

# **LT3000 ULTRASONIC LEVEL TRANSMITTER**

## **Owner's Manual**

- ◆ Specifications
- ◆ Installation
- ◆ Calibration
- ◆ Troubleshooting
- ◆ Warranty
- ◆ Drawings

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Revision 3; December 13, 2000

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## 1. SPECIFICATION

**It is good engineering practice to use a separate, independent high level alarm with any continuous level transmitter.**

LEVEL MEASUREMENT DEVICE FOR LIQUID MATERIALS

PRINCIPLE OF OPERATION:	ULTRASONIC SONAR
RANGE:	10" - 22'
RESOLUTION:	+/-0.06% OR +/-0.12" (WHICHEVER GREATER), AT CONST.TEMP. & HUMIDITY, DRY AND STILL AIR
ACCURACY:	+/-0.125% OR +/-0.25" (WHICHEVER GREATER), AT CONST.TEMP. & HUMIDITY, DRY AND STILL AIR
TEMPERATURE:	-40F TO +140F (ELECTRONICS AND TRANSDUCER)
LOST ECHO HOLD TIME:	30 SECONDS
TEMP.COMPEN.: OUTPUT:	YES (TEMPERATURE SENSOR INSIDE A TRANSDUCER) CURRENT LOOP 4.00mA - 20.00mA (<3.5mA ON ERROR), RESOLUTION 0.02Ma, 500 ohm MAXIMUM LOAD
POWER SUPPLY:	FACTORY WIRED - 115VAC/60Hz OR 230VAC/50Hz OR 24VDC (TOLERANCE=+/-20%)
CALIBRATION:	TWO-POINT SETTING, ONE PUSH-BUTTON, BI-COLOR LED STATUS INDICATOR. ASSIGNING HIGH AND LOW LEVELS AS 4 AND 20mA, OR 20 AND 4mA, RESPECTIVELY
FUSE:	0.125A/250V TYPE 2AG
SENSOR MOUNT.:	2" NPT
CABLE ENTRY:	1" NPT (CONDUIT)
HOUSING:	TRANSDUCER - PVC, HERMETICALLY SEALED ELECTRONICS - CAST ALUMINUM

DESIGNED ACCORDING TO IEC1010 (GENERAL SAFETY)

**2. PHYSICAL INSTALLATION**

The sensor should be installed on top of a tank pointing downwards, away from any inlet pipes, agitators and sources of mechanical vibrations. Entry for the supply and signal cables should be sealed against moisture by a conduit or by other means. Make sure that the power is off while wiring the cables and installing the boards. Note that only one LT3000 sensor may be installed per tank.

**2.1 Wiring**

**\*\*\*\*Note: All wiring should conform to NEC Code or applicable local standards\*\*\*\***

Electrical wiring (for 115, 230VAC power or 24VDC power). The correct voltage is marked on the baseboard "LT3000BB" card.

Pass the power (2 wires + GND) and signal cables (2 wires) through the conduit opening in the housing. Unplug the top part of the 5-way connector J2. Wire the leads in the following order: **See drawing # J2**

- J2,Pin 1: AC power, L1 - black (+ for DC Powered Units)  
(Note - pin 1 is the closest one to the board edge)
- J2,Pin 2: AC power, L2 - white (- for DC Powered Units)
- J2,Pin 3: protective ground yellow/green (enclosure ground) \*
- J2,Pin 4: current output (+)
- J2,Pin 5: current output negative (-)

*\* It is very important that the green earth grounding wire is connected to pin 3 for all units, both AC and DC powered. This assures shielding of the electronics from electrical noise by grounding the aluminum enclosure.*

Then, plug the connector into the board.

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**THE FOLLOWING WIRING IS NORMALLY DONE AT THE FACTORY, THESE INSTRUCTIONS WOULD ONLY BE NECESSARY IN THE EVENT THAT A TRANSDUCER HAS TO BE REPLACED IN THE FIELD.**

To replace transducer, take the LT3000BB out of the housing, screw the transducer into the bottom hole in the housing, and connect transducer cable to J1(**See Drawing J1**):

- J1,Pin 1: COMMON SHIELD (note - pin 1 is the closest one to the board edge)
- J1,Pin 2: RED (transducer lead)
- J1,Pin 3: leave unconnected
- J1,Pin 4: WHITE (temperature sensor)

Install first LT3000BB inside the housing, then plug LT3000SC in and screw the lid on (with a gasket).

