

# INSTRUCTIONS

## BENCH OVENS

<u>MODEL</u>	<u>MAXIMUM OPERATING TEMPERATURE</u>
NB-350	350°F
DR-350	350°F
NB-550	550°F
NT-800	800°F
NTR-800	800°F
NT-1000	1000°F
NTR-1000	1000°F



*Ovens and Furnaces For Industry Since 1949*

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**BENCH OVEN GENERAL INSTALLATION, OPERATION AND  
MAINTENANCE INSTRUCTIONS FOR  
MODELS NB-350, DR-350, NB-550, NT-800,  
NTR-800, NT-1000 AND NTR-1000**

**TABLE OF CONTENTS**

1	SHIPPING DAMAGE & HANDLING
2	PROPER OVEN APPLICATION
2-1	General
2-2	Flammable Solvents
2-3	Combustible Material
2-4	Personnel Hazards
2-5	Maintenance and Inspection
3	INSTALLATION
3-1	Location
3-2	Building Considerations
3-3	Clearances
3-4	Ventilation
3-5	Exhaust Ductwork
3-6	Thermometer
3-7	Electrical
4	PRIOR TO PLACING OVEN IN SERVICE
5	PROCESSING
6	SAFETY EQUIPMENT
7	MAINTENANCE
8	TROUBLE SHOOTING
9	APPENDIX A - REFERENCES
10	APPENDIX B - MINIMUM PERIODIC MAINTENANCE REPORT
11	APPENDIX C - REPLACEMENT PARTS LIST
11	APPENDIX D - WARRANTY AND LIMITATIONS OF REMEDIES

These GENERAL INSTRUCTIONS have been written for many different types of ovens, therefore, some equipment or components referred to may not be present on your particular piece of equipment.

## 1 SHIPPING DAMAGE AND HANDLING

### DO NOT RETURN DAMAGED MERCHANDISE TO US. FILE YOUR CLAIM AS OUTLINED BELOW

This merchandise has been thoroughly inspected and carefully packed before leaving our plant. Responsibility for its safe delivery was assumed by the carrier at the time of shipment. Claims for loss or damage to the contents must be made with the carrier, as follows:

#### 1-1 VISIBLE LOSS OR DAMAGE

Any external evidence of loss or damage must be noted, at the time of delivery, on the freight bill or express receipt and signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier refusing to honor a damage claim. Make a written request for inspection by the carrier's agent within fifteen days of the delivery date. Review the inspection report and do not sign it unless it adequately describes the damage.

A claim must be filed with the carrier since such damage is the carrier's responsibility.

#### 1-2 CONCEALED LOSS OR DAMAGE

Concealed loss or damage means loss or damage which does not become apparent until the merchandise has been unpacked. The contents may be damaged in transit due to rough handling even though the carton may not show external damage. When the damage is discovered upon unpacking, contact the carrier and make a written request for inspection by the carrier's agent within fifteen days of the delivery date. Review the inspection report and do not sign it unless it adequately describes the damage.

A claim must be filed with the carrier since such damage is the carrier's responsibility. By following these instructions carefully, we guarantee our full support of your claims to protect you against loss from concealed damage.

#### 1-3 RETURNING DAMAGED EQUIPMENT

Damaged equipment will not be accepted at our factory unless we have been advised and instructions provided on how it should be returned. A copy of the freight claim must be provided prior to returning the equipment.

#### 1-4 HANDLING

After inspection, store and handle all equipment and components in their original crates until ready for installation. Handle with care. The equipment may be heavy but some components are of a delicate nature. If the equipment is to be stored, keep it in the original crates and store in a location free from excessive dust, heat and moisture until ready for installation.

## 2 PROPER OVEN APPLICATION

### 2-1 GENERAL

- 2-1.1 While ovens are extremely versatile, they are usually purchased with a specific application in mind. If your process has changed significantly or if you should have reason to doubt that a specific application is a proper use of the equipment, consult the factory before proceeding.
- 2-1.2 Explanatory Material (Annex A1.1) of the National Fire Protection Association Publication 86 "Standard for Ovens and Furnaces" states; in part:
- "Explosions and fires in fuel-fired and electric heat utilization equipment constitute a loss potential in life, property and production."
- "Most failures can be traced back to human error. The most significant failures include inadequate training of operators, lack of proper maintenance, and improper application of equipment."
- 2-1.3 To protect the oven, oven contents, property and personnel, a responsible person should be in attendance during operation. **Do not operate oven unattended.** Special attention must be paid to:
- Setting correct temperature.
  - Placing flammable solvents in oven; these ovens are not designed for that purpose.
  - Placing combustibles in an oven that does not have adequate fire protection.
  - Allowing the product to remain in the oven too long, thereby encouraging combustion.
  - Using an oven for a process other than that for which it was designed.
- 2-1.4 Operator should turn off oven immediately and notify their supervisor if there is a change in performance and / or the excess temperature limit interlock trips – See 6-5.

