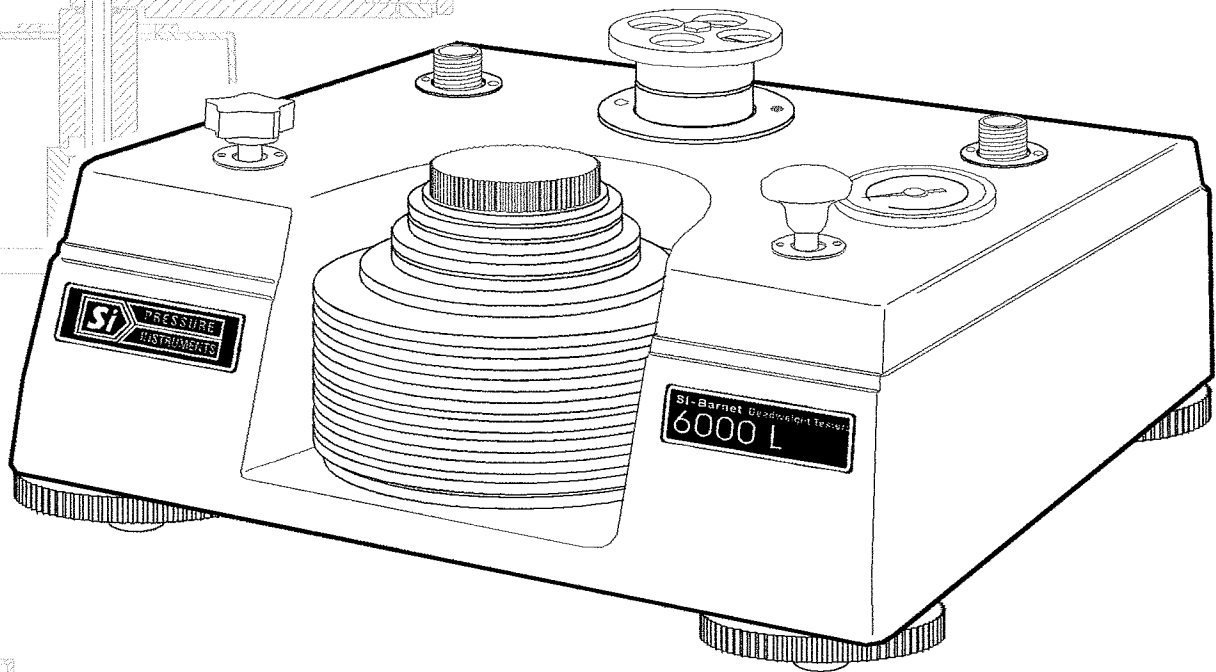


Si

6000L

Low Pressure Deadweight Tester



operating

manual

Si PRESSURE
INSTRUMENTS

SI-BARNET DEADWEIGHT TESTER 6000L

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MANUFACTURED BY:

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TABLE OF CONTENTS

SPECIFICATIONS	-1-
DESCRIPTION	-2-
PRESSURE / VACUUM RANGE TABLES	-2-
INSTALLATION & OPERATING PROCEDURES OF MODEL 6000L	-3-
LAYOUT OF MODEL 6000 DEADWEIGHT TESTER.....	-4-
MODEL 6100L VACUUM CONVERSION KIT INSTALLATION AND OPERATING PROCEDURES.....	-5-
LAYOUT OF MODEL 6100L CONVERSION KIT.....	-6-
ACCESSORIES	-7-
CARE AND MAINTENANCE / RE-CALIBRATION AND OVERHAUL.....	-8-
PRESSURE CORRECTIONS	-9-
TEMPERATURE AND GRAVITY CORRECTIONS.....	-10-
NOMOGRAM.....	-11-

SPECIFICATIONS

MODEL:	Single Piston, Pressure or Vacuum.
RANGE:	Pressure (see Table 1) on page 2
ACCURACY:	(See Calibration Certificate)
TRACEABILITY:	NIST, NVLAP Accredited Calibration Optional
STANDARD CORRECTIONS:	Gravity: 9.80665 m/s ² Temperature: 20°C Air Density: 1.2 kg/m ³
WEIGHTS:	Non-magnetic Stainless Steel.
OPERATING MEDIUM:	Pressure or Vacuum via integral pump.
WEIGHT:	DWT: 5.4 Kg. Weights: 5.4 Kg.
DIMENSIONS:	Approx. 310 x 250 x 150 mm
STANDARD ACCESSORIES:	See Table 2 on page 7.
OPTIONAL ACCESSORIES:	See Table 2 on page 7.
ORDERING CODES:	Pressure: See Table 1 on page 2.

