



**TRQ Series Full-automatic Liquid State
Resistance Soft Starter**

TRQ 系列全自动液体电阻起动器

Installation and Operation Instructions
安装使用说明书

XIANGYANG TENGHUI ELECTRIC MANUFACTURE CO., LTD

襄阳腾辉电气制造有限公司



Contents

目 录

1 Overview.....	1
1 概述.....	1
2 Major Technical Parameters	3
2 主要技术参数.....	3
2.1 Technical parameters.....	3
2.1 技术参数.....	3
2.2 Normal operating conditions of soft starter	3
2.2 起动器正常工作条件	3
2.3 Power source of controlling cabinet	4
2.3 控制柜电源	4
3 Outline and Installing Dimensions.....	5
3 外形及安装尺寸	5
4 Carry and Lifting.....	10
4 搬运与吊装	10
5 Introduction to Auxiliary Function and Application	11
5 辅助功能简介及应用	11
5.1 TRQ ₆ -1W type.....	11
5.1 TRQ ₆ -1W 型	11
5.2 TRQ ₆ -1 type	11
5.2 TRQ ₆ -1 型.....	11
5.3 TRQ ₆ -K type.....	11
5.3 TRQ ₆ -K 型.....	11
5.4 TRQ ₆ -0.6KJ type	12
5.4 TRQ ₆ -0.6KJ 型.....	12
5.5 TRQ ₆ -KC type.....	12
5.5 TRQ ₆ -KC 型.....	12
6 Installation of Soft Starter	13
6 起动器的安装.....	13
7 Testing of Equipment.....	14
7 调试.....	14
7.1 Confirmation of starting resistance.....	14
7.1 起动电阻的确定	14
7.2 Preparation of liquid resistance.....	14
7.2 液体电阻的配制	14
7.3 Measuring liquid resistance	15
7.3 液体电阻的测量	15
8 Equipment Use and Maintain.....	16
8 使用与维护	16



TRQ Series Full-automatic Liquid State Resistance Soft Starter

Installation and Operation Instructions

TRQ 系列全自动液体电阻起动器安装使用说明书

1 Overview

1 概述

TRQ series full-automatic liquid state resistance soft starter is developed for improving soft start of medium or large winding AC asynchronous motor. This equipment is applied in starting winding motor of construction materials, metallurgy, chemical engineering, coal and mine etc. This soft starter has the following features:

TRQ 系列全自动液体电阻起动器是为了改善大中型线绕式交流异步电动机的重载起动性能而研制的起动设备。该设备适用于建材、冶金、矿山、石油等工业部门的球磨机、提升机、破碎机、风机、水泵等机械设备的线绕式异步电动机起动，该起动器有以下显著特点：

a. Small starting current: $I_q \leq 1.3 I_e$;

1、起动电流小: $I_q \leq 1.3 I_e$

b. Small starting torque: $M_q \leq 1.3 M_e$;

2、起动转矩小: $M_q \leq 1.3 M_e$

c. It can be started 5~10 times continuously.

3、可连续起动 5—10 次

The auxiliary code meaning:

辅助代号的含义:

W—Multi-point temperature measurement and flash alarm function

W—多点温度测量及闪光报警功能

J—Automatic switching function of phase advancer

J—进相器自动转接功能

K—Primary circuit of low voltage motor

K—低压电机一次回路



KJ Phase advancer automatic switching function of primary and secondary circuit of low voltage motor

KJ 配低压电机一次回路和二次回路进相器全自动转接装置

KC Primary circuit of low voltage motor and capacitor power factor compensation device

KC 配低压电机一次回路和现场电容功率因数补偿装置



2 Major Technical Parameters

2 主要技术参数

2.1 Technical parameters

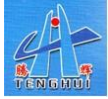
2.1 技术参数

Technical parameter 技术参数 Type 型号	Motor capacity (kw) 适用电机容量	Temperature during start (°C/time) 起动温升	Starting time (S) 起动时间	Liquid normal working temperature (°C) 液体正常工作温度	Max phase resistance range (Ω) 最大相电阻值范围	Remark 备注
TRQ4-0.2	below 210	<5	15±2	0-60	0.1-2	Integration 一体化
TRQ4-0.4	below 380	<5	20±2	0-60	0.1-2	Integration 一体化
TRQ4-0.4K(C)	below 380	<4	20±2	0-60	0.1-2	Integration 一体化
TRQ6-0.6	380-630	<5	20±2	0-60	0.2-3	
TRQ6-0.6J	380-630	<5	20±2	0-60	0.2-3	
TRQ6-0.6K(J)/(C)	280-380	<3	20±2	0-60	0.2-3	
TRQ6-1	630-1250	<3	28±2	0-60	0.4-3	
TRQ6-1W	630-1250	<5	28±2	0-60	0.4-3	
TRQ4-2	1250-3200	<5	35±2	0-60	0.3-3	

