



Muffle Furnace

OPERATION MANUAL AND PARTS LIST *Series 1249*

Model
5300A30/F6010-TS

Voltage
240V

Control
Single Setpoint

Display
°C

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Important Information

This manual contains important operating and safety information. The user must carefully read and understand the contents of this manual prior to the use of this equipment.

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Safety Information

Alert Signals



Warning

Warnings alert you to a possibility of personal injury.



Caution

Cautions alert you to a possibility of damage to the equipment.



Note

Notes alert you to pertinent facts and conditions.



Hot Surface

Hot surfaces alert you to a possibility of personal injury if you come in contact with a surface during use or for a period of time after use.

Your Thomas Scientific 5300A30/F6010-TS Furnace has been designed with function, reliability and safety in mind. It is your responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert signals throughout the manual.

This manual contains important operating and safety information. You must carefully read and understand the contents of this manual prior to the use of this furnace.

Warnings

To avoid electrical shock, this furnace must:

1. Use a properly grounded electrical outlet of correct voltage and current handling capacity.
2. Be disconnected from the power supply prior to maintenance and servicing.
3. Have the door switch operating properly.

To avoid personal injury:

1. Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such material.
2. Caution: Hot Surface - Avoid Contact. To avoid burns, do not touch the exterior or interior surfaces of this furnace during use or for a period of time after use.
3. Always wear safety glasses or a safety shield and high temperature gloves when loading or unloading the furnace. Long sleeved, fire retardant clothing and a fire retardant apron is also recommended.
4. Refer servicing to qualified personnel.

Warning

This warning is presented for compliance with California Proposition 65 and other regulatory agencies and only applies to the insulation in this product. This product contains refractory ceramic, refractory ceramic fiber or fiberglass insulation, which can produce respirable dust or fibers during disassembly. Dust or fibers can cause irritation and can aggravate pre-existing respiratory diseases. Refractory ceramic and refractory ceramic fibers (after reaching 1000°C) contain crystalline silica, which can cause lung damage (silicosis). The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber and fiberglass as possibly carcinogenic (Group 2B), and crystalline silica as carcinogenic to humans (Group 1).

The insulating materials can be located in the door, the hearth collar, in the chamber of the product or under the hot plate top. Tests performed by the manufacturer indicate that there is no risk of exposure to dust or respirable fibers resulting from operation of this product under normal conditions. However, there may be a risk of exposure to respirable dust or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing them in a manner which causes release of dust or fibers. By using proper handling procedures and protective equipment you can work safely with these insulating materials and minimize any exposure. Refer to the appropriate Material Safety Data Sheets (MSDS) for information regarding proper handling and recommended protective equipment. For additional MSDS copies, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department at Thomas Scientific at 1-800-345-2100.

Introduction



Caution

Do not exceed operating temperatures shown in “General Specifications.” Exceeding these limits will result in severely reduced element life.

Intended Use

The 5300A30/F6010-TS muffle furnace is a general purpose laboratory and heat treating furnace. For optimum element life, Thomas Scientific recommends observing these temperature ranges: from 100°C (212°F) to 1093°C (2000°F) continuous use or from 1093°C (2000°F) to 1200C (2192°F) for intermittent use. Continuous use is operating the furnace for more than 3 hours and intermittent use is operating the furnace for less than 3 hours.

Furnaces consists of: 1) a vented heating chamber; 2) a temperature controller; and 3) a door safety switch for operator safety.

General Usage

Do not use this product for anything other than its intended usage.

Principles of Operation

The furnace chamber is heated by electric resistance elements and is insulated with ceramic fiber insulation. The controller is located under the furnace chamber and is well insulated from the heat generated in the furnace chamber. A door safety switch removes power to the heating elements whenever the furnace door is opened. The temperature is controlled by one of three types of controllers.