WARNING: DO NOT CONNECT DEADWEIGHT TESTER TO EXTERNAL PRESSURE SOURCE.

DESCRIPTION

The SI-BARNET 6000L range of Pneumatic Deadweight Testers provide reliable primary standards of PRESSURE and VACUUM for use in all calibration environments.

The tester consists of a precision piston/cylinder (PCU) assembly of known effective area mounted onto a rigid aluminum baseplate. Stainless Steel weights of known mass are mounted onto the PCU assemblies and are balanced by either pressure or vacuum (generated by integral pump) until they "float" and spin freely thus generating a known pressure. A pressure gauge to monitor system pressure and control valve to adjust and release pressure are mounted to the case. The DWT can be leveled by means of four adjustable feet and a spirit level.

The set of non-magnetic weights is conveniently stored on the case and the tester comes complete with a set of "quick-fit" adaptors and seals for easy mounting of the items under test to the Deadweight Tester.

A list of standard and optional accessories is shown in Table 2 on page 7.

There are basically two models available:-

MODEL 6000L ...PRESSURE ONLY

See Table 1 below for pressure ranges and model numbers.

MODEL 6100L ...VACUUM CONVERSION KIT CONVERTS MODEL 6000L FOR VACUUM USE.

CAUTION: TO AVOID DAMAGE TO INSTRUMENTS UNDER TEST:

1. DO NOT apply positive pressure to a Vacuum instrument.
2. DO NOT apply vacuum to a positive Pressure instrument.

ORDER CODE NO.	PRESSURE RANGE	NO. OF WEIGHTS PER SET
6000L-1	10 to 1000 mbar	15
6000L-2	0.3 to 30 inHg	11
6000L-3	7.6 to 760 mmHg	14
6000L-4	4 to 400 inH ₂ O	15
6000L-5	100 to 10,000 mmH ₂ O	

TABLE 1

Other units available upon request.

INSTALLATION OF 6000L DEADWEIGHT TESTER

1. Refer to Figure 1 (on page 4) of this manual.
2. Level the Deadweight Tester by adjusting the four leveling feet (8) to the spirit level placed on the weight carrier (3).
3. Select the correct "quick-fit" adaptor from the selection provided to suit the item(s) to be tested.
Before fitting it ensure that the item(s) to be tested is / are internally clean. If oil, water, chemicals or dirt of any kind are sucked into the Deadweight Tester from contaminated instruments of the PCU assemblies may be seriously damaged.
4. Fit the "quick-fit" adaptor to the item(s) to be tested using an appropriate seal from the selection provided and tighten with a suitable spanner.
5. Fit the item(s) under test to the Test Station(s) (7). Screw all the way down by hand only, no spanners are necessary.
6. Select pressure using the pressure / vacuum selector (9).
7. The item(s) is/are now ready for test.

