

Sensor Circuit Option Kit

311603L

EN

**To upgrade E-Flo[®] 4-Ball Piston Pumps to include the sensor circuit option.
For professional use only.**



Important Safety Instructions

Read all warnings and instructions in this manual and in E-Flo Repair-Parts manual 311594. Save these instructions.

24J305 Series B Sensor Circuit Option Kit

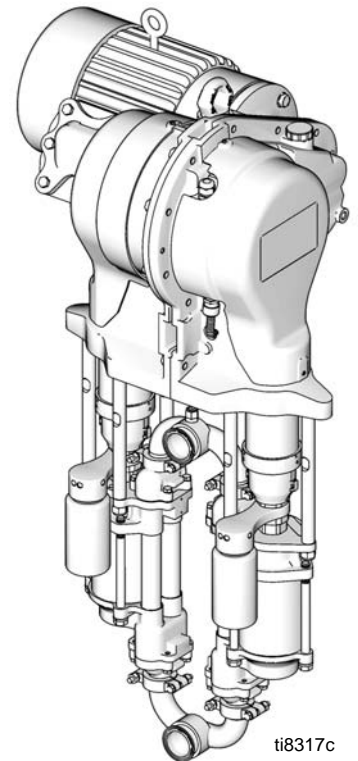
For E-Flo Pumps, Series D and later, and for use with the ACS E-Flo control module. Includes circuit board, pressure transducer, TDC sensor, motor position sensor, and 2-sensor conduit.

15J755 Series B Sensor Circuit Option/Service Replacement Kit

For E-Flo Pumps, Series C and earlier. Includes circuit board, pressure transducer, TDC sensor, and 1-sensor conduit.

For use with the Graco CT VFD. Includes the current revision application module and software to ensure compatibility of CT drive and pressure circuit hardware.

Approvals Note: This manual is used for Kit 24J305 and Kit 15J755. Each kit contains an intrinsically safe (IS) approved part, 288343. In this manual, this part is referred to as the IS Control Circuit. The IS Control Circuit is not available for purchase separately. The IS Control Circuit is called out as item 25 in the parts list on page 9. The subcomponents of the IS Control Circuit are called out as 25a, 25b, and 25c on the parts list. The approval label and approval information apply only to the IS Control Circuit. See page 3 for hazardous location approval information.



**E-Flo Pump with Sensor
Circuit Option installed.**

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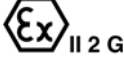

Graco Information 16

Related Manuals

Manual	Title
311592	E-Flo 4- Ball Piston Pumps, Installation
311593	E-Flo 4-Ball Piston Pumps, Operation
311594	E-Flo 4-Ball Piston Pumps, Repair/Parts
3A0006	24H372 ACS Module, Instructions
3A0539	4-Ball Lowers, Instructions/Parts

Approvals

This manual is used for Kit 24J305 and Kit 15J755. Each kit contains an intrinsically safe (IS) approved part, 288343. In this manual, this part is referred to as the IS Control Circuit. The IS Control Circuit is not available for purchase separately. The IS Control Circuit is called out as item 25 in the parts list on page 9. The subcomponents of the IS Control Circuit are called out as 25a, 25b, and 25c on the parts list. The approval label and approval information only apply to the IS Control Circuit.





Component	Description	Approvals
IS Sensor Circuit (Ref. 25 in Kit Parts, page 9)	The IS Sensor Circuit includes the pressure transducer (25a), the sensor (25b) and the circuit board (25c)	 Class 1, Div. 1, Group C & D T3 Hazardous Locations  Ex ib IIB Ta = 0°C - 50°C - FM 06 ATEX 0025U EN 60079-0:2012-A11:2013 EN 60079-11:2012  Ex ib IIB Ta = 0°C - 50°C - KTL 13-KB4BO-0088

Schedule of Limitations

ATEX:

1. After the installation of the Electric Circulation Pump Control into an enclosure the creepage and clearance distances shall meet the requirements of Table 5 of EN60079-11.
2. After the installation of the Electric Circulation Pump Control into an enclosure the assembly shall be capable of withstanding an r.m.s. a.c. test voltage of twice the voltage of the intrinsically safe circuit or 500 V, whichever is the greater.

Circuit Assembly Intrinsic Safe Control

 <p>APPROVED Conforms to FM std 3600 & 3610 CAN/CSA 22.2 No 157-92 & No. 1010.1-92 for use in Class 1 Div 1 Group C & D T3 Hazardous locations</p> <p>Intrinsically Safe (IS) System. Per IS Control Drawing No. 288110. Class I, Division 1, Group C & D T3 Hazardous Locations</p> <p>Read Instruction Manual Warning: Substitution of components may impair intrinsic safety. Advertissement: La Substitution de composants peut compromettre la Sécurité Intrinsèque.</p>	 <p>Ex ib IIB FM 06 ATEX 0025U</p>  <p>KTL 13-KB4BO-0088</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>PART NO.</th> <th>SERIES</th> <th>SERIAL</th> </tr> </thead> <tbody> <tr> <td>288343</td> <td></td> <td></td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3">Intrinsic Safe Input Parameters</th> </tr> <tr> <th></th> <th>TDC Circuit</th> <th>Pressure Circuit</th> </tr> </thead> <tbody> <tr> <td>Ui</td> <td>15 V</td> <td>35 V</td> </tr> <tr> <td>Ii</td> <td>60 mA</td> <td>200 mA</td> </tr> <tr> <td>Pi</td> <td>200 mW</td> <td>1.4 W</td> </tr> <tr> <td>Ci</td> <td>220 nF</td> <td>.036 uF</td> </tr> <tr> <td>Li</td> <td>280 uH</td> <td>.44 uH</td> </tr> </tbody> </table> <p style="text-align: right;">  GRACO INC. P.O. Box 1441 Minneapolis, MN 55440 U.S.A. </p> <p style="text-align: center;">MIN / MAX TEMP RANGE: 0° - 50°C (32° - 122°F)</p>	PART NO.	SERIES	SERIAL	288343			Intrinsic Safe Input Parameters				TDC Circuit	Pressure Circuit	Ui	15 V	35 V	Ii	60 mA	200 mA	Pi	200 mW	1.4 W	Ci	220 nF	.036 uF	Li	280 uH	.44 uH
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Ci	220 nF	.036 uF																											
Li	280 uH	.44 uH																											

