


MODEL 110E PUMP Oscillator Controlled

Operation / Maintenance Manual

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1 INSTALLATION

1.1 UNPACKING

After unpacking, the pump should be checked for any damage that may have occurred during shipment. Damage should be reported to the carrier immediately. The following items should be contained within the shipping container:

<u>Qty</u>	<u>Item</u>	<u>Description</u>
1	110E	Model 110E Pump
1	M110E	Operation/Maintenance Manual

1.2 TIE BOLT TORQUE

The tie bolts on the pump are tightened before leaving the factory. However, relaxation may occur due to handling, material creep, or other unforeseen events. Trebor recommends that all eight tie bolts be re-tightened upon pump install. The following procedure should be used.

1. Remove black tie bolt caps (Item 22 in 4.4 Parts Illustration) from both sides of all 8 tie bolts.
2. Apply 32 in-lbs. of torque to each slave side bolt while holding the master side bolt stationary. A star-pattern is advised.
 - a. The master side is the left side of the pump if you are looking at the fluid ports.
3. Replace tie bolt caps.

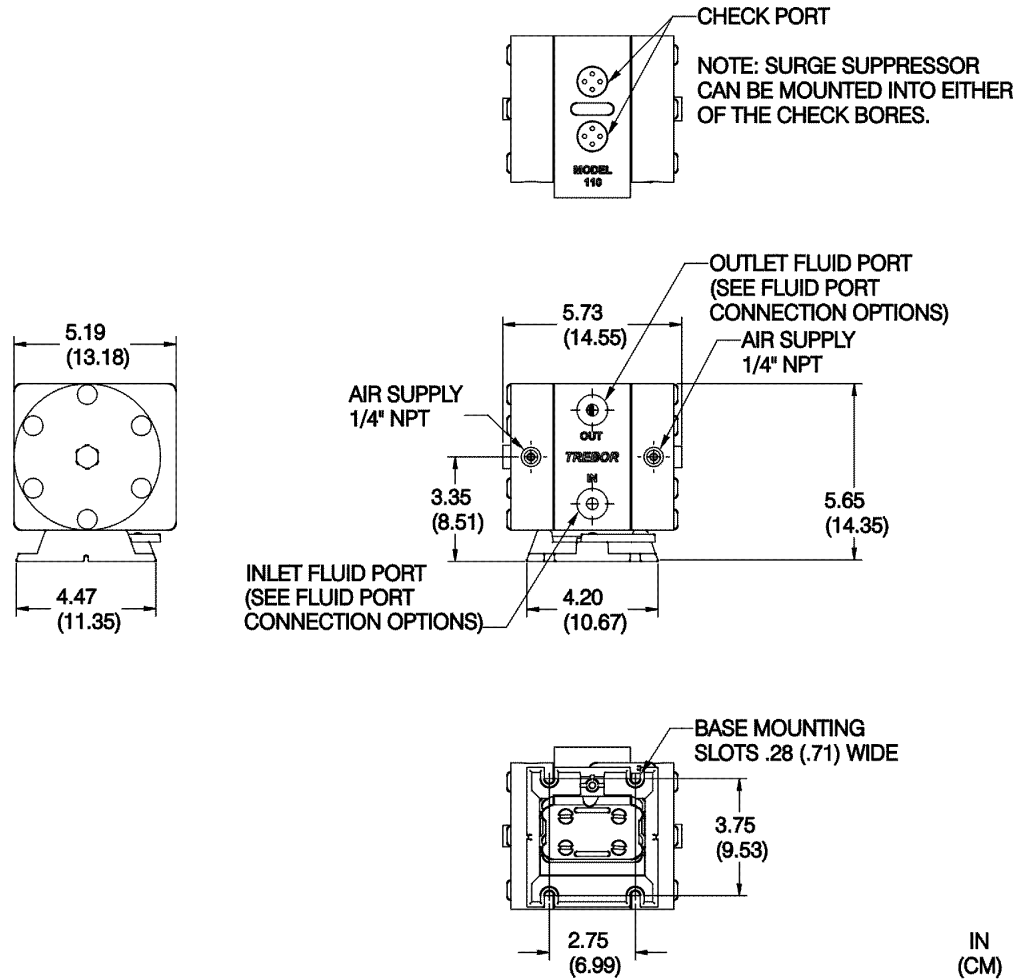
1.3 UTILITIES / HOOK-UP FOR 110E PUMP

The pump is mounted using four 1/4" bolts. It is recommended that the pump be mounted not more than 15° from level to maintain its self-priming and pumping efficiency.

NOTE: New pumps may contain residual moisture from their final DI water test.

Air Inlet: 1/4" FNPT (3/8" Dia. [8mm] supply tube minimum).

Fluid Ports: 1/2" FNPT - additional adaptor port options available.
Inlet/Outlet adaptor fluid fittings and Surge Suppressor require torqueing during pump installation. See Section 2 for hook-up diagram and torque values



CHECK PORT
NOTE: SURGE SUPPRESSOR
CAN BE MOUNTED INTO EITHER
OF THE CHECK BORES.

IN
(CM)
MTD0294
REV A

Figure 1-1

ATTENTION: The pump should be operated with clean, dry air or nitrogen. Particulate, water and oils in the air supply can damage the pump.

