

The Comparison Test Between The Two NDT Methods Of Magnetic Couple And Touch Head On The Branch Pipe Angle Weld

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Abstract

The joint of main pipe and its branch pipe is often welded while the pipe is used to transport higher pressure medium , and do not use the tee joint . The nondestructive test methods for the welded joint we can use according to the field are magnetic couple and touch head . But which one is better to find out defects of the welded joint ? So , we designed a comparison test to compare the results of finding out defects of the welded joint. The comparison test was made between the two NDT methods of magnetic couple and touch head on the angle weld composed by main pipe ($\Phi 219 \times 6$) and its branch pipe ($\Phi 159 \times 6$), the materials of the two pipes are L360 . And from the test, we get the conclusion that the length destingusied by C-15/50 test spiece along the weld length is equal or near the same, but the magnetic couple method is easier to practice.

Keywords: Magnetic-particle test; Magnetic Couple method; Touch Head method; Branch Pipe; Angle- weld

1 Abstruct and requirement of the test

1.1 Test piece

Specifications of the test piece : main pipe $\Phi 219 \times 6$ mm , length 400mm ; and its branch pipe $\Phi 159 \times 6$ mm , length 150mm .

The materials of the two pipes are L360 (low-alloy steel)

Width of the angle weld is 14-20mm

1.2 Equipement、 magnetic particles、 sensitivity test piece

1.2.1 Magnetic particle examination equipement

1.2.1.1 The yoke is N-IBS(AC) made in Japan , the lift force is 50N.

1.2.1.2 The prod is CJX-1000(AC) made in Sheyang, China.

1.2.2 The magnetic particles are made in Tongluo, China. The magnetic suspend liquid is mixed with the particles and water in accordance with the specification.

1.2.3 The sensitivity piece is C-15/50,length is 3x5mm cut along the cut-line.The edge of the piece is located on the pipe with glue belt,but the slot should not be covered.

1.3 Test requirement

1.3.1 Each method,the yoke or prod is layed on the weld twice times ,vertical and along at the same position.

1.3.2 The yoke or prod is located some position,moving the C style test piece along the weld from the center to two side of the weld, magnetizing the weld at the same time and examining the indication,until the indication is not found(including over-indication),and recording the distance from the center;then moving the C style test piece vertical the weld from the weld center to main pipe side, until the indication is not found,and recording the distance from the center or edge of the weld.The similarity test can be done on the heat affected zone also.

1.3.3 The test is done in accordance with JB/T4730.4—2005.The distance of yoke or prod should be 140mm,the bending distance of yoke is about 200mm.

2 Test result

The test result are showed in figure 1 and figure 2 .

