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Data Center Formation to Determine Productivity Schedule for Pipe Welding Activities

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To survive in the current competitive and global environment, it is important for organizations to continue to look at ways to increase efficiency and productivity. Organizations need to find new ways that are simple and cost effective for production or service. The formation of a data center can help plan and further increase productivity for pipe welding activities. The construction of this data center is planned from the beginning, where the relevant data is stored in a table based on size, thickness and type of metal. a certified welder completes a pipe weld. Matrix data linking the 3 main criteria and the required time period is developed, thereby determining the welding process commonly used in pipe fabrication. This data centre collects data based on confirmed welding procedures, The amount of time to make a complete welding should be increased by 30%, this extra time with the presumption of idle time. and manpower required for pipe connection fabrication. Early work planning can maximize resources, efficient handling of material layout, higher level of production while providing targets for the organization.

Keywords: Welding, Data welding, Welding time, welding planning.

1. Introduction

Welding is a method of connecting two or more metals using heat (Dahari et al, 2008). Heat and pressure are used during the welding process with the addition of auxiliary metals or not. "The welding process is used to weld different types of metal thicknesses and is used to connect various combinations of the same or different metals." Welding processes are classified on the basis of energy sources, natural base metals, welding purposes, physical processes produced during welding and manufacturing methods. Welding processes are commonly used in heavy industries especially in the fields of shipping, shipping, process plant construction and in oil and gas.

The Work Study is a systematic examination of the method of conducting activities to improve the effectiveness of resource use and to set performance standards for the activities being carried out". In this study, will focus on one industry namely oil and gas. In general, the use of welding methods is a common thing used mainly in the connection of pipes, ducts and iron structures.

In particular, this study will specialize in the formation of data centers to see productivity when welding in oil and gas piping fabrication. Welding in oil and gas pipe fabrication usually covers a wide range of sizes, thicknesses and types of metals. Each welding on different sizes, thicknesses and types of metals must go through the process of "Welding Procedure Qualification Test (WPQT)" to obtain ingredients for each parameter when welding work is done. Each WPQT differs according to the size, thickness and type of metal to be fabricated. Once the welding procedure is obtained, each welder must go through the process of "Welder Qualification Test (WQT)" to determine the ability and capability of the welder to weld a workpiece. Welders are also categorized according to the type of pipe to be welded in terms of size, thickness, type of metal and also the position of the workpiece when welding.

2. Objective

This study aims to build a data center to record productivity for welding work based on 3 main criteria namely differences in size, thickness and type of metal. the temperature and fluid passing through the pipe.

For the purpose of the study, the oil and gas company in Pasir Gudang, namely Malaysia Marine and Heavy Engineering Sdn Bhd (MMHE) as a study place to collect data.

The data center specifically aims to assist pipe fabrication engineers to make preliminary planning to determine the time period that needs to be taken to complete an MMHE pipe fabrication project.

Collectively there are 5 main objectives in the formation of a welding productivity data center:

1. The development of welding data is stored and recorded in a table based on the size, thickness and type of metal.
2. Record the time period to be taken for welding work according to the size, thickness and type of metal for the fabricated pipe.
3. Development of matrix data by linking between 3 main criteria and the required time period
4. Determination of the type of welding process commonly used in pipe fabrication according to 3 main criteria.

3. Methodology

For the purpose of forming the theory of pipe welding data for the oil and gas industry, the information and data used refers to the American Society of Mechanical Engineers, under the heading ASME IX- Qualification Standard for Welding and Brazing Procedure, Welders and Brazers Welding and Brazing Operators. To begin the study, preliminary planning is done in advance to obtain preliminary information to provide input in the formation of data centers.

