

**LANGRY**®

# LR-P40 Pull-off Tester

## Operating Instructions



## PREFACE

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# Chapter 1 Overview

## 1.1 Overview

LR-P40 Pull Off Tester is used to test the compressive strength of construction concrete、cement mortar strength and fiber cement mortar strength. The instrument is a small hydraulic force measuring device, which is composed of a through-hole jack, a hand pump, a chassis and a force measuring device. It is suitable for testing the strength of concrete with a strength range of C10 to C80. As a new micro-damage method, it has the advantages of high detection accuracy, less damage to the structure, one machine with dual functions, novel structure, small size, simple and convenient operation, etc. It has broad application prospects and greatly improves the technical level of construction engineering quality inspection. .

The oil pump of the tester is loaded manually, and the rocker lead screw does not need to be reversed in advance. It has the characteristics of small driving torque, comfortable and reasonable rocking direction, and continuous and uniform loading. Using single-chip microcomputer as the core intelligent data processor. The programming compatibility is high, and the data can be directly observed and saved. It has functions such as full digital display, peak hold selection, 500 data storage and over-range display.

## 1.2 Standard

JGJ\T208-2010 《Technical specification for inspection of concrete compressive strength by post-installed adhesive anchorage method》

CECS69: 2011 《Technical specification for test of concrete strength by pullout method》

CECS 389: 2014 《Technical specification for inspection of strength of cement mortar and fiber reinforced cement mortar by pullout method》



### **1.3 Product Accessories**

- (1) Post-anchoring Accessories
- (2) After-loading and Pulling Off Accessories
- (3) Plastic Instrument Case

### **1.4 Features**

- Integrated high-precision intelligent measurement LCD display circuit
- Built-in uninterrupted screw oil pump pressurization system
- Peak hold function
- Manual/automatic storage and deletion of measurement data (500 pieces)

### **1.5 Technical Parameters**

- Measuring Range: 0-40KN
- Working range: 4-40KN
- Accuracy Grade:  $\pm 1\%$ FS
- LCD Display: Segment LCD + Blue Backlight
- Inner diameter of Reaction Support Ring: 120mm
- Digital Display Resolution : 0.01kN
- Weight (host) :4.3 Kg



