衬管切割、打捞联作工艺

秦晓庆*　付 伟　袁 勇
(中国石化集团西南石油局油气测试中心)

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摘　要　随着油气开发的不断深入, 在井网密度越来越大, 征地困难, 环保要求越来越高的形势下, 修井已成为整个油气开发过程中一项必不可少的工作。衬管完成井传统的割、打捞分步进行处理方法存在施工周期长、劳动强度大、修井成本高等问题。衬管切割—打捞联作工艺的应用有效地解决了上述问题。文章详细介绍该项工艺的特点, 工艺施工及应用效果分析。

主题词　衬管　切割　打捞　联作

修井是一项为了恢复油气井的正常生产所进行的解除故障、完善井眼条件的工作。它是提高单井产量和采收率, 延长生产周期的一项重要措施, 也是挖掘老井潜力、发现新层位, 扩大勘探成果的重要手段。随着油气开发的不断深入, 生产时间的延长和产量的递减, 低产井和停产井不断增加。为确保稳产, 除了加快开发外, 就是要对老井进行挖潜改造。自加砂压裂技术在西南石油局气田的上侏罗系蓬莱镇组和中侏罗系沙溪庙组气藏成功应用以来, 大批的老井重显生机。因此, 目前修井的主要目的是改善井眼条件, 以利于加砂压裂增产工艺的实施。

西南石油局油气开发由于气藏较多, 油气井井型相对较复杂, 完井方式也呈多样化。仅以蓬莱镇组气藏为例, 根据区域储层情况(非均质性、致密砂岩、孔隙—裂缝性), 开发初期提出了“浅上产、中稳产、深后备”的滚动勘探开发思路, 以追求单井产量最高为原则选择完井方式, 大量的勘探开发井都是采用先期完井。据油气井井型统计数据表明, 衬管完成井占整个气田的 45.16%, 是目前修井的主要类型。

衬管完成井修井施工方案

衬管完成井修井施工总体方案是: ⑴ 处理出井内衬管; ⑵下入套管固井(或进行定向侧钻后下套管固井); ⑶对挖潜层段进行射孔、测试; ⑷ 实施加砂压裂及压后测试。

施工方案中处理井内衬管的过程较为复杂, 以往传统的处理方法通常采取“两步走”, 即切割、打捞作业分别起下一趟钻来完成。其程序是: ⑴ 通井至切割点井深以下; ⑵组钻具下入套管内割刀至切割点进行切割作业; ⑶确定套管割断后, 提出切割钻具; ⑷ 下入可退式打捞矛进行打捞作业。

因此, 在正常情况下, 每处理一段衬管至少须进行三趟起、下钻。对于衬管较长、井下情况较复杂的井, 起、下钻次数相当频繁。从而造成施工周期长, 劳动强度大, 修井成本高, 同时也因处理时间长而对油气层造成伤害等。衬管切割、打捞联作工艺的应用很好的解决了上述问题。该工艺将传统的割、打捞两步走通过技术改造, 合并为“一步走”, 即将割、打捞合为一趟起下钻来完成, 从而大大缩短了施工周期, 减少了劳动强度, 节约成本, 并且减少了修井液对气层的伤害。通过 X43 井、X22 井的现场应用表明, 衬管切割、打捞联作工艺具有操作方便、安全、易掌握、施工参数易控制等特点。具有很强的实用性和广阔的应用前景。

衬管切割、打捞联作工艺

1. 工具准备

1) ND 型机械式套管内割刀。

2) TLM 可退式捞矛。

3) 钻杆及各式配合接头。

2. 施工工艺

* 秦晓庆, 1964 年生, 高级工程师; 1984 年毕业于武汉地质学院。现从事油气井修井工程研究和管理工作。地址: (618000)四川省德阳市淮河街 11 号。电话: (0838)2409260。

1) 通井: 组下管串通井至切割点井深以下, 探衬管内埋砂情况及井深。

2) 组下切割、打捞联作管串, 结构为: 机械式套管内割刀+ 配合接头+ 钻杆+ 配合接头+ 可退式打捞矛+ 配合接头+ 钻杆。

3) 准确计算割、打捞方入。

4) 送钻, 到达衬管顶2 m左右开泵冲洗鱼顶。然后小心送钻, 确保割刀安全进入衬管。至切割点后, 画好方入进行切割作业。

5) 切割。[1] 割刀座挂, 缓慢开动转盘正转, 转速: 10 r/min, 钻压为0.2~ 0.3 t, 仔细观察指重表灵敏针, 轻微下放钻柱, 指重表上灵敏针显示钻压上升, 则割刀座挂成功; ④切割, 施工参数: 钻压0.5~ 1 t, 转速20~ 30 r/min, 钻压下降时须均匀送钻; ㈣当灵敏指针显示钻压随钻柱的下放而上升时, 表明衬管已割断。

