



**Williamson-Thermoflo**  
A United Dominion Company

# Temp-O-Matic Oil Furnaces **TCF Counterflow** **Furnace Manual**

**KEEP THESE INSTRUCTIONS  
WITH FURNACE FOR FUTURE  
REFERENCE.**



Contents	Page
Read this first! .....	2
1. Check furnace location .....	3
2. Prepare furnace and place in position .....	6
3. Connect supply and return ducts .....	7
4. Venting .....	10
5. Connect fuel oil piping .....	11
6. Wire furnace and burner .....	11
7. Start-up .....	14
8. Checkout procedure .....	14
9. Troubleshooting .....	16
10. Service and maintenance .....	17
11. Components and replacement parts .....	20
12. Dimensions and ratings .....	22
13. Warranty .....	23
14. Owner's information .....	24

## Hazard definitions

**DANGER** Hazards that **will cause severe** personal injury, death or substantial property damage.

**WARNING** Hazards that **can cause severe** personal injury, death or substantial property damage.

**CAUTION** Hazards that **will or can cause minor** personal injury or property damage.

**NOTICE** Special instructions on installation, operation or maintenance that are important but not related to personal injury or property damage.

**WARNING** **INSTALLER** — Read all instructions before installing. **Read page 2 first.** Follow all instructions in proper order to prevent personal injury or death.

- Consider ducting, fuel supply, venting and installation when determining furnace location.
- Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

**WARNING** **USER** — Please read the following. Failure to comply could result in severe personal injury, death or substantial property damage.

- **This manual is for use only by your qualified heating installer/service technician.**
- Please see the **Owner's information** only, on back page of this manual. See page 23 for warranty.
- Have the furnace serviced by a qualified service technician, at least annually.

**WARNING** Do not store or use gasoline or other flammable liquids or vapors near this furnace or any other appliance.

**CAUTION** Ventilate house while operating furnace for the first time. Odors may be emitted for a brief period.

**WARNING** Do not alter this furnace in any way. The manufacturer will not be liable for any damage resulting from changes made in the field to the furnace or its components or from improper installation. Failure to comply could result in severe personal injury, death or substantial property damage.

**WARNING** This manual must only be used by a **qualified heating installer/service technician.** Furnace and burner must be installed and serviced only by a qualified heating installer/service technician. Failure to comply could result in severe personal injury, death or substantial property damage.

**NOTICE** When calling or writing about the furnace— Please have:

- furnace model number from the rating label and
- Serial number from the furnace casing. You may list the serial number and model number in the space provided on the "Installation and service certificate" found on page 15.

# Read this first!

**WARNING** Failure to adhere to the guidelines below can result in severe personal injury, death or substantial property damage.

## Service and maintenance —

1. To avoid electric shock, disconnect electrical supply before performing maintenance.
2. To avoid severe burns, allow furnace to cool before performing maintenance.
3. Perform service and maintenance as described in this manual and the burner manual.
4. Do not attempt to make adjustments to the blower or motor while the furnace is in operation. Disconnect power to the furnace and be sure all parts have stopped moving before attempting adjustments or maintenance.
5. The burner must be set up and adjusted using combustion test instruments. Visual examination of the flame alone cannot determine combustion performance.

## Operation —

6. Do not use the furnace as a construction heater.
7. Do not operate any furnace if the heat exchanger is damaged, corroded or pitted. Toxic flue products could enter the air stream.
8. Do not jumper, attempt to by-pass or override any limit control.
9. Do not block flow of combustion or ventilation air to furnace. Do not block or obstruct the air openings in the furnace casing.
10. Do not store or use combustible materials, gasoline, or other flammable liquids or vapors in the furnace area.
11. Do not operate the furnace if the furnace area will be exposed to air contaminants as described on page 5.
12. Should overheating occur, do not turn off or disconnect electrical supply to furnace. Instead, shut off the oil supply at a location external to the appliance, if possible.
13. Do not use this furnace if any part has been under water. Immediately call a qualified service technician to inspect the furnace and to replace any part of the furnace, control system or burner that has been under water.
14. Do not operate furnace if temperature rise through heat exchanger exceeds 85 °F.

15. Inspect, clean and replace (if necessary) return air filter regularly.
16. Do not obstruct return air grills or supply air outlets.
17. Supply only #2 fuel oil to the burner. Never attempt to use gasoline, a mixture of gasoline and oil, waste fuel, refuse or any other substance in the burner or furnace.

## Installation —

18. Do not block flow of combustion or ventilation air to furnace. Do not block or obstruct the air openings in the furnace casing.
19. Connect furnace only to a functional vent system, in good condition. Place the furnace to allow proper venting, with the shortest possible horizontal run and minimum number of elbows.
20. Always connect and seal a return air duct to the furnace unless the furnace is located in a large space, such as an unpartitioned basement. Route the return air duct to an adjacent room if no return air manifold is used.
21. Install furnace maintaining minimum clearances for service and separation from combustible surfaces described in this manual. If furnace is installed on a combustible floor, you must use the combustible floor base or provide the minimum clearance from the furnace to the floor as given in this manual.
22. Install, start-up, service and maintain burner per instructions in this manual and the burner manual.
23. Verify burner is properly inserted through the combustion chamber opening.
24. Furnace must be installed so that burner and control system components are protected from dripping, spraying water or rain during operation or service.
25. If installing an air conditioning evaporator coil, install the coil downstream of, or in parallel with, the furnace to prevent condensation on the furnace heat exchanger. If the coil is in parallel, provide means to prevent flow of chilled air into the furnace, including an interlock to prevent simultaneous operation of heating and air conditioning.

**NOTICE** Apply the following suggestions to prevent unsatisfactory operation of the furnace.

## Installation —

1. Be sure to level the furnace, using a spirit level on the front and one side. If the furnace is not level, oil can drip into the combustion chamber after burner cycling, causing fouling of the heat exchanger and the burner head.
2. Make sure all six leveling legs are in contact with the floor to distribute the load and prevent the possibility of undue noise or vibration.
3. Avoid locating return grills in rooms that may contain undesirable odors.
4. Never locate a return air grill closer than approximately 20 feet from the furnace.
5. Locate the furnace near the center of the supply and return duct systems.
6. Always check the size of the ducts on a replacement installation, particularly if adding air conditioning.

# 1 Check furnace location

## Pre-installation checklist

### Verify code compliance

- Local, state, provincial, and national codes, laws, regulations and ordinances
- NFPA-31, Installation of Oil-Burning Equipment
- National Electrical Code
- All local codes and/or regulations take precedence over the instructions in this manual and should be followed accordingly.

**NOTICE**

TCF furnaces, their burners and controls met safe lighting and other performance criteria when furnace underwent tests specified in Underwriters Laboratories Standard UL727.

### Check location and furnace specifications

Use the table below to verify:

- Furnace heating capacity
- Space is large enough to provide required clearances

Verify the installation will meet the requirements of this manual:

- Clearances (page 4)
- Combustion/ventilation air openings (pages 4-5)
- Supply air duct (page 7)
- Return air duct (page 7)
- Vent system (page 10)
- Fuel oil piping (page 11 plus burner manual)
- Electrical connection (page 11)

### Specifications – TCF-105

	Belt-drive	Direct-drive
<b>OUTPUT (DOE heating capacity, Btuh)</b>	68,000 / 84,000 / 96,000	
<b>CFM @ 0.25 i.w.c. external static pressure</b>	1000	1200
<b>CFM @ 0.50 i.w.c. external static pressure</b>	800	900
<b>Supply plenum connection, inches</b>	17 x 19 ¼	
<b>Return plenum connection, inches</b>	20 x 20	
<b>Filter size</b>	(2) 10 x 20	
<b>Electrical load, amps</b>	11	11
<b>Blower motor horsepower</b>	1/3	1/3
<b>Blower assembly/model</b>	9-9	9-9T
<b>Blower pulley</b>	5	NA
<b>Motor pulley</b>	3 ¼ x ½	NA
<b>Belt size, inches</b>	33	NA
<b>Two fresh air openings, each minimum, square inches</b>	85 / 105 / 120 (based on input)	
<b>Burner data</b> — Please read burner manual shipped with burner for nozzle sizing and other burner information.		

REVIEW AND COMMENT ONLY

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# 1 Check furnace location (continued)

## Clearances

### Minimum clearance to combustible materials

1. Install the furnace, ductwork and vent such that no combustible surface is closer than listed in Table 1. Use a combustible floor base if on combustible floor.

**NOTICE** Flue pipe clearances must take precedence over jacket clearances (listed below).

### Service accessibility clearances

1. Provide no less than the minimum clearances given in Table 1 to ensure the furnace can be properly operated, serviced and maintained.
2. Always apply whichever clearance is **LARGER** — combustible construction or service accessibility.

**Table 1** Minimum clearances

Minimum clearances from furnace, ductwork and vent		
Service accessibility clearances are recommended minimum dimensions to allow access to furnace components (motor, blower, filters, etc.).	TCF Furnaces	
	To combustible construction	For service accessibility
Top of plenum to ceiling	2"	
Above warm air duct within 6 feet of furnace	2"	
Front of furnace	18" (alcove)	18"
Flue pipe (or barometric draft control) to combustible ceiling	18" (note 1)	
Flue pipe (or barometric draft control) to combustible wall	9" (note 1)	
Rear or side of furnace	6"	
Warm air plenum to wall	2"	
Combustible floor	12" (note 2)	
Note 1: Single wall metal vent (or barometric draft control) can be no closer than 18 inches to combustible ceiling or 9 inches to combustible wall. Apply requirements of NFPA 31 and local codes to reduce clearance using double-wall vent pipe and/or protective insulation between the flue pipe (or draft control) and combustible surfaces. Minimum clearance when using Type L double-wall vent pipe is 6". Note 2: This clearance is not required when the furnace is installed on the optional combustible floor base. This base is 2¼ inches high and provides proper protection for combustible flooring.		

