Ergonomic Assessment Worksheet v1.3.6

Plant	Gender of operator m ☐ f ☐	Body height
Line	MTM Analysis	Analyst
Task / Workplace	Task duration [s]	Observation ☐ Planning ☐ / 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.

☐ Green ☐ Yellow ☐ 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 none	3 middle	8 strong	15 very strong			Intensity
0b	Accessibility (e.g. entering motor or passenger compartment)	0 good	2 complicated	5 poor	10 very poor			Status
0c	Countershocks, impulses, vibrations 	0 light	1 visible	2 heavy	5 very heavy			Intensity × frequency
		0 [n]	1 1 - 2	2,5 4 - 5	4 8 - 10	6 18 - 20	8 > 20	
0d	Joint position (especially wrist) 	0 neutral	1 ~ 1/3 max	3 ~ 2/3 max	5 maximal			Intensity × duration or frequency
		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 none	5 middle	10 strong	15 very strong			Intensity
	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			=

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 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

Evaluation of static postures and/or high frequency movements of trunk/arms/legs

Duration [s/min] = $\frac{\text{duration of posture [s]} \times 60}{\text{Task duration [s]}}$

Asymmetric

												Sum of lines	Trunk Rotation 1)		Lateral Bending 1)		Far Reach 2)	
													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	0-2
		[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, 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							
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)

Trunk int	0	1	3	5
	slightly ≤10°	medium 15°	strongly 25°	extreme ≥30°
Trunk dur	0	1,5	2,5	3
	never 0%	4 s 6%	10 s 15%	≥ 13 s ≥ 20%

2)

Far Reach int	0	1	3	5
	close	60%	80%	arm stretched
Far Reach dur	0	1	1,5	2
	never 0%	4 s 6%	10 s 15%	≥ 13 s ≥ 20%

∑ (a)

∑ (max.=15) | ∑ (max.=15) | ∑ (max.=10)

∑ (max. = 40) (b)

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

note: correct evaluation, if task duration ≠ 60 s

Postures = ∑ lines 1 - 16	(a)	+	(b)	=	

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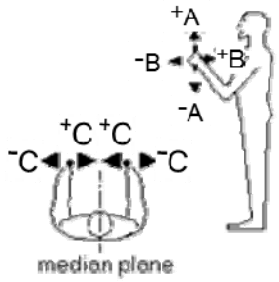
Action forces (per minute) — Forces

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	≥ 30
				[%]	5	10	15	20	33	≥ 50
			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	≥ 30
				[%]	5	10	15	20	33	≥ 50
			dyn	0	1	2	3	4,5	6,5	10
				[n]	1	3	6	8	10	≥ 12

Forces Fmax onto arms / whole body forces
M for males & F for females



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
+A	480	315	+A	435	285	+A	430	280
-A	500	325	-A	370	240	-A	495	320
+B	320	210	+B	400	260	+B	305	200
-B	485	315	-B	605	390	-B	480	310
+C	290	185	+C	310	200	+C	210	140
-C	255	165	-C	205	135	-C	210	140
KN Upright	M	F	**KN Bent**	M	F	**KN Above head**	M	F
+A	420	270	+A	380	245	+A	425	275
-A	430	280	-A	345	225	-A	495	320
+B	445	290	+B	495	320	+B	410	270
-B	495	325	-B	445	290	-B	425	275
+C	300	195	+C	290	190	+C	275	180
-C	245	160	-C	205	135	-C	280	180
SI Upright	M	F	**SI Bent**	M	F	**SI Above head**	M	F
+A	405	265	+A	385	250	+A	395	255
-A	440	285	-A	375	245	-A	455	295
+B	405	260	+B	455	295	+B	365	240
-B	380	250	-B	425	275	-B	370	240
+C	250	165	+C	270	175	+C	200	130
-C	235	155	-C	205	135	-C	210	135

Finger forces Fmax (F=Female M=Male)

Posture A1 (power grip, pliers)

F_{max} M	F_{max} F
315	205

Posture A2 (ball of the thumb)

F_{max} M	F_{max} F
235	155

Posture B1 (thumb or thumb to 4 fingers)

F_{max} M	F_{max} F
110	70

Posture B2 (index or wide pinch)

