# INSTRUCTIONS

# MANUAL

## Ceramic furnace 1200°C

## Model: N420A

Referencial Image

**File No.: TEST- V2.3-EN**

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# Table of Contents

# List of Figures

# Safety Notes

## Basic Operating Precautions

These operating instructions describe 1200°C box furnaces.

1200°C box furnaces have been manufactured to the latest state of the art and have been tested thoroughly for flawless functioning prior to shipping. However, the Box may present potential hazards, particularly if it is operated by inadequately trained personnel or if it is not used in accordance with the intended purpose. Therefore, the following must be observed for the sake of accident prevention:

- 1200°C box furnaces must be operated by adequately trained and authorized professional personnel.
- 1200°C box furnaces must not be operated unless these operating instructions have been fully read and understood.
- The present operating instructions, applicable safety data sheets, plant hygiene guidelines and the corresponding technical rules issued by the operator shall be used to create written procedures targeted at personnel working with the subject matter device, detailing:
  - The decontamination measures to be employed for the box furnace and the accessories used with it.
  - The safety precautions to be taken when processing specific agents.
  - The measures to be taken in case of accidents.
- Repair work on the box must be carried out only by trained and authorized expert personnel.
- The contents of these operating instructions are subject to change at any time without further notice.
- Concerning translations into foreign languages, the English version of these operating instructions is binding.
- Keep these operating instructions close to the furnaces so that safety instructions and important information are always accessible.
- Should you encounter problems that are not detailed adequately in these operating instructions, please contact immediately for your own safety.

# Safety Considerations

**DANGER**

Do not modify or use equipment in a manner other than expressly intended. Modification of equipment other than that for which it is explicitly designed could cause severe injury or death. Any customer after-market retrofit violates the warranty of the equipment.

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

Do not use components or materials not specifically designed for this equipment. Failure to comply with this precaution could result in damage to equipment used or the furnace and may create an overheat situation. Also, do not use anything other than OEM exact replacement equipment and parts. Not using OEM replacement parts could cause faulty. Instrumentation readings, inoperable equipment, or temperature overshoot. Both situations may cause personal injury or death, product, and property damage.

Before using, user shall determine the suitability and integrity of the product for the intended use and that the unit has not been altered in any way. Misapplication may compromise the safety of the end user or the life of the product.

**CAUTION**

This product contains refractory ceramic fiber which can result in the following:

- May be irritating to skin, eyes, and respiratory tract.
- May be harmful if inhaled.
- May contain or form cristobalite (crystalline silica) with use at high temperature (above 871°C) which can cause severe respiratory disease.
- Possible cancer hazard based on tests with laboratory animals. Animal studies to date are inconclusive. No human exposure studies with this product have been reported.

| | | |
|---|---|---|
| | | **WARNING**<br>Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) in the safety notes of this manual. |

# Warranty

Warrants the operational safety and functions of the Laboratory Box Furnaces only under the condition that:

- The Laboratory Box is operated and serviced exclusively in accordance with its intended purpose and as described in these operating instructions,
- The Laboratory Box is not modified,
- Inspections and maintenance are performed at the specified intervals,
- An operation verification test is performed after each repair activity.

The warranty is valid from the date of delivery of the Laboratory Box to the customer.

# Material Safety Data Sheet

**SDS No:** 5036
**Revision: 4**
**Date of last revision: 05/08/2015**

## SAFETY DATA SHEET

## 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

### 1.1 Product Identifier

**Substance Name:** **Mixture containing Refractory Ceramic Fibers (RCF)/Alumino-Silicate Wools (ASW)**
Index Number: 650-017-00-8 (CLP Annex VI)
CAS Number: 142844-00-6
CAS Name: refractories, fibers, aluminosilicate
Registration Number: 01-2119458050-50-000x

### 1.2 Relevant Identified Uses

Refractory shapes for "professional users" in industrial applications involving high temperature, heat treating, and molten metal processing.

### 1.3 Details of the Supplier of the SDS

RMG
Rex Materials Group
**P.O. Box 287**
**Howell, MI 48844**
**(517) 223-3787, (517) 338-5062, fax**
**info@rexmaterials.com**

### 1.4 Emergency Telephone Number

Chemtrec North America: (800) 424-9300
Chemtrec Outside North America: +1 (703) 527-3887

## 2. HAZARDS IDENTIFICATION

### 2.1 Classification of the Substance or Mixture

The U.S. Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (HCS) 2012 indicates that IARC group 2B corresponds to OSHA HCS 2012 Category 2 carcinogen classification (see, e.g., §1910.1200, Appendix F, Part D). Under OSHA HCS 2012, RCF is classified as a Category 2 carcinogen.

### 2.2 Labeling Elements

**2.2.1** Hazard Pictogram

**2.2.2** Signal Word
Warning

**2.2.3** Hazard Statements
Suspected of causing cancer by inhalation.

**2.2.4** Precautionary Statements
Do not handle until all safety instructions have been read and understood.
Use respiratory protection as required; see section 8 of the Safety Data Sheet
If concerned about exposure, get medical advice.
Store in a manner to minimize airborne dust.
Dispose of waste in accordance with local, state and federal regulations.

**2.3 Other Hazards**
Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

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

## 3. COMPOSTION/INFORMATION ON INGREDIENTS

| Name | CAS No | Index or EINECS No. | Weight % | Classification HCS 2012 |
|---|---|---|---|---|
| RCF/ASW | 142844-00-6 | 650-017-00-8 | 40-95 | Category 2 carc. |
| Amorphous Silica | 7631-86-9 | 231-545-4 | 0-60 | not classified |
| Inert Materials | na | na | 0-40 | na |

## 4. FIRST AID MEASURES

**4.1 Description of First Aid Measures**

**4.1.1 Inhalation:**
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.

**4.1.2 Eye Contact:**
If eyes become irritated, flush immediately with large amounts of lukewarm water. Eyelids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

**4.1.3 Skin Irritation:**
Handling of this material may cause mild mechanical temporary skin irritation. If this occurs, rinse affected areas with water and wash gently. Do not rub or scratch exposed skin. Using a skin cream or lotion after washing may be helpful.

**4.1.4 Ingestion:**
If gastrointestinal tract irritation develops, move the person to a dust free environment.

**4.2 Most Important Symptoms and Effects, Both Acute and Delayed**
Mild mechanical irritation to skin, eyes, and upper respiratory system may result from exposure. These effects are usually temporary.

**4.3 Indication of any Immediate Medical Attention and Special Treatment Needed.**
Treat symptomatically. Skin and respiratory effects are the result of temporary, mild mechanical irritation; exposure does not result in allergic manifestations.

## 5. FIREFIGHTING MEASURES

**5.1 Extinguishing Media**
Products are non-combustible. Use extinguishing media suitable for type of surrounding combustible materials.

**5.2 Special Hazards Arising from the Substance or Mixture**
See Section 10.6 (due to starch burnout).

**5.3 Advice for Firefighters**
Use protective equipment and precautions appropriate for type of surrounding fire.

**5.4 National Fire Protection Association (NFPA) Codes**
Flammability: 0 Health: 1 Reactivity: 0 Special: 0

## 6. ACCIDENTAL RELEASE MEASURES

**6.1 Personal Precautions, Protective Equipment, and Emergency Procedures**
Avoid dust formation. Use protective equipment and evacuate unnecessary personnel if appropriate. See Section 8, Exposure Controls/Personal Protection.

**6.2 Environmental Precautions**
None known.

**6.3 Methods for Cleaning Up**
Pick up and arrange disposal with minimal dust creation. Vacuum (HEPA) or wet sweep as appropriate. Do not use compressed air for clean up.

## 7. HANDLING AND STORAGE

**7.1 Precautions for Safe handling**
Avoid dust formation and its accumulation. Handle in accordance with good industrial hygiene and safety practices. Limit the use of power tools unless in conjunction with local exhaust ventilation. Wear personal protective equipment as outlined in Section 8.2.2.

**7.2 Conditions for Safe Storage, Including and Incompatibilities**
Keep dry. Protect against water and moisture. Product packaging may contain residue. Do not reuse. Minimize dust emissions during unpacking.

**7.3 Specific End Use(s)**
See Section 1.2.

# 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

**8.1 Control Parameters**
Industrial hygiene standards and occupational exposure limits vary between countries and local jurisdictions. Check which exposure levels apply to your facility and comply with local regulations. A qualified industrial hygienist can assist with specific workplace evaluation including recommendations for respiratory protection. Examples of national exposure limits are provided in the table below.

| | | **Exposure Limits** | |
|---|---|---|---|
| | **RCF/ASW** | **Amorphous Silica** | **Inert Materials** |
| US OSHA | na* | 80 mg/m$^3$ / % $SiO_2$ | 5 mg/m$^3$ (resp.) |
| ACGIH | 0.2 f/cc | 10 mg/m$^3$ | 10 mg/m$^3$ |
| Argentina | 0.2 f/cc | na | 10 mg/ m$^3$ |
| Australia | 0.5 f/cc | 2 mg/m$^3$ | 10 mg/ m$^3$ |
| Austria | 0.5 f/cc | 0.3 mg/m$^3$ | 6 mg/ m$^3$ |
| Belgium | 0.5 f/cc | na | 3 mg/ m$^3$ |
| Canada | 0.2-1.0 f/cc | na | na |
| Denmark | 1.0 f/cc | na | 5 mg/ m$^3$ |
| Egypt | na | na | na |
| EU | na | na | na |
| Finland | 0.2 f/cc | na | na |
| France | 0.1 f/cc | na | 5 mg/ m$^3$ |
| Germany | 0.2 f/cc | 4 mg/m$^3$ | 3 mg/ m$^3$ |
| Hungary | na | na | na |
| Iceland | 1.0 f/cc | na | na |
| India | na | 10 mg/m$^3$ | na |
| Italy | 0.2 f/cc | na | 3 mg/ m$^3$ |
| Poland | 0.5 f/cc | na | na |
| Spain | 0.5 f/cc | na | 3 mg/ m$^3$ |
| Sweden | 0.2 f/cc | na | 5 mg/ m$^3$ |
| The Netherlands | 0.5 f/cc | na | 5 mg/ m$^3$ |
| UK | 1.0 f/cc | 6 mg/m$^3$ | 4 mg/ m$^3$ |
| United Arab Emirates | na | na | na |
| Venezuela | 0.2 f/cc | na | na |

* Except for the state of California, where the PEL for RCF is 0.2 f/cc 8-hr TWA, there is no specific regulatory standard for RCF in the U.S. In the absence of an OSHA PEL, the HTIW Coalition has adopted a recommended exposure guideline (REG) of 0.5 f/cc, as measured under NIOSH Method 7400 B. For further information on the history and development of the REG see “Rationale for the Recommended Exposure Guideline” at Attachment II of the HTIW Coalition Product Stewardship Program http://www.htiwcoalition.org/documents/PSP_2012.pdf .

