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# **Magnetic flux leakage detection of drill pipe**

## **User's Manual**



Nanjing BKN Automation System Co.,Ltd.



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## 1. Instrument Description

The warranty period of this instrument is one year. In the warranty period, the instrument quality problems to implement free maintenance. charge maintenance outside the warranty period. The instrument users can get the consulting services of manufacturers for life. (The shelf life of the probe is three months, except for the special customized long life probe.)

Please note that the following are not covered by free warranty:

- (1) Mechanical damage. Failure caused by falling, colliding, not taking lightly;
- (2) Failure or damage caused by self-modification, adjustment or maintenance;
- (3) Circuit overload caused by failure to perform external wiring as required and failure to comply with the input and output electrical specifications;
- (4) Damage caused by force majeure such as natural disasters;
- (5) This guarantee is valid within the People's Republic of China;

## 2. Safety Notice

The central part of the magnetic saturator is a strong magnetic field. The equipment may cause strong interference or even damage to the surrounding electronic equipment when it is in operation, and it has an attractive effect on ferromagnetic materials. Any equipment or objects that are sensitive to magnetism and ferromagnetic should be kept away from this equipment.

Only trained operators can operate the equipment, equipment maintenance, maintenance operations should be carried out in the case of power failure, in the operation should be at least two personnel with operational qualifications in the presence.



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### 3. Precautions for use

(1) the electronic parts of this equipment, the power supply specifications are:

Voltage :180~240 V/AC

Frequency :50/60 Hz

Note: Make sure the enclosure is connected to the earth reliably before the equipment is energized.(Use a three-core power socket with secure grounding)

Failure caused by the use of power specifications other than the provisions is not covered by warranty.

(2) use of the electronic part of this equipment ambient temperature is -10°C~50°C, humidity is 10%~85%.

(3) earthing resistance of this equipment enclosure shall be less than 100Ω.

(4) the electronic part of the device is energized, open the enclosure.

(5) the electronic part of the equipment is a precision equipment, in the process of moving, transport should be lightly held gently. Special packing boxes shall be used during transportation.

### 4. summary

#### 4.1 Technical background

Based on the theory of classical Magnetic flux leakage detection technology, BKN MFL-06 Magnetic flux leakage flaw detector has accumulated a lot of practical experience on the basis of traditional theory after ten years of deep research. In recent years, with the rapid development of large-scale integrated circuit technology, real-time large data computing algorithm can be realized. The company keeps track of the latest technology, in the circuit, software, probe and other aspects of breakthrough. BKN MFL-06 Magnetic flux leakage flaw detector benefits from the above aspects, excellent performance, far exceeding various industry standards.

#### 4.2 Scope of application

BKN MFL-06 Magnetic flux leakage flaw detector can be used for the detection of various magnetic materials, such as steel pipe, steel bar, steel wire, etc. on-line or off-line inspection.

Compared with eddy current detection, Magnetic flux leakage has the advantages of large penetration depth and certain detection ability to the inner wall of pipe. The instrument has been widely used in oil industry sucker rod, pumping pipe, steel pipe and other detection. also suitable for tube rod detection in other industries.

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## 5. Technical parameters

- ◆ Specification :2 3/8 " ~6 5/8 pipe fittings
- ◆ False alarm rate : $\leq 0.5\%$
- ◆ Failure rate : $\leq 0.02\%$
- ◆ Detection coverage : $\geq 100\%$
- ◆ SNR:  $S/N \geq 12(\text{dB})$ , for manual defects, detection equipment produces a minimum S/N of 3:1
- ◆ Detection channels :6
- ◆ Thickness range :1~12 mm
- ◆ Continuous operation :24 hours, stable performance parameters
- ◆ Accuracy of position resolution :20 mm
- ◆ Qualcomm Filtering :0.1 Hz~650 Hz
- ◆ Low pass filter :1 Hz~10000 Hz
- ◆ Gain :0~90 dB continuously adjustable, step 1 dB
- ◆ Test method: the drill pipe does not move, the probe car automatically forward and backward
- ◆ Test speed :30 m /min, not less than 15 m /min
- ◆ sensitivity of through hole detection :1.6 mm through hole (calibrated with 8 holes)
- ◆ Blind area :100 mm (drill pipe body)
- ◆ compressed air :0.4~0.6 MPa
- ◆ Electricity: AC220V (-10%~+10%)

