



Model 905C
Hydraulic High Pressure Calibrator
Installation and Operating Manual

**For assistance with the operation of this product,
contact PCB Piezotronics, Inc.**

Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com



Repair and Maintenance

PCB guarantees Total Customer Satisfaction through its “Lifetime Warranty Plus” on all Platinum Stock Products sold by PCB and through its limited warranties on all other PCB Stock, Standard and Special products. Due to the sophisticated nature of our sensors and associated instrumentation, **field servicing and repair is not recommended and, if attempted, will void the factory warranty.**

Beyond routine calibration and battery replacements where applicable, our products require no user maintenance. Clean electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the material of construction. Observe caution when using liquids near devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth—never saturated or submerged.

In the event that equipment becomes damaged or ceases to operate, our Application Engineers are here to support your troubleshooting efforts 24 hours a day, 7 days a week. Call or email with model and serial number as well as a brief description of the problem.

Calibration

Routine calibration of sensors and associated instrumentation is necessary to maintain measurement accuracy. We recommend calibrating on an annual basis, after exposure to any extreme environmental influence, or prior to any critical test.

PCB Piezotronics is an ISO-9001 certified company whose calibration services are accredited by A2LA to ISO/IEC 17025, with full traceability to SI through N.I.S.T. In addition to our standard calibration services, we also offer specialized tests, including: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For more information, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

Returning Equipment

If factory repair is required, our representatives will provide you with a Return Material Authorization (RMA) number, which we use to reference any information you have already provided and expedite the repair process. This number should be clearly marked on the outside of all returned package(s) and on any packing list(s) accompanying the shipment.

Contact Information

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine: (716) 684-0001
General inquiries: info@pcb.com
Repair inquiries: rma@pcb.com

For a complete list of distributors, global offices and sales representatives, visit our website, www.pcb.com.

Safety Considerations

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the precautions required to avoid injury. While our equipment is designed with user safety in mind, the protection provided by the equipment may be impaired if equipment is used in a manner not specified by this manual.

Discontinue use and contact our 24-Hour Sensorline if:

- Assistance is needed to safely operate equipment
- Damage is visible or suspected
- Equipment fails or malfunctions

For complete equipment ratings, refer to the enclosed specification sheet for your product.

Definition of Terms and Symbols

The following symbols may be used in this manual:



DANGER

Indicates an immediate hazardous situation, which, if not avoided, may result in death or serious injury.

**CAUTION**

Refers to hazards that could damage the instrument.

**NOTE**

Indicates tips, recommendations and important information. The notes simplify processes and contain additional information on particular operating steps.

The following symbols may be found on the equipment described in this manual:



This symbol on the unit indicates that high voltage may be present. Use standard safety precautions to avoid personal contact with this voltage.



This symbol on the unit indicates that the user should refer to the operating instructions located in the manual.



This symbol indicates safety, earth ground.



PCB工业监视和测量设备 - 中国RoHS2公布表

PCB Industrial Monitoring and Measuring Equipment - China RoHS 2 Disclosure Table

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
住房	0	0	0	0	0	0
PCB板	X	0	0	0	0	0
电气连接器	0	0	0	0	0	0
压电晶体	X	0	0	0	0	0
环氧	0	0	0	0	0	0
铁氟龙	0	0	0	0	0	0
电子	0	0	0	0	0	0
厚膜基板	0	0	X	0	0	0
电线	0	0	0	0	0	0
电缆	X	0	0	0	0	0
塑料	0	0	0	0	0	0
焊接	X	0	0	0	0	0
铜合金/黄铜	X	0	0	0	0	0
本表格依据 SJ/T 11364 的规定编制。						
0：表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。						
X：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。						
铅是欧洲RoHS指令2011/65/ EU附件三和附件四目前由于允许的豁免。						

CHINA RoHS COMPLIANCE

Component Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Chromium VI Compounds (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Housing	O	O	O	O	O	O
PCB Board	X	O	O	O	O	O
Electrical Connectors	O	O	O	O	O	O
Piezoelectric Crystals	X	O	O	O	O	O
Epoxy	O	O	O	O	O	O
Teflon	O	O	O	O	O	O
Electronics	O	O	O	O	O	O
Thick Film Substrate	O	O	X	O	O	O
Wires	O	O	O	O	O	O
Cables	X	O	O	O	O	O
Plastic	O	O	O	O	O	O
Solder	X	O	O	O	O	O
Copper Alloy/Brass	X	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364.