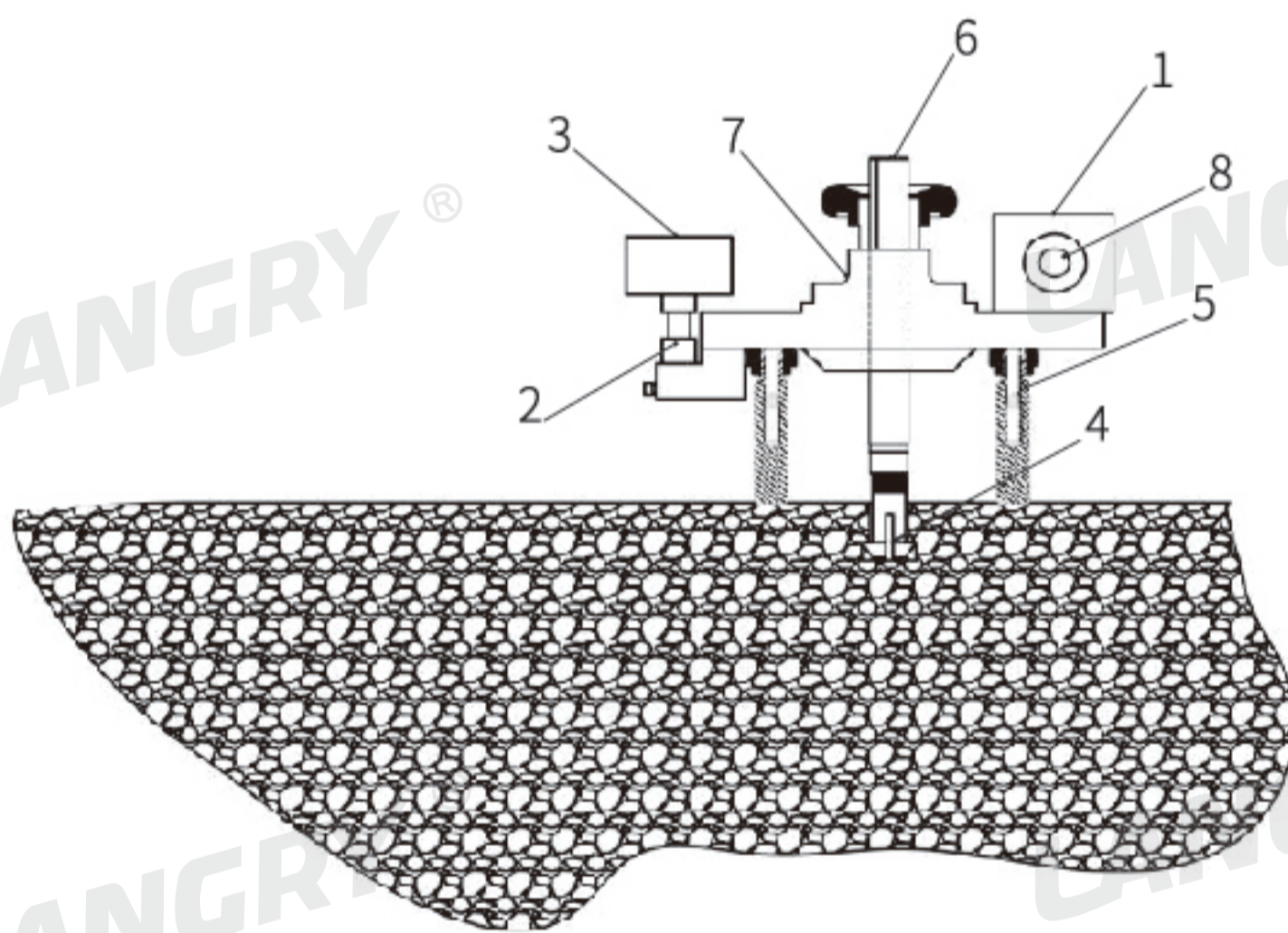
# Chapter 2 Structure Composition and Working Principle

## 2.1 Structure Composition

(1) The composition of the components tested by the after-loading and pulling out method, as figure 1.2.3:



Figure 1 : Top view of the tester host



- 1、 Screw pressurized Oil Pump
- 2、 Pressure Sensor
- 3、 Digital Pressure Gauge
- 4、 Expansion Spring Anchors
- 5、 Three-point Outriggers
- 6、 Pull Rod
- 7、 Tester Host
- 8、 Oil Hole

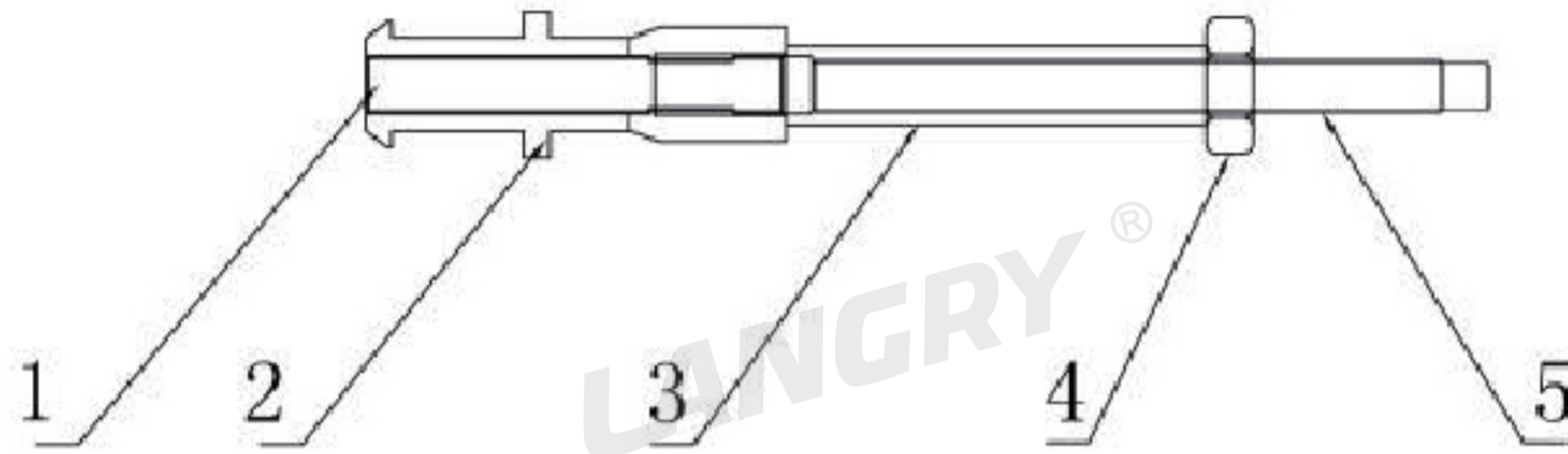
Figure 2 : Schematic diagram of the working state of the after-loading and pulling out method





