



Laboratory equipment co.,limited

## CPT-VST Dual-Use Apparatus TPC-3V

# 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](http://www.testmould.com)

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## I. Overview

The TPC-3V CPT-VST Dual-use Apparatus is simple structure, light and handy, don't need power supply, easy to transport, more convenient in the transportation inconvenience and no power supply regions. Applied to soft soil, general cohesive soil and medium density sand layer, it is the most widely used light-weight static penetrating device. This penetrometer is manpower to turn the handle, driving two pressure chain rotation through chain wheel and gear to change speed, pin by the extended chain and press the chevron plate and card block, to press the probe into the soil as penetrating speed 0.8m~1.0m/min, to raise the speed by changing the handle position. This machine can conduct not only static penetrating test but also vane shearing test.

## II. Technical Parameters

|                          |                    |
|--------------------------|--------------------|
| Penetration force        | 20~30 K            |
| Penetration speed        | 0.8~1.2 m/min      |
| Lifting speed            | 4~5 m/min          |
| Penetration rod diameter | 25~28 mm           |
| Sectional area of probe  | 10 cm <sup>2</sup> |
| Vane size                | 50 ×100mm          |
| Total weight             | 180 kg             |

## III. Static Penetration Test

### Application

This device is to press the penetration rod by two chains into the soil at a uniform rate, to determine the engineering properties of cohesive soil and sandy soil according to the probe resistance.

The static penetration test of this machine combined with other engineering geological exploration method, can determine on the spot:

- The average value of the upper layer in the horizontal and vertical direction.
- The buried depth of interarea and large pieces gravel soil



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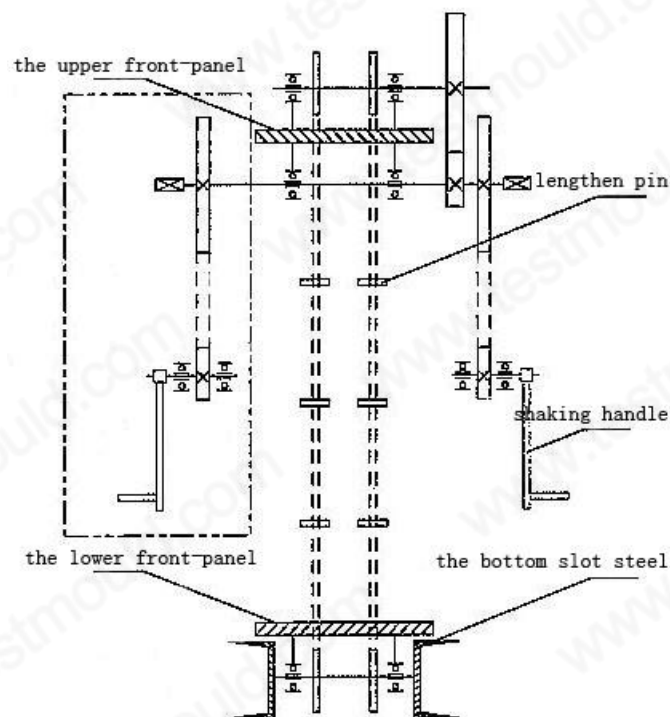
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- c) Approximately evaluate (quota) the strength and deformation characteristics for subsoil
- d) Pile length and single pile bearing capacity
- e) Compactness of artificial filling
- f) To select the representative test point for further research of physical mechanics properties of subsoil

## Structure



Types CLD-3 the still force strick to explore instrument structure sketch map

## Operation procedures

- a. Select position according to the distribution requirements of geological exploration. Firstly screw two ground anchors on the both sides ground of the test point. To dig a V-shaped pit with a shovel in the anchor site before screwing, pit depth is 25~30cm. Upright the ground anchor in the V-shape pit



