ICS 73.020
E 12
备案号：48169—2015

SY

中华人民共和国石油天然气行业标准

SY/T 5361—2014
中文/English
代替 SY/T 5361—2007

电缆测井仪器打捞技术规范

Technical specifications for fishing operation of wireline logging tool

2014－10－15 发布　　2015－03－01 实施

国家能源局　　发布

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前　言

本标准按照 GB/T 1.1—2009《标准化工作导则　第 1 部分：标准的结构和编写》给出的规则起草。

本标准代替 SY/T 5361—2007《测井电缆穿心打捞操作规程》。本标准与 SY/T 5361—2007 相比，除编辑性修改外，主要技术变化如下：

——将标准名称修改为《电缆测井仪器打捞技术规范》；

——修改了“范围”（见第 1 章，2007 年版的第 1 章）；

——增加了“反穿心打捞方法”、“非穿心打捞方法”、“电缆额定张力”等术语和定义（见 3.2，3.3 和 3.6）；

——将“电缆断裂强度”修改为“电缆破断拉力”（见 3.4，2007 年版的 3.2）；

——修改了信息资料收集（见 4.1，2007 年版的 4.3）；

——修改了打捞方式（见 4.2，2007 年版的 4.1）；

——打捞方式增加了“反穿心打捞方式”（见 4.2.2）；

——增加了“非穿心打捞方式”（见 4.2.3）；

——将“打捞工具及设备”修改为“打捞设备和工具选取”（见 4.3；2007 年版的 5.1～5.4 和 6.1）；

——修改了现场协调会（见 5.1；2007 年版的 4.2，4.4 和 4.5）；

——将“打捞筒的组装”修改为“打捞工具组装和检查”（见 5.2，2007 年版的 6.2）；

——修改了穿心打捞操作程序（见 6.1，2007 年版的 6.3～6.6 和 7.1～7.6）；

——增加了反穿心打捞操作程序（见 6.2 和附录 D）；

——增加了裸眼井、套管井非穿心打捞操作程序（见 6.3、附录 E 和附录 F）；

——修改了异常情况处理（见 7.1，2007 年版的第 8 章）；

——增加了风险控制（见 7.2）；

——删除了测井电缆弱点拉断力的规定（见 2007 年版的附录 A）；

——增加了使用马丁代克深度直接读取测定卡点深度方法（见 A.2）；

——增加了打捞工具选取推荐做法（见 B.1）。

本标准由石油工业标准化技术委员会石油测井专业标准化委员会（CPSC/TC11）提出并归口。

本标准起草单位：大庆钻探工程公司测井公司、中国石油集团测井有限公司、中石化中原石油工程有限公司地球物理测井公司。

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本标准英文版翻译人：丁柱、赵平。

本标准代替了 SY/T 5361—2007。

SY/T 5361—2007 的历次版本发布情况为：

——SY 5361—1989，SY/T 5361—1995。

本标准以中文和英语两种文字出版。当中文和英语两种版本有歧义时，以中文版为主。

电缆测井仪器打捞技术规范

1 范围

本标准规定了测井电缆及下井仪器的打捞方案设计、打捞设备和工具的选取、打捞前准备、打捞操作程序、异常情况处理和风险控制。

本标准适用于电缆测井仪器打捞的施工作业，其他打捞作业可参照使用。

2 规范性引用文件

下列文件对于本文件的应用是必不可少的。凡是注日期的引用文件，仅注日期的版本适用于本文件。凡是不注日期的引用文件，其最新版本（包括所有的修改单）适用于本文件。

SY 5131 石油放射性测井辐射防护安全规程

SY 5974 钻井井场、设备、作业安全技术规程

3 术语和定义

下列术语和定义适用于本文件。

3.1

穿心打捞方法 cut-and-thread fishing method

在井口附近，切断测井电缆，贯穿打捞工具，实施井下电缆和仪器解卡的方法。

3.2

反穿心打捞方法 anti-cut-and-thread fishing method

为了预防穿心捞获的仪器在上提钻具过程中再次遇卡落井，而采用不拉断电缆的方式，上提钻具和仪器，实施井下电缆和仪器解卡的方法。

3.3

非穿心打捞方法 non-cut-and-thread fishing method

不采用穿心的方式，实施对井下电缆和仪器打捞的方法。

3.4

电缆破断拉力 cable breaking strength

使测井电缆产生断裂的额定拉力。

3.5

电缆弱点拉断力 cable weak-point breaking strength

使测井电缆弱点部位产生断裂的额定拉力。

3.6

电缆额定张力 rated tension of cable

测井电缆允许使用的最大拉力。

3.7

正常测井电缆张力 normal logging cable tension

在正常测井状态下的电缆张力（以下简称正常张力）。

3.8

最大安全拉力　maximum security tension

绞车上提电缆时，允许使用的最大拉力。

注：最大安全拉力的规定见 6.1.1.1。

4　打捞方案

4.1　信息资料收集

4.1.1　测井队应提供的信息：

a）　测井遇卡过程描述及处理信息。

b）　电缆连接器、下井仪器、射孔枪或其他落物的型号、规格、几何尺寸，是否装有扶正器或其他测井辅助装置，是否装有放射性源等。

c）　对判断井身结构及卡点有帮助的测井资料。

d）　测井电缆规格型号、新旧程度、中间是否有电缆接头、长度和电缆额定张力。

e）　下井仪器、射孔枪、电缆等卡点深度；下井仪器等落物的落点深度。卡点深度测定方法见附录 A。

4.1.2　钻井队（作业队）应提供的信息：

a）　钻井过程井身情况的相关信息。

b）　井身结构示意图、钻井测斜数据。

c）　钻头尺寸、表层套管、技术套管规格及其下深情况。

d）　钻井液密度、黏度等数据。

e）　地层压力信息、产层信息。

f）　用于打捞的钻具或油管的规格型号及数据表。

4.2　打捞方式

4.2.1　穿心打捞

当测井电缆或下井仪器在井内遇卡时，绞车上提电缆，张力指示最大安全拉力，重复二至三次，若不能解卡，实施穿心打捞。

4.2.2　反穿心打捞

当完成穿心打捞后，为了预防捞获的仪器在上提钻具过程中再次遇卡落井，而采用不拉断电缆的方式，上提钻具和仪器，实施反穿心打捞。

4.2.3　非穿心打捞

在裸眼井测井、套管井测井、射孔或其他作业中，测井仪器、射孔枪或其他使用工具被卡或落井后，不具备或不需要采用穿心方式打捞，用钻杆或者油管实施打捞。

4.3　打捞设备和工具选取

4.3.1　打捞设备和工具

4.3.1.1　常用打捞工具类型及适用范围参见附录 B。

4.3.1.2　常用工具配备：

——“T”形卡钳；
——快速接头总成；
——“C”形卡盘；
——循环钻井液“C”形堵头；
——快速接头释放钳；
——加重杆；
——钻井液循环短节；
——电缆头制作工具及配件；
——钢丝绳；
——梅花扳手；
——管钳。

4.3.1.3 电缆张力系统：
——张力传感器；
——钻井指重表；
——拉力表。

4.3.1.4 绞车张力系统。

4.3.1.5 绞车通讯系统。

4.3.2 打捞设备和工具的选取

打捞工具的选取推荐做法参见 B.1。

5 打捞前准备

5.1 现场协调会

在实施打捞前，建设方应根据现场情况，组织由钻井监督、测井监督、钻井队（作业队）、测井队等相关方参加的现场协调会，内容应包括：

a) 打捞方案审定。
b) 打捞过程风险识别与控制。
c) 各岗位职责和分工如下：
——总协调：建设方负责打捞过程的总体协调；
——测井井口工：负责测井电缆快速接头的脱开、对接操作，使用标准手语指挥绞车工起、下电缆，监视天滑轮、测井电缆和游动滑车的运动状态，使用标准手语指挥司钻上提、下放钻具；
——绞车工：按照测井井口工的指挥起、下电缆，实时关注测井电缆的张力变化，发现异常情况，及时采取措施，并通知司钻和测井工程师；
——司钻：负责钻具操作，按照绞车工的异常情况提示及时处置，完成打捞工作；
——作业吊车工：负责作业吊车起、下操作，按照测井打捞工程师要求，完成打捞工作；
——内、外钳工：负责起下钻的常规操作；
——架子工：负责按照测井打捞工程师要求完成天滑轮的安装，将测井电缆快速接头投放到预下井的钻具水眼内，及起、下钻常规操作。
d) 打捞过程中，测井队、钻井队（作业队）如果出现人员倒班，上一班负责人应将相关信息传递给下一班。

5.2 打捞工具组装和检查

根据打捞方案所选择的工具进行组装和检查，具体方法参见附录 C。

6 打捞操作程序

6.1 穿心打捞操作程序

6.1.1 固定测井电缆

6.1.1.1 确定最大安全拉力，计算方法见公式（1）：

$$T = T_x + T_r \times 75\% \quad \cdots\cdots (1)$$

式中：

T——最大安全拉力，单位为千牛（kN）；

T_x——电缆悬重，单位为千牛（kN）；

T_r——电缆弱点拉断力，单位为千牛（kN）。

6.1.1.2 绞车上提电缆，直到电缆张力超过正常张力 5kN。

6.1.1.3 在转盘平面 0.1m～0.5m 以上，将“T”形卡钳安装在电缆上。

6.1.1.4 放松电缆，使“T”形卡钳坐于井口，检验“T”形卡钳紧固情况，观察 5min，固定位置无滑动显示，判断为电缆固定。

6.1.2 切断测井电缆

6.1.2.1 在转盘上方 1.5m～2.0m 处，确定电缆切断点，切断电缆。

6.1.2.2 将电缆剪断，并固定绞车端的电缆。

6.1.3 安装井口

6.1.3.1 安装天滑轮

6.1.3.1.1 安装天滑轮宜选在白天进行。安装期间，钻台上应无障碍物，钻台上应无人停留。

6.1.3.1.2 下放天滑轮，将天滑轮从游动滑车上卸掉。

6.1.3.1.3 用吊升装置将天滑轮提升到井架顶部前侧最高处，同时下放电缆，留出安装快速接头的余量。

6.1.3.1.4 用断裂强度大于八倍电缆拉断力的链条或钢丝绳、铁棒将天滑轮固定在井架顶部的横梁上，安装位置应尽量高，且尽量靠近井架前侧。

6.1.3.2 安装地滑轮

6.1.3.2.1 地滑轮安装位置应适当外移，地滑轮与井口之间的距离以不妨碍钻台上的起、下钻为宜。

6.1.3.2.2 连接井口电缆张力系统与绞车张力传感器，承重螺杆应安装固定销。用大于八倍电缆拉断力的链条或钢丝绳将张力传感器固定在钻机底座的横梁上。

6.1.4 安装快速接头

6.1.4.1 将井口端的电缆头套上绳帽盒后制作井口端电缆头。

6.1.4.2 在绳帽盒安装蘑菇头，组成测井电缆快速接头的公头（以下简称公头）。

6.1.4.3 在绞车端的电缆头上，套上导向头和绳帽盒，制作绞车端电缆头。

6.1.4.4 在绳帽盒上安装母头，组成测井电缆快速接头的母头（以下简称母头）。

6.1.4.5 在母头上方的电缆上安装加重杆。

6.1.5 检验测井电缆快速接头

6.1.5.1 系统检查测井电缆快速接头所有连接部位和固定部件，均应牢固可靠。

6.1.5.2 对接公头和母头。

6.1.5.3 绞车上提电缆至正常张力，校准井口张力表，使之与绞车面板上的指重表读数一致。

6.1.5.4 绞车继续增加拉力至最大安全张力，保持5min进行测井电缆快速接头强度试验。

6.1.5.5 放松电缆，脱开快速接头。

6.1.6 连接打捞工具

6.1.6.1 连接打捞工具。采用容纳式打捞器时，应预先使用游动滑车吊起一根钻杆，依次将打捞器短节、容纳器连接在钻杆上。

6.1.6.2 司钻操作游动滑车，提起预下井的钻杆，内、外钳工应扶持钻杆，将井下打捞工具连接在钻杆上。采用容纳式打捞器时，将打捞头连接在容纳器上。

6.1.6.3 绞车上提电缆，母头接近二层平台时应减速，上提电缆到位后，宜在绞车滚筒前的电缆上绑扎记号，用作上提电缆的参考标记。井架工应将母头放入预下井的一柱钻杆的水眼里。

