土力机械
TU LI MACHINERY

# 钻 杆 使 用 保 养 手 册

## 江苏土力机械科技有限公司

# 江苏土力机械科技有限公司简介

江苏土力机械科技有限公司是国内最大、最专业的旋挖钻机钻杆生产厂家之一。公司成立于2008年，注册资金5000万元，占地面积80余亩，厂房建筑占地面积3万平方米。公司有专业的钻杆研发团队，各类员工过百人，产品全部采用意大利、德国最先进的嵌岩钻杆技术和高强度材料生产，型号覆盖299～720各种标准与非标准规格，最大钻深150米，最大扭矩50吨/米。

专业的研发、生产团队为用户打造出最先进、最可靠的产品，并提供最合理的施工解决方案。公司首先在产品源头上选定了扎实的供货厂家，原材料供应、零部件加工过程、协作厂家的选择，颇为严格、慎重，为公司的产品质量奠定了良好的基础。

该公司产品设计、机械制造以及营销、管理人员配置齐全、结构合理，质量体系运行正常。该公司现有技术人员8人、专业质检人员10人、管理人员18人、生产车间员工80多人。针对颇为复杂的地质条件，能够提供较合理的施工解决方案。

目前，土力钻杆不仅实现了进口旋挖钻机钻杆的完全替代，并已成为徐工集团、山河智能、中联重科、宇通重工、玉柴重工、恒天九五、江苏泰信等多家国产钻机的标准配套产品，且批量出口印度、新加坡、南非、越南、缅甸等国家，深受用户的青睐和好评。

公司的核心精神是“质量为本、持续创新”，我们将以持之以恒的创新精神、坚实的专业知识，对领先技术的执着追求和产品质量的精益求精的态度，不断创造行业领先的优质产品。

# 致尊敬的用户和操作者

感谢您使用本公司产品！请您在使用和维护保养本产品前，仔细阅读并理解本手册，遵循其中的相关规定。

本手册包含有对钻杆进行正确使用和保养的资料，还包含重要的钻杆结构、使用保养技术、故障诊断与排除，以及售后服务的联系方式。

请将本手册和设备保存在一起，如果设备转让，应将本手册交给新用户。当设备更换操作者或培训新操作者时，务必使其在操作前阅读本手册，并理解、遵守。

产品质保期为交货后**1年或2000小时（以先到为准）**。质保期内，我们对由于设计、材料和加工的缺陷而造成的产品质量问题，免费维修或更换有缺陷的零部件；非正常磨损、超出钻杆使用范围以及误操作所导致的钻杆损坏均不在保修范围内，我们将提供有偿服务。

在使用、检查、保养、维修的过程中，如有疑问请及时与我们联系。

江苏土力机械科技有限公司

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# 目 录

# 第一章 钻杆的类型

一、钻杆类型及结构

钻杆总成是由钻杆、护筒、随动架、提引器等部件组成（图1-1）。根据钻杆的加压方式和结构特点，钻杆可以分成：

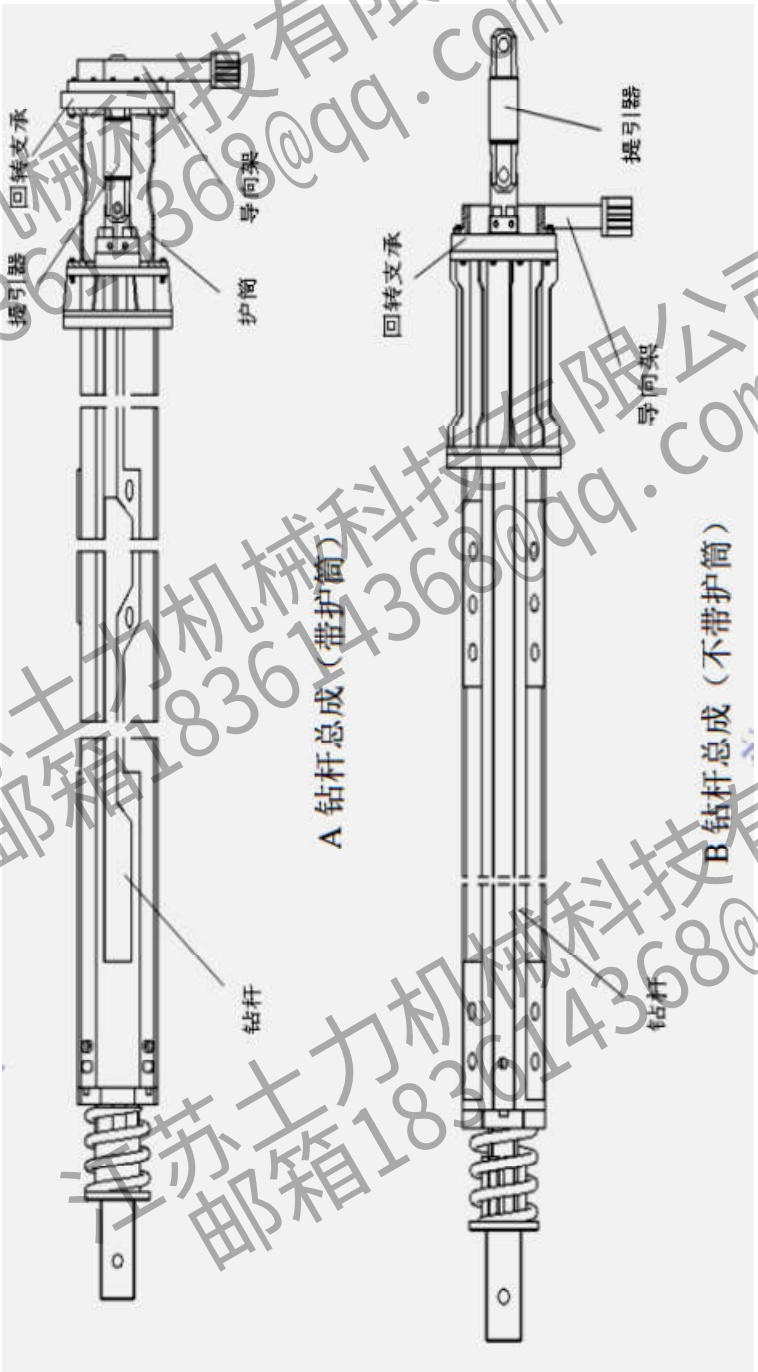



图1-1 钻杆的总成

## 1.1 摩阻式钻杆

每节钻杆由无缝钢管及焊接在其上的内外驱动键组成。外驱动键有三键式和六键式两种，在外驱动键中间无加压锁台。向下的加压力，是各节钻杆重力和钻进时内外键之间产生的向下的摩擦力。摩阻杆与机锁杆较大的区别在于键条结构，摩阻杆的键条通直到底。参见图1-2。

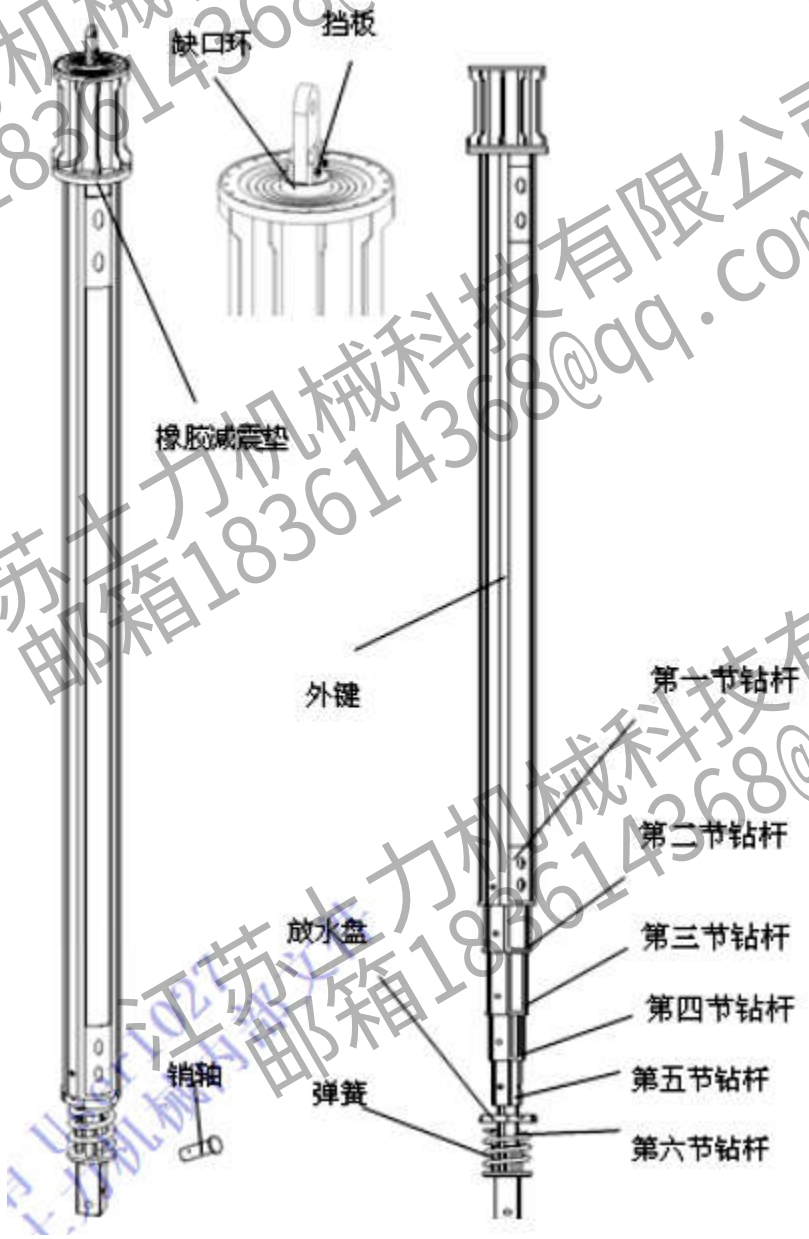



图1-2 摩阻式钻杆

## 1.2 机锁式钻杆

每节钻杆由无缝钢管及焊接在其上的内外驱动键组成。外驱动键有三键式和六键式两种，在外驱动键中间有二、三或四个加压锁台。当钻杆的内驱动键转动到外驱动键的加压锁台中时，由动力头加压油缸产生的向下的加压力，直接传递到钻具上。参见图1-3。

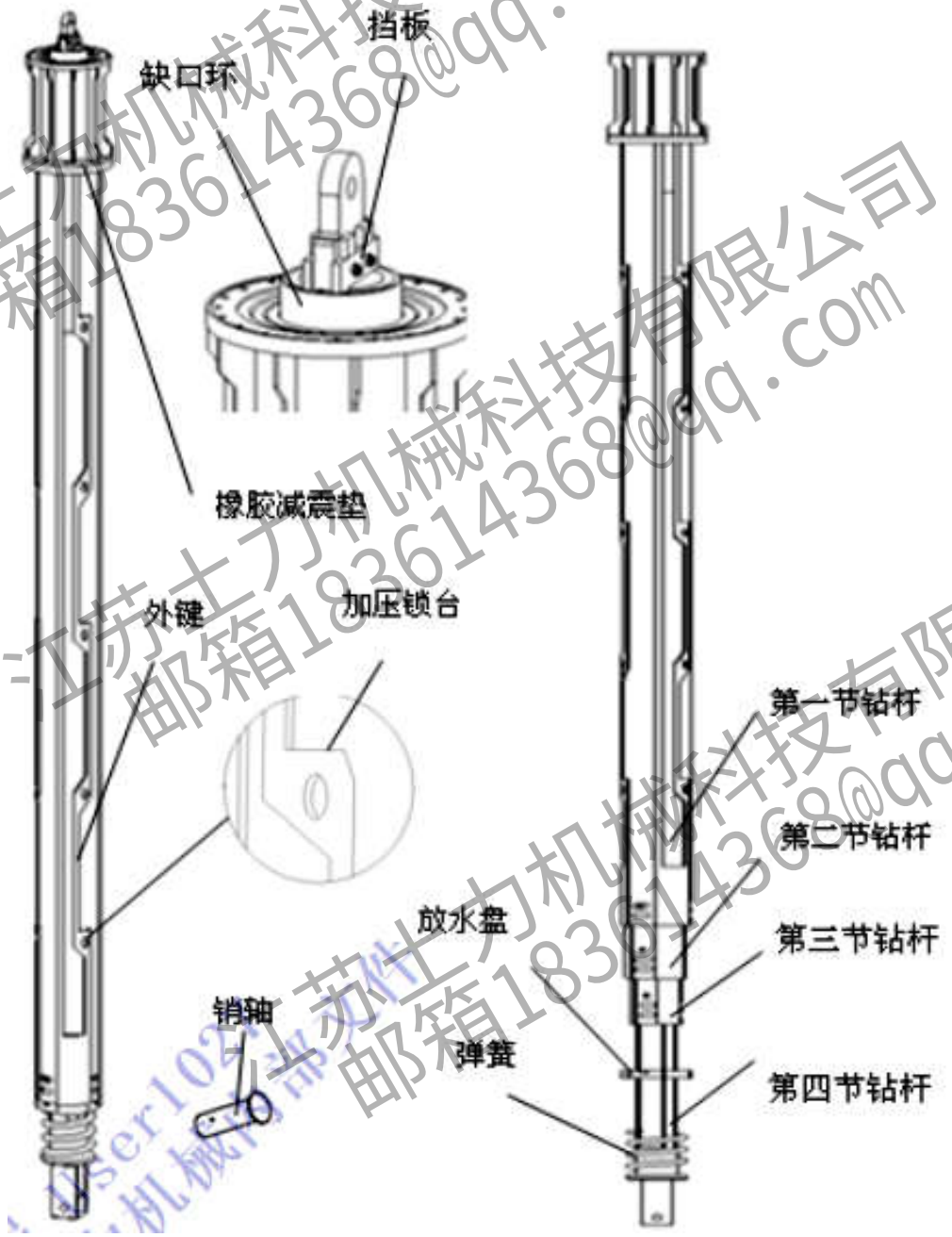



图1-3 机锁式钻杆

## 1.3 多锁式钻杆

每节钻杆由无缝钢管及焊接在其上的内外驱动键组成。内外驱动键均带有齿条式的连续台阶。当钻杆的内驱动键转动并与外驱动键咬合时，由加压油缸产生的加压力，直接传递到钻具上。参见图1-4。

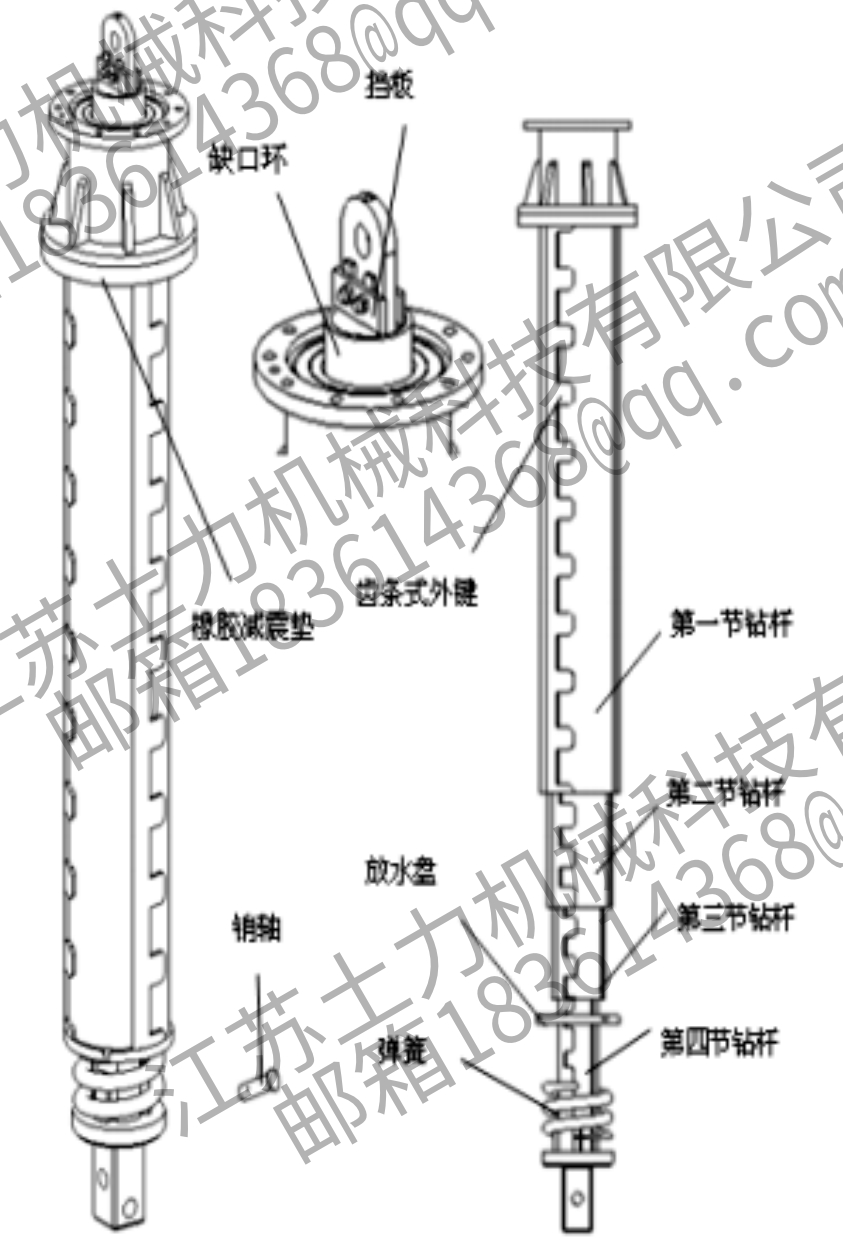



图1-4 多锁式钻杆

## 1.4 组合式钻杆

组合式钻杆的外面几节为机锁式，里面几节为摩阻式。旋挖钻机钻进时，各层杆间部分层通过摩擦，部分层通过承压锁块传递轴压的钻杆。参见图1-5。

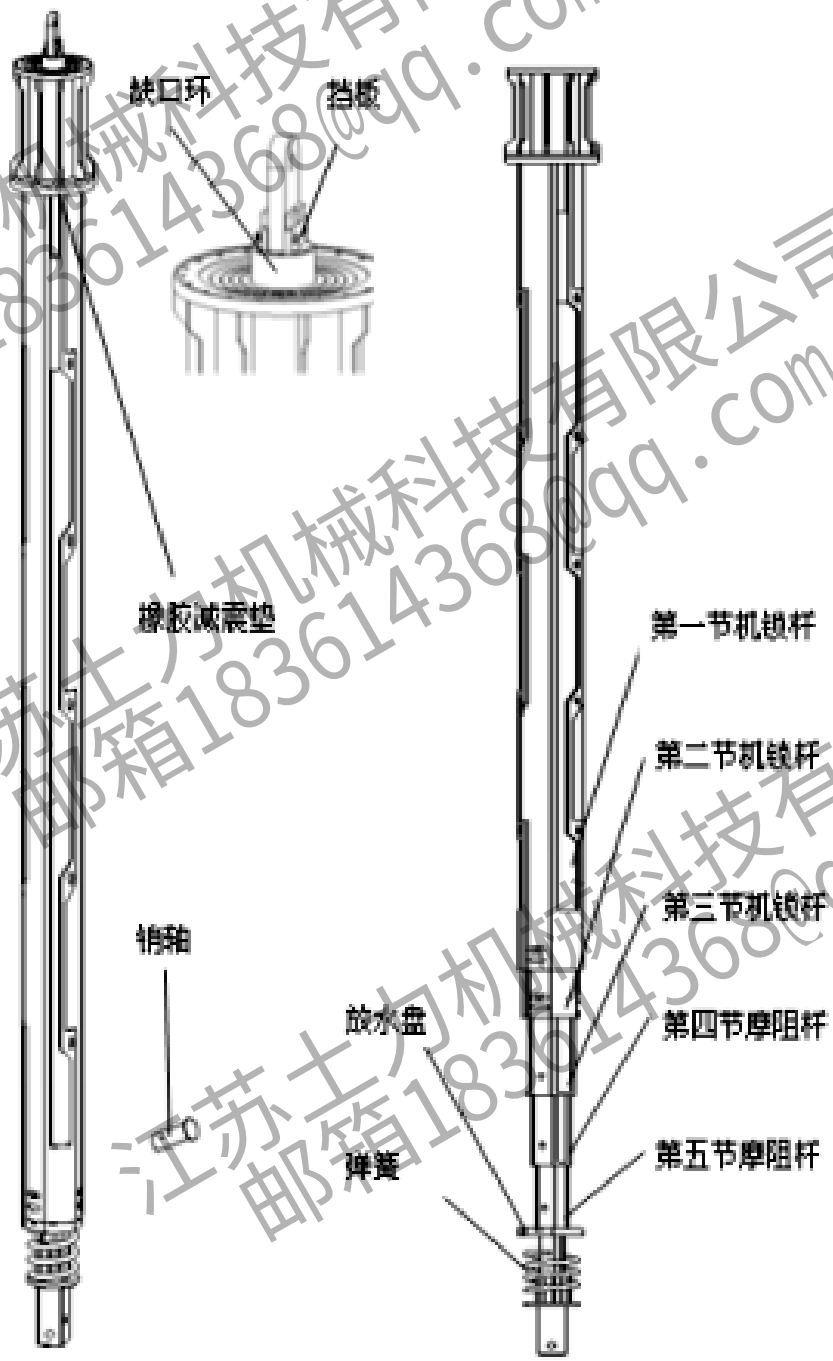



图1-5　组合式钻杆

## 1.5 钻杆零部件

钻杆零部件结构参见图1-6。

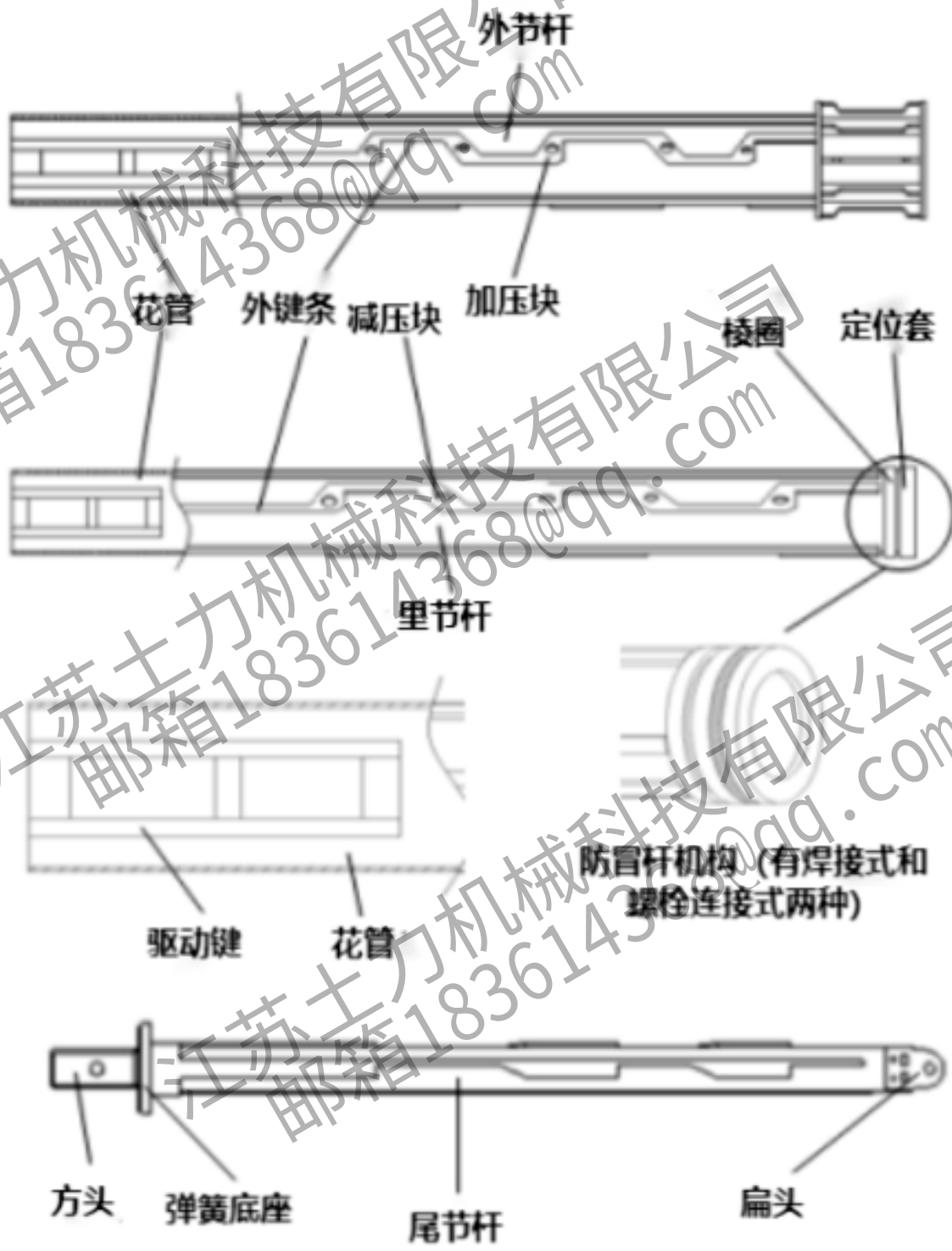



图1-6 钻杆零部件

## 1.6 钻杆的使用、适应性能比较

各种钻杆使用性能的比较

| | 摩阻式 | 机锁式 | 多锁式 | 组合式 |
|---|---|---|---|---|
| 操作性 | ★★★ | ★★ | ★ | ★★ |
| 地层适应性 | ★ | ★★★ | ★★★ | ★★ |
| 加压随时性 | ★★★ | ★ | ★★ | ★ |
| 耐磨损性 | ★★★ | ★★ | ★ | ★★ |
| 维修性 | ★★★ | ★★ | ★ | ★★ |
| 提升性 | ★★★ | ★★ | ★ | ★★ |

表格性能词汇说明：

| | |
|---|---|
| 操作性 | 钻机工作时，钻杆使用的方便程度 |
| 地层适应性 | 钻机工作时，钻杆对各种地层的适用能力 |
| 加压随时性 | 钻机工作时，找到加压点的方便程度 |
| 耐磨损性 | 钻杆在使用过程中，内外驱动键的耐磨损性 |
| 维修性 | 维修时的难易程度 |
| 提升性 | 钻杆在提升过程中的难易程度。 |
| ★★★ | 好 |
| ★★ | 较好 |
| ★ | 一般 |

## 1.7 常用规格钻杆

江苏土力机械科技有限公司　　常用规格钻杆

| 序号 | 外径D(mm) | 节数 (n) | 单节基本长度 L (m) | 加压形式 | 参考钻杆深 (m) |
|---|---|---|---|---|---|
| 1 | 630 | 3，4，5，6 | 10~25 | 机锁(JS)，摩阻(MZ) | 36~143 |
| 2 | 575 | 4，5，6 | 10~20 | 机锁(JS)，摩阻(MZ) | 36~110 |
| 3 | 530 | 3，4，5，6 | 10~20 | 机锁(JS)，摩阻(MZ) | 36~110 |
| 4 | 508 | 3，4，5，6 | 10~20 | 机锁(JS)，摩阻(MZ) | 36~110 |
| 5 | 470 | 3，4，5，6 | 10~17 | 机锁(JS)，摩阻(MZ) | 36~94 |
| 6 | 440 | 3，4，5，6 | 10~17 | 机锁(JS)，摩阻(MZ) | 36~94 |
| 7 | 426 (419) | 4，5，6 | 10~15 | 机锁(JS)，摩阻(MZ) | 36~85 |
| 8 | 406 (394) | 4，5 | 10~17 | 机锁(JS)，摩阻(MZ) | 36~79 |
| 9 | 377 (368) | 4，5 | 10~14 | 机锁(JS)，摩阻(MZ) | 36~65 |
| 10 | 355 | 4，5 | 10~13 | 机锁(JS)，摩阻(MZ) | 36~60 |
| 11 | 340 | 4， | 10~13 | 机锁(JS)，摩阻(MZ) | 36~48 |
| 12 | 299 | 4， | 10~13 | 机锁(JS)，摩阻(MZ) | 36~48 |

目前已配套使用于国内徐工集团、山河智能、中联重科、江苏泰信、三一重工、宇通重工、玉柴重工、恒天九五、南车时代、东明、金泰等系列旋挖钻机；国外宝峨、土力、迈特、意马、卡萨格兰地等系列旋挖钻机。并且出口到德国、意大利、阿联酋、土耳其、印度、泰国、新加坡、马来西亚、俄罗斯、乌克兰等国家和地区。还可根据用户需求及主机性能特殊定制旋挖钻杆。

# 第二章 钻杆的拆装

## 2.1 钻杆的拆解

钻杆的拆装如下图2-1、2-2

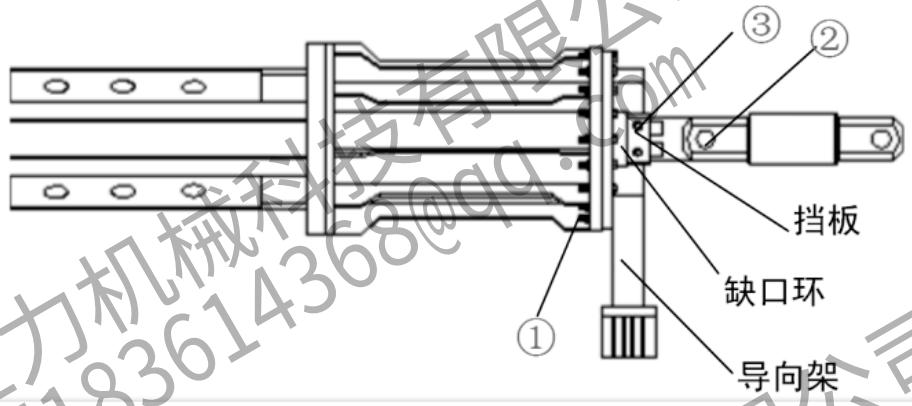



图2-1 钻杆拆装示意图

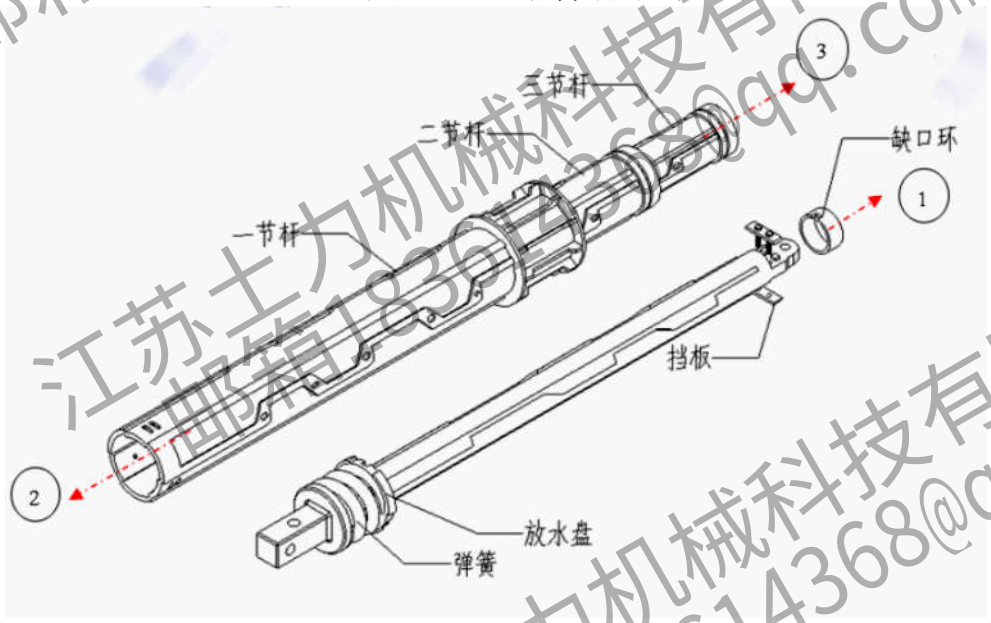



图2-2 拆装示意图

钻杆的拆解（以四节钻杆为例）

1）拆下图2-1中序号1所示螺栓，将钻杆护筒和导向架拆掉。

2）拆下图2-1中序号2所示销轴，将提引器拆掉。

3）拆下图2-1中序号3所示螺栓，将两块挡板及缺口环拆掉。

4）沿钻杆下方图2-2中序号②所示方向，将最里面一节钻杆（第四节钻杆）拉出。

5）沿钻杆上方图2-2中序号③所示方向，将第三节钻杆拉出。

6）再沿钻杆上方图2-2中序号③所示方向，将第二节钻杆拉出。拆解完毕。

注意：在拉出各节钻杆时，如相邻外节钻杆上部有防冒杆装置，应先将该防冒杆装置拆除（焊接式:气割切除；螺栓连接式:拆卸），然后抽出该节钻杆。

## 2.2 钻杆的安装

1）按图2-2中序号③所示反方向，将第二节钻杆从第一节钻杆的上方装入。在第二节插入第一节花管时，应将第二节的外牙和第一节的内牙槽对齐。

2）按图2-2中序号③所示反方向将第三节钻杆从第二钻杆的上方装入。

注意：在装入各节钻杆时，如相邻外节钻杆上部原来有防冒杆装置，在装入该节钻杆后，应将原防冒杆装置恢复（焊接或螺栓连接）。

3）再按图2-2中序号②所示反方向将第四节钻杆从第三节钻杆下方装入，注意不要遗忘弹簧和放水盘，放水盘带缺口的一面往上。

4）安装图2-2中序号1所示缺口环、挡板和螺栓。注意挡板的方向和反正面（带有记号）。

5）安装图2-1中序号2所示的销轴和提引器。

6）安装图2-1中。序号1所示的螺栓，将钻杆护筒和导向架连接好，拧紧螺母，安装完毕。

## 2.3 钻杆拆解和安装的注意事项：

钻杆在拆装前，需找一片开阔平整且较硬实的区域，用枕木将钻杆垫平离地，不得直接放于地上，不得与渣土、碎石以及其它可能进入钻杆的细碎物品放在一起。

在拆杆时，必须将挡套从芯节上拆除后，方可进行芯节的拆除。如不拆除挡套而直接拆除芯节，会因为挡套与芯节的卡滞造成无法正常拆除芯节，甚至会损伤到上一节钻杆的内键。最好在拆杆前，将各节的装配方向用油漆等在钻杆上做好装配方向标识，以便于装配。

在钻杆装配前，必须确认钻杆各节管体内无任何杂物，以防装配不畅或卡滞。

每节钻杆装配完成后，最好将沿钻进方向进行一次拉伸试验，观察钻杆伸缩情况。如发现伸缩异常，不得再进行装配，需将异常部位标识清晰，并拆除查看。待异常情况解除后，方可继续装配。

严禁无视钻杆异常的野蛮装配。

# 第三章 钻杆的使用

## 3.1 钻杆安装时应注意如下事项：

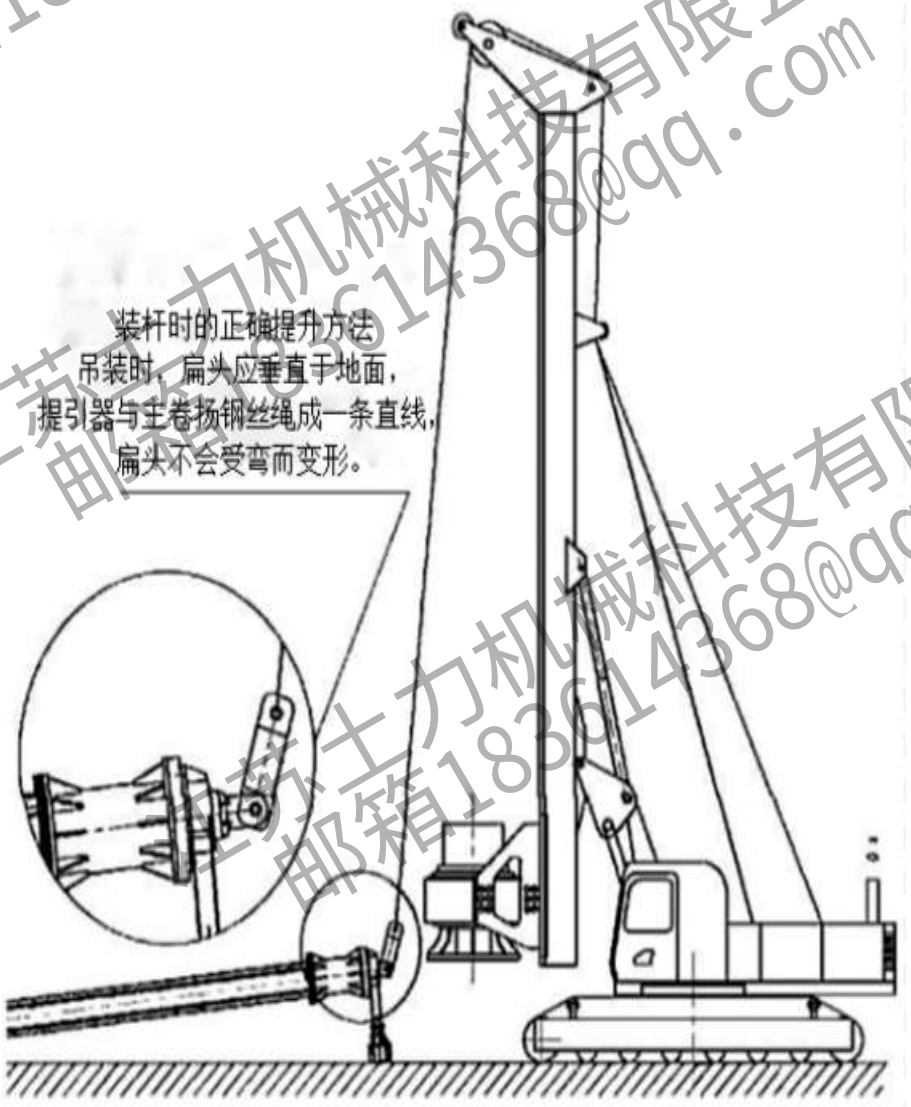
1）动力头最大扭矩和加压力不超过钻杆的最大允许值。

2）主卷扬钢丝绳、钻杆和动力头驱动套位于同一轴心。

3）钻机桅杆处于垂直。

4）钻头对好孔位，处于孔中心。

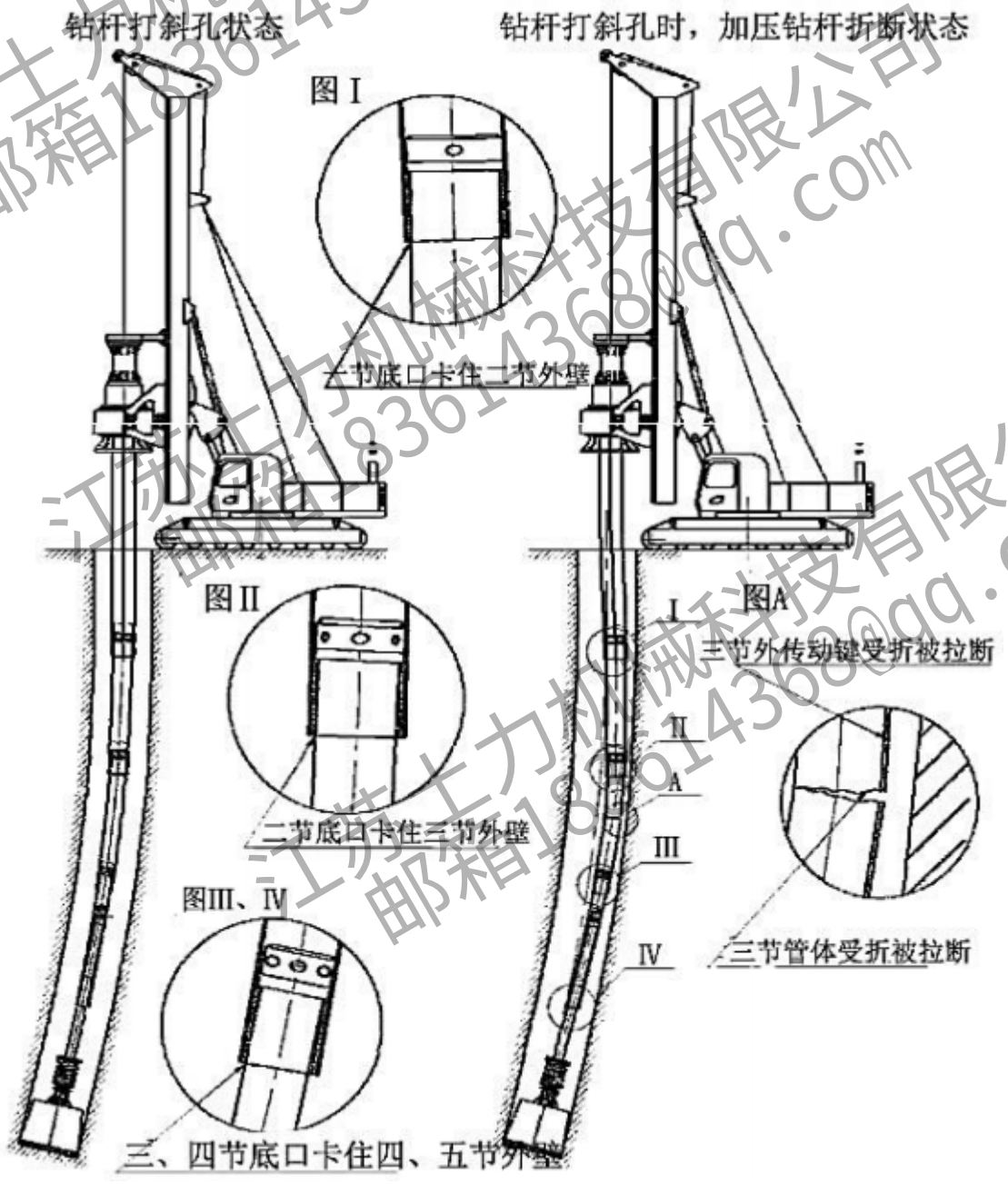
5）请参照本使用说明书及主机厂安装操作规范，正确连接各配套件。按下图所示提升钻杆，安装到钻机上。



### 3.2 钻孔施工前，钻机调整状态及应注意事项：

1）地面应平整且要有一定的硬度，在施工过程中，钻机不得出现履带局部下陷。履带局部下陷会引起桅杆前、后、左、右倾斜，导致打成斜孔。打成斜孔后，钻杆在孔内会受压弯曲变形，甚至折断。

当孔被打成一定斜度时，各节均会有一定的弯曲挠度，这时动力头向下加压，会使钻杆严重弯曲(这时各节因弯曲被卡住，不能够自由收缩)，钻杆因弯曲会产生不可回弹的塑性变形，弯曲严重时会将钻杆外键拉断。拉断外键后，如未及时修补，管体因严重弯曲钻进而会折断(如图)。



2）钻机工作一段时间后，应检查各支撑油缸有无软缸现象，以防桅杆前、后、左、右倾斜，导致打成斜孔。

3）钻杆与钻具连接牢靠，以防钻具销脱落，钻具掉落进孔内。

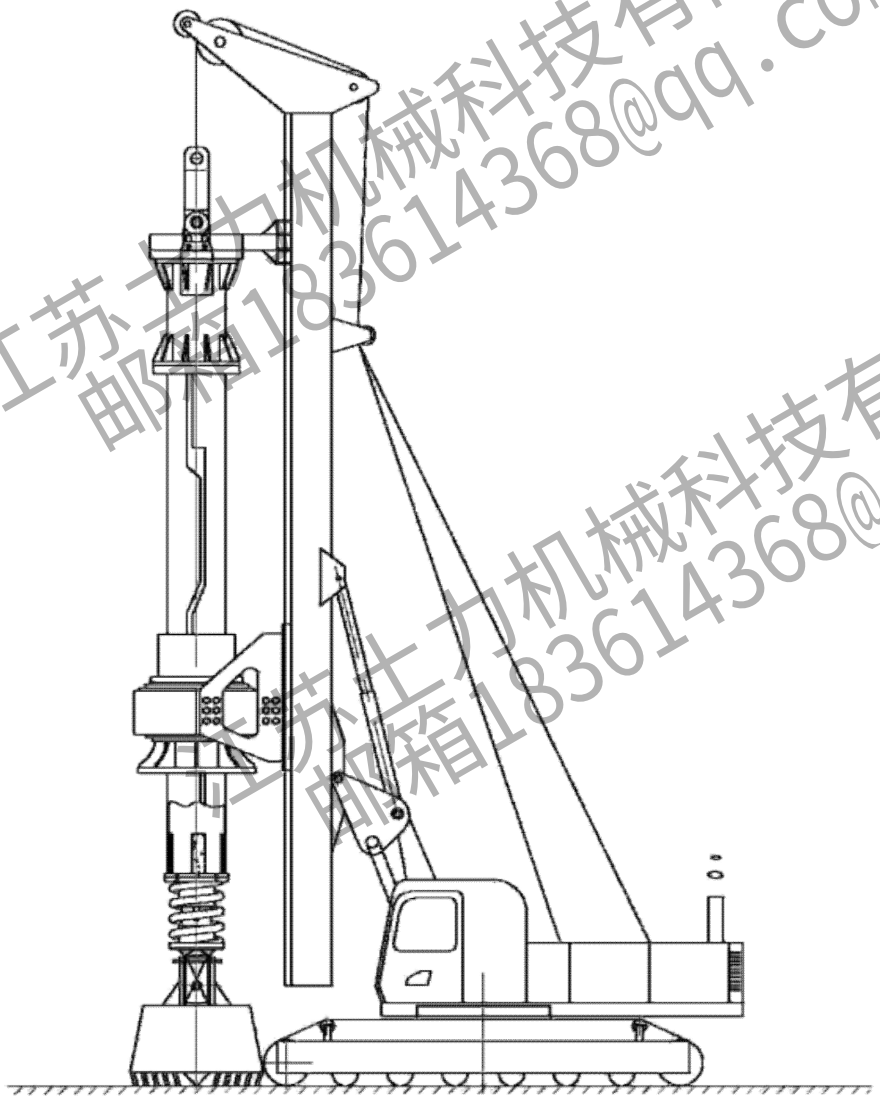
## 3.3 钻杆的使用

### A 机锁式钻杆

1）旋挖钻机转台回转，使钻具对准孔位并确保整个钻进工作过程桅杆垂直。

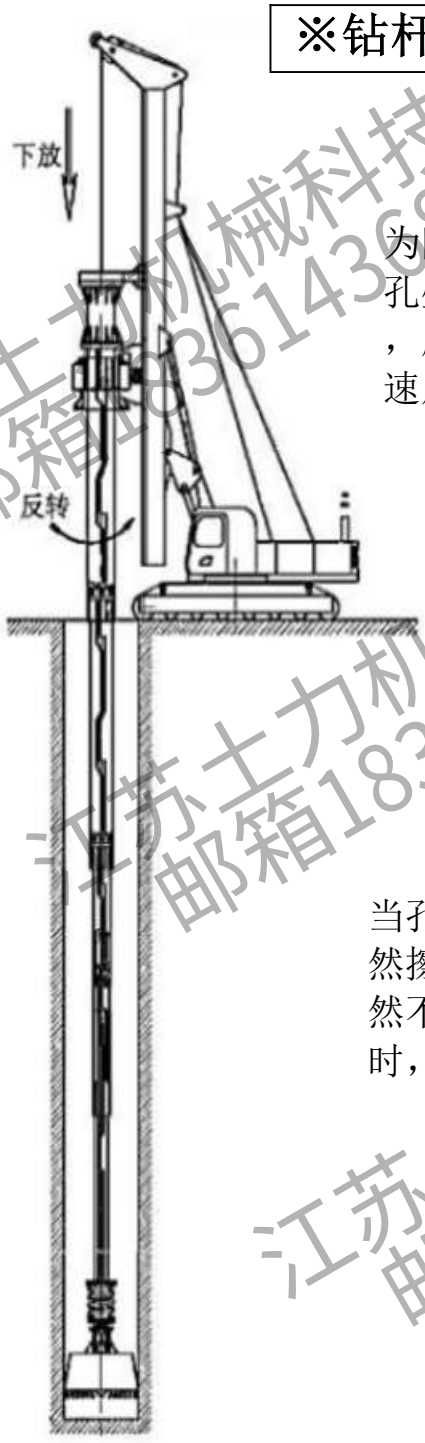
钻机在钻进前，进行桅杆调垂时应注意：

钻机在进入新孔位后，应先将钻斗放至地面，使钻机桅杆不受力后，进行桅杆调垂操作。此时，地面应平整且要有一定的硬度，在施工过程中，钻机不得出现履带局部下陷。履带局部下陷会引起桅杆前、后、左、右倾斜，导致打成斜孔。打成斜孔后，钻杆在孔内会受压弯曲变形，甚至折断。



