

Ergonomic Assessment Worksheet v1.3.5

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		Attention: Max. score = 40 (line 0c, 0d); Max. score = 15 (line 0a, 0e); Max. score = 10 (line 0b)			Attention: 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)	
											Duration [s/min] = $\frac{\text{duration of posture [s]} \times 60}{\text{Task duration [s]}}$											int	dur	int	dur	int	dur
											[%]	5	7,5	10	15	20	27	33	50	67		83	0-5	0-3	0-5	0-3	0-5
[s/min]	3	4,5	6	9	12	16	20	30	40	50	Intensity × Duration		Intensity × Duration		Intensity × Duration												
[min/8h]	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		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) arms above head	6	9	15	21	29	37	53	68	91	113				
16		Climbing	6,7	10	22	33	50	66								

1)	Trunk	int	0	1	3	5	2)	int	0	1	3	5	Σ	Σ	Σ	Σ
		slightly	medium	strongly	extreme	close		60%	80%	arm stretched	(max.=15)	(max.=15)		(max.=10)		
		≤10°	15°	25°	≥30°	never		4 s	10 s	≥ 13 s	Σ (max. = 40)					
		0	1,5	2,5	3	0		1	1,5	2	(a)	(b)				
dur	never	4 s	10 s	≥ 13 s	never	4 s	10 s	≥ 13 s								
	0%	6%	15%	≥ 20%	0%	6%	15%	≥ 20%								

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

Attention: 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									
			[s]	1	1	1,5	2	3,5										
			[n]	0	1,5	2	2,5	3										
			[s]	3	6	9	12	20										
			[%]	5	10	15	20	33										
[n]	0	4	10	15	20													
18		Forces onto arms / whole body forces	Int	0	6	15	25	50	Intensity × Duration									
			[s]	1	1	1,5	2	4										
			[n]	0	1	2	3	4,5										
			[s]	3	6	9	12	20										
			[%]	5	10	15	20	33										
[n]	1	2	3	4,5	6,5													
Forces Fmax onto arms / whole body forces (neutral to gender) P15 for planning & P40 for observation			ST Upright	P15	P40	ST Bent	P15	P40	ST Above head	P15	P40	Finger forces Fmax (neutral to gender)						
<p style="text-align: center;">median plane</p> <p style="text-align: center;">Data based on the "Assembly specific force atlas" (Wakula, Berg, Schaub, Glitsch, Ellegast 2009), adapted neutral to gender</p> <p style="text-align: center;">Score data are matter to change after the final completion of the force atlas project</p>			+A	245	315	+A	210	285	+A	230	280	Posture A1 (power grip, pliers)						
			-A	260	325	-A	200	240	-A	265	320	Fmax						
			+B	170	210	+B	205	260	+B	160	200	P15	P40	Posture A2 (ball of the thumb)				
			-B	245	315	-B	285	390	-B	255	310	150	205					
			+C	130	185	+C	145	200	+C	90	135	+C	105	140	Fmax			
			-C	110	165	-C	90	135	-C	100	140	-C	100	140	P15	P40	Posture B1 (thumb or thumb to 4 fingers)	
			+A	210	270	+A	180	245	+A	225	275	+A	225	275	115	155		
			-A	225	280	-A	190	225	-A	265	320	-A	265	320	Fmax			
			+B	215	290	+B	220	320	+B	210	270	+B	210	270	P15	P40	Posture B2 (index or wide pinch)	
			-B	240	325	-B	220	290	-B	220	275	-B	220	275	55	70		
			+C	145	195	+C	140	190	+C	130	180	+C	130	180	Fmax			
			-C	115	160	-C	105	135	-C	130	180	-C	130	180	P15	P40	Posture C (hook, palmar, strong pinch)	
+A	205	265	+A	190	250	+A	215	255	+A	215	255	40	50					
-A	245	285	-A	195	245	-A	260	295	-A	260	295	Fmax						
+B	215	260	+B	245	295	+B	195	240	+B	195	240	P15	P40	Posture C (hook, palmar, strong pinch)				
-B	205	250	-B	215	275	-B	210	240	-B	210	240	45	55					
+C	120	165	+C	130	175	+C	100	130	+C	100	130	Fmax						
-C	110	155	-C	100	135	-C	100	135	-C	100	135	P15	P40	Posture C (hook, palmar, strong pinch)				
+A	205	265	+A	190	250	+A	215	255	+A	215	255	45	55					
Action forces = ∑ lines 17 - 18			Attention: correct evaluation, if task duration ≠ 60s						=									


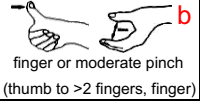

Manual Material Handling (per shift)										Loads						
Weights of loads [kg] for repositioning (lifting / lowering), carrying and holding as well as pushing and pulling																
+	Reposition, carrying & holding		Males	3	10	15	20	25	30	35	40	>40				
			Females	2	5	7	10	12	15	20	25	>25				
Load points			1	1,5	2	3	4	5,5	7	8,5	25					
+	Pushing and pulling	M1	Wheelbarrows and Dollies		Males	<50	75	100	150	200	250					
					Females	<40	60	80	115	155	195					
		M2	Carriage, roller, trolleys.		Males	<50	75	100	150	250	350	550				
					Females	<40	60	80	115	195	270	425				
		M3	No fixed rollers Carts, roller conveyors, pallet truck		Males	<50	75	150	250	350	500	600	800	1250		
					Females	<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 load at the body			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									
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 teared 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]																
×	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)	()	+	()	+	()	+	()	+	()	+	()	+	()
			x	=	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

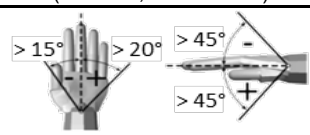
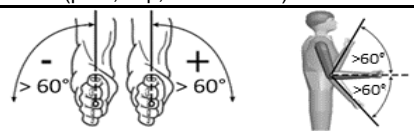
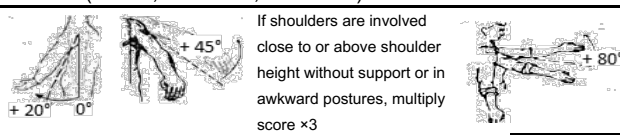
Force & Frequency & Grip (FFG) Basis: number of real actions per minute or percent static actions (analyze only the most loaded limb)

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	2-5	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 $FDGS = \sum SC_i$ 100% $FFG = FDGS + FFGD$ $\%DA = \sum FFD_j$ $FFGD = \sum DC_i$ %DA

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

20b	Wrist (deviaton, 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	PP

Additional factors

20c	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"/>
	Additional points (choose the highest value)	=	AF

Repetitive tasks duration

20d	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		+		
	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	3	2	1	0	-1	-2	-3	-4	
Break points cycle time > 30 s	0		-0,5		-1		-1,5	-2	=	
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