" because of large quantities of non-fibrous particles, and that this overload condition was likely responsible for the disease observed. In fact, evaluation of the aerosol samples used confirmed the presence of significant quantities of particulate matter.

In a subsequent multi-dose animal inhalation study at 25 f/cc, 75 f/cc, and 115 f/cc; a no observed effect level (NOEL) was found at 25 f/cc. This level is 50 times the RCFC recommended REG of 0.5 f/cc for humans.

12. ECOLOGICAL INFORMATION

No ecological concerns have been identified.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT

To prevent waste materials from becoming airborne during waste storage, transportation and disposal, a covered container or plastic bagging is recommended.

DISPOSAL

RCF, as manufactured, is not classified as a hazardous waste according to Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements. Under Federal regulations, it is the waste generator's responsibility to properly characterize a waste material, to determine if it is a "hazardous" waste. Check local, regional, state or provincial regulations to identify all applicable disposal requirements.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

Hazard Class: Not Regulated United Nations (UN) Number: Not Applicable
Labels: Not Applicable North America (NA) Number: Not Applicable
Placards: Not Applicable Bill of Lading: Product Name

INTERNATIONAL

Canadian TDG Hazard Class & PIN: Not regulated
Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

15. REGULATORY INFORMATION

UNITED STATES REGULATIONS

EPA: **Superfund Amendments and Reauthorization Act (SARA)** Title III – This product does not contain any substances reportable under Sections 302, 304, 313, (40 CFR 372). Sections 311 and 312 (40 CFR 370) apply (delayed hazard).
Toxic Substances Control Act (TSCA) - RCF has been assigned a CAS number; however, it is an "article" under TSCA and therefore exempt from listing on the TSCA inventory.
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Clean Air Act (CAA) - RCF contains fibers with an average diameter greater than one micron and thus is not considered a hazardous air pollutant.

OSHA: Comply with **Hazard Communication Standards** 29 CFR 1910.1200 and 29 CFR 1926.59 and the **Respiratory Protection Standards** 29 CFR 1910.134 and 29 CFR 1926.103.

Ceramic fibers (airborne particles of respirable size)" is listed in **Proposition 65**, **The California: Safe Drinking Water and Toxic Enforcement Act of 1986** as a chemical known to the State of California to cause cancer.

Other States: RCF products are not known to be regulated by states other than California however, state and local OSHA and EPA regulations may apply to these products. If in doubt, contact your local regulatory agency.

INTERNATIONAL REGULATIONS

Canada: **Canadian Workplace Hazardous Materials Information System (WHMIS)** – RCF is classified as Class D2A – Materials Causing Other Toxic Effects

Canadian Environmental Protection Act (CEPA) - All substances in this product are listed, as required, on the Domestic Substance List (DSL)

Europe: **European Directive 97/69/EC** classified RCF as a Category 2 carcinogen; that is it "should be regarded as if it is carcinogenic to man."

16. OTHER INFORMATION

RCF DEVITRIFICATION

As produced, all RCF fibers are vitreous (glassy) materials which do not contain crystalline silica. Continued exposure to elevated temperatures may cause these fibers to devitrify (become crystalline). The first crystalline formation (mullite) begins to occur at approximately 985° C (1805° F). Crystalline phase silica may begin to form at temperatures of approximately 1200° C (2192° F). When the glass RCF fibers devitrify, they form a mixed mineral crystalline silica containing dust. The crystalline silica is trapped in grain boundaries within a matrix predominately consisting of mullite. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure, fiber chemistry and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" fiber.

IARC's evaluation of crystalline silica states "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)" and additionally notes "carcinogenicity in humans was not detected in all industrial circumstances studied." IARC also studied mixed mineral crystalline silica containing dusts such as coal dusts (containing 5 – 15 % crystalline silica) and diatomaceous earth without seeing any evidence of disease. (IARC Monograph Vol. 68, 1997). NTP lists all polymorphs of crystalline silica amongst substances which may "reasonably be anticipated to be carcinogens".