- 1.Expansion Spring 2.Expansion Rod 3.Drift 4.Tie Rod and Knob Nut  
5.Rod and Nut 6.Tube

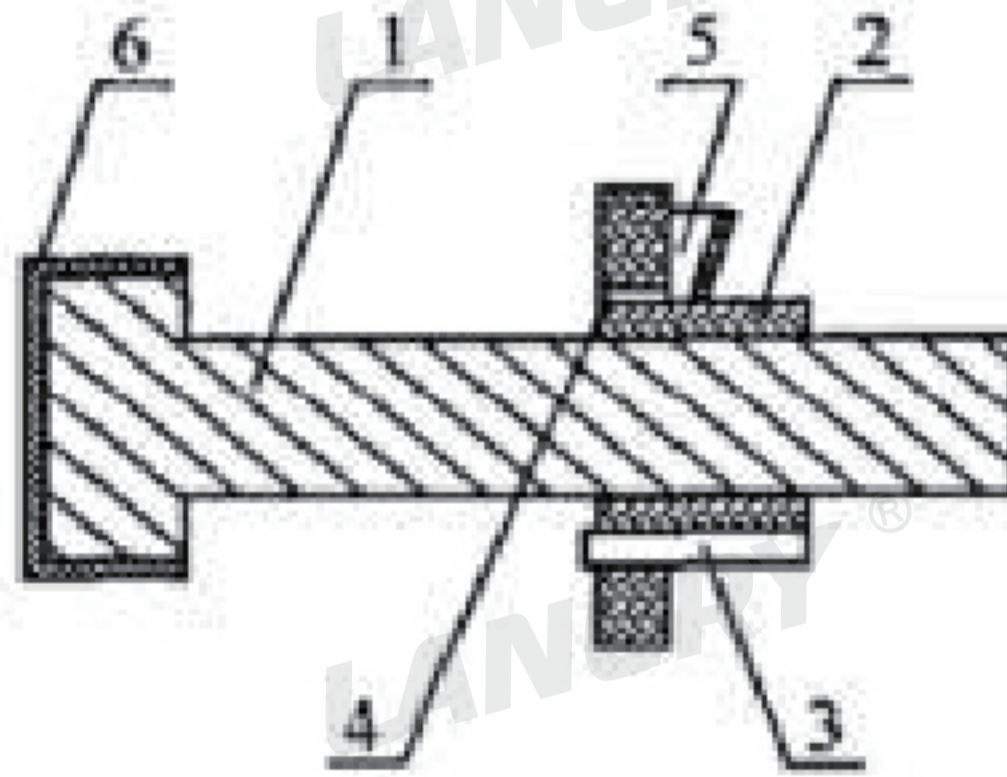
Figure 3: Schematic diagram of after-loading and pulling out anchorage accessories



