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YXZ型多绳提升 钢丝绳张力自动平衡悬挂装置

YXZ Type Steel-Rope Tension Auto-equilibrator
for
Multi-rope Winder

使用维护说明书
Maintenance Instruction

徐州煤矿安全设备制造有限公司

Xuzhou Coal Mine Safety Equipment Manufacture Co., Ltd.



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1. 简介:

1. Introduction

1.1 用途

1.1 Application

YXZ型多绳提升钢丝绳张力自动平衡悬挂装置是针对国内外普遍使用的液压螺旋式和液压垫块式调绳器存在的不能自动调整钢丝绳张力平衡而研制的一种实用新型产品。该装置采用闭环无源液压连通自动调整平衡系统，能高精度地实现钢丝绳在动、静状态下的张力自动平衡，完善了多绳提升机的一项关键技术，使多绳提升机无论从安全上、生产效率上都跃上了一个新水平。该装置现已系列化，可供老矿井改造，新矿井设计选用。

YXZ Type steel-rope tension auto-equilibrator for multi-rope winder is a utility model product developed against the rope adjuster (hydraulic spiral type and hydraulic pad-type, which are commonly used both home and abroad) cannot regulate the tension equilibrium of the steel-rope automatically. This product adopts closed loop passive hydraulic connection automatically balance adjustment system, which can achieve the tension auto-equilibrium of the steel-rope both under the dynamic and static conditions, and improved a key technology for the multi-rope winder. With this product, the multi-rope winder made a new step forward both in terms of security and productivity. This product has been serialized for rectification of the old mines and design of the new mines.

1.2 功能

1.2 Function

- 能使提升钢丝绳在动、静状态下实现张力自动平衡，不需停车调整。
- This equipment can make the hoisting steel-rope achieve tension auto-equilibrium under the static and dynamic state without stopping the winder to regulate.
- 能减少因滚筒绳槽直径误差而引起的钢丝绳张力差。
- This equipment can reduce the steel-rope tension differences caused by the diameter error of drum rope groove.
- 能减少或消除钢丝绳本身刚度误差引起的钢丝绳应力变化。
- This equipment can reduce or eliminate the variation of steel-rope stresses caused by the



stiffness error of itself.

- 能有效提高钢丝绳使用寿命，减少因张力不平衡而造成的断绳事故。
- This equipment can increase the service life of steel-rope and reduce the rope broken accident caused by the tension nonequilibrium.
- 能大大减轻提升机衬垫磨损，延长衬垫使用寿命。
- This equipment can reduce the liner abrasion greatly and extend the service life of the liners.
- 能大大减少或取消车削衬垫、测试张力、调整平衡，减少维护工作量。
- This equipment can reduce or cancel the turning liner、tension test、equilibrium adjustment greatly with less maintenance work.
- 能减少调整对罐截绳次数。
- This equipment can reduce the frequency of cutting rope when adjusting the cage.

1.3 特点

1.3 Features

- 结构简单、尺寸小、重量轻、外形美观。
- Simple structure, small size, light in weight, good looking.
- 平衡精度高、满足《安全规程》要求。
- High equilibrium precision, meet the requirements of 《Safety Regulation》.

1.4 主要技术特征

1.4 Major Technical Features

序号 No.	项 目 Description	单位 Unit	YXZ 600	YXZ 900	YXZ 1350	YXZ 1700	YXZ 2000	YXZ 2500	YXZ 3000	YXZ 4000
1	单架设计破坏载荷 Designed breaking load for single one	KN	600	900	1350	1700	2000	2500	3000	4000
2	适用钢丝绳直径 Applicable steel-rope diameter	mm	15-20	19-28	28-35	30-40	35-45	40-50	45-55	55-65
3	提升绳数 Numbers of hoisting rope	根 Strand	4 或 6 4 or 6							4
4	允许最小的提升间距 Allowable min. hoisting distance	mm	200		250		300			
5	最大调绳距离 Max. distance for adjusting ropes	mm	355	540	685	735	865	898	1130	933
6	单架设备自重 Deadweight for single device	kg	157	242	434	672	770	1198	1345	1678
	其中 XSD 型标准绳环重 Mass of XSD Type standard rope-ring	kg	46	77	136	250	250	430	430	630