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

X: Indicates that said hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement of GB/T 26572.

Lead is present due to allowed exemption in Annex III or Annex IV of the European RoHS Directive 2011/65/EU.

1.0 INTRODUCTION

PCB Model 905C High Pressure Calibration System is designed to calibrate piezoelectric pressure sensors, including ICP[®] pressure sensors with built-in electronics and charge type sensors.

2.0 SYSTEM DESCRIPTION

The Model 905C system consists of a high-pressure, hand-operated hydraulic pressure source, a 100,000 psi [690 MPa] N.I.S.T.-traceable precision reference pressure system, a 150,000 [1,034 MPa] non-precision dial gage, and a digital multi-meter. All necessary cables, adapters, seals and other accessories are supplied.

2.1 High-Pressure Hydraulic Source

The high-pressure hydraulic source consists of a hand-operated hydraulic pump, oil reservoir, and plumbing connections to the reference pressure transducer with adapters for the test sensor(s).

To prolong the life of the reference pressure transducer, a stop valve is provided at the side of the pump enclosure to shut off the transducer from the hydraulic pressure circuit when only pressure-cycling test sensors.

NOTE: The hydraulic pump is capable of producing greater than 100,000 psi [690 MPa] static pressure. However, the life of the pressure system is shortened by repeated, unnecessary cycling to 100 000 psi. Do not subject the reference pressure transducer to pressures above 100,000 psi [690 MPa].

A 150,000 psi [1,034 MPa] six-inch diameter non-precision dial pressure gage is provided at the front surface of the pump for the purpose of monitoring pressure while pressure-cycling test sensors. This dial gage is not calibrated and is intended to act only as a rough indicator of pressure. It cannot be shut off from the hydraulic pressure circuit.

2.2 Reference Pressure System

The reference pressure system consists of a calibrated, 100,000 psi [690 MPa] strain gage reference pressure transducer, a digital panel meter, and cabling. A momentary push button is provided on the rear of the Model 905C system (see PCB Drawing #2113) for internal calibration of the reference pressure transducer and meter.

The controls meter features software and serial excitation options. A separate operational reference manual is provided for this meter, along with calibration data for the strain gage reference pressure transducer.

3.0 INSTALLATION AND ASSEMBLY

Unpack the crates and cartons carefully and check the contents against the following list:

- 1 PCB Model 443B02 ICP[®] Power Conditioner with PCB Model 012AC005AC Coaxial Cable
- 1 Agilent Model 34401A Multi-Meter (or equivalent)
- 1 PPI Model OH-101 Hydraulic Pump with Handle (modified)
- 1 gallon MONOPLEX-DOS[®] Hydraulic Fluid
- 1 Flare Tube Wrench, 3/4 inch
- 1 Mounting Board and Shelf Assembly with 2 Support Brackets (PCB part No. 46600-01)
- 1 PCB Model 061A19 Mounting Adapter
- 1 Viatran Model 345 Pressure Transducer with Digital Panel Meter and Interconnect Cable
- 1 Bag of Assembly Hardware (includes seven #8 wood screws, two wire nuts, and two 065A06 seals supplied with the 066A02 Dummy Plug)
- 1 Pressure Port Adapter (PCB Part No. 2059-01) mounted in the pump outlet port
- 1 PCB Model 061M47 Adapter
- 1 PCB Model 003C05 Cable

Please refer to PCB Drawing #4079 for a graphical representation of the installation.

Bolt the pump to a table top or other raised surface, 20 to 24 inches above the floor. This height is convenient for pumping the unit. It also puts the multi-meter, power conditioner and reference pressure system meter at a convenient height.

Since it is normal for the pump to leak a small amount of fluid from time to time, and since some fluid is lost each time a sensor is removed, it is advisable to mount the pump inside a shallow drip pan.

Allow at least two feet of clearance at each side and to the rear of the installation to provide access to the rear of the unit.

An appropriate three-wire power receptacle should be available nearby. If an extension cord is necessary, use a three-wire cord.



WARNING!

Provide protection to personnel against rupture of test specimens under high pressure. The heavy metal housing provides adequate protection for an operator standing in front of the system; however, protection is required at the rear of the pump. Locate the pump in front of a heavy wall or barrier to guard against high-velocity metal parts should a rupture occur. DO NOT stand behind or along side the pump when the system is being used.