**8.2 Exposure Controls**
**8.2.1 Appropriate Engineering Controls:**
Use engineering 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 particulate emissions. If necessary, consult an industrial hygienist to design workplace controls and practices.

**8.2.2 Personal Protection Equipment:**

**Respiratory Protection:**

When engineering and/or administrative controls are insufficient, 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 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.

**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.

**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 or avoid 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.).

## 9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **APPEARANCE AND ODOR**: | white, gray, or tan board or shape / no odor |
| **pH**: | na |
| **MELTING POINT**: | >1650° C (3002° F) |
| **BOILING POINT**: | na |
| **FLASH POINT**: | na |
| **EVAPORATION RATE**: | na |
| **FLAMMABILITY**: | non-flammable |
| **EXPLOSIVE LIMITS**: | not explosive |
| **VAPOR PRESSURE**: | na |
| **VAPOR DENSITY** (Air = 1): | na |
| **BULK DENSITY**: | 0.2-0.8 g/cc |
| **SOLUBILITY (%):** | insoluble |
| **PARTITION COEFFICIENT**: | na |
| **AUTO-IGNITION TEMPERATURE**: | na |
| **DECOMPOSITION TEMPERATURE**: | na (see Section 10.6) |
| **VISCOSITY**: | na for a solid |

## 10. STABILITY AND REACTIVITY

**10.1 Reactivity**

None.

**10.2 Chemical Stability**

Stable under conditions of normal use.

**10.3 Possibility of Hazardous Reactions**

None.

**10.4 Conditions to Avoid**

None. Please refer to handling and storage advice in Section 7.

**10.5 Incompatible Materials**
None.

**10.6 Hazardous Decomposition Products**
Exposure to temperatures above approximately 1000°C (1832°F) may lead to the formation of crystalline silica. The occurrence and extent of crystalline phase formation is dependent on the duration and temperature of exposure and/or the presence of fluxing agents. The presence of crystalline phases can be confirmed only through laboratory analysis of the "hot face" material. Please refer to Section 11.4 for more information on “after-service” RCF.

# 11. TOXICOLOGICAL INFORMATION

Moldatherm products vary in hardness and friability. Especially if cut, ground, or otherwise broken up, exposure may be possible, predominantly by inhalation or ingestion of the dusts. The primary and most significant constituent of the dust is RCF/ASW, so the toxicological information provided below is exclusively related to RCF/ASW.

**HEALTH DATA SUMMARY**

**Epidemiological studies that include most people who have ever worked in domestic RCF production have indicated no increased incidence of respiratory disease or other significant health effects in occupationally exposed workers. In animal studies, long-term, high-dose inhalation exposure resulted in the development of respiratory disease in rats and hamsters.**

**11.1 Toxicokinetics, Metabolism and Distribution**
**11.1.1 Basic Toxicokinetic**
Exposure is predominantly by inhalation or ingestion. Man made vitreous fibers of a similar size to RCF/ASW have not been shown to migrate from the lung and/or gut and do not become located in other parts of the body. When compared to many naturally occurring minerals, RCF/ASW has a low ability to persist and accumulate in the body (half-life of long fibers (>20 µm) in 3 week rat inhalation test is approx. 60 days).

**11.1.2 Human Toxicological data**
In order to determine possible human health effects following RCF exposure, the University of Cincinnati has been conducting medical surveillance studies on RCF workers in the U.S. The Institute of Occupational Medicine (IOM) has conducted medical surveillance studies on RCF workers in European manufacturing facilities.

Pulmonary morbidity studies among production workers in Europe and USA have demonstrated an absence of interstitial fibrosis and no decrement in lung function associated with current exposures, but have indicated a reduction of lung capacity among smokers.

A statistically significant correlation between pleural plaques and cumulative RCF exposure was evidenced in the USA longitudinal study.

The USA mortality study did not show evidence of increased lung tumor development either in the lung parenchyma or in the pleura.

**11.2 Information on Toxicological effects**
*Acute toxicity: short term inhalation*
No data available: Short term tests have been undertaken to determine fiber (bio) solubility rather than toxicity; repeat dose inhalation tests have been undertaken to determine chronic toxicity and carcinogenicity.

*Acute toxicity: oral*
No data available: Repeated dose studies have been carried out using gavage. No effect was found.

*Skin corrosion/irritation:*
Not possible to obtain acute toxicity information due to the nature of the substance

*Serious eye damage/irritation:*
Not possible to obtain acute toxicity information due to the nature of the substance

*Respiratory or skin sensitization*
No evidence from human epidemiological studies of any respiratory or skin sensitization potential

G*erm cell mutagenicity*
Method: In vitro micronucleus test
Species: Hamster (CHO)
Dose: 1-35 mg/ml
Routes of administration: In suspension
Results: Negative

*Carcinogenicity*
Method: Inhalation. Multi-dose
Species: Rat,
Dose: 3 mg/m3, 9 mg/m3 and 16 mg/m3
Routes of administration: Nose only inhalation
Results: Fibrosis just reached significant levels at 16 and 9 mg/m3 but not at 3 mg/m3. None of the parenchymal tumor incidences were higher than the historical control values for this strain of animal.

Method: Inhalation. Single dose
Species: Rat
Dose: 30 mg/m3
Routes of administration: Nose only inhalation
Results: This study was designed to test the chronic toxicity and carcinogenicity of RCF at extreme exposures. Tumor incidence (incl. mesothelioma) was raised at this dose level. The presence of overload conditions (only detected after the experiment was completed), whereby the delivered dose exceeded the clearance capability of the lung, makes meaningful conclusions in terms of hazard and risk assessment difficult.

Method: Inhalation. Single dose
Species: Hamster
Dose: 30 mg/m3
Routes of administration: Nose only inhalation
Results: This low quality study in hamsters (no justification for exposure concentration used and pre existing and concurrent infections in the test animals) produced mesothelial lesions of uncertain significance. Subsequent studies in hamsters with glass fibers indicated that the lung burdens of RCF in this experiment were between 5 and 10 times more than that needed to produce overload, and the results are therefore difficult to interpret.

There are reports of injection studies with some similar materials. While some intraperitoneal injection (IP) studies reported the development of tumors in rats, the relationship of these results to classification remains controversial. Interpretation of these animal experiments is complex, and there is not agreement amongst scientists internationally. A summary of the evidence relating to RCF carcinogenicity in vivo can be found in SCOEL/SUM/165 and in Utel and Maxim 2010.

*Reproductive toxicity;*
Method: Gavage
Species: Rat
Dose: 250 mg/kg/day
Routes of administration: Oral
Results: No effects were seen in an OECD 421 screening study. There are no reports of any reproductive toxic effects of mineral fibers. Exposure to these fibers is via inhalation and effects seen are in the lung. Clearance of fibers is via the gut and the feces, so exposure of the reproductive organs is extremely unlikely.

STOT-Single exposure; NA
STOT-Repeated exposure; NA
Aspiration hazard: NA

**11.3 Irritant Properties**

Negative results have been obtained in animal studies (EU method B 4) for skin irritation. Inhalation exposures using the nose only route produce simultaneous heavy exposures to the eyes, but no reports of excess eye irritation exist. Animals exposed by inhalation similarly show no evidence of respiratory tract irritation.

Human data confirm that only mechanical irritation, resulting in itching, occurs in humans, Screening at manufacturers' plants in the UK has failed to show any human cases of skin conditions related to fiber exposure.

**11.4 Other Information**

After-service RCF may contain various crystalline phases, generally confined to a thin layer of material at the "hot-face" side of these products. However, an analysis of after-service RCF samples obtained pursuant to an exposure monitoring agreement with the EPA, 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 microg/cm$^2$; by comparison, pure quartz or cristobalite, two of the primary phases of silica, were significantly active at much lower levels circa 20 microg/cm$^2$.

**11.5 International Agency for Research on Cancer and National Toxicology Program**

IARC, in 1988, Monograph v.43 (and later reaffirmed in 2002, v.81), classified RCF as possibly carcinogenic to humans (group 2B). IARC evaluated the possible health effects of RCF as follows:

- There is inadequate evidence in humans for the carcinogenicity of RCF.
- There is sufficient evidence in experimental animals for the carcinogenicity of RCF.

The Annual Report on Carcinogens (latest edition), prepared by NTP, classified respirable RCF as "reasonably anticipated" to be a carcinogen).

Not classified by OSHA.

## 12. ECOLOGICAL INFORMATION

These products are inert materials that remain stable overtime. They are insoluble in the natural environment and are chemically identical to inorganic compounds found in the soil and sediment No adverse effects on the environment have been identified or are anticipated.