### 2.2 FLAMMABLE SOLVENTS

- 2-2.1 This oven is not equipped for handling flammable solvents. Do not place items that produce flammable solvents or vapors in the oven, such as, but not limited to, paint, ink, solder mask, adhesives or other coatings. Introduction of such items into the oven may result in fire and/or explosion.
- 2-2.2 It shall be the user's responsibility to insure that flammable solvents are not placed in the oven and the operating temperature does not exceed the maximum rated temperature of the oven.
- 2-2.3 In areas outside of the oven where flammable solvents are given off by material prior to entering the oven, provisions shall be made to exhaust these vapors to atmosphere to prevent them from being pulled into the oven or collecting and creating a flammable mixture.

## 2-3 COMBUSTIBLE MATERIAL

2-3.1 Introduction of combustible materials (such as paper, cardboard or wood) into the oven should be avoided because it might cause a fire. Do not use combustible racks, trays, holders, spacers, etc. Periodically, clean all combustible material from non-combustible racks, trays, holders, spacers, etc. If combustible products must be processed in an oven, extreme care must be taken to ensure that the operating temperature does not exceed the ignition temperature of the product.

2-3.2 Ovens containing or processing sufficient combustible materials (including consideration for combustible drippings or deposits) to sustain a fire shall either be located in an area where fire would not do damage or be equipped with an automatic fire protection system including areas in exhaust ducts that could accumulate combustible material. Fire protection systems should be installed in accordance with the applicable National Fire Protection Guidelines:

- Sprinkler Systems in accordance with NFPA 13
- Water Spray Systems in accordance with NFPA 15
- Carbon Dioxide Extinguishing Systems in accordance with NFPA 12
- Foam Extinguishing Systems in accordance with NFPA 11
- Dry Chemical Extinguishing Systems in accordance with NFPA 17
- Water Mist Systems in accordance with NFPA 750

The extent of protection required will depend upon the construction and arrangement of the oven as well as the materials handled. Fixed protection, such as automatic sprinklers or other types of fire extinguishing systems, should be designed and installed by a qualified contractor.

2-3.3 Drip pans shall be provided to collect any combustible materials that may accumulate beneath the product. A maintenance program must be developed to remove any such accumulation before a dangerous build up occurs. If you cannot acquire drip pans locally, contact us for a quotation.

## 2-4 PERSONNEL HAZARDS

2-4.1 Heat processing equipment must always be used with caution. Proper equipment such as insulated gloves, safety goggles and tongs should be used for loading hot equipment. Proper supervision is essential and only trained personnel should be allowed to operate the oven.

Always remember you are working with elevated temperatures.

- Do not touch surfaces - they could be hot and burns could result.
- Do not breathe hot oven air. Heated air could burn lungs.
- Many items become dangerous when heat is applied. Explosion or fire could result. Make sure you know what you are putting in the oven can be heated safely at the oven operating temperature.

2-4.2 Disconnect power before servicing equipment. Ovens operate under high voltage and electrical shock is possible. Proper panel lockout procedures should be followed.

2-4.3 Do not operate mechanical or electrical equipment with guards removed. Operating with guards removed could result in bodily injury.

## 2-5 MAINTENANCE AND INSPECTION

- 2-5.1 Regularly scheduled inspection and maintenance of all safety devices shall be performed by user. Failure to do this may result not only in fire or explosion damage, but also contribute to accidental shutdowns and loss of production. See Section 7 - "Maintenance" and Appendix B - "Minimum Periodic Maintenance Report".
- 2-5.2 Regularly scheduled inspection of the oven interior, heat chamber and ductwork shall be performed by user to determine need for cleaning and repair. Failure to do this may result in internal fires or component failure resulting in oven damage and loss of production.
- 2-5.3 It shall be the sole responsibility of the user to establish, schedule and enforce the frequency of and the extent of the inspection/maintenance program (as well as the corrective action to be taken) because only the user can know what the actual operating conditions are. Contact your insurance authority, Factory Mutual or the National Fire Protection Association, whose addresses are listed in Appendix B, for more information on inspection/maintenance programs.

## 2-6 RETROACTIVITY

This equipment has been designed and manufactured in accordance with applicable National Codes in effect as of the date of manufacture. It is the responsibility of the end user to update equipment as necessary to comply with future code changes. If you are in doubt, contact manufacturer to review your equipment design against current National Codes.

### 3 **INSTALLATION**

#### 3-1 **LOCATION**

- 3-1.1 Ovens shall be located to protect them from damage by external heat, vibration and mechanical hazards.
- 3-1.2 Ovens shall be located to minimize exposure to power equipment, process equipment and sprinkler risers. Unrelated stock and combustible materials shall be maintained at a fire-safe distance but not less than 2-1/2 feet from an oven or ductwork.
- 3-1.3 Ovens shall be located to minimize exposure to people from the possibility of injury from fire, explosion, asphyxiation, and hazardous materials and shall not obstruct personnel travel to exit ways.
- 3-1.4 Ovens shall be located to prevent an ignition source to flammable coating dip tanks, spray booths, storage and mixing rooms for flammable liquids, or exposure to flammable vapor or combustible dust clouds. Ovens should not be located in hazardous (classified) locations unless they are designed to comply with the applicable requirements of NFPA 70 "National Electrical Code" (see Appendix A).
- 3-1.5 Equipment shall be protected from corrosive external processes and environments, including fumes or materials from adjacent processes or equipment that produces corrosive conditions when introduced into the oven environment.
- 3-1.6 The oven is not intended for outdoor installation and must be sheltered from weather. Unheated shelters may result in non-uniform temperatures or insufficient heat to attain maximum operating temperature. Condensation may also occur which would be detrimental to the steel structure and electrical components.
- 3-1.7 Suitable portable fire extinguishers should be available and operators trained in their use. All such fire protection equipment should be inspected periodically in accordance with appropriate standards. Reference NFPA 10 "Standard for Portable Fire Extinguishers" (see Appendix A).