## Flooring and foundation

### Flooring

TCF furnaces are approved for installation on combustible flooring, but must never be installed on carpeting. Install a TCF furnace on combustible flooring **ONLY** if using the optional combustible flooring base.

**WARNING** Do not install furnace on carpeting even if foundation is used. Fire can result, causing severe personal injury, death or substantial property damage.

### Foundation

1. Provide a solid brick or minimum 2-inch thick concrete foundation pad if any of the following is true:
  - the floor can become flooded.
  - the furnace mounting area is not level.

## Residential garage installations

Take the following special precautions when installing the furnace in a residential garage. If the furnace is located in a residential garage:

- Mount the furnace a minimum of 18 inches above the floor of the garage.
- Locate or protect the furnace so it cannot be damaged by a moving vehicle.

## Air for combustion and ventilation

**WARNING** Adequate combustion and ventilation air ensures proper combustion and reduces risk of severe personal injury or death from possible flue gas leakage and carbon monoxide emissions.

**WARNING** Do not install exhaust fan in furnace room.

### Consider building construction

Older buildings with single-pane windows, minimal weather-stripping and no vapor barrier often provide enough natural infiltration and ventilation without dedicated openings.

New construction or remodeled buildings are most often built tighter. Windows and doors are weather-stripped, vapor barriers are used and openings in walls are caulked. As a result, such tight construction is unlikely to allow proper natural air infiltration and ventilation.

For buildings with tight construction, provide openings directly to outside or to a ventilated crawl space or attic. Size the openings to the same specifications as for the furnace location per the following paragraphs.

Follow state, provincial or local codes when sizing adequate combustion and ventilation air openings. In absence of codes, use the following guidelines when furnace is in a confined room (defined by NFPA 31 as less than 7200 cubic feet per 1 GPH input of all appliances in area. A room 8 ft. high x 30.0 ft. x 30.0 ft. is 7200 cu. ft.).

# 1 Check furnace location (continued)

## Air for combustion and... (continued)

### Provide two permanent openings:

#### Opening locations

One within 12 inches of ceiling, one within 12 inches of floor. Minimum height or length dimension of each rectangular opening should be at least 3 inches.

#### When inside air is used:

Each opening must freely connect with areas having adequate infiltration from outside. Each opening should be at least 140 sq. in. per 1 GPH input (1 sq. in. per 1000 Btu input) of all fuel-burning appliances plus requirements for any equipment that can pull air from room (including clothes dryer and fireplace).

#### When outside air is used:

Connect each opening directly, by ducts to the outdoors, or to crawl or attic space that freely connects with outdoors. Size per below:

- Through outside wall or vertical ducts — at least 35 sq. in. per 1 GPH input (1 sq. in. per 4000 Btu input) of all fuel burning appliances plus requirements for any equipment that can pull air from room (including clothes dryer and fireplace).
  - Through horizontal ducts — at least 70 sq. in. per 1 GPH furnace input (1 sq. in. per 2000 Btu input) of all fuel-burning appliances plus requirements for any equipment that can pull air from room (including clothes dryer and fireplace).
  - Where ducts are used, they should have the same cross-sectional area as free area of openings to which they connect. Compensate for louver, grille or screen blockage when calculating free air openings. Refer to their manufacturer's instructions for details. If unknown, use:
    - Wood louvers, which provide 20-25% free air.
    - Metal louvers or grilles, which provide 60-75% free air.
- Lock louvers in open position or interlock with equipment to prove open before furnace operation.

### Basement installations

When the furnace is located in an unconfined space, such as an unpartitioned basement, adequate air should normally be available without additional openings. An unconfined space is defined as one having no less than 50 cubic feet room volume per 1,000 Btuh input of all appliances in the space.

If the house is of tight construction, provide air openings to the basement directly from outside or from a ventilated attic. Size the openings as described above under "When outside air is used."

### Closet installations — special NOTICE

#### Openings in closet doors

Provide TWO openings — one within 6 inches of top of closet door, the other within 6 inches of the bottom of closet door.

EACH opening must be at least 24 inches wide by 12 inches high.

**WARNING** Advise homeowner that the openings to the closet must never be obstructed or blocked in any way. Failure to provide adequate air for combustion and ventilation could result in severe personal injury, death or substantial property damage.

## Air contamination

Please review the following information on potential combustion air contamination problems.

See Table 2 for products and areas which may cause contaminated combustion air.

**WARNING** To prevent potential of severe personal injury or death, check for products or areas listed below before installing furnace. If any of these contaminants are found:

- remove contaminants permanently.
- OR —
- isolate furnace and provide outside combustion air. See national, provincial or local codes for further information.

**Table 2** Corrosive contaminants and likely locations

Products to avoid
Spray cans containing chloro/fluorocarbons
Permanent wave solutions
Chlorinated waxes/cleaners
Chlorine-based swimming pool chemicals
Calcium chloride used for thawing
Sodium chloride used for water softening
Refrigerant leaks
Paint or varnish removers
Hydrochloric acid/muriatic acid
Cements and glues
Antistatic fabric softeners used in clothes dryers
Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms
Adhesives used to fasten building products and other similar products
Areas likely to have contaminants
Dry cleaning/laundry areas and establishments
Swimming pools
Metal fabrication plants
Beauty shops
Refrigeration repair shops
Photo processing plants
Auto body shops
Plastic manufacturing plants
Furniture refinishing areas and establishments
New building construction
Remodeling areas
Garages with workshops

## 2 Prepare furnace and place in position

### Inspect & prepare furnace

#### Remove furnace from carton

Remove the furnace from its shipping carton and inspect thoroughly. Remove access panels to inspect the furnace interior.

**NOTICE** Immediately file a claim with the transportation company if you discover concealed damage.

**WARNING** Do not install or attempt to operate the furnace if the heat exchanger, burner or controls have been damaged. Immediately contact your furnace supplier. Operating a damaged furnace could result in severe personal injury, death or substantial property damage.

#### Prepare burner

Remove the burner from its shipping carton and inspect thoroughly. Read the burner manual and follow instructions for preparing and installing the burner.

Install the correct nozzle for the required firing rate, using the burner manual shipped with the burner. Follow the burner manual instructions for nozzle installation. Verify the correct setting of electrodes after nozzle and burner oil tube assembly are in place.

### Openings in walls, floor & ceiling

#### General

Ensure that the finished door opening to the furnace room is large enough to install and remove the furnace, water heater or any other appliances in the room.

Before placing furnace in a closet or small room, cut all openings required in floor, ceiling or walls for ducts and vent. This will simplify the work and prevent construction dust from entering the furnace heat exchanger.

**WARNING** Verify that all clearances to combustible construction and as needed for service accessibility will be met. The vent must be no closer than 18 inches to any combustible surface unless closer clearances are specified in this manual; when using type L double-wall vent pipe; or when constructed per the requirements of NFPA 31. Provide ventilated thimble per all applicable codes where vent pipe passes through wall or ceiling. Failure to comply could result in severe personal injury, death or substantial property damage.

#### Duct locations and sizing

Verify the size of the supply and return duct system is sufficient for the application. The pressure drop through the duct system must not exceed 0.2 inches water column. The total drop through the duct system and air conditioning condensing coil (if used) must not exceed 0.5 inches water column.

See suggested duct sizing in this manual. For more detailed sizing information, refer to ACCA Manual D.

### Openings . . . (continued)

#### Supply and return ducts

You must install a return air duct, sealed to the furnace, even if no return manifold is used. Cut the required opening for the supply air duct in the floor of the room before placing the furnace. See Table 3 for required size of combustible floor opening and supply plenum.

**NOTICE** Verify that the filter will be easily accessible for removal after the furnace is in place.

When installing on **combustible flooring**, provide supply plenum size and floor opening as given in Table 3.

**Table 3** Combustible floor provisions for supply

Furnace model number	Combustible floor opening for supply duct	Supply plenum size
TCF-105	20 ½" x 23"	18" x 20 ½"

### Install furnace and burner

#### Install combustible floor base

If the furnace will be mounted on a combustible floor, you must install the optional combustible floor base.

#### Place furnace

Place the furnace in the desired location. Measure clearances and verify per page 4 of this manual.

Level the furnace using a spirit level on the front and one side.

#### Inspect combustion chamber

Inspect the combustion chamber. Verify it is in good condition and correctly in position inside the heat exchanger. The burner opening in the chamber must align with the burner heat exchanger opening.

**WARNING** The combustion chamber is constructed of ceramic fiber materials. See the WARNING information on page 18 of this manual. Comply with these instructions when handling any ceramic fiber or fiberglass materials. Failure to adhere to these guidelines could result in severe personal injury or death.

#### Insert burner

Following the burner manual instructions, install the burner and its gasket in the burner opening. Make sure the burner passes through the opening in the combustion chamber and does not protrude more than ¼ inch into the chamber.

Secure the burner in place with the three nuts and washers provided. Wire and pipe fuel to the burner per burner manual and this manual.

### 3 Connect supply and return ducts

#### Duct sizing

##### Determine air flow CFM

The temperature rise through the furnace must not exceed 85°F and should be at least 55°F for comfort. When calculating air flow, assume a temperature rise of 70°F.

The sensible heat temperature change for cooling would be approximately 27–30°F. Actual temperature change will be approximately 18–21°F due to humidity of the air.

To calculate the sensible heat temperature change ( $\Delta T$ ), you can use the formula:

$$\Delta T = \text{Btuh} / (1.1 \times \text{CFM}) \quad \text{Eq. 3-1}$$

To calculate air flow when you know temperature change ( $\Delta T$ ), you can use:

$$\text{CFM} = \text{Btuh} / (1.1 \times \Delta T) \quad \text{Eq. 3-2}$$

You can estimate air flow using the following rules of thumb:

- Heating: **14 CFM per 1,000 Btuh** output Eq. 3-3
- Cooling: **400 CFM per ton** air conditioning Eq. 3-4

Determine the required air flow based on whichever is larger — heating mode or air conditioning mode.