2.2 Normal operating conditions of soft starter

2.2 起动器正常工作条件

- a. The surrounding air temperature is not higher than +50°C and lower than -25°C;
- a. 周围空气温度上限不超过+50°C，下限不低于-25°C；
- b Altitude in installation site is no more than 2000m, except for special cases;
- b 安装地点的海拔高度不超过 2000 米。特殊情况另议；
- c Atmospheric relative humidity is less than 85%;



c 大气相对湿度不超过 85%;

d Working in without explosive tendency medium, that must be corrosion metal and damaging insulating air , and in conductive dirt place.

d 在无爆炸危险的介质中，且介质中无足以腐蚀金属和破坏绝缘的气体与尘埃（包括导电尘埃）；

e No significant vibration and impact in the installation site.

e 安装地点无显著的震动与冲击。

2.3 Power source of controlling cabinet

2.3 控制柜电源

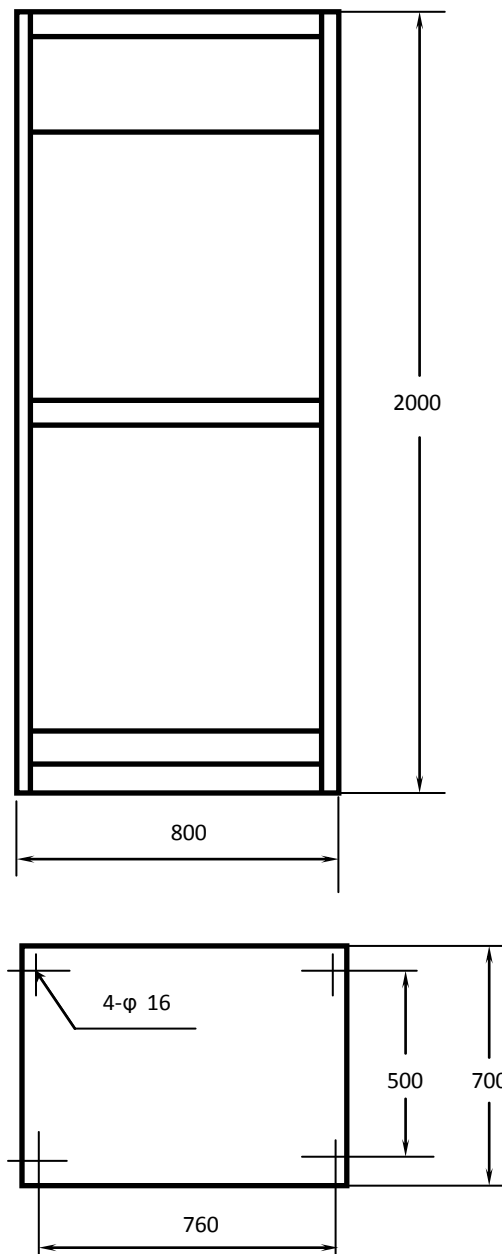
Three-phase four-wire 380/220 V 20A 50Hz

