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Introduction

This manual contains calibration and installation information for Moore Industries' Field mounted, Pressure-to-Current Transmitter (PIF). Also contained in this manual is a functional description of this transmitter, a simplified theory of operation, and maintenance information. Associated tables and illustrations are provided for reference purposes.

This manual contains notes and cautions that must be observed to avoid equipment damage and minor inconveniences while calibrating or installing the PIF transmitter. The following definitions describe the content of these captions:

A **NOTE** shall contain technical or literary information of a helpful nature. This information is intended to aid the reader's understanding of the subject being discussed and/or minimize inconveniences while performing technical tasks.

A **CAUTION** shall contain technical information of a serious nature, which if ignored may cause equipment damage.

Description

The PIF converts an instrument-quality air input into a proportional 4-20 mA output. This transmitter is specially designed for use in harsh environments. It is packaged in a two-piece, thermoplastic housing that meets NEMA 4X and IP65 standards. This rugged housing is water-tight, dust-tight, corrosion-resistant, and flame retardant.

The PIF interfaces reliably with most process control instrumentation. It can monitor a single loop or an entire pneumatic facility. Because it is such an accurate instrument, the PIF can interface directly with recorders, monitoring equipment or computers.

The PIF is a loop-powered device, requiring 12-42 Vdc (12-28 Vdc for intrinsically safe units) and has inherent RFI immunity. The 4-20 mA output is field-adjustable with Zero and Span potentiometers. The output can also be factory-configured so that it reacts inversely to the input pressure (i.e., as the input air pressure increases through the specified range, the output decreases toward 4 mA, option RD). The pneumatic input range is factory-configured for any one of 10 user-selected input ranges.

The PIF can be surface mounted or attached to a 2-inch pipe (option P), in any orientation. (Refer to the Installation Section of this manual for details.) A 1/2 NPT or M20X1.5 (metric) port provides access for electrical connections. The pneumatic connections are made to a 1/4 NPT female port or an optional tube fitting for 1/4 outside-dimension (OD) plastic tubing (option TF).

Table 1 contains the PIF equipment specifications, including pneumatic input options, power requirements and performance characteristics.

Model Number. The PIF model number describes the equipment type, functional characteristics, operating parameters, and configuration options. If all other documentation is missing, this number can be used to identify equipment characteristics. The model number is located on a stainless steel tag attached to the side of the unit.

Serial Number. Moore Industries maintains a complete history on every unit it sells and services. This information is keyed to the serial number. When service information is required about a PIF, it is necessary to provide the factory with this number. The serial number is on the tag on the side of the unit adjacent to the model number.

Table 1. PIF Equipment Specifications

Characteristic	Specifications
Input	Instrument Quality Air Only: 0-5, 0-15, 0-30, 1-5, 3-15, 3-27 or 6-30 psig 20-100 kPa 0.2-1 Bar 0.2-1 kg/cm ²
Output	4-20 mA
Performance	<p>Calibration Capability: Error shall not exceed $\pm 0.2\%$ of span including independent linearity as defined in SAMA Standard PMC 20.1-1973</p> <p>Response Time: 10 msec for a step change, on the input to reach 98% of output span</p> <p>Resolution: $\pm 0.05\%$ of input span</p> <p>Load Capability: 600 ohms at 24 Vdc (nominal)</p> <p>Repeatability: Within $\pm 0.1\%$ of input span</p> <p>Pressure Limit: Without damage, 150% of full scale input pressure</p> <p>Step Response: For a step change in the input, 10 ms to reach 98% of final output</p> <p>Output Limit: 130% of output span</p> <p>Output Ripple: Negligible</p> <p>RFI Immunity: Less than $\pm 0.1\%$ of span change with field strengths of 30 volts per meter at frequencies of 20-500 MHz</p> <p>Ambient Temperature Effect: Less than $\pm 2\%$ of full scale input over the ambient temperature range</p> <p>Power Supply Effect: Less than $\pm 0.01\%$ of span per volt of line voltage change at the input terminals</p> <p>Load Effect: $\pm 0.01\%$ of span from zero to maximum load</p>
Power	2-wire: 12-42 Vdc (standard) 12-28 Vdc (intrinsically safe units)
Adjustments	<p>Zero: Adjusts output to 0% of output range, $\pm 10\%$ of output span (e.g., 4 mA output, ± 1.6 mA)</p> <p>Span: Adjusts output to 100% (full scale) of output range (20 mA)</p>
Operating Temperature	Ambient Range: 30 to 130 °F (-1.1 to 54.4 °C)

NOTE: See Installation Section for physical dimensions.

