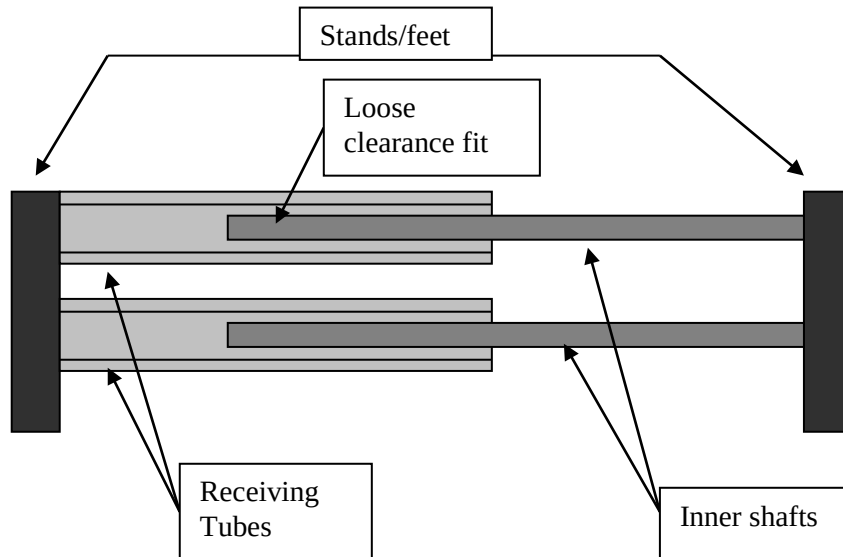


Limits & Fits Exercises

Exercise 1

You are involved with the design and development of an adjustable shoe rack featuring a frame which collapses to fit in small spaces.



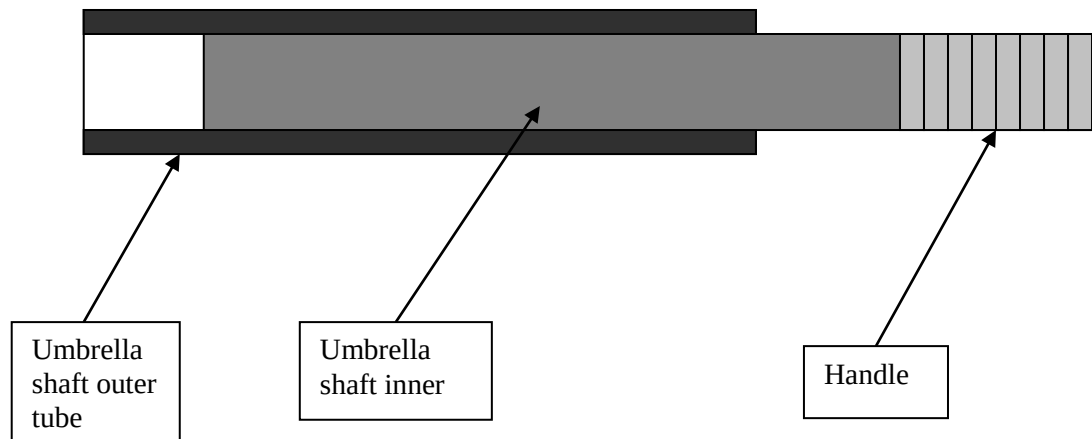
Collapsible Shoe Rack Frame

Use the 'Primary Selection of Fits (Abstract from BS 4500)' to derive the dimensions for a hole and shaft of nominal diameter 15mm so that a **loose clearance fit** is obtained. Determine the following:

- i) Hole & shaft diameters
- ii) Hole & shaft tolerances
- iii) Maximum & minimum clearance values

Exercise 2

You have been commissioned to design a compact umbrella with a telescopically collapsible handle.



Umbrella Telescopic Shaft

Use the 'Primary Selection of Fits (Abstract from BS 4500)' to derive the dimensions for a hole and shaft of nominal diameter 8mm so that a **close clearance fit** is obtained. Determine the following:

- i) Hole & shaft diameters
- ii) Hole & shaft tolerances
- iii) Maximum & minimum clearance values

Exercise 3

Use the 'Primary Selection of Fits (Abstract from BS 4500)' to derive the dimensions for a hole and shaft of nominal diameter 90mm so that a **transition fit** is obtained. Determine the following:

- i) Hole & shaft diameters
- ii) Hole & shaft tolerances
- iii) Maximum clearance & maximum interference values

Exercise 4

Use the 'Primary Selection of Fits (Abstract from BS 4500)' to derive the dimensions for a hole and shaft of nominal diameter 12mm so that an **interference fit** is obtained. Determine the following:

- i) Hole & shaft diameters
- ii) Hole & shaft tolerances
- iii) Maximum & minimum interference values

Primary Selection of Fits (Abstract from BS 4500)

