



DR/4000 SPECTROPHOTOMETER MODULES

Sipper Modules 48090-03, -06 and -07
Flow-Cell Modules 48070-04 and -05
Temperature Control Module 48070-08



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DR/4000 SPECTROPHOTOMETER SIPPER MODULES

Cat. No. 48090-03 1-inch Path Length

Cat. No. 48090-06 1-cm Path Length

Cat. No. 48090-07 2-mL Micro, 1-cm Path Length





SIPPER MODULE OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

PERIGO

A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

SAFETY PRECAUTIONS

Before attempting to unpack, set up, or operate this instrument, please read this entire manual. Pay particular attention to all warnings, cautions and notes. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, this equipment **MUST NOT** be installed or used in any manner other than that which is specified in this manual.

Use of Hazard Information

If multiple hazards exist, the signal word corresponding to the greatest hazard shall be used.

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTE

Information that requires special emphasis.

Precautionary Labels

Please pay particular attention to labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

 This symbol, if noted on the instrument, references the instruction manual for operational and/or safety information.

 1.3 Module Components

 2.4 Sample Measurements

SIPPER MODULE SPECIFICATIONS

Specifications are subject to change without notice.

Path Length:

Cat. No. 48090-03	1 in. (2.42 cm)
Cat. No. 48090-06	1 cm (0.394 inches) (50 μ L volume)
Cat. No. 48090-07	1 cm (0.394 inches)

Wavelength Range:

190 to 1100 nanometers

Purge Volume:

10 mL minimum for ± 0.002 ABS (0 to 2 ABS or 2 to 0 ABS sample change) – 1-inch path length
7 mL minimum for ± 0.002 ABS (0 to 0.830 ABS or 0.830 to 0 ABS sample change) – 1-cm path length
1.8 mL minimum for ± 0.002 ABS (0 to 0.830 ABS or 0.830 to 0 ABS sample change) – 1-cm path length (-07 model)

Flow Rate:

1 mL/second nominal

Storage Temperature:

-17 to 60 °C, 85% relative humidity, non-condensing

Operating Temperature:

10 to 40 °C; 95% relative humidity, non-condensing, at 25 °C; 75% relative humidity, non-condensing at 40 °C

All models include a quartz flow cell.

1.1 Module Description

The Sipper Module is an optional accessory for the DR/4000 Spectrophotometer. The same optical characteristics exist for both zeroing and measuring with the module, so errors resulting from optical differences between sample cells are eliminated. The module uses a peristaltic pump to assure consistent sample delivery to the sample cell. The module design also provides a convenient way to introduce samples without having to change sample cells.

The Sipper Module is available in two path lengths. Model 48090-03 comes with a 1-inch nominal quartz sample cell, Models 48090-06 and -07 come with a 1-cm quartz sample cell. The Micro Sipper (Model 48090-07) requires 1.8 mL or about 75% less sample than Model 48090-06. All models are compatible with the DR/4000V and DR/4000U instruments and can be used over their full wavelength range.

The 2-mL Micro Sipper Module is designed to measure sample volumes between 2 and 7 mL. Software version 1.05 or later must be installed in a DR/4000 Spectrophotometer before using the Micro Sipper Module. The instrument software version is displayed at the top of the screen during the instrument power-up sequence.

1.2 Unpacking

Remove the Sipper Module from the shipping container and inspect for any damage that may have occurred during shipment. All models are shipped with the following:

- Sipper Module
- Pump Tubing Replacement Kit

If any item is missing or damaged, please contact the Hach Customer Service Department in Loveland, Colorado. Do not return the module without prior authorization. In the United States, call 1-800-227-4224. Outside the United States, contact the Hach office or dealer serving you.

Section 1, continued

1.3 Module Components

DANGER

Do not use the Hach Flow-Cell Modules with flammable samples or those containing hydrocarbons, solvents, concentrated acids or concentrated bases that may attack wetted parts of the cells. Conduct tests prior to use of the Flow-Cell Modules if sample compatibility is questionable.

PELIGRO

No use las células de flujo de Hach con muestras inflamables o que contengan hidrocarburos, solventes, ácidos concentrados o bases concentradas que puedan atacar las partes mojables de la célula. Experimente antes de usar las células de flujo, si existe duda sobre la compatibilidad de la muestra.

PERIGO

Não se deverá usar cubetas de fluxo Hach com amostras inflamáveis ou aquelas que contêm hidrocarbonetos, solventes, ácidos concentrados ou bases concentradas que podem atacar as partes molhadas das cubetas. Realize os testes antes do uso das cubetas de fluxo se é questionável a compatibilidade das amostras.

DANGER

Ne pas utiliser les cuves à circulation Hach avec des échantillons inflammables ou ceux contenant des hydrocarbures, solvants, acides concentrés ou bases concentrées qui peuvent attaquer les parties au contact du liquide. Effectuer des essais avant l'utilisation des cuves à circulation si la compatibilité de l'échantillon est douteuse.

GEFAHR

Durchflußküvetten von Hach dürfen nicht in Verbindung mit brennbaren Proben oder Proben, die Kohlenwasserstoffe, Lösemittel, konzentrierte Säuren oder konzentrierte Basen enthalten, welche die benetzten Teile der Küvetten angreifen können, verwendet werden. Wenn die Verträglichkeit fraglich ist, sollten vor der Verwendung der Durchflußküvetten Tests durchgeführt werden.

Figure 1 on page 9 identifies the major components of the Sipper Module.

Figure 2 on page 9 shows proper placement of the 2-mL Micro Sipper Module sample cell.

Note: *The inlet and waste tubing can be cut to accommodate individual customer needs.*

When setting up the module, always run the drain tube below the bottom of the module and as vertically as possible, so samples will drain freely. If possible, insert the end of the tube into a drain (or suitable collecting vessel if treatment is necessary before discharge).

Note: *If the pump adjustment is made too tight or too loose, the pump will be ineffective and no sample will be delivered.*

The pump adjustment, located on the top of the pump, determines the flow rate of the sample stream. Turn the adjustment clockwise (tighten) to increase the flow rate, thus delivering more sample in a given period. Turn the adjustment counterclockwise (loosen) to decrease the flow rate, delivering less sample in a given period.

Section 1, continued

Figure 1
Sipper Module Components

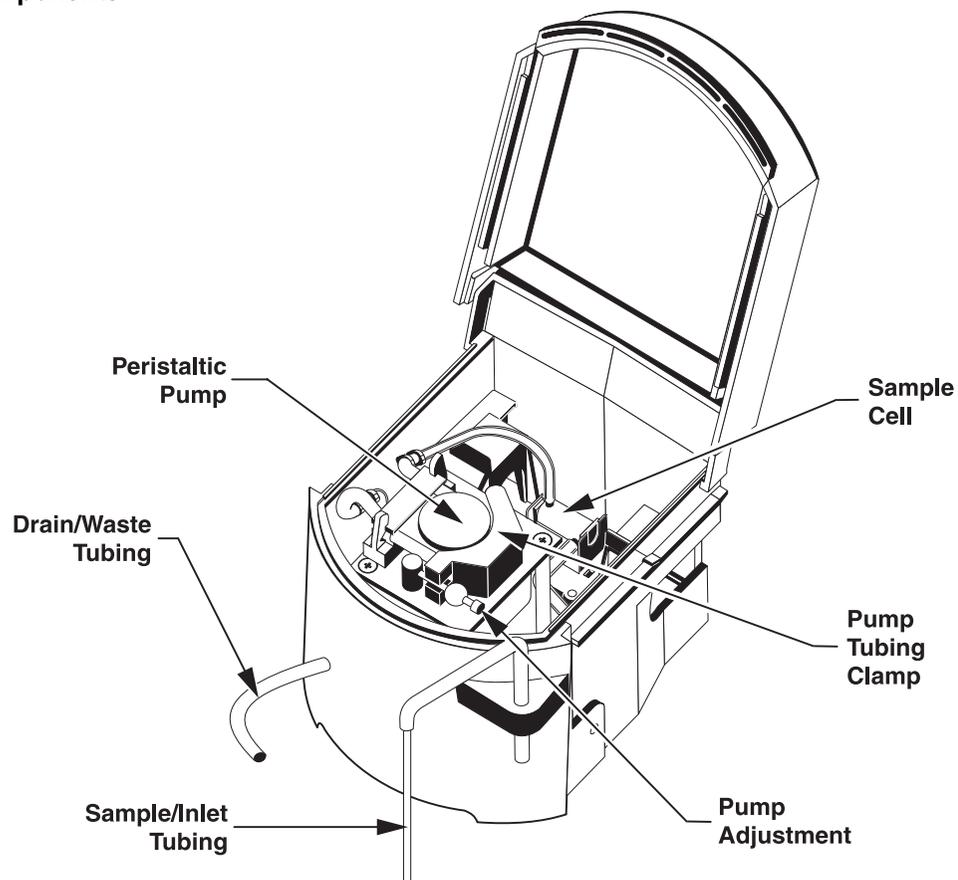
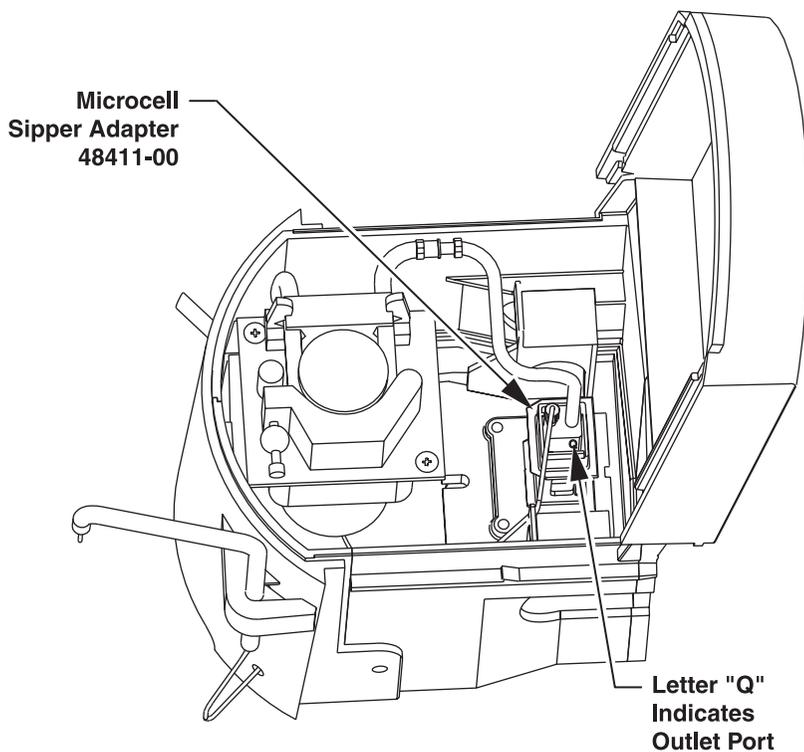


Figure 2
2-mL Micro Sipper Module



2.1 Changing Sample Modules

Use the following procedure to change the sample module:

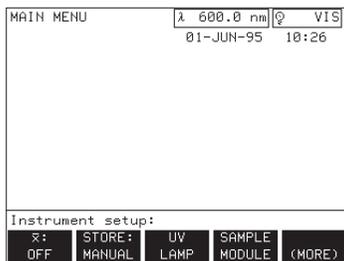
1. Unlock the currently installed module by turning the module lock (located directly under the module on the front of the instrument) counterclockwise until it rests horizontally (see *Figure 3*).
2. Grasp the recessed hand hold under the module and slide the module straight out (do not lift up).
3. Slide the Sipper Module into the module compartment, and press firmly into place.
4. Re-lock the module before use by turning the sample module lock clockwise to its vertical position.