Calibration

Every PIF is calibrated and checked at the factory prior to shipment. This calibration ensures that each unit meets equipment specifications and is operating properly before it leaves the factory. If requested by the user, the factory calibrates the unit and seals the Zero and Span potentiometers at their optimum settings. Units that have tabs covering the Zero and Span potentiometers are units that have been calibrated to exacting specifications. These tabs can be easily removed to access the potentiometers for re-adjustment.

Prior to installation, the user may wish to verify the accuracy of the output signals. To perform this verification, the PIF must be setup for calibration. The 4-20 mA output of the PIF is field-adjustable using the Zero and Span potentiometers.

If a unit fails to perform as specified, the user should contact Moore Industries' Customer Service Department for assistance.

Zero and Span Adjustments

If calibration of the PIF is required, the Zero and Span potentiometers are the only field adjustments to be performed. These two multi-turn potentiometers are accessible on the front panel of the unit. To avoid damage, these potentiometers are equipped with a slip-clutch at each end of their wiper blade travel, which requires 22 turns to go from one end to the other. When adjusting these potentiometers, use a slotted screwdriver with a head width no greater than 0.1 inch (2.54 mm).

The Zero potentiometer adjusts the 4 mA output (zero percent). The Span potentiometer adjusts the 20 mA output (100 percent). Turning these adjustments clockwise causes the related output to increase in quantity or become more positive; while turning them counterclockwise causes the related output to decrease in quantity or become more negative.

The Zero and Span potentiometers are located beneath the front cover. To access these potentiometers, use a slotted screwdriver to loosen the two captive screws holding the cover in place and lift it away. A strap is attached between the inside of the cover and the main unit, which keeps the cover in close proximity. The Zero and Span potentiometers are accessible on the front panel and are represented symbolically by the following markings:

→○← represents Zero

|←→| represents Span

Calibration Equipment

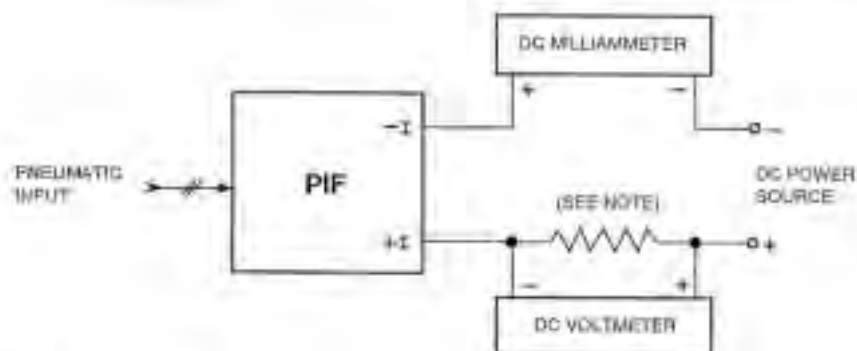
Table 2 lists the equipment required to calibrate the PIF. Included in this list is optional equipment that may be substituted for monitoring the output. This calibration equipment is not supplied with the PIF; it must be furnished by the user.

Calibration Setup

Figure 1 illustrates a typical calibration setup for the PIF. To checkout or calibrate the PIF, connect the unit as shown in this illustration. Specifications for the equipment required for calibration are listed in table 2.

Table 2. Calibration Equipment

Equipment	Characteristic
Adjustable Instrument Quality Air Supply	Pressure adjustable to the minimum and maximum inputs specified for the transmitter being calibrated.
DC Milliammeter (optional)	Fiske 8600A, or equivalent, accuracy of $\pm 0.05\%$ or better
DC Voltmeter, w/Resistor (optional)	Voltmeter, accuracy of 0.05% or better; Resistor: 250Ω ($\pm 0.1\%$) for 4-20 mA output
DC Power Supply	12-42 Vdc (12 Vdc minimum power source)
Screwdriver	Slotted, head width no greater than 0.1 inch (2.54 mm)



NOTE: EITHER DC MILLIAMMETER OR DC VOLTMETER MAY BE USED FOR MONITORING OUTPUT. NOTE POLARITY OF CONNECTIONS.