三相四线 380/220 V 20A 50Hz



3 Outline and Installing Dimensions

3 外形及安装尺寸



TRQ4-0.4 type

TRQ-0.4K type

TRQ6-0.6 type

outline and installation dimensions

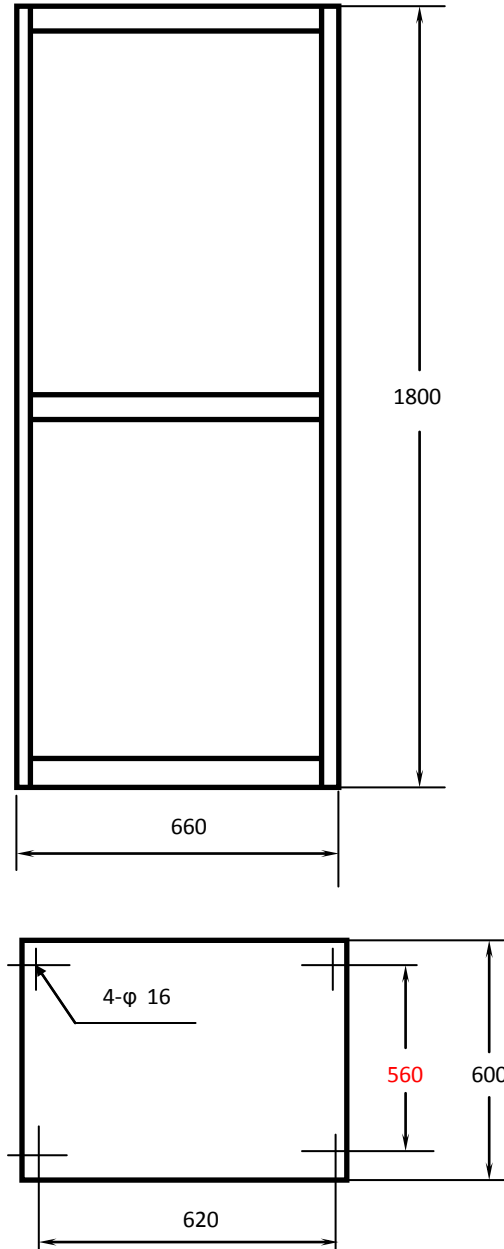
外形及安装尺寸

Note: Cable pipe is needed in the back of cabinet. TRQ4-0.4 type is only second pipe and controlling cable pipe, so it needs to be added as secondary bus-bar and primary



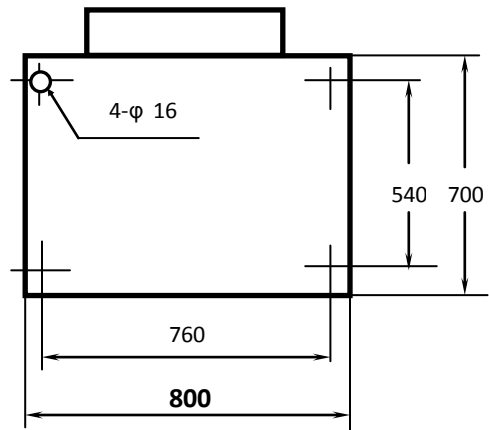
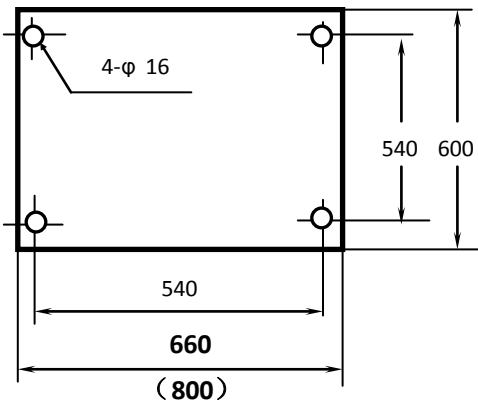
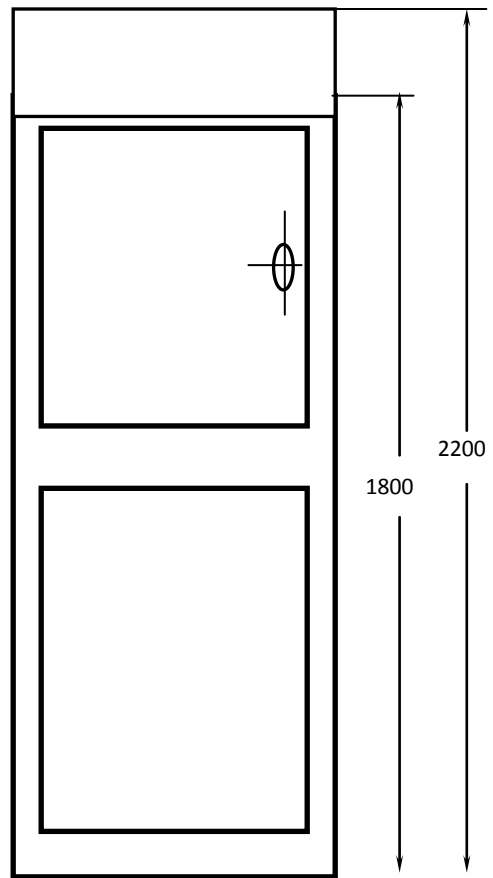
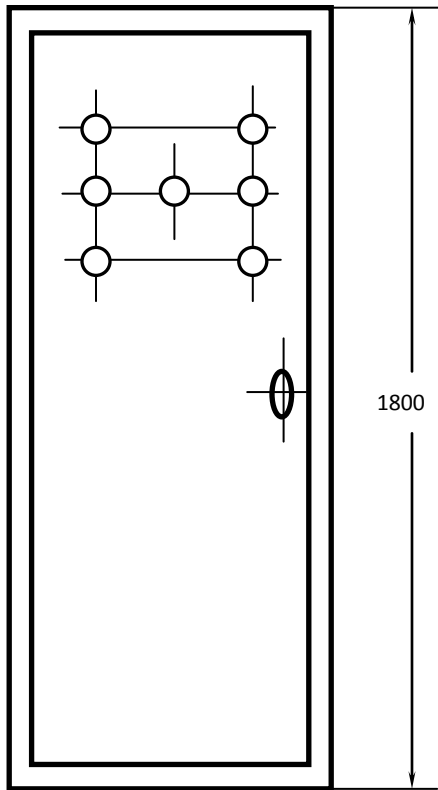
conduit of motor.