Figure 3
Unlocking and Removing the Module



Section 2, continued

2.2 Instrument Setup



Note: The *SAMPLE MODULE* option can be modified only when a Sipper Module is installed.

2.2.1 Automatic Mode

The DR/4000 Spectrophotometer provides several modes of operation when a Sipper Module is installed. The principal mode of sipper operation is the automatic mode. Automatic mode assures that sample is consistently delivered to the sample cell each time a sample is sipped. Manual mode is available for simplifying the sipper setup; however, it should not be used for general purpose measurements.

Manual and Auto modes are available in the instrument setup menu by pressing the **SETUP** key and then the **SAMPLE MODULE** soft key (directly under the menu label). The prompt line will show **Sipper options**. The soft key labels display the current sipper configuration.

Software version 1.05 or greater must be installed in a DR/4000 Spectrophotometer before using the 2-mL Micro Sipper Module. The instrument software version is displayed at the top of the screen during power up.

The automatic mode permits the operator to define the characteristics of the three basic sipper cycles: sip time, settling time, and purge time.

- The sip time, in conjunction with the pump adjustment, determines the amount of sample delivered to the sample cell.
- The settling time defines how long the instrument will wait between turning off the pump and taking a sample reading. This interval can be used to allow bubbles and sample turbulence to settle out of the light path.
- The purge time, in conjunction with the pump adjustment, determines the amount of air or rinsing solution pulled through the sample cell after a reading. This cycle is optional, and the sipper can be programmed to recover the sample or to send the sample to a waste vessel.

If the sipper is not in the automatic mode, press the **DEFAULT SETUP** soft key, or press the **MODE** soft key to toggle the mode to **AUTO**.

Section 2, continued

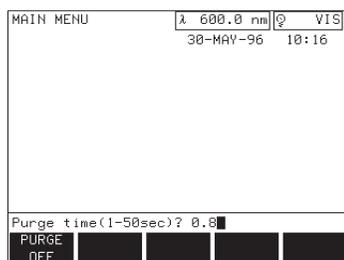
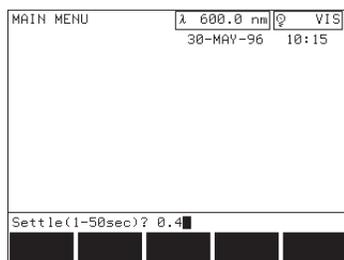
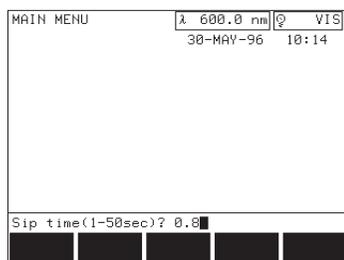
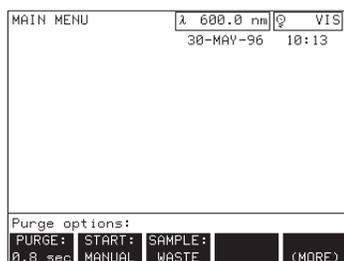
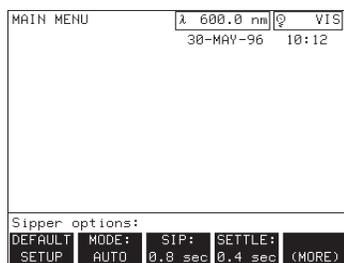


Table 1 Sipper Auto Setup Menu

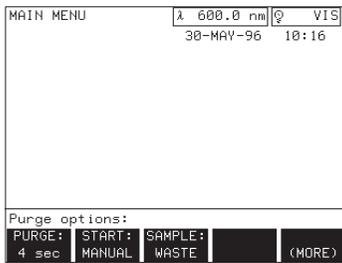
DEFAULT SETUP	Returns all sipper options to their default values (as listed in this table).
MODE	Toggles the sipper between AUTO (default) and MANUAL.
SIP	Prompts for the sip time (1 to 50 seconds). The default sip time is 8.0 seconds.
SETTLE	Prompts for the settling time (1 to 50 seconds). The default settling time is 5.0 seconds.
(MORE)	Toggles between sip and purge options.
PURGE	Prompts for the purge time (1 to 50 seconds, or OFF). The default purge time is 8.0 seconds.
START	Toggles between the Manual (default) and AUTO purge start modes. Displayed only if a purge time is set.
SAMPLE	Toggles between the sample WASTE (default) and RECOVER modes. Displayed only if a purge time is set.

Press the **SIP** soft key to select a value for the sip time. The display prompts for the sip time in seconds. The sip time can be set from 1.0 to 50.0 seconds with the digit keys. As a rule of thumb, the pump will move about 1 mL of water per second. Press **ENTER** to confirm the entry, or press **EXIT** to cancel the entry and return to the sipper options menu.

Press the **SETTLE** soft key to select a value for the settling time. The display prompts for the settling time in seconds. A value from 1.0 to 50.0 seconds may be selected with the digit keys. Press **ENTER** to confirm the entry, or **EXIT** to cancel.

The purge cycle, if enabled, can be programmed to start automatically after taking a reading, or to wait for a manual key press. Press the **(MORE)** soft key and then the **PURGE** soft key to specify the purge time. The display prompts for the purge time in seconds. The purge time can be set from 1.0 to 50.0 seconds by entering the value and pressing the **ENTER** key. The purge cycle can be disabled by pressing the **PURGE OFF** soft key. Press **EXIT** to cancel the entry.

Section 2, continued



Press the purge **START** soft key to toggle between the **AUTO** and **MANUAL** purge start modes. This option is not displayed if the purge time is turned off.

The purge cycle can also be programmed to send samples to a waste vessel (waste mode), or to recover samples by reversing the pump direction and returning the sample to the sample vessel (recover mode). Press the **SAMPLE** soft key to toggle between the **WASTE** and **RECOVER** options. These options are not displayed if the purge time is turned off.

2.2.2 Manual Mode

Note: The manual mode is provided as a setup tool and should not be used for general purpose measurements.

The sipper manual mode gives the operator manual control over the sip, settle, and purge cycles. No operation is performed automatically in this mode. The mode can be useful during setup to determine which parameter values to use in the automatic mode.

If the sipper is not in the manual mode under the sipper options menu, press the **MODE** soft key to toggle the mode to **MANUAL**.

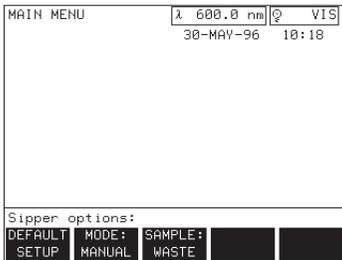
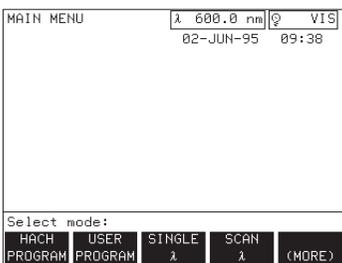


Table 2 Sipper Manual Setup Menu

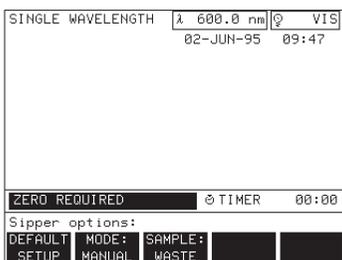
DEFAULT SETUP	Puts the sipper in AUTO mode and sets all options to their default values
MODE	Toggles the sipper between AUTO and MANUAL modes without affecting option settings.
SAMPLE	Toggles between the SAMPLE: WASTE and RECOVER modes. The function of this option is the same in manual or automatic mode.

2.3 Adjusting the Sample Volume



Before using the Sipper Module for sample measurement, set the sip and purge time intervals to deliver the correct sample volume. The sipper requires a minimum of 10 mL of sample to adequately flush the 1-inch sample cell, 7 mL to adequately flush the 1-cm sample cell, and 1.8 mL to flush the Micro Sipper.

1. From the main menu, press the **SINGLE** λ soft key (this mode is used as an example because it has the simplest measurement sequence). Since the photometric data are of no concern at this time, it is not necessary to set a particular wavelength.
2. Access the sipper setup menu by pressing the **SETUP** key and then the **SAMPLE MODULE** soft key.
3. Press the **MODE** soft key to toggle to the manual mode of operation.
4. Select the required sample purge mode (either **WASTE** or **RECOVER**). Press the **EXIT** key to return to the single wavelength measurement control menu.



Section 2, continued

SINGLE WAVELENGTH	λ 600.0 nm	Q VIS
	02-JUN-95	10:31
ZERO REQUIRED		
	⊙ TIMER	00:00
Measurement control:		
START	VIEW:	GOTO
SIP	ABS	λ
	OPTIONS	TIMER

SINGLE WAVELENGTH	λ 600.0 nm	Q VIS
	02-JUN-95	11:10
Group 0000	Sample ZERO	
0.062 ABS		
Sipping 07...		
	⊙ TIMER	00:00
Measurement control:		
STOP	VIEW:	GOTO
SIP	ABS	λ
	OPTIONS	TIMER

SINGLE WAVELENGTH	λ 600.0 nm	Q VIS
	02-JUN-95	11:26
Group 0000	Sample ZERO	
-0.169 ABS		
Settling 13...		
	⊙ TIMER	00:00
Measurement control:		
READ &	VIEW:	GOTO
PURGE	ABS	λ
	OPTIONS	TIMER

SINGLE WAVELENGTH	λ 600.0 nm	Q VIS
	02-JUN-95	12:23
Group 0000	Sample ZERO	
0.033 ABS		
Purging 07...		
	⊙ TIMER	00:00
Measurement control:		
STOP	VIEW:	GOTO
PURGE	ABS	λ
	OPTIONS	TIMER

Note: The maximum time interval for any sipper cycle is 99 seconds. The measurement cycle will automatically advance after 99 seconds if the cycle is not advanced manually.

