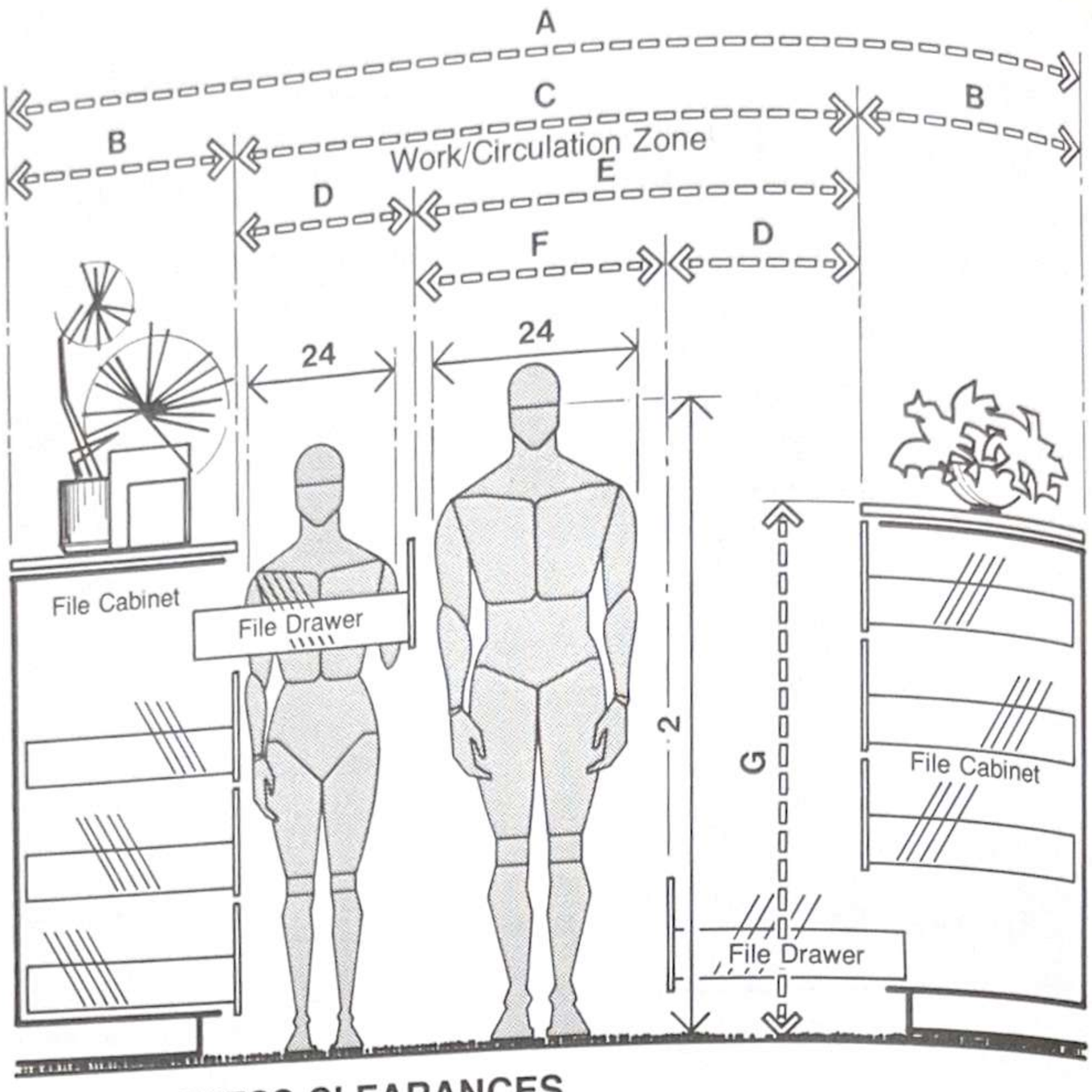
3.2 THE GENERAL OFFICE

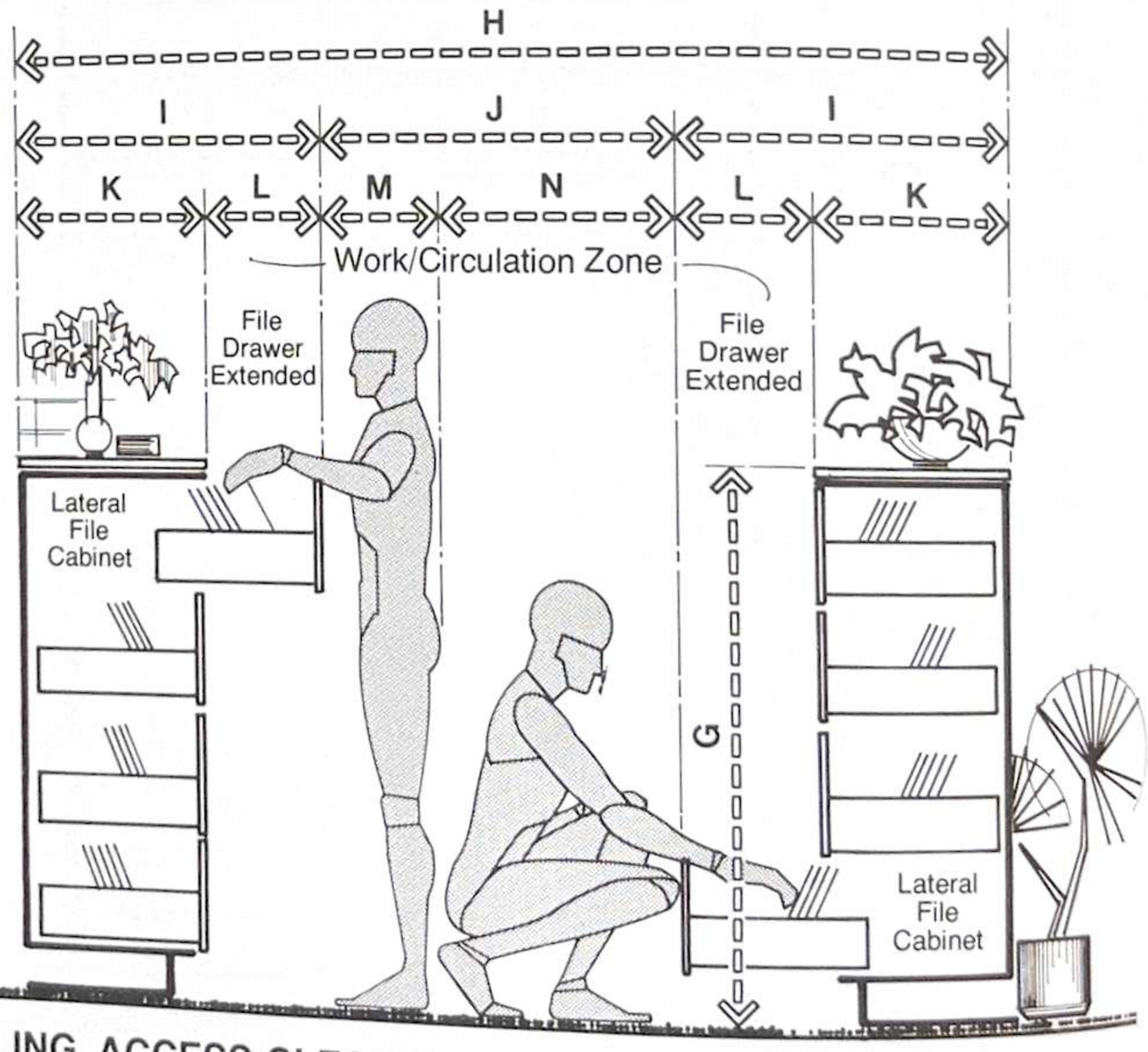
In many offices, file storage can be found lining the edges of a circulation zone. The combined work/circulation zone illustrated at the top of the page shows clearance required for a larger person to circulate between two extended file drawers. With opposing drawers fully extended, unobstructed circulation is clearly limited. If, however, the file drawers are separated by several feet along the path of circulation and access to the drawer is from the side, it is possible to provide circulation for two people.

The drawing at the bottom shows the space required within a typical file storage room where through circulation is not a major consideration. Depending upon the height of the file drawer, the human body must assume different positions to gain free and clear access. The male figure shown kneeling requires a space of 36 in, or 91.4 cm, for clearance. At the same time, the minimum work area needed for a person standing in front of a file has been established at 18 in, or 45.7 cm.