注：柜后作电缆穿管，TRQ4—0.4 型只作二次穿管和控制电缆穿管 TRQ4—0.4K 型需增作二次母线及电机一次穿线管



TRQ4-0.2 type outline and installation dimensions

TRQ4—0.2 型外观及安装尺寸



Controlling cabinet

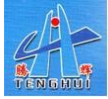
Resistor cabinet

控制柜

电阻柜

(TRQ6-0.6K type)

(TRQ6-0.6KC type)



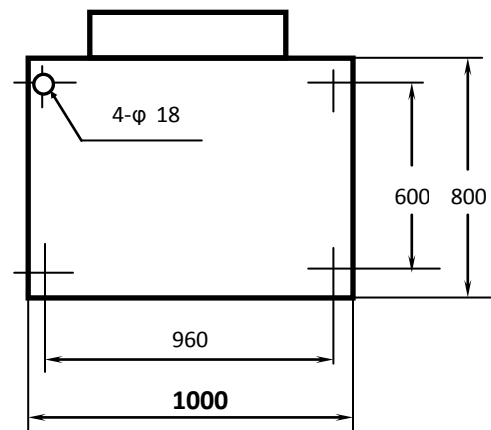
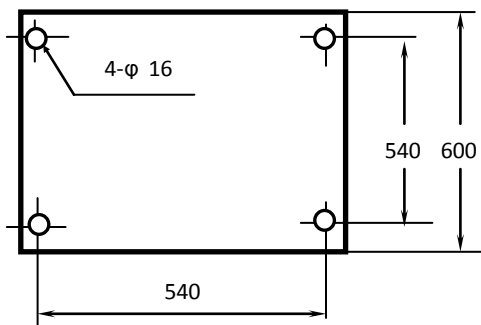
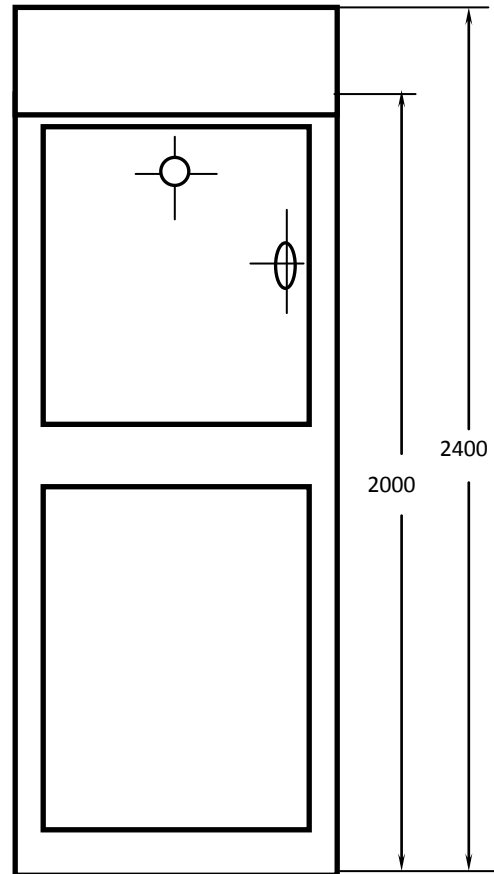
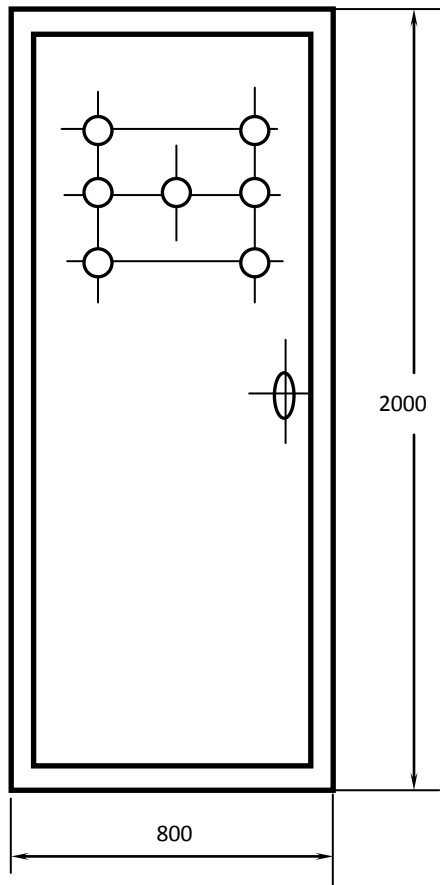
(TRQ6-0.6 type)

