

MANUAL



Nagman[®]
HYDRAULIC DEAD WEIGHT TESTERS

H3000N / H6000N / H6600N / H6900N / H6990N
SERIES

BRIEF PROFILE



An ISO 9001-2015 certified Instrumentation company (since 1972) serving Industries in India & Worldwide thro' the Manufacture & Supply of World-Class Calibration Instruments & Systems like Temperature, Pressure & Signal Calibrators, Black Body Calibration Sources, Pneumatic & Hydraulic Hand Pumps, Dead Weight & Comparison Testers, Calibration Test Benches, etc.

Dear User,

*Thank you for selecting **Nagman's Hydraulic Dead Weight Testers** and becoming a proud owner of this Calibration Instrument.*

We have strived hard to ensure the accuracy of the contents of this manual. We would appreciate any suggestions/feedback to correct any errors noticed and to improve the quality of contents of this Manual

Specifications are subject to change owing to continuous development and we reserve rights to effect Changes / Modifications to this Manual.

Read the Instructions before starting to use the Product.

Wishing you for a long association with us.

For any service related issues, please contact service@nagman.com

VERSION CONTROL

Version No.	Updated on	Updated by
V 1.1	01.09.2022	Nagman

CONTENTS

S.No.	Description	Page No.
1.	Introduction	5
2.	Specification.....	7
3.	Standard Delivery & Optional Accessories	10
4.	Parts Identification.....	12
5.	Connection Diagram	13
6.	Safety Instruction	14
7.	Operating Instructions	16
8.	Troubleshooting / Maintenance.....	20

1. INTRODUCTION

Nagman's Dead Weight Testers (DWT) Series H3000N / H6000N / H6600N / H6900N / H6990N provides facility for testing pressure indicating instruments for calibration accuracy.

The design uses the piston gauge principle in which an applied pressure within the system balances a known mass applied to a piston of known effective area.

In the comparison mode the Dead Weight Tester can be used to compare the readings of a test instrument directly with that of standard instrument.

All units have top loading facility for ease of use and weight sets are fully interchangeable.

DWT Model code Identification:

H	ABCD	N	EF	GHIJ	K
----------	-------------	----------	-----------	-------------	----------

H : Hydraulic

ABCD : Indicates Model Number
(3000 / 6000 / 6600 / 6900 / 6990)

N : Indicates Bellow Type

EF : Indicates No. of Piston – Single (SP) or Dual (DP)

GHIJ : Indicates Instrument Range (1000 / 1200)

K : Indicates Calibration Unit
(1 – bar, 2 – Kg/cm², 3-Psi, 4-KPa)

Model	Accuracy
H3000N	±0.1% of reading
H6000N	±0.05% of reading
H6600N	±0.025% of reading
H6900N	±0.015% of reading
H6990N	±0.01% of reading

Typical :

H6600N-DP-1200-1 refers to :

- H : Hydraulic
- 6990 : ±0.025 % of reading (Accuracy)
- N : Bellow Type
- DP : Dual Piston
- 1200 : Range
- 1 : bar

2. SPECIFICATION

Range	Upto 1200 bar
Piston	Single / Dual
Standard Accuracy	$\pm 0.1\%$ / $\pm 0.05\%$ / $\pm 0.025\%$ / $\pm 0.015\%$ / $\pm 0.01\%$ of Reading
Standard Corrections	Gravity : 9.80665 m/s^2 Temperature: 23°C Air Density: 1.2 Kg/Cm^2
Pressure generation	Thro' Priming Pump & Screw Ram
Weight (approx.)	Instrument : 19 Kg. Weight Sets : 8 to 33 Kg. (Refer Datasheet)
Number of weights	12 -15 (depends on model)
Dimension (LxWxH)	600×500×360 mm
Operating Fluid	Oil

