



CV series: Deadweight Tester

Operating Manual

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I: Usage

The deadweight tester is used for the high-accuracy pressure measurement and calibration.

II: Features of Structure

Features:

- a. Because of the tungsten carbide material of the whole piston system, the deformation error and additional temperature error are both extremely small. It can keep the right size of the piston system for a long term.
- b. Work medium: If the pressure of the gauge is more than 25MPa: the medium is diisooctyl sebacate and the CSt (when 20°C) is 20~25mm²/s, which is much smaller than the medium- ricinus oil of the common pressure gauge (its CSt is: 900-1100 mm²/s). Thus, the sensitivity is improved and also the measurement range is increased a lot. This tester is composed by three parts: calibration pump、 measurement system、 masses.
- c. Calibration pump includes pressurizer、 oil cup. The fast-joint is installed on the gauge base, which is used for connecting the tested precision pressure gauge.

III: Main Technical Parameters

1. Uncertainty of Measurement:

In the environment of $20 \pm 2^\circ\text{C}$ (The temperature fluctuation is less than 0.5°C), please see the measurement uncertainty as shown in the table below:

Accuracy	Maximum Permissible Error	
0.05%	±0.05% of lower limit of the measurement range (when the pressure is below lower limit of the measuring range)	±0.05% of actual measurement range (when the pressure is within the measuring range)

Main Parameters List

Model			CV-6T	CV-60T	CV-600T
Parameters		Unit	Measurement Range		
			0.04~0.6	0.1~6	1~60
Upper limit		MPa	0.6	6	60
Upper limit		MPa	0.04	0.1	1
Upper limit		MPa	0.6	6	60
Upper limit		MPa	0.04	0.1	1
Nominal area of piston		cm ²	1	0.5	0.05
Chassis & piston	Nominal weight	Kg	0.4	0.5	0.5
	Pressure	MPa	0.04	0.1	1
Specific masses	Nominal weight	Kg	0.1; 0.5	0.5; 2.5	0.5; 2.5
	Pressure	MPa	0.01; 0.05	0.1; 0.5	1; 5
	Quantity	unit	6; 10	4; 11	4; 11
Joint			M20×1.5	M20×1.5	M20×1.5
Weight		Kg	35	60	90
Work medium			Voltage transformer oil or the mixed oil (voltage transformer oil and kerosene oil) when 20°C, the CSt is 9~12mm ² /s; Acid value:≤0.05KOHmg/g.	Sebacate, at 20°C, the CSt is 20~25mm ² /s, Acid value:≤0.05KOHmg/g	

IV: Masses Calculation Formula

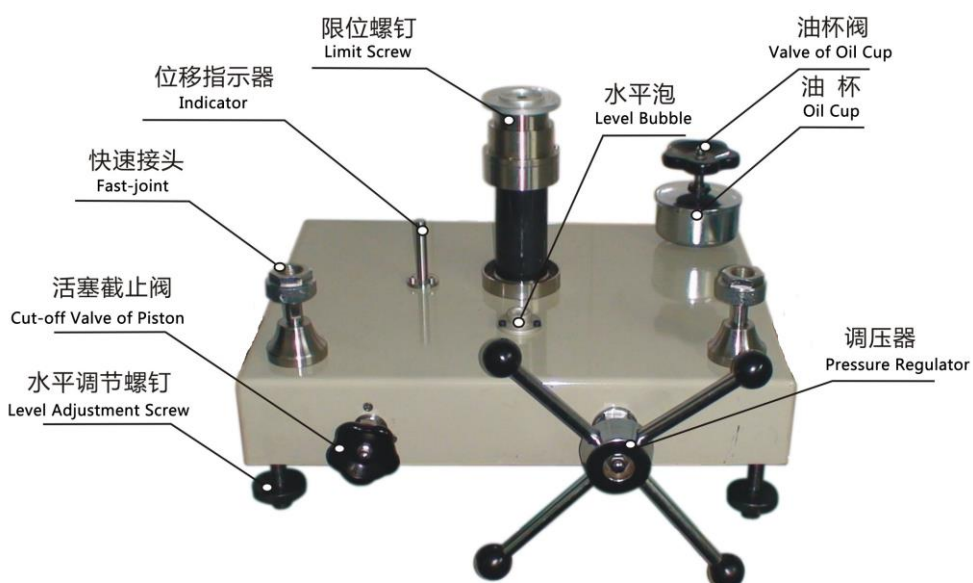
$$m_j = \frac{A_0' p_j}{g} \left(1 + \frac{\rho_a}{\rho_m}\right) [1 + (2j - 1)\lambda p_j]$$