NOTE:

1. It is recommended that a filter be placed on the discharge side of the pump.
2. Although extensive efforts are made to deliver pumps to our customers completely dry, new pumps may contain residual moisture from their final DI water test.

Recommended Maximum Operating Levels:

Maximum supply CDA/N2 pressure: 60 psig (4.1 bar)

Maximum fluid temperature: 212°F (100°C)

See Section 4.1 Preventative Maintenance Schedule for additional requirements for high temperature applications.

1.4 UTILITIES / HOOK-UP FOR REMOTE CONTROLLER

The Model 110E pump will work with many types of external control devices. Trebor's pneumatic Pump Control Module is recommended for its proven, reliable performance. Please consult factory for assistance with other external control devices.

1.4.a Trebor's Remote Pneumatic Oscillator

Air Inlet: 3/8" Dia. (9mm) supply tube (Use in-line 10 μ air filter).

Air Supply: 20-60 psig (1.4 – 4.1 bar) Clean Dry Air or Nitrogen (See Table 1: Consumption / Efficiency, Section 3.3 for air consumption).

The mufflers on the optional Oscillator Control Module can be removed for remote exhaust and purge connections.

Exhaust: 1/4" FNPT

Purge: 1/4" FNPT

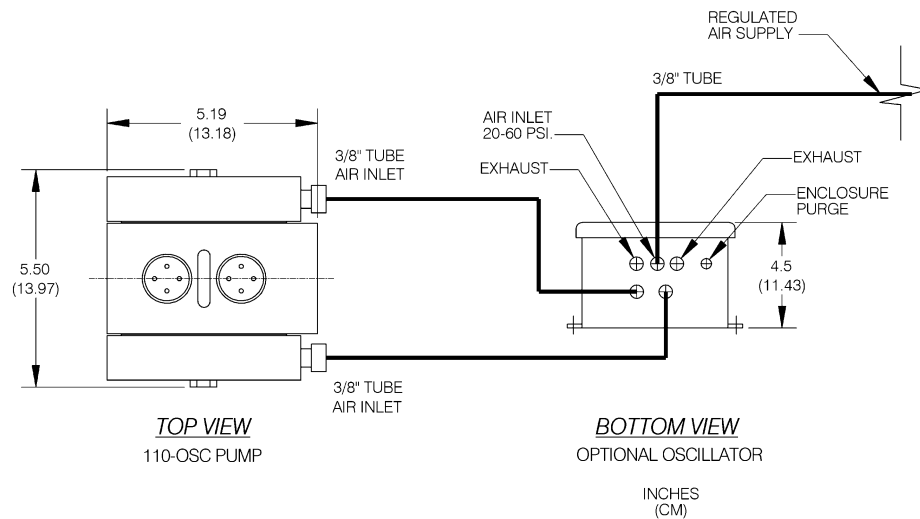


Figure 1-2

1.4.b Trebor's Remote Electronic Oscillator

Air Inlet: 5/16" Dia. (8mm) supply tube (Use in-line 10 μ air filter).

Air Supply: 20-60 psig 1.4 – 4.1 bar) CDA.

Exhaust: Internal with remote option (consult factory).

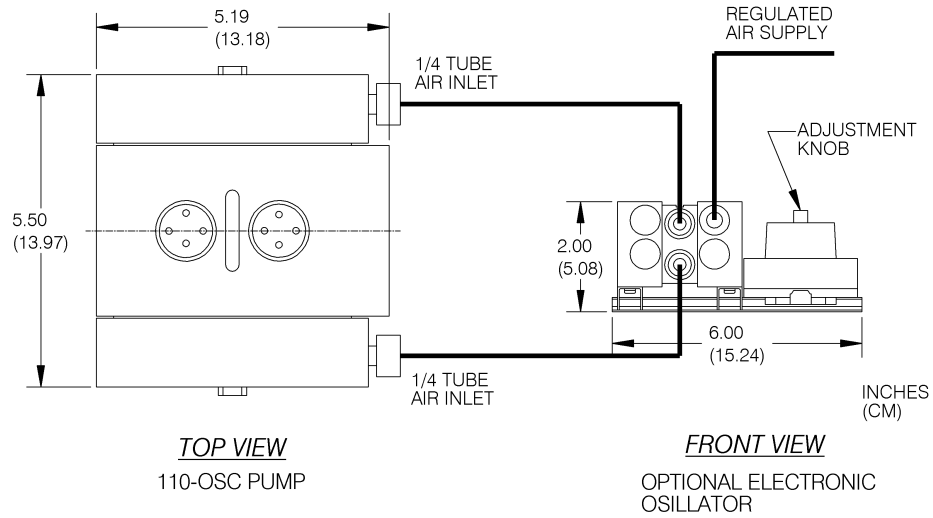


Figure 1-3

1.4.c Electronic Oscillation Controller (Example)

Air Inlet: 3/8" Dia. (9mm) supply tube (Use in-line 10 μ air filter).

Air Supply to Pump: 20-60 psig (1.4 – 4.1 bar) Clean Dry Air.

Solenoid Valve: C_v greater than .80, 3 position.

PLC/Electric Circuit: For timed oscillation up to 260 cpm.

