

**EXPLANATIONS OF ERGONOMICS
REQUIREMENTS:
PHYSICAL EXPOSURE**
FOR MACHINE SUPPLIERS

CHAPTERS

1 BODY POSTURE

2 INTERNATIONAL ANTHROPOMETRIC DATA

3 TYPE OF WORKPLACE

1 BODY POSTURE

EVALUATION OF BODY POSTURES

Definition of colors

Green: Optimal. This posture is allowed to be adopted **for a long time**.

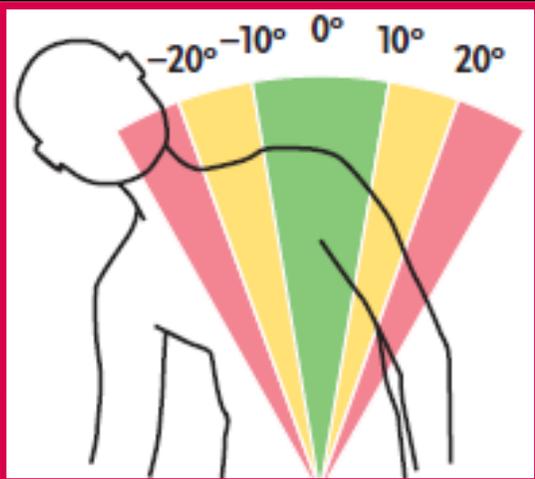
Yellow: Still acceptable body posture. This posture is only allowed to be adopted for a **short period of time** or to perform work-tasks with **low frequencies**.

Red: Extremely awkward Body Posture. **Has to be avoided!**

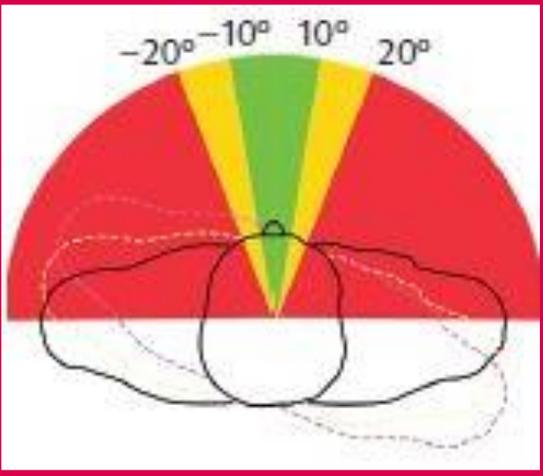
TRUNK FLEXION / EXTENSION

Trunk and Back Bending of the trunk		Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 Acc. to ISO 11226(2) & EN 1005-4		Optimal	Still acceptable posture	Extremely awkward posture
	Trunk Flexion (bending forwards)	+ 0° to 20°	20° to 60°	> 60°
	Trunk Extension (bending to a side)	- 0°		< 0°

BENDING OF THE TRUNK TO A SIDE

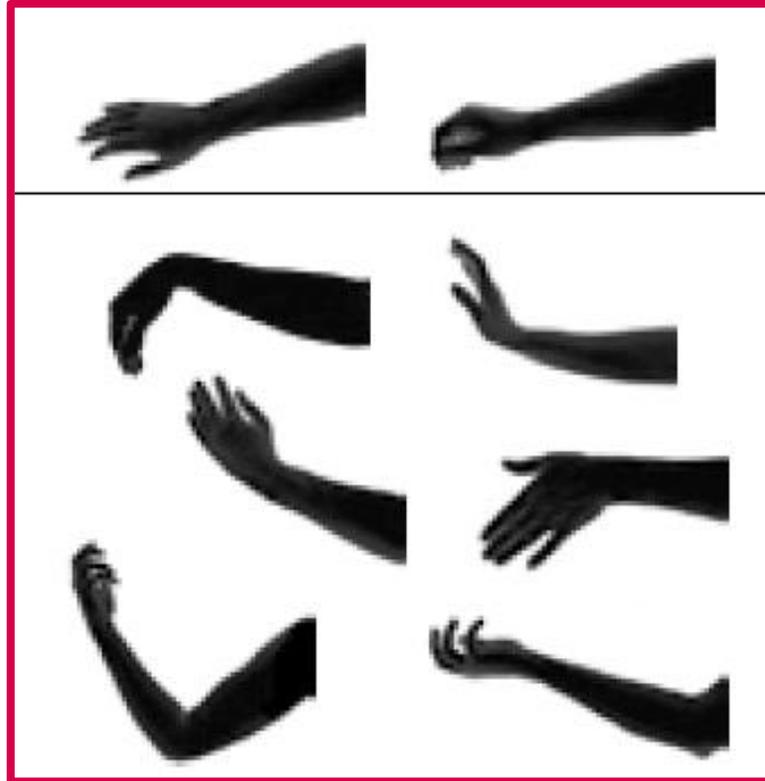
Trunk and Back Bending of the trunk		Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 Acc. to ISO 11226(2)		Optimal	Still acceptable posture	Extremely awkward posture
	Bending of the trunk to the right	+ 0° to 10°	10° to 20°	> 20°
	Bending of the trunk to the left	- 0° to -10°	-10° to -20°	< -20°

TORSION OF THE TRUNK

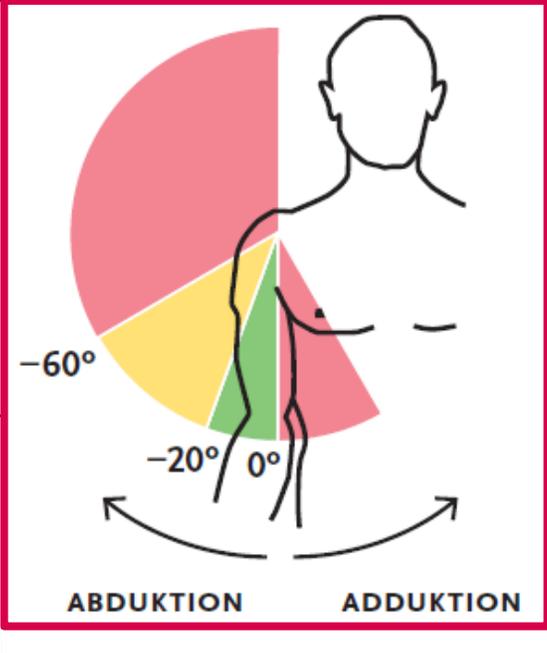
Trunk and Back Torsion of the trunk		Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 Acc. To ISO 11226(2)		Optimal	Still acceptable posture	Extremely awkward posture
	Torsion of the trunk to the right +	0° to 10°	10° to 20°	> 20°
	Torsion of the trunk to the left -	0° to -10°	-10° to -20°	< -20°

EVALUATION OF JOINT POSITIONS

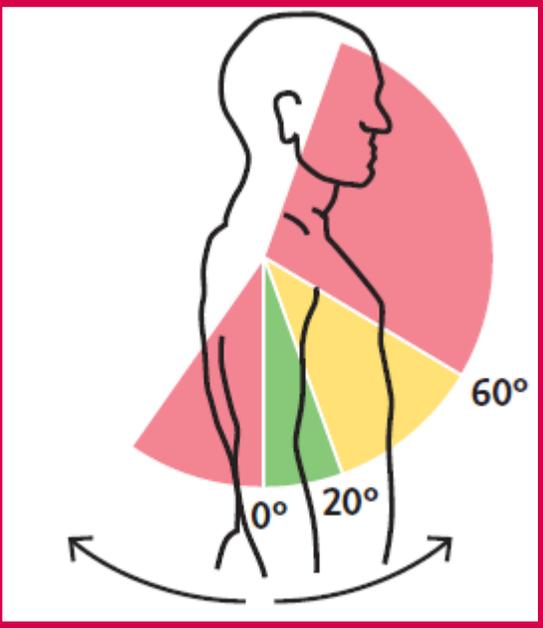
POSITIONS: HANDS / ARMS / SHOULDERS



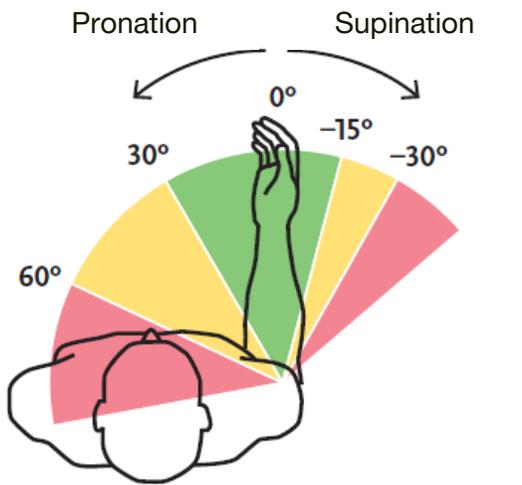
SHOULDER JOINT ADDUCTION / ABDUCTION

Shoulder Joint		Neutral (natural) Body Posture	Awkward Body Posture		
Source: German BGIA-Report 2/2007 Acc. To DIN EN 1005-4; German A 55		Optimal	Still acceptable posture	Extremely awkward posture	
 <p>The diagram shows a human silhouette with the right arm. A vertical line represents the body midline. The shoulder joint is shown with a green sector for adduction (0° to -20°) and a yellow sector for abduction (-20° to -60°). A red sector represents the range from -60° to the full range of motion. Arrows indicate the direction of movement: 'ABDUKTION' (abduction) to the left and 'ADDUKTION' (adduction) to the right. The angles 0°, -20°, and -60° are marked relative to the vertical midline.</p>	To the body = Adduction	+	0°		> 0°
	From the body = Abduction	-	0° to -20°	-20° to -60°	< -60°

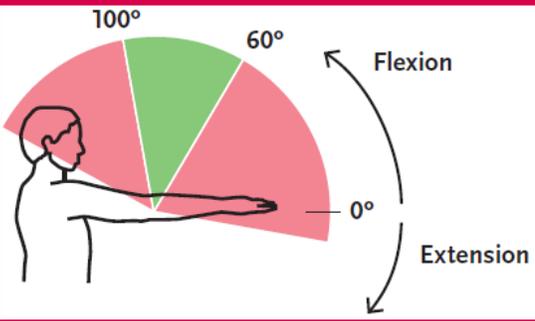
SHOULDER JOINT FLEXION / EXTENSION

Shoulder Joint		Neutral (natural) Body Posture	Awkward Body Posture		
Source: German BGIA-Report 2/2007 Acc. To DIN EN 1005-4; German A 55		Optimal	Still acceptable posture	Extremely awkward posture	
	Forwards (Flexion)	+	0° to 20°	20° to 60°	> 60°
	Backwards (Extension)	-			< 0°

SHOULDER JOINT PRONATION / SUPINATION

Shoulder Joint		Neutral (natural) Body Posture	Awkward Body Posture		
Source: German BGIA-Report 2/2007 German A 55		Optimal	Still acceptable posture	Extremely awkward posture	
	Pronation (to the body)	+	0° to 30°	30° to 60°	> 60°
	Supination (from the body)	-	0° to -15°	-15° to -30°	< -30°

CUBITAL JOINT FLEXION / EXTENSION

Cubital Joint		Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 Acc. To DIN EN 1005-4; German A 55		Optimal	Still acceptable posture	Extremely awkward posture
	Flexion	+	60° to 100°	> 100°
	Extension	-	60° to 100°	< 60°

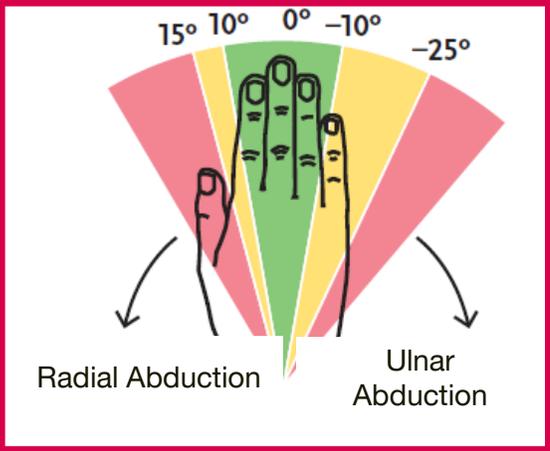
LOWER ARM PRONATION / SUPINATION

Lower Arm			Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 German A 55			Optimal	Still acceptable posture	Extremely awkward posture
	Pronation	+	0° to 20°	20° to 40°	> 40°
	Supination	-	0° to -30°	-30° to -55°	< -55°

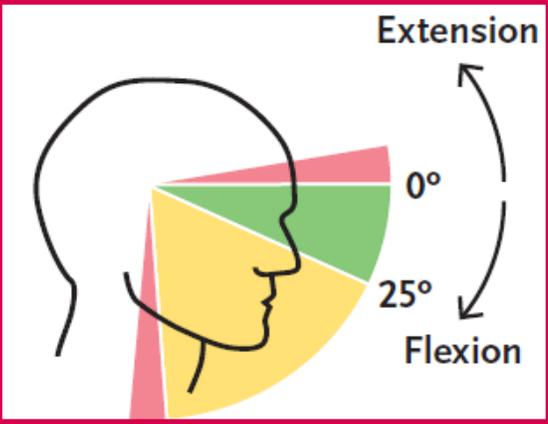
WRIST FLEXION / EXTENSION

Wrist		Neutral (natural) Body Posture	Awkward Body Posture		
Source: German BGIA-Report 2/2007 / German A 55		Optimal	Still acceptable posture	Extremely awkward posture	
	Extension	-	0° to -25°	-25° to -50°	< -50°
	Flexion	+	0° to 20°	20° to 45°	> 45°

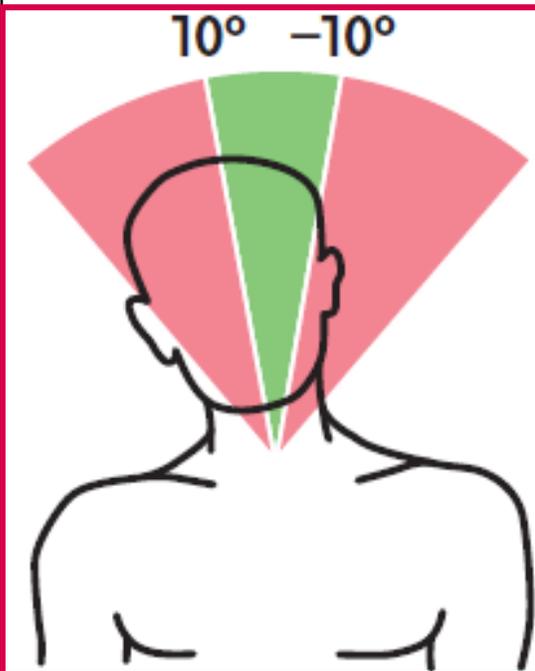
WRIST RADIAL ABDUCTION / ULNAR ABDUCTION

Wrist			Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 German A 55			Optimal	Still acceptable posture	Extremely awkward posture
	Radial Abduction	+	0° to 10°	10° to 15°	> 15°
	Ulnar Abduction	-	0° to -10°	-10° to -25°	< -25°

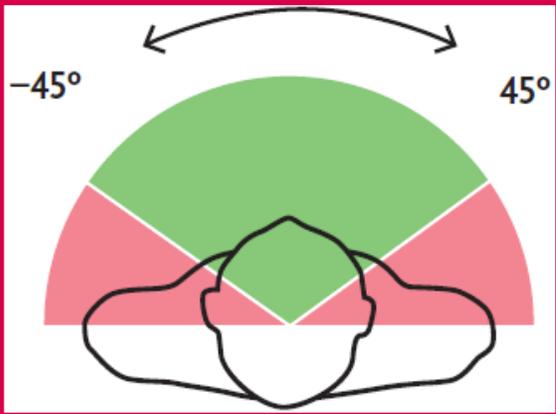
BENDING OF THE HEAD: FLEXION (FORWARDS) / EXTENSION (BACKWARDS)

Head and Neck Bending of the head		Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 Acc. to ISO 11226(2)		Optimal	Still acceptable posture	Extremely awkward posture
 <p>The diagram shows a profile of a human head and neck. A vertical line represents the neutral position. An upward arrow indicates 'Extension' (bending backwards) with a 0° angle. A downward arrow indicates 'Flexion' (bending forwards) with a 25° angle. A larger angle of 85° is also marked for flexion.</p>	-	0°	< 0°	
	Bending of the head forwards (Flexion)	+	0° to 25°	25° to 85°
85°				

BENDING OF THE HEAD TO A SIDE

Head and Neck Bending of the head to a side		Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 Acc. To DIN EN 1005-4 (3)		Optimal	Still acceptable posture	Extremely awkward posture
	To the right	+	0° to 10°	> 10°
	To the left	-	0° to -10°	< -10°