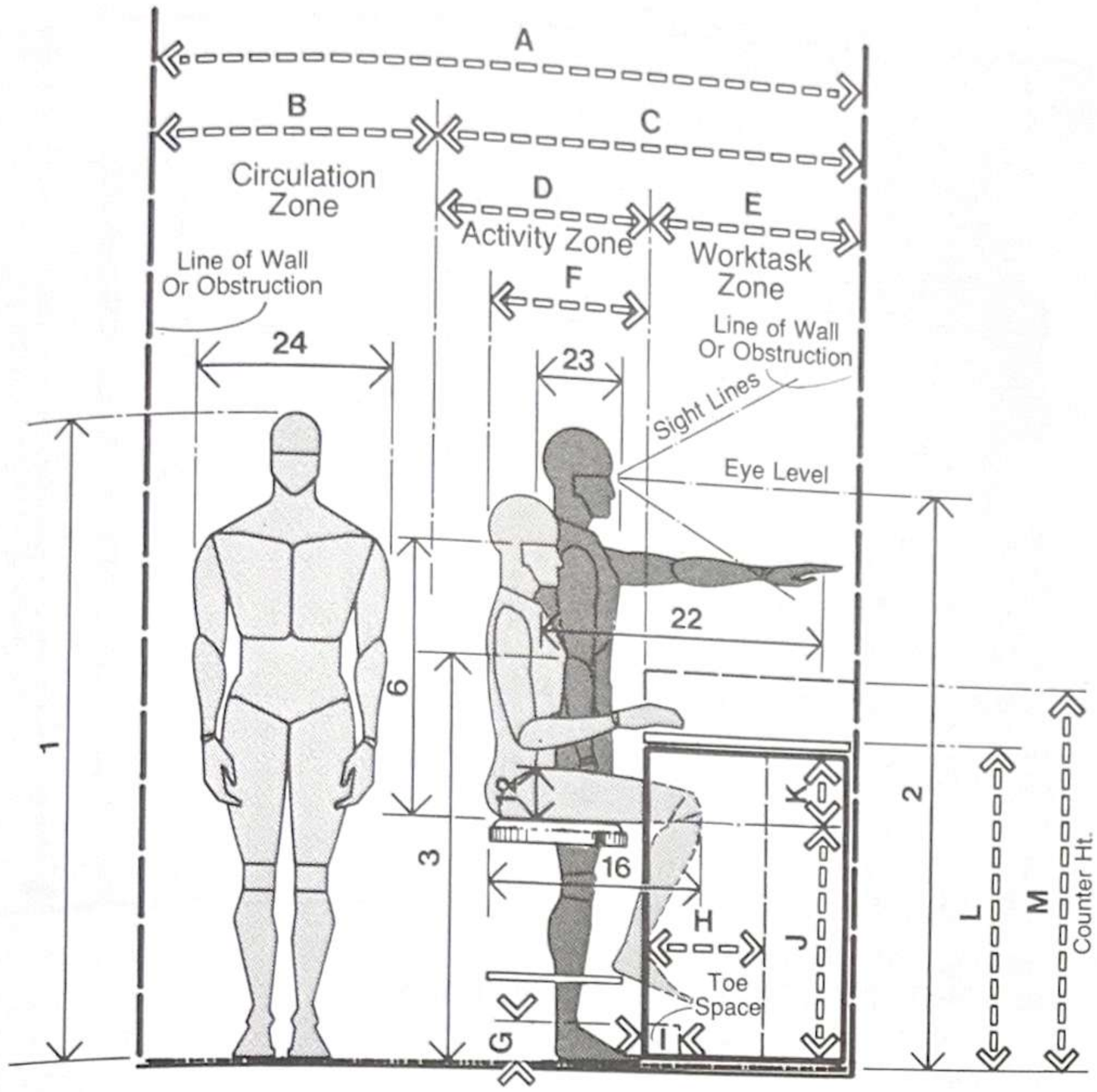


FILING/ACCESS CLEARANCES

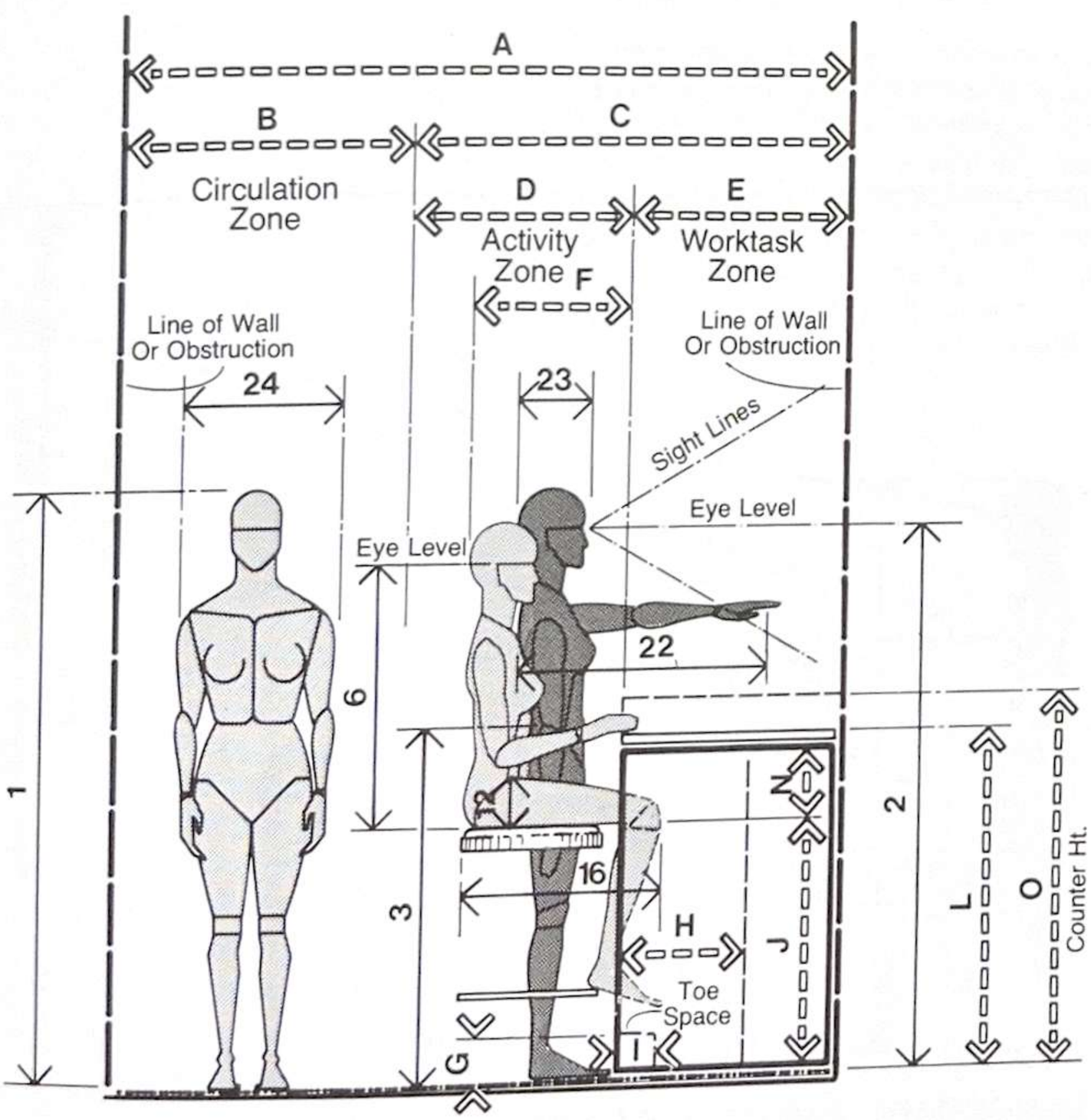
	in	cm
A	106–138	269.2–350.5
B	20–28	50.8–71.1
C	66–82	167.6–208.3
D	18–26	45.7–66.0
E	48–56	121.9–142.2
F	30	76.2
G	54–58	137.2–147.3
H	122–138	309.9-350.5
I	34–42	86.4–106.7
J	40–54	101.6–137.2
K	18–22	45.7–55.9
L	16–20	40.6–50.8
M	18	45.7
N	22–36	55.9–91.4



FILING ACCESS CLEARANCES



WORK COUNTER / MALE USER



WORKCOUNTER/FEMALE USER

3.2 THE GENERAL OFFICE

Within the general office, worktasks must be performed on horizontal counter-type worksurfaces. These tasks are performed while the male or female user is standing or sitting on a stool or perch-type seat. Many factors influence the design of this type of workstation, including the specific nature of the work being performed. Of critical importance in anthropometrically establishing the appropriate counter height is the elbow height measurement. A range of 34 to 39 in, or 86.4 to 99.1 cm, is recommended for counter height to accommodate a stool and of 40 to 44 in, or 101.6 to 111.8 cm, to accommodate a male or female user in a standing position.

Eye height must be considered if the counter height task relates to visual displays or controls. To the extent that ease of access to these displays or controls is of importance anthropometrically, the thumb tip reach measurement of the smaller person is critical in establishing proper counter depth. The designer must also be concerned with thigh clearance and buttock-knee length in finalizing any design. (For additional discussion, see Section 7.3, Work and Crafts Centers, and Section 9.2, Workstation Displays.)

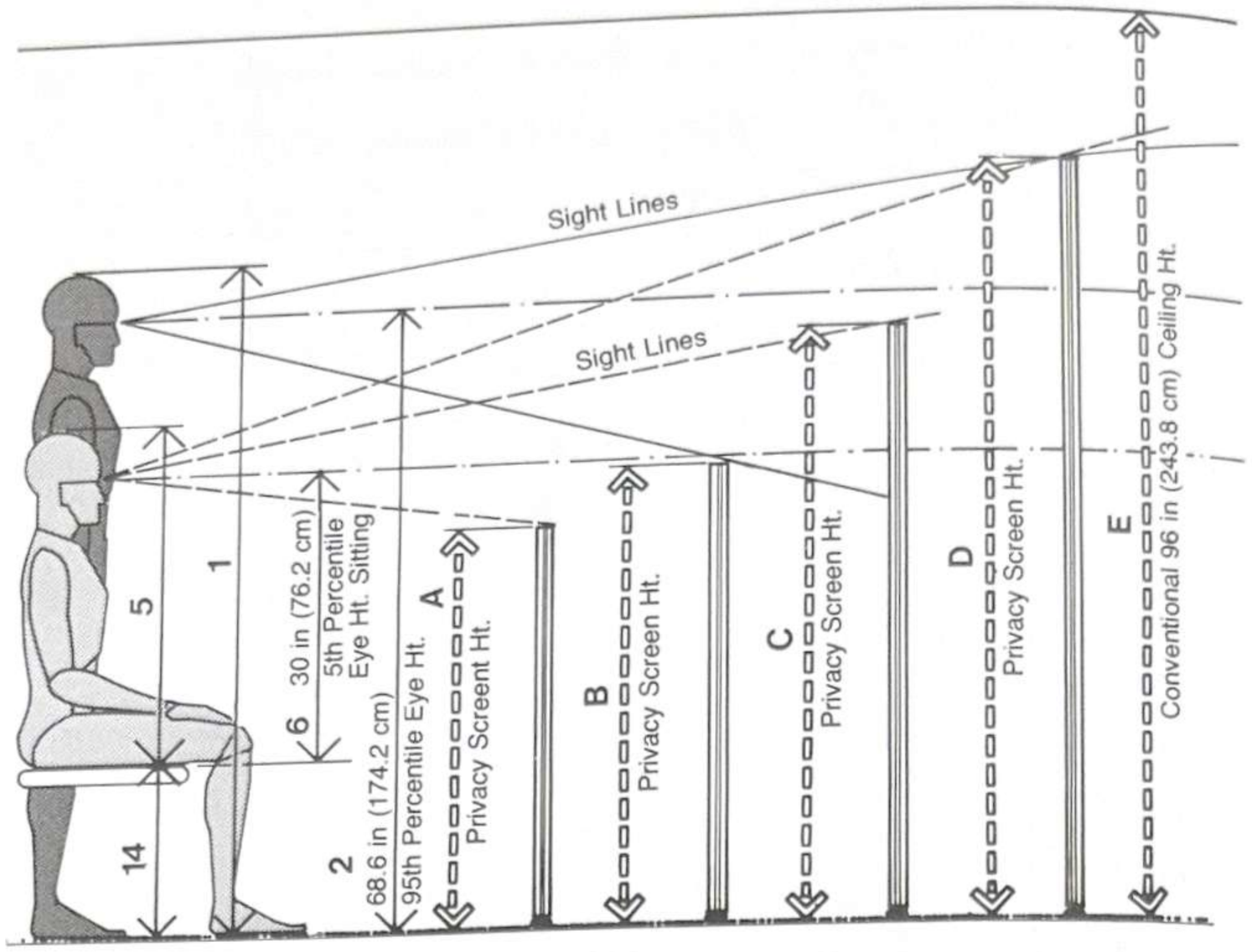
	in	cm
A	68–96	172.7–243.8
B	30–36	76.2–91.4
C	38–60	96.5–152.4
D	20–24	50.8–61.0
E	18–36	45.7–91.4
F	18	45.7
G	3	7.6
H	14–18	35.6–45.7
I	4	10.2
J	22–24.5	55.9–62.2
K	7.5 min.	19.1 min.
L	34–39	86.4–99.1
M	42–44	106.7–111.8
N	7 min.	17.8 min.
O	40–42	101.6–106.7