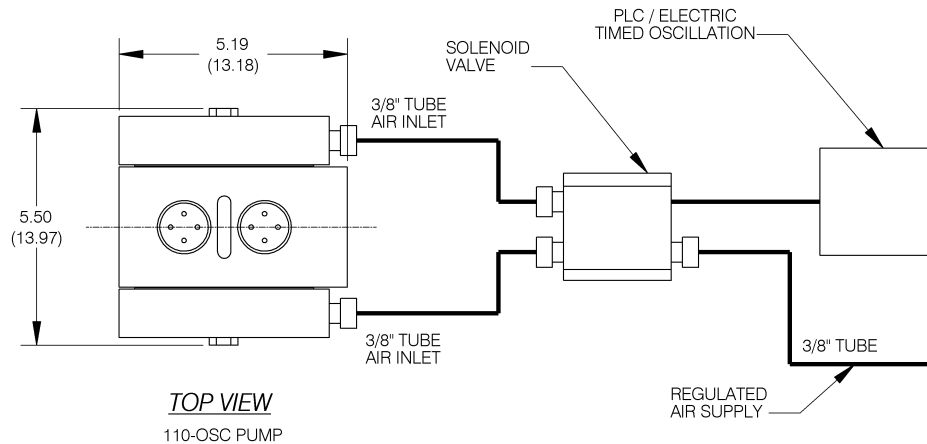


Figure 1-4

1.4.d Fiber Optic End-of-Stroke Detection

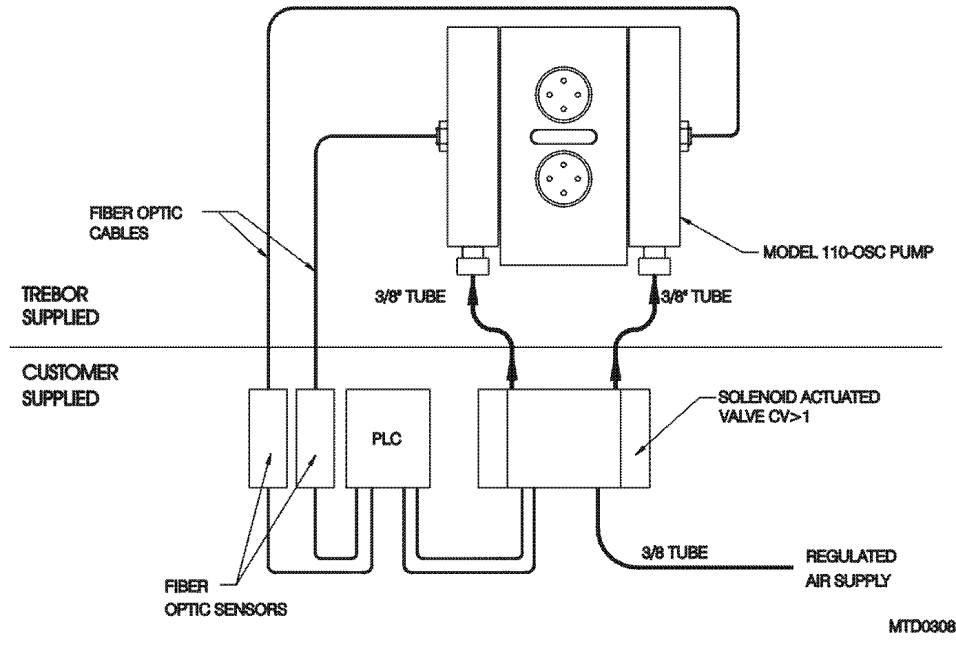


Figure 1-5: Shown with Sensors and PLC Connection

2 OPTIONS

2.1 FLUID PORT CONNECTION OPTIONS

NOTE: Use O-ring to seal stainless steel or other rigid plumbing.

Available Options

Flare style tube adapter.....3/8" and 1/2"

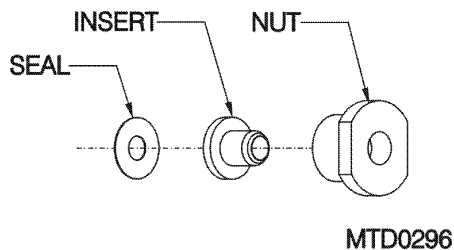


Figure 2-1

NOTE: 3/8" tube is not recommended for inlet of pump.

2.2 FLUID FITTINGS / SURGE SUPPRESSOR HOOK-UP

<u>Surge Suppressor</u>	<u>Assembled Height: IN (CM)</u>
MODEL SS40	12.37 (31.43)
MODEL SS75	11.39 (28.93)

