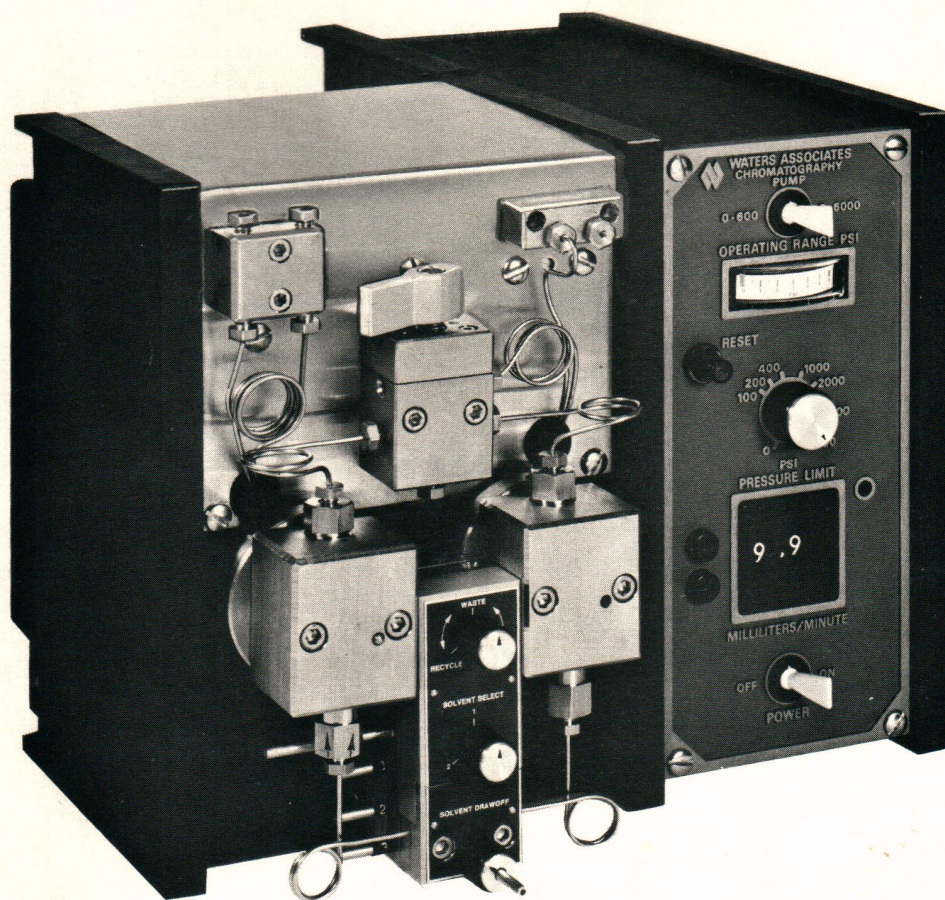


IEM

model 6000A solvent delivery system

instruction manual



Waters Associates

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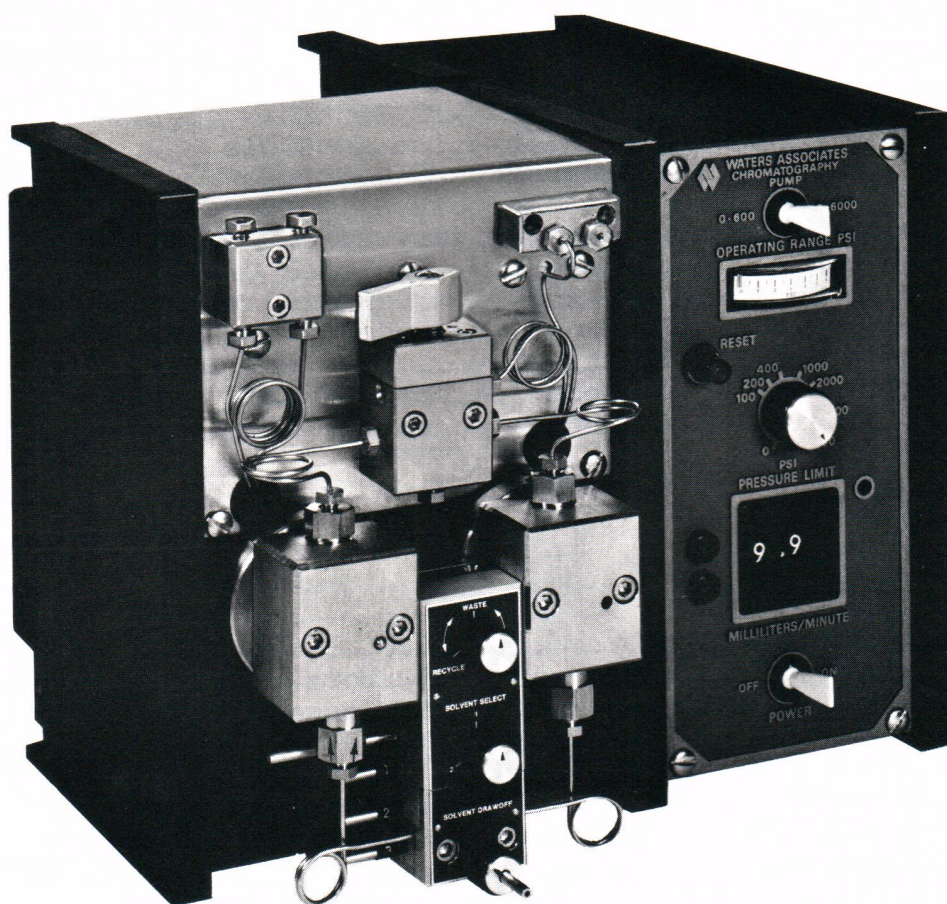


Figure 1-1. Model 6000A Solvent Delivery System

SECTION 1. GENERAL INFORMATION

1.1 BENEFITS OF THE MODEL 6000A SOLVENT DELIVERY SYSTEM

The Model 6000A Solvent Delivery System (Figure 1-1), referred to as the Model 6000A, is a high-performance solvent delivery system designed specifically for liquid chromatography applications. Constant flow of the solvent delivery is achieved with a pair of specially-driven positive-displacement pumping chambers. Flow rate is manually selectable in 0.1-milliliter-per-minute increments from 0.1 to 9.9 milliliters per minute (ml/min). An auxiliary electrical connection enables the flow rates to be programmed automatically by the Waters Model 660 Solvent Programmer. The maximum output pressure is 6000 pounds per square inch gauge (psig) with the overpressure limit adjustable from 100 to 6000 psig (7 to 420 bars).

Because of the low internal volume of the Model 6000A, solvent change-over time is minimized and recycle operation is permitted. For example, each piston in the pair of pumping chambers only displaces 100 microliters of solvent per stroke.

Electronic control of piston reciprocation rate governs the solvent flow rate. Variations in line voltage and line frequency do not affect Model 6000A operation. Solvent viscosity and system elasticity are automatically compensated to ensure a steady solvent flow.

The Model 6000A is available for operation on one of two nominal supply voltages: 115 Vac, 50/60 Hz (part No. 25990) or 220 Vac, 50/60 Hz (Part No. 25991). Converting from one supply voltage to another can be done by your local Waters Associates Field Service specialist.