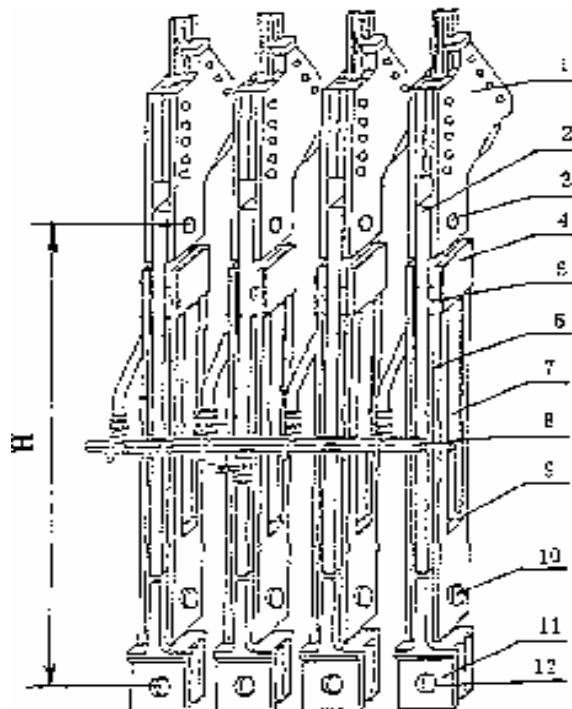


1.5 结构及张力自动平衡原理

1.5 Structure and Principle of the Tension Auto-equilibrium

张力自动平衡悬挂装置由楔形绳环、液压平衡系统、承力结构部件三部分组成。单架装置由楔形绳环1、中板2、上连接销3、档板4、压板5、侧板6、连通油缸7、连接组件8、垫块9、中连接销10、换向叉11、下连接销12组成。中板2和侧板6通过档板4、压板5、垫块9、中连接销10和连通油缸7组成抽拉扣环结构，再通过上连接销3和上部楔形绳环1连接，通过换向叉11，下连接销12和下部容器四角板相连，多个这样的结构加上连接组件8(软管、阀门、通管)形成了张力自动平衡悬挂装置。(见下图)

Tension auto-equilibrator consists of wedge rope-ring, hydraulic balance system, load bearing structure. Single device consists of 1- wedge rope-ring, 2-median plate, 3-top pin, 4-baffle plate, 5-pressure plate, 6-side plate, 7-oil cylinder, 8-connecting assemblies, 9-cushion block, 10-median pin, 11-connecting rod fork, 12-bottom pin. Median plate-2 and side plate-6 along with baffle plate-4, pressure plate-5, cushion block-9, median pin-10 and oil cylinder-7 consist of buckle structure. With the connection of top pin-3 to wedge rope-ring-1 and the connection of connecting rod fork-11, bottom pin-12 to the load bearing hanging plate of the vessel, several such structures along with connecting assemblies-8 (hose, valve, pipe) consist of tension auto-equilibrator (see below figure).



张力自动平衡悬挂装置结构图

Structure drawing for tension auto-equilibrator

1. 楔形绳环; 2. 中板; 3. 上连接销; 4. 档板; 5. 压板; 6. 侧板; 7. 连通油缸

1 - Wedge rope-ring, 2-Median plate, 3-Top pin, 4-Baffle plate, 5-Pressure plate, 6-Side plate, 7-oil cylinder

8. 连接组件; 9. 垫块; 10. 中连接销; 11. 换向叉; 12. 下连接销

8-Connecting assemblies, 9-Cushion block, 10-Median pin, 11-Connecting rod fork, 12-Bottom pin



这种悬挂装置的工作原理是：闭环无源液压连接式。无论是处于运动或静止时，只要各钢丝绳存在张力差，张力大的钢丝绳通过中板2、垫块9、侧板6、压板5压缩连通油缸使连通油缸7活塞杆压缩，悬挂伸长，钢丝绳的张力变小，油缸内的油液通过连通管进入张力小的连通油缸，使其活塞杆往外伸长，通过垫块9、中板2、压板5、侧板6使悬挂缩短，钢丝绳张力变大，直到每根钢丝绳的张力均相等，连通油缸运动才相应停止。