SINGLE WAVELENGTH	λ 600.0 nm	Q VIS
	02-JUN-95	12:35
Group 0000	Sample ZERO	
0.000 ABS		
READ SAMPLE		
	⊙ TIMER	00:00
Sipper options:		
DEFAULT	MODE:	SIP:
SETUP	AUTO	10 sec
	SETTLE:	5 sec
		(MORE)

- Place the sample inlet tube in a graduated cylinder filled with at least one sample volume of deionized water. Route the drain tube to an appropriate drain or collecting vessel.
- Press the **START SIP** soft key; the pump motor will activate and begin sipping the water sample. During the manual sip cycle, the status bar displays the elapsed sip time in seconds. If the sample is not moving, use the pump adjustment to establish the desired flow rate.
- When the desired sample volume has been sipped, record the elapsed time, then press the **STOP SIP** soft key.
- If necessary, refill the graduated cylinder for the purge cycle.
- Press the **READ & PURGE** soft key to begin the purge cycle. It is not necessary to record the settling time interval.
- When the required purge volume has been sipped or recovered, record the elapsed time, then press the **STOP PURGE** soft key.

If any difficulties are encountered, repeat Steps 1 through 10 until the proper sample volumes are sipped and purged.

- Access the sipper setup menu by pressing the **SETUP** key and then the **SAMPLE MODULE** soft key. Select the **AUTO** mode.
- Enter the sip time and purge time recorded in the previous steps. When first using the sipper, set the settling time to 5 seconds and the purge start mode to **MANUAL**.
- Press the **EXIT** key to return to the measurement control menu.

Section 2, continued

SINGLE WAVELENGTH	λ 600.0 nm	Q VIS
	02-JUN-95	12:46
Sipping 06....		
	⊙ TIMER	00:00
Measurement control:		
CANCEL	VIEW: ABS	GOTO λ
		START TIMER

SINGLE WAVELENGTH	λ 600.0 nm	Q VIS
	02-JUN-95	12:50
Group 0000	Sample 0011	
0.046 ABS		
Purging 07....		
	⊙ TIMER	00:00
Measurement control:		
CANCEL	VIEW: ABS	GOTO λ
		START TIMER

14. Refill the graduated cylinder with water, if necessary.
15. Press the **START SIP** soft key. In the automatic mode, the status bar counts down the time remaining in each cycle.
16. When sipping stops, verify that the correct amount of sample has been withdrawn from the graduated cylinder.
17. Press the **START PURGE** soft key. When the purge stops, verify that the correct amount of sample has been purged or recovered. Adjust the sip and purge times to obtain the required volumes and output stability.
18. Press the **EXIT** or **ENTER** key to return to the main menu.

2.4 Sample Measurements

DANGER

This instrument is not intended for use with flammable samples or those containing hydrocarbons.

PELIGRO

Este instrumento no está destinado para uso con muestras inflamables o que contengan hidrocarburos.

PERIGO

Este instrumento não é feito com o fim de ser empregado com amostras inflamáveis ou aquelas que contêm hidrocarbonetos.

DANGER

Cet instrument n'est pas conçu pour une utilisation avec des échantillons inflammables ou des échantillons contenant des hydrocarbures.

GEFAHR

Dieses Gerät nicht verwenden bei Tests mit brennbaren Lösemitteln oder Lösemitteln mit Kohlenwasserstoffen.

Note: Each Hach DR/4000 Spectrophotometer procedure includes a note in Step 1 indicating if a sipper can be used with that procedure.

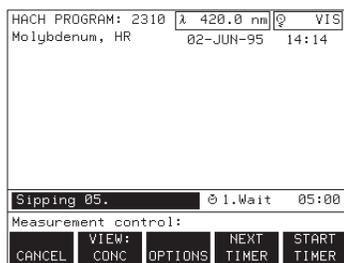
HACH PROGRAM: 2310	λ 420.0 nm	Q VIS
Molybdenum, HR	02-JUN-95	14:07
ZERO REQUIRED		
	⊙ 1.Wait	05:00
Measurement control:		
START SIP	VIEW: CONC	OPTIONS
		NEXT TIMER
		START TIMER

The Hach Program mode is used as an example in this section. Press the **HACH PROGRAM** soft key in the main menu and enter a program number (program 2310 is used as an example here).

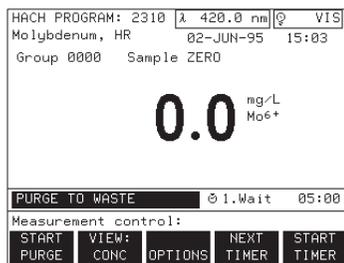
The sipper measurement sequence is similar for all of the measurement modes available on the DR/4000 Spectrophotometer. The sip cycle is controlled via soft keys in the measurement control menu. Initially, the status bar shows: **ZERO REQUIRED**.

1. Before taking measurements, set up the sipper to handle the required sample volume (see *Section 2.2 Instrument Setup* and *Section 2.3 Adjusting the Sample Volume*).
2. Route the drain tube to an appropriate drain or collection vessel.

Section 2, continued

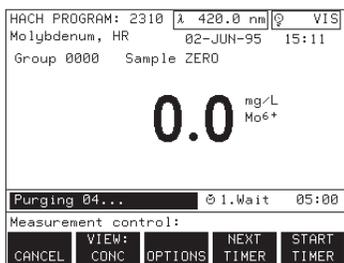


- Place the sample inlet tube into the blank sample and press the **START SIP** soft key. Leave the inlet tube in the sample until the sipper pump stops and the settling cycle begins. The status bar will count down the time remaining in seconds.
- Press the **CANCEL** soft key to cancel the sip cycle. The DR/4000 Spectrophotometer will skip the sip and settle cycles and will wait for the operator to start the purge.



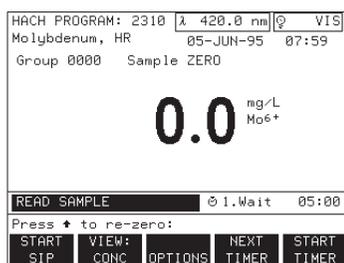
- When the settling cycle is complete, the zero value is displayed and the instrument is ready to purge the blank. If the purge is set up for a manual start (see *Section 2.2 Instrument Setup*) the DR/4000 will wait for the operator to press the **START PURGE** soft key. In the automatic purge start mode, the purge begins immediately after the reading without operator intervention. At this time, if the sample is going to waste, a demineralized water purge can be placed at the sample inlet to rinse the sample cell between readings. If the sample is to be recovered, place the sample cell or recovery vessel at the inlet.

Note: The purge cycle can be deactivated through the setup menu, in which case the DR/4000 Spectrophotometer will skip the purge cycle completely, relying on the next sample to purge the current sample.

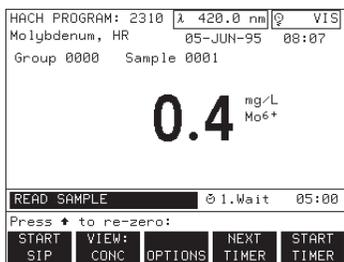


- Leave the inlet tube in the purge solution or recovery vessel until the sipper pump stops. The status bar will count down the time remaining in seconds.
- Pressing the **CANCEL** soft key during the purge will reset the purge cycle. Pressing the **START PURGE** soft key will restart the purge cycle. The display shows the zero result and the status bar displays: **READ SAMPLE**.

Note: A new sample cannot be started until the current purge cycle is completed.



- Follow the same procedure for delivering the sample as discussed above in *Steps 1* through *4*.



- When the sample purge is complete, the result is displayed and the DR/4000 Spectrophotometer is ready for the next sample.

Refer to the appropriate section of the *DR/4000 Spectrophotometer Instrument Manual* for additional information about using the selected mode of operation.

3.1 Cleaning Requirements

3.1.1 Sample Cell

Purge the cell with deionized water before and after each test session. If the cell is unusually dirty, repeat the sip and purge cycles several times with deionized water, or temporarily set the purge cycle to a higher setting before adjusting the timing parameters.

Occasionally inspect the sample cell windows. If the windows appear dirty or hazy, remove the sample cell and soak it in a soap solution or dilute acid and rinse thoroughly with deionized water. Refer to *Cleaning Requirements* in the *DR/4000 Spectrophotometer Instrument Manual*.

3.1.2 Module

If the module becomes dirty, wipe it clean with soap and water and a soft cloth. DO NOT immerse the module or use solvents (e.g., acetone) to clean the module.

3.2 Pump Tubing Replacement

Inspect the sipper pump tubing (see *Figure 4*) periodically for signs of wear, and replace as needed. The life of the tubing will vary considerably with the type of samples being measured, the amount of pressure applied with the pump adjustment, and the frequency of use. The tubing replacement kit (see *page 55* for replacement parts) comes with pre-cut lengths of tubing, and pre-assembled connectors.

1. Remove the Sipper Module from the instrument and open the module lid.
2. Unhook the pump adjustment by pulling it toward the front of the module, and then swing the tubing clamp open.
3. Pull down on the pump tubing retainers to release the white pump tubing from the pump.
4. Disconnect the pump tubing from the inlet and outlet tubing.
5. Wrap the new white pump tubing around the pump and clip it into place with the tubing retainers.
6. Adjust as needed and connect the tubing to the inlet and outlet tubing. The front end of the pump tubing connects with the outlet tubing.
7. Close the tubing clamp and push the pump adjustment back into place.