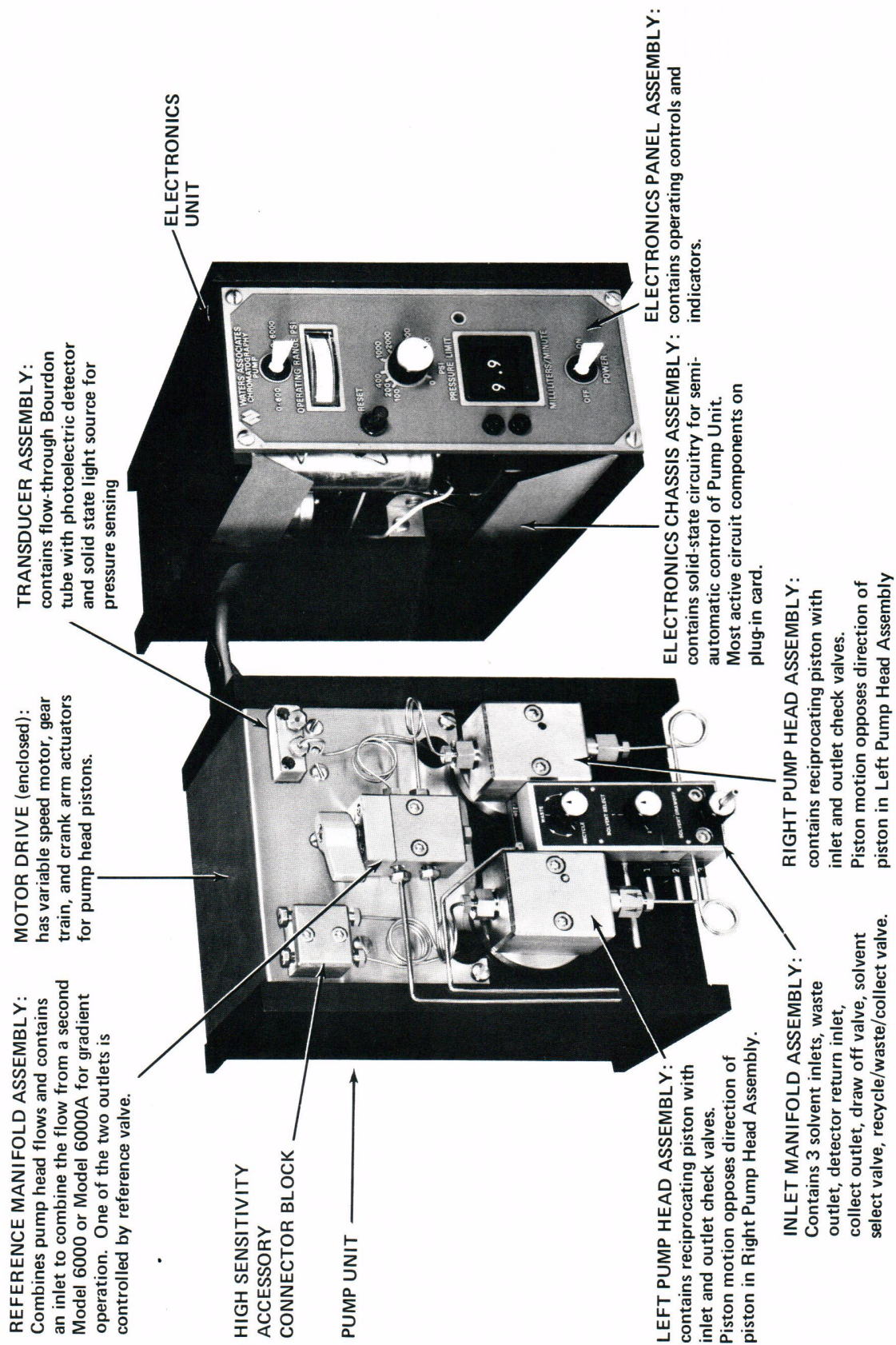
1.2 PHYSICAL DESCRIPTION

The Model 6000A is packaged as one module which can be disassembled into two functional sections -- the Pump Unit and the Electronics Unit (see Figure 1-2). Hydraulic assemblies and connections are readily accessible on the front of the Pump Unit. Operating controls are conveniently placed on the front of the Electronics Unit.

1.3 FUNCTIONAL DESCRIPTION

1.3.1 SOLVENT HYDRAULICS

Figure 6-1 illustrates the solvent pumping operation of the Model 6000A. Solvent from the reservoir(s) is pulled into the inlet manifold assembly, through a filter and check valve, and into both pump head assemblies. Pistons, in the fixed displacement chambers of the pump head assemblies, are driven alternately in a push-pull arrangement. Inlet and outlet check valves in each pump head assembly



ensure that one piston can draw in solvent while the other piston delivers solvent, and that the solvent will not flow back toward the supply reservoir. The outputs from both heads are combined in the reference manifold assembly to produce a continuous solvent delivery.

During normal operation, the solvent from the reference manifold assembly flows through the high-pressure filter. The filter smoothes the minor solvent flow fluctuations. In addition, this filter provides sufficient system capacity to minimize pressure upsets during manual injection.

