

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	Whole Body	=	Postures	+	Forces	+	Loads	+	Extra	Upper Limbs
		=		+		+		+		

EAWS evaluation	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 × frequency		
		light	visible	heavy	very heavy			
		0	1	2,5	4		6	8
		[n]	1 - 2	4 - 5	8 - 10	18 - 20	> 20	
0d	Joint position (especially wrist) 	0	1	3	5	Intensity × duration or frequency		
		neutral	~ 1/3 max	~ 2/3 max	maximal			
		0	2	2,5	4		6	8
		[s]	3	10	20		40	60
		[n]	1	8	11	16	20	
		[%]	5	17	33	67	100	
0e	Other physical work load (please describe in detail)	0	5	10	15	Intensity		
		none	middle	strong	very strong			

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

Shift Duration and Tasks:		
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]		

<p>Comments / proposals for improvements</p>

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Basic Postures / Postures and movements of trunk and arms												Postures																	
(incl. loads of <3 kg, forces onto fingers of <30 N and arms/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 					
												$Duration [s/min] = \frac{duration\ of\ posture\ [s] \times 60}{Task\ duration\ [s]}$																	
												[%]	5	7,5	10	15	20	27	33	50	67	≥ 83		int	dur	int	dur	int	dur
[s/min]	3	4,5	6	9	12	16	20	30	40	≥ 50		0-5		0-3		0-5		0-2											
[min/8h]	24	36	48	72	96	130	160	240	320	≥ 400		Intensity × Duration		Intensity × Duration		Intensity × Duration													
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, Confined space	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																		
5		Upright with elbow at / above shoulder level	3,3	5	8,5	12	17	21	30	38	51	63																	
6		Upright with hands above head level	5,3	8	14	19	26	33	47	60	80	100																	
Sitting																													
7		Upright with back support slightly bent forward or backward	0	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		Elbow at / above shoulder level	2,7	4	7	10	13	16	23	30	40	50																	
11		Hands above head level	4	6	10	14	20	25	35	45	60	75																	
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		Elbow at / above shoulder level	6	9	16	23	33	43	62	80	108	135																	
Lying or climbing																													
15		Lying (on back, breast or side) w/ arms above head	6	9	15	21	29	37	53	68	91	113																	
16		Climbing	6,7	10	22	33	50	66																					
1)			0	1	3	5	2)			0	1	3	5	Σ															
Trunk	int	slightly ≤10°	medium 15°	strongly 25°	extreme ≥30°	Far Reach	int	close	60%	80%	arm stretched		Σ	Σ	Σ														
	dur	0	1,5	2,5	3		dur	never	4 s	10 s	≥ 13 s		Σ (max. = 40)																
		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																													
Postures = Σ lines 1 - 16			(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									
					16,7% F _{max}	33,3% F _{max}	50,0% F _{max}	66,7% F _{max}	F _{max}										
			Duration stat		0	1	1	1,5	2			3,5	7						
			[s]		3	6	9	12	20			33	≥ 30						
Duration [%]		5	10	15	20	33	≥ 30	≥ 50											
Duration dyn		0	1,5	2	2,5	3													
[n]		4	10	15	≥ 20														
18		Forces onto arms / whole body forces	Int		0	6	15	25	50	Intensity × Duration									
					16,7% F _{max}	33,3% F _{max}	50,0% F _{max}	66,7% F _{max}	F _{max}										
			Duration stat		0	1	1	1,5	2			4	8,5						
			[s]		3	6	9	12	20			33	≥ 30						
Duration [%]		5	10	15	20	33	≥ 30	≥ 50											
Duration dyn		0	1	2	3	4,5	6,5	10											
[n]		1	3	6	8	10	≥ 12												
Forces F _{max} onto arms / whole body forces <small>M for males & F for females</small>			ST Upright		M	F	ST Bent		M	F	ST Above head		M	F	Finger forces F _{max} (F=Female M=Male)				
<p style="text-align: center;">Data based on the "Assembly specific force atlas" (Wakula, Berg, Schaub, Glitsch, Ellegast 2009)</p>					*A	480	315			*A	435	285			*A	430	280	Posture A1 (power grip, pliers)	
					F _{max}		F _{max}			F _{max}									
					M		F			M		F							
			*A		500	325	*A		370	240	*A		495	320	Posture A2 (ball of the thumb)		F _{max}		
			*B		320	210	*B		400	260	*B		305	200	M		F		
			*B		485	315	*B		605	390	*B		480	310	315		205		
			*C		290	185	*C		310	200	*C		210	140	M		F		
			*C		255	165	*C		205	135	*C		210	140	235		155		
						KN Upright		M	F	KN Bent		M	F	KN Above head		M	F	Posture B1 (thumb or thumb to 4 fingers)	
						F _{max}		F _{max}		F _{max}									
						M		F		M		F		M		F			
			*A		420	270	*A		380	245	*A		425	275	*A		495	320	Posture B2 (index or wide pinch)
*B		430	280	*B		345	225	*B		495	320	*B		410	270	F _{max}			
*B		445	290	*B		495	320	*B		425	275	*B		425	275	M		F	
*C		495	325	*C		445	290	*C		275	180	*C		280	180	110		70	
*C		300	195	*C		290	190	*C		275	180	*C		280	180	M		F	
*C		245	160	*C		205	135	*C		280	180	*C		280	180	75		50	
			SI Upright		M	F	SI Bent		M	F	SI Above head		M	F	Posture C (hook, palmar, strong pinch)				
			F _{max}		F _{max}		F _{max}												
			M		F		M		F		M		F		M		F		
*A		405	265	*A		385	250	*A		395	255	*A		455	295	F _{max}			
*A		440	285	*A		375	245	*A		455	295	*A		365	240	370		240	
*B		405	260	*B		455	295	*B		365	240	*B		370	240	*B		370	240
*B		380	250	*B		425	275	*B		370	240	*B		370	240	*B		370	240
*C		250	165	*C		270	175	*C		200	130	*C		200	130	*C		200	130
*C		235	155	*C		205	135	*C		210	135	*C		210	135	*C		210	135
Action forces = ∑ lines 17 - 18			note: correct evaluation, if task duration ≠ 60s							=									


