Review of weld angles on butt weld joint strength

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ABSTRACT

The pipe welding failures are majority in process industries. While working the weld can repair or making new weld. We will study the V-groove geometry and finding out one geometry. The V-groove geometries we will make different models on pipe varying included angle from 45^0,50^0,55^0,60^0.

Currently the V-geometry included angle using up to 45^0, but from studying the Indian Welding Journal, Indian Welding Society it is observed that if included angle increased up to 60^0 angular distortion decreases. This concept were using for regular V-groove but in this project using the V-groove with slotted portion at middle site of geometry. Because from studying different papers it is compared between different V-groove geometry that is new weld ,aged weld, full repair, partial repair-I, partial repair-II. So from these geometry selecting the partial repair-I that is V-groove with slotted portion at middle site of geometry. Because this is gives more strength as well as life time. But this is only for 45^0 angle and for only V-groove not more than that. In this project will finding for 45^0,50^0,55^0,60^0.

The tensile test has conducted to check that maximum tensile force sustain capacity. Also to check the welding quality and other parameters conducting the ultrasonic test as well as magnetic particle inspection test. To know the life time then calculating life time by conducting fatigue test. For all these tests make the four specimens for each test.

From all these tests it is observed that tensile strength increased up to 76.64% for 60^0 angle as compared to 45^0 angle. Also fatigue life strength increased up to 46.15% for 60^0 angle as compared to 45^0 angle. No any defect found in the weld area that is welding quality is very good. So 60^0 angle is better than 45^0 angle.

Keyword: - *Strength, fatigue life, welding V-groove included angle, Bending, Welding positions etc….*

1. INTRODUCTION

The life time of a welded joint depends on a number of parameters. These may vary widely and lead to reduction of the creep life. In the present study the creep process in a welded joint in order to study the effect of (i) the material properties in the weld metal and the heat affected zone (HAZ) as well as (ii) the load on life.

The different geometries are used for weld repair as well as new weld. This is selecting from them having more life time. Then, we will go to change the angle to 60^0 and experiment the results.

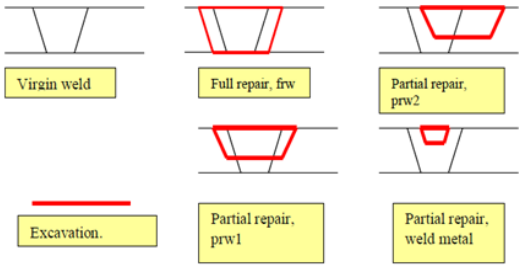


Figure 1: Typical excavations used in weld repair, (PowerGen plc, Innogy plc, British Energy plc.) [3]

Failure of weld joints majority due to the crack generation in heat affected zone (HAZ). Now, study is done on up to angle 45^0 not more than in terms of strength basis. Still there is failure of weld. [1]
From studied, that in doing this project Cracks- Arc strike cracking, Cold cracking, Hot cracking, Longitudinal crack, Reheat cracking, Root and toe cracks, Transverse crack, Distortion, Inclusions, Lack of fusion and incomplete penetration these types of cracks are observed.[2]
The results obtained have clearly shown the significant increase of the total life, as the end load increases, particularly when the time to re pair is close to the failure life of the original weld. Note, however, that at this stage, assessment of the homogeneous component needs to be considered. Therefore partial-I geometry is selected. [4]

2. OBJECTIVE OF PROJECT

The purpose of this work is to study the different V- groove geometry used in the pipe welding. To increases the life of weld.
Following are the objectives of the project work,

1) To study the effect of included angle in V-groove geometry, on pipe welding.
2) To find out the behavior of the different included angle in V-groove geometry, in terms of tensile strength.
3) To suggest the best suitable geometry and included angle in V-groove, particular in pipe welding application.