#### 3-2 **BUILDING CONSIDERATIONS**

- 3-2.1 When selecting the location for an oven, consideration must be given to the possibility of fire, building damage and personal injury. Hazards to be considered include overheating of material in the oven and escape of exhaust into the work place.
- 3-2.2 Ovens shall be located so that the building structural members are not affected adversely by the maximum anticipated temperature or by the additional loading caused by the oven and load.
- 3-2.3 Ovens should be placed on noncombustible surfaces.
- 3-2.4 Level the oven using shims, if necessary. Where mounting holes are provided, anchor the oven securely. Shims should be permanently mounted to the oven after installation. Mounting holes are provided on leg stands; anchor the stands securely.

#### 3-3 **CLEARANCES**

- 3-3.1 Ovens shall be located with adequate space above and on all sides to allow inspection and maintenance. Provisions also shall be included for the installation of automatic sprinklers, if applicable.

- 3-3.2 Do not place the oven up against a wall. A minimum air space of 3" must be provided on all sides to allow for air circulation, with additional space being provided for ovens operating over 450°F (232°C) to keep temperature at adjacent structures and materials below 160°F (71°C).
- 3-3.3 Do not store material on top of oven. The oven is not designed to carry exterior loads. Also, material may get hot, ignite and cause a fire.
- 3-3.5 The oven doors have spring loaded latches which will allow the doors to open if pressure develops in the oven. The door travel must not be restricted and should face away from main aisles, work areas and automatic sprinkler risers, feeds and cross mains.

#### 3-4 VENTILATION

- 3-4.1 Where ovens are located in basements or enclosed areas, sufficient room ventilation shall be supplied to prevent the hazardous accumulation of vapors from processing.
- 3-4.2 Fresh air inlets and exhaust outlets must never be restricted.
- 3-4.3 If the exhaust chamber adapter is used, mount it over the exhaust ports with the sheet metal screws provided and attach 3" diameter exhaust stack to the adapter outlet. Outlet can be installed on top or end of exhaust chamber adapter. If this stack is to be run outside, it must be in accordance with local codes and requirements. Exhaust gas temperature is the same as internal oven temperature. Caution must be taken to protect combustible building materials from coming in contact with the hot exhaust stack.
- 3-4.4 For additional ventilation information, refer to NFPA 31 "Standard for the Installation of Oil-Burning Equipment", NFPA 54 "National Fuel Gas Code" and NFPA 91 "Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists" and "Noncombustible Particulate Solids" (see Appendix A).
- 3-4.5 Exhausts systems should be installed in accordance with Chapter 1, 2 and 3 of NFPA 91 "Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids" (see Appendix A).

#### 3-5 EXHAUST DUCTWORK

- 3-5.1 Wherever oven ducts or stacks pass through combustible walls, floors, or roof, non-combustible insulation or clearance, or both, shall be provided to prevent combustible surface temperatures from exceeding 160°F (72°C).
- 3-5.2 Where ducts pass through non-combustible walls, floors or partitions, the space around the duct shall be sealed with non-combustible material to maintain the fire resistance rating of the barrier. Ducts that pass through fire walls should be avoided.
- 3-5.3 Ducts shall be constructed entirely of sheet steel or other non-combustible material capable of meeting the intended installation and conditions of service. The installation shall be of adequate strength and rigidity and shall be protected where subject to physical damage.



- 3-5.4 Ducts handling fumes that leave a combustible deposit shall be provided with clean-out doors and such doors should be equipped with tight fitting doors or covers. It is important that ovens and ducts be kept clean if they are subjected to a build-up of flammable deposits of dust or other combustible debris. The build-up of condensed vapors or combustible debris is a major cause of fires. Frequency of cleaning should be based on never allowing build-up to exceed 1/8" thickness in any location.
- 3-5.5 No portions of the building shall be used as an integral part of the duct.
- 3-5.6 Ducts handling combustible solids shall be designed to minimize the accumulation of solids within the ducts.
- 3-5.7 Exhaust ducts that will contain combustible deposits of any type require automatic sprinklers in accordance with NFPA 13 "Standard for Installation of Sprinkler Systems" (see Appendix A).
- 3-5.8 Clearance between metal ducts and stored combustible material should be at least 2-1/2 feet. Guards should be installed to assure this clearance.

### 3-6 THERMOMETER

- 3-6.1 On all standard models (except 800°F and 1000°F models), when the optional dial thermometer is purchased, insert it into the spring steel holder so that it extends at least three inches (3") into oven workspace.