2）下放钻杆时，必须缓慢反转动力头，避免孔壁擦碰钻具，造成下放时摔杆。

**※钻杆下放时，严禁正转动力头※**




为防止机锁式钻杆在下放过程中，因擦碰孔壁等原因自动挂锁，从而引起伸出不畅，所以在放杆的全过程中动力头应不停慢速反转。

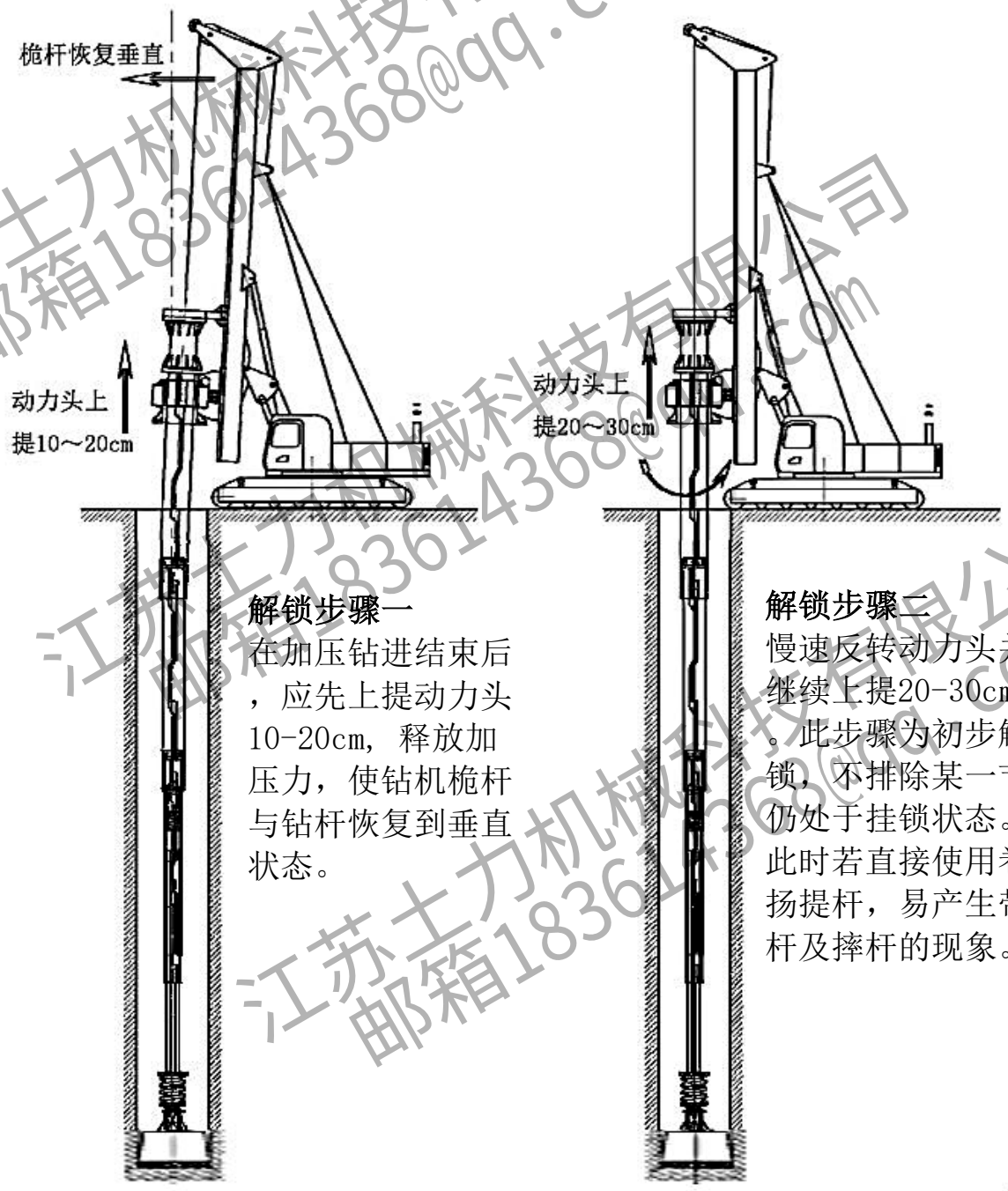
当孔已被打成斜孔时，钻杆下放，钻头必然擦碰孔壁。当擦碰严重时，钻杆下放必然不顺，极易产生摔杆现象。故放机锁杆时，动力头必须不停慢速反转。

3）钻具达到孔底后，要使机锁杆各节全部进入锁位，然后开始加压钻进。操作动力头使用 适当转速，使钻杆带动钻具转动，钻进致满斗。

4)钻杆解锁上提，操作方法如下(解锁提升步骤详见如下示意图)

5）钻具提出孔位，卸土。

6）循环重复。

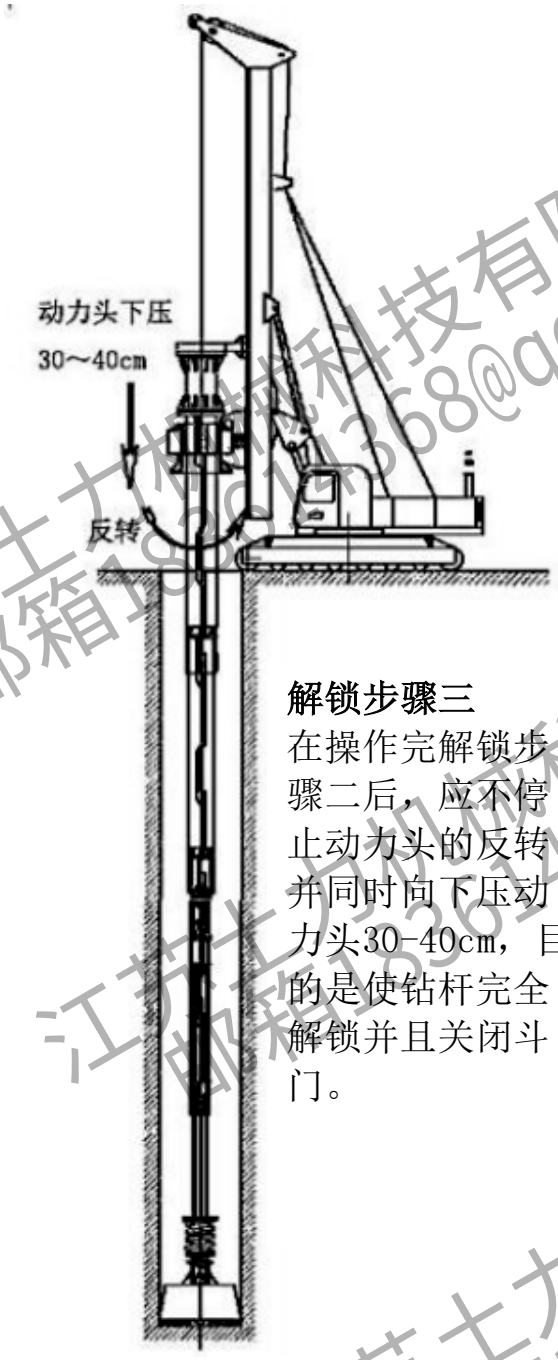



**解锁步骤一**

在加压钻进结束后，应先上提动力头10-20cm，释放加压力，使钻机桅杆与钻杆恢复到垂直状态。

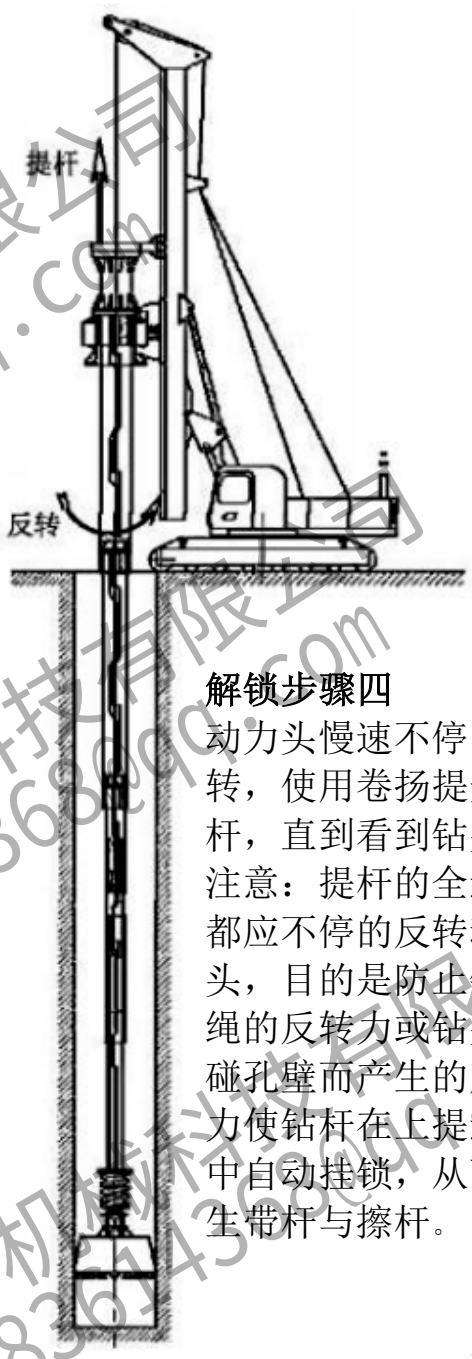
**解锁步骤二**

慢速反转动力头并继续上提20-30cm。此步骤为初步解锁，不排除某一节仍处于挂锁状态。此时若直接使用卷扬提杆，易产生带杆及摔杆的现象。




**解锁步骤三**

在操作完解锁步骤二后，应不停止动力头的反转并同时向下压动力头30-40cm，目的是使钻杆完全解锁并且关闭斗门。




**解锁步骤四**

动力头慢速不停的反转，使用卷扬提升钻杆，直到看到钻头。

注意：提杆的全过程都应不停的反转动力头，目的是防止钢丝绳的反转力或钻头擦碰孔壁而产生的反转力使钻杆在上提过程中自动挂锁，从而产生带杆与擦杆。

※此时需观察主卷扬压力表，倾听发动机的功率变化情况，判断是否有明显超重情况。如明显超重，则表明钻杆解锁不彻底，此时应重新下放钻杆至孔底，按解锁步骤重新解锁。

B 摩阻式钻杆

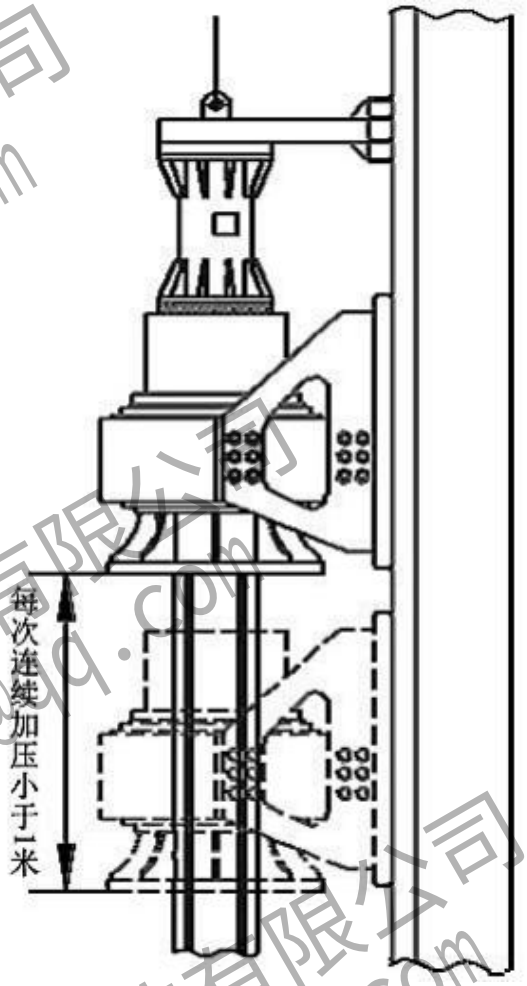
1）转台回转，使钻具对准孔位并确保整个钻进工作过程桅杆垂直。

2）操作动力头使用适当转速，使钻杆带动钻具转动，开始钻进，致满斗。

3）用主卷扬提出钻杆及钻具。

4）将土倒出。

5）一个工作循环结束，重复进行，至成孔。




注意：根据不同地层情况，使用动力头加压钻进时，不得连续加压超过1米(如右图所示)。摩阻杆通过滑动摩擦力加压，中间各节易产生相对滑动，从而导致某节悬空。当动力头停转或在反转时，悬空的单节下落复位，即会出现摔杆现象，造成钻杆损伤。为避免摔杆，每次加压近1米时，需使动力头停顿并上提一下或进行少许反转，使钻杆复位；随后动力头继续正转钻进，直至满斗

※摩阻式钻杆主要靠摩擦力加压，不能锁住，因此遇硬土层、砾石层、黏土层等地况时，各节钻杆之间容易打滑，工作效率低，且易造成砸杆，对此可通过以下方法避免或减少此现象：

① 每次下钻之前，在地面上先正转动力头，把钻具进料口打开；

② 钻进时，钻斗尽量不要过满，七、八分满即可；

③ 在已磨损的斗齿上焊接弹簧钢板，加长斗齿；

④ 更换钻具，如采用螺旋钻具等。

以上几种方法可根据具体情况，适当采用，摸索出合适方法，以提高摩阻杆的钻进效率。

C 多锁式钻杆

1）放钻头于工作面

2）操作动力头，旋转钻杆开始钻进，钻硬土时，结合加压油缸直至装满钻头

3）参照机锁杆的操作，反转动力头解锁，用主卷扬提出钻头

4）将土卸掉

多锁式钻杆不需专门寻找加压锁台，但是要特别注意步骤3，避免钻杆间没有解锁，否则一旦提升中解锁会自由落下，导致钻杆短节被砸坏，因此提升要尽量慢，一旦发现未解锁，应重新把钻杆放到孔底，反转动力头，帮助解锁，避免损坏钻杆。

D 组合式钻杆

1）放钻头于工作面

2）参照机锁杆的操作，操作动力头，旋转钻杆开始钻进，钻硬土时，合加压油缸加压，直至装满钻头

3）参照机锁杆的操作，反转动力头解锁，用主卷扬提出钻头

4）将土卸掉

随钻深加大，摩阻式单节伸出后，组合式钻杆的加压力和摩阻式钻杆一样小。

# 第四章 钻杆的保养

## 4.1 钻杆的检查和保养

定期正确的保养将防止钻杆过早磨损，延长钻杆的使用寿命，提高工作效率。

定期正确的检查保养将在钻杆损坏初期发现问题，因此将大幅减少钻杆的故障率和后期的维修工作量。

在进行检查和保养的过程时，应选择开阔平整的场地进行，并准备好足够的枕木。钻杆拆开和安装时，应放慢速度，使每一节钻杆都处在同一直线上。上下左右的大幅度摆动，将导致钻杆弯曲，产生裂纹，甚至产生断裂。

## 4.2 保养周期

**日常检查：**

在不拆解钻杆的情况下，每个工作日应检查：

钻杆外露部分：扁头、方头、弹簧、键条、钢管、焊缝等是否有裂纹、变形、异常磨损等；花管是否有开裂，花管及分水盘磨损情况等；螺栓联接式防冒杆机构的螺栓是否松动。如发现有异常情况，应在修复后继续工作。

**定期保养：**

根据钻杆的种类、工作时间、地层状况的不同，按照下表将钻杆拆解后进行保养。

**A、摩阻式**

单位：以发动机工作小时为准

| 工况 / 时间间隔/h | 较好（软土层） | 一般（沙层砾石层） | 恶劣（卵石层） |
|---|---|---|---|
| 第一次使用 | 100 | 80 | 50 |
| 正常使用 | 500 | 300 | 200 |

**B、机锁式**

单位：以发动机工作小时为准

| 工况 / 时间间隔/h | 较好（软土层） | 一般（沙层砾石层） | 恶劣（卵石层） |
|---|---|---|---|
| 第一次使用 | 80 | 60 | 40 |
| 正常使用 | 300 | 200 | 150 |

在使用过程中，如果发现以下现象时，也应及时将钻杆放下，拆开后检查并维护。

1）钻杆不能自由伸缩，有带杆、卡杆现象

2）不能正常加压，出现打滑现象，解锁困难

3）扁头变形

4）钻杆发现裂纹

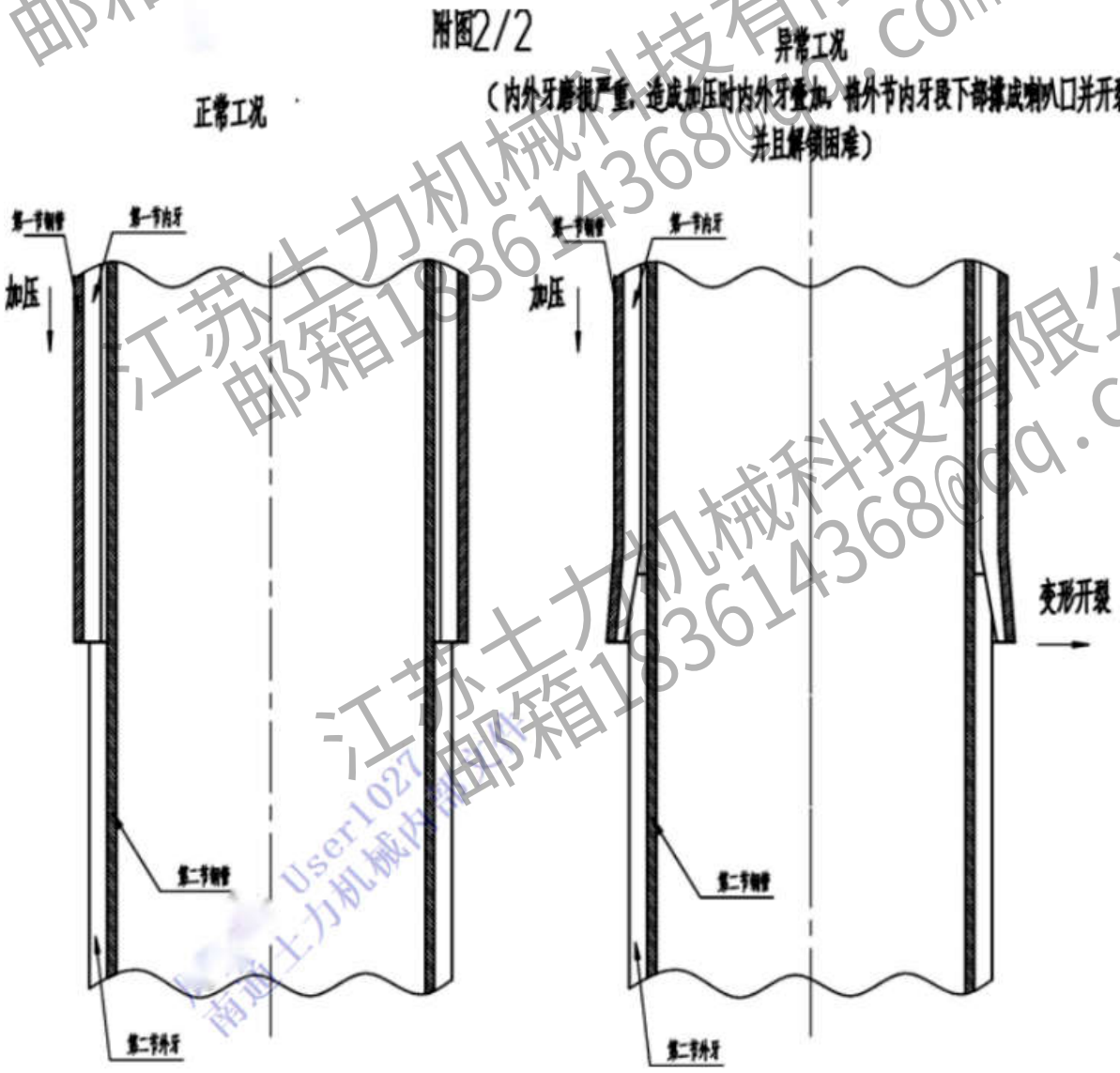
5）其他异常情况

### 4.3 检查与保养内容

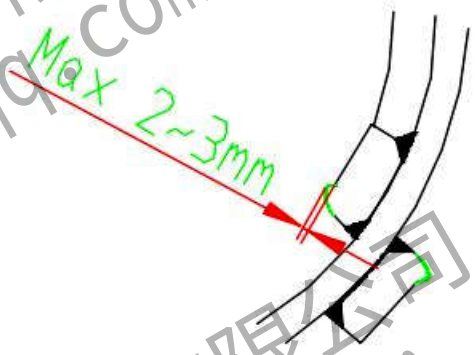
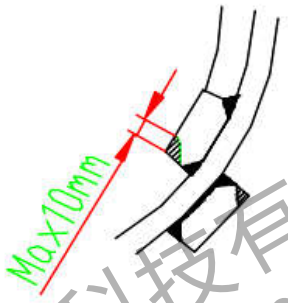
为了正确和全面的检查保养钻杆，最好彻底抽出每一节钻杆。

为了每次抽出钻杆检查保养，均应对钻杆内外易剐蹭的高点进行打磨，对磨损严重部位补焊，对开裂焊缝磨开后补焊。

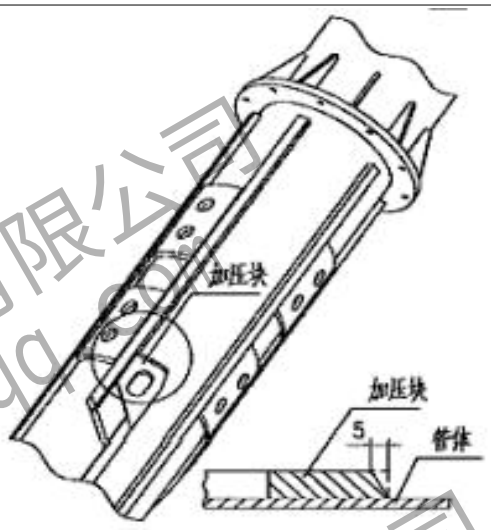
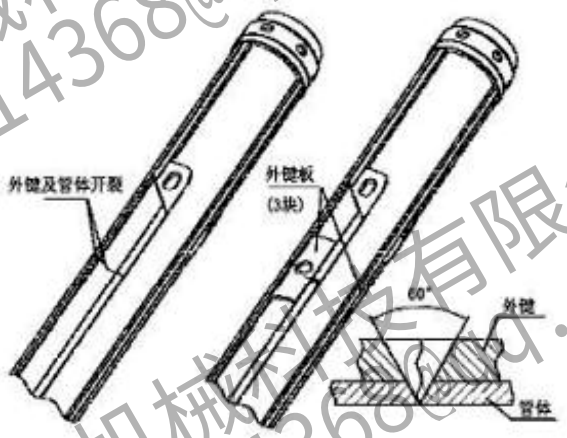
**注意：**对于机锁钻杆，必须特别注意内外加压锁面的检查保养！内外加压锁面磨损严重成楔形面后，加压时内外加压锁面卡住，将造成解锁困难、钢管凹陷变形开裂、花管开裂等故障！

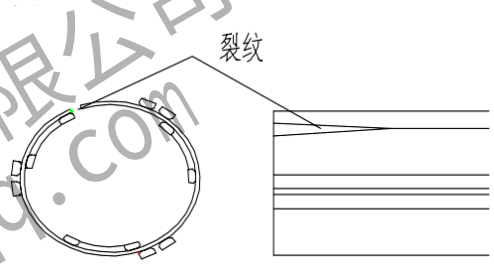
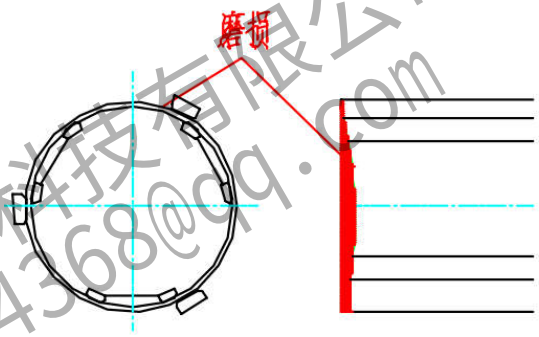


保养内容表

| 序号 | 部件 | 损坏情况 | 示意图 |
| --- | --- | --- | --- |
| 1 | 外键 | 外键卷边、磨损 | 内外键卷边<br>  <br>内外键磨损<br>  <br>1、卷边突出量为2-3mm。突出部分应及时打磨平整。<br>2、磨损最大量：10mm。磨损时，用耐磨焊条堆焊，磨平成 90° 。严重磨损时，应更换该件。 |

# 第四章 钻杆的保养

| | | | |
|---|---|---|---|
| 2 | 加压块 | 加压块磨损 |  <br>最大磨损量：承压面 5mm。磨损时，用耐磨焊条堆焊，焊后磨平成 90°。严重磨损时，应更换该件。 |
| 3 | 外键、管体 | 外键、管体开裂 |  <br>1、用角磨机将开裂处全面打磨成60°双面坡口至根部(钢管磨透)，用J506焊条焊接，焊后打磨平整。<br>2、在圆周方向，增加外撑板三块(拼焊于非滑道部位，尽量将开裂点置于撑板中部)等高拼点焊接，将开裂部位承护(注意上下两端面不得施焊)。 |

| | | | |
|---|---|---|---|
| 4 | 分水盘 | 分水盘磨损 | 扇形盘磨损时，用焊条堆焊，磨平。分水盘严重磨损时，应更换该件 |
| 5 | 花管 | 花管开裂 |  调形后焊接或更换花管 |
| | | 花管端面磨损 |  补焊或更换磨损的部位 |
| 6 | 弹簧 | 断裂 | 更换弹簧 |
| 7 | 螺栓 | 损坏 | 更换 |
| 8 | 橡胶减震垫 | 损坏 | 更换该部件 |
| 9 | 扁头 | 扁头变形或开裂 | 更换该部件 |
| 10 | 上端法兰 | 法兰变形或开裂 | 更换或补焊 |
| 11 | 方头 | 方头弯曲断裂或磨损严重 | 更换方头短节 |
| 12 | 钻杆 | 钻杆弯曲 | 火焰调直 |
| 13 | 销子 | 销子损坏 | 更换该件 |

# 第五章 钻杆的故障诊断与排除

旋挖钻机钻杆正常工作时，下放钻杆时各节应从外节到内节逐节完全伸出，提升钻杆时各节应从内到外逐节完全缩回。提升和下放钻杆时，钻杆各节如不能按正常顺序进行伸缩，称为带杆。

## 5.1 摩阻式钻杆

| 序号 | 症 状 | 原 因 | 排除措施 |
|---|---|---|---|
| 1 | 钻杆能下放不能上提 | 钻杆内部有杂物 | 钻杆抽开，清理杂物 |
| 2 | 钻杆下放时摔杆 | 打成孔斜 | 慢速反转下放 |
| | | 内部有杂物 | 钻杆抽开，清理杂物 |
| | | 钻杆弯曲 | 钻杆抽开，校直 |
| | | 上节管体被挤压下凹变形 | 更换变形部位 |
| 3 | 钻杆上提时带杆、摔杆 | 内部有杂物 | 钻杆抽开，清理杂物 |
| | | 钻杆弯曲 | 钻杆抽开，校直 |
| | | 打成斜孔 | 慢速反转上提 |
| | | 内外键严重磨损产生滚键 | 晃开钻杆，抽开检查，更换损坏部位 |
| 4 | 单节不能完全回收 | 下节杆被带至上节内键段上端 | 将钻杆放至地上，重新按顺序装回 |
| 5 | 钻杆鼓包 | 摔杆 | 更换鼓包部位 |
| 6 | 钻杆转，钻具不转 | 芯杆下端外键剥落 | 重新焊接芯杆下端外键 |
| 7 | 经常性带杆、摔杆 | 内部有毛刺卷边 | 钻杆抽开，打磨 |
| | | 钻杆弯曲 | 钻杆抽开，校直 |
| | | 内外键磨损严重 | 钻杆抽开，补焊或更换 |

| 序号 | 症 状 | 原 因 | 排除措施 |
|---|---|---|---|
| 8 | 钻杆最外节和钻机动力头之间卡杆 | 1.钻杆没有处于动力头驱动套的中心<br>2.动力头驱动套和钻杆之间有异物。 | 工作前先确认钢丝绳、钻杆、动力头驱动套三者同轴心<br>1.检查钻机主卷天轮，钻杆托架及动力头托架，使得钻杆位于动力头驱动套中心<br>2.检查动力头与钻杆之间是否有异物，若有异物及时清理。 |
| 9 | 方头弯曲断裂 | 直接受外力影响：如推土、平土，带钻具压护筒，安装钻具不当，主机行走、转台回转时方头或钻具碰到地面及障碍物等。 | 钻杆不能带钻具压护筒、推土等；钻机回转或行走时，钻杆钻具严禁触地；钻杆在钻机上水平放置时，将钻具卸掉。<br>更换方头短节总成。 |
| 10 | 扁头弯曲变形 | 吊装钻杆方法不正确 | 更换扁头部件 |
| 11 | 棱圈断裂 | 带杆引起的砸杆 | 发现钻杆有砸杆的现象时，马上停止施工，将钻杆拆开，排除故障后再施工，更换活动环。 |
| 12 | 分水盘及钻杆下端面快速磨损 | 钻孔孔径偏小或特粘土层，渣土不易抛出。采用快速正反转撞击，将钻筒内渣土抛出 | 改造或更换合适的钻具，尽量避免动力头快速正反转撞击。补焊或更换磨损的部位。 |

其他未列故障，可参阅本手册“六、钻杆使用中的注意事项”

在使用、检查、保养维修过程中，如有疑问请及时与本公司联系。

## 5.2 机锁式钻杆

| 序号 | 症 状 | 原 因 | 排除措施 |
|---|---|---|---|
| 1 | 钻杆能下放不能上提 | 钻杆内部有杂物 | 钻杆抽开，清理杂物 |
| 2 | 钻杆下放时摔杆 | 打成孔斜 | 慢速反转下放 |
| | | 钻杆弯曲 | 钻杆抽开，校直 |
| | | 管体被挤压下凹变形，卡滞下一节 | 更换变形部位 |
| | | 提引器旋转不灵，钢丝绳受力旋转， 产生自动挂锁 | 慢速反转下放维修或更换提引器 |
| 3 | 钻杆上提时带杆、摔杆 | 内部有杂物 | 钻杆抽开，清理杂物 |
| | | 钻杆弯曲 | 钻杆抽开，校直 |
| | | 管体变形 | 更换变形部位 |
| | | 解锁不彻底 | 按机锁杆解锁程序重新解锁 |
| | | 打成斜孔 | 慢速反转上提 |
| 4 | 单节不能完全回收 | 下节杆被带至上节内键段上端 | 将钻杆放至地上，重新按顺序装回 |
| 5 | 钻杆鼓包 | 解锁不彻底摔杆 | 更换鼓包部位 |
| 6 | 钻杆发出有规律的刺耳响声 | 钻杆加压力过大，钻杆弯曲 | 上提动力头，释放加压力 |
| 7 | 找不到锁点 | 打成严重斜孔 | 修正孔垂直度 |
| | | 加压油缸未达最大行程 | 将工作行程走完 |
| 8 | 按机锁杆解锁程序解锁，仍解不开锁 | 承压块严重磨损成楔形，与内键卡滞且上节钻杆底口变形或开裂 | 严重时气割去除内键，段，并更换损坏部位 |

| 序号 | 症 状 | 原 因 | 排除措施 |
|---|---|---|---|
| 9 | 钻杆最外节和钻机动力头之间卡杆 | 1.钻杆没有处于动力头驱动套的中心<br>2.动力头驱动套和钻杆之间有异物。 | 工作前先确认钢丝绳、钻杆、动力头驱动套三者同轴心<br>1.检查钻机主卷天轮，钻杆托架及动力头托架，使得钻杆位于动力头驱动套中心<br>2.检查动力头与钻杆之间是否有异物，若有异物及时清理。 |
| 10 | 方头弯曲断裂 | 直接受外力影响：如推土、平土，带钻具压护筒，安装钻具不当，主机行走、转台回转时方头或钻具碰到地面及障碍物等。 | 钻杆不能带钻具压护筒、推土等；钻机回转或行走时，钻杆钻具严禁触地；钻杆在钻机上水平放置时，将钻具卸掉。<br>更换方头短节总成。 |
| 11 | 扁头弯曲变形 | 吊装钻杆方法不正确 | 更换扁头部件 |
| 12 | 棱圈断裂 | 带杆引起的砸杆 | 发现钻杆有砸杆的现象时，马上停止施工，将钻杆拆开，排除故障后再施工，更换活动环。 |
| 13 | 分水盘及钻杆下端面快速磨损 | 钻孔孔径偏小或特粘土层，渣土不易抛出。采用快速正反转撞击，将钻筒内渣土抛出 | 改造或更换合适的钻具，尽量避免动力头快速正反转撞击。补焊或更换磨损的部位。 |

其他未列故障，可参阅本手册“六、钻杆使用中的注意事项”

在使用、检查、保养维修过程中，如有疑问请及时与本公司联系。

# 第六章 钻杆使用中的注意事项

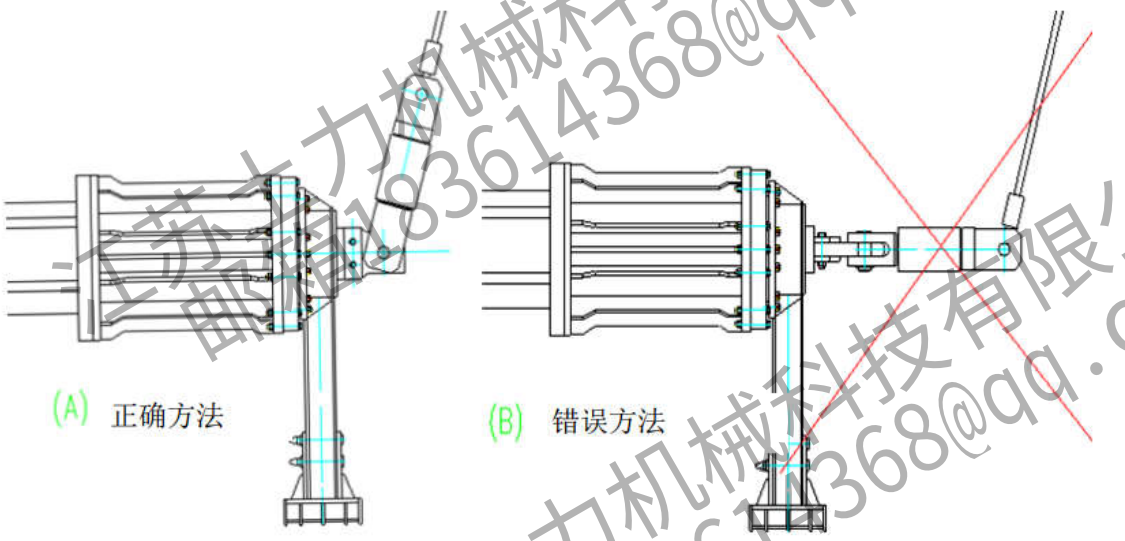
钻杆是旋挖钻机的重要部件，也是易损件。它主要承担传递动力头的扭矩，及加压装置的加压力，其使用的工况非常恶劣且复杂。

为避免钻杆发生损坏和误操作，请遵守如下使用注意事项：

1. 钻杆长期存放时，不得直接放于地上，不得与渣土、碎石以及其它可能进入钻杆的细碎物品放在一起；需找一片开阔平整且较硬实的区域，用枕木垫平离地。最好拆除随动架，以防回转支承的碰撞损坏。严禁按错误的方法放置钻杆。装卸时，需平衡起吊，小心慢速，避免碰撞损坏。

2. 动力头最大扭矩和加压力不得超过钻杆的最大允许值。

3. 在钻杆安装到整机时，应按下图（A）所示提拉钻杆。严禁按图（B）所示提拉钻杆，该操作会导致扁头弯曲变形，严重时将导致提引器断裂。在安装钻杆过程中，应放慢速度以免与钻机产生碰撞，损坏动力头及加压油缸。




图：6-1提拉钻杆示意图

4. 钻杆安装到钻机上后，在开始使用前，需利用动力头正转反转，抖动几次，以避免由于长期闲置，内部的或进入的杂物卡住钻杆。

5. 安装钻具时，严禁用钻杆方头直接推动平躺的钻具，试图拨动钻具立起，此操作将会导 致钻杆方头弯曲，严重时会导致方头断裂。应当使用钻机的副卷扬将钻具提起，使钻具的连接方孔垂直向上，以利于安装钻具。

6.在下护筒时，严禁用钻杆带动钻具，对护筒施压。在压护筒的过程中，由于钻具受力偏心，可能导致钻杆方头弯曲，严重时将导致方头断裂。

7.钻杆及其连接钻具后，只能用于钻孔，不能用于拨土(平整地面)，搅浆等其他非钻孔事项，这样都容易造成钻杆的损坏。

8.钻杆及其连接钻具后，只要触及地面或者放在孔内时，严禁整机行走，调节变幅，调整桅杆或左右回转等动作，避免钻杆弯曲变形。

9.操作人员应熟悉钻杆的各项性能、参数，如额定扭矩、额定深度、加压形式、单节钻杆的长度等。了解每节钻杆下放到底（单节全伸）时，钻具所在的深度，同时也应知道在某一深度时，钻杆所处的状态是第几节钻杆伸出，大概伸出的位置。这样在提钻时，知道哪一节钻杆在何位置开始上升，主卷提到了第几节钻杆，提升力大约的范围，当提升力不对时，就知道是否产生了带杆，从而避免摔杆现象的产生。

10.在操作摩阻杆遇到打滑、不进尺或进尺缓慢，以致动力头加压的行程超过进尺深度时，钻杆内部容易出现打滑，使某节悬空。当钻杆停止钻进或者反转时，悬空的单节突然落下，形成摔杆。在这种情况下，为减少摔杆，动力头的加压行程每次不宜超过1米，可通过反转动力头 或上提动力头来减少摔杆现象(见三、钻杆的使用--B摩阻式钻杆)。

11.操作人员在使用钻杆的初期，应尽快熟悉钻杆的性能和参数，如额定扭矩，额定深度，加压形式，每节杆的长度等。下放钻杆时，应能知道每节钻杆下放到底时，钻具所在的深度。在提升时，应能知道在相应深度时，哪一节钻杆开始上升。以避免产生爬杆时，而操作人员不知道，导致严重砸杆的情况。

12.对于坚硬地层，必须采用机锁式钻杆。钻杆工作时各节未正确加压将导致钻杆的异常磨损和损坏。机锁式钻杆在加压时，旋转动力头的同时，慢速加压，确保完全进锁（加压面完全贴合）后再正常加压钻进，否则将造成异常磨损、钢管变形等故障。

13.在操作机锁杆时，注意控制加压力，严禁过度加压，使主机前端顶起，前履带离地，钻机桅杆严重后仰，此时钻杆处于弯曲状态，会对钻杆造成极大损害，同时发出异常的响声，以致产生钻杆折断。

14.机锁式钻杆在使用时，必须严格按正确的解锁方法操作，否则解锁不彻底，上提的过程中产生带杆，造成严重的摔杆。(见三、钻杆的使用--A机锁式钻杆)。

15. 下放钻杆时，应注意主卷钢丝绳的放绳情况。因为钻具在孔中难免与孔壁摩擦，有时边齿或钻具边缘会刮住孔壁，尤其桩孔垂直度较差时，极易产生钻杆下放过程中，钻具刮住孔壁的现象，此时如果操作者未能及时发现，则会产生主卷过放，主卷乱绳，此时产生摔杆，极易断绳，从而产生重大操作事故。

16. 对于极其恶劣的施工条件（例如钻进钻头只能接触一边坚硬地层，即通常说的偏载），严禁在钻杆上施加除扭矩和轴向加压力外的任何其他外力，否则将造成钻杆的严重变形和损坏。

17. 当气温很低，钻杆内部结冰严重，钻杆提放出现带杆、砸杆等现象时应采用暖气等辅助措施将冰融化后再工作。

18. 在孔径较小或土质较粘时，会卸土困难，此时不得采用快速正反转撞击钻杆的方式卸土，这种方式会造成分水盘及钻杆下端面快速磨损并可能造成钻杆开裂及动力头造成损坏。

19. 当钻深孔或大孔时，要特别注意保证钻具的钻齿工作正常，及时更换磨损的钻齿，不能试图通过增大加压力来补偿钻齿的磨损。

20. 提升机锁式钻杆时，如出现带杆，应立即下放钻杆到孔底，按解锁程序解锁，待解开后重新提升，严禁在钻杆提到半空状态时，正反转动动力头，以免摔杆造成钻机及钻杆的损坏。

21. 在使用过程中，如果连续发现带杆现象时，应及时将钻杆放下，按钻杆装配、拆解步骤拆开后检查、保养。

22. 长钻杆长期打浅孔时，由于钻杆里边几节不伸缩，造成泥浆中的沉渣沉积在内几节钻杆间。越积越多最后造成钻杆卡死现象。所以务必要经常把钻杆拆开，用清水把各节钻杆内外壁冲洗干净。再重新工作。

23. 在使用带有螺栓连接式防冒杆机构的钻杆时，要每天检查防冒机构的固定螺栓，若螺栓松动，要及时紧固。一旦螺栓松动、脱落，掉进钻杆内部，会造成钻杆带杆，砸杆等严重事故。

24. 在钻杆上进行焊接等维修保养时，要确保钻杆与钻机完全脱开，或将钻机的电源与电器系统完全断开。否则，会造成电器系统短路，起火。

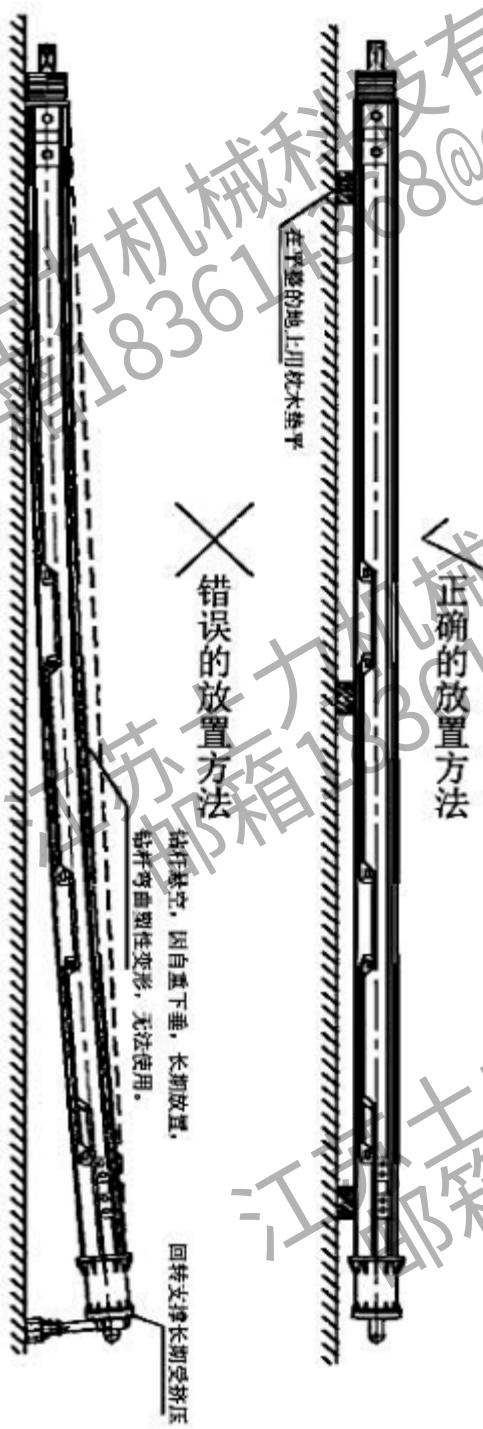
25. 钻杆在运输时，应在钻杆的两头和中间做三点支撑，以减小因为震动而产生的变形。

26. 钻杆在确定长期停止使用时，应及时冲洗花管部位，确保钻杆内部没有泥沙、渣土等杂物。

# 第七章 非钻机、钻杆质量责任图例

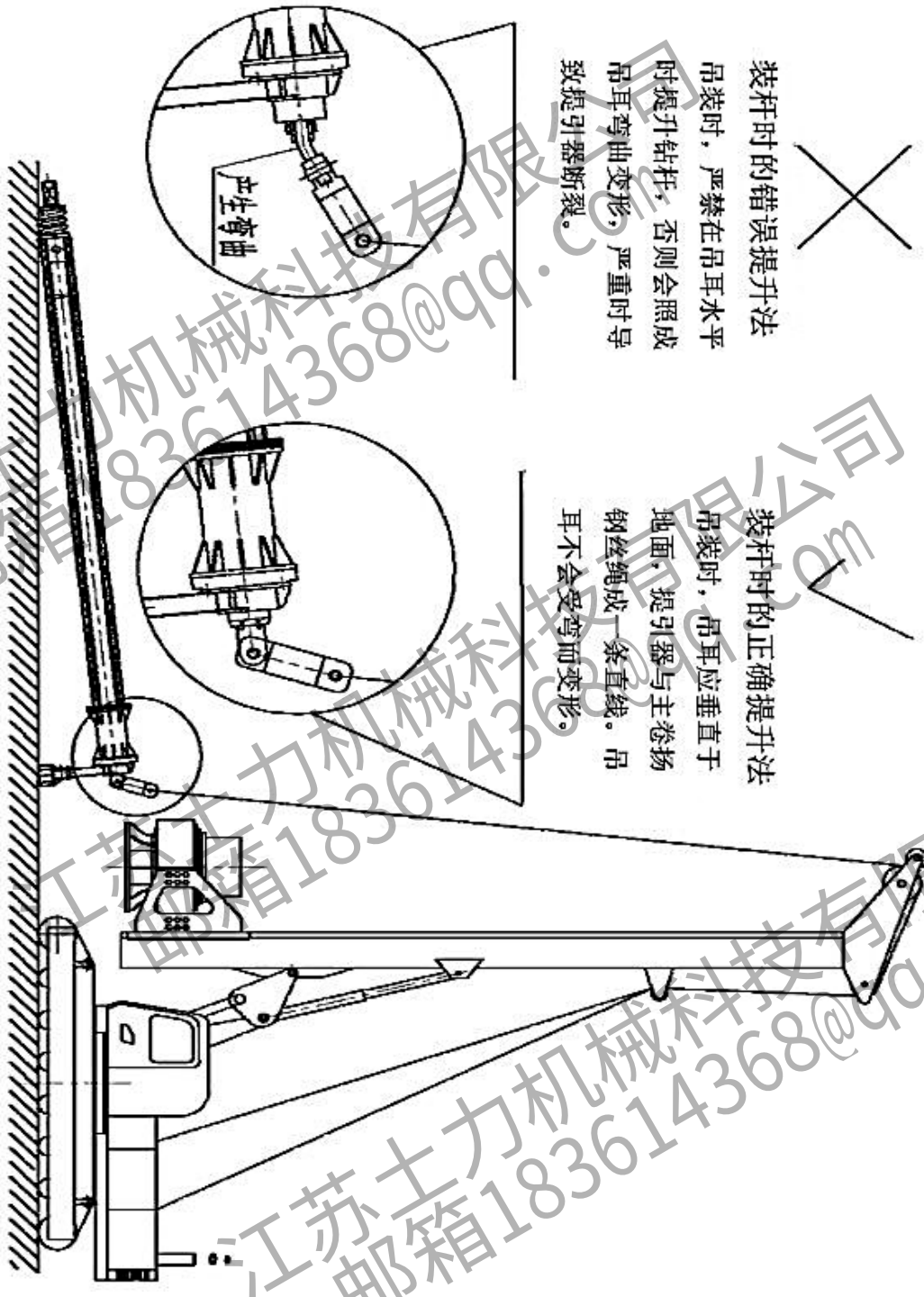
## 钻杆常见故障(一)

钻杆长期存放时，不得直接放于地上，不得与渣土、碎石以及其它可能进入钻杆的细碎物品放在一起;需找一片开阔平整且较硬实的区域，用枕木垫平离地。最好拆除随动架,以防回转支承的碰撞损坏严禁按错误的方法放置钻杆。




※严禁随意悬空放置※
※请将钻杆垫平、离地※

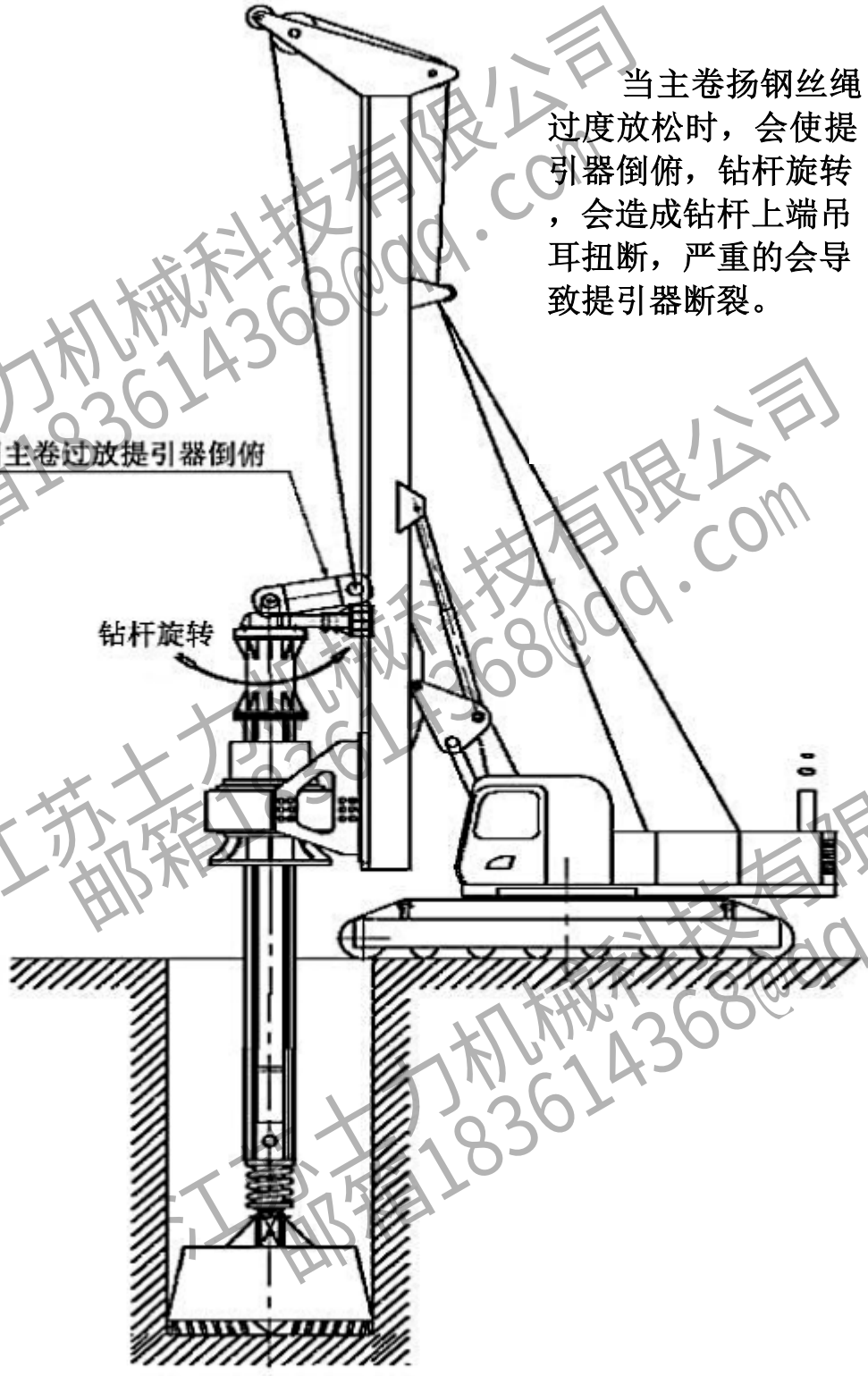
# 钻杆常见故障(二)