## 13. DISPOSAL CONSIDERATIONS

**13.1 Waste Treatment**

Waste from these products may be generally disposed of at a landfill which has been licensed for this purpose. Unless wetted, such a waste may be dusty and should be properly sealed in containers for disposal. At some authorized disposal sites, dusty waste may be treated differently in order to ensure they are dealt with promptly and to avoid being wind blown. This product, as manufactured, is not classified as a listed or characteristic hazardous waste according to U. S. Federal regulations (40 CFR 261). Any processing, use, alteration or chemical additions to the product, as purchased, may alter the disposal requirements.

Under U. S. 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.

**13.2 Additional Information**

When disposing of waste and assigning European Waste Code, any possible contamination during use will need to be considered and expert guidance sought as necessary. Please check for any national and/or regional regulations, and refer to the European list (Decision No 2000/532/CE as modified) to identify appropriate waste numbers.

# 14. TRANSPORT INFORMATION

Not classified as dangerous goods under relevant international transport regulations (ADR, RID, ICAO/IATA, IMDG, ADN).

# 15. REGULATORY INFORMATION

**15.1 U.S. 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).

**Hazard Categories**

Immediate Hazard – No
Delayed Hazard – Yes
Fire Hazard – No
Pressure Hazard – No
Reactivity Hazard - No

**Toxic Substances Control Act (TSCA)** – RCF has been assigned a CAS number; however, it is a simple mixture and therefore not required to be listed on the TSCA inventory. Other substances in this product are listed, as required, on the TSCA inventory. The components of RCF are listed on the 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.

**California**:

"Ceramic fibers (airborne particles of respirable size)" is listed in **Proposition 65, The 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.

**15.2 European Regulations**

RCF is classified under the CLP (classification, labeling and packaging of substances and mixtures) regulation as a category 1B carcinogen. On January 13, 2010 the European Chemicals Agency (ECHA) updated the candidate list for authorization (Annex XV of the REACH regulation) and added 14 new substances in this list including aluminosilicate refractory ceramic fibers.

As a consequence, EU (European Union) or EEA (European Economic Area) suppliers of articles which contain aluminosilicate refractory ceramic fibers in a concentration above 0.1% (w/w) have to provide sufficient information, available to them, to their customers or upon requests to a consumer within 45 days of the receipt of the request. This information must ensure safe use of the article, and as minimum contains the name of the substance.

**15.3 Canadian Regulations**

**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).

# 16. OTHER INFORMATION

### 16.1 Abbreviations and Acronyms

| | |
|---|---|
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ADN | European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways |
| ADR | Transport by road, Council Directive 94/55/EC |
| ASW | Alumino-Silicate Wool |
| CARE | Controlled and Reduced Exposure |
| CAS | Chemical Abstracts Service |
| CLP | Regulation (EC) No 1272/2008 on Classification, Labeling and Packaging of substances and mixtures |
| DSL | Domestic Substance List |
| EEA | European Economical Area |
| ECFIA | European Ceramic Fibre Industry Association |
| EINECS | European Inventory of Existing Chemical Substances |
| EPA | Environmental Protection Agency |
| EU | European Union |
| f/cc | fibers per cubic centimeter |
| g/cc | grams per cubic centimeter |
| GHS | Globally Harmonized System of Classification and Labeling Chemicals |
| HCS 2012 | Hazard Communication Standard of 2012 |
| HNOC | Hazards Not Otherwise Classified |
| HTIWC | High Temperature Insulating Wool Coalition |
| IARC | International Agency for Research on Cancer |
| ICOA/IATA | Regulations relating to transport by air |
| IMDG | Regulations relating to transport by sea |
| mg/ $m^3$ | milligrams per cubic meter |
| na | not available or not appropriate |
| OSHA | the U.S. Occupational Safety and Health Administration |
| PEL | Permissible Exposure Limit (OSHA) |
| RCF | Refractory Ceramic Fiber |
| REACH | Regulation (EC) No 1907/2006 dated 18 December 2006 on Registration, Evaluation, Authorization and Restriction of Chemicals |
| RID | Transport by rail, Council Directive 96/49/EC |
| SARA | Superfund Amendment and Reauthorization Act |
| SDS | Safety Data Sheet (replaces MSDS, Material Safety Data Sheet) |
| STOT | Specific Target Organ systemic Toxicity |
| WHMIS | Workplace Hazardous Materials Information System |

### 16.2 References

“Good Working Practices,” HTIW Coalition, July 2012, htiwcoalition.org
“CARE Guidance Documents,” ECFIA industrial hygiene guidance programme, ecfia.eu
“Hazards from the Use of Refractory Ceramic Fibre,” HSE 267 (1998)
Numerous other publications can be found at the websites of ECFIA and HTIWC.

### 16.3 Revision Summary

Rev 4 comprehensive revision to align with HCS 2012

# Explanation of Safety Information and Symbols

## Safety Notes and Symbols Used Throughout These Operating Instructions

| | | |
|---|---|---|
| | | **DANGER**<br>Indicates a hazardous situation which, if not avoided, will result in death or serious injuries. |
| | | **WARNING**<br>Indicates a hazardous situation which, if not avoided, could result in death or serious injuries. |
| | | **CAUTION**<br>Indicates a situation which, if not avoided, could result in damage to equipment or property. |
| | | *NOTE*<br>Is used for useful hints and information regarding the application. |

# Additional Symbols for Safety Information

| | | |
|---|---|---|
|  | | Wear safety gloves! |
|  | | Wear safety goggles! |
|  | | Harmful liquids! |
|  | | Electrical shock! |
|  | | Hot surfaces! |

| | | |
|---|---|---|
|  | | Fire hazard! |
|  | | Explosion hazard! |
|  | | Suffocation hazard! |
|  | | Biological hazard! |
|  | | Contamination hazard! |

# Introduction

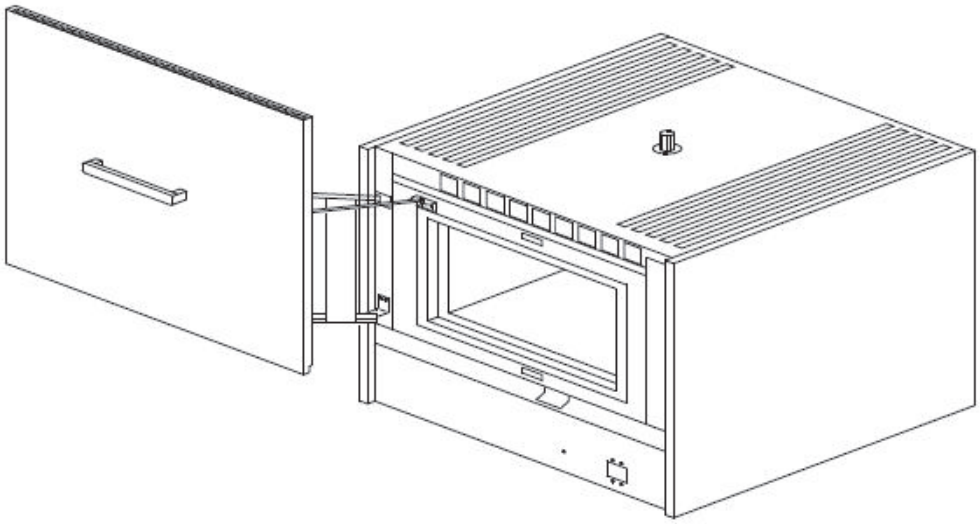


**Figure 2-1 Furnace**

Is a reliable, energy efficient 1200°C laboratory box furnace. The heating Silicon Carbide elements and low thermal mass nsulation provide fast duty cycles, energy conservation, and efficient programming. Refer to "Table 1" for specifications.

## Features and Benefits

- Controlled heat-up rate eliminates thermal shock to materials.
- Quick heat-up and cool-down rates.
- Safety interlock switch automatically interrupts power to heating elements when door is opened. This feature protects heating elements and eliminates operator's exposure to electrical shock.
- Energy efficient insulation suitable for high interior-exterior temperature differential. The unit is rated for a maximum operating temperature of 1200°C.

- Resists attack from most corrosive agents and can be used in atmospheres other than air.
- Replaceable hearth plates and shelves.
- Programmable Control.
- Main power ON/OFF switch and power indicator on control panel.
- Double wall construction.
- Front control panel is recessed at the top. This feature provides easy viewing of the control LED and protection for the control instrumentation.
- Optional flow meter regulates the flow of air or inert gas to the furnace chamber.

# Pre-Installation

## Unpacking

Carefully unpack and inspect the unit and all accessories for damage, if you find any damage, keep the packing materials and immediately report the damage to the carrier. We will assist you with your claim, if requested. Do not return goods to without written authorization. When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment.

## Operating Conditions

High concentrations of sulfates, chlorides, fluorides, alkalis, and $V_2O_5$ can have corrosive effects on the ceramic fiber. .

With prolonged use, airline cracks can develop in the insulation materials. These minor cracks will not affect the furnace's performance. We recommend turning off the furnace completely when not in use. The heating unit is not damaged by rapid heating and cooling cycles.

## Atmosphere Systems

Furnaces are not designed for use with combustible or inert atmospheres requiring an air tight chamber. If an exhaust port is used, the furnace should not be located in an enclosed area without proper ventilation.

| | | |
|---|---|---|
| | | **⚠WARNING**<br>Do not use combustible gases in this furnace. |

| | | |
|---|---|---|
| | | **CAUTION**<br><br>Avoid combustible products which generate toxic or hazardous vapor or fumes. Work should only be done in a properly vented environment. |

# Installation

Do not exceed the electrical and temperature ratings printed on the dataplate of the furnace.

| | | |
|---|---|---|
| | | **CAUTION**<br>Improper operation of the furnace could result in dangerous conditions. To preclude hazard and minimize risk, follow all instructions and operate within design limits noted on the dataplate. |

## Location

Install the furnace in a level area away from vibration. To permit proper airflow, leave at least three inches of space on all sides of the unit and 12 inches above the unit.