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## 2.2 Selecting Loop Power Source ; Internal or External

The 4-20mA output from the LT3000 can be either internally powered (LT3000 provides power on loop) or externally powered (Customer provides power source for loop).

To select internal loop power place jumper J5 on the center pin and the pin labeled INT (see Drawing J5).

To select external loop power place jumper J5 on the center pin and the pin labeled EXT (See Drawing J5).

The wiring of the loop may now be completed to a load or readout device. Typical wiring diagrams are shown in Diagram # 101 in this manual.

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## 3. SETTING UP 4mA AND 20mA CALIBRATION RANGE

### 3.1. Calibrating the "tank full" and the "tank empty" levels.

Setting the close (top) and the far (bottom) range is performed by a simple push-button sequence, while the sensor is pointed and locked-in on a target placed at the appropriate distance. It can also be done with the sensor mounted on the tank, as long as the level of the material is appropriate for the required (top or bottom) setting. It is entirely up to the user to decide whether 20mA output should represent the top or the bottom level (the same with 4mA). Note that one should normally avoid setting the 20mA and 4mA at the same level.

**Note: The close or top range must be at least 10" from the face of the transducer. This dead zone expands slightly at higher temperatures.**

Before starting the setup, make sure that the actual level (or target) does correspond to the required top or bottom range, and is not moving. Take off the lid and observe the LED indicator:

GREEN = OK

RED = errors (for example - Loss Of Echo, occurs with a 30 second delay)

YELLOW = first 4 sec after power-up

YELLOW FLASH = acknowledge (during user setup) Please notice that the LED will flash "Yellow" once per minute in normal operation

It is also advantageous (although not necessary) to have a milliampmeter connected in-series with the current loop - this will allow monitoring the stability of the target and also would help in case of trouble shooting by allowing you to read error codes (see appendix).

**To assign 20.0mA to the actual target distance (level):**

- a) Make sure that LED is *Green*, wait 30 seconds
- b) Press the push button and hold for 3s (2-5s). LED will turn *Yellow* - at this time, release the push-button and observe the LED producing a *Yellow* flash (acknowledge). The actual level is now stored.

**To assign 4.00mA to the actual target distance (level):**

- a) Make sure that LED is *Green*, wait 30s
- b) Press the push button and hold for 10s (7s-15s). LED will first turn *Yellow*, keep holding the button, when the LED turns *Red* - release the button and observe the LED producing a *Yellow* flash (acknowledge). The actual level is now stored.

The levels are stored in permanent memory that persists throughout power losses, until the setup procedure is repeated again.

The system ignores accidental pressing of the push button for times less than 1 sec.

Note that holding the button continuously for more than 1 minute when LED goes *Red* again (LED goes *Yellow*, *Red*, off and then *Red* again) will cancel the calibration sequence.

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**3.2. Temperature sensor calibration** (use only in case of transducer replacement, or of LT3000SC board replacement).

The temperature calibration is performed at 65-70F, may be done in-doors, regardless of the target placement. The current loop need not be connected. When bringing the unit indoors, make sure to wait about 30minutes for the temperature inside the transducer to equalize with the ambient temperature. Power the unit up, point it towards any target, wait for the LED to turn green, then press and hold the push-button for 17-30s, watch LED turn yellow, then red, then it turns off. Release the button when the LED is turned off (yellow flash=acknowledge).

**APPENDIX A**

**CURRENT LOOP OUTPUT AND ERROR CODES.**

4.00-20.00mA - NO ERROR, linear function of level or distance,  
resolution 0.02mA (+/-0.01mA)

ERROR CODES (not valid in the first 4s on power up):

0.00mA - LOSS OF POWER OR CIRCUIT FAILURE

0.02mA - BLANKING ERROR (target too close)

0.04mA - LOSS OF ECHO

0.08mA - TIMER/COUNTER FAILURE

0.16mA - ENVELOPE ERROR

0.32mA - TEMPERATURE ERROR

0.64mA - EEPROM CRC ERROR

1.28mA - EEPROM R/W ERROR

2.56mA - PUSH-BUTTON IS STUCK

>21mA - OUTPUT SHORT OR CIRCUIT FAILURE

Note: (1) the actual software revision number is displayed through the current output (in mA), in the first 4 seconds after power up, for example 1.02mA indicates the revision 1.02

(2) The error codes are additive, that is when more than one error occurs, their codes will add-up, for example, TEMPERATURE ERROR + LOSS OF ECHO will result in 0.36mA current.