※严禁吊耳(扁头)与地面平行时进行钻杆的吊装※

# 钻杆常见故障(三)

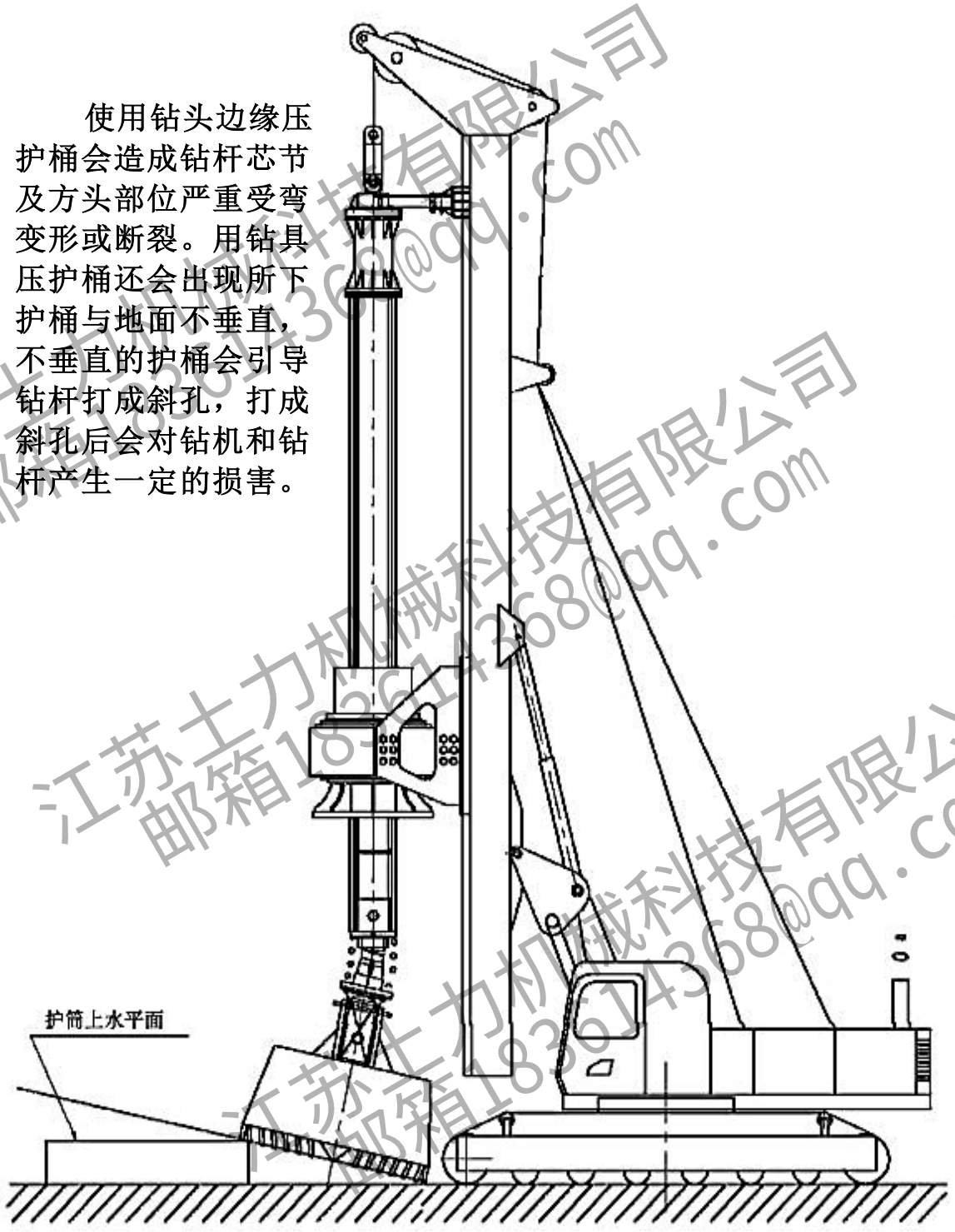
当主卷扬钢丝绳过度放松时，会使提引器倒俯，钻杆旋转，会造成钻杆上端吊耳扭断，严重的会导致提引器断裂。




**※严禁主卷过放※**

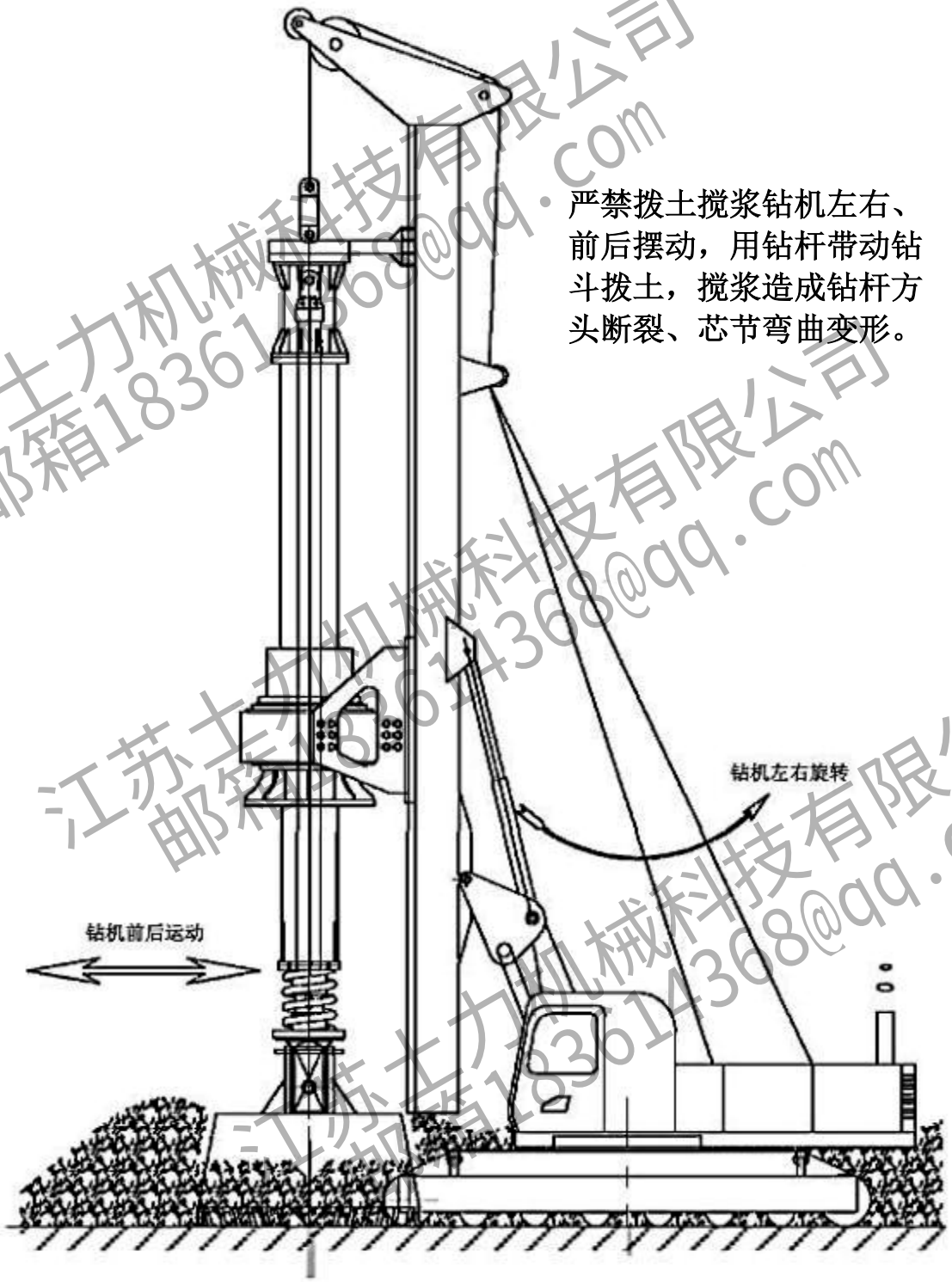
# 钻杆常见故障(四)

使用钻头边缘压护桶会造成钻杆芯节及方头部位严重受弯变形或断裂。用钻具压护桶还会出现所下护桶与地面不垂直，不垂直的护桶会引导钻杆打成斜孔，打成斜孔后会对钻机和钻杆产生一定的损害。




**※严禁用钻具压护桶※**

# 钻杆常见故障(五)



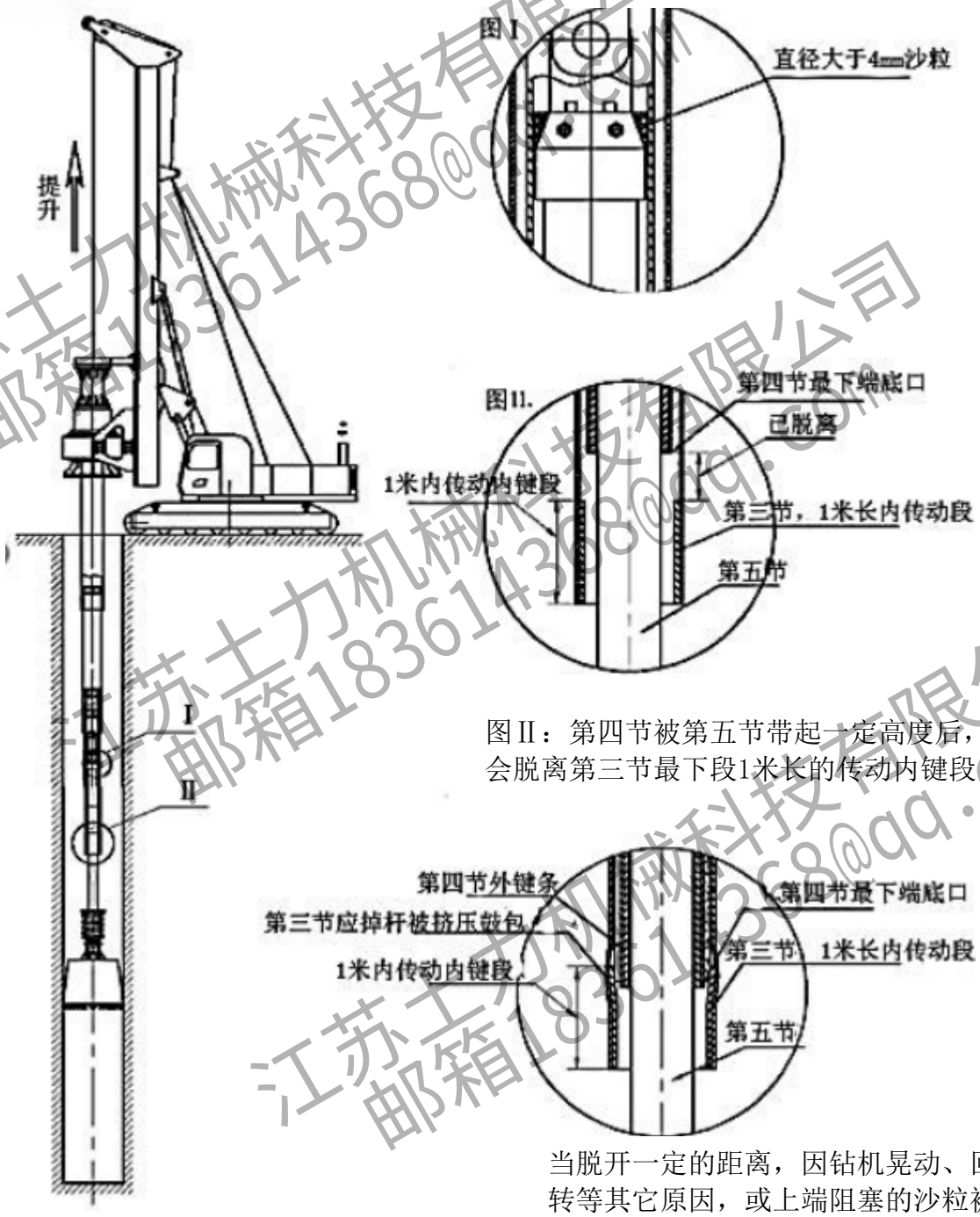

严禁拨土搅浆钻机左右、前后摆动，用钻杆带动钻斗拨土，搅浆造成钻杆方头断裂、芯节弯曲变形。

**※严禁拨土(平整地面)，搅浆等其他非钻孔事项※**

# 钻杆常见故障(六)

因泥浆中沙粒直径大，第四节被带起状态。

图Ⅰ：钻杆第四、五节之间因有大沙粒（直径大于4mm）的阻塞，使第四节与第五节不能够正常回收。




图Ⅱ：第四节被第五节带起一定高度后，会脱离第三节最下段1米长的传动内键段。

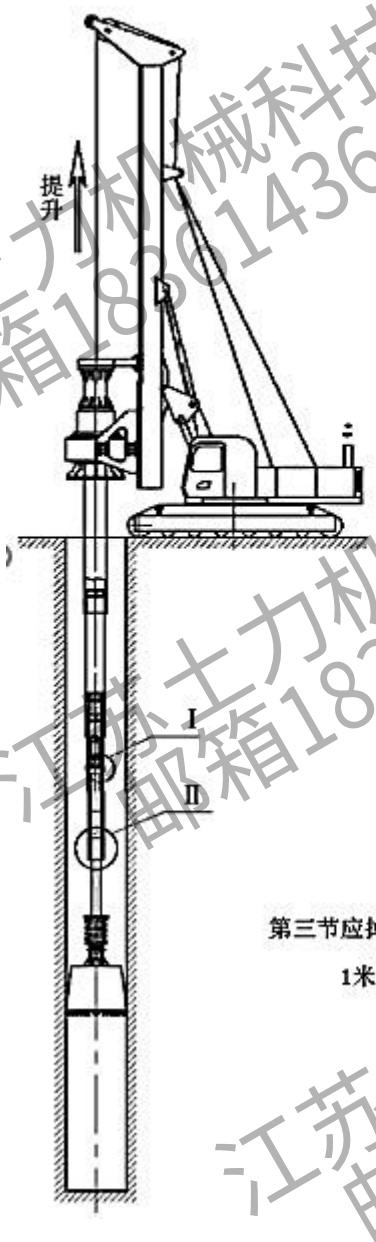



当脱开一定的距离，因钻机晃动、回转等其它原因，或上端阻塞的沙粒被挤碎时，第四节会自由下落，产生掉杆。砸在第三节内键段上，会使第三节内键段上端砸成鼓包。

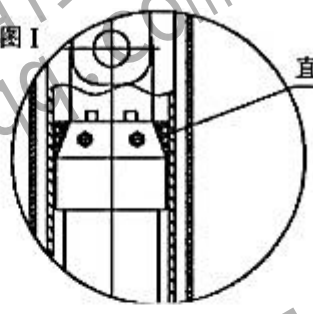
**※注意钻杆异常※**
**※严禁带病作业※**

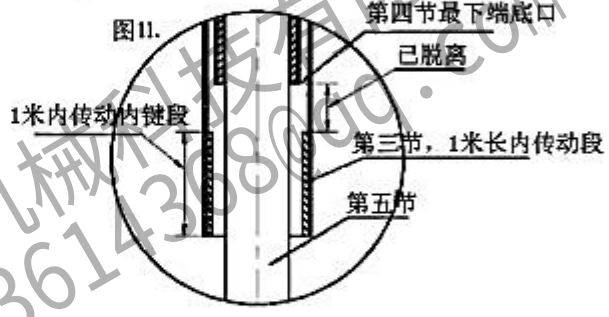
# 钻杆常见故障(七)

因异物第三节被带起状态

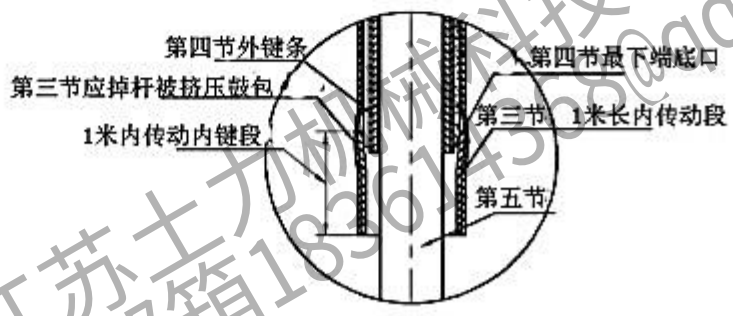



图Ⅰ：当三、四节之间有异物从外部进入（如螺栓等），使第三节与第四节不能够正常回收而带起。




图Ⅱ：第三节被第四节带起一定高度后，会脱离第二节最下段1米长传动内键段。

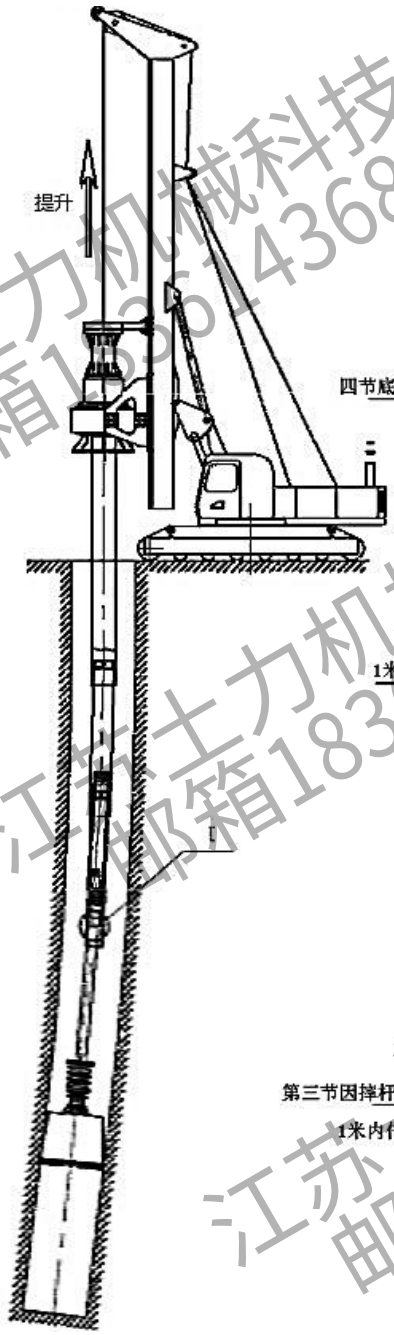



当脱开一定的距离，三节上端会窜出二节上端，这时任何钻机的晃动、回转，使阻塞在三、四节的异物（螺栓）松动，第三节会自由下落，产生摔杆，砸在第二节内键段上，会将第二节内键段上端砸成鼓包。

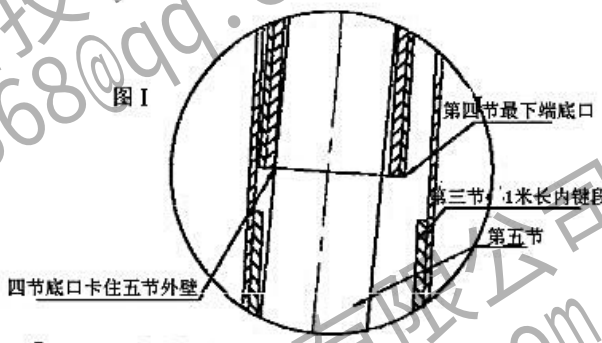
**※注意钻杆异常※**
**※严禁带病作业※**

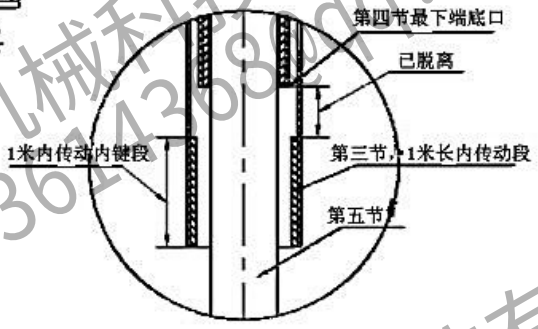
# 钻杆常见故障(八)

因打成斜孔第四节在上提时被带起状态

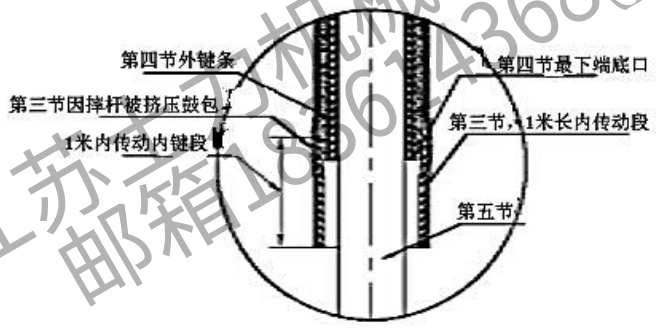



图Ⅰ：当孔被打成一定倾斜时，钻杆各节均有一定的弯曲挠度。提升钻杆时，第四节底口会卡在五节外壁，使第四节与第五节不能够正常回收而将第四节带起。




第四节被第五节带起一定高度后，会脱离第三节最下段1米长传动内键段。



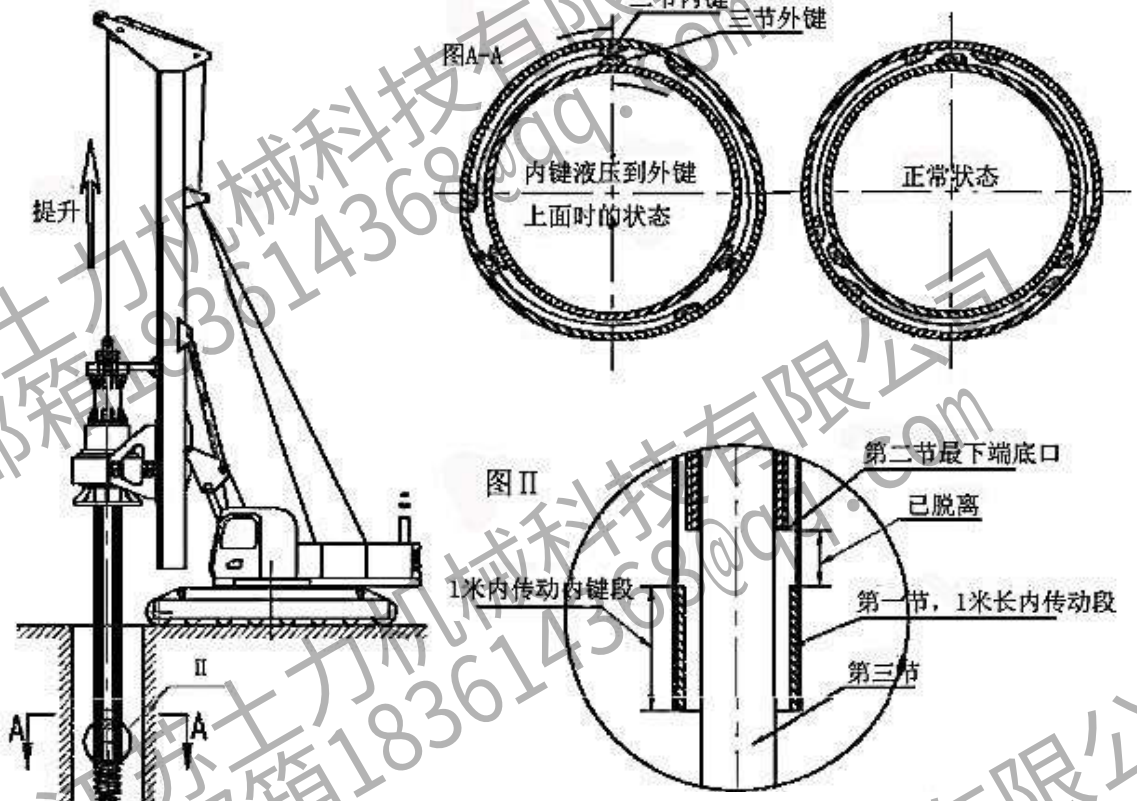

当脱开一定的距离，第四节弯曲弹性恢复，且孔弯曲值减少，自由下落，产生摔杆。砸在第三节内键段上，会将第三节内键段上端砸成鼓包。

**※注意钻杆异常※**
**※严禁带病作业※**

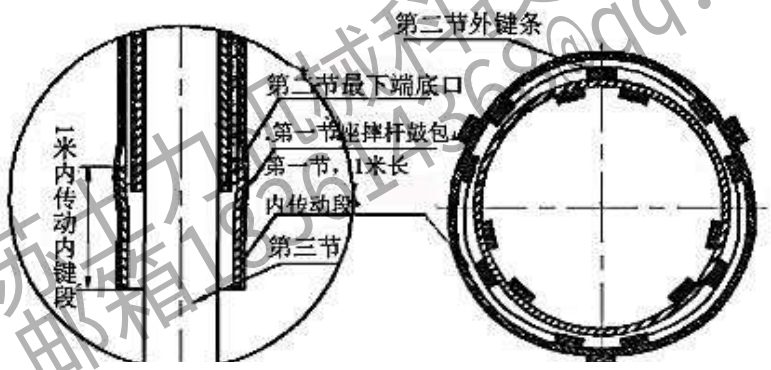
# 钻杆常见故障(九)

因内外键严重磨损，二节内键传扭时液压到三节外键上，第二节被第三节带起状态。

当第二节内键与第三节外键磨损较大，成大斜楔面。旋转时，会使第二节管壁因斜楔效应产生变形（如下图A-A），内键会液压到三节外键上面，第三节不能够正常回收而将第二节带起。




图Ⅱ：第二节被第三节带起一定高度后，会脱离第一节最下段1米长传动内键段。

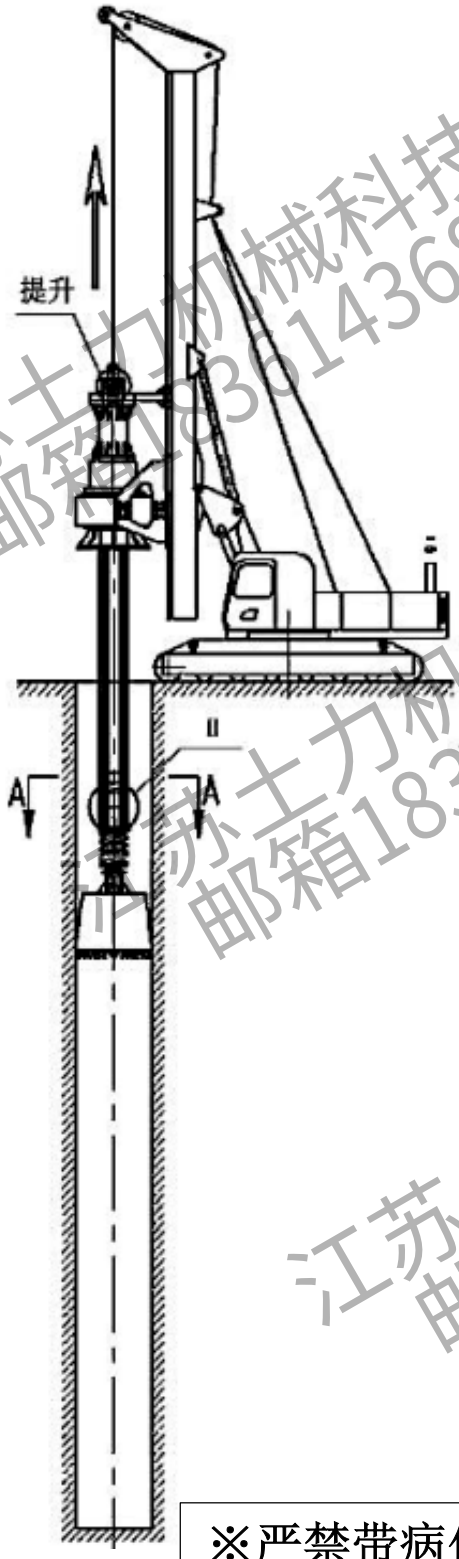



当脱开一定的距离，第二节上窜出随动架，这时晃动动力头或振动，第二节会下落，产生摔杆，砸在第一节内键段上，将第一节内键段上端砸成鼓包。

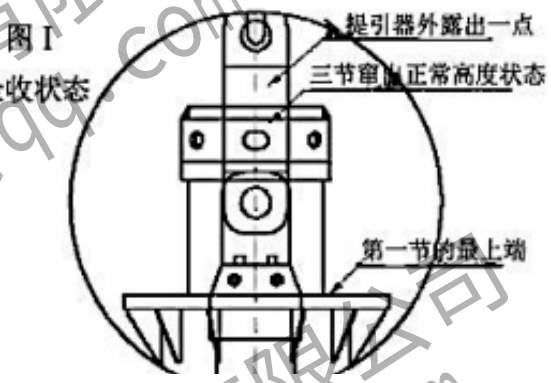
**※严格按说明书，按时检修、保养※**
**※严禁过度磨损※**

# 钻杆常见故障(十)

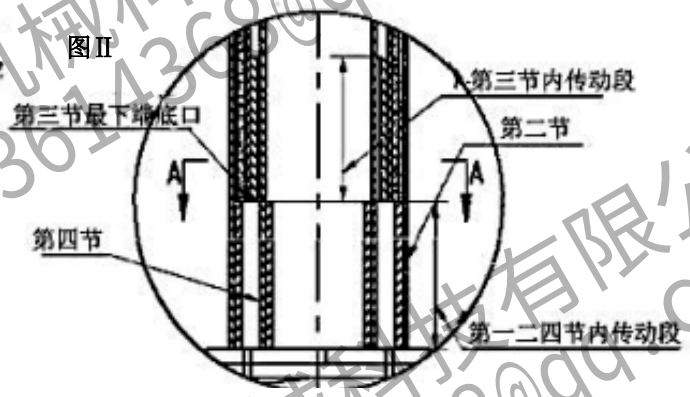
内节因各种原因被带起时的状态



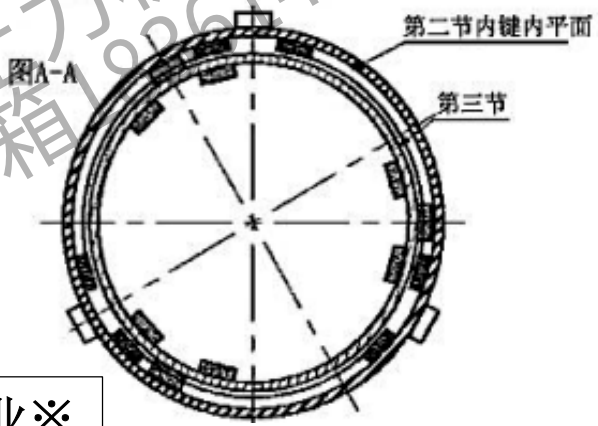

图Ⅰ：当三、四节之间有异物，使第四节与第三节不能够正常回收而带起，使第三节搭在第二节花管上端，窜出带杆，不能正常下方钻杆使用。




图Ⅱ：第三节被第四节带起一定高度后，第三节会脱离第四节最下端1米长传动内键段，并轻落在其上端。（没有高悬空摔杆，没有产生三节鼓包现象）




图A-A：上图带杆情况（轻摔）出现后，第三节外键没有归位到第二节内键槽中的状态。

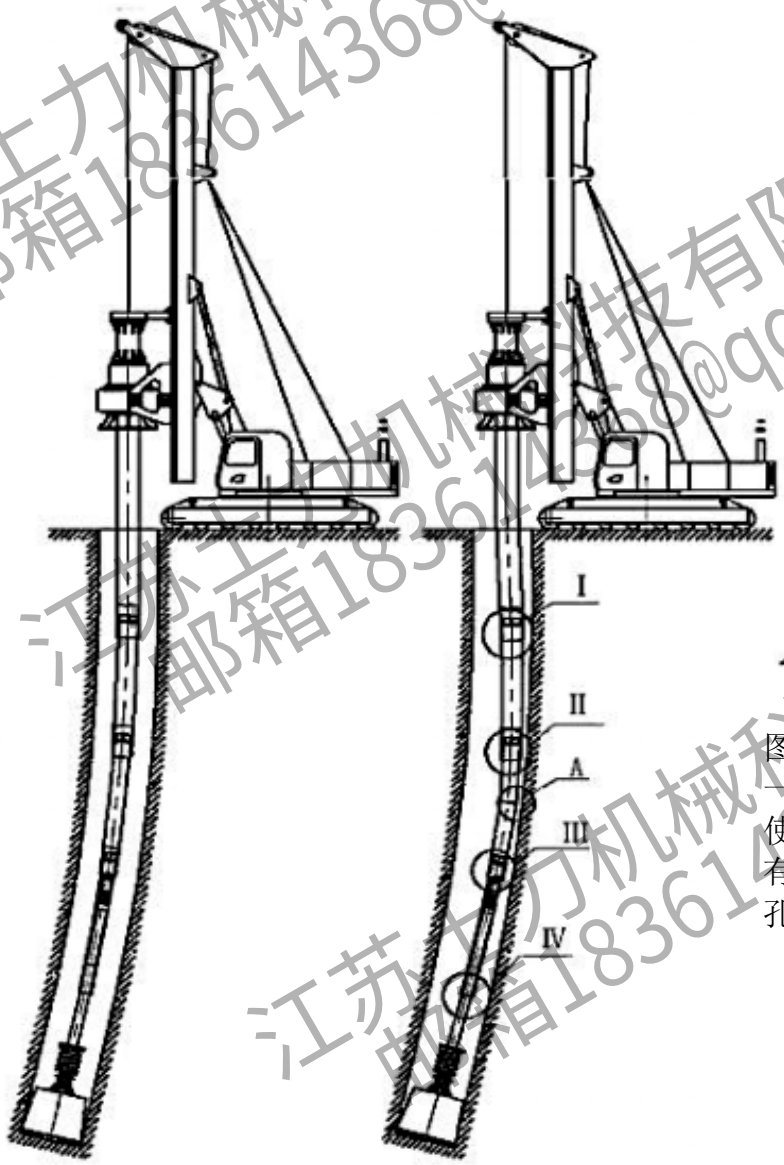


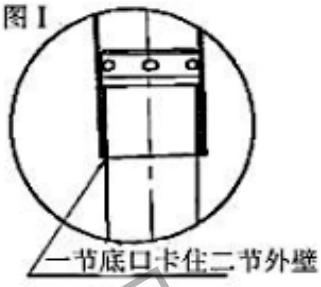

※严禁带病作业※
※注意钻杆异常※

# 钻杆常见故障(十一)

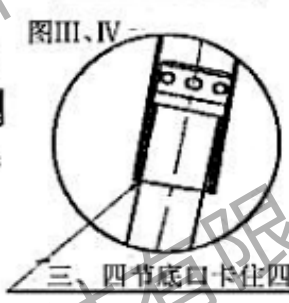
当孔被打斜时，钻杆各节均会有一定的弯曲。这时动力头继续向下加压， 会使钻杆产生严重的弯曲(这时各节因弯曲被卡住，不能够自由收缩)。钻杆因严重弯曲产生不可回避的塑性变形，弯曲严重时，会将钻杆外键拉断。外键断裂后，如不及时修补，管体会因严重弯曲钻进而折断。

钻杆打成斜孔状态　　钻杆打成斜孔时，钻杆折断状态



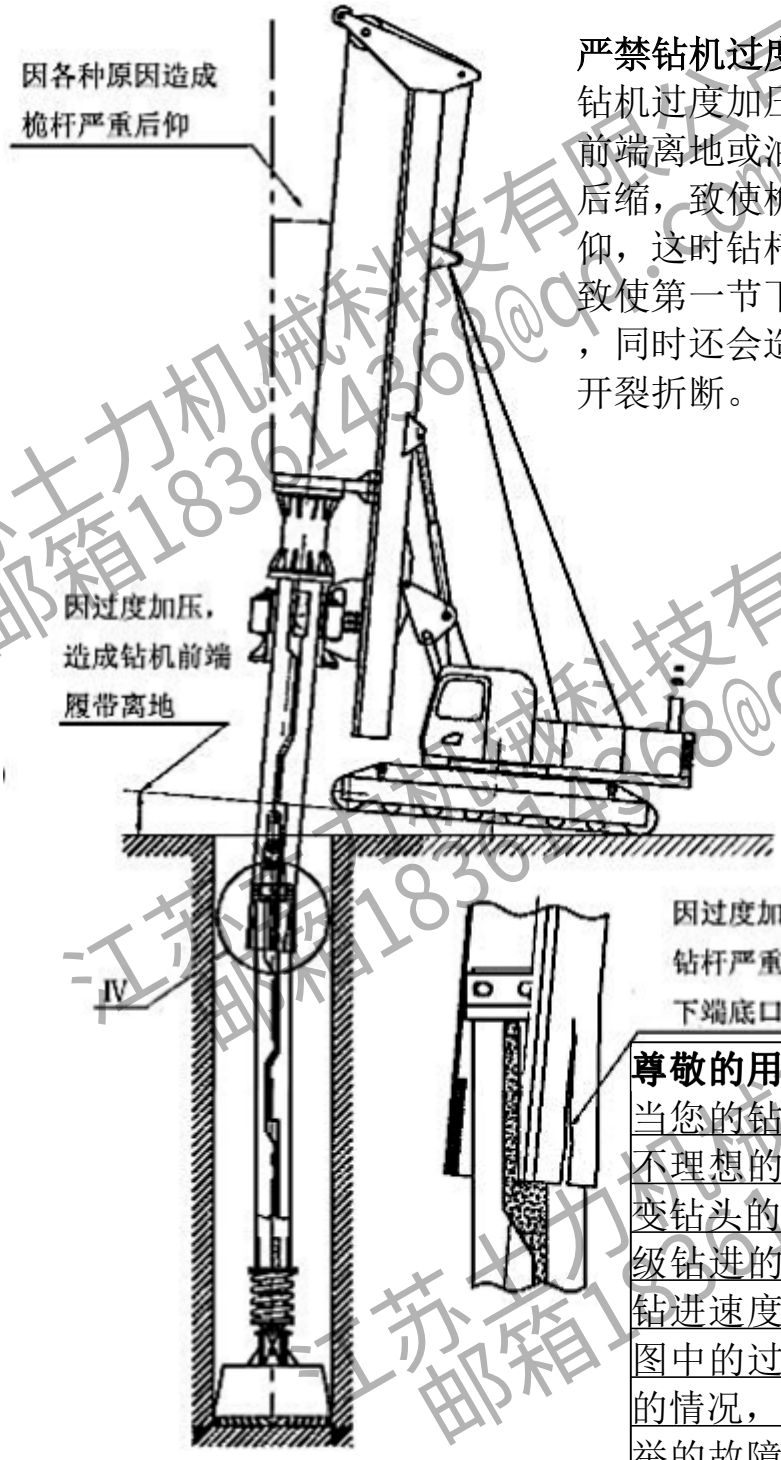





图A：当打成斜孔时，各节钻杆有一定的弯曲，当继续加压时，会使各节外键产生拉伸断裂，在没有及时修补，而继续使用钻杆钻孔时，就会把钻杆的管体折断。


**※注意钻孔情况※**
**※成斜孔时，严禁过度加压※**

# 钻杆常见故障(十二)




**严禁钻机过度加压**

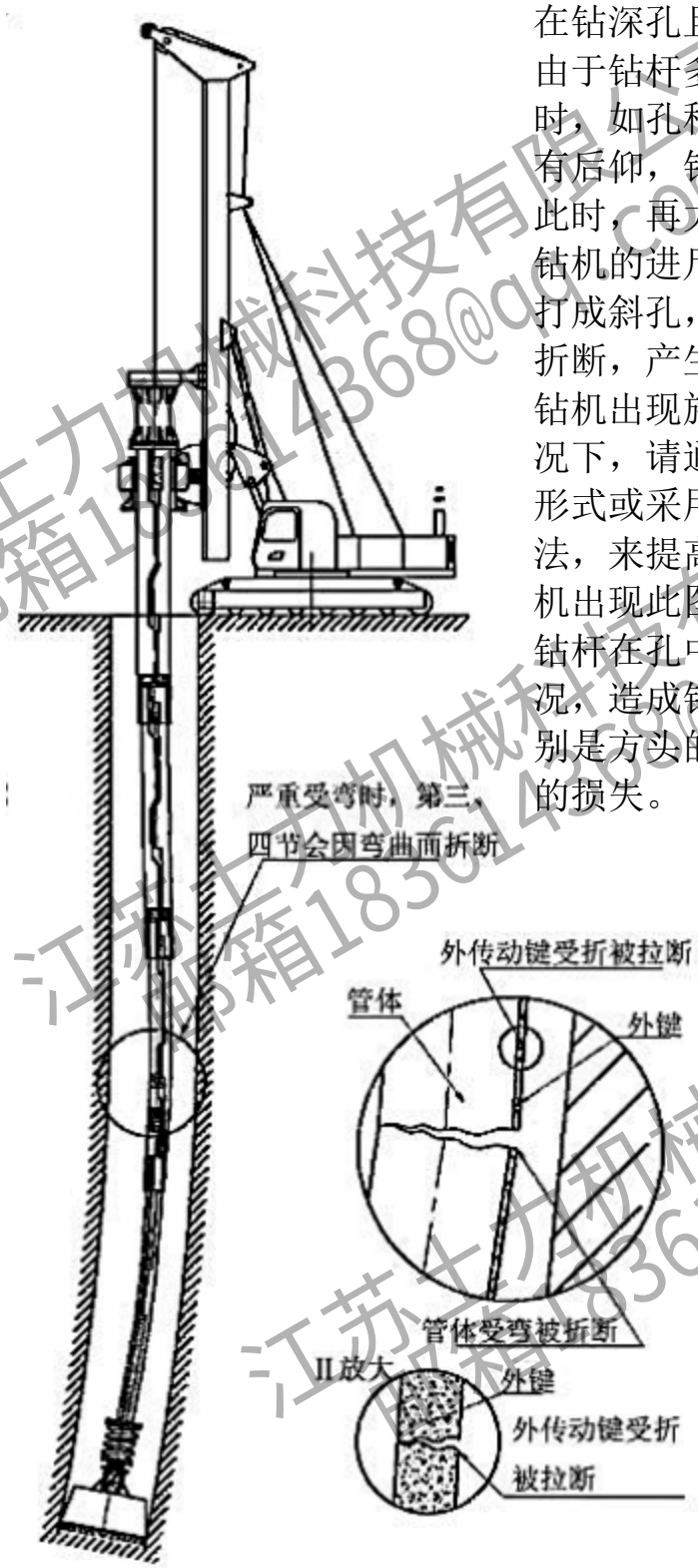
钻机过度加压会造成履带前端离地或油缸不能自锁后缩，致使桅杆会严重后仰，这时钻杆严重受弯，致使第一节下端底口开裂，同时还会造成管体中段开裂折断。

**尊敬的用户朋友：**

当您的钻机出现，施工进度不理想的情况下，请通过改变钻头的结构形式或采用分级钻进的施工方法，来提高钻进速度。严禁钻机出现此图中的过度加压及桅杆后仰的情况，已避免此图中所列举的故障出现。

**※严禁钻机过度加压，钻机钻桅后仰※**

# 钻杆常见故障(十三)

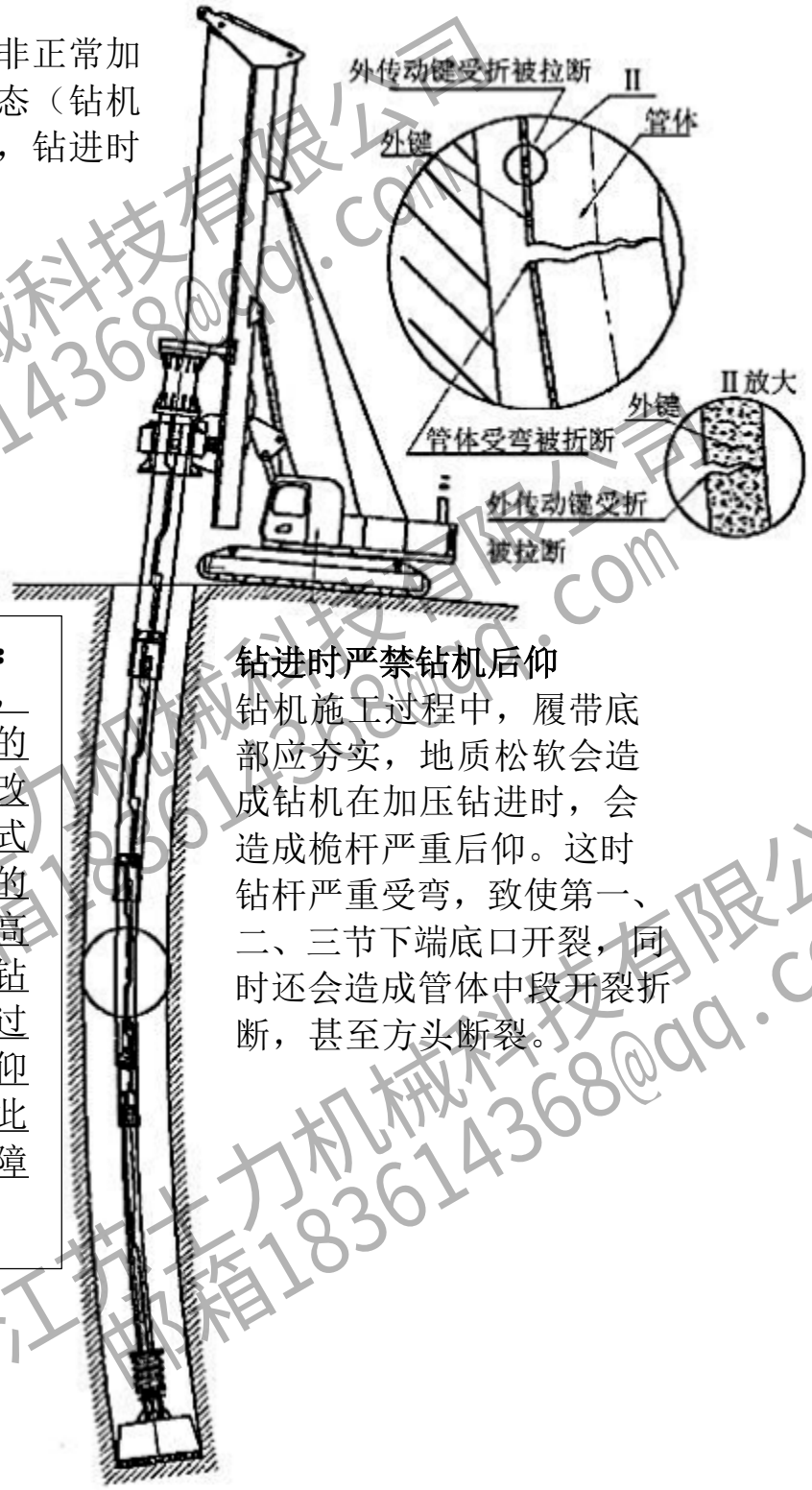



在钻深孔且桩孔地层较硬时，由于钻杆多节伸出，压力较大时，如孔稍有倾斜，或桅杆稍有后仰，钻杆极易产生弯曲。此时，再大力加压，不会提高钻机的进尺效率，反而会将孔打成斜孔，会造成钻杆折弯、折断，产生不必要的损失。当钻机出现施工进度不理想的情况下，请通过改变钻头的结构形式或采用分级钻进的施工方法，来提高钻进速度。严禁钻机出现此图中的过度加压，使钻杆在孔中出现严重弯曲的情况，造成钻杆折弯、折断，特别是方头的折断，产生不必要的损失。

**※钻深长硬孔时，严禁过度加压造成钻杆严重弯曲※**

# 钻杆常见故障(十四)

机锁杆全挂锁非正常加压钻进全伸状态（钻机后端地面不平，钻进时钻机后仰）




**尊敬的用户朋友：**
当您的钻机出现，施工进度不理想的情况下，请通过改变钻头的结构形式或采用分级钻进的施工方法，来提高钻进速度。严禁钻机出现此图中的过度加压及桅杆后仰的情况，以避免此图中所列举的故障出现。

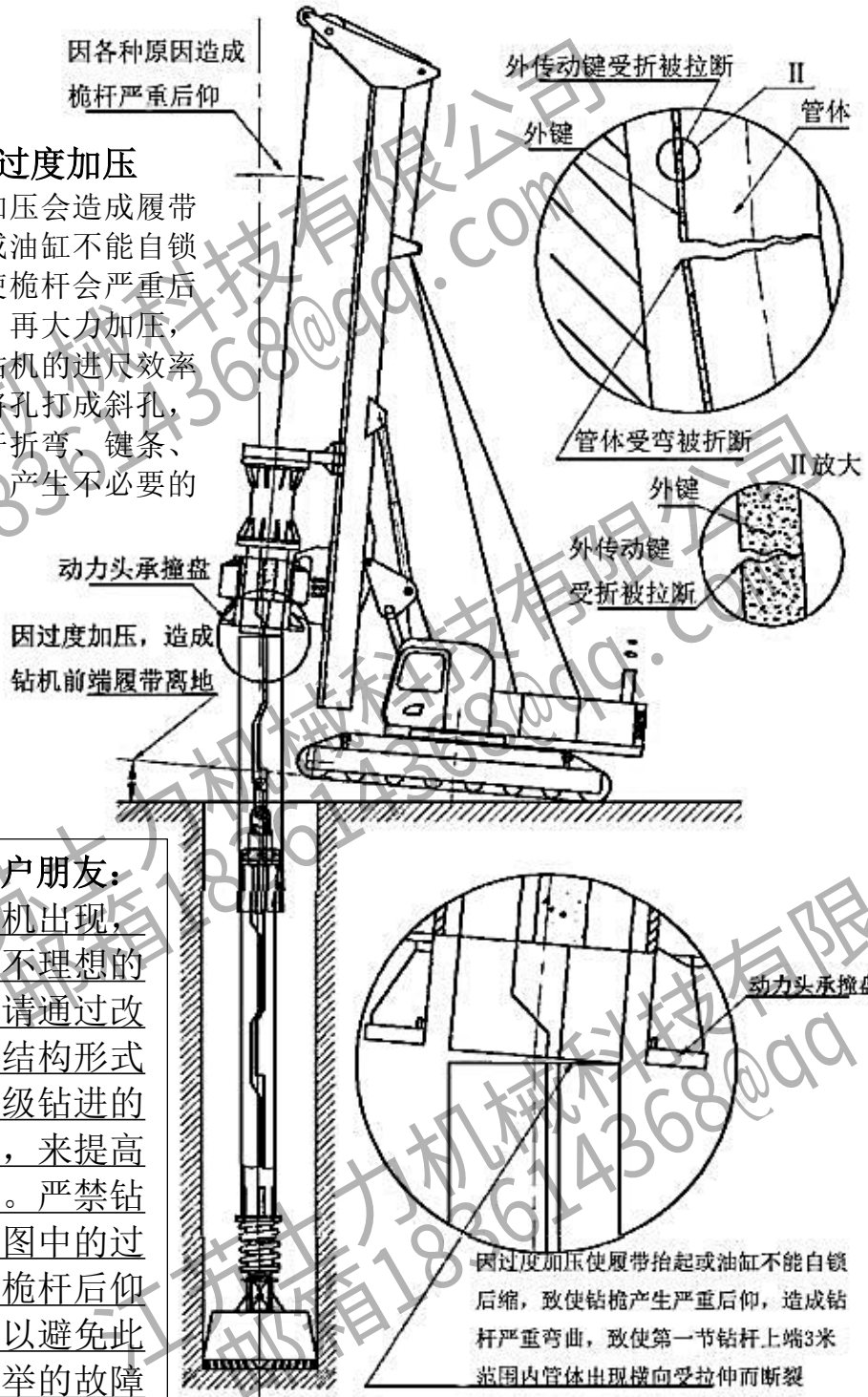
**钻进时严禁钻机后仰**
钻机施工过程中，履带底部应夯实，地质松软会造成钻机在加压钻进时，会造成桅杆严重后仰。这时钻杆严重受弯，致使第一、二、三节下端底口开裂，同时还会造成管体中段开裂折断，甚至方头断裂。