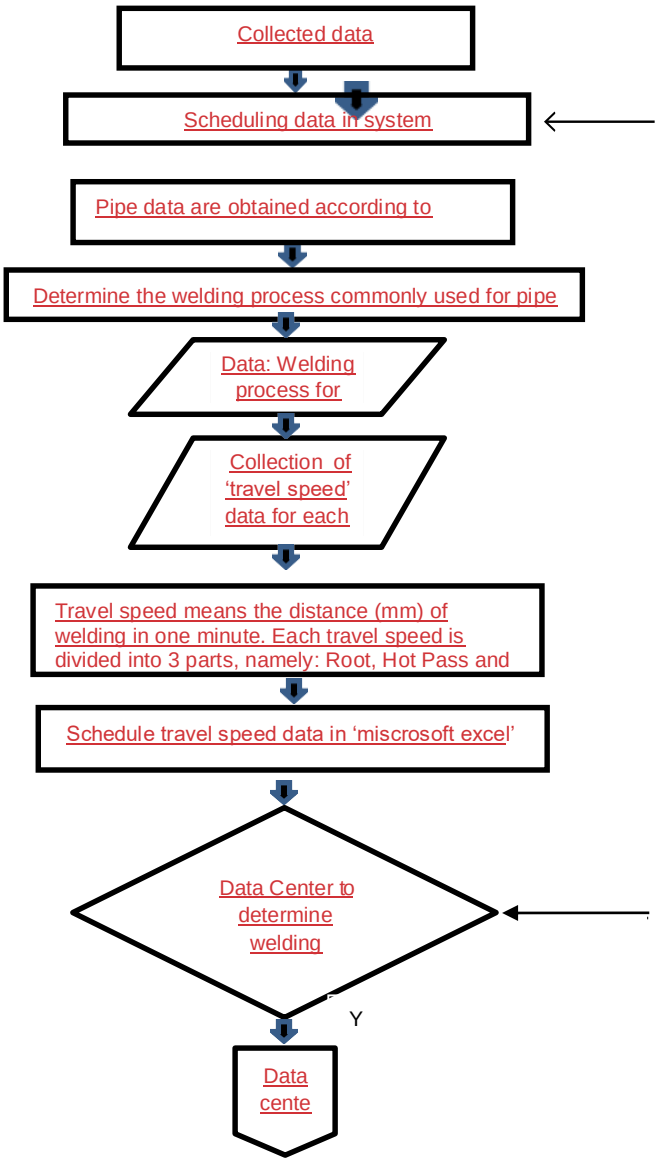


Figure 3.0: Data Center Formation Flow Chart To Determine Productivity

4.0 Discussion

The completed data center makes it easy for pipe engineers to refer to each product of the welder to complete pipe welding activities during the pipe fabrication process. Each pipe connection welded by the welder is based on the time taken during the welding procedure recognition process (WPQT) based on the size, thickness and type of metal. Each round of pipe welding refers to the measurement of the circumference of the circle for the diameter of the pipe to be welded.

For the purpose of data formation, the pipe size table is taken from "Shell Design Engineering Practice" or DEP 31.38.01.11. Referring to Table 4.0, DN is Nominal Diameter or pipe size based on diameter, OD is outer diameter, 'wall thickness' is pipe thickness and 'circumferences' refers to circle circumference based on outer diameter. The types of pipe thickness in the table below are classified by type and are represented by A, B and C.

DN	OD	A	B	C	WALL THICKNESS	ID	INSIDE AREA	OD	OD(mm)	Circumferences
50	6.033	-	-	5S	0.165	5.70	25.54	6.033	60.33	189.56
50	6.033	-	-	10S	0.277	5.48	23.54	6.033	60.33	189.56
50	6.033	40	Std	40S	0.391	5.25	21.67	6.033	60.33	189.56
50	6.033	80	XS	80S	0.554	4.93	19.05	6.033	60.33	189.56
50	6.033	160	-	-	0.871	4.29	14.45	6.033	60.33	189.56
50	6.033	-	XXS	-	1.107	3.82	11.44	6.033	60.33	189.56
80	8.890	-	-	5S	0.211	8.47	56.31	8.890	88.9	279.32
80	8.890	-	-	10S	0.305	8.28	53.86	8.890	88.9	279.32
80	8.890	40	Std	40S	0.549	7.79	47.67	8.890	88.9	279.32
80	8.890	80	XS	80S	0.762	7.37	42.58	8.890	88.9	279.32
80	8.890	160	-	-	1.110	6.67	34.96	8.890	88.9	279.32
80	8.890	-	XXS	-	1.524	5.84	26.77	8.890	88.9	279.32
100	11.430	-	-	5S	0.211	11.01	95.14	11.430	114.3	359.13
100	11.430	-	-	10S	0.305	10.82	91.91	11.430	114.3	359.13
100	11.430	40	Std	40S	0.602	10.23	82.11	11.430	114.3	359.13
100	11.430	80	XS	80S	0.856	9.72	74.18	11.430	114.3	359.13
100	11.430	120	-	-	1.110	9.21	66.63	11.430	114.3	359.13
100	11.430	160	-	-	1.349	8.73	59.86	11.430	114.3	359.13
100	11.430	-	XXS	-	1.712	8.01	50.31	11.430	114.3	359.13
150	16.828	-	-	5S	0.277	16.27	207.69	16.828	168.28	528.74
150	16.828	-	-	10S	0.340	16.15	204.47	16.828	168.28	528.74

Table 4.0: Pipe size based on “Shell Design Engineering Practice” or DEP 31.38.01.11

4.1 Addition of Time Input in the Data Center

Welding data center is based on size, thickness added with the time input required for pipe welding work as stated in the "travel speed" welding procedure. The data center in table 4.1 shows the input for each process, the type of metal used will be added according to need. Input data added in the table below refers to GTAW process, material type A106, thickness 1.6 mm to 17.4 mm and diameter 75mm and below. "Time average" is the average time required for each phase in completing the welding for a complete rotation of the circumference of the circle.

