

DOPPLER FLOW CONTROLLER & PUMPING SYSTEM

Model 700D

Revised April 2019

TABLE OF CONTENTS

Section	Page Number
Introduction	3
System Specifications	4
System Components	5
Spare Parts	5
Initial System Set-Up Procedure	6
Pump Driver and Pump Heads	6
Mounting the Flowmeters	7
Test Fluid Reservoir	8
Connecting the System	8
Activating The System	9
Operation of the Flowmeter	10
Doppler Flow Velocity and Laminar Flow	11
Pump Head Assembly and Tubing Replacement	12
Care and Maintenance	13
Replacement Parts	15
Statement of Warranty	16
Quality Assurance Record	17
Ultrasound Doppler Performance Measurements and Criteria	Appendix A
ATS #758-225 Accucal Flowmeter, Tube Size 225 Correlation Flow Table	Appendix B
ATS #759-235 Accucal Flowmeter, Tube Size 235 Correlation Flow Table	Appendix C

INTRODUCTION

The Model 700 Doppler Flow Controller and Pumping System provides an easy accurate means of evaluating a Diagnostic Doppler Ultrasound Imaging System's ability to detect sensitivity at varying depths, maximum penetration, flow velocity, location and directional discrimination.

Model 700 consists of a positive displacement, variable speed controlled pumping system, flow integrator, in-line flowmeters, and a test fluid reservoir. The Model 700 is designed to be used in conjunction with the ATS Doppler Flow Phantoms Models 523, 523A, 524, 525 and 527 and Model 707-DTF Doppler Test Fluid. These products are available as a separate purchase.

The System provides steady-state flow rates ranging from 9.6 to 960 ml/minute, with higher flow rates are available upon request. The speed of the pump, controlled by a multi-function switch, governs the flow rate of doppler test fluid through the phantom. In-line flowmeters permit continuous monitoring of the flow rate during the testing procedure.

The ATS Doppler Flow phantoms are constructed of a rubber-based tissue-mimicking material, developed by ATS Laboratories. This material extends the useful life of the phantom by avoiding problems due to melting, freezing, dehydration and breakage from dropping, which are commonly associated with hydrogel (water-based) phantoms.

Most diagnostic imaging systems are calibrated for a sound velocity of 1,540 meters per second (m/sec), which is the assumed average velocity of sound through human soft tissue. The rubber-based tissue-mimicking material, has a sound velocity of 1450 m/sec with an attenuation coefficient of 0.5 dB/cm/MHz at room temperature (23°C).

The rate of fluid flow through the phantom when measured by a Doppler imaging system is not affected by the differences in sound velocity, therefore, distortion of these measurements will not occur. However, if measurements such as depth or vessel diameters should be obtained, a correction factor must be used to compensate for the differences in the speed of sound. Simply multiply the measurement obtained by the correction factor of 0.94.

The acoustic properties of all biologic and non-biologic materials are affected by temperature variations. Most diagnostic imaging systems and tissue-mimicking phantoms are calibrated at room temperature, commonly referred to as 23°C. To ensure measurement accuracy ATS incorporates a thermometer strip affixed to the outside surface of the phantom housing.

WARNING: THE MODEL 700-115/230 DOPPLER FLOW PUMP DRIVER AND PUMPING SYSTEM IS NOT DESIGNED NOR INTENDED FOR MEDICAL USE IN TREATMENT OF PATIENTS AND ACCORDINGLY, THIS PRODUCT HAS NOT RECEIVED FDA APPROVAL AS A DEVICE FOR MEDICAL USES.

SYSTEM SPECIFICATIONS

Pump Heads and Drive:

RPM Range:	6-600
Pump Heads:	2
Fluid Contact:	Tubing only
Flow Rate:	9.6 - 960 ml/min.
Voltage:	Universal input - 90-260 VAC 50/60 Hz
	1.8m (6 ft) 3-wire cord
Temperature:	
Operating:	23°C
Storage:	-45° to 65°C
Pump Head Tubing:	Silicon, 3.1 mm (1/8") I.D.
System Tubing:	PVC 6.4 mm (1/4") I.D.
	PVC 10 mm (13/32") I.D.

Flowmeters:

Number of Flowmeters:	2
Flow Range:	.2-1300 ml/min.
Accuracy:	± 2% of reading
Repeatability:	± 1%

Fluid Reservoir:

Type:	Heavy-duty bottle with inlet/outlet cap
Capacity:	2 Liters (.5 Gallon)

Doppler Test Fluid #707:

Type:	Blood-mimicking
Density:	1.04 ± 0.01 g/cc
Viscosity:	1.66 ± 0.1 centistokes
Particulate size:	30 micron +/- 3 micron mean diameter
Particulate Concentration:	1.7 ± 0.1x10 ⁴ particles per cc

Weight/Dimensions:

Size (L X W X H)*:	55.8 x 43.18 x 24.13 cm
	22 x 17 x 9.5 in
Weight*:	17.27 Kg (38 lb.)