3. TESTING PROCEDURE AND RESULTS

3.1 Specimen Preparation for Tensile Testing

i) Tensile Requirements for the Steel
Longitudinal tension test specimens taken from the steel shall conform to the requirements as to tensile properties. At the manufacture's option, the tension test specimen for sizes 8 5/8 in. (219.1 mm) in outside diameter and larger may be taken transversely.[5]
ii) Production Test Specimens and Methods of Testing
(1) The test specimens and the tests required by these specifications shall conform to those described in Test Methods and Definitions A 370.
(2) The longitudinal tension tests specimens of the steel shall be taken from the end of the pipe in accordance with Figure 2, or by agreement between the purchaser and the manufacturer, or may be taken from the pipe or plate, at a point which will be approximately 900 of arc from the weld in the finished pipe.

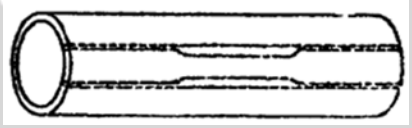


Figure 2: Location from Which Longitudinal Tension Test Specimens are to be cut from large diameter pipes

(3) If the tension test specimen is taken transversely, the specimen shall be taken in accordance with Figure 3.

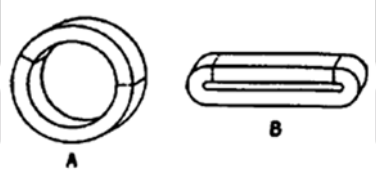


Figure 3: Location of Transverse Tension Test Specimen in Ring Cut from Tubular Steel Products

(4) The specimens for the reduced –section tension test of production welds shall be taken perpendicularly across the weld at the end of the pipe. The test specimens shall be straightened and tested at room temperature.
(5) Reduced-section tension test specimens shall be prepared in accordance with Figure 4. [5]

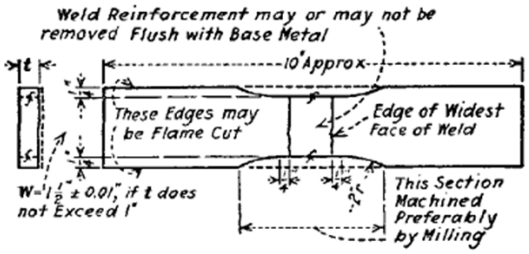


Figure 4: Reduced-Section Tension Test Specimen

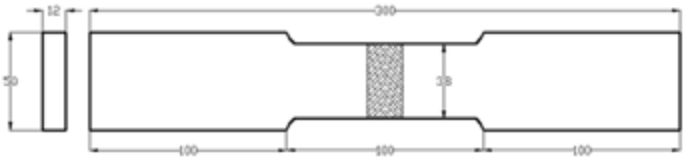


Figure 5: Tensile Test Specimen (As per ASTM Vol. XI)

3.2 Tensile Testing- Procedure

i) Determine the mean diameter of the nominal 0.505 inch specimen & record.

ii) Mark a 2-inch gage length on the specimen using the gage punch & hammer.

iii) Insert the specimen in the Universal Testing Machine (UTM) and attach the extensometer. Carefully follow the manufacturer's directions for

attachment of the extensometer. Select a load range for the UTM that will accommodate the maximum anticipated load during the test.

iv) Apply the load slowly, obtaining simultaneous readings of load from the UTM and elongation from the extensometer. When the extensometer nears its range, remove. Then continue monitoring the elongation of the specimen using the mechanical dividers and machinist scale in 0.05 inch increment until fracture occurs. Attempt to obtain the load at fracture.

iv) After failure, fit the broken halves together and measure the final "gage" length, and the smallest diameter.[16]

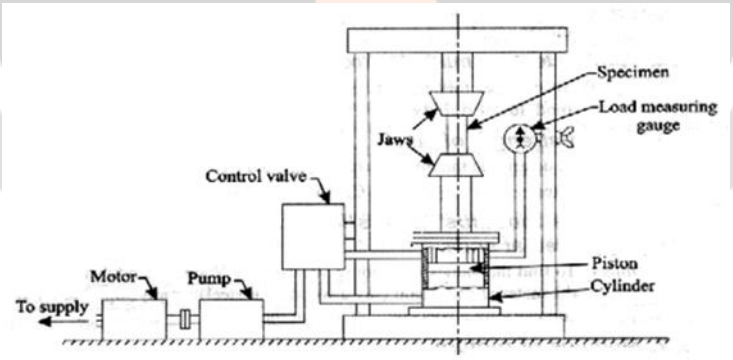


Figure 6: Schematic diagram of experimental Setup for Tensile test

Table 1: Specimens dimensions

Sample No.	Included angle (Θ/2)	Included angle (Θ/2)	Total Included angle (Θ) degree	Slot (S) mm	Height (h1) mm	Height (h2) mm
1 (K-0)	22.5	22.5	45^0	2	5	5
2 (K-1)	25	25	50^0	2	5	5
3 (K-2)	27.5	27.5	55^0	2	5	5
4 (K-3)	30	30	60^0	2	5	5