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◆ Working temperature :-10°C~50°C

## 6. Equipment composition

- A 、 portable notebook and Magnetic flux leakage interface operating system;
- B 、 Magnetic flux leakage detection instrument;
- C 、 automatic skid system
- D 、 magnetization coil magnetic saturation system;
- E 、 ring probe sensor;
- F 、 pneumatic support system;
- G 、 supporting control and distribution, instrumentation, power, randomly provided tools and spare parts;
- H、 Calibration Sample Tube

## Magnetization System and Principle

For magnetic nondestructive testing, the first is the design of magnetization to let the detected workpiece reach the magnetic saturation state, which is the basis of magnetic detection. In order to improve the efficiency of magnetic circuit, it is necessary to optimize the structure of magnetic circuit.

The function of the excitation power supply is to provide the current for the transverse magnetization, and then to convert it into a steady magnetic field through the magnetization. In testing, the magnetic field magnetized the drill pipe passing through the magnetizing device, and then formed an inductive magnetic field of sufficient strength in the drill pipe, which provided the basis for the feasibility of Magnetic flux leakage detection. thus, it seems that whether a sufficient intensity excitation magnetic field source and a sufficient intensity magnetic induction intensity can be generated in the steel tube will determine whether the defects in the detection can be detected; in order to optimize the detection signal, there needs to be a best magnetization state in the detection, which can be achieved by adjusting the current size of the magnetic saturation power supply (the current regulation operation is simple and should be the preferred method).

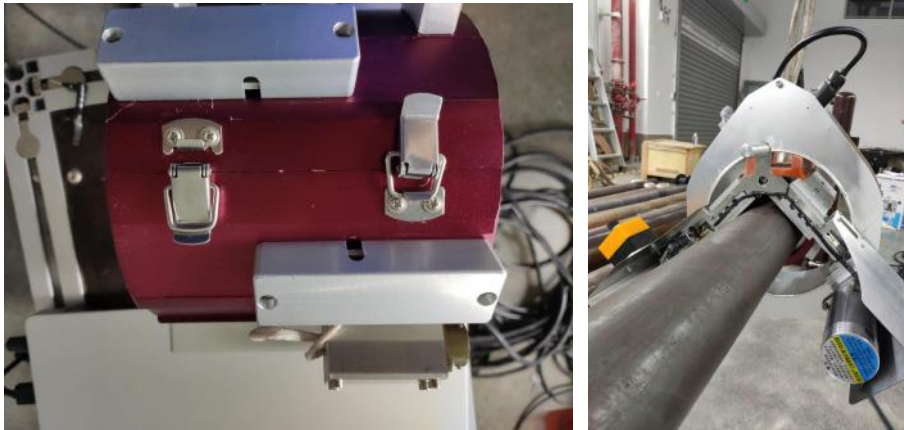
## 7. Equipment operation sequence

- (1) Turn on the POWER main power switch on the right side of the distribution cabinet.





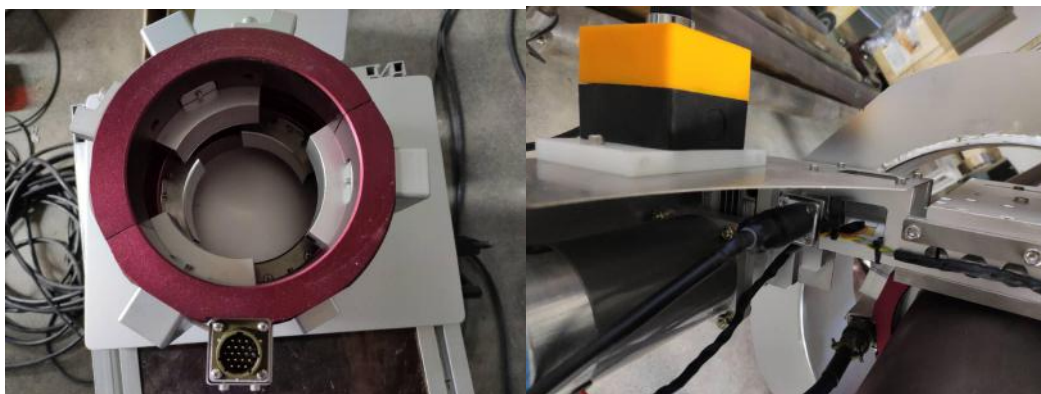
(2) Place the drill pipe on the pneumatic support system, select the Magnetic flux leakage ring probe sensor to install on the automatic pulley system according to the type of drill pipe detected, open the lock buckle, load the sample drill pipe, and then close the lock buckle



(3) Connect the probe 2, probe 3, probe 4, I/O interface, network communication, power supply line behind the instrument, and dial the power switch to the starting block. Note: Probe 1 position do not connect the probe line, probe 2,3,4 is a 6-channel detection system.