6.1.6.4 绞车工同时应下放电缆，直到母头露出钻杆，母头与公头对接。下放电缆到位后，宜在绞车滚筒前的电缆上绑扎记号，用作下放电缆的参考标记。

6.1.6.5 对接测井电缆快速接头，上提测井电缆，使电缆张力超过正常张力5kN。

6.1.7 下放打捞工具

6.1.7.1 拆除“T”形卡钳。

6.1.7.2 将打捞工具和钻杆下入井中。

6.1.7.3 下放电缆，测井井口工用“C”形挡板将公头卡在钻杆顶端，放松电缆后将快速接头脱开。

6.1.7.4 绞车上提电缆，使母头到达二层平台附近。架子工将母头放入预下井的下一柱钻杆的水眼里。

6.1.7.5 司钻操作游动滑车，提起钻杆立柱。绞车工同时下放电缆，直到母头露出钻杆与公头对接为止。

6.1.7.6 对接测井电缆快速接头，上提测井电缆，使电缆张力超过正常张力5kN，抽出“C”形挡板，检查快速接头的连接部位和测井电缆的磨损情况。

6.1.7.7 连接钻杆，下入井中。

6.1.7.8 重复6.1.7.3和6.1.7.4的操作，直到将打捞工具下放到距离下井仪器打捞头的深度16m～25m的位置为止，停止下钻，准备循环钻井液。

6.1.7.9 下放打捞工具注意事项：

a) 下放打捞工具过程中，应保持母头低于游动滑车，不应使快速接头缠绕进游动滑车的钢丝绳中。

b) 下放钻具应平稳、速度均匀，裸眼井段以6min下放一柱为宜。接近卡点部位时，应慢速逐渐靠近卡点。每当下放钻具至最后一个单根时，速度应减慢，加重杆通过钻杆水眼时不应挂碰。

c) 下放钻具时，绞车工应保持电缆张力，防止测井电缆在下钻过程中被卡断。实时关注电缆张力，发现张力突然增大，应立即放松电缆，并通知司钻停止下钻。

d) 下放打捞工具过程中，司钻和井口人员应实时观察井筒液面变化，发现异常情况，立即按

照井控要求，及时采取措施处理。

e） 下放打捞工具过程中，司钻和井口人员应实时观察指重表张力变化，发现异常情况，立即停止下钻，慢速上提至恢复正常后再下钻。

f） 下放打捞工具过程中，应冲洗打捞工具。直井穿心打捞，每 1000m 应循环一次钻井液；斜井穿心打捞，每 500m 应循环一次钻井液；对于一些井况复杂井（钻井过程中发生过卡钻、井喷、井漏或空井时间过长，井壁出现坍塌等），每 300m 应循环一次钻井液。

g） 对高压、高含 H_2S 或高危地区的井，钻井队应按照 SY 5974 的要求，实时关注井况的变化，根据井控的需要及时安排循环钻井液。

6.1.8 循环钻井液

6.1.8.1 连接钻井液循环短节。

6.1.8.2 将循环钻井液“C”形堵头放入钻井液循环短节水眼内。

6.1.8.3 下放电缆，使公头坐落在循环钻井液“C”形堵头上后，将快速接头脱开。

6.1.8.4 连接方钻杆，用低排量循环钻井液 1 周至 2 周，处理井中的钻井液，同时冲洗打捞器具。

6.1.8.5 循环钻井液时应上、下活动钻具，下放幅度不宜过大，上提高度不应超过下放前的位置。

6.1.9 打捞下井仪器

6.1.9.1 卸掉方钻杆和钻井液循环短节，对接电缆快速接头，上提电缆检验电缆张力有无异常变化。

6.1.9.2 连接一柱钻杆，缓慢下放，逐渐靠近下井仪器打捞头。当张力增加 5kN 时，停止下钻。

6.1.9.3 上提钻具 10m，如果打捞到下井仪器，电缆张力应下降到悬重。

6.1.9.4 下放钻具 10m，电缆张力恢复到原来数值。

6.1.9.5 再次上提钻具 10m，电缆张力又下降到悬重。

6.1.9.6 绞车上提电缆 10m，张力恢复到原来数值，可确认捞获下井仪器。

6.1.10 回收测井电缆

6.1.10.1 卸掉一柱钻杆，绞车上提至正常测井张力。

6.1.10.2 将“T”形卡钳安装在电缆快速接头下面的电缆上。

6.1.10.3 进行安全检查，疏散钻台上的无关人员。用游动滑车上提“T”形卡钳，逐渐增加拉力直到拉断电缆弱点，拉力下降后再上提 2m，若拉力保持不变，证明弱点已被拉断。

6.1.10.4 下放测井电缆，使“T”形卡钳坐落在井口，固定电缆，切除快速接头和加重杆。

6.1.10.5 将测井电缆两端铠装对接在一起，铠装长度应不小于 6m。

6.1.10.6 绞车上提测井电缆，拉直后去掉“T”形卡钳。

6.1.10.7 确认天滑轮和电缆处于正常运行状态，慢速回收测井电缆。待电缆对接部位安全通过天、地滑轮，在绞车滚筒上正常排列后，用正常速度回收测井电缆，同时，应活动钻具预防钻具粘卡。

6.1.10.8 测井电缆的端头离井口 30m～40m 时，绞车停止上提电缆，井口工将电缆从井内拉出来，查看断点是否在弱点处。切除鱼雷，回收剩余电缆。

6.1.11 回收下井仪器

6.1.11.1 测井电缆回收完毕，起钻回收下井仪器。起钻应保持慢速、匀速，使用液压大钳卸扣。

6.1.11.2 下井仪器起到井口时，用“C”形卡盘将仪器卡在井口进行拆卸，所有仪器起出后，盖井口。

6.1.11.3 下井仪器装有放射性源时，应先取出放射性源，再拆卸仪器。卸除放射性源的安全防护应按 SY 5131 的要求执行。

6.1.11.4 回收测井仪器和打捞用具，清理现场。

6.2 反穿心打捞操作程序

反穿心打捞操作程序见附录D。

6.3 裸眼井、套管井非穿心打捞操作程序

裸眼井、套管井非穿心打捞操作程序分别见附录E、附录F。

7 异常情况处理和风险控制

7.1 异常情况处理

7.1.1 快速接头上移处理

穿心打捞过程中，如果快速接头上移超过3m时，应切断电缆重新砸制快速接头。

7.1.2 电缆张力突然增大处理

穿心打捞过程中，下放打捞工具时，电缆张力突然增大，可能是电缆打结所致，绞车工应立即放松电缆，及时通知司钻停止下钻，上提钻具。适当增加电缆张力（不超过最大安全张力）后，缓慢下钻，能够通过则继续打捞。再次下放，现象仍然未能消除，应选用其他方法进行打捞。

7.1.3 电缆张力渐进增大至陡增处理

下放打捞工具的过程中，电缆张力起初缓慢增大，随后增速加快，可能是电缆外皮钢丝断裂所致，按7.1.2的方法处理。

7.1.4 遇阻处理

下放打捞工具的过程中，发生遇阻现象，采用循环钻井液或套铣作业的方法解除。

7.1.5 突发井控异常事件处理

打捞过程中发生井涌、井喷、井喷失控等突发事件，应按“井控应急预案”的要求执行。

7.2 风险控制

7.2.1 仪器损坏风险控制

7.2.1.1 抓获测井仪器过程中，应准确判断遇卡仪器顶部位置。

7.2.1.2 捞获仪器过程中，不应旋转钻具。

7.2.1.3 下压打捞工具时，速度应缓慢，下压力应不大于仪器额定承压力；上提时，拉力不应超过仪器最大拉断力。

7.2.2 公头落井风险控制

7.2.2.1 快速接头使用前应认真检查，发现问题应及时更换。

7.2.2.2 快速接头应定期更换。

7.2.2.3 快速接头应有防转措施，使用时螺纹应上紧。

7.2.2.4 打捞工具应安装防落堵头。

7.2.3 电缆遇卡风险控制

7.2.3.1 打捞矛不能下过电缆顶部 10m。

7.2.3.2 旋转打捞矛圈数不能多于三圈。

7.2.4 井口落物风险控制

在井口安装井口盖。

附　录　A
（规范性附录）
卡点深度测定方法

A.1　张力测定判断卡点深度测定方法

A.1.1　绞车上提电缆，测井指重表指示正常张力，在转盘面处的电缆上绑扎记号“1”。

A.1.2　增加电缆张力4.5kN，持续3min后在转盘面处的电缆上绑扎记号“2”，并测量出电缆伸长值$\triangle L_1$（记号“1”与记号“2”之间的距离）。

A.1.3　在不超过最大安全拉力的前提下，再增加电缆张力4.5kN，在钻盘面处的电缆上绑扎记号“3”，并测量出电缆伸长值$\triangle L_2$（记号“1”与记号“3”之间的距离）。

A.1.4　根据公式（A.1）计算卡点深度：

$$D = \triangle L/(\triangle T \cdot E) \qquad \cdots\cdots (A.1)$$

式中：

D——卡点深度，单位为千米（km）；

$\triangle L$——从电缆上量出的电缆伸长值，单位为米（m）；

$\triangle T$——增加的电缆张力值，单位为千牛（kN）；

E——末端固定的电缆伸长系数，单位为米每千米千牛［m/（km·kN）］。

示例：

以某系列七芯测井电缆为例，其电缆伸长系数E为0.174m/（kN·km），第一次增加电缆张力4.5kN，电缆伸长值$\triangle L_1$为2.59m；再增加电缆4.5kN后，电缆伸长值$\triangle L_2$为5.18m，计算结果见公式（A.2）和公式（A.3）：

$$D_1 = \triangle L_1/(\triangle T_1 \cdot E) = 2.59/(4.5 \times 0.174) = 3.308 \qquad \cdots\cdots (A.2)$$

$$D_2 = \triangle L_2/(\triangle T_2 \cdot E) = 5.18/[(4.5 + 4.5) \times 0.174] = 3.308 \qquad \cdots\cdots (A.3)$$

式中：

D_1——第一次计算的卡点深度，单位为千米（km）；

$\triangle L_1$——第一次增加电缆张力后的电缆伸长值，单位为米（m）；

$\triangle T_1$——第一次电缆张力增加值，单位为千牛（kN）；

D_2——第二次计算的卡点深度，单位为千米（km）；

$\triangle L_2$——第二次增加电缆张力后电缆总的伸长值，单位为米（m）；

$\triangle T_2$——第二次电缆张力增加值，单位为千牛（kN）。

A.1.5　判断：

a）　如果两次计算深度一致，则可确定卡点深度。

b）　如果两次计算深度不一致，而且第二次计算深度比第一次计算深度大，说明遇卡的实际深度比计算的深度深。一般在大斜度井或井眼不规则井中会发生这种情况。此时不能准确判断卡点深度，穿心打捞时，宜参考第二次的计算深度进行施工。

A.2　使用马丁代克深度直接读取测定卡点深度方法

遇卡时，直接从绞车深度面板上显示的马丁代克测量的深度值判断卡点深度。

附　录　B
（资料性附录）
常用打捞工具类型及适用范围

B.1　打捞工具的选取推荐做法

打捞工具的选取推荐做法见表 B.1。

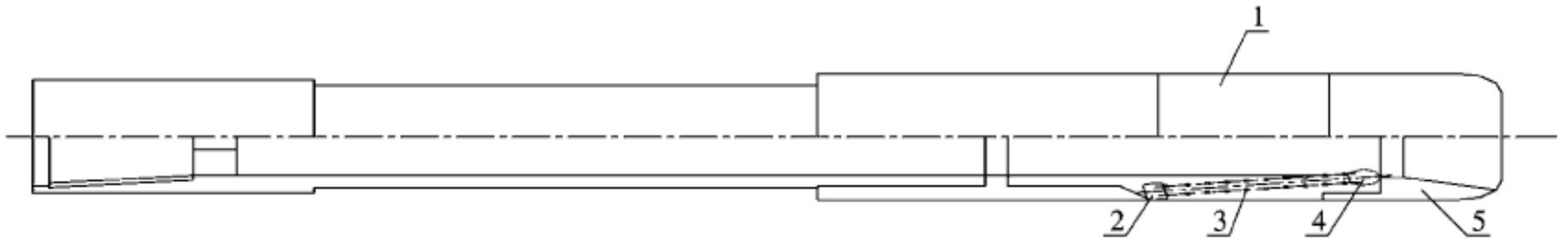
表 B.1　打捞工具的选取推荐做法

井型	现象描述		打捞方法选用	打捞工具选用
裸眼井	测井仪器遇卡，仪器上端有电缆和仪器绞车相连		穿心打捞（特殊情况增加反穿心打捞）	三球（五球）、容纳式打捞器、卡瓦打捞器、滑块式打捞器
	在直井，遇卡深度较浅，仪器上端有电缆和仪器绞车相连		非穿心打捞	旁开式打捞器
	井下仪器上端无电缆		非穿心打捞	三球（五球）、容纳式打捞器、卡瓦打捞器、滑块式打捞器
	电缆断开，长度不大于 10m		非穿心打捞	用容纳式打捞器、短电缆三球打捞器、卡瓦打捞器
	电缆断开，长度大于 10m		非穿心打捞	矛式打捞器、勾式打捞器
套管井	强拉电缆未解卡后	非穿心打捞	打捞工具直接打捞	三球（五球）、容纳式打捞器、卡瓦打捞器、滑块式打捞器
		非穿心打捞	打捞工具直接打捞	矛式打捞器
		作业队打捞	作业队打捞	作业队确定