3.1 Assembly Procedure

Please refer to PCB Drawing #4079 for assembly layout while performing the following procedures:

1. Attach the mounting board assembly to the forward face of the metal angle bracket that is mounted to the top of the pump housing. Insert seven #8 x 7/8" wood screws (supplied) into the pre-drilled holes in the mounting board.
2. The pointer on the six-inch dial gage has been secured with a clip for shipping. This clip must be removed from the pointer before operating the calibrator. To do this, pull the seal ring tab and remove the seal ring. Grasp the plastic ball on the window and lift the window straight out. Remove the screw and the clip holding the pointer. Be sure to replace the screw after removing the clip. Reinstall the window and seal ring.

NOTE: The reference pressure transducer has already been mounted on the tubing and pressure cycled to 100,000 psi. DO NOT REMOVE THIS TRANSDUCER from the tubing.

3. Insert the pump handle into the socket in the lever at the pump base.
4. Connect the reference pressure transducer cable to the reference pressure transducer from meter, as shown in the Operational Hook-Up Drawing (PCB Drawing #2113).
5. Wait for the meter to read zero. If the meter is reading anything other than zero, press and hold the "up" arrow reset button, then press the "right" arrow menu button simultaneously, then release them both. This zeroes the display on the meter.

4.0 OPERATION

Be sure to check the reservoir to be certain that it is filled. A gallon of hydraulic fluid is supplied with the pump. Only the supplied fluid should be used to replenish the reservoir. Additional fluid may be purchased directly from the pump manufacturer. Contact information is listed at the end of this manual.

Consult the included instruction manual supplied by pump manufacturer for operation and maintenance of the pump. Do not operate the pump before reading these instructions.

Plug the AC line cords from the digital multi-meter and the digital panel meter of the reference pressure standard into appropriate outlets. Turn the units on and allow them to warm up for several minutes.

4.1 Operating Pressure System

To calibrate a high pressure test sensor, proceed as follows:

1. A dummy plug (PCB Model 066A02) is mounted in the manifold adapter prior to shipment. If installed, remove it from the adaptor.
2. Ensure the appropriate test sensor mounting adapter is installed in the pressure port. PCB Model

061A19 (supplied) is the proper adapter for use with the following PCB Sensors:

- 108/118 Series High-Pressure Ballistic Pressure Sensors
- 109/119 Series High Frequency Pressure Sensors
- 117 Series Conformal Ballistics Pressure Sensors
- 165/167 Series Ballistics Pressure Sensors

A blank mounting adapter, PCB Model 061M47, is also supplied. This adapter may be machined for use with other configuration high pressure test sensors. Be sure to heat treat the adapter after machining (see PCB Drawing #250-1064-00). Torque the adapter to 20 to 30 ft-lb [27 to 41 N-m].

3. Install the test sensor according to the instructions on the installation drawing for the given test sensor.
4. Connect a low noise cable from the test sensor to Model 443B02 amplifier. The proper cable for most PCB pressure sensors is PCB Model 003C05 (supplied). Select charge or ICP[®] and range accordingly. See 443B02 operating manual for instructions.
5. Connect PCB Model 012AC005AC Coaxial Cable from the output of Model 443B02 Dual-Mode Charge Amplifier to the input of the supplied multi-meter. See separate documentation supplied for use and operation of multi-meter.
6. Locate the vent valve on the top of the unit labeled "A". Close until it is finger tight.
7. Locate the stop valve on the side of the unit labeled "B". Close until it is finger tight.
8. Move the pump handle with smooth strokes until pressure begins to build, as observed on the six-inch dial gage.

NOTE: The reference pressure system does not indicate pressure with stop valve "B" closed.

9. Continue pumping, observing the pressure on the six-inch dial gage and checking for leaks at the test sensor. If the pressure does not hold, falling off slowly as the pump handle is held steady; a leak at the test sensor seal is usually indicated. If this

occurs, release the pressure by slowly opening vent valve "A". When the pressure goes down to zero, remove the test sensor and seal. Reinstall the test sensor with a new seal ring and tighten to the torque specified on the installation drawing.



WARNING!

Do not inspect for leaks, nor bring the face close to the rear of the pump while pump is in operation. High pressure leaks can cause injury.