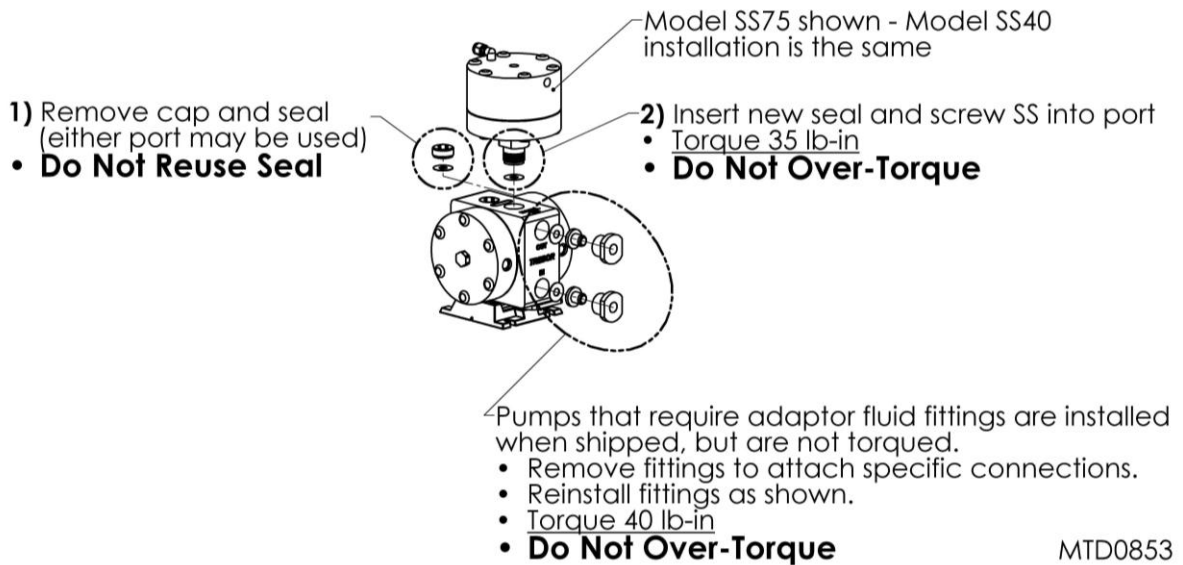


Figure 2-2

NOTE: See Surge Suppressor Operation Manual for detailed installation instructions.

3 START-UP

- Pump air supply pressure should be regulated.
- Open the fluid suction (IN) line valve, if necessary.
- Open the fluid discharge (OUT) line valve, if necessary.
- Start with air regulator at low (> 15 psi) pressure setting. Increase pressure to attain desired flow, up to the maximum rating (See Section 3.2).
- Table 1: Consumption / Efficiency can be used to determine approximate air consumption.
- Refer to Troubleshooting Section 5, if pump fails to start.

ATTENTION: Prolonged periods (> 5 minutes) of dry running will damage critical internal pump parts.



CAUTION: When handling potentially dangerous fluids under pressure, the pump and its fittings should be placed in an enclosure.

3.1 PNEUMATIC OSCILLATOR/CONTROLLER CYCLE RATE (PC10)

Applications with low flow or highly viscous fluid may require a slower cycle rate for increased efficiency. A slower cycle rate will also decrease air consumption.

3.1.a Adjustment Instructions for Trebor Pneumatic Oscillator

- Remove access plug from the pump control module cover.
- Rotate adjustment knob with screwdriver.
- Rotate CW (clockwise) to slow cycle rate.
- Rotate CCW (counter-clockwise) to increase cycle rate.
- Re-install access plug.

NOTE: The TREBOR Pneumatic Oscillator comes pre-set from the factory to meet the flow requirements in most applications.

3.2 ELECTRONIC OSCILLATOR/CONTROLLER CYCLE RATE (PC5)

Applications with low flow or highly viscous fluid may require a slower cycle rate for increased efficiency. A slower cycle rate will also decrease air consumption.

3.2.a Adjustment Instructions for Trebor Electronic Oscillator

- Locate knob on top of potted electronics cube.

- White arrow on top of knob indicates approximate cycle time in seconds.
- Rotate CW to slow cycle rate.
- Rotate CCW to increase cycle rate.

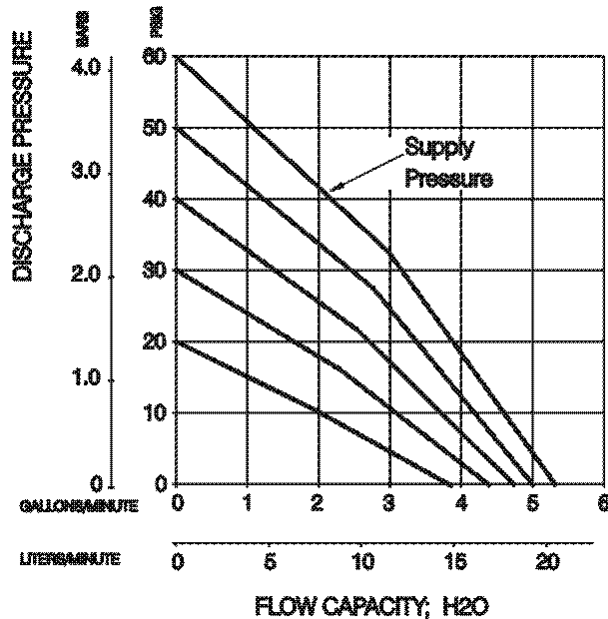
NOTE: Operate pump at slowest possible cycle rate that will deliver desired flow. This will extend pump diaphragm life!

3.3 PERFORMANCE CHARTS

Pumping capacity is a function of air supply pressure and volume, suction head, suction line restrictions, discharge head, discharge line restriction, and fluid specific gravity and viscosity.

Air Supply Pressure (PSIG)	Discharge Fluid Pressure (PSIG)	Air Used (SCFM)	Cycles Per Minute	Displacement IN ³ Per Cycle
20	0	2.0	210	4.1
20	10	1.7	125	3.7
30	0	5.0	245	4.1
30	15	3.0	145	3.8
40	0	5.2	255	4.3
40	20	4.2	160	3.9
50	0	6.9	265	4.4
50	25	5.9	175	4.1
60	0	8.5	290	4.2
60	30	7.4	180	4.1

Table 1: Consumption / Efficiency



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Figure 3-1: Pressure & Capacity Chart

NOTE: Test information is based on specific conditions and limited sampling. Use for general reference only.