Printed in China

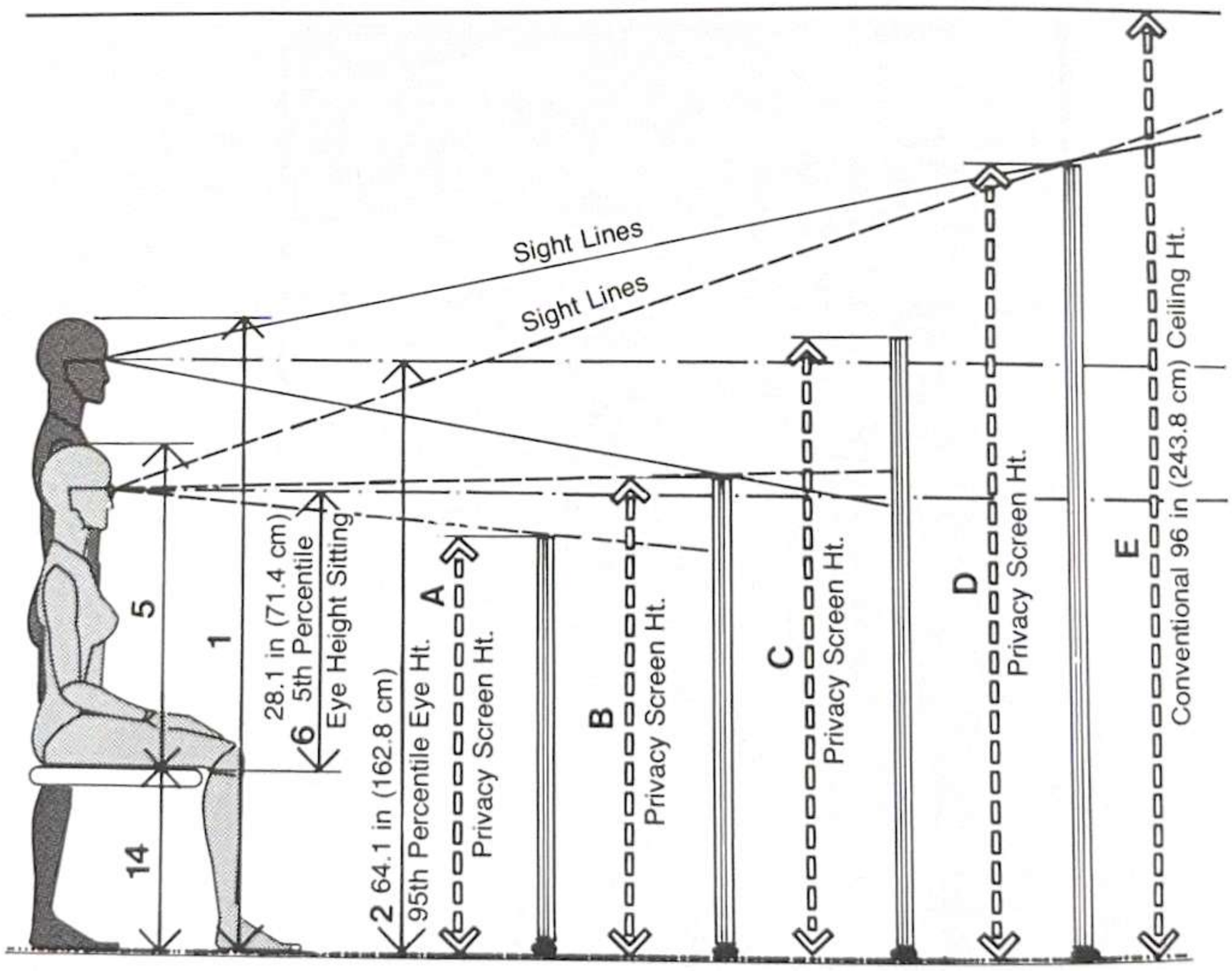
3.2 THE GENERAL OFFICE

The growth and development of open office planning and office landscape systems have spurred the design and manufacture of numerous free-standing low partitions or privacy screens. These partitions are used to subdivide office space, providing various degrees of acoustic and visual privacy, and to define territory and circulation paths. A basic decision always confronting the designer concerns the height of the partition system. The information provided on this page represents a survey of privacy screens manufactured by some of the largest producers of office systems furniture and equipment. All are shown in relation to the large and small male and female user in both a sitting and standing position.

In considering the selection of the appropriate partition or screen height, the anthropometric dimensions of critical importance are those of eye height standing and eye height sitting. It should be understood, however, that sight lines are also important in establishing visual privacy. What should be considered too is the nature of the visual privacy desired. Is the seated person on one side of the screen to be shielded from the view of a standing or seated person on the other side of the screen? Is the seated person to be permitted to look over the screen? The purpose of the privacy screen will determine if seated or standing eye level data should be used and if that data should be 5th or 95th percentile data. (More detailed information on vision and sight lines can be found in Section 9.1.)



LANDSCAPE PARTITIONS / MALE ANTHROPOMETRIC CONSIDERATIONS



LANDSCAPE PARTITIONS/ FEMALE ANTHROPOMETRIC CONSIDERATIONS

	in	cm
A	40–44	101.6–111.8
B	47–50	119.4–127.0
C	60–64	152.4–162.6
D	78–80	198.1–203.2
E	96	243.8

3.3 RECEPTION SPACES

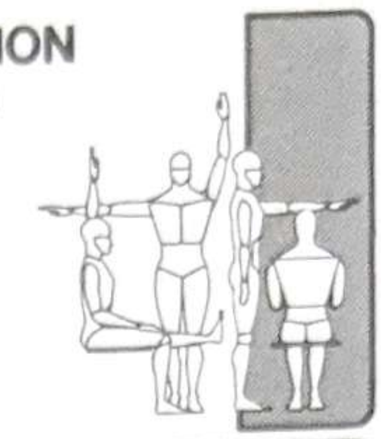


TABLE	VISUAL	WORKSTATION	SEATING	CIRCULATION	ACTIVITIES	ANTHROPOMETRIC DATA
1A,2B		●			1	STATURE
1B,3C	◐	◐			2	EYE HEIGHT
1F,3G	◐	◐			6	EYE HEIGHT SITTING
1J,2F			●		10	HIP BREADTH
1L,2H		●			12	THIGH CLEARANCE
1P,2L		●	●		16	BUTTOCK-KNEE LENGTH
1U,4E		○			21	SIDE ARM REACH
1W,6B		●	●	●	23	MAXIMUM BODY DEPTH
1X,6A		●	●	●	24	MAXIMUM BODY BREADTH

The drawings on the following pages examine the relationship of human dimension to the design of reception spaces. The three key areas of concern include visitor seating, the reception desk, and location of graphics or corporate identification. In regard to seating, the clearances around the seating elements to accommodate circulation are stressed more than the design of the individual seating unit itself, which is examined in more detail in Section 4 of Part A and Section 1 of Part C. Of particular importance is the design of the reception desk in terms of its responsiveness to the anthropometric requirements of the seated receptionist and the standing visitor within the context of a high counter-type arrangement and a conventional desk arrangement.

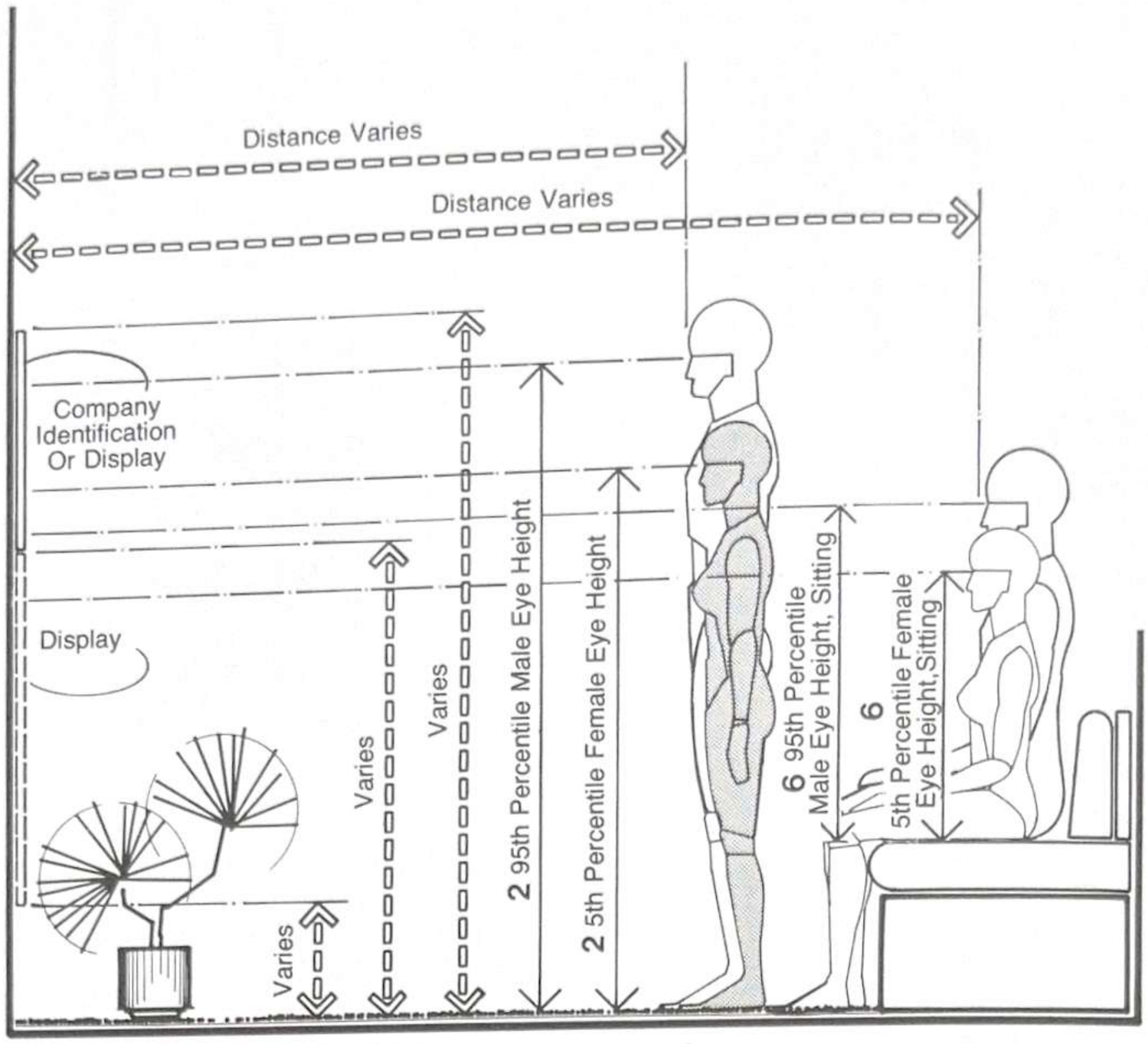
The depth of the worksurface should accommodate the thumb tip reach measurements of the user of smaller body size so that packages and correspondence can be exchanged. Of equal importance is eye height sitting to ensure visibility over the counter and eye contact with the standing visitor. Eye height of both the seated and standing person is also essential in establishing the height and location of corporate signage or other graphic material to ensure its visibility. Details of such elements of reception spaces are included in this section as well as suggested clearances and other dimensions for use in preliminary design assumptions. The key anthropometric measurements are indicated in the above matrix.

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3.3 RECEPTION SPACES

The corporate logo is often displayed within the reception room. Since it is used to graphically identify the tenant, it must be placed in a visually prominent location. The drawing at the top of the page indicates the critical anthropometric measurements to be considered. The eye height of the smaller and larger seated and standing viewer defines the visual ranges to be considered. The specific vertical and horizontal dimensions of the company identification or display should vary with the distance of the viewer from the display as well as the design intent of the graphics. (Section 9 in Part C should be consulted for additional information on sight lines.)