10. Again, close vent valve "A" and increase pressure, pumping to the desired level. Cycle the sensor in this manner three times before attempting to calibrate.
11. To calibrate, open stop valve "B" and close vent valve "A." Check the meter and adjust the meter to zero, if necessary, by pressing and holding the "up" arrow reset button, then press the "right" arrow menu button simultaneously, then release them both.
12. Pump the reference standard digital output quickly to the desired pressure. Note the reading on the digital readout, and then release the pressure by opening vent valve "A."

NOTE: Pump to each pressure calibration point quickly, then release the pressure after reading each corresponding output. This prevents appreciable loss of charge output due to the discharge time constant.

4.2 Operation of the Reference Pressure System

1. Close off the test sensor port by mounting the supplied plug and seal (PCB Model 066A02 and 065A06). Torque to 32 ft-lb [43 N-m].
2. Open stop valve "B" and close vent valve "A".
3. Using the handle, pump up the system and watch the numbers on the meter increase. The numbers are

directly related to the applied pressure. If the meter reads “11550”, it means the system is pressurized to 11,550 psi [80 MPa].

NOTE: When venting the pressure by opening vent valve “A,” the user may notice that the meter displays some negative values that recover back to zero. This is common when using strain gage pressure transducers, since by venting, the transducer diaphragm is subjected to a sudden change in surface temperature change for a very short period of time.

4.3 Discharge Time Constant

To understand the significance of ICP[®] high pressure test sensor discharge time constant, consider that in one percent (1%) of the time constant, one percent (1%) of the signal is lost. For example, when calibrating an ICP[®] test sensor with a 2,000-second time constant, a one percent accurate reading can be taken within a total time span of 20 seconds, including the time to reach a specific pressure and take the reading. An ICP[®] test sensor with a 1,000-second time constant has a one percent (1) accurate reading if the total time is ten seconds or less.

A practical lower limit in time constant for ICP[®] test sensors for this calibration method is about 1,000 seconds. Sometimes only one pressure calibration point can be taken each time, especially at the higher pressures, since longer pumping times are required.

If a charge mode high pressure test sensor is being used, be sure that a sufficiently long time constant is set on the charge amplifier.

4.3 Calibration of the Reference Pressure System

The following steps are used to internally adjust the reference pressure system on sight to agree with the supplied reference pressure system performance certificate. (Please note that the reference pressure system is pre-adjusted at the factory. The following procedure is used only if the reference pressure transducer is removed and remounted. An offset can be created when the reference pressure transducer is removed, then remounted.)

Please refer to PCB Drawing #2113 and the reference pressure system performance certificate while following these steps:

1. Mount the reference pressure transducer. Torque to 32 ft-lb [43 N-m].
2. Open stop valve “B” and close vent valve “A.” Pressure-cycle the reference pressure transducer five times to 100,000 psi [690 MPa], using the six-inch dial gage. Check for any hydraulic fluid leak around the reference pressure transducer. If a leak is detected, loosen and re-torque the reference pressure transducer and cycle it to 100,000 psi [690 MPa].
3. Setup the digital panel meter (DPM) using the settings listed in **Table 1**. Refer to the “DC VOLTS, AMPS, PROCESS, STRAIN GAGE” section of the supplied DPM owner’s manual and the performance certificate of the reference pressure system.

NOTE: The DPM is pre-set at the factory prior to shipment. Adjustment is not necessary unless the reference pressure transducer has been removed and reinstalled or replaced.

INPUT TYPE:	DC Amps
INPUT RANGE:	20.0 Ma
METER DISPLAY:	4 ½" Digits (±20,000)
POWER LINE FREQUENCY:	60 Hz
SCALING METHOD:	Coordinates of 2 points
CONTROL INPUTS:	1 = Function Reset, 2 = Peak or Valley
OPERATION AS RATE OF CHANGE:	Not rate of change
OPERATION OF PEAK BUTTON:	Peak Display
AUTO-TARE:	Auto-Tare mode
NON-LINEAR INPUT SCALING:	Linear Input
ALARM FILTERING:	Filtered
PEAK/VALLEY FILTERING:	Filtered
DISPLAY FILTERING:	Filtered
ADAPTIVE FILTER THRESHOLD:	Low
INPUT SIGNAL FILTERING:	Autofilter
DECIMAL POINT:	None, full display
LOW SIGNAL INPUT:	mA reading @ 0% F.S.
DESIRED READING @ LO IN:	00000 (0 psi)
HIGH SIGNAL INPUT:	mA reading @ 100% F.S.
DESIRED READING @ HI IN:	99999 (100,000 psi)

5.0 MAINTENANCE AND REPAIR

A recalibration schedule based on frequency of use should be established by the user. The reference pressure system maintains recalibration twelve months after the date of purchase. Consult the reference pressure system manufacturer for details on recalibration. Contact information may be found at the end of this manual.