General Specifications

Model 5300A30/F6010-TS Furnace

Dimensions in. (cm)	Overall	Width	19.25 (48.9)
		Height	21 (53.3)
		Depth	20 (50.8), w/door open 29.5" (74.9)
	Chamber	Width	12.75 (32.4)
		Height	6.75 (17.1)
		Depth	10 (25.4)
Weight	Lbs. (kg)		96 (43.5)
Electrical	Volts		220-240
Ratings	Amps		12.9
	Watts		3095
	Freq.		50/60
	Phase		1
Oper. Temp. Range	°F (°C)		212-2192°F
			(100-1200°C)

Notes: The maximum ramp rates for this furnace for heat up are: 12°C (22°F) per min. from 25°C-537°C (75°F-1000°F), 10°C (18°F) per min. from 537°C-1093°C (1000°F-2000°F).

Environmental Conditions

Operating: 17°C to 27°C; 20% to 80% relative humidity, non-condensing. Installation Category II (overvoltage) in accordance with IEC 664. Pollution degree 2 in accordance with IEC 664.

Altitude Limit: 2,000 meters.

Storage: -25°C to 65°C; 20% to 85% relative humidity

Unpacking

**Note**

The 5300A30/F6010-TS is supplied with cord and plug (240V, 15 amp cord set).

1. Visually check for any physical damage to the shipping container.
2. Inspect the equipment surfaces that are adjacent to any damaged area.
3. Open the furnace door and remove the packing material from inside the furnace chamber.
4. Vacuum the chamber prior to use to remove the insulation dust due to shipment.
5. Retain the original packaging material if reshipment is foreseen or required.

Installation



Caution

Be sure ambient temperature does not exceed 104°F (40°C). Ambients above this level may result in damage to the controller.

Allow at least six inches of space between the furnace and any vertical surface. This permits the heat from furnace case to escape so as not to create a possible fire hazard.



Warning

To avoid electrical shock, this furnace must be installed by a competent, qualified electrician who ensures compatibility among furnace specifications, power source and grounding code requirements.



Warning

Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such material.



Hot Surface

“Caution: Hot Surface. Avoid Contact.”
To avoid burns, this furnace must not be touched on the exterior or interior surfaces during use or for a period of time after use.

Site Selection

Install furnace on a sturdy, level surface and allow space for ventilation.

Electrical Connections

1. The electrical specifications are located on the specification plate on the back of the furnace. Consult Thomas Scientific if your electrical service is different than those listed on the specification plate. Prior to connecting your 5300A30/F6010-TS furnace to your electrical supply, be sure the front power switch is in the OFF position.

NOTE: Please observe the alert signals on the left-hand side of this page before operating your furnace.

Operation, All Models



Warning

To avoid personal injury do not use in the presence of flammable or combustible chemicals; fire or explosion may result. This device contains components which may ignite such materials.



Hot Surface

Caution: Avoid Contact. To avoid burns, this furnace must not be touched on the exterior or interior surfaces during use or for a period of time after use.



Warning

Always wear safety glasses or a safety shield and high temperature gloves when loading or unloading the furnace. Long sleeved, fire retardant clothing and a fire retardant apron is also recommended.



Warning

To avoid electrical shock, the door safety switch must be operating properly.

Power Switch

Both the ON/OFF power switch and the digital display will illuminate when power is switched ON. The furnace will begin to heat to its controller's current setpoint. (See the instructions for information on checking and setting the setpoint.)

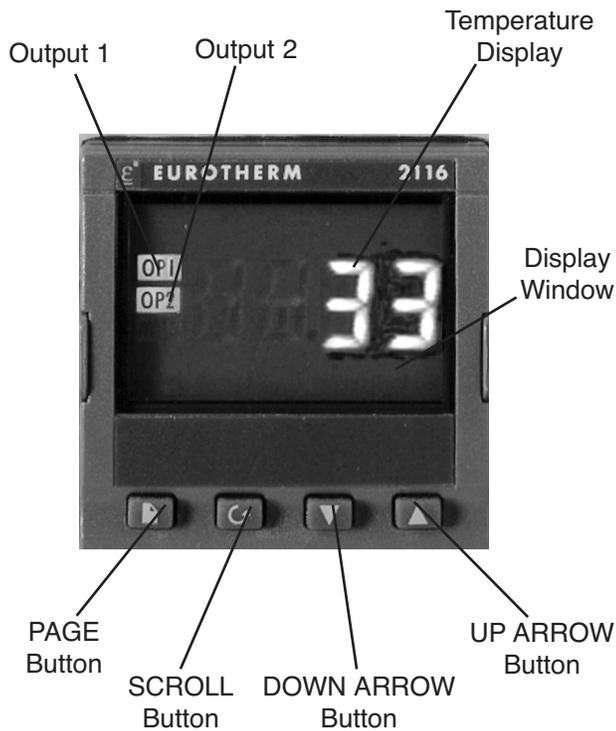
Cycle Light

The amber cycle light will illuminate whenever the power is being applied to the heating elements. The cycle light will turn on and off as the furnace reaches the setpoint.

