

# Ergonomic Assessment Worksheet v1.3.6

Plant	Gender of operator    m <input type="checkbox"/> f <input type="checkbox"/>	Body height
Line	MTM Analysis	Analyst
Task / Workplace	Task duration [s]	Observation <input type="checkbox"/>
		Planning <input type="checkbox"/>
Date		

**Result of overall evaluation:**

Calculate the total score of whole body and compare it to the UL score. The overall result is determined by the higher value and the appropriate traffic light is checked. Anyway, interpretation should take into account both values.

<input type="checkbox"/> Green <input type="checkbox"/> Yellow <input type="checkbox"/> Red	<b>Whole Body</b>	=	<b>Postures</b>	+	<b>Forces</b>	+	<b>Loads</b>	+	<b>Extra</b>	<b>Upper Limbs</b>
		=		+		+		+		

<b>EAWS evaluation</b>	0-25 Points	Green	Low risk: recommended; no action is needed
	>25-50 Points	Yellow	Possible risk: not recommended; redesign if possible, otherwise take other measures to control the risk
	>50 Points	Red	High risk: to be avoided; action to lower the risk is necessary

Extra points "Whole body" (per minute / shift)						Extra points		
0a	Adverse effects by working on moving objects	0	3	8	15	Intensity		
		none	middle	strong	very strong			
0b	Accessibility (e.g. entering motor or passenger compartment)	0	2	5	10	Status		
		good	complicated	poor	very poor			
0c	Countershocks, impulses, vibrations	0	1	2	5	Intensity x frequency		
		light	visible	heavy	very heavy			
		0 [n]	1 1 - 2	2,5 4 - 5	4 8 - 10		6 18 - 20	8 > 20
0d	Joint position (especially wrist)	0	1	3	5	Intensity x duration or frequency		
		neutral	~ 1/3 max	~ 2/3 max	maximal			
		0	2	2,5	4		6	8
		[s] [n] [%]	3 1 5	10 8 17	20 11 33		40 16 67	60 20 100
0e	Other physical work load (please describe in detail)	0	5	10	15	Intensity		
		none	middle	strong	very strong			
<b>Extra = ∑ lines 0a – 0e</b>		note: Max. score = 40 (line 0c, 0d); Max. score = 15 (line 0a, 0e); Max. score = 10 (line 0b)			note: correct evaluation, if duration of evaluation ≠ 60 s		=	

Lines 0a-b mainly relate to the Automotive Industry, for other sectors additional elements may be necessary. For details see the EAWS manual.

For scoring of repetitive tasks only:		
Description	Formula	Result
Real shift duration [min]		
Lunch break [min]	-	
Other official pauses [min]	-	
Non repetitive tasks (i.e. cleaning, supplies, etc) [min]	-	
Net duration of repetitive task/s (a) [min]	=	
No. of real units (or cycles) (b)		
Net cycle time [s]	(a/b × 60) =	
Idle Time [s]		

Comments / proposals for improvements

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Basic Positions / Postures and movements of trunk and arms (per shift)											Postures																
(incl. loads of <3 kg, forces onto fingers of <30 N and whole body forces of <40 N)  Static postures: ≥ 4 s  High frequency movements: Trunk bendings (> 60°) ≥ 2/min Kneeling/crouching ≥ 2/min Arm liftings (> 60°) ≥ 10/min											Symmetric										Asymmetric						
											Evaluation of static postures and/or high frequency movements of trunk/arms/legs										Sum of lines	Trunk Rotation 1)		Lateral Bending 1)		Far Reach 2)	
																						int	dur	int	dur	int	dur
																						0-5	0-3	0-5	0-3	0-5	0-2
										Intensity x Duration		Intensity x Duration		Intensity x Duration													
											$Duration [s/min] = \frac{duration\ of\ posture [s] \times 60}{Task\ duration [s]}$																
											5	7,5	10	15	20	27	33	50	67	83							
											3	4,5	6	9	12	16	20	30	40	50							
											24	36	48	72	96	130	160	240	320	400							

## Standing (and walking)

1		Standing & walking in alteration, standing with support	0	0	0	0	0,5	1	1	1	1,5	2								
2		Standing, no body support (for other restrictions see Extra Points)	0,7	1	1,5	2	3	4	6	8	11	13								
3		a Bent forward (20-60°)	2	3	5	7	9,5	12	18	23	32	40								
		b with suitable support	1,3	2	3,5	5	6,5	8	12	15	20	25								
4		a Strongly bent forward (>60°)	3,3	5	8,5	12	17	21	30	38	51	63								
		b with suitable support	2	3	5	7	9,5	12	18	23	31	38								
5		a Elbow at/above shoulder level	3,3	5	8,5	12	17	21	30	38	51	63								
		b With certif. exoskeleton	2,5	3,8	6,4	9,0	13,1	16,2	23,1	29,0	39,0	48,0								
6		a Hands above head level	5,3	8	14	19	26	33	47	60	80	100								
		b With certif. exoskeleton	4,1	6,2	11,0	14,8	20,0	25,5	36,5	46,5	62,0	77,5								