- 1.Expansion Rod 2.Expansion Spring 3.Tube 4.Nut 5.Rod

Figure 4: Schematic diagram of dismantling the expansion rod

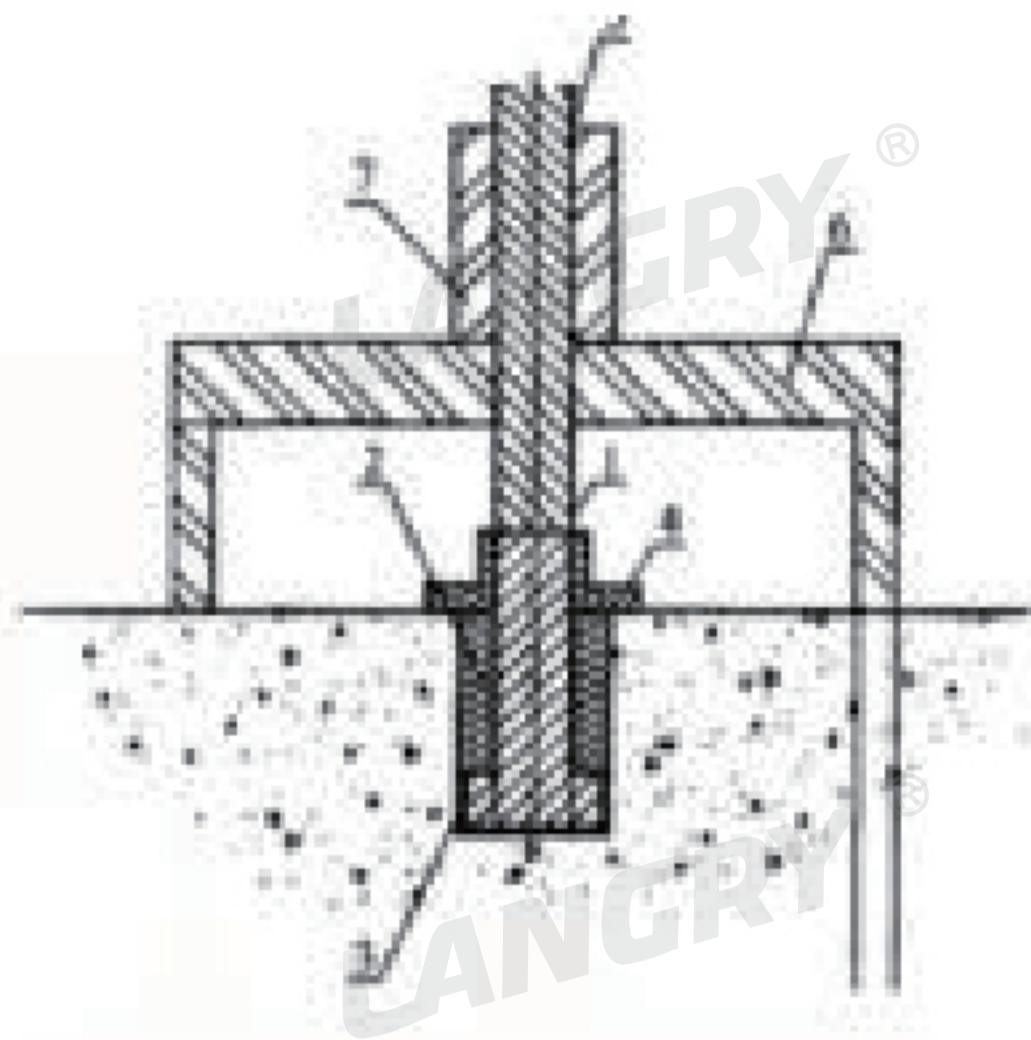
(2)Composition of post-anchoring method components, as shown:



1. Anchors 2.Positioning Disc 3.Disc Injection Hole 4.Disc Vent  
5. Pressure-holding Funnel 6. Rubber

Figure 5: Schematic diagram of the assembly of the injection positioning disc and the plastic cap





1. Anchors 2. Anchoring glue 3. Rubber 4. Positioning Disc 5. Pull Rod  
6. Reaction support ring 7. Tester Host

Figure 6: Schematic diagram of post-anchoring pull off structure

(3) Pull-off method accessories:



Figure 7: Pull-off method accessories

## 2.2 Working Principle

### 2.2.1 After-loading and Pulling Out Method

Drill holes on the hardened concrete surface, grind grooves, embed anchors, and install pull-off instruments to perform pull-off tests to determine the ultimate pull-off force, and according to the relationship between the pre-established ultimate pull-off force and the concrete compressive strength to deduce the test method of the concrete compressive strength.

### 2.2.2 Post-anchoring Method

Drill holes in hardened concrete, and implant anchors with high-strength adhesives. After the adhesive is cured, pull-off tests are performed, and the strength of concrete is deduced according to the pull-off force.