IARC and NTP did not evaluate after-service RCF, which may contain various crystalline phases. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the USEPA, found that in the furnace conditions sampled, most did not contain detectable levels of crystalline silica. Other relevant RCF studies found that (1) simulated after-service RCF showed little, or no, activity where exposure was by inhalation or by intraperitoneal injection; and (2) after-service RCF was not cytotoxic to macrophage-like cells at concentrations up to 320 g/cm^2 - by comparison, pure quartz or cristobalite were significantly active at much lower levels (circa 20 g/cm^2).

RCF AFTER-SERVICE REMOVAL

Respiratory protection should be provided in compliance with OSHA standards. During removal operations, a full face respirator is recommended to reduce inhalation exposure along with eye and respiratory tract irritation. A specific evaluation of workplace hazards and the identification of appropriate respiratory protection is best performed, on a case by case basis, by a qualified industrial hygiene professional.

PRODUCT STEWARDSHIP PROGRAM

The Refractory Ceramic Fibers Coalition (RCFC) and the U.S. Occupational Safety and Health Administration (OSHA) introduced a voluntary worker protection program entitled PSP HTW (High Temperature Wools), a comprehensive, multi-faceted risk management program designed to control and reduce workplace exposures to refractory ceramic fiber (RCF). For more information regarding PSP HTW, please refer to the RCFC web site: http://www.rcfc.net.

MSDS Prepared By: RISK MANAGEMENT DEPARTMENT

DISCLAIMER

The information presented herein is presented in good faith and believed to be accurate as of the effective date of this Material Safety Data Sheet. Employers may use this MSDS to supplement other information gathered by them in their efforts to assure the health and safety of their employees and the proper use of the product. This summary of the relevant data reflects professional judgment; employers should note that information perceived to be less relevant has not been included in this MSDS. Therefore, given the summary nature of this document, Thermcraft, Inc. does not extend any warranty (expressed or implied), assume any responsibility, or make any representation regarding the completeness of this information or its suitability for the purposes envisioned by the user.

DEFINITIONS

ACGIH: American Conference of Governmental Industrial Hygienists
ADR: Carriage of Dangerous Goods by Road (International Regulation)
CAA: Clean Air Act
CAS: Chemical Abstracts Service
CERCLA: Comprehensive Environmental Response, Compensation and Liability Act
DSL: Domestic Substances List
EPA: Environmental Protection Agency
EU: European Union
f/cc: Fibers per cubic centimeter
HEPA: High Efficiency Particulate Air
HMIS: Hazardous Materials Identification System
HTW: High Temperature Wools
IARC: International Agency for Research on Cancer
IATA: International Air Transport Association
IMDG: International Maritime Dangerous Goods Code
mg/m^3: Milligrams per cubic meter of air
mmpcf: Million particles per cubic meter
NFPA: National Fire Protection Association
NIOSH: National Institute for Occupational Safety and Health
OSHA: Occupational Safety and Health Administration
29 CFR 1910.134 & 1926.103: OSHA Respiratory Protection Standards
29 CFR 1910.1200 & 1926.59: OSHA Hazard Communication Standards
PEL: Permissible Exposure Limit (OSHA)
PIN: Product Identification Number
PNOC: Particulates Not Otherwise Classified
PNOR: Particulates Not Otherwise Regulated
PSP: Product Stewardship Program
RCFC: Refractory Ceramic Fibers Coalition
RCRA: Resource Conservation and Recovery Act
REG: Recommended Exposure Guideline (RCFC)
REL: Recommended Exposure Limit (NIOSH)
RID: Carriage of Dangerous Goods by Rail (International Regulations)
SARA: Superfund Amendments and Reauthorization Act
SARA Title III: Emergency Planning and Community Right to Know Act
SARA Section 302: Extremely Hazardous Substances
SARA Section 304: Emergency Release
SARA Section 311: MSDS/List of Chemicals and Hazardous Inventory
SARA Section 312: Emergency and Hazardous Inventory
SARA Section 313: Toxic Chemicals and Release Reporting
STEL: Short Term Exposure Limit`
SVF: Synthetic Vitreous Fiber
TDG: Transportation of Dangerous Goods
TLV: Threshold Limit Value (ACGIH)
TSCA: Toxic Substances Control Act
TWA: Time Weighted Average
WHMIS: Workplace Hazardous Materials Information System (Canada)

14. Control System Operation

The temperature control system controls the amount of power to the resistive heating elements in order to achieve and maintain the desired temperature as measured through the control thermocouple.