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and screw down slowly. When anchoring should over a anchor weight on the ground anchor rod, insert two torque rods on both sides of the anchor weight, two or more people to slowly rotate and screw down the ground anchor like grinding. The distance between two anchors is about 0.8m, and then flatten the ground, and cover with two wooden plates.

b. Connect the chassis channel steel with four M8 bolts and place it on the wooden plate, to make the two anchored ground anchor on both sides of the bracket. In the middle of the two channel steels, over the anchor weight on the anchor rod to make the chassis channel steel connect with the anchor weight, plug the anchor pin, screw four butterfly screws in the bolt hole on the anchor weight, continue to screw to make it top tight the chassis steel. When spinning please pay attention that the penetration bracket must be perpendicular to the ground, if not vertical to screw the bolt on one side to make it vertical. If the penetration bracket is tile, and the screw is tightened and cannot be adjusted, can loose the screw and twitch one side (the higher side) plate to push out some soil under the plate to reduce its height to guarantee the bracket vertical to the ground.

c. Connect the probe with one end cable to the cable that has been passed through the penetration rod, and wrap the plug with a polyester insulation tape to prevent damp of water and increase the resistance of the socket. Connect the first rod, when connecting with one hand holding the probe, the other hand holding the rod, the probe does not move, turning the rod to make them connect. Do not turn the probe to prevent cable breakage.


d. Place the rod has already connected with the cable and probe on one side of the penetrating device. Take out the first rod with probe, pass the first rod from the hole that the top plate against the bottom plate, to make the first penetration rod in the hole of the bottom plate, make the rod on the central place. And connect the second rod with the first one.


e. Place the data acquisition instrument near the rod, connect the other end of the cable to the data acquisition instrument. The wiring and adjustment of the data acquisition instrument, please see the Product Manual. When the data acquisition instrument is adjusting, the probe should be vertical suspended and avoid direct sunlight. Clip the U-shape fixture block on the rod joint, and place the chevron pressing plate under the U-shape block to make its slots on both sides stuck on the chain, and the middle slot stuck the rod. Turn the handle to make the longer pin on the two chains that stuck by the chevron plate move from the bottom to up, until the chevron plate and rod were lifted up, dangling vertical to the ground, read the initial readings.


f. After the adjustment is finished, the preparation is ready, starts to work. Can be operated by 4 persons, 2 persons are specially supervise the handle, press down the rod at uniform speed, one



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person is to place and remove the U-shape block on the rod joint and chevron plate, and connect the rod, one person is to record the measurement meter readings. Block the U-shape block on the rod when working, then place the chevron plate over the U-shape block, turn the handle, to make the longer pin press the chevron plate, when the longer pin working by pressing the chevron plate, to make the rod to be penetrated down at the speed of 0.8~1.2m/min.

g. Mark scale on the column per 10cm, to observe the movement position of the chevron plate, record the meter reading each 10cm.

h. When one rod is pressed into the bottom, the chevron plate and U-shape block is nearing to the bottom plate (when the rod is being penetrated, another rod can connect with the rod according to the working condition), at this time stop turning the handle, the hand that hold the handle cannot loosen at one time, should rotate in the opposite direction slowly until the elastic force caused by the chain deformation is eliminated, otherwise the handle will be rebounded suddenly to hurt people. Remove the chevron plate and U-shape block, place them over the top joint, repeat the above procedures, to make the rod be pressed into the soil continuously, until reach the predetermined penetration depth or the limit of resistance meter, the penetration is come to the end.

i. When the rod is penetrating, if the ground anchor is pulled up slightly and rack up caused by the too large resistance, should stop penetrating, to make the rack fall down, screw a little the butterfly bolt on the anchor weight, to make it press the chassis channel steel again. When anchoring should select the suitable anchor blade according to the soft condition of top soil. When replace the blade, just need to screw off the anchor cone head, after replacing with new blade, retighten the anchor cone head.

