

经验交流

浅谈 ERW 钢管错边缺陷

赵 坤

(宝鸡住金石油钢管有限公司, 陕西 宝鸡 721008)

摘 要: 对 ERW 焊管生产中错边产生的原因进行了较详细的论述, 指出 ERW 焊管错边产生的主要原因是成型质量不好, 挤压辊挤压量过大以及挤压辊磨损及安装不当等。给出了错边缺陷的判定方法, 并提出了消除错边的方法和措施。

关键词: ERW; 钢管; 错边; 毛刺

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近年来, 国内 ERW 钢管生产线日趋增多, 产能和产量逐年增大。随着焊接、成型工艺、自动控制、热处理和无损检测等技术水平的不断提高, ERW 焊管的各项性能指标得到了较大改善, 现已广泛应用于一般管路(输水、输气)、特殊管线(高级输送管)、锅炉热交换器、机械结构、油井(套管)用管等。然而, 在中大直径 ERW 焊管, 尤其是薄壁焊管(t/D 为 0.02 ~ 0.05)管坯成型时, 常出现焊缝错边缺陷, 严重影响了 ERW 焊管的质量。为此, 笔者针对该缺陷的产生原因进行了分析研究。

1 ERW 钢管的错边缺陷(搭焊)

ERW 钢管的错边缺陷, 也叫搭焊, 指的是管坯两边缘在焊接时错位, 如图 1 所示。即使在清除内外毛刺后在钢管内外表面仍能够看到错边的痕迹, 如图 2 所示。

错边的主要危害是使钢管的有效壁厚减小, API SPEC 5L 标准规定, 电焊钢管错边加残留毛刺不得大于 1.5 mm (0.060 in)。另外, 错边也会影响钢管超声波和 X 光检验。在钢管的使用过程中, 错边还会成为钢管化学腐蚀的起点部位。

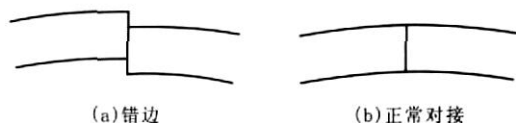


图 1 错边和正常对接示意图

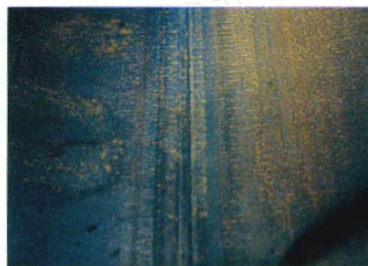


图 2 内毛刺清除后错边残余

2 ERW 钢管错边缺陷产生的原因

2.1 成型质量不好产生的错边

ERW 钢管要经过一系列轧辊(粗成型、辊串、精成型)把卷板逐渐卷成桶状, 成型质量对焊接质量影响很大。成型时如果钢带出现中心偏移, 将导致管坯边缘高低不平产生错边, 通常这种错边朝着一个方向, 比较容易判断。其次, 如果成型辊参数设定不当, 进入挤压辊前, 带钢两边缘高低变化呈波浪形, 进入挤压辊后产生局部小错边, 且错边方向不定。

2.2 挤压力的影响

ERW 钢管是通过加热带钢边缘同时通过挤压辊的挤压完成焊接, 挤压力是焊接工艺的主要参数之一, 对 ERW 钢管的质量影响很大。挤压力小, 形成共晶体的数量少, 焊缝强度低, 同时非金属夹杂和形成的氧化物残留在焊缝中也影响焊缝强度; 挤压力过大, 会将达到焊接温度的金属全部挤出, 使焊缝强度降低。另外, 过大的挤压力很容易形成错边, 而且这种错边不减少挤压力很难