The operating principle of this device is closed loop passive hydraulic connection type. The steel-rope with larger tension, no matter in dynamic or static, as long as each steel-rope has tension differences, will compress the oil cylinder through median plate-2, cushion block-9, side plate-6 and pressure plate-5 to make the piston rod of cylinder-7 compress and lead to a relative move between median plate-7 and side plate-6, and also can get a smaller steel-rope tension. The fluid in the cylinder with larger tension will flow into the one with smaller tension through the connecting assemblies-8 to make the piston rod extend. The steel-rope tension can be increased by shortening the relative move between median plate-7 and side plate-6 through the cushion block-9, pressure plate-5 and side plate-6. The cylinder will stop moving until each steel-rope tension becomes equal.

2. 安装与调试

2. Installation and Testing

2.1 安装准备

2.1 Preparation for Installation

2.1.1 工具准备

2.1.1 Preparation of Instruments

起吊工具，要有能可靠吊起容器的吊链或电动葫芦。要有能快速吊放悬挂的小型电动葫芦或吊链，如没有可用滑轮。

Lifting instruments. Make sure sling chain and electric block with high reliability can be provided to hoist the containers. Make sure the small electric block or sling chain, which can assure the product could be moved up and down with high speed, can be provided. Pulley is allowed to be used to instead of small electrical block and sling chain if they are not available.



切割工具，由于老液压螺旋式悬挂销、卡板容易锈死，所以必须准备切割设备。

Cutting tools. The cutting tools are necessary due to the old hydraulic spiral type pin and plate are inclined to rust.

常用工具，保险带6付，柴油20kg，液压油50~60kg。南方(黄河以南)选用高级齿轮油，北方(黄河以北)选用N₆₈低凝液压油，棉沙2kg，夹绳卡20~30副。

Common tools, including six security belts, diesel oil 20kg, hydraulic oil 50~60kg. For hydraulic oil, advanced gear oil should be selected for the south (south to Yellow River), while N₆₈ low-freezing hydraulic oil should be selected for the north (north to Yellow River). Also, cotton 2kg, rope clamp 20~30 pairs are required.

2.1.2 人员准备

2.1.2 Personnel Preparation

如有电动起吊设备，一般有6~8人即可，如用滑轮最好要有10人左右。

Generally, 6~8 persons for electric lifting equipment, 10 persons for pulley.

2.1.3 注意

2.1.3 Attention

注意事先测量两端悬挂H最大或最小尺寸及原使用悬挂相应尺寸，以判断是否需要截绳。

Attention should be paid to the measurement of the max. or min. dimension of H (see above figure) and the previous dimensions to determine whether the need to cut off ropes.

2.2 悬挂安装

2.2 Installation of the YXZ Type Tension Auto-equilibrator

1. 确定首先安装悬挂的容器和操作场地，一般塔式提升机操作场地可选在2层或3层平台，落地式提升机选在井口车场。

1. Determine the vessels and operating site for installing this device. Generally, the site of tower winder can be placed at the second or third floor, ground type winder can be placed at the shaft



entrance.