### 3-7 ELECTRICAL

- 3-7.1 All electrical connections should be made in accordance with the appropriate local and national codes. Refer to NFPA 70 "National Electric Code" (see Appendix A).
- 3-7.2 Properly size the electrical supply using information provided on the oven nameplate. Electric supply must include a safety shut off such as a circuit breaker or fused disconnect switch between your power supply and the equipment.
- 3-7.3 Where a plug is provided, it must not be removed or changed. A properly sized circuit and receptacle must be installed.
- 3-7.4 The oven must be adequately grounded. Where a plug is provided, do not remove the ground prong. Grounding wire must be sized in accordance with local codes. Where more strict codes do not exist, refer to the National Electrical Code - NFPA 70. Ovens without a cord and plug have a grounding lug near the power input terminals.

#### 4 **PRIOR TO PLACING THE OVEN IN SERVICE**

- 4-1 Read instruction manual completely.
- 4-2 After the installation is completed, replace all covers and guards that had been removed for installation. At no time should equipment be operated if covers or guards are open, removed or partially closed.
- 4-3 Check incoming voltage against that shown on the nameplate.
- 4-4 Check operating current against nameplate rating.
- 4-5 Tighten all terminals, especially on power connections, to minimize terminal and component failure due to poor contact. Connections should be checked periodically for tightness and signs of overheating.
- 4-6 All ovens rated for temperatures above 500°F should be operated for 4 hours at 300°F to dry the insulation before heating to maximum temperature.
- 4-7 All ovens will produce smoke and odors when first heated. The smoke and odors come from three sources:
  - 1) Surfaces that were not heated during test such as shelves and pans
  - 2) Binders that remain in the insulation
  - 3) Moisture that has been absorbed by the insulation.

If during the initial run of the oven, the smoke and odors become objectionable, set the temperature at 300°F and allow the oven to remain at 300°F until the smoke is no longer generated. Increase the temperature in steps until you've reached the maximum operating temperature. It may take several days of running at the maximum operating temperature to eliminate all smoke and odors.

If the oven is not heated for an extended time period, moisture may accumulate in the insulation. When heated, this moisture will be driven out and the above process may have to be repeated.

- 4-8 Personnel operating, maintaining or supervising shall be instructed and trained in their job functions and be required to demonstrate an understanding of the equipment, its operation and safe operating procedures including emergency shutdown.
- 4-9 Equipment shall be operated in accordance with original design parameters.
- 4-10 Personnel operating, maintaining or supervising shall be informed of the danger of removing, or rendering ineffective, safety devices.

## 5 **PROCESSING**

### 5-1 **DO NOT LEAVE THIS EQUIPMENT IN OPERATION UNATTENDED**

When using any heat processing equipment there is always the risk of overheating due to a component malfunction. A trained operator should always be present. If this is not possible, the oven should be located where overheating will not cause damage to the building, adjacent stock or endanger personnel. Special consideration should be made for the potential of smoke damage should a fire ensue. Fire suppression equipment should be installed to protect the oven and building. Excess temperature limit interlock should be connected to the building alarm system.

5-2 When loading an oven care must be taken to avoid touching or insulating the thermocouple or temperature sensor. Free air movement around this sensor is essential for safe and correct temperature control.

5-3 Do not overload the oven. Air circulation is very important to the proper operation of an oven.

5-3.1 Ovens designed for shelf loading should not have parts placed on floor of work space. This surface is not designed to support a load.

5-3.2 Leave space between articles on each shelf to allow air to move between parts.

5-3.3 Parts should be staggered from one shelf to another, to prevent dead spots in the air pattern.

5-4 To turn oven on, push top of on-off switch in. When the oven is not in use, the on-off switch must be turned OFF - bottom pushed in. Do not rely on the thermostat to interrupt power to the heating elements indefinitely.

5-5 Set desired operating temperature on temperature controller; Refer to controller instructions included.

### 5-6 **EMERGENCY SHUT DOWN:**

-press power switch to "OFF" - bottom pushed in

-unplug oven

-disconnect power to oven at disconnect switch or circuit breaker

## 6 SAFETY EQUIPMENT

- 6.1 Practically all explosions and fires in ovens can be traced back to human error. It should be noted that:
  - 6-1.1 For the protection of personnel and property, careful consideration should be given to the supervision and monitoring of conditions that could cause, or could lead to, a real or potential hazard on any installation.
  - 6-1.2 The presence of safety equipment on an installation cannot, in itself, ensure absolute safety of operation.
  - 6-1.3 There is no substitute for a diligent, capable, well-trained operator.
  - 6-1.4 Highly repetitive operational cycling of any safety device can reduce its life span.
- 6-2 Thermostats, switches and electric relays should not be used as substitutes for electrical disconnects or unplugging equipment.
- 6-3 Regularly scheduled inspection, testing, and maintenance of all safety devices shall be performed. (See Section 7 - Maintenance and Appendix B - Minimum Periodic Maintenance Report)
- 6-4 Safety devices shall not be removed or rendered ineffective by bypassing them electrically or mechanically.
- 6-5 All units are equipped with a manual reset excess temperature limit interlock. Operating at temperatures above the setting of the excess temperature limit interlock will result in opening the circuit to the heating elements. These devices must be reset before power will be restored to the heating elements. If the excess temperature limit interlock repeatedly trips, the cause of over-heating should be determined and corrected before processing is continued.
  - 6-5.1 Non-adjustable excess temperature limit interlock (standard on Models NB, DR) will trip at approximately 50° to 100°F above the maximum operating temperature of the oven. These devices are reset by depressing the red button located on the rear of control panel. The non-adjustable excess temperature limit interlock is installed to protect the oven from a runaway condition. It is the users responsibility to monitor any product in the oven if over-heating can cause damage to the product or cause a fire.
  - 6-5.2 Adjustable excess temperature limit interlock (standard on Models NT and NTR) are mounted on the front of the control panel and have a dial on which to set the trip temperature. It is recommended that this temperature be set slightly (15° to 25°F) above the operating temperature to protect the oven workload as well as the oven from a runaway condition.
  - 6-5.3 Do not operate oven without a functional excess temperature interlock. Do not bypass or otherwise defeat the excess temperature interlock.
- 6.6 No matter how much safety equipment is provided on the oven, it cannot protect the operator, other personnel or property from unsafe conditions caused by poor judgement or misapplication. Common sense must be used for safe operation. If in doubt, contact the factory. Check the process periodically to ensure oven is being used as originally intended.