Examples:

- What would the temperature rise be for a 100,000 Btuh output furnace with an air flow rate of 1200 cfm?

Use Equation 3-1 since you know CFM and Btuh:

$$\Delta T = 100,000 / (1.1 \times 1200) = 76^\circ\text{F}$$

- The temperature rise would be 76°F.
- If the air enters the furnace at 70°F, it would leave the furnace at 70°F + 76°F = 146°F.

- What would the air flow be to obtain a 70°F rise through a 120,000 Btuh output furnace?

Use equation 3-2 since you know  $\Delta T$  and Btuh:

$$\text{CFM} = 120,000 / (1.1 \times 70) = 1,558 \text{ CFM}$$

- The air flow would have to be 1,558 CFM to obtain a temperature rise of 70°F.

- Estimate the required air flow for a 75,000 Btuh output furnace installed with a 2-ton air conditioning evaporator coil.

Heating mode air flow (use Equation 3-3):

$$\text{CFM} = 75 \times 14 = 1,050 \text{ cfm}$$

Cooling mode air flow (use Equation 3-4):

$$\text{CFM} = 2 \times 400 = 800 \text{ cfm}$$

- The larger number is 1,050 cfm (heating), so the duct system should be sized for 1,050 cfm.
- The supply duct would need to be 16" round or a rectangular equivalent such as 8" x 25" or 12" x 16", using Table 5, page 8.

- Estimate the required air flow for the same furnace installed with a 4-ton air conditioning evaporator coil.

Heating mode air flow is still 1,050 cfm.

Cooling mode air flow (use Equation 3-4):

$$\text{CFM} = 4 \times 400 = 1,600 \text{ cfm}$$

- The larger number is 1,600 cfm (cooling), so the duct system should be sized for 1,600 cfm.
- The supply duct would need to be 18" round or a rectangular equivalent such as 8" x 36" or 12" x 21", using Table 5, page 8.

**CAUTION** Always check the size of existing ducts, particularly if you are adding air conditioning. The air pressure loss through the cooling evaporator coil reduces available air flow. If the ducts are too small as well, the system may not work satisfactorily on either heating or cooling.

#### Determine duct dimensions

Table 5, page 8, and Table 6, page 9, provide typical round and rectangular duct sizes for rectangular and flat oval galvanized ducts. Do not apply these tables to size ductwork if the total equivalent length of the duct exceeds approximately 100 feet. For longer systems or for ductboard, fiberglass-lined or flexible duct sizing, use the ACCA Manual D or the ACCA duct sizing slide rule. These tables are based on pressure loss of approximately 0.10 inch water column per 100 feet equivalent length of duct.

Use Table 4 below to size or check sizing of take-offs to supply registers or return grills.

Verify the size and type of registers, diffusers and grills from the manufacturer's ratings. Do not exceed the recommended flow rate. The pressure drop allowance for each should not exceed approximately 0.05 inch water column.

Install a return air filter, sized per specifications in page 3.

Use only a return air filter mounted to the furnace. Do not add additional filters unless the duct system is carefully sized to allow for the additional pressure drop.

**Table 4** Suggested maximum flow to runouts

TAKE-OFF SIZE (Inches)	CFM	
	SUPPLY	RETURN
<b>Sheet metal or ductboard</b>		
5 Round	60	45
6 Round	100	75
7 Round	140	110
8 Round	210	160
3 1/4 x 8 Stack	70	55
3 1/4 x 10 Stack	100	75
3 1/4 x 14 Stack	140	110
2 1/4 x 12 Stack	70	55
2 1/4 x 14 Stack	90	70
<b>Flexible duct (keep bends to minimum)</b>		
6 Round	55	40
8 Round	120	90
10 Round	200	160
12 Round	320	250
14 Round	480	375
16 Round	660	530
18 Round	880	680
20 Round	1200	900

### 3 Connect supply and return ducts (continued)

#### Duct sizing (continued)

**Table 5** Typical duct sizing for systems not over 100 feet equivalent length — round or rectangular galvanized

		<b>Typical duct sizing</b>																
		<small>(For approximately 0.10 inches w.c. in a typical residential installation of galvanized metal duct)</small>																
<b>CFM</b>	<b>Round duct diameter (inches)</b>	<b>Rectangular duct equivalent sizes</b>																
		<b>Minimum width (inches) for duct heights (inches) of:</b>																
		4 x	5 x	6 x	7 x	8 x	9 x	10 x	12 x	14 x	16 x	18 x	20 x	22 x	24 x	26 x	28 x	30 x
45	4	4	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	5	6	5	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-
100	6	8	6	5	5	4	4	-	-	-	-	-	-	-	-	-	-	-
150	7	12	9	7	6	5	5	5	4	4	-	-	-	-	-	-	-	-
200	8	14	11	9	8	7	6	6	5	4	4	-	-	-	-	-	-	-
250	9	18	13	10	9	8	7	6	6	5	5	4	4	-	-	-	-	-
300	9	20	15	12	10	9	8	7	6	6	5	5	4	4	-	-	-	-
400	10	26	19	15	13	11	10	9	8	7	6	6	5	5	5	4	4	-
500	12	32	23	18	15	13	12	11	9	8	7	6	6	6	5	5	5	5
600	12	38	28	22	18	15	13	12	10	9	8	7	7	6	6	6	5	5
700	12	46	32	25	20	17	15	14	11	10	9	8	7	7	7	6	6	6
800	14	52	36	28	23	19	17	15	13	11	10	9	8	8	7	7	6	6
900	14	58	41	31	25	21	19	17	14	12	11	10	9	8	8	7	7	7
1000	16	64	45	34	28	23	20	18	15	13	11	10	9	9	8	8	7	7
1100	16	72	49	38	30	25	22	19	16	14	12	11	10	9	9	8	8	7
1200	16	-	54	41	33	27	24	21	17	15	13	12	11	10	9	9	8	8
1300	16	-	58	44	35	29	25	22	18	16	14	12	11	10	10	9	9	8
1400	18	-	63	47	38	31	27	24	19	16	14	13	12	11	10	10	9	9
1500	18	-	68	51	40	34	29	25	20	17	15	14	12	12	11	10	10	9
1600	18	-	72	54	43	36	30	27	21	18	16	14	13	12	11	11	10	9
1700	18	-	-	58	45	38	32	28	23	19	17	15	14	13	12	11	10	10
1800	18	-	-	61	48	40	34	29	24	20	17	16	14	13	12	11	11	10
1900	20	-	-	64	51	42	35	31	25	21	18	16	15	14	13	12	11	11
2000	20	-	-	68	53	44	37	32	26	22	19	17	15	14	13	12	12	11
2200	20	-	-	-	59	48	41	35	28	23	20	18	16	15	14	13	12	12
2400	22	-	-	-	64	52	44	38	30	25	22	19	17	16	15	14	13	12
2600	22	-	-	-	69	56	47	41	32	27	23	21	19	17	16	15	14	13
2800	22	-	-	-	-	61	51	44	34	29	25	22	20	18	17	15	15	14
3000	22	-	-	-	-	65	54	47	37	30	26	23	21	19	17	16	15	14
3500	24	-	-	-	-	-	63	54	42	34	29	26	23	21	19	18	17	16
4000	26	-	-	-	-	-	72	61	47	39	33	29	26	23	21	20	19	18

**WARNING** Do not apply this table for duct systems over approximately 100 equivalent feet length. For longer systems or systems using other duct materials, refer to ACCA Manual D. Incorrectly sizing duct systems can result in unsafe or uncomfortable operation.

### 3 Connect supply and return ducts (continued)

#### Duct sizing (continued)

**Table 6** Typical duct sizing for systems not over 100 feet equivalent length — round or flat oval galvanized

<b>Typical duct sizing</b>														
<small>(For approximately 0.10 inches w.c. in a typical residential installation of galvanized metal duct)</small>														
CFM	Round duct diameter (inches)	Flat oval duct equivalent sizes												
		Minimum width (inches) for duct heights (inches) of:												
		3 x	4 x	5 x	6 x	7 x	8 x	9 x	10 x	12 x	14 x	16 x	18 x	20 x
45	4	6	5	-	-	-	-	-	-	-	-	-	-	-
65	5	8	6	-	-	-	-	-	-	-	-	-	-	-
100	6	11	8	7	-	-	-	-	-	-	-	-	-	-
150	7	16	11	9	8	-	-	-	-	-	-	-	-	-
200	8	21	15	11	10	8	-	-	-	-	-	-	-	-
250	9	26	18	14	11	10	9	-	-	-	-	-	-	-
300	9	30	20	16	13	11	10	-	-	-	-	-	-	-
400	10	40	26	20	16	14	12	11	-	-	-	-	-	-
500	12	49	32	24	19	16	14	13	12	-	-	-	-	-
600	12	59	38	28	22	19	16	15	13	-	-	-	-	-
700	12	69	44	32	25	21	18	16	15	13	-	-	-	-
800	14	-	50	36	29	24	20	18	16	14	-	-	-	-
900	14	-	56	41	32	26	22	20	18	15	-	-	-	-
1000	16	-	63	45	35	29	24	22	19	17	15	-	-	-
1100	16	-	69	49	38	31	26	23	21	18	16	-	-	-
1200	16	-	75	53	41	33	28	25	22	19	17	-	-	-
1300	16	-	-	58	44	36	30	26	24	20	18	-	-	-
1400	18	-	-	62	47	38	32	28	25	21	18	17	-	-
1500	18	-	-	66	50	41	34	30	26	22	19	18	-	-
1600	18	-	-	71	54	43	36	31	28	23	20	18	-	-
1700	18	-	-	-	57	46	38	33	29	24	21	19	-	-
1800	18	-	-	-	60	48	40	35	31	25	22	20	-	-
1900	20	-	-	-	63	50	42	36	32	26	23	21	19	-
2000	20	-	-	-	67	53	44	38	33	27	24	21	20	-
2200	20	-	-	-	73	58	48	41	36	29	25	23	21	-
2400	22	-	-	-	-	63	52	44	39	32	27	24	22	21
2600	22	-	-	-	-	68	56	48	42	34	29	25	23	22
2800	22	-	-	-	-	-	60	51	44	36	30	27	24	23
3000	22	-	-	-	-	-	64	54	47	38	32	28	26	24
3500	24	-	-	-	-	-	-	63	54	43	36	32	28	26
4000	26	-	-	-	-	-	-	71	61	48	40	35	31	29

**WARNING** Do not apply this table for duct systems over approximately 100 equivalent feet length. For longer systems or systems using other duct materials, refer to ACCA Manual D. Incorrectly sizing duct systems can result in unsafe or uncomfortable operation.