TORSION OF THE HEAD

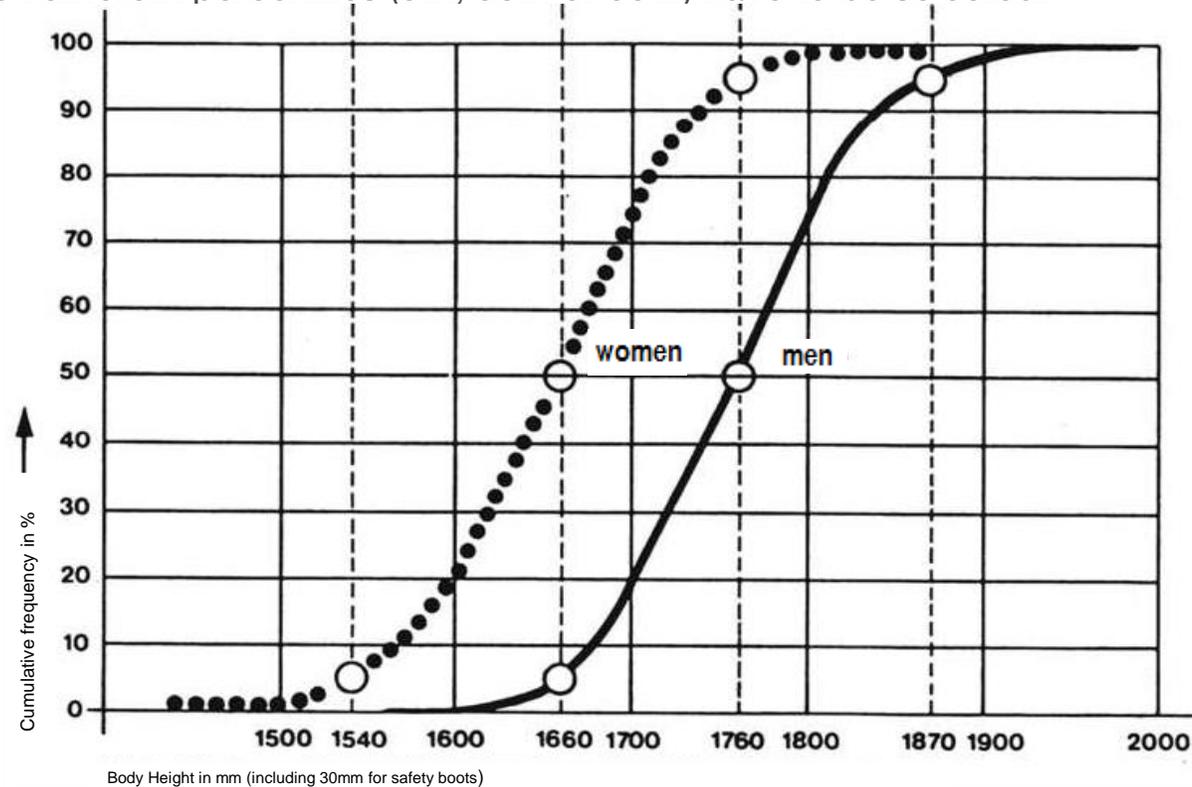
Head and Neck Torsion of the head		Neutral (natural) Body Posture	Awkward Body Posture	
Source: German BGIA-Report 2/2007 Acc. To DIN EN 1005-4 (3)		Optimal	Still acceptable posture	Extremely awkward posture
	To the right	+	0° to 45°	> 45°
	To the left	-	0° to -45°	< -45°

2 INTERNATIONAL ANTHROPOMETRIC DATA

GERMANY, EUROPE, ITALY, JAPAN, KOREA, THAILAND, USA, CHINA, MEXICO, MALAYSIA

INTRODUCTION

- > The distribution of the body measurements shows a Gaussian distribution.
- > For use, the measurements are taken in each case by gender in percentiles. For ergonomic design, the 5th, 50th and 95th percentiles are commonly used.
- > Depending on the worktask different percentiles (5th, 50th or 95th) have to be selected.



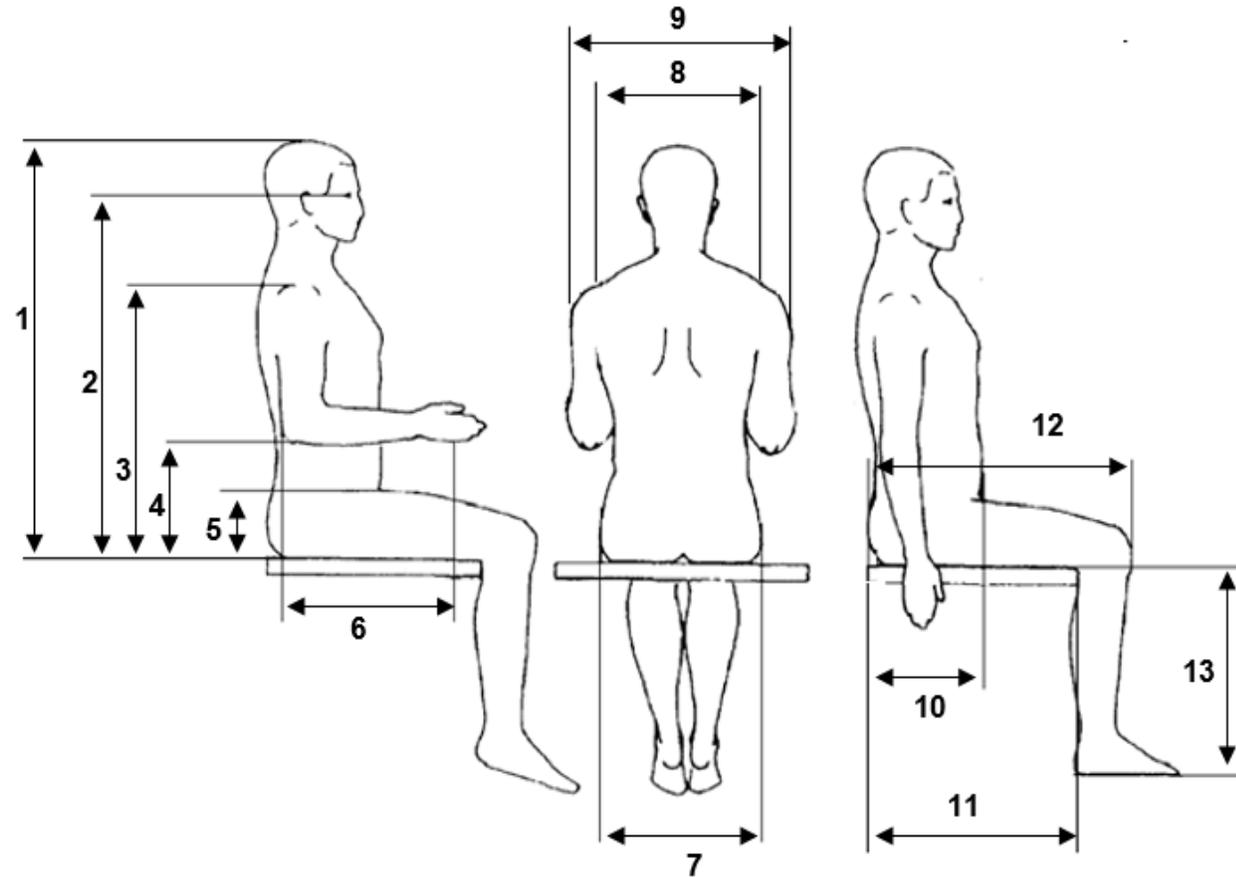
BODY WEIGHT (KG)



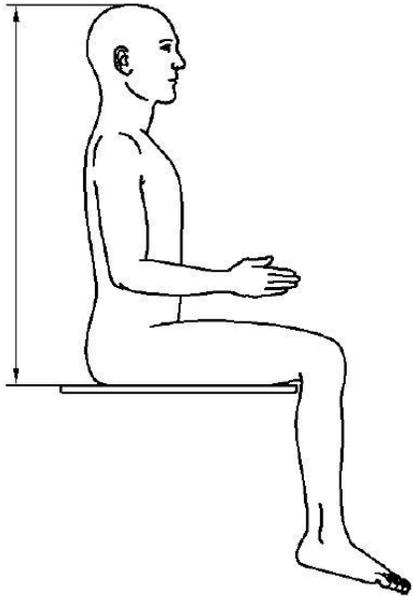
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	64	79	100	52	66	87
Euro (n.a.)						
Italy	60	75	93	48	59	78
Japan	54	67	84	43	51	64
Korea	55	70	87	45	55	71
Thailand	51	64	82	42	53	69
USA	63	80	115	49	66	103
China	48	59	75	42	52	66
Mexico	55	72	97	48	61	88
Malaysia (n.a.)						

MEASUREMENTS FOR SITTING OPERATIONS

- 1: Height, sitting
- 2: Eye Height, sitting
- 3: Shoulder Height, sitting
- 4: Elbow Height, sitting (n.a.)
- 5: Thigh Height
- 6: Elbow Grip Reach
- 7: Hip Breadth, sitting
- 8: Shoulder Breadth (biacromial)
- 9: Shoulder Breadth (bideltoid)
- 10: Distance from Back to Stomach, sitting
- 11: Buttock Popliteal Length
- 12: Buttock Knee Length
- 13: Lower Leg Length including Foot

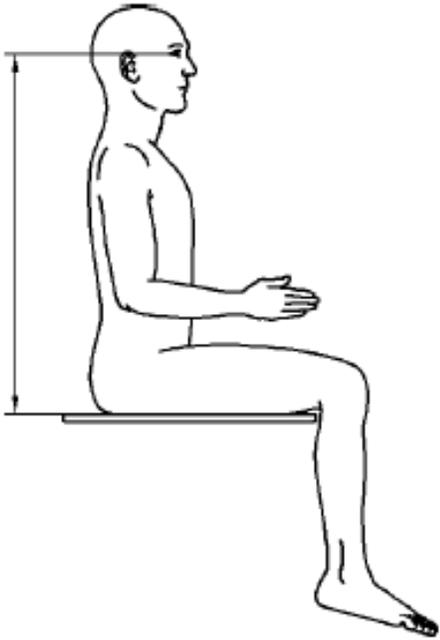


HEIGHT, SITTING



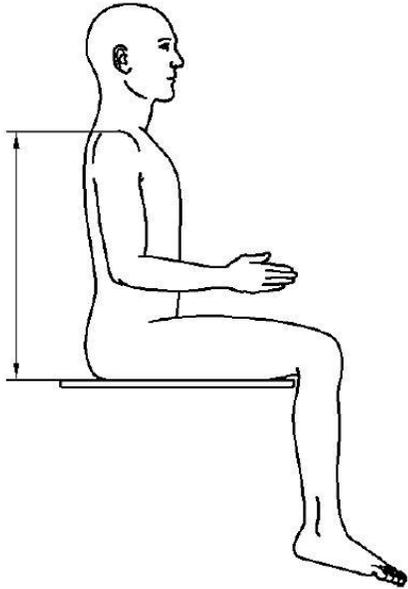
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	855	910	965	810	860	910
Euro	790		905		985	
Italy	820	882	946	775	835	894
Japan	856	909	964	800	850	898
Korea	869	922	974	811	858	905
Thailand	813	870	925	778	823	925
USA	856	919	985	809	861	925
China	858	908	958	809	855	901
Mexico	825	877	927	790	831	879
Malaysia	776	857	929	757	820	876

EYE HEIGHT, SITTING



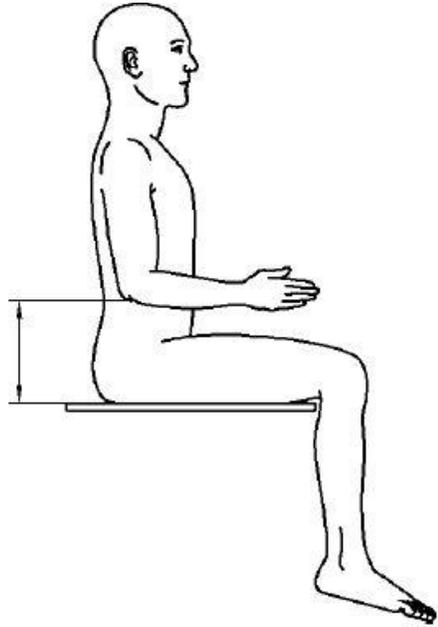
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	740	795	855	705	755	805
Euro	680		790		860	
Italy (n.a.)						
Japan	738	789	842	687	735	780
Korea	755	805	857	701	747	792
Thailand	705	758	810			
USA	739	801	867	701	753	811
China	749	798	847	695	739	783
Mexico (n.a.)						
Malaysia	654	731	803	621	696	760

SHOULDER HEIGHT, SITTING



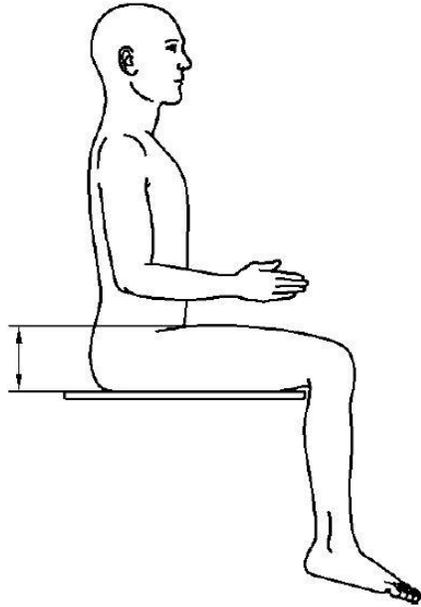
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	570	625	670	540	590	630
Euro	510		623		695	
Italy	520	571	631	501	549	602
Japan	542	585	633	504	546	586
Korea	522	596	640	516	556	597
Thailand	509	546	588			
USA	549	601	656	523	566	615
China	557	598	641	518	556	594
Mexico	535	582	638	511	552	591
Malaysia	510	580	637	498	551	614

ELBOW HEIGHT ABOVE SITTING LEVEL



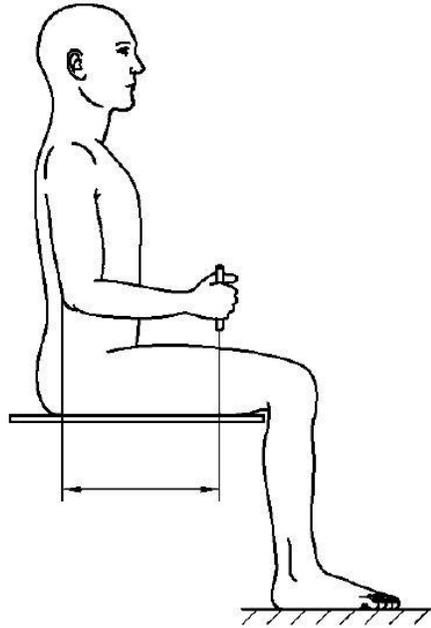
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	210	240	285	185	230	275
Euro	190		243		280	
Italy (n.a.)						
Japan (n.a.)						
Korea (n.a.)						
Thailand (n.a.)						
USA (n.a.)						
China (n.a.)						
Mexico (n.a.)						
Malaysia (n.a.)						

THIGH HEIGHT, SITTING



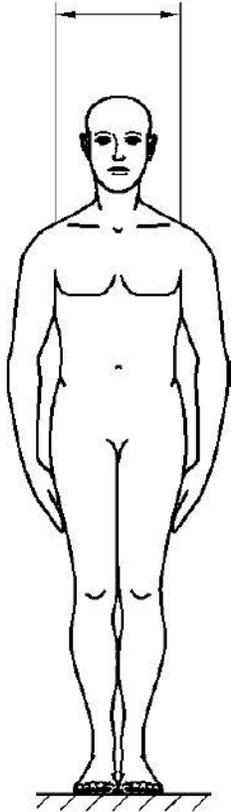
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	130	150	180	125	145	175
Euro	112		146		170	
Italien	116	138	160	110	134	159
Japan	129	149	171	114	131	152
Korea	128	153	179	117	137	159
Thailand	124	139	163	117	137	159
USA (n.a.)						
China	112	130	151	113	130	151
Mexiko	127	150	178	126	150	185
Malaysia (n.a.)						

ELBOW GRIP REACH, SITTING



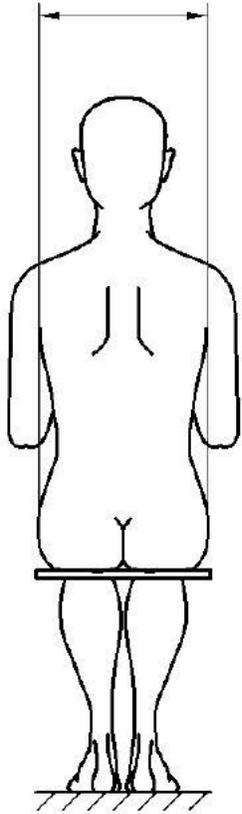
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	325	350	390	295	315	350
Euro	298		338		403	
Italy (n.a.)						
Japan	311	335	362	282	305	331
Korea	300	327	356	275	302	329
Thailand				268	292	318
USA (n.a.)						
China (n.a.)						
Mexico (n.a.)						
Malaysia (n.a.)						

SHOULDER BREADTH (BIACROMIAL)



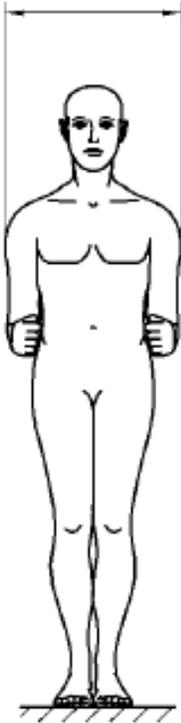
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	370	405	435	345	370	400
Euro	320		380		425	
Italy	344	395	435	308	345	379
Japan	374	401	431	335	358	383
Korea	359	397	430	331	360	388
Thailand	330	370	420	305	342	390
USA	383	418	455	343	375	412
China	344	375	403	320	351	377
Mexico (n.a.)						
Malaysia (n.a.)						

HIP BREADTH, SITTING



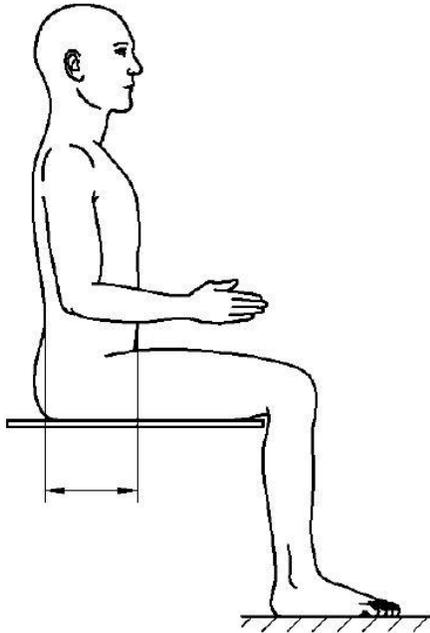
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	350	375	420	360	390	460
Euro	333		368		440	
Italy	305	343	397	312	355	417
Japan	327	358	393	327	359	398
Korea	315	346	385	317	347	383
Thailand	310	343	382	310	350	400
USA	329	372	435	348	403	557
China	295	321	355	310	344	382
Mexico	328	372	423	347	392	472
Malaysia (n.a.)						