Model	Accuracy	PCU	Weight Set	Certification	Remarks
H3000	±0.1% of Reading	Tungsten Carbide Piston & Matching Cylinder	Mild Steel or Non-Magnetic Stainless Steel	Overall Accuracy	Traceable to ISO/IEC 17025:2017 Accredited Calibration Lab
H6000	±0.05% of Reading	-do-	Non-Magnetic Stainless Steel	-do-	-do-
H6600	±0.025% of Reading	-do-	-do-	Overall Accuracy + PCU (Area) + Weights (Mass)	Issued by NABL ISO/IEC 17025:2017 Accredited Lab
H6900	±0.015% of Reading	Tungsten Carbide Piston & Matching Hardened Cylinder	-do-	-do-	-do-
H6990	±0.01% of Reading	Tungsten Carbide Piston & Matching Hardened Cylinder	-do-	-do-	-do-

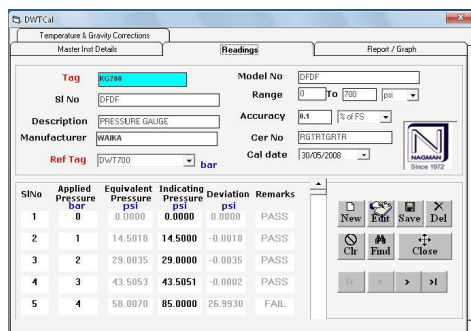
Piston Type	Piston Model	Pressure Ranges		
		1 / bar	2 / Kg/Cm ²	3 / psi
Single	SP-35	0.5 to 35	0.5 to 35	10 to 500
Single	SP-70	0.5 to 70	0.5 to 70	10 to 1000
Single	SP-100	5 to 100	5 to 100	75 to 1500
Single	SP-160	5 to 160	5 to 160	75 to 2500
Single	SP-350	5 to 350	5 to 350	75 to 5000
Single	SP-600	10 to 600	10 to 600	150 to 9000
Single	SP-700	10 to 700	10 to 700	150 to 10000
Dual	DP-160	1 to 160	1 to 160	15 to 2500
Dual	DP-350	1 to 350	1 to 350	15 to 5000
Dual	DP-600	1 to 600	1 to 600	15 to 9000
Dual	DP-700	1 to 700	1 to 700	15 to 10000
Single	SP-1000	10 to 1000	10 to 1000	150 to 15000
Single	SP-1200	10 to 1200	10 to 1200	150 to 18000
Dual	DP-1000	1 to 1000	1 to 1000	15 to 15000
Dual	DP-1200	1 to 1200	1 to 1200	15 to 18000

Dead Weight Tester Software - DWTCal

(Standard supply for Models H6600/H6900/H6990 only)

*Pressure Calculation,
Correction &
Certificate Generation
Software for Precision
Dead Weight Testers*

*Flexible Working Tool
for Easier, Quicker &
More Accurate
Calibration.*



3. STANDARD DELIVERY & OPTIONAL ACCESSORIES

S.No.	Description	H3000	H6000	H6600	H6900	H6990
1	Basic Instrument	✓	✓	✓	✓	✓
2	Set of Weights - S.S. (M.S. for H3000 series only - Optional)	✓	✓	✓	✓	✓
3	Operating Fluid (500 ml)	✓	✓	✓	✓	✓
4	"O ring" & Spare seals.	✓	✓	✓	✓	✓
5	Dust cover, wooden carrying case (for weight sets)	✓	✓	✓	✓	✓
6	Traceable Calibration Certificate	✓	✓	✓	✓	✓
7	Instruction manual	✓	✓	✓	✓	✓
8	Full set of Adaptors consisting of 1/8", 1/4", 3/8", 1/2" BSP (Set of NPT Adaptors available on request)	★	✓	✓	✓	✓
9	Pointer Puller / Punch	★	✓	✓	✓	✓
10	Spanners Set & Screw Drivers	★	✓	✓	✓	✓
11	Spirit Level	✓	✓	✓	✓	✓
12	Calibration Certificates issued in Accordance with our Scope as granted by NABL per ISO/IEC 17025:2017 Standards	★	★	✓	✓	✓