6) 割刀解挂。缓慢停下转盘后, 上提钻柱超出钻柱自重1~ 2 t即可解挂。

7) 打捞。[1] 准确量好方入, 下放钻柱至计算方入时, 缓慢反转转盘(一般3~ 4圈), 下放钻柱, 使捞矛进入捞住状态; ④缓慢停止转动转盘, 下放钻柱至超出悬重2~ 3 t, 巩固捞矛吃入深度。㈣上提钻柱, 缓慢加大提升吨位。当提至一定井深而钻柱负荷忽然降至接近原钻柱悬重加打捞管柱重量时, 表明打捞成功。

8) 起钻。打捞成功后即可起钻。

3. 施工技术要点

1) 认真分析井眼资料, 通过通井详细掌握井内情况, 准确计算割、捞方入。

2) 割刀与捞矛之间的连接距离视切割衬管长度、井底砂埋深度而定。原则上切割时捞矛不能进入衬管, 而打捞时捞矛能顺利的进入鱼顶。即:

$$L = L_1 + K$$

式中: L 为割刀与捞矛之间的距离。L_1 为衬管鱼顶到切割点的距离。K 为附加值。一般10 m左右。

3) 切割时严禁上提钻柱, 不得猛压。严格控制转速, 以免转速过大而打刀、烧刀。密切注意指重表指针变化, 钻压下降时须均匀送钻。

4) 捞矛捞住衬管后, 缓慢停止转动转盘, 切忌猛刹猛停。否则会使捞矛卡瓦滑脱, 造成打捞失败。

5) 上提钻具时, 严禁转盘转动, 用悬绳卸扣, 以避免在衬管内因钻柱转动使割刀重新座挂和正转甩脱所捞衬管。

效益分析

X43井、X22井、X60井、X75井、X55井等五口井都是新场气田以蓬莱镇组为主要目的层的开发井, 完井方式为衬管完井。经过几年的生产, 产量下降。地质论证选层后进行修井, 以满足挖潜层位实施加砂压裂的要求。各井衬管处理基本数据见表1。

表1　各井衬管处理基本数据表

井号	衬管井段	处理衬管长度	处理工艺	处理时间(h)
X60	φ127 mm×(544.51~ 1 150 m)	77.86 m	割、捞分步	44
X75	φ127 mm×(698.36~ 1 100 m)	179.81 m	割、捞分步	96
X55	φ127 mm×(524.43~ 800 m)	229.14 m	割、捞分步	57
X43	φ127 mm×(530.15~ 1 050 m)	84.00 m	割、捞联作	16
X22	φ127 mm×(522.31~ 1 050 m)	267.29 m	割、捞联作	12

从表1可以看出, 在处理衬管长度基本相同情况下, 采用割、打捞联作工艺的X22井比割、打捞分步走的X55井节约时间78.9%, X43井比X60井节约时间72.7%。从而大大提高了作业效率。

结　论

1) 衬管切割、打捞联作工艺的应用使衬管处理时间缩短了70%左右, 减少了起、下钻次数, 修井成本降低, 提高了经济效益。

2) 减少了修井液对气层的浸泡时间, 有利于气层保护。

3) 该工艺具有较强的可操作性, 施工安全、操作易于掌握, 施工参数易控制。

4) 针对西南石油局油气田该类型的待修老井较多, 因此, 该工艺应用前景广阔。

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Add: No. 11, Huaihe Street, Deyang, Sichuan (618000), China
Tel: (0838) 2409681

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LINER CUTTING-FISHING JOINT OPERATION TECHNOLOGY

Qin Xiaoqing, Fu Wei and Yuan Yong (Oil and Gas Testing Centre of Southwest Petroleum Bureau, Sinopec). *NATUR. GAS IND.* v. 22, no. 3, pp. 47~48, 5/25/2002. (ISSN 1000-0976; **In Chinese**)

ABSTRACT: Because the well-pattern density is getting larger and larger, to solicit for land being difficult, owing to the unceasing deepening of oil and gas development and the requirements of environmental protection are higher and higher, well workover has become a necessary work in the whole process of oil and gas development. The traditional treatment method separating the fishing from the cutting in a liner-completion well is of some shortcomings, such as a long operating cycle, strong labour strength and high workover cost, etc., and these shortcomings may be effectively overcome by applying liner cutting-fishing joint operation technology. The properties, operational procedure and applied result analysis of this technology are introduced in the paper.