SHOULDER BREADTH (BIDELTOIDAL)



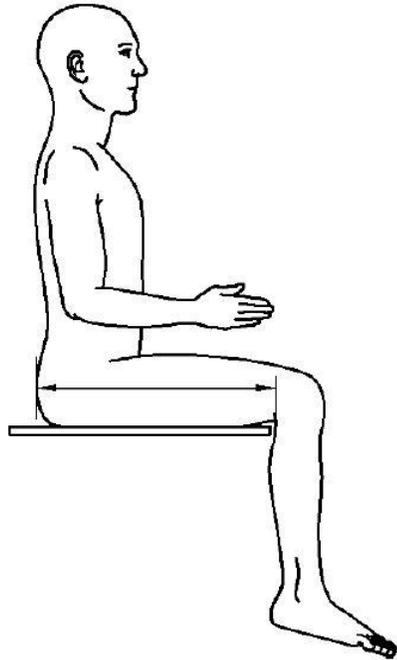
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	440	480	525	395	435	485
Euro	395		474		485	
Italy	421	459	500	368	406	459
Japan	423	457	500	377	405	444
Korea	425	465	506	381	417	458
Thailand	407	446	489	362	397	448
USA	440	486	550	385	426	493
China	398	431	469	363	397	438
Mexico	422	472	544	389	435	521
Malaysia (n.a.)						

DISTANCE FROM BACK TO STOMACH, SITTING



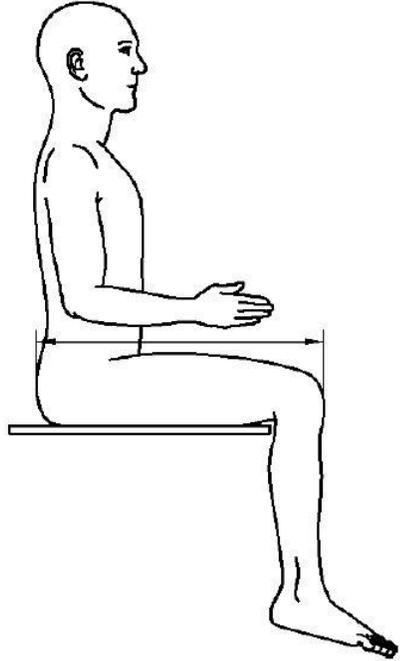
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	200	280	330	205	250	325
Euro	195		237		350	
Italy	194	243	307	175	225	320
Japan	187	234	290	171	204	268
Korea	184	230	287	169	210	280
Thailand (n.a.)						
USA (n.a.)						
China (n.a.)						
Mexico (n.a.)						
Malaysia (n.a.)						

BUTTOCK POPLITEAL LENGTH



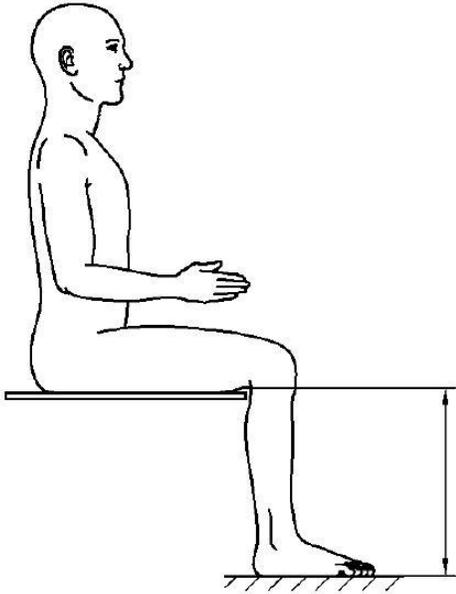
	Male			Female		
	P5	P50	P95	P5	P50	P95
Deutschland	450	495	540	435	485	530
Euro	430		499		560	
Italien	434	480	529	427	475	520
Japan	429	465	507	412	448	483
Korea	424	466	511	410	445	483
Thailand	416	472	522	437	473	515
USA (n.v.)						
China	421	457	494	401	433	469
Mexiko	432	475	526	434	470	513
Malaysia	433	478	526	403	456	511

BUTTOCK KNEE LENGTH, SITTING



	Male			Female		
	P5	P50	P95	P5	P50	P95
Deutschland	565	610	655	545	590	640
Euro	543		604		664	
Italy (n.a.)						
Japan	525	565	608	497	532	570
Korea	530	570	616	504	541	581
Thailand	520	565	611	507	545	587
USA	562	610	673	533	584	648
China	515	554	595	495	529	570
Mexico	537	582	640	534	572	625
Malaysia (n.a.)						

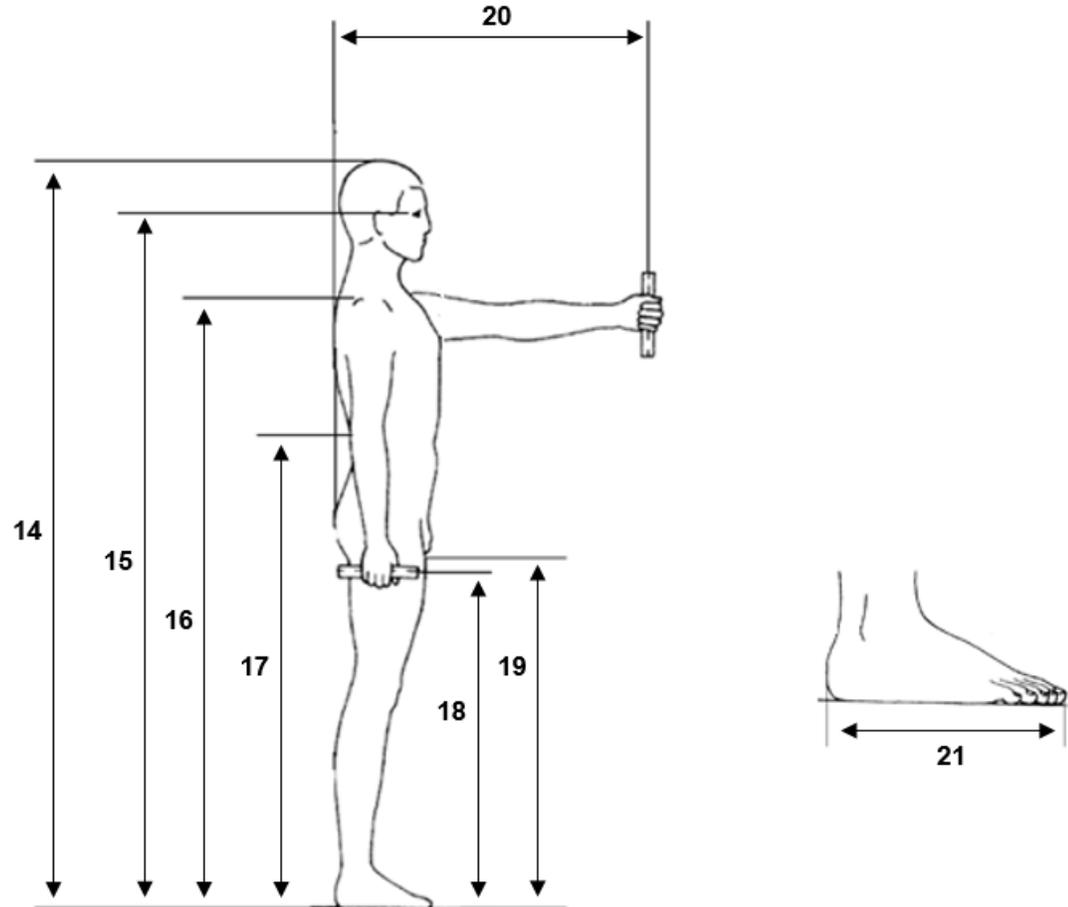
LOWER LEG LENGTH INCLUDING FOOT



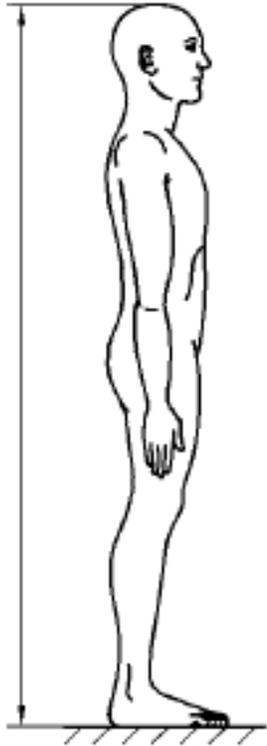
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	410	450	490	375	415	450
Euro (n.a.)						
Italy	412	460	511	362	411	472
Japan	370	405	442	340	369	403
Korea	365	399	437	333	369	403
Thailand	380	413	450	355	389	423
USA (n.a.)						
China	383	413	448	342	382	405
Mexico	374	412	453	338	376	406
Malaysia (n.a.)						

MEASUREMENTS FOR STANDING OPERATIONS

- 14 Height, standing
- 15 Eye Height, standing
- 16 Shoulder Height, standing
- 17 Elbow Height, standing
- 18 Fist Height (Grip Reach)
- 19 Crotch Height
- 20 Operating Reach Forward
- 21 Foot Length

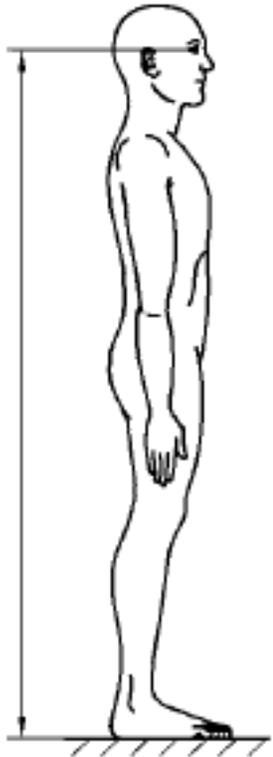


HEIGHT, STANDING



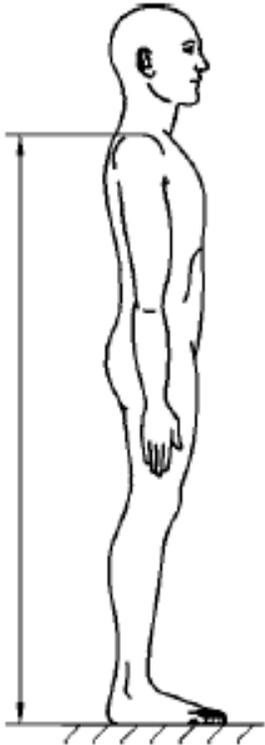
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	1650	1750	1855	1535	1625	1720
Euro	1530		1719		1880	
Italy	1601	1714	1834	1490	1590	1695
Japan	1597	1696	1795	1481	1570	1664
Korea	1608	1708	1805	1491	1577	1670
Thailand	1576	1663	1770	1467	1546	1633
USA	1650	1759	1901	1526	1630	1767
China	1583	1678	1775	1484	1570	1659
Mexico	1576	1668	1780	1471	1570	1658
Malaysia	1590	1692	1805	1483	1562	1665

EYE HEIGHT, STANDING



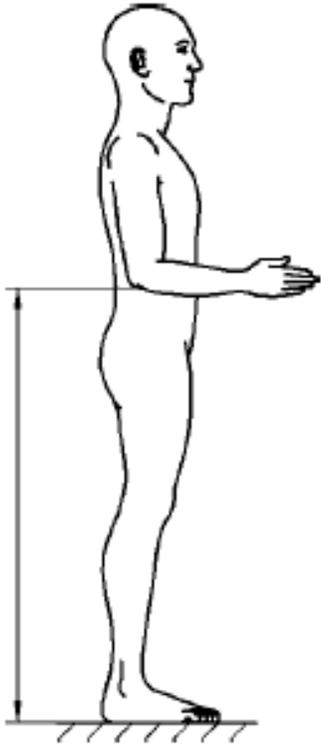
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	1530	1630	1735	1430	1515	1605
Euro	1420		1603		1750	
Italy (n.a.)						
Japan	1484	1579	1675	1372	1459	1552
Korea	1493	1592	1687	1384	1470	1556
Thailand	1462	1549	1650	1353	1433	1515
USA (n.a.)						
China	1474	1568	1664	1371	1454	1541
Mexico	1447	1546	1651	1351	1450	1540
Malaysia	1457	1570	1685	1345	1443	1546

SHOULDER HEIGHT, STANDING



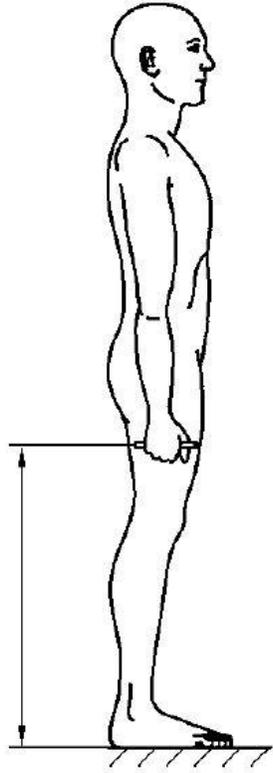
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	1345	1450	1550	1260	1345	1425
Euro	1260		1424		1570	
Italy	1323	1405	1508	1210	1302	1394
Japan	1282	1369	1460	1182	1263	1350
Korea	1304	1392	1479	1209	1284	1366
Thailand	1282	1369	1467	1190	1265	1340
USA	1341	1442	1570	1243	1336	1456
China	1281	1367	1455	1195	1271	1350
Mexico	1281	1377	1477	1209	1290	1380
Malaysia	1314	1402	1506	1220	1296	1387

ELBOW HEIGHT, STANDING



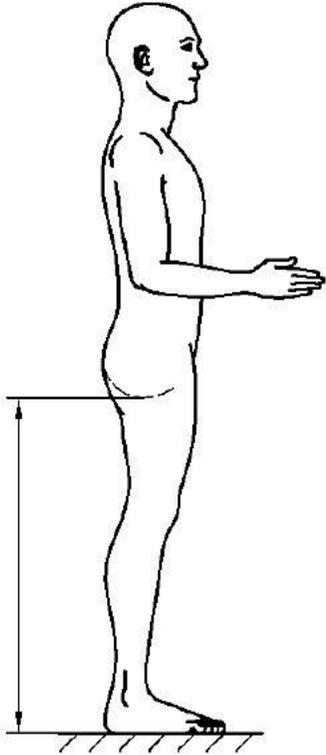
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	1025	1100	1175	960	1020	1080
Euro	960		1078		1190	
Italy	1004	1082	1170	925	1000	1078
Japan	960	1031	1102	889	953	1020
Korea	974	1045	1115	907	967	1032
Thailand	953	1024	1100	895	952	1014
USA (n.a.)						
China	954	1024	1096	899	960	1023
Mexico	906	969	1046	906	969	1044
Malaysia	964	1042	1130	902	965	1048

FIST HEIGHT (GRIP REACH)



	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	730	765	825	670	715	760
Euro	660		764		845	
Italy (n.a.)						
Japan	697	753	812	642	699	752
Korea	699	758	815	655	708	764
Thailand	683	740	800	647	696	746
USA (n.a.)						
China	680	741	801	650	704	757
Mexico (n.a.)						
Malaysia (n.a.)						

CROTCH HEIGHT

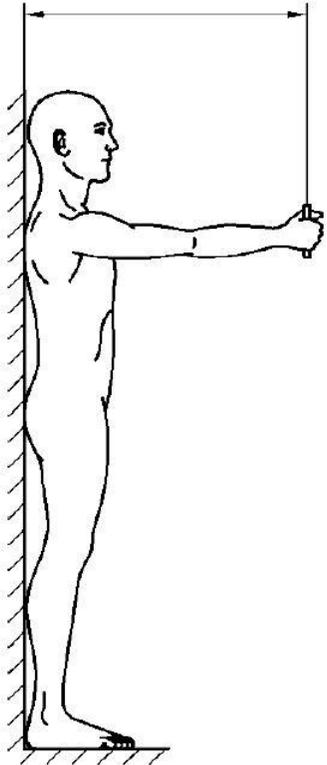


	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	760	830	905	710	775	830
Euro	709		816		890	
Italy	760	834	914	689	756	827
Japan	707	771	837	645	705	768
Korea	707	778	843	649	707	768
Thailand (n.a.)						
USA	719	796	880	672	744	831
China	728	790	856	673	732	792
Mexico (n.a.)						
Malaysia						

Italy: Definition distinguishes from ISO 7250-2 or has been replaced

USA: Definition distinguishes from ISO 7250-1 or has been replaced

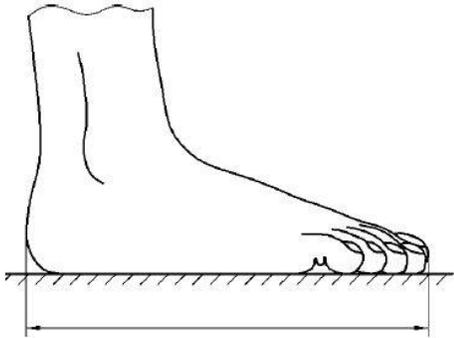
OPERATING REACH FORWARD



	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	685	740	815	625	690	750
Euro	640		728		820	
Italy (n.a.)						
Japan	635	693	750	588	635	690
Korea	621	700	766	612	658	709
Thailand	665	720	780	627	677	730
USA (n.a.)						
China (n.a.)						
Mexico (n.a.)						
Malaysia (n.a.)						

