

Experimental Ergonomic Risk Assessment of Welding Tasks



**Eur.Erg. Gábor Mischinger
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What is the Status Quo?

We have

- **CERA (Composite Ergonomic Risk Assessment) and other methods and,**
- **experience from several industrial fields, from automotive to food industry, from ICT factory to offices and services.**

But

- **we didn't try to evaluate welding workplaces with sophisticated methods**



Where to find such welding workplaces?

We have industrial partners

- **with automated welding workplaces, or**
- **in strictly secret environment, or**
- **limited in space and time...**

I had a chance in December...

- **But I was not at home....**

But we have a Welding Section at BUTE....

- **Thanks to Levente Bakos and Sándor Uzonyi!**



So it was just an experience in a laboratory

There was no

- time pressure,
- qualitative and quantitative requirements,
- thermal environment,
- outdoor circumstances and
- angry boss....



What are the ergonomic problems with welding?

- **Posture?** - **YES!**
- **Force?** - **Often moderate, sometimes high!**
- **Material handling?** - **Usually as aided task!**
- **Repetitive movements?** - **YES!**
- **Others?**
 - Awful air quality
 - PPE-s (helmet, gloves,
 - and high static load,
 - sometimes it is monotonous,
 - something else (e. g. flashing, outdoor work, thermal environment)....



What is the problem with CERA?

Connected to welding tasks....

- **Posture?** - We can evaluate it just in real situation!
- **Force?** - Always critical.....
- **Material handling?** - As a separated task!
- **Repetitive movements?** - Just knowing the parameters of the real task.

Additionally:

- **Usually high static physical load!**
- **Mental load?**



What is the right method?

REBA?
Is this
a
correct
result?
I'm
afraid!

REBA Employee Assessment Worksheet

based on Technical note: Rapid Entire Body Assessment (REBA), Hignett, McAtamney, Applied Ergonomics 31 (2000) 201-205

A. Neck, Trunk and Leg Analysis

Step 1: Locate Neck Position

Step 1a: Adjust...
If neck is twisted: +1
If neck is side bending: +1

2+1
Neck Score

Step 2: Locate Trunk Position

Step 2a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

3+1
Trunk Score

Step 3: Legs

Step 3a: Adjust...
If leg is bent at knee: +1
If leg is bent at hip: +1

2+1
Leg Score

Step 4: Look-up Posture Score in Table A
Using values from steps 1-3 above, locate score in Table A

Score A (score from table A + load/force score)	1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	2	3	3	4	5	6	7	7	7
2	1	2	2	3	4	4	5	6	6	7	7	8
3	2	3	3	3	4	5	6	7	7	8	8	8
4	3	4	4	4	5	6	7	8	8	9	9	9
5	4	4	4	5	6	7	8	8	9	9	9	9
6	6	6	6	7	8	8	9	9	10	10	10	10
7	7	7	7	8	9	9	9	10	10	11	11	11
8	8	8	8	9	10	10	10	10	11	11	11	11
9	9	9	9	10	10	11	11	11	12	12	12	12
10	10	10	10	11	11	11	11	12	12	12	12	12
11	11	11	11	11	12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12	12	12	12	12	12

Step 5: Add Force/Load Score
If load < 11 lbs: +0
If load 11 to 22 lbs: +1
If load > 22 lbs: +2
Adjust: If shock or rapid build up of force: add +1

2+1
Force/Load Score

Step 6: Score A, Find Row in Table C
Add values from steps 4 & 5 to obtain Score A. Find Row in Table C.

8
Posture Score A
+
1
Force/Load Score
=
9
Score A

Step 7: Locate Upper Arm Position:

Step 7a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

3+1
Upper Arm Score

Step 8: Locate Lower Arm Position:

2
Lower Arm Score

Step 9: Locate Wrist Position:

Step 9a: Adjust...
If wrist is bent from midline or twisted: Add +1

1+1
Wrist Score

Step 10: Look-up Posture Score in Table B
Using values from steps 7-9 above, locate score in Table B

Score B (table B value + coupling score)	1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	2	3	3	4	5	6	7	7	7
2	1	2	2	3	4	4	5	6	6	7	7	8
3	2	3	3	3	4	5	6	7	7	8	8	8
4	3	4	4	4	5	6	7	8	8	9	9	9
5	4	4	4	5	6	7	8	8	9	9	9	9
6	6	6	6	7	8	8	9	9	10	10	10	10
7	7	7	7	8	9	9	9	10	10	11	11	11
8	8	8	8	9	10	10	10	10	11	11	11	11
9	9	9	9	10	10	11	11	11	12	12	12	12
10	10	10	10	11	11	11	11	12	12	12	12	12
11	11	11	11	11	12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12	12	12	12	12	12

Step 11: Add Coupling Score
Well fitting Handle and mid range power grip: good: +0
Acceptable but not ideal hand hold or coupling acceptable with another body part: fair: +1
Hand hold not acceptable but possible, No handles, awkward, unsafe with any body part: poor: +2
Unacceptable: +3

Step 12: Score B, Find Column in Table C
Add values from steps 10 & 11 to obtain Score B. Find column in Table C and match with Score A in row from step 6 to obtain Table C Score.

11
Table C Score
+
1
Activity Score
=
12
Final REBA Score

Step 13: Activity Score
+1 or more body parts are held for longer than 1 minute (static)
+1 Repeated small range actions (more than 4x per minute)
+1 Action causes rapid large range changes in postures or unstable base

B. Arm and Wrist Analysis

Step 7: Locate Upper Arm Position:

Step 7a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
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3+1
Upper Arm Score

Step 8: Locate Lower Arm Position:

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Lower Arm Score

Step 9: Locate Wrist Position:

Step 9a: Adjust...
If wrist is bent from midline or twisted: Add +1

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Wrist Score

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7	7	7	7	8	9	9	9	10	10	11	11	11
8	8	8	8	9	10	10	10	10	11	11	11	11
9	9	9	9	10	10	11	11	11	12	12	12	12
10	10	10	10	11	11	11	11	12	12	12	12	12
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Scoring:
1 = negligible risk
2 or 3 = low risk, change may be needed
4 to 7 = medium risk, further investigation, change soon
8 to 12 = high risk, implement change

11+ = very high risk, implement change



Task name: ANY WELDING TASK Reviewer: MGX Date: ANY/TIME

This tool is provided without warranty. The author has provided this tool as a simple means for applying the concepts provided in REBA.

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rbarker@ergosmart.com (816) 444-1667

Posture

- REBA scores are higher?
- How long is the static position of trunk or upper arm?
- Squatting, crouching, stretching, etc.



Force Exertion

How much effort
needed to handle ...

- a welding torch or
- an electrode holder?



*Welding in a car service
station....*



Posture illustration



Material Handling

Who is delegated to handle....

- the welding machine and the gas cylinders?
- the necessary metal parts before and after welding?

Posture illustration



Repetitive Movements

Features of work:

- Is it a regular cyclic task?
- Are there little cycles of hand movements?

What about

- CTD/RSI and
- dynamic load?

Posture illustration



Final conclusion: In the future ...

- **attention should be paid** to the welding tasks,
- we have to **choose a suitable method** for MSD risk assessment, on the base of the EN 1005 standard series.

We have to give it to OHS practitioner

- as a useful **tool**,
- to minimize the risk of WMSD,
- to investigate the causes of injuries.



Thanks for Your Attention!