*Includes the carrying case without the Doppler Test Fluid.

WARNING: THIS PRODUCT IS NOT DESIGNED NOR INTENDED FOR MEDICAL USE IN TREATMENT OF PATIENTS AND HAS NOT RECEIVED FDA APPROVAL AS A DEVICE FOR MEDICAL USES.

SYSTEM COMPONENTS

Please check to make sure you have received the following components with your new Model 700-115/230 Doppler Flow System:

ATS Part Number	Description	Quantity	Unit
703	1400-1620 Universal Voltage Pump Driver, 90-260 VAC, 50-60 Hz	1	Each
704	Pump head mounting hardware	1	Set
705	2 Pump heads, mounting hardware, silicone tubing, and reducing tees installed	2	Each
708	PVC tubing ½" OD x ¼" ID	3 ft.	Each
709	PVC tubing 9/16" OD x 13/32" ID	10 ft.	Each
710	Flow Integrator w/tubing connectors installed	1	Each
711	Pressure gauge	1	Each
712	Pressure gauge 'T' connector, w/ hose barb fittings 1/4" NPT x 3/8" installed	1	Each
758	Accucal Flowmeter #225, w/ hose barb fittings 1/8" NPT x 3/8" installed	1	Each
759	Accucal Flowmeter #235, w/ hose barb fittings 1/8" NPT x 3/8" installed	1	Each
744	Flowmeter Stand	1	Each
755	Test fluid reservoir bottle, cap with inlet/outlet barb tubing connectors	1	Each
756	Reducing union, w/ PVC tubing ½" OD x ¼" ID installed	1	Each
707-DTF	Doppler test fluid	1 gal.	Each
728	Carrying case w/ foam inserts	1	Each

Spare Parts

ATS Part Number	Description	Quantity	Unit
721	Ratchet tubing clamp ¾" OD Tubing	1	Each
716	Hose barb fittings 1/8" NPT x 1/8" (white)	1	Each
717	Hose barb fittings 1/8" NPT x 3/8" (white)	1	Each
719	Hose barb fittings 1/8" NPT x 3/8" (black)	2	Each
706	Tubing, silicone, 18" lengths	2	Each
707	Tubing replacement key	1	Each
718	Reducing 'T' connector	1	Each
713	Hose barb fitting 1/4" NPT x 3/8"	1	Each

NOTE: The Model 700 Pumping System does not include a Doppler Flow Phantom; this product must be purchased separately.

INITIAL SYSTEM SET-UP PROCEDURE

Arrange the system components for easy access during a testing procedure, prior to cutting the PVC connecting tubing as shown on Diagram 1.