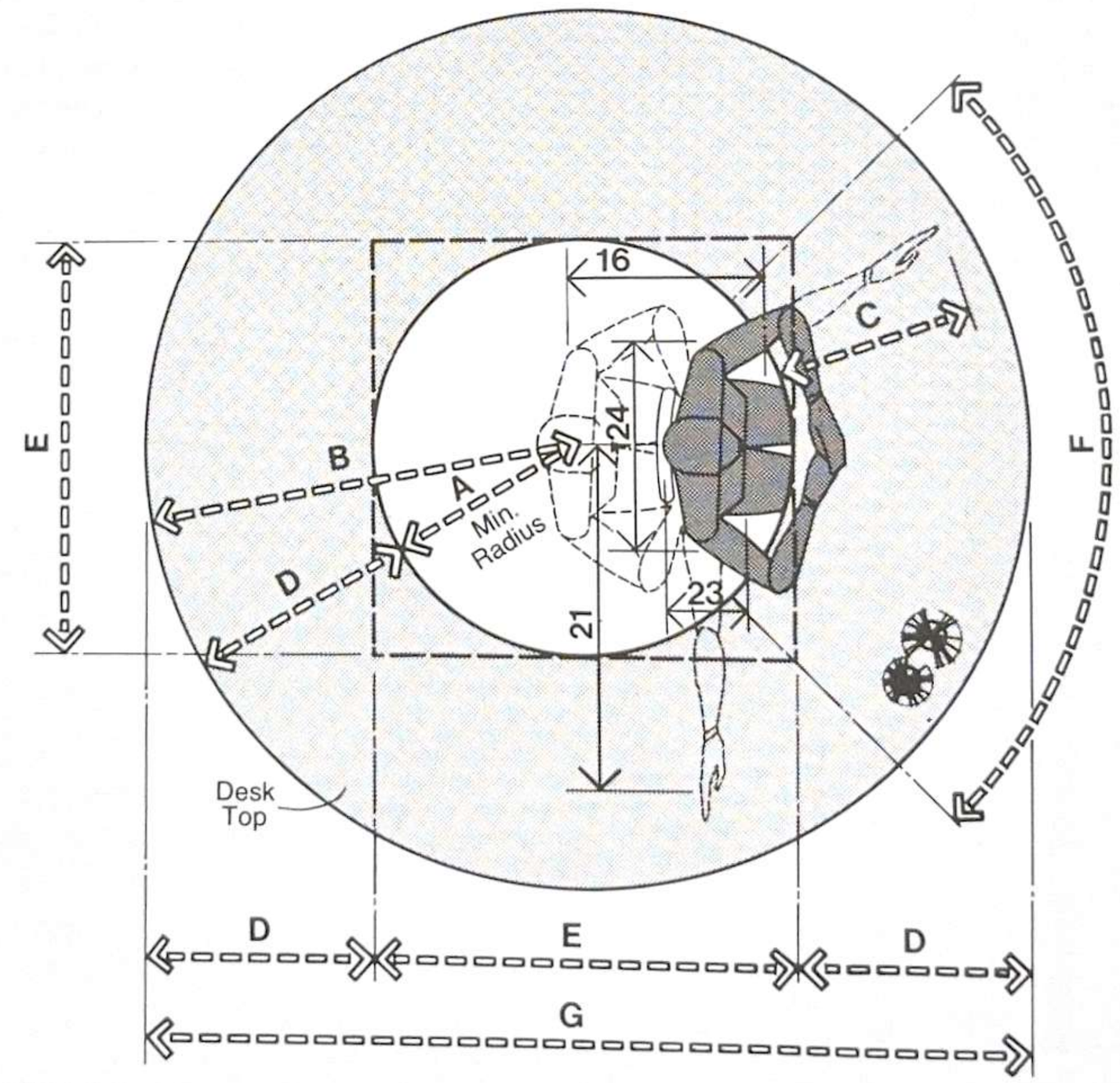
Illustrated at the bottom of the page is the circular workstation sometimes used in relatively large reception spaces. Two major factors that influence the ultimate size of this element are the minimum radius to accommodate the receptionist within the inner circular area and the circumference of the outer perimeter available to accommodate visitors.



DISPLAY / VISUAL RELATIONSHIPS

The key anthropometric body dimensions required to accommodate the receptionist are that of buttock-knee length and body depth, permitting the movement and clearance of the chair. The minimum recommended diameter is shown as 44 in, or 111.8 cm. The depth of the worksurface, anthropometrically, should accommodate the side arm reach and thumb tip reach dimensions of the smaller person. A dimension in the range of 24 to 30 in, or 61 to 76.2 cm, is recommended.

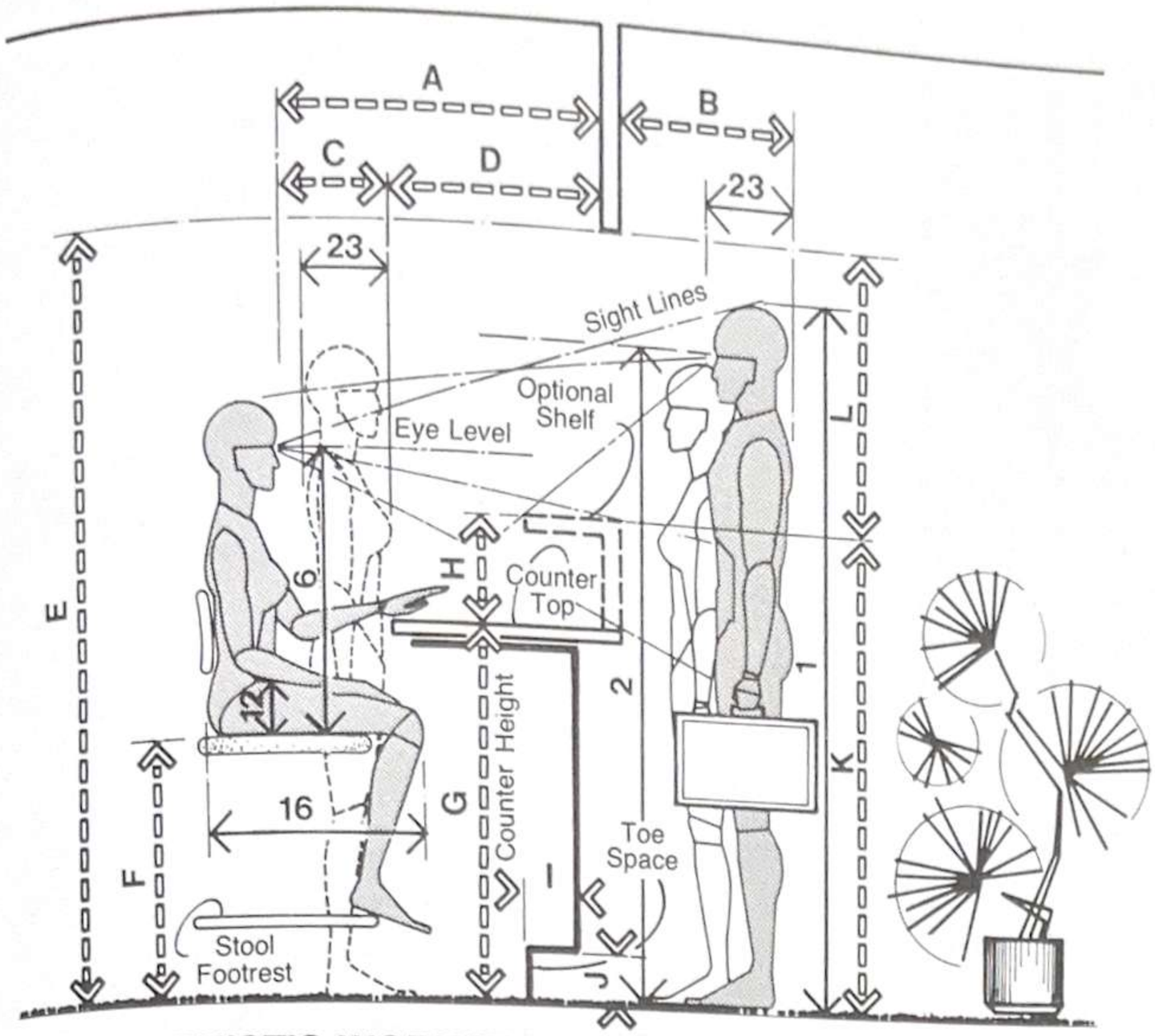
	in	cm
A	22	55.9
B	46–52	116.8–132.1
C	18–22	45.7–55.9
D	24–30	61.0–76.2
E	44	111.8
F	76	193.0
G	92–104	233.7–264.2