B.2　常用打捞工具类型及适用范围

B.2.1　三球、五球式打捞器

三球、五球式打捞器结构示意图如图 B.1 所示。三球、五球式打捞器适用于外径小于打捞头最大内径，且大于三个球（五个球）公共内切圆直径的下井仪器。

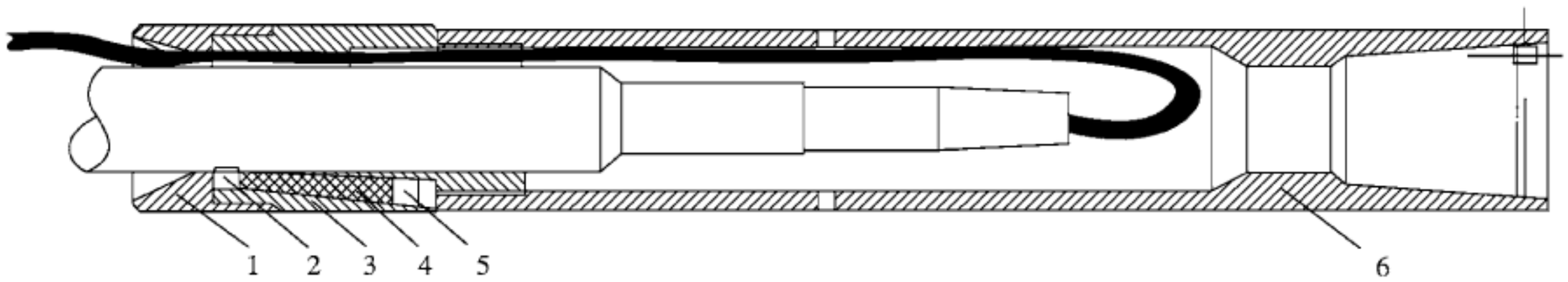


1—筒体；2—堵头；3—弹簧；4—钢球；5—引鞋

图 B.1　三球、五球式打捞器结构示意图

B. 2. 2　短电缆三球打捞器

短电缆三球打捞器结构示意图如图 B. 2 所示。短电缆三球打捞器适用于电缆断开，鱼头上端电缆长度不大于 10m 的井下仪器。

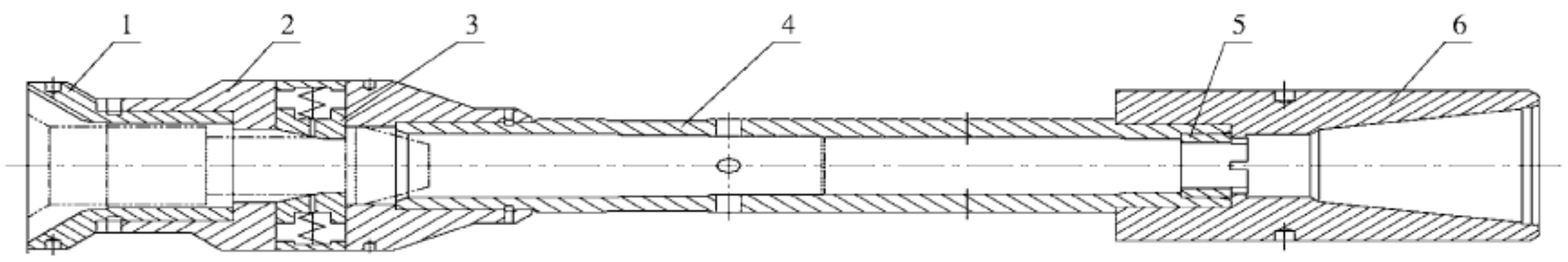


1—引鞋；2—三球；3—筒体；4—弹簧；5—堵头；6—上接头

图 B. 2　短电缆三球打捞器结构示意图

B. 2. 3　滑块式打捞器

滑块式打捞器结构示意图如图 B. 3 所示。滑块式打捞器适用于具有标准尺寸蘑菇头式打捞头的下井仪器。

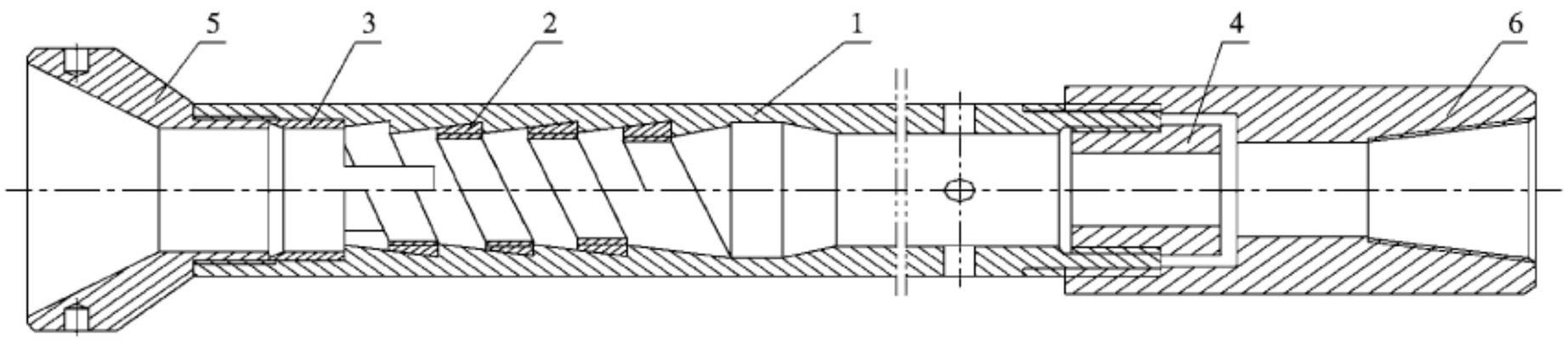


1—引鞋；2—打捞器本体；3—滑块；4—管体；5—防落环；6—转换接头

图 B. 3　滑块式打捞器结构示意图结构

B. 2. 4　卡瓦式打捞器

卡瓦式打捞器结构示意图如图 B. 4 所示。卡瓦式打捞器适用于有标准打捞头的下井仪器。



1—打捞器本体；2—螺旋式卡瓦；3—卡瓦固定套；4—变径衬套；5—引鞋；6—打捞器短节

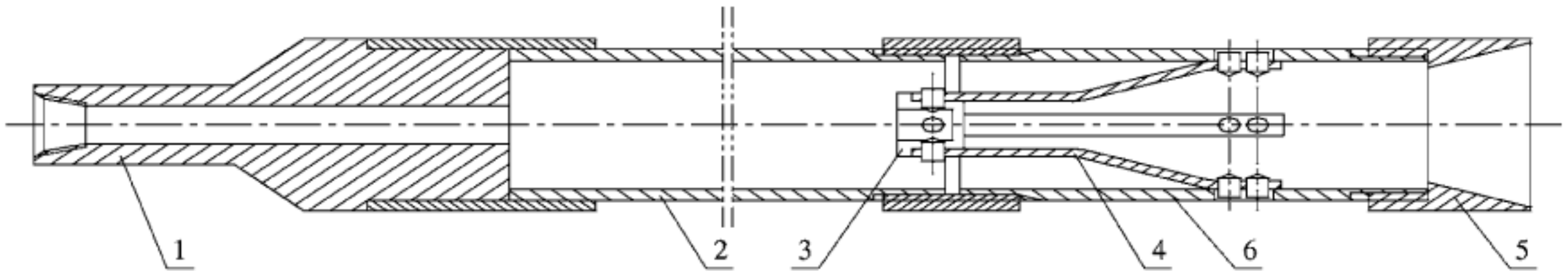
图 B. 4　卡瓦式打捞器结构示意图

B. 2. 5　容纳式打捞器

容纳式打捞器结构示意图如图 B. 5 所示。容纳式打捞器适用于外径小于打捞头内径的下井仪器，也适用于带有短电缆的井下落物。

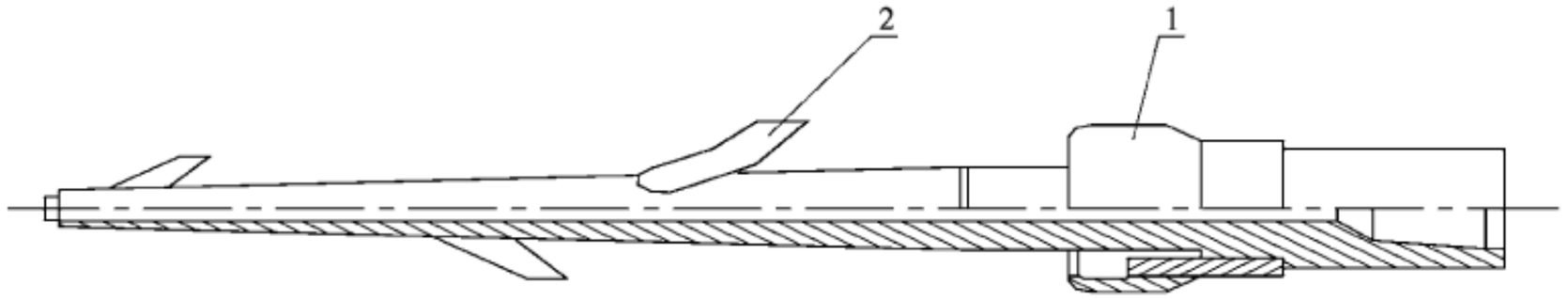
B. 2. 6　勾式打捞器

勾式打捞器结构示意图如图 B. 6 所示。勾式打捞器适用于电缆已经拉断，井下电缆长度在不少于 10m 时，对下井落物进行打捞，因其抗拉强度大，电缆缠绕多易卡钻，宜慎用。



1—打捞器短节；2—容纳器；3—电缆扶正器；4—弹簧钢板；5—引鞋；6—打捞头

图 B.5　容纳式打捞器结构示意图

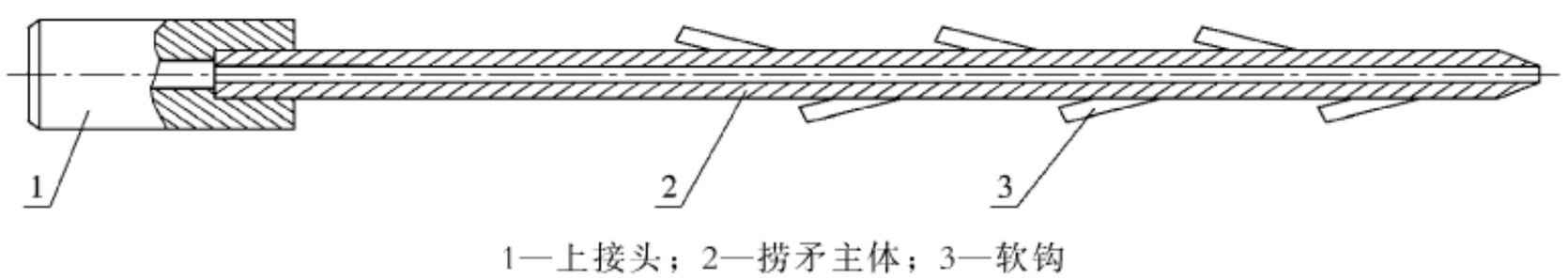


1—挡绳帽；2—捞钩

图 B.6　勾式打捞器结构示意图

B.2.7　矛式打捞器

矛式打捞器结构示意图如图 B.7 所示。矛式打捞器适用于电缆已经拉断，井下电缆长度在不少于 10m 时，为预防因电缆缠绕过多避免卡钻的情况下使用。

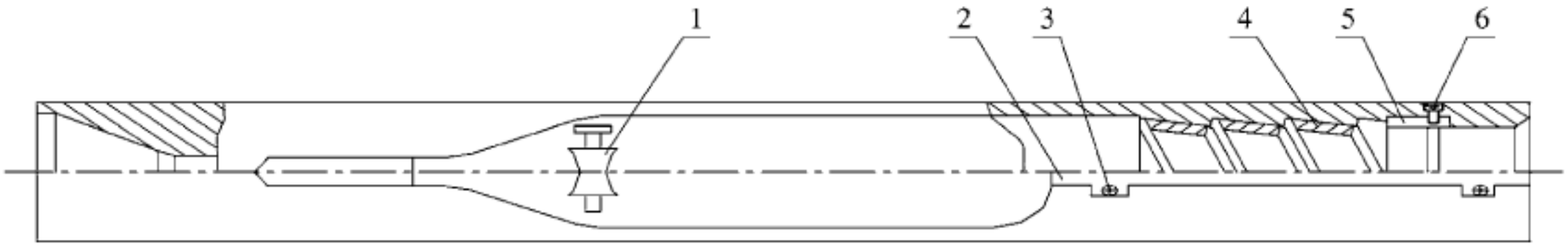


1—上接头；2—捞矛主体；3—软钩

图 B.7　矛式打捞器结构示意图

B.2.8　旁开式卡瓦（三球）打捞器

旁开式卡瓦（三球）打捞器结构示意图如图 B.8 所示。在直井，遇卡深度较浅的情况井下，仪器或落物上端有电缆和仪器绞车相连，可在不剪断电缆的情况下，选择旁开式卡瓦（三球）打捞器进行打捞。