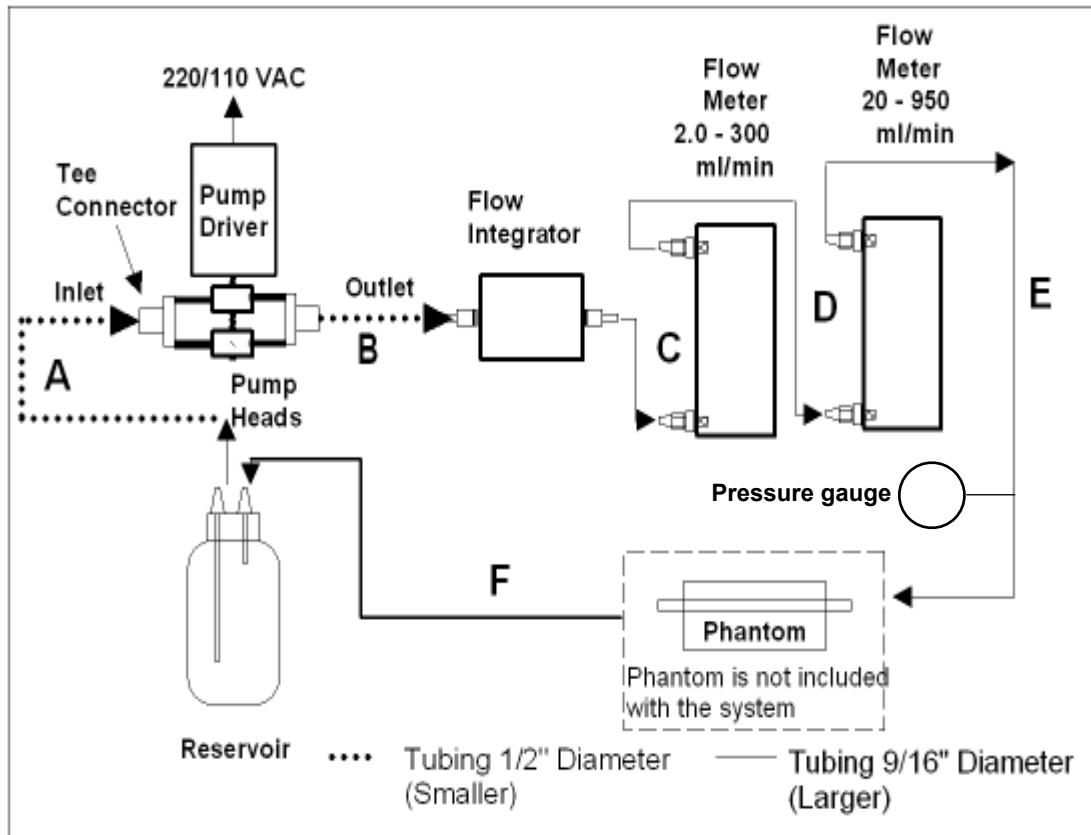
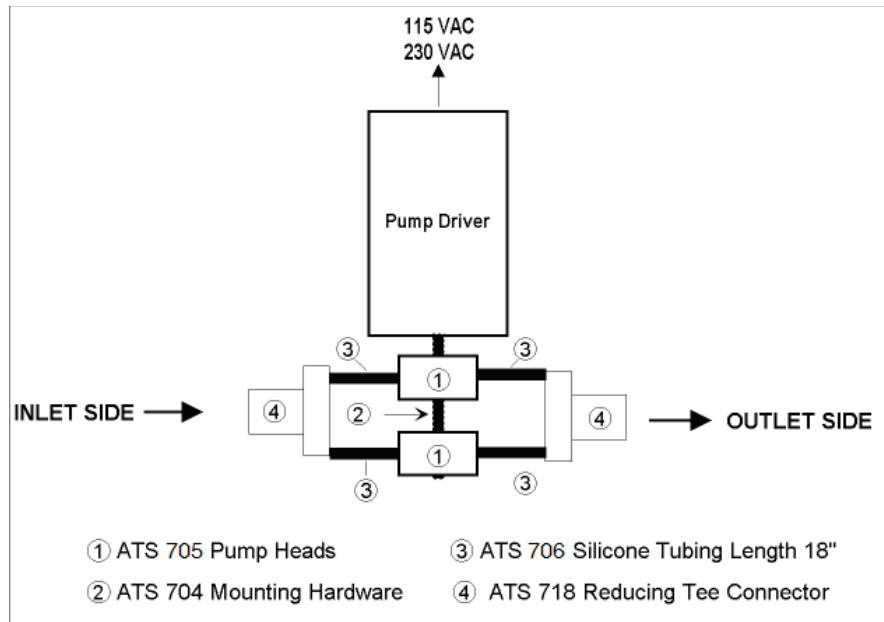


Diagram 1

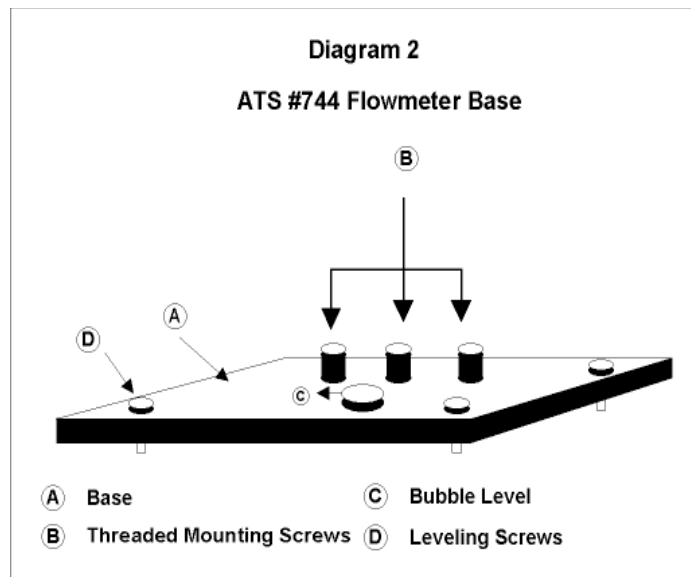
Pump Driver and Pump Heads:

The pump driver has been provided with the pump heads, mounting hardware, silicon tubing, reducing Tee connectors installed. The pumping system is divided into two sides. The "fluid inlet" is located to the left of the pump heads, and the "fluid outlet" to the right as shown in Diagram 1. When setting up the system, position the pump driver with access to an electrical outlet.



Mounting the Flowmeters

1. Place the flowmeter base (A) on a clean, level work surface (see Diagram 2).
2. On the top surface of the base (A), three threaded screws (B) are provided for installing the flowmeters. Using the outer two screw positions, secure the base to the bottom of the flowmeters. Hand tighten the screws.
3. A built-in "bubble level" (C) located on the base (A), ensures the base is level for maximum accuracy. Four leveling screws (D) are used to adjust the base. Position the bubble in the center of the ring by adjusting the leveling screws. Reading accuracy decreases if the flowmeters are not placed in the vertical position.