j. In order to eliminate the influence of temperature changes on initial readings, in the initial 3~5m penetration should lift the rod up slightly per 1m penetration, read the initial readings when the probe is not affected by forces. The operation method is to stop turning the handle, place the chevron plate under the U-shape block and turn the handle in the opposite direction, lift the rod up slightly, and read the readings.

k. After penetration finished, when extracting the rod, place the chevron plate under the U-shape block, turn the handle in the opposite direction to make the rod lifted. After lifting several rods, turning the handle is become easy, can insert the handle into the spindle nose on the gear shaft, the extracting speed can be 4 times faster.

l. After all rods lifted, remove the rack of penetrating device and twist off the ground anchor, the test



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finished.

### Installation and matters need attention

- a. After the handle was inserted into the square spindle nose, should tighten the M8 screw to prevent the handle escape and injury people when turning. If stop penetrating, the handle cannot be loose at one time, should turn in the opposite direction slowly to prevent the handle rebound and injury people.
- b. During the penetrating process, the person who grasp the handle should approximately estimate the readings reliability according to the hand rotating force, if there is abnormal phenomenon (the meter readings is very small but the hand rotating force is very large or reverse) should find out the reason. Moreover, if the the rod pressed touches the edge of the guide hold the lower plate, knock a little bit about the chassis channel steel to make the rod in the center of the guide hole. During the penetrating should also record the sound when the probe is penetrated into the sandy layer or encounter stone, for reference when analyzing the data.
- c. In the hard cohesive soil layer, when the probe resistance is not very large (the meter readings is not large) and the penetration depth is not deep but the handle rotating force is very large, up to that cannot turn the handle by one handle, then can adopt the method of extracting and pressing down repeatedly to solve it.
- d. After the penetration finished, the rod should be extracted at once, in order to avoid that the cohesive force increased the rod cannot be lifted up after a long while. Or the probe is affected with damp and lose efficacy by the effect of underground water. When the extracting resistance is too large, rotate the rod several cycles clock-wisely, in order to reduce the cohesive force.
- e. When extracting the rod, should check whether the rod and probe is bent or scratched. After the probe is extracted, should check the soil sample adhered to the cone tip, to determine the soil layer type that the probe reached.
- f. After one project finished, should disassemble and wipe clean the probe, and coat with lubricant oil after wiping up, for the next use.
- g. The host of penetrating device should be in good working condition perennial, each rotating parts and rod joint should keep lubricant and flexible. The rod should keep straight to avoid penetrating hole defective.



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- h. The probe calibration should conduct according to Static Penetration Technology Standard, the unqualified probe should not be used.
- i. There will be wear the probe after a period of time of using, these ones wear serious should replace with new cone tip and shell, and re-calibrate.
- j. Generally if feel difficult when two persons rotate the handle by one hand, the instrument has reached its designed load capacity, at this time should not increase the hand rotating force, in order to avoid damaging the rod and probe.
- k. The test point should keep away from the underground installation (pipelines, cables and so on), and keep away from the high-tension line, in order to avoid accident.
- l. When the longer pin is cut off because of the too large penetration force, should disassemble the damaged longer pin and replace with a new one.

### Data processing

- a. The penetration test result should be organized in time, you'd better collect and organize them in site at the same day, in order to find possible questions and solve in time.
- b. Recondition the initial recorded readings, uniformly insert the produced reading difference caused by temperature change at each depth range according to the linear rules into the various readings.
- c. Depth (m) as the ordinate, probe penetrating force PS (kg/cm<sup>2</sup>) that is 1/10 of the measuring meter readings as the abscissa, draw a relation curve that the probe penetrating resistance changes along with the depth changing.
- d. Penetration results and nearby drill hole bar chart, combined with other in situ test data, compose the static penetration comprehensive bar chart.
- e. Based on the penetration comprehensive bar chart and the structural type of buildings, evaluate the basic type, burial depth, allowable bearing capacity of foundation soil and deformation characteristics according to the relevant regulations.