F_{max} M	F_{max} F
75	50

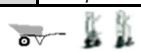
Posture C (hook, palmar, strong pinch)

F_{max} M	F_{max} F
85	55

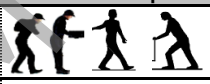
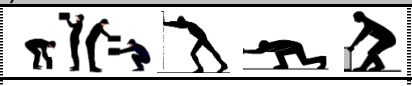
Action forces = ∑ lines 17 - 18 | note: correct evaluation, if task duration ≠ 60s | =

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	 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

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	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 teared off when starting, strongly damaged floor	very high rolling resistance
	Conditions points	0	1	3	5	6	8

Frequency of load manipulations [frequecy/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)	(+)	× =	Holding 1)	(+)	× =	Carrying 1)	(+)	× =	Pushing & Pulling short 1)	(+ +)	× =	Pushing & Pulling long 1)	(+ +)	× =

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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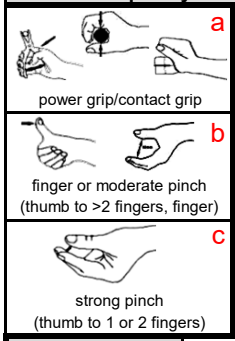
Upper limb load in repetitive tasks — Upper Limbs

Force & Frequency & Grip (FFG)

Basis: number of real actions per minute or percent static actions (analyze only the most loaded limb)



Legend

%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

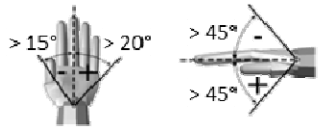
Force [N]	Calc Stat				Static actions (s/min)						Grip			Dynamic actions (real actions/min)							Calc Dyn			
	FDS	GS'	%FLS	SC	≥45	30	20	10	5	3	0	2	4	2	10	15	20	25	30	35	≥40	FFD	GD	%FLD	DC
0 — 5					1	1	0	0	0	0	abc			0	0	0	1	2	3	4	7				
> 5 — 20					4	2	1	1	0	0	ab	bc		0	0	1	2	3	4	6	9				
> 20 — 35					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_i	100%		**FFG** = FDGS + FFGD	FFG	%DA = ΣFLDj	FFGD = ∑ DC_j	%DA	

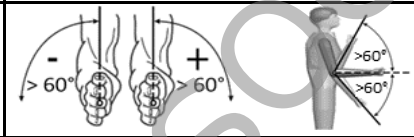
Hand / arm / shoulder postures (use duration for worst case of wrist / elbow / shoulder)

20b

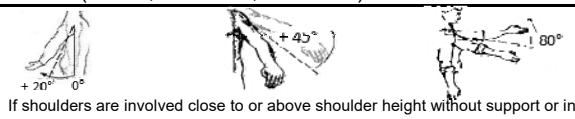
Wrist (deviaton, flex./extens.)



Elbow (pron, sup, flex./extens.)



Shoulder (flexion, extension, abduction)



If shoulders are involved close to or above shoulder height without support or in awkward postures, multiply score ×3

Posture points	10%	25%	33%	50%	65%	85%	PP
	0	0,5	1	2	3	4	

Additional factors

20c

Gloves inadequate (which interfere with the handling ability required) are used for over half the time	2	☐
Working gestures required imply a countershock. Frequency of 2 time per minute or more (i.e.: hammering over hard surface)	2	☐
Working gestures imply a countershock (using the hand as a tool) with freq. of 10 time per hour or more	2	☐
Exposure to cold or refrigeration (less than 0 degree) for over half the time	2	☐
Vibrating tools are used for 1/3 of the time or more	2	☐
Tools with a very high level of vibrations	4	☐
Tools employed cause compressions of the skin (rednesses, callosities, blebs, etc.)	2	☐
Precision tasks are carried out for over half the time (tasks over areas smaller than 2-3 mm)	2	☐
During almost the whole time one or more additional factor/s is/are present	3	☐
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 (Cycle time longer than 10 minutes)	Breaks are possible at given conditions (Cycle time between 1 and 10 minutes)	Breaks lead to a stop of the process (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

Upper limb load in repetitive tasks

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