## 4 Venting

### General venting requirements

**WARNING**

Failure to follow all instructions can result in flue gas spillage and carbon monoxide emissions, causing severe personal injury or death.

**DANGER**

Inspect existing chimney before installing furnace. Clean chimney thoroughly. Replace or repair chimney if visual inspection indicates chimney may be unsuitable for use. Insufficient draft can cause flue gas leakage and carbon monoxide emissions. Failure to clean or replace perforated pipe or tile lining and/or patch mortar and joints can cause severe personal injury or death.

- TCF furnaces are designed to operate with an over-fire draft of -0.01" to -0.02" w.c. Proper draft for these oil furnaces may be achieved using either a conventional chimney (natural draft) or a power vent (sidewall) system that has been properly designed for use with oil-fired equipment. Power vent manufacturer's instructions must be followed.
- Use vent material approved by local codes for oil-fired burners. In their absence, refer to:
  - NFPA 31, Installation of Oil-Burning Equipment.
  - NFPA 211, Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.
  - In Canada, refer to CSA B139, Installation Code for Oil-Burning Equipment.
  - NFPA 211 requires chimney to be lined before connected to furnace.
- To prevent downdrafts, extend chimney at least 3 feet above highest point where it passes through roof and 2 feet higher than any portion of building within 10 feet. Increase chimney cross-sectional area and height at least 4% per 1,000 feet above sea level.
- Provide minimum clearances from vent (flue) pipe to combustible material:
  - Single-wall vent — 18 inches minimum
  - Type "L" double-wall vent — 6 inches minimum
- Provide a chimney no smaller than that listed in Table 7.

**NOTICE**

Oversized chimneys, outside masonry chimneys and/or derated inputs can result in condensation in chimney.

### Connect venting

**WARNING**

Long horizontal vent runs, excessive number of tees and elbows, or other obstructions restricting combustion gas flow can result in the possibility of condensation, flue gas leakage and carbon monoxide emissions, which can lead to severe personal injury or death.

1. The horizontal vent must slope upwards, away from the furnace, a minimum of ¼ inch per foot.
2. Connect full-sized venting when possible. See Table 7.
3. Connection must be made above bottom of chimney to avoid blockage. Vent pipe must not enter chimney far enough to cause obstruction. Use thimble or slip joint where vent pipe enters chimney to allow removal for cleaning.

### Connect venting (continued)

4. When burner and furnace are properly installed, draft overfire will be approximately -0.01" to -0.02" w.c. Install barometric control in vent, per control manufacturer's instructions, when excess draft needs to be relieved or to comply with applicable codes and regulations. Use draft gauge to adjust proper opening.
5. An induced draft fan for the chimney may be necessary if:
  - Excessive resistance to flow of combustion gases can be expected.
  - Cross-sectional area of chimney is smaller than minimum recommended.
  - Chimney height is less than recommended.
  - When using induced draft fan seal all vent joints and interlock burner with fan operation.

**Table 7** Minimum chimney/vent size

Furnace model number	Minimum vent diameter	Minimum chimney size		Minimum chimney height
		Rectangular (minimum inside dimensions)	Round	
TCF-105	6"	6" x 6"	6"	15'

### Vent dampers

**WARNING**

Do not install a thermal-type vent damper on this furnace. Failure to comply could result in severe personal injury, death or substantial property damage.

**NOTICE**

If vent damper is required, use only a motorized vent damper, installed and wired to the furnace following the vent damper manufacturer's instructions.

### Barometric draft control

1. Install barometric draft control in vent pipe at least one foot from the furnace vent connection, preferably in the highest part of the vent pipe before the vent enters the chimney. If headroom doesn't provide enough clearance to locate the control at least one foot from the vent connection, install an elbow at the furnace and mount the control in a horizontal pipe at least one foot from the elbow. Install an elbow after the control to turn vertically.
2. The barometric draft control must be located in the same room as the furnace to operate correctly.
3. Ensure the barometric draft control is accessible. Adjust the damper to obtain the correct overfire draft, as described in this manual and the burner manual.

## 5 Connect fuel oil piping

### General oil piping requirements

- Location and installation of oil tanks, oil piping and burners must follow:
  - NFPA 31, Standard for the Installation of Oil-Burning Equipment.
  - In Canada, CSA B139, Installation of Oil-Burning Equipment.
  - Local codes and regulations.
  - Information provided with burner and fuel pump.
- If any part of fuel oil tank is above level of burner, an anti-siphon device must be used to prevent flow of oil in case of oil line break.
- Support oil lines as required by codes.
- Make tank connections with swing joints or copper tubing to prevent breaking in case the tank settles. Make swing joints so they will tighten as tank settles. Non-hardening pipe joint compounds should be used on all threads.

**WARNING** Do not use Teflon tape as an oil pipe sealant. It can cause valves to fail, creating hazards. Use only flare fittings. Do not use compression fittings. Failure to comply could result in severe personal injury, death or substantial property damage from oil leakage and/or fire hazard.

- Underground pipe must be run in a casing to prevent oil leaking into ground or under floor. Check local codes for information.

### Oil piping connection at burner

- Connect oil line to burner using a flare fitting.

**WARNING** Use of any connection other than a flare fitting at the oil connection to the burner could result in a fuel oil leak, with the potential for severe personal injury, death or substantial property damage.

- See local codes for appropriate arrangement and piping of filter, control valves, etc. connecting to oil tank.
- Refer to burner manual for oil system requirements. Verify that suction lift does not exceed stated limit. Where lift exceeds limit for a one-pipe system, use a two-pipe system as directed in burner manual.

**WARNING** Auxiliary limit control — The auxiliary limit control will shut the furnace off when air flow through the furnace is reduced excessively. This can occur if the filter becomes clogged, return or supply air is blocked, the motor fails or the blower belt breaks. If the furnace shuts down, inspect the filter, motor and duct system to determine the cause before attempting to restart the furnace. Be sure to replace access doors when returning furnace to operation. Failure to correct the condition could result in a hazardous condition.

## 6 Wire furnace & burner

**WARNING** Electric shock hazard. Can cause severe personal injury or death if power source, including service switch on furnace, is not disconnected before installing or servicing.

### Wire burner

The burner harness is factory-wired to the furnace at the factory. Plug the burner harness into the mating burner connector to wire the burner. Refer to the wiring diagram on pages 12 and 13 for further information.

### Install and wire thermostat

Locate the room thermostat on an interior wall in the natural circulating path of room air. Do not locate thermostat so it is exposed to cold air infiltration, drafts from windows or doors, air currents from supply or return air registers, behind obstructions, on a shelf, in a closet, or in a corner.

Ensure the thermostat won't be exposed to heat from nearby fireplace, radio, television, lamp or rays from the sun. Do not mount thermostat on a wall over a supply or return duct, chimney or vent.

Wire thermostat to furnace and set thermostat anticipator as shown on wiring diagram, pages 12 and 13.

### Connect power wiring

All wiring must conform to:

- National Electrical Code, ANSI/NFPA 70, latest edition and any additional national, state or local codes.
- In Canada, CSA C22.1 Canadian Electrical Code Part One and any local codes.
- Wiring must be N.E.C. Class 1. If original wire as supplied with furnace must be replaced, type 105 °C wire or equivalent must be used. Supply wiring to furnace and additional control wiring must be 14 gauge or heavier.
- Provide electrical ground at furnace as required by codes.

Connect 120 VAC/60 Hertz, single phase separate electrical line from the main house panel to the power leads in the external burner junction box as shown on wiring diagram, pages 12 and 13. Provide a fused disconnect in the power wiring, following all local codes.

Ensure the wire size and type are adequate for the electrical load (see page 3 and furnace nameplate for value).