		Process	GTAW				
		Material	A106				
		Thickness	1.6mm - 17.4mm				
		Diameter	75mm and below				
OD	A	Circumferences	Root(min)	Root(max)	Time(min)	Time(max)	Time Av
6.033	-	189.56	66	80	2.87	2.37	2.62
6.033	-	189.56	66	81	2.87	2.34	2.61
6.033	40	189.56	66	82	2.87	2.31	2.59
6.033	80	189.56	66	83	2.87	2.28	2.58
6.033	160	189.56	66	84	2.87	2.26	2.56
6.033	-	189.56	66	85	2.87	2.23	2.55
8.890	-	279.32	66	86	4.23	3.25	3.74
8.890	-	279.32	66	87	4.23	3.21	3.72
8.890	40	279.32	66	88	4.23	3.17	3.70
8.890	80	279.32	66	89	4.23	3.14	3.69
8.890	160	279.32	66	90	4.23	3.10	3.67
8.890	-	279.32	66	91	4.23	3.07	3.65

OD	A	Circumferences	Hot(min)	Hot(max)	Time(min)	Time(max)	Time Ave
6.033	-	189.56	72	80	2.63	2.37	2.50
6.033	-	189.56	72	80	2.63	2.37	2.50
6.033	40	189.56	72	80	2.63	2.37	2.50
6.033	80	189.56	72	80	2.63	2.37	2.50
6.033	160	189.56	72	80	2.63	2.37	2.50
6.033	-	189.56	72	80	2.63	2.37	2.50
8.890	-	279.32	72	80	3.88	3.49	3.69
8.890	-	279.32	72	80	3.88	3.49	3.69
8.890	40	279.32	72	80	3.88	3.49	3.69
8.890	80	279.32	72	80	3.88	3.49	3.69
8.890	160	279.32	72	80	3.88	3.49	3.69
8.890	-	279.32	72	80	3.88	3.49	3.69

OD	A	Circumferences	Cap(min)	Cap(max)	Time(min)	Time(max)	Time Ave
6.033	-	189.56	72	80	2.63	2.37	2.50
6.033	-	189.56	72	80	2.63	2.37	2.50
6.033	40	189.56	72	80	2.63	2.37	2.50
6.033	80	189.56	72	80	2.63	2.37	2.50
6.033	160	189.56	72	80	2.63	2.37	2.50
6.033	-	189.56	72	80	2.63	2.37	2.50
8.890	-	279.32	72	80	3.88	3.49	3.69
8.890	-	279.32	72	80	3.88	3.49	3.69
8.890	40	279.32	72	80	3.88	3.49	3.69
8.890	80	279.32	72	80	3.88	3.49	3.69
8.890	160	279.32	72	80	3.88	3.49	3.69
8.890	-	279.32	72	80	3.88	3.49	3.69

Table 4.1: construction of welding data center

Refer to Table4.1 welding structure of each size and thickness have different process welding approaches. For example, for small and thin pipe sizes only need to go through one welding process which is TIG. However, for large and thick sizes usually need to go through two welding processes, namely TIG and SMAW. Each process has its own time difference such as the data center that has been developed in excel.

In particular, each welding work for pipe connection requires a different time, which depends on several factors:

a) Pipe size (Circle circumference measurement)

b) Thickness (Thickness of the pipe wall is based on the type of connection preparation as shown in the diagram below which is commonly called "single V")

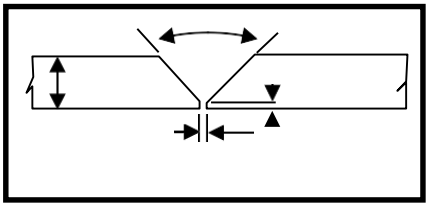


Figure 4.0: Single Connection V

c) Welding process commonly used to weld pipe connections either TIG or SMAW

d) Each pipe thickness has a different number of "passes". "Pass" is a complete round of welding against the circumference of a circle.