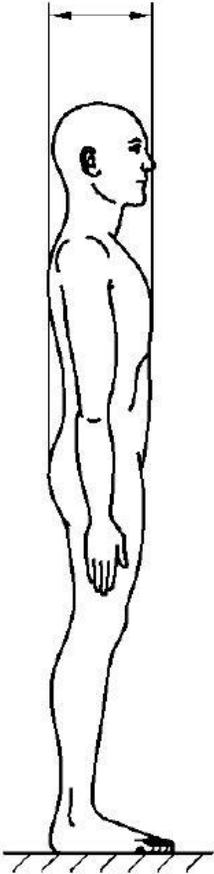
FOOT LENGTH

Add 30mm for safety boots



	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	245	265	285	225	245	260
Euro	232		255		280	
Italy (n.a.)						
Japan	234	251	270	215	230	246
Korea	232	250	270	214	230	246
Thailand	229	246	267	210	227	243
USA (n.a.)						
China (n.a.)						
Mexico (n.a.)						
Malaysia (n.a.)						

BODY DEPTH, STANDING



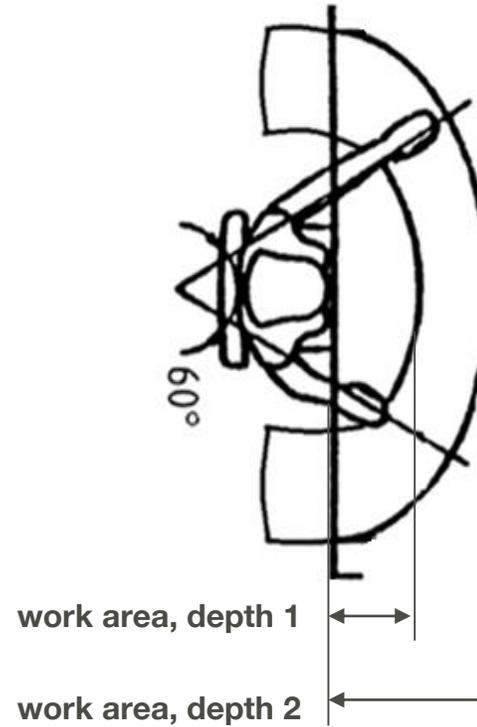
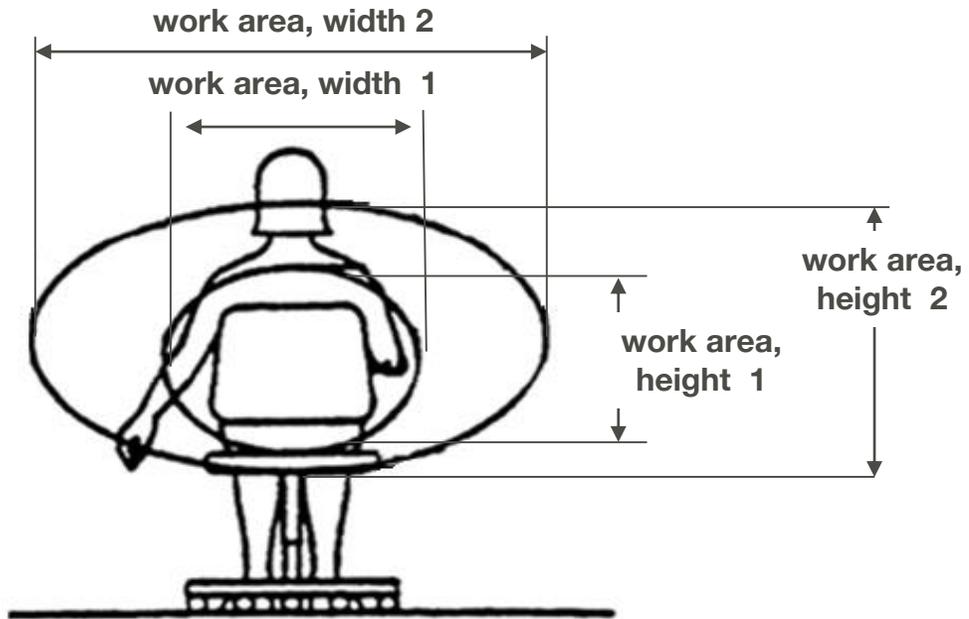
	Male			Female		
	P5	P50	P95	P5	P50	P95
Germany	260	285	380	245	290	345
Euro (n.a.)						
Italy (n.a.)						
Japan	205	245	296	185	217	268
Korea	186	225	275	193	231	285
Thailand (n.a.)						
USA (n.a.)						
China (n.a.)						
Mexico	219	272	323	233	269	344
Malaysia (n.a.)						

SOURCES AND REFERENCES

- > Body Measurements taken from:
R. Chaurand, L. León, E. Munoz (2007): Anthropometric Data of the Latin-American population, 2. Run, University Guadalajara (Size of sample about 600 persons)
- > Measurements for Euro:
AWE Nr. 108
- > Other Measurements taken from:
DIN CEN ISO/TR 7250-2
- > Images taken from:
DIN 33402-2:2005-12
- > “n.a.” stands for “not available”
- > Measurements for European population (listed as “Euro”) are gender neutral

OPERATING DISTANCES

› All dimensions in [mm]



OPERATING DISTANCES

- › For work places with permanent change between men and women, the dimensions for women have to be selected for work place design.

Table 1: work place dimensions in [mm] for design purposes					
	Europe	Germany		Korea	
	M/F	M	F	M	F
Work area, width 1	480	571	519	538	485
Work area, width 2	1167	1227	1202	1216	1188
Work area, height 1	505	570	540	552	516
Work area, height 2	730	790	755	1120	751
Work area, depth 1	170	201	147	179	154
Work area, depth 2	415	495	435	431	422

OPERATING DISTANCES

General Information:

- > The dimensions represent the maximum operating distances which can be realized without subsidiary movement of shoulder and without completely stretched arms.
- > The small work areas (height 1, depth 1, width 1) are recommended for work in sitting position with work tasks requiring precise fine motor skills.
- > The large work areas (height 2, depth 2, width 2) are recommended for work in standing position (work tasks requiring major physical strength within a large sphere of action)
- > In sitting work position the boundary areas of the large work area (area outside of the small work area) are predominantly used for deposition of tools or for displays and actuators with minor frequency of use.
- > Dimensions with supplement for movement of feet
(DIN EN ISO 14738: 2009-07)
(DIN CEN ISO/TR 7250-2)

WORKING HEIGHT AND WORK SURFACE HEIGHT

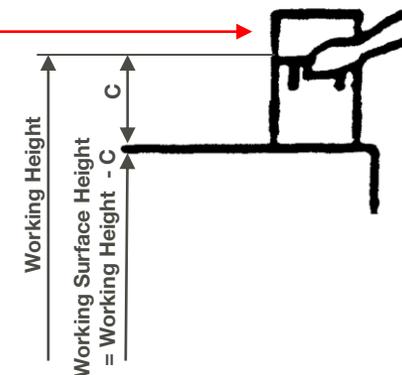
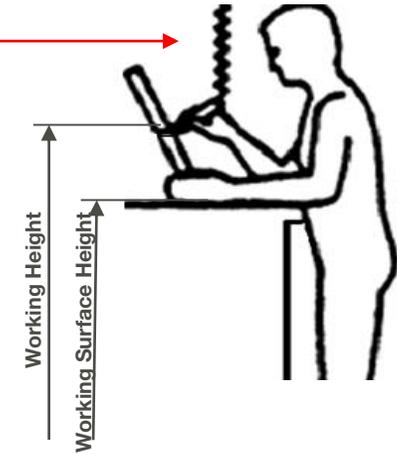
- > When working on workpieces, work equipment, or operating equipment, there may be a certain difference between between the working height and work surface height!

Working Height

- > The working height is the distance between the place of the manual work on the object and the floor.
- > The working height should be chosen in such a way as to enable the worker to maintain an acceptable posture and simultaneously ensure that the visual requirements placed on the work task can be met.
- > The optimum working height therefore primarily depends on two factors:
 - > The visual / fine motor requirements,
 - > The size of the object to be handled.

Work Surface Height

- > The work surface height is the distance between the floor and the surface on which the workpiece itself or the apparatus holding the workpiece is / are laid out.



3 TYPE OF WORKPLACE

1A WORKPLACE FOR SIT-STAND POSITION

VARIABLE HEIGHT OF BENCH

Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 1: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working Height	560-1464	650-1440	590-1326	590-1440	615-1368	573-1268	573-1368
Height of Bench	Working height- C	Working height-C					
Height of Legroom	Height of Bench-K	Height of Bench – K					
Depth of Legroom	547	505	485	505	474	449	484
Depth of Footwell Area	882	840	795	840	720	685	730
Width of Legroom	790	770	810	810	735	733	735
Seating Height	370-535	440-520	405-480	405-520	395-467	363-433	363-467

1A WORKPLACE FOR SIT-STAND POSITION

VARIABLE HEIGHT OF BENCH

Working height with average requirements for visual control and/or fine motor skills (k=1)

Table 2: Dimensions [mm] for work tasks with “average requirements for visual control and/or fine motor skills” (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working Height	560-1225	650-1205	590-1110	590-1205	615-1145	573-1062	573-1145
Height of Bench	Working height-C						
Height of Legroom	Height of bench-K						
Depth of Legroom	547	505	485	505	474	449	484
Depth of Footwell area	882	840	795	840	720	685	730
Width of Legroom	790	770	810	810	735	733	735
Seating Height	370-535	440-520	405-480	405-520	395-467	363-433	363-467

1A WORKPLACE FOR SIT-STAND POSITION

VARIABLE HEIGHT OF BENCH

Definitions:

- > **C** is the distance between area of manual handling and work bench surface (height of object / tool)
- > **K** is the thickness of the work bench / desk top

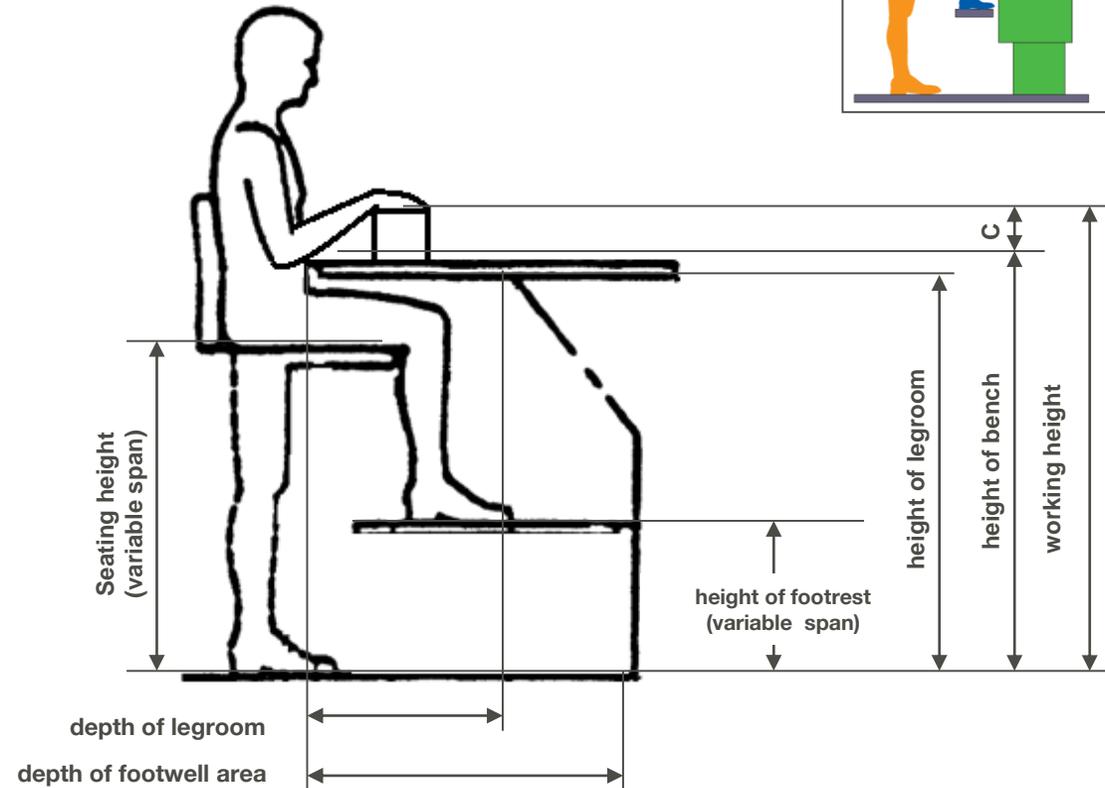
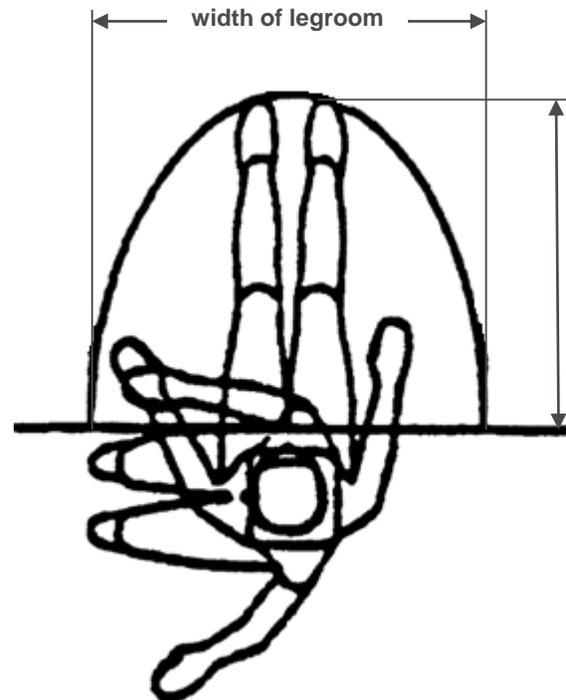
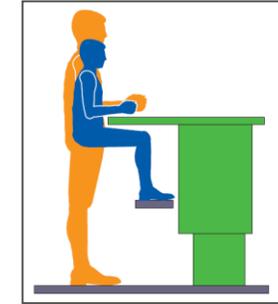
Further Information:

- > For checking purposes after design of work places it is always recommended to calculate and validate that there is enough free space for thighs

1B WORKPLACE FOR SIT-STAND POSITION

FIXED HEIGHT OF BENCH

- > Dimensions with supplement for movement of feet (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)
- > All dimensions in [mm]



1B WORKPLACE FOR SIT-STAND POSITION

FIXED HEIGHT OF BENCH

> Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 1: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1305	1350	1254	1311	1283	1193	1243
Height of bench	Working height - C						
Height of legroom	Height of bench - K						
Depth of legroom	497	455	435	455	424	399	434
Depth of footwell area	782	740	695	740	620	585	630
Width of legroom	994	910	870	910	848	798	868
Seating height	783-873	815-890	745-835	783-883	745-825	687-760	714-801
Height of footrest	248-503	295-450	265-430	263-478	281-430	254-397	247-438

1B WORKPLACE FOR SIT-STAND POSITION

FIXED HEIGHT OF BENCH

> Working height with average requirements for visual control and/or fine motor skills (k=1)

Table 2: Dimensions [mm] for work tasks with “average requirements for visual control and/or fine motor skills” (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)

	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1093	1130	1050	1098	1075	1000	1041
Height of bench	Working height - C						
Height of legroom	Height of bench - K						
Depth of legroom	497	455	435	455	424	399	434
Depth of footwell area	782	740	695	740	620	585	630
Width of legroom	994	910	870	910	848	798	868
Seating height	783-873	815-890	745-835	783-883	745-825	687-760	714-801
Height of footrest	248-503	295-450	265-430	263-478	281-430	254-397	247-438

1B WORKPLACE FOR SIT-STAND POSITION

FIXED HEIGHT OF BENCH

Definitions:

- > **C** is the distance between area of manual handling and work bench surface (height of object / tool)
- > **K** is the thickness of the work bench / desk top