Artwork No. 293140 Rev. N





293140I

Sensor Circuit Wetted Parts:

Pressure transducer: 17-4 PH stainless steel

Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbols refer to procedure-specific risks. When these symbols appear in the body of this manual, refer back to these Warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

 WARNING	
 	<p>FIRE AND EXPLOSION HAZARD</p> <p>Flammable fumes, such as solvent and paint fumes, in work area can ignite or explode. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> • Use equipment only in well ventilated area. • Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static arc). • Keep work area free of debris, including solvent, rags and gasoline. • Do not plug or unplug power cords, or turn power or light switches on or off when flammable fumes are present. • Ground all equipment in the work area. See Grounding instructions. • Use only grounded hoses. • Hold gun firmly to side of grounded pail when triggering into pail. • If there is static sparking or you feel a shock, stop operation immediately. Do not use equipment until you identify and correct the problem. • Keep a working fire extinguisher in the work area. <p>Static charge may build up on plastic parts during cleaning and could discharge and ignite flammable vapors. To help prevent fire and explosion:</p> <ul style="list-style-type: none"> • Clean plastic parts only in a well ventilated area. • Do not clean with a dry cloth. • Do not operate electrostatic guns in equipment work area.
	<p>EQUIPMENT MISUSE HAZARD</p> <p>Misuse can cause death or serious injury.</p> <ul style="list-style-type: none"> • Do not operate the unit when fatigued or under the influence of drugs or alcohol. • Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See Technical Data in all equipment manuals. • Use fluids and solvents that are compatible with equipment wetted parts. See Technical Data in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request MSDS forms from distributor or retailer. • Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only. • Do not alter or modify equipment. • Use equipment only for its intended purpose. Call your distributor for information. • Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces. • Do not kink or over bend hoses or use hoses to pull equipment. • Keep children and animals away from work area. • Comply with all applicable safety regulations.

! WARNING**ELECTRIC SHOCK HAZARD**

Improper grounding, setup, or usage of the system can cause electric shock.

- Turn off and disconnect power at main switch before disconnecting any cables and before servicing equipment.
- Connect only to grounded power source.
- All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.

**PERSONAL PROTECTIVE EQUIPMENT**

You must wear appropriate protective equipment when operating, servicing, or when in the operating area of the equipment to help protect you from serious injury, including eye injury, inhalation of toxic fumes, burns, and hearing loss. This equipment includes but is not limited to:

- Protective eyewear
- Clothing and respirator as recommended by the fluid and solvent manufacturer
- Gloves
- Hearing protection

System Wiring Schematics

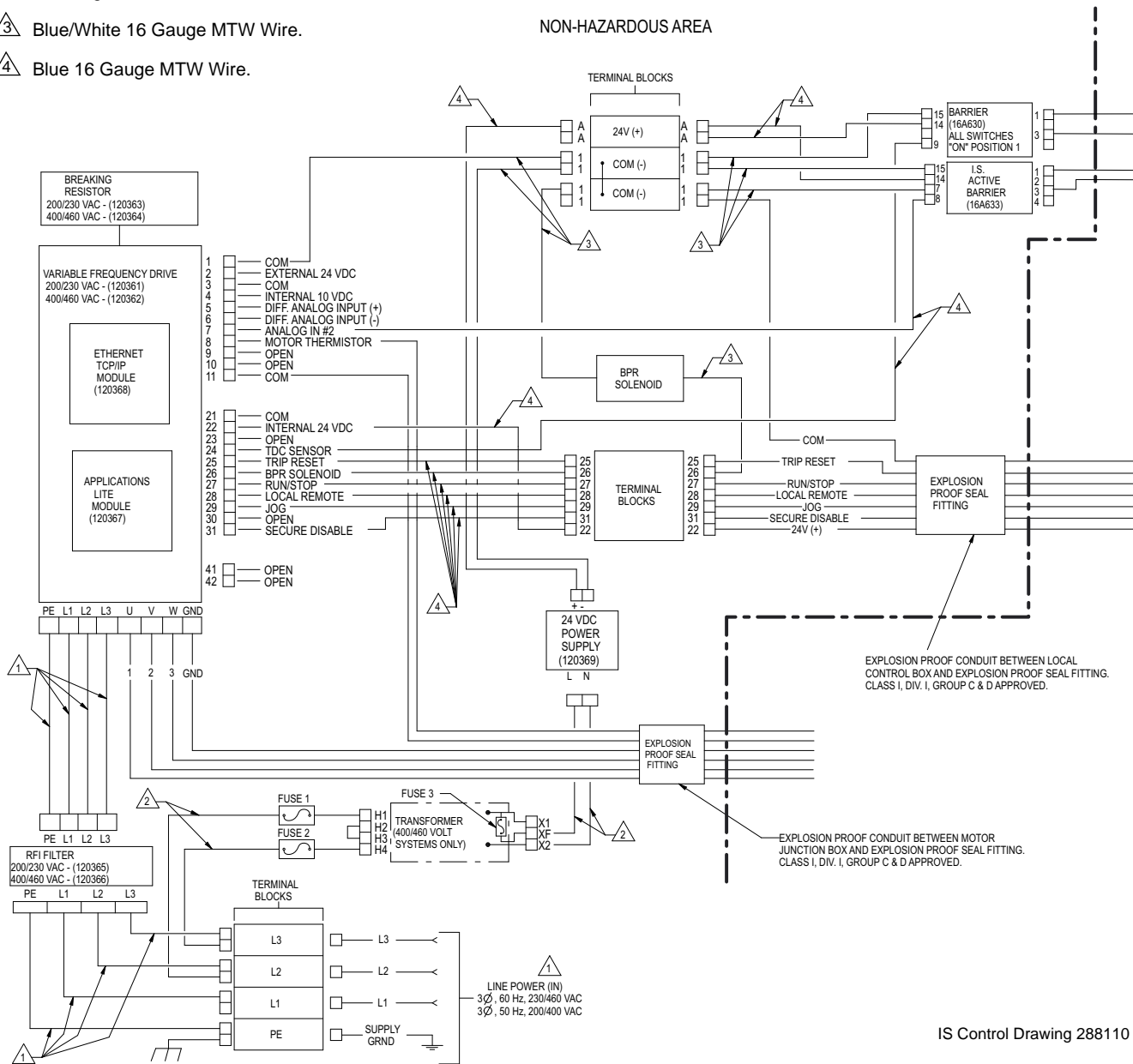
For use with Variable Frequency Drive (VFD) Accessory