3.3 Module Tubing Replacement

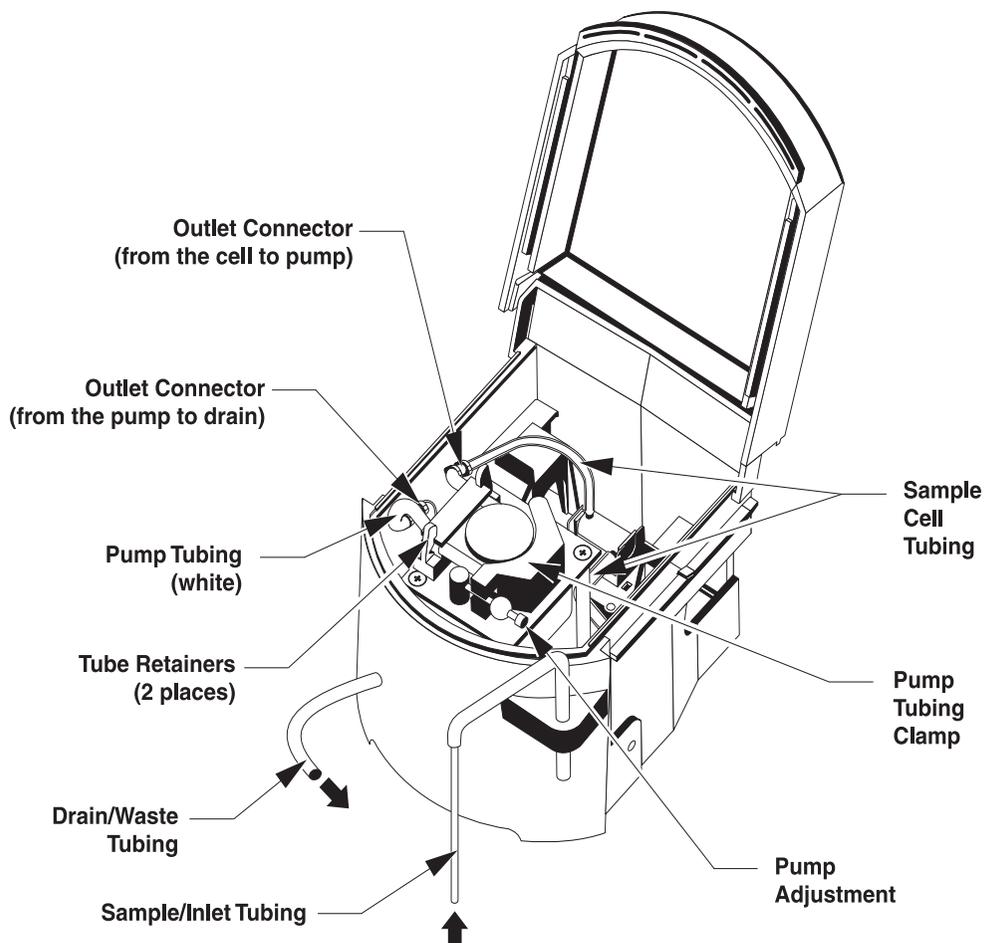
Replacement of the module tubing should be infrequent; however, the following instructions are supplied in case the need to replace tubing arises, or if the operator would like to use a different type of tubing. The life of the module tubing will vary according to the type of samples used. The tubing replacement kits (see *page 55* for replacement parts) comes with tubing and connectors. Refer to *Figures 4* and *5* on *pages 20* and *21* as needed.

1. Remove the Sipper Module from the instrument and open the module lid.
2. Disconnect the sample cell tubing from the inlet tubing and the white pump tubing.

Section 3, continued

3. Loosen the sample cell retaining screw by turning the plastic nut on the bottom of the module clockwise. Remove the sample cell adapter.
4. Carefully remove sample cell tubing from the sample cell using a fingernail. Pulling directly on the tubing may cause the tubing to break and leave remnants on the glass. DO NOT use tools to remove the tubing as the glass may break.
5. Unhook the pump adjustment by pulling it toward the front of the module and then swing the tubing clamp open.
6. Pull down on the pump tubing retainers to release the white pump tubing from the pump.
7. Disconnect the pump tubing from the outlet tubing.
8. Remove the six plastic connectors from the inlet, outlet, and pump tubing.
9. Remove the inlet tubing from the module. First draw the tubing out of the center hole in the module and then out through the hole in the front of the module. Next, ease the tubing through the stainless steel tubing support with a push-pull action.

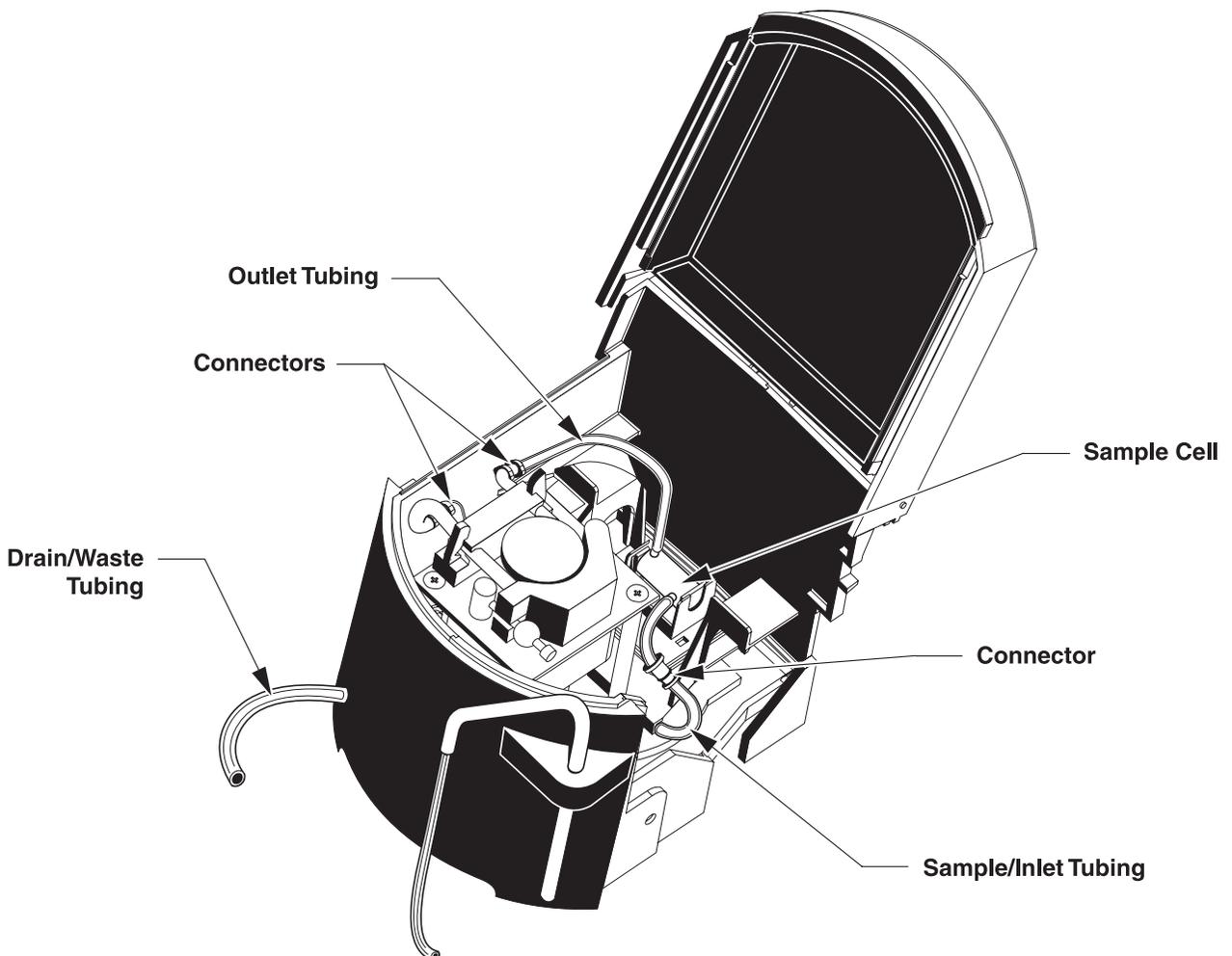
Figure 4
Pump Tubing Replacement



Section 3, continued

10. Remove the outlet tubing from the module: First draw the tubing out of the center bottom hole of the module and then out the hole in the front of the module.
11. Thread the new outlet tubing (the larger $\frac{3}{16}$ -inch clear tubing) into the left side of the module and through the two holes in the hand-hold under the module.
12. Bring about 6 inches of the tubing inside the module through the left hole in the floor of the module.
13. Wet the outside of the new sample inlet tubing (the smaller $\frac{1}{8}$ -inch clear tubing) with water and thread it, with a twisting motion, through the stainless steel tubing support, starting at the short end of the support.
14. Thread the inlet tubing through the right side of the module and through the two holes in the hand-hold underneath the module.
15. Draw about 6 inches of the inlet tubing into the sample compartment through the right center hole in the bottom of the module (see *Figure 6*).
16. Attach the new sample cell tubing to the sample cell inlet and outlet connectors. Place the plastic connectors on the sample cell tubing.

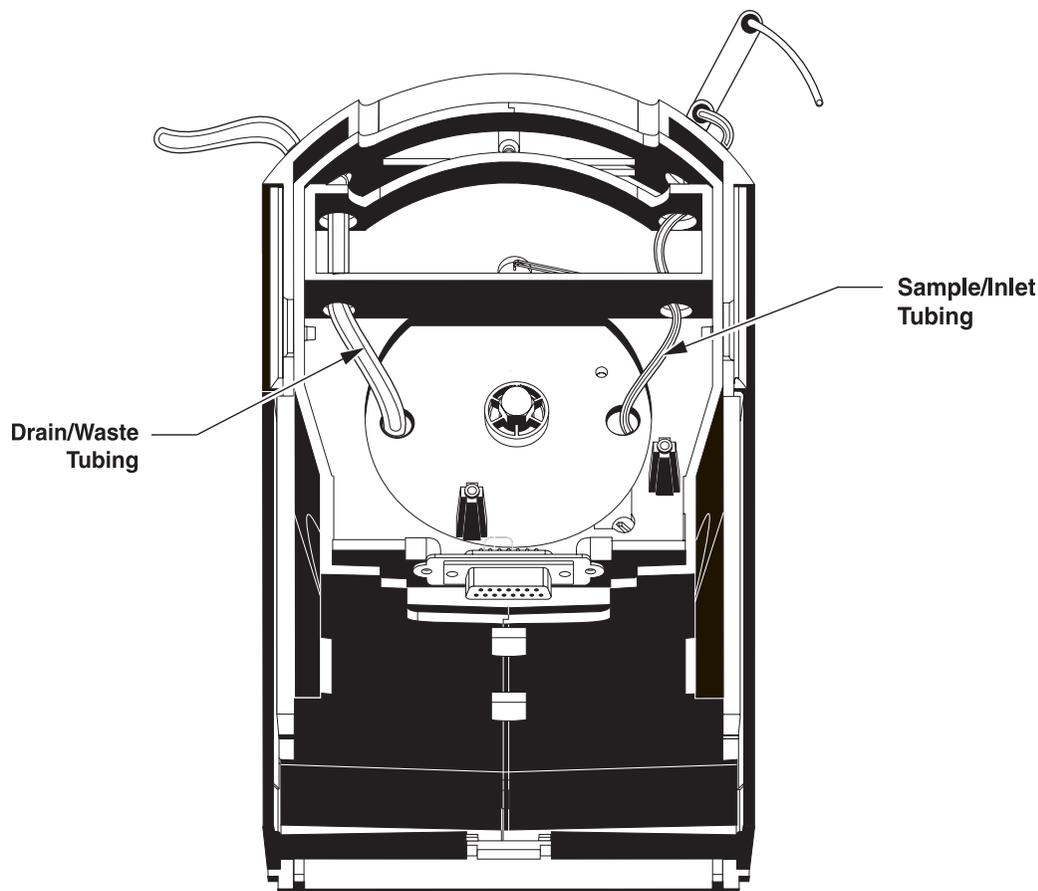
Figure 5
Inlet and Outlet Tubing Replacement



Section 3, continued

17. Replace the sample cell bracket (with the sample cell and connected tubing) in the module and tighten the plastic nut (counterclockwise) from underneath, making sure not to pinch the tubing. The tubing should lie to the right side and left side of the front corners of the sample cell adapter (see *Figure 5*).
18. Wrap the white pump tubing around the pump and clip it into place with the tubing retainers. Adjust as needed when connecting the tubing. Insert the plastic connectors into the new tubing and connect as follows:
 - Inlet tubing to the sample cell inlet connector tubing.
 - Outlet connector sample cell tubing to the back end of the white pump tubing
 - Front end of the white pump tubing to the outlet tubing
19. Close the tubing clamp and snap the pump adjustment into place. The black ball should lie opposite the white tube on the clamp.
20. Make sure the tubing does not block the light path.

