

# Ergonomic Assessment Worksheet - AGADEXO ESO

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	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
		[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			
<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.*

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]		

Comments / proposals for improvements

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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
[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 x Duration		Intensity x Duration		Intensity x Duration												
<b>Standing (and walking)</b>																											
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	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															
<b>Sitting</b>																											
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		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															
<b>Kneeling or crouching</b>																											
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															
<b>Lying or climbing</b>																											
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) Trunk			int	0	1	3	5	2) Far Reach			int	0	1	3	5	Σ	Σ (max.=15)	Σ (max.=15)	Σ (max.=10)								
				slightly ≤10°	medium 15°	strongly 25°	extreme ≥30°					close	60%	80%	arm stretched												
			dur	0	1,5	2,5	3				dur	0	1	1,5	2												
				never	4 s	10 s	≥ 13 s					never	4 s	10 s	≥ 13 s												
				0%	6%	15%	≥ 20%					0%	6%	15%	≥ 20%	(a)	Σ (max. = 40)		(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 x Duration				
			Duration stat	[s]	3	6	9	12			20	≥ 30	
			Duration dyn	[%]	5	10	15	20			33	≥ 50	
18		Forces onto arms / whole body forces	Int	0	6	15	25	50	Intensity x Duration				
			Duration stat	[s]	3	6	9	12			20	≥ 30	
			Duration dyn	[%]	5	10	15	20			33	≥ 50	
<b>Forces Fmax onto arms / whole body forces</b> M for males & F for females			ST Upright	M	F	ST Bent	M	F	ST Above head	M	F	Finger forces Fmax (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)	
			*B	320	210	*B	400	260	*B	305	200	Posture A2 (ball of the thumb)	
			*C	290	185	*C	310	200	*C	210	140	Posture B1 (thumb or thumb to 4 fingers)	
			*A	420	270	*A	380	245	*A	425	275	Posture B2 (index or wide pinch)	
			*B	445	290	*B	495	320	*B	410	270	Posture C (hook, palmar, strong pinch)	
			*C	300	195	*C	290	190	*C	275	180	Posture A1 (power grip, pliers)	
			*A	405	265	*A	385	250	*A	395	255	Posture A2 (ball of the thumb)	
			*B	440	285	*B	375	245	*B	455	295	Posture B1 (thumb or thumb to 4 fingers)	
			*C	405	260	*C	455	295	*C	365	240	Posture B2 (index or wide pinch)	
			*B	380	250	*B	425	275	*B	370	240	Posture C (hook, palmar, strong pinch)	
			*C	250	165	*C	270	175	*C	200	130	Posture A1 (power grip, pliers)	
			*C	235	155	*C	205	135	*C	210	135	Posture A2 (ball of the thumb)	

Action forces = Σ lines 17 - 18

note: correct evaluation, if task duration ≠ 60s

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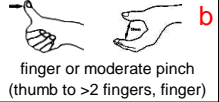

Manual Material Handling (per shift)							Loads							
<b>Weights of loads [kg] for repositioning (lifting / lowering), carrying and holding as well as pushing and pulling</b>														
+	Reposition, carrying & holding	Male (kg)		3	5	10	13	15	20	22				
		a. Load points		1,0	1,1	1,5	1,8	2,0	3,0	3,4	3,4			
		b1. Load point		0,79	0,87	1,27	1,53	1,7	2,6	2,9	2,9			
		b2. Load point		0,96	1,05	1,41	1,72	1,9	3,0	3,4	3,4			
		b3. Load point		0,65	0,72	1,05	1,31	1,5	2,4	2,8	2,8			
		Female (kg)		3	5	10	13	15	20	22	22			
	Load points		1,2	1,5	3,0	4,5	5,5	7,0	7,6	7,6				
	b1. Load point		0,95	1,19	2,54	3,83	4,7	6,0	6,6	6,6				
	b2. Load point		1,15	1,43	2,82	4,30	5,3	6,9	7,6	7,6				
	b3. Load point		0,78	0,98	2,10	3,29	4,1	5,6	6,2	6,2				
+	Pushing and pulling	M1	Wheelbarrows and Dollies		Male (kg)		50	75	100	150	200	≥ 250		
			Female (kg)		40	60	80	115	155	≥ 195				
		M2	Carriage, trolleys. No fixed rollers		Male (kg)		50	75	100	150	250	350	≥ 550	
			Female (kg)		40	60	80	115	195	270	≥ 425			
M3	Carts, roller conveyors, pallet truck		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	
<b>Posture, position of load (select characteristic posture)</b>														
+									The reduction is 80% of the score reduction of the corresponding weight.					
	trunk upright and / or not twisted load at the body		load at or close to the body, no twisting and lateral bending		load far from body or above shoulder level, no twisting and lateral bending									
	Posture points		1	2	4									
<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			very high rolling resistance		
	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)) x duration points		Repositioning 1)	( ) + ( )	Holding 1)	( ) + ( )	Carrying 1)	( ) + ( )	Pushing & Pulling short	( ) + ( )	Pushing & Pulling long	( ) + ( )	( ) + ( )	( )
	x =		x =	x =	x =	x =	x =	x =	x =	x =	x =	x =	x =	x =
<b>Handling = Σ line 19</b>			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

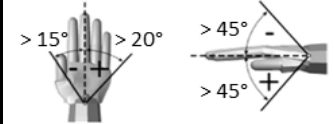
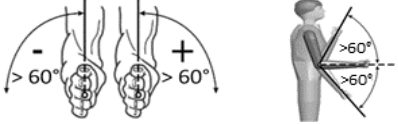

**Force & Frequency & Grip (FFG)** Basis: number of real actions per minute or percent static actions (analyze only the most loaded limb)

<b>Legend</b>	 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 = ∑ SC <sub>i</sub>	100%	FFG = FDGS + FFGD	FFG	%DA = ∑ FLD <sub>j</sub>	FFGD = ∑ DC <sub>j</sub>	%DA
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### 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)				
							
	Posture points	10% 0	25% 0,5	33% 1	50% 2	65% 3	85% 4

### 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"/>
	During almost the whole time one or more additional factor/s is/are present	3	<input type="checkbox"/>
<b>Additional points (choose the highest value)</b>		=	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	3	2	1	0	-1	-2	-3	-4		
	Duration Points	cycle time ≤ 30 s		cycle time > 30 s						=	DP

### Upper limb load in repetitive tasks

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