The only routine maintenance required for the hydraulic pump, other than that of keeping the reservoir filled, is the replacement of seals and packing as they become worn. The instruction manual supplied by the hydraulic pump manufacturer contains drawings, instructions, and parts lists. Replacement parts and hydraulic fluid may be obtained directly from the pump manufacturer. Contact information may be found at the end of this manual.

6.0 ADDITIONAL WARRANTY NOTES

The standard PCB Warranty (PCB Document #21354) applies only to the portions of the system that are manufactured by PCB Piezotronics, Inc. It is found in the rear of this manual.

Since the manufacturer of the hydraulic pump system does not warrant this product, PCB cannot apply the standard warranty to this item. For warranty and recalibration of the reference pressure system, refer to the reference pressure system performance certificate and manufacturer contact information listed at the end of this manual.

Hydraulic Pump Manufacturer:



900 Louis Drive
Warminster, PA 18974
(215) 675-1600

<http://pressureproductsindustries.com>

Reference Pressure System Manufacturer:



3829 Forest Parkway, Suite 500
Wheatfield, NY 14120
(800) 688-0030

<http://www.viatran.com>



3425 Walden Avenue
Depew, New York 14043-2495 USA
(800) 828-8840
24-hour SensorLineSM: 716-684-0001

<http://www.pcb.com>

Model Number 905C	HYDRAULIC HIGH PRESSURE CALIBRATOR	Revision: D ECN #: 34533
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Performance	<u>ENGLISH</u>	<u>SI</u>
Measurement Range	0 to 100,000 psi	0 to 690 MPa
Measurement Accuracy	≤ 2 % FS	≤ 2 % FS
Auxiliary Gage Range	0 to 150,000 psi	0 to 1034 MPa
Maximum Pump Pressure	150 kpsi	1034 MPa

Physical	<u>ENGLISH</u>	<u>SI</u>
Reference Sensor System Meter Display(output)	psi	MPa
Auxiliary Gage Display(output)	psi	MPa
High Pressure Pump(type)	Positive Displacement	Positive Displacement
Hydraulic Fluid	Monoplex®-DOS	Monoplex®-DOS
System Fluid Volume	250 in ³	4100 cc
Size (Height)(33 inch pump handle on front)	27 in	69 cm
Size (Width x Depth)	14 in x 12 in	36 cm x 31 cm
Weight(approximate)	100 lb	45 kg
Power(electronics)(60 Hz)	110 volts	.5 amps

*All specifications are at room temperature unless otherwise specified.
In the interest of constant product improvement, we reserve the right to change specifications without notice.*

ICP® is a registered trademark of PCB Group, Inc.

OPTIONAL VERSIONS

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

F - 230 VAC operation

SUPPLIED ACCESSORIES:

Model 003C05 Low-noise, blue, coaxial, Teflon cable, 5-ft, 10-32 coaxial plug to BNC plug
 Model 012AC005AC CABLE 5FT BNC PLUG TO BNC PLUG
 Model 061A19 MOUNTING ADAPTOR
 Model 061M47 BLANK THREAD ADAPTOR
 Model 066A02 Dummy sensor plug
 Model 119B02 High frequency pressure sensor, 100k psi, 0.25 pC/psi, accel comp., integral thds (ceramic coated dia.)
 Model 443B02 1-channel system, dual-mode charge amplifier system, line powered
 Model Digital Panel Meter (Viatran Model VL20001ABY or equivalent)
 Model Flare Tube Wrench, 3/4 inch
 Model Monoplex® -DOS (1 gallon) or equivalent
 Model Multi-Meter with Digital Display RS-232 (Agilent Model 34401A or equivalent)
 Model Pressure Readout Mounting Board and Shelf Assembly
 Model Reference Pressure Transducer (Viatran Model 345 or Equivalent)

Entered: DMW	Engineer: MJK	Sales: RWM	Approved: EB	Spec Number:
Date: 1/10/11	Date: 1/10/11	Date: 1/10/11	Date: 1/10/11	5541