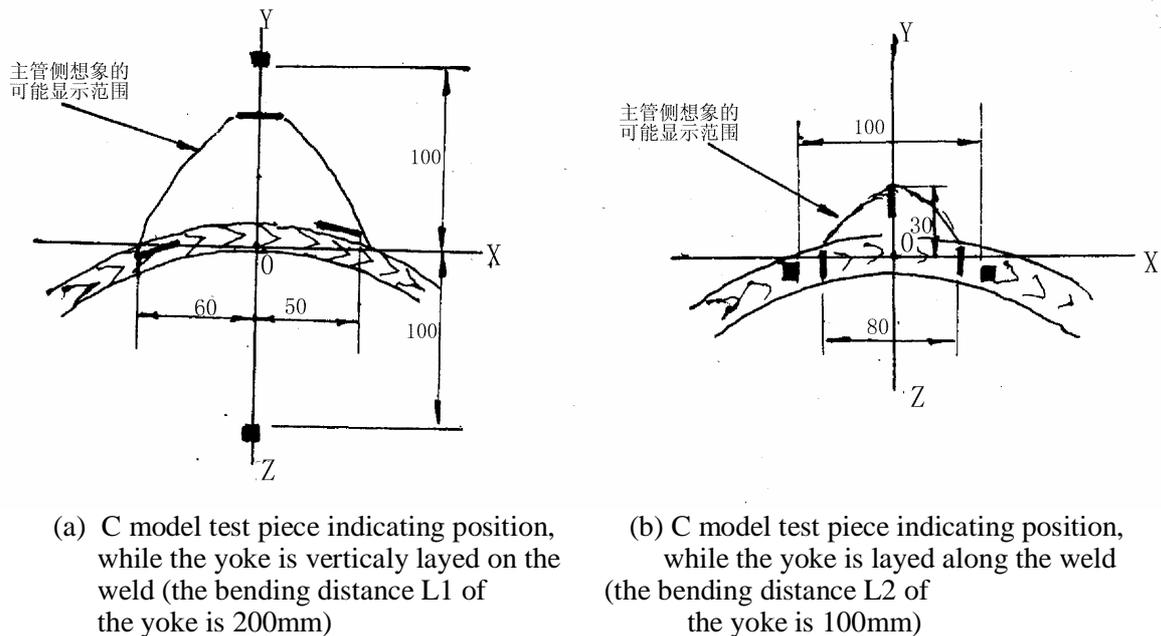
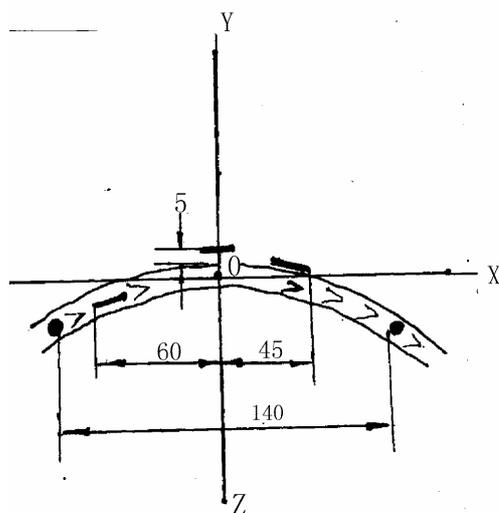
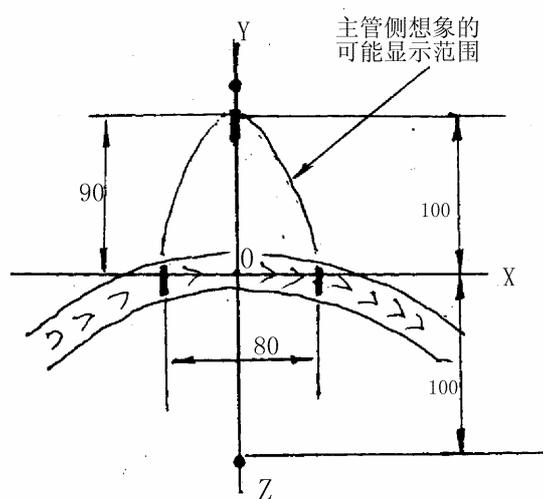


Figure 1 the effective indicating range with yoke

Explaining: The yoke is N-IBS(AC) made in Japan ,the lift force is 50N; The sensitivity piece is C-15/50; main pipe $\Phi 219 \times 6 \text{mm}$; branch pipe $\Phi 159 \times 6 \text{mm}$, width of the angle weld (bevel face) is 14-20mm ; the black square showed the yoke position,the black horizontal short line showed the C model test piece position ;XY axial showed the water level area , and the XZ axial showed the vertical area.



(b) C model test piece indicating position, while the prod is layed along the weld (not drawing out the imagine possible indicating range)



(b) C model test piece indicating position, while the prod is vertically layed on the weld (the bending distance L2 of the yoke is 100mm)

Figure 2 the effective indicating range with prod

Note:the prod type (made by china sheyang) is CJX-1000;the black circle in the figure representative the position of prod; the other data is same as figure 1 .

3 analysising about the experiment result

3.1 The yoke moving distance b1 along the weld ,while the yoke is vertically layed on the weld

The possible indication range of langitudinal defect along the weld with C model test piece is not less than 100 mm from the figure 1(a). We think the yoke moving distance b1 along the weld should be suitable with 80 mm , according to the rule that the magnetization area overlap each other should not be less than 15 mm.