**※钻深长硬孔时，严禁过度加压，造成钻杆严重弯曲※**

# 钻杆常见故障(十五)

**严禁钻机过度加压**

钻机过度加压会造成履带前端离地或油缸不能自锁后缩，致使桅杆会严重后仰，此时，再大力加压，不会提高钻机的进尺效率，反而会将孔打成斜孔，会造成钻杆折弯、键条、管体开裂，产生不必要的损失。

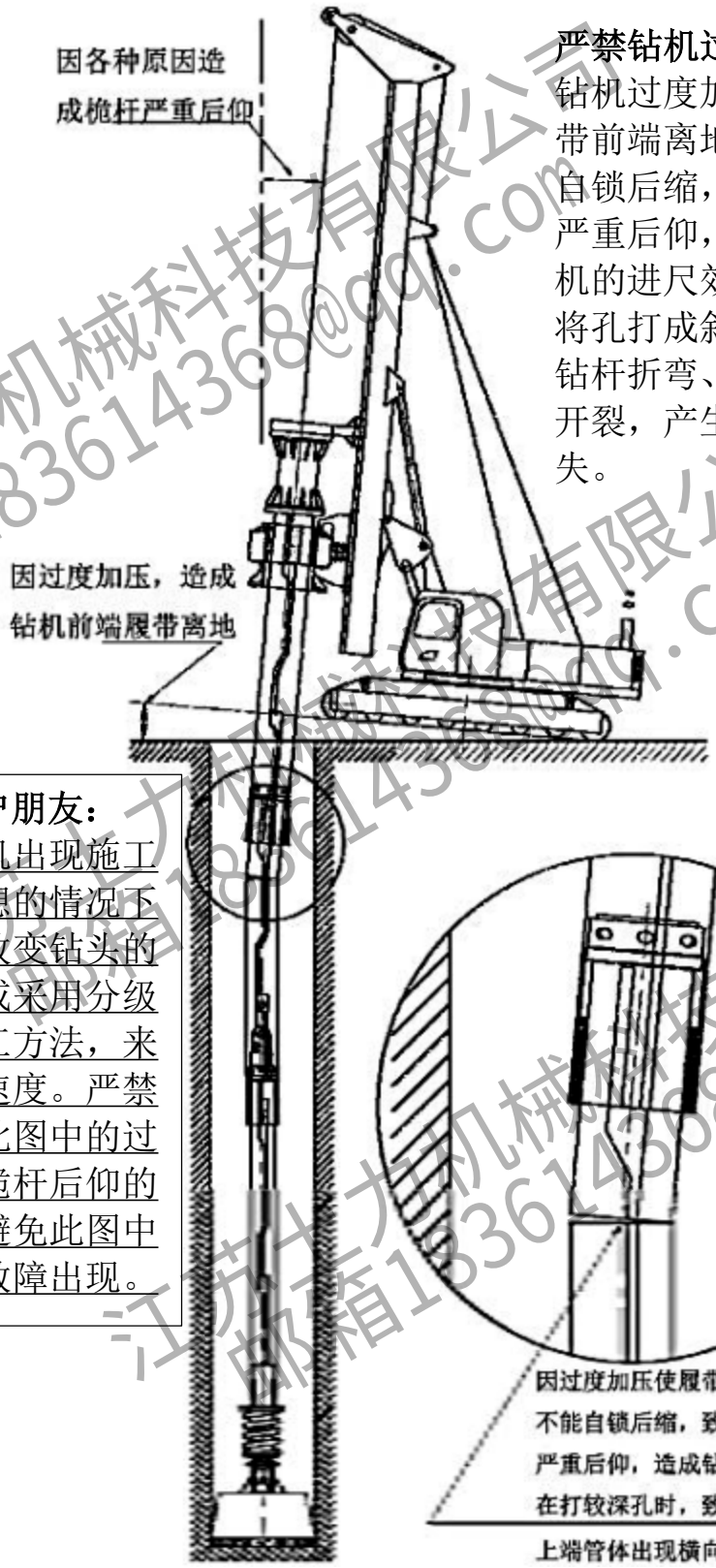



**尊敬的用户朋友：**

当您的钻机出现，施工进度不理想的情况下，请通过改变钻头的结构形式或采用分级钻进的施工方法，来提高钻进速度。严禁钻机出现此图中的过度加压及桅杆后仰的情况，以避免此图中所列举的故障出现。

※严禁过度加压※

# 钻杆常见故障(十六)




**严禁钻机过度加压**

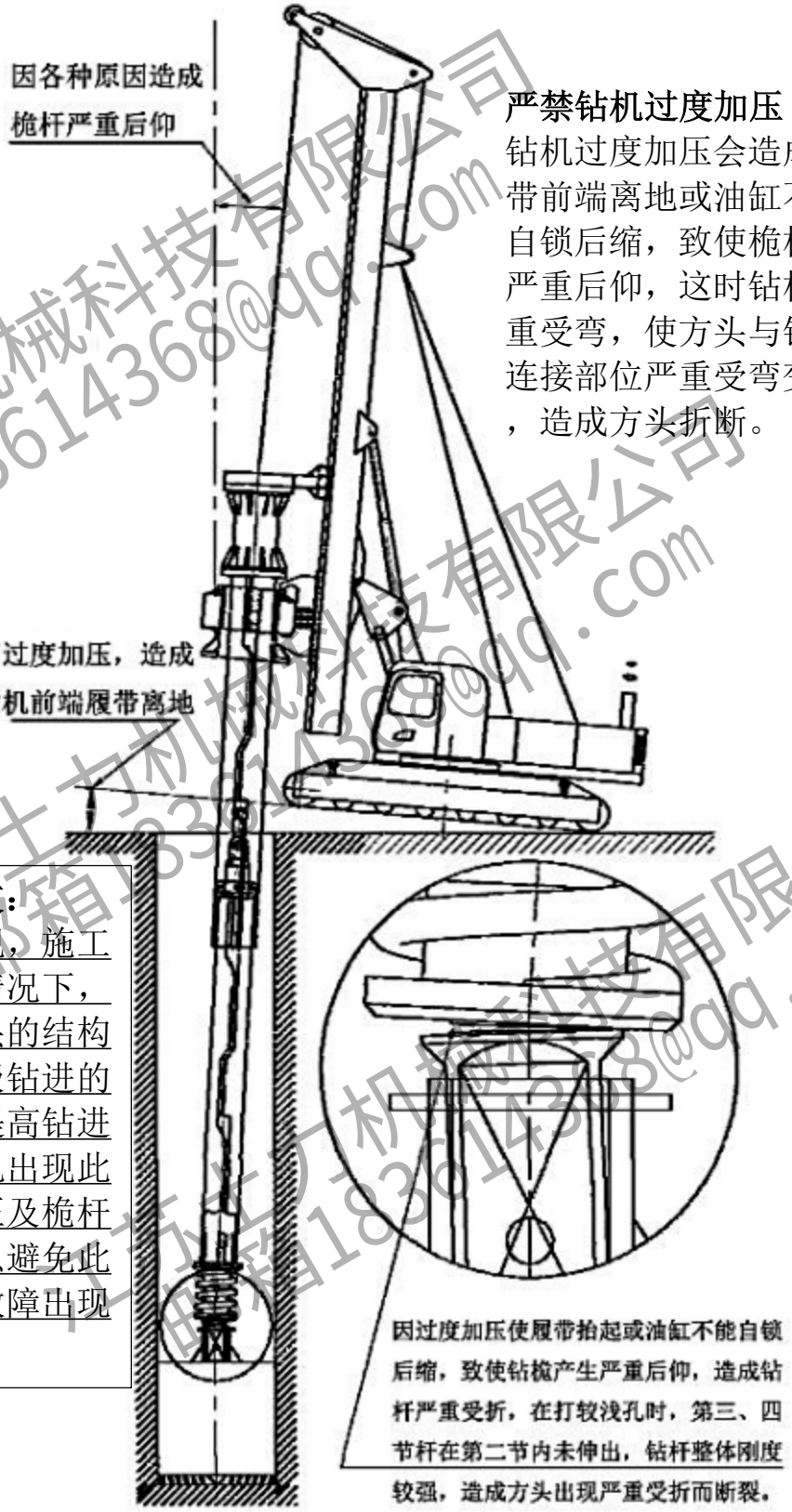
钻机过度加压会造成履带前端离地或油缸不能自锁后缩，致使桅杆会严重后仰，不会提高钻机的进尺效率，反而会将孔打成斜孔，会造成钻杆折弯、键条、管体开裂，产生不必要的损失。

**尊敬的用户朋友：**

当您的钻机出现施工进度不理想的情况下，请通过改变钻头的结构形式或采用分级钻进的施工方法，来提高钻进速度。严禁钻机出现此图中的过度加压及桅杆后仰的情况，以避免此图中所列举的故障出现。

**※严禁钻杆过度加压，钻机钻桅后仰※**

# 钻杆常见故障(十七)




**严禁钻机过度加压**

钻机过度加压会造成履带前端离地或油缸不能自锁后缩，致使桅杆会严重后仰，这时钻杆严重受弯，使方头与钻具连接部位严重受弯变形，造成方头折断。

**尊敬的用户朋友：**

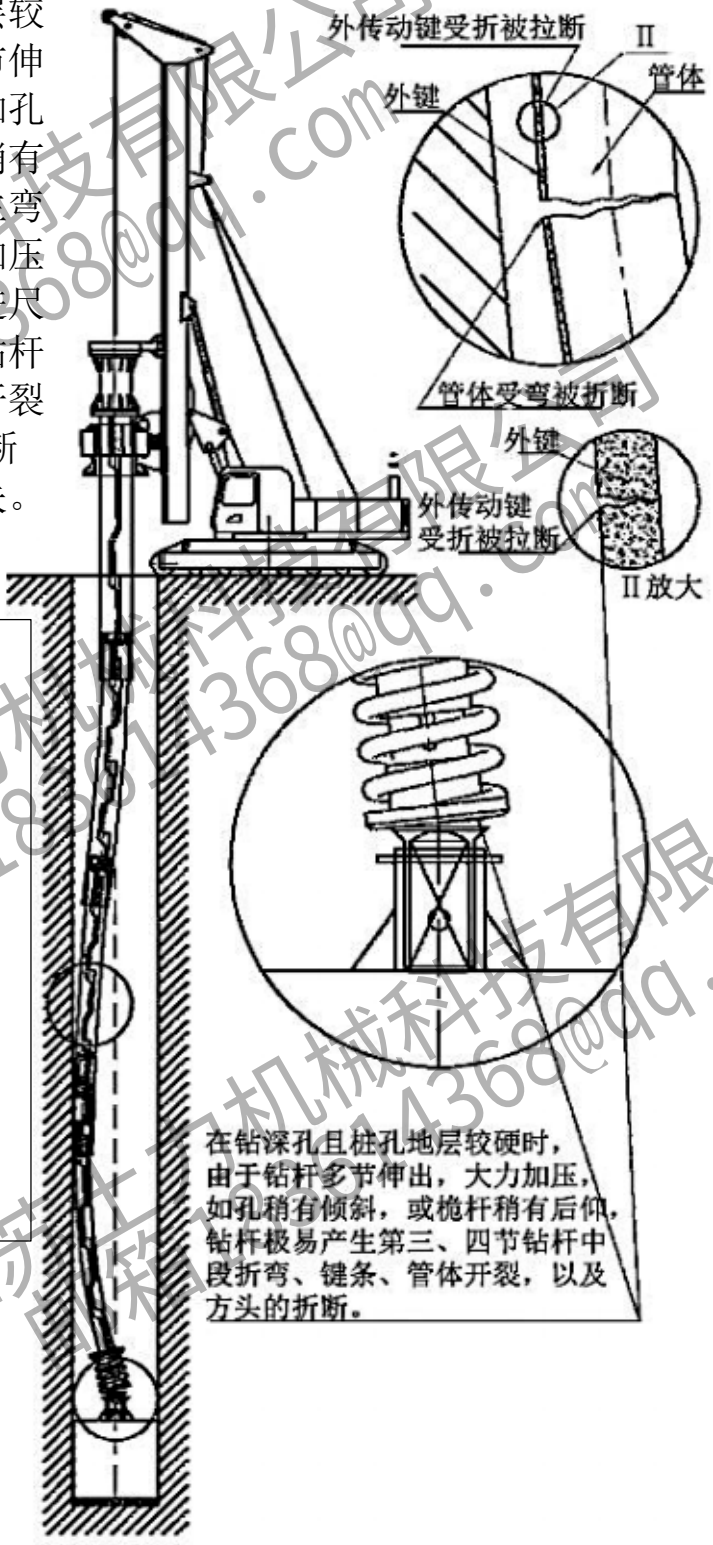
当您的钻机出现，施工进度不理想的情况下，请通过改变钻头的结构形式或采用分级钻进的施工方法，来提高钻进速度。严禁钻机出现此图中的过度加压及桅杆后仰的情况，以避免此图中所列举的故障出现。

**※严禁钻机过度加压，钻机钻桅后仰※**

# 钻杆常见故障(十八)

**严禁钻机过度加压**

在钻深孔且桩孔地层较硬时，由于钻杆多节伸出，压力较大时，如孔稍有倾斜，或桅杆稍有后仰，钻杆极易产生弯曲。此时，再大力加压，不会提高钻机的进尺效率，反而会造成钻杆折弯、键条、管体开裂，特别是方头的折断，产生不必要的损失。

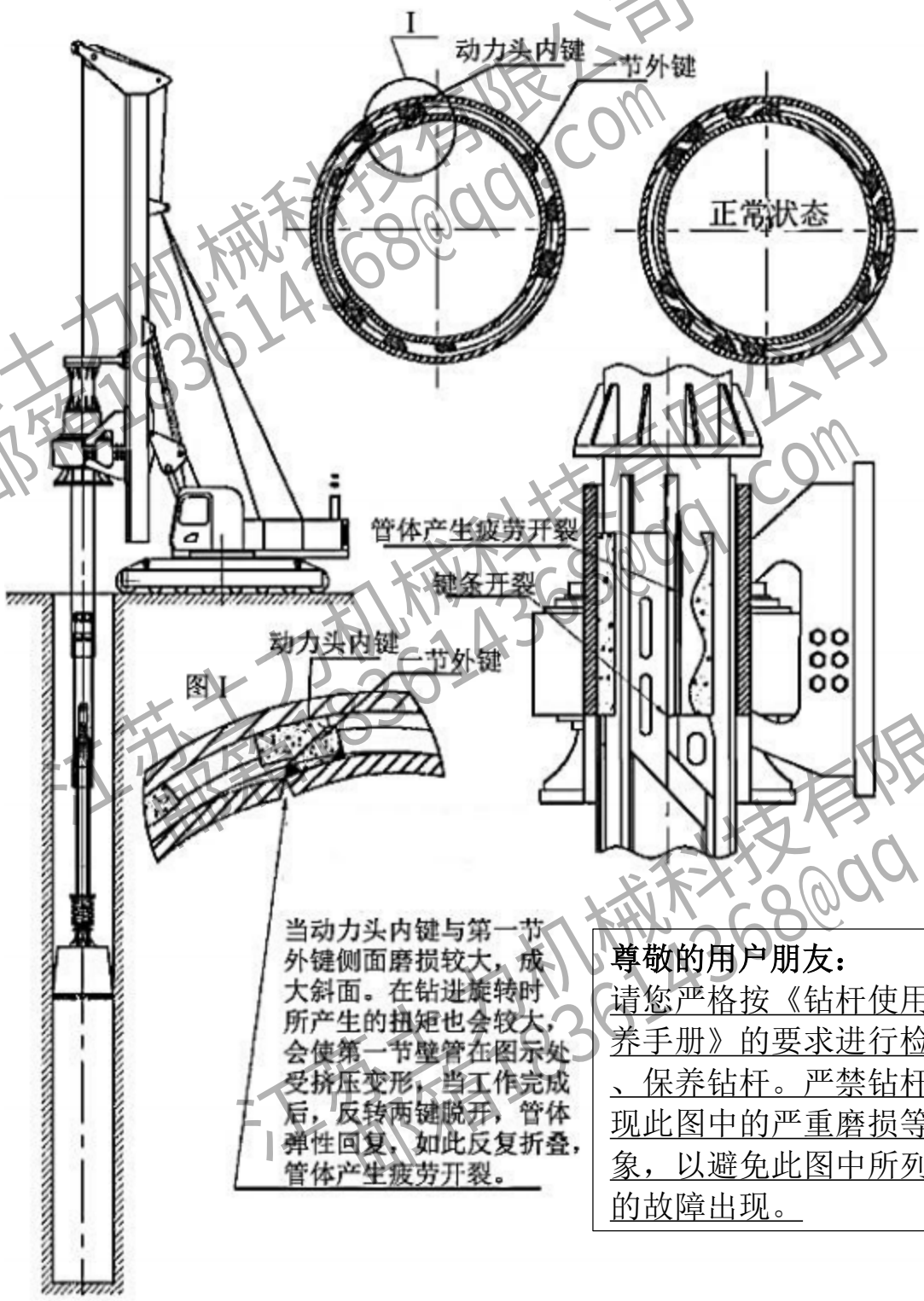



**尊敬的用户朋友：**

当您的钻机出现，施工进度不理想的情况下，请通过改变钻头的结构形式或采用分级钻进的施工方法，来提高钻进速度。严禁钻机出现此图中的过度加压及桅杆后仰的情况，以避免此图中所列举的故障出现。

**※严禁过度加压，造成钻杆严重弯曲※**

# 钻杆常见故障(十九)

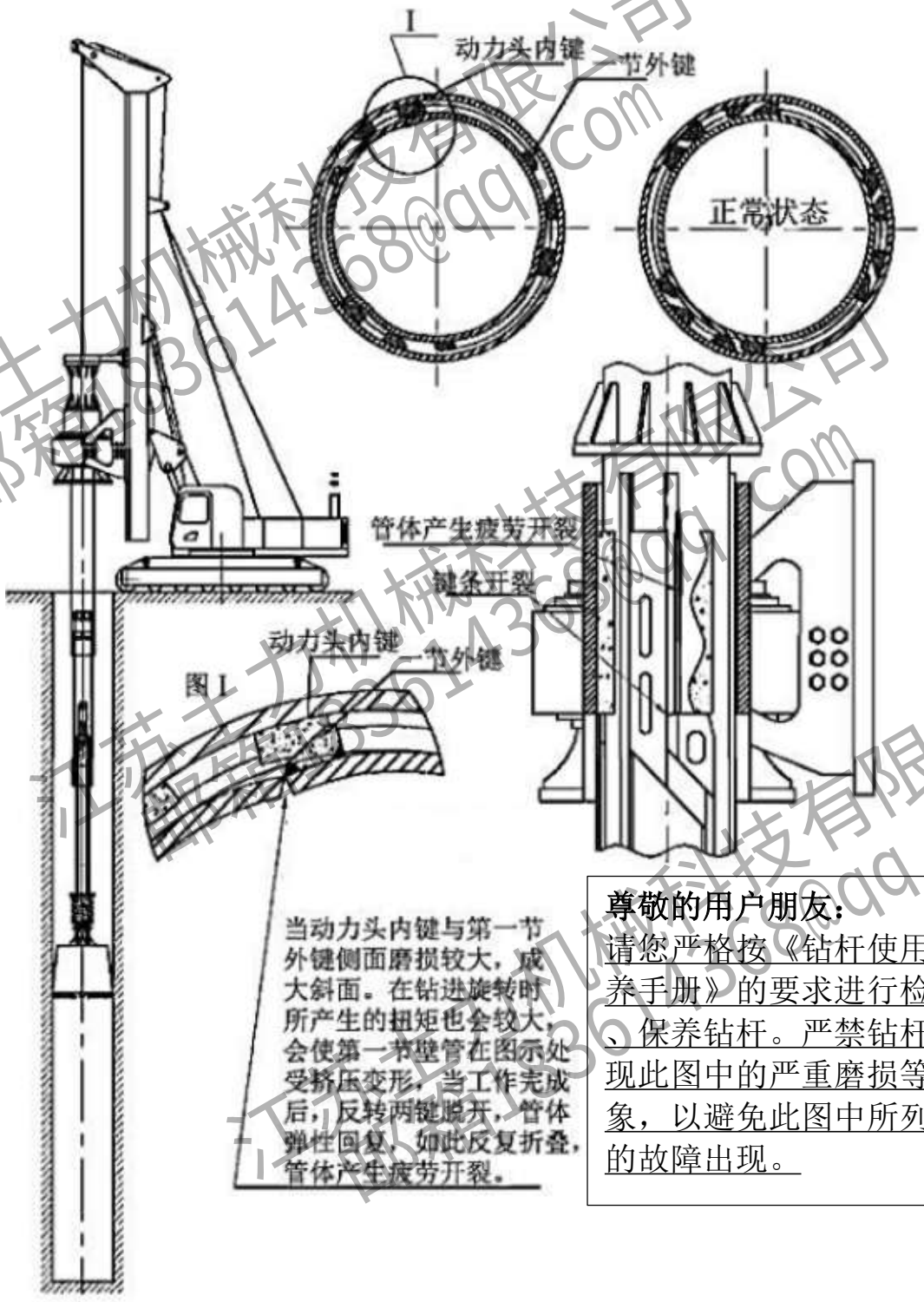



**尊敬的用户朋友：**

请您严格按《钻杆使用保养手册》的要求进行检查、保养钻杆。严禁钻杆出现此图中的严重磨损等现象，以避免此图中所列举的故障出现。

**※严格按说明书，按时检修、保养，严禁过度磨损※**

# 钻杆常见故障(二十)

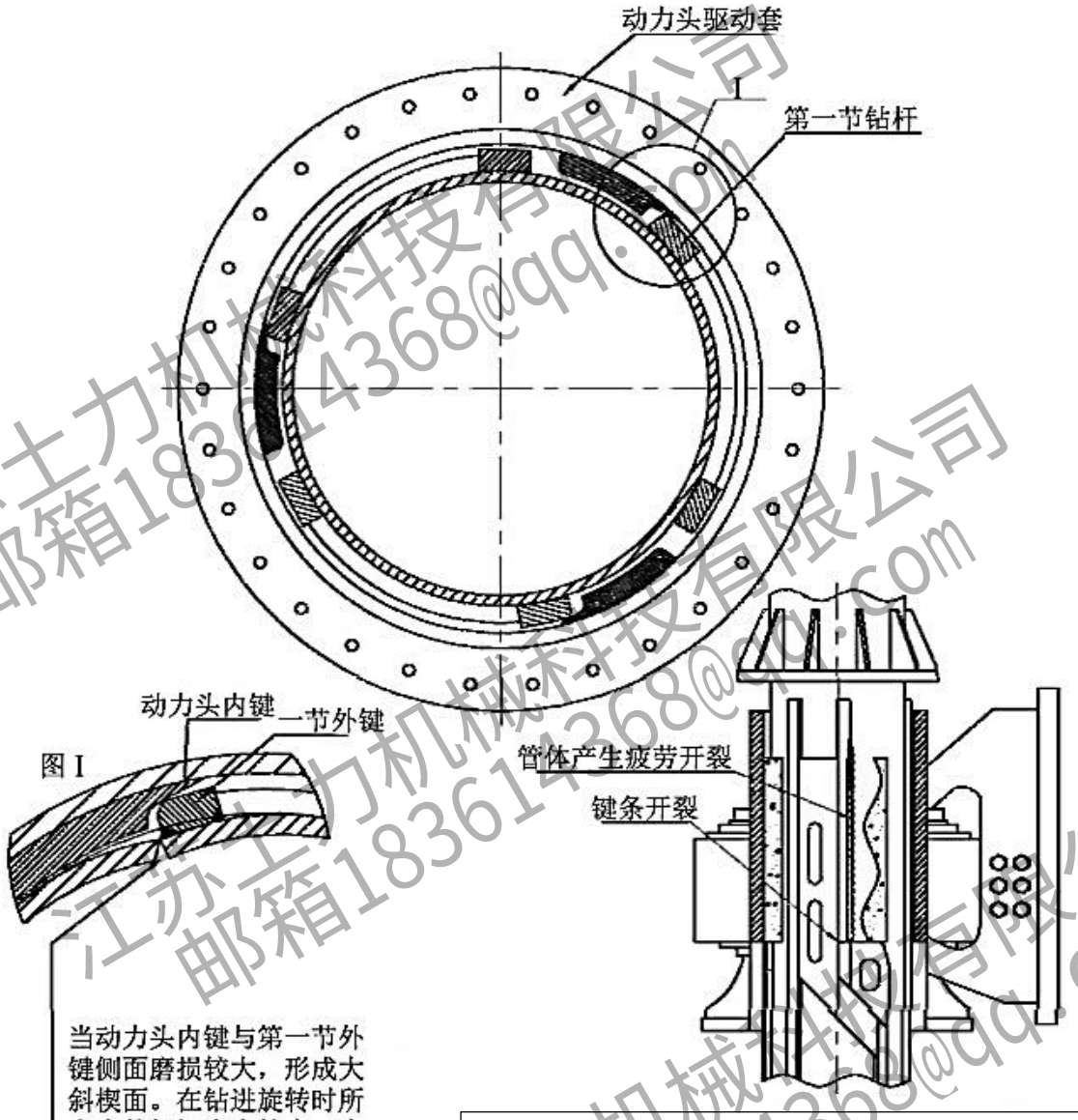



**尊敬的用户朋友：**

请您严格按《钻杆使用保养手册》的要求进行检查、保养钻杆。严禁钻杆出现此图中的严重磨损等现象，以避免此图中所列举的故障出现。

**※严格按说明书，按时检修、保养，严禁过度磨损※**

# 钻杆常见故障(二十一)



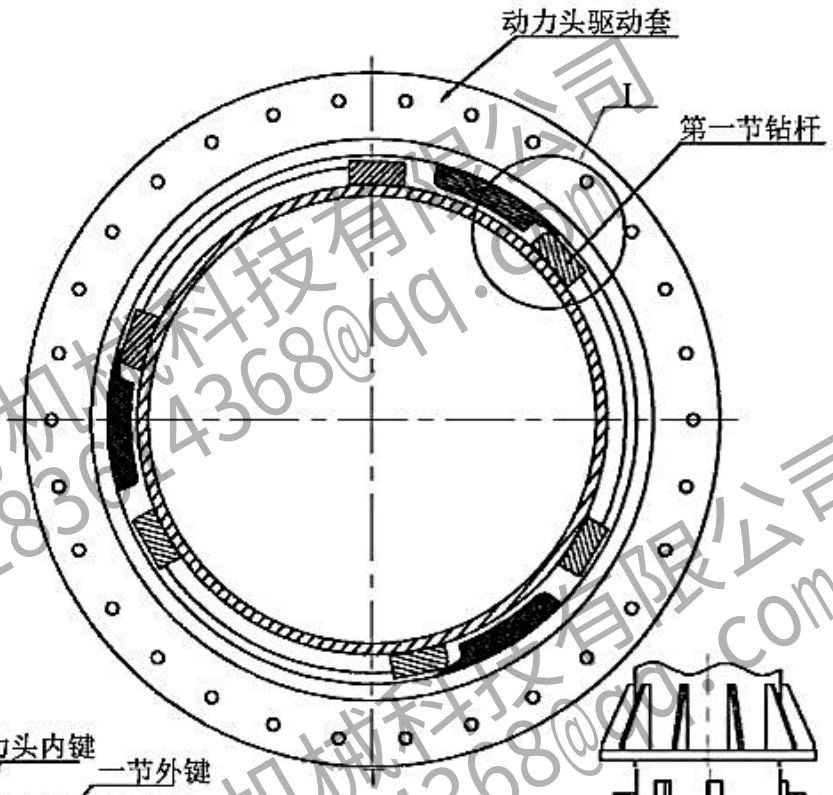

当动力头内键与第一节外键侧面磨损较大，形成大斜楔面。在钻进旋转时所产生的扭矩也会较大，会使第一节管壁在图示处受挤压变形，当工作完成后，反转两键脱开，管体弹性回复。如此反复折叠，管体产生疲劳开裂。

**尊敬的用户朋友：**

请您严格按《钻杆使用保养手册》的要求进行检查、保养钻杆。严禁钻杆出现此图中的严重磨损等现象，以避免此图中所列举的故障出现。

**※严格按说明书，按时检修、保养，严禁过度磨损※**

# 钻杆常见故障(二十二)



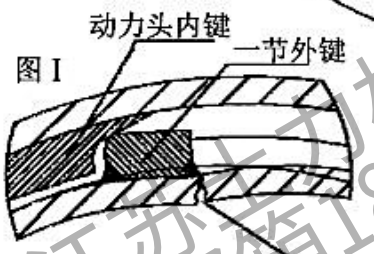
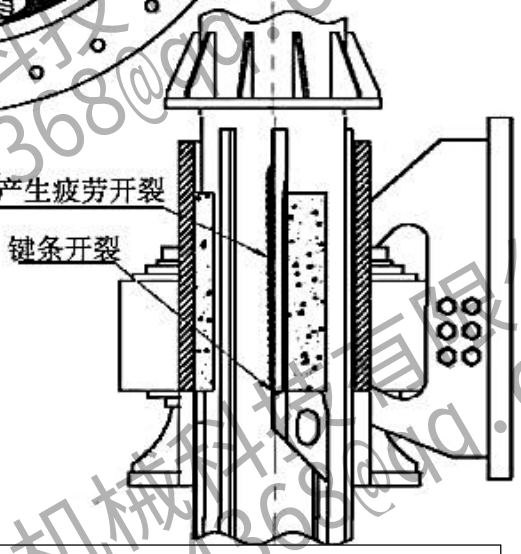




图 I

当动力头内键侧面磨损较大时，形成大斜楔面。在钻进旋转时所产生的扭矩也会较大，会使第一节管壁在图示处受挤压变形，当工作完成后，反转两键脱开，管体弹性回复。如此反复折叠，管体产生疲劳开裂。

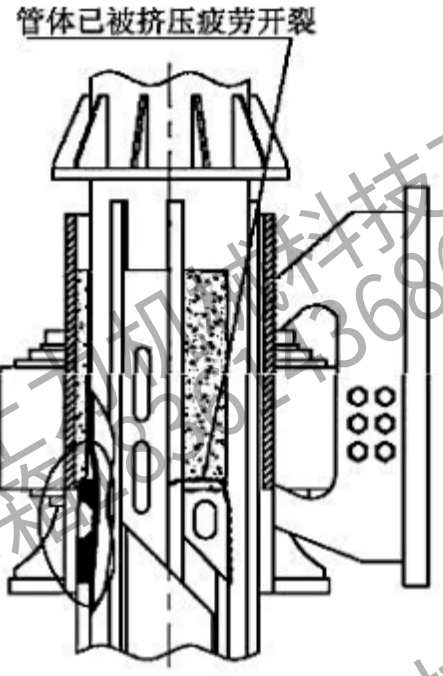



**尊敬的用户朋友：**

请您严格按《钻杆使用保养手册》的要求进行检查、保养钻杆。严禁钻杆出现此图中的严重磨损等现象，以避免此图中所列举的故障出现。

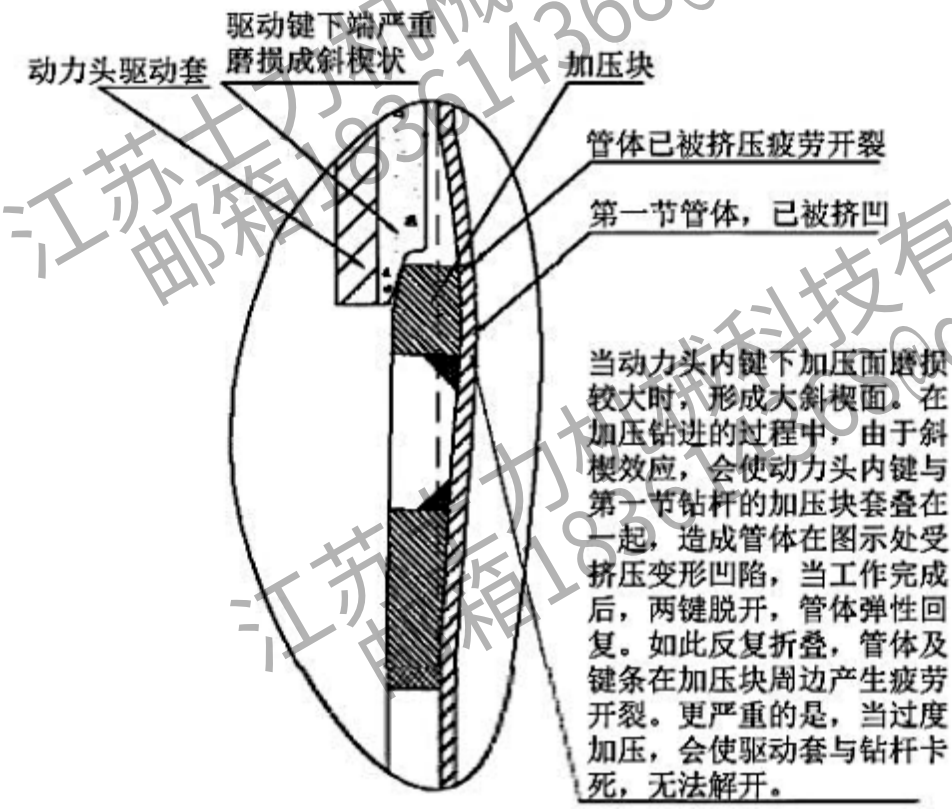
**※严格按说明书，按时检修、保养，严禁过度磨损※**

# 钻杆常见故障(二十三)




尊敬的用户朋友：

请您严格按旋挖钻机的检修、保养要求及《钻杆使用保养手册》的要求进行检查、保养钻杆。严禁钻杆出现此图中的严重磨损等现象，以避免此图中所列举的故障出现，造成更大的损失。




**※严格按说明书，按时检修、保养，严禁过度磨损※**

# 第八章 定制钻杆参数测量示意图

## 8.1 方头选型参数

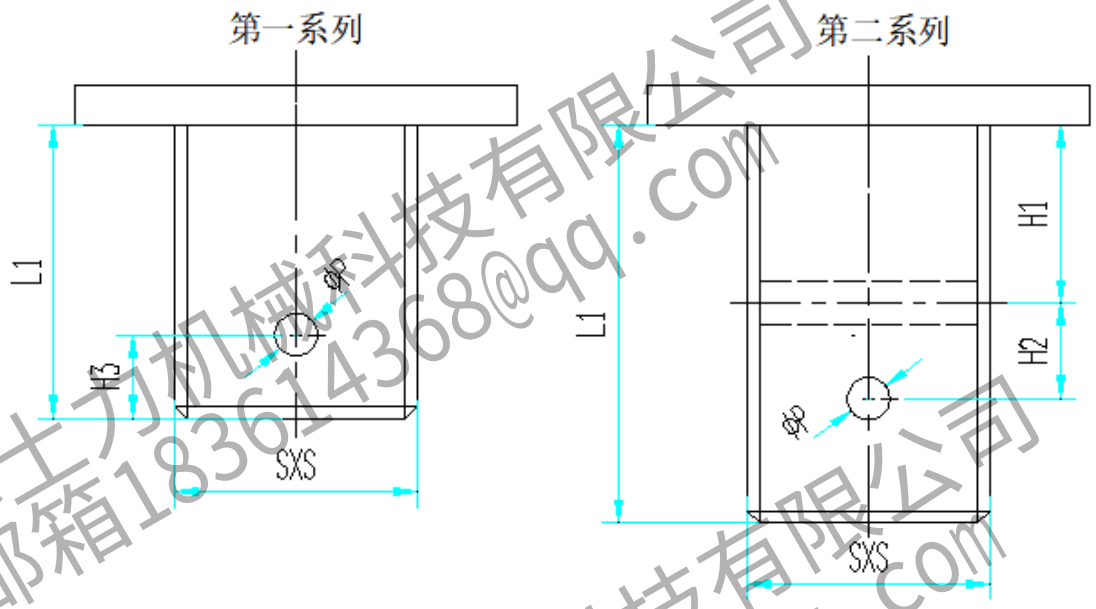



图8-1 方头示意图

表8-1-1　　方头类型（见图8-1）　　单位为毫米

| 方头类型 | 100方 | 130方 | 150方 | 200方 | 250方 | 300方 | 400方 |
|---|---|---|---|---|---|---|---|
| 方头尺寸(SxS) | 110x110 | 130x130 | 150x150 | 200x200 | 250x250 | 300x300 | 400x400 |
| 销孔个数 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 销孔尺寸ΦP | 40 | 40 | 50 | 62 | 62 | 72 | 82 |
| H1 | | | | 290 | 290 | 290 | 290 |
| H2 | | | | 100 | 100 | 150 | 150 |
| H3 | 130 | 130 | 130 | | | | |
| L1 | 300 | 300 | 300 | 480 | 480 | 600 | 600 |
| 第一系列 | √ | | √ | √ | √ | √ | √ |
| 第二系列 | | √ | | | | | |
| **注：** “√”表示推荐的类型。 | | | | | | | |

## 8.2 扁头选型参数

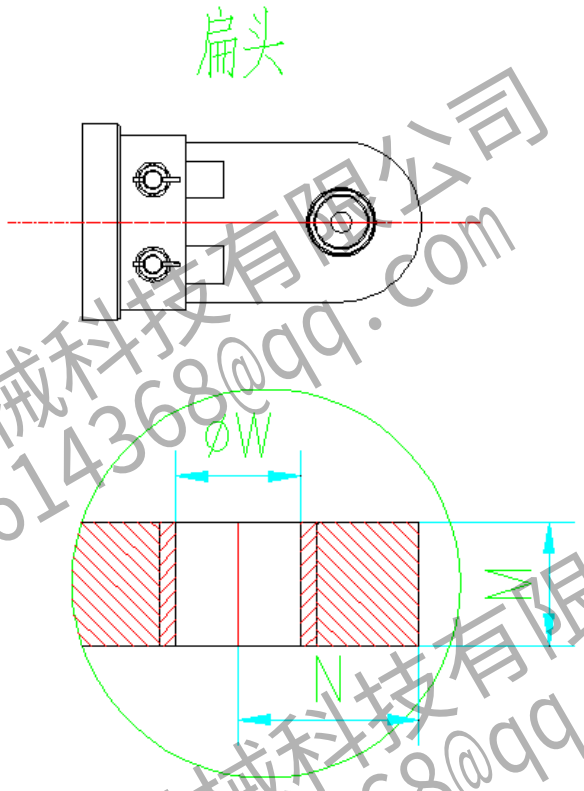
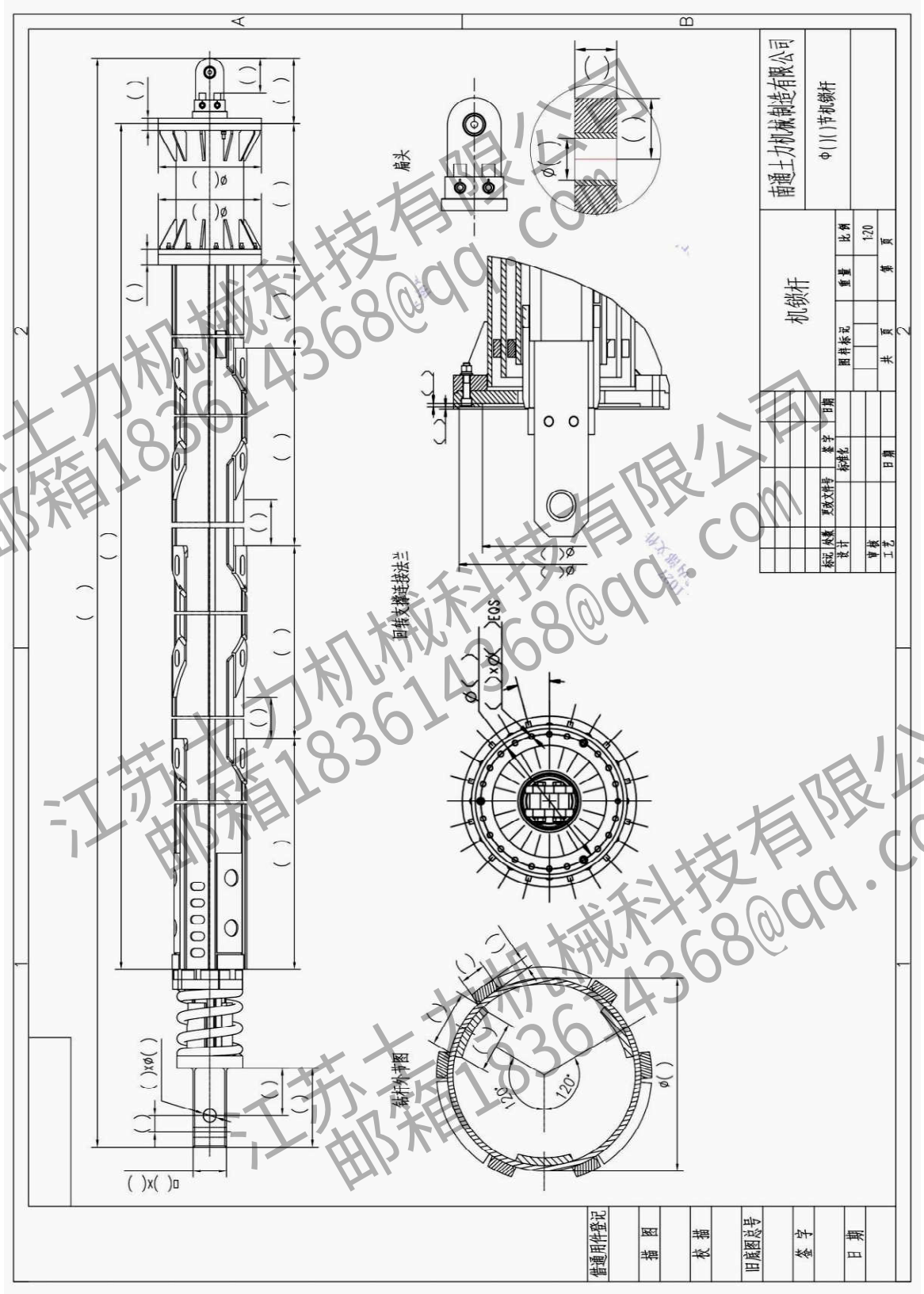



图8-2 扁头示意图

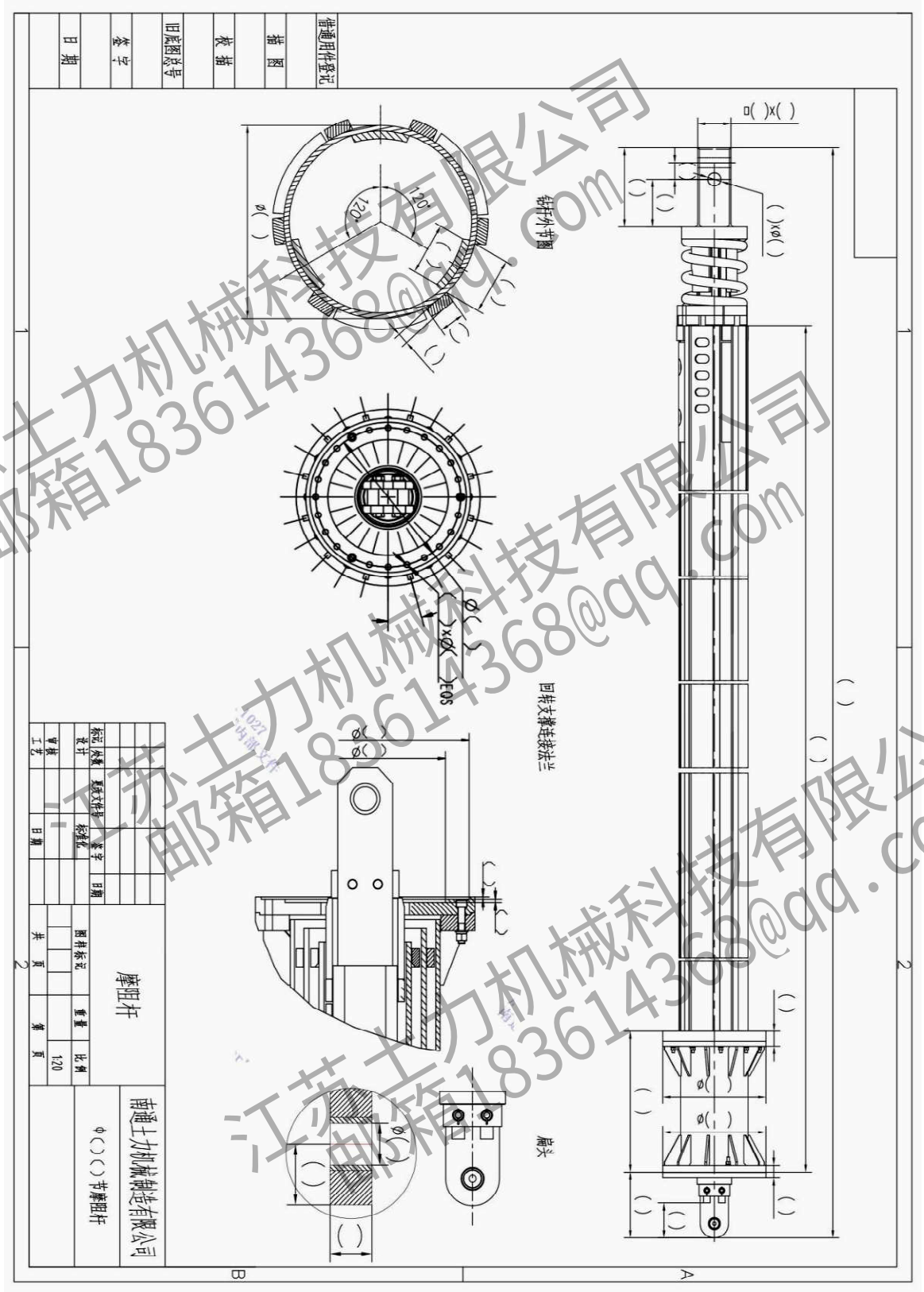
表8-2-2　　扁头类型（见图8-2）　　单位为毫米

| 扁头类型 | 40 | 50 | 55 | 60 | 70 | 80 | 100 | 110 | 130 |
|---|---|---|---|---|---|---|---|---|---|
| 扁头销孔尺寸 ΦW | Φ40 | Φ50 | Φ55 | Φ60 | Φ70 | Φ80 | Φ100 | Φ110 | Φ130 |
| 扁头厚度 M | 40 | 50 | 55 | 60 | 70 | 80 | 100 | 110 | 130 |
| 第一系列 | √ | | √ | | √ | √ | | √ | √ |
| 第二系列 | | √ | | √ | | | √ | | |
| **注：**“√”表示推荐的类型。 | | | | | | | | | |

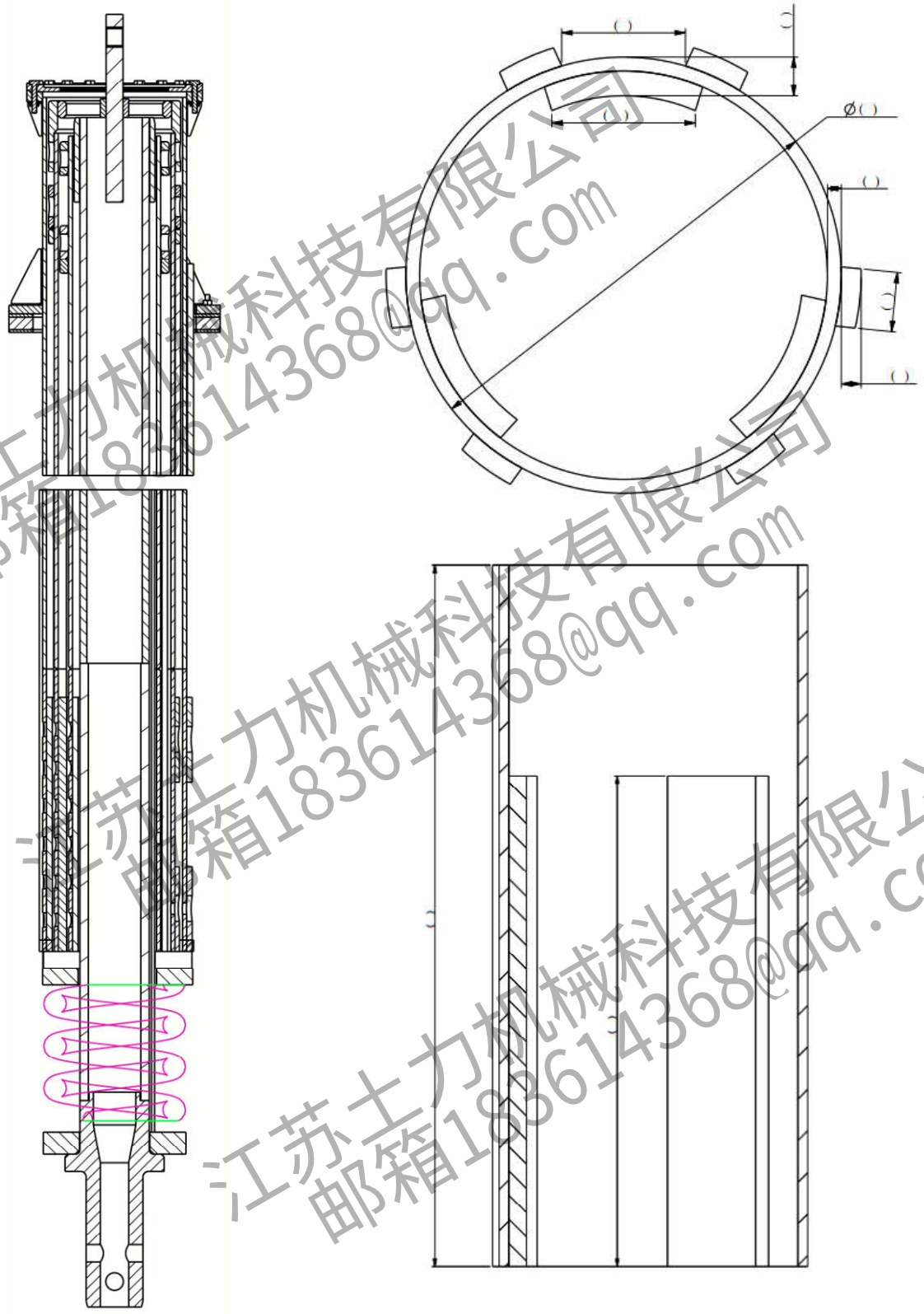
## 8.3 机锁钻杆参数



## 8.4 摩阻钻杆参数



## 8.5 钻杆花管参数




# 江苏土力机械科技有限公司

Jiangsu TU LI Machinery Technology Co. LTD



江苏土力机械科技有限公司

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# Company Profile

Jiangsu Tu Li Machinery Technology Co., Ltd. Is one of the biggest and most professional drill rod company for rotary rig in China.The company was established in 2008 with a registered capital of 50 million yuan , takes about 80 acres , the factory building covers an area of 30,000 square meters.The company has specialized research team , and have more than hundred workers . All products are made of the most advanced rock-socked drill pipe technology and high strength materials from Italy and Germany.Models cover a variety of standard and non-standard specifications from 299 to 720,Maximum drilling depth 150 m, maximum torque 50 tons/m.