1—滚轮；2—侧板；3—固定螺钉；4—螺旋卡瓦；5—卡瓦锁环；6—控制螺钉

图 B.8　旁开式卡瓦（三球）打捞器结构示意图

附　录　C
（资料性附录）
打捞工具组装和检查

C.1　三球、五球式打捞器的组装和检查

C.1.1　检查打捞器各个部件，根据仪器组合情况选择合适的弹簧、钢球、堵头，钢球变形或磨损应更换。

C.1.2　用六方工具把标准钢球、弹簧和堵头依次组装到打捞器本体上，安装完成后检查钢球在容纳体内滑动情况。

C.1.3　依次连接打捞器本体与引鞋、长器接头、加长器和变扣接头。

C.2　滑块式打捞器的组装和检查

C.2.1　弹簧、盖板依次组装到打捞器本体上。

C.2.2　依次连接打捞器本体、引鞋、管体。

C.2.3　依次把防落环、转换接头安装到管体上。

C.3　卡瓦式打捞器的组装和检查

C.3.1　检查打捞器各个部件，检查外观应无断裂，螺纹应无变形，壳体应无磨损。

C.3.2　将打捞器本体引鞋端向上立于地面。

C.3.3　将螺旋卡瓦装入打捞器本体内，向左旋转卡瓦，使卡瓦锁舌落入打捞器本体键槽内。

C.3.4　将卡瓦固定套的锁定舌朝下，对准打捞器本体键槽插入，使卡瓦固定。

C.3.5　连接引鞋与打捞器本体，把加力杆插入引鞋四周侧孔内，紧固螺纹，对称点焊加固。

C.3.6　将打捞器翻转立于地面，把变径衬套旋入打捞器本体并紧固。

C.3.7　装上打捞器短节。

C.4　容纳式打捞器的组装和检查

C.4.1　将弹簧板固定在打捞头的内壁上，采取措施防止螺母松扣，螺杆和螺母的顶面应不高于打捞头外壳弧面。

C.4.2　将电缆扶正器固定在弹簧钢板上。

C.4.3　在打捞头上安装引鞋。

C.5　勾式、矛式打捞器的组装和检查

检查打捞器各部件，外观检查应无断裂，螺纹应无变形，壳体应无磨损。

C.6　旁开式卡瓦（三球）打捞器的组装和检查

C.6.1　检查导向器、滚轮、螺旋卡瓦、控制环、侧板及固定螺钉等应无损坏。

C.6.2　开口控制环应用螺钉固定于导向器底部。

附　录　D
（规范性附录）
反穿心打捞操作程序

D. 1　起出一柱钻具，将钻具拆开，上提钻具 0. 5m，把“C”形挡板垫在钻具水眼上，并将快速接头放在“C”形挡板上方。

D. 2　缓慢下放电缆，将快速接头脱开。

D. 3　上提电缆，使快速接头的母头到达二层平台附近。将快速接头母头从钻具水眼内取出，缓慢下放电缆至钻井平台。

D. 4　将钻具排放在钻井平台上方。

D. 5　连接快速接头，慢慢上提电缆，将“C”形挡板取下。

D. 6　绞车收回一柱钻具长度电缆后停止。

D. 7　井口工在井口打上“T”形卡钳，将“T”形卡钳坐井口上，绞车下放电缆 50m。

D. 8　在“T”形卡钳上方 6m～8m 处铰断电缆，用“T”形卡钳上方的 6m～8m 电缆做一个绳套。

注：铰断带有电缆的快速接头和电缆加重，放在安全位置，不再使用。

D. 9　在绞车电缆一端再做一个绳套，做的过程中应与下方“T”形卡钳上方绳套链接在一起。

D. 10　绞车提升电缆，将绳套拉紧，拆下“T”形卡钳。

D. 11　缓慢起出下一柱钻具，拆开钻具，并上提钻具 2m。

D. 12　打上“T”形卡钳，将“T”形卡钳坐在井口上。

D. 13　下放电缆 10m～12m，在“T”形卡钳上方 6m～8m 处铰断电缆。

D. 14　收回电缆，在二层平台处，缓慢将电缆上方的绳套拉出钻具水眼后，下放电缆至钻井平台。

D. 15　钻具排放在钻井平台上方。

D. 16　保持绞车端电缆绳套完好，在绳套连接处铰断电缆。

D. 17　在“T”形卡钳上方做绳套，并与绞车绳套链接。

D. 18　重复 D. 10～D. 17 的操作，直到下井仪器取出井口。

D. 19　将打捞工具卡在井口卡盘上，拆开钻具并上提 2m 钻具，将电缆铰断。

D. 20　收回下井仪器及打捞工具，清理现场。

附　录　E
（规范性附录）
裸眼井非穿心打捞操作程序

E.1　井下仪器上端无电缆或带有不大于 10m 电缆时的打捞操作

E.1.1　使用游动滑车吊起钻具，依次将打捞筒短节、容纳器或其他选取的打捞工具连接在钻杆上。

注：带有不大于 10m 电缆时，宜采用容纳式打捞器或短电缆三球打捞器。

E.1.2　连接钻杆和打捞工具，下入井中，直到将打捞工具下放到距离下井仪器打捞头的深度 25m 处，停止下钻。

E.1.3　下放打捞工具时，应按 6.1.7.9 中 b），d），e），f）和 g）的要求执行。

E.1.4　缓慢下放，逐渐靠近下井仪器打捞头，观察钻井队指重表有 10kN～20kN 压力变化时，停止下钻。

E.1.5　循环钻井液，如果钻井液压力表压力上升停止打压，判断为下井仪器可能被捞获。

E.1.6　上提钻具 10m，循环钻井液，如果钻井液压力表压力上升停止打压，可确认下井仪器被捞获。

E.1.7　如打捞没有成功，可以重新循环钻井液，重复 E.1.4～E.1.6 的操作，或起钻更换打捞工具。

E.2　井下仪器带有大于 10m 电缆时的打捞操作

E.2.1　使用游动滑车吊起钻具，依次将打捞矛、打捞勾或其他选取的打捞工具连接在钻杆上。

E.2.2　连接钻杆和打捞工具，下入井中，直到将打捞工具下放到距离下井仪器打捞头的深度 25m 处，停止下钻。

E.2.3　缓慢下放打捞矛或打捞勾。

E.2.4　逐渐靠近井下仪器打捞头，下深不能超过仪器卡点深度，当发现打捞勾或打捞矛有轻微遇阻显示时，停止下钻，此时，钻井配合，由现场总协调人根据井下电缆情况确定转动钻具圈数，转动钻具圈数宜二至三圈。

E.2.5　上提钻具，如拉力瞬间上升，判断为仪器捞获。

E.2.6　上提钻具，如拉力无变化，重复 E.2.3～E.2.5 的操作，或起钻更换打捞工具。

E.3　不剪断电缆的打捞操作

E.3.1　选用合适规格的旁开式卡瓦（三球）打捞器。

E.3.2　在转盘平面 0.1m 以上，将“T”形卡钳安装在电缆上，检验“T”形卡钳紧固情况。

E.3.3　放松电缆，使“T”形卡钳坐于井口。

E.3.4　把天滑轮固定在井架上部，以电缆不妨碍游动滑车的上下运行为宜，把地滑轮固定在钻台上，以其不妨碍井口施工为宜。将测井指重表装在地滑轮支架上。

E.3.5　卸下控制环、侧板，取出螺旋卡瓦，连接打捞器与打捞钻具。

E.3.6　通过侧板开口引入电缆，将螺旋卡瓦套在电缆上再放入筒体内左旋到位，再装上控制环和侧板，用螺钉固定。将电缆挂在滚轮上，使其处于打捞器中心。

E.3.7　连接钻具和打捞工具。

E. 3. 8 绞车拉紧电缆，卸去“T”形卡钳。

E. 3. 9 以不超过 10m/min 的速度下钻，转盘面侧面安装导向滑轮引出电缆。下钻时应锁住转盘和大钩，钻具不应转动。应实时监视钻井指重表和测井指重表的变化。

E. 3. 10 下到仪器上部 15m～20m 处时，注意观察电缆指重表张力变化，此时按如下方法判断：

a) 若电缆张力增加，判断为仪器捞获或电缆打折，同时观察测井曲线，有变化确定为仪器捞获。

b) 下放钻具的同时下放电缆，测井曲线值有变化，判断仪器解卡。

c) 电缆不动钻具上提，测井曲线值有变化，说明仪器已捞获。

d) 电缆不动钻具上提，测井曲线值无变化，但上提电缆时测井曲线值有变化，判断为仪器已解卡，但未进入打捞器，仍然可以起钻。

e) 若电缆张力不增加，判断为钻具长度和电缆长度存在误差，继续下放探测，同时观察测井曲线显示，若电缆被压断或仪器被压掉，测井曲线值无显示。

E. 3. 11 下到仪器被卡部位，如电缆张力不增加，判断为钻具长度和电缆长度存在一定的误差，应继续下放探测，同时观察地面系统测量值，若电缆被压断或仪器被压掉，测量显示无测井曲线。

E. 3. 12 仪器捞获或解卡后，同时上提钻具和电缆。

E. 3. 13 起钻时，钻井队和测井队配合，预防挤压井口电缆。应锁住转盘与大钩，钻具、转盘不应转动。

E. 3. 14 地面取出仪器时，应向下顿击，使卡瓦向上移动，再右旋捞筒，退出仪器。

E. 3. 15 回收下井仪器，按 6. 1. 11 的要求执行。

附　录　F
（规范性附录）
套管井非穿心打捞操作程序

F.1　直接强拉电缆解卡的打捞操作

F.1.1　在井口上打上吊钳，锁紧后连接拉力表及绳套。放下大钩，与绳套连接。

注：根据打捞仪器或枪身的重量和电缆的自重，确定强拉的初始数值。

F.1.2　缓慢上提作业大钩，随着电缆的提升，观察拉力表的变化。上提过程中如拉力表数值突然明显回落（在弱点最大拉力之前），判断为仪器解卡。

F.1.3　如拉力表数值在上升，说明仪器处于卡死状态，仪器未解卡，继续加大拉力，直至拉力表数值明显突然回落，根据弱点最大拉力值和拉力表数值进行初步判断，是解卡还是电缆拉断。

F.1.4　放下大钩，把吊钳坐在井口上，绞车收紧电缆，拆下吊钳。

F.1.5　上提电缆到井口。

F.1.6　若井下仪器捞获，收回电缆，取出仪器，清理现场。

F.1.7　若仪器或落物未捞获，根据绞车上来电缆长度、状态等判断井下落物基本情况，计算落井电缆长度，选取打捞工具。

F.2　井下仪器带有大于 10m 电缆时的打捞操作

F.2.1　将矛式打捞器连接在油管下方，慢慢吊起，下入井中，直到将打捞工具下放到距离下井仪器打捞头的 10m 处。

F.2.2　缓慢下放油管至遇阻，下压，矛式打捞器的最大深度不应超过鱼顶，下压后上提油管。

F.2.3　缓慢上提油管，实时观察拉力变化，随着指重表拉力逐渐增大，在指重表显示最大电缆拉断力之前，如果电缆张力表突然摆动，随后张力数值下降，表明仪器可能解卡。

F.2.4　缓慢上提油管，随着指重表拉力逐渐增大，在指重表显示最大电缆拉断力之前，拉力表的指针突然摆动，拉力下降，可能是井下落物没有解卡，电缆拉断。

F.2.5　缓慢起出油管，收回井下打捞工具和打捞上来的电缆，清理现场。

F.2.6　根据打捞上来的电缆长度，判断井下状况，确定下一步打捞方案。

F.3　井下仪器带有小于 10m 电缆时的打捞操作

井下仪器带有小于 10m 的电缆时，由作业队负责打捞。

F.4　下井仪器上端没有电缆时的打捞操作

F.4.1　连接油管和打捞工具，将打捞工具下放到距离下井仪器打捞头 25m 处。

F.4.2　缓慢下放油管至遇阻，逐渐增大压力，注意观察油管悬重，当悬重为零时，停止下放油管。

F.4.3　上提油管，观察指重表，如果拉力逐渐增大，当拉力大于悬重情况下，油管缓慢上提过程中，拉力表的指针突然摆动，拉力下降，则判断为打捞成功。

F.4.4　上提油管，观察指重表拉力，随着油管上提，拉力逐渐增大，当拉力大于悬重情况下，油管

缓慢上提过程中，拉力一直上升，没有摆动下降，表明仪器仍然被卡。此时应采取的方法如下：

a） 下放油管，增大下放压力，将仪器压活，上下活动油管，上提油管。

b） 采取强拉，破坏打捞工具的方法，将打捞工具和仪器分离。

F.4.5 上提油管，收回井下仪器及打捞工具，清理现场。

ICS 73.020
E 12
Ref. No. :48169—2015

SY

Standard of Petroleum and Natural Gas Industry of the People's Republic of China

SY/T 5361—2014
Replace SY/T 5361—2007

Technical specifications for fishing operation of wireline logging tool

Issued Date: 10—15—2014 Implementation Date: 03—01—2015

Issued by National Energy Administration, P. R. C.

Contents

Foreword

The standard is drafted according to the rules given in GB/T 1.1—2009 *Directives for standardization—Part 1: Structure and drafting of standards*.

The standard replaces SY/T 5361—2007 *Code for the cut - and - thread fishing operation for logging cable*. In comparison with SY/T 5361—2007, the technical modifications of this standard are as follows:

——The standard name of *Code for the cut - and - thread fishing operation for logging cable* has been changed into *Technical specifications for fishing operation of wireline logging tool*;

——"Scope" has been modified (See Chapter 1, Chapter 1 of Edition 2007);

——"Anti - cut - and - thread fishing method", "Non - cut - and - thread fishing method" and "Rated tension of cable" have been added into "Terms and definitions" (See 3.2, 3.3 and 3.6);

——"Cable breaking strength" has been modified into "Cable breaking strength" (See 3.4, 3.2 of Edition 2007);

——"Information and data collection" has been modified (See 4.1, 4.3 of Edition 2007);

——"Fishing mode" has been modified (See 4.2, 4.1 of Edition 2007);

——"Anti - cut - and - thread fishing operation" has been added to fishing method (See 4.2.2);

——"Non - cut - and - thread fishing operation" has been added (See 4.2.3);

——"Fishing tool and equipment" has been modified into "Selection of fishing equipment and tool" (See 4.3, 5.1～5.4 and 6.1 of Edition 2007);

——"On - site coordination meeting" has been modified (See 5.1, 4.2, 4.4 and 4.5 of Edition 2007);

——"Assembly of fishing socket" has been modified into "Assembly and inspection of fishing tool" (See 5.2, 6.2 of Edition 2007);

——"Cut - and - thread fishing procedure" has been modified (See 6.1, 6.3～6.6 and 7.1～7.6 of Edition 2007);

——"Anti - cut - and - thread fishing procedure" has been added (See 6.2 and Appendix D);

——"Non - cut - and - thread fishing procedure for open hole and cased hole" has been added (See 6.3, Appendix E and Appendix F);

——"Abnormal circumstance handling" has been modified (See 7.1, Chapter 8 of Edition 2007);

——"Risk control" has been added (See 7.2);

——"Regulation on weak - point breaking strength of logging cable" has been deleted (See Appendix A of Edition 2007);

——"Martin - Deck encoder is adopted to read and determine the depth of sticking point" has been added (See A.2);

——"Recommendation for selection of fishing tools" has been added (See B.1).