调整过来。一般情况下,挤压力是用挤压辊前后管坯的周长差——挤压量来表示和计算的,通常挤压量为钢管壁厚的一半。

2.3 轧辊、工装的影响

(1)轧辊的影响 对 ERW 钢管错边有影响的轧辊主要是精成型轧辊和挤压辊,精成型轧辊磨损量过大、精成型轧辊导向片两侧磨损量不一样、挤压辊尤其是上挤压辊边缘损伤以及两个挤压辊磨损量不一样,都会产生错边,这种错边一般都有有一定的周期性。

(2)轧辊轴承的影响 挤压辊的轴承损坏导致挤压辊不转或旋转不均匀,从而导致挤压力不均匀,就会产生错边。另外,轴承磨损量大或轴承间隙大,也会造成挤压辊旋转不均匀,产生错边。

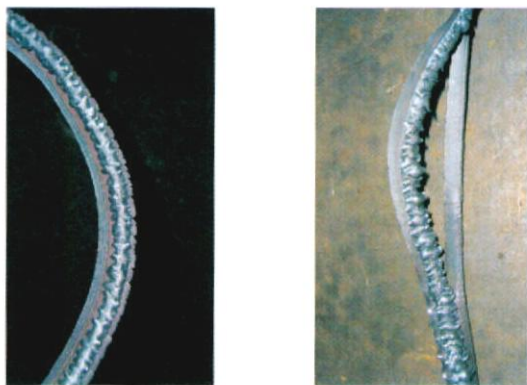
(3)轧辊工装安装质量的影响 精成型轧辊和侧挤压辊未安装水平,上挤压辊轴和轴承以及轴和辊座之间间隙过大都会导致错边的产生。

3 错边的判断与确认

错边的判断与确认主要靠目测观察,出现明显的错边时,在挤压辊后就可以发现,但是对于小的错边还要观察内外毛刺以及内外毛刺清除后的焊缝形态。可以从以下几个方面进行判断。

(1)观察外毛刺,焊接挤出的熔化物不在外毛刺的中部,如图 3(a)所示。

(2)毛刺清除后外焊道不平直,刮削后的外焊道宽度、形状有变化。



(a) 外毛刺 (b) 内毛刺

图 3 错边时的内外毛刺

(3)观察内毛刺,如果内毛刺出现断续开叉或开裂,可能存在错边缺陷,如图 3(b)所示。

4 错边的调整与消除

出现错边时,根据错边现象判断错边的原因,可采取以下措施进行调整:

(1)带钢进入成型机后,要确保带钢中心不要偏离轧制中心,管坯边缘出现波浪和鼓包时,合理调整精成型减径量和小排辊压下量,减小和消除边缘波浪和鼓包。

(2)选择合理的工艺参数,尤其是合适的焊接挤压力。

(3)对磨损量过大或精成型轧辊导向片两侧磨损量不一样的轧辊进行修磨,修理边缘损伤的挤压辊。

(4)检查并更换磨损量大或轴承间隙大的轴承,做好轴承的润滑工作。

(5)换道时确保轧辊安装水平,消除挤压辊轴和轴承以及轴和辊座之间过大的间隙。

5 结 语

错边现象是 ERW 钢管生产中的常见现象,尤其是在薄壁管的生产中。产生错边时首先要找出错边的原因,然后采取相应的措施消除错边。需要注意的是在正常生产中,由于原料对接焊前后鼓包较大,经过挤压辊时易产生错边,可通过微调上挤压辊消除错边。

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作者简介:赵坤(1973-),男,工程师,1996年毕业于西安石油大学,从事 ERW 焊管技术质量管理工作。

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structive testing method, and also put forward guideline to evaluate weld quality of pipeline with metal magnetic memory method

Key words: non-destructive testing(NDT); welding defect; metal magnetic memory; X-ray inspection; ultrasonic inspection

Digital Image Processing Method of Weld Tracking System for SAW

CHENG Shi-dong, TANG Nan, GAO Wei-xin, MU Xiang-yang

Abstract D: 1001-3938 (2008) 01-0049-EA

Abstract: The primary problem of real-time weld tracking system is to extract weld information and identify weld center line. A detection weld tracking system is designed which based on the visual CCD sensor and V-series image acquisition card. According to the collected information of welding scene images, weld image is processed with dephi designed tool by combing Sobel edge detection operators and two connected domain image pixel marking algorithm, as a result this algorithm can fulfill the requirements of real-time image processing for SAW, and moreover, it has no strict requests to the light source.