## Wiring

Power and ground wires are not provided with the furnaces.

1. Suitable lengths of properly sized wires must be acquired prior to the installation of your furnace. The will draw approximately 20 amps on 240 VAC. Minimum recommended wire gauge size is 14 gauge. A high temperature (150°C) wire casing is also recommended. A ground wire should be provided per local code.
2. Remove the right panel (side with High Voltage label) of the furnace by removing the appropriate screws. Removing the side panel allows for access to the terminal block and grounding screw, located at the base of the unit.
3. The 7/8 inch diameter hole located on the lower rear panel may be used to mount a standard 1/2 inch electrical conduit connector.

4. Thread two properly sized power wires and one properly sized ground wire through the conduit hole. The wires should be marked L1, L2, and ground. Insert power leads L1 and L2 into the terminal block and tighten down securely. Ground on the provided ground screw.
5. Check that the thermocouple (top left of rear of furnace chamber) is securely mounted and that it is not damaged. Remove small cover on the rear panel of furnace to check thermocouple wiring connections. Red is always negative. Refer to Figure **"Thermocouple"**.
6. As a final inspection step, check that all electrical connections are secure and verify that the door stop bracket properly contacts the power interrupt switch near the front of the furnace. If mechanical adjustment is necessary, slight bending of the switch arm can be done.
7. Replace and secure the small cover on the rear panel and right side panel of the furnace using the necessary screws.

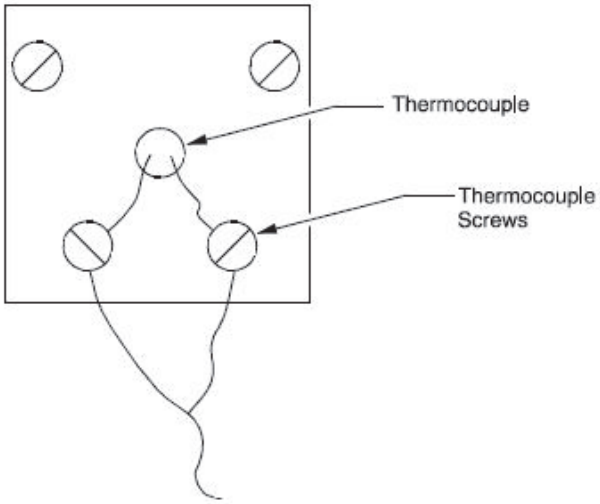



**Figure 4-1. Thermocouple**

# Gas Inlet Tube Assembly

The gas inlet tube assembly has been packaged separately to avoid breakage during shipping and handling. Refer to Figure **"Gas Inlet Tube Assembly"**

Even if you do not intend to use the gas inlet, you must install the assembly before operating the furnace. The only tool you need is a Phillips head screwdriver.

To install the gas inlet assembly:

1. Carefully remove the assembly from the package and inspect for any damage.
2. Remove the two mounting screws from the rear housing panel of the furnace.

3. Insert the ceramic tube end through the access hole in the rear of the furnace and guide the tube into the back of the chamber.
4. Align the mounting holes in the rear housing panel with the holes in the gas inlet tube assembly and secure the assembly with the mounting screws.

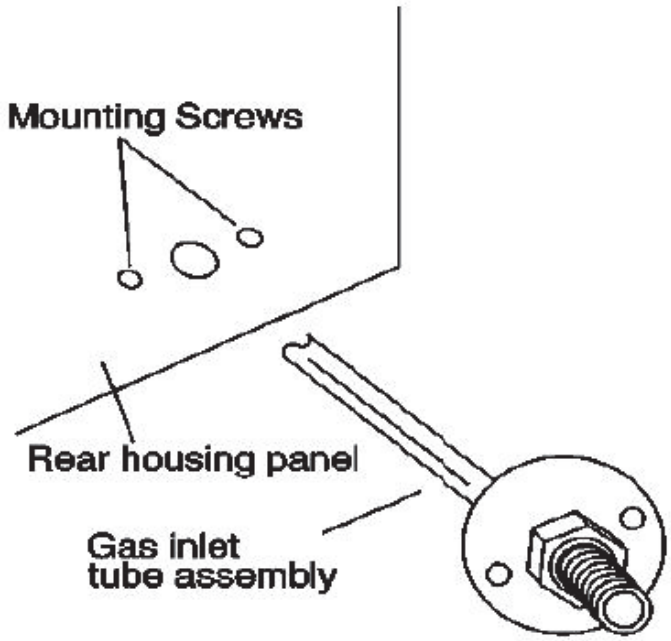



**Figure 4-2. Gas Inlet Tube Assembly**

# Guidelines for Ashing Applications

Ashing products at relatively low furnace temperatures (400°C to 800°C) may cause carbon residue to build up on the walls, floor, ceiling and heating elements inside the furnace chamber. The carbon will look like a black powder, similar to smoke on glass from a candle.

Carbon is an electrical conductor. If the furnace chamber and heating elements are coated with carbon, an electrical short-circuit may occur and cause the elements to overheat and burn out.

There is also some danger that the carbon residue will be absorbed through the surface of the insulation and affect the fully embedded heating elements.

The best way remove carbon residue from the chamber and elements surfaces is to operate the empty furnace at a chamber temperature above 900°C for one hour. Do this regularly, whenever the chamber interior shows signs of carbon residue.

Do not scrub or scrape the chamber surfaces - this may damage the heating elements and the insulation.

# Hearth Plate Information

### Why to Use

- To provide a load bearing surface and distribute the weight of product being heated.
- To protect the furnace chamber from spillage.
- To lengthen the life of furnace, by allowing heat from the chamber floor to circulate into the chamber center.

### When to use

- Hearth Plates are recommended during each furnace operation.

### How to Install

- Hearth plates are designed with a grooved surface.
- The grooved surface must be positioned against the chamber floor.

| | | |
|---|---|---|
| | | **CAUTION**<br>Most hearth plate materials made of ceramic fibre and can be broken if dropped. |

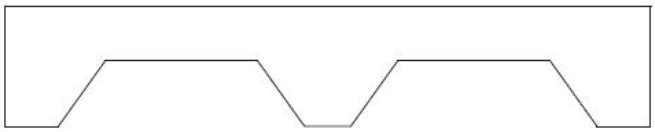


**Figure 4-3. Hearth Plate Ripped**

# Shelf Installation in Box Furnaces

1. Model series are supplied with a pair of half-depth shelves.

2. One or both of these shelves can be installed into the chamber using any of the three groove sets near the mid-point on each side wall.

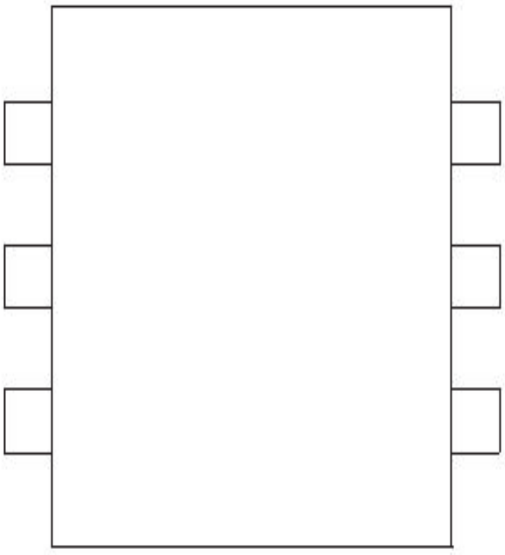


**Figure 4-4.**

**Table 4. Parameters**

| Parameter | Values | Meaning |
|---|---|---|
| AL2 | oFF | Alarm 2 |
| JC | 1 | Junction code (1=dwell; 0=stop 2= repeat, 3= Repeat to local Setpoint at the end of program.). |
| wtz | oFF | Wait Zone |

### Running a Program

To run a program such as the one outlined above, press and hold the "DOWN/RUN" button making the "RUN" indicator illuminate. At the end of this program the "HLD" (hold) indicator is illuminated to indicate this program is in the indefinite dwell at the last target temperature. This hold indicator is caused by the "JC" selection of "1", while the "JC" selections of "2" or "3" will not illuminate the "HLD" (hold) indicator.

### Ending a Program

To end a program while in the "RUN" at "HLD" (hold) mode, press and hold the "UP/RESET" button to turn off the current program and extinguish the "RUN" or "HLD" indicator.

Turning off the unit's power will also stop the program. When power is restored, the controller is in the Reset or standby mode with no power to the heaters.

| | | |
|---|---|---|
| | | **NOTE**<br><br>The programmer/controller will not operate the Unit's heaters (to change or maintain a temperature) unless there is a program running or a single setpoint value is selected in the Local Mode. This Controller details to the "RESET" (rES) mode with each power "ON". If power supply is introduced during program run or single setpoint mode, these action operation mode must be reselected. |

# Using the Hold Function

To hold a running program:

1. Press and hold the SET/ENT key for 3 second, "noDE" will appear in the upper display. Press SET/OUT key to "Hold".

2. Press the "arrow up" key so that "on" with flashing decimal appears in the lower display.
3. Press the SET/ENT key to accept.
4. Press and hold the SET/ENT key again to return to the normal display.

To stop the hold mode:

1. Press and hold the SET/ENT key for 3 seconds. "noDE" will appear in the upper display. Press SET/ENT key to "Hold".
2. Press the "arrow down" key so that "oFF" with flashing decimal appears in the lower display.
3. Press the SET/ENT key to accept.
4. Press and hold the SET/ENT key again to return to the normal display.