Solvent, after passing through the high-pressure filter, passes through the transducer assembly to the pump output connection of the Model 6000A. The transducer assembly contains a flow-through Bourdon-type pressure sensor which detects changes in solvent pressure and is monitored by the electronic control assembly. Several alternate solvent connections are provided in the Model 6000A. A control of the inlet manifold assembly enables a system to operate in recycle, collect, and waste modes by simply turning a knob. A drawoff port located on the inlet manifold assembly facilitates manual drawoff of the solvent. In addition, a solvent select valve is also located on the inlet manifold assembly which enables the user to select from one of the three solvents by the turn of a knob.

A reference port on the reference manifold assembly is controlled by the reference valve. It provides a solvent reference for a refractive index detector (when used) and a means to fast flush the Model 6000A system when the valve is opened. In addition, a gradient connection port is also located on the reference manifold assembly. It enables the reference valve to be used as a mixer manifold when the Model 6000A is used for gradient operations.

1.3.2 ELECTRONIC CONTROL

Automatic control of the solvent flow rate is accomplished by the Electronics Control Unit. The flow rate is determined by the speed of the electronically-powered motor which drives both pump head assemblies. The motor speed is accurately controlled by the setting of a digital flow switch on the Electronics Unit front panel. The higher the switch setting, the faster the motor speed and the higher the resultant flow rate.

The output of the transducer assembly is fed back to the Electronics Unit which performs the following:

1. Changes current of the drive motor, as pressure changes, to minimize heat at low pressure operation.
2. Compensates for solvent compressibility and system elasticity to maintain a constant flow rate.
3. Halts Model 6000A operation if the pressure exceeds the preset pressure limit.

4. Provides panel meter indication of solvent pressure.
5. Provides an electrical output (via terminal jacks) of solvent pressure for recording by an external device, to aid in monitoring Model 6000A operation and troubleshooting.

1.4 MODEL 6000A INSTALLATION REQUIREMENTS

NOTE

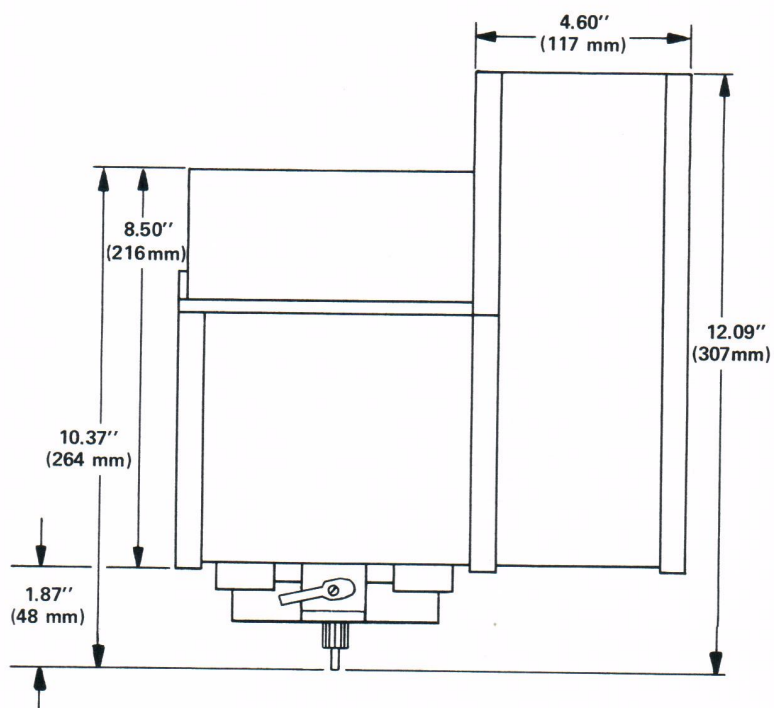
The shipping carton is reusable. Should it become necessary to transport the Model 6000A, the shipping carton provides excellent protection.

The Model 6000A is designed to be factory mounted in a Waters Associates Liquid Chromatograph system. It may also be used as a free-standing unit. The outline dimensions for the Model 6000A are shown in Figure 1-3.