## 7 MAINTENANCE

- 7-1 For safe oven operation, a preventative maintenance program must be developed and followed for each individual oven application. The user should review recommendations from their insurance underwriters. We suggest the review of Factory Mutual (FM) Specification 6-9 on Industrial Ovens and Dryers and the National Fire Protection Association (NFPA) Specification 86 on Ovens and Furnaces. We also recommend a Maintenance Report be developed which lists tests and inspections performed. A copy of this report should be kept on file for future review.

A Minimum Periodic Maintenance Report is provided in Appendix B as an example for developing your own periodic maintenance schedule and report.

- 7-2 Regularly scheduled inspection and maintenance of all safety devices shall be performed by the user to ensure proper function. At a minimum, the unit should be fully inspected annually.
- 7-3 Disconnect electric power and any other energy source before servicing equipment. Ovens operate under high voltage and electrical shock is possible. Proper OSHA required lockout procedures should be followed.
- 7-4 Do not operate mechanical or electrical equipment with guards removed. Operating with guards removed could result in bodily injury.

### 7-5 RECOMMENDED MAINTENANCE ITEMS:

It shall be the sole responsibility of the user to establish, schedule and enforce the frequency of and the extent of the inspection/maintenance program (as well as the corrective action to be taken) because only the user can know what the actual operating conditions are. The tests should be made by personnel who are familiar with the equipment. It is usually better that maintenance personnel from mechanical and electrical departments check the equipment rather than regular oven operators. These additional hands and eyes may catch things that may be otherwise overlooked.

The following are minimum maintenance items we recommend be covered. Your list will vary depending upon the specific oven and operating conditions.

#### 7-7.1 Application

- 7-5.1.1 The user is responsible to insure that the oven process has not changed from the conditions for which it was originally purchased and that the oven is not modified. It is the user's responsibility to ensure that flammable solvents are not placed in the oven and the operating temperature does not exceed the maximum design temperature.

#### 7-5.2 Electrical

- 7-5.2.1 Periodically tighten all terminals, especially on power connections, to minimize terminal and component failure due to poor contact.
- 7-5.2.2 Periodically inspect contacts in relays for signs of wear or sticking.

### 7-5.3 Oven Body

- 7-5.3.1 Do not allow accumulation of combustible material or other foreign matter in the work space, heat chamber (including heating elements) ductwork, air inlets, exhaust outlets, control enclosures, motors, safety switches, door latches, and door hinges. Care must be taken in cleaning any combustible build-up to avoid creating a source of ignition (spark). Scraping with non-sparking tools or melting with steam is suggested. Lint and dust should be removed by vacuum cleaning. Blowing with compressed air or steam should be avoided if there is a possibility of explosion from a combustible dust cloud.
- 7-5.3.2 Do not allow accumulation of combustible material on work holders, drip pans or on floor of oven.
- 7-5.3.3 Temperature control and excess temperature limit interlock thermocouples or sensing bulb must be inspected periodically for damage. Location of these cannot be changed.
- 7-5.3.4 Oven repair by cutting, welding or any other method that could produce a source of ignition (spark) should be avoided and only then after all combustible deposits have been removed.

### 7-5.4 Duct Work

- 7-5.4.1 It is important oven ducts be kept clean. If they are subjected to a build-up of flammable deposits of condensed solvent, oil vapors, dust or other combustible debris they must be periodically cleaned. The build-up of condensed vapors or combustible debris is a major cause of fires. Cleaning frequency should be determined by process requirements.

### 7-5.5 Lubrication

- 7-5.5.1 Electric motors having oil holes require lubrication after every 25,000 hours or 3 years of light duty operation. Use a good grade of SAE 10 electric motor oil or as recommended by the manufacturer of the motor.

### 7-5.6 Doors/Gaskets

- 7-5.6.1 The oven doors should be inspected regularly to see that latches are holding the door firmly and uniformly against the oven providing a maximum sealing force.
- 7-5.6.2 The door should be inspected for damage which would allow excessive leakage of hot air. The gasket (Models NT and NTR only) should be replaced when damaged or when an adequate seal cannot be maintained.
- 7-5.6.3 The door and associated spring loaded latches should be checked periodically.