Then the other end of the probe line is connected to the probe socket, and the magnetic saturation power cord is connected to the magnetic saturation socket.



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(4) Open the Magnetic flux leakage software of the portable computer type, check the connection status of the software and instrument (see figure below) and set the parameters.



(5) Start the motor switch on the portable magnetic flux leakage, carry on the reference setting and signal acquisition, then detect the drill pipe, observe the Magnetic flux leakage detection interface graphics.

**Note: When the motor starts, the magnetizing coil power supply and synchronous signal are turned on at the same time**

(6) Click on the circuit settings of the software interface

Adjust system parameters: start delay, stop delay, sampling rate.

Adjust circuit parameters: high pass, gain

Adjusting alarm zone parameters: warning value and scrap value

(7) Click on the filtering settings of the software interface

Adjust filter parameters for each channel: high pass filter, low pass filter, broadband, multiple (gain)

(8) Adjust the parameters, start the automatic pulley system, reconfirm the test pattern of drill pipe sample, ensure that the signal of 8 standard sample holes of drill pipe sample can be detected completely.

(9) The automatic pulley system and drill pipe samples are taken out respectively, and the drill pipe that needs Magnetic flux leakage detection is placed on the starting support system, and the Magnetic flux leakage detection is carried out using the parameters of the current circuit setting and filter setting.

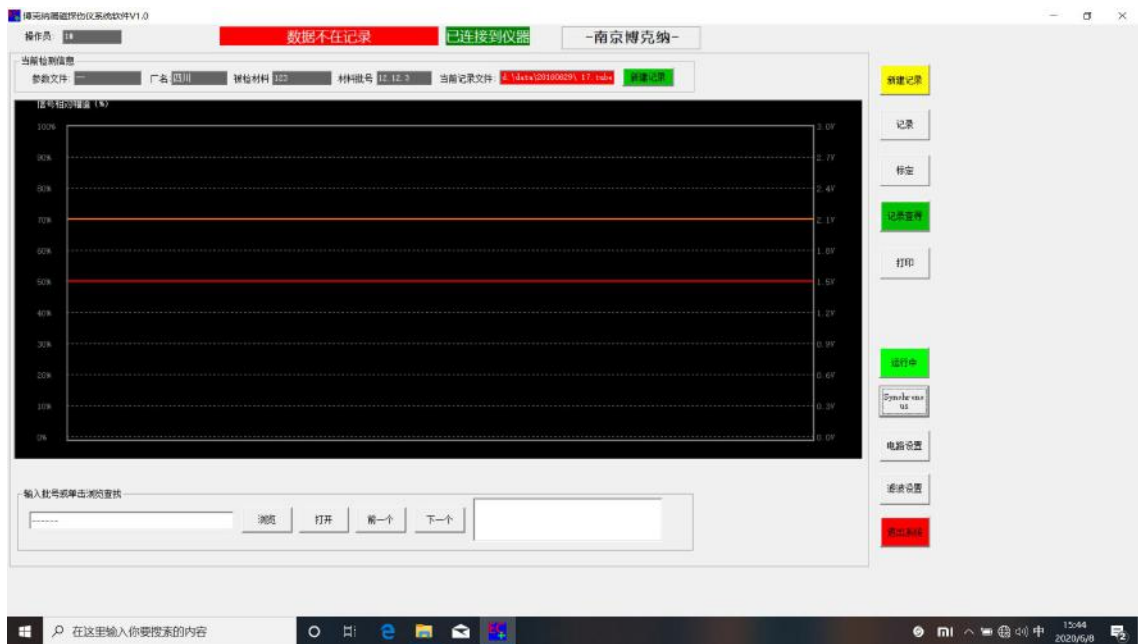
(10) Take the file name, start the motor switch on the automatic pulley system, start to detect the current drill pipe, the subsequent drill pipe detection signals and graphics can be automatically collected through the computer software control system.