**APPENDIX B**

**TROUBLE-SHOOTING**

**0.00mA - LOSS OF POWER OR CIRCUIT FAILURE**

- If LED is off - check the power supply wiring. Make sure that the voltage rating is correct. Check the fuse F1, replace if blown. Otherwise replace the unit or LT3000BB (Note - new LT3000BB requires tuning of inductors L1 and L2)
- If LED is green, check the current-loop wiring, make sure that the current loop voltage is within 14-30V and of the correct polarity (J2 pin 4 = "+"). Replace LT3000SC (plug-in) board.

**0.02mA - BLANKING ERROR**

- Make sure that the transducer is not covered by a build-up, not immersed or is not in contact with a hard object (face-on). If the above is not the case, then replace the transducer.

**0.04mA - LOSS OF ECHO (LOE)**

- This can happen intermittently under certain severe conditions, for example - if liquid material in the tank is severely agitated, covered with thick foam or if there is excessive amount of certain gases (i.e. CO<sub>2</sub> or CH<sub>4</sub>). Normally, the device will hold the last valid level measurement for 30s before the LOE error is displayed, thus if an abnormal condition lasts less than 30s, LOE error will not show up though the response time may be compromised. If the LOE error persists even under optimal condition (i.e. indoors pointing at a wall 15' away), then check if transducer is not covered with a build-up (clean it!) or broken. Note that the transducer may physically break when exposed to temperatures higher than 80C, or in certain chemically active solvents or vapors.

**0.08mA - TIMER/COUNTER FAILURE**

- Circuit failure, replace LT3000SC (plug-in) board

**0.16mA - ENVELOPE ERROR**

- Under present software revision, this error is not tested against and should not happen.

**0.32mA - TEMPERATURE ERROR**

- Check if the temperature inside the tank is not exceeding 100C or is below -60C. Note that the transducer may physically break when exposed to temperatures higher than 80C. Otherwise, if the process temperature is within a spec, check the transducer connection (J1 pin 4, white). Check the temperature sensor by connecting it to a 9V battery through a 1kohm series resistor (the shield = "-", the white lead = "+") Measure a voltage drop across the temp sensor - should be 1.6-2.2V  
Replace the transducer, if broken or LT3000SC (plug-in) board otherwise.

**0.64mA - EEPROM CRC ERROR**

- This may happen temporarily under a condition of extreme external electrical noise. Make sure that the power line is not shared with high power mechanically commutated electric motors, electric welders etc. Otherwise, if the error is persistent, replace LT3000SC (plug-in) board.

**1.28mA - EEPROM R/W ERROR**

- Circuit failure, replace LT3000SC (plug-in) board.



**2.56mA - PUSH-BUTTON IS STUCK**

- Push button is mechanically stuck (in), or electrically shorted (for example, by excessive moisture). Pull it up and clean it, otherwise replace LT3000SC (plug-in) board.

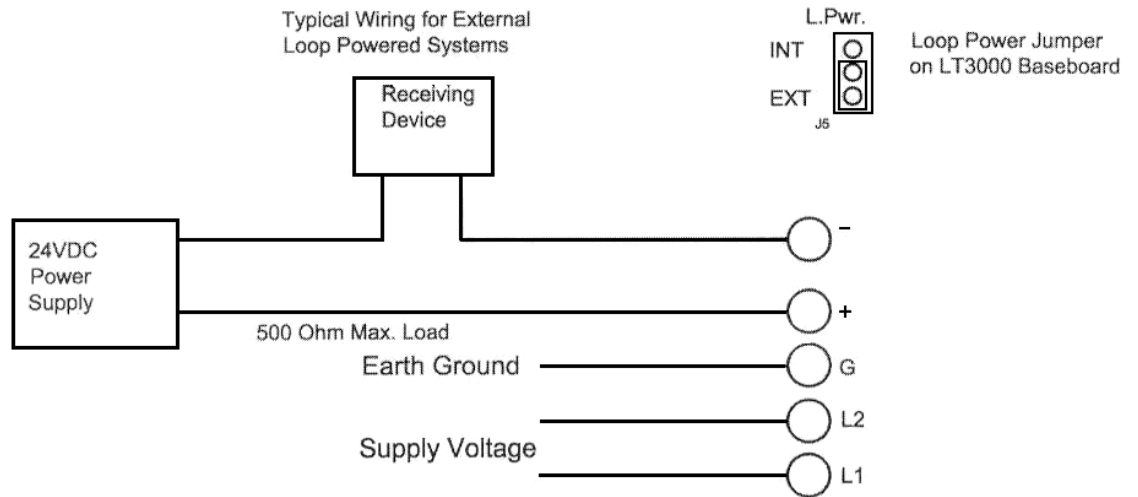
**>21mA - OUTPUT SHORT OR CIRCUIT FAILURE**