Professional R & D, production team for users to create the most advanced, the most reliable products, and provide the most reasonable construction solutions.The company first in the product source selected a solid supplier, raw material supply, parts processing process, the choice of cooperative manufacturers, quite strict, careful, for the company's product quality has laid a good foundation.

The company product design, machinery Technology and marketing,management personnel configuration is complete, reasonable structure, the quality system runs normally. The company has 8 technical personnel, 10 professional quality control personnel, 18 management personnel, more than 80 workshop employees. In view of the complex geological conditions, it can provide more reasonable construction solutions.

At present, the Tu Li drill pipe not only realizes the complete replacement of imported rotary drilling rig drill pipe, and has become the standard supporting products of many domestic drilling RIGS, such as XCMG, SUNWARD, ZOOMLION, YUTONG, YUCHAI Heavy Industry, CHTCJOVE, TYSIM etc. And a large number of exports to India, Singapore, South Africa, Vietnam, Myanmar and other countries, by the user's favor and praise.

The core spirit of the company is "quality based, continuous innovation",We will continue to create industry-leading quality products with the spirit of persistent innovation, solid professional knowledge, the persistent pursuit of leading technology and the attitude of improving product quality.

# Respected users and operators

Thanks for using our product! Be sure to carefully read and understand the manual before using and maintaining them. The relevant requirements herein shall be complied with.

This manual contains information on the proper use and maintenance of drill pipe, as well as important drill pipe construction, use of maintenance techniques, troubleshooting and troubleshooting, and after-sales service contact information.

Keep this manual with the equipment and give it to the new user if the equipment is transferred. When changing the equipment operator or training the new operator, make sure that the operator read this manual before operation, and understand and comply with it.

The warranty period is 1 year or 2000 hours after delivery（whichever occurs first）. During the warranty period, we are responsible for any product quality problems caused by defects in design, materials and processing,Repair or replace defective parts free of charge;no drill pipe damage caused by normal wear, abnormal use, or incorrect operation is covered in the warranty, but we provide paid services.

If you have any question during the use, inspection, maintenance, or repair of the product, do not hesitate to contact us.

Jiangsu TU LI Machinery Technology Co. LTD
Add: No.77, Xi yuan Avenue, Hai an High-tech Zone, Nan tong City, Jiangsu Province
National unified customer service hotline (Tel) : 0513-88992688
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Postcode: 226600
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# Table of Contents

# Ⅰ.Drill pipe type

1. Drill pipe type

The drill pipe assembly is composed of drill pipe,drill pipe guide, swivel and other components (figure1-1).

According to the way the drill pipe is pressurized and the structural characteristics, the drill pipe can be divided into:

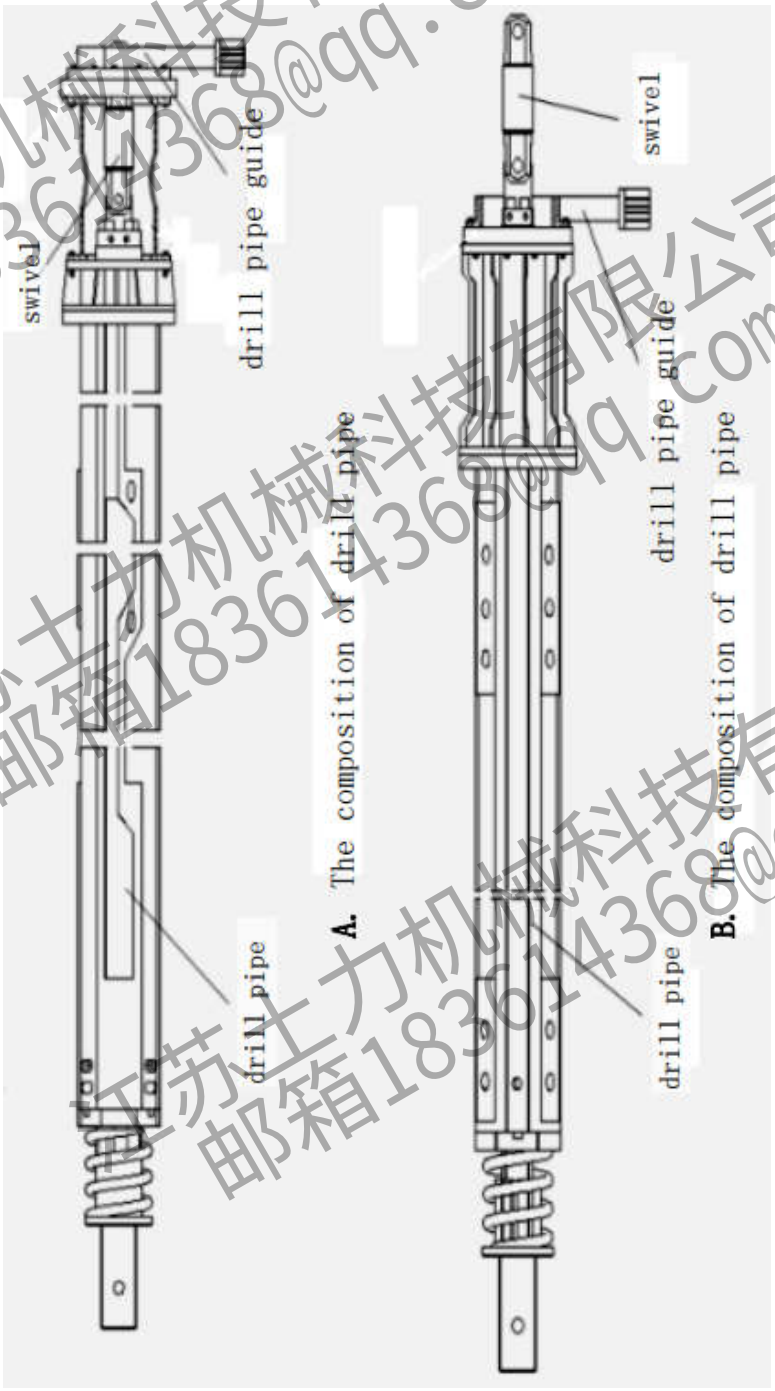



Figure1-1 The composition of drill pipe

## 1.1 Frictional drill pipe

Each drill pipe is composed of seamless steel pipe and internal and external drive keys welded to it.The external drive key have three key types and six key types,there is no pressurized lock in the middle of the outer drive key.The downward pressure is the downward friction force between the gravity of each drill pipe and the internal and external keys during drilling.The major difference between the friction rod and the mechanical lock rod is the key bar structure,the key bar of the friction rod goes to the bottom.See figure1-2.

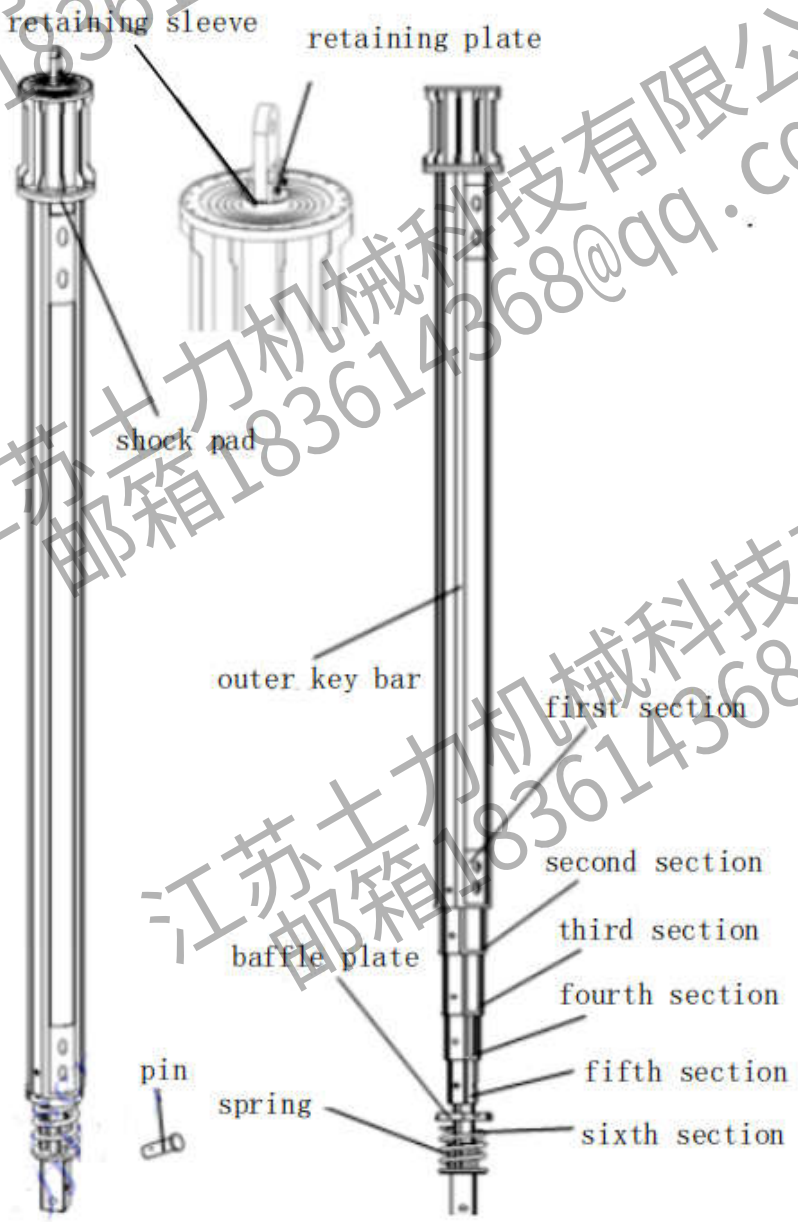



Figure1-2 Frictional drill pipe

## 1.2 Mechanical lock drill pipe

Each drill pipe is composed of seamless steel pipe and internal and external drive keys welded to it.The external drive key have three key types and six key types,There are two, three or four pressurized locks in the middle of the outer drive key. When the inner drive key of the drill pipe is rotated to the pressure lock of the outer drive key, the downward pressure generated by the power head pressure cylinder is transferred directly to the drill tool.See figure1-3.

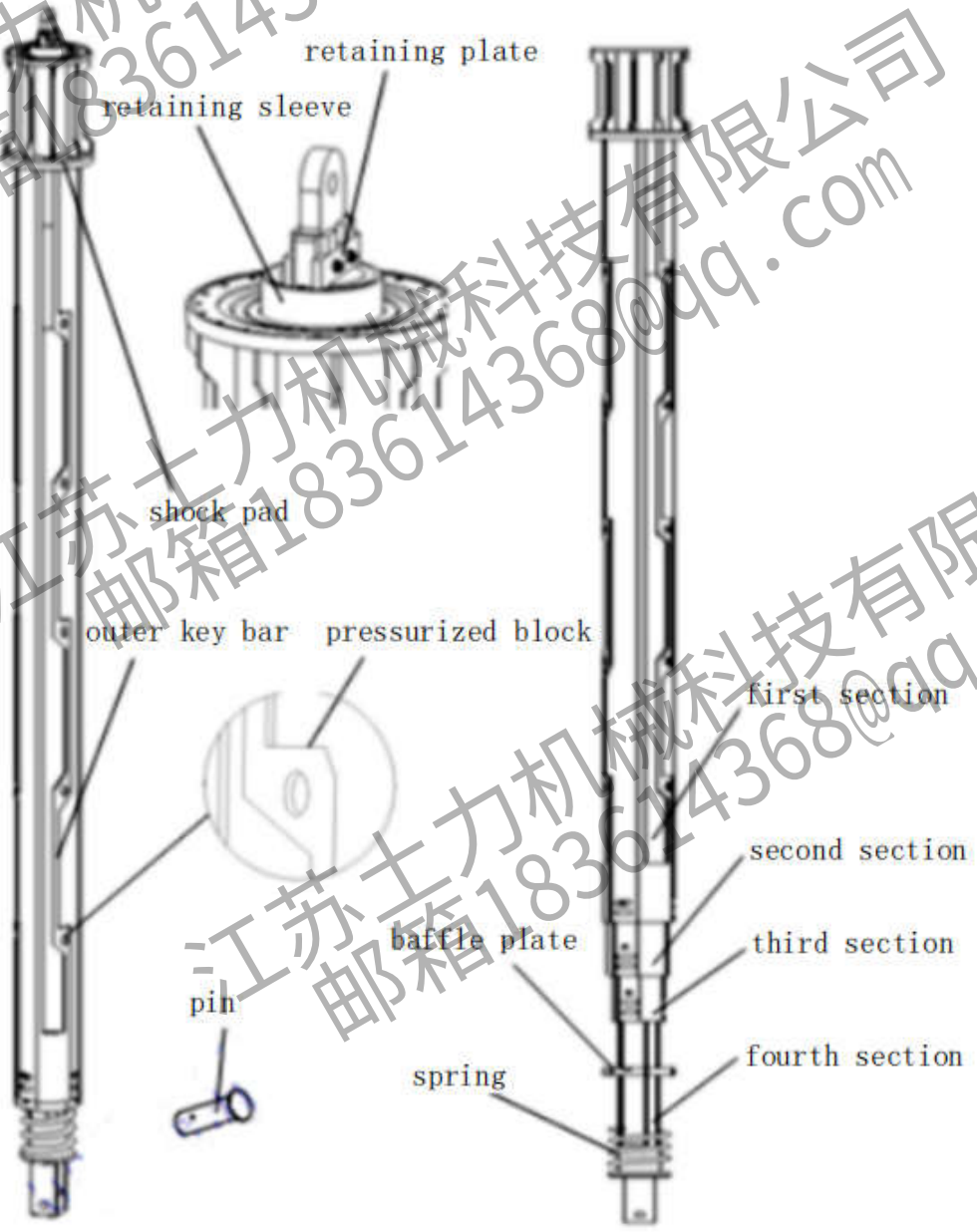



Figure1-3 Mechanical period

### 1.3 Multi-lock drill pipe

Each drill pipe is composed of seamless steel pipe. Internal and external drive keys are equipped with rack type continuous steps. As the inner drive key of the drill pipe rotates and engages with the outer drive key, the added pressure generated by the pressurized oil cylinder is transferred directly to the drill tool. See figure1-4.

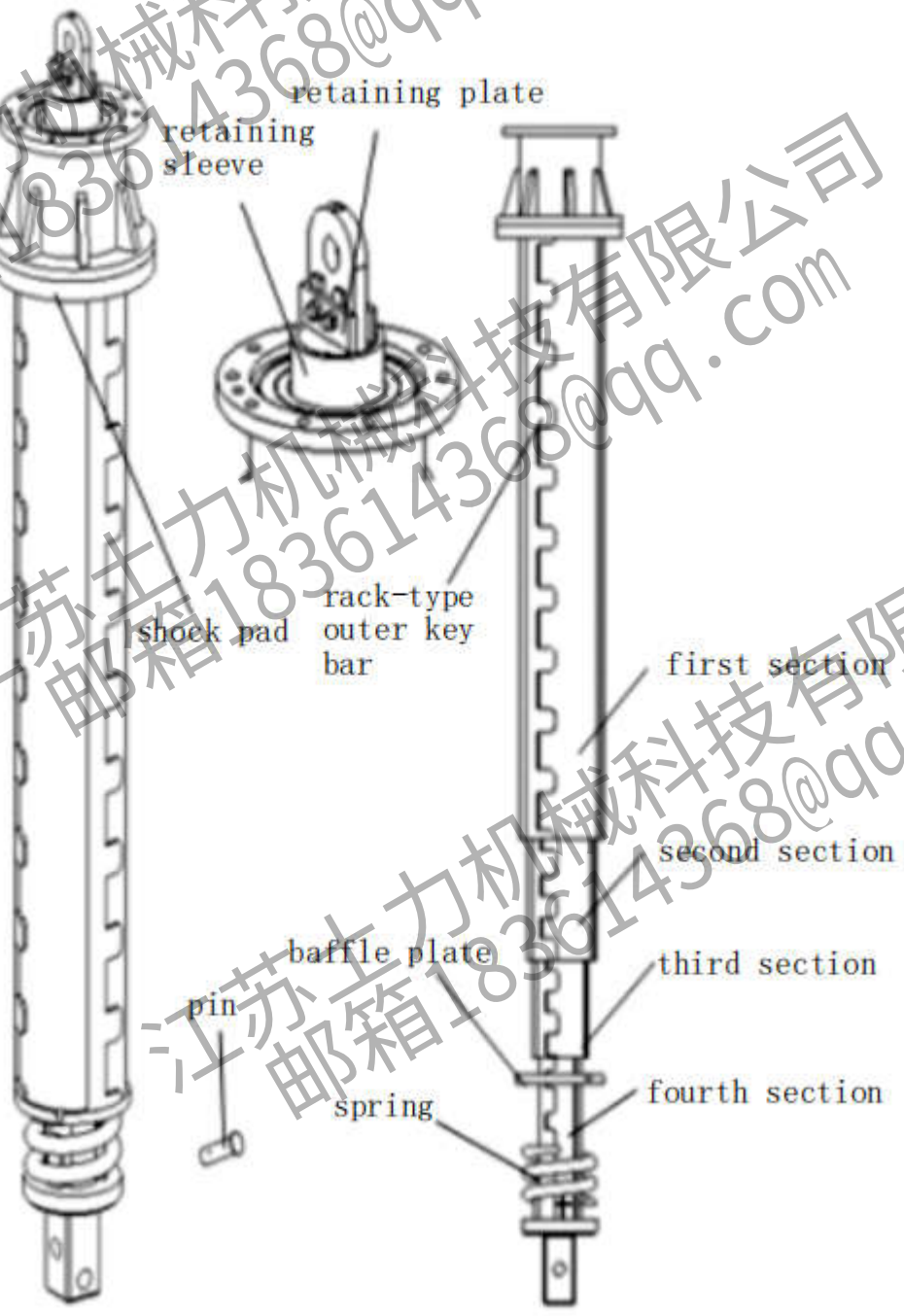



Figure1-4 Multi-lock drill pipe

## 1.4 Comparison drill pipe

The outer sections of the combined drill pipe are mechanically locked,The inner sections are of frictional type.During the drilling of rotary drilling rig,some layers between each layer rod through friction, and some layers through the pressure lock block to transfer axial pressure of the drill pipe.See figure1-5.

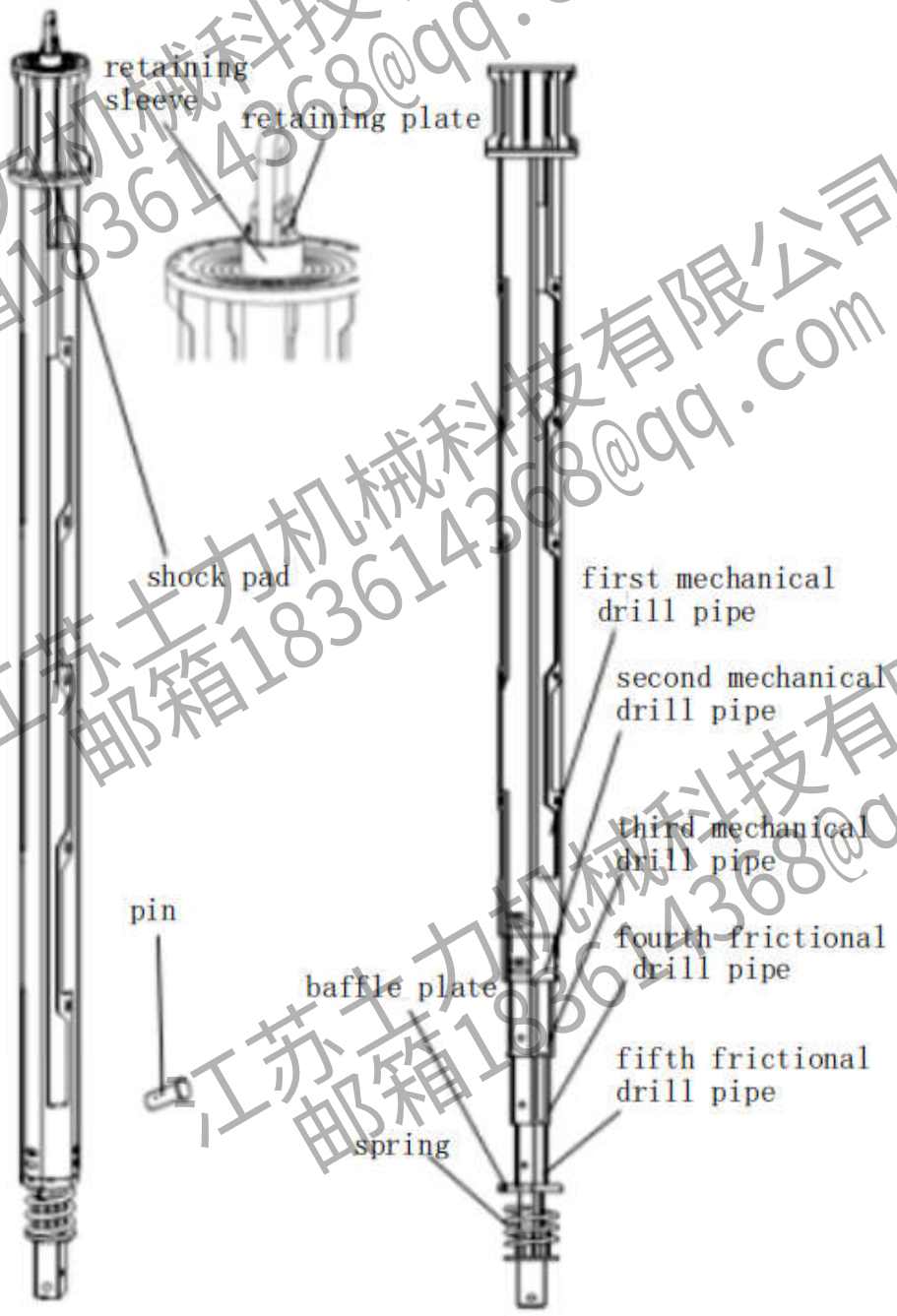



Figure1-5 Combined drill pipe

## 1.5 Drill pipe parts

Figure1-6 shows the structure of drill pipe components.

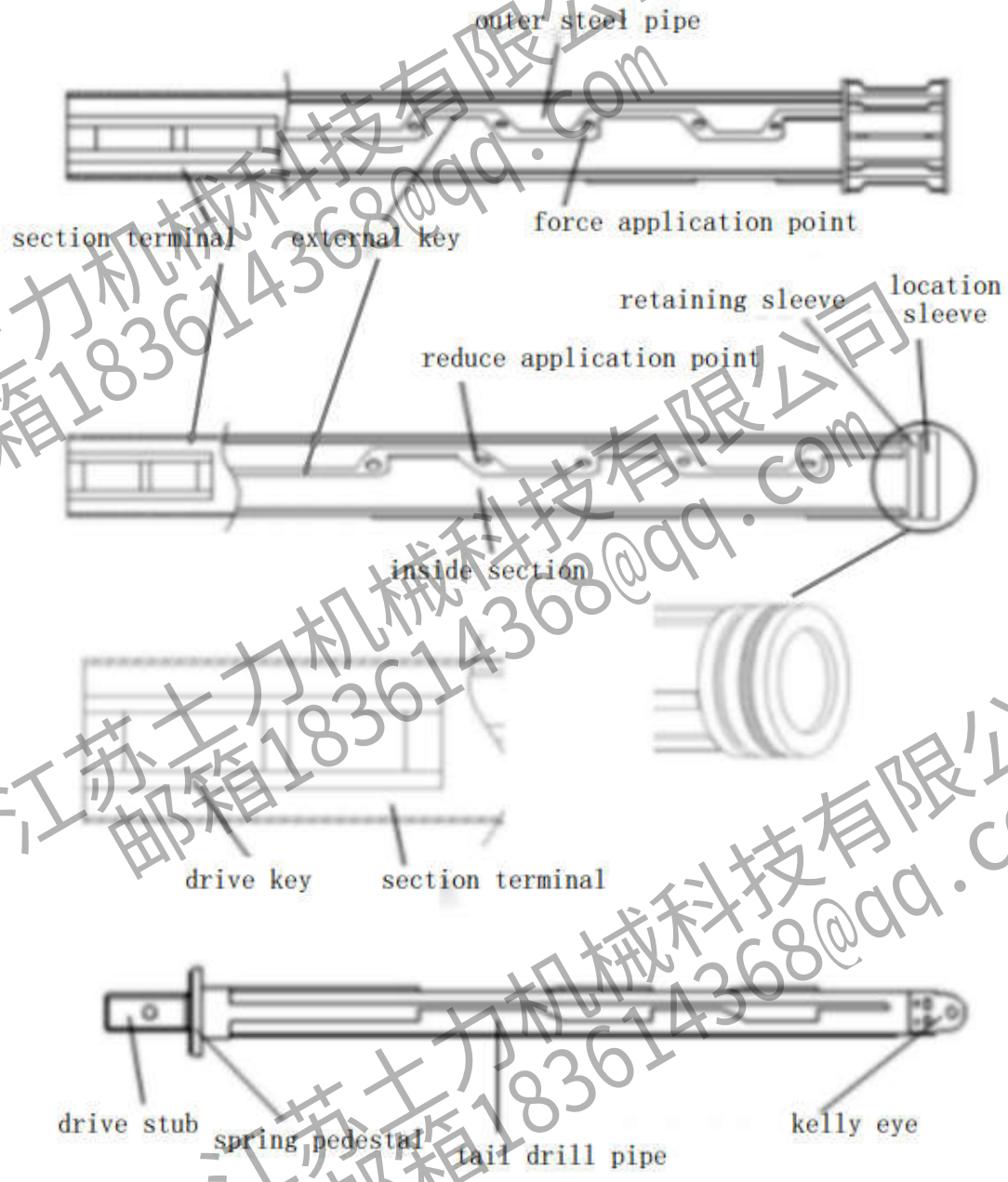



Figure1-6 Drill pipe parts

## 1.6 Comparison of the use and adaptability of drill pipe

Performance comparison of drill pipe types

| | Frictional | Mechanical lock | Multi-lock | Combined |
|---|---|---|---|---|
| Operability | ★★★ | ★★ | ★ | ★★ |
| Adaptability | ★ | ★★★ | ★★★ | ★★ |
| Available applied force | ★★★ | ★ | ★★ | ★ |
| Wearability | ★★★ | ★★ | ★ | ★★ |
| Maintainability | ★★★ | ★★ | ★ | ★★ |
| Liftability | ★★★ | ★★ | ★ | ★★ |

Table performance vocabulary description:

| | |
|---|---|
| Operability | Convenience of using the drill pipe when the drilling rig works |
| Adaptability | Ability to adapt to a hard rock formation when the drilling rig works |
| Available applied force | Ease of finding pressurized points When the rig is working |
| Wearability | Ability to resist the wears of its internal and external driving keys and bearing parts |
| Maintainability | The difficulty of repair |
| Liftability | Difficulty in lifting the drill pipe |
| ★★★ | High |
| ★★ | Relatively high |
| ★ | Fair |

## 1.7 Common specification drill pipe

Jiangsu TU LI Machinery Technology Co. LTD

Common specification drill pipe

| Serial number | Outer diameter D(mm) | Pitch number (n) | The basic length of a single section L (m) | Form of pressure | Reference depth of drill (m) |
|---|---|---|---|---|---|
| **1** | 630 | 3，4，5，6 | 10~25 | Mechanical(JS)，Frictional(MZ) | 36~143 |
| **2** | 575 | 4，5，6 | 10~20 | Mechanical(JS)，Frictional(MZ) | 36~110 |
| **3** | 530 | 3，4，5，6 | 10~20 | Mechanical(JS)，Frictional(MZ) | 36~110 |
| **4** | 508 | 3，4，5，6 | 10~20 | Mechanical(JS)，Frictional(MZ) | 36~110 |
| **5** | 470 | 3，4，5，6 | 10~17 | Mechanical(JS)，Frictional(MZ) | 36~94 |
| **6** | 440 | 3，4，5，6 | 10~17 | Mechanical(JS)，Frictional(MZ) | 36~94 |
| **7** | 426 (419) | 4，5，6 | 10~15 | Mechanical(JS)，Frictional(MZ) | 36~85 |
| **8** | 406 (394) | 4，5 | 10~17 | Mechanical(JS)，Frictional(MZ) | 36~79 |
| **9** | 377 (368) | 4，5 | 10~14 | Mechanical(JS)，Frictional(MZ) | 36~65 |
| **10** | 355 | 4，5 | 10~13 | Mechanical(JS)，Frictional(MZ) | 36~60 |
| **11** | 340 | 4， | 10~13 | Mechanical(JS)，Frictional(MZ) | 36~48 |
| **12** | 299 | 4， | 10~13 | Mechanical(JS)，Frictional(MZ) | 36~48 |

At present, it has been used in domestic , such as XCMG,SUNWARD,ZOOMLION,TYSIM,SANY HEAVY INDUSTRY, YUTONG,YUCHAI HEAVY INDUSTRY,CHTCJOVE,CSR TIMES,DONGMING,JINTAI and other series of rotary drilling rigs; A series of rotary drilling RIGS such as foreign BAO E,TU LI, MAIT,IMAGI,CASA GRANDI etc.And exported to Germany, Italy, UAE, Turkey, India, Thailand, Singapore, Malaysia, Russia, Ukraine and other countries.

Rotary drilling pipe can also be customized according to user requirements and host performance.

# Ⅱ.Disassembly of drill pipe

## 2.1 The dismantling of drill pipe

Drill pipe disassembly and assembly are shown in figure2-1,2-2

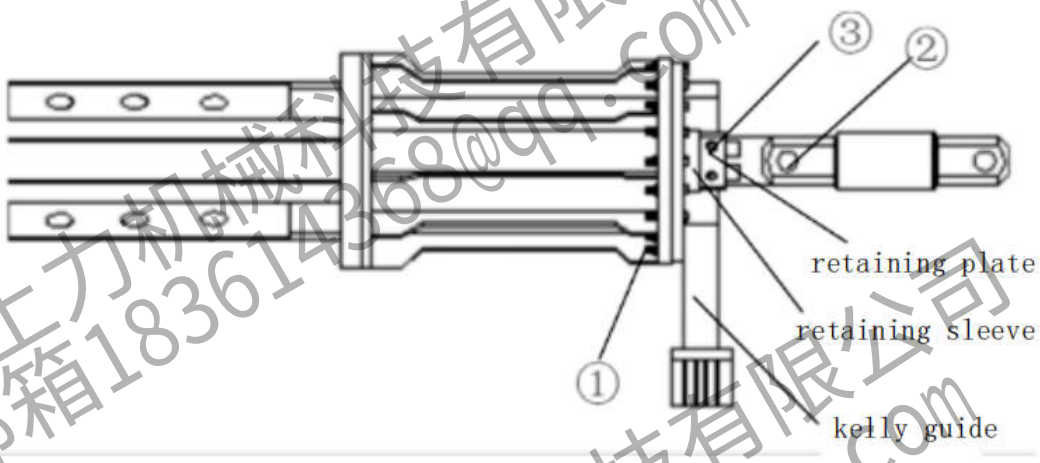



Figure2-1 Schematic diagram of drill pipe disassembly and assembly

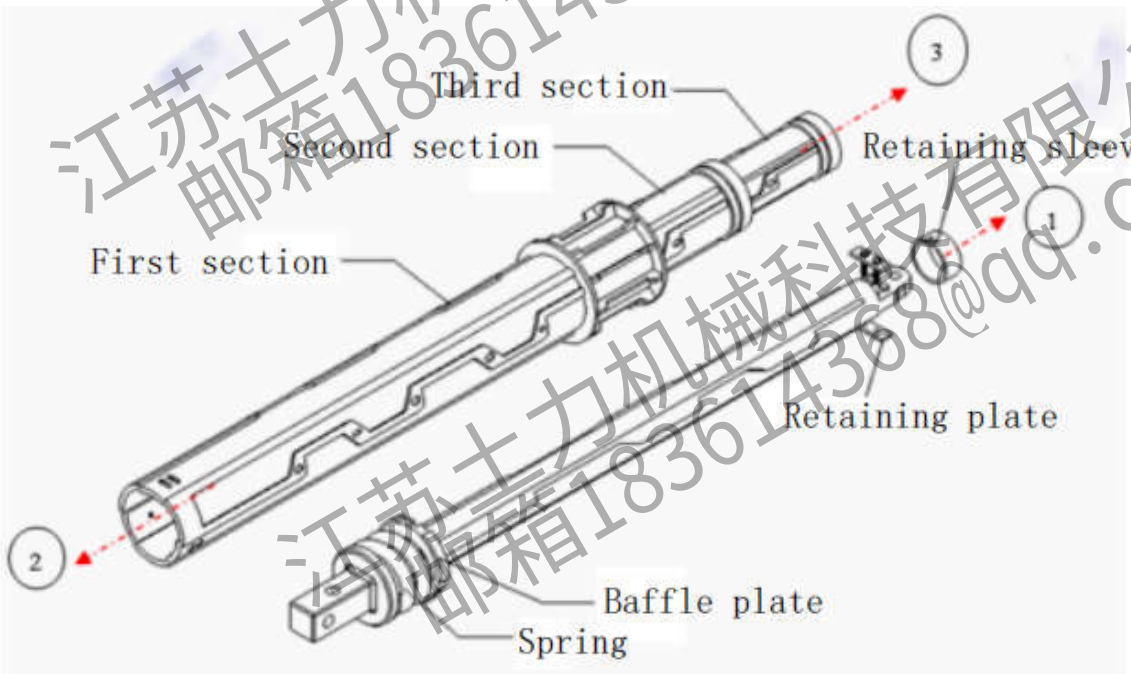



Figure 2-2 Schematic diagram of the disassembly and assembly

Disassembly of drill pipe (for example, four drill pipe):

1）Remove the bolt shown in No. 1 in Figure 2-1, and remove the drill pipe guard and guide frame.

2）Remove the pin shaft shown in No. 2 in Figure 2-1 and remove the puller.

3) Remove the bolts shown in No. 3 in Figure 2-1, and remove the two baffle plates and notch rings.

4) Pull the innermost drill pipe (the fourth drill pipe) out along the bottom of the drill pipe in the direction (2) shown in Figure 2-2.

5) Pull out the third drill pipe in the direction shown by No. 3 in Figure 2-2 above the drill pipe.

6) Then pull the second drill pipe out along the top of the drill pipe in the direction (3) shown in Figure 2-2. The dismantling is complete.

Attention：When pulling out each drill pipe, if there is a riser preventer on the upper part of the adjacent outer drill pipe, the riser preventer should be removed first (welded: gas cutting; Bolted: disassembled), and then pull out the drill pipe.

## 2.2 Installation of drill pipe

1）Load the second drill pipe from the top of the first drill pipe in the opposite direction as shown by No. 3 in Figure 2-2. When inserting the first flower tube in the second segment, align the outer teeth of the second segment with the inner alveoli of the first segment.

2）Load the third drill pipe from the top of the second drill pipe in the opposite direction as shown by No. 3 in Figure 2-2.

Attention：When loading each drill pipe, if there was a riser preventer on the upper part of the adjacent outer drill pipe, after loading the drill pipe, the original riser preventer shall be restored (welded or bolted).

3）Then load the fourth drill pipe under the third drill pipe in the opposite direction as shown by No. (2) in Figure 2-2. Do not forget the spring and the water discharger.

4）Install the notch ring, baffle, and bolt as shown by No. 1 in Figure 2-2. Note the orientation of the baffle and the reverse front (marked).

5）Install the pin and swivel shown in number 2 in Figure 2-1.

6）Figure 2-1 shows the installation. Connect the drill pipe guard with the guide frame, tighten the nut and install the bolt as shown in No. 1.

## 2.3 Notes for drill pipe disassembly and installation:

Before drill pipe assembly, find an open, flat, and hard ground area. Use sleepers to support the drill pipes off the ground rather than directly place them on the ground. Do not place the drill pipes together with residue soil, broken stones, and other fine items that may enter them.

During drill pipe disassembly, it is necessary to remove the retaining sleeve from the core section before the core section can be removed. To directly remove the core section without removing the retaining sleeve in advance will lead to the failure to remove the core section normally due to the sticking by the retaining sleeve or even the damage to the last drill pipe section's internal key. Before drill pipe removal, direction marks had better be painted on drill pipes for reassembly.

Before drill pipe assembly, check that there are no irrelevant items in the drill pipes, so as to avoid assembly failure or sticking.

After the installation of each drill pipe section is completed, a tensile test should be carried out in the forward direction to observe its stretch and retrieval. If any anomaly is found during its stretch or retrieval, do not carry out the assembly any more. In this case, it is necessary to mark the abnormal portion and remove and check it. The assembly procedure can be resumed only after the anomaly is removed.

Do not carry out any violating assembly in spite of a drill pipe anomaly.

# III. The use of drill pipe

3.1 Pay attention to the following items when installing drill pipe:

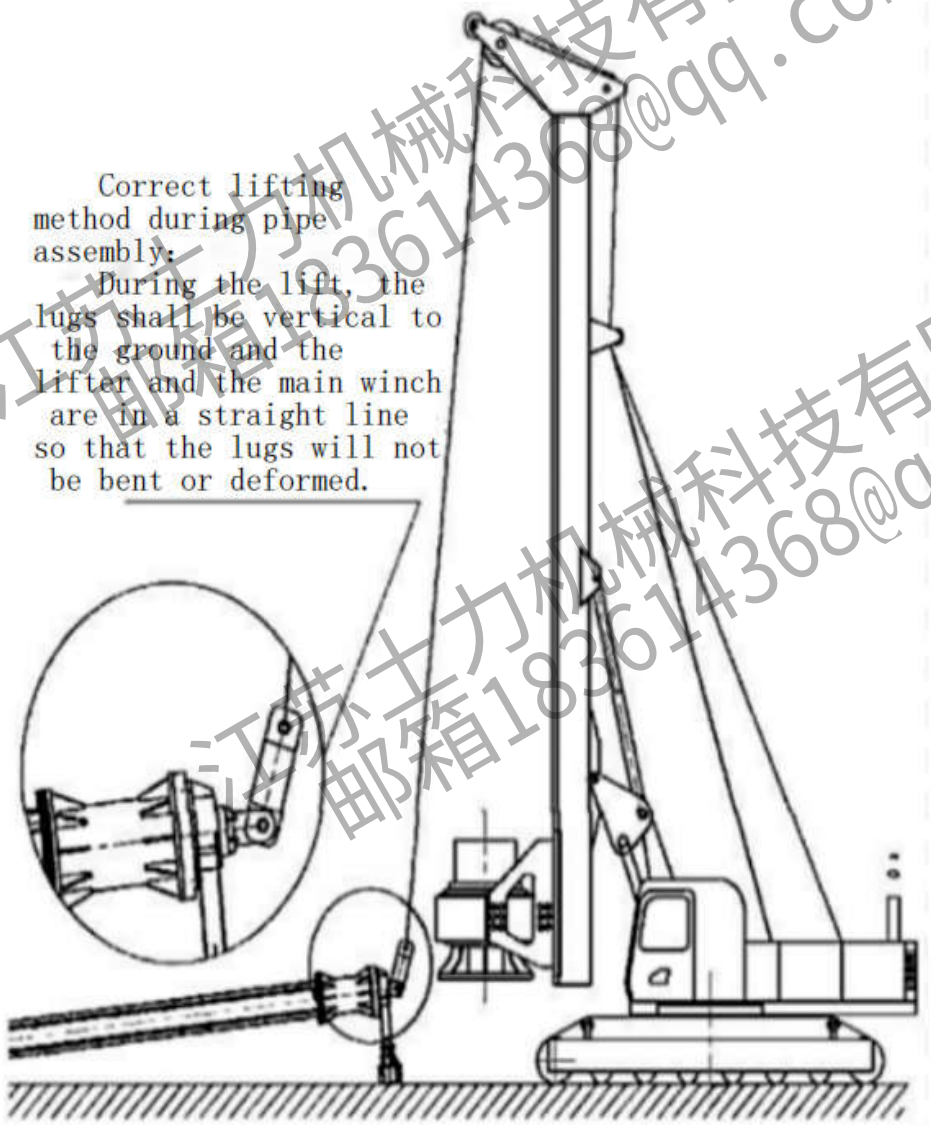
1) The maximum torque and pressure of the power head shall not exceed the maximum allowable value of drill pipe.

2) The main winch wire rope, drill pipe and power head drive sleeve are located on the same axis.

3) The rig mast is vertical.

4) The drill bit is positioned in the center of the hole.

5)Please refer to this instruction manual and the installation and operation specification of the main engine factory to correctly connect the accessories. Lift the drill pipe as shown below and install it on the rig.

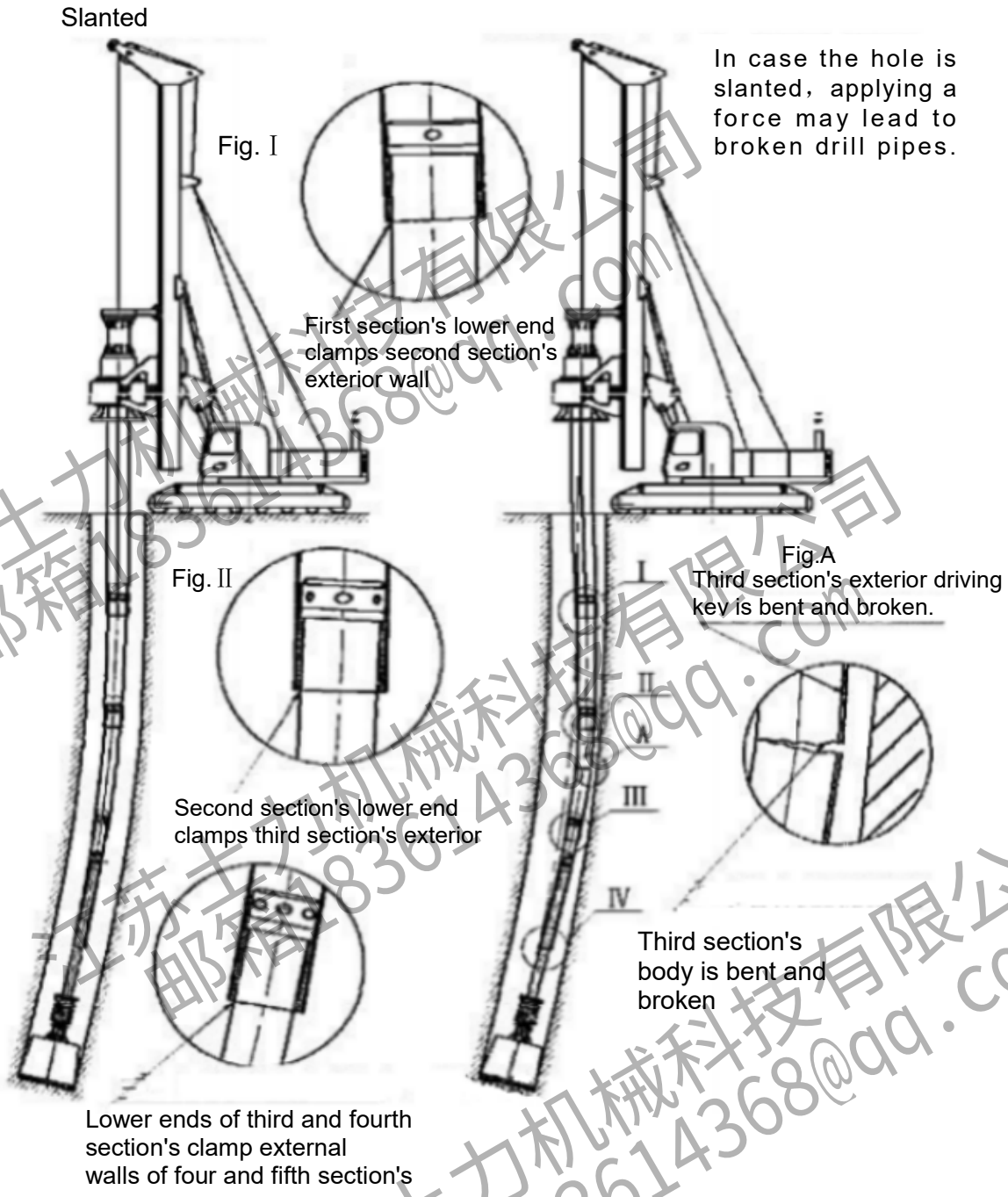


### 3.2 Drilling rig adjustment and precautions before drilling :

1）The ground shall be level with a certain degree of hardness. During the construction, the drilling rig cannot have any local track sag. Local track sag may cause the mast to incline toward, backward, leftward, or rightward, with the result that an inclined hole is made.

In this case, the drill pipe is bent and deformed or even broken in the hole.

If the hole is slanted to a certain degree of inclination, each of all the sections has a certain degree of deflection. In this case, applying a force on the power head will bend the drill pipes seriously (the sections are stuck and cannot be retrieved freely). The drill pipes are plastically deformed due to bending. When seriously bent, they will have external keys broken. Broken external keys, if not timely repaired, lead to their serious bendings, and during drilling, they will be broken (as shown in Fig.A).




2) After the drilling rig operates for a period of time, check that the support cylinders are soft to prevent the mast from tilting forward, backward, leftward, or rightward and thus avoid slanting the hole.

3) he drill pipes shall be firmly fixed to the drilling tool to prevent the latter from falling into the hole.

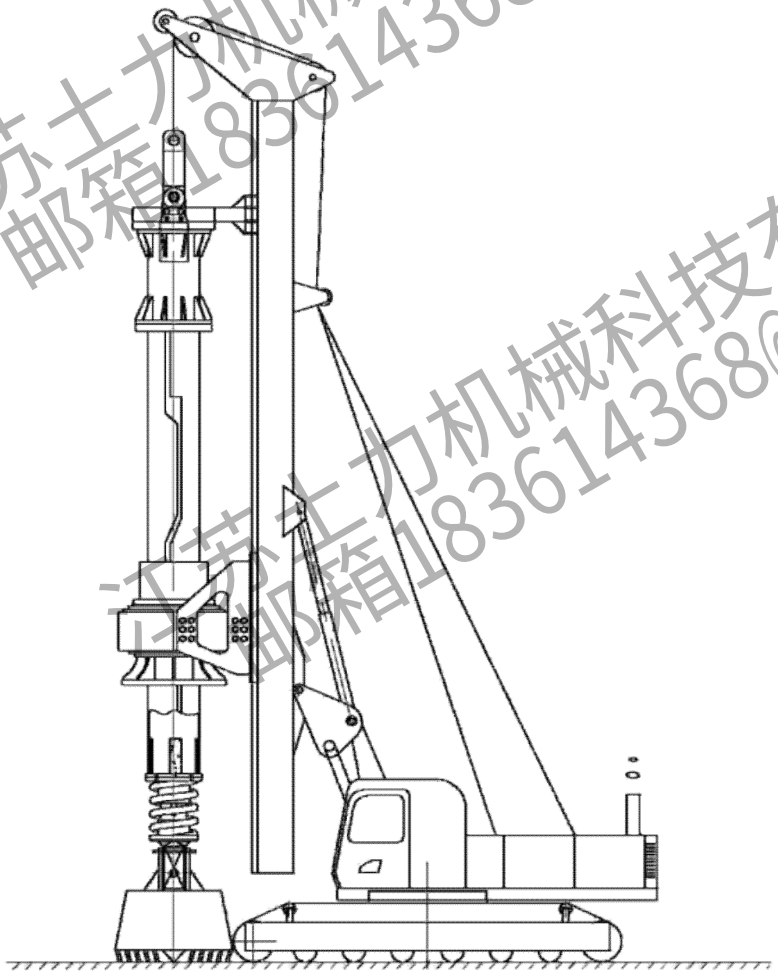
## 3.3 The use of drill pipe

### A Mechanical lock drill pipe

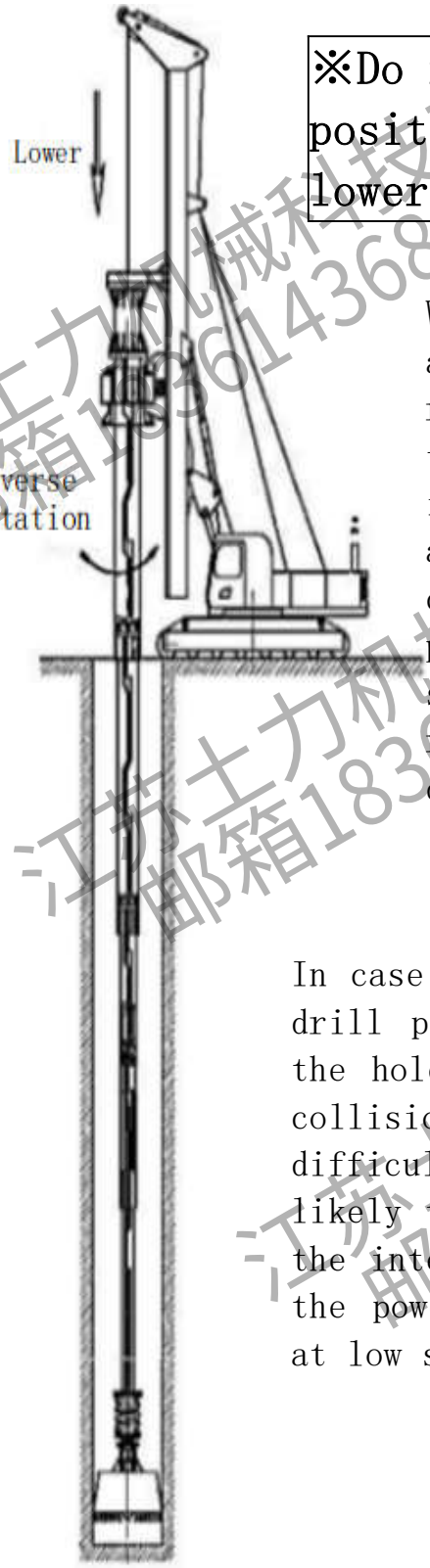
1）Rotate the rotary table to allow the drilling tool to be aligned with the hole position and ensure that the mast is vertical during the entire drilling process.

Before the drilling rig begins to drill，its mast shall be adjusted into the position.

After the drilling rig enters the new drilling site, firstly place the drilling bucket on the ground and carry out the mast verticality adjustment when its mast does not bear any force.At the moment, the ground shall be level with a certain degree of hardness. During the construction, the drilling rig cannot have any local track sag. Local track sag may cause the mast to incline toward, backward, leftward, or rightward, with the result that an inclined hole is made. In this case, the drill pipe is bent and deformed or even broken in the hole.