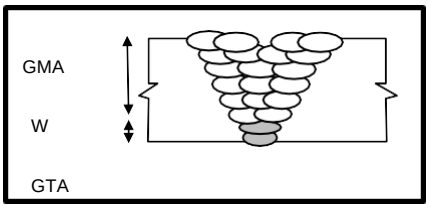
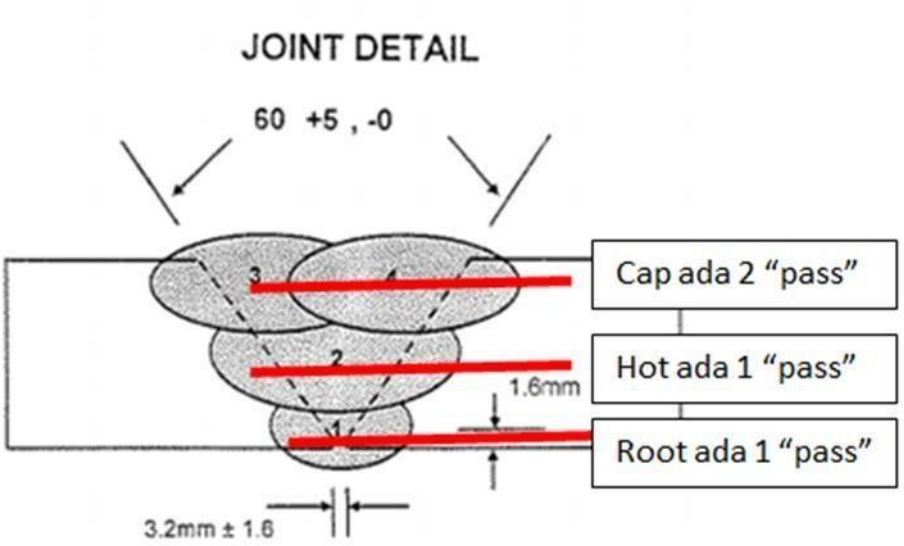


Figure 4.1: "Pass" a complete welding cycle based on the circumference of a circle

e) The circumference of the circle is based on the diameter of the pipe size used. The time taken to complete a complete rotation of the "pass" is directly proportional to the diameter of the pipe used.

4.2 USE OF WELDING DATA CENTER

The use of this data depends on the diameter of the pipe, thickness and type of material used. The welding speed depends on three layers namely root, hot and cap. the fourth is the stamp area. As in figure 4.2 shows three welding layers, the first layer is the root area, the second is hot, the third and the fourth is the stamp area.



To get the amount of time used for a welder depends on the average speed time on the hot, root and cap layers. Below shows an example of data to retrieve data taken to obtain welding time.

To explain the method of using the Data Center for the Pipe Welding Productivity Schedule, an example of pipe size is taken to show a clearer way:

Case Example:

Data Pipe- Size DN 50, Thickness: 1.65mm, Material: CS A106

Referring to Table 4.1 as in paragraph 4.1,

Based on the selection of pipe size (DN), wall thickness and type (material) in table 4.1 above, the welding process used can be identified

Welding Process - Tungsten gas arc welding (GTAW)

Average Time For 'Root pass' - 2.62 minutes x 1 Average

time for 'pass hot' - 2.5 minutes x 1

Average time for 'pass cap' - 2.5 minutes x 2

Example of calculation for welding time: -

$$(1) time = time\ average\ root + time\ average\ hot + time\ average\ cap$$

$$= 2.62 + 2.50 + 5$$

$$= \mathbf{13.52}\ minit$$

$$(2) real\ time = time\ average\ root + time\ average\ hot + time\ average\ cap + 30\%\ from\ total\ time\ (consider\ lost\ time)$$

$$= 2.62 + 2.50 + 6 + 3.4$$

$$= \mathbf{13.52}\ minute$$

Therefore, basically, the time required to weld CS A106 pipe for DN50 size with a thickness of 1.65mm is 13.52 minutes. The time taken only counts for one pipe connection. If the number of connections more than one time per connection is multiplied by the number ofconnections.

For example, in the field or work of pipe fabrication the number of connections that need to be connected is 10 joints (Joint) so the time period required for 10 pipe connections is:

13.52 minitper penyambungan x 10 bil penyambungan = 135.2 minit(2.25 hour)

Based on this calculation, it allows engineers and supervisors to make preliminary plans to determine the time required to complete a pipeline project in the oil and gas industry. With the construction ofthis welding schedule is able to facilitate supervisors and engineers to plan quickly and accurately based on specifications project on the size, material and thickness of pipes used.

5.0 Conclusion

Overall, with the data center for this pipe welding productivity schedule, in this oil and gas pipe connection fabrication industry will be able to help pipe engineers and pipe supervisors make preliminary planning of the amount of time and manpower required for pipe connection fabrication. This is because over a period of time the data that has been recorded according to the pipe size, thickness and type of metal will be a standard productivity of pipe welding to be done.

For organizations, these data centers can help increase productivity through good planning. As a result of systematic planning, production efficiency can be improved, higher levels of production, optimal use of resources, efficient handling of material layout, level of benchmark performance and standards are established, thus providing targets for organizations. In the education sector, students usually focus on welding methods in the workshop, but with this paper to some extent will help students on the application of welding in the oil and gas sector. Pipe welding in oil and gas is a very broad field in building a career as a welder, supervisor or engineer. The data collected is based on global standards applied in the fabrication of oil and gas pipes.

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