Figure 1. PIF Calibration Setup

Calibration Procedures

There are two options shown in figure 1 for monitoring the output of the PIF. Either a dc milliammeter or a dc voltmeter, with a load resistor, may be used to monitor and set the current output. Either method may be used to properly calibrate the PIF.

When using a voltmeter and load resistor, output readings of 1-5 volts correspond to current output readings of 4-20 mA. A 250 ohm load resistor should be used to achieve the equivalent output of 4-20 mA.

For calibration, an adjustable instrument air supply is required. This supply should be adjustable over the required input range of the PIF being calibrated.

The following procedures contain step-by-step instructions for checkout and/or calibration of the PIF:

1. Connect adjustable instrument air supply to PIF input port.

CAUTION

Ensure proper polarity is maintained when connecting equipment for calibration. See figure 1.

2. If using a milliammeter to monitor output, connect 12-42 Vdc power source in series with milliammeter. Go to step 4.
3. If using a voltmeter with specified load resistor to monitor output, connect 12-42 Vdc power source in series with load resistor; connect voltmeter across load resistor.

4. Connect monitoring equipment to +I and -I terminals of PIF using a small slotted screwdriver. (Check polarity of connections.)
5. Set adjustable instrument air supply to zero percent of input range (as specified for unit).

CAUTION

To avoid damaging their housings, use a screwdriver with a head no wider than 0.1 inch (2.54 mm) when adjusting the Zero and Span potentiometers.

6. If using a milliammeter to monitor output, adjust Zero potentiometer for 4 mA output (zero percent). Go to step 8.
7. If using a voltmeter with specified load resistor to monitor output, adjust Zero potentiometer for 1 volt.
8. Set adjustable instrument air supply to 100 percent of input range (as specified for unit).
9. If using a milliammeter to monitor output, adjust Span potentiometer for 20 mA output (100 percent). Go to step 11.
10. If using a voltmeter with specified load resistor to monitor output, adjust Span potentiometer for 5 volts.
11. Repeat steps 5 through 10, as applicable, until output levels require no further adjustments when switching from minimum to maximum input settings.

PIF

Installation

Installation of a PIF is divided into three phases; mounting, pneumatic connections and electrical connections. In most cases, it is easier to mount the transmitter before completing the pneumatic or electrical connections.

Mounting

The PIF is designed for mounting in harsh environments. Its highly durable housing can be surface mounted or pipe mounted (on 2-inch pipe) in any orientation. It is important, however, that the positioning of the PIF allow for access to the front cover and to the pneumatic and electrical ports.

Figure 2 shows the mounting dimensions for the PIF. Pipe mounting hardware is an optional item (option P) for the unit. The recommended hardware for mounting to 2-inch pipe is available through Moore Industries.

CAUTION

Should other hardware be used to mount the PIF to a 2-inch pipe, ensure that the substitute hardware supports the PIF properly and does not cause undesirable mechanical stress on the housing.

Pneumatic Connections

Before connecting a pneumatic input line to any Moore Industries product, ensure that the line is free of debris. To do this, supply high input pressure (up to 60 psig) and then open each valve slightly to force loose debris towards the valve. Small pieces of foreign matter may flow out the valve while clearing the line. It may be necessary to remove the valve to clear larger objects from the line (e.g., loose tape, pipe compound). While pressure is supplied to the line, check for valve leaks and take corrective action if necessary.

There are two input ports on the PIF. One port is plugged at the factory, and the other is intended for the pneumatic input. Either input port may be used, but the unused port must be securely plugged to prevent leakage. Figure 2 shows the location of the input ports. These ports are 1/4 -18 NPT (female) openings. Plastic tube fitting for 1/4 OD plastic tubing is available as an option (option TF1), and may be used if desired.

NOTE

The part with the red plastic plug should not be tampered with. This plug works as an atmospheric vent.

CAUTION

Teflon tape is recommended for installation of fittings. In applications requiring pipe sealants other than teflon tape, contact the factory for technical assistance or test a sample under actual end-use conditions.

Electrical Connections

The PIF has two electrical terminals. These terminals are the 4-20 mA output connections, and they are accessed by removing the front cover. The terminals are marked +I and -I on the front label. Electrical wires enter the PIF through either a 1/2 NPT port or a M20X1.5 (metric) port, depending on the housing.

CAUTION

Ensure that proper polarity is maintained when connecting the PIF to other instruments.

Terminal wires used should be between 14 and 22 AWG. Terminations are made with compression-screw sockets; so terminal lugs are not used with this equipment. To terminate wires, strip the insulation 0.25-inch from the end of the wire, then slide it in the opening adjacent to the screw, and tighten the corresponding screw while holding the wire in place.