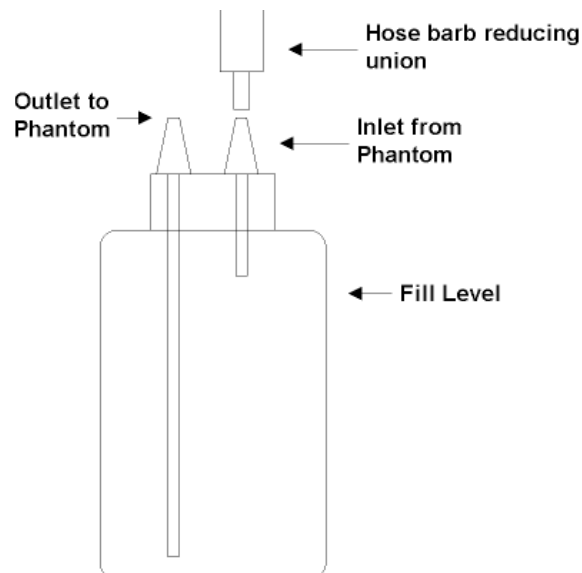
Test Fluid Bottle Reservoir

In the operation of any flow phantom it is likely some bubbles will enter the fluid stream, either through cavitation in areas of expanded diameters or entrainment of air at a fitting or connector.

The test fluid reservoir included in the System has a capacity of .5 gallons. This capacity allows enough time for the entrapped air bubbles to separate from the returning test fluid, by drawing the fluid from the bottle, while allowing the bubbles to rise to the top.

As the pump begins to circulate the test fluid through the system, entrapped air bubbles will enter the fluid and be pumped into the return side of the reservoir.

1. Gently shake one of the gallons of ATS #707 Doppler Test Fluid to ensure any material which may have settled to the bottom is dispersed within the solution. Slowly fill the reservoir to just below the neck of the bottle, with approximately 1/2 gallon of the fluid.
2. Check to make sure the tubing on the inside of the Inlet/outlet cap is secure. You will note the outlet (delivers fluid to the phantom) is longer and should reach the bottom of the bottle. The inlet (delivers fluid from the phantom back to the reservoir) is shorter and should reach just below the neck of the bottle.



Connecting the System

1. The phantom should be positioned near the flowmeters. The actual distance will depend on the individual testing area available. Make sure you are comfortable with the positioning of the components before cutting the PVC tubing.
2. The system has been provided with two sizes of PVC tubing and should be used as indicated in the diagram below. The tubing is cut to the required length (as indicated below),

using a pair of heavy-duty scissors or a sharp knife. Care should be taken when cutting the tubing to avoid cutting yourself.

3. To connect the tubing to the tapered barb end of the connectors, push the tubing onto the tapered end of the connector as far as it will go. If the tubing is difficult to connect, soak the end of the tubing in hot water for a few minutes and try again. Do not use a lubricant for this purpose, as the pressure created when the system is activated may dislodge the tubing creating an uncontrolled shower of test fluid. Please refer to Diagram 1.

1. Tubing "A," (smaller tubing) connects the SUPPLY SIDE OF THE TEST FLUID RESERVOIR to the INLET SIDE OF THE PUMP HEADS. Connect one end of the tubing to the open end of the T-Connector and the opposing end to the outlet barb connector on the top of the Test Fluid Reservoir bottle.

2. Tubing "B," (smaller tubing) connects the OUTLET SIDE OF THE PUMP HEADS to the INLET SIDE OF THE FLOW INTEGRATOR. Connect one end of the tubing to the open end of the T-Connector and the opposing end to one of the **smaller diameter hose barb tubing connector** on the flow integrator.

3. Tubing "C," (larger tubing) connects the OUTLET SIDE OF THE FLOW INTEGRATOR to the INLET SIDE OF THE ATS 758-225 FLOWMETER.

4. Tubing "D," (larger tubing) connects the OUTLET SIDE OF THE ATS 758-225 FLOWMETER to the INLET SIDE OF THE ATS 759-235 FLOWMETER.

5. Tubing "E," (larger tubing) connects the OUTLET SIDE OF THE ATS 759-235 FLOWMETER through the PRESSURE GAUGE 'T' CONNECTOR to the INLET SIDE OF THE DOPPLER FLOW PHANTOM.

6. Tubing "F," (larger tubing) connects the OUTLET SIDE OF THE PHANTOM to the RETURN SIDE OF THE TEST FLUID RESERVOIR.

Activating The System

1. Plug the power cord from the pump driver into an electrical outlet providing proper AC power.
2. The power switch is located on the back of the pump driver unit. Toggle the switch to turn the unit ON.
3. Use the up and down arrows on the touch pad to select RPM, indicated in the display window. 6 RPM is the minimum and 600 is the maximum. The FLOW DIRECTION key sets the pump rotation either clockwise or anti-clockwise. The active direction will be indicated by the LED annunciator. The INT/EXT key selects internal (keypad control from the front panel) or remote operation via a DB9 connector.
4. The red START/STOP key is used to toggle the driver motor OFF/ON.