#### 7-5.7 Fans

- 7-5.7.1 Tighten set screws between fans and motor shaft before operating and check periodically.
- 7-5.7.2 Periodically inspect and clean fan wheels to remove any build-up of deposits on the blade surfaces.

#### 7-5.8 Contactors

(Note: Some temperature controllers and excess temperature limit interlocks control the current to the heating elements directly. In these cases, contactors will not be present.)

- 7-5.8.1 Temperature controller should cycle main contactor (if present) only. Separate (back-up) contactor should not cycle.
- 7-5.8.2 Excess temperature limit interlock should open both main contactor and separate (back-up) controller.

#### 7-5.9 Temperature Controls

- 7-5.9.1 Heat oven to operating temperature and check oven temperature at control point against a separate reliable temperature indicator to make sure temperature controller calibration is correct.
- 7-5.9.2 Heat oven above maximum operating temperature and make sure excess temperature limit interlock shuts down oven heat.
- 7-5.9.3 On temperature controllers and excess temperature limit interlocks with thermocouples, disconnect one side of thermocouple connection to confirm upscale break protection is operative.

#### 7-5.10 Location

- 7-5.10.1 The user is responsible to determine that facility changes in the vicinity of the oven have not created a hazardous condition. Specifically, the oven should be protected from external heat, vibration, mechanical hazards and corrosive environment.
- 7-5.10.2 Processes involving flammable liquids or creating explosive vapor or combustible dust clouds must not be located near the oven.
- 7-5.10.3 Portable fire extinguishers located in the vicinity of the oven must be inspected periodically.
- 7-5.10.4 Fire suppression system installed in the oven should be periodically tested. All sprinkler heads in oven and duct work should be periodically inspected and cleaned.

## 8 TROUBLE SHOOTING

### 8-1 NO HEAT

#### 8-1.1 Excess temperature limit interlock actuation

The excess temperature limit interlock may be tripped by either an excessively high oven temperature or a sensing element failure. Before placing the equipment back into operation, it should be determined what caused the excess temperature limit interlock to actuate and the condition be corrected.

Thermocouple actuated excess temperature limit interlocks are located in the face of the control panel and have a reset button on the face of the interlock.

Fluid filled excess temperature limit interlocks are located at the rear of the control panel and have a red reset button protruding from the control panel.

See the excess temperature limit interlock manufacturer's literature for the proper operation and adjustment of the control used. In either type of interlock, if the interlock fails to reset at room temperature, the sensing element has failed. For thermocouple actuated excess temperature limit interlocks, the thermocouples can be replaced. For fluid filled excess temperature limit interlocks, the entire interlock must be replaced.

#### 8-1.2 On/Off switch

Check for defective switch.

#### 8-1.3 A fuse burned out or circuit breaker tripped

Make sure there is power at the oven.

#### 8-1.4 Burned out heating element

Check there is power to each heating element and that elements are not open.

### 8.2 REDUCED OR INCORRECT OVEN TEMPERATURE

#### 8-2.1 Excessive exhaust

The amount of heated air removed from the oven may be excessive and result in a reduced operating temperature. In this case, the oven heat will be running continuously. This can be corrected by reducing the exhaust until the maximum operating temperature is achieved.

#### 8-2.2 Door Leakage

Damaged door gaskets (Model NT and NTR only) combined with excessive exhaust could result in cold air being drawn in around the doorway. Replace or repair gaskets and reduce exhaust.

#### 8-2.3 Fan Failure

Units with recirculating fans may have had a motor failure or the fan come loose on the motor shaft. This results in reduced air flow and inefficient heat transfer from the heating elements to the work space.

#### 8-2.4 Defective or Improperly Calibrated Temperature Controller

See the temperature controller manufacturer's instructions for the proper operation and adjustment for the specific controller used.



#### 8-2.5 Defective Thermocouples

Some temperature controllers and excess temperature limit interlocks are provided with thermocouples for sensing. Compare known reading at sensor inside oven to controller display. If it varies grossly, sensor may have to be replaced. If sensor is damaged or broken open, the controller display may give thermocouple error codes (see controller manual for proper error code meanings).

#### 8-2.6 Improper Line Voltage

Voltage at the oven should be measured to determine if an excessive line drop is causing reduced power input to the heating elements on an electrically heated oven. This could be caused by too many devices connected to the same circuit or by undersized wiring between the oven and the power source. Measure the voltage with the oven heating elements on and all other equipment on the same circuit operating.

## 9 **APPENDIX A - REFERENCES**

The following sources of additional information are referenced in these instructions. This is not presented as a complete list of all possible reference sources.