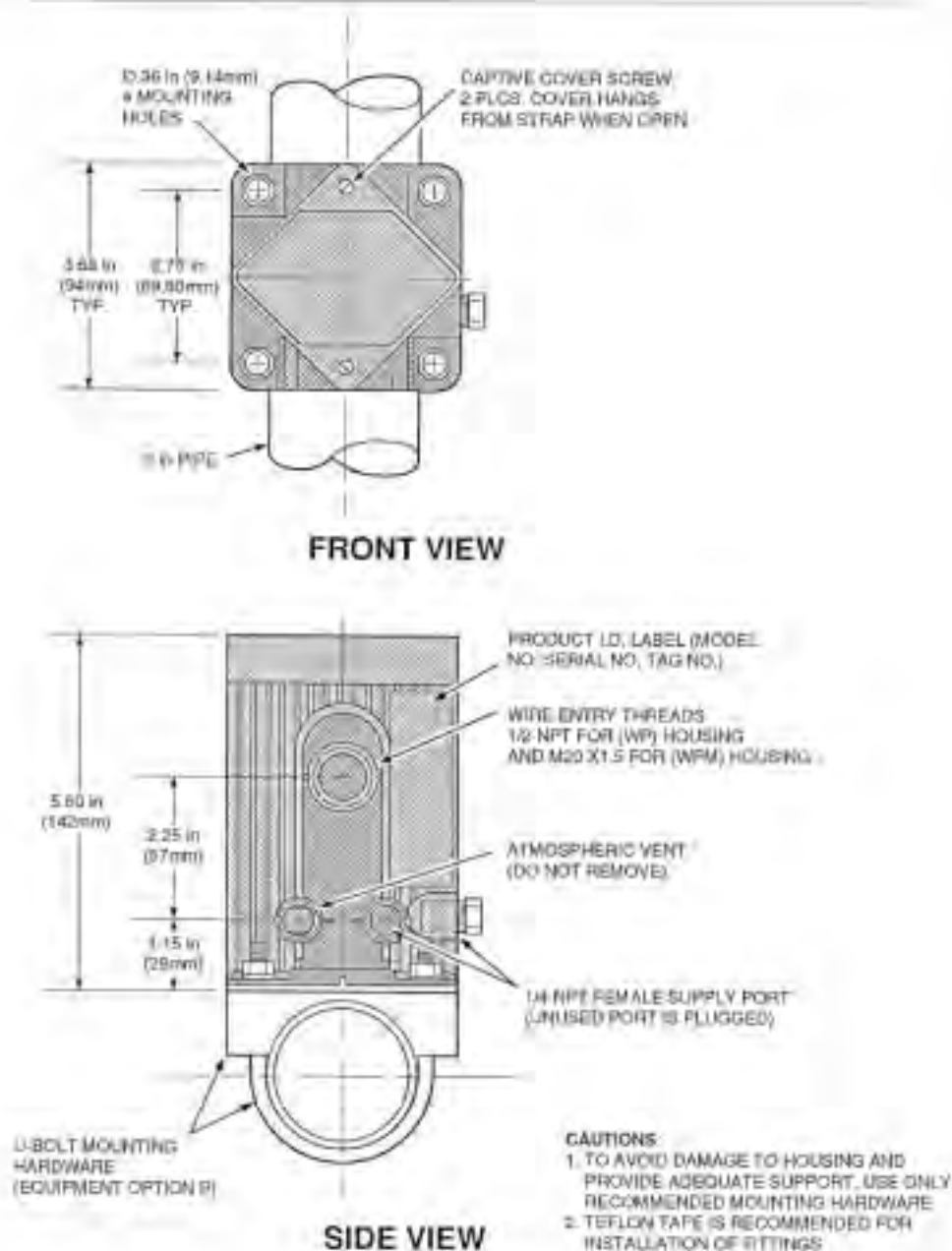


Figure 2. PIF Mounting Dimension

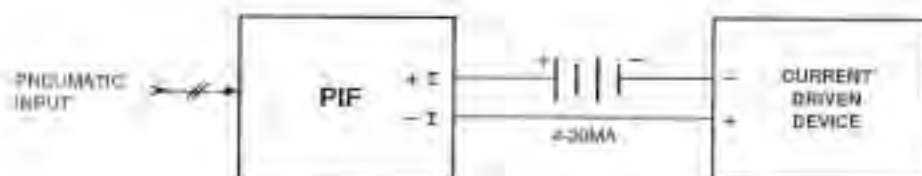


Figure 3. Typical PIF Hookup Diagram

The PIF is a loop-powered device that requires a 12-42 Vdc source (standard). This loop-power is connected to the + I and - I terminals on the unit. The + I terminal is connected to the positive (+) side of the source. The - I terminal is connected in series with other devices to the negative (-) side of the source. Figure 3 illustrates a typical 2-wire hook-up configuration for the PIF.