The standard is proposed by and under the jurisdiction of the Petroleum Logging Specialty Standardization Committee of China Petroleum Standardization Technology Committee (CPSC/TC11).

The main organizations drafting the standard: the Wireline Logging Company of Daqing Drilling and Exploration Engineering Corporation, CNPC China Petroleum Logging Co., Ltd, Geophysical Well Logging Company of Zhongyuan Petroleum Engineering Limited Company of Sinopec Oilfield Service Corporation.

The main drafters of the standard: Zhang Baifeng, Tao Honggen, Cao Yuxin, Hu Qiyue, An Tao, Wang Hongjian, Zhu Xiaokang, Hu Xiuni, Xu Rui, Zhang Xiaodong, Gan Mengguang, Sun Weili, Liu Guohui and Liu Bingzhong.

Translators of the standard: Ding Zhu and Zhao Ping.

This standard replaces SY/T 5361—2007.

SY/T 5361—2007's following previous editions:

——SY 5361—1989, SY/T 5361—1995.

This standard is published in both Chinese and English. In case of any discrepancy occurring, the Chinese version shall prevail.

Technical specifications for fishing operation of wireline logging tool

1 Scope

This standard specifies the schematic design for fishing operation of logging cable and downhole tools, selection of fishing equipment and tool, preparation for fishing operation, fishing operation procedure, abnormal circumstance handling and risk control.

This standard is applicable to fishing operation of wireline logging tools, other fishing operations can also be conducted according to this standard.

2 Normative references

The following documents are indispensable for the application of this document. For the dated references, only the dated edition is applicable to this document. For the undated references, the latest edition of the referenced document (including all amendments) is applicable to this document.

SY 5131 *Safety codes for radiation protection in petroleum radioactive log*

SY 5974 *Code for safety technology of drilling wellsite, equipment and operation*

3 Terms and definitions

The following terms and definitions are applicable to this document.

3.1

cut-and-thread fishing method

It is the method to cut off logging cable, and thread fishing tool on the rig floor to release downhole cable and tool.

3.2

anti-cut-and-thread fishing method

It is the method to lift drilling rig and tool to release the stuck downhole cable and tool by the method not to cut off cable by tensioning to prevent the tool obtained by cut - and - thread fishing method from falling as a result of sticking again.

3.3

non-cut-and-thread fishing method

It is the method to fish downhole cable and tool without the cut - and - thread fishing method.

3.4

cable breaking strength

It is the rated tension to break logging cable.

3.5

cable weak-point breaking strength

It is the rated tension to break the weak point of logging cable.

3.6

rated tension of cable

It is the maximum allowable tension for logging cable.

3.7

normal logging cable tension

It is the cable tension (hereinafter referred to as normal tension) in the normal logging operation.

3.8

maximum security tension

It is the maximum allowable tension for a winch to pull up the logging cable.

Note: Maximum security tension is defined in 6.1.1.1.

4 Fishing plan

4.1 Information and data collection

4.1.1 Information shall be provided by logging

crew:

a) Description and disposal of sticking during the logging operation.

b) Type, size, specification and geometrical dimension of cable connector, downhole tools, perforating gun or other junks, whether centralizer or other auxiliary devices for logging are installed or whether radioactive source is installed.

c) Log information useful for determination of casing program and sticking point.

d) Type, size and estimated depreciation, whether there is cable joint; and the length and rated tension of logging cable.

e) Depth of sticking point of downhole tool, perforating gun and cable and depth of point of fall of junk such as downhole tool. Method to determine the depth of sticking point depth is given in Appendix A.

4.1.2 Information shall be provided by drilling crew (operating crew):

a) Information on well bore in drilling process.

b) Schematic diagram for casing program, deviation survey data in drilling process.

c) Bit size, surface casing, size and depth of intermediate casing.

d) Data of drilling fluid, such as specific gravity and viscosity.

e) Information on formation pressure and pay zone.

f) Size and type and datasheet of drilling rig or tubing for fishing operation.

4.2 Fishing mode

4.2.1 Cut-and- thread fishing operation

When logging cable or downhole tool is sticking in the well, the winch shall pull up cable, with the maximum safe tension indicated by tension indicator, repeating for twice or three - times. If the sticking is still not released, cut - and - thread fishing operation shall be conducted.

4.2.2 Anti-cut-and-thread fishing operation

After completion of cut - and - thread fishing operation, in order to prevent the fished tool from falling as a result of sticking again during lifting of drilling tool, the method not to cut off cable by tension shall be adopted to lift drilling tool and instrument to conduct anti - cut - and - thread fishing operation.

4.2.3 Non-cut-and-thread fishing operation

As logging instrument, perforating gun or other tool sticking or falling downhole during open hole logging, cased hole logging, perforation or other operation, if the cut - and - thread fishing method is impractical or unnecessary, perform fishing operation with drill rod or oil pipe.

4.3 Selection of fishing equipment and tool

4.3.1 Fishing equipment and tool

4.3.1.1 Type and scope of application of fishing tools in common use are given in Appendix B.

4.3.1.2 Tools in common use:

—— "T" shaped caliper;

——Quick acting coupling assembly;

—— "C" shaped plate;

——"C" shaped end cap for circulating drilling fluid;

——Quick coupling release clamp;

——Sinking bar;

——Drilling fluid circulating nipple;

——Tool and fitting for cable head;

——Cable wire;

——Box wrench;

——Pipe wrench.

4.3.1.3 Cable tension system:

——Tension sensor;

——Weight indicator;

——Tension meter.

4.3.1.4 Winch tension system.

4.3.1.5 Winch communication system.

4.3.2 Selection of fishing equipment and tool

Recommendation for selection of fishing tools is given in B.1.

5 Preparation for fishing job

5.1 On-site coordination meeting

Prior to fishing operation, project owner shall, in accordance with the on-site situations, organize drilling supervisor, logging supervisor, drilling crew (operation crew), and logging crew etc. to attend coordination meeting, the contents shall be included:

a) Examination and approval of fishing method.

b) Risk identification and control during fishing operation.

c) Job responsibility and division of work are as follows:

——General coordination: project owner shall be responsible for general coordination of fishing operation;

——Logging operator is responsible to release or connect the quick-acting coupling of logging cable, direct winchman to lift and lower cable in sign language, monitor the operating state of top sheave, logging cable and travelling block and direct driller to lift and lower drilling tool by sign language;

——Winchman is responsible to lift and lower cable according to the direction of logging operator, pay close attention to variation of cable tension so as to take immediate measures to handle abnormal conditions and inform drilling and logging engineer in time;

——Driller is responsible to operate drilling tool according to the abnormal condition prompt from winchman to complete fishing operation in time;

——Crane operator is responsible to lift and lower crane so as to complete fishing operation according to the requirement of fishing engineer;

——Backup tong man and Lead-tong man are responsible to lift and lower drill bit as routine operation;

——Scaffolder is responsible to complete installation of top sheave according to the requirement of logging and fishing engineer and put quick coupling of logging cable into bit port and lift and lower drill bit as routine operation;

d) During fishing operation, if logging crew and drilling crew (operating crew) work in shifts, the person in charge of the previous shift shall convey the relevant information to the next shift.

5.2 Assembly and inspection of fishing tool

Perform assembly and inspection by the tool defined in fishing program, the method is defined in Appendix C.

6 Fishing procedure

6.1 Cut-and-thread fishing procedure

6.1.1 Fixing logging cable

6.1.1.1 Determine the maximum security tension and the method of calculation is as Formula (1):

$$T = T_x + T_r \times 75\% \qquad \cdots (1)$$

Where:

T is the maximum security tension, the unit is kN;

T_x is the cable hook load, the unit is kN;

T_r is the cable weak point breaking strength, the unit is kN.

6.1.1.2 Lift the cable by winch till the cable tension exceeds normal tension of 5kN.

6.1.1.3 Install "T" shaped caliper on the cable at the position 0.1m～0.5m above rotary table.

6.1.1.4 Loosen the cable to make "T" shaped caliper sit on well head; check "T" shaped caliper for fastening, observe it for 5 min, if the fixture is free of slide, the cable is considered as having been properly fixed.

6.1.2 Cutting logging cable

6.1.2.1 Determine the breaking point of the cable in the position 1.5m～2.0m above rotary table and break the cable.

6.1.2.2 Shear the cable and fix the cable at the end of winch.

6.1.3 Installing at well head

6.1.3.1 Installing top sheave

6.1.3.1.1 The top sheave shall be installed by daylight. During installation, the derrick floor shall be free of obstacle and person.

6.1.3.1.2 Lower the top sheave down and remove the top sheave from travelling block.

6.1.3.1.3 Lift the top sheave to the highest point in front of the derrick top by lifting device and lower the cable, with allowance left for quick coupling.

6.1.3.1.4 Fix the top sheave to crossbeam of derrick top by chain or cable wire or iron bar whose breaking strength is eightfold more than the breaking strength of cable, the installation position shall be as high as possible and close with the front of derrick to the greatest extent.

6.1.3.2 Installing lower sheave

6.1.3.2.1 The installation position of lower sheave shall properly move outside, and the interval between lower sheave and well head shall not adversely affect the operation of drilling bit on derrick floor.

6.1.3.2.2 Connect cable tension system at well head to winch tension sensor, and plug a fixed pin for the bearing screw. Fix the tension sensor to the crossbeam of the rig substructure by a chain or wirerope with breaking strength more than eightfold that of the cable.

6.1.4 Installing quick acting coupling

6.1.4.1 Set the rope socket to the cable－head at the wellhead end, and then prepare cable－head at the wellhead end.

6.1.4.2 Set the mushroom head to the rope socket and form the male joint of the logging cable quick coupling (hereinafter referred to as male joint).

6.1.4.3 Set the guide head and rope socket to the cable－head at the winch end and then prepare the cable head at the winch end.

6.1.4.4 Install the female joint on the rope socket and form the female joint of logging cable quick coupling (hereinafter referred to female joint).

6.1.4.5 Install the sinking bar on the cable above female joint.

6.1.5 Inspecting quick coupling of logging cable

6.1.5.1 All joint parts and fixed parts on the quick coupling of logging cable shall be subject to systemic inspection and shall be properly fastened.

6.1.5.2 Connect male coupling and female coupling.

6.1.5.3 Lift cable by winch to its normal tension and calibrate tensiometer at well head to make its reading identical to the reading of weight indicator on winch panel.

6.1.5.4 Increase table tension by winch continually to the maximum security tension of table, holding it for 5min to conduct strength testing of quick coupling of logging cable.

6.1.5.5 Loosen cable and release quick coupling.

6.1.6 Connecting fishing tool

6.1.6.1 Connect fishing tool. If using container fisher, lift a drill pipe by a travelling block firstly, and then connect the fisher nipple and the container to the drill pipe in turn.

6.1.6.2 Driller shall operate travelling block to lift the drill pipe to be lowered, backup tong man and Lead－tong man shall support driller to connect the downhole fishing tool to drill pipe. If using container fisher, connect the fishing head to the container.

6.1.6.3 Lift cable by winch. The lifting speed shall be reduced when the female joint is close to racking platform. As the cable being lifted to the proper position, it is advisable to fix a mark to the cable in front of the winch drum as a reference mark for lifting cable. The derrickman shall put female coupling into bit port to be lowered.

6.1.6.4 Winchman shall lower cable till female coupling comes out of drill pipe to connect to male coupling. After the cable is lowered to proper position, it is advisable to fix a mark to the cable in front of winch drum as a reference mark for lowering cable.

6.1.6.5 Connect the quick coupling of logging cable, lift logging cable to make cable tension 5kN more than normal tension.

6.1.7 Lowering fishing tool

6.1.7.1 Remove "T" shaped caliper.

6.1.7.2 Lower the fishing tool and drill pipe down into the borehole.

6.1.7.3 Lower the cable. The logging operator clamps the male joint to the drill pipe top with a "C" shaped baffle to fix, and release the quick coupling after cable loosening.

6.1.7.4 Lift cable by winch and make female joint close to racking platform. Scaffolder shall put the female joint into the bit port of the next drill pipe to be lowered.

6.1.7.5 While the driller operates travelling block to lift drilling string, the winchman lowers the cable till the female joint comes out of drill pipe and connect to male joint.

6.1.7.6 Connect quick coupling of logging cable. Lift logging cable and make cable tension 5kN more than normal tension. Draw out "C" shaped baffle. Check the joint part of quick coupling and logging cable for damage and wear.

6.1.7.7 Connect drill pipe and then lower down into borehole.

6.1.7.8 Repeat the operations defined in 6.1.7.3 and 6.1.7.4 till the fishing tool is lowered to the position 16m～25m away from the depth of fishing head for downhole instrument. Stop lowering the drill pipe, and prepare for circulating drilling fluid.