9.1 Factory Mutual Engineering Corporation  
1151 Boston-Providence Turnpike  
P.O. Box 9102  
Norwood, Massachusetts 02062  
Attn: Publications Order Processing  
  
Specifications 6-9, Industrial Ovens and Dryers

9.2 National Fire Protection Association  
One Batterymarch Park  
Quincy, Massachusetts 02209-9101

Most current issue of:

NFPA 86 - Ovens and Furnaces  
NFPA 70 - National Electric Code  
NFPA 10 - Standard for Portable Fire Extinguishers  
NFPA 11 - Standard for Low-Expansion Foam  
NFPA 12 - Standard on Carbon Dioxide Extinguishing Systems  
NFPA 13 - Standard for the Installation of Sprinkler Systems  
NFPA 14 - Standard for the Installation of Standpipe and Hose Systems  
NFPA 15 - Standard for Water Spray Fixed Systems for Fire Protection  
NFPA 17 - Standard for Dry Chemical Extinguishing Systems  
NFPA 17A - Standard for Wet Chemical Extinguishing Systems  
NFPA 25 - Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems  
NFPA 30 - Flammable and Combustible Liquids Code  
NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids

**10 APPENDIX B - MINIMUM PERIODIC BENCH OVEN INSPECTION REPORT**

Model: \_\_\_\_\_ Serial No.: \_\_\_\_\_

Inspected By: \_\_\_\_\_ Date: \_\_\_\_\_

**BEFORE APPLYING POWER CHECK THAT:**

- 1. \_\_\_\_\_ No changes in process have been made including types of materials processed and temperature:  
 -Oven originally purchased for: (Reference previous Inspection Report) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 -Oven being used for: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- 2. \_\_\_\_\_ No flammable solvents are involved in process.
- 3. \_\_\_\_\_ All electrical connections are tight without stray strands.
- 4. \_\_\_\_\_ All contactors and relays have been inspected for contact wear or sticking.
- 5. \_\_\_\_\_ Oven interior inspected, cleaned, and all foreign matter removed from:  
 \_\_\_\_\_ Floor  
 \_\_\_\_\_ Heat chamber (including heating elements)  
 \_\_\_\_\_ Duct work  
 \_\_\_\_\_ Air inlets  
 \_\_\_\_\_ Exhaust outlets  
 \_\_\_\_\_ Control enclosure and components  
 \_\_\_\_\_ Door hinges
- 6. \_\_\_\_\_ Remove and clean all drip pans. Inspect and clean all work racks, trays, holders or spacers.
- 7. \_\_\_\_\_ Locate temperature controller and excess temperature limit interlock sensor and inspect for damage. Make sure sensors are in free air and not touching anything.
- 8. \_\_\_\_\_ Inspect heating elements for contamination, distortion and adequate support.
- 9. \_\_\_\_\_ Doors are free to move and not obstructed.
- 10. \_\_\_\_\_ Exhaust ductwork from oven (if applicable) has been inspected and cleaned; all foreign matter removed.
- 11. \_\_\_\_\_ Lubricate motors.
- 12. \_\_\_\_\_ Inspect door latches and check for freedom of movement.
- 13. \_\_\_\_\_ Inspect and tighten set screws between fan and motor shaft.
- 14. \_\_\_\_\_ Inspect fan for residue build-up on fan blades and housing. Clean as necessary.

## 10 APPENDIX B - MINIMUM PERIODIC BENCH OVEN INSPECTION REPORT

### APPLY POWER AND CHECK:

15. \_\_\_\_ Supply voltage agrees with oven nameplate - measure and record: \_\_\_\_\_.
16. \_\_\_\_ Check that temperature controller does not cycle separate (back-up) contactor.
17. \_\_\_\_ Shut down oven and make sure main contactor and separate contactor are open.

### TEMPERATURE CONTROLS:

18. \_\_\_\_ Heat oven to operating temperature and check oven temperature against a separate reliable temperature indicator to make sure temperature controller calibration is correct.
19. \_\_\_\_ Set oven temperature above excess temperature limit interlock setting to make sure excess temperature limit interlock shuts down oven heat. If contactors are present, make sure both main and separate contactors open.
20. \_\_\_\_ On controllers with thermocouples, disconnect one side of thermocouple connection to confirm upscale break protection is operating on main temperature controller and excess temperature limit interlock.
21. \_\_\_\_ On adjustable excess temperature limit interlock, set temperature 15°F above normal maximum operating temperature.

### LOCATION:

22. \_\_\_\_ No changes in the oven area have created a hazardous condition such as external heat, vibration, mechanical hazard or corrosive environment.
23. \_\_\_\_ No process change has resulted in flammable liquids or explosive vapors or dust cloud being stored or produced in vicinity of oven.
24. \_\_\_\_ Portable fire extinguishers in the area have been inspected.
25. \_\_\_\_ Fire suppression systems, such as sprinkler system, have been inspected.
26. \_\_\_\_ Sprinkler heads in oven and duct work has been inspected and cleaned.

### TRAINING:

27. \_\_\_\_ Review job function, oven operation and emergency shutdown with operators and supervisors.

11 **APPENDIX C - REPLACEMENT PARTS LIST**  
(Please specify oven model and voltage when ordering)

**ITEM NUMBER**

**MODEL NB-350**

- Tubular heating element ..... B1000
- Electrical power cord with plug (115 volt only) .....PWRCRD12GA
- Temperature controller ..... B10-2-48
- Excess temperature limit interlock ..... LCH400
- Temperature controller knob ..... KNB450
- Door (specify whether right or left)...RIGHT..... DOORNB3R  
LEFT..... DOORNB3L
- Door catch. . . . . CTCH4
- Door latch pin. . . . . LTCH4
- Silicone rubber door gasket (requires 9 feet).....GSKTRBP
- Dial Thermometer (10°-290°C / 50°-550°F) ..... TDIAL