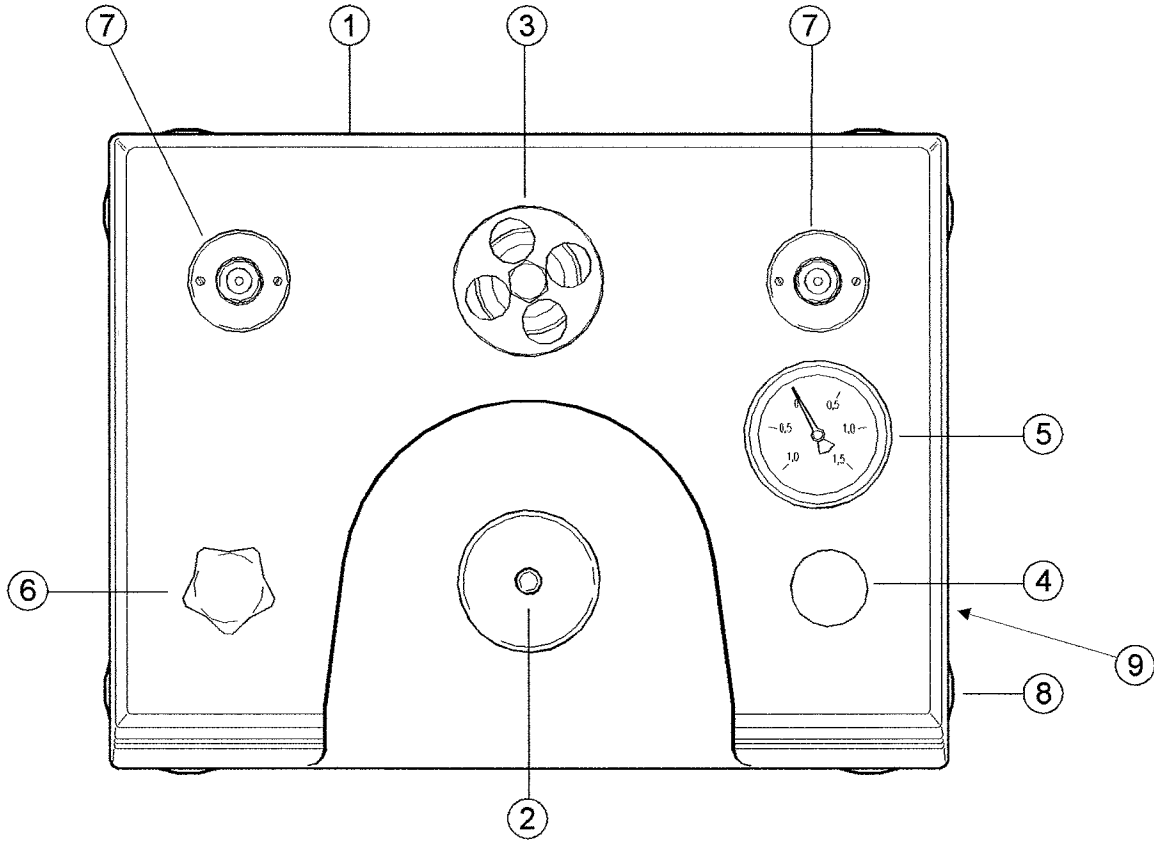
OPERATING PROCEDURE FOR 6000L DEADWEIGHT TESTER

1. Close Valve (6) fully clockwise.
2. Select the weights for the required pressure and place them onto the weight carrier (3). **THE PRESSURE GENERATED WILL BE THE SUM OF THE PRESSURES MARKED ON THE WEIGHTS PLUS THE PRESSURE MARKED ON THE WEIGHT CARRIER.**
3. Apply pressure to the system with the pump (4) until the weights start to rise. The weights should float at approximately Mid-travel of the PCU assembly. IF the weights are too high or against the travel stop, open Valve (6) anti-clockwise VERY SLOWLY and then close again quickly to lower the weights to their correct position. The approximate pressure in the system is indicated by the monitor gauge (5).
4. Spin the weights clockwise by hand at approximately 60 rpm and maintain the "floating" condition using valve (6) and pump (4).
5. To increase pressure add the required weights to the weight stack and repeat the procedure as above. **WEIGHTS SHOULD NOT BE ADDED OR SUBTRACTED WHILE THE WEIGHT STACK IS STILL SPINNING.**
6. To decrease pressure remove weights as required then SLOWLY open Valve (6) until the weights fall to mid float once more and close the valve quickly again. Spin the weight stack and maintain the "floating" condition as before.

IMPORTANT

1. DO NOT rotate the weight stack while against the top or bottom travel stops.
2. ALWAYS add and remove weights carefully.
3. DO NOT rapidly increase or decrease pressure in the system.

Failure to observe the above precautions could result in serious damage to the PCU assembly.



