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Characterization of Filler Welding on Mechanical Properties of Copper

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Abstract:- In this era, the world temperature is rising. Manufacturers in the air conditioning industry are developing environmentally friendly compressors and refrigerants. However, the current refrigerant, R32, has a very high pressure, which negatively affects the copper pipes of the air conditioner, making them prone to leaks. To save costs, a brazing method is often used to connect the pipes, but this method often causes repeated leaks in the welded area. This study was conducted experimentally by testing the welded pipes, applying pressure, and examining the microhardness. The purpose of this study is to analyze the microhardness of the welding results of copper material on 0.41mm, 0.58mm, 0.61mm AC pipes. The results of reading this journal provide insight into the welding results of copper pipes in air conditioning systems by pressure test and hardness test.

I. INTRODUCTION

Copper (Cu) is a material that is widely used for industrial applications because it has excellent rust resistance, corrosion resistance, and can conduct hot and cold temperatures well [1]. This study aims to test the manufacturing strength of copper using Harris O welding filler with the Brazing welding method [2]. This strength test was carried out using the pressure test method and microstructure test. It is hoped that this research can provide useful information for the manufacturing industry in improving product quality.

Based on the research conducted, the authors used copper material with 3 thickness sizes, namely 0.41mm, 0.58mm, 0.61mm. the authors chose these 3 sizes because they are often used in the air conditioner (AC) pipe industry [3][4], so that the writing of this thesis report can be a reference for the development of the industrial world specifically in the field of air conditioners(AC).

II. METHODS AND MATERIAL

➢ *Experiment*

The research was conducted experimentally and aims to find out how much the possibility of leakage in copper pipes when given a pressure of 80-100Psi for a long time. 1 hour using a split air conditioner size l/2PK. As well as getting the microstructure by using microscope and micro hardness. After the data is recorded, the data is processed, and further analyzed.

➢ *Material*

The materials and tools used in the research are:

- *Copper Pipe (0.41mm, 0.58mm, 0.61mm)*

The copper pipes used are 0.41mm, 0.58mm, 0.61mm because they match the thickness of pipes commonly used to install air conditioners in housing.

- *Flaring Equipment*

The flaring tool is used to make the hole at the end of the pipe expand so that the pipe can be connected with a threaded pipe connection.

- *Welding head(torch)*

The welding head is used to regulate gas delivery when welding.

- *Flux*

Flux is used to reduce the surface tension of the filler melt so that welding is easy to do and useful for preventing the formation of oxide layers.

- *Portable Gas*

Portable gas as fuel for welding in combination with a welding head (torch).

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- *Sandpaper*

Sandpaper is used before welding, aiming to remove the coating layer on the pipe so that the pipe can be heated perfectly.

- *Harris Welding Wire Type O*

Harris type O welding wire as filler to perform welding.

- *Gloves*

Gloves as one of the safety gear so that hands are not injured when welding.

- *Air Conditioner*

In this study using air conditioner as a pressure test that provides 80-100Psi pressure.

- *Micro hardness Machine*

The micro hardness machine has the purpose of testing the hardness of the welded pipe.

III. RESULTS AND DISCUSSION

Based on the welding process carried out, 3 specimens of pipe sizes 0.41mm, 0.58mm, 0.61mm data will be analyzed:

Fig 1. 0.41mm Thick Copper Pipe

Fig 2. 0.58mm Thick Copper Pipe

Fig 3. 0.61mm Thick Copper Pipe

Based on the results of the pressure test process carried out for 1 hour, there were no leaks during the pressure test, no oil was seen and a suspicious sound indicated that the results of the welding had no leaks.

The results of micro hardness on pipe sizes 0.41mm, 0.58mm, 0.61mm are:

Table 1. Result of vikers test

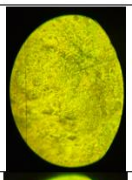
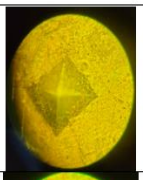
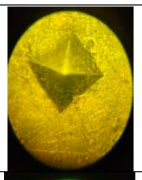
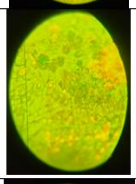
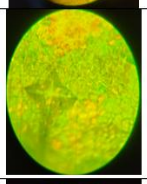
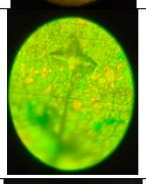
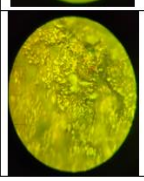
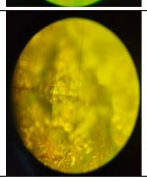
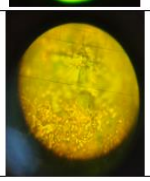
Pipe sizes	Basic drawing	Picture d1	Picture d2	HV Result	Conclusion
0.41mm				52.43HV	The hardness value of the material is quite low
0.58mm				98.71 HV	The hardness value of the material is quite high
0.61mm				159.2 HV	High material hardness value

Table 2. Result data of vikers test

Spesimen	D1 (µm)	D2 (µm)	Rata-Rata (µm)	P (kgf)	HVN
0.41mm	195.88	180.31	188.095	1000	52.43
0.58mm	136.19	136.13	136.16	1000	98.71
0.61mm	125.19	90.75	107.97	1000	159.2

IV. CONCLUSION

Based on the research carried out by pipes measuring 0.41mm, 0.58mm, 0.61mm, the author gets the results:

- The results of the welding do not show leakage, so it is concluded that welding using sock, flux, and the correct brazing technique will not leak.
- In pressure testing using 1/2 PK AC with R22 refrigerant at a pressure of 80-100Psi or 5.5-6.8Bar no sign of leakage was found in pipes 0.41mm, 0.58mm, 0.61mm.
- The results of micro hardness test show that the pipe which has a thickness of 0.61mm has the highest HVN number, so it can be concluded that the thicker the pipe, the stronger the pipe resistance will be if given pressure.

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