

Ergonomic Assessment Worksheet V1.3.4

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

Result of overall evaluation:

Calculate the total score of the whole body sections and compare it to the upper limbs score. The overall result is determined by the higher value but interpretation should also take into account the second value.

<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 x 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 x duration or frequency		
		neutral	~ 1/3 max	~ 2/3 max	maximal			
		0	2	2,5	4		6	8
		[sec]	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 ≠ 60s	=
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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.

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 [sec]	(a/b x 60) =	
Observed cycle time [sec]		

Comments / proposals for improvements

Ergonomic Assessment Worksheet V1.3.4

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: ≥ 4sec High frequency movements: Trunk bendings (> 60°) ≥ 2/min Kneeling/crouching ≥ 2/min Arm liftings (> 60°) ≥ 10/min			Evaluation of static postures and/or high frequent movements of trunk/arms/legs									Sum of lines	Asymmetry effects																			
			$\text{Duration [sec/min]} = \frac{\text{duration of posture(s)} \times 60}{\text{cycle time}}$										Trunk Rotation 1) 	Lateral Bending 1) 	Far Reach 2) 																	
			int	dur	int	dur	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										
[%]	[sec/min]	[min/8h]	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 alternation, standing with support	0	0	0	0	0,5	1	1	1	1,5	2																				
2		Standing, no body support (for other restrict. see Extra Points)	0,7	1	1,5	2	3	4	6	8	11	13																				
3		Bent forward (20-60°)	2	3	5	7	9,5	12	18	23	32	40																				
		with suitable support	1,3	2	3,5	5	6,5	8	12	15	20	25																				
4		Strongly bent forward (>60°)	3,3	5	8,5	12	17	21	30	38	51	63																				
		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 restrict. 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			0	1	3	5	2) Far Reach			0	1	3	5	Σ																		
int			slightly ≤10°	medium 15°	strongly 25°	extreme ≥30°	int			close	60%	80%	arm stretched		Σ (max.=15)	Σ (max.=15)	Σ (max.=10)															
dur			0	1,5	2,5	3	dur			0	1	1,5	2		Σ (max. = 40)																	
			never	4 sec	10 sec	13 sec				never	4 sec	10 sec	13 sec	(a)	(b)																	
			0%	6%	15%	20%				0%	6%	15%	20%																			
Attention: Max. duration of evaluation = duration of task or 100%!														Attention: correct evaluation, if duration of evaluation ≠ 60s																		
Postures = Σ lines 1 - 16			(a)	+	(b)	=																										

Ergonomic Assessment Worksheet V1.3.4

Action forces (per minute / shift)						Forces						
17		Forces onto fingers (e.g. clips, plugs)	0	7	15	25	50	Intensity x time	Σ			
			~1/6 F _{max}	~1/3 F _{max}	~1/2 F _{max}	~2/3 F _{max}	F _{max}					
			0	1	1	1,5	2			3,5	7	
			[sec]	3	6	9	12			20	30	
			[%]	5	10	15	20			33	50	
						0	1,5	2	2,5	3		
						[n]	4	10	15	20		
18		Forces onto arms / whole body forces	0	6	15	25	50	Intensity x time	Σ			
			~1/6 F _{max}	~1/3 F _{max}	~1/2 F _{max}	~2/3 F _{max}	F _{max}					
			0	1	1	1,5	2			4	8,5	
			[sec]	3	6	9	12			20	30	
			[%]	5	10	15	20			33	50	
						0	1	2	3	4,5	6,5	10
						[n]	1	3	6	8	10	12

Forces F _{max} onto arms / whole body forces (neutral to gender) <small>P15 for planning & P40 for analysis</small>	ST Upright		ST Bent		ST Above head		Finger forces F _{max} (neutral to gender)		
 <small>Data based on the "Assembly specific force atlas" (Wakula, Berg, Schaub, Glitsch, Ellegast 2009), adapted neutral to gender</small> <small>Score data are matter to change after the final completion of the force atlas project</small>		+A	245	315	+A	210	285		<small>F_{max}</small> P15 P40 150 205
		-A	260	325	-A	200	240		
		+B	170	210	+B	205	260		
		-B	245	315	-B	285	390		
	+C	130	185	+C	145	200		<small>F_{max}</small> P15 P40 115 155	
	-C	110	165	-C	90	135			
	+A	210	270	+A	180	245			
	-A	225	280	-A	190	225			
	+B	215	290	+B	220	320		<small>F_{max}</small> P15 P40 55 70	
	-B	240	325	-B	220	290			
	+C	145	195	+C	140	190			
	-C	115	160	-C	105	135			
+A	205	265	+A	190	250		<small>F_{max}</small> P15 P40 40 50		
-A	245	285	-A	195	245				
+B	215	260	+B	245	295				
-B	205	250	-B	215	275				
+C	120	165	+C	130	175		<small>F_{max}</small> P15 P40 45 55		
-C	110	155	-C	100	135				
+A	215	275	+A	215	255				
-A	260	295	-A	260	295				
+B	195	240	+B	195	240		<small>F_{max}</small> P15 P40 45 55		
-B	210	240	-B	210	240				
+C	100	130	+C	100	130				
-C	100	135	-C	100	135				