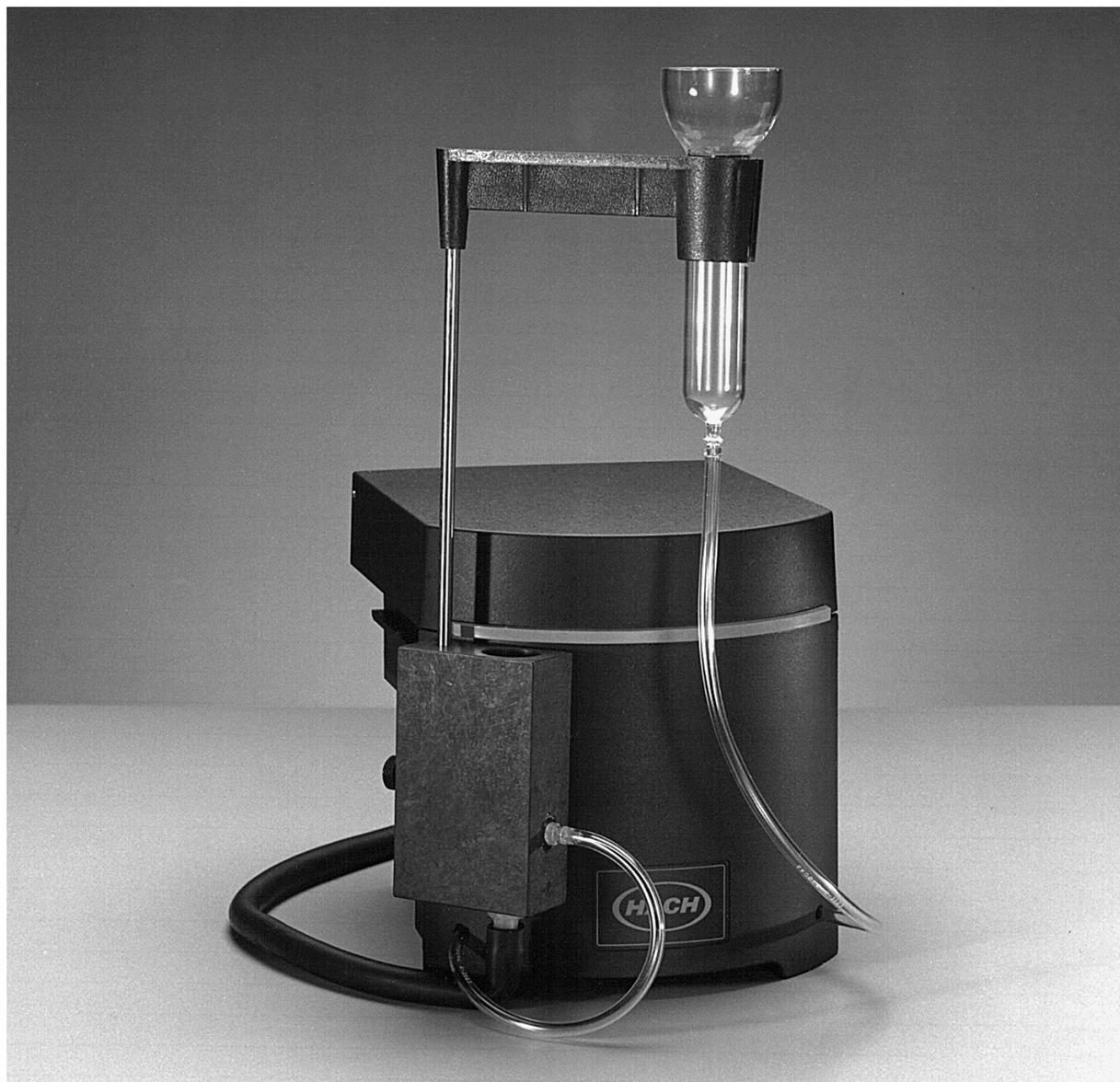
Figure 6
Bottom View of the Sipper Module



DR/4000 SPECTROPHOTOMETER FLOW CELL MODULES

Cat. No. 48070-04 1-inch Path Length

Cat. No. 48070-05 1-cm Path Length





FLOW-CELL MODULE OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

PERIGO

A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

SAFETY PRECAUTIONS

Before attempting to unpack, set up, or operate this instrument, please read this entire manual. Pay particular attention to all warnings, cautions and notes. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, this equipment **MUST NOT** be installed or used in any manner other than that which is specified in this manual.

Use of Hazard Information

If multiple hazards exist, the signal word corresponding to the greatest hazard shall be used.

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTE

Information that requires special emphasis.

Precautionary Labels

Please pay particular attention to labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.



This symbol, if noted on the instrument, references the instruction manual for operational and/or safety information.



2.2 *Flow-Cell Setup*



2.3 *Flow-Cell Measurements*

FLOW-CELL MODULE SPECIFICATIONS

Specifications are subject to change without notice.

Path Length:

Cat. No. 48070-04: 1 in. (2.42 cm)

Cat. No. 48070-05: 1 cm (0.394 inch)

Wavelength Range:

190 to 1100 nanometers

Purge Volume:

20 mL minimum for ± 0.002 ABS (0 to 2 ABS or 2 to 0 ABS sample change) – 1-inch path length

10 mL minimum for ± 0.002 ABS (0 to 0.830 ABS or 0.830 to 0 ABS sample change) – 1-cm path length

Storage Temperature:

-17 to 60 °C, 85% relative humidity, non-condensing

Operating Temperature:

10 to 40 °C; 95% relative humidity, non-condensing at 25 °C; 75% relative humidity, non-condensing at 40 °C

1.1 Module Description

The Flow-Cell Module is an optional accessory for the DR/4000 Spectrophotometer. The module provides improved measurement accuracy because the same optical characteristics exist for both zeroing and reading, or when comparing measurements of different samples. Errors resulting from optical differences between individual sample cells are eliminated because samples flow through to a stationary cell. The pour-through design provides a convenient way to introduce samples without having to change sample cells.

The Flow-Cell Module is available in two path lengths. Cat. No. 48070-04 comes with a 1-inch quartz sample cell, and Cat. No. 48070-05 comes with a 1-cm quartz sample cell. Both modules are compatible with the DR/4000V and DR/4000U Spectrophotometers and can be used over the instrument's full wavelength range.

1.2 Unpacking

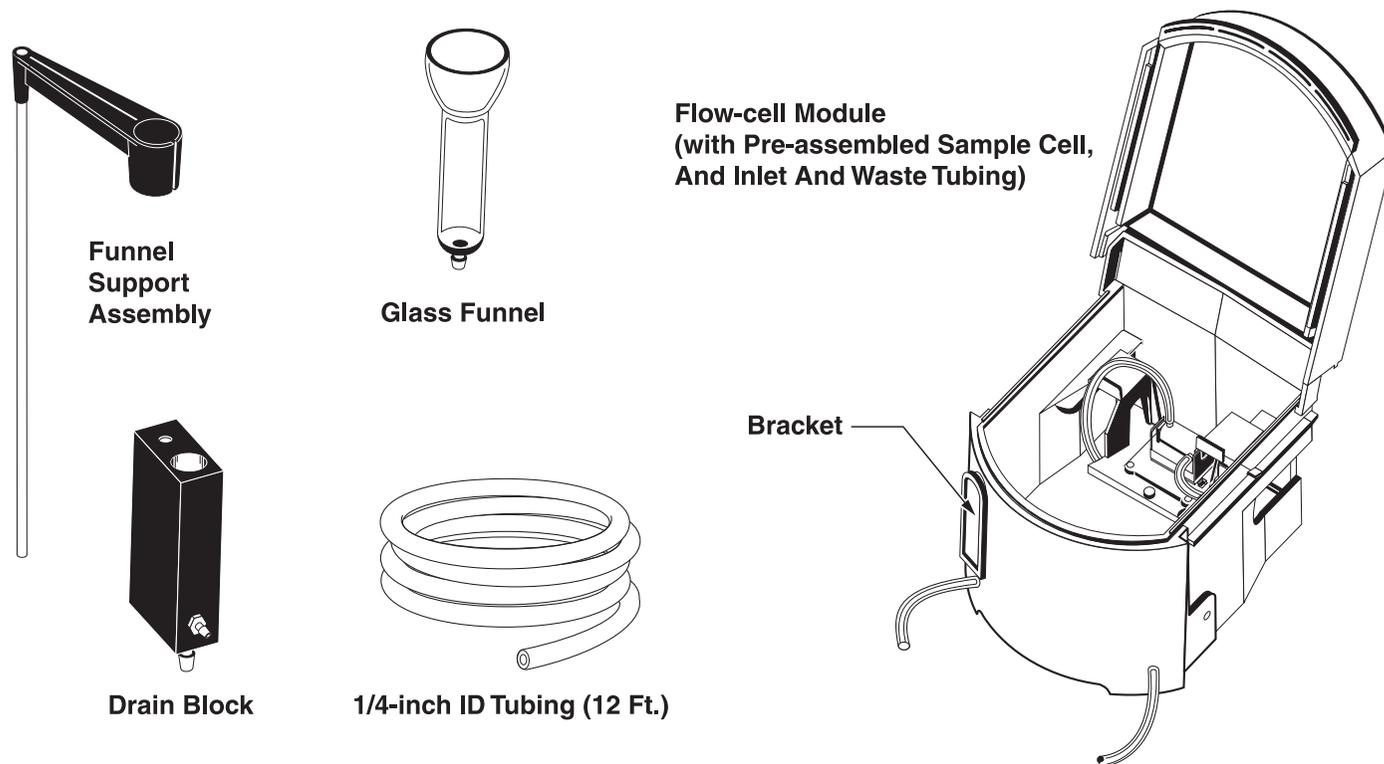
Remove the Flow-Cell Module and accessories from the shipping container, and inspect each item for any damage that may have occurred during shipment. Both the 1-inch and the 1-cm models are shipped with the following (*see Figure 7*):

- Flow Module with pre-assembled sample cell, and inlet and waste tubing
- Glass funnel
- Funnel support assembly
- Drain block
- ¼-inch ID rubber tubing (12 ft.)