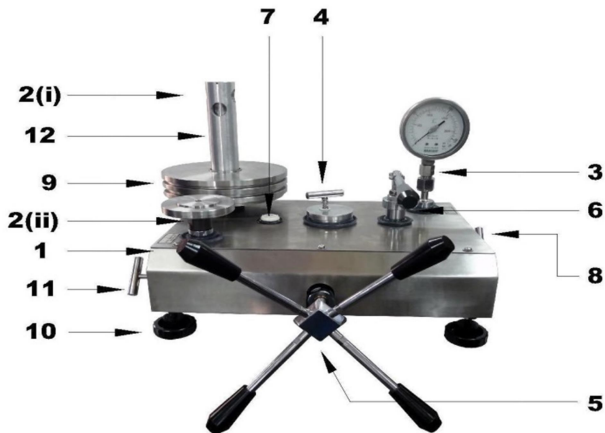
S.No.	Description	H3000	H6000	H6600	H6900	H6990
13	DWTCal Calibration Software	×	★	★	✓	✓
14	Two gauge adaptor & Right angled adaptor	★	★	★	★	★
15	Conversion Weight Sets to convert from one unit of Pressure to another	★	★	★	★	★
16	Incremental weight sets for smaller increments of pressure	★	★	★	★	★
17	Motorized Version	★	★	★	★	★

✓ *Standard Delivery*

★ *Optional Item*

× *Not Available*

4. PARTS IDENTIFICATION (Typical Photo)



The Dead Weight Tester comprises of...

1. Instrument Housing
2. (i) High piston assembly
(ii) Low piston assembly
3. Test port $\frac{1}{2}$ " BSP (F) (Swivel Adaptor)
4. Fluid reservoir with needle valve
5. Ram system
6. Priming pump
7. Spirit level
8. Isolating valve
9. Weight Sets
10. Leveling Adjustment Legs
11. Low Piston Isolating Valve
12. Weight Carrier (Bellow)
13. Weight Carrying Case



13





5. CONNECTION DIAGRAM (Typical Photo)



1. Master / Reference Measurement
2. Unit Under Test

Note : Accessories viz. Gauge / Indicator / Adaptors shown in photo are not part of standard supply.

6. SAFETY INSTRUCTIONS

S. No.	Symbol	Description
1		Read the user manual before operating the instrument.
2		Warning - conditions that may pose hazards to the user.
3		Caution-conditions that may damage the instrument.
4		Special Information



- Do not remove the piston from the adaptor when pressure is applied.
- Do not touch piston-operating surfaces (they could get damaged).
- Do not leave the unit in open condition when not in use.



Do not suddenly open the reservoir needle valve when the unit is under pressure & while the weights floating and spinning, it may lead to the piston pin damage.

7. OPERATING INSTRUCTIONS

Priming

- Open the oil reservoir needle valve & cover (4)
- Rotate the RAM (5) in anti-clockwise direction
- Open the isolating valve (8).
- Operate the priming pump (6) and allow the air bubbles trapped in the fluid got released through the reservoir.
- Rotate the RAM in clockwise and in anti-clockwise direction and ensure that no air bubbles come out of the reservoir.
- Fix the reservoir cover/spring/needle valve with the tank.

Test Procedure

- Connect the test gauges on the test port with suitable adaptors.
- Ensure that the priming operation has been carried out.

Low Pressure Piston Mode:

- Place the base weight (Low) carrier on top of the piston (2ii) pin.
- Apply initial pressure using priming pump and close the isolating valve.

- Rotate the RAM screw in clockwise direction to the required pressure for calibration.
- Select correct weight (10) according to the range of the instrument under test & place it on the weight carrier.
- Apply the pressure (using RAM) until the weight floats & stop at the mark on the piston.
- Rotate the weights gently by both the hands in clockwise direction.
- While weights floating and spinning, the pressure generated in the test port will be the pressure marked on the weights & balances pressure on the weight carrier.
- Increase or decrease pressure by operating the RAM in clockwise or anti-clockwise.
- To reduce the pressure to zero, operate the RAM fully anti-clockwise and open the isolating valve & oil tank valve and simultaneously remove the weights from the weight carrier, one by one slowly.
- Remove the instrument under test.

High Pressure Piston Mode

- Repeat the same procedure, as followed for Low Pressure Piston Mode.

Correction Factors

The dead weight tester has been calibrated to the gravity, Temperature and air density stated on the certificate.

The following correction factor has to be applied if the Dead weight tester is operated in the environment conditions apart from the conditions stated in the certificate.