SUBJECT HEADINGS: Liner (well), Cutting, Fishing, Joint operation

Qin Xiaoqing *(senior engineer)*, born in 1964, graduated from the former Wuhan College of Geology in 1984. Currently he is engaged in the research and management of oil and gas well workover engineering. Add: No. 11, Huaihe Street, Deyang, Sichuan (618000), China Tel: (0838) 2409260

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GAS-CHANNELING PREVENTION PERFORMANCE DESIGN OF CEMENT SLURRY AND REASONABLE SLURRY COMPOSITION

Liu Naizhen and Wang Tingrui (Liaohe Petroleum Exploration Bureau), Liu Xiaoliang and Liu Chongjiao (Southwest Petroleum Institute). *NATUR. GAS IND.* v. 22, no. 3, pp. 49~51, 5/25/2002. (ISSN 1000-0976; **In Chinese**)

ABSTRACT: It is a key technique of raising cement job quality and protecting oil and gas reservoirs to solve the problem of gas-channeling prevention in cementing job. Although there are many methods used for the gas-channeling prediction and prevention of cement slurry there at present, it is difficult to apply on the spot. Because the factors considered are simplistic, some performance parameters of cement slurry at high temperature and high pressure are difficult to be measured. On the basis of analyzing these methods used for gas-channeling prediction and prevention at home and abroad, a set of design methods of raising the displacement efficiency of slurry and keeping up the pressure equalization in both dynamic and static processes of cement slurry are put forward in the paper through applying the slurry composition in annular space, the GFP coefficient, the consistency resistance coefficient A of cement slurry and the multiple solidification point cement as well as the annular pressurizing, etc.

SUBJECT HEADINGS: Well cementing, Gas-channeling prevention, Performance, Slurry composition, Gas-channeling potential coefficient, Cement slurry consistency, Displacement efficient

Liu Naizhen *(senior engineer)*, born in 1960, graduated in drilling engineering at the University of Petroleum in 1990. Now he is a postgraduate studying for his Master's degree in China University of Geosciences and is the director of the Research Institute of Petroleum Technology, the Liaohe Petroleum Exploration Bureau. Add: Xinglongtai, Panjin, Liaoning (124010), China Tel: (0427) 7821122

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CHARACTERIZING AND MODELLING OF UPPER SHAXIMIAO FORMATION GAS RESERVOIRS IN XINCHANG FIELD

Liu Zhengzhong (Chengdu University of Technology), Wu Min, Li Huaji and Yang Cheng (Geological Research Institute of Southwest Petroleum Bureau of Star Petroleum Corporation, Sinopec). *NATUR. GAS IND.* v. 22, no. 3, pp. 52~55, 5/25/2002. (ISSN 1000-0976; **In Chinese**)

ABSTRACT: On the basis of analyzing the data on seism, geology, drilling, logging, testing and production collected from 58 wells in Upper Shaximiao Formation (J_2s_2) gas reservoirs in Xinchang field, and by applying fully the new deterministic (Post Stack/PAL, Strata, Rave, RM, Integralplus, Stratimagic) and random (Jason) modeling techniques and methods, the reservoir may be characterized in detail, overall, three-dimensionally and quantitatively and the 3-D reservoir attributive parameters (including porosity, permeability and water saturation) model with a network size of 20m × 20m × 1μs(2m) was set up for each of the $J_2s_2^1$, $J_2s_2^2$, $J_2s_2^3$ and $J_2s_2^4$ gas reservoirs, thus raising the accuracy of reservoir description and overcoming the shortcomings in the interwell interpolation method used for original reservoir prediction, which provides reasonable technical support for the stimulation of various reservoirs and the reasonable utilization of the proved reserves in Upper Shaximiao Formation gas reservoirs, and supplies reliable basis for gas reservoir