If any items are missing or damaged, please contact the Hach Customer Service Department in Loveland, Colorado. Do not return the module without prior authorization. In the United States, call 1-800-227-4224. Outside the United States, contact the Hach office or dealer serving you.

Section 1, continued

Figure 7
Flow-Cell Module Components



1.3 Assembly

The Flow-Cell Module requires assembly before use (see *Figure 7* as needed).

1. Open the module lid.
2. Slide the drain block channel onto the bracket on the front left side of the module and press firmly into place.
3. Close the module lid. Check that the lid closes properly and does not contact the drain block.
4. Attach the waste tubing (left side of module) to the hose barb on the right side of the drain block.
5. Slide the funnel support into place in the top of the drain block. Tighten the thumb screw on the side of the drain block to hold the funnel support in place.
6. Place the glass funnel in the funnel support.
7. Attach the inlet tubing (right side of module) to the bottom of the funnel.
8. Attach the 1/4-inch drain tubing to the hose barb on the bottom of the drain block.

2.1 Changing Sample Modules

Use the following procedure to change the sample module (see *Figure 8*).

1. Unlock the currently installed module by turning the module lock (located directly under the module on the front of the instrument) counterclockwise until it rests horizontally.
2. Grasp the recessed hand hold under the module and slide the module straight out (do not lift up).
3. Slide the Flow-Cell Module into the sample compartment, and press firmly into place.
4. Re-lock the module before using it by turning the sample module lock clockwise to its vertical position.

Figure 8
Unlocking and Removing the Module



Section 2, continued

2.2 Flow-Cell Setup

DANGER

Do not use the Hach Flow-Cell Modules with flammable samples or those containing hydrocarbons, solvents, concentrated acids or concentrated bases that may attack wetted parts of the cells. Conduct tests prior to use of the Flow-Cell Modules if sample compatibility is questionable.

PELIGRO

No use las células de flujo de Hach con muestras inflamables o que contengan hidrocarburos, solventes, ácidos concentrados o bases concentradas que puedan atacar las partes mojables de la célula. Experimente antes de usar las células de flujo, si existe duda sobre la compatibilidad de la muestra.

PERIGO

Não se deverá usar cubetas de fluxo Hach com amostras inflamáveis ou aquelas que contém hidrocarbonetos, solventes, ácidos concentrados ou bases concentradas que podem atacar as partes molhadas das cubetas. Realize os testes antes do uso das cubetas de fluxo se é questionável a compatibilidade das amostras.

DANGER

Ne pas utiliser les cuves à circulation Hach avec des échantillons inflammables ou ceux contenant des hydrocarbures, solvants, acides concentrés ou bases concentrées qui peuvent attaquer les parties au contact du liquide. Effectuer des essais avant l'utilisation des cuves à circulation si la compatibilité de l'échantillon est douteuse.

GEFAHR

Durchflußküvetten von Hach dürfen nicht in Verbindung mit brennbaren Proben oder Proben, die Kohlenwasserstoffe, Lösemittel, konzentrierte Säuren oder konzentrierte Basen enthalten, welche die benetzten Teile der Küvetten angreifen können, verwendet werden. Wenn die Verträglichkeit fraglich ist, sollten vor der Verwendung der Durchflußküvetten Tests durchgeführt werden.

The following procedure is used to prepare the Flow-Cell for use:

1. Run the drain tubing attached to the bottom of the drain block so that samples will drain freely. The tubing should always remain below the bottom of the drain block and should not run horizontally. If possible, insert the end of the tube into a drain (or suitable collecting vessel if treatment is necessary before discharge).
2. Test the Flow-Cell by pouring 25 to 50 mL of deionized water into the funnel and allowing the funnel to drain smoothly.
3. Adjust the level of the funnel up or down to increase or decrease the flow rate through the cell. Higher flow rates improve the cell purge characteristics with low sample volumes.

Section 2, continued

2.3 Flow-Cell Measurements

Note: Each Hach DR/4000 Spectrophotometer procedure provides a note in Step 1 indicating if a Flow-Cell Module can be used with that procedure.

Note: The minimum sample volumes required are 20 mL for the 1-inch Flow-Cell and 10 mL for the 1-cm Flow-Cell.

Note: Use of the 1-inch path length Flow-Cell Module requires 25 mL chemistry. If using 10 mL chemistries, and 1-inch pathlength detection is preferred or required, Hach recommends using the 1-inch pathlength Sipper Module.

Operation of the DR/4000 Spectrophotometer with the Flow-Cell Module installed is the same as using a Single-Cell Module. Refer to the *DR/4000 Spectrophotometer Instrument Manual* for operating instructions. When instructed to place a zero or sample in the sample compartment, simply pour the zero or sample into the funnel.

3.1 Cleaning Requirements

3.1.1 Sample Cell

Occasionally inspect the sample cell windows. If the windows appear dirty or hazy, remove the sample cell and soak it in a cleaning solution or dilute acid and rinse thoroughly with demineralized water. Refer to *Cleaning Requirements* in the *DR/4000 Spectrophotometer Instrument Manual*.

3.1.2 Module

If the module becomes dirty, wipe it clean with soap and water and a soft cloth. DO NOT immerse the module or use solvents (e.g., acetone) to clean the module.

3.2 Tubing Replacement

Inspect the module tubing periodically for signs of wear, and replace as needed. The life of the tubing will vary considerably with the type of samples being measured and the frequency of use. The tubing replacement kit (see *page 55* for replacement parts) comes with tubing and connectors. Refer to *Figure 9* and *Figure 10* as needed.

1. Remove the drain tubing from the bottom of the drain block.
2. Remove the Flow-Cell Module from the instrument.
3. Disconnect the inlet tubing from the glass funnel, and remove the funnel support and funnel from the drain block.
4. Disconnect the waste tubing from the drain block.
5. Open the module lid and carefully detach the inlet and waste tubing from the sample cell using a fingernail. Pulling directly on the tubing may cause the tubing to break and leave remnants on the glass. DO NOT use tools to remove the tubing as the glass may break.
6. Loosen the thumb screw located in the center of the module and remove the sample cell.
7. Draw out the inlet and waste tubing from the module.
8. Attach the waste tubing to the small hose barb on the drain block. Thread the tubing through the left hole in the front of the module, then through the two holes in the left of the hand-hold piece under the module. Then thread the tubing through the left hole in the center left bottom of the module. Draw approximately 6 inches of tubing into the module compartment.
9. Thread the inlet tubing through the hole in the right front side of the module, and through the two holes in the right of the hand-hold piece under the module. Then thread the tubing through the hole in the center right bottom of the module. Draw approximately 6 inches of tubing into the module compartment.

Section 3, continued

Note: If the tubing does not easily reach the bottom of the glass funnel, gently pull excess tubing from the module compartment through the hole in the bottom of the module, then pull the excess through the front of the module.

10. Place the sample cell in the module. Make sure the positioning pins on the bottom of the module compartment match the holes on the bottom of the adapter and that the tubing is not pinched. The tubing should exit to the left and right of the front corners of the sample cell bracket (see *Figure 9*).

11. Tighten the thumb screw.

12. Carefully press the inlet and waste tubes onto the sample cell as follows:

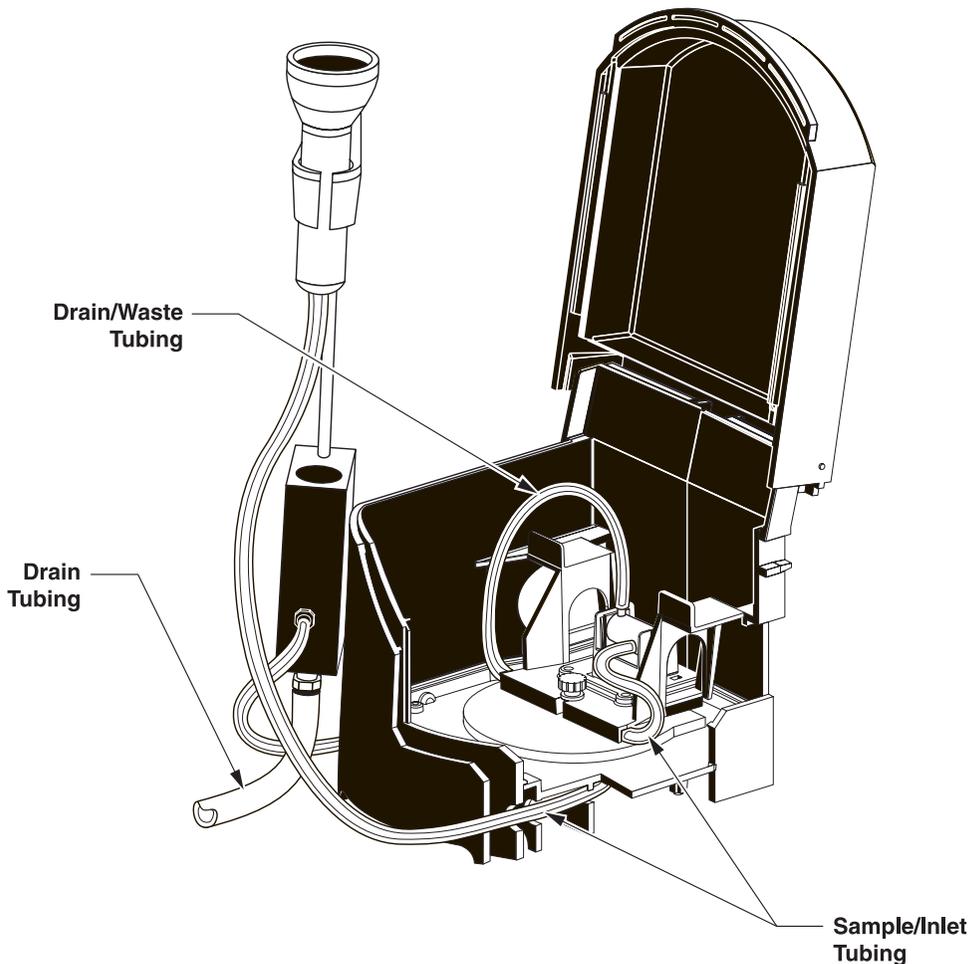
For the 1-inch Flow Cell: Connect the inlet tube to the right hose fitting and the waste tube to the left hose fitting.

For the 1-cm Flow Cell: Connect the outlet tube to the hose fitting above the letter Q, printed on the sample cell. Connect the inlet tubing to the other fitting.