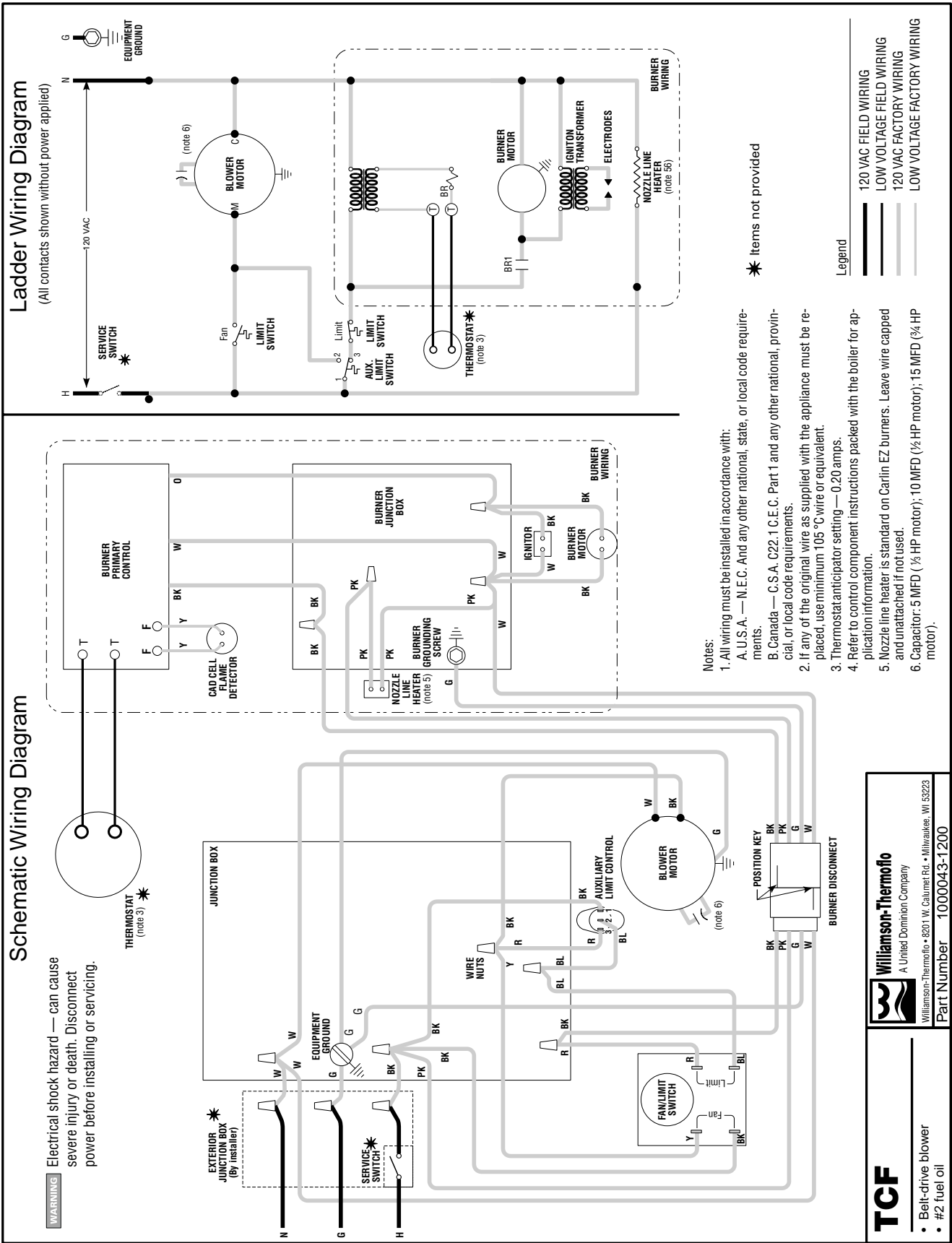
### Limit control

The furnace is equipped with a fan switch/limit control. This control limits the air leaving the heat exchanger to 200°F or less. The fan switch continues fan operation until the air drops to a preset temperature. For most installations, set the blower ON setting at 140°F and blower OFF setting at 90°F. If a longer cool down period is desired, lower the OFF setting.

Counterflow furnaces also contain an auxiliary limit control to prevent blower motor and filters from being overheated. See WARNING at left.

# 6 Wire furnace & burner (continued)

**Figure 1** Wiring — TCF furnaces with belt-drive blowers



**TCF**

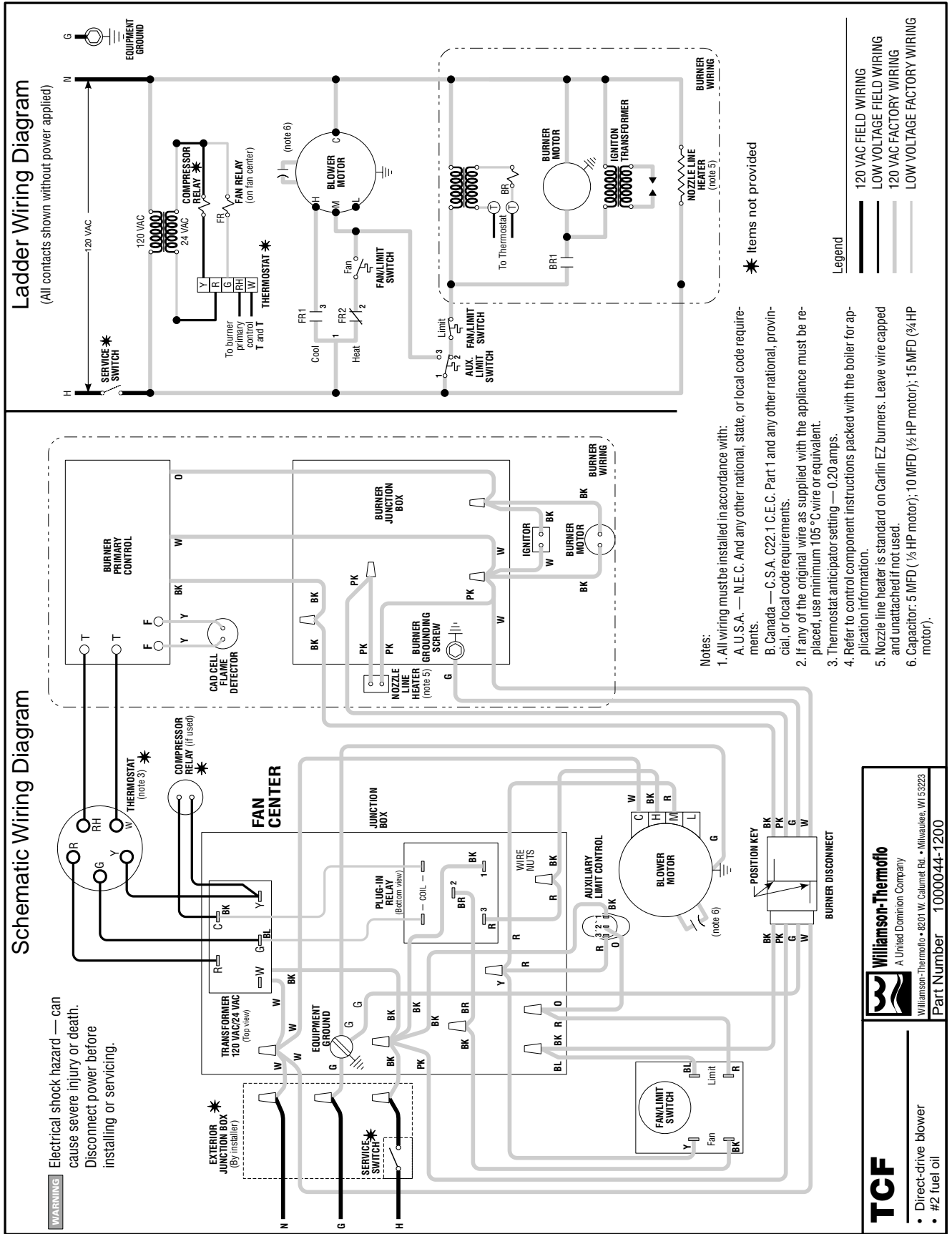
- Belt-drive blower
- #2 fuel oil

**Williamson-Thermofo**  
A United Dominion Company  
Williamson-Thermofo • 8201 W. Calumet Rd. • Milwaukee, WI 53223

Part Number 1000043-1200

# 6 Wire furnace & burner (continued)

**Figure 2** Wiring — TCF furnaces with direct-drive blowers



**TCF**

• Direct-drive blower  
• #2 fuel oil

**Williamson-Thermo**  
A United Dominion Company  
Williamson-Thermo • 6201 W. Calumet Rd. • Milwaukee, WI 53223  
Part Number — 1000044-1200

## 7 Start-up

**DANGER** Follow information below to prevent severe personal injury, death or substantial property damage:

- Do not use gasoline, crankcase drainings or any oil containing gasoline. See burner manual for proper fuel oil.
- Do not attempt to start burner when excess oil has accumulated, when unit is full of vapor or when combustion chamber is very hot.
- Do not start burner unless collector box, venting and burner mounting plate are secured in place.
- Never burn garbage or paper in the furnace.
- Never leave combustible material around it.

### To start furnace:

1. Factory burner adjustment and settings may not be suitable for specific job conditions. Refer to burner manual for burner start-up, adjustment and checkout procedures.
2. Set room thermostat to call for heat.
3. Start burner as described in burner manual.
4. The furnace blower will delay for a short time after burner starts, until the limit/fan switch senses air temperature above the fan ON setting.
5. Set room thermostat to its lowest setting. Burner should turn off.
6. Furnace blower will continue to run until the limit/fan switch senses air temperature below the fan OFF setting.
7. Set the room thermostat to call for heat again. Allow furnace to heat to design temperature. Then adjust burner for correct combustion, using combustion test equipment. Adjust burner for:
  - Draft: -0.01 to -0.02 inches water column draft in furnace combustion chamber.
  - CO<sub>2</sub>: between 10% and 11½%, with 0 smoke.

### To start furnace: (continued)

**WARNING** Make final burner adjustments using combustion test equipment to assure proper operation.

8. Check furnace and duct system for proper operation and conditions.
9. Inspect vent system for proper operation.
10. To set limit/fan switch:
  - The blower operates until the air temperature drops below the fan OFF setting. If the air at the supply registers is too warm at blower startup or shutdown, lower the fan OFF and ON settings on the limit/fan switch.
  - To check operation of the limit switch, slide a piece of cardboard into the furnace filter slot. After a few minutes of operation (not more than 5 minutes), the burner should shut off (limit switch open). The blower will operate until the furnace cools down. Remove cardboard when finished.
11. Complete testing of the burner cad cell control using the instructions in the burner manual.

### To shut down furnace:

1. Set the room thermostat to its lowest setting.
2. Turn off the disconnect switch in the 120-VAC power line to the furnace.
3. If the burner will be shut down for an extended time, tightly close all oil valves.
4. Refer to burner manual for any additional instructions.

