



C-Tech
Laboratory equipment co.,limited

VANE SHEAR APPARATUS AS-1

PRODUCT MANUAL



C-TECH LABORATORY EQUIPMENT CO., LTD

📍 Building C28, Hegu Technology Industrial Park, Development Zone,
Zhuozhou, Hebei, China

☎ +86-312-3868016/3852880

📠 +86-312-3868882

🌐 www.testmould.com


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I. Description

The vane shear tester is an instrument used to measure the natural shear strength of saturated soft clay on site. For soft clay with higher sensitivity, the intensity is very obvious due to the disturbance of soil sampling and sample preparation. Therefore, the strength index closer to the actual can be obtained by using this instrument.

Because this instrument measures the strength index in the borehole, it must be used in conjunction with drilling equipment. Generally, various depths within 30 meters can be tested.

II. Technical specifications

Vane size: diameter*height=75*150mm and 50*100mm

Torsion of steel ring: 80N.m

Torsion accuracy: 0.55N.m

Dimensions: Upper length*width*height=430*910*220mm

Lower length*width*height=1000*75*75mm

Accessories guide rod length*diameter=1040*30mm

III. Structure

The instrument uses the worm fixed on the base plate to drive the worm wheel and the vane, to insert the borehole into the soil layer, in order to measure the strength of the soil.

The strength is calculated according to the deformation of the open steel ring fixed on the worm wheel.

The transmission parts are composed of worm, worm wheel, open steel ring, swivel seat, bottom plate and fixed sleeve. The fixed sleeve has locking device, which can be locked with the base.

The base part is composed of a white base seat, guide rod support ring, etc., which is connected with the driving part and the drilling casing. The base and the sleeve are connected with threads (threaded by the user) and tightened with a tightening shaft.



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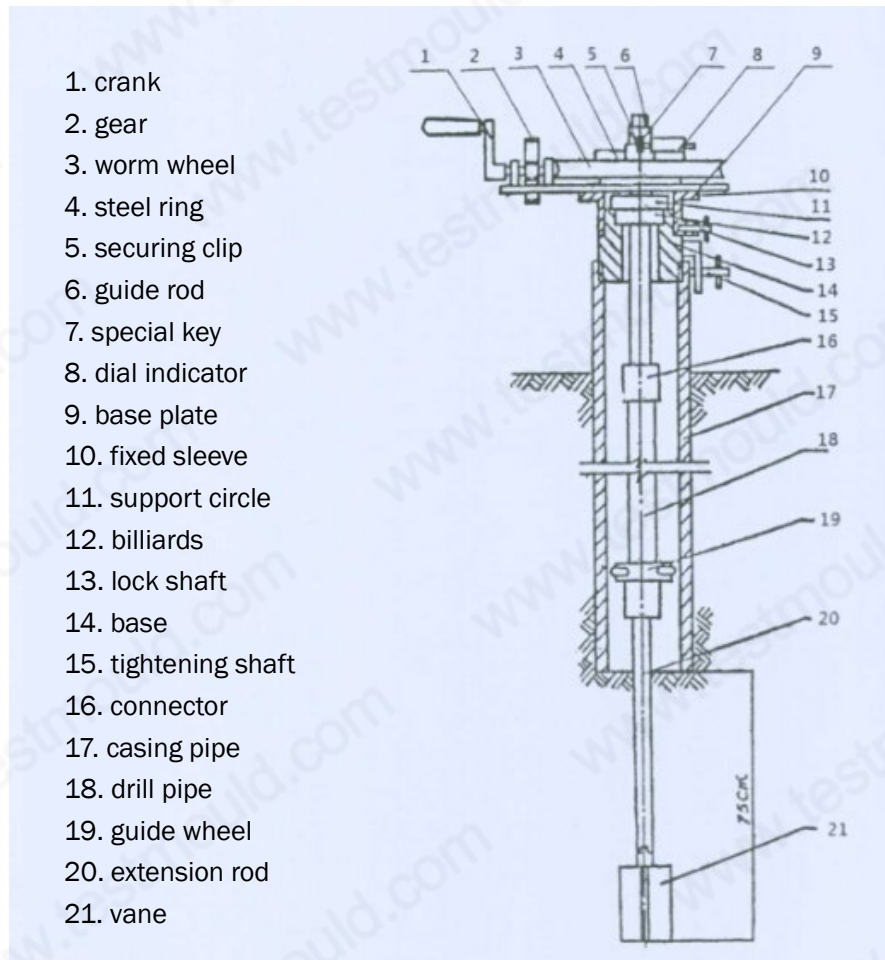
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The vane part is composed of a connecting rod, a clutch tooth and a cross plate. The vane can be freely clutch along the clutch tooth. The vane is connected with the drilling drill pipe, which is connected with the lower end of the guide rod supported on the support ring.

Accessories include guide rod, special key, joint, regulating wheel, wrench and calibration equipment.