FIG. 1 shows components that must be installed in a non-hazardous location.

FIG. 2 shows components approved for installation in a hazardous location, and FIG. 3 shows detail views of hazardous location components.

NON-HAZARDOUS AREA

- 1 12 Gauge Alpha Wire P/N V16012/equiv.
- 2 16 Gauge MTW Wire.
- 3 Blue/White 16 Gauge MTW Wire.
- 4 Blue 16 Gauge MTW Wire.



IS Control Drawing 288110

FIG. 1: System Wiring Schematic, Non-Hazardous Location Only

 Alpha Wire P/N M16107LW/equiv.

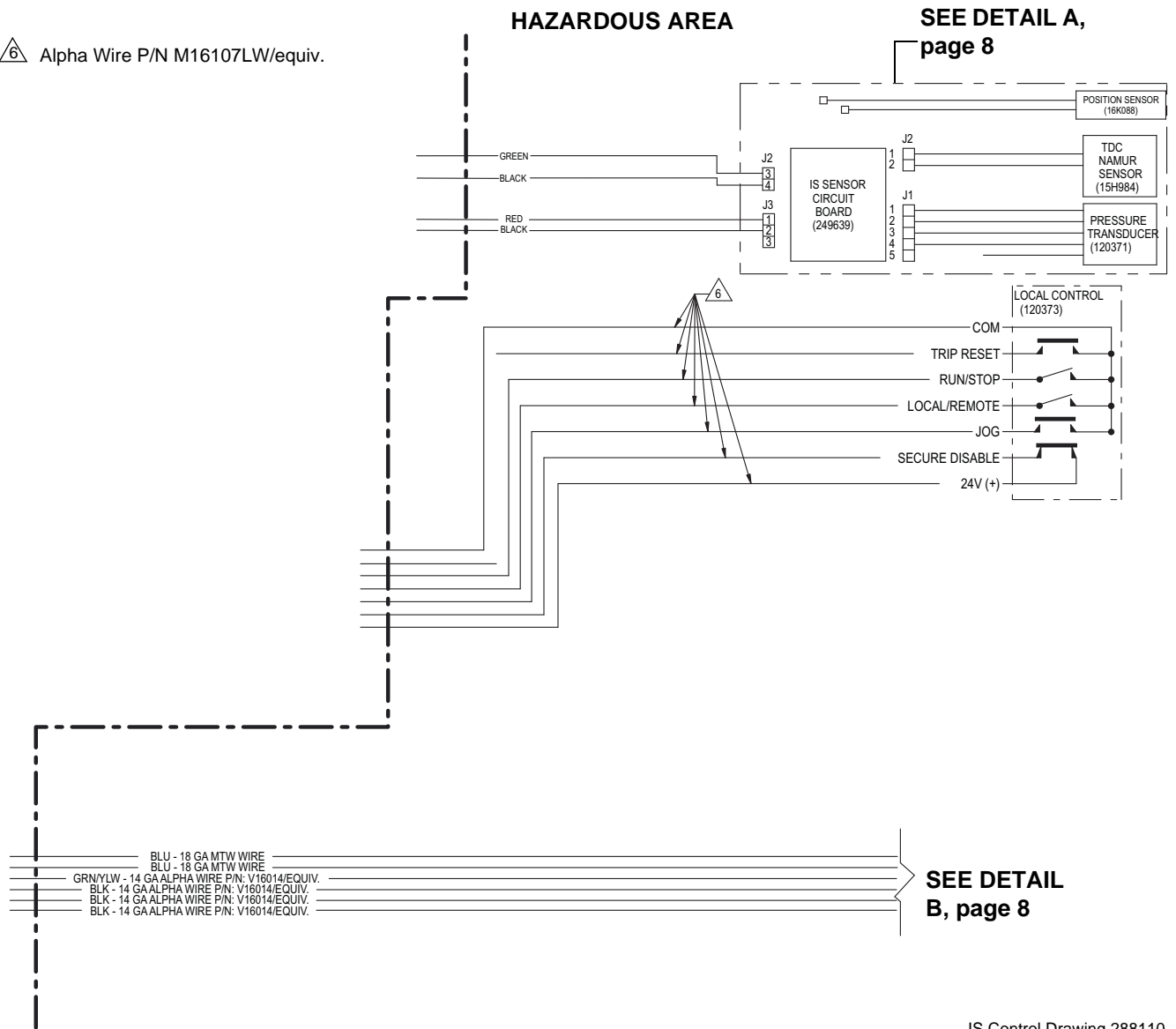
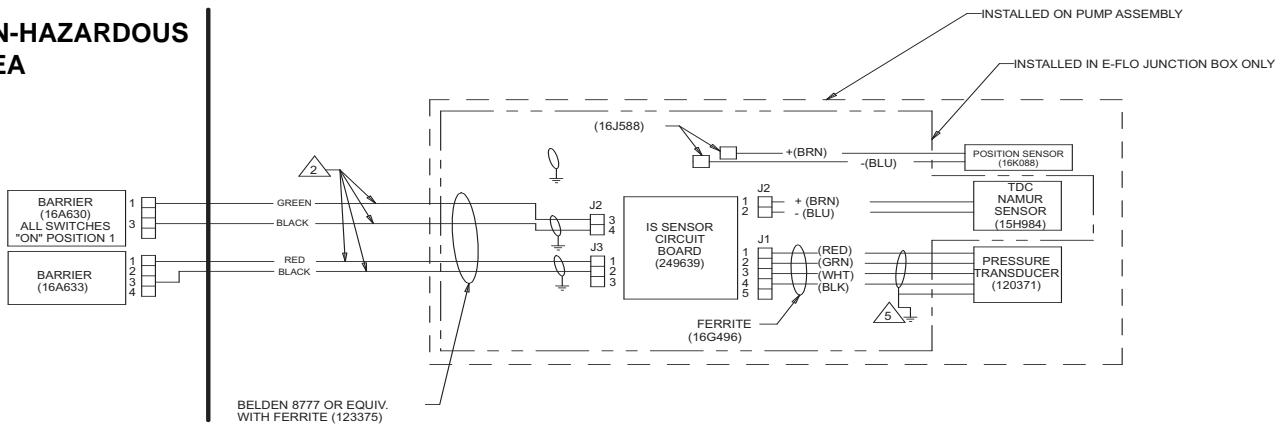