Multiple PIF Hook-ups

Some precautions must be taken when powering more than one PIF from a single supply; one side of the power source must be common to all PIF's. The other side of the power source must be common to all loads. Figure 4 is an example of a typical hookup configuration for multiple 2-wire units powered by a common source.

When using a single power source to power multiple units, care must be taken to avoid ground loop problems due to the loads being at different potentials. Another disadvantage in using this type hookup is that loss of power could result in the loss of a number of operational loops.

Operation

PIF transmitters are designed to operate unattended. Should a malfunction occur during normal operation, the troubled unit can be checked out by setting it up as shown in the calibration setup, figure 1.

Because the PIF is a low current device, it should not become warm during operation, unless the ambient temperature is unusually high.

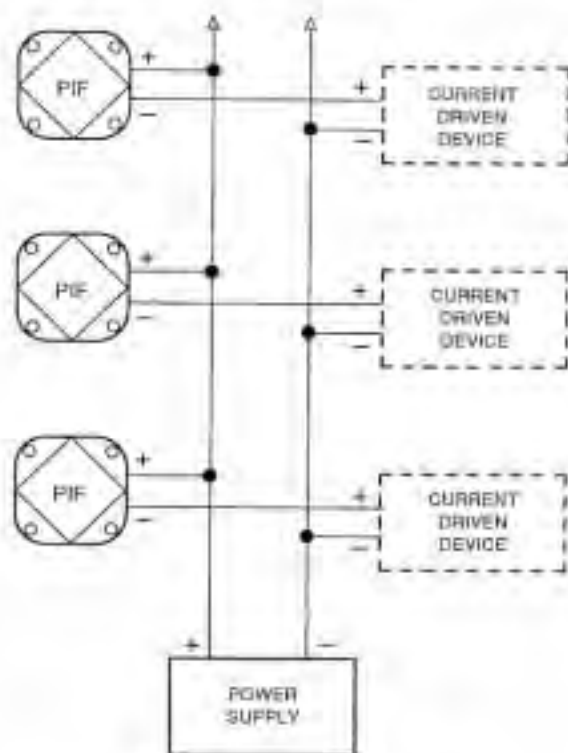


Figure 4. Multiple PIF Hookup Diagram

Theory of Operation

The theory of operation for the PIF is described here based on the simplified block diagram shown in figure 5.

Two-wire transmitters are loop-powered devices. The PIF requires a 12-42 Vdc source (standard units) for normal operation. The positive (+) side of this source is connected to an internal power supply circuit. This power supply generates the regulated voltages for the electronics and provides stable reference voltages. These reference voltages are supplied to the zero adjustment, span adjustment, and the constant current excitation circuits.

The sensor and temperature compensation network detects changes in air pressure (input) and produces current changes with a piezoresistive strain gauge sensor and laser-trimmed, temperature compensation resistors. The span adjustment is accomplished by setting the excitation current of the sensor. The output of the sensor and temperature compensation network is fed to the differential amplifier, which outputs to the current output stage.

Zeroing is accomplished by summing an adjustable signal with the amplified output of the sensor and the loop current signal. This summation controls the output current stage, which forces the current flowing through, and output by, the device to be a precise linear representation of the input pressure.