3.2 The yoke moving distance b2 along the weld ,while the yoke is layed along the weld

The possible indication range of circumference defect along the weld with C model test piece is 80 mm from the figure 1(b). According to the rule that the magnetization area overlap each other should not be less than 15 mm,we think it is suitable that the requirement of $b2 \leq L2 - 50\text{mm}$ in table B1 of JB/T4730.4-2005.In this experiment, $b2 = 100\text{mm} - 50\text{mm} = 50\text{mm}$. Ought to contact a flat surface since explanatory being trying the piece of structure and yoke of the magnet waiting for cause more here, spacing touches a yoke of the magnet no well, if choosing 140 mm , reasons , the effect is relatively poor

3.3 The prod moving distance b1 ,while the prod is layed along the weld

It can be seen from the figure 2(a), this method which the placing effect is the same like figure 1

(a) , is also to examine the direction defect. The effective length of this placing method is not lower than 90 mm along weld, or it is close with that of figure 1 (a). For the magnetization area overlap each other request, b1 should be 70 mm. This is consistent with JB/T4730.4-2005 attached list B1, $b = L/2$ request .

3.4 The prod moving distance b2 ,while the prod is vertically layed on the weld

Comparatively,figure 2 (b) and figure 1 (b), we can regard that the effective length along the weld is the same ,equal to 80 mm ,for the lateral defect examination. Choosing $b_2 = 50$ mm therefore which is narrated 3.2 section, it is in order to accordance with the demands of table B1 attached in JB/T4730.4-2005 . We think the prod moving distance b2 should be also equal to 50 mm ,while it is vertically layed on the weld.

3.5 Discussion About the defect detecting number of times N for all lenth along the weld circle

Because of the location diversity placing of the yoke or prod, the b1 and b2 of two kinds method has each respectively. Suppose the outside diameter of the branch pipe be D, the average circle length L of the circumference weld is approximately equal to $\pi(D + 8)$, and then L is divided by b1 or b2 ,we get the defect detecting number of times N approximately . The outside lane circumference of the test piece measured is 545 mm , the circumference calculated is 525 mm, disregarding which crack detection method to use, the crack detection number of times N is not smaller than 11 ,while b2 takes 50 mm. It is very overlaborate to calculate the crack detection number of times while the position is changed ,but this is the thing we should do in order to ensure the detection quality.

4 The other problems discovered in the experiment and the limitation discussing

4.1 Shortcoming of prod method

4.1.1 Very much, the pipe surface that prod get in touch with must be polished bright and clean, otherwise it is able to affect the effective length of detecting gravely.

4.1.2 Operation personnel must put forth self's strength and presses the prod very stably on the piece, in order to ensure that the prod and the piece get in touch with very well, Otherwise an arc can be occurred and affect display.

4.2 The limitation being in charge of the leg of a fillet weld magnetic particle crack detection is discussed

4.2.1 It may be more difficulty to practice detecting whatever using yoke or prod while the branch caliber is smaller than 159 mm, the moving spacing b1 and b2 of yoke or prod will be smaller, even it is not able to practice detecting. We have used yoke to detect fillet weld of branch pipe ($\Phi 89 \times 4$) , the effect is extremely not good. The problem of branch pipe diameter suitable for that the yoke follows,is not the main point discussing therefore , so not having given unnecessary details.

4.2.2 the experiment piece adopt is that the branch pipe and main pipe in charge are orthogonal , is that the pipe axis intersection angle is 90'. If the branch pipe and main pipe in charge are tilted , the angle of one side is greater than 90°, and the other side is smaller than 90°,for the side that the angle is smaller than 90°,it is difficult to detect whatever using yoke or prod .

5 Conclusion

5.1 Tt is suitable to detect angle weld for the steel-made branch pipe which its diameter is 159 mm ,whatever using yoke or prod .

5.2 The effective length along the weld displayed with C-15/50 test block for the two kinds method are equal or close, yoke of the magnet operation is simple and convenient but .