2. 将容器提到便利安装位置。
2. Lift the vessels to the position that facilitates to install.
3. 在适当位置将另一侧所有首绳用绳卡或专用工具卡绳器卡死、固定。
3. Fix all the head ropes on the other side in appropriate position with rope clamp or special tools.
4. 用电动葫芦或吊链将要换悬挂一侧容器吊起，使上端悬挂处于松弛状态。
4. Lift the vessel with the electric block or sling chain to change the to be replaced tension auto-equilibrator.
5. 拆掉老悬挂(最好拆一个旧的换一个新的)，注意拆卸时一定要将销孔内锈斑清淨涂上黄油，再装新悬挂。
5. Disassemble the old device (use new one to instead of old one). Rusty spots remained in the pin holes have to be cleaned and butter to be added during disassembling. Then install the new device.
6. 全部新悬挂装完后，安装通管(注意清洗接头)，检查销、卡、阀、管等元件。
6. After finishing the installation, install the pipe (pay attention to clean the joints) and inspect components such as pins, clips, valves and pipes.
7. 放下容器，让容器自由下垂，让首绳承力。
7. Drop the vessel to let it down freely with head rope bearing loads.
8. 连接电动泵。
8. Connect the motor pump.
9. 向连通器内充液，充液量为连通缸活塞杆都能均匀伸出总伸出量的1/4~1/2为止。
9. Fill in the connecting vessel with fluid. The volume is suitable when all the piston rods can extend uniformly to 1/4~1/2 out of the total volume.
10. 关闭总阀门后再关闭所有分阀门。
10. Close king valve then close all the sub-valves.
11. 将另一侧绳卡拆除。
11. Remove the rope clamp on the other end.
12. 将另一侧容器提到安装位置。
12. Lift the other end of the vessel in position.



另一侧悬挂安装方式同上。

Device on the other end should be installed ditto.

2.3 平衡系统安装与注意事项

2.3 Installation of Equilibrium System and Cautions

2.3.1 液压连通器出厂前均通过耐压试验，运动检验，均为无油状态。安装时认真检查堵头是否完好，缸筒是否受损，一切完好后方可定为安装用件。

2.3.1 Hydraulic connecting vessels have been done the pressure test, exercise test under oil-free condition. Plugs shall be inspected during installation as well as the cylinder. They cannot be used if defects found.

2.3.2 安装前去掉堵头，用汽油反复清洗连通器入口，高压胶管两个接头密封件，特别注意管内要用汽油冲一下，洗好后检查密封圈，挡圈是否完好，齐备，方向是否正确，检查完全合格后将油管、阀门、连通管一一接入，上好“u”型卡。

2.3.2 Remove the plugs before installation, clean the inlet of the connecting vessel with gasoline several times as well as two sealing joints of the high-pressure rubber pipe. Special attention shall be paid to clean the inside of the pipe with gasoline. After cleaning, inspect the seal rings and rings. If no problems, connect the pipes and valves.

2.3.3 一切安装完毕，经检查确认无误后即可向连通器内充液。油品选用：北方用 N₆₈ 低凝液压油、运动粘度为 $V_{40} \approx 61 \sim 74 \text{mm}^2/\text{S}$ ，南方用高级齿轮油 N₃₂₀，粘度为 $288 \sim 352 \text{mm}^2/\text{S}$ 。充油前将全部截止阀开启为最大量，即完全打开，进行有载充油，充油速度不要太快，充油量为全部缸杆伸出 $1/4 \sim 1/2$ 为止，如伸出量少有不均衡属正常情况，说明原钢丝绳张力不平衡。

2.3.3 When all the installation is finished and confirmed correct, fill in the connecting vessel with fluid. For the north, the oil shall be used N₆₈ low-freezing hydraulic oil with kinematical viscosity of $V_{40} \approx 61 \sim 74 \text{mm}^2/\text{S}$. While for the south, the oil shall be used N₃₂₀ advanced gear oil with viscosity of $288 \sim 352 \text{mm}^2/\text{S}$. The shut off valves shall be fully opened before filling oil. Speed of filling oil shall be not fast, and the volume is suitable when all rods spread $1/4 \sim 1/2$ out of its total length. It's a normal situation if not within the scope, because the tension of the previous steel-rope is



nonequilibrium.

如出现严重伸出不平衡时，说明钢丝绳张力已严重不平衡，通过楔形绳卡预调平衡，方法是排放缸内油压，垫起容器，打开楔形绳卡，记录绳号及不均衡量，使缸杆伸出量基本一致时，截去多余绳量，把绳调到基本平衡。

If the extensions of all the rods differ from each other too much, that means the tension of steel-rope has been serious disequilibrium. This can be adjusted by the wedge rope clamp: Discharge the oil pressure inside the cylinder, underlay the vessel, open the wedge rope clamp, record rope no. and values of disequilibrium, make sure the extensions are approx. the same, cut off the redundant rope.