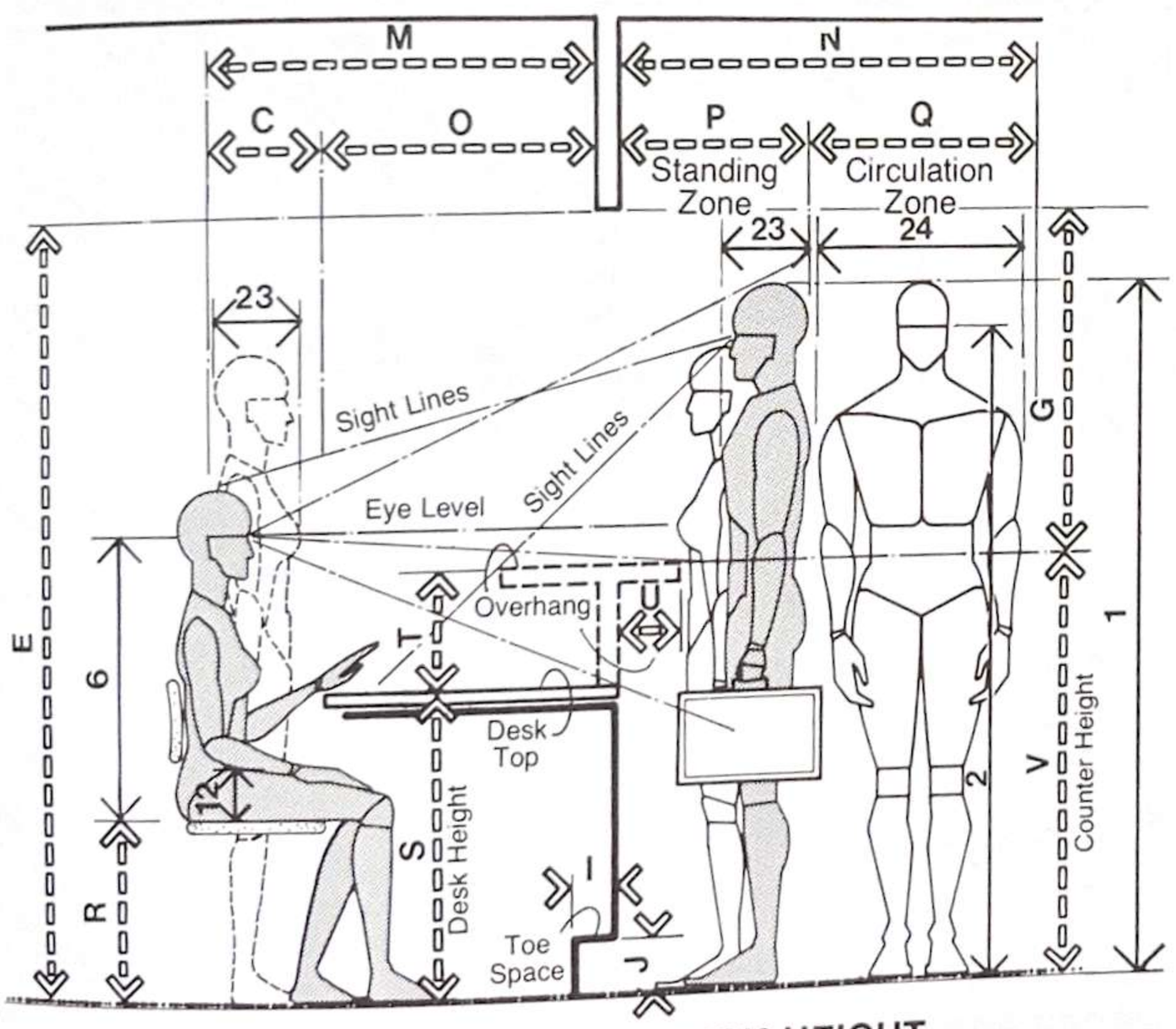
CIRCULAR RECEPTIONIST'S WORKSTATION

3.3 RECEPTION SPACES

For the purpose of privacy or security, the receptionist's workstation is often an area physically separated by built-in furniture and/or partitions. The drawing at the top of the page shows a counter height receptionist's workstation. While the relationship of worksurface to seat height is key, other anthropometric considerations are eye height and sitting height normal. The minimum height of the opening above the floor has been established at 78 in, or 198.1 cm. Sitting height and eye height are significant in providing unobstructed vision. The drawing at the bottom depicts a desk height receptionist's workstation. The depth of the worksurface ranges from 26 to 30 in, or 66 to 76.2 cm, allowing for thumb tip reach required for the exchange of papers and packages. Both drawings show in broken line an added counter top element often provided for security or as a visual screen of the worksurface top.



RECEPTIONIST'S WORKSTATION / COUNTER HEIGHT



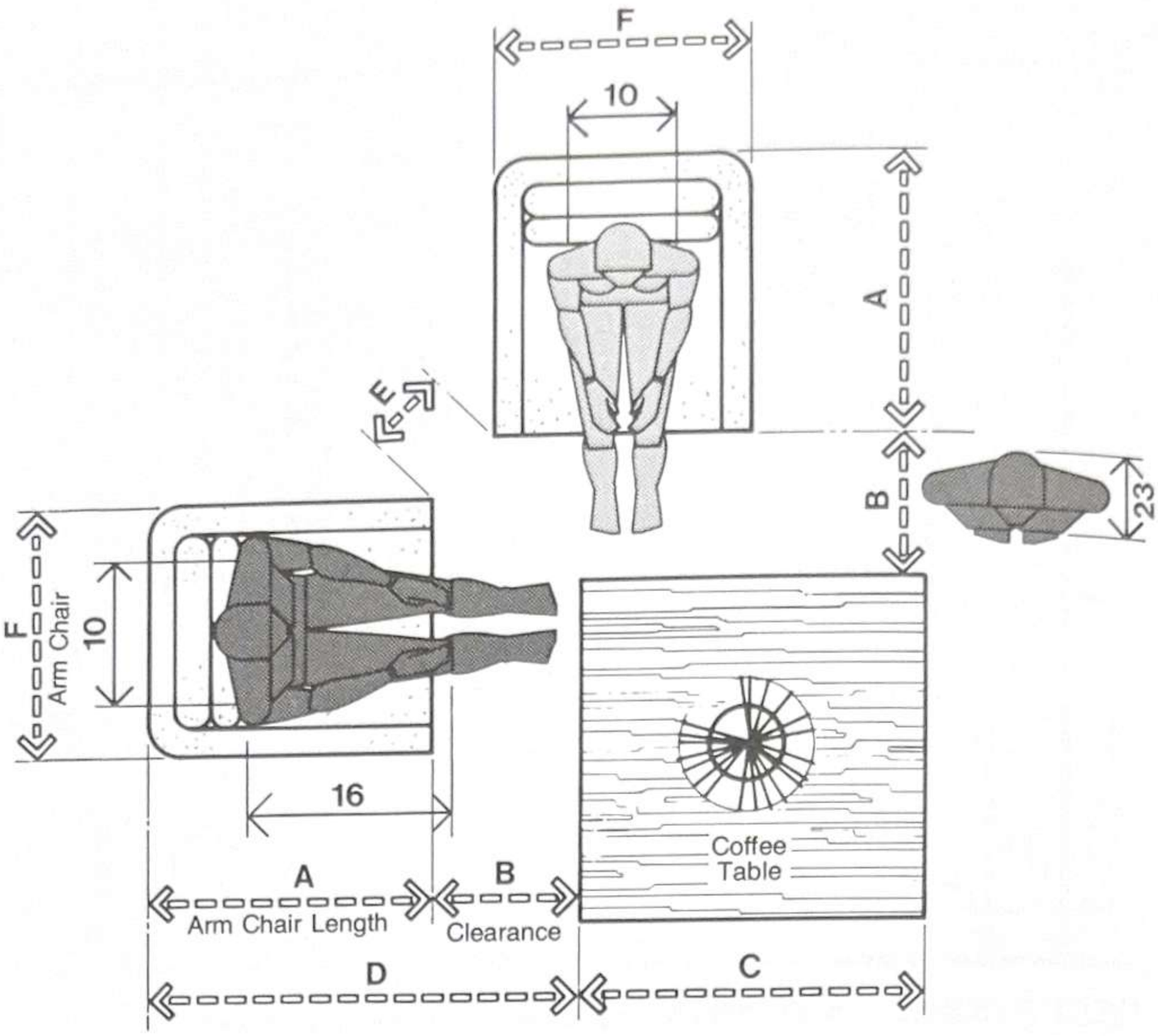
RECEPTIONIST'S WORKSTATION / DESK HEIGHT

	in	cm
A	40–48	101.6–121.9
B	24 min.	61.0 min.
C	18	45.7
D	22–30	55.9–76.2
E	78 min.	198.1 min.
F	24–27	61.0–68.6
G	36–39	91.4–99.1
H	8–9	20.3–22.9
I	2–4	5.1–10.2
J	4	10.2
K	44–48	111.8–121.9
L	34 min.	86.4 min.
M	44–48	111.8–121.9
N	54	137.2
O	26–30	66.0–76.2
P	24	61.0
Q	30	76.2
R	15–18	38.1–45.7
S	29–30	73.7–76.2
T	10–12	25.4–30.5
U	6–9	15.2–22.9
V	39–42	99.1–106.7

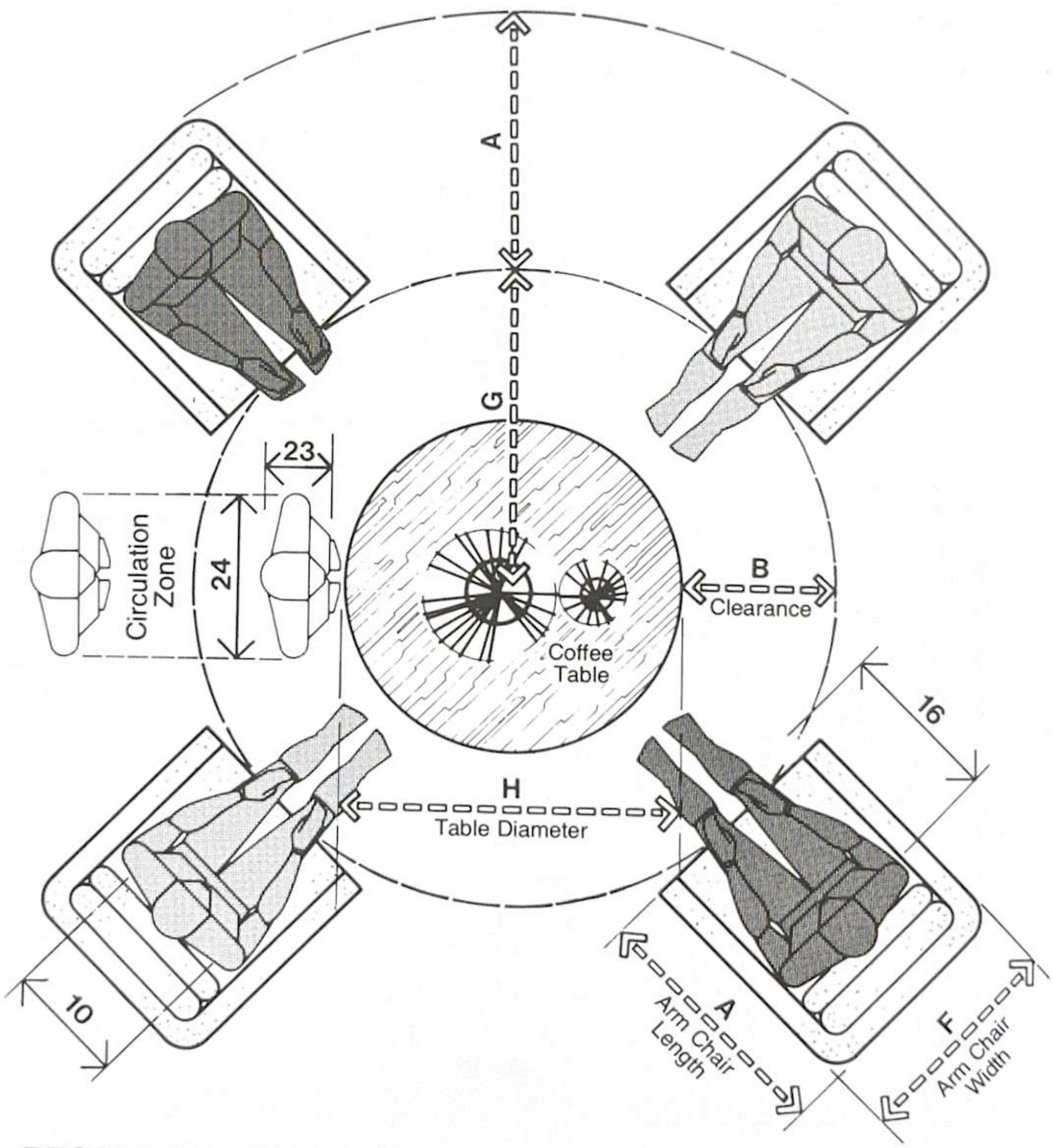
Printed in China

3.3 RECEPTION SPACES

Typical reception room visitor seating arrangements are shown on this page, with emphasis on the individual seating unit instead of sofa-type seating. While the width of the individual seating unit varies, certain key anthropometric dimensions influence the placement of the unit as well as the overall dimensions. The primary anthropometric dimension determining seat width is that of hip breadth. Seat depth is determined by the buttock-popliteal length measurement. For a more detailed discussion of seating design criteria, Section 4 in Part A and Section 1 in Part C should be consulted. Location of the armchair in relation to a coffee table must take into account two conflicting requirements: clearance for circulation between chair and table and placement of the table to accommodate the reach limitations of the smaller person. There is no perfect solution. A distance between 15 and 18 in, or 38.1 and 45.7 cm, however, allows for the leg projection of the seated person and also accommodates the maximum body depth of the larger person so that he may sidestep, if necessary, to pass. Some body contact and/or adjustment of body position or posture of both seated and standing person may be required.