IV. Operation

Operating requirement

(1) the instrument must be used with drilling equipment, and the connecting part (with the thread with the casing) should be processed first, generally with $\phi 127$ casing.

(2) The drill pipe is required to be straight, and the outer joint and the regulating wheel can be



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installed are adopted. Generally, the $\Phi 42$ drill pipe is mainly used.

(3) The drilling hole should be vertical, the hole wall should not collapse and protected by casing pipe, and the residual broken soil at the bottom of the hole should be as little as possible.

(4) When the test is carried out in the deep hole, a guide wheel should be installed every 10 meters to prevent the drill pipe from deviating from the center and damaging the vane when pulling out.

operational approach

(1) Press the hole sleeve 75 cm above the test depth to remove residual mud in the hole.

(2) Connect the vane, the connecting rod and the drill pipe into the hole step by step until the vane contacts the bottom of the hole, connect the guide rod, and the joints must be tight.

(3) Put the Crank on the sleeve rod and rotate it slowly to the right to make the vane clutch teeth.

(4) According to the test depth, slowly press down the drill pipe to a slightly higher predetermined depth.

(5) Install the base on the casing pipe and tighten it with a tightening shaft.

(6) Press down the drill pipe until the guide rod teeth are in contact with the claws, and release the claws.

(7) Install the upper transmission part, rotate the bottom plate to make the guide rod keyway and the steel ring fixing clip keyway align, put in the special key, and lock the fixing sleeve and the base with the locking device.

(8) Align pointer to any integer scale, mount dial indicator and adjust to zero.

(9) Rotate the Crank with the right hand, and start the stopwatch with the left hand. Make a revolution every 10 seconds, and record the dial indicator reading once. Generally, the failure can be achieved within 3-10 minutes, and then continue for another minute to obtain the maximum torque value when the original soil is sheared and damaged.

(10) Pull out the special key, put on the Crank and continuously rotate the guide rod for 6 times to completely disturb the soil layer. Then plug in the special key and press the previous (8) and (9) to test again to get the maximum torque value of the damaged soil.



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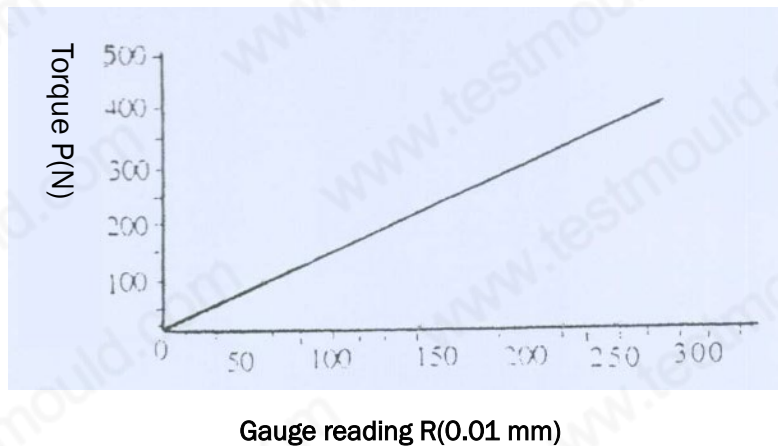
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(11) Lift the guide rod by 10-20 mm to separate the clutch teeth from each other, and still carry out the test according to the previous (8) and (9) to obtain the friction torque value between the shaft and the soil.

(12) Remove the instrument, take out and remove each section of the drill pipe. Take out the vane, clean it and wipe off the water stains. If you no longer use it, apply oil and save it.

Calculation method

(1) According to the measured deformation readings of each steel ring, obtain the corresponding torque value from the curve or the deformation coefficient of the steel ring.



(2) Calculate the shear strength according to the formula $C_u = 10K (P_f - f)$

In the formula: C_u —the shear strength of soil (KPa)

P_f —Torque at shear loss (N)

f —Shaft friction torque (N)

K —a coefficient related to the length of the open steel ring rate timing torsion moment and the size of the cross plate ($1/\text{cm}^2$)

$$K = \frac{2R}{\pi d^2 h \left(1 + \frac{d}{3h}\right)}$$

R—arm length = 20cm



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D-vane diameter = 5.0cm or 7.5cm

(4) Hang a 7.5 Newton weight on the two nylon rope ends at the same time, and record the stable reading of the steel ring.

(5) Add 17.5 Newtons at both ends, and then record the reading.