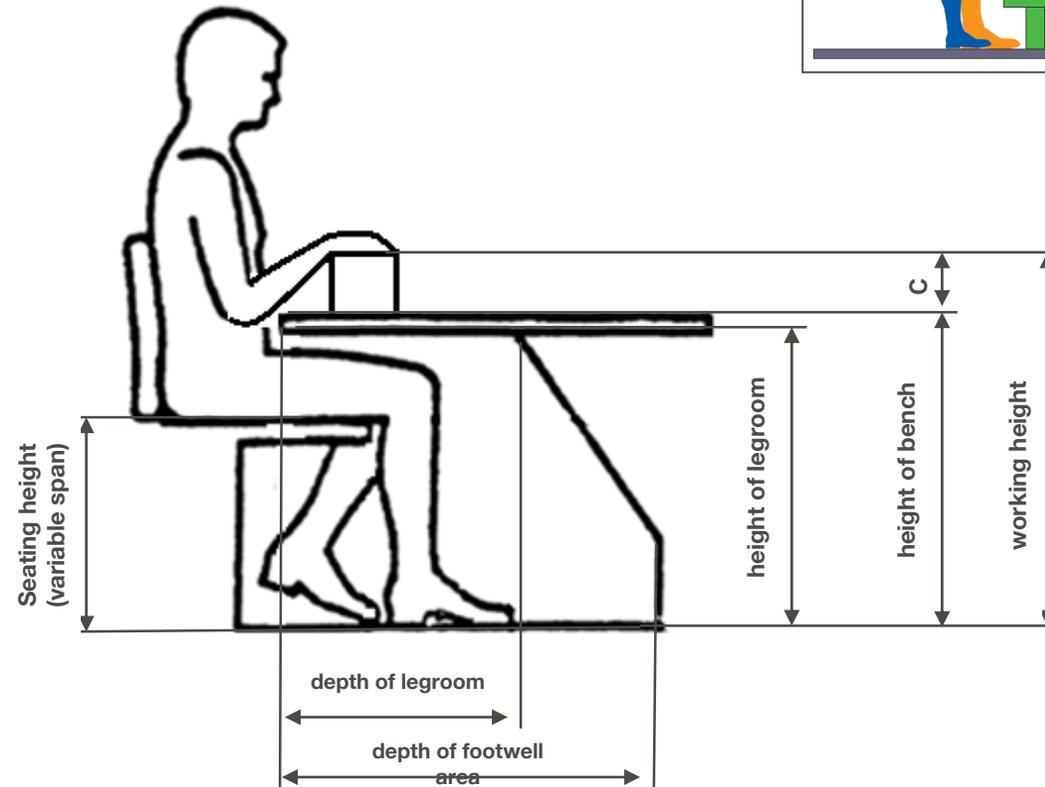
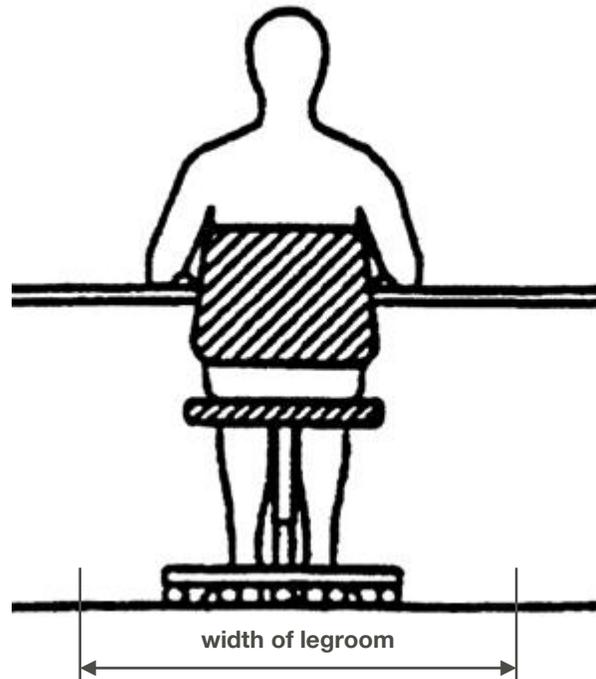
Further Information:

- > For checking purposes after design of work places it is always recommended to calculate and validate that there is enough free space for thighs

2A WORKPLACE IN SITTING POSITION

VARIABLE HEIGHT OF BENCH

- > Dimensions with supplement for movement of feet (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)
- > All dimensions in [mm]



2A WORKPLACE IN SITTING POSITION

VARIABLE HEIGHT OF BENCH

> Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 1: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	598-871	692-862	627-810	627-862	635-823	615-773	615-823
Height of bench	Working height - C						
Height of legroom	Height of bench – K						
Depth of legroom	547	505	485	505	474	449	484
Depth of footwell area	882	840	795	840	720	685	730
Width of legroom	790	770	810	810	735	733	735
Seating height	370-535	440-520	405-480	405-520	395-467	363-433	363-467

2A WORKPLACE IN SITTING POSITION

VARIABLE HEIGHT OF BENCH

> Working height with average requirements for visual control and/or fine motor skills (k=1)

Table 2: Dimensions [mm] for work tasks with “average requirements for visual control” and/or “fine motor skills” (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	560-815	650-805	590-755	590-805	595-764	573-716	573-764
Height of bench	Working height - C						
Height of legroom	Height of bench - K						
Depth of legroom	547	505	485	505	474	449	484
Depth of footwell area	882	840	795	840	720	685	730
Width of legroom	790	770	810	810	735	733	735
Seating height	370-535	440-520	405-480	405-520	395-467	363-433	363-467

2A WORKPLACE IN SITTING POSITION

VARIABLE HEIGHT OF BENCH

Definitions:

- > **C** is the distance between area of manual handling and work bench surface (height of object / tool)
- > **K** is the thickness of the work bench / desk top

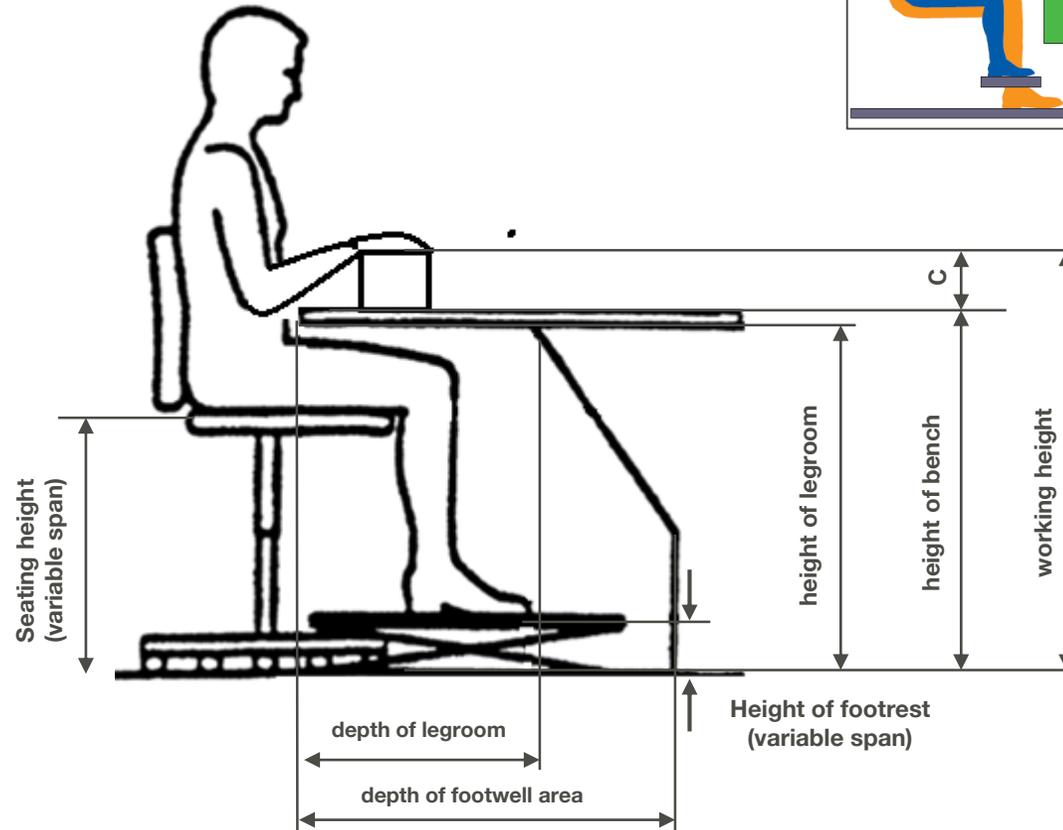
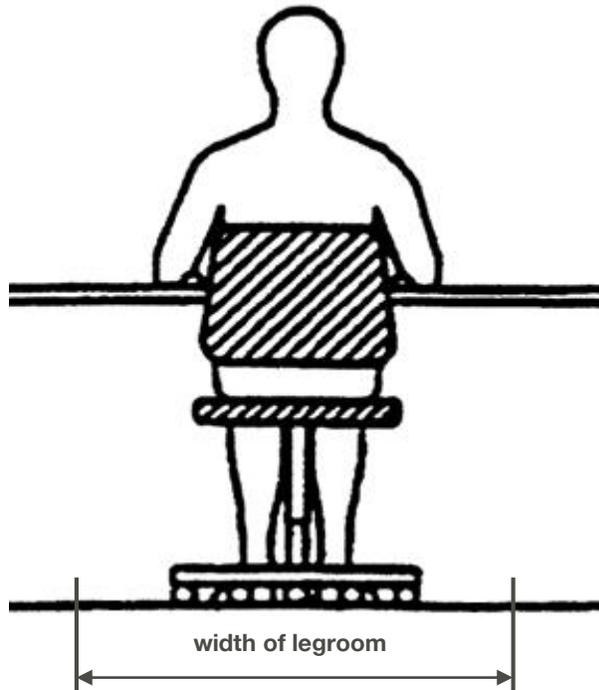
Further Information:

- > For checking purposes after design of work places it is always recommended to calculate and validate that there is enough free space for thighs

2B WORKPLACE IN SITTING POSITION

FIXED HEIGHT OF BENCH

- > Dimensions with supplement for movement of feet (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)
- > All dimensions in [mm]



2B WORKPLACE IN SITTING POSITION

FIXED HEIGHT OF BENCH

> Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 1: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)

	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	871	862	810	862	823	773	823
Height of bench	Working height - C						
Height of legroom	Height of bench – K						
Depth of legroom	547	505	485	505	474	449	484
Depth of footwell area	882	840	795	840	720	685	730
Width of legroom	790	770	810	810	735	733	735
Seating height	535-625	520-592	480-570	520-620	467-564	433-506	467-554
Height of footrest	0-165	0-80	0-75	0-115	0-72	0-70	0-104

2B WORKPLACE IN SITTING POSITION

FIXED HEIGHT OF BENCH

> Working height with average requirements for visual control and/or fine motor skills (k=1)

Table 2: Dimensions [mm] for work tasks with “average requirements for visual control” and/or “fine motor skills” (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	815	805	755	805	764	716	764
Height of bench	Working height - C						
Height of legroom	Height of bench - K						
Depth of legroom	547	505	485	505	474	449	484
Depth of footwell area	882	840	795	840	720	685	730
Width of legroom	790	770	810	810	735	733	735
Seating height	535-625	520-595	480-570	520-620	467-564	433-506	467-554
Height of footrest	0-165	0-80	0-75	0-115	0-72	0-70	0-104

2B WORKPLACE IN SITTING POSITION

FIXED HEIGHT OF BENCH

Definitions:

- > **C** is the distance between area of manual handling and work bench surface (height of object / tool)
- > **K** is the thickness of the work bench / desk top

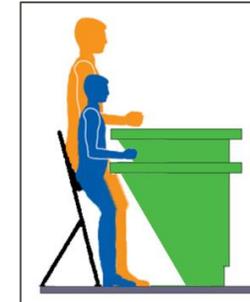
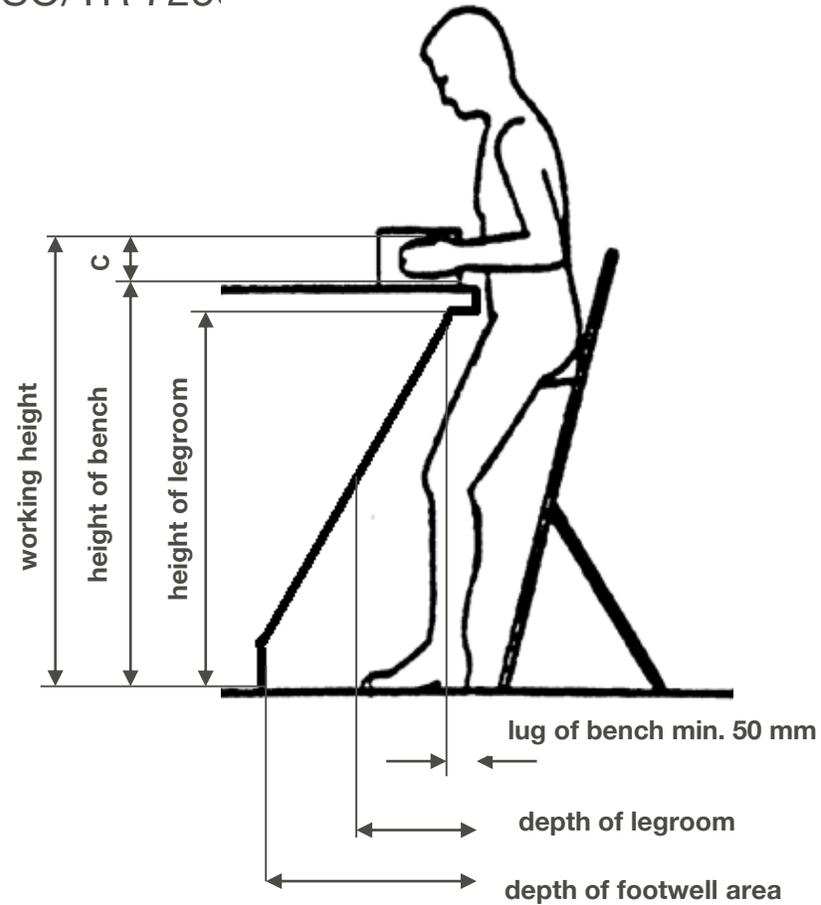
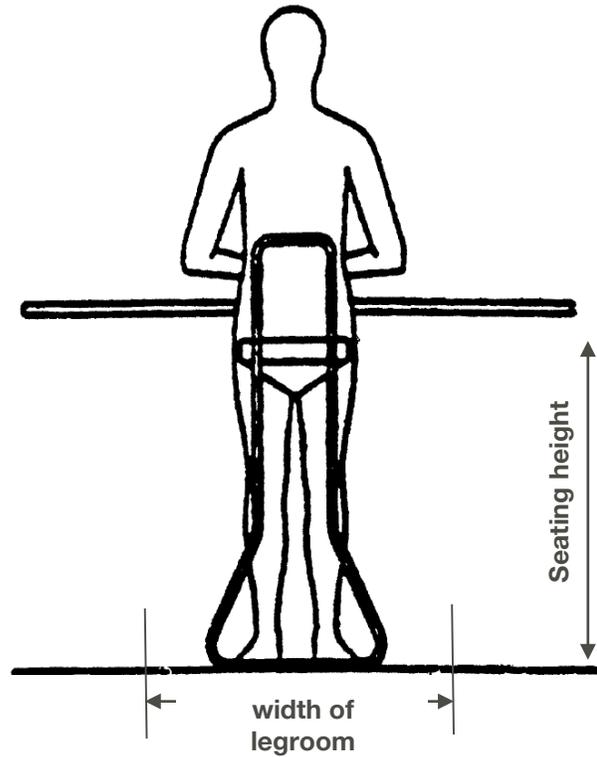
Further Information:

- > For checking purposes after design of work places it is always recommended to calculate and validate that there is enough free space for thighs

3A WORKPLACE WITH SIT-STAND-CHAIR

VARIABLE HEIGHT OF BENCH

- > Dimensions with supplement for movement of feet (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)
- > All dimensions in [mm]



3A WORKPLACE WITH SIT-STAND-CHAIR

VARIABLE HEIGHT OF BENCH

> Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 1: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1037-1323	1140-1301	1069-1199	1069-1301	1084-1237	1012-1147	1012-1237
Height of bench	Working height - C						
Height of legroom	Height of bench - K						
Depth of legroom	285	285	260	285	186	186	196
Depth of footwell area	570	570	520	570	372	372	392
Width of legroom	790	770	810	810	735	733	735
Seating height	629-840	714-845	669-777	669-845	666-789	614-721	614-789

3A WORKPLACE WITH SIT-STAND-CHAIR

VARIABLE HEIGHT OF BENCH

> Working height with average requirements for visual control and/or fine motor skills (k=1)

Table 2: Dimensions [mm] for work tasks with “average requirements for visual control and/or fine motor skills” (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	864-1103	950-1085	891-999	891-1085	904-1031	843-956	843-1031
Height of bench	Working height - C						
Height of legroom	Height of bench - K						
Depth of legroom	285	285	260	285	186	186	196
Depth of footwell area	570	570	520	570	372	372	392
Width of legroom	790	770	810	810	735	733	735
Seating height	629-840	714-845	669-777	669-845	666-789	614-721	614-789

3A WORKPLACE WITH SIT-STAND-CHAIR

VARIABLE HEIGHT OF BENCH

Definitions:

- > **C** is the distance between area of manual handling and work bench surface (height of object / tool)
- > **K** is the thickness of the work bench / desk top

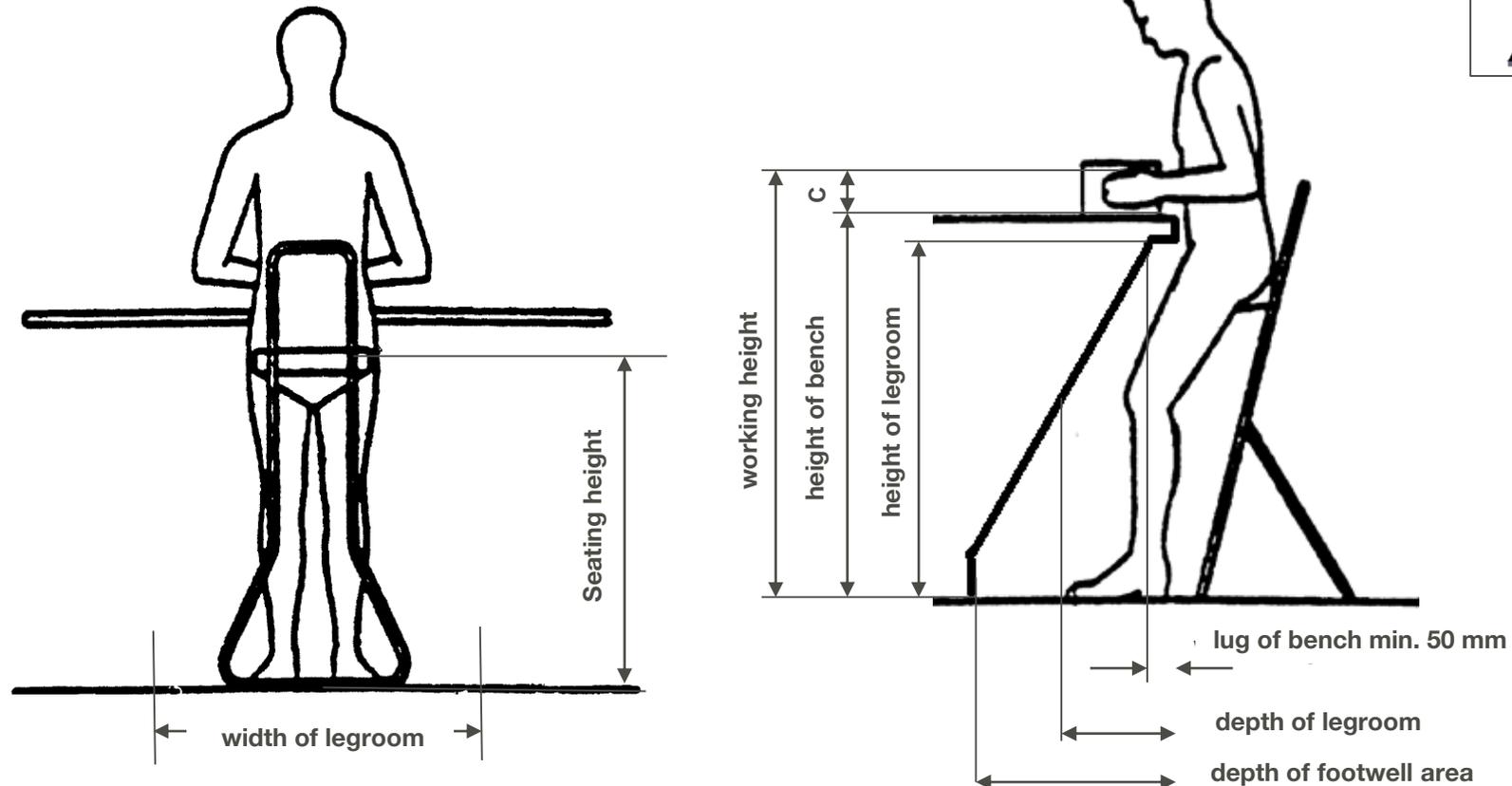
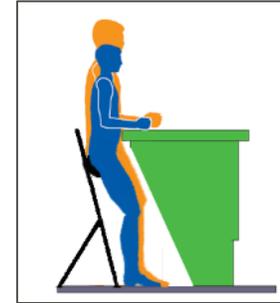
Further Information:

- > For checking purposes after design of work places it is always recommended to calculate and validate that there is enough free space for thighs

3B WORKPLACE WITH SIT-STAND-CHAIR

FIXED HEIGHT OF BENCH

- > Dimensions with supplement for movement of feet
(following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)
- > All dimensions in [mm]



3B WORKPLACE WITH SIT-STAND-CHAIR

FIXED HEIGHT OF BENCH

> Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 1: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1148	1188	1102	1153	1128	1047	1092
Height of bench	Working height - C						
Height of legroom	Height of bench - K						
Depth of legroom	285	285	260	285	186	186	196
Depth of footwell area	570	570	520	570	372	372	392
Width of legroom	790	770	810	810	735	733	735
Seating height	629-840	714-845	669-777	669-845	666-789	614-721	614-789

3B WORKPLACE WITH SIT-STAND-CHAIR

FIXED HEIGHT OF BENCH

> Working height with average requirements for visual control and/or fine motor skills (k=1)

Table 2: Dimensions [mm] for work tasks with average requirements for visual control and/or fine motor skills (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	956	990	918	961	940	873	910
Height of bench	Working height - C						
Height of legroom	Height of bench - K						
Depth of legroom	285	285	260	285	186	186	196
Depth of footwell area	570	570	520	570	372	372	392
Width of legroom	790	770	810	810	735	733	735
Seating height	629-840	714-845	669-777	669-845	666-789	614-721	614-789

3B WORKPLACE WITH SIT-STAND-CHAIR

FIXED HEIGHT OF BENCH

Definitions:

- > **C** is the distance between area of manual handling and work bench surface (height of object / tool)
- > **K** is the thickness of the work bench / desk top

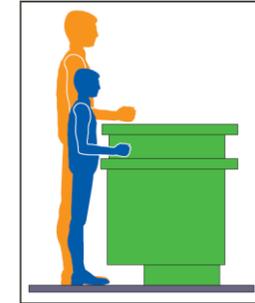
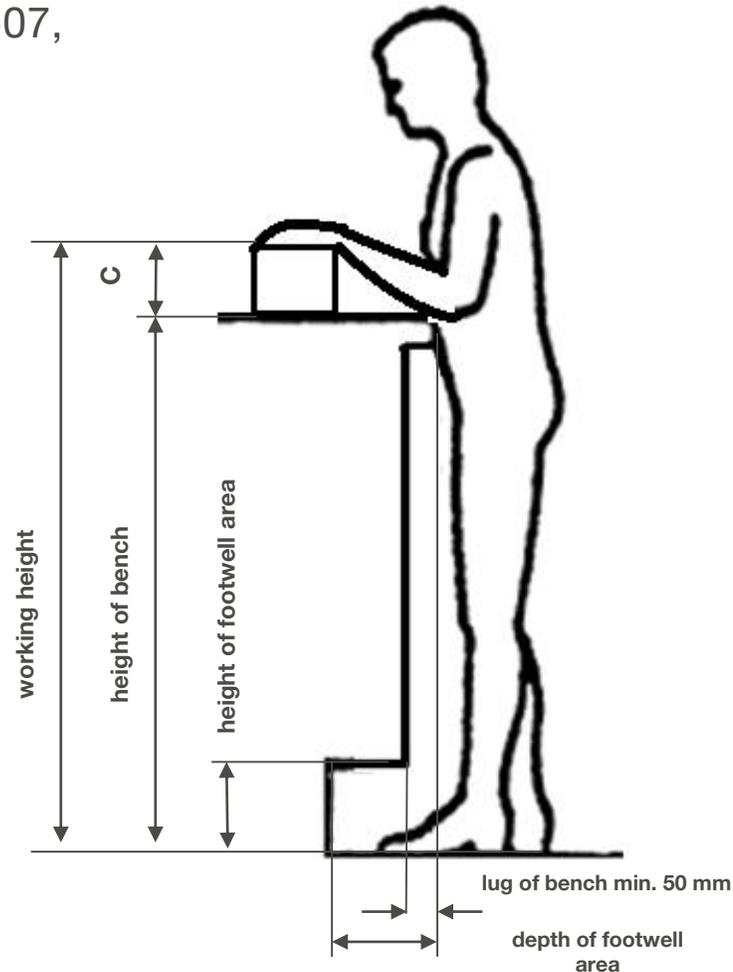
Further Information:

- > For checking purposes after design of work places it is always recommended to calculate and validate that there is enough free space for thighs

4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH

- > Dimensions with supplement for movement of feet (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)
- > All dimensions in [mm]



4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH

> Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 1: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1152-1470	1266-1446	1188-1332	1188-1446	1205-1374	1124-1274	1124-1374
Height of bench	Working height - C						
Height of footwell area	96	96*	96*	96*	96*	96*	96*
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141

* Dimensions out of DIN EN ISO 14738: 2009-07, ** Fixed dimension for change of exposure by weight stabilizing on other foot

4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH

> Working height with average requirements for visual control and/or fine motor skills (k=1)

Table 2: Dimensions [mm] for work tasks with “average requirements for visual control and/or fine motor skills” (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	960-1225	1055-1205	990-1110	990-1205	1004-1145	937-1062	937-1145
Height of bench	Working height - C						
Height of footwell area	96	96*	96*	96*	96*	96*	96*
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141

* Dimensions out of DIN EN ISO 14738: 2009-07, ** Fixed dimension for change of exposure by weight stabilizing on other foot

4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH

> Working height with **minor requirements** for visual control, activities with increased use of muscle of upper part of the body (k = 0,9)

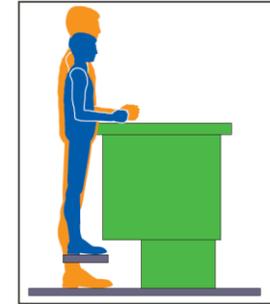
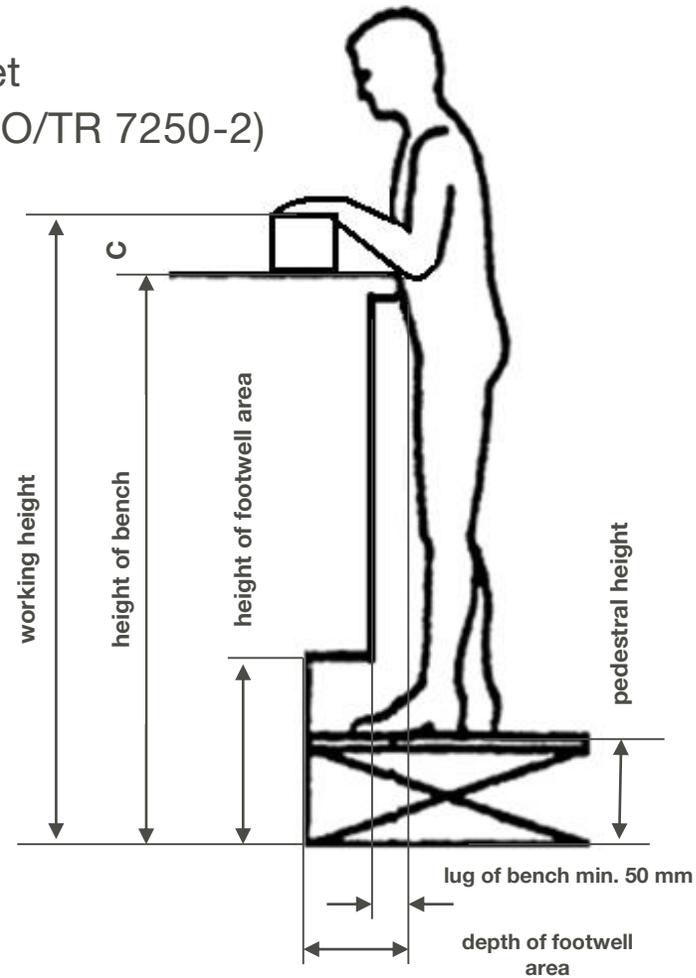
Table 3: Dimensions [mm] for work tasks with “minor requirements for visual control, activities with increased use of muscle of upper part of the body” (k=0,9) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	864-1103	950-1085	891-999	891-1085	904-1031	843-956	843-1031
Height of bench	Working height - C						
Height of footwell area	96	96*	96*	96*	96*	96*	96*
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141

* Dimensions out of DIN EN ISO 14738: 2009-07, ** Fixed dimension for change of exposure by weight stabilizing on other foot

4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH (VARIABLE BY PEDESTAL)

- > Variable by pedestal
- > Dimensions with supplement for movement of feet
(following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)
- > All dimensions in [mm]



4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH (VARIABLE BY PEDESTRAL)

> Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 4: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)

	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1470	1446	1332	1446	1374	1274	1374
Height of bench	Working height - C						
Height of footwell area	361	246	216	311	237	221	304
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141
Pedestral height	265	150	120	215	141	125	208

** Fixed dimension for change of exposure by weight stabilizing on other foot

4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH (VARIABLE BY PEDESTRAL)

> Working height with average requirements for visual control and/or fine motor skills (k=1)

Table 5: Dimensions [mm] for work tasks with “average requirements for visual control and/or fine motor skills” (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)

	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1225	1205	1110	1205	1145	1062	1145
Height of bench	Working height - C						
Height of footwell area	361	246	216	311	237	221	304
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141
Pedestral height	265	150	120	215	141	125	208

** Fixed dimension for change of exposure by weight stabilizing on other foot

4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH (VARIABLE BY PEDESTRAL)

> Working height with **minor requirements** for visual control, activities with increased use of muscle of upper part of the body (k = 0,9)

Table 6: Dimensions [mm] for work tasks with minor requirements for “visual control, activities with increased use of muscle of upper part of the body” (k=0,9) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)

	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1103	1085	999	1085	1031	956	1031
Height of bench	Working height - C						
Height of footwell area	361	246	216	311	237	221	304
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141
Pedestral height	265	150	120	215	141	125	208

** Fixed dimension for change of exposure by weight stabilizing on other foot

4A WORKPLACE IN STANDING POSITION

VARIABLE HEIGHT OF BENCH (VARIABLE BY PEDESTRAL)

Definition:

> **C** is the distance between area of manual handling and work bench surface (height of object / tool)

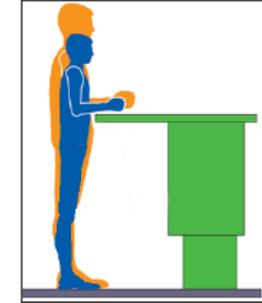
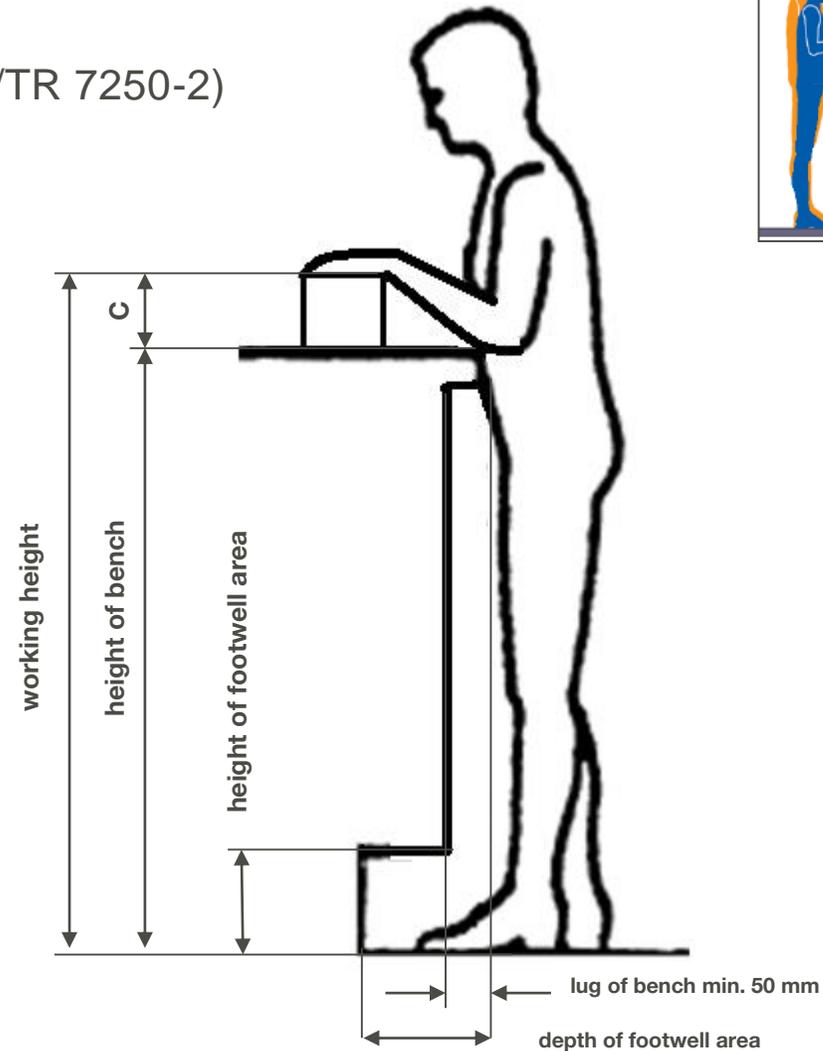
Further Information:

> For checking purposes after design of work places it is always recommended to calculate and validate that there is enough free space for thighs

4B WORKPLACE IN STANDING POSITION

FIXED HEIGHT OF BENCH

- > Dimensions with supplement for movement of feet
(following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)
- > All dimensions in [mm]



4B WORKPLACE IN STANDING POSITION

FIXED HEIGHT OF BENCH

> Working height with **high requirements** for visual control and fine motor skills (k=1,2)

Table 1: Dimensions [mm] for work tasks with “high requirements for visual control” and “fine motor skills” (k=1,2) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1275	1320	1224	1281	1253	1163	1213
Height of bench	Working height - C						
Height of footwell area	96	96	96	96	96	96	96
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141

** Fixed dimension for change of exposure by weight stabilizing on other foot

4B WORKPLACE IN STANDING POSITION

FIXED HEIGHT OF BENCH

> Working height with average requirements for visual control and/or fine motor skills (k = 1)

Table 2: Dimensions [mm] for work tasks with “average requirements for visual control and/or fine motor skills” (k=1) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	1063	1100	1020	1068	1045	970	1011
Height of bench	Working height - C						
Height of footwell area	96	96	96	96	96	96	96
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141

** Fixed dimension for change of exposure by weight stabilizing on other foot

4B WORKPLACE IN STANDING POSITION

FIXED HEIGHT OF BENCH

> Working height with **minor requirements** for visual control, activities with increased use of muscle of upper part of the body (k = 0,9)

Table 3: Dimensions [mm] for work tasks with “minor requirements for visual control, activities with increased use of muscle of upper part of the body” (k=0,9) (following DIN EN ISO 14738: 2009-07, DIN CEN ISO/TR 7250-2)							
	Europe	Germany			Korea		
	M/F	M	F	M/F	M	F	M/F
Working height	956	990	918	961	940	873	910
Height of bench	Working height - C						
Height of footwell area	96	96	96	96	96	96	96
Depth of legroom	50**	50**	50**	50**	50**	50**	50**
Depth of footwell area	205	205	187	205	141	134	141

** Fixed dimension for change of exposure by weight stabilizing on other foot

4B WORKPLACE IN STANDING POSITION

FIXED HEIGHT OF BENCH

Definitions:

> **C** is the distance between area of manual handling and work bench surface (height of object / tool)

Further Information:

> For checking purposes after design of work places it is always recommended to calculate and validate that there is enough free space for thighs

CONTROL CALCULATION FOR CHECKING THE THIGH LEG ROOM

- > For checking if there is still enough thigh leg room after the dimensional work place design, we recommend to always perform a control calculation.
- > This is performed with the below mentioned equation 1 respectively equation 2 in which the outcome is compared with the respective measure for the thigh height according table1.
- > In case the existing thigh leg room (TLR) is smaller than the respective thigh leg room according table 1, it has to be checked by which measures the distance between the place of manual operation and the work surface (c) respectively the design thickness (K) can be reduced.
- > The impact of the modification measures have to be checked again with a control calculation.