## 8 Checkout procedure

### Furnace selection

1. Heat loss \_\_\_\_\_ Btuh at \_\_\_\_\_ °F outdoor design temperature.
2. Furnace model \_\_\_\_\_ output \_\_\_\_\_ Btuh.
3. Burner model \_\_\_\_\_ nozzle: \_\_\_\_\_ gph \_\_\_\_\_ ° type \_\_\_\_\_.
4. Burner pump pressure \_\_\_\_\_ psig.

### Furnace installation

5. Furnace leveled?
6. Return and supply ducts securely attached to furnace?
7. Fuel filter and fuel lines installed per burner manual and inspected?
8. Furnace and burner wired per wiring diagram?
9. 120 VAC wiring: type \_\_\_\_\_ size \_\_\_\_\_ AWG.

## 8 Checkout procedure (continued)

### Vent and combustion air

- 10. Existing chimney/vent system inspected and in good condition?
- 11. New vent piping installed, sealed and in good condition?
- 12. Vent sizing checked against furnace manual and codes?

### Ductwork

- 13. Duct sizing checked against furnace manual and/or ACCA Manual D?
- 14. Supply and return registers checked for size based on air flow?
- 15. Balancing dampers installed as needed?
- 16. Ductwork sealed and insulated as needed?

### Furnace operation

- 17. Clean air filter in place?
- 18. Temperature rise through furnace checked (not to exceed 85°F) and blower speed adjusted if necessary?
- 19. Thermostat heat anticipator set per wiring diagram?
- 20. Burner started and tested per burner manual?
- 21. Proper draft and burner flame? Final adjustment made with combustion test equipment?

### Furnace operation (continued)

- 22. Air purged from oil piping? Piping checked for leaks?
- 23. Burner sealed to furnace and nuts tight? Burner harness securely plugged in?

**WARNING** Obtain gas-tight seal at burner flange, cleanout plates and/or flue collector box to prevent possible flue gas leakage and carbon monoxide emissions, leading to severe personal injury or death.

- 24. Limit control tested per "To start up furnace" in this manual?
- 25. Furnace cycled with thermostat? Raise to highest setting and verify furnace goes through normal start-up cycle. Lower to lowest setting and verify furnace goes off.
- 26. Observed several operating cycles for proper operation?
- 27. Set room thermostat(s) to desired room temperature?

### After installation

- 28. Completed "Installation and service certificate" below?
- 29. Reviewed Owner's information in this manual with owner or maintenance person and instructed person to keep for future reference?
- 30. Replaced all instructions provided with furnace for future reference?

## Installation and service certificate

**Furnace model** \_\_\_\_\_ **Series** \_\_\_\_\_

**Serial number** \_\_\_\_\_ **Date installed** \_\_\_\_\_

- Installation instructions have been followed.**
- Checkout sequence has been performed.**
- Above information is certified to be correct.**
- Information received and left with owner/maintenance person.**

**Installer** \_\_\_\_\_  
(company) (address) (phone)

\_\_\_\_\_  
(installer's signature)

## 9 Troubleshooting

**Before beginning these troubleshooting procedures, ALWAYS:**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Check 120 volt supply to furnace. If there is no supply voltage, check fuses and service switch. CAUTION: When testing electrical equipment, always follow standard electrical safety procedures.</li> </ul> | <ul style="list-style-type: none"> <li>• To successfully service the oil furnace, you must have these instruments:                         <ul style="list-style-type: none"> <li>• smoke tester</li> <li>• carbon-dioxide (CO<sub>2</sub>) or oxygen (O<sub>2</sub>) analyzer</li> <li>• draft gauge (scale should read from -.01" w.c. to -.25" w.c.)</li> <li>• volt/OHM/milliamper multimeter</li> <li>• pressure gauge capable of reading 0-150 lbs/sq. inch (for oil only)</li> </ul> </li> <li>• Be familiar with these instruments as well as the burner manufacturers recommended settings.</li> </ul> |
| <ul style="list-style-type: none"> <li>• Make sure thermostat is calling for burner operation.</li> </ul>   |   |
| <ul style="list-style-type: none"> <li>• Check oil supply and make sure all valves are open.</li> </ul>   |   |

Symptom – Burner	Possible corrections:	
<b>Burner motor does not start.</b>	<ul style="list-style-type: none"> <li>• Check fuses and make sure service switch is on.</li> </ul>	<ul style="list-style-type: none"> <li>• Check for voltage from primary relay to burner motor. Make sure the primary relay has not locked out on safety.</li> </ul>
	<ul style="list-style-type: none"> <li>• Check for line voltage into furnace junction box.</li> </ul>	<ul style="list-style-type: none"> <li>• Make sure the thermostat is calling for heat and that the wiring to the thermostat is correct.</li> </ul>
<b>Burner short cycles or locks out on primary relay safety.</b>	<ul style="list-style-type: none"> <li>• If the primary relay control is not popping out the reset button measure the milliamperage at the thermostat and set the heat-anticipator accordingly. Also check wiring from the thermostat to the burner.</li> </ul>	<ul style="list-style-type: none"> <li>• Check the alignment of the cad cell to assure it is aimed at the fire.</li> </ul>
	<ul style="list-style-type: none"> <li>• Check nozzle and electrode position. (Reference burner manufacturers instructions.)</li> </ul>	<ul style="list-style-type: none"> <li>• Check ignition transformer output (9,000 volts/AC minimum)</li> </ul>
<b>Unable to achieve clean combustion by setting air adjustments.</b>	<ul style="list-style-type: none"> <li>• Check tube insertion and alignment.</li> </ul>	<ul style="list-style-type: none"> <li>• Check nozzle and electrode position (Reference burner manufacturers instructions.)</li> </ul>
	<ul style="list-style-type: none"> <li>• Replace nozzle</li> </ul>	<ul style="list-style-type: none"> <li>• Check pump pressure (varies with manufacturer and application; see burner manual)</li> </ul>
	<ul style="list-style-type: none"> <li>• Check overfire draft.</li> </ul>	
<b>To check CAD cell operation, use the following procedure:</b>	<ol style="list-style-type: none"> <li>1. Remove CAD cell leadwires from the f-f terminals on the primary safety control, then start burner. Shortly after burner starts, place a temporary jumper between terminals f-f. Connect ohmmeter across CAD cell leadwires—resistance should be under 1,600 ohms.</li> </ol>	<ol style="list-style-type: none"> <li>3. With burner off, check dark cell resistance across CAD cell leadwires. Resistance should be greater than 20,000 ohms. If cell resistances are different from above, recheck wiring and location of cell, etc. If necessary, replace plug-in portion of cell.</li> </ol>
	<ol style="list-style-type: none"> <li>2. Stop burner and remove temporary jumper.</li> </ol>	

Symptom – Furnace blower	Possible corrections:	
<b>Furnace blower will not start.</b>	<ul style="list-style-type: none"> <li>• Check belt and pulleys</li> </ul>	<ul style="list-style-type: none"> <li>• Check for 120V to the blower motor. If present, replace motor.</li> </ul>
	<ul style="list-style-type: none"> <li>• Check wiring from Fan and Limit control. See if blower motor will run when it is switched on manually at the thermostat sub-base (if sub-base is installed).</li> </ul>	
<b>Blower cycles on and off after the burner has shut down.</b>	<ul style="list-style-type: none"> <li>• Adjust fan “off” setting. The fan “off” setting should be 30-50 degrees below the fan “on” setting.</li> </ul>	
<b>Blower short cycles on limit control</b>	<ul style="list-style-type: none"> <li>• Return ducts may be undersized.</li> </ul>	

# 10 Service and maintenance

## Annual service and start-up

**WARNING** Follow the “Service and maintenance” procedures given throughout this manual and in component literature shipped with the furnace. Failure to perform the service and maintenance could result in damage to the furnace or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death or substantial property damage.

**WARNING** The furnace should be inspected and started annually, at the beginning of the heating season, only by a qualified service technician. In addition, the maintenance and care of the furnace designated in the table below, and explained on the following pages must be performed to assure maximum furnace efficiency and reliability. Failure to service and maintain the furnace and system could result in equipment failure.

**WARNING** This furnace contains fiberglass and ceramic fiber materials. These materials require special attention. Please refer to the WARNING and guidelines given on page 18. Failure to comply could result in severe personal injury, death or substantial property damage.

<b>Service technician annual maintenance/start-up</b> (see following pages and burner manual for instructions)	
<b>Service and maintenance</b>	<b>Annual start-up</b>
<p style="text-align: center;"><b>Furnace and air system</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Consult with homeowner to see if there were any problems with furnace or system during the prior heating season (or cooling season)</li> <li><input type="checkbox"/> Clean, inspect, and lubricate blower motor and wheel</li> <li><input type="checkbox"/> Check condition of electrical wiring and tightness of terminals and connectors</li> <li><input type="checkbox"/> Clean and inspect heat exchanger and combustion chamber</li> <li><input type="checkbox"/> Clean and inspect system accessories</li> </ul> <p style="text-align: center;"><b>Vent system</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Clean and inspect flue pipe, chimney/vent, and draft regulator</li> </ul> <p style="text-align: center;"><b>Fuel oil system</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Check oil tank and piping for leaks</li> <li><input type="checkbox"/> Replace oil filter</li> </ul> <p style="text-align: center;"><b>Oil burner</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Clean and inspect oil burner assembly</li> <li><input type="checkbox"/> Bleed system of air (single-pipe system)</li> <li><input type="checkbox"/> Check oil pump pressures</li> <li><input type="checkbox"/> Check combustion air ducts, grilles, etc. (if applicable)</li> </ul>	<p style="text-align: center;"><b>Check operation</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Check sequence of operation</li> <li><input type="checkbox"/> Check flame characteristics</li> <li><input type="checkbox"/> Perform combustion checks/tests per burner manual and furnace manual</li> <li><input type="checkbox"/> Check temperature rise</li> <li><input type="checkbox"/> Check thermostat heat anticipator setting</li> <li><input type="checkbox"/> Check safety controls (high-temperature limit switch, flame cutoff time, etc.)</li> </ul>

# Handling ceramic fiber and fiberglass materials

## HANDLING OR REMOVAL OF COMBUSTION CHAMBER

### WARNING

The combustion chamber in this product contains ceramic fiber materials. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, "Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1).":

- Avoid breathing dust and contact with skin and eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH web site at <http://www.cdc.gov/niosh/homepage.html>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this web site.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Apply enough water to the combustion chamber lining to prevent airborne dust.
- Remove combustion chamber lining from the furnace and place it in a plastic bag for disposal.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

### NIOSH stated First Aid.

- Eye: Irrigate immediately
- Breathing: Fresh air.