outline and installation dimensions

(TRQ6-0.6J type)

外形及安装尺寸

(TRQ6-0.6KJ type)



Controlling cabinet

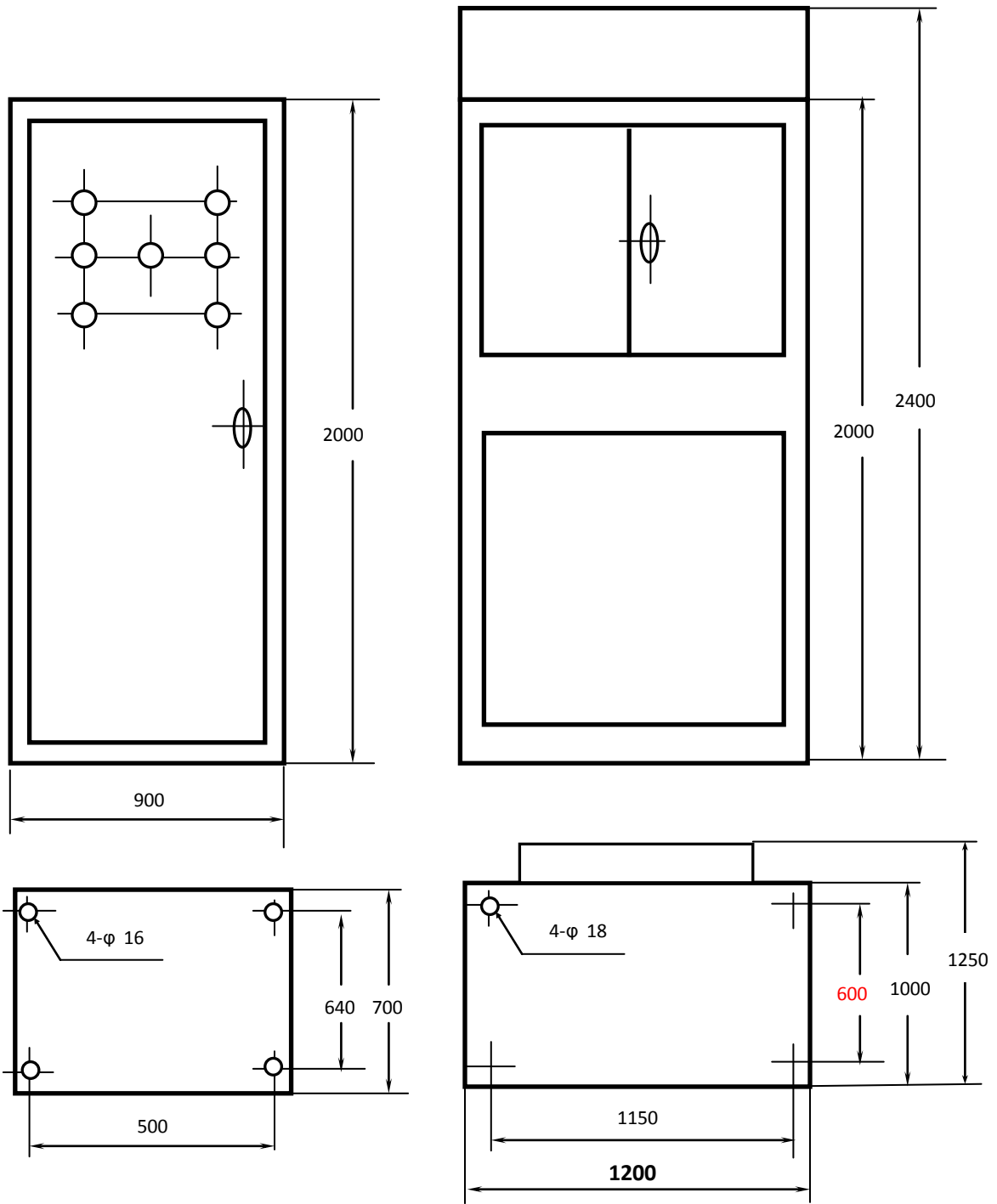
Resistor cabinet

控制柜

电阻柜

TRQ6-1 type outline and installation dimensions

(TRQ6-1W)型外形安装尺寸



Controlling cabinet

控制柜

Resistor cabinet

电阻柜

TRQ4-2 type outline and installation dimensions

TRQ4-2 型外形及安装尺寸

(Without controlling cabinet, it is a Integration cabinet. Its size is same with LDQ4-2 resistor cabinet)



(一体化柜、无控制柜、尺寸同 LDQ4—2 电阻柜)

4 Carry and Lifting

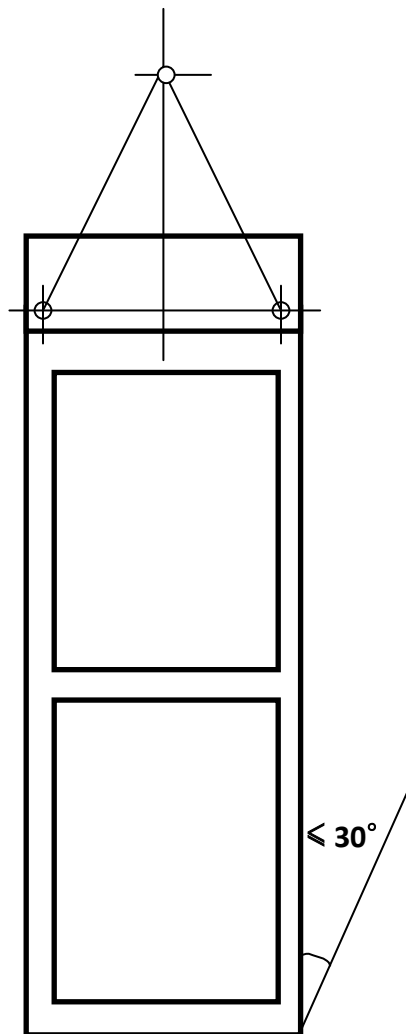
4 搬运与吊装

1 This equipment should be lifted in a single container;

1 单箱吊装避免撞击

2 In case of damaging transfer group and insulation components, this resistor cabinet should not be laid to carry. (Do not lift more than 30 angle when carrying.)

2 电阻柜的搬运不得躺倒搬运，以免损坏传动组件及绝缘箱件（搬运时柜体倾斜角不得超过 30° ）。



Lifting schematic drawing

吊装示意图



5 Introduction to Auxiliary Function and Application

5 辅助功能简介及应用

5.1 TRQ₆-1W type

5.1 TRQ₆-1W 型

Aside from functions of TRQ₆-1, this type of soft starter also has 4 digital temperature accommodometers, 8 flash light alarm, controlling switchboard, Mill auxiliary transmission circuits, controlling cabinet power of thin oil station and reducer lubrication.