5. Select a low pump speed, i.e., less than 100 rpm and allow the system to prime itself with test fluid. Check for leaks at the tubing connections. If a leak should occur, turn off the pump and tighten the connection.

6. If no leaks are noted, allow the pump to run for several minutes to circulate the test fluid through the system, permitting any entrapped air bubbles to enter the fluid and be pumped into the return side of the reservoir. The phantom/flow system is now ready for performance testing.

NOTE: THE MAXIMUM PRESSURE DELIVERED TO THE DOPPLER FLOW PHANTOM MUST NOT EXCEED 15 PSI OR 1.05 KG/CM². PRESSURES ABOVE THIS LIMIT WILL PERMANENTLY DAMAGE THE PHANTOM.

OPERATION OF THE FLOWMETER

A built-in "bubble level" (C) located on the base (A), ensures that the base is level for maximum accuracy. Four leveling screws (D) are used to adjust the base. Position the bubble in the center of the ring by adjusting the leveling screws in or out as necessary. A deviation of 5° or more from vertical will affect the accuracy of the indicated readings.

The Model 700-115/230 has been supplied with two flowmeters to accurately monitor a wider range of flow rates. The #758-225 (tube size 225) flowmeter is designed to monitor flow rates ranging from 0.2 to 300 ml/min, whereas the #759-235 (tube size 235) has a range of approximately from 20 to 1300 ml/min. Please note that the standard pump heads and tubing supplied with the Model 700-115/230 are capable of delivering a maximum of 960 ml/min using the pump driver with a maximum of 600 rpm.

Contained within the flowmeter tube is a stainless steel ball (flowmeter ball) which travels up or down within the tube as the flow rate of the fluid is increased or decreased. The flowmeter tubes are provided with a graduated scale ranging from 0 to 100.

To obtain the flow rate of fluid through the system:

1. Locate the center on the ball within the flowmeter tube and read the corresponding number from the graduated scale.
2. Refer to the appropriate calibration chart or graph for the size and serial number of the flowmeter being used, located at the end of this manual.
3. Locate the value of the reading obtained. This reading will correspond to the actual flow rate in milliliters per minute of ATS Doppler Test Fluid through the system.

Doppler Flow Velocity and Laminar Flow

The fluid flow characteristics of the Model 700-115/230 Doppler Flow Controller and Pumping System when used in conjunction with the ATS Doppler Flow Phantoms and Model 707 Doppler Test Fluid are given below:

The objective of any flow system used to evaluate Doppler flow imaging systems, is to achieve consistent laminar flow, free of turbulence. The type of fluid flow produced is a function of the flow velocity, diameter of the flow channel, density of the fluid, and fluid viscosity. The combined effect of these parameters can be summarized in a dimensionless number, the Reynolds number. The Reynolds number expresses the balance of inertial and viscous forces acting on a flowing fluid. A Reynolds number higher than a critical value will result in disturbed or turbulent flow.

For fluids flowing in straight channels with a circular cross section, a Reynolds number of 2000 or less will almost always produce laminar flow. For Reynolds numbers above 3200, the flow is usually turbulent. In the transition zone, between 2000 and 3200, the flow may be either turbulent or laminar.

The ATS #707 Doppler Test Fluid consists largely of water. Accordingly, flow conditions resulting in a Reynolds number less than 2000 will be laminar.

The Reynolds number is calculated as follows:

$$\text{Reynolds number} = \frac{\text{Diameter Flow Channel} \times \text{Linear Velocity}}{\text{Kinematic Viscosity}}$$

Physical Data of ATS products:

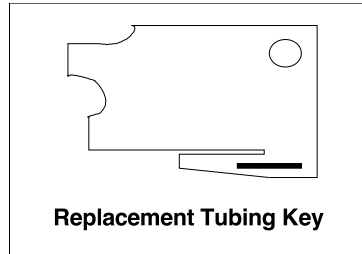
ATS Doppler Flow Channel Diameters:	2, 4, 5, 6, 8, 10 mm
Linear Velocity:	Refer to Flowmeter Correlation Tables
Model 707 DTF Kinematic Viscosity:	1.66 Centistokes

LAMINAR FLOW TABLE

Flow Channel Diameter (mm)	Flow Rate Range (ml/min)	Flow Velocity Range (cm/sec)	Reynolds Number Range
2.0	9.6 – 313	.051 – 166	1 – 2000
4.0	9.6 – 626	.025 – 83.0	1 – 2000
5.0	9.6 – 782	.020 – 66.4	1 – 2000
6.0	9.6 – 939	.017 – 55.3	1 – 2000
8.0	9.6 – 960	.013 – 31.8	1 – 1533
10.0	9.6 – 960	.010 – 20.4	1 – 1229

Pump Head Assembly and Tubing Replacement

The pump head configuration incorporated in this system has been specially modified to provide steady-state fluid flow virtually free of pulsation. The silicon tubing installed with this system is matched to the pump head configuration to optimize performance.