- Circuit failure or current loop connection is shorted. Unplug the J2 plug and see if the error persists, if so then fix the current loop wiring, otherwise replace LT3000SC (plug-in) board.

**<3.5mA and LED stays yellow all the time**

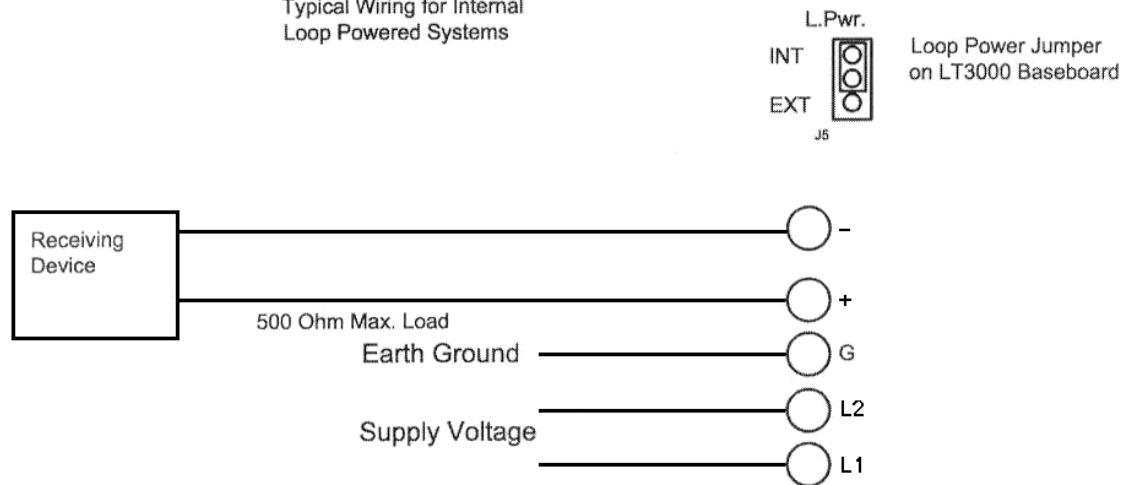
- Circuit failure, replace LT3000SC (plug-in) board.

