

HAND TOOLS OPERATOR 'S HEALTH WORKSHOP ON MECHANICAL AND LEVEL OF RISK WHITE SYNDROME FINGERS

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Graphical abstract



Abstract

Workers in the metal industry are using the equipment (hand tool) that produces vibrations. These vibrations have a negative effect on the fingers, forearm, or shoulder joints. Disorders that often arises is often called the effects of hand arm vibration. These effects vary of workers, ranging from finger whitened condition to the inability to move the finger. Lack of security and safety equipment will further enlarge this negative effect, because the disturbance will result in declining labor productivity. This study aims to model safety equipment in the form of fluidic damper to reduce glove hand arm vibration. This objective will be carried out in stages: 1) obtain field data on working conditions, workload with a hand tool and type of equipment used, 2) determine the parameters of vibration hand tool that is widely used, 3) modeling and making fluidic damper glove, perform the test comparison of the use and without the use of glove, 4) glove on field trials that have been surveyed. In the period of the study for 2 years, each parameter vibration hand tools frequently used can be measured in the laboratory. Tests conducted to determine the vibration of the arms that operate hand tools. Fluidic damper glove designed to dampen vibrations in the arm so that its effect on health problems can be reduced.

Keywords: Hand tools, hand arm vibration, white finger, fluidic damper glove, safety equipment

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1.0 INTRODUCTION

These health problems are called with a hand arm vibration (HAV) syndrome. "Vibration disease", including the signs and symptoms associated with brain dysfunction, headache, irritability, sleep disturbances and impotence commonly found in workers who operate hand tool [1]. Another source claimed health effects on the circulatory system may include tingling of fingers working time, paresis. Against the system of bones, joints and muscles, such as osteo articular disorders (disorders of the joints of fingers). Against the nervous system that is paraesthesia, decreased sensitivity, impaired ability to distinguish and subsequent atrophy. Body system has its own vibrational frequency. In general, the vibration that affects the body has a frequency of 0.5 to 80Hz, with a contact for 1 second to 24 hours [2]. On the

other hand, the low-frequency vibration corresponding to improve the performance arm. The results showed that treatment at the hands of some 30Hz vibration boxers can significantly increase the power arm of the boxer [2]. The use of safety equipment for workers who use hand tools are needed to reduce this health disorder. Besides the parameters of hand tool that is widely used to be known as a material design recommendations equipment safer.

a. Hand Arm Vibration

The use of mechanical equipment (hand tools) such as the hands and saws grinding machine is widely used in industry, among others in the mining, construction, manufacturing and forestry [3]. This equipment generates vibrations that cause the risk of health problems in the arm operator (hand arm

vibration syndrome). Hand tools are not designed properly can lead to musculoskeletal injury.

The human body can be considered as a mechanical system where vibrations can affect the system. The influence of vibration can be on the whole body (whole body vibration) or part of the body in the form of resonance. The resonant frequency of vibration that affect the fingers and wrist 150-200 Hz, arms 13-60 Hz and shoulder joints 4-5 Hz. Vibration at the hand operating the hand tool occurs 3 axis X, Y and Z as shown in Figure 1.

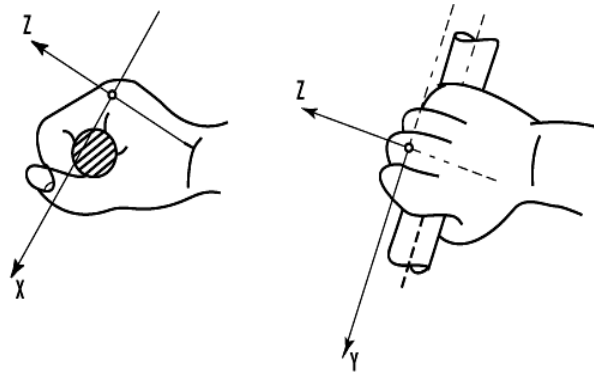


Figure 1 Axis Vibration At Hand

Vibrations that occur are shown in the form of energy- equivalent frequency-weighted acceleration for a period of 4 hours with:

$$(\bar{a}_{h,w})_{eq(4)} = (T / 4)^{1/2} (\bar{a}_{h,w})_{eq(T)} \quad (1)$$

b. Hand Tool

Since the 1980s, an increase in cases of health problems found in forestry workers in Europe and Japan. This occurred before the introduction of anti-vibration chain saws and measurement administrative of data about the number of hours of use of the equipment. But other mechanical devices are still not equipped with anti-vibration system [4].