Door Safety Switch

The door safety switch removes power from the heating elements when the door is opened. Open and close the door a few times; note that the amber CYCLE light will switch off when the door is opened. If this condition is not true, consult the Troubleshooting section before proceeding. This check must be done when the furnace is heating and the cycle light is illuminated.

Single Setpoint Models



Single Setpoint Models



Note

If at any time you want to return to the HOME DISPLAY, simultaneously press the PAGE and SCROLL buttons.

The **single setpoint model** furnace provides a single digital display to indicate the current chamber temperature or setpoint temperature. This temperature controller features sensor break protection and self-tuning capability.

Basic Operation

When the controller is turned ON it will perform a short self-test and then display the measured value (process value) in the HOME DISPLAY.

Buttons and Indicators

OP1 (Output 1): Illuminates when the logic output is ON.

OP2 (Output 2): Illuminates when the relay output is ON (will go out during an alarm situation).

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

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

DOWN button: Allows you to decrease a value.

UP button: Allows you to increase a value.

To View or Change the Setpoint

To view the setpoint, press and release the UP or DOWN buttons. If you want to change the setpoint, continue pressing until the desired setpoint value is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and revert to the HOME DISPLAY.

To View the Display Units

From the HOME DISPLAY press the SCROLL button. The display will show the temperature units in °C/F/K and then return to the HOME DISPLAY. (Call Customer Service if you require a different temperature unit.)

To View the % Output Power

From the HOME DISPLAY press the SCROLL button twice. Press and release the UP or DOWN button to view the % output power. This value is a read-only value and cannot be changed.

Controller Parameters

Home display

°C: Temperature units in Celsius. Temperature units can not be changed without entering the configuration. Contact Customer Service if a different temperature unit is required.

OP: % output power demand.

IdHi: Deviation high alarm. Factory preset to 50.

AI List

IdHi: Deviation high alarm. Factory preset to 50.

3FSL: Full scale low alarm. Factory preset to -82°C. Cannot be adjusted by end users.

Atun List

tunE: One-shot autotune enable.

Pid List

Pb: Proportional band (in display units). Factory preset to 11.



Note

The following alarm messages are factory default settings and may vary if you have changed the configuration of your controller:

IDHi: = 50°C
2FSH = 1225°C



Note

3FSL is not a true alarm. The value can be seen in the user list but cannot be changed.

ti: Integral time in seconds. Factory preset to 10.25.

td: Derivative time in seconds. Factory preset to 1.44.

ACCS List Code: Access code (Code needed to enter or change the other configuration parameters which are not normally accessible.) Not accessible.

Alarms

The controller will flash an alarm message in the home display if an alarm condition is detected.

2FSH: Measured value full scale high alarm. The full scale high alarm is for furnace protection. The parameter is not accessible from the user list.

IdHi: Measured value deviation high alarm. The deviation alarm is for load protection. Factory preset at 50°C. If the chamber temperature rises to 50°C above the setpoint temperature, this error condition will alert end users. The furnace will continue to heat as the **IdHi** is only a soft alarm. End users must power off the furnace and contact Customer Service for troubleshooting assistance. Do not reset this alarm below 20.

S.br: Sensor break: check that sensor is connected correctly.

L.br: Loop break: check that the heating circuits are working properly.

Ld.F: Heater Circuit fault: indication of either an open or short solid state relay, a blown fuse, missing supply or open circuit heater.

Sensor Break Protection

This controller provides sensor break protection in the event the thermocouple opens. If an open thermocouple condition occurs, the digital display will blink "S.br" and the power to the heating element will be shut OFF (Cycle light will extinguish).