FIG. 2: System Wiring Schematic, Hazardous Location

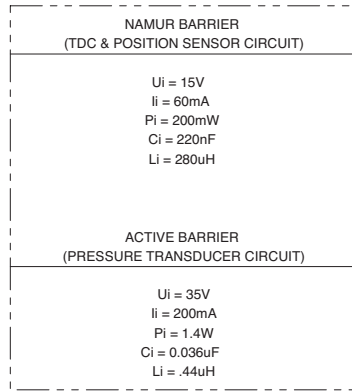
DETAIL A

**HAZARDOUS (CLASSIFIED) LOCATION
CLASS I, DIV. 1, GROUP C & D, T3 (U.S. and Canada)
GROUP II, CATEGORY 2 - ZONE 1, GAS (ATEX ONLY)**

**NON-HAZARDOUS
AREA**



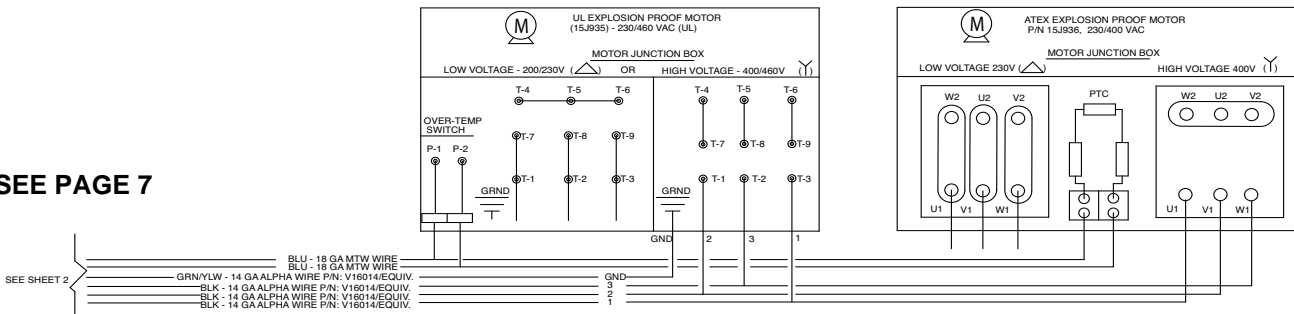
- 1 The installation must meet the requirements of the National Electric Code, Canadian Electrical Code Part I, Article 504, NFPA 70, and ANSI/ISA 12.06.01.
- 2 Individually shielded cables needed to ensure separation of sensor and transducer circuits.
- 3 The voltage (V_{max} or U_i), current (I_{max} or I_i), and power (P_i) must be equal to or greater than the voltage (V_{oc} , U_o , or V_t), current (I_{sc} , I_o , or I_t), and power (P_o or P_t) levels, which can be delivered by the associated apparatus. In addition, the maximum unprotected capacitance (C_i) and inductance (L_i) of the intrinsically safe apparatus, including interconnecting wiring, must be less than the capacitance (C_a) and inductance (L_a) which can be safely connected to the associated apparatus.
- 5 Land shield drain and foil to conductive strain relief.



DETAIL B

HAZARDOUS AREA

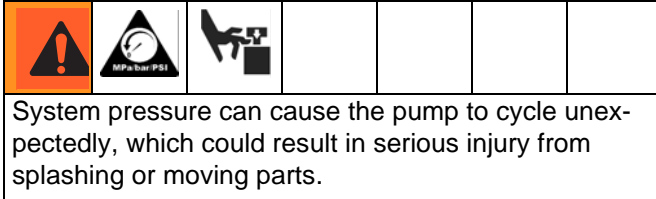
SEE PAGE 7



IS Control Drawing 288110

Fig. 3: System Wiring Schematic, Hazardous Location Detail Views

Pressure Relief Procedure



1. Set START/STOP switch to STOP.
2. Push in SECURE DISABLE switch.
3. Open the back pressure regulator and all fluid drain valves in the system, having a waste container ready to catch drainage. Leave open until you are ready to pressurize system again.
4. Check that pressure gauges on fluid supply and return lines read zero. If gauges do not read zero, determine cause and carefully relieve pressure by VERY SLOWLY loosening a fitting. Clear obstruction before pressurizing system again.