4 MAINTENANCE

Trebor pump maintenance can be divided into two categories: air system maintenance and fluid system maintenance. The purpose of air system maintenance is to prevent air system failures such as stalling or erratic cycling. The purpose of fluid system maintenance is to maintain suction and lift capabilities.

Pump Rebuild Service

Trebor International provides a factory rebuild service for customers using Trebor products. Trebor will rebuild any standard pump (exclusive of options). Please contact Trebor International Sales Department for current rebuild pricing. The fixed rebuild price includes a factory rebuild and parts equivalent to the standard rebuild kit. Each factory rebuild comes with a new one-year warranty. Repairs requiring more extensive part replacements will be quoted prior to proceeding with the pump rebuild. If the pump has exceeded its useful life and cannot be rebuilt, the customer may elect to purchase a new Trebor pump. If the customer chooses not to rebuild or replace the pump, a \$150.00 evaluation charge will be required.

All returned pumps are to be shipped freight prepaid with a valid Purchase Order for the cost of rebuild service. Please contact Trebor International prior to returning your pump to obtain an RMA Number and Pump Return Data Sheet to ensure proper safety precautions. Each pump will be evaluated and repaired within 5 working days of the receipt of pump at Trebor facility.

4.1 PREVENTIVE MAINTENANCE SCHEDULE

The following maintenance schedule is recommended to optimize pump performance and minimize failures. Tie bolt torque should be checked within 30 days of start-up and at periodic intervals thereafter. If the pump is subjected to thermal cycle operation, the tie bolt torque should be checked after the first 3 thermal cycles and periodically thereafter. Certain operating conditions that require more frequent maintenance intervals have been noted. In positive pressure inlet conditions where suction or lift is not required, fluid system maintenance may be extended. However, tie bolt retorque is still recommended.

Adhering to the recommended preventative maintenance schedule along with periodic inspection of the pump will ensure continued efficient operation and overall reliable pump performance.

It is recommended that the Preventive Maintenance Record (Section 4.1.a) be copied, maintained and kept with this unit for future reference.

MODEL 110E Maintenance Schedule

Normal Operating Conditions										
	Install	30 Days	3 Months	6 Months	9 Months	12 Months	15 Months	18 Months	21 Months	24 Months
Tie Bolt Torque (32 in-lbs.)	I	I	I*	I	I*	I	I*	I	I*	I
Check Balls and O-Rings										R
Shaft Seal and Shaft										R
Diaphragms and Main Seals										R
I=Inspect, R=Replace										
Normal operating conditions are those not described in the Extreme Operating Conditions below										
*Required if operating temperature exceeds 60°C or thermal cycling occurs										
Extreme Operating Conditions*										
	Install	30 Days	3 Months	6 Months	9 Months	12 Months	15 Months	18 Months	21 Months	24 Months
Tie Bolt Torque (32 lb-in)	I	I	I**	I	I**	I	I**	I	I**	I
Check Balls and O-Rings				R***		R		R***		R
Shaft Seal and Shaft				R***		R		R***		R
Diaphragms and Main Seals				R***		R		R***		R
I=Inspect, R=Replace										
*Extreme operating conditions are applications requiring high suction or the fluid is HF, ACT 935, or TMAH (strong etchants)										
**Required if operating temperature exceeds 60°C or thermal cycling occurs										
***Required if fluid is ACT 935 or TMAH										

4.1.a Preventive Maintenance Record

Company Name: _____

Company Address: _____

Product: _____ Serial Number: _____

Date: _____ Tech: _____ Notes: _____

Date: _____ Tech: _____ Notes: _____

Date: _____ Tech: _____ Notes: _____

Date: _____ Tech: _____ Notes: _____

Date: _____ Tech: _____ Notes: _____

Date: _____ Tech: _____ Notes: _____

Date: _____ Tech: _____ Notes: _____

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Date: _____ Tech: _____ Notes: _____

4.2 RECOMMENDED SPARE PARTS

KR110E-00-A Spares Rebuild Kit, which includes:

<u>Part No</u>	<u>Qty</u>	<u>Description</u>
KD110-00-A	1	Diaphragm Kit
		Includes: (2) J0090 Diaphragm Sets
		(2) 98001423 Main Seals
11001015	1	Protective Cap Set
1110A0035	1	Shaft
98001167	2	Shaft Seal
98002318	4	O-Ring, PTFE
J0094	2	Fiber Optic Target
J0097	4	Check Ball
J0100	2	Check Cap Seal