RECEPTION ROOM SEATING



RECEPTION SEATING/CIRCULAR CONFIGURATION

	in	cm
A	28–32	71.1–81.3
B	15–18	38.1–45.7
C	30–48	76.2–121.9
D	43–50	109.2–127.0
E	9–12	22.9–30.5
F	28–36	71.1–91.4
G	33–42	83.8–106.7
H	36–48	91.4–121.9

3.4 CONFERENCE ROOMS

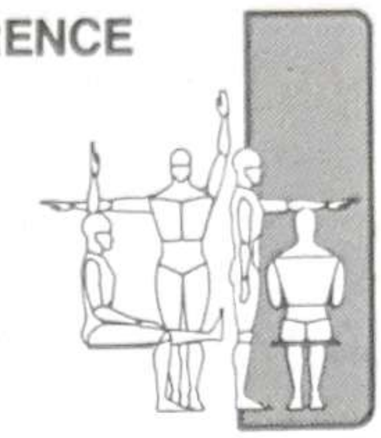


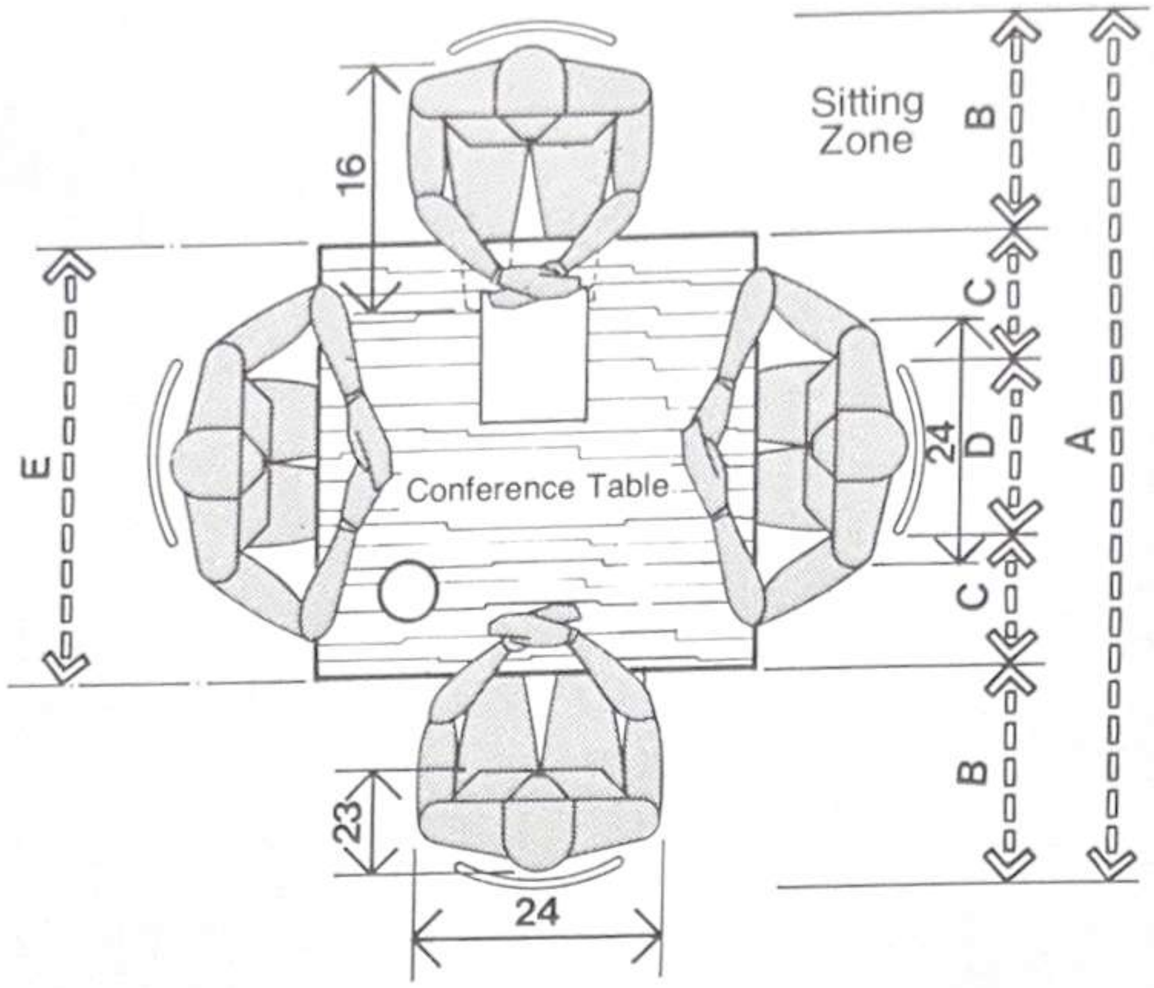
TABLE	TABLE	AUDIOVISUAL	CIRCULATION	ACTIVITIES	ANTHROPOMETRIC DATA
1F,3G	◑	◑			6 EYE HEIGHT SITTING
1L,2H	●				12 THIGH CLEARANCE
1M,2I	●				13 KNEE HEIGHT
1N,2J	◑				14 POPLITEAL HEIGHT
1O,2K	◑				15 BUTTOCK-POPLITEAL LENGTH
1P,2L	●				16 BUTTOCK-KNEE LENGTH
1W,6B	●	●	●		23 MAXIMUM BODY DEPTH
1X,6A	●	●	●		24 MAXIMUM BODY BREADTH

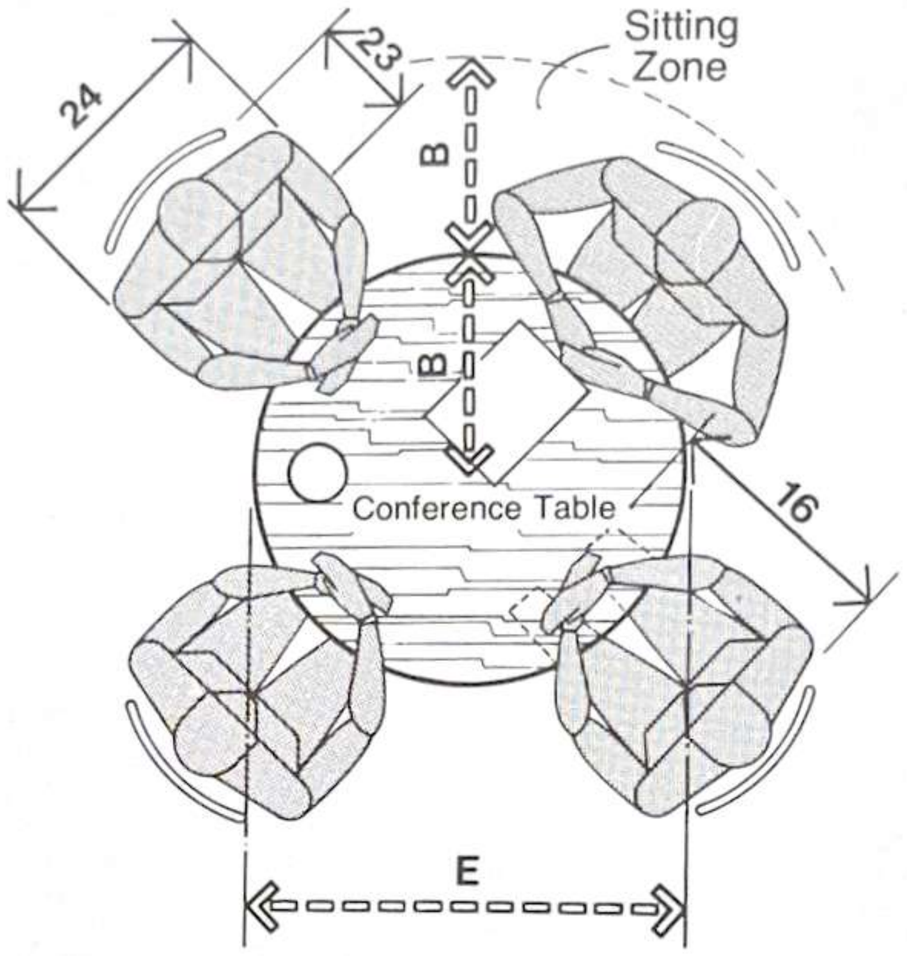
The general approach in establishing conference table sizes is much the same as that used for dining tables. Instead of the place setting used with dining tables, a workzone to accommodate documents, papers, and other reference materials should be taken into consideration. The amount of material to be accommodated, however, may vary greatly depending on the nature of the organization involved and the type of meeting. The amount of perimeter space allocated to each individual should at the very least be adequate to accommodate the maximum body breadth, allow for the extension of the elbows away from the body, and provide for documents and other material. If public hearings or meetings involving a large degree of formality and protocol are involved, allowances around the table may be increased so significantly as to make the accommodation of human dimension academic. The other factor to be considered in conjunction with seat spacing is its effect on sight lines directed at either end of the table. Clearances around the table for circulation should accommodate the maximum body breadth of the user of larger body size and allow for the space taken up by the chair itself. The drawings on the following pages illustrate various table configurations and include dimensional data suggested for use in making preliminary design assumptions. The key anthropometric data to be considered is indicated in the above matrix.