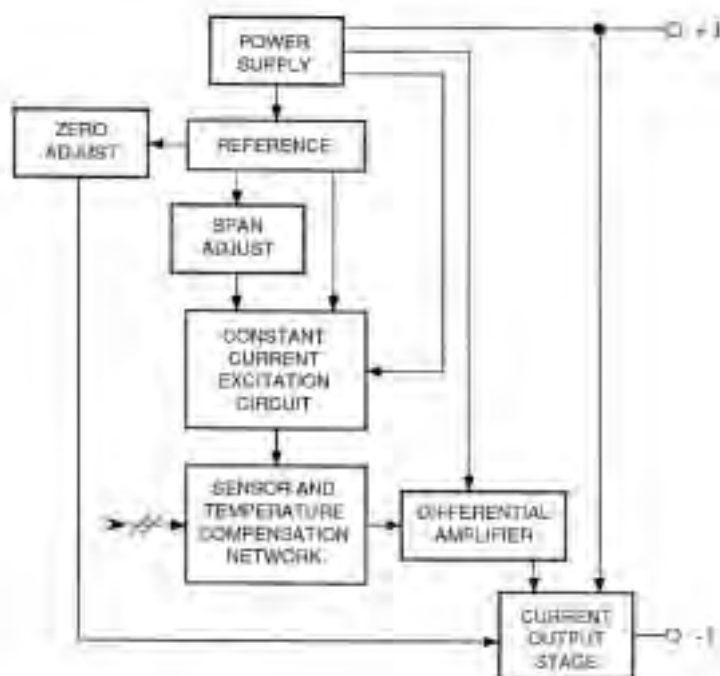


Figure 5: PIF Simplified Block Diagram

Maintenance

PIF transmitters are built with highly reliable components and contain no moving parts. These two aspects ensure that these units operate reliably for extended periods of time.

Once installed and operating, the PIF requires no field maintenance. However, a visual inspection of the unit is recommended at least once every six months.

Troubleshooting

Field troubleshooting of the PIF is limited to visual inspection of the housing, the pneumatic connections, and verification of specified signal response. To verify proper functioning of the PIF, the unit must be connected as shown in the calibration setup, figure 1. Then the output signal response can be checked.

For additional technical assistance, or to obtain related product drawings, the user should contact Moore Industries' Customer Service Department by dialing 1-800-999-2900.

NOTES

NOTICE: This manual is complete as of its issue date; however, subsequent product changes may be incorporated in later editions.

RETURN PROCEDURES

To return equipment to Moore Industries for repair, follow these four steps:

1. Call Moore Industries and request a Returned Material Authorization (RMA) number.

Warranty Repair –

If you are unsure if your unit is still under warranty, we can use the unit's serial number to verify the warranty status for you over the phone. Be sure to include the RMA number on all documentation.

Non-Warranty Repair –

If your unit is out of warranty, be prepared to give us a Purchase Order number when you call. In most cases, we will be able to quote you the repair costs at that time. The repair price you are quoted will be a "Not To Exceed" price, which means that the actual repair costs may be less than the quote. Be sure to include the RMA number on all documentation.

2. Provide us with the following documentation:
 - a) A note listing the symptoms that indicate the unit needs repair
 - b) Complete shipping information for return of the equipment after repair
 - c) The name and phone number of the person to contact if questions arise at the factory
3. Use sufficient packing material and carefully pack the equipment in a sturdy shipping container.
4. Ship the equipment to the Moore Industries location nearest you.

The returned equipment will be inspected and tested at the factory. A Moore Industries representative will contact the person designated on your documentation if more information is needed. The repaired equipment, or its replacement, will be returned to you in accordance with the shipping instructions furnished in your documentation.

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ANY CAUSE OF ACTION FOR BREACH OF ANY WARRANTY BY THE COMPANY SHALL BE BARRED UNLESS THE COMPANY RECEIVES FROM THE BUYER A WRITTEN NOTICE OF THE ALLEGED DEFECT OR BREACH WITHIN TEN DAYS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH, AND NO ACTION FOR THE BREACH OF ANY WARRANTY SHALL BE COMMENCED BY THE BUYER ANY LATER THAN TWELVE MONTHS FROM THE EARLIEST DATE ON WHICH THE BUYER COULD REASONABLY HAVE DISCOVERED THE ALLEGED DEFECT OR BREACH.

RETURN POLICY

For a period of thirty-six (36) months from the date of shipment, and under normal conditions of use and service, Moore Industries ("The Company") will at its option replace, repair or refund the purchase price for any of its manufactured products found, upon return to the Company (transportation charges prepaid and otherwise in accordance with the return procedures established by The Company), to be defective in material or workmanship. This policy extends to the original Buyer only and not to Buyer's customers or the users of Buyer's products, unless Buyer is an engineering contractor in which case the policy shall extend to Buyer's immediate customer only. This policy shall not apply if the product has been subject to alteration, misuse, accident, neglect or improper application, installation, or operation. THE COMPANY SHALL IN NO EVENT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.



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