Kit Parts

Sensor Circuit Kit 24J305 Series B

For E-Flo Pumps, Series D and later
Includes items 12-42, 44a, 46-80

Sensor Circuit Kit 15J755 Series B

For E-Flo Pumps, Series C and earlier
Includes items 12-43, 44b, 58, 74a-77

Ref. No.	Part No.	Description	Qty
12*	116719	SCREW, 8-32 hex washer head	14
25	n/a	SENSOR CIRCUIT; includes items 25a-25c	1
25a*	n/a	PRESSURE TRANSDUCER	1
25b*	n/a	TDC SENSOR	1
25c*	n/a	CIRCUIT BOARD	1
32*	n/a	COVER, side opposite motor	1
33*	n/a	GASKET, circuit board	1
35*	n/a	CONNECTOR, strain relief, 45°	1
36*	n/a	LABEL, calibration	1
41*	111316	O-RING; chemically resistant fluoro-elastomer	1
42*	n/a	ADAPTER, transducer	1
43*	n/a	NUT, transducer; Kit 15J755 only	1
44a*	n/a	CONDUIT, 2-sensor; Kit 24J305 only	1
44b*	n/a	CONDUIT, 1-sensor; Kit 15J755 only	1
46*	16J588	TERMINAL BLOCK; Kit 24J305 only	2
58*	n/a	SPACER; brass	1
74a*	16J487	BUSHING, strain relief; steel	1
76*	16G496	FERRITE; for pressure transducer leadwires	1
77*	123375	FERRITE; for IS circuit field wiring	1
78*	n/a	ADAPTER, position sensor; Kit 24J305 only	1
79*	n/a	SLEEVE, position sensor; Kit 24J305 only	1
80*	16K088	POSITION SENSOR; Kit 24J305 only	1

Parts designated n/a are not available separately.

Installation

Disassembly



1. Jog the motor to bring the lower on the side opposite from the motor to the bottom of its stroke.
2. Relieve pressure, page 2.
3. Shut off electrical power to the unit.
4. See FIG. 4. Remove two screws (12) and the cover (32).
5. See FIG. 6, page 11. Remove six screws (12), the circuit board cover (B), and the gasket (33). Discard the old gasket.

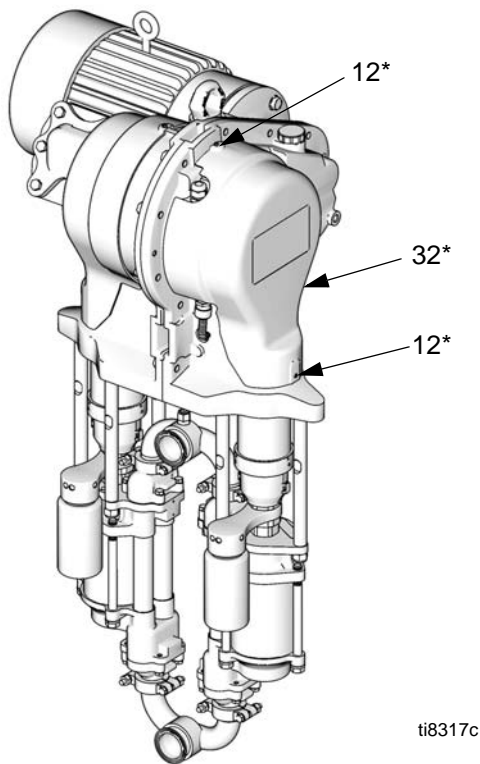


FIG. 4. Remove Cover

Install the Kit

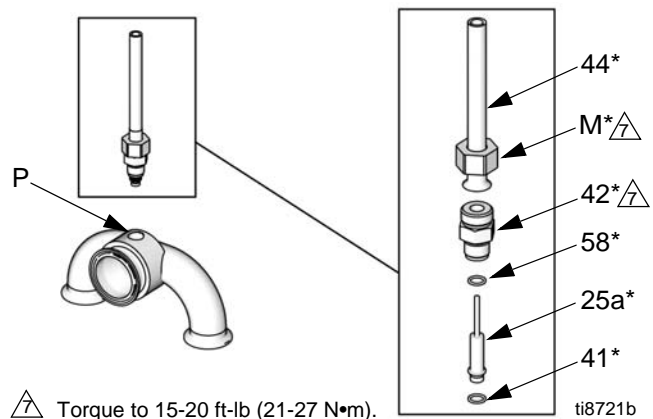
NOTE: Parts included in the Sensor Circuit Kit are marked with an asterisk, for example (12*). Use all the new parts in the kit. Kit 24J305 Series B (for Series D and later pumps) includes parts for the position sensor which are not included in Kit 15J755 Series B. These differences are noted in the text and illustrations.

1. See FIG. 6. Unscrew the plug from the TDC port (C) and clean old sealant from the port. Apply pipe sealant and screw the TDC sensor (25b*) into the port. Torque to 66-78 in-lb (7.4-8.8 N•m).

NOTE: TDC sensor nuts are locked in place to ensure correct positioning. Do not adjust.

2. Connect the TDC cable (25b*) to J2 on the circuit board (25c*).
3. Install the circuit board (25c*) using four screws (12*).
4. Screw the 45° conductive strain relief (35*) tightly into the housing.
5. See FIG. 5. Install the black o-ring (41*) and the brass spacer (58*) on the transducer (25a*). Thread the transducer's cable (25a*) through the adapter (42*), conduit (44*), and conductive strain relief (35*).