## Chapter 3 Test Workflow

### 3.1 Check Before Use

Install the three legs on the chassis, turn the crank handle of the oil pump of the tester clockwise, the jack piston should rise slowly, when it can't be turned, the stroke of the oil pump reaches the limit, and the displacement of the jack piston should reach 8mm, otherwise hydraulic oil should be added.

The method of refueling is: unscrew the oil filling hole, drop No. 10 aviation hydraulic oil or engine oil with similar index into the oil hole, and slowly turn the handle counterclockwise to suck the oil in, and do not let the air in. When the maximum stroke is reached, gently shake the handle clockwise to discharge the gas in the pipeline from the oil hole (oil can be discharged from the oil hole). The above process should be repeated several times to fill up the oil and fully discharge the air in the hydraulic system, and then tighten the oil hole screw.

### 3.2 Post-anchoring Method Test Workflow

#### (1) Measuring Point Arrangement Regulations

1. Each component should be evenly arranged with 3 measuring points. When the difference between the maximum pull-off force or the minimum pull-off force and the median value is greater than 15% of the median value, 2 more measuring points should be measured near the minimum pull-off force measuring point;
2. The measuring points should be arranged preferentially on the side of the concrete pouring. When the measuring points cannot be arranged on the side of the concrete pouring, the measuring points can be arranged on the top surface of the concrete pouring. Before arranging the measuring points, the concrete surface laitance should be removed. If the concrete pouring surface is uneven, the concrete at the measuring point should be polished to a smooth surface;



3. The distance between two adjacent measuring points should not be less than 300mm, and the distance between the measuring point and the edge of the component should not be less than 150mm;

4. The measuring points should avoid joints, honeycombs, and pockmarked areas, and there should be no exposed steel bars on the damaged surface of the post-anchoring method.

5. The measuring points shall be marked with numbers, and if necessary, a schematic diagram of the measuring point arrangement shall be drawn.

#### (2) Start Drilling

Drilling machines can use impact drills. The drilling machine should have a device to control verticality and depth. During drilling, the drill bit should always be kept perpendicular to the concrete surface. The hole size should meet the following requirements:

1. The drilled hole diameter should be  $(27 \pm 1)$  mm;

2. The drilling hole depth should be  $(45 \pm 5)$  mm.

#### (3) Hole Cleaning and Anchoring

1. After the drilling is completed, the dust in the hole should be removed. If a diamond thin-wall hollow drill is used for drilling, the hole wall should be clean and dry.

2. The glue injection positioning disc should be equipped with glue injection holes, vent holes and pressure-holding funnels.

3. The anchoring glue should be injected after the glue injection positioning disc is connected with the anchors. Before glue injection, a small amount of butter can be applied on the contact surface between the glue injection positioning disc and the concrete to facilitate disassembly. After the anchoring glue is cured, the pull-off test can be carried out. After the post-anchoring method is tested, the damaged parts of the components caused by the test should be repaired effectively in time.

#### (4) Pull Off Test and Precautions

1. During the pull-off test, the reaction support ring should be used to provide reaction support.



2. During the pull-off test, the pull-off force should be applied continuously and uniformly, and the speed should be controlled at (0.5-1.0) kN/S.

3. Apply the pull-off force until the reading of the force-measuring device of the pull-off instrument no longer increases, and record the limit pull-off force, accurate to 0.1kN.

4. During the test, effective measures should be taken to prevent the test device from falling off.

#### (5) Exception Handling

When one of the following abnormal conditions occurs in the post-anchoring method test, it should be recorded in detail, and the value should be discarded, and re-measure a measuring point near it.

1. The post-anchoring method damage body is in a non-complete cone damage state;

2. There are defects or foreign matters that significantly affect the test accuracy on the cone damage surface of the post-anchoring damage body;

3. Cracks appear in the concrete outside the reaction support ring.

### **3.3 After-loading and Pulling Out Method Test Workflow**

First of all, the test position should be selected, and then the bit of the impact drill should be connected with the drilling machine to drive the impact drill bit to drill holes, the hole puncher and the concrete surface should be kept perpendicular to each other.