Key words: CCD; weld image processing

Computer Aided Design for Rollforming Shaped Tube

LU Ji-ying, Albert Sedmaier

Abstract D: 1001-3938 (2008) 01-0053-EA

Abstract: Shaped steel tube is more and more widely used in automobile and construction industry. Tooling design method is very important to form the shaped tube. The optima design of high precision and complex contour tooling is obtained by computer aided design technology. Using CAD method, we can short the design time and get lower manufacturing and setting up cost. Now the design of shaped tube tooling is no long depend on the designer experience only. Some successful examples which designed by COPRA are discussed and showed in this paper.

Key words: shaped tube; rollforming; CAD; COPRA

Design of Stepping Motor Driver based on PCI-9118HR Data Acquisition Card

KANG Li, TANG Nan, MU Xiang-yang

Abstract D: 1001-3938 (2008) 01-0055-EA

Abstract: For an automatic welding machine control system, a motor drive control scheme based on PCI-9118HR data acquisition card with industrial computer is put forward. A program written in Delphi 7.0 development environment creates the control square wave signals which are sent to control the stepping motor. Through PCI-9118 it realizes to control motor's direction and speed so that achieve welding gun aligning task. The experimental results show that this method not only has better real-time and fast performance, but also has strong practicability.

Key words: square wave pulse; driving control; stepping motor

Design of the Flux of Water Charging Pump and Oil Charging Pump in the Hydrostatic Tester for Big Diameter Welding Pipe

ZHOU Xiu-feng

Abstract D: 1001-3938 (2008) 01-0059-EA

Abstract: This paper introduces the calculation methods for the flux of water charging pump and oil charging pump in the hydrostatic tester for welding pipe, analyses the influences of such factors as compression of the liquids, air residual in the pipe and the elastic deformation of the pipe etc. It puts forward some issues shall be concerned by designer and operator based on the calculation results.

Key words: hydrostatic tester; water charging pump; oil charging pump; flux; calculation methods

Improvement of Machining Process for Strip Edges-replacing Edges Cutting with Double Milling

LI Bi-wen, YANG Chun-yu, WANG Shu-ren, WANG Tie-min

Abstract D: 1001-3938 (2008) 01-0063-EA

Abstract: This article introduces several machining process of strip edges for spiral submerged arc welded pipe. Combining with actual production of welded steel pipe, it analyzes superiority of replacing plate edge cutting with double milling based on production procedure, and also emphasizes improvement process of plate edge machining process replacing plate edge cutting with double milling which is executed by Liaoyang petroleum steel pipe mill, as well as methods to improve service life of milling cutter.

Key words: spiral submerged arc welded pipe; double edges milling; edges cutting; strip edge machining; cutter

Brief Discussion on Offset Defect of ERW Pipe

ZHAO Kun

Abstract D: 1001-3938 (2008) 01-0067-EA

Abstract: This article discusses in detail occurrence cause of offset defect during production of ERW steel pipe, and indicates that primary occurrence cause of offset are inferior forming quality, excessive pressing of pressing roller and abrasion of pressing roller, as well as improper installment. It also puts forward judgment method, removal method and measure of offset defect.

Key words: electric resistance welded pipe; steel pipe; offset; burr

Selection Example on Forming Mode of Cold-bending Square/Rectangular Pipe

LI Guo-rong

Abstract D: 1001-3938 (2008) 01-0069-EA

Abstract: Roll cold-bending forming of square/rectangular pipe have two forming methods, namely, first round and square as well as directly to