NOTE: On Kit 24J305 Series B, thread the transducer cable through the short length of the 2-sensor conduit (44a*).



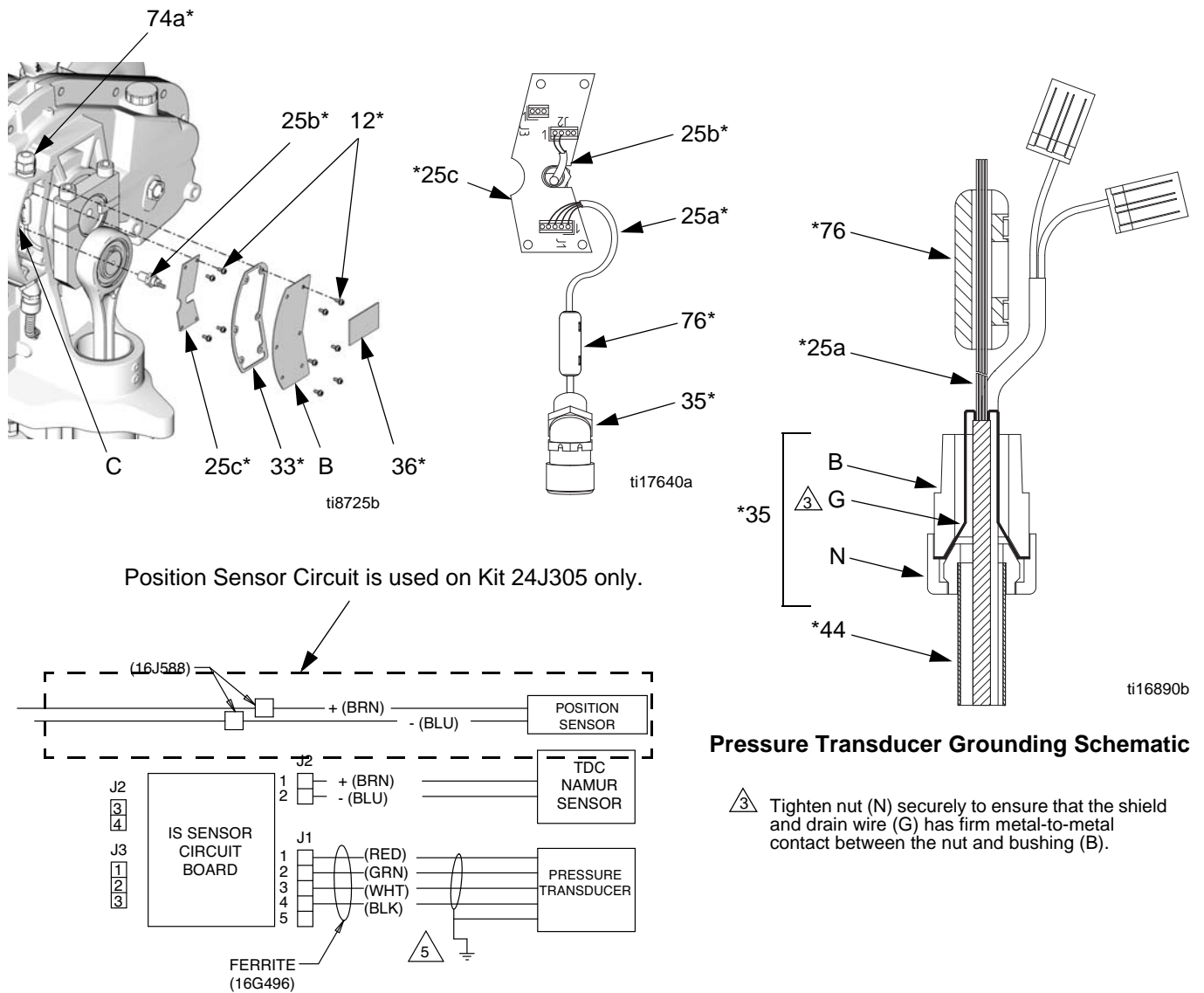
Torque to 15-20 ft-lb (21-27 N•m).

FIG. 5. Pressure Transducer

6. Connect the transducer's cable to J1 on the circuit board (25c*). Install the ferrite (76*) around the transducer leadwires. See FIG. 6.

7. See FIG. 5. At the pump outlet manifold, remove the plug from the transducer port (P). Insert the transducer into the port. Torque the adapter (42*) first, then the conduit nut (M) to 15-20 ft-lb (21-27 N•m).

NOTE: The conduit nut (M) is included with the conduit (44a*) on Kit 24J305 Series B. It is a separate part (43*) in Kit 15J755 Series B.



Position Sensor Circuit is used on Kit 24J305 only.

Pressure Transducer Grounding Schematic

⚠ Tightly tighten nut (N) securely to ensure that the shield and drain wire (G) has firm metal-to-metal contact between the nut and bushing (B).

⚠ Land shield drain and foil to conductive strain relief.

FIG. 6. Circuit Board and Sensor Circuit Wiring Connections

8. See FIG. 6. Ensure that the conductive strain relief (74a*) is screwed tightly into the housing. Units with a sensor circuit **must** use the conductive strain relief to ensure proper grounding of the IS field wire.
9. See FIG. 7. Thread the IS field wire and shield through the conductive strain relief (74a*) and connect to J2 and J3 on the circuit board (25c*). See FIG. 6 and the Electrical Schematic in the E-Flo Repair-Parts Manual 311594.
10. See FIG. 7. Tighten the nut (N) on the conductive strain relief (74a*) securely. Install the ferrite (77*) on the field wire (F), not more than 2 in. (51 mm) from the bottom of the conductive strain relief. Install ground wire (G) to grounding screw in junction box.