Temperature and Gravity Correction:

The value of gravitational acceleration (g) varies with latitude, height above sea level and geological conditions at the location of the DWT.

The following standard values are applied during calibration unless otherwise requested by customer for special values.

Standard Gravitational
Acceleration (G) : 9.80665 m/s²

Standard Temperature (T) : 20°C

DWT calibrated
gravitational acceleration (g) : 9.78244215 m/s²

Thermal expansion of
piston and cylinder unit (a) : 20 ppm/°C

$$P_1 = P_2 (1 + a (t - T)) * g/G$$

Where:

P_1 : Corrected Pressure

P_2 : Applied Pressure

a : Thermal expansion of piston and cylinder unit

T : DWT calibrated temperature °C

t : Temperature at position of DWT °C (Room Temperature)

g : Gravitational acceleration at position of DWT (Site Gravity)

G : DWT calibrated gravitational acceleration

For Example:

Weight Applied: 100 bar

$$P_1 = P_2(1+a(t-T)) * g/G$$

$$P_1 = 100(1+0.00002(27-20)) * (9.78244215/9.80665)$$

$$P_1 = 100(1+0.00002(7)) * (0.997531486)$$

$$P_1 = 100(1+(0.00014)) * (0.997531486)$$

$$P_1 = 100(1.00014) * (0.997531486)$$

$$P_1 = 100 * 0.9976711404$$

$$P_1 = 99.76711404$$

8. TROUBLESHOOTING / MAINTENANCE

Unable to do priming

- Check whether the reservoir needle valve is closed.
- Check whether there is sufficient fluid in the reservoir.
- Check whether the isolating valve is open

Pressure not developing

- Ensure for the correct position of reservoir needle valve and the isolating valve during priming.
- Check instrument under test is not leaking.
- Check for fluid leak by applying pressure. Wherever fluid appears & found traces of fluid, replace the seal. Check sealing faces are clean and undamaged before re-assembly.

If fluid is traced near the RAM, replace the 'O' ring in the RAM spindle by following the below instructions.

- Unscrew the collar nut and take out the RAM spindle.
- Check the 'O' ring present in the quill (which is in end of the RAM spindle).
- If the 'O' ring is damaged, replace with the new one.
- Re-assemble the parts in the reversed order

Maximum pressure is not attained (even though the RAM screw is turned fully in).

Probable reasons may be due to occurrence of Airlock in the priming pump. Release the air lock by following below instructions:

- Ensure correct level of oil in the reservoir.

- Remove the priming pump along with the pulling rod assembly by loosening the lock nut and stud nut which in turn consists of 'O' rings (2 Nos) and Teflon bush.
- Pour the fluid in the vertical sleeve of the priming pump.
- Re-assemble the parts in the reversed order.
- Perform the priming operation.

Maintenance

- The DWT has been designed for minimal maintenance. Routine maintenance entails that the equipment is kept free from dirt and dust. Repair maintenance is limited to self-evident replacement of seals, fluid and felt pads.
- Oil should be changed periodically if the oil becomes rust.

Service & Recalibration

The Dead Weight Tester's accuracy mainly depends on the effective area of the piston and the mass of the weights.

The dead weight tester should immediately be overhauled and recertified if either:

- Piston performance degrades (Spin, Sensitivity, drop rate).
- The weights are damaged.

The recalibration frequency of the dead weight tester depends on the usage. Generally for laboratory use, the suggested recalibration frequency is one year.

Returning Instrument for Service

When returning the instrument to the manufacturer for service, please provide complete information about the problems faced for clear analysis of the problem. The calibrator should be returned in the original packing.

Nagman's liability ceases if :

- Parts are replaced / repaired using spare parts which are not identical to those recommended by the manufacturer.

Nagman's liability is restricted to errors that originated from the factory.

For more details, write to :

**NAGMAN INSTRUMENTS AND ELECTRONICS
PRIVATE LIMITED**

170/1a2, Chennai Bangalore Highway Road,
Sembarambakkam, Chennai - 600 123. INDIA.

Phone: +91-44-66777000, 011, 022, 033

Email: support@nagman.com

Website : www.nagman.com