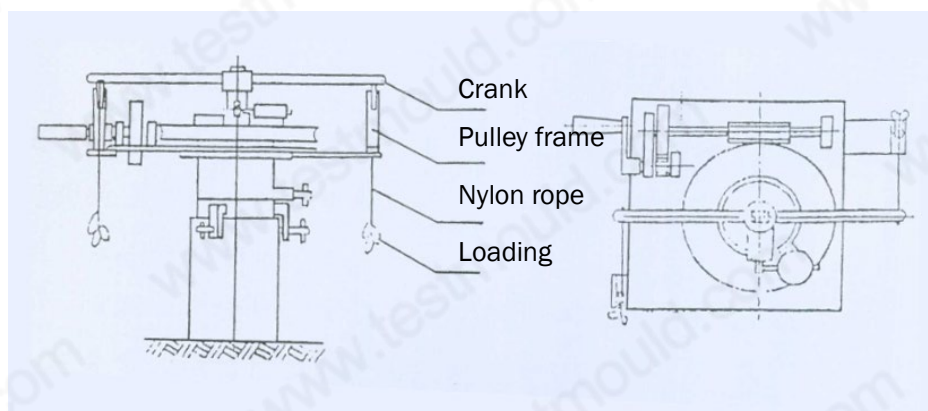
(6) After the two ends, add 25 Newtons step by step, and record the readings until the total weight of each end is 200 Newtons, and stabilize for several minutes.

(7) Unload the load step by step, and record the meter reading after stabilization.

(8) Repeat the above (4)-(7)

(9) Record format

Calibration record of open steel ring of vane shear tester									
Device number					Date				
Arm of force					Calibrated by				
Loading P (N)	Gauge reading R(0.01 mm)								
	First Time		Second Time		Third Time		Average		Remark
	Load	Unload	Load	Unload	Load	Unload	Load	Unload	
0									
15									
.....									
400									



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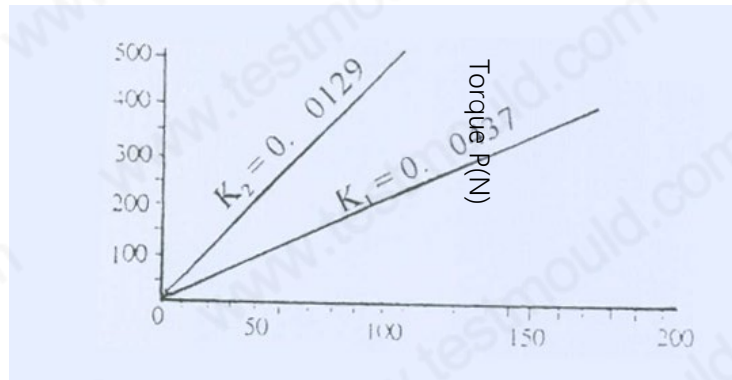
h1-vane height=10cm

h2-vane height=15cm

$K_1=0.0437\text{cm}^2(d=5, h_1=10)$

$K_2=0.0129\text{cm}^2(d=7.5, h_2=15)$

In order to facilitate the calculation, the Cu-P relationship curve is drawn with P as the ordinate and Cu as the abscissa.



Shear strength Cu(Kpa)

According to the deformation of the steel ring, the corresponding torsion value is obtained, and the corresponding shear strength is obtained from the Cu-P curve (or formula).

V. Maintenance

- After the instrument is used, it should be washed, wiped dry, coated with grease to prevent rust, and placed in a special box.
- The rods should not be used to lift objects and must be kept straight.
- Keep all the threads in good condition, and don't damage them.
- The tools used must be suitable, not forced to use, so as to avoid damaging the parts.
- Avoid collision and falling during transportation. It is better to wrap the outside of the box with straw rope.
- The steel ring can be calibrated with accessories before use or at intervals. Calibrate once and compare with the previous one. If any problem is found, send it to the factory for inspection.



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VI. Instrument life

The instrument can be used normally for five consecutive years. The steel ring should be calibrated once every six months. If any abnormality is found, please send it to the factory for inspection and re-calibration.

VII. Instruments and Accessories

Complete set of instruments: transmission part, base part, vane part (1 piece for each of $\phi 7.5\text{cm}$ and $\phi 5.0\text{cm}$ vane).

Accessories

Special key	1 piece	Guide rod	1 piece
Dial indicator	1 piece (self-provided)	Joints (Drill pipe joint roller grain with self-processing)	1 piece
Hook	1 piece	Guide wheel	1 piece
Crank	1 piece	Calibration equipment (load not attached)	1 piece
Wrench (for unloading the vane)	1 piece	Base	1 piece
vane (spare parts) $\phi 7.5\text{cm}$ and $\phi 5.0\text{cm}$	1 piece each		


VIII. The method of steel ring calibration


When using the calibration equipment on site, the load used to apply torsion needs to be prepared in advance. You can use weights, sand, stone and other materials. The calibration sequence is as follows:


(1) Install the instrument base on the casing pipe, fix it properly, and put the transmission parts on it.



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(2) Install the calibration equipment on both sides of the bottom plate, paying attention to the direction not to be wrong.


(3) Install the guide rod and adjust it to an appropriate height. Put on the Crank so that the height of the axis of the Crank is equal to the height of the upper end of the pulley of the calibration device. Pass one end of the nylon rope into the small hole of the Crank and place the other end on the pulley. Adjust the guide rod so that the Crank and the nylon rope are at a right angle, fix the transmission parts, and install a dial indicator to adjust the zero.



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