1. Locate the Replacement Tubing Key supplied with your system
2. The Silicon tubing installed in the pump heads should be inspected on a regular basis and replaced as needed.
3. Position the toggle switch on the pump driver to the OFF position. Unplug the power cord from the electrical outlet.
4. Remove the two T-connector-PVC adapters from the reducing unions connecting the two pump heads.
5. The pump heads are mounted onto the pump driver by four threaded rods (mounting hardware). Remove the four wing-nuts by turning them counterclockwise.
6. Remove the first pump head by sliding it towards you along the mounting hardware. Put the first pump head aside and remove the second pump head.
7. The pump heads are constructed in two sections or halves. Separate the first pump head by grasping one side and pull apart the two sections.
8. Remove the old tubing by pulling it from the pump rollers.
9. Remove the reducing unions from the old tubing. Re-install the small end of the unions onto the open ends of the new tubing. Discard the old tubing.
10. Place the new tubing in the outer port against the rollers at the 2 and 6 o'clock position, keeping your thumb on the tubing to hold it in place.
11. Hold the pump head section containing the rollers in one hand. Turn the rotor shaft until the rollers are positioned at 2, 6 and 10 o'clock.
12. Position the key wrench with the long rectangular slot at the bottom. Slide the rectangular slot between the 2 and 6 o'clock roller with the top portion of the wrench resting on the top of the roller shaft pushing the key down as far as possible against the tubing. With the

key firmly pressed against the rotor shaft, turn counterclockwise, pushing down while turning, until the tubing has surrounded the rotor. The tubing is now positioned deep into the cavity.

13. The tubing is now in place. Remove the key and position the other pump half onto the motor shaft and snap into place. Be careful not to pinch the tubing between the plastic halves.
14. Repeat steps 5 through 13 for the second pump head.
15. Prior to remounting the pump heads onto the mounting hardware, check to make sure the threaded mounting rods are screwed firmly (finger tightening only) in place on the pump driver.
16. You will note on the pump driver the rotor shafted is notched to accept the keyed side of the pump heads. Place the pump heads side-by-side with the keyed side up. One of the pump heads is marked with a black line while the other has no markings. The first pump head to be mounted will be the one without markings.
17. Grasp the pump head with the tubing pointing upward and slide the pump head onto the mounting hardware until the threaded portion of the rod is visible.
18. Using the key wrench, rotate the pump head shaft until the keyed portion of the shaft slides into the mating notch on the pump driver. Once matched push the pump head against the driver.
19. Using the same procedure, match the keyed shaft of the second pump head with that of the matching notch on the rotor shaft of the first pump head.
20. Replace the four wing-nuts on the mounting rods. Do not over tighten.

CARE AND MAINTENANCE

General:

When Doppler flow testing has been completed, pump clean tap water through the system and all flow channels of the phantom for several minutes to remove any residual test fluid prior to storing.

Phantom:

For best results the phantom should be kept clean at all times. In particular, a buildup of dried coupling gel on the scan surface should be avoided. The phantom may be cleaned with warm water using a lint free cloth. Particularly stubborn stains and dirt may be removed with a mild household cleaner. The use of petroleum solvents should be avoided since they may adversely react with the rubber-based material.

Pump Driver and Controller:

Please refer to Operating Manual (on the CD) supplied with your System for specific maintenance instructions and a listing of spare parts.

Silicon Tubing:

The silicon tubing should be checked on a regular basis and replaced whenever required. A tubing rupture may cause an overload condition on the pump motor resulting in failure of some of the electrical components. To replace the tubing please refer to section 7.

Flowmeters:

The flowmeters should rarely need any form of cleaning if they are routinely flushed with fresh water following use. However, should cleaning be necessary, it may be accomplished following disassembly.

1. Disassemble the flowmeter:
 - a. Remove the four screws holding the clear plastic front shield in place, remove the shield and set aside.
 - b. Remove the four screws holding the lower inlet assembly, then remove the assembly. There will be an o-ring between the assembly and a white plastic coupling.
 - c. Remove the white coupling from the graduated flow tube. There will be an o-ring between it and the tube. The stainless steel float ball may now be removed from the tube. Unseat the flow tube from the upper outlet assembly.
2. Clean all parts with mild dish detergent and water. Soak if necessary. Rinse thoroughly.
3. Re-assemble the flowmeter using the above steps in reverse. Make sure that the graduated scale on the flow tube is properly aligned facing forward.
4. Connect the flowmeter to the pumping system and check for leaks.