2) When the drill pipes are lowered, it is necessary to reversely rotate the power head slowly so as to prevent the hole wall from contacting the drilling tool. The contact will lead to drill pipe throw otherwise.




※Do not rotate the power head positively during the drill pipe lowering process※

When the interlocking drill pipes are lowered, the power head shall be reversely rotated at low speed all the time. In order to prevent the interlocking drill pipes from being automatically locked due to wall collision, etc. during the lowering process, thus avoiding unsmooth stretch, the power head shall be reversely rotated at low speed during the entire lowering process.

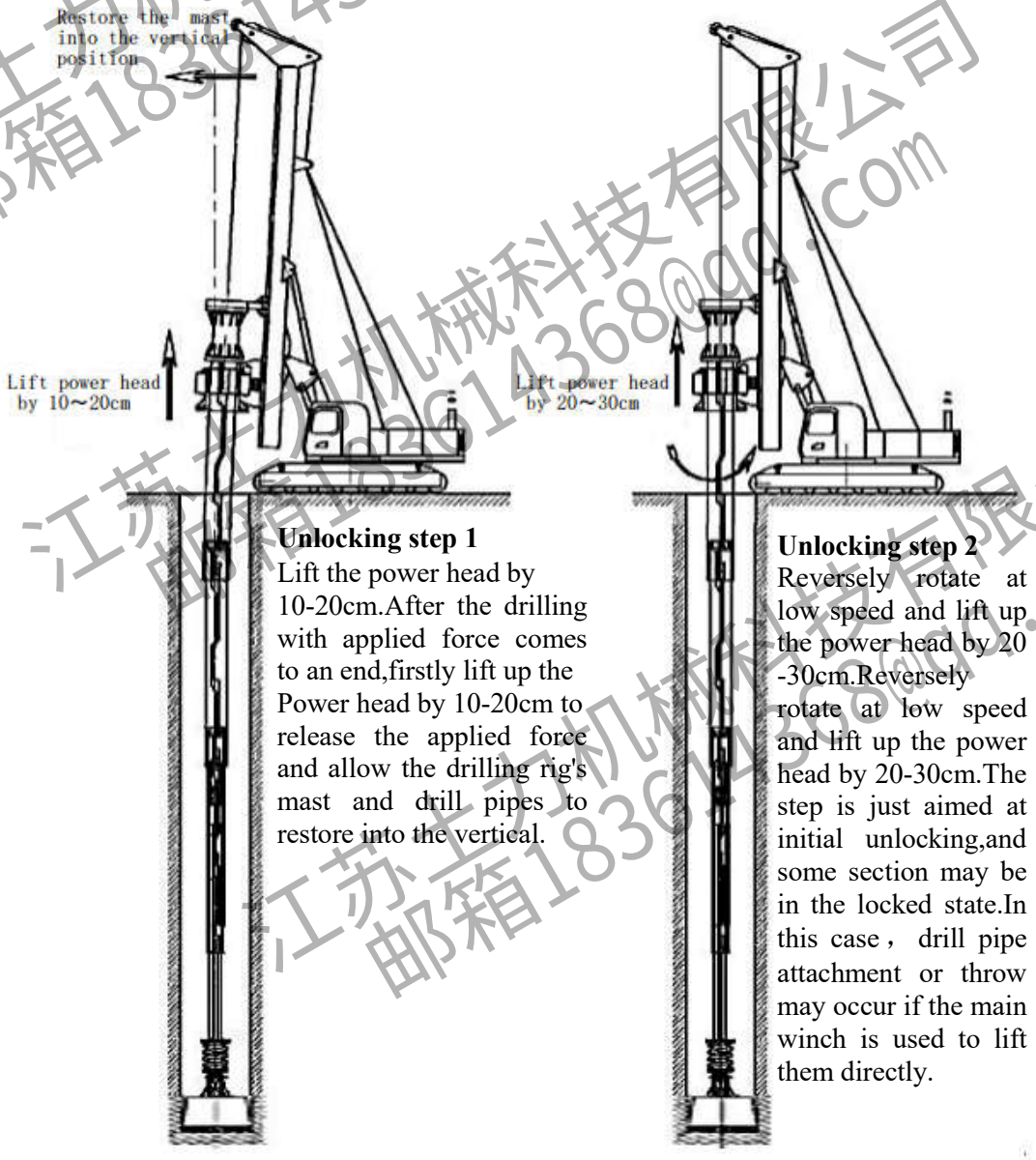
In case the hole is slanted, lowering the drill pipes will inevitably collide with the hole wall. In case serious hole wall collisions occur, it is inevitably difficult to lower them and it is very likely to throw the drill pipes. So, when the interlocking drill pipes are lowered, the power head must be reversely rotated at low speed all the time.

3）When the drilling tool arrives at the bottom of the hole, lock all the interlocking drill pipes and then begin to drill forward with a force applied. The power head shall be rotated at an appropriate speed to allow the drill pipes to drive the drilling tool and the drilling bucket to become full.

4) The drill pipe unlocking and lifting procedure is as follows (see the following diagram):

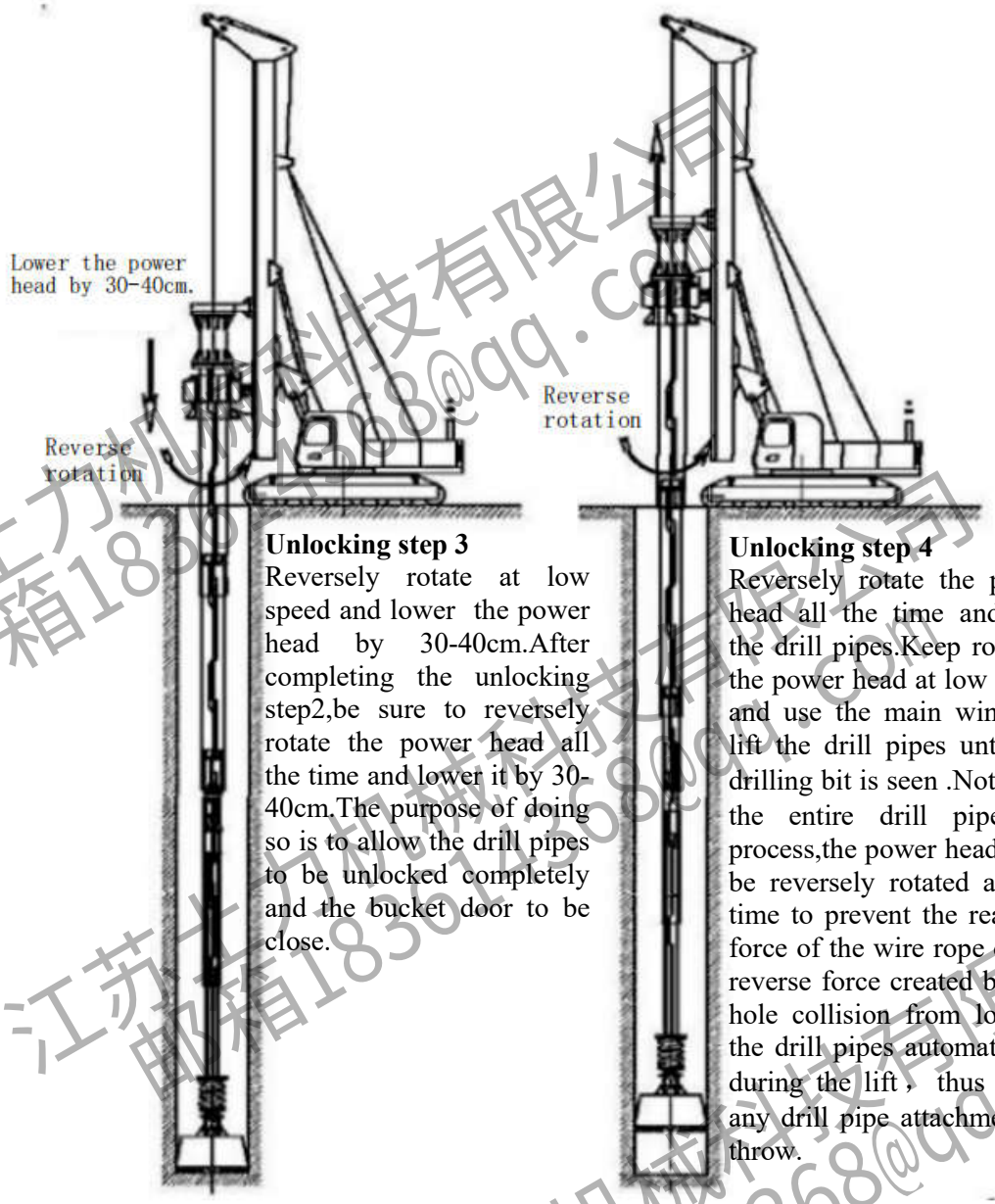
5）Pull out the drilling tool and empty the earth.

6）Repeat the procedure.




**Unlocking step 1**
Lift the power head by 10-20cm.After the drilling with applied force comes to an end,firstly lift up the Power head by 10-20cm to release the applied force and allow the drilling rig's mast and drill pipes to restore into the vertical.

**Unlocking step 2**
Reversely rotate at low speed and lift up the power head by 20 -30cm.Reversely rotate at low speed and lift up the power head by 20-30cm.The step is just aimed at initial unlocking,and some section may be in the locked state.In this case， drill pipe attachment or throw may occur if the main winch is used to lift them directly.




**Unlocking step 3**
Reversely rotate at low speed and lower the power head by 30-40cm.After completing the unlocking step2,be sure to reversely rotate the power head all the time and lower it by 30-40cm.The purpose of doing so is to allow the drill pipes to be unlocked completely and the bucket door to be close.

**Unlocking step 4**
Reversely rotate the power head all the time and pull the drill pipes.Keep rotating the power head at low speed and use the main winch to lift the drill pipes until the drilling bit is seen .Note：in the entire drill pipe lift process,the power head shall be reversely rotated all the time to prevent the reacting force of the wire rope or the reverse force created by bit-hole collision from locking the drill pipes automatically during the lift， thus avoid any drill pipe attachment or throw.

※At the moment, observe the main winch's pressure gauge and listen to the power change of the engine to judge whether there is any obvious overload. In case of an obvious overload, it is indicated that the drill pipe unlocking is incomplete, and it is necessary to lower the drill pipes to the hole bottom again and carry out the unlocking procedure.

## B. Frictional drill pipe

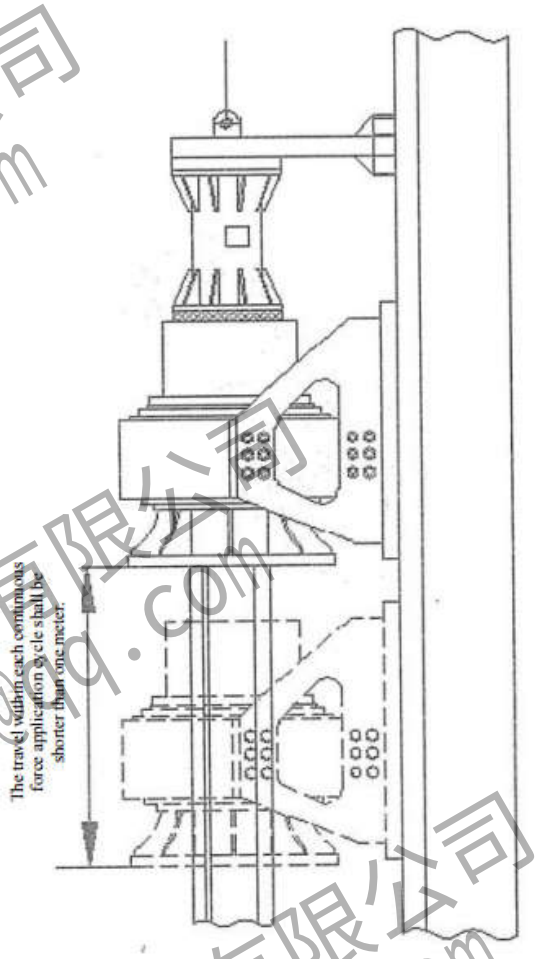
1) Rotate the rotary table to allow the drilling tool to be aligned with the hole position and ensure that the mast is vertical during the entire drilling process.

2) The power head shall be rotated at an appropriate speed to allow the drill pipes to drive the drilling tool and the drilling bucket to become full.

3) Lift the drilling pipes and tool using the main winch.

4) Empty the earth.

5) Repeat the procedure until the hole is developed.




Attention: In each drilling cycle with an applied force by the power head, the continuous drilling footage cannot exceed one meter (as shown in the right figure), depending on the formation conditions. Force is applied on the frictional drill pipes through sliding friction. The drill pipes tend to slide relatively, thus possibly causing some section to be suspended. In case the power head is idle or reversely rotates, drill pipe throw and damage will occur when the suspended drill pipe is lowered into position. In order to avoid any drill pipe throw, it is necessary to pause the power head and lift or rotate the drill pipes a little every one-meter drilling footage with applied force is completed, so as to allow them to be restored in position; resume the operation of the power head until the bucket is full.

※In case frictional drill pipes are used, the methods as follows can be employed to reduce the no-footage and sliding scenario:

① Before each RIH cycle, firstly rotate the power head positively on the ground and open the drilling tool's feed port.

② During the drilling, the drilling bucket shall not be too full and 70~80% of its internal space is preferably occupied by earth.

③ Weld a spring steel plate on the worn bucket teeth to extend them.

④ Substitute another drilling tool, such as an auger, etc.

One or more of the above methods can be used according to the specific situation to improve the drilling efficiency of frictional drill pipes.

C. Multi-lock drill pipe

1) Place the drill bit on the working face.

2) Operate the power head, rotate the drill pipe to start drilling, and when drilling hard soil, combine the pressurized oil cylinder until the bit is filled.

3) With reference to the operation of the lock bar, reverse the power head to unlock and lift the bit with the main winch.

4) Remove the soil.

Multi-lock drill pipe does not need to find the pressurized lock platform, but pay special attention to step 3, avoid the drill pipe is not unlocked, otherwise once the unlock will fall freely during lifting, resulting in the drill pipe nipple is broken, so the lifting should be as slow as possible, once found unlocked, should re-put

the drill pipe to the bottom of the hole, reverse the power head, to help unlock, avoid damage to the drill pipe.

D .Combined drill pipe

1）Place the drill bit on the working face.

2）With reference to the operation of the lock rod, operate the power head and rotate the drill pipe to drill. When drilling hard soil, press the pressurized oil cylinder until the bit is filled.

3）With reference to the operation of the lock bar, reverse the power head to unlock and lift the bit with the main winch

4）Remove the soil.

As the drill depth increases, the combined drill pipe can apply the same pressure as the frictional pipe when the single section is extended.

# Ⅳ. Maintenance of drill pipe

## 4.1 Drill pipe inspection and maintenance

Regular and correct maintenance will prevent premature wear of drill pipe, extend the service life of drill pipe and improve work efficiency.

Regular and proper inspection and maintenance will identify problems in the early stages of drill pipe damage, thus significantly reducing the failure rate of drill pipe and later maintenance work.

In the process of inspection and maintenance, should choose an open flat field, and prepare enough ties. When the drill pipe is disassembled and installed, the speed should be slowed so that each drill pipe is in a straight line. A large swing up and down will cause the drill pipe to bend, crack, or even fracture.

## 4.2 Maintenance period

**Daily check:**

The drill pipe should be inspected every business day without disassembly:

The exposed part of drill pipe: flat head, square head, spring, key bar, steel pipe, weld seam, whether there are cracks, deformation, abnormal wear, etc.; Flower tube is cracked, flower tube and water distribution plate wear condition, etc.; Whether the bolts of the bolt-connected anti-riser mechanism are loose. If abnormal conditions are found, work should continue after repair.

**Periodic maintenance:**

According to the type of drill pipe, working time, formation conditions, according to the following table to disassemble the drill pipe for maintenance.

A、Frictional Unit: engine working hours shall prevail

| Working condition / Time interval/h | Better (Soft layer) | General (Sand layer Gravel layer) | Wicked (Pebble bed) |
|---|---|---|---|
| Initial operation | 100 | 80 | 50 |
| Normal operation | 500 | 300 | 200 |

B、Interlocking Unit: engine working hours shall prevail

| Working condition / Time interval/h | Better (Soft layer) | General (Sand layer Gravel layer) | Wicked (Pebble bed) |
|---|---|---|---|
| Initial operation | 80 | 60 | 40 |
| Normal operation | 300 | 200 | 150 |

In the process of use, if the following phenomenon is found, the drill pipe should be put down in time, disassembled after inspection and maintenance.

6) Drill pipe can not be freely telescopic, there are belt rod, stick rod phenomenon;

7) Can not be pressurized normally, there is skid phenomenon, unlocking difficulty;

8) Kelly eye deformation;

9) A crack was found on the drill pipe;

10) Other abnormal situations.

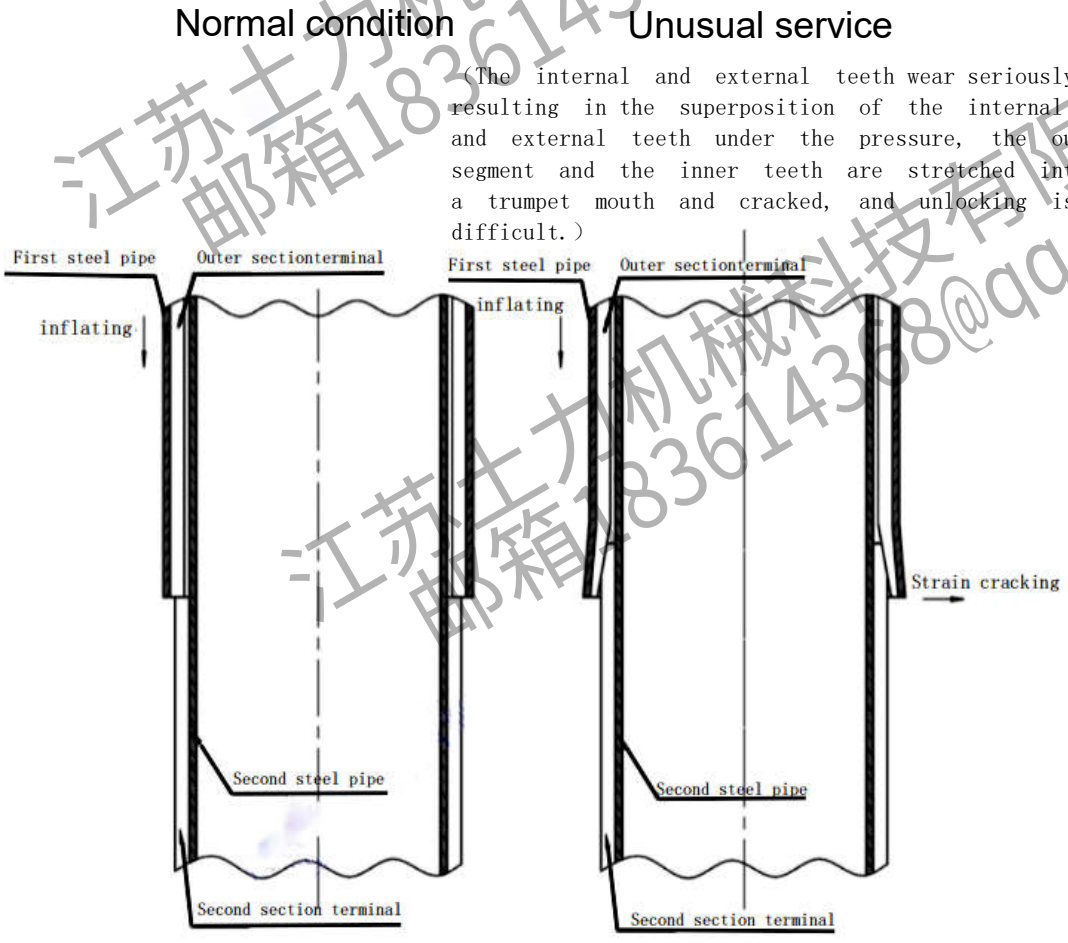
### 4.3 Check and maintain the contents

For proper and thorough inspection and maintenance of drill pipe, it is best to pull out each drill pipe thoroughly.

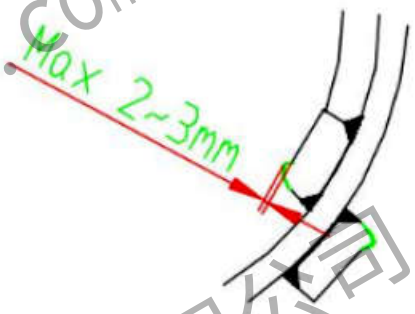
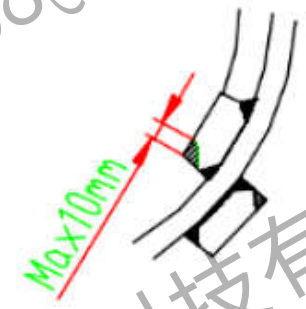
In order to pull out the drill pipe each time for inspection and maintenance, should be easy to scratch the drill pipe inside and outside the high point of grinding, repair welding of severely worn parts, repair welding of cracked weld after grinding open.

**Attention:** For mechanical locking drill pipe, special attention must be paid to the internal and external pressure locking surface inspection and maintenance! When the inner and outer pressurized lock surfaces are severely worn into wedges, the inner and outer pressurized lock surfaces are stuck during pressurization, which will cause difficulties in unlocking, sagging deformation and cracking of steel tubes, and cracking of flower tubes, etc.

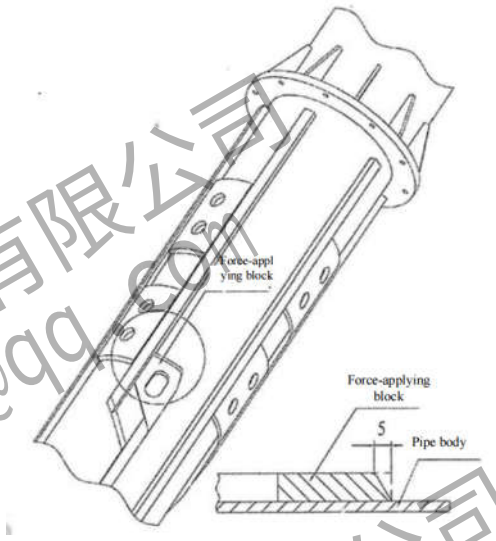
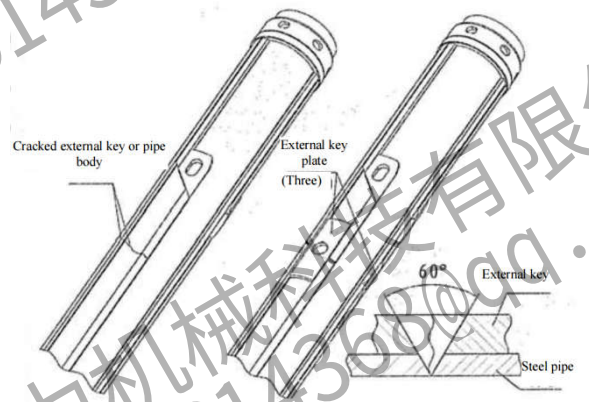
Figure2/2

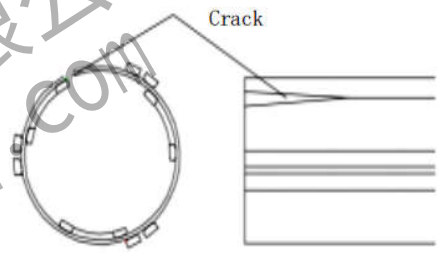
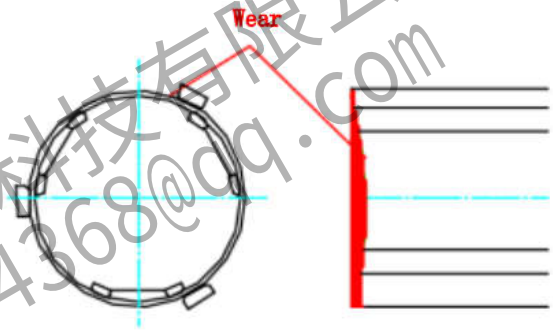


List of maintenance items

| NO. | Part | Damage | Schematic |
|---|---|---|---|
| 1 | External key | External key warp or wear | Inner and outer keys curl edges<br>  <br>Inner and outer bond wear<br>  <br>1.The warp length is 2-3mm.The protruding portion shall be timely Ground and leveled.<br>2.Maximum wear: 10mm. In case of wear, bead welding shall be performed using wear-resistant welding rods, and they are ground to 90°. In case of serious wear, change the part. |

# Ⅳ.Maintenance of drill pipe

| | | | |
|---|---|---|---|
| 2 | Force application point | Worn force-applying block |  <br>Maximum wear: pressure-bearing surface, 5mm. In case of wear, bead welding shall be performed using wear-resistant welding rods, and then they are ground to 90°. In case of serious wear, change the part. |
| 3 | External key or pipe body | Cracked external key or pipe body |  <br>1.Grind the cracked portion with an angle grinder to 60° double groove leading to the base (the entire steel pipe thickness is ground off), weld it using J506 rods, and then grind to level the surface.<br>2.In the circumferential direction, add three external support plates by means of equal-height joint point welding (they should be welded where there is no sliding channel and the crack point should be in the middle of the support plates) and providing protection for the cracked portion. Both of the upper and lower end faces cannot be welded. |

| | | | |
|---|---|---|---|
| 4 | Baffle plate | Worn baffle plate | In case of wear, carry out bead welding using weld rods and grind it level. In case of serious wear, change the part. |
| 5 | Section terminal | Section terminal cracking |  Weld or replace the section terminal after adjusting the shape |
| | | Section terminal surface wear |  Repair welding or replace worn parts |
| 6 | Spring | Cracked | Change |
| 7 | Bolt | Damage | Change |
| 8 | Shock pad | Damage | Change |
| 9 | Kelly eye | Kelly eye deformed or cracked | Change |
| 10 | Top flange | Top flange deformed or cracked | Change or repair welding |
| 11 | Drive stub | The drive stub is bent and broken or badly worn | Change drive stub nipple |
| 12 | Drill pipe | Drill pipe bending | Straightening of flame |
| 13 | Pin | Damage | Change |

# V. Drill pipe fault diagnosis and troubleshooting

When the drill pipe of rotary drilling rig works normally, each section of the drill pipe should extend completely from the outer section to the inner section, and each section should retract completely from the inner section to the outer section when lifting the drill pipe. When lifting and lowering drill pipe, if the drill pipe can not be extended in the normal order, it is called belt rod.

## 5.1 Frictional drill pipe

| NO. | Symptom | Cause | Measure |
|---|---|---|---|
| 1 | The drill pipe can be lowered but cannot be lifted up | There are junks in the drill pipe | Move away the drill pipe and remove the junks |
| 2 | Drill pipe throw during lowering | An inclined hole is made | Reversely rotate and lower it slowly |
| | | There are junks inside | Move away the drill pipe and remove the junks |
| | | The drill pipe is bent | Move away the drill pipe and make it upright |
| | | The upper pipe Body collapses due to extrusion | Change the deformed drill pipe |

| | | | |
|---|---|---|---|
| 3 | Drill pipe attachment or throwing occurs during drill pipe lift | There are junks inside | Move away the drill pipe and remove the junks |
| | | The drill pipe is bent | Move away the drill pipe and make it upright |
| | | An inclined hole is made | Reversely rotate and lift it slowly |
| | | The internal and external keys are seriously worn into rolling ones | Shake away the drill pipes and check them. Change the damaged part |
| 4 | The single pipe cannot be fully retrievable | A lower section is brought into the upper end of an upper section's internal key section | Place the drill pipes on the ground and reassemble them in the specified sequence |
| 5 | Drill pipe swell | Pipe throw | Change the swell portion |
| 6 | Drill pipes rotating but drilling tool failing to rotate | The core section's lower-end external key falls off | Reweld the core section's low-end external key |
| 7 | Frequent pipe attachment or throw | There are warps or burrs inside | Move away the drill pipe and grind it. |
| | | The drill pipe is bent | Move away the drill pipe and make it upright |
| | | Seriously worn internal and external keys | Move away the drill pipe and repair weld or change it |
| 8 | Outer drill pipe and the rig power head between the clamp rod | 1. Drill pipe is not centered on the power head drive sleeve<br>2. There is a foreign body between the power head driving sleeve and the drill pipe. | Before work, confirm the same axis of wire rope, drill pipe and power head drive sleeve<br>1. Check the main coil of the rig, the drill pipe bracket and the power head bracket, so that the drill pipe is located in the center of the power head drive sleeve<br>2. Check whether there are foreign bodies between the power head and drill pipe, and clean them up in time. |

| NO. | Symptom | Cause | Measure |
|---|---|---|---|
| 9 | The drive stub is bent and broken or badly worn | Directly affected by external force: such as earth, flat earth, with drilling tool pressure guard, improper installation of drilling tools, main engine walking, rotary table when square head or drilling tools meet the ground and obstacles. | Drill pipe shall not be equipped with drill pipe pressure guard, earth removal, etc. Drill pipe drilling tool is strictly prohibited to touch the ground when the rig is turning or walking. When the drill pipe is placed horizontally on the rig, the drill tool is removed.<br>Replace the square stub assembly. |
| 10 | Kelly eye deformed or cracked | The drill pipe was lifted incorrectly | Change kelly eye parts |
| 11 | Retaining sleeve cracked | Belt rod caused by rod smashing | When the drill pipe is found to be broken, the construction should be stopped immediately, the drill pipe should be disassembled, the fault should be removed, and the movable ring should be replaced. |
| 12 | Baffle plate or section terminal surface wear | The hole diameter is small or special clay layer, muck is not easy to throw out. The dregs in the drill barrel are thrown out by rapid positive and negative impact | Modify or replace the appropriate drilling tool, try to avoid the power head rapid positive and negative impact. Repair welding or replace worn parts. |

For other faults not listed, please refer to the manual "VI. Precautions in the Use of Drill Pipe".

In the use, inspection, maintenance process, if you have any questions please contact the company.

## 5.2 Mechanical lock drill pipe

| NO. | Symptom | Cause | Measure |
|---|---|---|---|
| 1 | The drill pipe can be lowered but cannot be lifted up | There are junks in the drill pip | Move away the drill pipe and remove the junks |
| 2 | Drill pipe throw during lowering | An inclined hole is made | Reversely rotate and lower it slowly |
| | | The drill pipe is bent | Move away the drill pipe and make it upright |
| | | The upper pipe body collapses due to extrusion | Change the deformed drill pipe |
| | | The swivel does not rotate well, and the wire rope is rotated by force, resulting in an automatic padlock | Slow reverse down maintenance or replace the swivel device |
| 3 | Drill pipe attachment or throwing occurs during drill pipe lift | There are junks inside | Move away the drill pipe and remove the junks |
| | | The drill pipe is bent | Move away the drill pipe and make it upright |
| | | Tube body deformation | Change the deformed drill pipe |
| | | Incomplete unlock | Press the lock lever unlock procedure to re-unlock |
| | | An inclined hole is made | Reversely rotate and lower it slowly |
| 4 | The single pipe cannot be fully retrievable completely recycled | A lower section is brought into the upper end of an upper section’s internal key section | Place the drill pipes on the ground and reassemble them in the specified sequence |

| NO. | Symptom | Cause | Measure |
|---|---|---|---|
| 5 | Drill pipe swell | Unlock not completely drop bar | Change the swell portion |
| 6 | The drill pipe squealed regularly | The drill pipe bends because of excessive pressure | Lift the power head to release the pressure |
| 7 | Can't find the lock point | Severe oblique holes were made | Correct the verticality of the hole |
| | | The pressurized oil cylinder has not reached its maximum stroke | Finish your work schedule |
| 8 | Press the lock lever unlock program to unlock, but the lock still cannot be unlocked | The bearing block is severely worn into a wedge, stuck with the inner key, and the bottom orifice of the upper drill pipe is deformed or cracked | In severe cases, remove the inner key and section terminal and replace the damaged part |
| 9 | Outer drill pipe and the rig power head between the clamp rod | 1. Drill pipe is not centered on the power head drive sleeve<br>2. There is a foreign body between the power head driving sleeve and the drill pipe. | Before work, confirm the same axis of wire rope, drill pipe and power head drive sleeve<br>1. Check the main coil of the rig, the drill pipe bracket and the power head bracket, so that the drill pipe is located in the center of the power head drive sleeve<br>2. Check whether there are foreign bodies between the power head and drill pipe, and clean them up in time |

| NO. | Symptom | Cause | Measure |
|---|---|---|---|
| 10 | The drive stub is bent and broken or badly worn | Directly affected by external force: such as earth, flat earth, with drilling tool pressure guard, improper installation of drilling tools, main engine walking, rotary table when square head or drilling tools meet the ground and obstacles. | Drill pipe shall not be equipped with drill pipe pressure guard, earth removal, etc. Drill pipe drilling tool is strictly prohibited to touch the ground when the rig is turning or walking. When the drill pipe is placed horizontally on the rig, the drill tool is removed. Replace the square stub assembly. |
| 11 | Kelly eye deformed or cracked | The drill pipe was lifted incorrectly | Change kelly eye parts |
| 12 | Retaining sleeve cracked | Belt rod caused by rod smashing | When the drill pipe is found to be broken, the construction should be stopped immediately, the drill pipe should be disassembled, the fault should be removed, and the movable ring should be replaced. |
| 13 | Baffle plate or section terminal surface wear | The hole diameter is small or special clay layer, muck is not easy to throw out. The dregs in the drill barrel are thrown out by rapid positive and negative impact | Modify or replace the appropriate drilling tool, try to avoid the power head rapid positive and negative impact. Repair welding or replace worn parts. |

For other faults not listed, please refer to the manual "VI. Precautions in the Use of Drill Pipe".

In the use, inspection, maintenance process, if you have any questions please contact the company.

# Ⅵ. Precautions in the use of drill pipe

Drill pipe is an important part and a quick-wear part for a rotary drilling rig. Drill pipes are mainly used to transfer the torque of the power head as well as the force applied by the force-applying mechanism. Their application environments are very severe and complicated.

In order to avoid their damage or misoperation, comply with the following precautions:

1. When the drill pipes are intended for long-period storage, do not directly place them on the ground and do not place them together with residue soil, broken stones, and other fine items that may enter them. It is necessary to find an open, flat, and relatively hard ground area where some sleepers are used to support them off the ground. The compliance rack had better be removed to prevent the slewing bearing from being knocked or damaged. Do not place the drill pipes using any other incorrect method. During installation and removal, carefully and slowly lift them in balance to avoid collision or damage.

2. The power head's maximum torque and applying force cannot exceed the maximum allowed values of the drill pipes.

3. When the drill pipe is installed into the machine, pull the drill pipe as shown in Figure (A) below. It is strictly prohibited to pull the drill pipe as shown in Figure (B). This operation will cause the flat head to bend and deform, and in serious cases, it will cause the lift to break. During the installation of drill pipe, the speed should be slowed down to avoid collision with the rig and damage to the power head and pressurized oil cylinder.

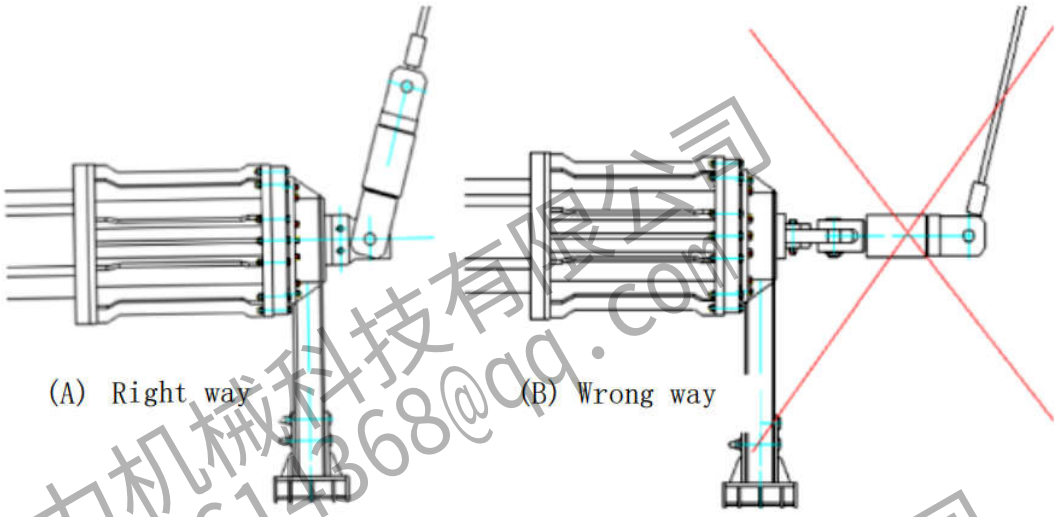



Figure: 6-1 Diagram of drawing drill pipe

4. After the drill pipes are installed on the rig and before they are used, it is necessary to positively and reversely rotate the power head several cycles and shake it several times so as to prevent any inside irrelevant items from sticking them because they have been left unused.

5. When the drilling tool is installed, do not use the square head of any drill pipe to directly push the lying drilling tool in order to make it vertical. This operation will make the square head bent or even broken. It is necessary that the drilling rig's secondary winch shall be used to pull up the drilling tool and make its connection square hole face upright to facilitate its installation.

6. When the guard casing is lowered, do not use the drill pipes to move the drilling tool to apply a force onto it. If the drilling tool is used to apply a force onto the guard casing, then the drilling tool's eccentric force may cause the drill pipe's square head to be bent or even broken.

7. The drilling pipes and attached drilling tool can be used only for drilling rather than for moving earth (ground leveling), slurry mixing, etc. Such an application easily causes them to be damaged.

8.Once the drill pipes and attached drilling tool contact the ground or are placed in the hole, do not carry out the following operations to avoid drill pipe bending: drilling rig travel, amplitude regulation, mast adjustment, left or right rotation, etc.

9.The operators must be familiar with the various properties and parameters of the drill pipes such as rated torque, rated depth, force application mode, length of single drill pipe, etc. They shall know the depth of the drilling tool when each drill pipe is fully stretched to the bottom as well as which drill pipe is stretched at the bottom at some depth and its rough position. Thus, it can be known which drill pipe begins to be lifted by the main winch at what position and what range the lifting force is within. When the lifting force is incorrect, it can be known whether drill pipe attachment has occurred, so as to avoid drill pipe throw.

10.In case the frictional drill pipes skid without any footage or have a slow drilling footage so as to allow the force-applying travel of the power head to exceed the footage, skidding tends to occur in the drill pipes to make some section suspended. When the drill pipes stop proceeding or reversely rotate, the suspended single section tends to suddenly fall, thus causing a drill pipe throw. In this case, in order to reduce the drill pipe throws, the single-cycle force-applying travel of the power head is not supposed to exceed one meter. The drill pipe throws can be reduced by reversely rotating or lifting the power head (refer to B. Frictional Drill Pipes in III.Use of Drill Pipes).

11.At the beginning of using drill pipe, the operator should familiarize himself with the performance and parameters of drill pipe, such as torque rating, depth rating, pressure form, length of each rod, etc. When the drill pipe is lowered, it should be possible to know the depth of the drill pipe at which each drill pipe is lowered to the bottom. When lifting, it should

be possible to know which drill pipe starts to rise at the corresponding depth. To avoid the occurrence of rod climbing when the operator is unaware, resulting in a serious rod smashing situation.

12.For hard formations, mechanical lock drill pipe must be used. Abnormal wear and damage of drill pipe will result from improper pressurization of drill pipe. When the mechanical lock drill pipe is pressurized, the power head is rotated and pressurized at a slow speed at the same time to ensure that the lock is completely entered (the pressurized surface is completely fitted) before normal pressurized drilling, otherwise it will cause abnormal wear, steel pipe deformation and other faults.

13.When operating interlocking drill pipes, properly control the applied force. Do not apply too great a force. Otherwise, the drilling rig's front end is jacked, the fronts of the tracks are suspended, and the mast leans backward seriously. In this case, the drill pipes are bent and abnormal noise is emitted. This would inflict great damage upon the drill pipes and cause them to be broken.

14.When interlocking drill pipes are used, comply strictly with the correct unlocking procedure. Otherwise, incomplete unlocking would cause drill pipe attachment and serious drill pipe throw (refer to A. Mechanical lock drill pipe in Ⅲ.the use of drill pipe).

15.When the drill pipes are lowered, pay attention to how long wire rope has been paid out. The drilling tool inevitably rubs the hole wall. Sometimes, the edge teeth or the drilling tool stick the hole wall. Especially when the pile hole has a poor verticality, it is very likely that the drilling tool sticks the hole wall during the lowering of the drill pipes. If the operator fails to notice this timely, the main winch would pay out the wire rope excessively, thus causing the wire rope to be out of order. In this case, a drill

pipe throw is very likely to break the wire rope so as to result in a major work accident.

16.It is strictly prohibited to apply any force other than torque and axial pressure to the drill pipe under extremely harsh working conditions (for example, the drill bit can only touch the hard formation on one side, commonly known as off-load), otherwise it will cause serious deformation and damage to the drill pipe.

17.When the temperature is very low, the icing inside the drill pipe is serious, and the phenomenon of the drill pipe lifting rod, rod smashing, etc. should be used to melt the ice and then work.

18.If the hole diameter is small or the soil is sticky, it is difficult to unload the soil. In this case, quick positive and reverse rotations to knock the drill pipes have to be done for soil unloading. The method may result in too early drill pipe fatigue crack.

19.When drilling deep holes or large holes, special attention should be paid to ensure that the drill teeth of the drill tool work normally, timely replacement of worn drill teeth, do not try to increase the pressure to compensate for the wear of drill teeth.

20.If drill pipe attachment occurs when the interlocking drill pipes are lift up, immediately lower them to the hole bottom and unlock them according to the unlocking procedure. Resume the lifting after unlocking. Do not stop to positively and/or reversely rotate the power head during the lifting of the drill pipes, so as to avoid any drill pipe throw that would otherwise damage the drilling rig and drill pipes.

21.During the use of drill pipes, if drill pipe attachment is continuously found, immediately lower the drill pipes and disassemble, inspect, and maintain them according to the disassembly procedure.

22.Long drill pipe for a long time to drill shallow holes, because the drill pipe inside a few sections do not expand, resulting in mud sediment between the

several sections of the drill pipe. The accumulation eventually resulted in stuck drill pipe. So be sure to disassemble drill pipe frequently and rinse the inside and outside walls of each section with clean water. And go back to work.

23.When using drill pipe with bolt-connected riser mechanism, check the fastening bolts of the riser mechanism every day, and tighten them in time if they become loose. Once the bolt loosens, falls off, and falls into the drill pipe, it will cause serious accidents such as drill pipe belt rod, rod smashing and so on.

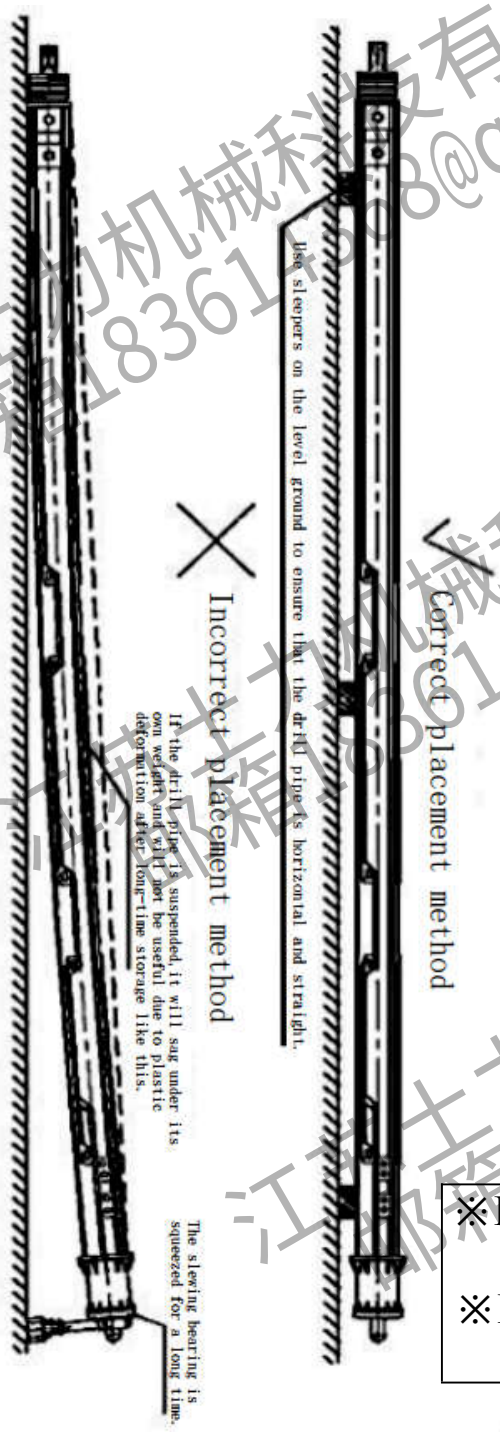
24.During welding and other maintenance on the drill pipe, make sure that the drill pipe is completely detached from the rig, or that the power supply and electrical system of the rig are completely disconnected. Otherwise, will cause electrical system short circuit, fire.

25.During the transportation of drill pipe, three supports should be made at both ends and in the middle of the drill pipe to reduce the deformation caused by vibration.

26.If drill pipes need to be out of service for a long time, timely wash their internal tooth portions to ensure that there is no mud, sand, or soil inside.