## Sitting

7		Upright with back support slightly bent forward or backward	0	0	0	0	0	0,5	1	1,5	2									
8		Upright no back support (for other restriction see Extra Points)	0	0	0,5	1	1,5	2	3	4	5,5	7								
9		Bent forward	0,7	1	1,5	2	3	4	6	8	11	13								
10		a Elbow at / above shoulder level	2,7	4	7	10	13	16	23	30	40	50								
		b With certif. exoskeleton	1,9	2,8	4,9	7,0	9,1	11,2	16,1	21,0	28,0	35,0								
11		a Hands above head level	4	6	10	14	20	25	35	45	60	75								
		b With certif. exoskeleton	2,8	4,2	7,0	9,8	14,0	17,5	24,5	31,5	42,0	52,5								

## Kneeling or crouching

12		Upright	3,3	5	7	9	12	15	21	27	36	45								
13		Bent forward	4	6	10	14	20	25	35	45	60	75								
14		a Elbow at / above shoulder level	6	9	16	23	33	43	62	80	108	135								
		b With certif. exoskeleton	5,2	7,8	13,9	20,0	29,1	38,2	55,1	71,0	96,0	120								

## Lying or climbing

15		(Lying on back, breast or side) arms above head	6	9	15	21	29	37	53	68	91	113								
16		Climbing	6,7	10	22	33	50	66												


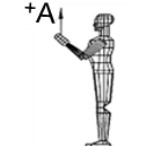
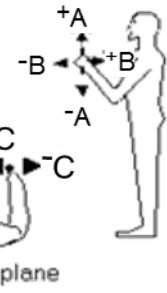
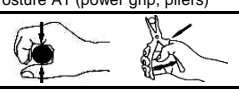

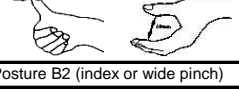
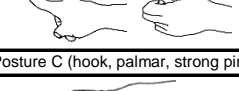




1)	int	0	1	3	5	2)	int	0	1 (0,8)	3 (2,3)	5 (3,8)	Σ	Σ (max.=15)	Σ (max.=15)	Σ (max.=10)
		slightly ≤10°	medium 15°	strongly 25°	extreme ≥30°			close	60%	80%	arm stretched				
	0	1,5	2,5	3	0		1	1,5	2						
	dur	never	4 s	10 s	≥ 13 s		dur	never	4 s	10 s	≥ 13 s				
		0%	6%	15%	≥ 20%			0%	6%	15%	≥ 20%	(a)			(b)



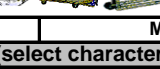




note: Max. duration of evaluation = duration of task or 100%!