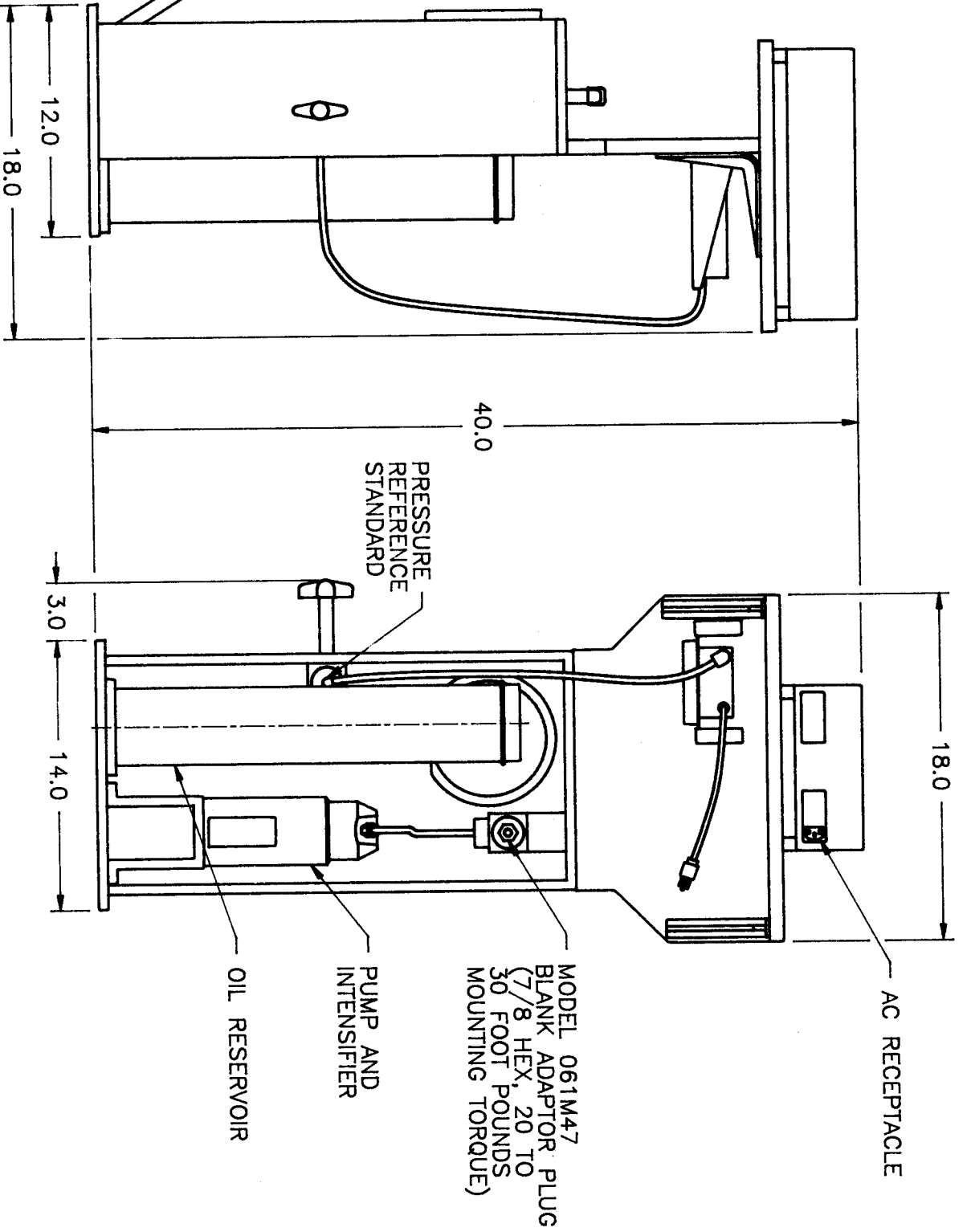
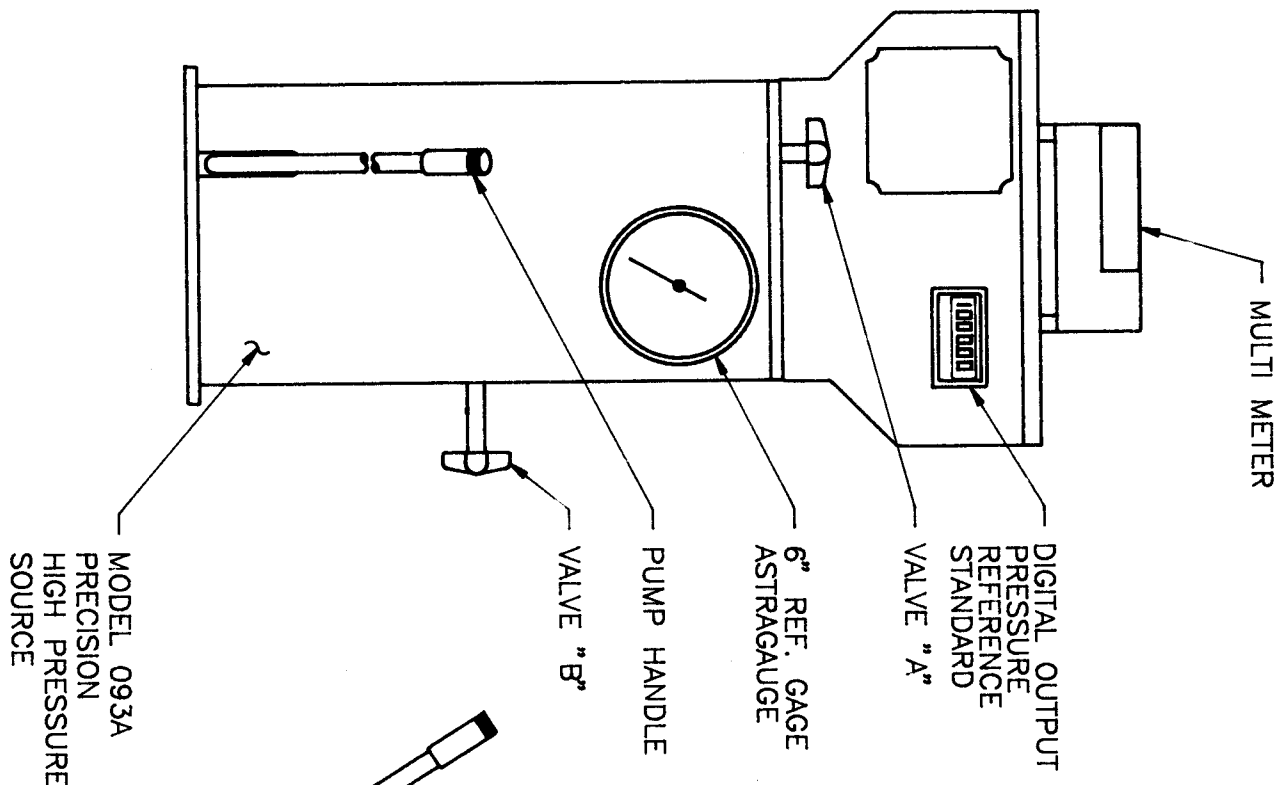