**Note**

Furnace must be at ambient temperature before starting a tune.

**Note**

Tune has completed when “tunE” stops flashing on display.

Tuning

This controller incorporates a self-tuning feature which determines the optimum control parameters for the best temperature accuracy with your load and setpoint. Use this feature the first time you use your furnace and each time you change either your setpoint or the type of load you are heating. Thomas Scientific recommends you use this feature to provide the best temperature accuracy the controller can attain. To use the tuning feature:

1. Adjust the setpoint to your desired value.
2. Press the PAGE button until display reads, “Atun.”
3. Press the SCROLL button. Display will read, “tunE.”
4. Press the UP or DOWN button to select, “on.”
5. Simultaneously press the PAGE and SCROLL buttons to return to the HOME DISPLAY. The display will alternately flash between “tunE” and the HOME DISPLAY while tuning is in progress.
6. The controller will then turn the heating on and off to induce an oscillation. When the measured value reaches the required setpoint the first cycle will end.
7. Tuning will be complete after two oscillation cycles and then the tuner will turn itself off.
8. Normal control function will resume after the controller calculates tuning parameters.

Furnace Loading



Caution

Do not overload your furnace chamber. If the load is to be heated uniformly, it should not occupy more than two-thirds of the furnace chamber. Failure to observe this caution could result in damage to furnace components.

For best results, use only the center two-thirds of the furnace chamber.

- If you are heating a number of small parts, spread them throughout the center of the furnace chamber.
- Keep objects away from thermocouple.
- Use insulated tongs and mittens when loading and unloading furnace.
- Always wear safety glasses.
- Use Thomas Scientific hearth plates if you place load on bottom of chamber. PHX2 (three required), PH177X1 is an optional hearth plate, (one required.)

Maintenance and Servicing



Note

Discoloration of chassis paint (especially above the door) is to be expected over time. This is normal wear and tear due to heat escaping the chamber when the door is opened.



Warning

Disconnect from the power supply prior to maintenance and servicing.



Warning

Refer servicing to qualified personnel.



Warning

Replace fuses with same type and rating.



Hot Surface

“Caution. Hot Surface. Avoid Contact.”
To avoid burns, this furnace must not be touched on the exterior or interior surfaces during use or for a period of time after use.



Note

Perform only maintenance described in this manual. Contact an authorized dealer or our factory for parts and assistance.

Preventative Maintenance

This unit is equipped with a venting system on the top of the furnace. This is for the removal of fumes from the chamber of the unit. Contamination is a major cause of element failure, therefore, remove all fume forming material before heating. (e.g. clean cutting oil from tool steel). Thomas Scientific offers a ventilation kit (AY408X1A) including 5' (1.5 m) of flexible stainless steel exhaust tubing and mounting hardware to connect the tubing to the vent port on the roof of the furnace.

Housekeeping is vital to your electric furnace - KEEP IT CLEAN. Run your furnace up to 871°C (1600°F) empty occasionally to burn off the contamination that may exist on the insulation and elements. Maintain 871°C (1600°F) for at least 4 hours to ensure complete ashing of foreign materials.

Element life is reduced somewhat by repeated heating and cooling. If the furnace is to be used again within a few hours, it is best to keep it at the operating temperature or at a reduced level such as 260°C (500°F).

Change the thermocouple every six months to a year as a preventative measure.

General Cleaning Instructions

Wipe exterior surfaces with lightly dampened cloth containing mild soap solution.

To Replace a Heating Element

1. Disconnect furnace from power supply.
2. Remove the back terminal cover of the furnace. (Note placement and connections of wires)
3. Loosen the nuts on the terminals of the element to be replaced.
4. Open the door and pull the defective element out. (It may be easiest to turn the furnace so that the element to be removed is on top).

5. Slide the new element into place, threading the leads through the insulating porcelain bushing on the back of the furnace.
6. Tighten the nuts securely. Cut off any excess lead wire.
7. Replace the back terminal cover.
8. Reconnect furnace to power supply.
9. Test operation of furnace.