note: correct evaluation, if task duration ≠ 60 s

<b>Postures = Σ lines 1 - 16</b>	(a)	+	(b)	=	
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Action forces (per minute)										Forces						
17		Forces onto fingers (e.g. clips, plugs)	Int	0	7	15	25	50	Intensity × Duration							
			F <sub>max</sub>	16,7% F <sub>max</sub>	33,3% F <sub>max</sub>	50,0% F <sub>max</sub>	66,7% F <sub>max</sub>	F <sub>max</sub>								
			Duration stat	[s]	0	1	1	1,5				2	3,5	7		
			Duration dyn	[%]	0	5	10	15				20	33	50		
18		Forces onto arms / whole body forces	Int	0	6	15	25	50	Intensity × Duration							
			F <sub>max</sub>	16,7% F <sub>max</sub>	33,3% F <sub>max</sub>	50,0% F <sub>max</sub>	66,7% F <sub>max</sub>	F <sub>max</sub>								
			Duration stat	[s]	0	1	1	1,5				2	4	8,5		
			Duration dyn	[%]	0	1	2	3				4,5	6,5	10		
<b>Forces F<sub>max</sub> onto arms / whole body forces</b> M for males & F for females  median plane Data based on the "Assembly specific force atlas" (Wakula, Berg, Schaub, Glitsch, Ellegast 2009)			ST Upright		M	F	ST Bent		M	F	ST Above head		M	F	Finger forces F <sub>max</sub> (F=Female M=Male)	
			+A	480	315	+A	435	285	+A	430	280	 Posture A1 (power grip, pliers)		F <sub>max</sub>		M
-A	500	325	-A	370	240	-A	495	320	315	205						
+B	320	210	+B	400	260	+B	305	200	 Posture A2 (ball of the thumb)		F <sub>max</sub>		M	F		
-B	485	315	-B	605	390	-B	480	310			235	155				
+C	290	185	+C	310	200	+C	210	140	 Posture B1 (thumb or thumb to 4 fingers)		F <sub>max</sub>		M	F		
-C	255	165	-C	205	135	-C	210	140			110	70				
			KN Upright		M	F	KN Bent		M	F	KN Above head		M	F	Posture B2 (index or wide pinch)	
			+A	420	270	+A	380	245	+A	425	275	 Posture B2 (index or wide pinch)		F <sub>max</sub>		M
-A	430	280	-A	345	225	-A	495	320	235	155						
+B	445	290	+B	495	320	+B	420	270	 Posture C (hook, palmar, strong pinch)		F <sub>max</sub>		M	F		
-B	495	325	-B	445	290	-B	435	275			110	70				
			SI Upright		M	F	SI Bent		M	F	SI Above head		M	F	Posture C (hook, palmar, strong pinch)	
			+A	405	265	+A	385	250	+A	395	255	 Posture C (hook, palmar, strong pinch)		F <sub>max</sub>		M
-A	440	285	-A	375	245	-A	455	295	75	50						
+B	405	260	+B	455	295	+B	365	240	 Posture C (hook, palmar, strong pinch)		F <sub>max</sub>		M	F		
-B	380	250	-B	425	275	-B	370	240			85	55				
+C	250	165	+C	270	175	+C	200	130	 Posture C (hook, palmar, strong pinch)		F <sub>max</sub>		M	F		
-C	235	155	-C	205	135	-C	210	135			85	55				
Action forces = ∑ lines 17 - 18			note: correct evaluation, if task duration ≠ 60s						=							

Manual Material Handling (per shift)										Loads											
<b>Weights of loads [kg] for repositioning (lifting / lowering), carrying and holding as well as pushing and pulling</b>																					
+	Reposition, carrying & holding	Male	3	10	15	20	25	30	35	40	>40										
		Female	2	5	7	10	12	15	20	25	>25										
Load points		1	1,5	2	3	4	5,5	7	8,5	25											
+	Pushing and pulling	M1 	Wheelbarrows and Dollys		Male	<50	75	100	150	200	250										
			Female	<40	60	80	115	155	195												
		M2 	Carriage, roller, trolleys, No fixed rollers		Male	<50	75	100	150	250	350	550									
			Female	<40	60	80	115	195	270	425											
M3 	Carts, roller conveyors, pallet truck		Male	<50	75	150	250	350	500	600	800	1250									
	Female	<40	60	115	195	270	385	460	615	960											
Load points		Means of transport			0,5	1	1,5	2	3	4	5	6	8								
<b>Posture, position of load (select characteristic posture)</b>																					
+	trunk upright and / or not twisted																				
		little trunk bending or twisting; load at or close to the body			bending trunk deep or far forward; little trunk bending forward and trunk twisting simultaneously; load far from body or above shoulder level			bending trunk far forward and twisting; load far from the body; limited postural stability while standing; crouching or kneeling													
Posture points		1	2	4				8													
<b>Working Conditions (pushing and pulling only)</b>																					
(+)	very low rolling resistance	trolley pushing / pulling on (very) slick floor			rough floor and above small gaps / edges			on structured sheet metal, into / out of a track			trolleys have to be teared off when starting, strongly damaged floor										
		Conditions points		0	1	3	5	6	8												
<b>Frequency of load manipulations [frequency/shift], holding time [min/shift] or travel distance [meter/shift]</b>																					
x	Frequency (#) of repositionings / pushing & pulling short				5	25	120	350	750	1000	1500	2000	2500	3000							
	Duration (holding time) [min]				2,5	10	37	90	180	≥240											
	Distance (carrying, pushing & pulling long) [m]				300	650	2500	6000	12000	≥16000											
	Duration points				1	2	4	6	8	10	11	13	14	15							
<b>Manual Material Handling (result)</b>																					
19	(Load + posture + (condition points)) × duration points	Repositioning 1)	(	+	)	Holding 1)	(	+	)	Carrying 1)	(	+	)	Pushing & Pulling short	(	+	)	Pushing & Pulling long	(	+	)
		x	=	x	=	x	=	x	=	x	=	x	=								
Handling = ∑ line 19			1) Maximal cumulative duration points for all tasks of repositioning, holding, carrying as well as pushing & pulling all together = 15						=												