Put the diamond grinding head on the matching groove grinding machine into the drill hole, hold the groove grinding machine in hand, make the positioning disc next to the concrete surface, and rotate slowly and evenly around the drilling hole. During this process, the positioning disc and the drill hole should always be kept vertical. When the central rod of the grinding head collides with the hole wall, the grinding groove can be stopped and the residue in the hole can be cleaned.



First put the expansion spring into the forming hole, then screw punch into the expansion rod, hit the punch with a small hammer to drive the expansion rod into the expansion spring cavity, so that the expansion spring expands, When the punch is in contact with the expansion spring, the punch can be removed, screw the pull rod into the expansion spring and tighten. Install the tester so that the pull rod is centered on the piston, and install the pull rod nut so that it is about 2mm away from the piston.

After the test is finished, unscrew the nut on the pull rod, remove the pull rod from the expansion spring, connect the rod with the expansion rod in the expansion spring, install the tube and nut, rotate the nut with a wrench, and pull out the expansion rod from the expansion spring.





# Chapter 4 Parameters of Intelligent Pressure Numerical Display

## 4.1 Working Principle and Usage Method





The intelligent pressure numerical display is mainly composed of a pressure sensor and a measurement display circuit, which are connected through a data connection line. The pressure sensor generates a voltage signal under force, which is converted into a digital signal by a 20-bit A/D converter, and the pressure value is displayed on a LCD display after being processed by a single-chip microcomputer.



## 4.2 Key Function Description

Name	Description
	<p>In the measurement state: Long press for 2 seconds to enter the password state</p> <p>In the password state: when the password is 2222, long press for 2 seconds to enter the setting state, otherwise return to the measurement state</p> <p>In the calibration state: Long press for 2 seconds to return to the measurement state</p> <p>In the setting state: Press to return to the measurement state</p>
	<p>In the measurement state: Press to enter the query state</p> <p>In query state: press to return to measurement state</p> <p>In the password state and setting state: Enter the modify state and move for modification</p>



	<p>In the calibration state: Press to calibrate the current measured value as the calibration point value</p> <p>In the setting state: When modifying parameters, press to save the modified value</p> <p>In the setting state: Press to switch settings</p> <p>In the measurement state: Long press for 2 seconds to save the current peak record</p> <p>In the query state: Long press for 2 seconds to delete all peak records</p> <p>In the password state: When the password is 1111, long press for 2 seconds to enter the calibration state; otherwise, it is invalid</p>
	<p>In the measurement state: Switch the upper display content: storage location number / current real-time measurement value / MPa conversion value</p> <p>In the measurement state: Long press to switch peak hold function</p> <p>In query state: View the previous record</p> <p>When changing the value in password and setting state: Increase the modified value</p> <p>In the setting state: Switch the parameters</p>
	<p>In the measurement state : Long press for 2 seconds to clear the measured value and take the current measured value as the zero point</p> <p>In Setting state: Switch the parameters</p> <p>In query state: View the next record</p>
	<p>In any state: Press this key to turn on and off</p>


### 4.3 Working Status

The instrument has 5 display states, and the upper left corner of the LCD screen is marked corresponding to the states, which are:




number , password, view, calibration, setting and peak.

#### 4.4 Instrument Operation Steps

Press  to switch between measurement and query status, the number is displayed in the upper left corner of the measurement state, and the number and view are displayed in the upper left corner of the query state.

In the measurement state, if the peak hold function is turned on, the number and peak value will be displayed in the upper left corner of the screen, and the value is displayed as the maximum value in the current measurement; if the peak value is not turned on, the number will be displayed in the upper left corner of the screen, and it will be displayed in real time The current force value of the



sensor. At this time, press  Manually save the pressure value. The record saving number displayed on the left side of the screen is automatically incremented by 1. If 501 is displayed, it means that 500 pieces of data have been saved (full).

·The machine must be used within the working range, otherwise it will affect the detection accuracy or cause permanent damage.

In the measurement state, if the measured value is within the set value of the allowable zero clearing range (the factory setting of the

instrument is 0.30KN), press the  for 2 seconds to reset the measured value and use the current measured value as zero.