Equation 1: Calculating the existing thigh leg room for standing/seated work places

Thigh leg room (TLRmin.) = work surface height (WSHmin.) – seating surface height (SSHmin.) – design thickness (K)

Equation 2: Calculating the existing thigh leg room for seated work places

Thigh leg room (TLRmin.) = work surface height (WSHmin.) – seating surface height (SSHmin.) – design thickness (K)

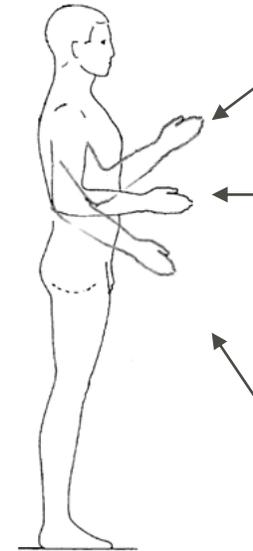
Thigh leg room (TLRmax.) = work surface height (WSHmax.) – seating surface height (SSHmax.) – design thickness (K)

Table 1: Percentile of thigh height of women (F) und men (M)

	Euro-human		Germany				Korea			
	M/F		M		F		M		F	
	P5	P95	P5	P95	P5	P95	P5	P95	P5	P95
Thigh height	125	185	130	180	125	175	128	179	117	159

FACTOR K FOR CONSIDERING THE VISUAL AND FINE MOTOR REQUIREMENTS

- > At the individual workplace types the working heights were multiplied by factor k in order to consider the different requirements concerning the work task (see right side).
- > These consider the required reduction of the viewing distance during visual controlled tasks with increased visual requirements as well as the required deflection angles of the arms during manual tasks, which require an increased use of the upper body muscles.
- > The gap between the place of manual operation and the worktop (e.g. height of equipment) is characterized by C .
- > C has to be subtracted from the working height in order to get the worktop height of the machine respectively the height of the assembly table



High requirements concerning visual inspection as well as on fine motor tasks (**$k = 1.2$**)

Average requirements concerning Manual tasks with free arm movement (**$k = 1$**)

Low requirements concerning visual inspection, tasks with increased used of the upper body muscles (**$k = 0.9$**)
(only at standing workplaces)

EXAMPLE CALCULATION 1: STANDING/SEATED WORK PLACE

WORK SURFACE HEIGHT VARIABLE

Given:

- > Work place with **variable work surface** height and computer support
- > Part of the work task is the data comparison and the transfer of the findings into a SAP-mask with **average visual and/or fine motor requirements (k =1)**
- > The thickness of the tabletop measures 2 cm.
- > There is a permanent change between women and men at this work place.
- > The measurements for the work place design result from **table 2 1A** seated work place/ work surface height variable



EXAMPLE CALCULATION 1: STANDING/SEATED WORK PLACE

WORK SURFACE HEIGHT VARIABLE

Resulting in a :

Adjustable working height	= 560 mm up to 1225 mm
Adjustable work surface height	= 560 – C up to 1225 – C = 560 mm up to 1225 mm
Foot room depth	= 96 mm
Leg room height between	= 560 – K up to 1225 – K = 540 mm up to 1205 mm
Leg room depth	= 497 mm
Leg room width	= 994 mm
Adjustable seating height	= 370 mm – 535 mm

Tabelle 2: Arbeitsplatzmaße für Anforderungen (k = 1)

	Euro-Mensch
	M/F
Arbeitshöhe	560-1225
Arbeitsflächenhöhe	Arbeitshöhe - C
Beinraumhöhe	Arbeitsflächenhöhe - K
Beinraumtiefe	497
Fußraumtiefe	782
Beinraumbreite	994
Sitzflächenhöhe	370-535



EXAMPLE CALCULATION 1: STANDING/SEATED WORK PLACE

WORK SURFACE HEIGHT VARIABLE

The thigh leg room is to be checked:

> According equation 1 the thigh leg rooms are:

$$\text{TLR (P5)} = \text{WSH min.} - \text{SSH min.} - K$$

$$\text{TLR (P5)} = 560 \text{ mm} - 370 \text{ mm} - 20 \text{ mm}$$

$$\text{TLG (P5)} = 170 \text{ mm} > 125 \text{ mm (thigh height P5)}$$

> According to table 1 the thigh height is smaller than the existing thigh leg room, the design measures can be implemented.

EXAMPLE CALCULATION 2: SEATED WORK PLACES

WORK SURFACE HEIGHT FIXED

Given:

- > Microscope work place with **fixed work surface height**
- > Work task **with height requirements concerning the visual inspection and fine motor tasks ($k = 1,2$)**
- > The distance between the place of manual operation and the worktop (C) is 18 cm.
- > The thickness of the tabletop measures 2 cm.
- > The measurements for the work place design result from **table 1 2B Seated work place/ work surface height fixed**
- > There are only women deployed at this workplace.



EXAMPLE CALCULATION 2: SEATED WORK PLACES

WORK SURFACE HEIGHT FIXED

Resulting in a :

Working height	= 871 mm
Work surface height	= 871 mm – C = 691 mm
Leg room height	= 853 mm –K = 671 mm
Leg room depth	= 547 mm
Foot room depth	= 882 mm
Leg room width	= 790 mm
Adjustable seating height	= 535 mm – 625 mm
Adjustable foot rest height	= 0 mm – 165 mm

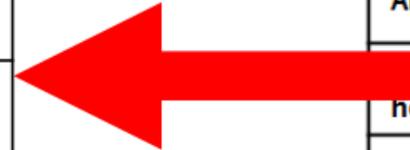


Tabelle 1: Arbeitsplatzmaße für Art (k = 1,2)	
	Euro-Mensch
	M/F
Arbeitshöhe	871
Arbeitsflächenhöhe	Arbeitshöhe -C
Beinraumhöhe	Arbeitsflächenhöhe -K
Beinraumbreite	547
Fußraumbreite	882
Beinraumbreite	790
Sitzflächenhöhe	535-625
Fußauflagenhöhe	0-165

EXAMPLE CALCULATION 2: SEATED WORK PLACES

WORK SURFACE HEIGHT FIXED

The thigh leg room is to be checked:

> According to equation 1 the thigh leg rooms are :

$$\text{TLR (P5)} = \text{WSH} - \text{SSHmax.} - \text{K}$$

$$\text{TLR (P5)} = 691 \text{ mm} - 625 \text{ mm} - 20 \text{ mm}$$

$$\text{TLR (P5)} = \underline{46 \text{ mm}} < 125 \text{ mm (thigh height P5)}$$

$$\text{TLR (P95)} = \text{WSH} - \text{SSHmin.} - \text{K}$$

$$\text{TLR (P95)} = 691 \text{ mm} - 535 \text{ mm} - 20 \text{ mm}$$

$$\text{TLR (P95)} = \underline{136 \text{ mm}} < 185 \text{ mm (thigh height P5)}$$

> According to table 1 the thigh heights are bigger than the existing thigh leg rooms, changes have to be made concerning the construction thickness (K) or concerning the distance between the place of manual operation and work surface (C).

EXAMPLE CALCULATION 2: SEATED WORK PLACES

WORK SURFACE HEIGHT FIXED

In this case the required thigh leg room can be implemented by the following changes:

- > With a height adjustable base plate with hand rest and / or
- > With a height adjustable tube body.

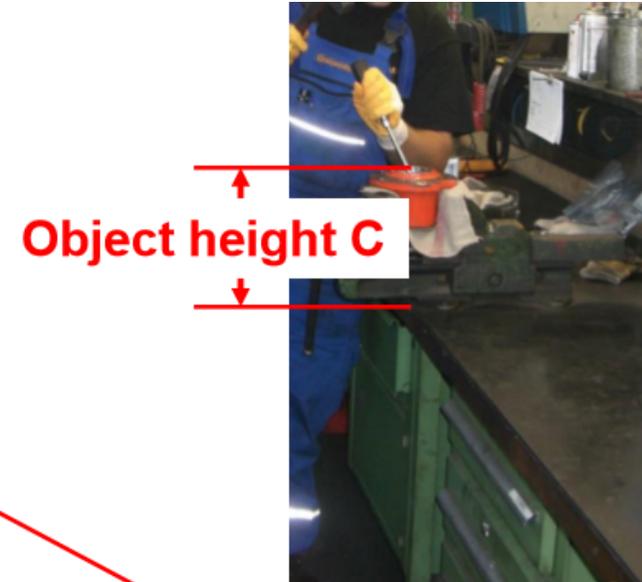


EXAMPLE CALCULATION 3: STANDING WORK PLACES

WORK SURFACE HEIGHT FIXED

Given:

- > Work place with **fixed work surface height** for manual reprocessing with **low requirement** concerning the visual inspection, tasks with a greater usage of the upper body muscles ($k = 0,9$)
- > Workbench and vise with an object height of $C = 150$ mm
- > The measurements for the work place design result from **table 3** 4B standing work place/ work surface height fixed



Fixed working height	= 956 mm
Fixed work surface height	= $956 - C = 800$ mm
Foot room height	= 96 mm
Leg room height = 50 mm	= 50 mm
Foot room depth	= 205 mm

Tabelle 3: Arbeitsplatzmaße für Arbeitstätigkeiten mit verstärktem Einsatz

	Euro-Mensch
	M/F
Arbeitshöhe	956
Arbeitsflächenhöhe	Arbeitshöhe - C

EXAMPLE CALCULATION 3: STANDING WORK PLACES

WORK SURFACE HEIGHT FIXED

Additional recommendation

Avoiding constrained postures and securing efficient work movements by implementing devices for adjusting the height of vises

Further tips:

Layout: rotatable by 360°
Adjustment range : 220 mm respectively 380 mm



EXAMPLE WORKPLACE ASSESSMENT

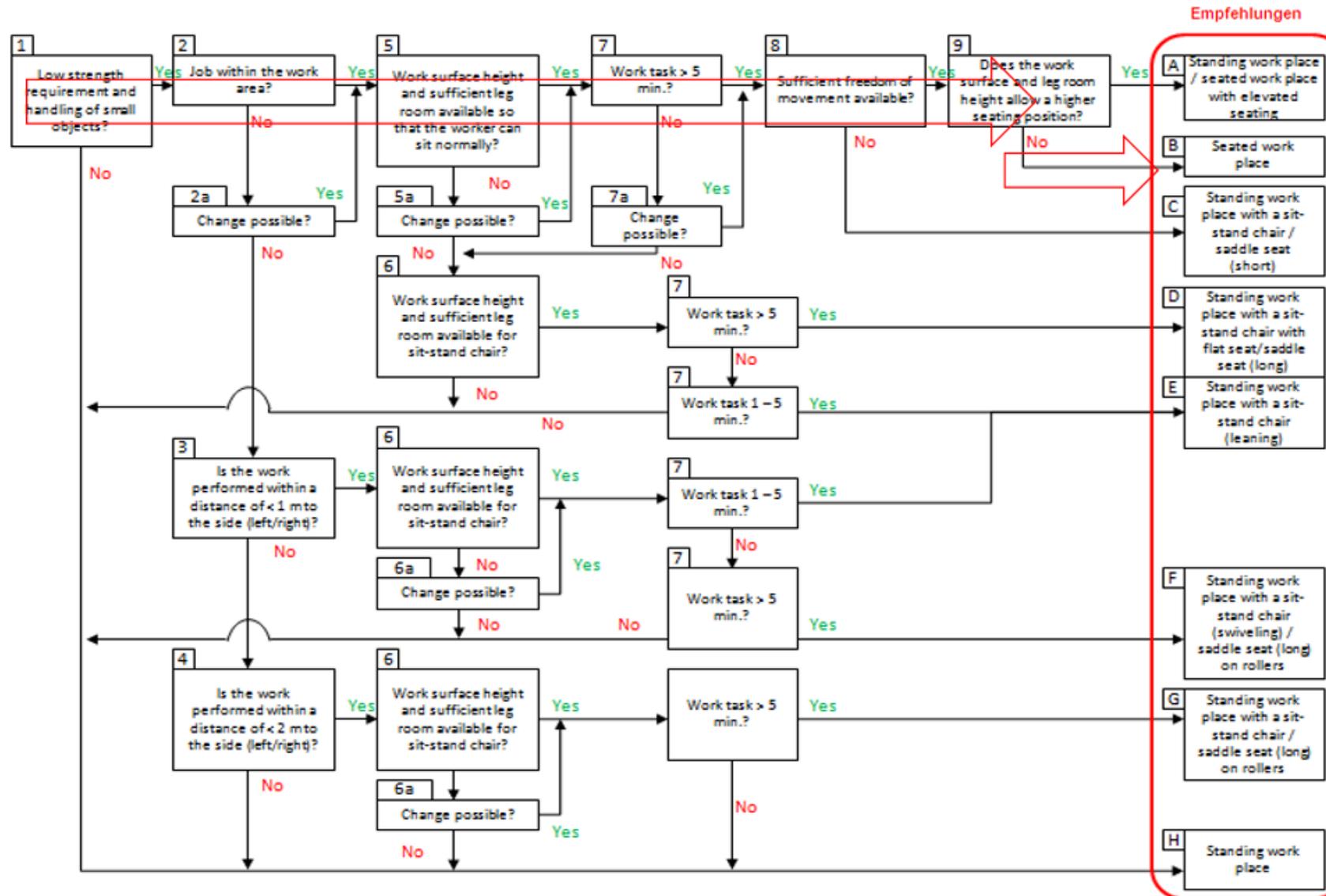
- > **Work task:** Vulcanisate processing
- > **Force requirement:** The vulcanisate is placed in the machine. This task requires low force.
- > **Work area:** The vulcanisates and is arranged as single item in the extended reaching area.
- > The work piece carrier is placed horizontally on the worktop, the work piece carrier and the structural height are not adjustable (C).
- > **Leg room:** The leg room of the workplace is concerning width and depth of restricted use.
- > **Duration of work task:** Average processing time is 30 minutes.
- > **Free movement area:** > 1,000 mm



EXAMPLE WORKPLACE ASSESSMENT

Date of assessment:		Assessed by:		Work place:			
Design thickness (K)/structural height (C):							
No.	Checkpoint	Wert	Ja	Nein	Wert	Ja	Nein
1	Is there a low strength requirement and handling of small objects? Does the maximum depth of the work area (ABT) equal 415 mm?		X				
2	Does the maximum width of the work area (ABB) equal 1.167 mm? Does the maximum height of the work area (ABH) equal 130 mm?		X				
2a	(Only answer if point above is not satisfied!) Is it possible to work in the work area by implementing simple change measures?		X				
3	(Only answer if point 2 or 2a above is not satisfied!) Is the work performed at a maximum distance of 1 m to the side (left/right)?						
4	(Only answer if point above is not satisfied!) Is the work performed at a maximum distance of 2 m to the side and behind?						
5	Does the minimum leg room depth (BBT) equal 547 mm? Does the minimum foot room depth (FBT) equal 882 mm? Does the minimum leg room height (BBH) equal 102 mm? Does the minimum leg room width (BBB) equal 330 mm?			X			
5a	(Only answer if point above is not satisfied!) Can the required leg room according to the dimensions specified previously be achieved through simple change measures?		X	X			
6	Does the previously determined minimum leg room depth (BBT) equal 285 mm? Does the previously determined minimum foot room depth (FBT) equal 570 mm? Does the previously determined minimum leg room width (BBB) equal 100 mm? Does the previously determined minimum leg room height (BBH) equal 225 mm?		X	X			
6a	(Only answer if point above is not satisfied!) Can the required leg room according to the dimensions specified previously be achieved through simple change measures?		X	X			
7	Does the worker spend more than 5 min. at a time at this work place? Does the worker spend more than 1 min. at a time at this work place?		X	X			
7a	(Only answer if point above is not satisfied!) Can the duration of the main activity be increased using simple organisational and/or design-related measures?			X			
8	Is freedom of movement of at least 1.000 mm available behind the work place?		X				
9	Does the minimum leg room width (BBB) equal 334 mm? Does the minimum leg room height (BBH) equal 1.063 mm?			X			
Result of the assessment:		The work place satisfies all requirements for a					

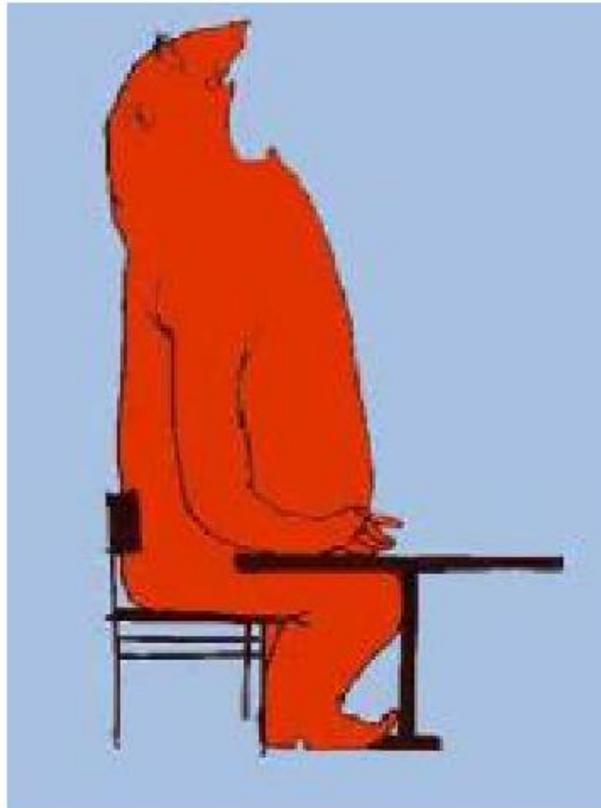
EXAMPLE WORKPLACE ASSESSMENT



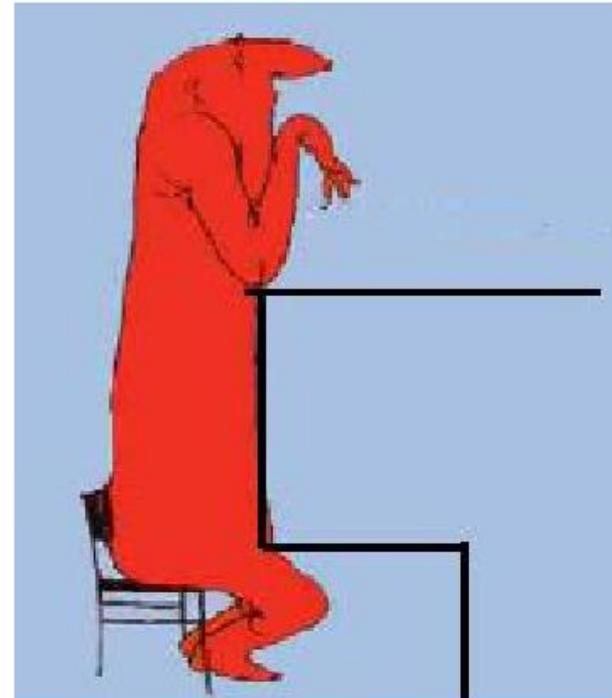
EXAMPLE WORKPLACE ASSESSMENT

Question: Do the existing structure (C) and design thickness (K) offer :

1) Sufficient thigh leg room for the tallest person?