- m_j : The mass of the No. j weight which loaded according to the sequence; kg
- p_j : The pressure of the No. j weight loaded (In the condition of the reference temperature and standard acceleration of gravity): Pa or (MPa)
- A_0' : The effective area of the piston on the piston pressure gauge (in the condition of the 0 pressure and reference temperature): m^2
- g : The user's local gravity: m/s^2

V: Notice of Use

1. The tester should be placed on the strong and vibration-free platform; and the level of the pressure tester should be in the center.
2. The temperature of the working environment should be $20 \pm 2^\circ\text{C}$ (The temperature fluctuation is less than $\pm 0.5^\circ\text{C}$).
3. When pressure range is less than 25MPa, media is mixed oil (transformer oil and kerosene oil), at 20°C , the CSt is $9 \sim 12 \text{mm}^2/\text{s}$; When pressure range is more than 25MPa, media is diisooctyl sebacate.
4. Follow the operation process strictly to operate this instrument.
- 5. Be careful when users load or unload the masses to avoid damaging the piston.**
- 6. When rotating the piston, make sure to operate steadily to avoid damaging the piston rod.**
7. The instrument should be calibrated periodically.

VI: Operation Process



Piston System Installation

Tips: Open the valve - rotate the handle counterclockwise

Close the valve - rotate the handle clockwise

1. Installation of Piston System

Tips: 1) Piston systems of 0.6 MPa and 6 MPa shall be installed according to step a-h;

2) For piston systems of 25MPa and above, loose the plug, screw in piston module and add a hoist (refer to Figure 1). Pay attention to check that the “O”-ring at the measurement base shall be centered before installation.



0.6MPa/6MPa

25 MPa /60MPa/100 MPa

Figure 1

a. Screw out the three stop screws in the pressure gauge with slotted screwdriver, as

shown in the figure above.

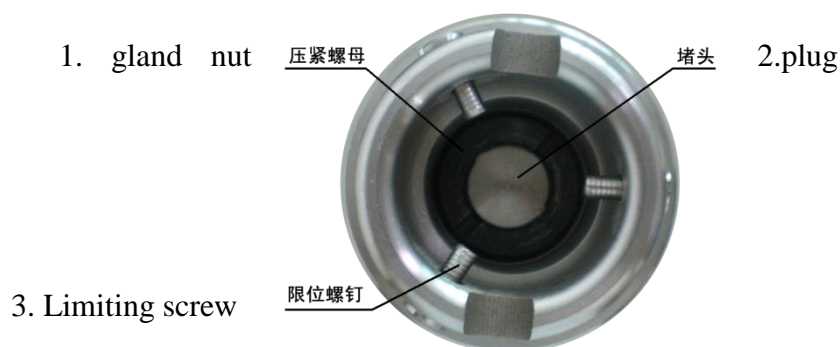


Figure 2

b. Insert the end A of special tool (see Figure 2) into the piston cylinder block (see Figure 3), rotate the tool to make the protruding part entering the gland nut groove, and then rotate the tool counterclockwise to completely separate the gland nut from the piston cylinder block. At this time, lift up the special tool and remove the gland nut. Then insert the end B of special tool into the piston cylinder block, rotate the handle with reticulated mottles counterclockwise to open the tool and thread in the plug, rotate the handle clockwise to clamp the plug, and lift up the tool to remove the plug.