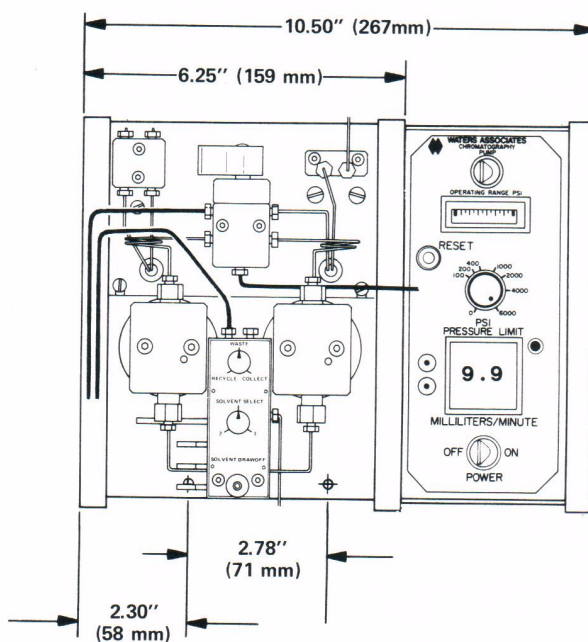
A start-up kit (Appendix B) is provided with each Model 6000A to facilitate its start-up, operation, and maintenance. Various types of tubing and fittings are supplied to make up the standard solvent supply, reference, fraction collect, and delivery connections for the Model 6000A as well as special connections for specific system operation requirements. The tools required to start-up, operate, and maintain the Model 6000A are listed in Table 1-1. Refer to paragraph 2.2 for the Model 6000A start-up procedures.

NOTE

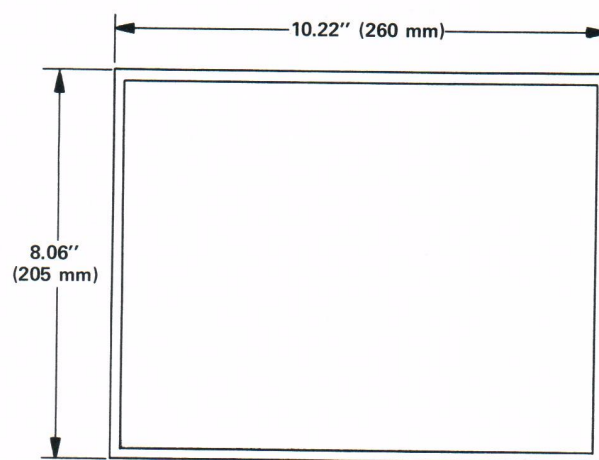
A Waters Associates representative will perform the start-up if the user desires.



TOP



FRONT



RIGHT SIDE

Figure 1-3. Outline Dimensions

Table 1-1.
Required Tools

| Description of Tool* | Waters Part # | Qty. | Used for | |
|--|------------------|------|----------|--------|
| | | | Start-Up | Maint. |
| 5/16 in., 80° Bend, Open-End Wrench | 96148 | 1 | x | x |
| 5/16 in., Open-End Wrench | 22527 | 1 | x | x |
| Blade-Edge Screw- driver | 96166 | 1 | | x |
| 5/32 in. Allen Wrench | 27725 | 1 | | x |
| 9/64 in. Allen Wrench | 25567 | 1 | | x |
| .050 in. Allen Wrench | 27949 | 1 | | x |
| #8 Spline, 6-Flute Wrench | 40398 | 1 | | x |
| 3/32 in. Allen Wrench | 96167 | 1 | | x |

*These tools are among the tools supplied with each Waters Associate Liquid Chromatograph and are located in the start-up tool kit, Part No. 96146.

If the Model 6000A was purchased as a component, the start-up tool kit or the individual tools required may be purchased from Waters Associates. Alternately, most of the tools can be purchased from your local hardware supply house.

1.5 HOW TO GET ANSWERS TO CHROMATOGRAPHY QUESTIONS

For answers to specific chromatography questions in areas such as applications, methods development, quality control, etc. contact your local Waters Associates representative or Waters Associates Home Office at 1-617/478-2000.