Replacement Parts List			
ATS Part Number	Description	Quantity	Units
703	1400-1620 P/S General Purpose Pump Drive 90-260 VAC, 50-60 Hz	1	Each
704	Mounting hardware set	1	Each
705	Pump Head Set (2-Pump Heads, Replacement Tubing Key, silicone tubing with reducing Tee connectors)	1	Set
706	Tubing, silicone #16	10	Feet
707	Replacement Tubing Key		
707-DTF	Doppler Test Fluid	1	Gallon
708	PVC Tubing, clear, 1/2" OD x 1/4" ID	10	Feet
709	PVC Tubing, clear, 9/16" OD x 3/8" ID	10	Feet
710	Flow Integrator w/tubing connectors & O-rings installed	1	Each
711	Pressure gauge	1	Each
712	Pressure gauge 'T' connector	1	Each
713	Hose barb fittings, 3/8" x 1/4" NPT	1	Each
716	Hose barb fittings 1/8" x 1/8" NPT	1	2/Pack
717	Hose barb fittings 3/8" x 1/8" NPT	1	2/Pack
718	Reducing Tee connectors	1	2/Pack
719	Hose barb fittings 3/8" x 1/8"PT	1	Each
721	Ratchet Tubing Clamp	1	2/Pack
728	Carrying Case,w/foam insert	1	Each
732	Motor Bushes	1	Set of 2
744	Flowmeter Stand	1	Each
753	Fluid Reservoir Bottle	1	Each
754	Inlet/Outlet Test Fluid Reservoir Cap	1	Each
755	Fluid Reservoir Bottle w/Inlet-Outlet cap	1	Each
756	Reducing union	1	Each
758-225	Accucal Flowmeter, tube size 235, w/tubing barb connectors	1	Each
759-235	Accucal Flowmeter, tube size 235, w/tubing barb connectors	1	Each

STATEMENT OF WARRANTY

ATS Laboratories, Inc. warrants that for the duration of the warranty period, its products are free from functional defects in materials and workmanship. If ATS Laboratories, Inc. deems the product to be defective, at our sole option, we will repair or replace the product, free of charge in a reasonable amount of time.

Warranty Period:

The warranty period begins on the date the product is delivered to the purchaser.

Rubber-Based Phantoms: Lifetime defined as between 7-10 years

Model 700 Instrumentation: 3 Months

Conditions of Warranty

1. The defect must be reported and the Product returned to ATS Laboratories, Inc. within the warranty period.
2. The Product must be packaged properly to avoid damage during shipping.
3. All transportation charges will be paid by the purchaser.

Invalidation of Warranty

1. If the product has been altered or repaired other than by ATS Laboratories, Inc.
2. If the product has been subject to abuse, misuse, negligence or accident such as;
 - a. If the purchaser has exposed the Rubber-Based Phantom to petroleum solvents.
 - b. The Doppler Flow Phantoms have been exposed to pressures in excess of 15 PSI or 1.05 Kg/cm².

ATS shall not be otherwise liable for any damages, including but not limited to incidental damages, consequential damages, or special damages.

There are no express or implied warranties which extend beyond the warranties as stated above.

WARNING: THIS PRODUCT IS NOT DESIGNED NOR INTENDED FOR MEDICAL USE IN TREATMENT OF PATIENTS AND, ACCORDINGLY, HAS NOT RECEIVED FDA APPROVAL AS A DEVICE FOR MEDICAL USES.

Quality Assurance Record Model 700D

ATS: Serial Number: _____

Date: _____

Pump driver SN: _____

Accucal Flowmeters #758-225 Tube size 225 SN: _____

Accucal Flowmeters #759-235 Tube size 235 SN: _____

ATS Part #	Description	Qty
703	1400-1620 P/S General Purpose Pump Driver	1
	90-260 VAC, 50-60 Hz with power cord	
704	Mounting hardware set	1
705	Pump heads w/ silicon #16 tubing and T-fittings	2
706	Spare tubing, silicon #16	2-18" Lengths
707	Replacement tubing key	1
718	Reducing Tee 5/32" x 1/4" x 5/32"	3
710	Flow Integrator w/ fittings	1
716	Spare hose barb fittings 1/8" NPT x 1/8"ID	1
717	Spare hose barb fittings 1/8" NPT x 3/8"ID	1
708	PVC Tubing 1/2" OD x 1/4" ID	3-Ft
709	PVC Tubing 9/16" OD x 3/8" ID	10-Ft
711	Pressure gauge	1
712	Pressure gauge 'T' connector w/ hose barb fittings	1
713	Spare hose barb fitting, 1/4" NPT x 3/8"	1
758-225	Accucal Flowmeter, Tube size 225 w/ fittings	1
759-235	Accucal Flowmeter, Tube size 235 w/fittings	1
719	Spare hose barb fittings 1/8" NPT x 3/8"ID	2
744	Flowmeter stand base	1
755	Test Fluid reservoir bottle with inlet/outlet cap	1
	Reducing union	1
721	Ratchet Tubing Clamp	1
728	Carrying case 26 x 14.5 x 9.63	1
701	Model 700 Instruction Manual	1
707-DTF	Doppler Test Fluid	1-Gal.