Efforts to improve the hand tool to reduce the effect of vibration has been widely performed. Enforced standardization system, for example with ISO 2631, ISO DIS 5349 or 16-7063-2004 requiring vibration exposure to hand-arm acceleration parameters on the dominant axis 4 m / s² or 0.40 Grav. Major Contractors Group (MCG) in the UK to make improvements to the testing laboratory of construction equipment at Loughborough University and the Off-Highway Plant and Equipment Research Centre (OPERC). The data obtained is used to guide the use and reliable information about the risks of use of equipment to workers.

Other efforts that can be done to reduce the risk of this vibration are an improvement in working conditions. It is associated with the use of hand tools in the correct working position and working environment with good ventilation. Another way is with safety equipment such as tire (hand grip) and

gloves (glove), which can reduce vibration. While efforts to treatment can be done by soaking the affected part in warm water or with a massage on a regular basis.

c. Health Problems Arising

In general, health problems arising so-called hand arm vibration syndrome. Its influence varies depending on the equipment used, the intensity of use, the physical condition of workers, environmental factors and others. Disruption initially on the one hand, can then be spread on both hands asymmetrically. Attacks last from several minutes to several hours.

Hand arm vibration syndrome is often used to refer to the signs and symptoms associated with the vibration transmitted through the hands, including:

- a. Vascular disorders
- b. Peripheral neurologic disorders
- c. Bone and joint disorders
- d. Disorders of muscle tissue
- e. Other disorders such as disorders in the body, the central nervous system and others

Vibration transmissibility of the measurement results obtained that the high-frequency vibration affects the damage to soft structure of the fingers and hands. But the low frequency vibration of high amplitude may be associated with injury to the wrist, elbow and shoulder. The objectives of this research are:

- a. To obtain field data on the condition of workers using hand tools on workshop 20 small and medium scale metal in forge welding, lathe workshop, car body repair shop in the city of Malang.
- b. For modeling and manufacture of fluidic damper glove.
- c. To test the feasibility of fluidic dumper glove based on ease of manufacture, the manufacturing cost and in terms of convenience of use.

2.0 RESEARCH METHODS

1. Using a dial indicator (Figure 2)
 - Brand: Mitutoyo
 - Serial number: 2046FE
 - Made in Japan
2. Equipment and utensils to be measured is positioned on the frame ditumpu by 2 pieces of spring.
3. The tip of the needle dial indicator is positioned perpendicular to the direction of movement of tooling apparatus side.
4. The tool tooling turned on.
5. Change the needle on the dial indicator recorded with a camcorder.
6. The recordings are played back with windows media player using an image-by-image option method (frame by frame) as a time of data collection.

7. The data recorded in accordance with the number designated by the needle on the dial indicator bersesuaian time data retrieval.

