

**HAND ARM
VIBRATION**



Comparison of anti-vibration gloves performe in the laboratory and in the field. Similarities and difference

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Laboratory certification for the anti-vibration gloves

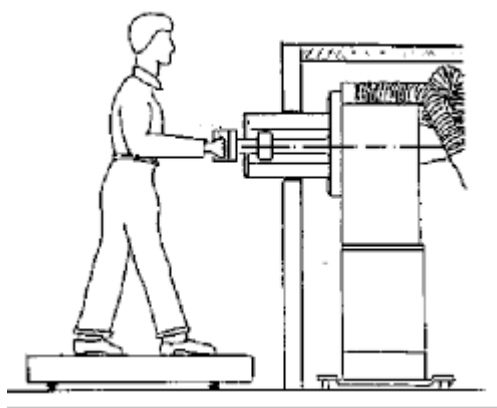
Certification of anti-vibration gloves is nowadays performed following UNI EN ISO 10819:2013.

This certification is a laboratory standardized protocol that prescribes a series of conditions to perform tests on anti-vibration gloves

Laboratory measurements are a physical model of real field events.
In such a role they constitute a rough simplification of the real process.



It is well known that field measurements differs from laboratory in many points:



Posture

variability of engine speed



Force

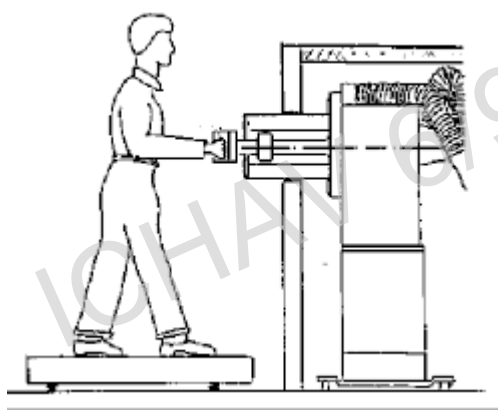


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Posture in the field vs posture in the laboratory

It is almost impossible to have a static posture in the field.

For ergonomic and safety factors, the operator has to move constantly.



In the laboratory, the principal aim is to find a static and standardized posture.



UNI EN ISO 10819:2013

The calculation of the transmissibility value was performed using the UNI EN ISO 10819:2013 model, i.e., 3 measurements for each of the 6 subjects, with and without gloves. Two methods have been used to calculate the transmissibility which we will call the direct method and the corrected transmissibility:

1. Direct method: Acceleration inside the glove / acceleration on the handle; $TR_{sg} = (a_{wsPg} / a_{wsRg})$
2. corrected transmissibility : (Gloved hand transmissibility / Handle acceleration) / (Bare hand transmissibility / handle acceleration)

$$TR_{sg} (a_{wsPg} / a_{wsRg}) / TR_{sb} (a_{wsPb} / a_{wsRb}) \longrightarrow TR_{sg} / TR_{sb}$$



MEDIUM AND HIGH FREQUENCY

In order to have the prescribed transmissibilities in medium and high frequency the signal was split in these two frequency

20-250 Hz (T_m)

200-1250 Hz (T_h).

Certification values

(T_m) < 0.90

(T_h) < 0.60



Result

Actual results are depicted in Table 1, referred to the handle of the chainsaw, in which are reported, for comparison, certification data declared by manufacturer. In Table 2 are reported transmissibility referred to the bare hand. Those latter are measured in two different cutting session: one for the bare hand and one for the gloved hand.



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Table 1 Transmissibility calculated with the direct method for each subject.

Subject	Anti-vibrating glove					
	GLOVE 1		GLOVE 2		GLOVE 3	
	T _m	T _h	T _m	T _h	T _m	T _h
1	0.88	0.81	0.88	0.55	0.88	0.81
2	0.74	0.74	0.70	0.68	0.74	0.74
3	0.74	0.68	0.46	0.52	0.85	0.82
4	0.61	0.52	0.50	0.52	0.61	0.57
5	0.55	0.43	0.46	0.36	0.66	0.57
6	0.81	0.44	0.77	0.40	0.34	0.34
Mean±SD ¹	0.72±0.12	0.60±0.16	0.63±0.18	0.50±0.12	0.68±0.20	0.64±0.18
Declared	0,90	0,52	0,80	0,57	N.a.	N.a.
Difference	0,18	-0,08	0,17	0,7	N.a.	N.a.

Table 2 Transmissibility calculated with the corrected transmissibility for each subject.

Subject	Anti-vibrating glove					
	GLOVE 1		GLOVE 2		GLOVE 3	
	T _m	T _h	T _m	T _h	T _m	T _h
1	0.79	0.79	0.59	0.66	0.82	0.98
2	0.82	0.80	0.80	0.83	0.84	0.89
3	1.02	0.98	0.64	0.44	1.16	1.17
4	0.85	0.62	0.62	0.51	0.77	0.68
5	0.73	0.61	0.62	0.51	0.88	0.81
6	0.80	0.45	0.76	0.40	0.34	0.35
Mean±SD ¹	0.84±0.10	0.71±0.18	0.67±0.09	0.56±0.16	0.80±0.27	0.81±0.28
Declared	0,90	0,52	0,80	0,57	N.a. ²	N.a.
Difference	0,6	-0,19	0,13	0,01	N.a.	N.a.

Discussion

The difference between the transmissibility measured in the field, using the direct transmissibility as a reference, and the values declared by the manufacturers is very small, with some exceptions, and the standard deviation of the values measured in the field stands at good values. In the case of experimental transmissibility, however, two out of three gloves would not pass the certification because, for some subjects, they amplify rather than reduce vibrations.



Next Step and opportunities

The current data seem to confirm the effectiveness of the certification protocol by comparing the measured data with those declared. It seems reasonable to assume, given the high standard deviation, that in the field it would be right to measure a greater number of subjects to account for the high variability. The next step to conclude the work will be to carry out laboratory measurements by reproducing the average signal obtained in the field on the chainsaw and adopting the indications of the UNI EN ISO 10819:2013 certification standard.



THANK YOU
FOR YOUR KIND ATTENTION

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