6.1.7.9 Precautions for lowering fishing tool:

a) During lowering the fishing tool, the female joint shall be lower than travelling block to prevent quick coupling from winding in the cable wire of travelling block.

b) Lowering drilling tool shall be stable and at uniform speed. It is advisable to lower a string every 6min for open hole section. When it is close to sticking point, its speed shall be gradually slowed to get close to sticking point. When lowering the last single drill string, the lowering speed shall be slowed to prevent weight bar from colliding with bit port.

c) During lower the drilling pipe, the winchman shall maintain cable tension to prevent logging cable from breaking due to sticking in going down process and pay real－time attention to cable tension so as to loosen the cable in case of abrupt increase of tension and inform driller to stop going down process in time.

d) During lowering fishing tool, driller and well head operator shall carry out real－time observation of variation of liquid level in well bore indicated by weight indicator so as to take immediate measures according to well control requirement in case of abnormal circumstance.

e) During lowering fishing tool, driller and well head operator shall carry out real－time observation of the variation of tension indicated by weight indicator so as to stop

going down in case of abnormal circumstances and lift the tool at slow speed till tension indicator return to normal.

f) During lowering fishing tool, it shall be subject to washing. For cut - and - thread fishing in vertical wells, drilling fluid shall be subject to circulation once every 1000m; for cut - and - thread fishing in deviated well, drilling fluid shall be subject to circulating once every 500m; for wells in complex conditions (drilling pipe sticking, well blowout, circulation loss during drilling process, or long - term barren hole, borehole wall heaving), drilling fluid shall be subject to circulating once every 300m.

g) For high pressure wells, or wells rich in H_2S or wells in high and dangerous region, drilling crew shall carry out real - time observation of the variation of well condition and prepare for drilling fluid circulation based on the requirement of well control in time according to regulations of SY 5974.

6.1.8 Drilling fluid circulation

6.1.8.1 Connect circulation nipples for drilling fluid.

6.1.8.2 Put "C" shaped casing cap in bit port of circulation nipple for drilling fluid.

6.1.8.3 Lower the cable and make male joint sit on "C" shaped casing cap for drilling fluid circulation and then release quick coupling.

6.1.8.4 Connect kelly bar, adopting drilling fluid circulation with low displacement for one and two weeks, in addition, fishing tool shall be subject to washing.

6.1.8.5 During the drilling fluid is circulated, drill pipe shall be moved upward and downward, and it is advisable to lower the drill pipe within measure and the lifting height shall be no more than the position in height previous to lowering.

6.1.9 Downhole instrument fishing

6.1.9.1 Remove Kelly bar and drilling fluid circulation nipple. Connect the cable quick coupling and lift the cable to check whether there is abnormal variation in cable tension.

6.1.9.2 Connect a drill string and lower it down slowly and make it gradually close to the fishing head for downhole instrument. When the tension is increased by 5kN, stop lowering down.

6.1.9.3 Lift the drill pipe by 10m, if the downhole instrument is fished, the cable tension shall be decreased to hook load.

6.1.9.4 Lower the drill pipe by 10m, the cable tension shall restore to original value.

6.1.9.5 Lift the drill pipe by 10m again, the cable tension shall fall to hook load again.

6.1.9.6 Lift the cable with winch shall by 10m, the tension shall restore to original value, confirming that downhole instrument has been fished.

6.1.10 Recovery of logging cable

6.6.10.1 Remove a drill string. Pull up cable by winch to the normal logging tension.

6.1.10.2 nstall the "T" shaped caliper on the cable below the quick coupling of the cable.

6.1.10.3 Carry out safety inspection and evacuate irrelevant personnel on drilling platform, the travelling block shall lift "T" shaped caliper to gradually increase the tension till breaking the weak point of the cable, after the tension is decreased, lift the caliper by 2m again, if the tension remains unchanged, indicating that the weak point is broken.

6.1.10.4 Lower the logging cable to make "T" shaped caliper sit on well head, fix the cable and remove quick coupling and weight bar.

6.1.10.5 Connect the armor on both ends of logging cable, the armoring length shall be no less than 6m.

6.1.10.6 Lift the logging cable by winch and remove "T" shaped caliper after straightening up.

6.1.10.7 Confirm that the top sheave and ca-

ble are in normal operating condition and recover the logging cable at slow speed. After the cable butting joint passes through top sheave and lower sheave in safety and properly arranges on winch drum, recover the logging cable at normal speed, in addition, shake the drilling tool to prevent sticking.

6.1.10.8 When logging cable socket is 30m～40m away from well head, stop lifting the cable by winch. well head operator shall draw the cable out of the well to check whether the breaking point is at the weak point. Remove the torpedo and recover the remaining cable.

6.1.11 Recovery of downhole instrument

6.1.11.1 After logging cable is recycled, the drilling rig is pull out and the downhole instrument is retrieved. Keep a slow and uniform speed when the drilling rig is pull out. Unscrew turnbuckle using the hydraulic tongs.

6.1.11.2 When it is lifted to well head, the downhole instrument stuck at well head using adopt "C" shaped chuck will be dismantled. After all instruments are lifted out, the well head is covered.

6.1.11.3 When the downhole instrument is equipped with radioactive source, first take out the radioactive source and then dismantle the instrument. Removaling the safety protection for radioactive source shall be in accordance with the requirement of SY 5131.

6.1.11.4 Retrieve the logging instrument and fishing tool and clean the site.

6.2 Anti-cut-and-thread fishing procedure

Anti－cut－and－thread fishing procedure is given in Appendix D.

6.3 Non-cut-and-thread fishing procedures for open hole and cased hole

Non－cut－and－thread fishing procedures for open hole and cased hole are given in Appendix E and Appendix F respectively.

7 Abnormal circumstance handling and risk control

7.1 Abnormal circumstance handling

7.1.1 Upward movement handling of quick coupling

During thecut－and－thread fishing process, if the quick coupling is more than 3m in upward movement, cut off the cable and prepare quick coupling again.

7.1.2 Handling of abrupt increase in cable tension

During the cut－and－thread fishing process, if there is an abrupt increase in cable tension in lowering the fishing tool as a result of cable knotting, winchman shall loosen the cable immediately and inform the driller to stop going down and lift drilling tool in time. After proper increase in cable tension (no more than maximum security tension), go down slowly, if it is able to pass through, continue to fish and then lower it again, if the problem remains unsolved, other methods are adopted to carry out fishing.

7.1.3 Handling of gradual increase to abrupt increase in cable tension

During lowering the fishing tool, first, the cable tension slowly increases and then quickly increases as a result of breaking of cable sheath and steel wire, the problem shall be disposed of by the method defined in 7.1.2.

7.1.4 Handling sticking

In case of sticking in lowering the fishing tool, adopt drilling fluid circulation or wash－over to dispose of the problem.

7.1.5 Handling emergency in well control

Emergency such as kick, blowout, blowout out of control during fishing operation shall be disposed according to the requirements of "Emergency plan for well control".

7.2 Risk control

7.2.1 Risk control for instrument damage

7.2.1.1 During fishing operation of logging instrument, the stuck instrument top shall be accurately identified.

7.2.1.2 During fishing operation of instrument, the drilling tool shall not be rotated.

7.2.1.3 Fishing tool shall be lowered at slow speed, the downward pressure shall be no more than the rated bearing pressure of instrument; during lifting process, the tension shall be no more than the maximum breaking strength of instrument.

7.2.2 Risk control for male coupling falling

7.2.2.1 Quick coupling, prior to operation, shall be subject to careful inspection so as to find and change the defected one in time.

7.2.2.2 Quick coupling shall be subject to regular replacement.

7.2.2.3 Quick coupling shall be subject to anti-rotation, its screw thread shall be subject to tightening before operation.

7.2.2.4 Fishing tool shall be equipped with anti-falling cap.

7.2.3 Risk control for cable sticking

7.2.3.1 Spear fisher shall not be lowered 10m lower than the cable top.

7.2.3.2 The spear fisher shall not be rotated for more than three turns.

7.2.4 Risk control for falling at well head

Well head cover shall be equipped.

Appendix A
(Normative)
Determination method for sticking point depth

A. 1 Determination method for sticking point depth by tension measurement

A. 1. 1 Pull up the cable by winch with the normal tension indicated by the weight indicator, and tie the mark "1" to the cable on rotary table surface.

A. 1. 2 Increase the cable tension by 4. 5 kN and keep for 3min; tie the mark "2" to the cable on rotary table surface and measure the cable elongation value $\triangle L_1$ (the spacing between mark "1" and mark "2") .

A. 1. 3 On the premise of no more than the maximum security tension, increase the cable tension by 4. 5kN again; tie mark "3" to the cable on rotary table surface and measure the cable elongation value $\triangle L_2$ (the spacing between mark "1" and mark "3") .

A. 1. 4 Calculate the sticking point depth according to Formula (A. 1)

$$D = \triangle L/(\triangle T \cdot E) \qquad \cdots\cdots \text{(A. 1)}$$

Where:

D is the sticking point depth, the unit is km;

$\triangle L$ is the cable elongation value measured from the cable, the unit is m;

$\triangle T$ is the increased cable tension value, the unit is kN;

E is the elongation factor of cable with end piece fixed, the unit is m/ (km · kN) .

Example:

Take a seven - core logging cable as an example, the cable elongation factor E is 0. 174m/ (kN · km), after increasing the cable tension by 4. 5kN for the first time, the cable elongation value $\triangle L_1$ is 2. 59m; after increasing the cable tension by 4. 5kN for the second time, the cable elongation value $\triangle L_2$ is 5. 18m, the results are given in Formula (A. 2) and Formula (A. 3):

$$D_1 = \triangle L_1/(\triangle T_1 \cdot E)$$

$$= 2.59/(4.5 \times 0.174) = 3.308 \qquad \cdots\cdots \text{(A. 2)}$$

$$D_2 = \triangle L_2/(\triangle T_2 \cdot E)$$

$$= 5.18/[(4.5 + 4.5) \times 0.174] = 3.308 \qquad \cdots\cdots \text{(A. 3)}$$

Where:

D_1 is the first calculated sticking point depth, the unit is km;

$\triangle L_1$ is the cable elongation value after increasing the cable tension for the first time, the unit is m;

$\triangle T_1$ is the first cable tension increment, the unit is kN;

D_2 is the second calculated sticking point depth, the unit is km;

$\triangle L_2$ is the total cable elongation value after increasing the cable tension for the second time, the unit is m;

$\triangle T_2$ is the second cable tension increment, the unit is kN.

A. 1. 5 Determination:

a) If the depth values calculated twice are in accord with each other, the sticking point depth can be determined.

b) If the depth values calculated twice are out of accord with each other and the second calculated depth is larger than the first calculated depth, it indicates that the actual sticking depth is deeper than the calculated depth, which often takes place in highly - deviated well or ragged hole, thus the sticking point depth can not be accurately determined. The second calculated depth should be advisable to be adopted for the cut - and - thread fishing operation.

A. 2 Determination method for sticking point by Martin-Deck

In case of sticking, the sticking point depth shall be read from the depth value indicated on depth panel of winch by Martin - Deck.

Appendix B
(Informative)
Type and applicable scope of conventional fishing tools

B. 1 Recommendation for selection of fishing tools

Recommendation for selection of fishing tools see Table B. 1.

Table B. 1 Recommendation for selection of fishing tools

Type	Description	Fishing method	Fishing tool
Open hole	When the logging instrument is stuck, the cable is connected to the winch on the top of instrument	Cut - and - thread fishing (Reverse anti - cut - and - thread fishing in case of need)	Three - ball (five - ball), container fisher, slip fisher and sliding bock fisher
	In vertical hole, sticking depth is shallow and the cable is connected to the winch on the top of instrument	Non - cut - and - thread fishing	Side opening fisher
	No cable on the downhole instrument top	Non - cut - and - thread fishing	Three - ball (Five - ball), container fisher, slip fisher, sliding block fisher
	Cable breaking, the length is no more than 10m	Non - cut - and - thread fishing	Container fisher, short cable three - ball fisher, slip fisher
	Cable breaking, the length is more than 10m	Non - cut - and - thread fishing	Spear fisher and hook fisher
Cased hole	The cable fails to be released after tensioning: Non - cut - and - thread fishing	Fishing by fishing tool	Three - ball (five - ball), container fisher, slip fisher, sliding block fisher
	The cable fails to be released after tensioning: Non - cut - and - thread fishing	Fishing by fishing tool	Spear fisher
	The cable fails to be released after tensioning: Fishing by operating crew	Fishing by operating crew	Determined by operating crew

B. 2 Types and applicable scopes of conventional fishing tools

B. 2. 1 Three-ball and five-ball fishers

Schematic diagram for three - ball and five - ball fishers isshown in Figure B. 1. Three - ball and five - ball fishers are applicable to downhole instrument with outside diameter smaller than maximum inside diameter of fishing head and more than common incircle diameter of three - ball (five - ball) .

B. 2. 2 Three-ball fisher for short cable

Schematic diagram for three - ball fisher for short cable structure is shown in Figure B. 2. It is applicable to downhole instrument with bro-

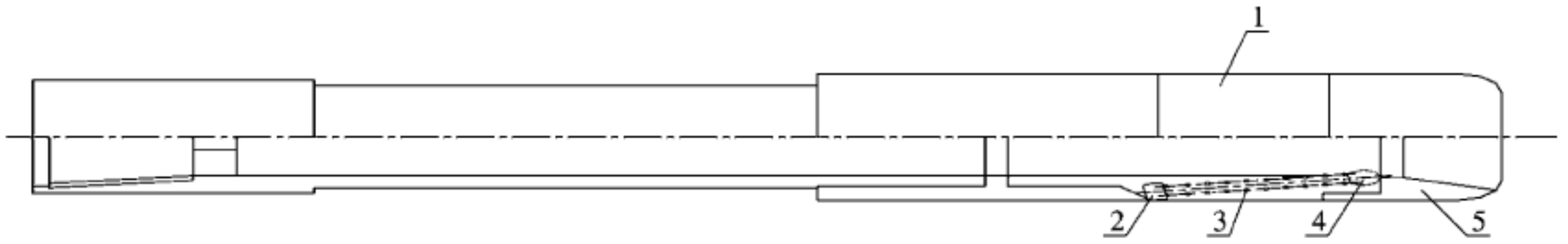
ken cable, and cable length on fishing head of no more than 10m.