## 8. Software Operations Guide

For Nanjing BKN Automation System Co., Ltd. BKN MFL-06 Magnetic flux leakage detection system matching application software. The main functions of the software are detection signal acquisition, real-time data processing, control signal

output and input, real-time transmission of detected data; the main functions of the server program are related parameters manual and automatic setting, system settings, speed testing, channel testing, data acquisition and analysis, including data real-time receiving, processing, graphical display, data storage, analysis, automatic calibration, single drill tube detection report, the total report of this test, detection waveform and report printing.

The software interface is mainly divided into: the whole interface waveform display area, circuit equipment area (most parameters are related to the hardware performance of Magnetic flux leakage instrument), filter setting area, record preservation and printing area.



## 8.1 Parameter setting

This software takes into account that outdoor use of the field keyboard input is more inconvenient, the company uses a humanized pure mouse input method. To set parameters, click on the number to set the parameters, and then the system will pop up a digital soft keyboard. Use the mouse on the soft keyboard to click on the value to enter, click on the "ENTER" to complete the input, if you want to give up the input, click ESC ". Note: the power supply of the instrument must be turned on when setting the parameters, so that the instrument is in working condition, otherwise the set parameters are invalid!



### I. Above the interface:



1. Shows whether the instrument is connected to the instrument, i.e. the instrument and Magnetic flux leakage software are successfully communicated
2. Current detection information: record setting information, can record drill pipe Magnetic flux leakage detection information

### II. Below interface: Record batch number query



system

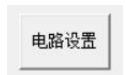
### III. Right side of interface:



◆◆: Instrument detection status, operation and stop



◆◆: synchronous mode, when the instrument starts to check whether in the synchronous gear, when the Magnetic flux leakage equipment motor switch on, in this mode the instrument starts to detect at the same time



◆◆: adjustment of parameters in circuit setting, adjustment interface appears after clicking



启动延时-- 100 (ms)

: How long is the time delay after the motor switch is turned on to open the detection ms generally set to 50

停止延时-- 1 (ms)

: Click on the switch after the delay of how long to stop detection, generally set ms 50

sampling rate: the frequency of data collected by the instrument, generally set to 1000 sps..

高通-- 3.0 (Hz)

: Circuit Parameters The internal parameters of the instrument are generally set Hz.0.2

增益-- 55 (dB)

: Circuit Parameters The internal parameters of the instrument are generally set dB 5

Alarm area parameters:

预警值-- 99 (Unit)

This parameter is used to set the first level alarm value. When the Magnetic flux leakage detected reaches this value, the system outputs an alarm signal. unit of this parameter is "Unit", please select between 1 and 99.

报警值-- 99 (Unit)

This parameter is used to set the second level alarm value. When the magnetic flux leakage detected reaches this value, the system outputs an alarm signal. unit of this parameter is "Unit", please select between 1 and 99. General setting range 50-80

板级FirHp 200 (Hz)  
板级FirLp 1200 (Hz)  
板级FirBw 241 (Hz)

These parameters are system parameters and are used for further data processing. Users can keep factory settings, please do not modify, the modification may occur abnormal.

滤波设置

◆◆: The instrument adjusts the signal state parameter, after clicking enters the adjustment interface



**高通 (Hz) 低通 (Hz) 带宽 (Hz)**

These three parameters are used for the first stage processing of the Magnetic flux leakage signal collected by the embedded system. Reasonable setting of these two parameters can maximize the program to remove the interference signal and retain the Magnetic flux leakage signal. it should be noted that the "high pass" value must be less than the "low pass" value, and the "broadband" value is a bifurcation band of high pass and low pass, which has been tested and optimized by our company's technicians.

High pass filter :0.1-650 Hz, the general set range is between 1-30, adjusted according to the Magnetic flux leakage detection.

low pass filter :1-10000 Hz, the general set range is between 50-200, adjusted according to the Magnetic flux leakage detection.

broadband: the isolation band between high-pass filter and low-pass filter, with a general range of 20-50.

**倍数**

This parameter is the signal (gain) regulation continuous adjustable, generally set in the range of 1-90, according to the Magnetic flux leakage signal size to adjust.