Diagram #101

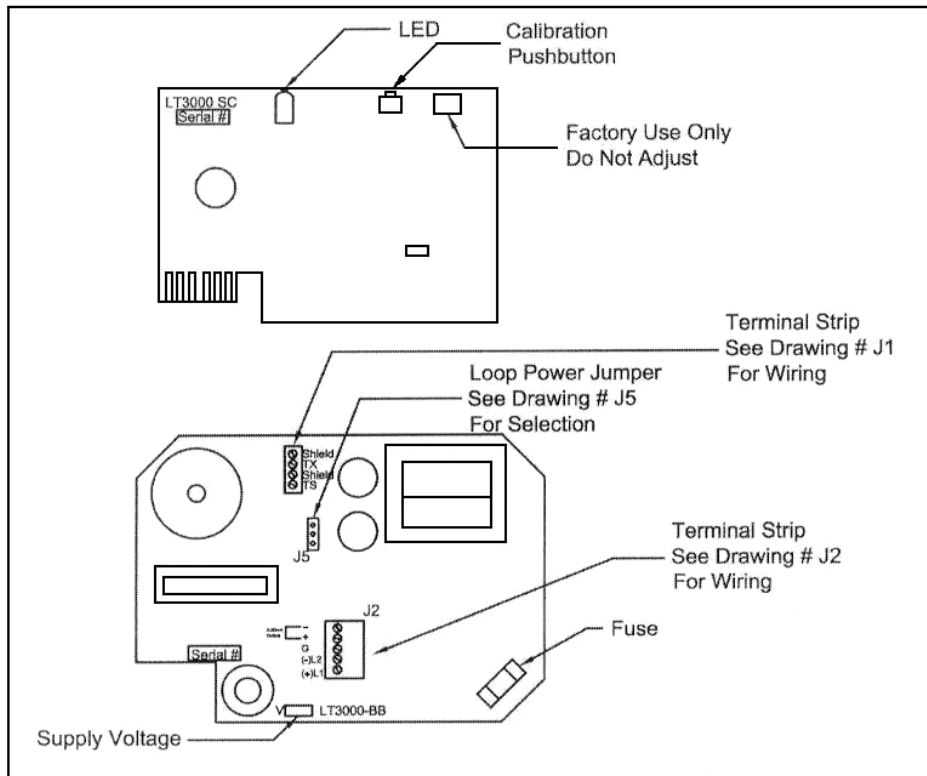
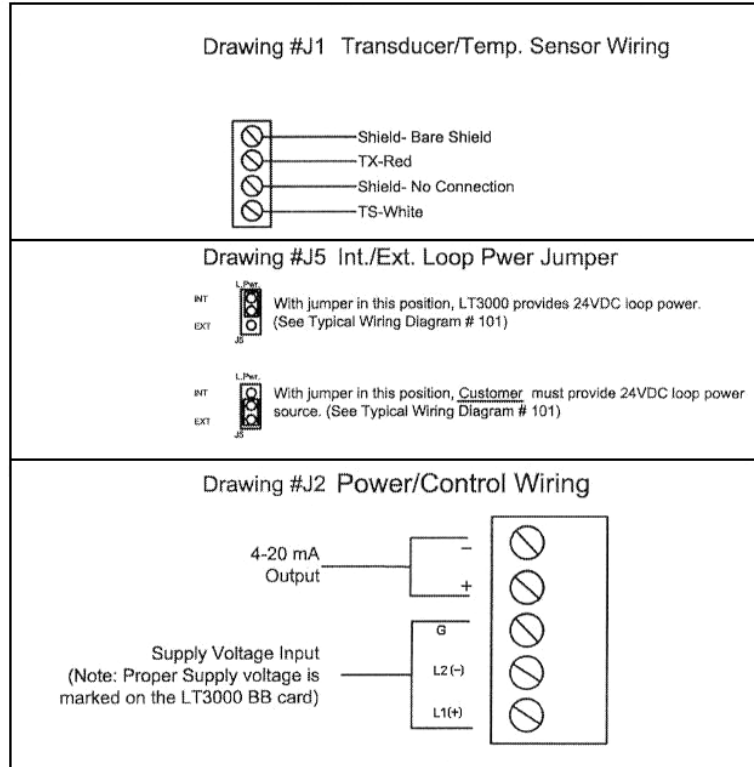