2.3.4 检查充油量和缸杆伸出总量，确定充油量合适、缸杆伸出量均匀时可关死补油截止阀，其他连接平衡缸截止阀仍处在全开状态。拆除补油管路用堵头封好，即安装完好，可进入运行状态。

2.3.4 Inspect volume of oil charging and extensions of rods to assure the volume is appropriate and the extensions are uniform. Then close recharging shut off valve, and keep the shut off valves open which are used for connecting the cylinder. Remove the recharging pipe and seal with plug. With this, the device can be put into operation.

2.3.5 进入运转前检查各个销、卡是否有松掉迹象，“U”卡一定不能开口向上以免松落。

2.3.5 Inspect each pin and clip before operation to make sure they are not loose. The opening of 'U' clip cannot be upward to avoid loosening.

2.3.6 检查连通油管左右窜动是否灵活，有无抗力现象，无抗力、窜动灵活为好。

2.3.6 Inspect connecting pipe to check whether they can move flexibly, whether exists resistance. No resistance and move is preferred.

2.3.7 运转前首先在双容器上站上人，(带保险带，注意安全)用粉笔在悬挂上标出初始位置，开始轻载、慢速运转，容器上人随容器观察悬挂平衡系统运转情况，观察运动是否平稳，有无抖动现象，当一个行程运行终了时，测量并记录各连通缸运动量，这时可根据测量数据准确地计算出各绳槽直径误差。



2.3.7 People shall be stand on the double vessels before operation (with security belts for the sake of safety), mark the initial position on the device. Then begin to operate with light loads. The person on the vessel should observe the operation status of the device to check whether it operates smoothly. When an operation cycle is finished, measure and record the displacement of each cylinder rod. Thus, the diameter errors of the rope groove can be calculated according to the measurement data.

2.3.8 根据测量出的绳槽直径误差，进行绳槽修调、确保绳直径尽可能一样，这样可以减少平衡调整量，增加悬挂调罐能力，提高悬挂运行可靠性和使用寿命。

2.3.8 According to the diameter errors of the rope groove, rectify the rope groove to make each rope diameter the same as much as possible. Thus, lesser adjustments and high reliability and longer service life can be achieved.

2.3.9 进入运转前必须进行带压试验，检查每个油缸接头，卡口都不渗漏为合格，方可进入运转。如有渗漏，不得使用。

2.3.9 Pressure test must be done before operation. Check each cylinder joint whether exists leakage. It is not allowed to be used if it leaks.

2.4 运转调试

2.4 Testing

当两端悬挂全部安装完毕并检查一切完好后方可进行运转调试，对于双容器提升，由于钢丝绳塑性伸长，对罐是必然的、经常的，为减少截绳对罐次数，可区别对待。

Testing cannot be done until all the check and installation have been finished. For the double vessels hoisting, adjusting cage and cutting rope is essential and regular due to the plastic elongation.

2.4.1 使用旧绳

2.4.1 The use of old ropes

因为钢丝绳塑性伸长变化不大，两端充液量为所有油缸活塞杆伸出 $1/2$ 为止，关闭总阀即可运行。



When the old rope is used, due to little variation of the plastic elongation, the piston rod extends $1/2$ out of its length. Thus, it can operate with the king valve closed.

2.4.2 使用新绳

2.4.2 The use of new ropes

钢丝绳塑性伸长变化大，两端充液量为所有油缸活塞杆伸出 $1/4$ 为止，钢丝绳塑性伸长至影响进车或装卸载，可通过增加充液量调整对罐，如充液量已使两端的油缸活塞杆伸出量达 $4/5$ 时，可进行截绳调整对罐。截绳后充液量仍为油缸活塞杆伸出 $1/4$ 为止，如此几次，约需一个月时间，待钢丝绳稳定后，将两端充液至油缸活塞杆伸出 $1/2$ 为止，关闭总阀进入正常运行。

When the new rope is used, due to great variation of the plastic elongation, the piston rod extends $1/4$ out of its length. The plastic elongation of steel-rope will create a negative effect on the car entering into the hoisting vessel, loading and unloading. And this can be regulated by adjusting cage through increasing liquid-filled volume. If the liquid-filled volume made the piston rod extend $4/5$ out of its length, adjusting cage and cutting rope should be done. After this, the liquid-filled volume shall be stopped at the position when the piston rod extends $1/4$ out of its length. Thus, about one month, when the steel-rope becomes stable, keep filling in the cylinder with oil until the piston rod extends $1/2$ out of its length. Finally, close the king valve and put into operation.