**偏移**

This parameter is the detection signal offset position ,0 in the middle of the interface, the larger the detection signal baseline offset to the lower, generally set to 0 can not be adjusted.



If you need to unify the other channel parameters, you can select the o button of the channel you want to change, then click the copy parameter, click the application below the interface -- save the key, and the current channel parameter can be copied to the other channel parameters.

## 9. equipment status



This identification indicates that the data collected by the system is not recorded in the computer, even if the device is started and the waveform is displayed. will not display only after clicking this button. When "calibration, record search" will show



"data is not recorded ", please pay special attention to this.



indicates the connection state of the instrument, normally the first two should be green connection state, the latter two groups should be red unconnected state. please note any red logo on the software interface, generally this represents abnormal status, please confirm it before use.

## 10. Recording and reporting functions

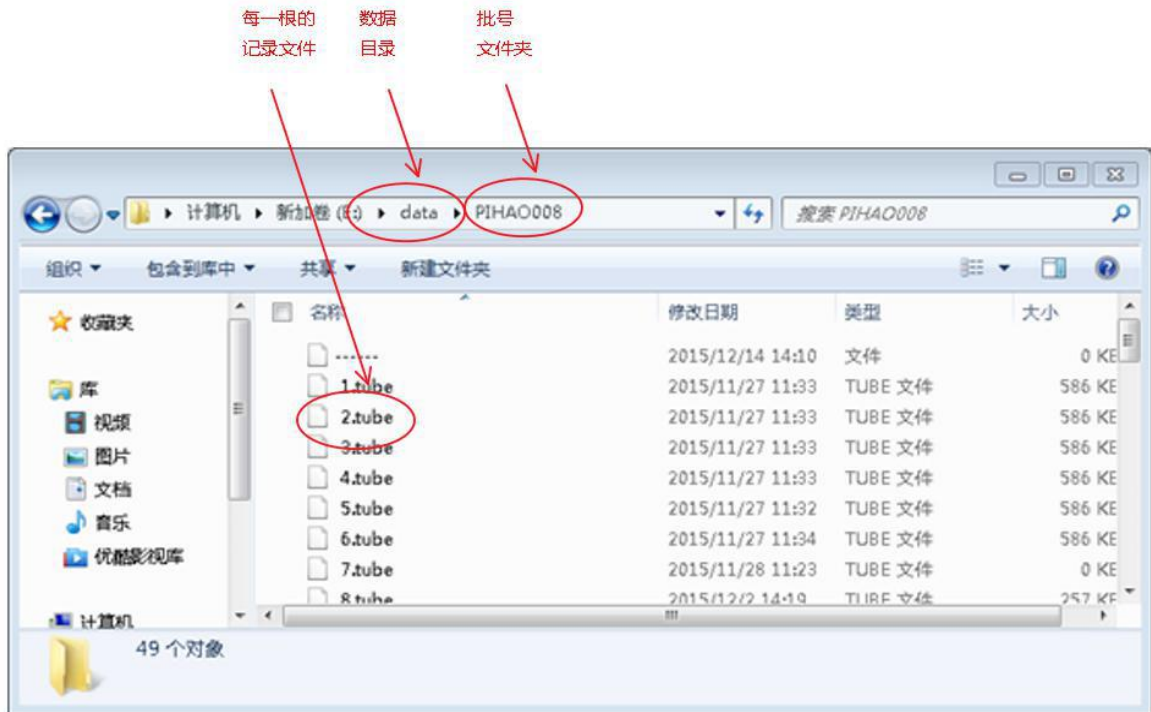


This button is used to create a set of record data. Users can establish records according to their job management requirements, such as: records of a certain day, records of a certain type of steel pipe, and so on, generally we call it batch number. In the computer's file system, the batch number exists as a folder, which is stored in a data directory. Generally this directory is "E:\data\". Users can also set their own. Set up method please consult





the trainer. For each steel pipe to be tested, its record is a file under this batch directory.



Start a batch number step:



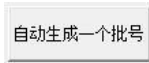
Click the following window:



Enter the name of a batch number on the left of the Start this batch number



button, click, and the batch number establishment is



Another way to create a batch number is to automatically generate a new batch number by clicking on the existing batch number. When a batch number has not been completed, the computer is shut down, the next boot is the default batch number.