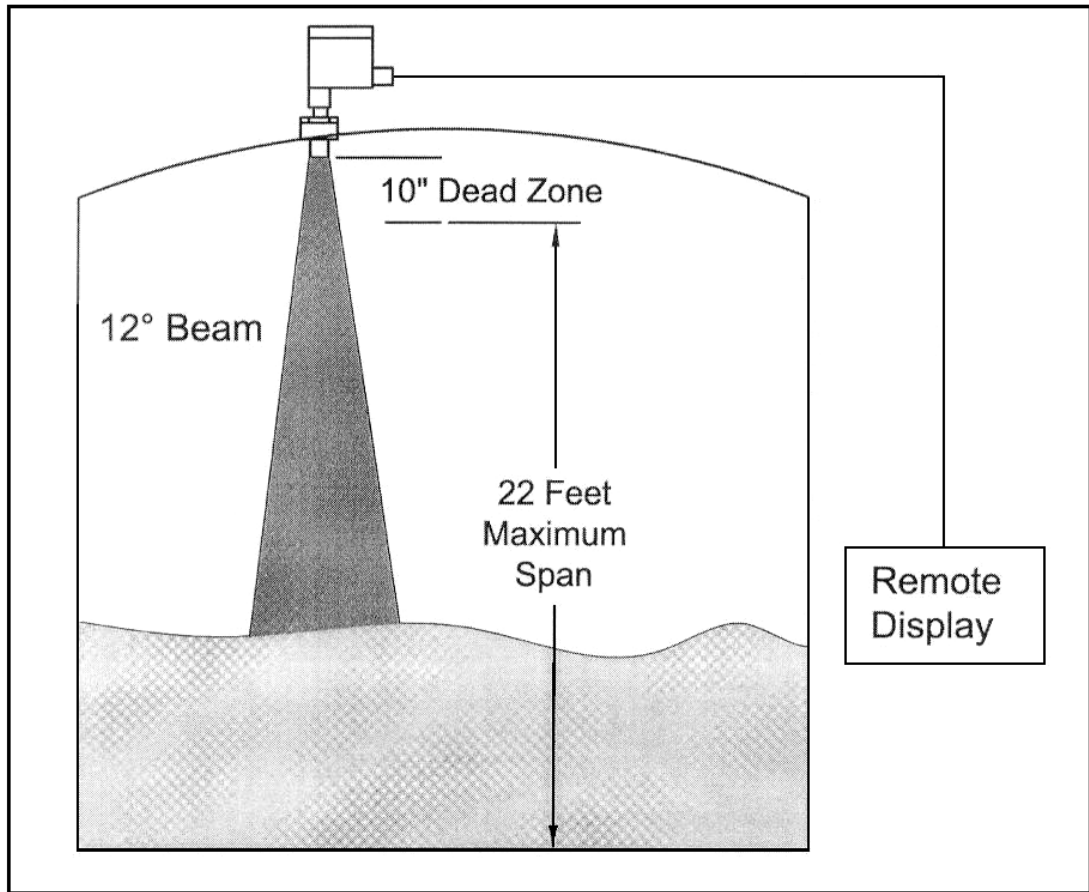
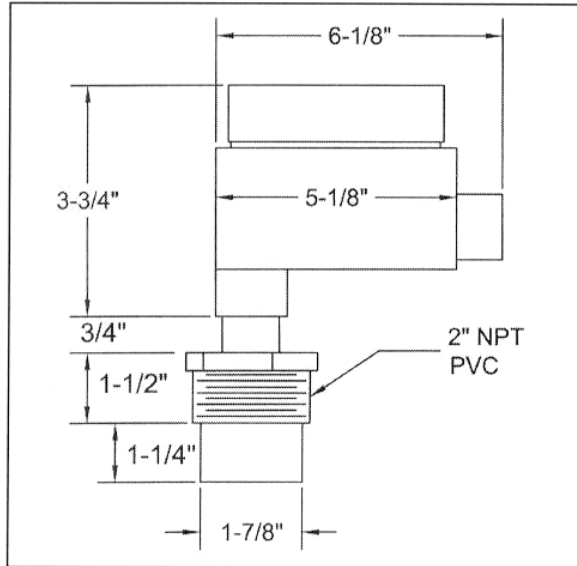
Each LT3000 is designed to work with a specific supply voltage. The supply voltage is written on the Baseboard.

Typical Wiring for Internal Loop Powered Systems



Each LT3000 is designed to work with a specific supply voltage. The supply voltage is written on the Baseboard.





**Warranty**

All components of the LT3000 are warranted to be free from defects in material and workmanship for a period of one year from the date of purchase. This warranty applies to general purchaser and to components installed, serviced and operated according to instructions.

Babbitt International, Inc. will repair or replace, at its option, FOB at its plant or any other location designated, any part which proves to be defective in manufacture or workmanship.

All claims must be made in writing within the warranty period. No claims outside the warranty period will be honored.

Warranties are not applied to any components which have been damaged by improper installation, use, exposure to unusual atmospheric conditions or components which have been misused, abused, damaged by neglect or accident. This warranty shall not apply to any components, which have been altered or repaired without the prior written consent of Babbitt International, Inc.

Babbitt International, Inc. assumes no responsibility or liability for any labor or material backcharges, without written authorization.

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