3.4 CONFERENCE ROOMS

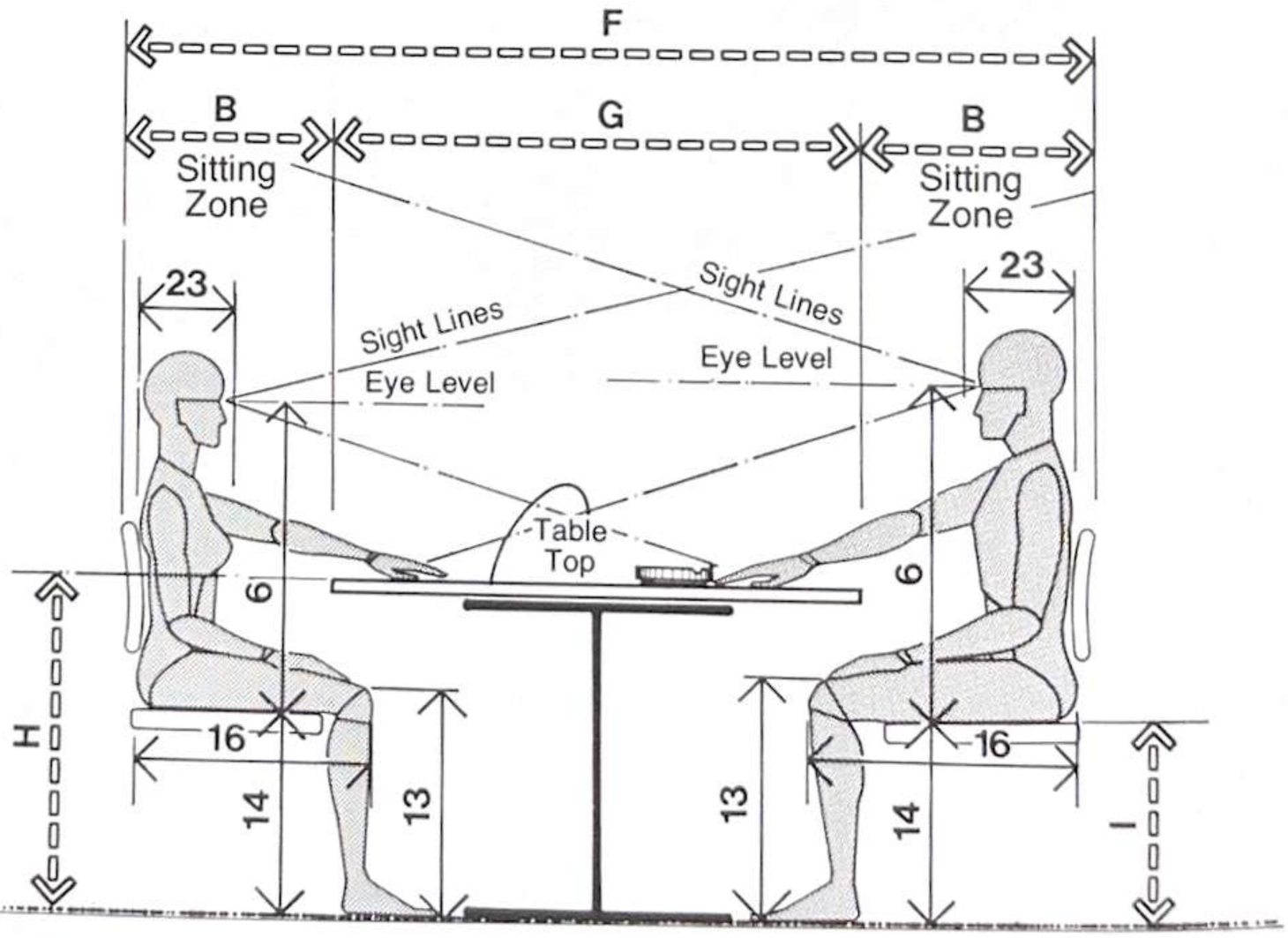
The two drawings at the top of the page illustrate a square and a circular conference arrangement for four people. Such a minimal-size table might be found within a small room or, more commonly, interspersed within the framework of a larger space or open office plan. A recommended distance of 18 to 24 in, or 45.7 to 61 cm, is shown for the distance required from the edge of the table to the back of the chair, with the chair in a normal position. Anthropometric considerations determining this dimension are buttock-knee length and maximum body depth measurements of people of larger body size.

The drawing at the bottom of the page shows the typical relationship of two people sitting across from each other at a conference table. The distance across the table becomes an important factor if papers are to be exchanged. A width of 36 to 54 in, or 91.4 to 137.2 cm, is recommended. Table height should also be analyzed for its relationship to popliteal height, knee height, and thigh clearance. A range of 29 to 30 in, or 73.7 to 76.2 cm, is preferred, with the smaller dimension favored where writing tasks are emphasized.





CONFERENCE TABLES / SQUARE AND CIRCULAR



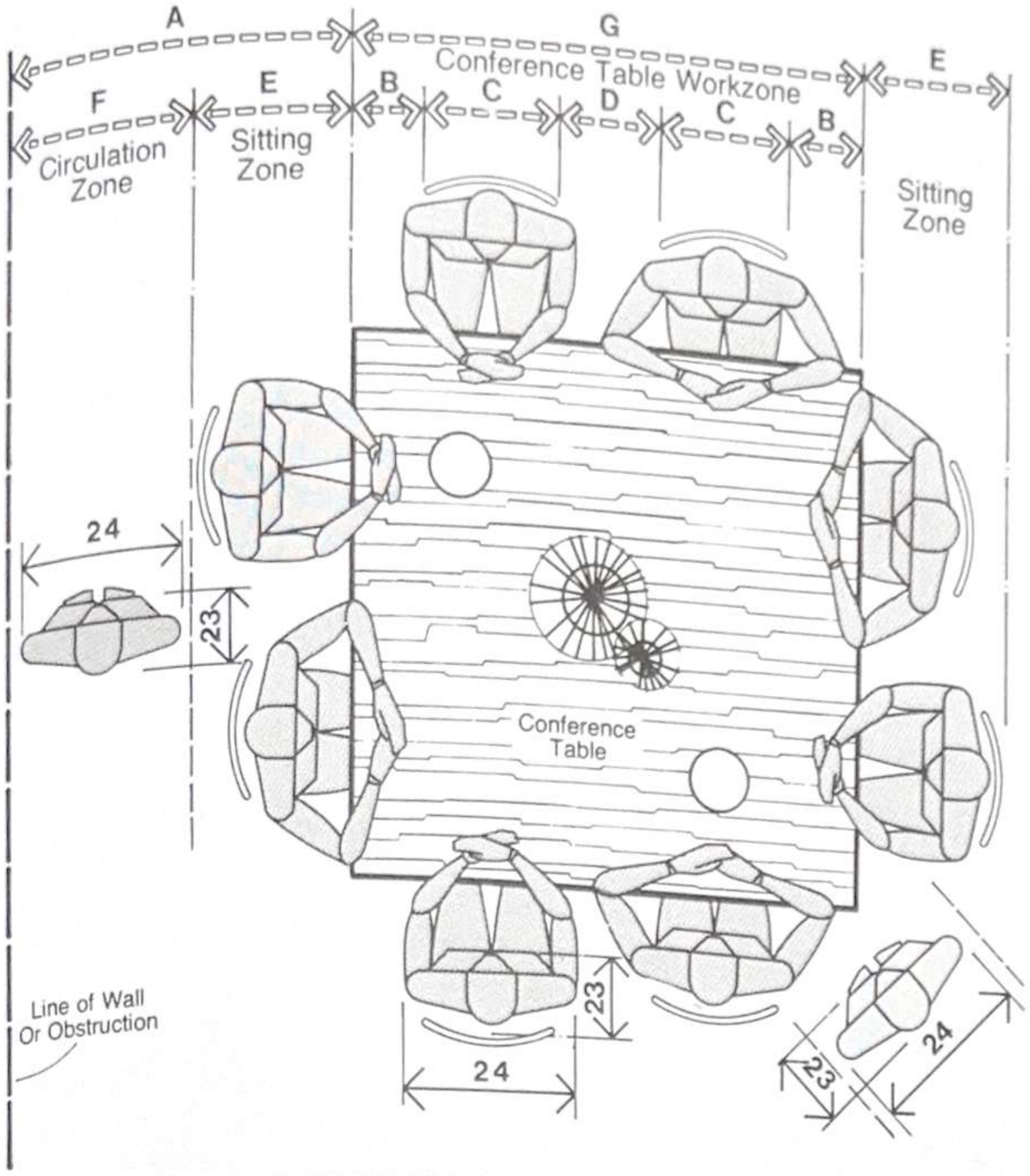
CONFERENCE TABLES / GENERAL
MALE AND FEMALE CONSIDERATIONS

	in	cm
A	72–96	182.9–243.8
B	18–24	45.7–61.0
C	8–12	20.3–30.5
D	20–24	50.8–61.0
E	36–48	91.4–121.9
F	72–102	182.9–259.1
G	36–54	91.4–137.2
H	29–30	73.7–76.2
I	16–17	40.6–43.2

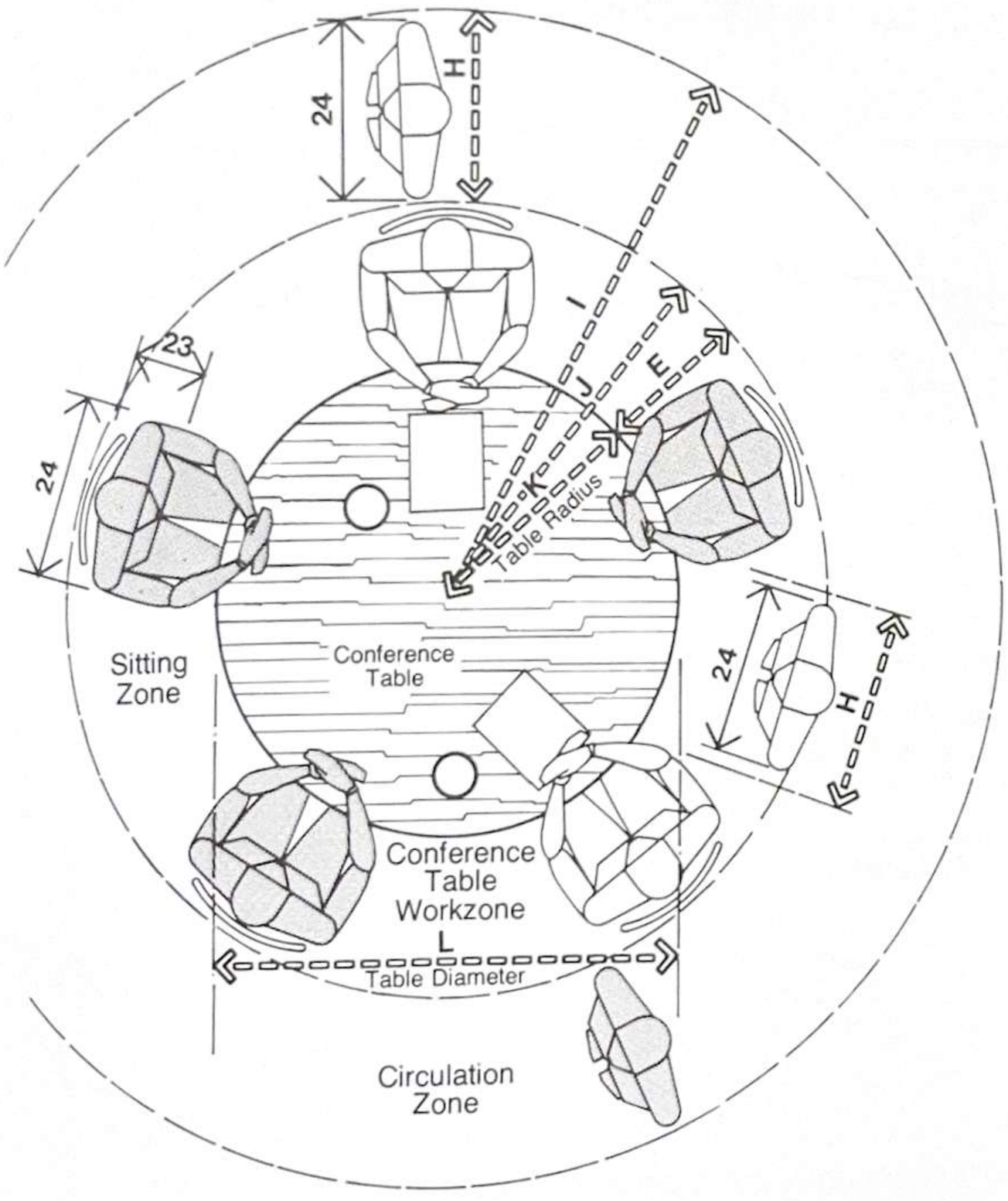
3.4 CONFERENCE ROOMS

Consideration must be given to clearances and circulation around the larger conference table, as indicated on the drawings. A minimum of 48 in, or 121.9 cm, is suggested from the edge of the table to the wall or nearest obstruction. This dimension under ordinary circumstance allows for a circulation zone beyond the sitting zone of 30 to 36 in, or 76.2 to 91.4 cm, based upon a maximum body breadth measurement of the larger person. The greater dimension is recommended to allow for the chair in a pulled-out position.