The temperature control system consists of the following:

1. Setpoint temperature controller
2. Solid state power controller or mechanical contactor
3. Matching control thermocouple

Heat/cool control systems provide heating control to the unit in addition to cooling control.

Additional optional features include:

1. Over-temperature controller
2. Current limit SCR power controller
3. Multiple zone independent control

INSTALLATION

1. Position control cabinet in the desired location making sure it is permanently secured. NOTE: Do not position controller in such a manner as to be difficult to operate disconnect.
2. Study all instrument manuals before energizing the control system and furnace.
3. Review all electrical wiring diagrams.
4. Make all external wire connections specified in the electrical wiring diagrams including connection of the cables between the furnace and the control console. All conduit supplied shall be permanently secured / mounted during the installation process. CAUTION: Control system must be grounded according to local wiring requirements.
5. Connect the thermocouple to the control system.
6. Close main circuit breaker or disconnect switch.
7. Turn on main power.
8. Check red and green indicating lights on control cabinet and temperature controller for control power indication.
9. Set temperature controller and over temperature controller to desired temperature setting. (Check instrument control manuals for fine-tuning).
10. Turn on control cabinet power. The furnace will continue to heat until the controller setpoint is reached. The controller will start cycling to maintain selected setpoint.

15. Over-Temperature Controller Operation (if applicable)

Furnaces equipped with this option al controller will have a complete independent control system, including a separate upper limit controller and a separate thermocouple.

The over temperature controller is usually set 50 °F higher than the furnace chamber controller. Under no circumstances should the high limit setpoint be set higher than the maximum temperature of the furnace. If the normal control system malfunctions and the temperature continues to rise above the control point, the over temperature controller will shut the power off when the set temperature is reached. On some models, this is a manual reset control. Power will not be restored until the reset button is pressed.

NOTE: During system start up, the system may tend to over- or undershoot the desired temperature setting. After proper adjustment of proportional band, rate and reset (when supplied), the controller will accurately hold the selected setpoint. See controller manual for instructions on setting these adjustments.

CAUTIONS:

1. Do not block cooling vents on control cabinet.
2. Do not operate temperature control system in ambient temperature higher than 120°F without using a cooling fan or air conditioning.
3. Make sure output power rating of temperature control system is higher than power rating of the furnace.
4. When changing fuses, use fuse types specified by the power controller manufacturer.
5. Use properly sized interconnecting cables to match ratings on data labels for the furnace and controller.
6. Use the appropriate thermocouple, including extension wires and connectors, in order to eliminate errors due to faulty control. Do not allow thermocouple to come in contact with others metals so as to avoid inaccuracies in the control readings.

Operating Manual

Warranty Registration

Product Information

TBD - NEED LINK

Cole-Parmer®
an antylia scientific company

625 East Bunker Court
Vernon Hills, IL 60061
United States

United States
T: +1.800.323.4340 or +1.847.549.7600
E: sales@antylia.com
W: coleparmer.com

Canada
T: +1.514.355.6100
E: info@antylia.ca
W: coleparmer.ca

China
T: 86.21.5109.9909
E: sales@antylia.com
W: coleparmer.cn

France
T: +33 (0) 1486 37800
E: fr.sales@antylia.com
W: coleparmer.fr

Germany
T: +49 (0) 9377 92030
E: de.sales@antylia.com
W: coleparmer.de

India
T: +9122 61394444
E: info@coleparmer.in
W: coleparmer.in

Italy
T: +39 (0) 284349215
E: it.sales@antylia.com
W: coleparmer.it

UK
T: +44 (0) 1480 272279
E: uk.sales@antylia.com
W: coleparmer.co.uk

Other
T: +1.847.549.7600

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