3425 Walden Avenue, Depew, NY 14043

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 E-Mail: pressure@pcb.com

APPLICATION		
NEXT ASSY	USED ON	VAR
PCB Piezotronics Inc. claims proprietary rights in the information disclosed hereon. Neither it nor any reproduction thereof will be disclosed to others without written consent of PCB Piezotronics Inc.		

REVISIONS					
ZONE	REV	DESCRIPTION	ECN	DATE	APP'D
		-SEE SHEET ONE-			



MODEL 093A
PRECISION
HIGH PRESSURE
SOURCE

MODEL 061M47
BLANK ADAPTOR PLUG
(7/8 HEX, 20 TO
30 FOOT POUNDS
MOUNTING TORQUE)

UNLESS SPECIFIED TOLERANCES		MATERIAL	
DIMENSIONS ARE IN INCHES DECIMALS XX ±.01		HEAT TREAT	
XXX ±.005		FINISH	
ANGLES ±2 DEGREES			
FILLET AND RADIUS .003 - .005			
DD008 REV. A 05/26/95			
DRAWN	JTC	MFG	ACT
CHK'D	DM	ENGR	ACT
APP'D	DM		
MODEL 905C HIGH PRESSURE CALIBRATION SYSTEM			
PCB PIEZOTRONICS, INC. 3425 WALDEN AVE. DEPT. NEW YORK 14043 PHONE: (716) 894-0001		CODE	DWG. NO.
		52681	4079
SCALE: 1=8		SHEET 2 OF 2	