该型号起动器除具有 TRQ₆-1 型的功能外，另配有 4 点数字温度调节仪和 8 点闪光信号报警、控制配电盘、磨机辅助传动回路、稀油站和减速机润滑控制箱电源等。

As digital display and alarm, 4 digital temperature accommodometers can respectively measure temperature of reducer and mill, and stator temperature of high voltage motor. This soft starter also has control relay to tripping control and cooling control.

4 点温度调节仪可以分别测减速机温度，磨机入、出口轴承温度。高压电机定子温度等。作数显和报警用，并带有控制继电器可进行跳闸控制，冷却控制等。

5.2 TRQ₆-1 type

5.2 TRQ₆-1 型

This type of soft starter has automatic switching function like phase advancer.

该型号起动器配有进相器自动转接功能。

After starting motor, it can automatically switch secondary circuit to compensation state of phase advancer by contactor.

在电机起动完毕之后，自动将二次回路通过接触器切换到进相器补偿状态。

5.3 TRQ₆-K type

5.3 TRQ₆-K 型

This type of soft starter is designed for low voltage motor. It can save one-time investment and installation space through a combination of primary and secondary circuits.

该型号主要为低压电机配套设计，将一次回路和二次回路合而为一，可以节省一次性投资和安装空间。



5.4 TRQ₆-0.6KJ type

5.4 TRQ₆-0.6KJ 型

This type of soft starter is a perfect starting and energy-saving equipment with a combination of primary circuit, secondary starting circuit and compensator of secondary phase advancer.

该型号将一次回路、二次起动回路和二次进相器补偿器转接回路合为一体，构成比较完美的平滑起动和节能运行装置。

5.5 TRQ₆-KC type

5.5 TRQ₆-KC 型

This type of soft starter is a perfect low-cost and energy-saving equipment with a combination of primary circuit, secondary starting circuit and power factor compensation capacitor.

该型号将一次回路和起动回路,现场功率因数补偿电容合为一体，成本低，具有良好的节能效果。



6 Installation of Soft Starter

6 起动器的安装

- 1 Liquid resistance cabinet is best for installing on a self draining cement platform;
1 液体电阻柜最好安装在可以泄水的水泥平台上;
- 2 Cabinet should be perpendicularly installed on a platform;
2 安装地面应水平，柜体应垂直于水平面安装;
- 3 Controlling cabinet should be equipped with channel steel base and installed right above cable duct;
3 控制柜应装在电缆沟的正上方，配槽钢基座;
- 4 Rotor cable of motor should be wired from controlling cabinet to three-electrode of resistor cabinet.
4 电机转子电缆接入控制柜，再从控制柜到电阻柜的三电极。



7 Testing of Equipment

7 调试

7.1 Confirmation of starting resistance

7.1 起动电阻的确定

Resistance value series in rotor circuit of motor can be confirmed as the following formula:

串入电动机转子回路的相间电阻 R 阻值，可按下列公式确定：

$$R_0 = \frac{2U_{2e}}{\sqrt{3}I_{2e}k_m} \cdot \frac{I_{1e}}{I_1}$$

U_{2e} : Rotor open-circuit voltage (转子开路电压)

I_{2e} : Rotor rated current (转子额定电流)

I_{1e} : Stator rated current (定子额定电流)

I_1 : Stator running current (定子运行电流)

k_m : Starting torque ratio: 1.1~1.3 (起动转矩比)

7.2 Preparation of liquid resistance

7.2 液体电阻的配制

a Move plate to starting position and inject water in tank to three-quarters water level;

a 先将活动极板移到起动位置,并将清水注入水箱到规定水位的 3/4 处;

b Dissolve electrolytic powder and respectively inject into three water tanks, keep electrolyte have 3% concentration;

b 将电解粉溶解后分别注入三个水箱内，使溶液浓度在 3%左右;

c Rise and fall plate in water tank to stir electrolyte, and then reset plate to measure resistance value between the two poles;

c 将活动极板升降数次，溶液搅拌均匀，将极板复位后测任意两极之间电阻值 R;

d If resistance value is in R_0 range, then the motor can test soft start; if not, resistance value needs to be adjusted. When resistance is too large, raise electrolyte concentration; when it is too small, reduce electrolyte concentration.