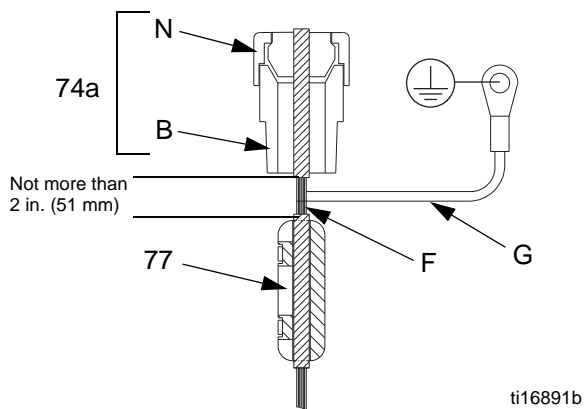


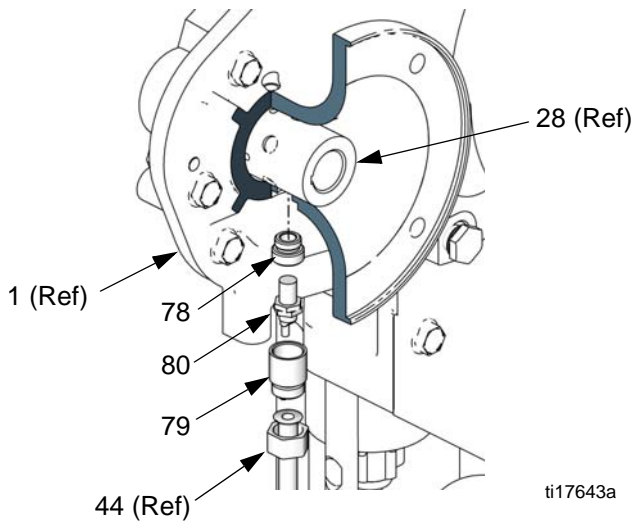
FIG. 7. IS Circuit Field Wire

NOTE: Steps 11 through 14 apply only to Kit 24J305 Series B for use with Series D and later pumps. If you are installing Kit 15J755 Series B on a Series C or earlier pump, go to step 15.

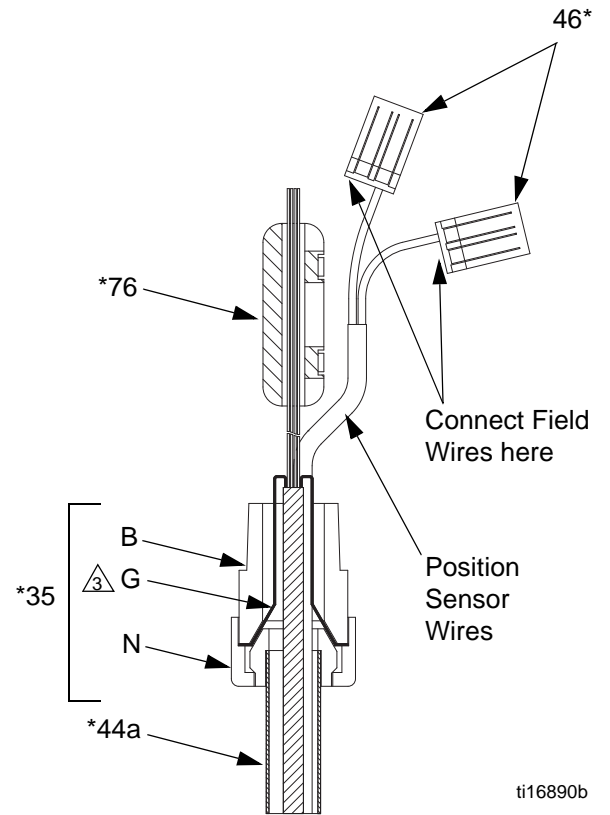
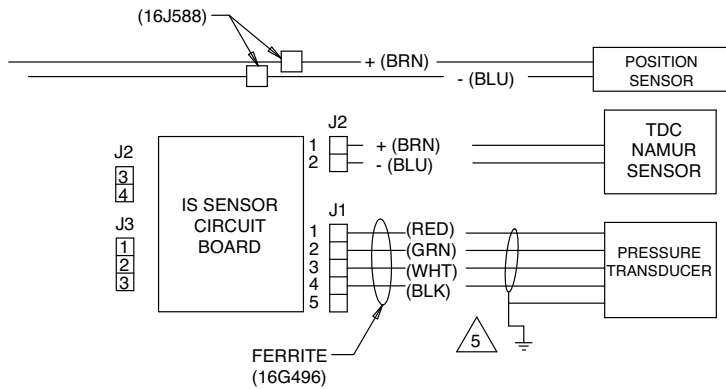
11. Mount the position sensor in the port on the underside of the gear housing, on the opposite side of the housing from the circuit board. See FIG. 8. Apply thread lubricant to the adapter (78*) and screw the adapter into the port. Torque to 75-80 ft-lb (102-108 N•m).
12. Install the position sensor (80*) into the adapter (78*) and secure with the sleeve (79*).

NOTE: The Position Sensor nuts are locked in place to ensure correct positioning. Do not adjust.