## Using the Advance Function

### Introduction

This section describes the sequence to advance or skip segment in a routine program. This is useful if a power out occurred and the program needs to be advanced, skipped procedure already computed.

While the program is running, press and hold the "SET/ENT" key for 3 second. "node" will appear in the upper display. Press the “SET/ENT” key again and "AdV" will appear in the upper display. "oFF" will appear in the lower display.Press the "arrow up" key so that "on" with flashing decimal appears in the lower display. Press the “SET/ENT” key to accept. The controller will automatically return to the normal display and the increment the program segment by one.

### Changing a Program

To make changes only to the target temperature and segment length times for simple program operation, follow these steps:

1. Assure the indicators beside "RUN" and "L" on the controller display are extinguished. If either indicator is illuminated, press and hold the "SET/ENT" button until the display shows "mode", Select "Res" in the lower display with the "arrow" buttons. Press and release the "SET/ENT" button once.
2. Press the “SET/ENT” button for 3 seconds to display "mode" in the upper display and "rES" in the lower display. Press and release “SET/ENT” repeatedly to display "LoC". Make sure the value below "LoC" is "0" (zero). If it is not "0", use “DOWN” arrow to select "0" and press and release "SET/ENT" button to register the change to "0".
3. Press and release the “SET/ENT” button once to show "PrG" on the upper display.

4. Press the "UP" arrow to make the lower value "1".
5. Press and release "SET/ENT" button twice to display "SP1" Using the arrow buttons to revise the target setpoint.
6. Press and release "SET/ENT" button twice to display "tml". Using the arrow buttons to revise the segment time length needed to get to the target setpoint “SP1”.
7. Press and release “SET/ENT” button to display other setpoints and segment time lengths. Use the arrow buttons to change the temperature set points and time lengths. Press and release the “SET/ENT” button to register any new values.
8. Press and HOLD the “SET/ENT” button for 3 seconds to exit the program menu and return to the reset or standby display.

# Auto Tuning the Controller

Auto tuning maximizes the performance of the chamber at a selected temperature with the product load's characteristics, by operating with the quickest response and minimal temperature overshoot.

Factory settings are for general purposes, but your process can be enhanced through the auto tune feature. To obtain this maximum performance, follow these steps to auto the controller.

1. Load the chamber with materials that have the same mass and thermal characteristics as an actual product load.
2. Operate the chamber to the process temperature using either locator run mode.
3. Start the Auto Tune: Press and hold the “SET/ENT” button for three seconds to display the "modE" parameter of the Operating Parameter menu.
4. Press and release the “SET/ENT” button five times to advance to the "At" parameter.
5. Press and release the “UP” arrow button to show "on" in the lower display.
6. Press the “SET/ENT” button once to enter the auto tune mode and exit the Operating Parameters menu.
7. The controller will cycle three times through a heating and cooling pattern, measuring the characteristics of the load and chamber temperature controls. During the auto tuning, “At” will alternately flash with the measured temperature (PV) display to indicate that the auto tuning progress. The length of time for the auto tune vanes with the load, chamber size and temperature selected.
8. The auto tune is completed when the regular display of the measured temperature is shown without the "At" value flashing. The chamber should now

| | | |
|---|---|---|
| | | NOTE<br>Level 1=Operator, Level 2=Customer Technician |

## 1. Program Segment Types

### a) Rate

A Ramp segment provides a controlled change of setpoint from an original to a target setpoint. The duration of the ramp is determined by the rate of change specified. Two styles of ramp are possible in the range, Ramp-Rate or Time-To-Target.

The segment is specified by the target setpoint and the desired ramp rate. The ramp rate parameter is presented in engineering units (°C,°F, Eng.) per real time units (Seconds, Minutes or Hours). If the units are changed, all ramp rates are re-calculated to the new units and clipped if necessary

### b) Dwell

The setpoint remains constant for a specified period at the specified target. The operating setpoint of a dwell is inherited from the previous segment.

### c) Step

The setpoint changes instantaneously from its current value to a new value at the beginning of a segment. A Step segment has a minimum duration of 1 second.

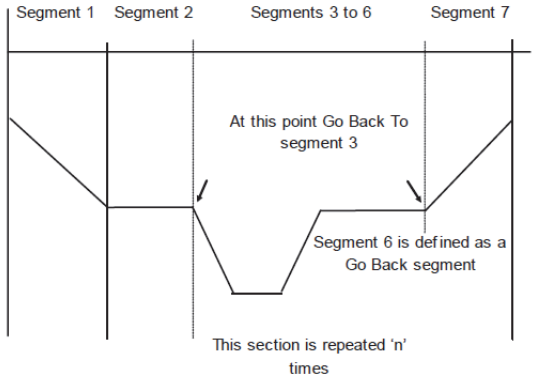
### d) Time

A time segment defines the duration of the segment. In this case the target setpoint is defined and the time taken to reach this value. A dwell period is set by making the target setpoint the same value as the previous setpoint.

### e) GoBack

Go Back allows segments in a program to be repeated a set number of times. The diagram shows an example of a program which is required to repeat the same section a number of times and then continue the program.

When planning a program it is advisable to ensure that the end and start setpoint of the program are the same otherwise it will step to the different levels.



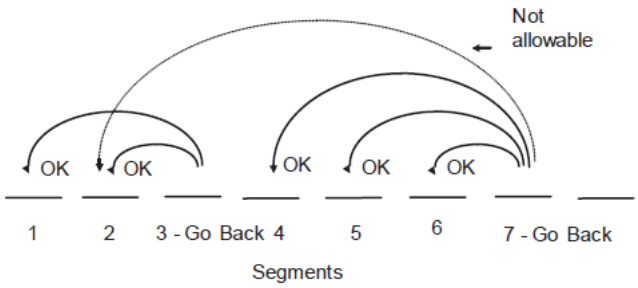

'Goback Seg' specifies the segment to go back to

'Goback Cycles' specifies the number of times the goback loop is executed

Overlapping Goback loops are disallowed

**NOTE:** If a second or more 'Go Back' segments are created, they cannot return to a segment before the previous 'Go Back' segment as shown.

In this diagram a Go Back segment can be created from 3 to 2 or 1. Go Back segments can also be created from 7 to 6 or 5 or 4 but not from 7 to 2 or 1.



### f) Call

A CALL segment is only available when single programmer mode is configured. Call segments may only be selected in instruments offering multiple program storage.

The Call segment allows programs to be nested within each other.

To prevent re-entrant programs from being specified, only higher number programs may be called from a lower program.

i.e. program 1 may call programs 2 through 50, but program 49 may only call program 50.

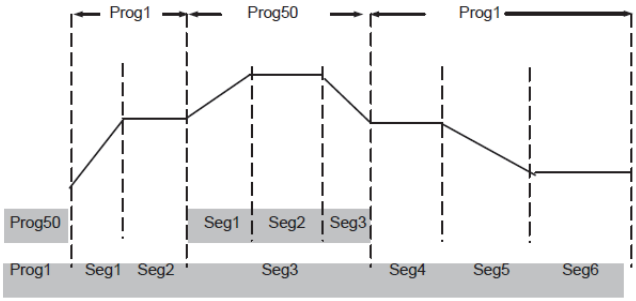
When a CALL segment is selected, the operator may specify how many cycles the called program will execute. The number of cycles is specified in the calling program. If a called program has a number of cycles specified locally, they will be ignored.

A CALL segment will not have a duration, a CALL segment will immediately transfer execution to the called program and execute the first segment of that program.

Called programs do not require any modification, the calling program treats any END segments as return instructions.

The example shows Prog 50 (Ramp/Dwell/Ramp) inserted in place of segment 3/Program1.

Prog 50 can be made to repeat using the ‘Cycles’ parameter.




### g) End

A program may contain one End segment. This allows the program to be truncated to the number of segments required.

The end segment can be configured to have an indefinite dwell at the last target setpoint or to reset to the start of the program or to go to a defined level of power output (SafeOP). This is selectable by the user.

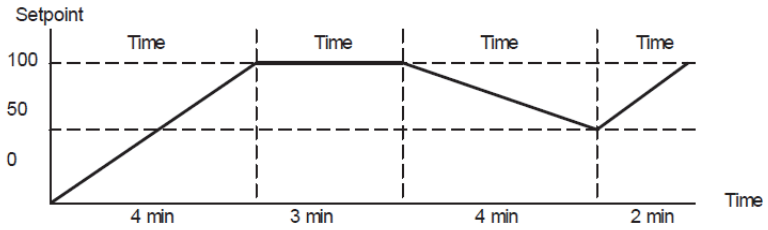
If a number of program cycles are specified for the program, then the End segment is not executed until the last cycle has completed.

## 2. Programmer Types

### A. Time to Target Programmer:

Each segment consists of a single duration parameter and a set of target values for the profiled variables.

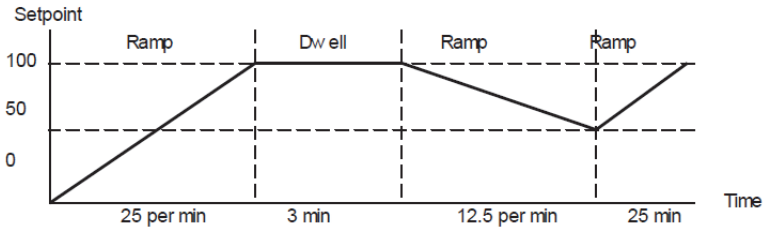
1. The **duration** specifies the time that the segment takes to change the profiled variables from their current values to the new targets.
2. A **dwell** type segment is set up by leaving the target setpoint at the previous value.
3. A **Step** type segment is set up by setting the segment time to zero.