4.3 TOOLS

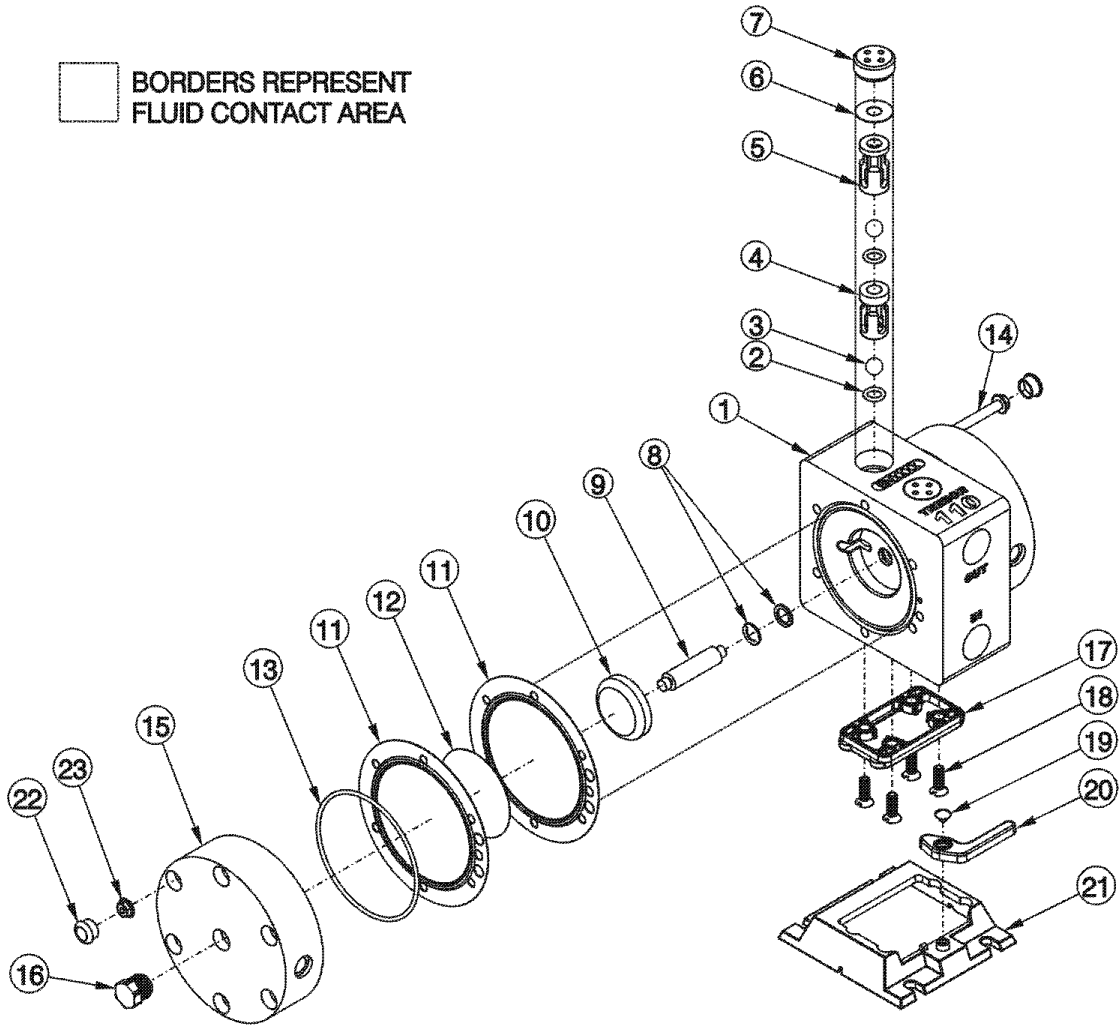
The following tool kit is recommended as standard service equipment.

KT110E-00-A Tool Kit, which includes:

<u>Part No</u>	<u>Qty</u>	<u>Description</u>
98001225	2	3/8" Nut Driver
98002327	1	Tool Case
98003305	1	1/4" Drive Handle
T000B0014	1	Check Sleeve Removal Tool
T000B0019	1	Check Sleeve Insertion Tool
T0148	1	1/2" Pin Tool
T11002104	1	Shaft Bullet
T0144	1	Cleaning Tool

4.4 PARTS ILLUSTRATION

 BORDERS REPRESENT
FLUID CONTACT AREA



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4.5 PARTS LIST

ILL NO	PART NO	QTY	DESCRIPTION	PM YEAR #	MATERIAL
1	J0092	1	Body		PTFE
2	98002318	4	O-ring, PTFE Check Valve	2	PTFE
3	J0097	4	Check Ball	2	PFA
4	1110B0012	2	Suction Sleeve		PTFE
5	1110B0013	2	Discharge Sleeve		PTFE
6	J0100	2	Seal	2	PTFE
7	J0101	2	Check Bore Cap		PTFE
8	98001167	2	Shaft Seal	2	PTFE
9	1110A0035	1	Shaft	2	PFA
10	J0093	2	Push Plate		PTFE
11	J0090	2	Diaphragm Set	2	PFA
12	J0094	2	Fiber Optic Target	2	PTFE
13	98001423	2	Main Seal	2	Viton
14	J0096	6	Tie Bolt Assembly		SS416, PFA
15	J0091	2	Head		PP
16	98001804	2	3/8" NPT Plug		PE
17	AM022	1	Base Mount		PP
18	98003207	4	Screw		PP
19	98003071	1	Screw		PP
20	AM023	1	Locking Lever		PP
21	C0102	1	Quick Release Base		PP
22	98001109	12	Tie Bolt Cap	2	PU
23	98002338	6	Nut, Flanged		SS18-8

4.6 CLEAN-UP

The pump fluid cavities may be flushed clean by cycling with the suction (IN) and discharge (OUT) lines connected to a DI water flushing or rinsing tank. Flushing using an external pressure source without allowing the pump to cycle will result in incomplete removal of potentially dangerous chemicals.