B. 2. 3 Sliding block fisher

Schematic diagram for sliding block fisher structure is shown in Figure B. 3. It is applicable to downhole instrument with standard mushroom head type fishing head.

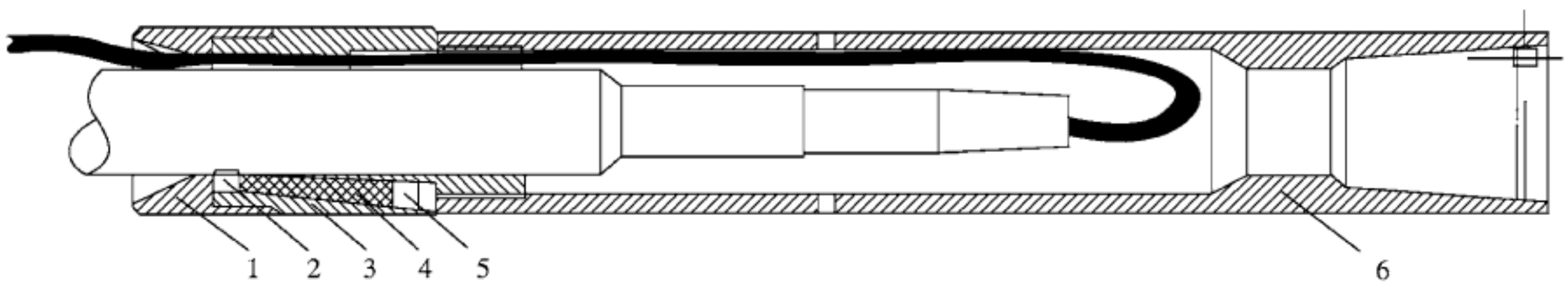
B. 2. 4 Slip fisher

Schematic diagram for slip fisher structure is as shown in Figure B. 4. It is applicable to the downhole instrument with standard fishing head.



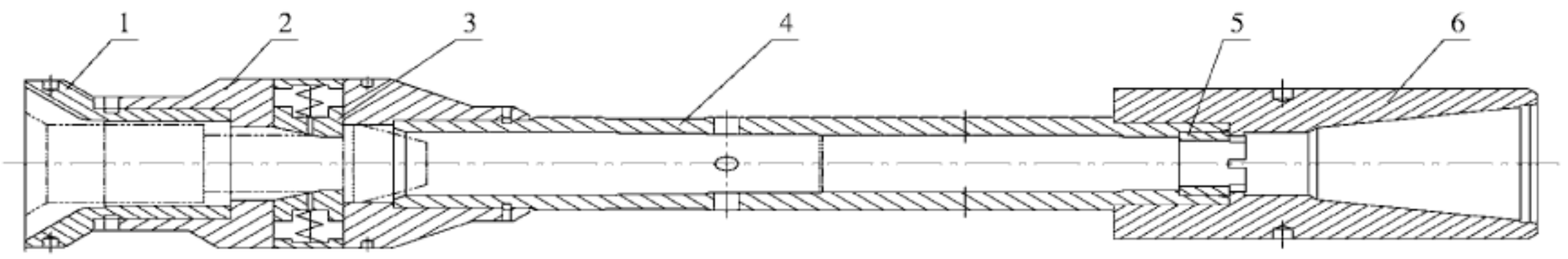
1—cylinder; 2—casing cap; 3—spring; 4—steel ball; 5—guide shoe

Figure B. 1 Schematic diagram for three-ball and five-ball fishers structure



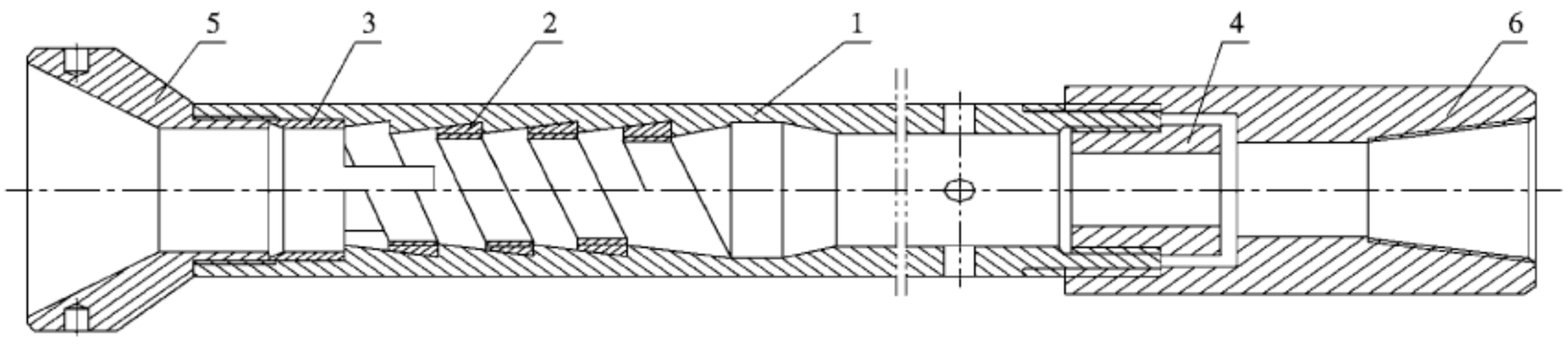
1—guide shoe; 2—three－ball; 3—cylinder; 4—spring; 5—casing cap; 6—top connection

Figure B. 2 Schematic diagram for three-ball fisher for short cable structure



1—guide shoe; 2—fisher body; 3—sliding block; 4—pipe; 5—anti－falling ring; 6—adapter substitute

Figure B. 3 Schematic diagram for sliding block fisher structure



1—fisher body; 2—spiral slip; 3—clip retainer; 4—variable diameter liner; 5—guide shoe; 6—fisher nipple

Figure B. 4 Schematic diagram for slip fisher structure

B. 2. 5 Container fisher

Schematic diagram for container fisher structure is shown in Figure B. 5. It is applicable to downhole instrument with outside diameter smaller than inside diameter of fishing head, and also applicable to junks with short cable.

B. 2. 6 Hook fisher

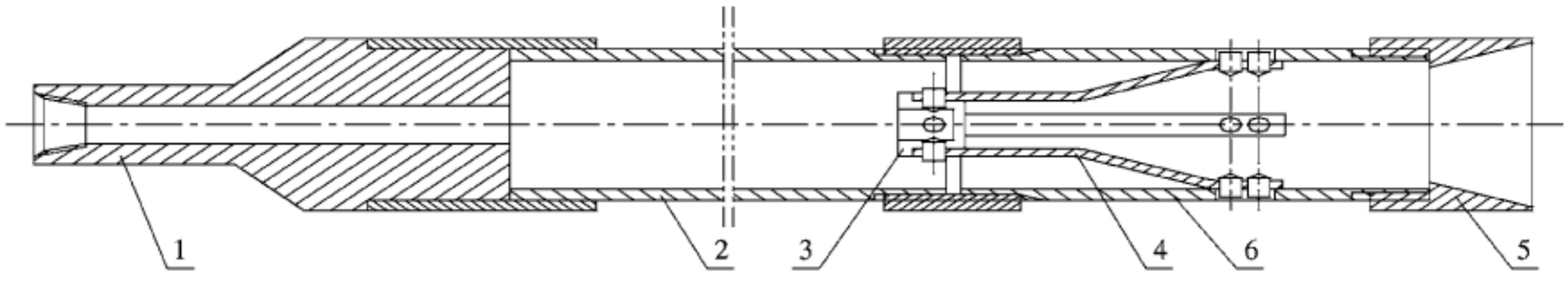
Schematic diagram for hook fisher structure is shown in Figure B. 6. It is applicable to fishing of the junks with broken cable and downhole cable length is no less than 10m. It should be used cautiously due to its high tensile strength and prone to sticking due to too much enwinding of cable.

B. 2. 7 Spear fisher

Schematic diagram for spear fisher structure is shown in Figure B. 7. It is applicable to the case with broken cableand cable length is no less than 10m to avoid sticking as a result of too much enwinding of cable.

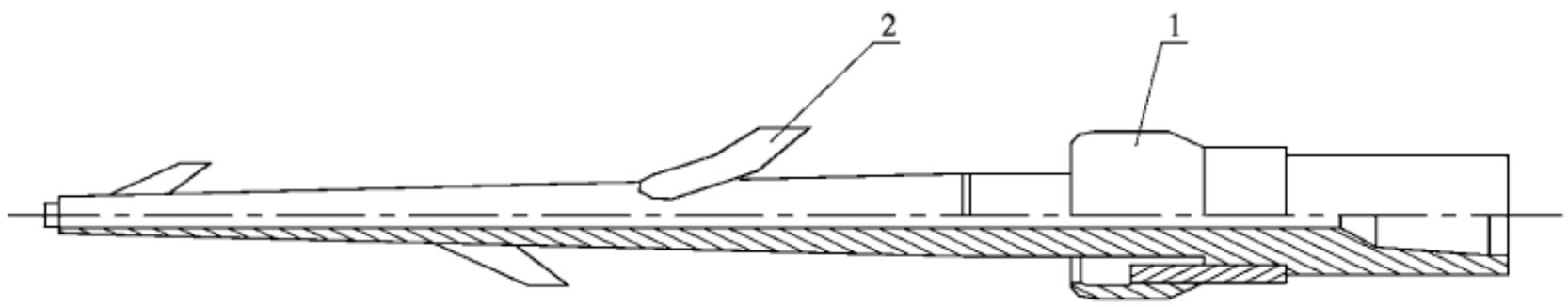
B. 2. 8 Side opening slip (three-ball) fisher

Schematic diagram for side opening slip (three-ball) fisher structure is shown in Figure B. 8. It is applicable to fishing the instrument or junk with shallow sticking level and cable connecting to instrument winch in vertical well without cutting off the cable.



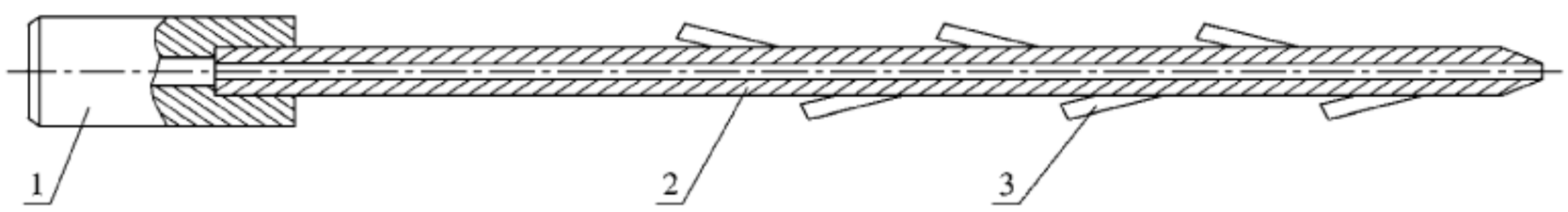
1—fisher nipple; 2—container; 3—cable centralizer; 4—spring steel sheet; 5—guide shoe; 6—fishing head

Figure B. 5 Schematic diagram for container fisher structure



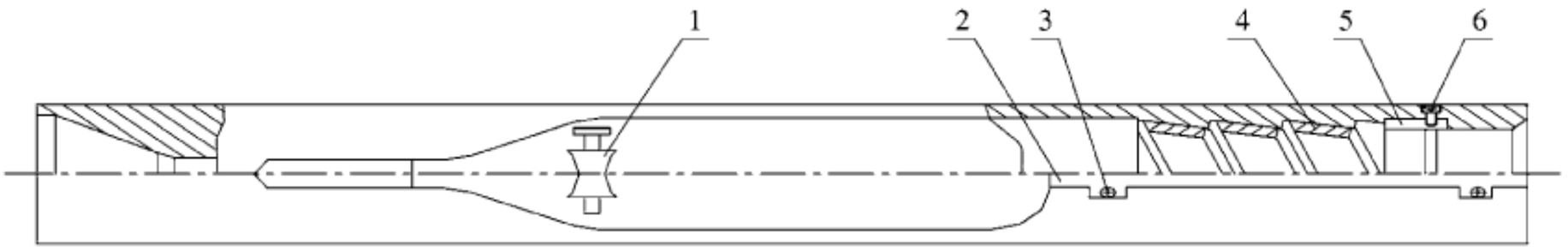
1—rope socket; 2—fishing hook

Figure B. 6 Schematic diagram for hook fisher structure



1—top connector; 2—spear fisher body; 3—soft hook

Figure B. 7 Schematic diagram for spear fisher structure



1—roller; 2—side plate; 3—set screw; 4—spiral slips; 5—lock ring; 6—control screw

Figure B. 8 Schematic diagram for side opening slip (three-ball) fisher structure

Appendix C
(Informative)
Assembly and inspection of fishing tool

C. 1 Assembly and inspection of three-ball and five-ball fishers

C. 1. 1 Inspect every part of fisher, and select the suitable spring, steel ball and casing cap based on the combination of the instrument. If the steel ball is deformed or worn, it shall be changed.

C. 1. 2 Install the standard steel ball, spring and casing cap on the fisher body with a hexagonal tool and then check the sliding condition of steel ball in container.

C. 1. 3 Connect fisher to guide shoe, lengthener joint, lengthener and reducing joint in turn.

C. 2 Assembly and inspection of sliding block fisher

C. 2. 1 Assemble the spring and cover plate onto the fisher body in turn.

C. 2. 2 Connect fisher body, guide shoe and pipe body in turn.

C. 2. 3 Install anti－fall ring, adapter onto the pipe body in turn.

C. 3 Assembly and inspection of slip fisher

C. 3. 1 Inspect every part of the fisher, its appearance shall be free of fracture, its screw shall be free of deformation, its shell shall be free of wearing.