**FIGURE 1
LAYOUT OF 6000L DEADWEIGHT TESTER**

ITEM	DESCRIPTION
1.	Model 6000L Deadweight Tester
2.	Weight Storage
3.	Weight Carrier
4.	Pressure/Vacuum Pump
5.	Monitor Gauge
6.	Pressure Release Valve
7.	Test Stations
8.	Leveling Feet
9.	Pressure/Vacuum Selector

INSTALLATION OF MODEL 6100L VACUUM CONVERSION KIT

1. Refer to Figure 2 on page 6 of this manual. Unscrew and remove the PCU/Carrier assembly from its station (take great care not to touch the polished surface of the piston with fingers).
2. Fit the Vacuum Conversion assembly to the station ensuring the 1/2" BSP bonded seal is in position, and tighten. Position the assembly as required and then tighten the fixing screw by hand.
3. Load the weight set onto the Vacuum Kit as shown.
4. Turn the PCU/Carrier assembly upside down and fit to the vacuum kit with the 1/2" BSP bonded seal supplied and tighten.
5. Close Valve (5) gently fully clockwise.
6. Level the Deadweight Tester by adjusting the four leveling feet (7) to the spirit level placed on the weight carrier.
7. Select the correct "quick-fit" adaptor from the selection provided to suit the item(s) to be tested. **Before fitting it ensure that the item(s) to be tested is/are internally clean. If oil, water, chemicals or dirt of any kind are sucked into the Deadweight Tester from contaminated instruments the PCU assemblies may be seriously damaged.**
8. Fit the "quick-fit" adaptor to the item(s) to be tested using an appropriate seal from the selection provided and tighten with a suitable spanner.
9. Fit the item(s) under test to the Test Station(s) (6). Screw all the way down by hand only, no spanners are necessary.
10. Select Vacuum using the pressure/vacuum selector (9).
11. The item(s) is/are now ready for test.