## HANDLING OR REMOVAL OF FIBERGLASS WOOL — OR —

## INSTALLATION OF FIBERGLASS WOOL OR COMBUSTION CHAMBER:

### WARNING

This product contains fiberglass jacket insulation and ceramic fiber materials in combustion chamber. Airborne fibers from these materials have been listed by the State of California as a possible cause of cancer through inhalation.

- Avoid breathing dust and contact with skin and eyes.
  - Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for fiberglass wool at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH web site at <http://www.cdc.gov/niosh/homepage.html>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this web site.
  - Wear long-sleeved, loose fitting clothing, gloves, and eye protection.
- Operations such as sawing, blowing, tear out, and spraying may generate airborne fiber concentration requiring additional protection.
- Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

### NIOSH stated First Aid.

- Eye: Irrigate immediately
- Breathing: Fresh air.

# 10 Service and maintenance (continued)

## Service/maintenance procedures

### To lubricate and inspect blower motor

**CAUTION** DO NOT over-oil motors. Adding too much oil can damage the motor bearings, resulting in blower motor failure.

Blower motor — Oil annually using 2 drops of S.A.E. #10 oil (or other if specified by motor manufacturer). Oiling is normally not required until beginning of third year of operation.

Clean blower wheel — Vacuum dust from blower wheel blades and surrounding area.

### To clean heat exchanger

**WARNING** The heat exchanger must be cleaned and inspected at least once each year. Operating the furnace with a fouled or leaking heat exchanger could result in severe personal injury, death or substantial property damage.

**WARNING** The combustion chamber contains ceramic fiber materials. Wear a NIOSH-approved respirator while cleaning the furnace and follow WARNING on page 18 for proper handling.

1. Remove the burner and mounting plate.
2. Inspect the heat exchanger using a mirror inserted through the burner opening.
3. Using a brush on a flexible handle, loosen the soot on the inside of the heat exchanger.
4. Remove the soot with a vacuum. Be careful not to damage the combustion chamber while cleaning the heat exchanger.
5. See page 20 for component locations. Remove the flue collector box. Using a brush on a flexible handle, loosen the soot from the heat exchanger surfaces. Remove as much soot as possible using a vacuum.
6. Replace flue collector box.
7. Inspect combustion chamber and replace with a new one if chamber is damaged in any way.
8. Re-install burner and mounting plate.

**WARNING** Replace damaged gaskets if necessary. You must obtain gas-tight seal at burner flange and flue collector box to prevent possible flue gas leakage and carbon monoxide emissions, leading to severe personal injury or death.

### Inspect vent system

Thoroughly inspect the entire vent system at least annually, including horizontal vent pipe and chimney or vertical vent. Ensure vent system is repaired or replaced if necessary before placing furnace in operation.

### Oiled-bearing burner motors

The burner may need to be lubricated if motor is equipped with oiling cups. Refer to burner manual for specific instructions. If instructed, apply a few drops only of S.A.E. 20 detergent oil (never use household oils). Do not attempt to "fill up" the oil cup. Over-oiling can damage the motor.

## Annual start-up

**DANGER** Follow information below to prevent severe personal injury, death or substantial property damage:

- Do not use gasoline, crankcase drainings or any oil containing gasoline. See burner manual for proper fuel oil.
- Do not attempt to start burner when excess oil has accumulated, when unit is full of vapor or when combustion chamber is very hot.
- Do not start burner unless collector box, vent and burner mounting door are secured in place.
- Never burn garbage or paper in the furnace.
- Never leave combustible material around it.

## To start furnace:

1. Factory burner adjustment and settings may not be suitable for specific job conditions. Refer to burner manual for burner start-up, adjustment and checkout procedures.
2. Set room thermostat to call for heat.
3. Refer to burner manual for start-up.
4. The furnace blower will delay for a short time after burner starts, until the limit/fan switch senses air temperature above the fan ON setting.
5. Set room thermostat to its lowest setting. Burner should turn off.
6. Furnace blower will continue to run until the limit/fan switch senses air temperature below the fan OFF setting.
7. Set the room thermostat to call for heat again. Allow furnace to heat to design temperature. Then adjust burner for correct combustion, using combustion test equipment. Adjust burner for:

Draft: -0.01 to -0.02 inches water column draft in furnace combustion chamber.

CO<sub>2</sub>: between 10% and 11½%, with 0 smoke.

**WARNING** Make final burner adjustments using combustion test equipment to assure proper operation.

8. Check furnace and duct system for proper operation and conditions.
9. Inspect vent system for proper operation.
10. To set limit/fan switch:

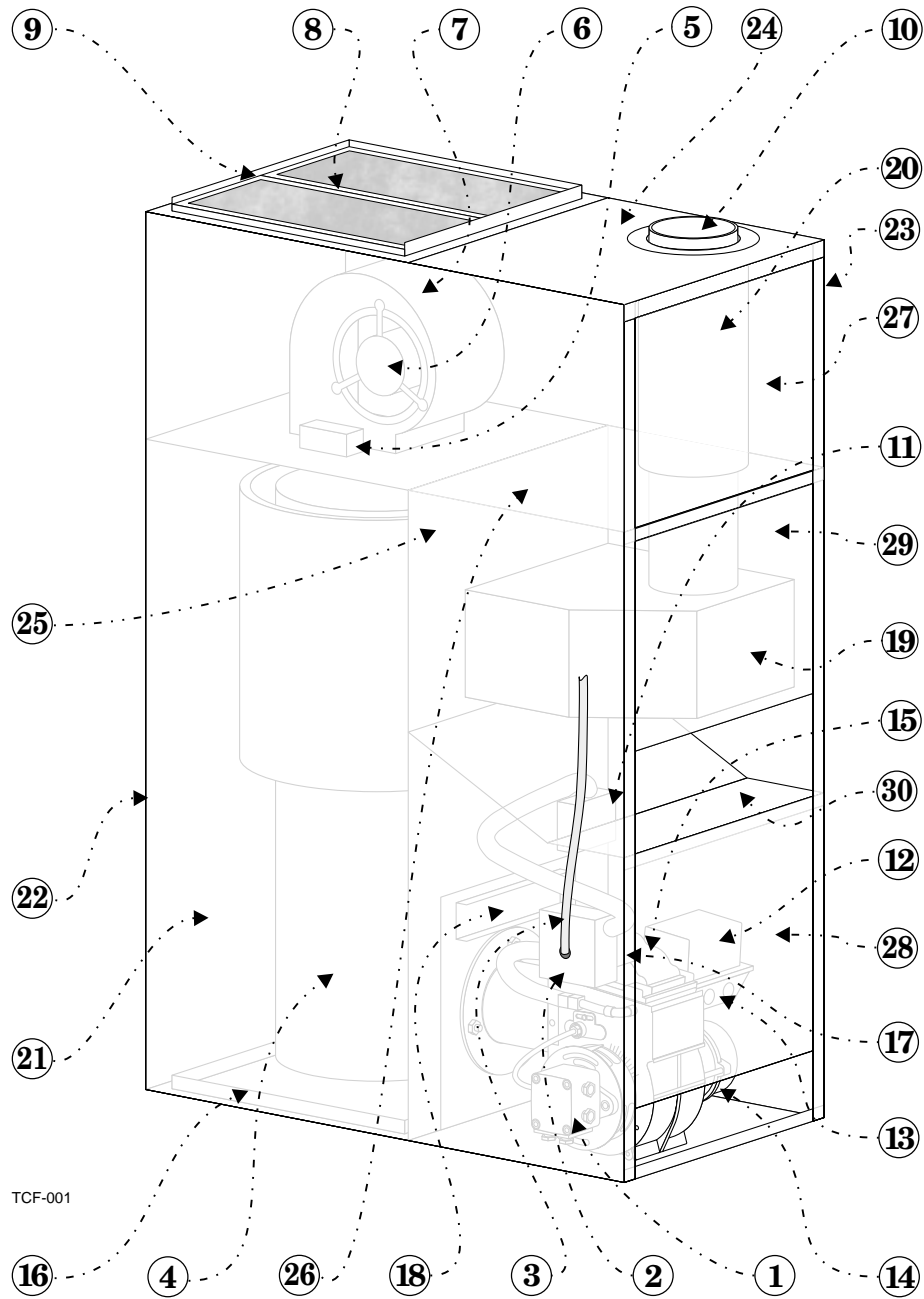
The blower operates until the air temperature drops below the fan OFF setting. If the air at the supply registers is too warm at blower startup or shutdown, lower the fan OFF and ON settings on the limit/fan switch.

To check operation of the limit switch, slide a piece of cardboard into the furnace filter slot. After a few minutes of operation (not more than 5 minutes), the burner should shut off (limit switch open). The blower will operate until the furnace cools down. Remove cardboard when finished.