## IV. Electrical-Logging Vane Shear Test



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## Application

In the specified depth, electrical-logging vane shear test is insert a four-bladed vane into soft cohesive soils, rotate at a certain speed and determine its torsion, and obtain the undrained shearing strength.

## Structure

The instrument includes the penetrating parts and vane test torsion system.

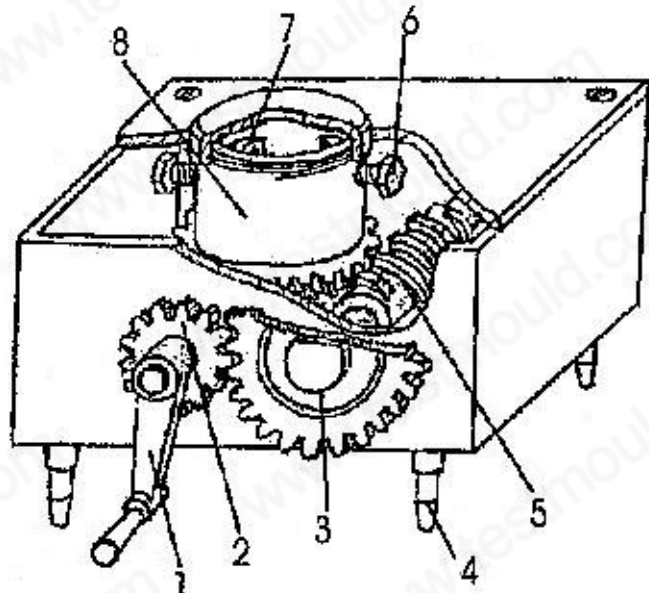
## Operations

a. If the static penetration test and vane shear test will be conducted at the same test point, extract all rods and probe after static penetration test finished, loose the butterfly bolt on the ground anchor weight, move the rack to the vane drill hole, tighten the butterfly bolt and fix the rack 15 cm away from the original static penetrating hole.

b. Install the ground anchor as the same method of static penetration test and fix the rack, insert the four feet of vane gear box. When inserting should pay attention that the central hole in the vane gear box should be in a line with the hole center on the lower plate with a cross slot.

c. Loosen the rod clamping device on the vane gear box.

d. Insert the rod into Cava and upper plate. Connect the four-bladed vane with the cable plug, socket on the rod. The method is same as static penetration test, rotate the rod to connect the vane and



- |                   |                       |
|-------------------|-----------------------|
| 1, Shaking handle | 2, Small wheel gear   |
| 3, Big wheel gear | 4, Join               |
| 5, worm           | 6, tighten screw nail |
| 7, Card tile      | 8, Worm wheel gear    |



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rod, insert the four-bladed vane into the cross slot on the lower plate, the other end of the cable connect with meter box.

e. Calibrate and reset the meter according to the instrument calibration regulations, to make the calibration coefficient is the vane calibration coefficient.

f. Press the four-bladed vane into the depth required with the same method of static penetration test, remove the chevron plate and U-shape block.

g. Clamp the rod tightly with Cava.

h. Rotate (clock-wise) the vane gear box handle, when there is reading on meter, record the handle loop.

i. Rotate the handle one cycle per 10 seconds uniformly. Record the reading every cycle, when the reading is peak or stable, continue to test and record for 1 minute. The peak or stable value is the torsion T when the undisturbed soil is sheared to damage.

j. Rotate the four-bladed vane 3~6 cycles quickly, to make the around and upper layer soil of the vane fully disturbed, repeat the step i to determine the torsion T of the remolding soil.

k. If need to continue the test, loosen the clamping device of the torsion device, press down the four-bladed vane to the next test depth, repeat as the above procedures.

l. After all test finished, extract the rod and four-bladed vane, wipe clean, check each part.

The maintenance and data processing of electrical-logging vane shear test is similar to the static penetration test.



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