To Replace the Thermocouple

1. Disconnect furnace from power supply.
2. Remove both back covers. (Note placement and connection of wires).
3. Remove clip holding thermocouple in place (1 screw) and remove the two screws on the thermocouple terminals.
4. Remove the thermocouple. Pull thermocouple straight out of hole in the chamber first to avoid damage to the insulation.
5. Guide the looped ends of the new thermocouple through the plastic bushings with the red (-) lead to the right as you face the back of the furnace.
6. Insert the thermocouple straight through the hole in the chamber.
7. Secure the thermocouple with clip and screw. Connect the looped ends of the thermocouple to the terminals with + to + (yellow wire). Chromel/Alumel thermocouples and lead wire are easily tested with a magnet. The non-magnetic wire is positive (+) and the magnetic wire is negative (-).
8. Replace both back covers.
9. Reconnect to power supply. Test operation of furnace.

To Replace Solid State Relay

1. Disconnect furnace from power supply.
2. Remove back control cover. (Note connection and placement of wires to relay). Remove the front control panel screws to provide access to solid state relay. Slide control section forward.
3. Disconnect wires from terminals. Identify or mark wires.
4. Remove nuts, washers, and screws from relay, then remove relay.
5. Install new relay.
6. Reconnect the wires identified or marked in step 3.
7. Replace covers.
8. Reconnect furnace to power supply.
9. Test operation of furnace.

To Replace Door Switch

1. Disconnect furnace from power supply.
2. Remove the four top screws on the front dial and the four bottom screws on the back cover.
3. Slide the control section forward. (Do not pull excessively on the internal wires).
4. Disconnect the wires from the door switch. (Note connection and placement of wires to micro switch). Identify or mark wires.
5. Remove the two screws and nuts from the door switch(es).
6. Insert new door switch(es) and secure with screws and nuts removed in Step 5.

7. Reconnect wires identified or marked in Step 4 to new door switch(es).
8. To realign door switch see "To Realign Door Switch" section.
9. Slide control section back in and replace the screws described in Step 2.
10. Reconnect to power supply.
11. Test operation of door switch. (See "To Realign Door Switch" section.)

To Realign Door Switch

1. Disconnect furnace from power supply.
2. Remove the four top screws on the front dial and the four bottom screws on the back cover.
3. Slide the control section forward. (Do not pull excessively on the internal wires).
4. With the door closed loosen the screws on the microswitch and slide the switch downward, so that the screws are at the bottom of the slots in the mounting bracket.
5. Finger tighten both screws. While holding down the rear of the micro switch housing, gently push up on the front of switch until you hear a click.
6. Open and close the door; the switch should click approximately 1" to 1.5" before the door is closed.
7. Tighten the two screws to secure the micro switch. Check the operation of the switch as described in Step 6 after tightening the screws.
8. Slide control section back and replace the screws described in Step 2.
9. Reconnect to power supply.

10. To test the operation of the door switch: turn the power switch on, set the control setting high enough to keep the control from cycling, open and close the door; the cycle light should turn off approximately 1" to 1.5" before the door is closed.

To Replace the Controller

The controller plugs into a panel mounting sleeve which should be left permanently installed in the furnace housing. To remove the controller, release the side clips and slide the controller out. Do not attempt to dismantle this unit further.