### B. Ramp Rate Programmer:

A ramp rate programmer specifies it's ramp segments as maximum setpoint changes per time unit. Each segment can be specified by the operator as Ramp **Rate**, **Dwell or Step**.

1. **Ramp Rate** – the setpoint changes at a rate in units/time
2. **Dwell** – the time period is set – there is no need to set the target value as this is inherited from the previous segment
3. **Step** – specify target setpoint only – the controller will use that setpoint when the segment is reached.




### Program Edit Summary Parameters:

The table below shows a list of all possible parameters which may be set up in operator levels 1 and 2 using the procedure in the below programming example.

| **Parameter Name** | **Parameter Description** | **Value** | |
|---|---|---|---|
| Program | Program number (and name if this has been configured) | 1 to 25 | |
| Segments Used | Displays the number of segments in the program. This value automatically increments each time a new segment is added | 1 to max number of segments (500) | |
| Ch1HldBkVal | Channel 1 holdback value | 0 to 99999 | |
| Cycles | Number of times the whole program repeats | Continuous<br>Repeats 1 to 999 times | |
| Segment | To select the segment number | 1 to 50 | |
| Segment Type | Defines the type of segment. The type of segment varies depending on whether the program is Single, SyncAll or SyncStart. Call only available in single programmer<br>Rate, Dwell, Step not available in SyncAll programmer | Rate | Rate of change of SP |
| | | Time | Time to target |
| | | Dwell | Soak at constant SP |
| | | Step | Step change to new SP |
| | | Wait | Wait for condition |
| | | GoBack | Repeat previous segs |
| | | Call | Insert new program |
| | | End | Final segment |
| Target SP | Value of SP required at the end of the segment. | Range of controller | |
| Ramp Rate | Rate of change of SP. Only shown if the Segment Type = Rate. | Units/sec, min or hour | |
| Holdback Type | Deviation between SP and PV at which the program is put into a hold condition to wait for the PV to catch up. Only appears if configured | Off<br>Low<br>High<br>Band | No holdback<br>PV<SP<br>PV>SP<br>PV<>SP |
| Duration | Time for a Dwell or Time segment. Only shown if Segment Type = Time. | 0:00:00 to 500.00 secs, mins or hours | |

# Operation - Excess Temperature Controller

The  controller serves as the Excess Temperature controller, when installed in the unit, provides an additional, independent temperature control system to help protect products from excess temperatures. The excess temperature controller is a single setpoint controller, which provides a single digital display to indicate the setpoint temperature (excess temperature Alarm threshold).

The Excess Temperature Alarm Threshold is typically set about 10°C (18°F) above the operating temperature of the chamber to account for variance for the process value temperature of the chamber. For example, Chamber temperature = 1200°C (2192°F) then Excess Temperature Alarm Threshold = 1210°C (2210°F). The maximum allowable Excess Temperature Alarm Threshold for this unit is 1250°C (2282°F) or +50°C (122°F) from maximum rating of the chamber temperature.

Excess temperature controller features are OTP (Over temperature protection), sensor break protection, and power failure indication.

| | | |
|---|---|---|
| | | **NOTE**<br>*After turn on the unit & power failure, user must press PAGE button + SCROLL button for the normal operation of the unit. |

## Default settings for the Excess temperature controller

| Parameter | Description | Value | Access |
|---|---|---|---|
| ALARM.1.Threshold | Excess temp threshold | 1250°C | Level 1+2 Read/Write |
| ALARM.1.Hysteresis | Alarm Hysteresis | 1°C | Level 2 Read only |
| INPUT.Units | Display Units | °C | Level 1+2 Read/Write |

| Parameter | Description | Value | Access |
|---|---|---|---|
| INPUT.PVInValue | PV Input Value | Displays Process Value | Level 1+2 Read only |
| ACCESS.HomeDisplay | Home Display | Excess temp threshold (1250°C) | Level 1+2 Read/Write |
| INPUT.PeakHigh | Peak High | Peak High PV value | Level 1+2 Read only |
| INPUT.PeakReset | Peak Reset | Peak Reset | Level 1+2 Read/Write |
| INPUT.PVOffset | PV Offset | +/- adjusted with respect to main controller PV reading | Level 1+2 Read/Write |
| Customer ID | Customer ID | 1200 | Level 2 Read only |

# Excess Temperature controller Operation

When the controller is turned ON it will perform a short self-test and then display a default page as shown in the below image. The excess temperature Alarm threshold (setpoint) is found in the display. This excess temperature controller will be configured with respect to its functionality in the factory.

### Buttons and Indicators

**PAGE button:** Allows you to select a new list of parameters.

**SCROLL button:** Allows you to select a parameter within a list of parameters.

**DOWN button:** Allows you to decrease a value.

**UP button:** Allows you to increase a value.

# Operational Instructions

| | | |
|---|---|---|
| | | NOTE<br>If at any time you want to return to the HOME DISPLAY, press **PAGE** button. |

1. **To turn on the Load:**

   Press “**PAGE + SCROLL**” buttons to acknowledge the “**ALM**”.

   Following image will be displayed after acknowledging the **ALARM** and load (heating element) will be turned on.

2. **To change the Display Units:**

   Press **SCROLL** button until “**UNITS**” is displayed, then change the desired unit’s type with up/down arrow. A few seconds after the button is released, the controller will accept the new value and is indicated by a brief flash of the display.

   Press **PAGE** button to return to **HOME DISPLAY**.

   Units Choice of **Celsius** (°C), **Fahrenheit** (°F), **Kelvin** (°K), **Percentage** (%), or **None** (none).

3. **To get the PV value (Process Value):**

   Press **SCROLL** button until "**PV.IN**" shows on the controller display.

4. **To change the Excess temperature Alarm threshold (High Limit / Setpoint)**

   Press the **SCROLL** button until "**A1.HI**" is displayed, then press the **UP** or **DOWN** button for the desired alarm threshold value is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and is indicated by a brief flash of the display.

   Press **PAGE** button to return to **HOME DISPLAY**.

# Communication Option (COM)

The factory installed optional RS485 Digital Communications Port allows controller to be connected to a PC for remote monitoring and control of the furnace. The equipment with communication option (COM) is equipped with two DB9 serial ports (1 Male port & 1 Female port). These ports are intended for connection to the PC or a Laptop & making a communication chain of furnace with communication option (COM) Capability. The RS-485 communication allows multiple devices (up to 30) to communicate at half-duplex on a single pair of wires, plus a ground wire.

| | | |
|---|---|---|
| | | **NOTE**<br>The RS485 pin should match with your DB9 to USB or 232 adapters for the communication option to work. |

The following table shows the DB9 pinout to the connections in the RS485.

| **Furnace DB9-Pinout** | **RS485 Output** |
|---|---|
| Pin 2 | A / D- |
| Pin 3 | B / D+ |
| Pin 5 | Ground |

## Adapters - RS 485 to USB/RS 232

The communication option requires an RS485 to USB Adapter or RS485 to RS232 Adapter to for the furnace to communicate with the PC or Laptop. The RS485 to USB or RS485 to RS232 adapter with terminal block is recommended for free wire connections. RS485 adapter is suggested as pin connections vary with different adapter manufacturers and may not work properly if they don’t match with the above DB9 pinout of the furnace.

| | | |
|---|---|---|
| | | **NOTE**<br>Please ensure the adapter is compatible with the operating system of your PC/Laptop. Some adapter needs driver softwares & port access privileges on your PC/Laptop for proper functioning. Please contact your local IT for assistance. |

# RS485 Pinout & Connections

The furnace is provided with a communication cable for connecting the furnace to the RS485 adapter. The communication cable consists of DB9 connector in one end & open-end wire on the other end. Use the accessory Cable # 7044 for second and additional units.

# Cable Installation

1. To install the communication cable, disconnect the electrical power from both the unit and PC/Laptop
2. Connect the cable end with a black housing to the DB 9-pin port on the rear of the unit.
3. Connect the other end of cable to the RS485 to USB or RS485 to RS232 adapter terminal block as shown in the following table (Terminal block adapter accessory is available as an accessory with most of the adapter manufacturer if this is not a standard feature).

| **Wire Color** | **RS 485 Adapter Terminal Block** |
|---|---|
| Black | A / D- |
| Red | B / D+ |
| Shield (Ground) | Ground |

4. Apply electrical power to the unit and the PC.

| | | |
|---|---|---|
| | | **NOTE**<br>Please don’t connect the RS485 adapter directly to the DB9 connector on the equipment. The pins will not match as different manufacturer adopt use different pins. Use the communication cable supplied with the equipment. |

# Host Computer & Software

The host computer can communicate with furnaces with communication option (COM). A datalogging & control software is required for data logging & control of the furnace using the RS485 communication. Software like Spec view is suitable for these applications. These softwares can communicate with either a single Furnace or a network of Furnaces with the communication option.

# Controller Parameters for Communication

| Parameter | Value |
|---|---|
| Comms Module Identity | Comms (67) |
| Communications Protocol | Modbus (2) |
| Baud Rate | 9600_baud (0) |
| Parity | Even (1) |
| Comms Address | 1 |
| Comms Wait States | No (0) |
| Single Value Broadcast Enable | No (0) |
| Network Watchdog Flag | Off (0) |
| Network Watchdog Action | Auto (1) |
| Network Watchdog Timeout | 0 |
| Network Watchdog Recovery | 0 |

# Troubleshooting

If your connection is not working properly, check the following conditions:

A. Verify complete and tight cable connections

B. Verify that power has been supplied to the unit and temperature controller before starting the software program.

C. Verify the configuration values in the controller, listed in the Table for the section “Controller Parameters for Communication”.