Figure 3

c. Check whether the O-ring is centered in the piston cylinder block (see Figure 4); if

not, place it in the center position.

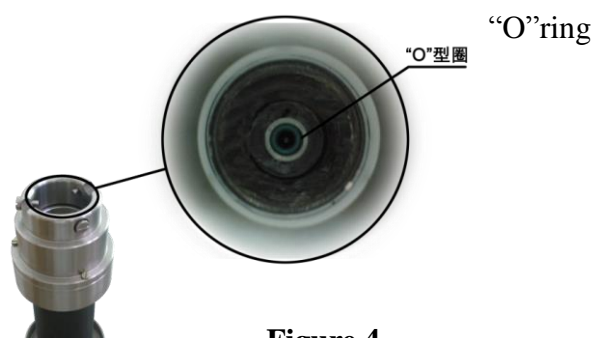


Figure 4

- d. Use clean aviation gasoline to clean the piston and piston cylinder.
- e. Use a special tool to clamp the piston cylinder (with the numbered end upward), and vertically place it inside the piston cylinder block; place the gland nut on tool end A, vertically place it inside the piston cylinder block and rotate clockwise until the gland nut press tightly the piston cylinder.
- f. Pour the clean pressure transmitting medium into the oil cup (2/3 of the oil cup volume is advisable).
- g. Close the piston stop valve, open the valve of oil cup and rotate the regulator out anticlockwise;
- h. Pressurize slowly with pressure regulator and observe whether there are pressure transmitting medium overflow from the piston cylinder; if there are overflowing pressure transmitting medium without bubbles, put the piston slowly insert in the piston cylinder, open the valve of oil cup, and make the piston down to the lowest position and tighten the limiting screw. Then load the weight carrier or the tray



0.6MPa/6MPa



25MPa/60MPa

2. Measurement

- a. Balance Adjustment: adjust the screw until the bubble is in the center of the pressure gauge level.

- b. Calculate the mass of each weight according to the formula.
- c. Pre-heat the thermometer in the work environment for 1~2 hours.
- d. Take off the pressure-release valve and cut-off valve; drain the air by the pre-pressurizing valve, then install the being tested gauge on this pressure tester. .
- e. After reading the first point data, decline the pressure by pressure regulator; until the pressure declining to the lowest position, then add the weight onto the second measuring point, pressurize by regulator until the whole positive measuring completed.
- f. When begin the opposite-turn measurement, still use the regulator to decline the pressure. (During the operation, do not decline the pressure by pressure-release valve as much as possible especially during the high-pressure measuring. This operation can easily damage the piston system).**
- g. When measuring completed, open the pressure-release valve and the shut-off valve; screw in the pressure regulator and close the pressure-release valve, take off the being test instrument and add one plug at the connector.

VII: Maintenance and Repair

1. The testers should be kept clean, pressure and piston rods and piston cylinders are precision parts, which must not be randomly disassembled; other parts should be cleaned regularly. Cleaning and installation must be careful to prevent dirt or cloth fibers from mixing. The pressure gauge cannot be placed in an environment where humidity is too high to avoid rust.
2. The "O" rings under quick connector and the lower end of the piston cylinder are more vulnerable, and should be replaced if there is any leakage.
3. Oil must be filtered, not mixed with impurities or dirt, after a certain period of time, the oil must be replaced with new oil.
4. When the tester is not in use, a dust shield must be covered so that the dust does not enter the pressure gauges.

VIII: Acceptance and Storage

1. When the users receive the instruments, firstly check whether the tester is completed; if any damage, check out the reason.
2. After opening the package of the tester, check out whether the whole document is complete, such as the instruction book, the certificate and so on and check all extra components attached. Any shortage, contact the manufacturer.
3. Pressure Tester should be stored in room and the temperature is around $+5\sim 35^{\circ}\text{C}$, and the humidity should be less than 80%; And make sure there is no other corrosive substance which is harmful for the pressure tester.

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