13. Thread the position sensor wires through the long length of the 2-sensor conduit (44a*) into the circuit board cavity. Connect a terminal block (46*) to each wire. Reconnect the IS circuit field wires to the terminal blocks. See FIG. 8 and the Electrical Schematic in the E-Flo Repair-Parts Manual 311594.
14. Secure the conduit (44a*) to the position sensor sleeve (79*) with the nut (M). Torque to 15-20 ft-lb (21-27 N•m). Continue with step 15.
15. See FIG. 6 or FIG. 8. Tighten the nut (N) on the conductive strain relief (35) securely to ensure that the shield and drain wire (G) has firm metal-to-metal contact between the nut and bushing (B).
16. See FIG. 6. Install the new gasket (33*), the cover (B), and six screws (12*).
17. Attach the label (36*) to the cover (B).
18. Calibrate the transducer, entering the calibration information found on the new label (36*):
 - For systems using the Graco ACS Module, see the ACS manual 3A0006.
 - For non-ACS systems, see page 14.
19. See FIG. 4. Reinstall the cover (32*) with two screws (12*).



Position Sensor Parts and Location



Position Sensor Wires and Terminals

Tighten nut (N) securely to ensure that the shield and drain wire (G) has firm metal-to-metal contact between the nut and bushing (B).

FIG. 8. Position Sensor

Pressure Sensor Calibration Information (non-ACS systems)

NOTE: To calibrate the transducer in systems using the Graco ACS Module, see the ACS manual 3A0006.

Pressure sensor information (Pr 20.34, 20.35, and 20.36) for your system must be keyed into the Variable Frequency Drive before system start-up.

To prevent accidental change of pressure sensor calibration parameters, they are locked by Pr 20.16. To enter calibration parameters, perform the following steps:

- a. Set Pr 20.16 to 777, to unlock pressure sensor parameters.
- b. Enter calibration parameters Pr 20.34, 20.35, and 20.36.
- c. Set Pr 20.16 to 0 to lock pressure sensor parameters.

Calibration Parameters from the label:

Pr 20.34 – Zero Calibration

Pr 20.35 – Calibration Pressure

Pr 20.36 – High Calibration

Pressure Transducer Calibration Procedure (non-ACS systems)

E-Flo pressure sensor must be calibrated against an instrument grade High Precision Pressure Transducer, which should be installed near the E-Flo pressure sensor.

1. Ensure that the High Precision Pressure Transducer calibration is up to date.
2. Set Pr 20.16 to 777, to unlock pressure sensor parameters.

3. Calibrate Low Pressure Point as follows:
 - a. Ensure that system is not pressurized. Calibration instrument pressure reading should be 0 psi.
 - b. Use Keypad to navigate to Pr 20.33; monitor its reading for 5 – 10 seconds to determine its average value. Make a record of it.
 - c. Navigate to Pr 20.34 and enter the recorded average value of Pr 20.33.
4. Calibrate the High Pressure Point as follows:
 - a. Pressurize the system to 250 – 275 psi.

<p>Do not exceed pressure rating of the system! If system is rated to a pressure lower than 250 psi, use maximum allowable rated pressure. Refer to Operation Manual 311593.</p>						

- b. Keep the system pressurized and ensure that pressure does not fluctuate.
 - c. Take a pressure reading from the calibration instrument and make a record of it.
 - d. Navigate to Pr 20.35 and enter the recorded system pressure.
 - e. Navigate to Pr 20.33; monitor its reading for 5-10 seconds to determine its average value. Make a record of it.
 - f. Navigate to Pr 20.36 and enter the recorded value of Pr 20.33.
5. Set Pr 20.16 to 0 to lock pressure sensor parameters.
6. Verify pressure calibration.
 - a. Relieve system pressure.
 - b. Navigate to Pr 20.31 and verify that its reading is within the range of 0-3 psi.
 - c. Pressurize the system to about 100 psi. Verify that reading of Pr 20.31 is within +/- 2.5 psi of the system pressure.
 - d. Pressurize system to about 250 psi. Verify that reading of Pr 20.31 is within +/- 2.5 psi of the system pressure.

Technical Data

Maximum Working Pressure	<i>E-Flo 1500:</i> 425 psi (2.93 MPa, 29.3 bar) <i>E-Flo 2000:</i> 460 psi (3.22 MPa, 32.2 bar) <i>E-Flo 3000:</i> 330 psi (2.31 MPa, 23.1 bar) <i>E-Flo 4000:</i> 250 psi (1.75 MPa, 17.5 bar)
Maximum Fluid Temperature	150°F (66°C)
Electrical Requirements	<i>European Models:</i> 230/400 Vac, 3 phase, 20 A/15 A <i>North American Models:</i> 230/460 Vac, 3 phase, 20 A/15 A
Ambient Temperature Range	32-104°F (0-40°C)
Maximum Fluid Output	See charts in E-Flo Installation Manual 311592.
Fluid Inlet and Outlet Size	2 in. Tri-clamp
Gear Reducer Oil Capacity	2 quarts (1.9 liters)
Required Gear Reducer Lubricant	ISO VG220 grade oil (Graco Part No. 288414)
Weight (with motor and 2000 cc lowers)	<i>Pump:</i> 550 lb (249 kg)
Wetted Parts.	<i>Lower:</i> see manual 3A0539 300 Series SST, CV-75, 17-4 PH SST, PTFE
Electric Motor	<i>E-Flo 1500:</i> 3 HP, 1800 rpm (60 Hz) or 1500 rpm (50 Hz), NEMA 182 TC Frame <i>E-Flo 2000/3000/4000:</i> 5 HP, 1800 rpm (60 Hz) or 1500 rpm (50 Hz), NEMA 184 TC Frame
Maximum Production Motor Speed	1500 rpm (50 Hz) 1800 rpm (60 Hz)
Maximum Motor Torque	<i>E-Flo 1500:</i> 9.1 ft-lb (12.3 N•m) <i>E-Flo 2000/3000/4000:</i> 15 ft-lb (20.3 N•m)
Gear Reduction Ratio	75.16:1

NOTE: All brand names or marks are used for identification purposes and are the trademarks of their respective owners.

Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

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Phone: 612-623-6921 **or Toll Free:** 1-800-328-0211 **Fax:** 612-378-3505

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