**MODEL NB-550**

- Tubular heating element (115 volt oven) ..... B1200
- Tubular heating element (230 volt oven) ..... B1500
- Electrical power cord with plug (115 volt only) .....PWRGRD10GA
- Temperature controller ..... D1V3036
- Excess temperature limit interlock ..... LCH575
- Temperature controller knob ..... KNB550
- Door (specify whether right or left)...RIGHT ..... DOORNB5R  
LEFT..... DOORNB5L
- Door catch. . . . . CTCH4
- Door latch pin. . . . . LTCH4
- Silicone rubber door gasket (requires 10 feet).....GSKTRBP
- Dial Thermometer (10°-290°C / 50° - 550°F) ..... TDIAL

**MODEL DR-350**

- Drawer (solid).....DWRDR3SLD
- Drawer (perforated) DWRDR3EXP
- Tubular heating element ..... B1000
- Electrical power cord .....PWRCRD12GA
- Temperature controller ..... B10-2-48
- Excess temperature limit interlock ..... LCH400
- Temperature controller knob ..... KNB450
- Dial Thermometer (10°-290°C / 50°-550°F) ..... TDIAL

**ALL MODELS NB and DR**

- Blower wheel. . . . . FG05203163HIW
- 115 volt, AC motor with 5/16" dia. shaft ..... MTR1/1001
- 230 volt, AC motor with 5/16" dia. shaft ..... MTR1/802
- Handle (door or drawer) ..... HNDLB
- Motor mount. . . . . MTRMNNB
- On-off switch. . . . SW212
- Pilot light..... 115 volt ..... PLT115R  
230 volt..... PLT230R

**APPENDIX C - REPLACEMENT PARTS LIST (Cont'd):**

**MODEL NT/NTR-800**

**ITEM NUMBER**

-Door (specify whether right or left)...RIGHT .....DOORNT8R  
LEFT .....DOORNT8L

**MODEL NT/NTR-1000**

-Door (specify whether right or left)...RIGHT .....DOORNT1R  
LEFT .....DOORNT1L

**MODEL NTR ONLY**

-Blower wheel. . . . . FG05203163HIW  
-115 volt, AC motor with 5/16" dia. shaft .....MTR1/1001  
-230 volt, AC motor with 5/16" dia. shaft .....MTR1/802  
-Motor mount (2 part assembly) .....MTRMNNT

**ALL MODELS NT/NTR**

-Handle (door). . . . . HNDLB  
-Tubular heating element (115v models only) .....B2400  
-Tubular heating element (230v models only) .....B3000  
-Electrical power cord (115v models only) .....PWRGRD10GA  
-On-off switch. . . . . SW212  
-Pilot light..... 115 VOLT .....PLT115R  
230 VOLT .....PLT230R  
-Door gasket (10 feet required) .....GSKTTDPL  
-1" X 1/8" flat fiberglass tape (11 feet required) .....GSKTTP1

**12 APPENDIX D - WARRANTY AND LIMITATIONS OF REMEDIES**

Any equipment sold is warranted for one (1) year after the Purchaser receives the equipment to be free from defects of material and workmanship. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF; WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, THE CORPORATION EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE PURCHASER'S EXCLUSIVE REMEDY FOR ANY BREACH OF THIS WARRANTY SHALL BE FOR THE REPAIR OR REPLACEMENT (AT THE CORPORATION'S OPTION) OF THE DEFECTIVE EQUIPMENT OR PART.

Parts under warranty are shipped via ground transportation. Express or expedited shipping costs are the sole responsibility of the customer. In order to obtain repair or replacement under this warranty, the user must deliver the defective product or part to the factory on a prepaid basis promptly after discovery of the defect. Warranty ceases to be effective if the equipment is altered or modified, repaired other than by persons authorized by THE CORPORATION, misused, used by any person in an unsafe or unreasonable manner or used other than in accordance with "THE CORPORATION's" written instructions. Although THE CORPORATION makes no additional or extended warranty with respect to thermostats, recorders, control equipment or other accessories, to the extent such items may also be warranted by their respective manufacturers, those warranties are passed on to you by THE CORPORATION as agent of the respective manufacturer and not as a separate warrantor.

In no event shall THE CORPORATION be liable for any direct, indirect, special, incidental or consequential damages hereunder, whether such damages are sought based on breach of warranty, breach of contract, negligence, strict liability in tort, or any other theory of legal liability.

**INSPECTION RECORD**

OVEN MODEL (Check One)

POWER SUPPLY (Check One)

- NB-350 ( )
- DR-350 ( )
- NB-550 ( )
- NT-800 ( )
- NTR-800 ( )
- NT-1000 ( )
- NTR-1000 ( )

- | <u>Volts</u> | <u>Phase</u> | <u>Hertz</u> |
|--------------|--------------|--------------|
| 115 ( )      | 1 ( )        | 50 ( )       |
| 208 ( )      | 3 ( )        | 60 ( )       |
| 230 ( )      |              |              |
| 460 ( )      |              |              |

**ASSEMBLED BY:** \_\_\_\_\_

**INSPECTED BY:** \_\_\_\_\_

**PACKED BY:** \_\_\_\_\_

**SERIAL NO.:** \_\_\_\_\_

(**Note:** If this oven is in any way defective, please return a copy of this Inspection Record with your report.)