2.4.3 钢丝绳伸长处理

2.4.3 Elongation Treatment of the Steel-rope

在运动中如出现一端悬挂平衡油缸活塞杆伸出到极限，另一端油缸活塞杆缩回到极限，则称为钢丝绳伸长，此时钢丝绳仍是平衡的，不影响提升，如需对罐，一是强行充液对罐，二是先排掉一端油液，正反微动来回两次，再充液，则可以消除伸长。

When in move, if the piston rod at one end extends to the limit, while the one at the other end retract to the limit, we call it elongation, but the steel-rope is still under equilibrium with no effect to hoisting. If need to adjust cage, one solution is to charge oil by force, and the other solution is to discharge the oil at one end, move the cylinder up and down twice, and recharge again. Thus, elongation can be eliminated.



2.4.4 换缸方法

2.4.4 Methods of changing cylinder

- 先关闭不需更换的油缸的各分阀。
- Close the sub-valves of the cylinders which are not to be changed.
- 用专用工具塞住需更换油缸的悬挂使其保持不变，拆下需要换油缸的高压软管，插入油缸另一端接口，打开总阀向需更换的油缸下部充液，使其上部油液排出，活塞杆缩回。
- Use special tools to stuff up the device, disassemble the high pressure hose of the cylinder that to be replaced, insert into the other interface of the cylinder, open the king valve and fill in the bottom of cylinder that to be replaced to make the oil on the top discharged, retract the piston rod.
- 拆掉一块弧形板及油缸吊挂螺栓，油缸可换下(一定要注意接住防止落井)。
- Then the cylinder can be removed by disassembling one curved plate and cylinder hanging bolt (Attention should be paid to avoid dropping).
- 换上新缸，接好连接油管，向新缸充液，拆下特殊工具。
- Change the old one with new one, connect the pipe, fill in the cylinder with oil and disassemble the special tools.
- 打开所有油缸阀门，使新缸进入连通状态，正常运行。
- Open all the cylinder valves, make sure the cylinder under connecting status and can work well.

3. 维护与保养

3. Maintenance

- 正常运转每天检修时要检查管路的每一个接头有无松动现象，有松动时敲实。
- Daily inspection to each joint of the pipe shall be done to check whether it's loose. Make it firm when it's loose.
- 每次检修必须擦掉油缸上管路上的灰尘污物，检查所有平衡系统零部件是否有被井中落物砸伤，是否有渗漏现象，一旦发现须及时更换(为防止砸伤建议用废旧皮带做一活动护帘保护软管、阀门、连通管等)。



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- ☞ Dirt and dust on the pipeline shall be cleaned for each inspection. Check all the components of the equilibrium system whether they are damaged by the falling objects and whether there are leakage. Replacement shall be done once found (to avoid damaging, recommend to make a movable protection hose with wasted belts, valves and pipes).
 - ☞ 悬挂装置的承力件(中板、侧板、销、压块、垫块、连接叉)应每年进行一次探伤检查, 如出现影响强度的伤裂、腐蚀富裕度超限(2%)、碰撞伤痕等, 必须更换, 不得继续使用。
 - ☞ Defection test to the load bearing components of the device (median plates, side plates, pins, pressure plates, cushion blocks and connecting rod fork) shall be done once annually. If cracks, corrosions (more than 2%), collisions that affect to the strength have been discovered, replacement have to be done, and it's not allowed to use any more.
 - ☞ 平衡系统的管路、阀、连通管两年必须更换。
 - ☞ The pipeline, valve and connecting pipe shall be replaced every two years.
 - ☞ 平衡系统必须使用指定油液。
 - ☞ Specified oil shall be use for the equilibrium system.
 - ☞ 建立使用档案, 作好使用、检修记录。
 - ☞ Set up archive as well as operation and maintenance record.