Troubleshooting

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
The power switch does not illuminate.	The furnace is not connected to power supply.	Check furnace connection to power source.
	ON and OFF power switch is defective.	Replace power switch.
	Fuses blown.	Replace fuses.
The furnace does not heat, cycle light illuminated.	Heating elements burned out or improper connections.	Replace heating elements or repair connections.
The furnace does not heat.	No power.	Check power source and fuses or breakers.
	Two or more heating elements in 208V or 240V furnaces are burned out.	Replace defective elements.
	Thermocouple has oxidized and opened the circuit.	Replace thermocouple.
	Defective electrical hookup.	Repair electrical hookup.
	Door switch malfunction.	Re-align or replace door safety switch.
	Defective mechanical relay coil or contacts.	Replace relay.
No temperature control.	Shorted thermocouple circuit.	Check thermocouple connection and/or replace thermocouple.
	Shorted solid state relay - over temperature protection may be activated.	Replace solid state relay.
	Defective control - error message on display may appear.	Return control for repair or replace.
	Thermocouple leads are reversed.	Connect leads correctly (see manual).
Slow heat-up.	One or two heating elements are burned out.	Replace burned out elements.
	Heavy load in chamber.	Lighten load in chamber to allow heat to circulate.
	Low line voltage.	Install line of sufficient size and proper voltage (isolate furnace from other electrical loads).
	Wrong heating elements.	Install proper elements.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Door switch does not cut power to the furnace chamber.	Door switch is not functioning.	Re-align or replace door safety switch.
	Mechanical relay contacts sticking.	Replace relay.
Repeated element burnout.	Chamber improperly loaded.	See loading procedures in start-up procedure.
	Heating harmful materials.	Enclose material in container. Clean up spills on chamber. Ventilate chamber by leaving door cracked slightly open when heating known harmful reagents.
	Overheating furnace.	Keep furnace under maximum temperature. Closer supervision of control setting.
	Wrong element.	Install proper element.
	Oxidized thermocouple.	Replace thermocouple.
Inaccurate temperature display.	Contamination present from previous burnout.	Replace insulation material.
	Wired improperly.	Check wiring diagram for correct wiring of your furnace.
	Oxidized or contaminated thermocouple.	Replace thermocouple.
	Improper loading.	Use proper loading procedures. Refer to start-up procedure.
	Poor thermocouple connection.	Tighten connections.
	Solid state relay malfunction.	Replace solid state relay.
	Thermocouple connections	Reconnect thermocouple correctly.

Replacement Parts List

Listed below is the common replacement parts for the 5300A30/F6010-TS furnace.

REPLACEMENT PART	DESCRIPTION
0165A27	Controller
0165A69	Pilot Light
0165A40	Heating Element, top
0165A42	Heating Element, bottom
0165A41	Heating Element, side
0165A71	Solid State Relay
0165A79	Power Switch
0165A80	Micro Switch (2)
0165A84	Thermocouple, Type K
0165A50	Fuse Holder
0165A23	Fuse
0165A55	Hearth Collar
0165A64	Ceramic Insulator for Vent Port

Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

Warranty Repair and Service

Thomas Scientific provides product descriptions and photographs that are in effect at the time of catalog publications. Specifications and appearances are subject to change; therefore delivered products sometimes vary from those depicted.

In addition to manufacturer warranties, Thomas Scientific (the Company) warrants all instruments and equipment (other than supplies, small items, reagents and chemicals) delivered to and retained by their original purchasers to be free from defect in material and workmanship for one year from the date of the Company's invoice to the purchaser (Thomas Scientific makes no warranty with respect to consumable parts or supplies). For a period of one year from the date of such invoice, the Company will correct, either by repair or replacement at the Company's sole election, any defect in material or workmanship (not including defects due to misuse, abuse, abnormal conditions or operation, accident, alteration, improper installation, acts of God, or service or modification of the product without prior authorization of the Company) without charge for labor, parts or shipment of the product to and from the service facility designated by the Company. Manufacturer warranties that extend beyond this 1-year period are the sole responsibility of the manufacturer.

The determination of whether any product has been subject to misuse or abuse will be made solely by the Company. The Company shall not be liable for any delay in performance under this warranty caused by any contingency beyond the Company's control, including war, government restrictions, strikes, acts of God, or reduced supply of materials. The Company shall not be liable for any special, incidental, or consequential damages, or any damage to plant, personnel, equipment or products, directly or indirectly resulting from the use or misuse of any product. Representations and warranties made by any person, including dealers and representatives of the Company which are inconsistent, in conflict with or in excess of the terms of this warranty shall not be binding upon the Company unless placed in writing and approved by an officer of the Company.

This warranty and all claims hereunder shall be governed by the laws of the State of New Jersey, United States of America.

The foregoing warranty is in lieu of all other warranties, guarantees, or representations, whether oral, written or implied, including any warranty of merchantability or fitness for use or purpose.

The Company's liability under this warranty or otherwise with respect to products of their use (including liability for negligence or otherwise in tort) is limited exclusively to the remedies provided herein and no other right or remedy shall be available to any person.



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