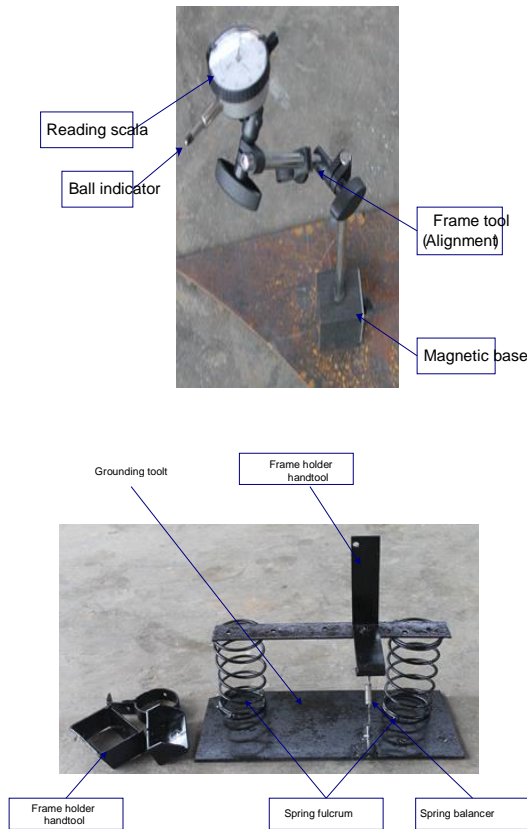


Figure 2 Dial Indicator (Mitutoyo Brand)

Data taken include:

- a. Worker's identity: name, age
- b. Job data: length of work, type of work, hours of work per day
- c. Data equipment: the type of equipment used, the brand of equipment, the number of hours of use, how to use (working position), methods of treatment equipment
- d. Worker health data: health history, complaints are often experienced health problems, a common habit (smoking, alcohol consumption, etc.), security and safety equipment used.
- e. Modeling and manufacture of vibration arrestors Gloves (fluidic damper glove.)

It also conducted a survey on product specifications hand tool. The survey was conducted in stores seller or manufacturer. The survey results are used to determine the two types of hand tools most widely used in the field. Each type is taken 5 different brands. Hand tool is then tested in the laboratory to determine the parameters of the resonance. The test results are then compared with existing standards (SNI).

3.0 RESULTS AND DISCUSSION

Table 1 shows the experimental results obtained from hand grinder apparatus.

Table 1 Results from Hand Grinder

Time (second)	BRANDS GRINDING	AMPLITUDE VIBRATION (mm)		
		1	2	3
10	Modern	0,42	0,45	0,46
20		0,68	0,64	0,62
30		0,87	0,90	0,88
40		1,15	1,20	1,22
10	Bosch (rough)	0,42	0,48	0,50
20		0,73	0,75	0,68
30		0,98	0,92	0,95
40		1,22	1,20	1,28
10	Bosch (smooth)	0,34	0,30	0,36
20		0,62	0,54	0,52
30		0,73	0,75	0,68
40		0,94	0,98	0,95

Table 2 shows the results obtained from hand drill apparatus.

Table 2 Results from Hand Drill

TIME (second)	Brand Hand Drill	Amplitude Vibration (mm)		
		1	2	3
10	Hitachi	0,20	0,22	0,24
20		0,45	0,44	0,48
30		0,70	0,68	0,75
40		0,95	0,90	0,92
10	Bosch (rough)	5,40	4,35	4,80
20		8,20	7,95	7,60
30		1,05	9,40	9,75
40		1,20	1,30	1,25
10	Bosch (small)	4,38	4,56	4,60
20		7,45	7,60	7,20
30		9,40	9,65	9,50
40		1,10	1,05	1,02

On the other hand, Table 3 shows the results obtained from wood planners apparatus.

Table 3 Results from wood Planners

TIME (second)	Wood Planers	Amplitude Vibration (mm)		
		1	2	3
10	Modern	4,50	4,35	4,60
20		0,65	0,65	0,64
30		0,85	0,89	0,75
40		1,25	1,20	1,22
10	Maktec	4,20	4,10	4,50
20		0,57	0,55	0,60
30		0,78	0,81	0,79
40		1,10	1,05	1,02
10	Makita	0,38	0,42	0,41
20		0,54	0,51	0,50
30		0,72	0,74	0,68
40		0,96	0,98	0,92

4.0 CONCLUSION

a. Hand grinding work equipment, drilling machines and planers wood is equipment that cause vibration.

b. Vibration that occurs will make the hand and shoulder joint pain and tingling in the fingers when used for a long time (over 1 hour of work).

c. Effect of continuous use of hand tools for the health workers to fizzle

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