13. Replace the funnel support and attach the inlet tubing to the bottom of the funnel.

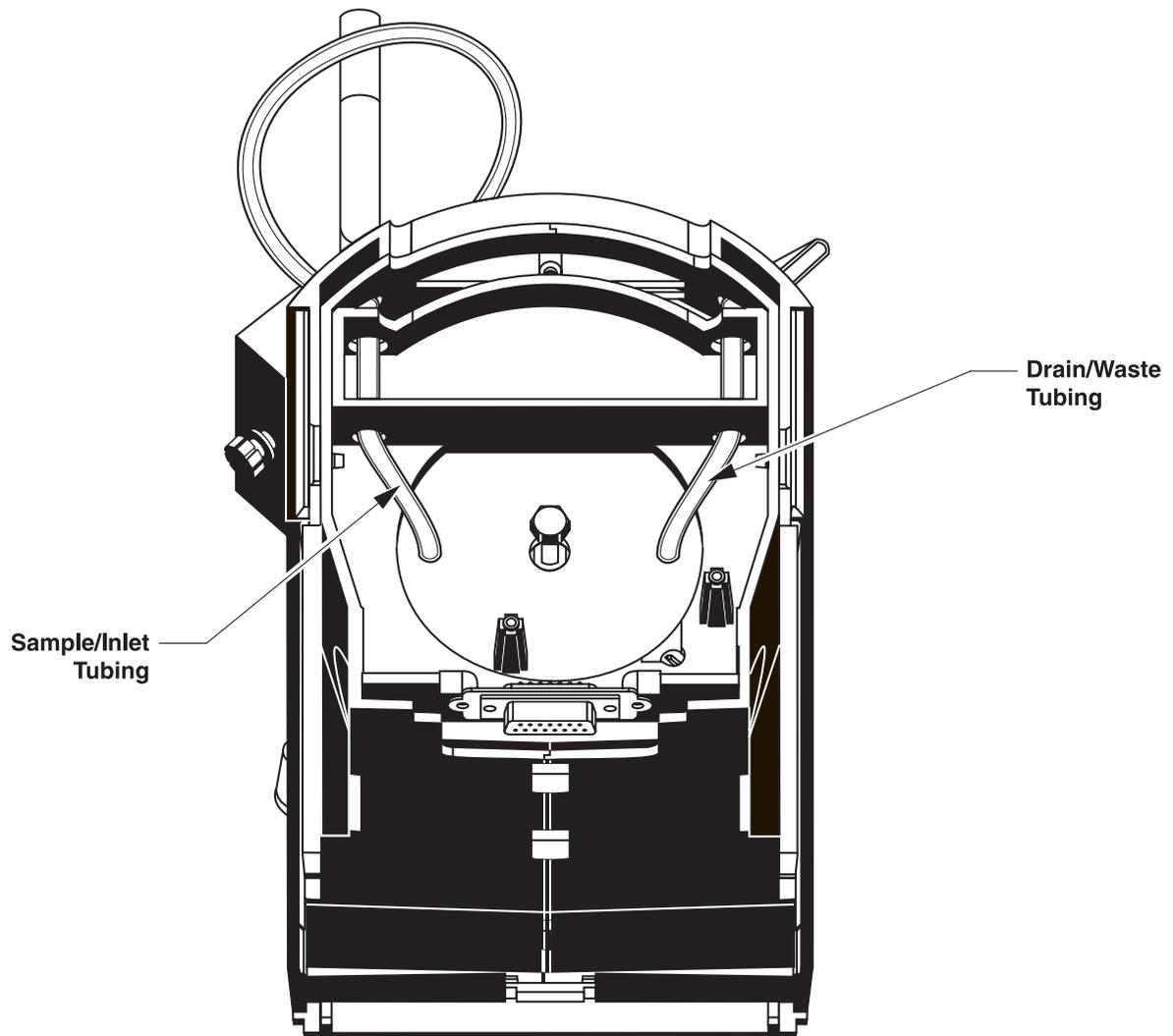
14. Attach the ¼-inch drain tubing to the hose barb on the bottom of the drain block.

Figure 9
Tubing Replacement on 1-inch Flow Cell



Section 3, continued

Figure 10
Bottom View of the Flow-Cell Module



DR/4000 SPECTROPHOTOMETER TEMPERATURE CONTROL MODULE

Cat. No. 48070-08, 3 mL, 1-cm Path Length





TEMPERATURE CONTROL MODULE OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

PERIGO

A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

SAFETY PRECAUTIONS

Before attempting to unpack, set up, or operate this instrument, please read this entire manual. Pay particular attention to all warnings, cautions and notes. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, this equipment **MUST NOT** be installed or used in any manner other than that which is specified in this manual.

Use of Hazard Information

If multiple hazards exist, the signal word corresponding to the greatest hazard shall be used.

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTE

Information that requires special emphasis.

Precautionary Labels

Please pay particular attention to labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.



This symbol, if noted on the instrument, references the instruction manual for operational and/or safety information.



1.1 Module Description and Operation

TEMPERATURE CONTROL MODULE SPECIFICATIONS

Specifications are subject to change without notice.

Path Length:

1 cm (0.394 inches)

Wavelength Range:

190 to 1100 nanometers

Sample Temperature Maintenance Range:

15 to 50 °C (59 to 121 °F)

Temperature Tolerance

±0.5 °C (±0.9 °F)

Storage Temperature:

-17 to 60 °C, 85% relative humidity, non-condensing

Operating Temperature:

10 to 40 °C; 95% relative humidity, non-condensing, at 25 °C; 75% relative humidity, non-condensing at 40 °C

1.1 Module Description and Operation

DANGER

This instrument is not intended for use with flammable samples or those containing hydrocarbons.

PELIGRO

Este instrumento no está destinado para uso con muestras inflamables o que contengan hidrocarburos.

PERIGO

Este instrumento não é feito com o fim de ser empregado com amostras inflamáveis ou aquelas que contêm hidrocarbonetos.

DANGER

Cet instrument n'est pas conçu pour une utilisation avec des échantillons inflammables ou des échantillons contenant des hydrocarbures.

GEFAHR

Dieses Gerät nicht bei Tests mit brennbaren Lösemitteln oder Lösemitteln mit Kohlenwasserstoffen verwenden.

The Temperature Control Module is an optional accessory designed to support analyses where sample temperature considerations are critical and will maintain the temperature of aqueous samples within ± 0.5 °C over a temperature range of 15 to 50 °C (59 to 121 °F). Measurements are most accurate if you use the 1-cm quartz cells provided with the instrument. Operation of the Temperature Control Module requires a DR/4000 Spectrophotometer with a software version of 2.01 or higher. Early versions of DR/4000 Spectrophotometers may require a hardware upgrade (see Section 2.2 on page 48).

The temperature sensor for thermal feed back in the module does not directly touch the sample. This avoids contamination of the sample or having the sample react with the sensor material. The sensor is located in the metal sample cell holder that surrounds the sample cell. The module uses an algorithm to compensate for the difference between the thermal rise time measured at the block versus the rise time of the sample (based on a 3-mL sample in a 1-cm quartz cell).

When the analysis requires the module to change the sample temperature from one setpoint to another, tests run with a 1-cm, 3-mL quartz cell indicate that it takes about 10 minutes for the temperature to stabilize within ± 1 °C of the setpoint and 15 minutes to stabilize within ± 0.5 °C of the setpoint. The stabilization time will vary due to the difference in the temperatures of the setpoints and ambient air temperature. If you use plastic sample cells instead of quartz cells, allow additional time for the sample temperature to stabilize due to the difference in the thermal conductivity of plastics.

For best results with kinetic testing, Hach recommends using a separate thermometer and an aliquot of sample to establish the stabilization time of each type of sample. Record the ambient air temperature and the temperature of the sample that will be used. Pour 3-mL of sample into a representative cell. Place the temperature probe (use one with a small thermal mass) into the sample and insert the cell into the module. Set the desired setpoint temperature for the sample. Set a timer and record how long it takes for the sample to reach the desired temperature. You may use this value to set the timer option on the DR/4000 screen to control your procedure with greater accuracy.

Section 1, continued

1.2 Unpacking

Remove the Temperature Control Module from the shipping container and inspect for any damage that may have occurred during shipment. The module is shipped with the following:

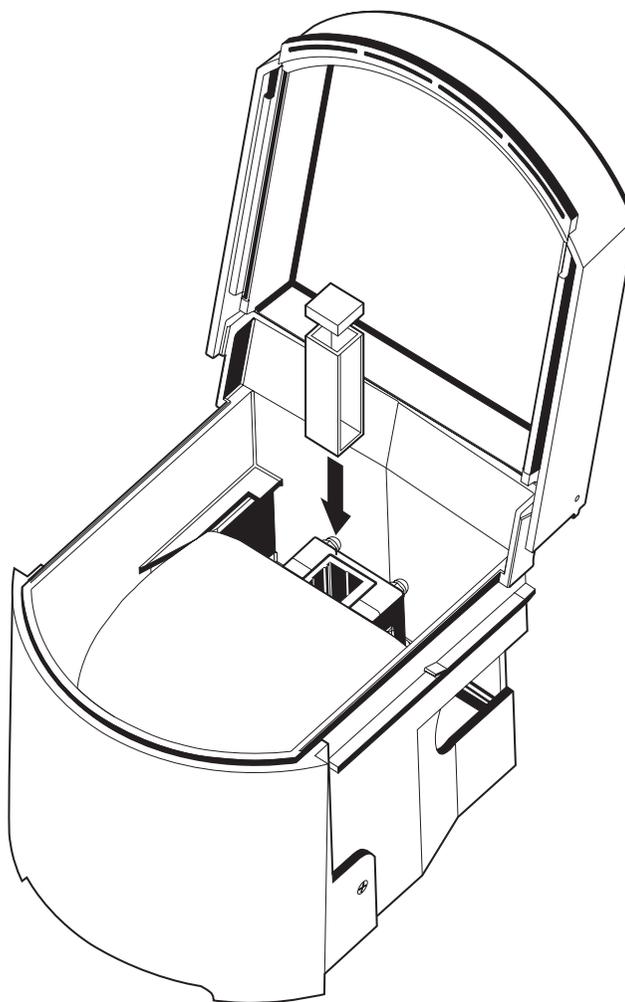
- Two matched quartz 1-cm cells designed for a 3 mL of liquid sample

If any item is missing or damaged, please contact the Hach Customer Service Department in Loveland, Colorado. Do not return the module without prior authorization. In the United States, call 1-800-227-4224. Outside the United States, contact the Hach office or dealer serving you.

1.3 Module Components

Figure 11 identifies the major components of the Temperature Control Module and proper placement of the quartz sample cell. When using the module, the quartz cell must be inserted so the optical faces are in line with the light beam path which runs from right to left.