In the query state, you can view the peak data records, press the

 and  to turn the page to view all records.

In the query state, press the  for 2 seconds to delete all recorded data and return to the measurement state.

·**Note:** Data deletion cannot be restored, so proceed with caution.

The battery of this machine is an 8.4V lithium battery. When charging is required, please use the charger provided with the






machine, and connect the charging plug to the charging hole of the instrument.

#### 4.5 Instrument Calibration

The broken line calibration setting is controlled by a password, and the password is 1111. When the password verification is incorrect, the pressure calibration state cannot be entered.

**Steps:** ① Long press the  to enter the password state, enter the password 1111 and then press and hold the  for 2 seconds to enter the calibration state.

② The upper row of the meter displays "0%". At this time, make sure that the instrument is not pressurized. Press the  once, and the upper row of the meter displays "20%".

③ Then turn the handle to start pressurizing until the force measuring ring shows 8kN, press the  once, and the upper row of the LCD will show "40%". Then pressurize to 16kN and press .

④ Complete the full-scale 5-segment broken line point calibration by analogy. After the calibration of the 100% range point is completed, the meter will automatically exit the calibration state, and the calibration accuracy can be maintained even if the power is turned off.

·When calibrating, you don't need to look at the value displayed on the lower row of the LCD, as long as you ensure that the displayed value is stable.



# Chapter 5 Conversion Values of Concrete Strength at Measuring Points

## 5.1 Intensity Curve

### 5.1.1 Post Anchoring Method

When there are no special strength measurement curves and regional strength measurement curves, the JGJ\T208-2010 《Technical specification for inspection of concrete compressive strength by post-installed adhesive anchorage method》 unified strength curve formula can be used to calculate the concrete strength conversion value.

$$f_{cu, i}^c = 2.1667P_i + 1.8288$$

$f_{cu, i}^c$  : Concrete strength conversion value(MPa),

accurate to 0.1(MPa)

$P_i$  : Pull off force(kN),accurate to 0.1(kN)

### 5.1.2 After-loading and Pulling Out Method (three-point type):

$$f_{cu}^c = 2.76F - 11.54$$

$f_{cu}^c$ : Concrete strength conversion value(MPa), accurate to 0.1(MPa)

$F$ : Pull off force(kN),accurate to 0.1(kN)

The representative value of the pull-off force of a single component shall be taken according to the following provisions:

(1)When the absolute value of the difference between the maximum and minimum pull-off forces and the median value among the three pull-off forces of the component is less than 15% of the



median value, the minimum value is taken as the representative value of the pull-off force of the component.

(2) When adding the test, the two pull-off force values and the minimum pull-off force value of the additional test are averaged together, and compared with the middle value of the pull-off force of the previous time, the smaller value is taken as the representative pull-off force of the component value.

Calculation of strength conversion values as concrete deduced values for a single component

$$f_{cu, e} = f_{cu}^c$$

## 5.2 Scope of Application of Regulations

The unified strength measurement curve is applicable to concrete meeting the following conditions:

1. Conforms to ordinary concrete materials and the coarse aggregate is gravel, and its maximum particle size is not greater than 40mm;
2. The range of compressive strength is (10-80) MPa;
3. Using ordinary molding process;
4. Natural curing for 14 days or steam curing for more than 7 days after leaving the pool.



## Chapter 6 Precautions and Maintenance

(1)The intelligent pressure display is a precision instrument, so pay attention to shockproof and moisture-proof during use.

(2)There is discreteness between each sensor. The sensor of this tester and the host have been calibrated together, and cannot be exchanged with other sensors or hosts.

(3)Always keep the tester and accessories clean, and add lubricating oil to the rotating parts if necessary. The hydraulic system should be filled with clean No. 10 aviation hydraulic oil or engine oil with similar indicators.


(4)The tester has been calibrated before leaving the factory, and it can be calibrated once a year according to the actual situation during use.

(5)In order to ensure the correct use of the tester, please carefully read the terms of this manual, and refer to the relevant technical standards to correctly select the test plan. The product is guaranteed for one year, and we will provide you with technical consultation, instrument maintenance and calibration services at any time, and sincerely hope that you can provide valuable opinions on the product.



V1.2

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