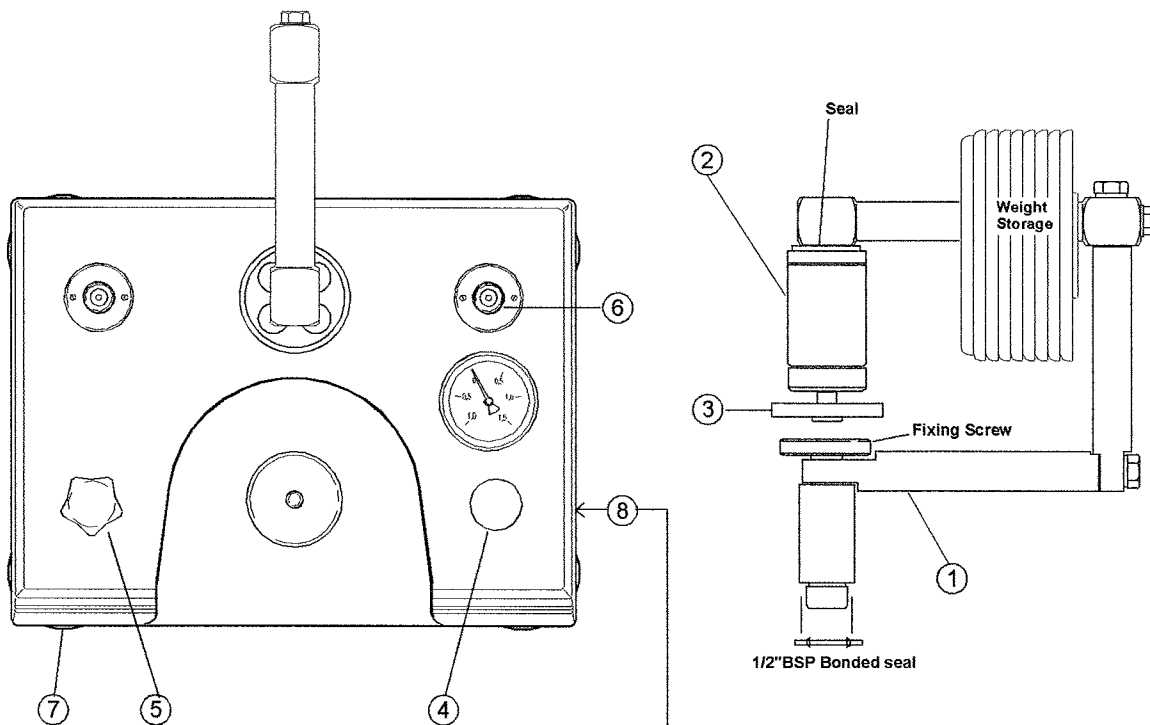
OPERATING PROCEDURE FOR TYPE 6100L DEADWEIGHT TESTER

1. Close valve (5) fully clockwise.
2. Select the weights for the required Vacuum and place them onto the weight carrier (3). **THE VACUUM GENERATED WILL BE THE SUM OF THAT MARKED ON THE WEIGHTS PLUS THAT MARKED ON THE WEIGHT CARRIER.**
3. Apply vacuum to the system with the pump (4) until the weights start to rise. The weights should be at approximately mid-travel of the PCU assembly. If the weights are too high or against their travel stop, open Valve (5) anti-clockwise VERY SLOWLY and then close again quickly to lower the weights to their correct position.
4. Spin the weights clockwise by hand at approximately 60 rpm and maintain the "floating" condition using the pump (4) and valve (5).
5. To increase vacuum, add the required weights to the weight stack and repeat the procedure above. **WEIGHTS SHOULD NOT BE ADDED OR REMOVED WHILE THE WEIGHT STACK IS STILL SPINNING.**
6. To decrease vacuum, remove weights as required. Open Valve (5) SLOWLY until the weights fall to the required position once more. Spin the weight stack and maintain the "floating" condition as before.

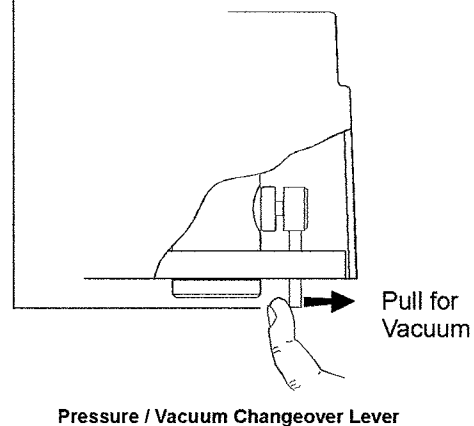
IMPORTANT

1. DO NOT rotate the weight stack while against the top or bottom travel stops.
2. ALWAYS add and remove weights carefully.
3. DO NOT rapidly increase or decrease Vacuum in the system.

Failure to observe the above precautions could result in serious damage to the PCU assembly.



ITEM	DESCRIPTION
1.	Vacuum Adapter
2.	PCU Assembly
3.	Weight Carrier
4.	Pressure / Vacuum Pump
5.	Pressure Release Valve
6.	Test Station
7.	Leveling Feet
8.	Pressure/Vacuum Selector



**FIGURE 2
LAYOUT OF MODEL 6000L WITH 6100L CONVERSION KIT FITTED**

Note: Maximum Vacuum generated: -900 mbar

**TABLE 2
ACCESSORIES**

ITEM	DESCRIPTION
STANDARD ACCESSORIES FOR 6000L DWT	
1	Certificate of Accuracy for Deadweight Tester
2	Certificates of Test and Inspection for Deadweight tester PCU Assemblies
3	User Manual (this manual)
4	Set of Stainless Steel, BSP Adaptors (quick-fit type)
5	Set of various seals to suit adaptors above
6	Spirit Level
7	Set of non-magnetic Stainless Steel Weight
8	Dust Cover
OPTIONAL ACCESSORIES	
8	6100 Vacuum Conversion Kit comprising of Vacuum adapter housed in a plastic carrying case.
9	Conversion Weight Set (PRESSURE) Converts any specified Deadweight Tester for use with any alternative unit of pressure.
10	Incremental Weight Set Allows smaller increments of pressure to be generated and measured.
11	Set of four Stainless Steel, NPT Adaptors. Part No. DW6127. (quick-fit type).
12	Aluminum Carrying Case

CARE AND MAINTENANCE

Deadweight Testers are precision instruments and must be treated accordingly. For maximum and lasting efficiency, the working parts must be kept free from dirt and dust of all kinds.

NOTE: ALWAYS REPLACE DUST COVER WHEN MACHINE IS NOT IN USE.

The PCU assemblies must be kept perfectly DRY AND POLISHED, in this condition they will spin and "float" freely. When they do require re-polishing, use a soft, lint free cloth such as a camera lens cloth/cleaner. Great care must be taken!

WARNING:

1. DO NOT touch polished surface with fingers.
2. Avoid using solvents where possible.
3. NEVER use abrasives of any kind.

Release valve must only be closed "finger" tight otherwise the tapered seats may become permanently damaged.

A Spares Kit (part No. DWSK6000L) consisting mainly of seals, is available for routine maintenance.