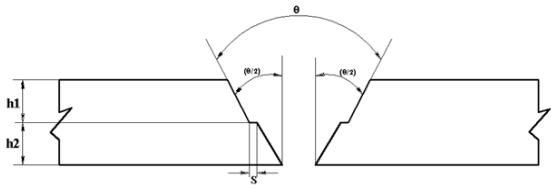
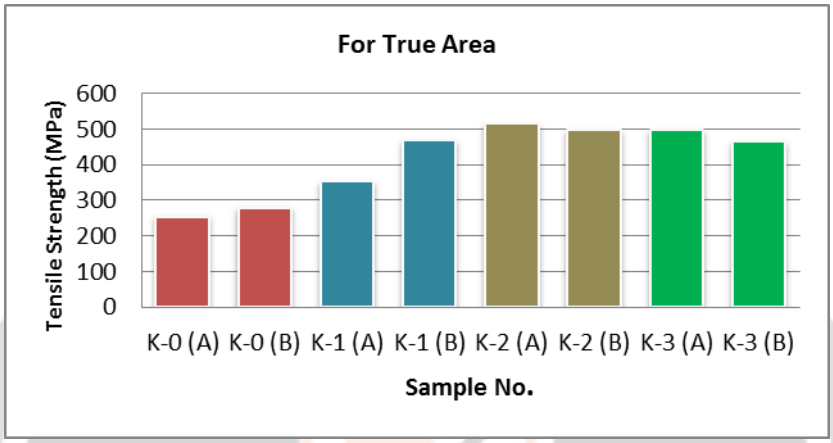


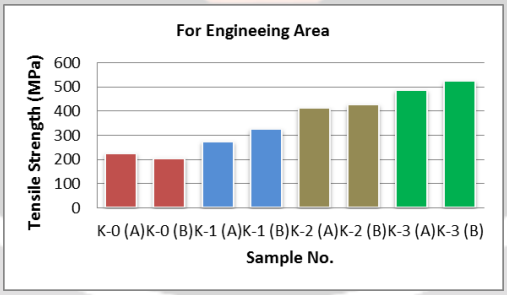
Figure 7: Geometry dimensions as per standard of ASTM

3.3Results-Comparison of results after tensile test for true area



From experimental results, it is observed that, the tensile strength for true area has been increased as included angle increases. The optimum strength for sample K-2(A) i.e. for 55^0 angle. The strength for 60^0 angle obtained less as compared to 55^0; due to variation in area while cutting the specimen, therefore there are changes in the strength. Also it is observed that maximum specimen were break in weld area.[15]

3.4 Results-Comparison of results after tensile test for engineering area[15]



4. CONCLUSIONS

From the above experiments it is observed that,

1. The strength for specimens of included angle 45^0, 50^0, 55^0 and 60^0 in increasing continuously, as angle increases strength will be increases.
2. The tensile strength has increased by 34.08% for 50^0 included angle as compared to 45^0 included angle.
3. The tensile strength has increased by 49.75% for 55^0 included angle as compared to 50^0 included angle.
4. The tensile strength has increased by 17.95% for 60^0 included angle as compared to 55^0 included angle.
5. The tensile strength has increased by 136.86% for 60^0 included angle as compared to 45^0 included angle.

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And finally this day has come. We are presenting the paper with great pride. There are too much efforts of gardener to yield the beautiful flowers. So we should not forget him while praising flower. It is a matter of gratification for us to pay my respects and acknowledgements to all those who have imparted knowledge and helped us to complete our paper.

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BIOGRAPHIES

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