# Ⅶ. Legend of quality responsibility for non-drilling rig and drill pipe

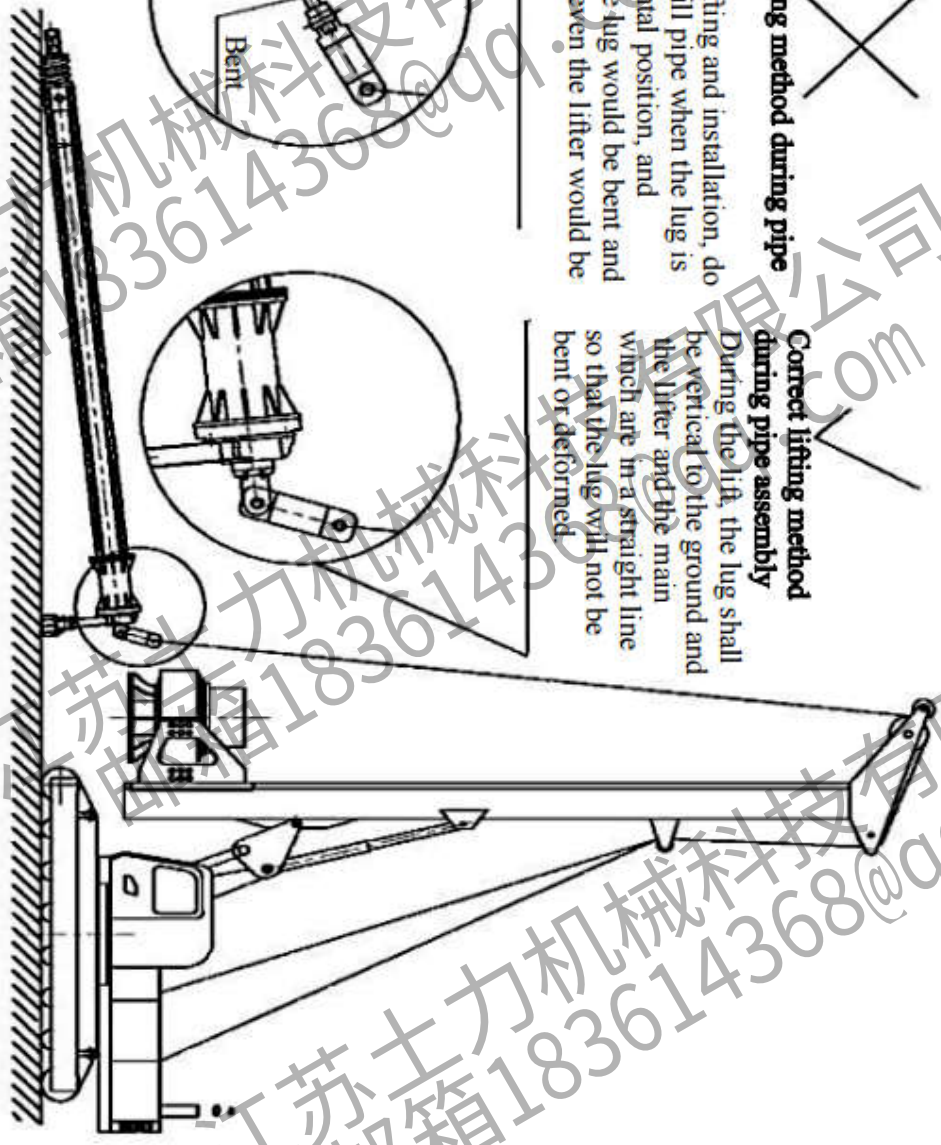
## Failures Caused by Abnormal Operations(1)




**When the drill pipes are intended for long-period storage, do not directly place them on the ground and do not place them together with residue soil, broken stones, and other fine items that may enter them.It is necessary to find an open, flat, and relatively hard ground area where some sleepers are used to support them off the ground. The compliance rack had better be removed to prevent the slewing bearing from being knocked or damaged.Do not place the drill pipes using any other incorrect method.**

**※Do not place the drill pipes in the suspended way at will※**
**※Be sure to support the drill pipes off the ground※**

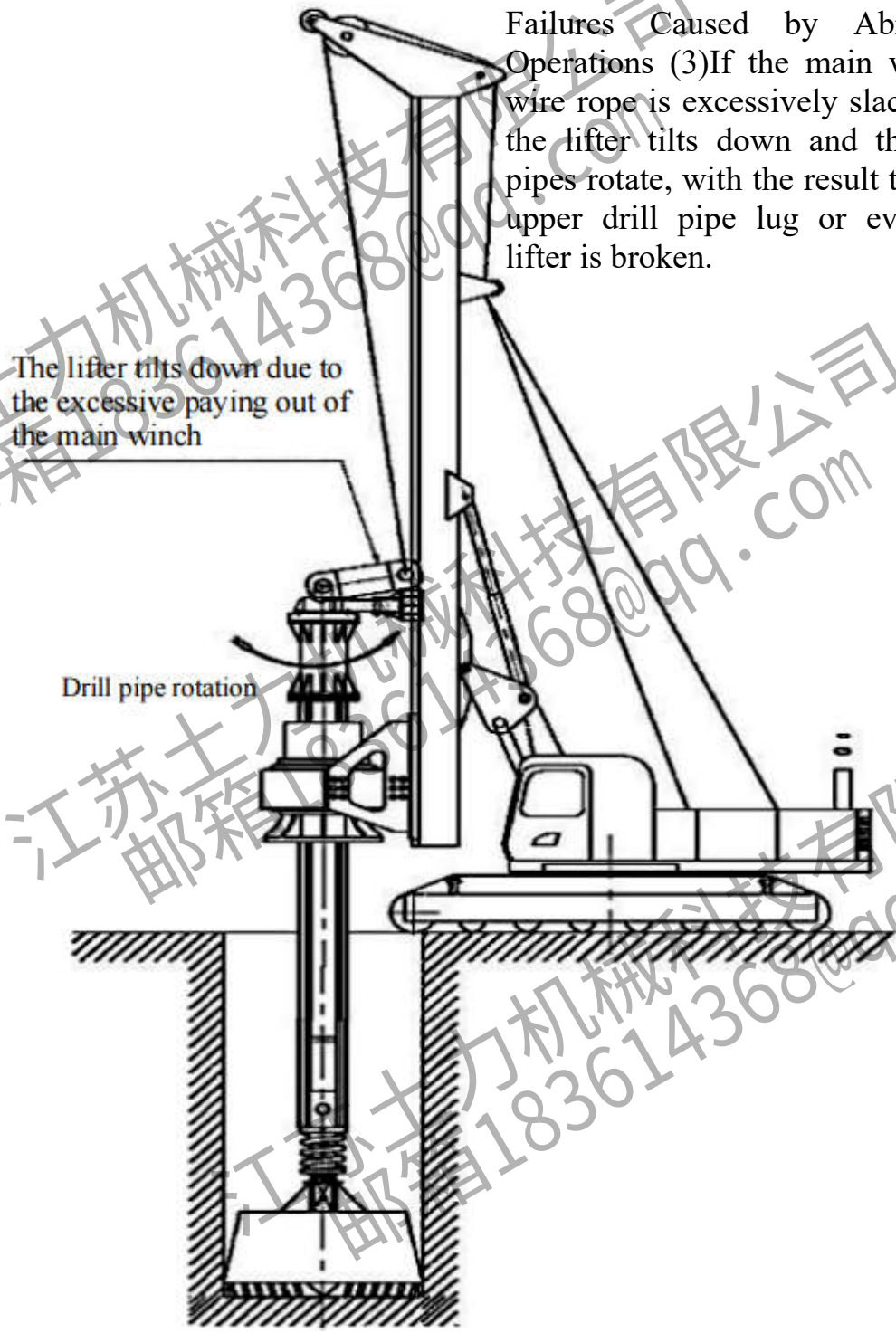
# Failures Caused by Abnormal Operations(2)




**※Do not lift the drill pipe when the lug (flat head) is parallel to the ground※**

# Failures Caused by Abnormal Operations(3)

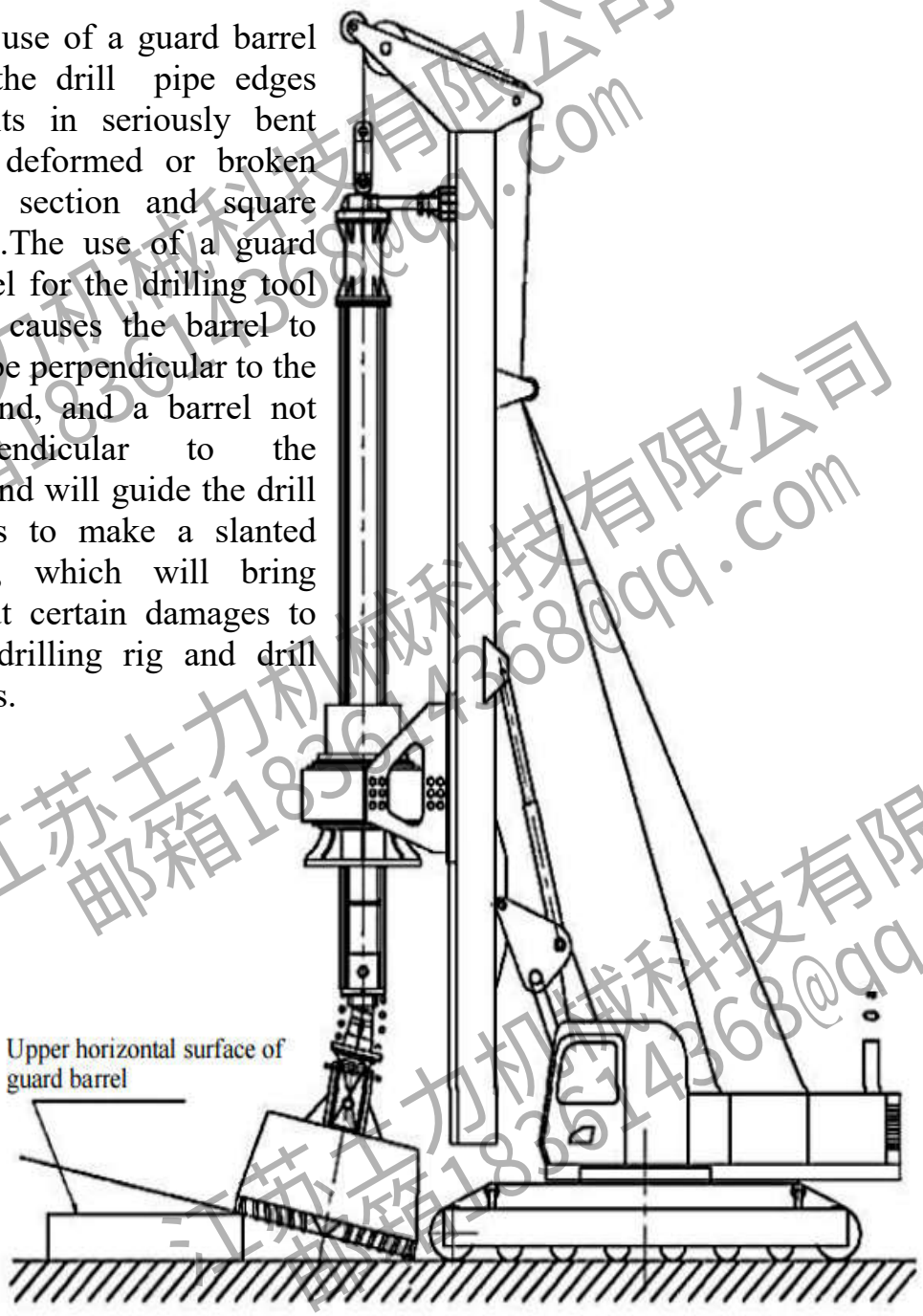
Failures Caused by Abnormal Operations (3)If the main winch's wire rope is excessively slackened, the lifter tilts down and the drill pipes rotate, with the result that the upper drill pipe lug or even the lifter is broken.




**※Do not cause the main winch to pay out the wire rope excessively ※**

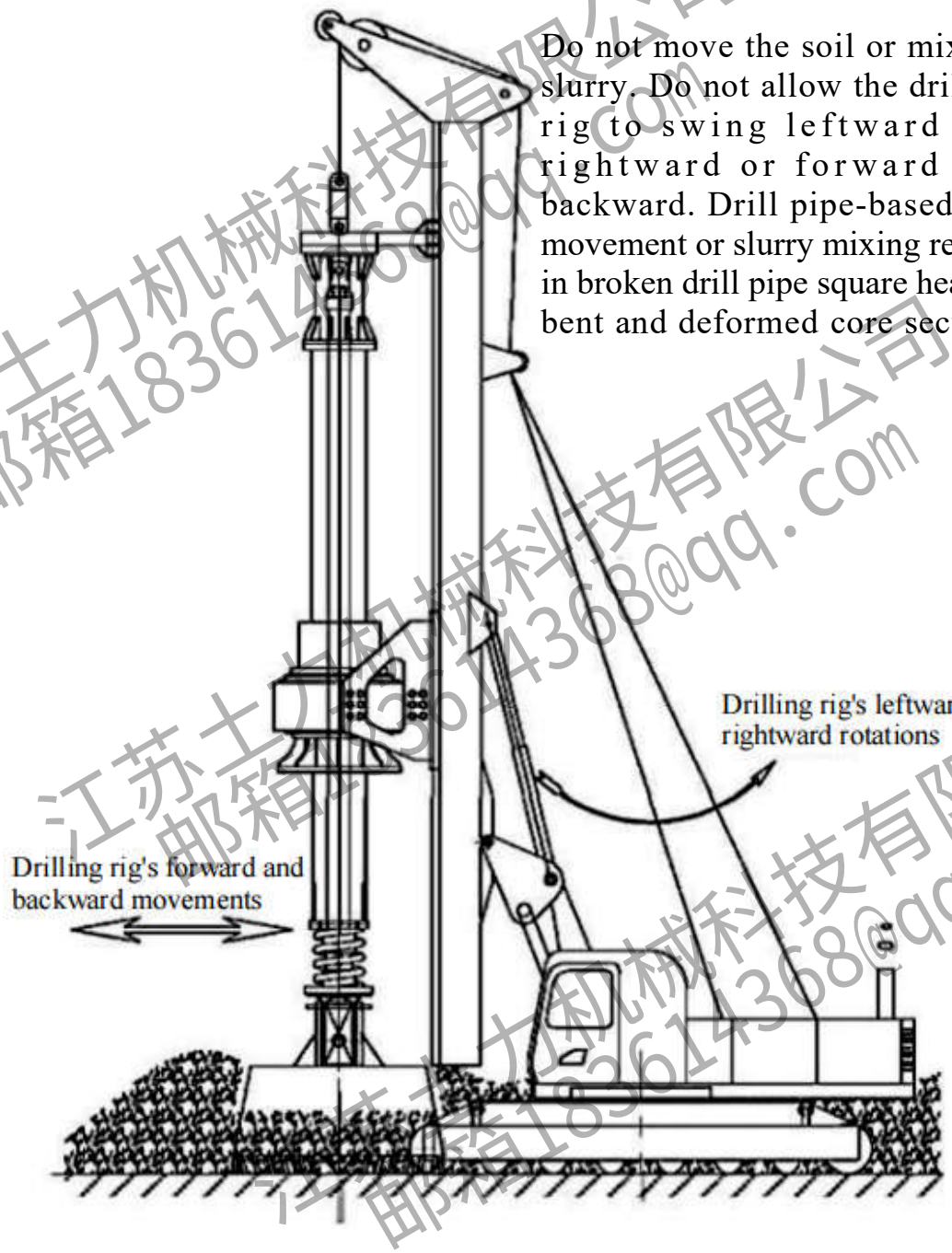
# Failures Caused by Abnormal Operations(4)

The use of a guard barrel for the drill pipe edges results in seriously bent and deformed or broken core section and square head.The use of a guard barrel for the drilling tool also causes the barrel to not be perpendicular to the ground, and a barrel not perpendicular to the ground will guide the drill pipes to make a slanted hole, which will bring about certain damages to the drilling rig and drill pipes.




**※Do not use any drilling tool guard barrel ※**

# Failures Caused by Abnormal Operations(5)




Do not move the soil or mix the slurry. Do not allow the drilling rig to swing leftward and rightward or forward and backward. Drill pipe-based soil movement or slurry mixing results in broken drill pipe square head or bent and deformed core section.

**※Do not carry out any other drilling-irrelevant operation such as soil movement (ground leveling) or slurry mixing※**

# Failures Caused by Abnormal Operations(6)

Fourth section lifted up along due to large sand grains in slurry.

Fig. I: There are large blocking sand grains (>4mm) between the fourth and fifth sections so that they cannot be normally retrieved; the fourth section is lifted up along by the fifth section.

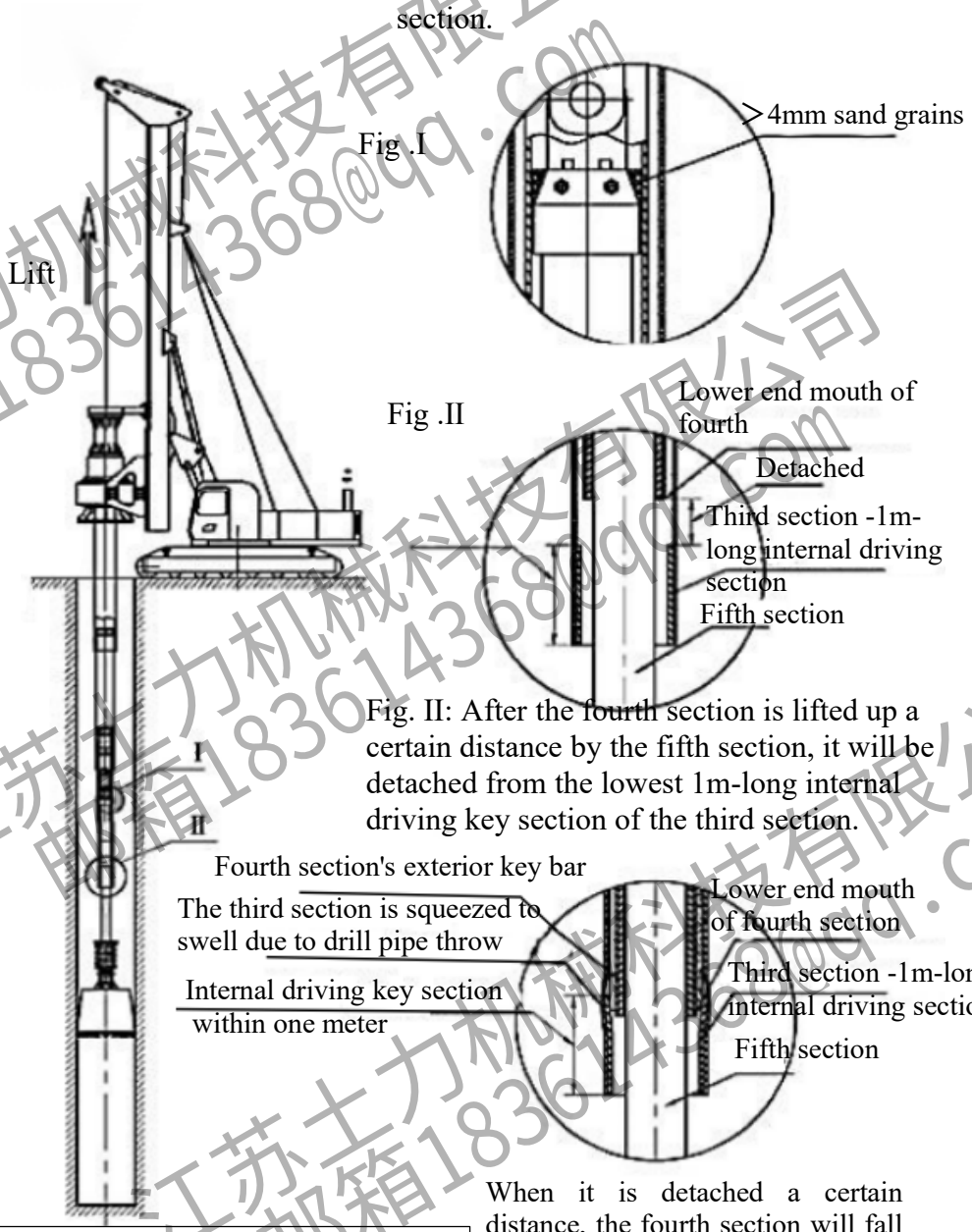



Fig. II: After the fourth section is lifted up a certain distance by the fifth section, it will be detached from the lowest 1m-long internal driving key section of the third section.

When it is detached a certain distance, the fourth section will fall freely and be thrown because of some reason such as drilling rig sway or rotation or crushing of upper sand grains, thus hitting the internal key section of the third section and causing its upper end to swell.

**※Pay attention to any drill pipe anomaly※**
**※Do not operate when being sick ※**

# Failures Caused by Abnormal Operations(7)

The third section is lifted up along due to irrelevant items .

Fig. I: Irrelevant items such as a bolt enter between the third and fourth sections and thus cause them to be incapable of being normally retrieved.

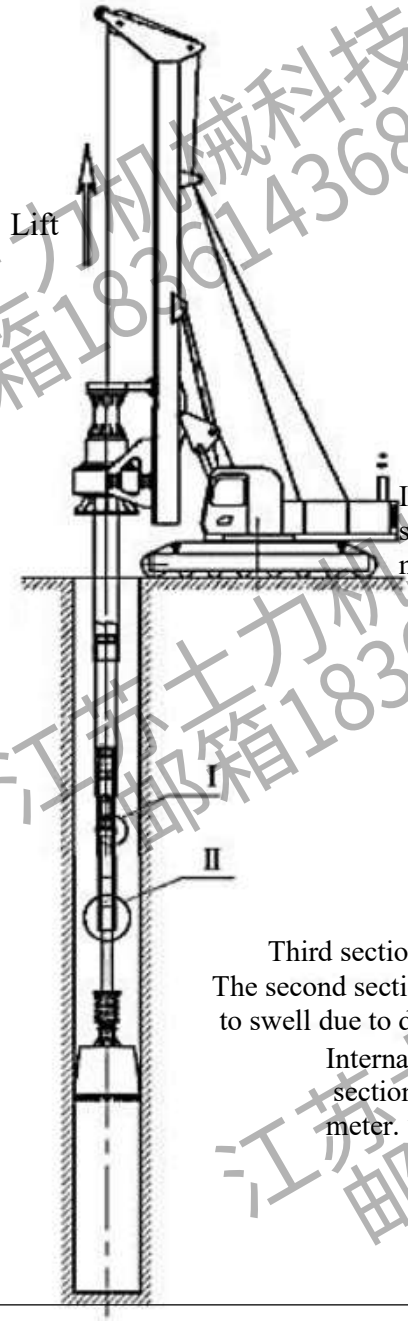



Fig .I

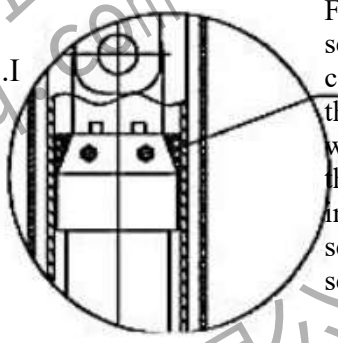


Fig. II: After the third section is lifted up a certain distance by the fourth section, it will be detached from the lowest 1m-long internal driving key section of the second section.

Fig .II

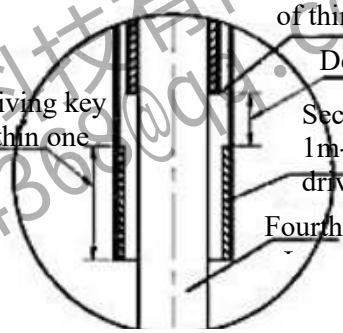
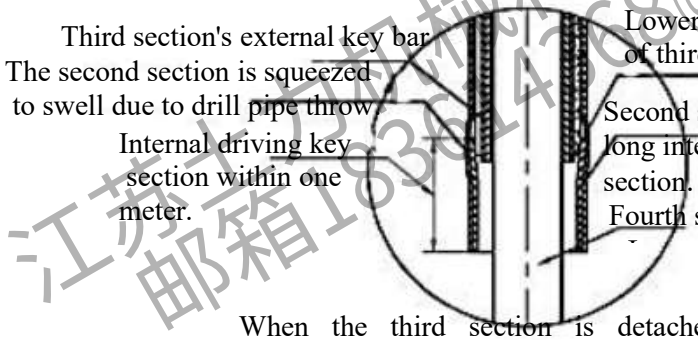



Fig. II: After the third section is lifted up a certain distance by the fourth section, it will be detached from the lowest 1m-long internal driving key section of the second section.



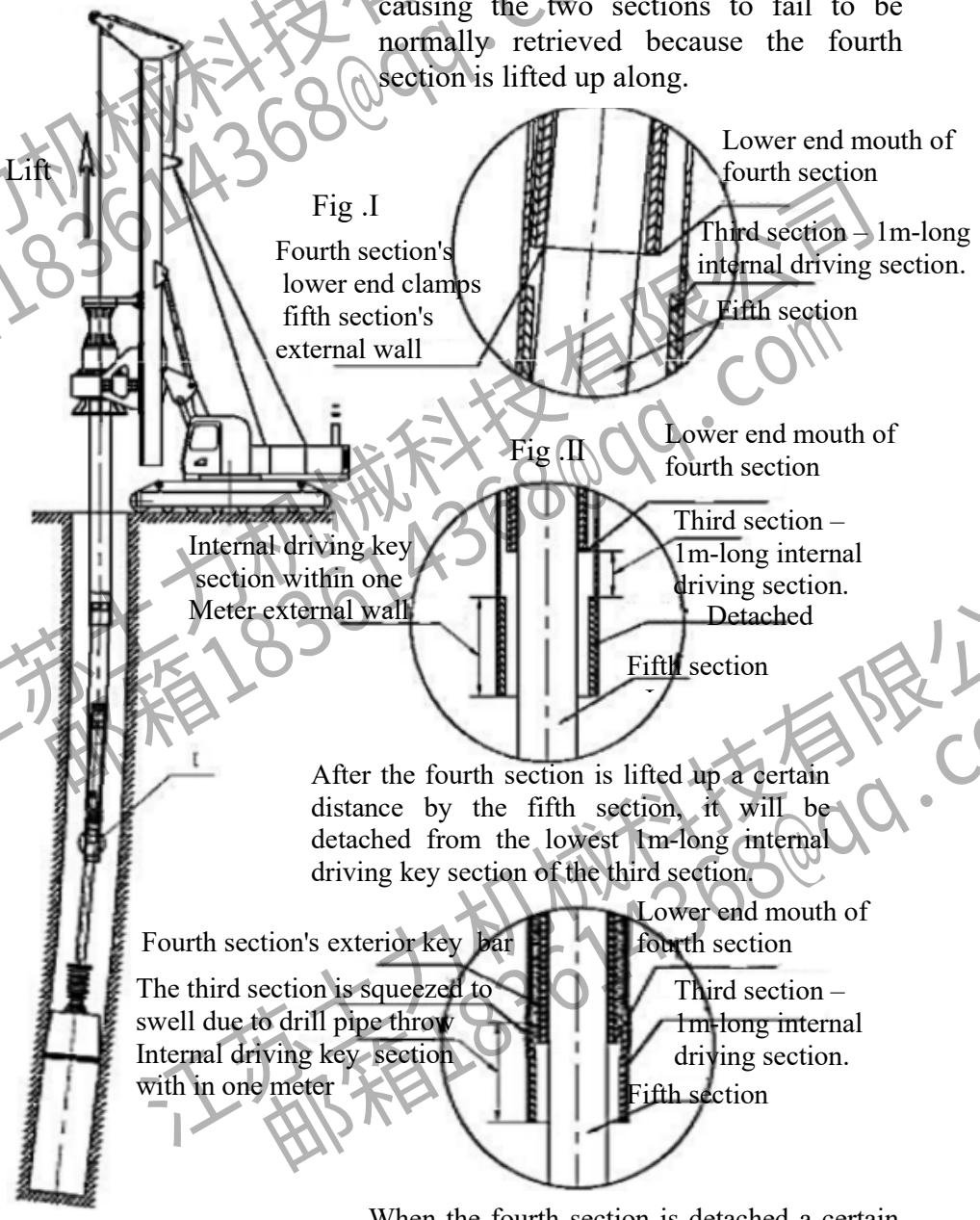

When the third section is detached a certain distance, it will be out of the upper end of the second section. Now, any drilling rig sway or rotation will loosen the blocking irrelevant items between the third and fourth sections such as a bolt. Thus,the third section will fall freely and be thrown to hit the internal key section of the second section and cause its upper end to swell.

**※Pay attention to any drill pipe anomaly※**
**※ Do not operate when being sick※**

# Failures Caused by Abnormal Operations(8)

The fourth section is lifted up along because the hole is drilled into a slanted one.

Fig. I: When the hole is drilled into one with a certain inclination degree, the drill pipes will have some deflections. When the drill pipes are lifted, the fourth section's bottom mouth will stick the external wall of the fifth section, thus causing the two sections to fail to be normally retrieved because the fourth section is lifted up along.




After the fourth section is lifted up a certain distance by the fifth section, it will be detached from the lowest 1m-long internal driving key section of the third section.

When the fourth section is detached a certain distance, it will be elastically restored from the bent state with the reduced curvature and fall freely to hit the internal key section of the third section. This will cause the upper end of the internal key section of the third section to swell.

**※Pay attention to any drill pipe anomaly※**
**※Do not operate when being sick ※**

# Failures Caused by Abnormal Operations(9)

Due to seriously damaged internal and external keys, the second section's internal key rolls onto the third section's external key and the second section is lifted up along by the third section.

When the second section's internal key and the third section's external key wear each other considerably, a large wedge surface is formed. During rotation, the second section is deformed due to the wedging effect (refer to Fig. A-A). The internal key rolls onto the external key of the third section, and thus, the third section cannot be normally retrieved and lifts the second.

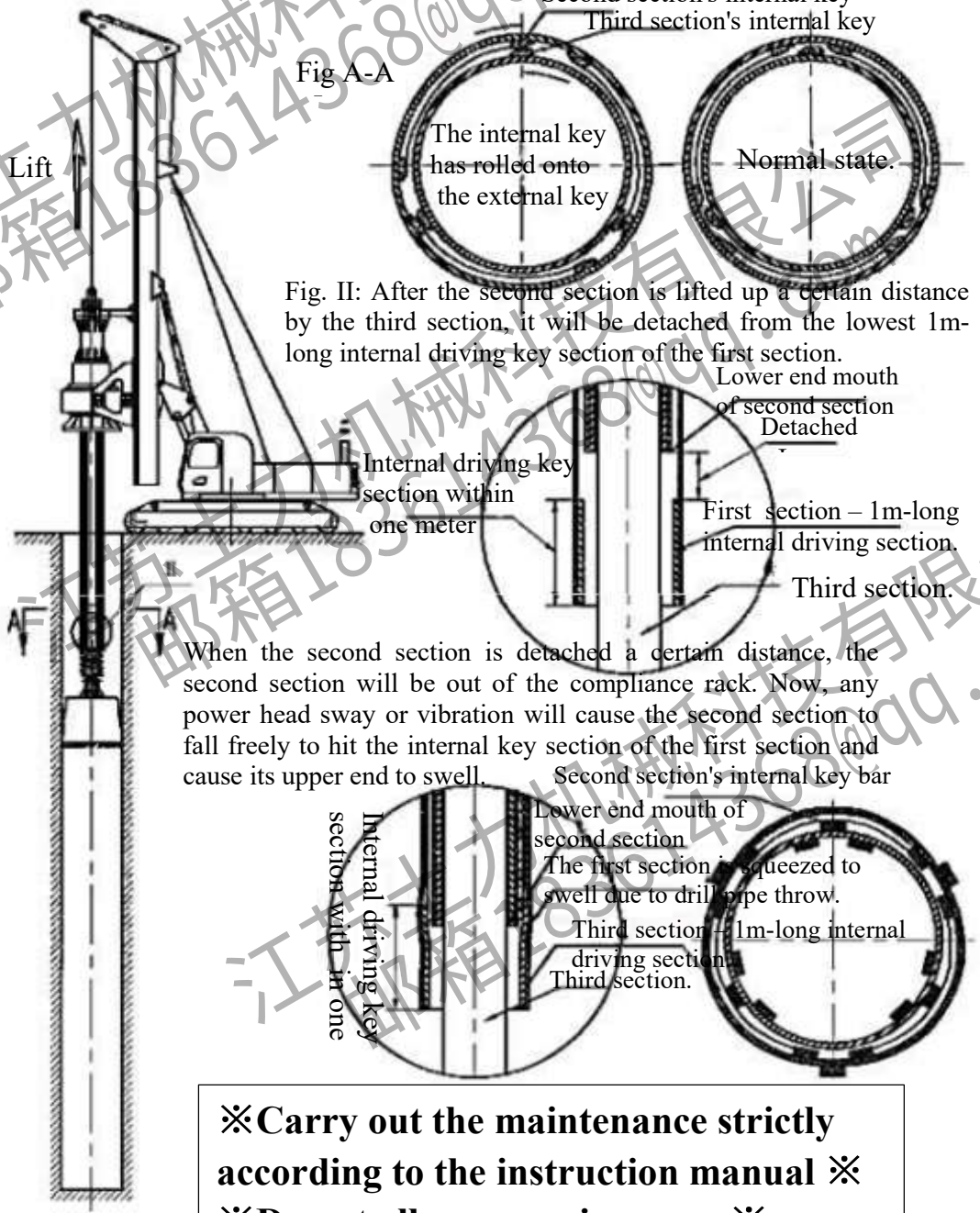



Fig. II: After the second section is lifted up a certain distance by the third section, it will be detached from the lowest 1m-long internal driving key section of the first section.

When the second section is detached a certain distance, the second section will be out of the compliance rack. Now, any power head sway or vibration will cause the second section to fall freely to hit the internal key section of the first section and cause its upper end to swell.

**※Carry out the maintenance strictly according to the instruction manual ※**
**※Do not allow excessive wear ※**

# Failures Caused by Abnormal Operations(10)

An internal section has been lifted up along due to some reason.

Fig. I: Irrelevant items between the third and fourth sections cause the two sections to fail to be normally retrieved because the third section is lifted up along, and in this case, the third section's lower end firstly contacts the internal teeth end of the second section and then runs out of it, thus failing to lower the drill pipe for its use.

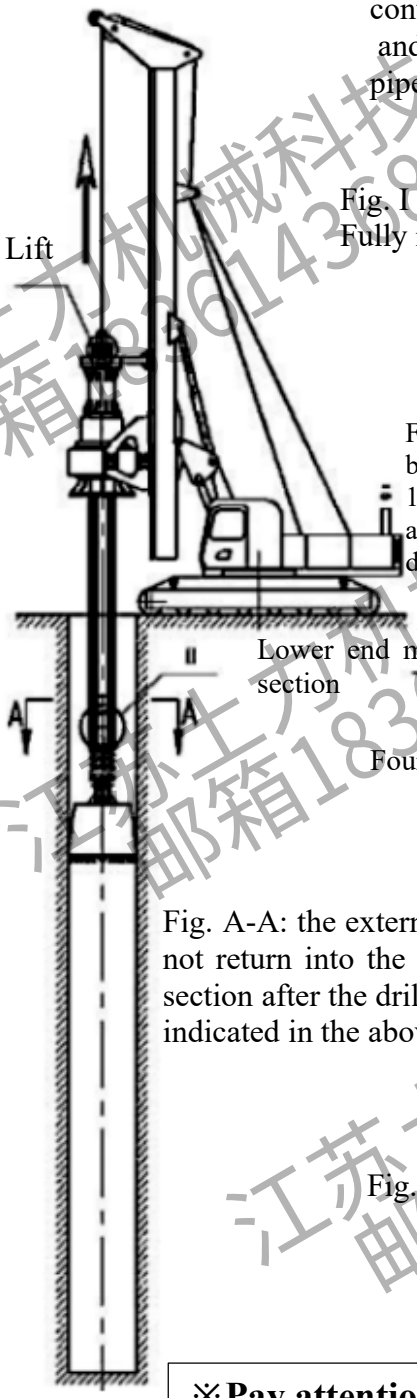



Fig. I
Fully retrieved

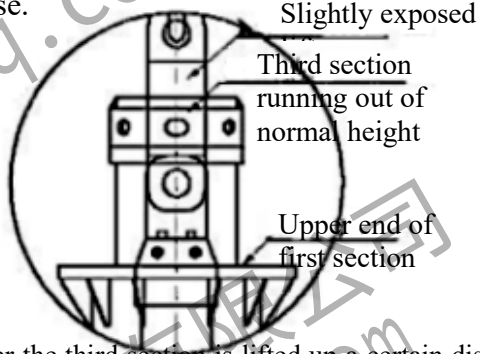



Fig. II: After the third section is lifted up a certain distance by the fourth section, it will be detached from the lowest 1m-long internal driving key section of the second section and fall slightly on the upper end of the latter (no violent drill pipe throw and no third section swell).

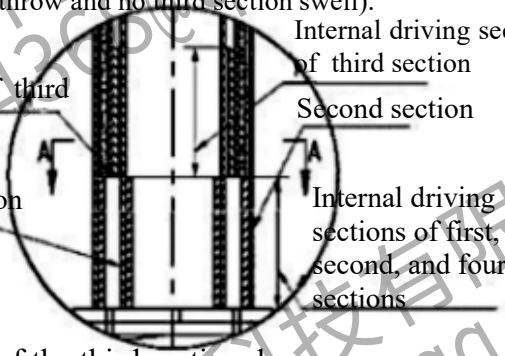



Fig. A-A: the external key of the third section does not return into the internal key slot of the second section after the drill pipe attachment (slight throw) indicated in the above figure occurs.

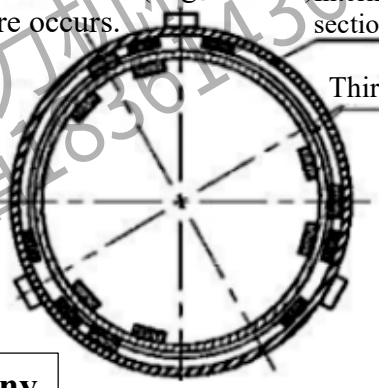



Fig.A-A

**※Pay attention to any drill pipe anomaly※**
**※Do not operate when being sick ※**

# Failures Caused by Abnormal Operations(11)

If the hole is slanted, each of all the sections has a certain degree of deflection. In this case, applying a force on the power head will bend the drill pipes seriously (the sections are stuck due to bending and cannot be retrieved freely), and the drill pipes will suffer unrecoverable plastic deformation due to serious bending. In case of serious bending, the external keys of these drill pipes will be broken. A broken external key, if not timely repaired, will cause the drill pipe body to be seriously bent and broken during drilling.

Slanted hole

Slanted hole and broken drill pipes

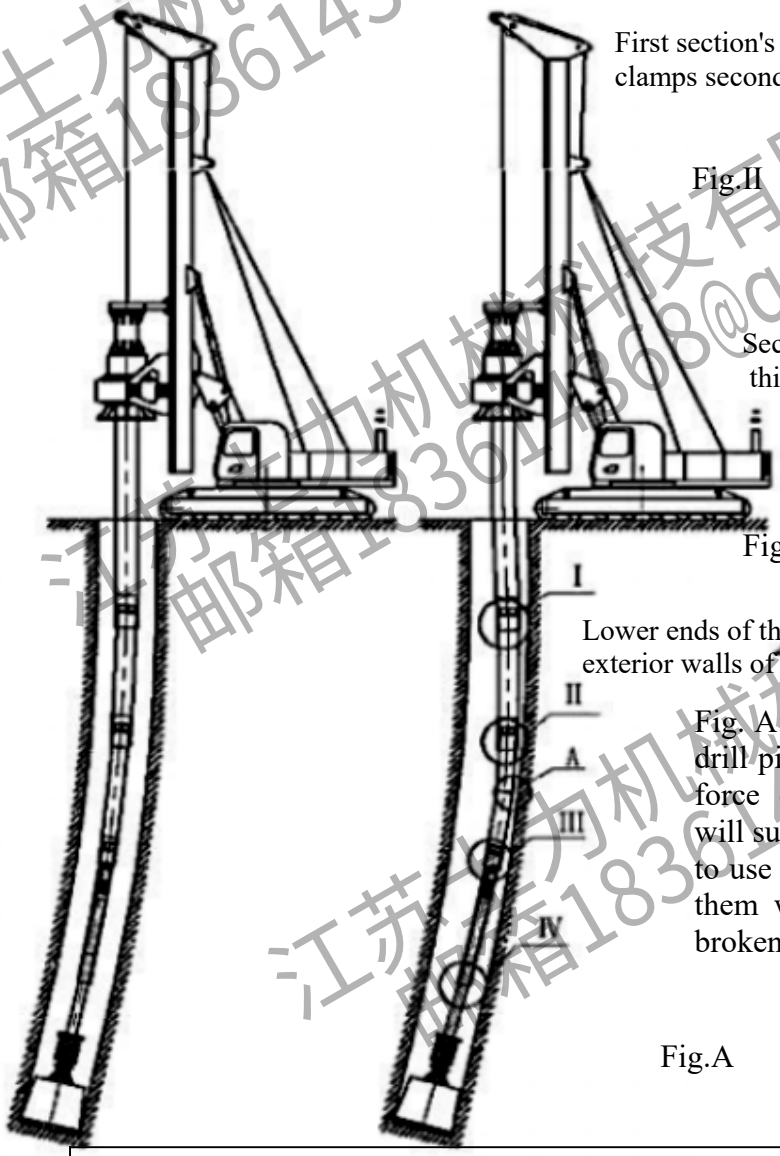



Fig.I

First section's lower end clamps second section's exterior wall

Fig.II

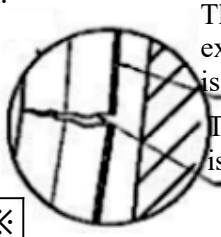
Second section's lower end clamps third section's exterior wall

Fig.III、IV

Lower ends of third and fourth sections clamp exterior walls of four and fifth sections

Fig. A: When the hole is slanted, the drill pipes are bent somewhat; if the force continues to be applied,they will suffer tensile failure. Continuing to use them without timely repairing them will cause their bodies to be broken.

Fig.A



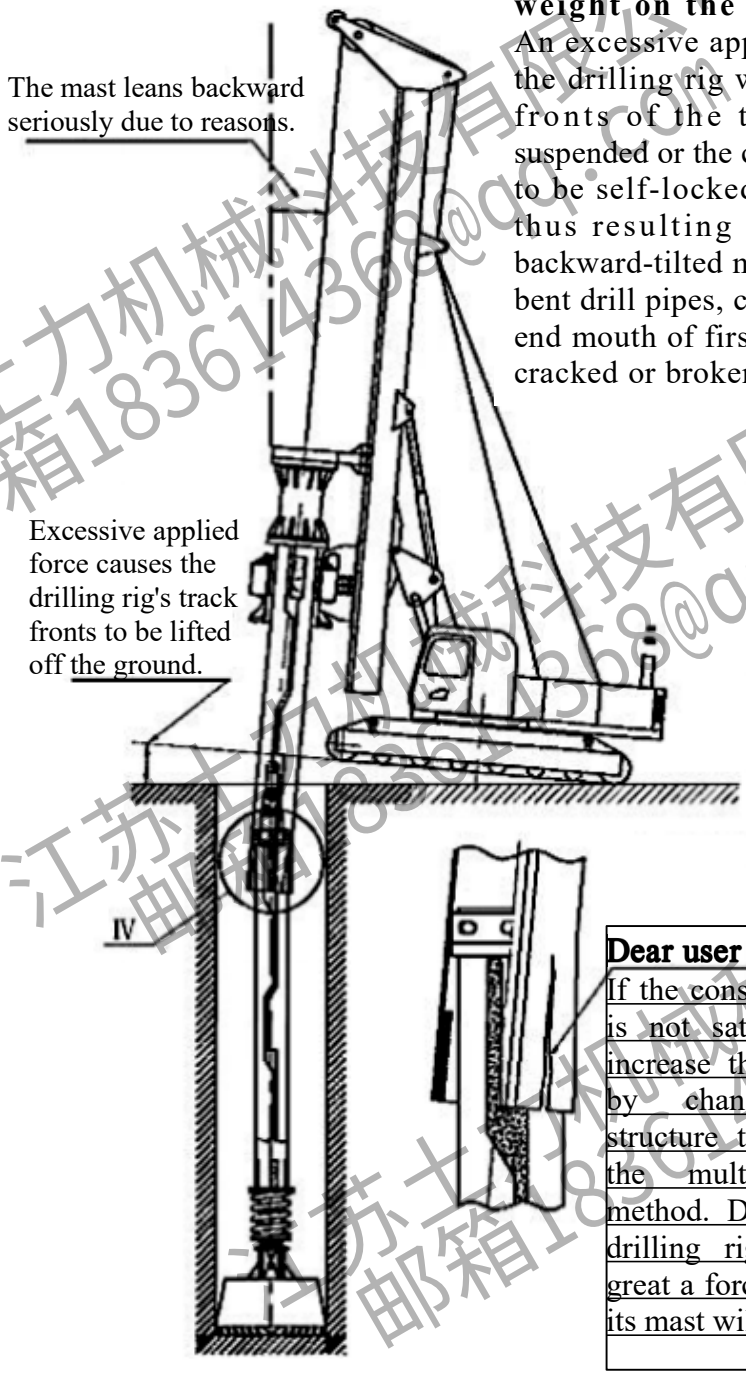
Third section's exterior driving key is bent and broken

Third section's body is bent and broken

**※Pay attention to the condition of the hole ※**
**※Do not apply an excessive force when the hole is slanted ※**

# Failures Caused by Abnormal Operations(12)

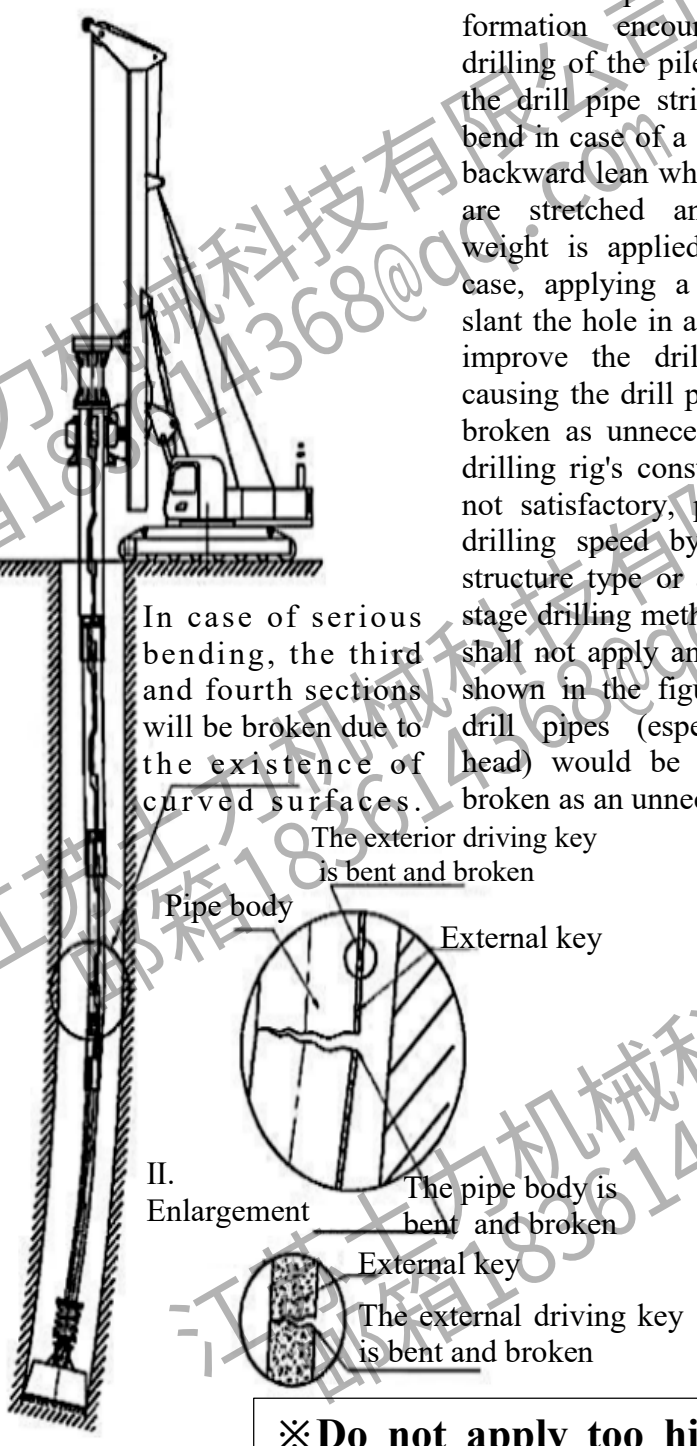
**Do not apply too heavy a weight on the drilling rig**
An excessive applied force of the drilling rig will cause the fronts of the tracks to be suspended or the cylinder to fail to be self-locked and retract, thus resulting in seriously backward-tilted mast, seriously bent drill pipes, cracked lower-end mouth of first section, and cracked or broken pipe bodies.




**Dear user friends:**
If the construction progress is not satisfactory, please increase the drilling speed by changing the bit structure type or adopting the multi-stage drilling method. Do not cause the drilling rig to apply too great a force, and otherwise its mast will lean backward.

**※Do not cause the drilling rig to apply too great a force, and otherwise its mast will lean backward ※**

# Failures Caused by Abnormal Operations(13)

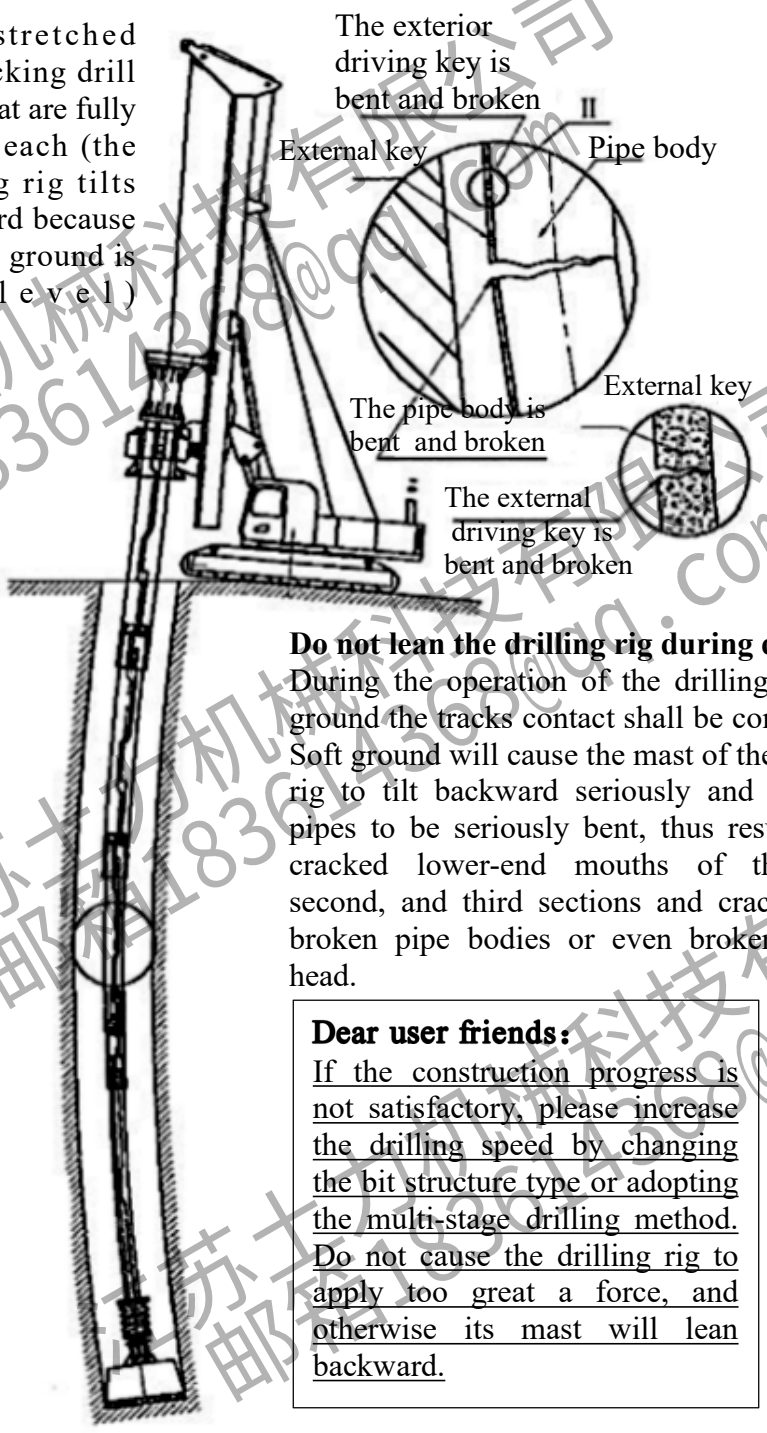



When a deep hole is drilled and the formation encountered during the drilling of the pile hole is very hard, the drill pipe string is very easy to bend in case of a slight inclination or backward lean when most of its pipes are stretched and a considerable weight is applied on them. In this case, applying a greater force will slant the hole in addition to failure to improve the drilling footage, thus causing the drill pipes to be bent and broken as unnecessary losses. If the drilling rig's construction progress is not satisfactory, please increase the drilling speed by changing the bit structure type or adopting the multi-stage drilling method. The drilling rig shall not apply an excessive force as shown in the figure. Otherwise, the drill pipes (especially the square head) would be seriously bent and broken as an unnecessary loss.

**※Do not apply too high a weight on the drill pipes when drilling a deep hole in a hard rock formation, and otherwise, serious drill pipe bending may occur※**

# Failures Caused by Abnormal Operations(14)

Fully stretched interlocking drill pipes that are fully locked each (the drilling rig tilts backward because the rear ground is not level)

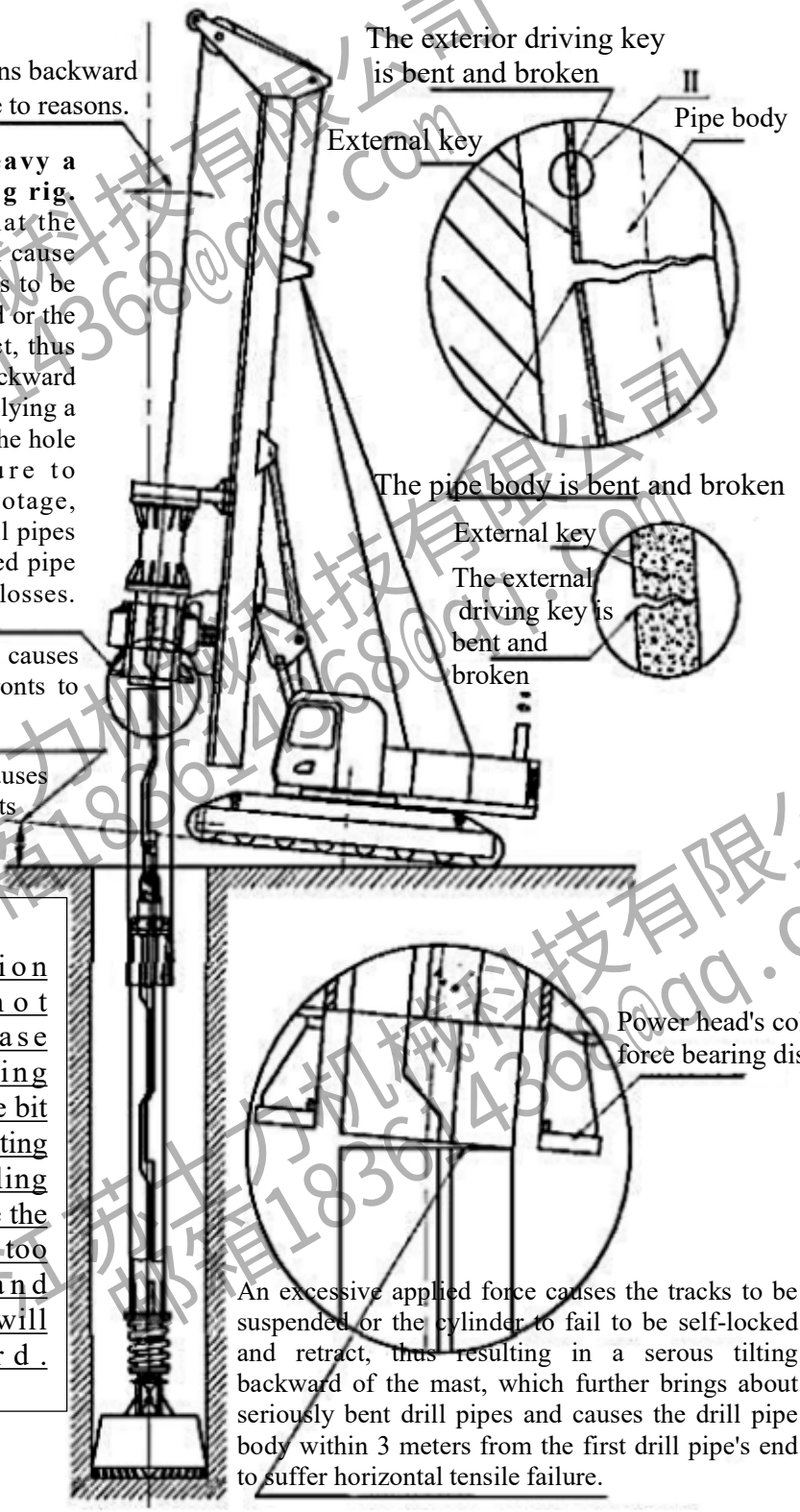



**Do not lean the drilling rig during drilling.** During the operation of the drilling rig, the ground the tracks contact shall be compacted. Soft ground will cause the mast of the drilling rig to tilt backward seriously and the drill pipes to be seriously bent, thus resulting in cracked lower-end mouths of the first, second, and third sections and cracked and broken pipe bodies or even broken square head.