NOTE: To effectively eliminate chemical contamination, the pump should cycle for 10-15 minutes using the flushing DI water as described above.

4.7 DISASSEMBLY

During the life of the pump it will be necessary to perform certain preventative maintenance procedures to ensure its continued high performance. This section and the next (4.8 Assembly) are provided for the user's convenience in disassembly and re-assembly procedures.

- Thoroughly clean / flush the pump using DI water (Refer to Section 4.6 Clean-Up).
- Disconnect fluid and air connections from pump.
- Unlock pump from quick release base by pulling out locking lever on front of quick release base. Slide pump forward until it stops. Lift pump off quick release base.
- Remove 3/8" NPT plugs from heads.
- Remove tie bolt caps from both heads.
- Remove the un-tact flanged nuts from the tie bolt assemblies. Using both 3/8" nut drivers. Leave tie bolts in place.

- Lay the pump on its side with the tact nuts facing down.
- Lift off head.
- Remove the main seal and diaphragms.
- Remove the body assembly.
- Remove the second set of diaphragms and main seal.
- Remove tie bolts.

NOTE: All polypropylene and fluoroplastic parts, when disassembled, should be thoroughly washed and be free from acid residue for handling purposes.

4.7.a Body Disassembly

- Remove check bore caps using ½" pin tool and remove seals.
- Remove sleeves with sleeve removal tool, check balls and O-rings.
- Unthread one push plate from the shaft.
- Remove remaining push plate and shaft from body.
- Unthread second push plate from shaft.
- Remove shaft seals from the shaft bore, taking care not to damage the shaft bore or shaft seal grooves.
- Remove base mount from body.

4.8 ASSEMBLY

4.8.a Body Assembly

NOTE: Check Sleeves that fit too tightly for easy installation should be placed in a freezer prior to assembly to assist insertion.

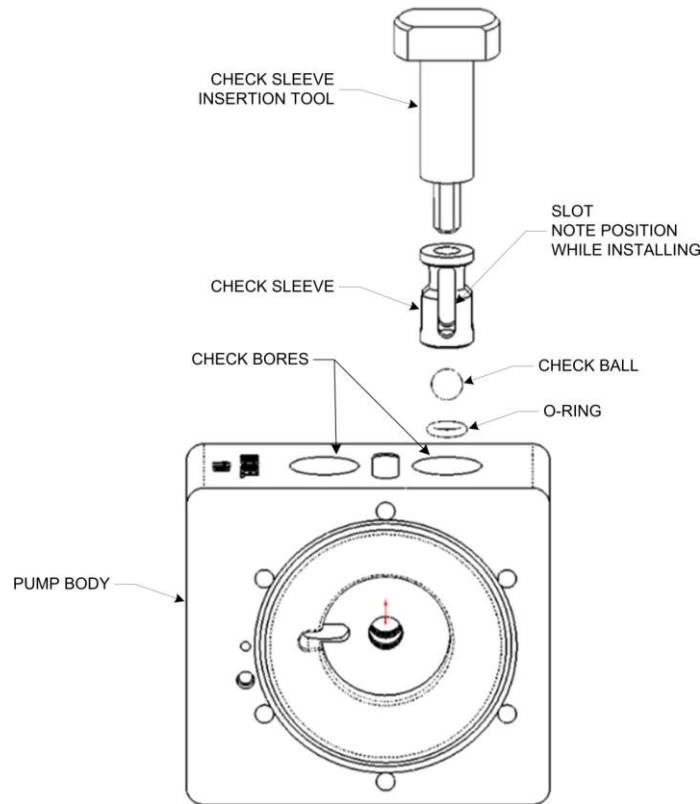
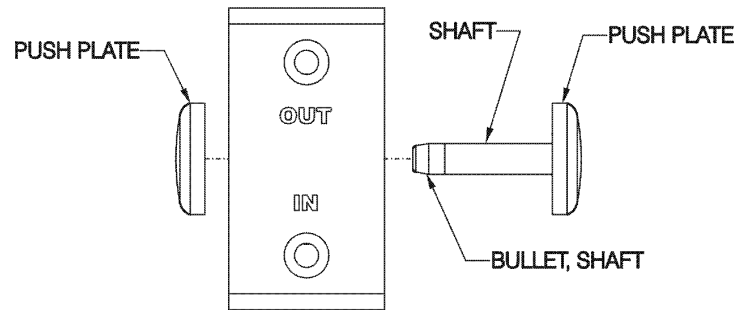


Figure 4-1

- Insert suction sleeve, check ball and O-ring carefully into check bore.

NOTE: The Suction Sleeves have a shoulder diameter larger than their body diameter. Additionally the Suction Sleeves when compared to the Discharge Sleeves have a thicker top region which acts as a robust contact point for the O-rings.

- Repeat insertion process with the discharge sleeve, check ball and O-ring.
- Repeat process for second check bore.
- Replace check cap seals and tighten check bore caps to 35in-lbs.
- Install shaft seals into shaft bore grooves.
- Thread shaft into push plate until engagement with the shaft shoulder is achieved. Additionally apply a ¼" turn to ensure proper installation.
- Insert shaft through shaft bore using shaft bullet as shown (This prevents damage to the TFE shaft seals and prevents dislodgement of shaft seals).