Component Part list is complete: _____ Yes ____ No Results of Leak Test: _____ Pass _____ Fail

Technician: _____

Date: _____

Production Quality Assurance Record Model 700D

ATS: Serial Number: _____

Date: _____

Pump driver SN: _____

Accucal Flowmeters #758-225 Tube size 225 SN: _____

Accucal Flowmeters #759-235 Tube size 235 SN: _____

ATS Part #	Description	Qty
Pump Components		
703	1400-1620 P/S General Purpose Pump Driver _____ (90-260 VAC, 50-60 Hz) w/ Power cord	1
	115 VAC cord _____ 230 VAC cord _____	1 or 2
704	Pump heads	2
705	Tubing, silicon #16 installed on pump heads	2-18" Lengths
718	Reducing Tees 5/32" x 1/4 x 5/32" installed in #16 tubing	2
Assembly Required		
1. Fit pump heads with silicon tubing. Using the replacement tubing key to mount the tubing onto the pump heads. 2. Install reducing Tees into open ends of silicon tubing, mounted on the pump heads.		
Spare Parts:		
Place in zip-lock bag:		
707	Replacement tubing key	1
706	Tubing, silicon #16 (18" lengths)	2
718	Reducing Tee, 5/32" x 1/4 x 5/32"	1
704	Mounting hardware set	1
	Place power cord(s) in plastic bag.	1
Flow Integrator Components		
710	Flow Integrator	1
716	Hose barb fittings, 1/8" NPT x 1/8"ID	1
717	Hose barb fittings, 1/8" NPT x 3/8"ID	1
Assembly Required		
1. Tape the threads on the adapter with Teflon tape. 2. Screw 2 adapters into flow integrator.		
Spare Parts:		
Place in zip-lock bag:		
716	Hose barb fittings 1/8" NPT x 1/8"ID	1
717	Hose barb fittings 1/8" NPT x 3/8"ID	1

708 709	Tubing PVC Tubing 1/2" OD x 1/4" ID PVC Tubing 9/16" OD x 3/8" ID 1. Coil tubing and place into plastic bag.	3-Ft 10-Ft
711 712 713	Pressure Gauge Pressure gauge Pressure gauge 'T' connector Hose barb fittings, 1/4" NPT x 3/8" Assembly Required 1. Tape the threads on the pressure gauge with Teflon tape. 2. Screw pressure gauge into 'T' connector 3. Tape the threads on the hose barb fittings with Teflon tape 4. Screw hose barb fittings into 'T' connector Spare Parts: Place in zip-lock bag: Hose barb fittings, 1/4" NPT x 3/8"	1 1 2
713	Flowmeter Components Hose barb fittings, 1/8" NPT x 3/8"ID Accucal Flowmeter, Tube size 225 Accucal Flowmeter, Tube size 235 Flowmeter stand base Assembly Required 1. Disassemble flowmeters and remove glass balls. Install stainless steel balls and assemble flowmeters. 2. Tape threads on hose barb fittings with Teflon tape. 3. Screw 4 into flowmeters. Spare Parts: Place in zip-lock bag: Hose barb fittings, 1/8" NPT x 3/8"	1 1 1 1
719	Flowmeter Components Hose barb fittings, 1/8" NPT x 3/8"ID Accucal Flowmeter, Tube size 225 Accucal Flowmeter, Tube size 235 Flowmeter stand base Assembly Required 1. Disassemble flowmeters and remove glass balls. Install stainless steel balls and assemble flowmeters. 2. Tape threads on hose barb fittings with Teflon tape. 3. Screw 4 into flowmeters. Spare Parts: Place in zip-lock bag: Hose barb fittings, 1/8" NPT x 3/8"	4 1 1 1
719	Flowmeter Components Hose barb fittings, 1/8" NPT x 3/8"ID Accucal Flowmeter, Tube size 225 Accucal Flowmeter, Tube size 235 Flowmeter stand base Assembly Required 1. Disassemble flowmeters and remove glass balls. Install stainless steel balls and assemble flowmeters. 2. Tape threads on hose barb fittings with Teflon tape. 3. Screw 4 into flowmeters. Spare Parts: Place in zip-lock bag: Hose barb fittings, 1/8" NPT x 3/8"	2
753 754	Test Fluid Reservoir Components Test Fluid reservoir bottle and protective cap Inlet/Outlet test fluid reservoir bottle cap Reducing union, Assembly Required: 1. Attach 3" piece of Magaflex #24 tubing to the inlet (return) barb and 6" length to the outlet (to pump) barb of the bottle cap. 2. Attach a 4" length of 1/2" OD tubing to the reducing union, place in ziplock bag.	1 1 1
721	Ratchet Tubing (Keck) Clamp 3/4" OD Tubing, 14mm	1
728	Carry Case Components Platt carrying case w/foam	1

707-DTF	Doppler Test Fluid 1. Apply tape to caps. 2. Double bag and tie	1-Gal.
701	Model 700 Instruction Manual	1

Component Part list is complete: ____Yes ____ No Results of Leak Test: ____ Pass ____Fail

Technician: _____ Date: _____