**Dear user friends:**
If the construction progress is not satisfactory, please increase the drilling speed by changing the bit structure type or adopting the multi-stage drilling method. Do not cause the drilling rig to apply too great a force, and otherwise its mast will lean backward.

**※Do not apply too high a weight on the drill pipes when drilling a deep hole in a hard rock formation, and otherwise, serious drill pipe bending may occur※**

# Failures Caused by Abnormal Operations(15)




**Do not apply too heavy a weight on the drilling rig.** An excessive force that the drilling rig applies will cause the fronts of the tracks to be suspended off the ground or the cylinder to fail to retract, thus causing the mast to tilt backward seriously. In this case,applying a greater force will slant the hole in addition to failure to improve the drilling footage, thus resulting in bent drill pipes and key bars and cracked pipe bodies as unnecessary losses.

**Dear user friends:**

If the construction progress is not satisfactory, please increase the drilling speed by changing the bit structure type or adopting the multi-stage drilling method. Do not cause the drilling rig to apply too great a force, and otherwise its mast will lean backward.

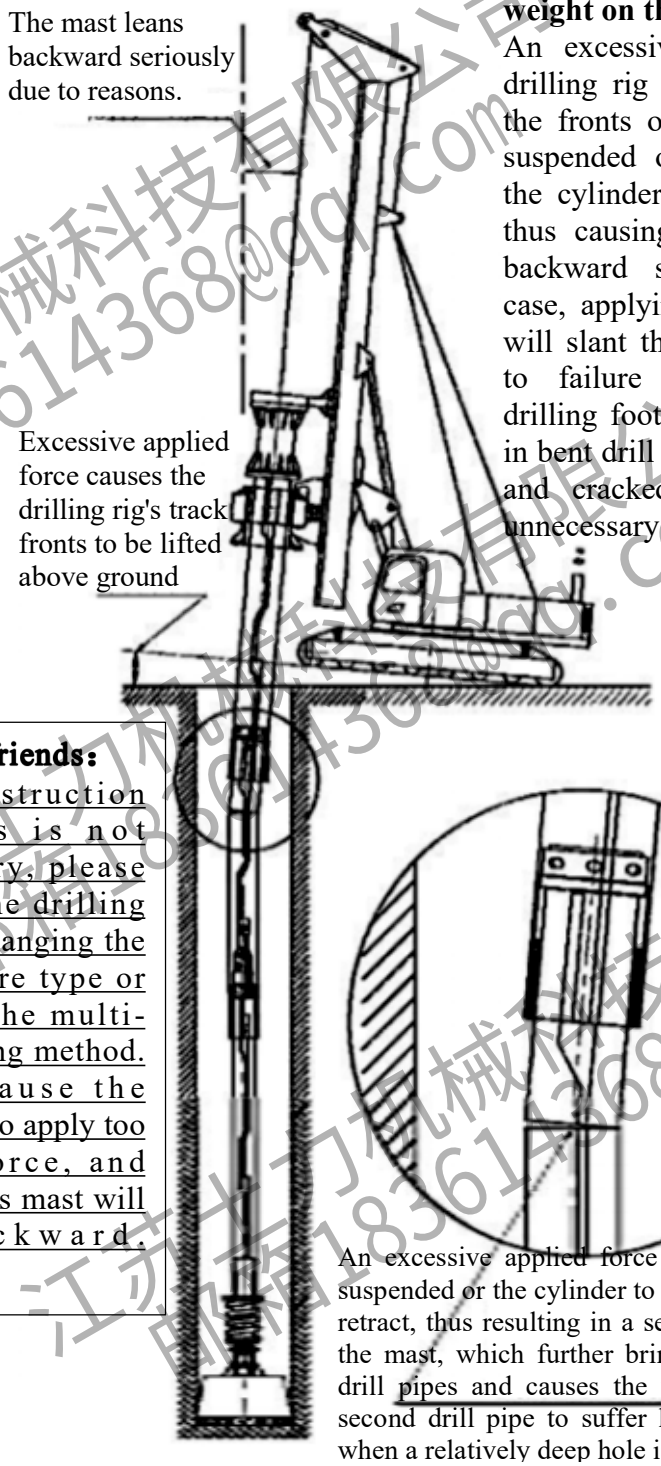
An excessive applied force causes the tracks to be suspended or the cylinder to fail to be self-locked and retract, thus resulting in a serous tilting backward of the mast, which further brings about seriously bent drill pipes and causes the drill pipe body within 3 meters from the first drill pipe's end to suffer horizontal tensile failure.

**※Do not apply an excessive force※**

# Failures Caused by Abnormal Operations(16)

**Do not apply too heavy a weight on the drilling rig.**

An excessive force that the drilling rig applies will cause the fronts of the tracks to be suspended off the ground or the cylinder to fail to retract, thus causing the mast to tilt backward seriously. In this case, applying a greater force will slant the hole in addition to failure to improve the drilling footage, thus resulting in bent drill pipes and key bars and cracked pipe bodies as unnecessary losses.




**Dear user friends:**

If the construction progress is not satisfactory, please increase the drilling speed by changing the bit structure type or adopting the multi-stage drilling method. Do not cause the drilling rig to apply too great a force, and otherwise its mast will lean backward.



An excessive applied force causes the tracks to be suspended or the cylinder to fail to be self-locked and retract, thus resulting in a serous tilting backward of the mast, which further brings about seriously bent drill pipes and causes the upper pipe body of the second drill pipe to suffer horizontal tensile failure when a relatively deep hole is drilled.

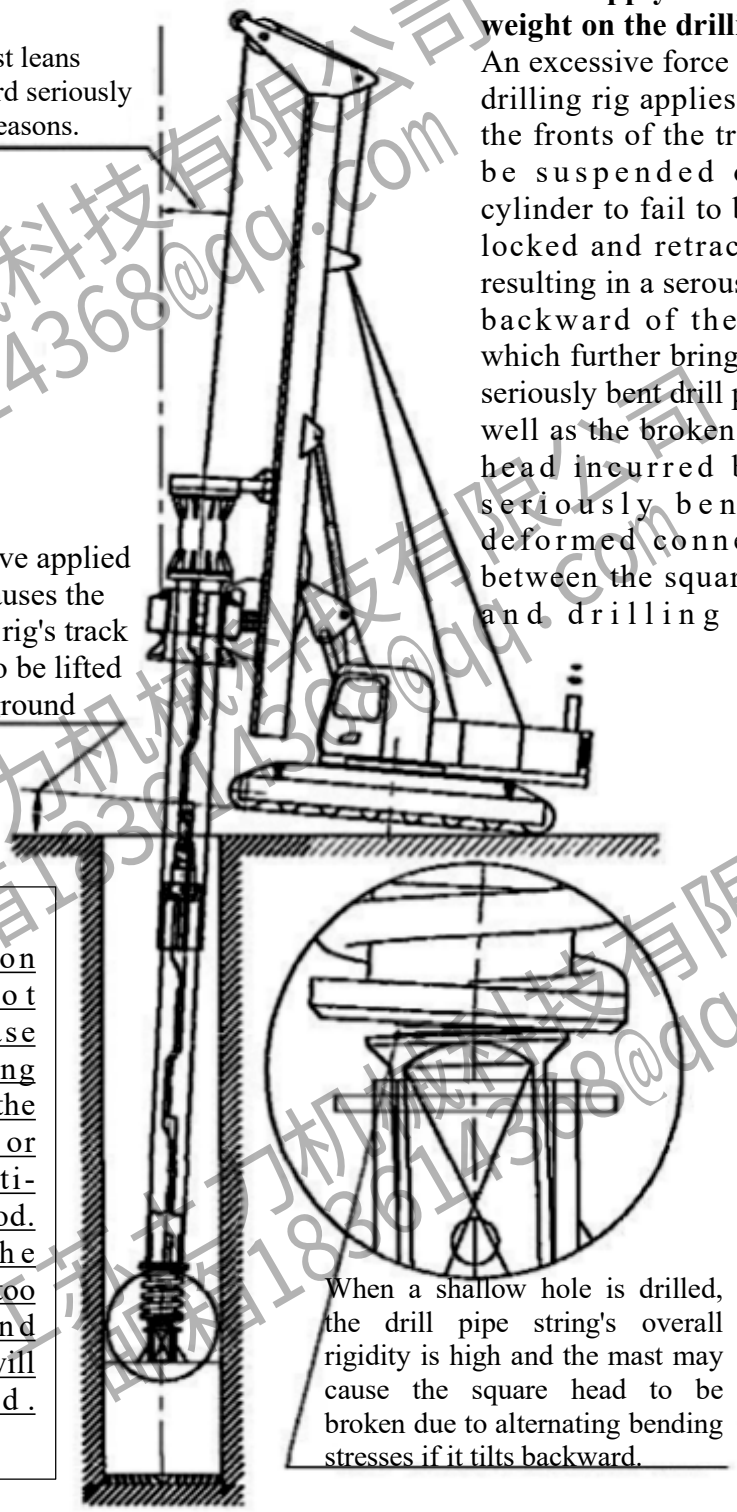
**※Do not apply too high a force to the drilling rig, and otherwise its mast will lean backward※**

# Failures Caused by Abnormal Operations(17)

The mast leans backward seriously due to reasons.

Excessive applied force causes the drilling rig's track fronts to be lifted above ground

**Do not apply too heavy a weight on the drilling rig.** An excessive force that the drilling rig applies causes the fronts of the tracks to be suspended or the cylinder to fail to be self-locked and retract, thus resulting in a serous tilting backward of the mast, which further brings about seriously bent drill pipes as well as the broken square head incurred by the seriously bent and deformed connection between the square head and drilling tool.



**Dear user friends:**
If the construction progress is not satisfactory, please increase the drilling speed by changing the bit structure type or adopting the multi-stage drilling method. Do not cause the drilling rig to apply too great a force, and otherwise its mast will lean backward.

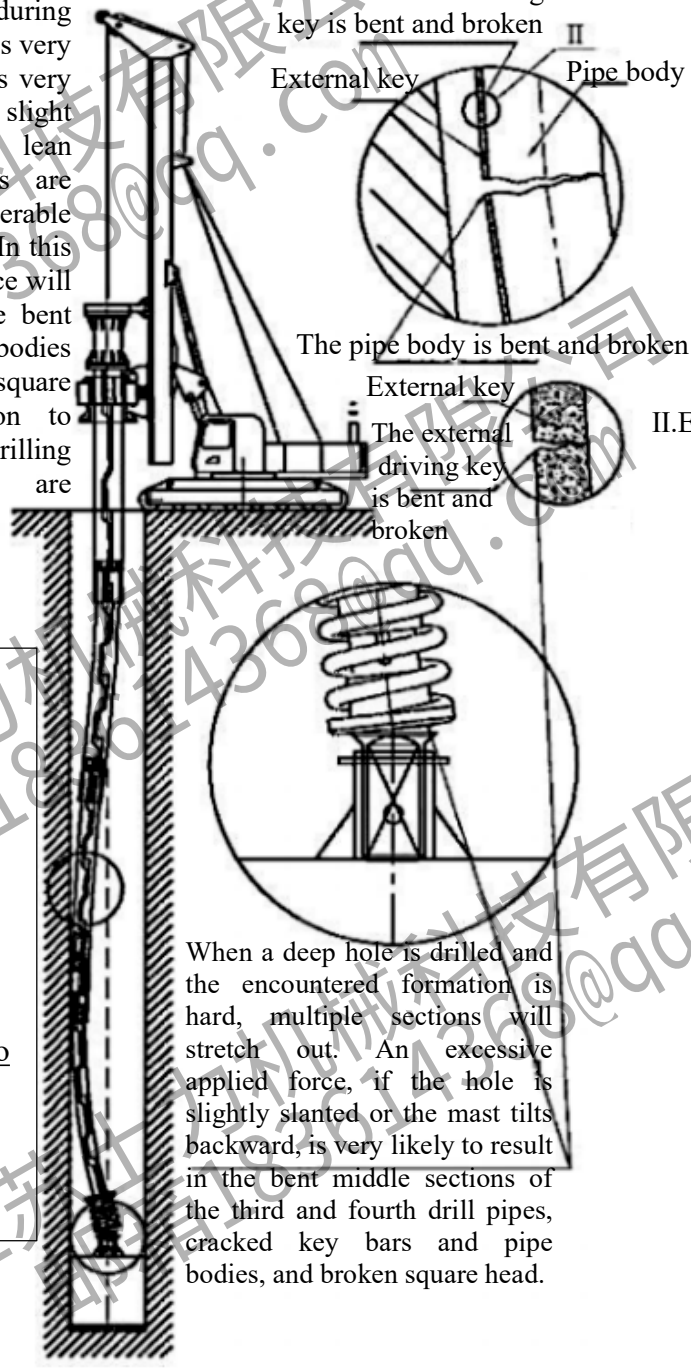
When a shallow hole is drilled, the drill pipe string's overall rigidity is high and the mast may cause the square head to be broken due to alternating bending stresses if it tilts backward.

**※Do not apply too high a force to the drilling rig, and otherwise its mast will lean backward※**

# Failures Caused by Abnormal Operations(18)

**Do not apply too heavy a weight on the drilling rig.**

When a deep hole is drilled and the formation encountered during the drilling of the pile hole is very hard, the drill pipe string is very easy to bend in case of a slight inclination or backward lean when most of its pipes are stretched and a considerable weight is applied on them. In this case, applying a greater force will cause the drill pipes to be bent and the key bars and pipe bodies to be cracked (esp. the square head section) in addition to failure to improve the drilling footage. All of these are unnecessary losses.




**Dear user friends:**

If the construction progress is not satisfactory, please increase the drilling speed by changing the bit structure type or adopting the multi-stage drilling method. Do not cause the drilling rig to apply too great a force, and otherwise its mast will lean backward.

When a deep hole is drilled and the encountered formation is hard, multiple sections will stretch out. An excessive applied force, if the hole is slightly slanted or the mast tilts backward, is very likely to result in the bent middle sections of the third and fourth drill pipes, cracked key bars and pipe bodies, and broken square head.

**※Do not apply any force. Otherwise, the drill pipes would be seriously bent. ※**

# Failures Caused by Abnormal Operations(19)

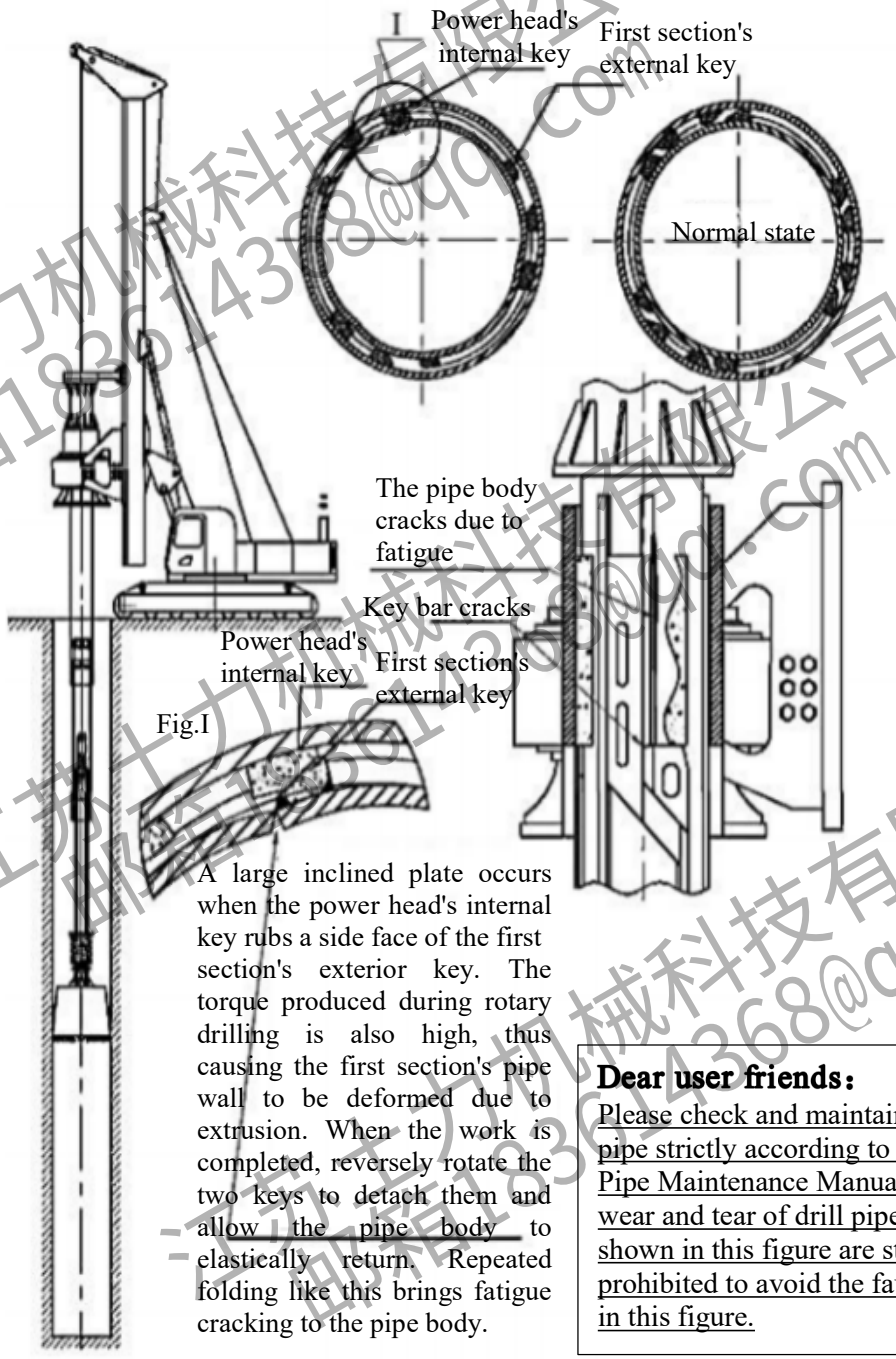



Fig.I

A large inclined plate occurs when the power head's internal key rubs a side face of the first section's exterior key. The torque produced during rotary drilling is also high, thus causing the first section's pipe wall to be deformed due to extrusion. When the work is completed, reversely rotate the two keys to detach them and allow the pipe body to elastically return. Repeated folding like this brings fatigue cracking to the pipe body.

**Dear user friends:**

Please check and maintain drill pipe strictly according to the Drill Pipe Maintenance Manual. Severe wear and tear of drill pipe as shown in this figure are strictly prohibited to avoid the faults listed in this figure.

**※Carry out timely inspections and maintenance according to the manual. Excessive wear shall be prohibited※**

# Failures Caused by Abnormal Operations(20)

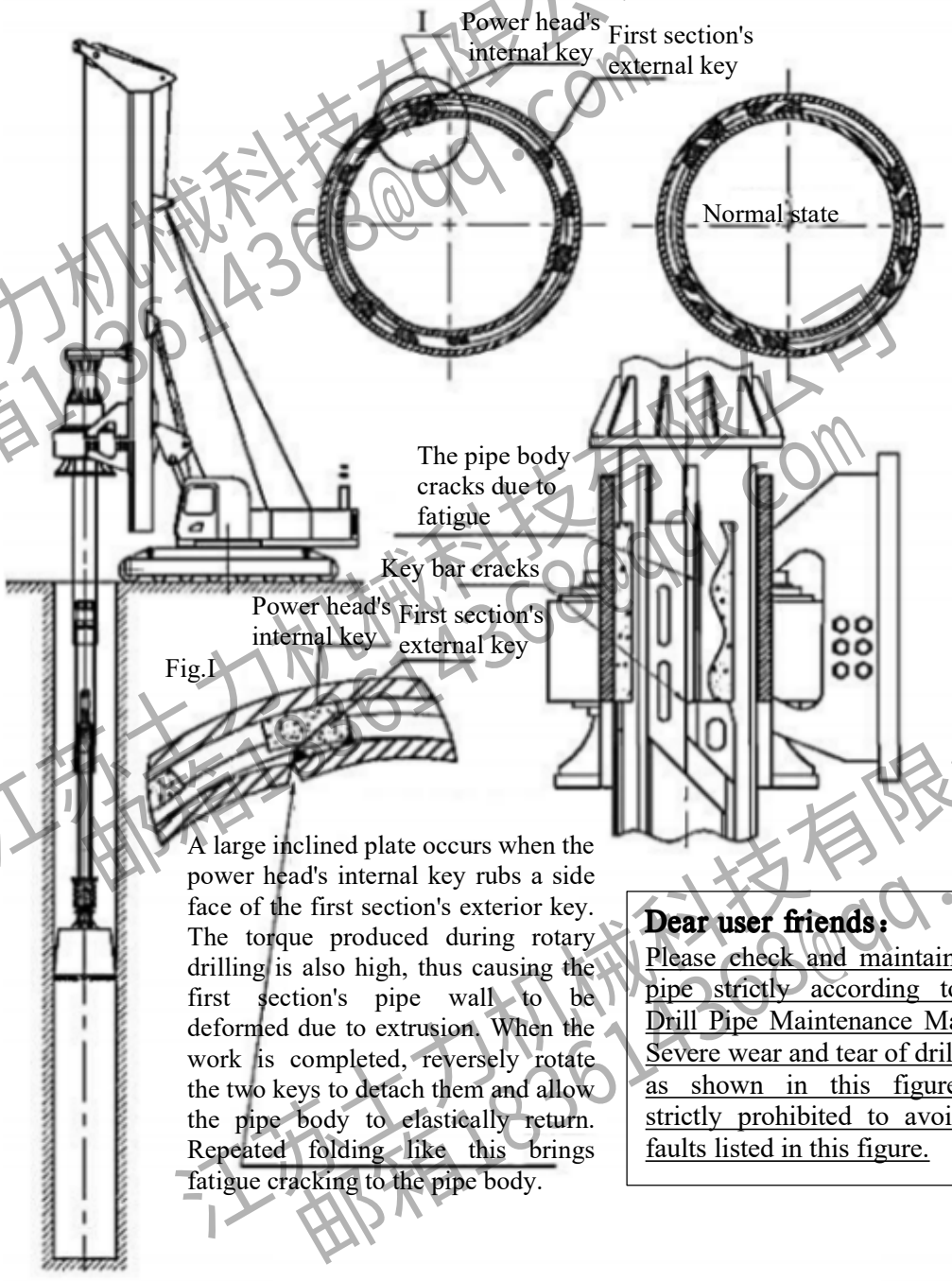



Fig.I

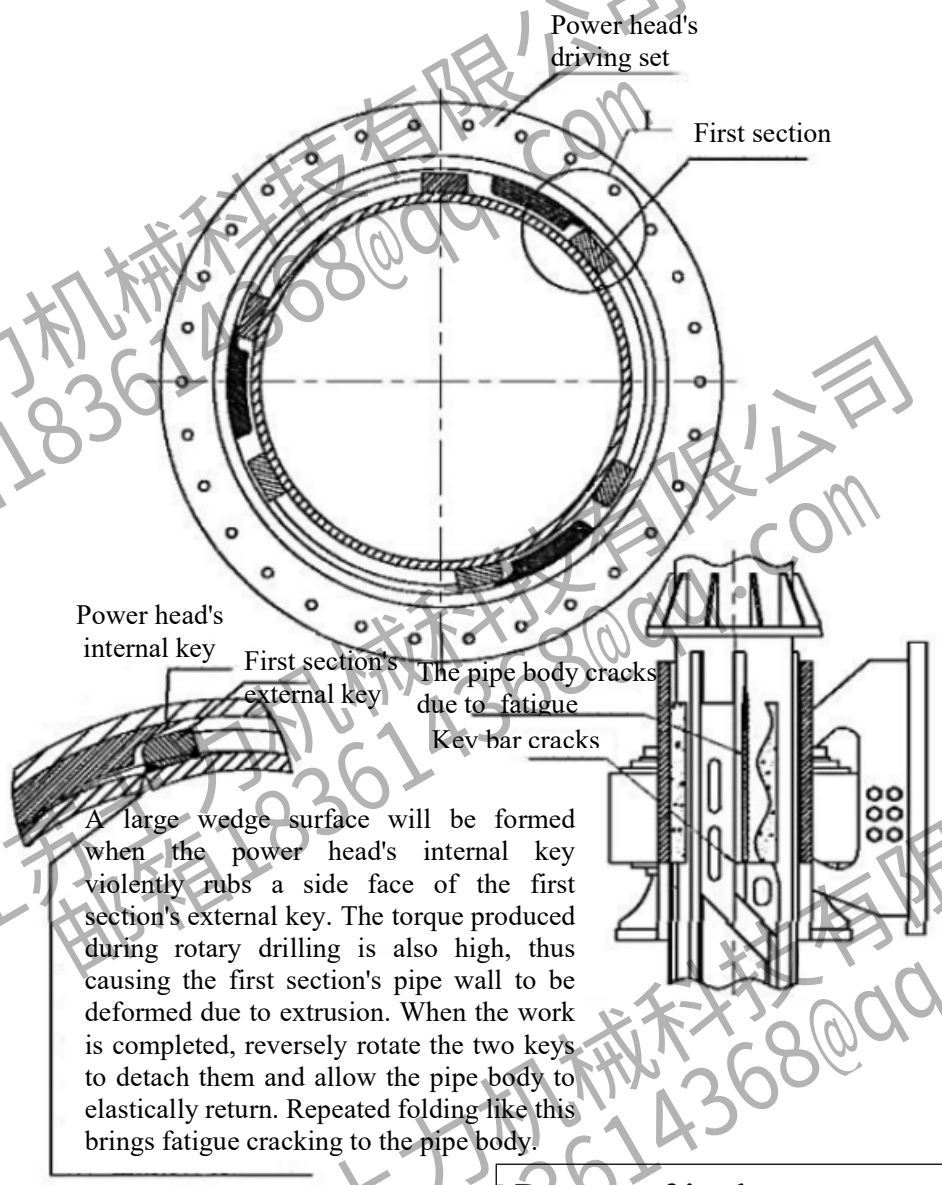
A large inclined plate occurs when the power head's internal key rubs a side face of the first section's exterior key. The torque produced during rotary drilling is also high, thus causing the first section's pipe wall to be deformed due to extrusion. When the work is completed, reversely rotate the two keys to detach them and allow the pipe body to elastically return. Repeated folding like this brings fatigue cracking to the pipe body.

**Dear user friends:**

Please check and maintain drill pipe strictly according to the Drill Pipe Maintenance Manual. Severe wear and tear of drill pipe as shown in this figure are strictly prohibited to avoid the faults listed in this figure.

**※Carry out timely inspections and maintenance according to the manual. Excessive wear shall be prohibited ※**

# Failures Caused by Abnormal Operations(21)



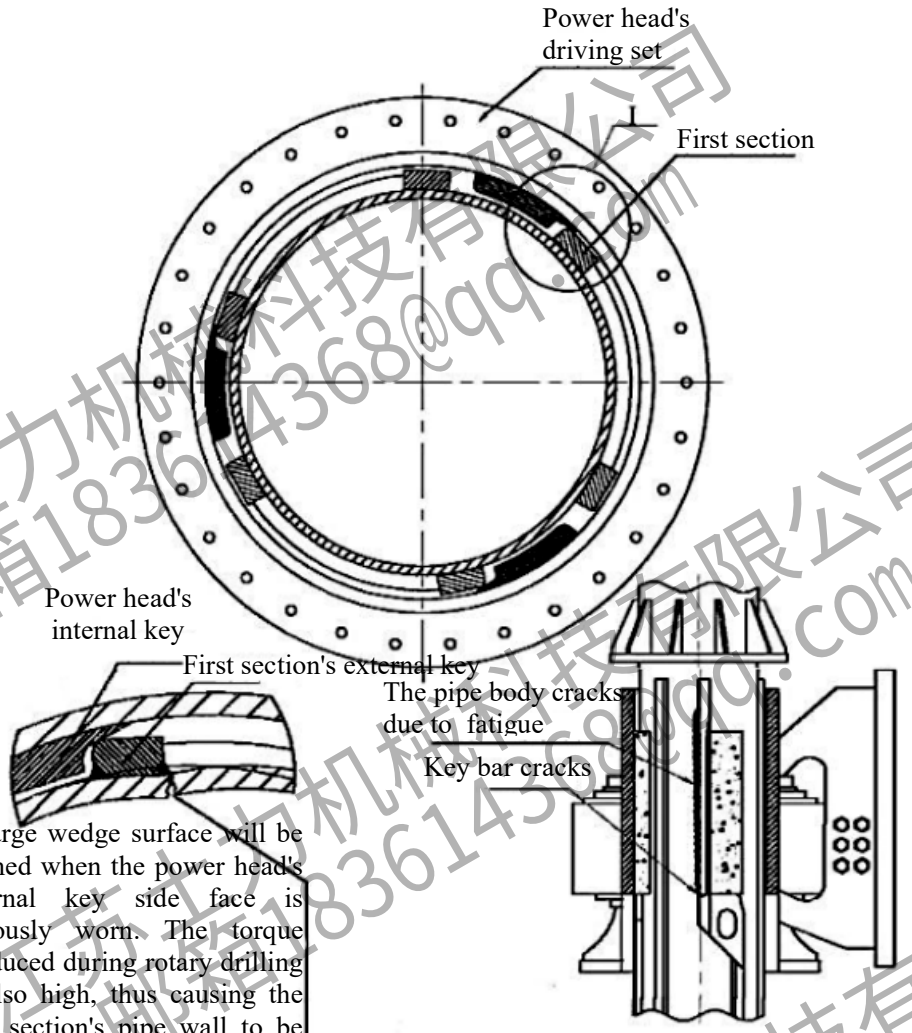

A large wedge surface will be formed when the power head's internal key violently rubs a side face of the first section's external key. The torque produced during rotary drilling is also high, thus causing the first section's pipe wall to be deformed due to extrusion. When the work is completed, reversely rotate the two keys to detach them and allow the pipe body to elastically return. Repeated folding like this brings fatigue cracking to the pipe body.

**Dear user friends:**

Please check and maintain drill pipe strictly according to the Drill Pipe Maintenance Manual. Severe wear and tear of drill pipe as shown in this figure are strictly prohibited to avoid the faults listed in this figure.

**※Carry out timely inspections and maintenance according to the manual. Excessive wear shall be prohibited※**

# Failures Caused by Abnormal Operations(22)




A large wedge surface will be formed when the power head's internal key side face is seriously worn. The torque produced during rotary drilling is also high, thus causing the first section's pipe wall to be deformed due to extrusion. When the work is completed, reversely rotate the two keys to detach them and allow the pipe body to elastically return. Repeated folding like this brings fatigue cracking to the pipe body.

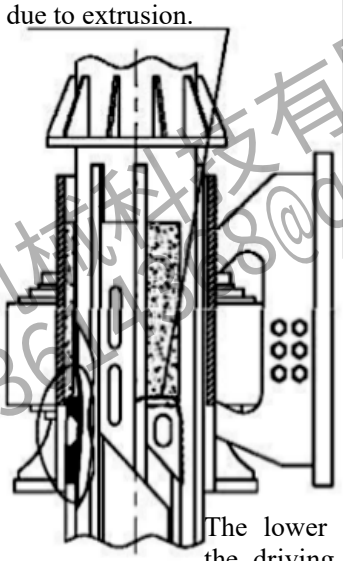
**Dear user friends:**
Please check and maintain drill pipe strictly according to the Drill Pipe Maintenance Manual. Severe wear and tear of drill pipe as shown in this figure are strictly prohibited to avoid the faults listed in this figure.

**※Carry out timely inspections and maintenance according to the manual. Excessive wear shall be prohibited※**

# Failures Caused by Abnormal Operations(23)

The pipe body has been fatigue-cracked due to extrusion.

**Dear user friends:**
Please check and maintain drill pipe strictly according to the Drill Pipe Maintenance Manual. Severe wear and tear of drill pipe as shown in this figure are strictly prohibited to avoid the faults listed in this figure.



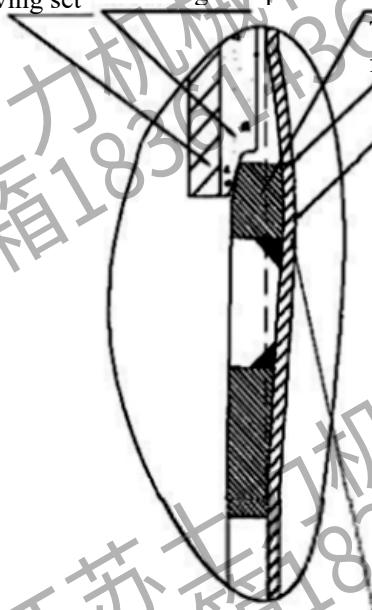
The lower end of the driving key is seriously worn into a wedge shape

Power head's driving set

Force-applying block

The pipe body has been fatigue-cracked due to extrusion

The first section's pipe body has collapsed due to squeeze.



A large wedge surface will be formed when the power head's internal key lower force-applying face is seriously worn. During the force-applied drilling process, the wedging effect will cause the internal key of the power head to overlap the force-applying block of the first section so that the pipe body will collapse inward due to squeeze as shown in the figure. When the work is finished, the two keys are detached from each other and the pipe body is elastically returned. In case of repeated folding like this, the pipe body and key bar near the force-applying block will suffer fatigue cracking. More seriously, an excessive applied force will stick the driving set and drill pipe, which cannot be freed.

**※Carry out timely inspections and maintenance according to the manual. Excessive wear shall be prohibited※**

# Ⅷ. Custom drill pipe parameter measurement diagram

## 8.1 Drive stub selection parameters

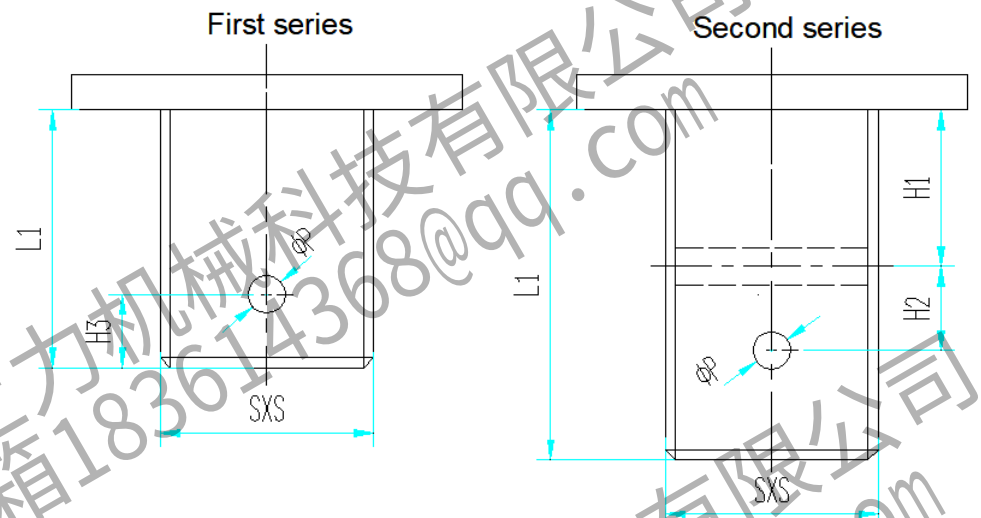



Figure 8-1 drive stub diagram

Table8-1-1 Drive stub type（See figure8-1） Unit：millimeter

| Drive stub type | 100 square | 130 square | 150 square | 200 square | 250 square | 300 square | 400 square |
|---|---|---|---|---|---|---|---|
| Drive stub size (SxS) | 110x110 | 130x130 | 150x150 | 200x200 | 250x250 | 300x300 | 400x400 |
| Pin number | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| Pin size ϕP | 40 | 40 | 50 | 62 | 62 | 72 | 82 |
| H1 | | | | 290 | 290 | 290 | 290 |
| H2 | | | | 100 | 100 | 150 | 150 |
| H3 | 130 | 130 | 130 | | | | |
| L1 | 300 | 300 | 300 | 480 | 480 | 600 | 600 |
| First series | √ | | √ | √ | √ | √ | √ |
| Second series | | √ | | | | | |
| Note: "√" indicates the recommended type. | | | | | | | |

## 8.2 Kelly eye selection parameters

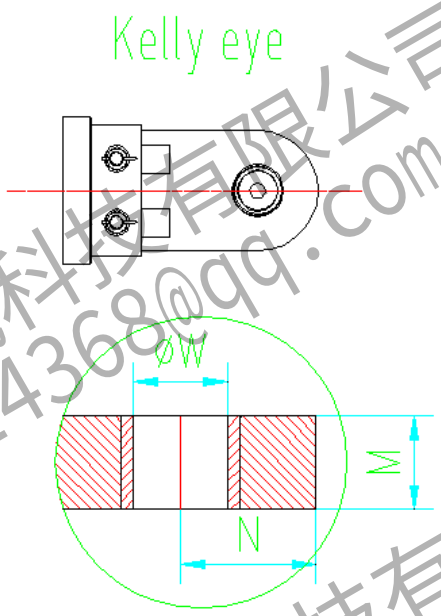
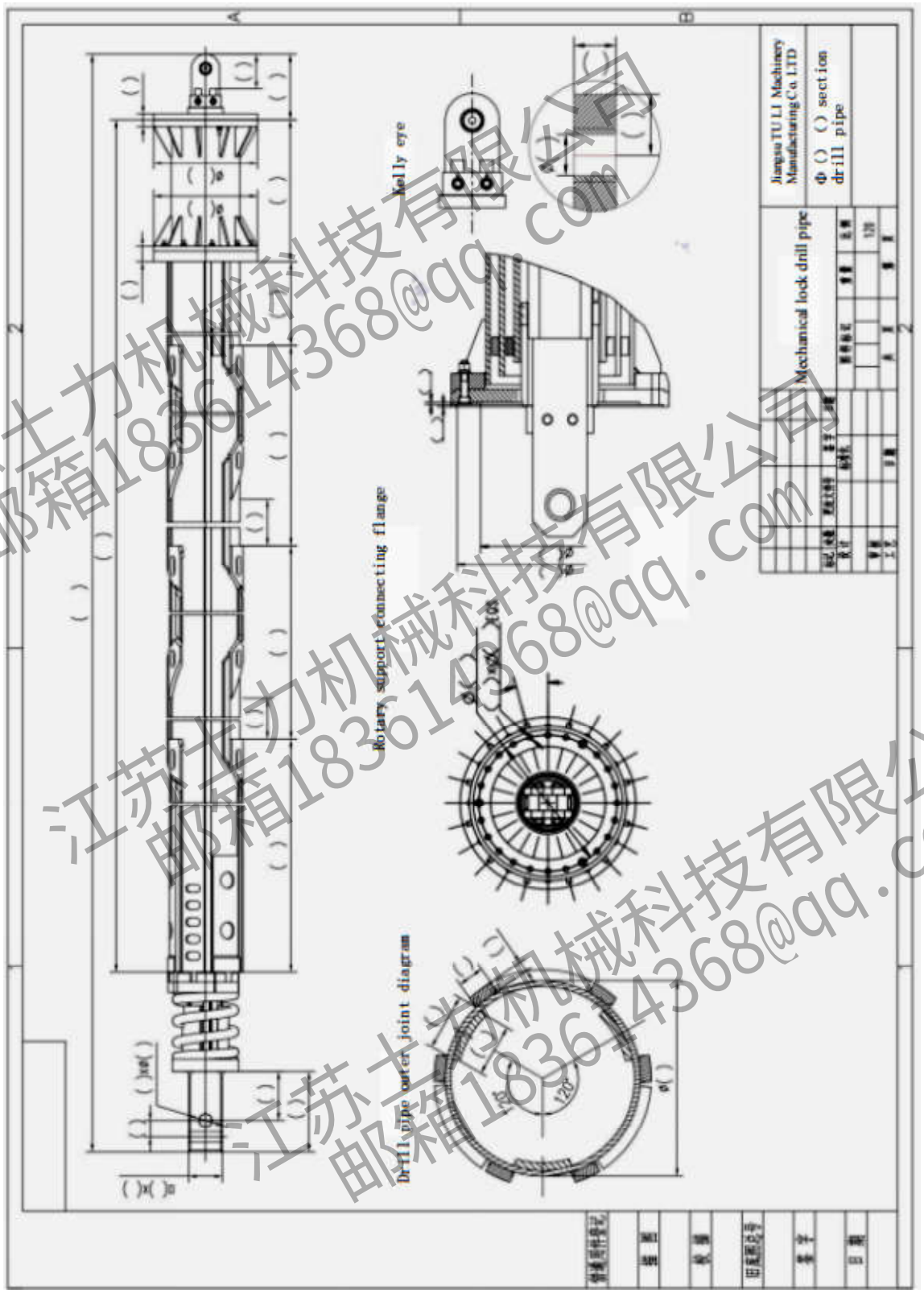



Figure 8-2 kelly eye diagram

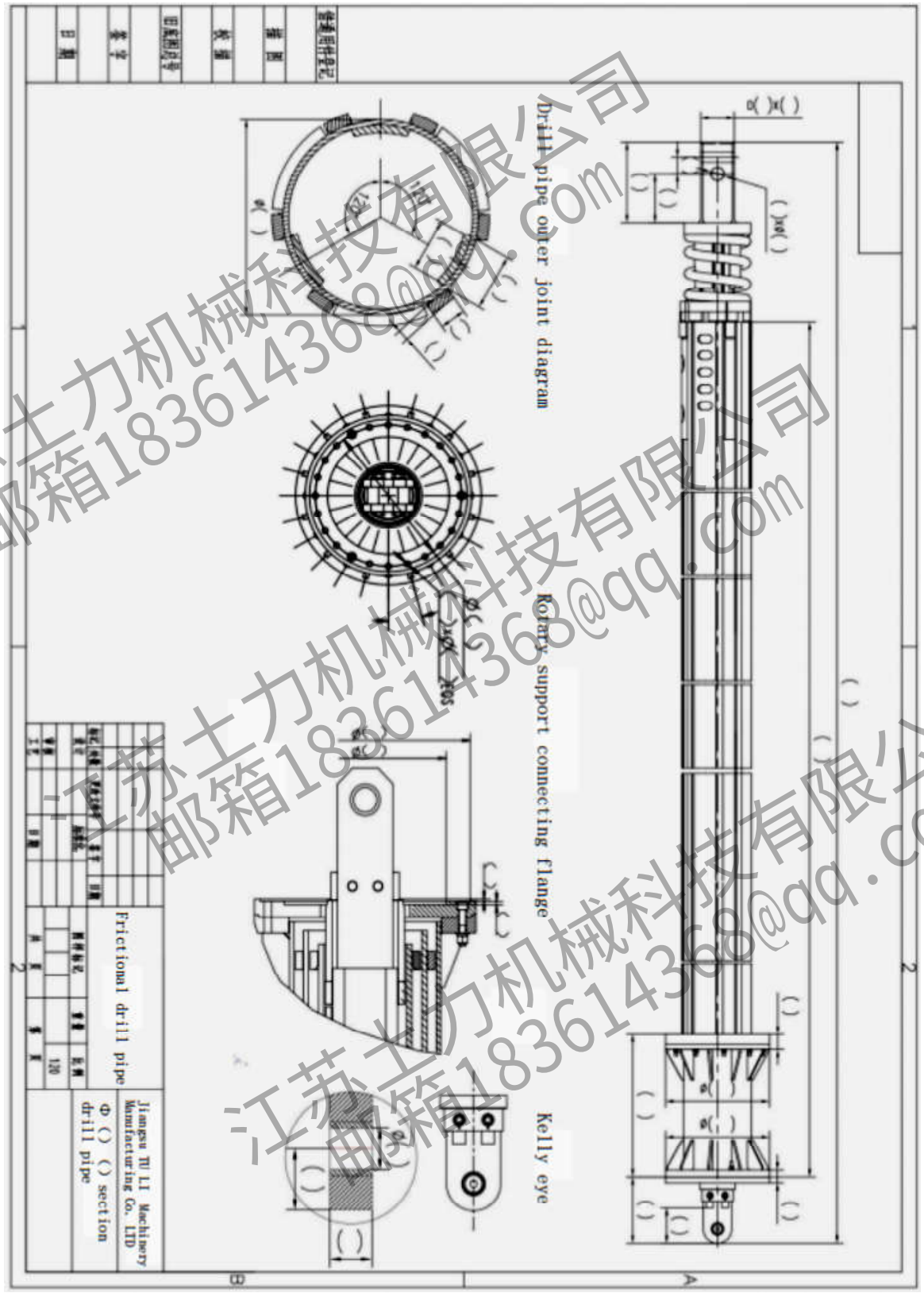
Table8-2-2 Kelly eye（See figure8-2） Unit：millimeter

| Kelly eye type | 40 | 50 | 55 | 60 | 70 | 80 | 100 | 110 | 130 |
|---|---|---|---|---|---|---|---|---|---|
| Kelly eye pin size<br>ϕ W | ϕ 40 | ϕ 50 | ϕ 55 | ϕ 60 | ϕ 70 | ϕ 80 | ϕ 100 | ϕ 110 | ϕ 130 |
| Kelly eye thickness<br>M | 40 | 50 | 55 | 60 | 70 | 80 | 100 | 110 | 130 |
| First series | √ | | √ | √ | √ | | √ | √ | |
| Second series | | √ | | √ | | | √ | | |
| Note: "√" indicates the recommended type. | | | | | | | | | |

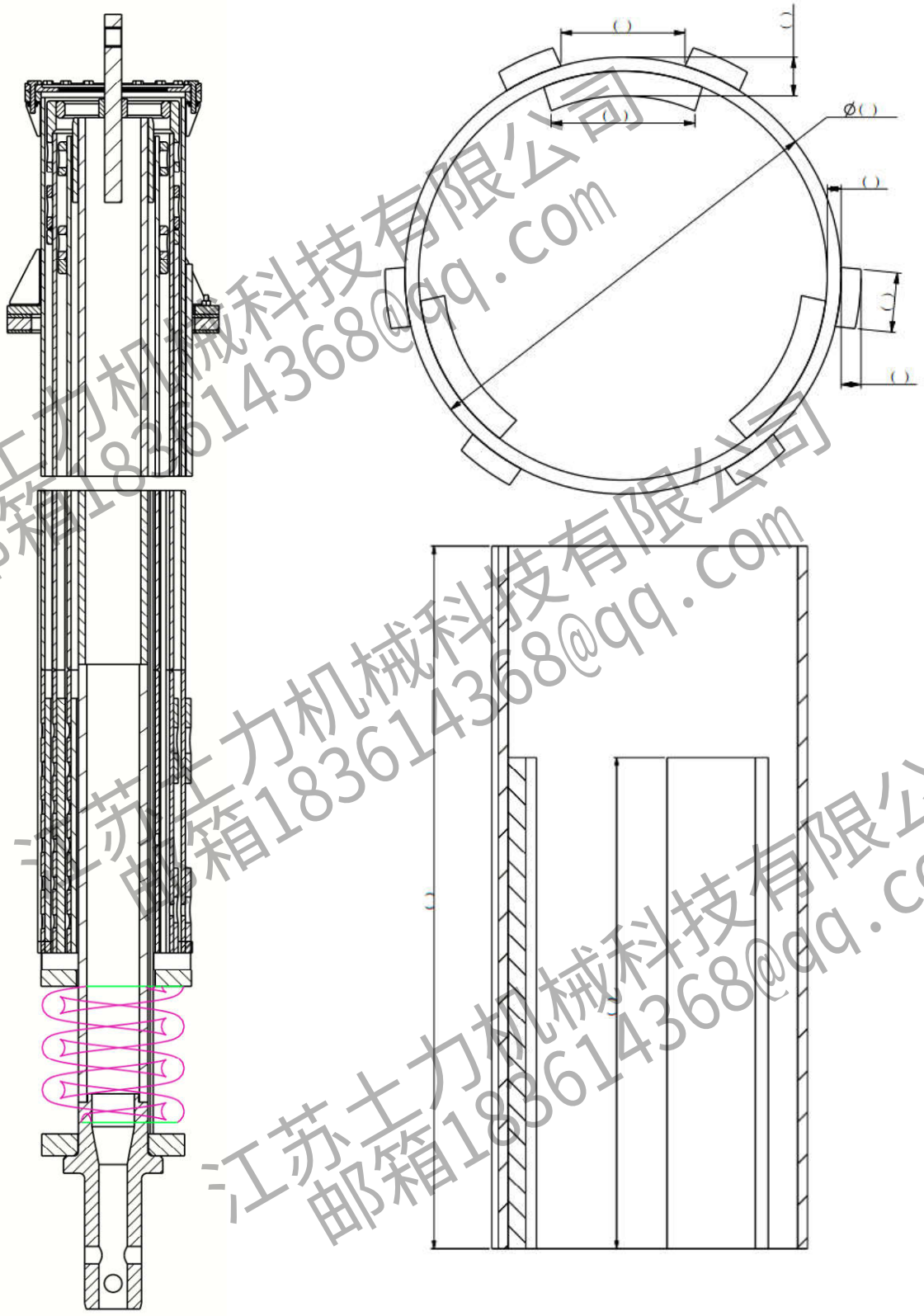
## 8.3 Mechanical lock drill pipe parameter



## 8.4 Frictional drill pipe parameter



## 8.5 Drill pipe terminal parameters

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