The batch directory currently in use is displayed in the upper right corner of the main interface. display green when in record state and red when not record state.



When the batch number has been set up, or using the existing batch number, click this button to start normal detection and record.



Click this button after the program does not record the number of detection, but can normally display the detection curve, to restore the recording function click the "record" button can.



To view previously recorded data, click the Record Search button to keep the program in search. When in search, the data being detected is not recorded and displayed



Each query button in the middle of the main interface becomes available. (These

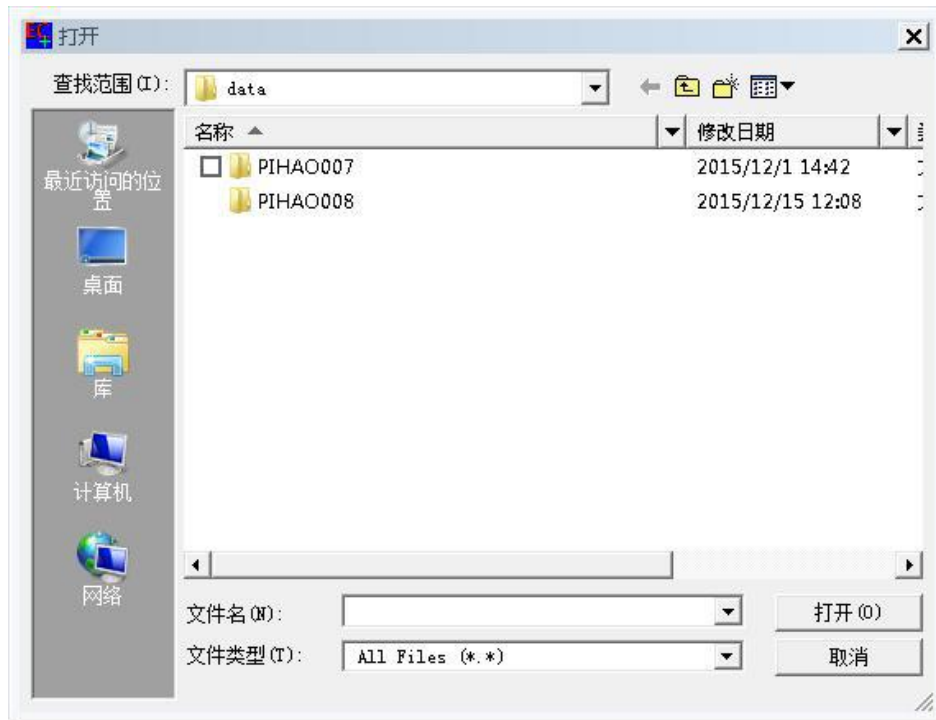
buttons are not available when not in search

status)

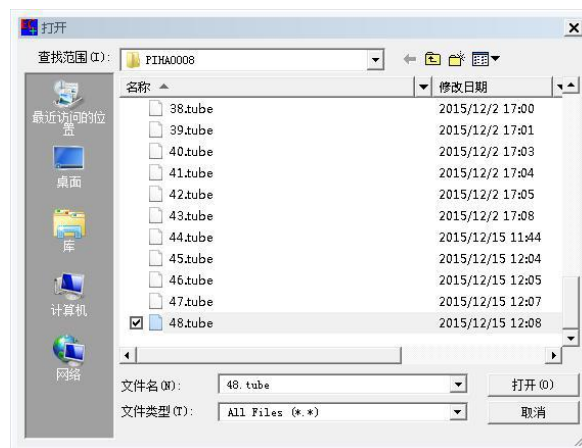


浏览

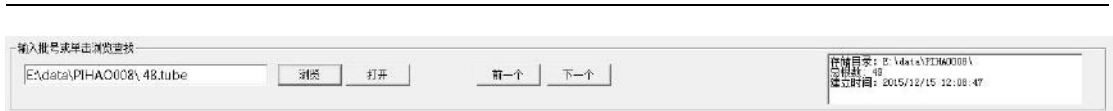
Click the pop-up data file directory dialog box



Select Lot Number folder



Select the drill pipe record file, click on "open ", the main interface search related content becomes like this:



Click on the "open" button on the main interface to display the record of the selected drill pipe.



If you want to view other records in this batch number, click these two buttons.



Click this button to print the record of the current view.