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Upper limb load in repetitive tasks																		Upper Limbs																																														
<b>Force &amp; Frequency &amp; Grip (FFG)</b>																		<b>Basis:</b> number of real actions per minute or percent static actions (analyze only the most loaded limb)																																														
		<b>Legend</b>																																																														
		%SA = Percentage of Static Actions						%DA = 100% - %SA																																																								
		FDS = Force-Duration Static						FFD = Force-Frequency Dynamic																																																								
		GS' = Modified Grip Points Static (Grip x %SA)						GD = Grip Points Dynamic																																																								
		%FLS = Percentage of Static Actions at force level						%FLD = Percentage of Dynamic Actions at force level																																																								
SC = Static Contribution						DC = Dynamic Contribution																																																										
FDGS = Sum of Static Contributions						FFGD = Sum of Dynamic Contributions																																																										
Force [N]	Calc Stat				Static actions (s/min)					Grip			Dynamic actions (real actions/min)							Calc Dyn																																												
	FDS	GS'	%FLS	SC	≥45	30	20	10	5	3	0	2	4	2-5	10	15	20	25	30	35	≥40	FFD	GD	%FLD	DC																																							
0 – 5					1	1	0	0	0	0	abc			0	0	0	1	2	3	4	7																																											
> 5 – 20					4	2	1	1	0	0	ab	bc		0	0	1	2	3	4	6	9																																											
> 20 – 35					7	5	3	2	1	1	ab	b	c	0	1	2	3	4	6	8	12																																											
> 35 – 90					11	8	5	3	2	1	a	b	b	1	2	3	5	7	9	12	18																																											
> 90 – 135					16	11	7	4	3	2	a	ab	b	2	3	5	7	9	12	15	24																																											
> 135 – 225					21	14	10	6	4	3	a	a	b	4	5	6	8	11	14	20	32																																											
> 225 – 300					28	18	12	8	5	4	a	a	b	5	6	7	9	12	16	26	40																																											
20a	FDGS = ∑ SC <sub>i</sub>				FFG = FDGS + FFGD					FFG			%DA = ∑ FLD <sub>i</sub>							FFGD = ∑ DC <sub>i</sub>				%DA																																								
<b>Hand / arm / shoulder postures (use duration for worst case of wrist / elbow / shoulder)</b>																																																																
Wrist (deviaton, flex./extens.)									Elbow (pron, sup, flex./extens.)									Shoulder (flexion, extension, abduction)																																														
Posture points									10%									25%									33%									50%									65%									85%									PP	
Wrist/Elbow									0									0,5									1									2									3									4										
Shoulder									0									1,5									3									6									9									12										
Shoulder w/exosk									0									1,1									2,3									4,5									6,8									9										
<b>Additional factors</b>																																																																
Gloves inadequate (which interfere with the handling ability required) are used for over half the time																								2		<input type="checkbox"/>																																						
Working gestures required imply a countershock. Frequency of 2 time per minute or more (i.e.: hammering over hard surface)																								2		<input type="checkbox"/>																																						
Working gestures imply a countershock (using the hand as a tool) with freq. of 10 time per hour or more																								2		<input type="checkbox"/>																																						
Exposure to cold or refrigeration (less than 0 degree) for over half the time																								2		<input type="checkbox"/>																																						
Vibrating tools are used for 1/3 of the time or more																								2		<input type="checkbox"/>																																						
Tools with a very high level of vibrations																								4		<input type="checkbox"/>																																						
Tools employed cause compressions of the skin (rednesses, callosities, blebs, etc.)																								2		<input type="checkbox"/>																																						
Precision tasks are carried out for over half the time (tasks over areas smaller than 2-3 mm)																								2		<input type="checkbox"/>																																						
More than one additional factor is present at the same time and overall occupy the whole of the time																								3		<input type="checkbox"/>																																						
<b>Additional points (choose the highest value)</b>																								=		AF																																						
<b>Repetitive tasks duration</b>																																																																
Net Duration [min/shift]												< 60		90		180		300		420		> 480																																										
Duration Points												1		1,5		3		5		7		10																																										
Work Organization												Breaks are possible at every time						Breaks are possible at given conditions						Breaks lead to a stop of the process																																								
												(Cycle time longer than 10 minutes)						(Cycle time between 1 and 10 minutes)						(Cycle time shorter than 1 minute)																																								
Work Organization Points												0						1						2																																								
Breaks (≥ 8 min) [#]/shift												0		1		2		3		4		5		6		≥7																																						
Break points												cycle time ≤ 30 s		3		2		1		0		-1		-2		-3		-4																																				
												cycle time > 30 s		0		-0,5		-1		-1,5		-2																																										
Duration Points												=		DP																																																		
<b>Upper limb load in repetitive tasks</b>																																																																
20		(a) Force & Frequency & Grip				(b) Postures				(c) Additional factors				(d) Duration				Upper Limbs																																														
		FFG				PP				AF				DP				=																																														