Action forces = Σ lines 17 - 18

Attention: correct evaluation, if duration of evaluation \neq 60s

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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	Males	Barrows				<50	75	100	150	200	250			
		Females					<40	60	80	115	155	195			
		Males	Carriage, roller, trolleys				<50	75	100	150	250	350	550		
		Females					No fixed rollers				<40	60	80	115	195
		Males	Carts, roller tables, carriages. Fixed rollers								<50	75	150	250	350
		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 torn off when starting, strongly damaged floor		very high rolling resistance			
	Conditions points		0		1			3		5		6	8		
Frequency of load manipulations [#]/shift, holding time [min] 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 or distance points					1	2	4	6	8	10	11	13	14	15
Manual Material Handling (result)															
19	(Load + posture + (condition points)) x (#, duration or distance points)		Repositioning 1)	(+)	Holding 1)	(+)	Carrying 1)	(+)	Pushing & Pulling short	(+ +)	Pushing & Pulling long 1)	(+ +)			
			x	=	x	=	x	=	x	=	x	=			

Handling = Σ line 19

1) Maximal cumulative time points for all tasks of repositioning, holding, carrying as well as pushing & pulling all together = 15


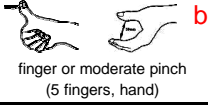

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Ergonomic Assessment Worksheet V1.3.4

Upper limb load in repetitive tasks

Upper Limbs

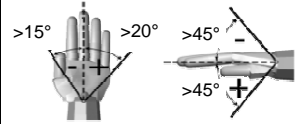
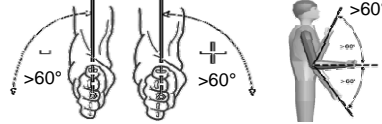
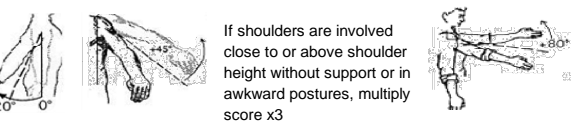
Force & Frequency & Grip (FFG) Basis: number of real actions per minute or percent static actions (analyze only the most loaded limb)

 power grip/contact grip	Force & Duration	Grip	Percentage of time involved	(Force & Duration) + (Grip x Percentage of time involved)	Very long lasting static actions; almost 75%	Long lasting static actions; almost 50%	Substantial amount of static actions ~ 35%	Considerable amount of static actions ~ 15%	Low amount of static actions; ~ 10%	Very low amount of static actions; < 5%	Good gripping conditions	Moderate gripping conditions	Poor gripping conditions	Seldom	Slow arm movements; freq. short interruptions	Arm movements not too fast; short interrupt	Normal arm movements; but short or occasional and irregular interruptions	Faster arm movements; occasional and irregular short pauses	Continuous arm movements. Lack of interruptions make difficulties to keep pace	Very high frequencies; absolutely no interruptions	More	(Force & Frequency) + Grip	Percentage of time involved	(Force & Frequency) + Grip) x percentage
 finger or moderate pinch (5 fingers, hand)					(Force & Frequency) + Grip	Percentage of time involved	(Force & Frequency) + Grip) x percentage																	
 strong pinch (thumb to 1 or 2 fingers)					(Force & Frequency) + Grip	Percentage of time involved	(Force & Frequency) + Grip) x percentage																	

Force [N]	Calc Stat			Static actions (sec/min)						Grip			Dynamic actions (real actions/min)							Calc Dyn				
	FFS	GS	%	FFGp	≥45	30	20	10	5	3	0	2	4	2-5	10	15	20	25	30	35	≥40	FFG	%	FFGp
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 $\Sigma FFSI = 100\%$ $FFGS = \Sigma FFGp$ 100% $FFG = FFGS + FFGD$ FFG $\%DA = \Sigma FFDJ$ $FFGD = \Sigma FFGp$ $\%DA$

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

20b	Wrist (deviation, flex./extens.)	Elbow (pron, sup, flex./extens.)	Shoulder (flexion, extension, abduction)
			 <p style="font-size: small;">If shoulders are involved close to or above shoulder height without support or in awkward postures, multiply score x3</p>
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	Duration [h/shift]	< 1	1,5	3	5	7	> 8	+			
	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 sec		3	2	1	0	-1	-2		
Duration Points	cycle time > 30 sec		0	-0,5			-1	-1,5	-2	=	DP

Upper limb load in repetitive tasks

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