Normal sizes Over Up to mm mm		Loose clearance		Average clearance		Close clearance		Precision clearance		Transition		Interference	
		H9	e9	H8	f7	H7	g6	H7	h6	H7	k6	H7	p6
—	3	+25 +0	-14 -39	+14 +0	-6 -16	+10 +0	-2 -8	+10 +0	-0 -6	+10 +0	+6 +0	+10 +0	+12 +6
3	6	+30 +0	-20 -50	+18 +0	-10 -22	+12 +0	-4 -12	+12 +0	-0 -8	+12 +0	+9 +1	+12 +0	+20 +12
6	10	+36 +0	-25 -61	+22 +0	-13 -28	+15 +0	-5 -14	+15 +0	-0 -9	+15 +0	+10 +1	+15 +0	+24 +15
10	18	+43 +0	-32 -75	+27 +0	-16 -34	+18 +0	-6 -17	+18 +0	-0 -11	+18 +0	+12 +1	+18 +0	+29 +18
18	30	+52 +0	-40 -92	+33 +0	-20 -41	+21 +0	-7 -20	+21 +0	-0 -13	+21 +0	+15 +2	+21 +0	+35 +22
30	50	+62 +0	-50 -112	+39 +0	-25 -50	+25 +0	-9 -25	+25 +0	-0 -16	+25 +0	+18 +2	+25 +0	+42 +26
50	80	+74 +0	-60 -134	+46 +0	-30 -60	+30 +0	-10 -29	+30 +0	-0 -19	+30 +0	+21 +2	+30 +0	+51 +32
80	120	+87 +0	-72 -159	+54 +0	-36 -71	+35 +0	-12 -34	+35 +0	-0 -22	+35 +0	+25 +3	+35 +0	+59 +37
120	180	+100 +0	-85 -185	+63 +0	-43 -83	+40 +0	-14 -39	+40 +0	-0 -25	+40 +0	+28 +3	+40 +0	+68 +43
180	250	+115 +0	-100 -215	+72 +0	-50 -96	+46 +0	-15 -44	+46 +0	-0 -29	+46 +0	+33 +4	+46 +0	+79 +50
250	315	+130 +0	-110 -240	+81 +0	-56 -108	+52 +0	-17 -49	+52 +0	-0 -32	+52 +0	+36 +4	+52 +0	+88 +56
315	400	+140 +0	-125 -265	+89 +0	-62 -119	+57 +0	-18 -54	+57 +0	-0 -36	+57 +0	+40 +4	+57 +0	+98 +62
400	500	+155 +0	-135 -290	+97 +0	-68 -131	+63 +0	-20 -60	+63 +0	-0 -40	+63 +0	+45 +5	+63 +0	+108 +68

Standard Tolerance Table

Nominal sizes		Tolerance grades																	
Over	Up to and including	IT01	IT0	IT1	IT2	IT3	IT4	IT5	IT6†	IT7	IT8	IT9	IT10	IT11	IT12	IT13	IT14*	IT15*	IT16*
mm	mm																		
—	3	0.3	0.5	0.8	1.2	2	3	4	6	10	14	25	40	60	100	140	250	400	600
3	6	0.4	0.6	1	1.5	2.5	4	5	8	12	18	30	48	75	120	180	300	480	750
6	10	0.4	0.6	1	1.5	2.5	4	6	9	15	22	36	58	90	150	220	360	580	900
10	18	0.5	0.8	1.2	2	3	5	8	11	18	27	43	70	110	180	270	430	700	1100
18	30	0.6	1	1.5	2.5	4	6	9	13	21	33	52	84	130	210	330	520	840	1300
30	50	0.6	1	1.5	2.5	4	7	11	16	25	39	62	100	160	250	390	620	1000	1600
50	80	0.8	1.2	2	3	5	8	13	19	30	46	74	120	190	300	460	740	1200	1900
80	120	1	1.5	2.5	4	6	10	15	22	35	54	87	140	220	350	540	870	1400	2200
120	180	1.2	2	3.5	5	8	12	18	25	40	63	100	160	250	400	630	1000	1600	2500
180	250	2	3	4.5	7	10	14	20	29	46	72	115	185	290	460	720	1150	1850	2900
250	315	2.5	4	6	8	12	16	23	32	52	81	130	210	320	520	810	1300	2100	3200
315	400	3	5	7	9	13	18	25	36	57	89	140	230	360	570	890	1400	2300	3600
400	500	4	6	8	10	15	20	27	40	63	97	155	250	400	630	970	1550	2500	4000
500	630	—	—	—	—	—	—	—	44	70	110	175	280	440	700	1100	1750	2800	4400
630	800	—	—	—	—	—	—	—	50	80	125	200	320	500	800	1250	2000	3200	5000
800	1000	—	—	—	—	—	—	—	56	90	140	230	360	560	900	1400	2300	3600	5600
1000	1250	—	—	—	—	—	—	—	66	105	165	260	420	660	1050	1650	2600	4200	6600
1250	1600	—	—	—	—	—	—	—	78	125	195	310	500	780	1250	1950	3100	5000	7800
1600	2000	—	—	—	—	—	—	—	92	150	230	370	600	920	1500	2300	3700	6000	9200
2000	2500	—	—	—	—	—	—	—	110	175	280	440	700	1100	1750	2800	4400	7000	11000
2500	3150	—	—	—	—	—	—	—	135	210	330	540	860	1350	2100	3300	5400	8600	13500

* Not applicable to sizes below 1 mm
 † Not recommended for fits in sizes above 500 mm