11. Complete testing of the burner cad cell control using the instructions in the burner manual.

# 11 Components and replacement parts

Figure 3 Model TCF furnaces — Component locations



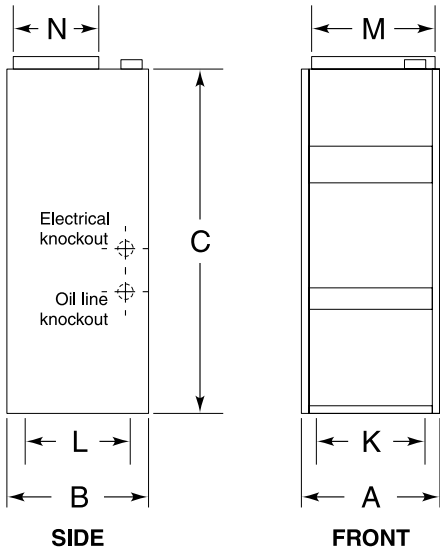
# 11 Components and replacement parts (continued)

Model TCF furnaces — Parts list (parts preceded by an asterisk (\*) are not shown in drawing)

Item	Part description	Part number
1	Oil burner pump	See burner manual
2	Main junction box	--
3	Burner harness Direct-drive Belt-drive	1000017 1000016
4	Heat exchanger	1000229
5	Auxiliary limit control	1000287
6	Blower motor: . . . . . 1/3 hp Direct-drive Belt-drive	1000210 1000108
7	Blower: Direct-drive . . . . . 9-9T Belt-drive . . . . . 9-9	1000209 1000206
8	Filter: (inches). . . . . (2) 10 x 20	1000237
9	Return air opening	--
10	Flue pipe	1000285
11	Fan and limit control	1000192
12	Primary safety control	See burner manual
13	Burner junction box	See burner manual
14	Oil burner motor	See burner manual
15	Oil burner ignitor	See burner manual
16	Supply air opening	--
17	Fan center (direct-drive units only)	1000114
18	Observation door	1000220
19	Flue collector box	1000227
20	Insulating pipe	1000228
21	Left panel, jacket	1000221
22	Back panel, jacket	1000281
23	Right panel, jacket	1000222
24	Top panel	1000223
25	Front divider	1000282
26	Blower divider	1000283
27	Blower access door	1000224
28	Burner access door	1000225
29	Front access panel	1000226
30	Spill way baffle	1000284
31	* Draft regulator . . . . . .6"	1000186
32	* Heat exchanger clean-out cover assembly with gasket	1000105
33	* Mounting plate gasket	1000219
34	* Burner mounting plate	1000241
<b>Following used for belt-drive units only</b>		
35	* Motor pulley . . . . . 3 1/4" x 1/2"	1000110
36	* Blower pulley . . . . . 5"	1000207
37	* Belt. . . . . 33"	1000208

# 12 Dimensions and ratings

Figure 4 Model TCF dimensional data — ALL DIMENSIONS IN INCHES

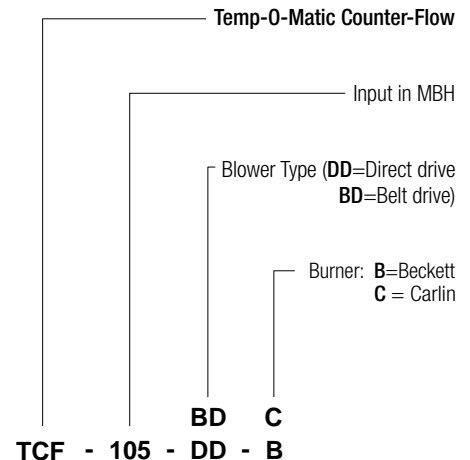


Model	Furnace casing			Warm air supply (bottom)		Return air (top)		Flue pipe diam.
	Width A	Depth B	Height C	Width K	Depth L	Width M	Depth N	
TCF-105	22	31	60	17	19¼	20	20	6

**NOTICE** TCF furnaces require special combustible floor base when installed on combustible flooring (obtain part number 6100-CFSB-T165).

Model	Input	Output	Firing rate	Installed nozzle	AFUE	Blower size	Blower motor hp	Blower pulley	Motor pulley	Belt size	Maximum cooling capacity	Ship wt.	Blower CFM	
	(Btuh)	(Btuh)	(GPH)								(tons)	(pounds)	@ 0.25" WC	@ 0.50" WC
Direct-drive units														
TCF-105	85,000	68,000	0.60		83.5	9-9T	1/3	-	-	-	3	300	1200	900
	105,000	84,000	0.75	✓	82.0	9-9T	1/3	-	-	-	3	300	1200	900
	120,000	96,000	0.85		81.0	9-9T	1/3	-	-	-	3	300	1200	900
Belt-drive units														
TCF-105	85,000	68,000	0.60		83.5	9-9	1/3	5	3¼ x ½	33	2½	300	1000	800
	105,000	84,000	0.75	✓	82.0	9-9	1/3	5	3¼ x ½	33	2½	300	1000	800
	120,000	96,000	0.85		81.0	9-9	1/3	5	3¼ x ½	33	2½	300	1000	800

**NOTICE** Please see information at right for explanation of model numbering.



## 13 Warranty

# *Williamson-Thermoflo Limited Lifetime Warranty for Residential Oil-Fired Warm Air Furnaces*

### ◆ RESIDENTIAL OIL-FIRED WARM AIR WARRANTY— Limited Lifetime

**NOTE:** The residential oil-fired warm air warranty does not cover residential furnaces installed in buildings other than one or two family dwelling units, unless they are buildings with individual furnaces for each dwelling unit.

#### **First Five (5) Year Limited Warranty for Furnaces:**

Williamson-Thermoflo warrants that its oil-fired warm air furnaces (except parts listed below) are free from defects in material and workmanship for five (5) years from the date of installation. If any parts are found to be defective in manufacture, Williamson-Thermoflo will provide replacement of such defective parts except for nozzles, electrodes, cad cells, end cones, air filters, and blower belts.

#### **Sixth Year and Beyond Limited Warranty for Furnaces:**

Williamson-Thermoflo warrants that the heat exchanger is free from defects in material and workmanship for the sixth year and beyond from the date of installation. If, during such time period, the heat exchanger is found to be defective, Williamson-Thermoflo will provide a replacement heat exchanger or the necessary repair parts.

This warranty is subject to the condition that the oil-fired warm air furnace must have been installed by a heating contractor whose principal occupation is the sale and installation of heating and/or air conditioning equipment.

#### **This warranty does not cover:**

1. Components that are part of the heating system but were not furnished by Williamson-Thermoflo as a part of the furnace.
2. The workmanship of any installer of Williamson-Thermoflo furnaces. In addition, this warranty does not assume any liability of any nature for unsatisfactory performance caused by improper installation.
3. Any costs for labor for removal and reinstallation of the alleged defective part, transportation to Williamson-Thermoflo, if necessary, and any other materials necessary to perform the exchange.

4. Improper burner adjustments, control settings, care or maintenance. Information is included in the Installation Instructions, Owner's Information Manual and/or Start-up, Service and Maintenance Instructions, and other printed technical material furnished by Williamson-Thermoflo with the furnace.

5. Furnaces operated with combustion air contaminate externally by chemical vapors or with improper fuel additives.

This warranty extends only to the first retail purchaser of the furnace and only to a furnace that has not been moved from its original installation site.

**THE WARRANTY DESCRIBED ABOVE IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY. WILLIAMSON-THERMOFLO EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR CONSEQUENTIAL, INCIDENTAL, INDIRECT OR PUNITIVE DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY.**

For prompt product warranty claims, notify the installer who, in turn, will notify the Williamson-Thermoflo distributor from whom he purchased the furnace. If this action does not result in warranty resolution, contact Williamson-Thermoflo, 8201 W. Calumet Rd., Milwaukee, WI 53223, with details in support of the warranty claim. Alleged defective part or parts must be returned through trade channels in accordance with the Williamson-Thermoflo procedure currently in force for handling returned goods for the purpose of inspection to determine cause of failure. Williamson-Thermoflo will furnish new part(s) to an authorized Williamson-Thermoflo distributor who, in turn will furnish the new part(s) to the heating contractor who installed the furnace. If you have any questions about the coverage of this warranty, contact Williamson-Thermoflo at the address above.



**Williamson-Thermoflo**  
A United Dominion Company

8201 W. Calumet Rd., Milwaukee, WI 53223  
Phone: 1-800-736-BEST ● Fax: 1-414-354-2623  
[www.williamson-thermoflo.com](http://www.williamson-thermoflo.com)

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## 14 Owner's information

**WARNING**

**The furnace must be inspected and started ANNUALLY, at the beginning of the heating season, only by a qualified service technician.**

The service technician must perform annual service and maintenance on the furnace to ensure reliable operation. Failure to service and maintain the furnace and system could result in equipment failure, causing severe personal injury, death or substantial property damage.

As the owner, you need to be aware of the following needs of your furnace. You must inspect and clean or replace the furnace filter monthly, as described below, and perform the other inspection procedures as well. Failure to maintain a clean filter will result in unsatisfactory cycling of the furnace and could lead to a no-heat condition. Failure to perform this maintenance could result in substantial property damage.

Follow all of the procedures below. Failure to comply could result in severe personal injury, death or substantial property damage.

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### Operating the furnace

1. The furnace should operate automatically on call for heat from the room thermostat.
2. If the furnace oil burner should shut down on flame failure, the burner primary control will lock out. Ask your service technician to show you the correct procedure to reset the primary control button. NEVER push the button more than once in an attempt to start the burner after lockout. Continued lockout of the control means something is wrong with the burner, controls or oil system. The condition must be corrected by a qualified service technician.

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### Daily inspection

1. Verify there are no combustible materials in the furnace room or near the furnace.
2. Verify the air openings to the furnace room are not obstructed in any way.
3. Verify the furnace seems to be operating normally. Notify your service technician immediately if you notice any abnormal behavior.

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### Monthly – inspect and clean/replace filter

1. Ask your service technician to show you the correct way to remove and clean your furnace filter. Replace the filter if you are unable to thoroughly clean it.

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### To shut down furnace:

1. Set the room thermostat to its lowest setting.
2. Turn off the disconnect switch in the 120-VAC power line to the furnace.
3. If the burner will be shut down for an extended time, tightly close all oil valves.
4. Refer to burner manual for any additional instructions.



**Williamson-Thermoflo**

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