Figure 11 Temperature Control Module Components



2.1 Changing Sample Modules

Use the following procedure to change the sample module:

1. Unlock the currently installed module by turning the module lock (located directly under the module on the front of the instrument) counterclockwise until it rests horizontally (*see Figure 12*).
2. Grasp the recessed hand hold under the module and slide the module straight out (do not lift up).
3. Slide the Temperature Control Module into the module compartment and press firmly into place.
4. Before use, re-lock the module by turning the sample module lock clockwise to its vertical position.

Figure 12
Unlocking and Removing the Module



Section 2, continued

2.2 Instrument Setup

Software version 2.01 or greater must be installed in the DR/4000 before using the Temperature Control Module. The instrument software version is displayed at the top of the screen during the power up sequence. If the instrument was purchased before June, 1997 it may also need to be updated at the factory to include the most recent electronic changes.

To access the Temperature Control Module menu options, press the **SAMPLE MODULE** soft key in the setup menu.

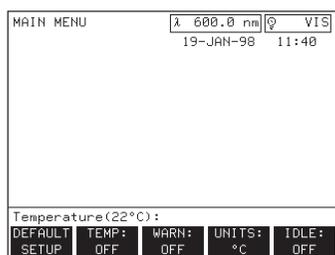
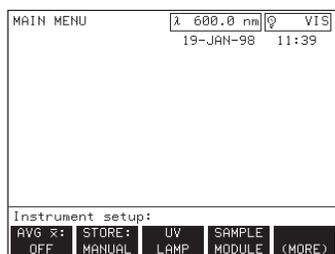


Table 3 Temperature Control Setup Menu

DEFAULT SETUP	Sets the sample temperature setpoint to 37 °C.
TEMP:	Allows the operator to enter a temperature setpoint between 15 and 50 °C.
WARN:	Toggles between ON and OFF. When ON, the warning will indicate if a test is being run before the temperature setpoint has been reached.
UNITS:	Toggles between °C and °F.
IDLE:	Toggles between On and OFF. When ON, the operator can tell the DR/4000 Spectrophotometer to turn the temperature controller off after a desired amount of time (from 1 to 8 hours).

Press the **DEFAULT TEMP** key to set the sample setpoint to 37 °C. This default temperature cannot be changed by the operator. If you do not wish to use 37 °C as the setpoint, press the **TEMP:** soft key. The display will prompt for a numerical entry between 15 to 50 °C. Using the number keys, enter the desired setpoint temperature. Press **ENTER** to confirm the entry or **EXIT** to cancel it.

The **UNITS** soft key allows the operator to choose between degrees Centigrade and degrees Fahrenheit. When the unit is changed with this key, all the screens will display temperature values in the chosen unit.

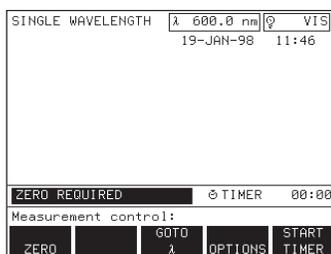
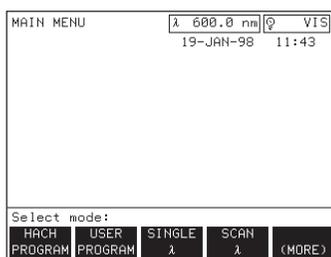
The **IDLE** soft key allows you to limit how long the instrument will keep the module at a setpoint. Enter a numeric value from 1 to 8 hours and press **ENTER** to accept the value or **EXIT** to cancel the entry. If you are in a simple measurement mode, the instrument will shut off after the specified time limit and the temperature control module will cool to room temperature (the instrument will continue to measure). If you are doing a scan or time-course mode, the time limit countdown will begin after the scan or time-course mode is complete.

2.3 Temperature Equilibration

Before measuring a sample in the Temperature Control Module, allow at least 10 minutes for the sample to reach the desired temperature. The quartz sample cells supplied with the instrument offer the most accurate sample temperature control. Sample cells not made of quartz may cause the actual sample temperature to stabilize at a slightly different temperature than the desired value.

Section 2, continued

2.4 Sample Measurements



The temperature control measurement sequence is similar for all of the measurement modes available on the DR/4000 Spectrophotometer. You may use all modes of operation. The following instructions are for the single wavelength mode.

1. Select the setup menu by pressing the **SETUP** key. To adjust the settings of the module, press the **SAMPLE MODULE** soft key. After making the desired adjustments, press **EXIT** until the main menu is displayed. Before taking measurements, allow the empty module to reach the set point.
2. Select the desired measurement mode from the main menu. Then insert the sample cell containing sample and let the sample equilibrate for at least 10 minutes.
3. Zero the instrument by pressing the **ZERO** soft key.
4. Add the appropriate reagents/indicators to the cell. Mix by inversion if necessary.
5. After the appropriate reaction period, press the **READ** soft key.

Refer to the appropriate section of the *DR/4000 Spectrophotometer Instrument Manual* for more information about using the selected mode of operation.

3.1 Quartz Sample Cells

The quartz sample cells used in the temperature control module require special handling and care. The following suggestions will help extend the life of the sample cells:

- When using cells with stoppers, leave an air gap between the sample and the stopper. The force caused by pressing the stopper into the liquid can cause the cells to weaken and crack.
- Cells used with phosphoric acid will etch over time. It is best to keep the sample in the cell the minimum time necessary. The best way to clean these cells is to immerse them in a detergent solution for a short time, then rinse well with distilled water.
- Store the cells in the velvet-lined boxes or the plastic and foam boxes they were shipped in. This helps to protect against scratches, cracking and breakage.
- Never touch the clear sides of the cells with your fingers as skin oils may etch the windows. When using the cells, wipe the sides of the cells with a soft cloth to eliminate smudges and accidental fingerprints.

3.1.1 Cleaning the Quartz Sample Cells

The cells can resist damage by most laboratory cleaning agents. However, strong alkalis will damage the optical surface and should only be used as a last resort.

Quartz and glass cells may absorb some metal ions onto the surface; it may require many rinses or special cleaning to remove the residue. Some methods that may be used are:

- a. Detergent Solutions:** Most laboratory detergents may be used at recommended concentrations. If the pH is greater than 8.5, etching may occur. Neutral detergents (Neutracon) are safer for regular cleaning.
- b. Chromic Acid:** Use chromic acid as a 5-10% solution in 90% sulfuric acid or as a 5% solution in 20 nitric acid:80 sulfuric acid. Soak cells for up to 12 hours and rinse at least 10 times with distilled water to remove chromate and other ions from the cell walls. These reagents are very corrosive; only properly trained staff should use them. Do not use this reagent more than once a month or etching of the cells may occur.
- c. Chlorate-Hydrochloric Acid:** Immerse the cells in concentrated hydrochloric acid (1.18 sg) and potassium chlorate added in small amounts up to about 10% with frequent agitation. This must be done in a fume hood with properly trained staff.
- d. Alcohol Potassium Hydroxide:** Alcoholic potassium hydroxide may be used as a 5% solution, but it will etch the cells if used repeatedly. Use this method as a last resort.

If you use a detergent, increasing the temperature or using an ultrasonic bath can decrease cleaning time. Be careful if you use a sonic bath; if the cell touches the metal bath liner or the cell is already flawed when it is put in, the ultrasonic energy may destroy the cell.

Section 3, continued

Rinsing is more efficient if you use distilled water followed by ethanol or acetone. Use only analytical grade reagents.

3.2 Module Maintenance

The Temperature Control Module is designed to offer many years of trouble-free service and has no replaceable parts. If the module becomes dirty, wipe it clean with soap and water and a soft cloth. DO NOT immerse the module or use solvents (e.g., acetone) to clean the module.



GENERAL INFORMATION

At Hach Company, customer service is an important part of every product we make.

With that in mind, we have compiled the following information for your convenience.

REPLACEMENT PARTS

Sipper Module Replacement Parts

Description	Cat. No.
DR/4000 Spectrophotometer Optional Modules Instruction Manual	49540-89
Sample cell, 1-inch with adapter	49514-00
Sample cell, 1-cm with adapter	49539-00
Software Upgrade Package	49544-00
Tubing Replacement Kit for pump.....	49521-00
Tubing Replacement Kit for inlet and waste	49557-00
Tubing Replacement Kit for 2-mL Micro Sipper.....	48401-00

Flow-Cell Module Replacement Parts

Description	Cat. No.
DR/4000 Spectrophotometer Optional Modules Instruction Manual	49540-89
Fitting, hose barb, waste.....	19065-00
Fitting, hose barb, drain.....	19576-00
Funnel, Flow-Thru, glass	21123-00
Sample cell, 1 inch with adapter	49514-00
Sample cell, 1 cm with adapter	49539-00
Tubing, rubber, drain.....	560-18
Tubing Replacement Kit for inlet and waste	48249-00

Temperature Control Module Replacement Parts

Description	Cat. No.
DR/4000 Spectrophotometer Optional Modules Instruction Manual	49540-89
Sample Cells, quartz, 1-cm, 3 mL, matched pair	48228-00

HOW TO ORDER

By Telephone:

6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH
(800-227-4224)

By FAX: (970) 669-2932

By Mail:

Hach Company
P.O. Box 389
Loveland, CO 80539-0389
U.S.A.

Ordering information by E-mail: orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you.

Call **1-800-227-4224** or E-mail techhelp@hach.com.

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send E-mail to intl@hach.com or contact:

In Canada, Latin America, Africa, Asia, Pacific Rim:

Telephone: (970) 669-3050; FAX: (970) 669-2932

In Europe, the Middle East, or Mediterranean Africa:

HACH Company, c/o
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Willstätterstr. 11
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REPAIR SERVICE

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the HACH Service Center serving your location.

In the United States:

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100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
Telephone: (515) 232-2533
FAX: (515) 232-1276

In Canada:

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1313 Border Street, Unit 34
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(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
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**In Latin America, the Caribbean, the Far East, the
Indian Subcontinent, Africa, Europe, or the Middle East:**

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FAX: (970) 669-2932
E-mail: intl@hach.com

WARRANTY

Hach Company warrants this product to the original purchaser against any defects that are due to faulty material or workmanship for a period of **one year from date of shipment**.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price, excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- damage caused by misuse, neglect, accident or improper application or installation
- damage caused by any repair or attempted repair not authorized by Hach Company
- any product not used in accordance with the instructions furnished by Hach Company
- freight charges to return merchandise to Hach Company
- freight charges on expedited or express shipment of warranted parts or product
- travel fees associated with on-site warranty repair.

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.



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Outside the U.S.A. - **Contact the HACH office or distributor serving you.**

On the Worldwide Web - **www.hach.com**; E-mail - **techhelp@hach.com**