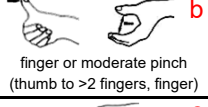
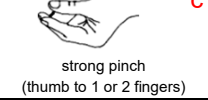
Manual Material Handling (per shift)										Loads																	
Weights of loads [kg] for repositioning (lifting / lowering), carrying and holding as well as pushing and pulling																											
+	Reposition, carrying & holding	Male (kg)		3	10	15	20	25	30	35	≥40																
		Load points		1	1,5	2	3	4	10	17	25																
		Female (kg)		2	5	7	10	12	15	20	≥25																
		Load points		1	1,5	2	3	4	5,5	7	25																
+	Pushing and pulling	M1		Male (kg)		50	75	100	150	200	≥ 250																
				Female (kg)		40	60	80	115	155	≥ 195																
		M2		Male (kg)		50	75	100	150	250	350	≥ 550															
				Female (kg)		40	60	80	115	195	270	≥ 425															
		M3		Male (kg)		50	75	150	250	350	500	600	800	≥ 1250													
				Female (kg)		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													
Posture, position of load (select characteristic posture)																											
+																											
	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			Asymmetric postures (bending trunk far forward and twisting; load far from the body; limited postural stability while standing or crouching) or kneeling																	
	Posture points		1	2	4	8																					
Working Conditions (pushing and pulling only)																											
(+)	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 torn off when starting, strongly damaged floor		very high rolling resistance													
	Conditions points		0	1	3	5	6	8																			
Frequency of load manipulations [frequency/shift], holding time [min/shift] or travel distance [meter/shift]																											
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												
Manual Material Handling (result)																											
19	(Load + posture + (condition points)) × duration points		Repositioning (1)		(+)	Holding (1)		(+)	Carrying (1)		(+)	Pushing & Pulling short		(+)	Pushing & Pulling long (1)		(+)
			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

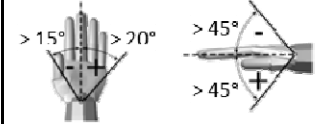
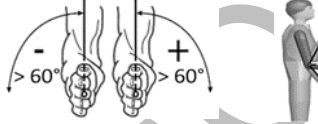
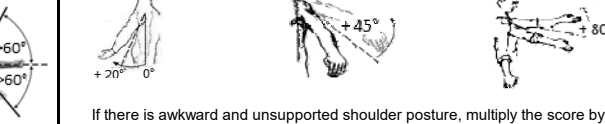
Force & Frequency & Grip (FFG) Basis: number of real actions per minute or percent static actions (analyze only the most loaded limb)

Legend	 power grip/contact grip	%SA = Percentage of Static Actions	%DA = 100% - %SA
	 finger or moderate pinch (thumb to >2 fingers, finger)	FDS = Force-Duration Static	FFD = Force-Frequency Dynamic
	 strong pinch (thumb to 1 or 2 fingers)	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	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 $FDGS = \sum SC_i$ 100% $FFG = FDGS + FFGD$ $\%DA = \sum FFLD_j$ $FFGD = \sum DC_j$ $\%DA$

Hand / arm / shoulder postures (use duration for worst case of wrist / elbow / shoulder)

20b	Wrist (deviatn, flex./extens.)	Elbow (pron, sup, flex./extens.)	Shoulder (flexion, extension, abduction)
			
	Posture points 10% → 0 25% → 0,5 33% → 1 50% → 2 65% → 3 85% → 4	If there is awkward and unsupported shoulder posture, multiply the score by 3	

Additional factors

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"/>
During almost the whole time one or more additional factor/s is/are present	3	<input type="checkbox"/>
Additional points (choose the highest value)	=	AF

Repetitive tasks duration

20d	Net Duration [min/shift]	60	90	180	300	420	≥480	+		
	Shift Points (1 hour = 1 point)	1	1,5	3	5	7	8			
	Work Organization	Breaks are possible at every time		Breaks are possible at given conditions		Breaks lead to a stop of the process		+		
	Work Organization Points	(Cycle time longer than 10 minutes)		(Cycle time between 1 and 10 minutes)		(Cycle time shorter than 1 minute)				
	Breaks (≥ 8 min) [#]/shift	0	1	2	3	4	5	6	≥7	+
Break points	cycle time ≤ 30 s		cycle time > 30 s							
Duration Points									=	DP

Upper limb load in repetitive tasks

20 ((a) Force & Frequency & Grip **FFG** + (b) Postures **PP** + (c) Additional factors **AF**) × (d) Duration **DP** = Upper Limbs