# Maintenance

## General Maintenance

| | | |
|---|---|---|
| | | **CAUTION**<br>Maintenance should only be performed by trained personnel. |

| | | |
|---|---|---|
| | | **WARNING**<br>Disconnect console from main power before attempting any maintenance to console or its controls. |

| | | |
|---|---|---|
| | | **WARNING**<br>Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) in the safety notes. |

| | | |
|---|---|---|
| | | **WARNING**<br><br>When installing, maintaining, or removing the fiberglass Insulation, the following precautions will minimize airborne dust and fiber:<br>• Keep personnel not involved in the installation out of the area.<br>• Use a good vacuum to clean area and equipment. Use a dust suppressant if sweeping is necessary. Do not use compressed air.<br>• Use a disposable mask suitable for nuisance dust.<br>• Wear long sleeve clothing, gloves, hat, and eye protection to minimize skin and eye contact. Do not wear contact lenses.<br>• Thoroughly wash self after work is complete.<br>• Launder work clothing separate from other clothes and thoroughly clean laundering equipment after use. If clothing contains a large amount of dust and/or fiber, dispose of rather than clean.<br>• Promptly place used fiberglass parts and dust in plastic bags and dispose of properly. |

# Heating Elements

The heating units are rated for a maximum of 1200°C. They will resist attack from most corrosive agents. High concentrations of atmospheres or chemicals which may have corrosive effects on the ceramic fiber are sulfates, chlorides, fluorides, alkalis, and vanadium. Please contact regarding questions on the effect of specific atmospheres on your furnace performance.

High concentrations of volatile materials being burnt off in the furnace may reduce heating element life. Proper venting of the volatiles is essential.

After prolonged use, hairline cracks may develop in the insulating materials. Minor cracks will not affect furnace performance.

Care should be taken when working with or handling the heating units, as the ceramic fibers and dust particles are a possible eye/skin/lung irritant. Refer Section **“Safety Notes”**.

# Heating Unit Replacement

Replacement of the heating units requires partial disassembly of the furnace. Two persons may be required for parts of the procedure. Allow adequate work space for the disassembly.

1. Be sure to disconnect all power to the furnace.
2. Remove the outer panels of the furnace by removing the appropriate hex-head screws.
3. Remove the thermocouple and the power wires/connecting straps from the heating elements at the rear of the furnace.
4. Open furnace door slightly. Disassemble the chamber frame starting from the top rear and working toward the base. The front supports do not have to be removed. The heating elements can then be pulled back and out of the remaining front support brackets.
5. A gasket made of ceramic fiber blanket is located between the two heating units. This material should be retained and used with the replacement heating units.
6. Install the replacement heating units in the frame and reverse the above procedure to reassemble the furnace.

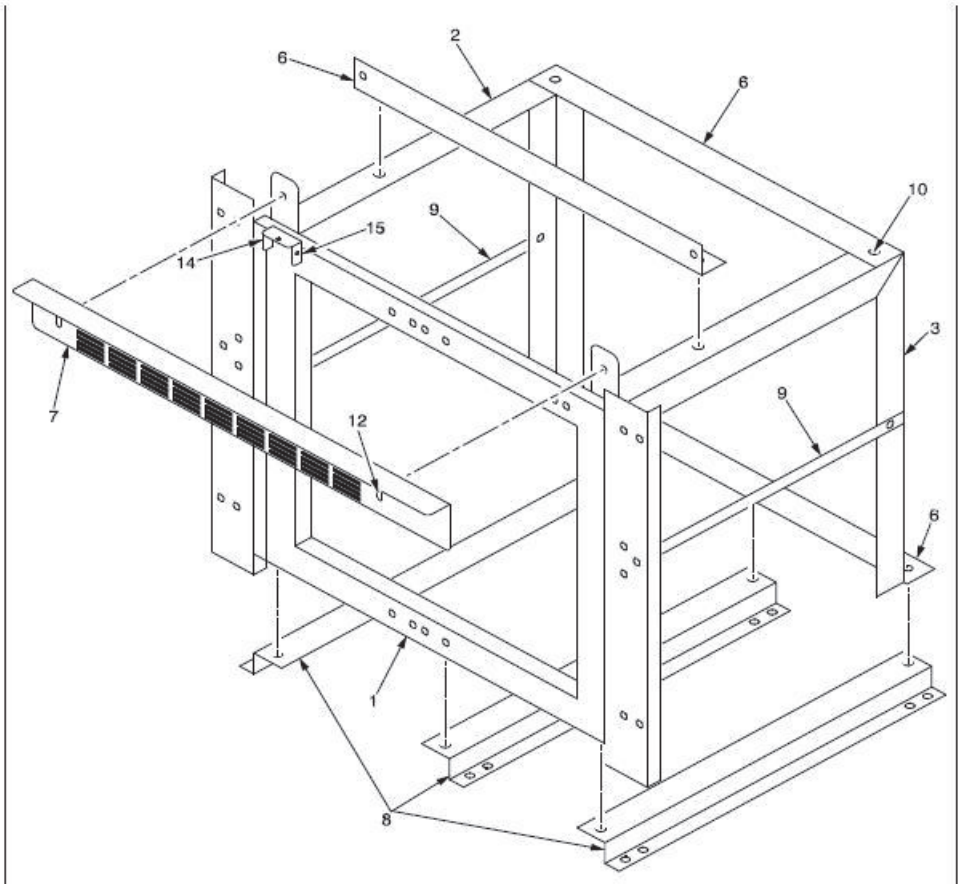



**Figure 11-1. Heating Unit Replacement**

# Thermocouple (T/C) Replacement

To replace the thermocouple:

1. Disconnect power to the furnace.
2. Remove the back panel of the furnace by removing the appropriate eight hex-head screws.
3. The thermocouple is located in the upper left hand corner of the rear of the furnace. Note location and color of the thermocouple and lead wires. Remove the mounting and connection screws. Carefully pull the thermocouple assembly out of the furnace chamber.
4. Replace the cylindrical thermocouple section with the new section. Put the thermocouple assembly back into the furnace chamber. Fasten with the mounting screws and reconnect wires. Refer to Figure **“Thermocouple”** for proper wire connections.
5. Replace the back panel.

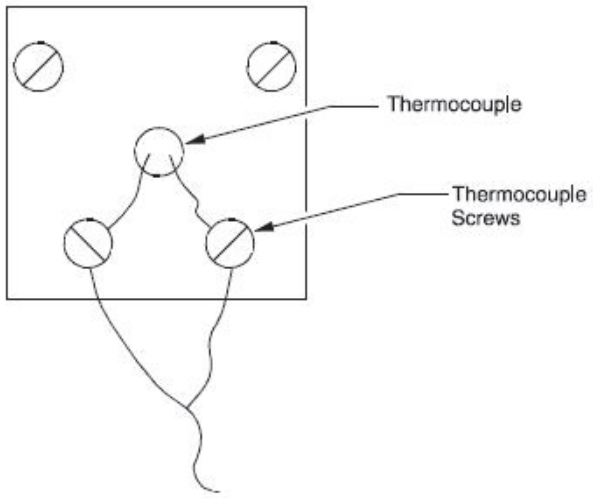



**Figure 11-2. Thermocouple**

# Solid State Relay (SSR) Replacement

To replace the solid state relay:

1. Disconnect power to the furnace.
2. Remove the left side panel (facing front) to provide access to the SSR assembly.
3. Note positions of the wires on the SSR. Disconnect the wires and remove outer screws. Remove the heatsink and SSR from the furnace.
4. Remove the SSR from the heat sink. Replace with the new SSR and reverse the above procedure for reassembly.

# Door Insulation Replacement

To replace the door insulation:

1. Disconnect power.
2. Open furnace door.
3. Loosen the screws holding the upper and lower door insulation brackets in place. The screws do not need to be removed.
4. Pull the door insulation out of the support brackets. Insert new insulation and reassemble the support brackets.