d 若 R 值在 R_0 范围内，就可以试车起动。若 R 未在 R_0 范围内，则需要调整，R 过大



时，应增大电液粉浓度；R 过小时，应降低电液粉浓度。

7.3 Measuring liquid resistance

7.3 液体电阻的测量

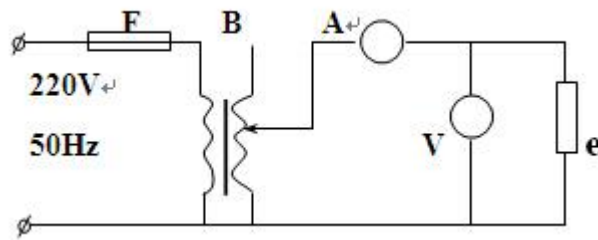
After moving plate to starting position, charge 10A, 50Hz AC current I to the two poles and measure voltage between two poles. Here is the formula to measure liquid resistance:

将液体电阻的活动极板移到起动位置后，给任意两电极之间通入 10A、50Hz 交流电流 I (A)，并测量两极之间的压降 V (v) 测液体电阻值为：

$$R (a) = \frac{V (v)}{I (A)}$$

Measurement circuit as follows:

测量回路如下：



F-Fuse (熔断器) 2A

B-Voltage regulator (调压器) 5KVA

A- AC ammeter (交流电流表) 0.5 level

V-AC voltmeter (交流电压表) 0.5 level



8 Equipment Use and Maintain

8 使用与维护

1 There are 2 control switches equipped on panel of soft starter controlling cabinet.

1 起动器控制柜面板，配有两个主令开关。

(1) Stop button: it is applied for emergency stop;

(1) 停车按钮：用于现场紧急停车；

(2) Start button: it is applied for starting motor.

(2) 起动按钮：主要用于现场起动。

2 Before starting motor, controlling cabinet needs to be powered on. Motor can be softly started when the light “allow start” is on.

2 设备起动之前必须先给控制柜送电，当“允许起动”信号灯亮时，方可起动。

3 Soft starter needs to be detected if the light “start allow” is off. We need to detect:

3 若“允许起动”信号灯不亮时，不得起动，此时应该检查：

(1) Signal light;

(1) 信号灯；

(2) Liquid temperature is higher than 60C° or not, if it is, soft starter needs to cool down and restart at 50C°;

(2) 液温是否高于 60℃，若高于 60℃应等冷却至 50℃以下方可再起动；

(3) Active plate is on upper limit position or not, if not, we should detect fault and reset plate;

(3) 活动极板是否在上限位置，若未到上限位，应先查原因，故障诊断并处理后，使至复位；

(4) Low limit switch is released or not, if not, it needs to be changed;

(4) 下限开关是否未释放，若未释放则应更换下限开关；

(5) Contactor KA2-4 switch on or not. If switch on, iron core and contact of contactor need to be cleaned and then start the starter.

(5) 接触器 KA2-4 是否处于粘合状态，若处于粘合状态，应将接触器铁芯及触头清理好



后，再起动。

4 Maintain of soft starter

4 起动器的维护

Regularly check whether the liquid is within the limits prescribed. If liquid level is too low, water should be injected to keep liquid level.

经常检查液体是否在规定的范围之内，若液位太低，应加适量清水保持液位。

NOTE:

注意：

(1) When preparing liquid resistance or injecting water in tank, we should avoid spoiling water and damage insulation;

(1) 在配制液体电阻或充水时，应防止水珠飞溅，破坏绝缘。

(2) Regularly replace water after 4 or 5 years and clean plate and insulated cabinet.

(2) 定期更换液体，一般4~5年更换一次，同时清洗极板和绝缘箱体。

* Plate can be corroded by diluted hydrochloric acid and cleaned by water;

* 极板清洗可先用稀盐酸腐蚀导电面后，再用清水冲洗。

* Insulated cabinet can be cleaned by water firstly, and then paint on PVC anti-corrosion glue 3 or 5 times.

* 绝缘箱体的清洗：先用清水洗刷后晾干，然后涂覆3-5次PVC防腐蚀胶。

In general, it is best not to remove and clean insulated cabinet. It should be protected from breaking when disassembly.

一般情况下，绝缘箱体最好不要拆卸清洗，拆卸时要避免振动和撞击，以免箱体破裂。