C. 3. 2 Make the fisher stand on the ground with the guide shoe end upward.

C. 3. 3 Install the spiral slip into the fisher body, turn the slip leftward to make slip dead bolt fall into the key slot of the fisher body.

C. 3. 4 Make the dead bolt of slip retainer face down to insert it into the key slot of the fisher body to fix the slip.

C. 3. 5 Connect guide shoe with fisher body and insert the load bar into the side ports around guide shoe, tighten screw, and carry out spot welding symmetrically for reinforcement.

C. 3. 6 Turn the fisher over and make it stand on the ground. Turn the reducing bushing into the fisher body and make it fasten.

C. 3. 7 Install the fisher nipple.

C. 4 Assembly and inspection of container fisher

C. 4. 1 Fix the spring plate to the internal wall of the fishing head and take measures to prevent nut from loosening, the top surface of screw and nut shall be no higher than the cambered surface of the shell of fishing head.

C. 4. 2 Fix the cable centralizer to the spring steel sheet.

C. 4. 3 Install the guide shoe on the fishing head.

C. 5 Assembly and inspection of hook and spear fishers

Inspect every part of the fisher, its appearance shall be free of fracture, its screw shall be free of deformation, and its shell shall be free of wearing.

C. 6 Assembly and inspection of side opening slip (three-ball) fisher

C. 6. 1 Inspect guider, roller, spiral slip, control ring, side plate and set screw, which shall be free of damage.

C. 6. 2 Split control ring shall be fixed to the bottom of guider by screw.

Appendix D
(Normative)
Anti-cut-and-thread fishing procedure

D. 1 Lift and disconnect a string of drill pipe, lift the drill pipe by 0.5m and put the "C" shaped baffle under the bit port, and place the quick coupling on the top of "C" shaped baffle.

D. 2 Lower the cable slowly and release the quick coupling.

D. 3 Lift the cable to make the female coupling of the quick coupling close to racking platform and take the female coupling of the quick coupling out of the bit port, lower the cable to drilling platform slowly.

D. 4 Arrange the drill rig over the drilling platform.

D. 5 Connect the quick coupling, lift the cable slowly, and remove "C" shaped baffle.

D. 6 After taking back the cable for the length of a string of drill rig, the winch shall stop work.

D. 7 Well head operator shall install "T" shaped caliber at well head, make "T" shaped caliber sit on well head, then the winch shall lower the cable for 50m.

D. 8 Cut off the cable at the point 6m～8m above type "T" shaped caliper and make a sling with the cable 6m～8m above the type "T" caliper.

Note: The quick coupling with cable and cable load cut off shall be placed in a safe position and out of use.

D. 9 Make another sling at the winch cable terminal, it shall be connected to the sling above the "T" shaped caliper below it.

D. 10 Lift the cable by winch to tighten sling and then remove "T" shaped caliper.

D. 11 Lift slowly the next string of drill pipe, disconnect the drill pipe and lift the drill pipe by 2m.

D. 12 Install "T" – shaped caliper and make "T" shaped caliper sit on the well head.

D. 13 Lower the cable by 10m～12m and cut off the cable at the point 6m～8m above "T" shaped caliper.

D. 14 Retrieve the cable, and on the racking platform, lower the cable to drilling platform after drawing the sling over the cable out of bit port.

D. 15 Arrange the drill tool over the drilling platform.

D. 16 Maintain the cable at the winch in good condition and cut off the cable at the sling joint.

D. 17 Make a sling over "T" shaped caliper and connect it to winch sling.

D. 18 Repeat the operation defined in D. 10～D. 17 till the downhole instrument is taken out of well head.

D. 19 Chuck the fishing tool at well head, disconnect and lift the drill tool by 2m, and cut off the cable.

D. 20 Recover the downhole instrument and fishing tool and clear the site.

Appendix E
(Normative)
Anti-cut-and-thread fishing procedure for open hole

E. 1 Fishing operation for downhole instrument without cable or with cable of no longer than 10m

E. 1. 1 Lift the drilling tool by travelling block. Connect fishing socket nipple, container or other fishing tool selected to the drill pipe in turn.

Note: It is advisable to adopt container fisher or three－ball fisher for short cable in case of the cable of no more than 10m in length.

E. 1. 2 Connect the drill pipe and fishing tool, lower them down till the fishing tool is 25m away from the fishing head for downhole instrument in depth.

E. 1. 3 Fishing tool shall be lowered according to the requirements of b), d), e), f) and g) in 6. 1. 7. 9.

E. 1. 4 Lower the fishing tool slowly to make it gradually close to the fishing head for downhole instrument, observing the weight indicator, if there is variation of 10kN～20kN in pressure, stop going down process.

E. 1. 5 Circulate drilling fluid, if the pressure gauge of the drilling fluid indicates pressure is rising, stop pressurization, indicating that the downhole instrument has been fished.

E. 1. 6 Lift the drilling tool by 10m and circulate drilling fluid, if the pressure gauge of the drilling fluid indicates pressure is rising, stop pressurization and indicating that the downhole instrument has been fished.

E. 1. 7 If fishing operation fails, circulate the drilling fluid again and repeat operation defined in E. 1. 4～E. 1. 6, or pull out to change the fishing tool.

E. 2 Fishing operation for downhole instrument with cable of more than 10m in length

E. 2. 1 Lift the drilling rig by travelling block. Connect fishing spear, fishing hook or other fishing tool selected to the drill pipe in turn.

E. 2. 2 Connect the drill pipe and fishing tool, lower them down till the fishing tool is 25m away from the fishing head for downhole instrument in depth.

E. 2. 3 Lower fishing spear or fishing hook slowly.

E. 2. 4 Make it gradually close to the fishing head for downhole instrument, the lowering depth shall not exceed the sticking point depth, if fishing hook or fishing spear is slightly stuck, stop going down, at this time, the general coordinator shall determine the number of turns necessary for drilling rig according to the downhole cable condition, it is advisable to turn the drilling rig for two or three turns.

E. 2. 5 Lift the drilling rig, if the tension rises for an instant, indicating that the instrument has been fished.

E. 2. 6 Lift the drilling rig, if the tension remains unchanged, repeat the operation defined in E. 2. 3～E. 2. 5, or pull out to change fishing tool.

E. 3 Fishing operation without cutting off the cable

E. 3. 1 Select a suitable side opening slip (three－ball) fisher.

E. 3. 2 Install "T" shaped caliper on the cable 0. 1m above rotary table, check whether the "T" shaped caliper is properly fastened.

E. 3. 3 Loosen the cable and make "T" shaped caliper sit on the well head.

E. 3. 4 Fix the top sheave to the top of derrick and make the cable not to interfere with the upward and downward operation of travelling block, and fix the lower sheave to the derrick

floor to make it not to adversely affect the operations at well head. Install the weight indicator on the lower sheave stand.

E. 3. 5 Remove the control ring, side plate, and take out spiral slip, connect fisher and fishing tool.

E. 3. 6 Lead in the cable from the opening of side plate and put the spiral slip on the cable and then place it into the shell and turn it leftward to the proper position, and then install the control ring and side plate again and fix them with screw. Hang the cable on the roller and make it in the center of fisher.

E. 3. 7 Connect drilling tool and fishing tool.

E. 3. 8 Tighten the cable by winch, and remove "T" shaped caliper.

E. 3. 9 The lowering speed shall be no more than 10m/min, with cable out of leading sheave installed on the side of rotary table. During going down process, the rotary table and hook shall be locked, and the drilling tool shall not rotate. The indication by the drilling weight indicator and logging weight indicator shall be under constant observation.

E. 3. 10 When going down to the point 15m～20m away from the top of the instrument, pay attention to the variation in tension indicated by weight indicator, the details are as follows:

a) If the cable tension is increased, indicating that the instrument has been fished or the cable is twisted. In addition, observe the log curve, if it changes, indicating that the instrument has been fished.

b) The drilling rig and cable shall be lowered at same time, if there is a change in log curve, indicating that the instrument has been released.

c) The cable remains standstill, with drilling rig being lifted and change in log curve value, indicating that the instrument has been fished.

d) The cable remains standstill, with drilling rig being lifted and without changes in log curve value, but there is a change in log curve value during lifting the cable, indicating that the instrument has been released but does not enter the fisher, pulling out is still available.

e) If the cable tension fails to increase, indicating that there is an error in length of drilling rig and cable, continue to go down for detection and observe the indication of log curve, if the cable is broken or the instrument falls off, there shall be no indication in log curve value.

E. 3. 11 When go down to the stuck point, if the cable tension fails to increase, it is indicate that there is an error in length of drilling rig and cable to a certain extent. Continue to go down and observe the measured value of ground system at the same time, if the cable is broken or the instrument falls off, there shall be no log curve indication.

E. 3. 12 After the instrument is fished or released, the drilling rig and cable shall be lifted at the same time.

E. 3. 13 During pulling out the drilling rig, the drilling crew shall work with logging crew to prevent wellhead cable from being squeezed. The rotary table and hook shall be locked; the drilling rig and rotary table shall not rotate.

E. 3. 14 After the instrument is taken out of ground, it shall be moved down to make slip move upward and then turn the fishing socket rightward to take out the instrument.

E. 3. 15 The downhole instrument shall be retrieved according to the requirement of 6. 1. 11.

Appendix F
(Normative)
Non-cut-and-thread fishing procedure for cased hole

F.1 Fishing operation by direct drawing the cable for release

F.1.1 Install the suspension clamp at the well head, after locking, connect it to draw-bar dynamometer and sling. Lower the hook and connect it to sling.

Note: Determine the initial value for drawing based on the weight of fishing instrument or gun body and deadweight of cable.

F.1.2 Lift the hook slowly and observe the reading of draw-bar dynamometer as the cable lifts, during lifting process, if the reading of draw-bar dynamometer falls on the sudden (before the maximum tension at weak point), indicating that the instrument has been released.

F.1.3 If the reading of draw-bar dynamometer goes up, indicating that the instrument is stuck and unreleased, continue to increase the tension till the reading of draw-bar dynamometer falls on the sudden, and determine whether it is to release or break the cable according to the maximum tension at weak point and reading of draw-bar dynamometer.

F.1.4 Lower the hook and make suspension clamp sit on well head, the winch shall tighten the cable, and remove suspension clamp.

F.1.5 Lift the cable to well head.

F.1.6 If the downhole instrument is fished, recover the cable, take out the instrument and clear the site.

F.1.7 If the instrument or junk fails to be fished, determine the basic condition of the downhole junk according to the length and condition of the cable lifted by winch and calculate the length of falling cable and select fishing tool.

F.2 Fishing operation for downhole instrument with cable of more than 10m in length

F.2.1 Connect the spear fisher to the bottom of tubing, slowly lift it and lower it into the well till the fishing tool is 10m away from the fishing head for downhole instrument.

F.2.2 Slowly lower the tubing till it sticks, press it down, the maximum depth of spear fisher shall not in excess of fish top, lift the tubing after pressing down.

F.2.3 Slowly lift the tubing and carry out real-time observation of variation of tension, as the tension indicated by weight indicator increases, before the weight indicator indicates the maximum breaking strength of cable, if the cable tensiometer pointer sways on the sudden, and then the tension reading falls, indicating that the instrument may be released.

F.2.4 Slowly lift the tubing, as the tension increases indicated by weight indicator step by step, before the weight indicator indicates the maximum breaking strength of cable, if the draw-bar dynamometer pointer sways on the sudden, with tension drop, indicating that the downhole junk fails to release and the cable is broken.

F.2.5 Slowly take out the tubing and recover downhole fishing tool and the fished cable and clear the site.

F.2.6 Determine the downhole condition based on the length of the cable fished to further confirm the next fishing program.

F. 3 Fishing operation for downhole instrument with cable of less than 10m in length

If downhole instrument has the cable of less than 10m in length, the operating crew shall be responsible for fishing.

F. 4 Fishing operation for downhole instrument without cable

F. 4. 1 Connect the tubing and fishing tool, and lower the fishing tool to the depth 25m away from the fishing head for downhole instrument.

F. 4. 2 Slowly lower the tubing till it sticks, gradually increase the pressure and observe the hook load of tubing, when the hook load is zero, stop lowering the tubing.

F. 4. 3 Lift the tubing, observe the weight indicator, if the tension is increased on the sudden, when the tension is more than hook load, the draw - bar dynamometer pointer sways on the sudden during the tubing lifting, with tension drop, indicating that the fishing is successful.

F. 4. 4 During lifting of tubing and observation of weight indicator, as the tubing lifts, the tension shall gradually increase, when the tension is more than hook load, with the tension rise during slow lifting of tubing, without pointer sway and tension drop, indicating that the instrument is still stuck. Accordingly, the following measures shall be taken:

a) Lower the tubing and increase the lowering pressure to activate the instrument and move the tubing upward and downward to lift the tubing.

b) Damage the fishing tool so as to separate fishing tool from instrument by forcing.

F. 4. 5 Lift the tubing, recover downhole instrument and fishing tool and clear the site.

中华人民共和国
石油天然气行业标准
电缆测井仪器打捞技术规范
SY/T 5361—2014
*
石油工业出版社出版
（北京安定门外安华里二区一号楼）
北京中石油彩色印刷有限责任公司排版印刷
新华书店北京发行所发行
*
880×1230 毫米 16 开本 3 印张 87 千字 印 1—1500
2015 年 2 月北京第 1 版　2015 年 2 月北京第 1 次印刷
书号：155021·7282　定价：36.00 元