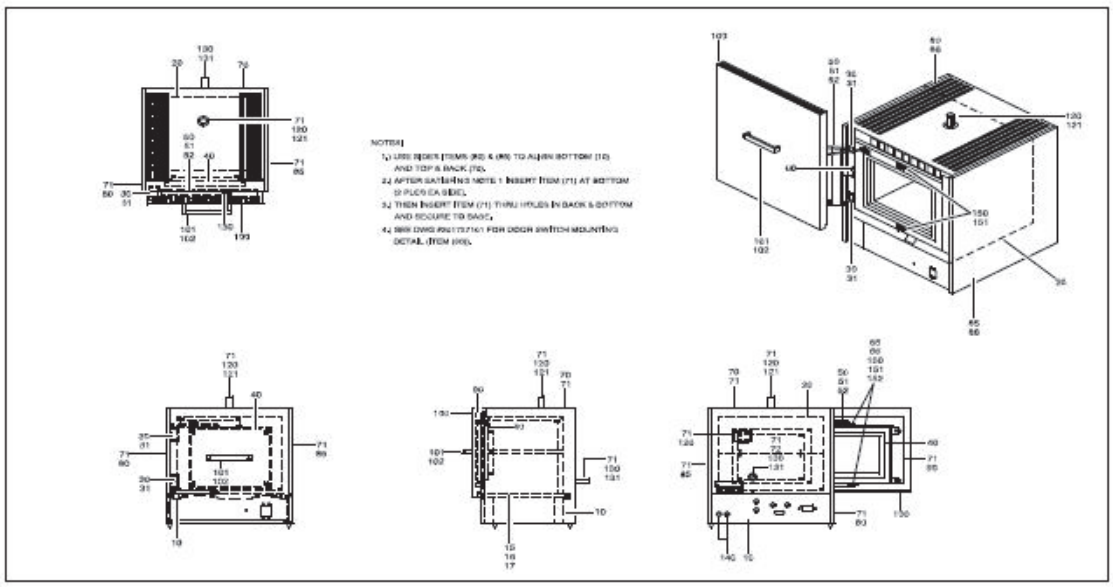


**Figure 11-3. Door Insulation**

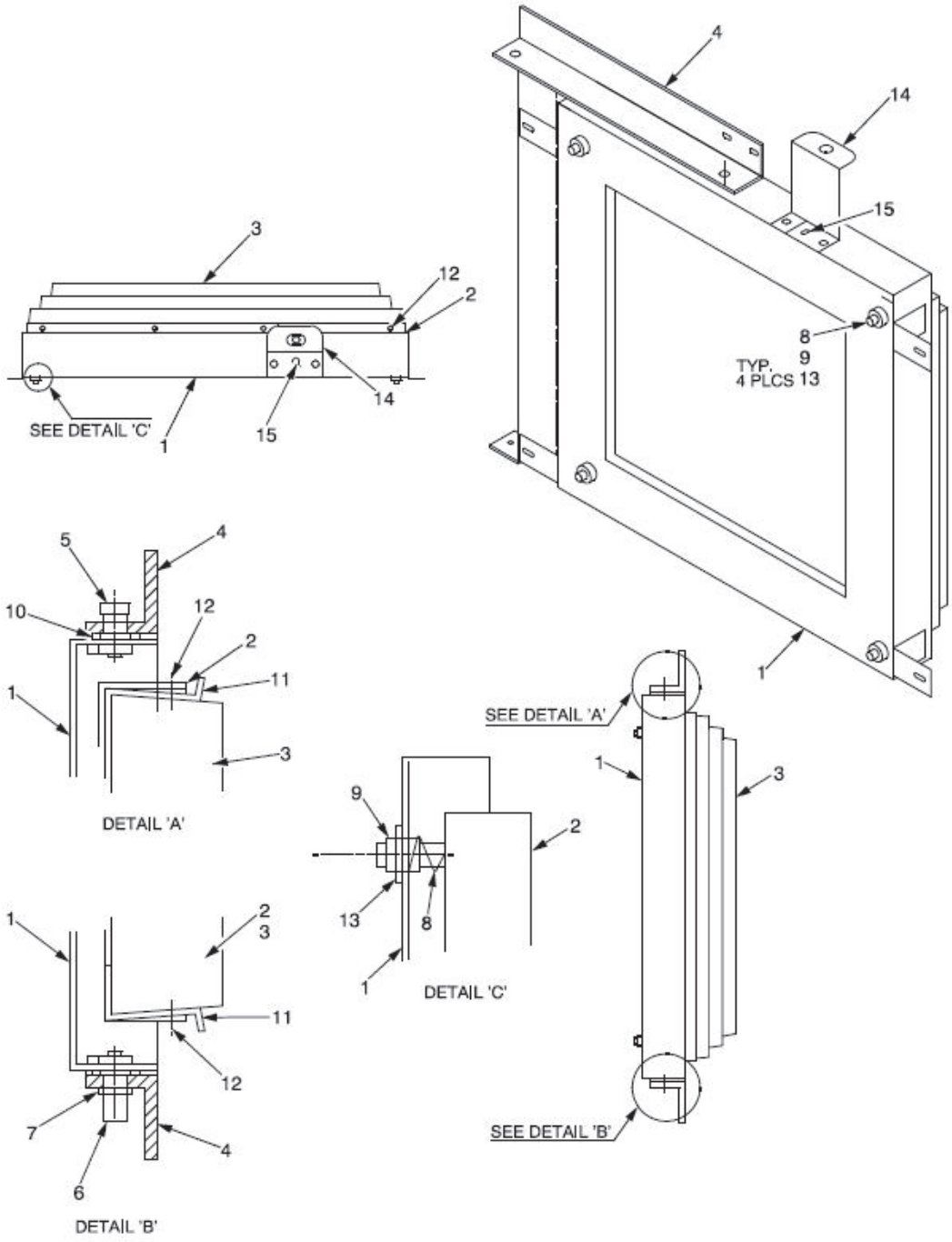



**Figure 11-4. Door Insulation Replacement**

# Right Hand Door Conversion

The furnace door can easily be converted to a right hand swing door as fallows:

1. Open and support the furnace door. Remove the four bolts holding the door assembly to the furnace frame.
2. Remove the contact switch mounted below the door.
3. Install door on right hand side of the chamber frame, using the bolts in the holes provided. Install the contact switch in the mounting location provided at the right of old location.
4. Check alignment of the door insulation with the chamber.

Sideways adjustment can be made by loosening the door insulation supports and moving the insulation plug. Vertical adjustment can be made by placing or removing spacers on the door hinge.

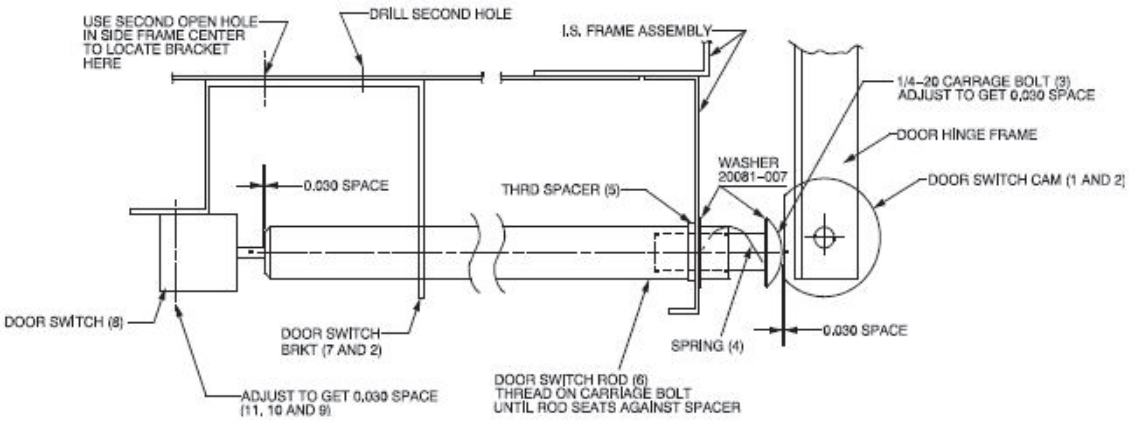



**Figure 11-5. Door Hinge (Sheet 1/2)**

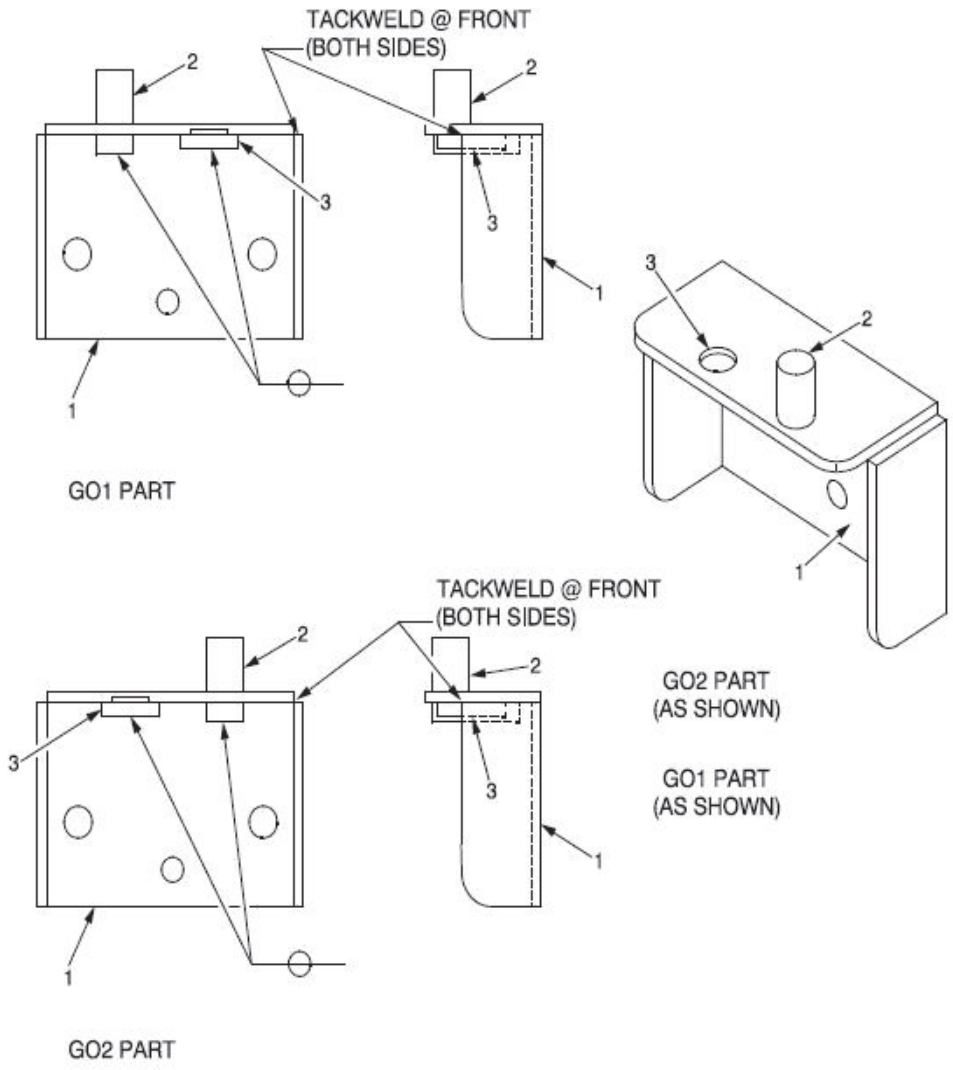



**Figure 11-6. Door Hinge (Sheet 2/2)**