RE-CALIBRATION AND OVERHAUL

We recommend that our Deadweight Testers should be overhauled and re-calibrated on a regular basis. The period between overhaul/re-calibration obviously depends on frequency and conditions of use but we consider the minimum to be 1 YEAR and the maximum to be 3 YEARS.

When ordering spares or requiring information on SI-BARNET Deadweight Tester please quote.

PRESSURE CORRECTIONS

Pressure correction is required for high accuracy work and is due to the effects of pressure on the PCU assembly during operation. By reference to the certificate of calibration provided the actual pressure in the system can be obtained. All values relate to the environmental conditions stated on the certificate.

The pressure in the system when the carrier is loaded with major weights can be read directly from the second column of the certificate.

The pressure in the system when the carrier is loaded with incremental weights is given together with the pressure in the system when the carrier is loaded with major and incremental weights. From these values, assuming effects are linear, the incremental weight corrections over the range may be calculated.

If the DWT is located at a position where the values of the gravitational acceleration and temperature of the operation are the same as those values specified for calibration, then the Actual Pressure is fully corrected. If the DWT is used under different conditions then further correction is necessary (see Figure 3). The reference level is specified on the certificate.

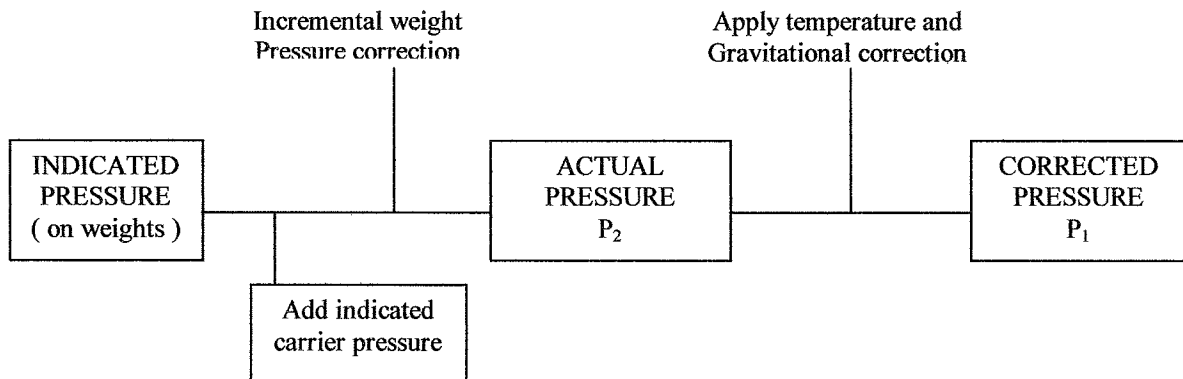


FIGURE 3
PRESSURE CORRECTIONS

Temperature and Gravity Corrections

Deadweight testers are manufactured to give an accurate pressure reference at the specified temperature and gravity values indicated on the certificates. The following Standard Values are applied during calibration unless otherwise requested during manufacture (see Certificate).

Standard Gravitational acceleration (G)	9.80665 m/s ²
Standard Temperature (T)	20°C

$$P_1 = P_2 \left(1 + (T - t) \frac{g}{G}\right)$$

Where:

P_1	= Corrected Pressure
P_2	= ACTUAL PRESSURE
α	= Coefficient of Linear Expansion (The value for a specific piston/cylinder assembly (PCU) is shown on the Calibration Certificate)
T	= DWT calibrated temperature (°C)
t	= Temperature at position of DWT (°C)
g	= Gravitational acceleration at position of DWT
G	= DWT calibrated gravitational acceleration

The value of gravitational acceleration (g) varies with latitude, height above sea level and geological conditions at the location of the DWT. When the gravitational acceleration varies from that for which the DWT was calibrated, the above correction must be made. The local value of gravitational acceleration (g) can be obtained as follows:

Data from the appropriate geophysical authority

Approximated from the Nomogram (Figure 4)

Calculated from the formula:

$$g = 9.7803184 \left(1 + 0.0053024 \sin^2 L - 0.0000059 \sin^2 2L\right) - 0.0000038086 H$$

Where:

L = geographical latitude, H=height above sea level in meters and units of g are m/sec²

Height Corrections

Tests carried out at locations other than the test stations may require corrections for fluid heights. The pressure exerted by a column of fluid 25.4 mm high will not exceed 0.0025 bar using the recommended fluids.