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Figure 4-2

- Remove bullet and thread on remaining push plate, tighten per previous practice.
- Install base mount to pump using screws.

4.8.b Final Assembly

- Insert tie bolt assemblies through slave head and lay flat with tie bolts sticking up.
- Place main seal O-ring into the main seal groove in head.
- Install a diaphragm set (with PTFE target between the diaphragms), removing all air from between diaphragms, onto the tie bolts noting the relative orientation of the formed main seal groove in the diaphragms with respect to conforming to the main seal.
- Carefully place and press the body assembly onto the tie bolts.
- Install the remaining diaphragm set onto the tie bolts and body, again noting formed main seal groove.
- Place the main seal O-ring into the formed groove of the master head.
- Lift the slave head and body, while maintaining compression of the main seal, flip the head and body over and insert the tie bolts into the master head. Ensure that the main seal of the master head is not dislodged.
- Install flange nuts onto tie bolts; tighten evenly in a star pattern and torque to 32 in-lbs.
- Install tie bolt caps and 3/8" NPT fittings into each head.

4.9 TESTING

4.9.a Performance Test

- Start with air regulator at low (< 15 psi) pressure setting.
- Pump must prime once pressure is increased
- 60 psig Supply Pressure
- Check for fluid leaks, listen for air leaks, check for irregularity
- Prepare the pump for drying

4.9.b Dry Pump

- Connect vacuum hose to discharge line
- Connect purge line to fluid inlet
- 60 psig Supply Pressure
- Cycle pump & vacuum dry by rotating pump side to side for 30 seconds.
- Turn off Air Supply and allow the pump to purge for 5 minutes.

4.9.c Dry Suction

- 20 psig Supply Pressure Target
- Record Suction Value
- Target = 6in-Hg.

5 TROUBLESHOOTING

Pump Will Not Start, Fails to Operate

Cause:

- Insufficient air pressure.
- Insufficient air volume.
- Remote air logic system.

Solution:

- Must be 10-15 psi greater than fluid discharge line pressure.
- See performance Chart (Section 3.3) for requirements.
- Replace or repair air logic system.

Bubbles in Fluid Discharge

Cause:

- Leaking fluid inlet fitting.
- Leaking main seal.
- Ruptured (perforated) diaphragm.

Solution:

- Tighten, or remove and wrap with TFE thread tape prior to tightening.
- Tighten tie bolt nuts to 32 in-lbs. Replace diaphragms if damaged.
- Replace Diaphragms.

Fluid Leaks

Cause:

- Tie bolt torque not enough to effect seal.
- Damaged main seal.
- Check bore cap.
- Ruptured diaphragm(s) can result in fluid leaks through air exhaust port and remote air logic system.

Solution:

- Tighten all nuts to 32 in-lbs.
- Replace.
Check for irregularities in diaphragm groove on pump body.
- Tighten, or remove and replace seal.
- Replace diaphragms, and any parts that may have been damaged by fluid exposure.

Erratic Cycling

Cause:

- Check ball(s) not seating.
- Remote air logic system malfunctions.

Solution:

- Replace check balls and O-rings.
- Replace or repair remote control air logic system.

6 WARRANTY



MODEL 110E PUMP

TREBOR International, Inc. warrants to the purchaser of new equipment manufactured by TREBOR to be free from defects in material and workmanship when used for its intended purpose under normal operating conditions, and maintained according to the Operation/Maintenance Manual.

TREBOR's obligation under this warranty is limited to repairing or replacing, at TREBOR's option and at the TREBOR factory, any part or parts thereof which shall, within 1 year after delivery thereof to the original purchaser, be demonstrated to TREBOR's satisfaction to have been defective. This warranty may be transferred to subsequent owners. The warranty period is based on the original ship date from the factory. All warranty related freight costs shall be borne by the customer.

Excessive wear to pump components caused by pumping abrasive solutions or chemicals, as well as damage caused by ingesting foreign objects shall not be covered by this warranty.

This warranty shall not apply to any equipment which, in the judgment of TREBOR, shall have been repaired or altered outside TREBOR's factory in any way, so as to affect its performance or reliability; subjected to misuse, negligence or accident; or used other than in accordance with TREBOR's printed instructions.

There are no terms, conditions or warranties, expressed, implied or statutory, of merchantability, fitness, capacity, or otherwise, of the goods ordered, other than, or different from, the warranty set forth above. This warranty takes precedence over any other warranty, expressed or implied.

TREBOR neither assumes, nor authorizes any other party to assume for it, any liability in connection with said equipment except as set forth above.

7 CONTACT INFORMATION

7.1 GENERAL CONTACT INFORMATION

Web: www.treborintl.com
Phone Number: (801) 561-0303
Toll Free Number: (800) 669-1303
Fax Number: (801) 255-2312
Email: treborinfo@idexcorp.com
treborsales@idexcorp.com
Address: Trebor International
8100 South 1300 West
West Jordan, Utah 84088 U.S.A.

7.2 TECHNICAL SUPPORT

Email: treborservice@idexcorp.com
Phone Number: (801) 244-6156

7.3 REGIONAL REPRESENTATIVES

Web: www.treborintl.com