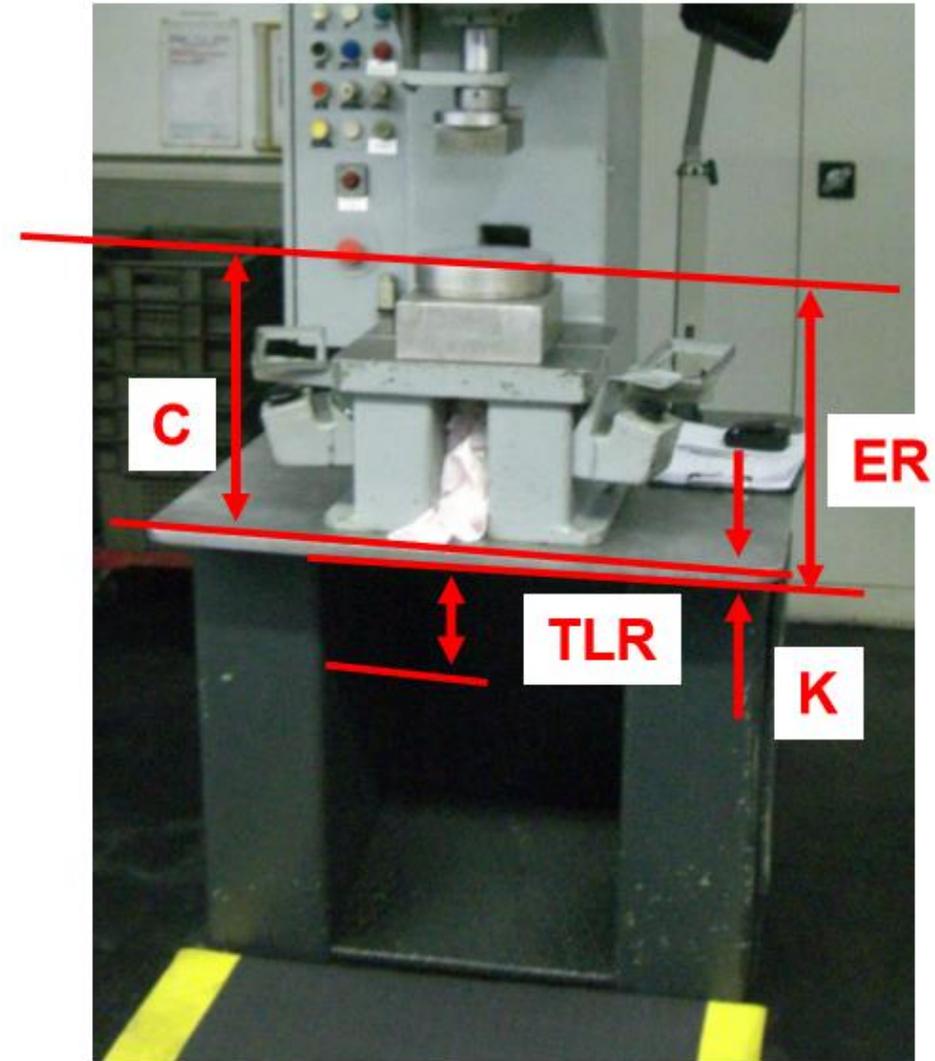
2) Is the distance between the place of manual work (top edge C) and the smallest person's thighs small enough?



EXAMPLE WORKPLACE ASSESSMENT

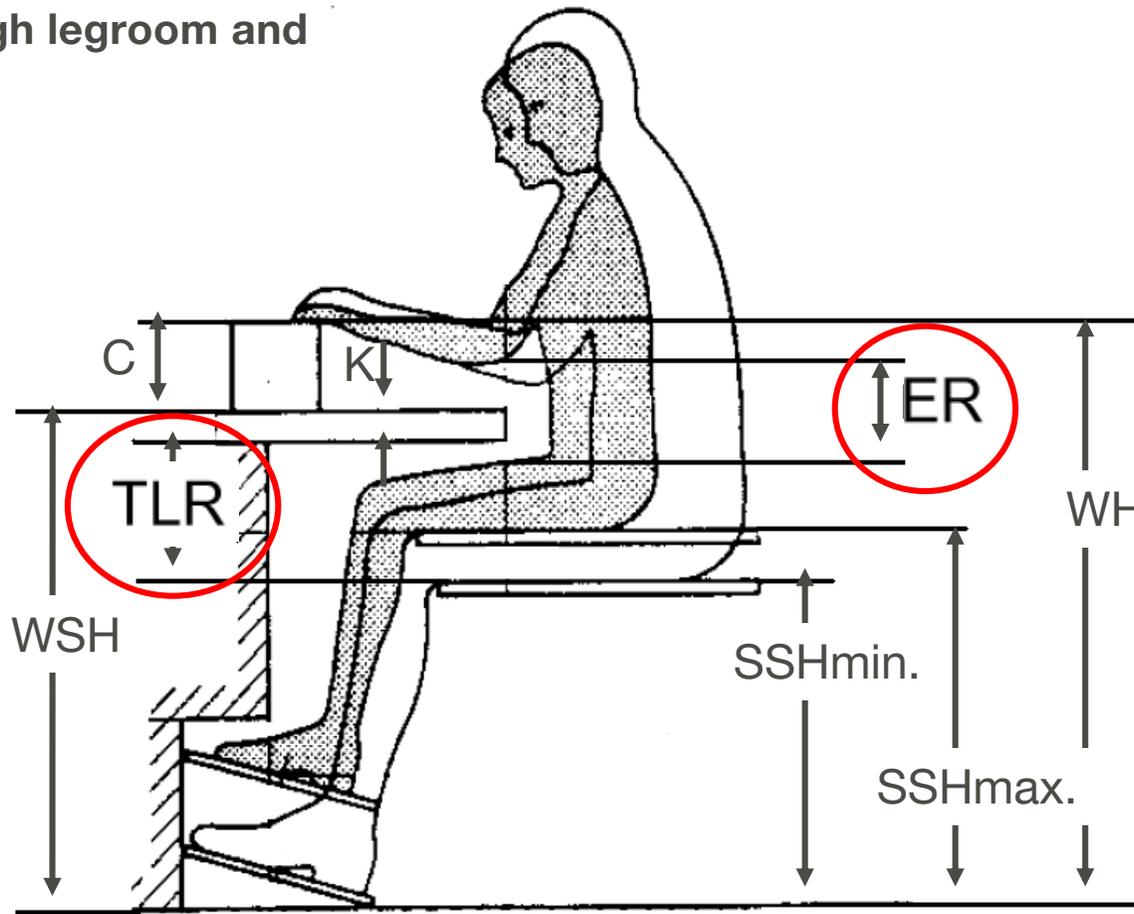
Structural height (C)

Design thickness (K)



EXAMPLE WORKPLACE ASSESSMENT

> Checking thigh legroom and elbow room



WH	Working height
SSHmax	Seating surface height of the smallest person
SSHmin	Seating surface height of the tallest person
ER	Elbow room
C	Structural height
K	Design thickness
WSH	Work surface height
TLR	Thigh legroom

To determine !

To determine !

EXAMPLE WORKPLACE ASSESSMENT

Resulting from work place assessment

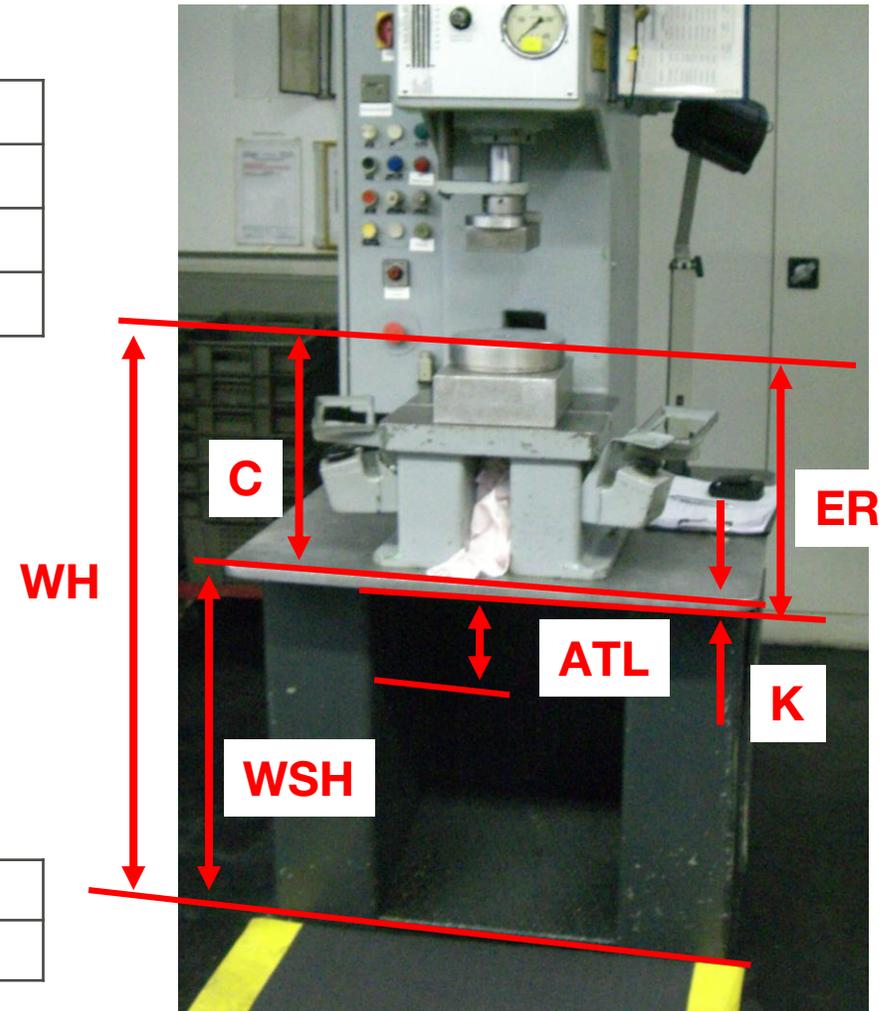
Working height (WH)	= 1120 mm
Structural height (C)	= 380 mm
Work surface height (WSH)	= AH - C = 740 mm
Design thickness (K)	= 20 mm

Resulting from recommendations for seating workplace with fixed working height

Seating surface height for the smallest person (SSHmax.)	= 625 mm
Seating surface height for the tallest person (SSHmin.)	= 535 mm

Target dimensions

Available thigh legroom (ATL)	= ??? mm
Available elbow room (ER)	= ??? mm



CHECKING THE EXISTING THIGH LEGROOM AND ELBOW ROOM

Checking the thigh legroom

- > Equation to calculate the available thigh legroom for standing/seated work places and seated work places (according to control calculation for checking the thigh leg room)

$$\text{TLR} = \text{Work surface height (WSH)} - \text{SSHmin.} - K$$

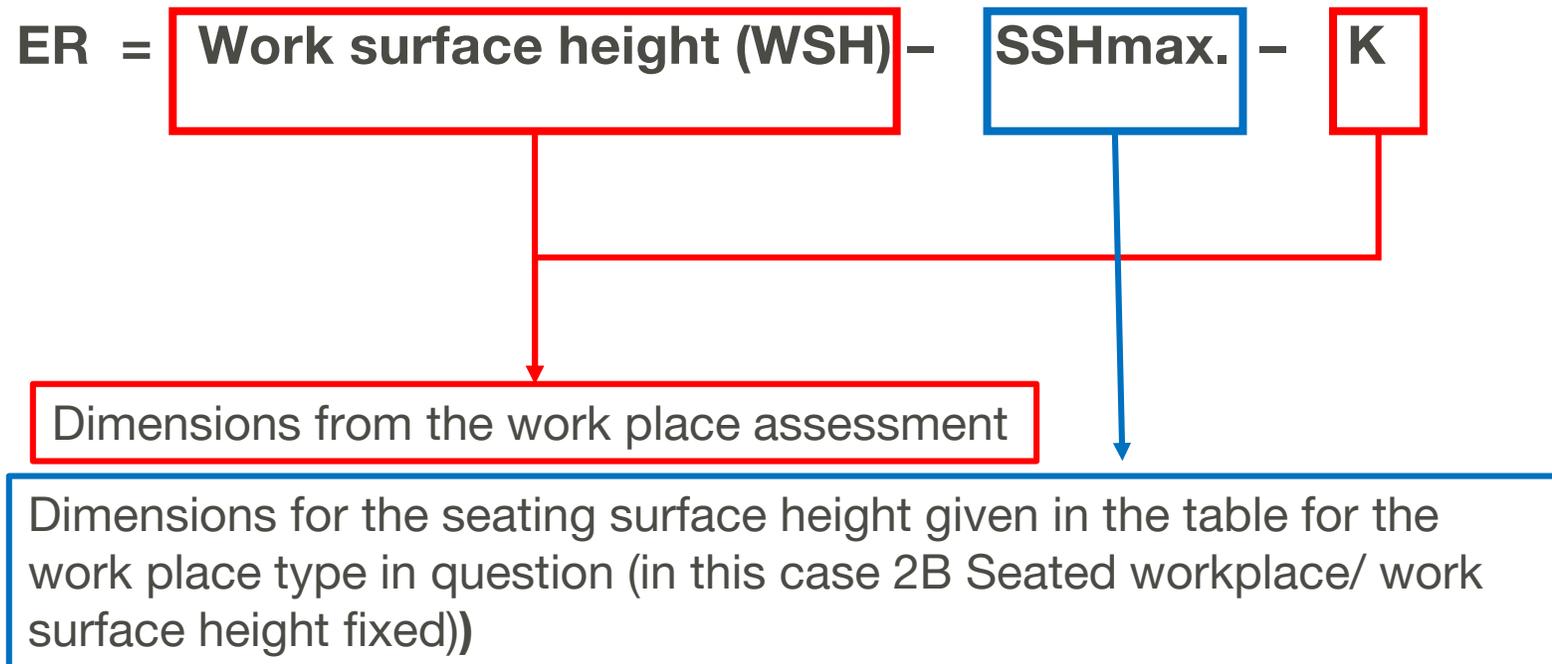
Dimensions from the work place assessment

Dimensions for the seating surface height given in the table for the work place type in question (in this case for 2B Seated workplace/ work surface height fixed)

CHECKING THE EXISTING THIGH LEGROOM AND ELBOW ROOM

Checking the elbow room:

- > Equation to calculate the available elbow room for standing/seated work places and seated work places (according to control calculation for checking the thigh leg room)



CHECKING THE EXISTING THIGH LEGROOM AND ELBOW ROOM

Checking the elbow room:

Necessary elbow room:

ER = Work surface height (WSH) – SSHmax. – K

ER = 740 mm – 625 mm – 20 mm

ER = 95 mm < 125 mm (thigh height P5, according to table1)

Tabelle 1: Perzentile der Oberschenkelhöhen von Frauen (F) und Männer (M)

	Euro-Mensch		Deutschland				Korea			
	M/F		M		F		M		F	
	P5	P95	P5	P95	P5	P95	P5	P95	P5	P95
Oberschenkelhöhe	125	185	130	180	125	175	128	179	117	159

Source table1: Control calculation for checking the thigh legroom and elbow room

CHECKING THE EXISTING THIGH LEGROOM AND ELBOW ROOM

Checking the thigh leg room:

Necessary thigh leg room:

TLR = Work surface height (WSH) – SSHmin. – K

TLR = 740 mm – 535 mm – 20 mm

TLR = 185 mm = 185 mm (Thigh height P95, according to table1)

	Euro-Mensch		Deutschland				Korea			
	M/F		M		F		M		F	
	P5	P95	P5	P95	P5	P95	P5	P95	P5	P95
Oberschenkelhöhe	125	185	130	180	125	175	128	179	117	159

Source table 1: Control calculation for checking the thigh leg room and elbow room

EXAMPLE WORK PLACE ASSESSMENT

Result of the calculation:

> Thigh height of the tallest person equals the existing thigh leg room

→ OK!

> The required room for sufficient free moving space of the elbows (relating to the smallest person) is below target

→ Not OK!

EXAMPLE WORK PLACE ASSESSMENT

Modification measures:

→ Reduce structural height (C) by 30 mm!

If no modification measures possible:

→ Standing work place