Explanation of Nomogram
 A straight line passing through the known values of altitude (H) and latitude (L) of the site of the DWT, when extended to scale "g", will indicate the approximate value of "g".

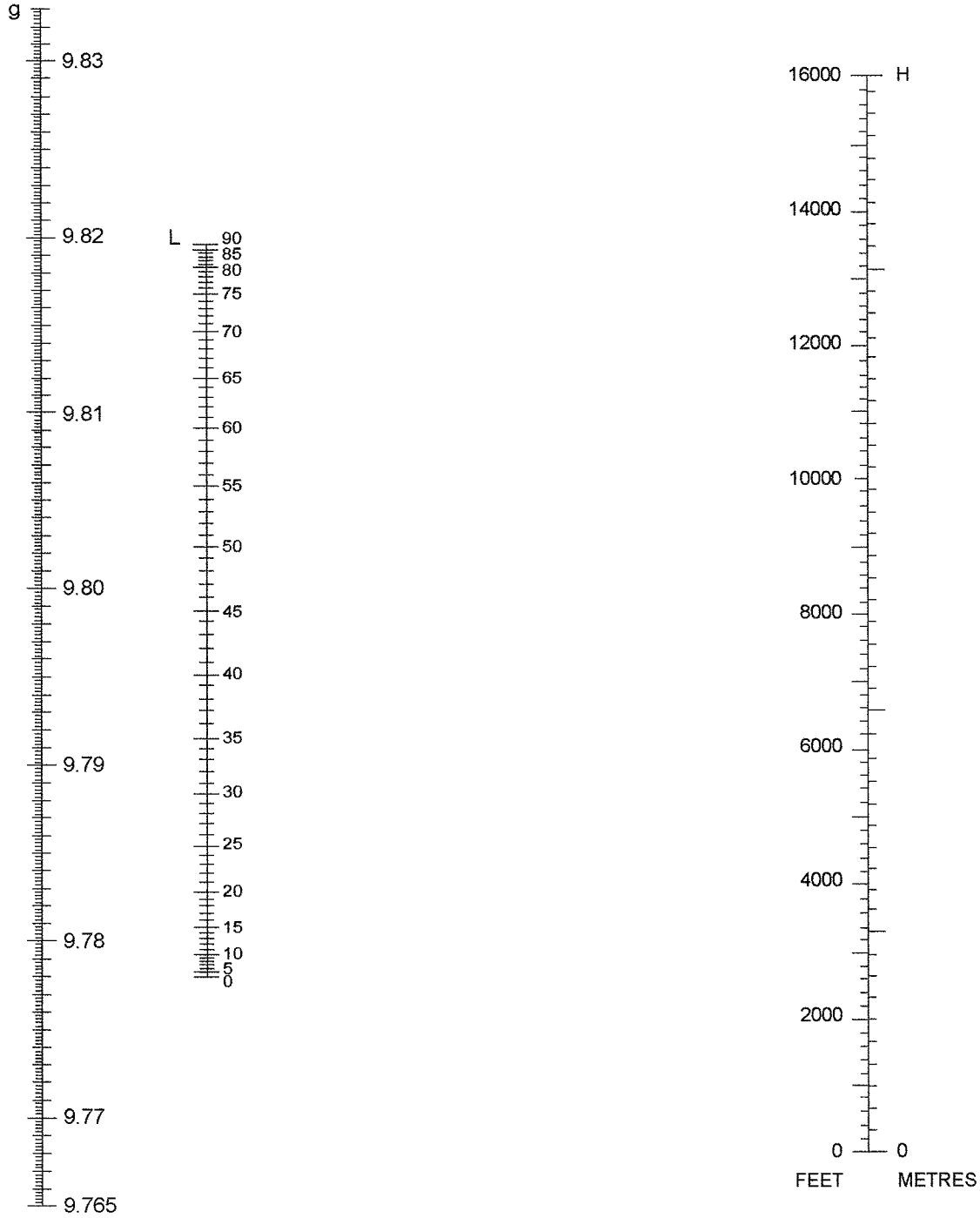


FIGURE 4
NOMOGRAM FOR FINDING THE VALUE OF "G" FROM ALTITUDE AND LATITUDE