The actual dimensions of the conference table are a function of the number of people to be seated. The square table illustrated provides for eight people, with each side ranging from 54 to 60 in, or 137.2 to 152.4 cm. The larger dimension is more appropriate to accommodate people of larger body size and to allow for a more generous work zone for each person. This translates into 30 in, or 76.2 cm, per person, which constitutes a comfortable perimeter allocation. The circular table at the bottom comfortably accommodates five people while allowing for a 30-in, or 76.2-cm, access zone between chairs. To accommodate both sitting zone and circulation zone, a space with a radius ranging from 72 to 81 in, or 182.9 to 205.7 cm, must be provided.



SQUARE CONFERENCE TABLE



CIRCULAR CONFERENCE TABLE

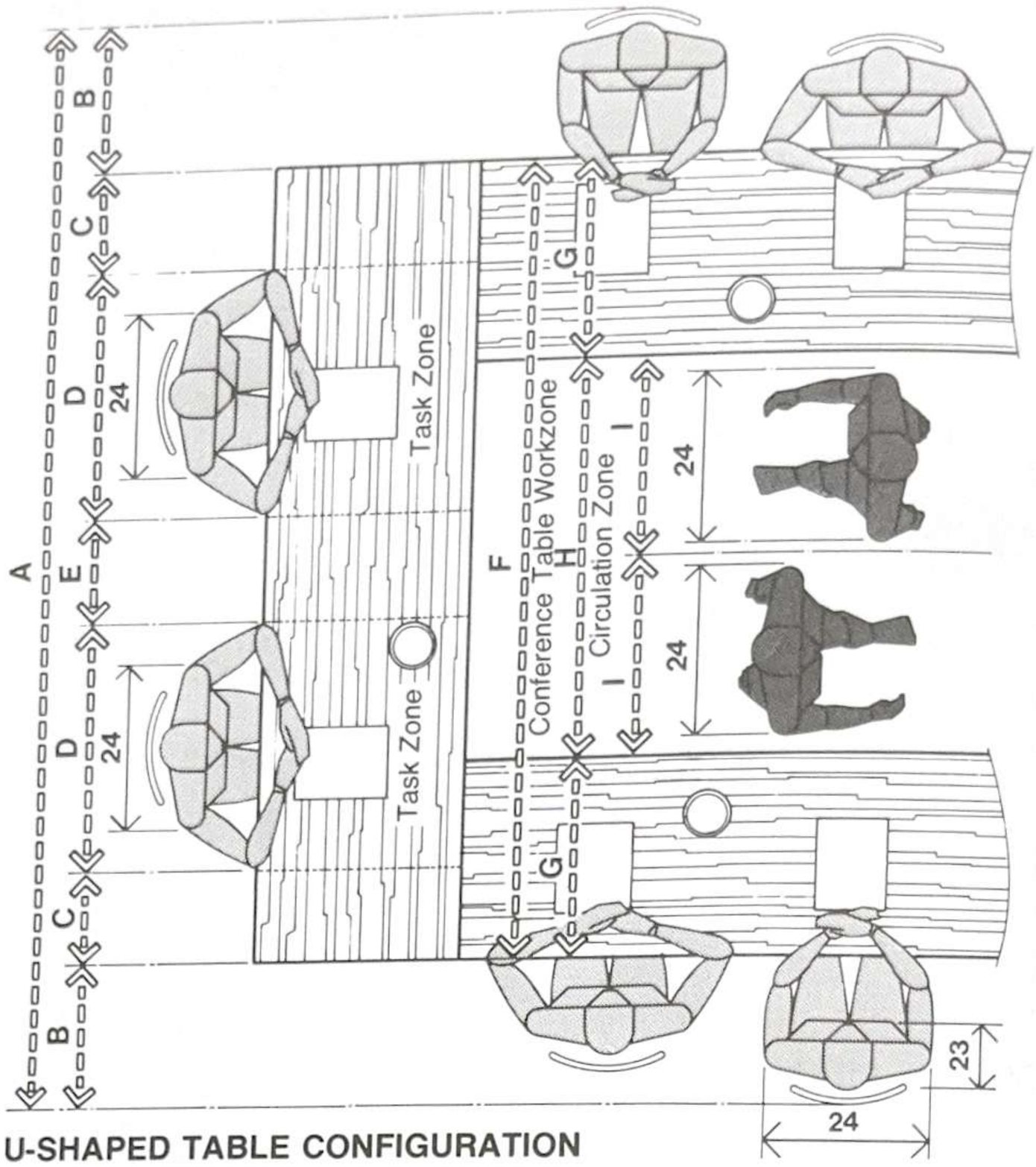
	in	cm
A	48–60	121.9–152.4
B	4–6	10.2–15.2
C	20–24	50.8–61.0
D	6–10	15.2–25.4
E	18–24	45.7–61.0
F	30–36	76.2–91.4
G	54–60	137.2–152.4
H	30	76.2
I	72–81	182.9–205.7
J	42–51	106.7–129.5
K	24–27	61.0–68.6
L	48–54	121.9–137.2

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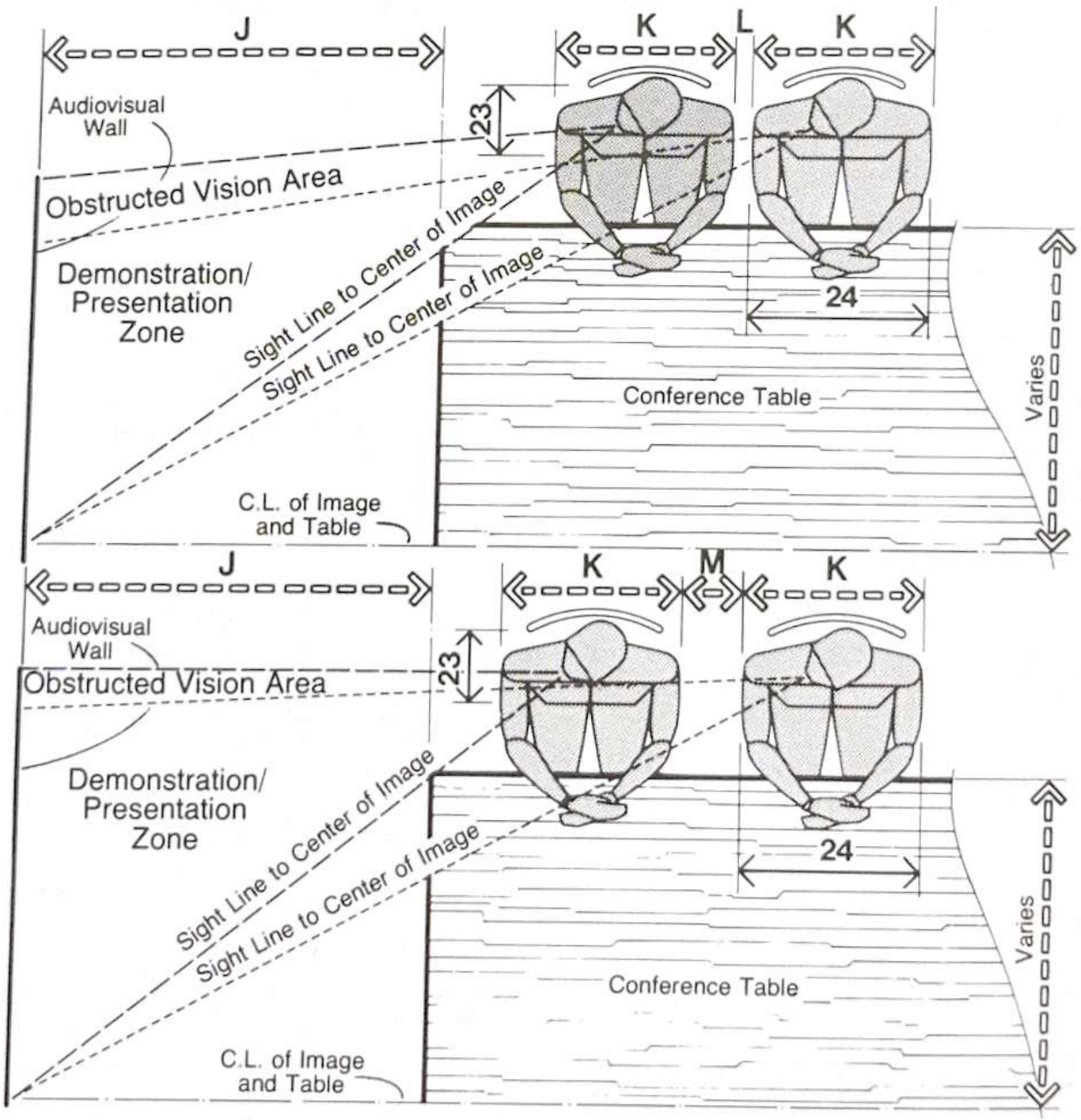
3.4 CONFERENCE ROOMS

The drawing at the top of the page represents a U-shaped conference table that might ordinarily be associated with a large-scale corporate board meeting or a public hearing. Such an arrangement, in addition to the basic anthropometric considerations mentioned on the previous pages, must also accommodate access and circulation. In the situation shown, the conference table work zone includes an internal circulation zone for two people, with maximum body breadth the controlling factor in establishing the 54- to 60-in, or 137.2- to 152.4-cm, clearance.

The spacing of chairs is not only important in terms of defining appropriate work zones at the table, but essential in providing optimal sight lines where the room must also incorporate an audiovisual wall. As indicated in the two plans at the bottom of the page, a minimal clearance between chairs creates an unnecessarily large obstructed vision area, compared with the limited obstructed vision area when the chair spacing is increased. Sight lines and angles of vision are also a function of the distance of the table edge to the audiovisual wall. A minimum of 72 in, or 182.8 cm, is recommended. (Section 9, Audiovisual Spaces, in Part C should be consulted for more specific information.)



U-SHAPED TABLE CONFIGURATION



AUDIOVISUAL CONFERENCE TABLE CONFIGURATION AND VISION LINES

	in	cm
A	138–180	350.5–457.2
B	18–24	45.7–61.0
C	12–21	30.5–53.3
D	32–36	81.3–91.4
E	14–18	35.6–45.7
F	108–132	274.3–335.3
G	24–36	61.0–91.4
H	60	152.4
I	30	76.2
J	72	182.9
K	24–28	61.0–71.1
L	3–6	7.6–15.2
M	12–16	30.5–40.6

4 MERCANTILE SPACES

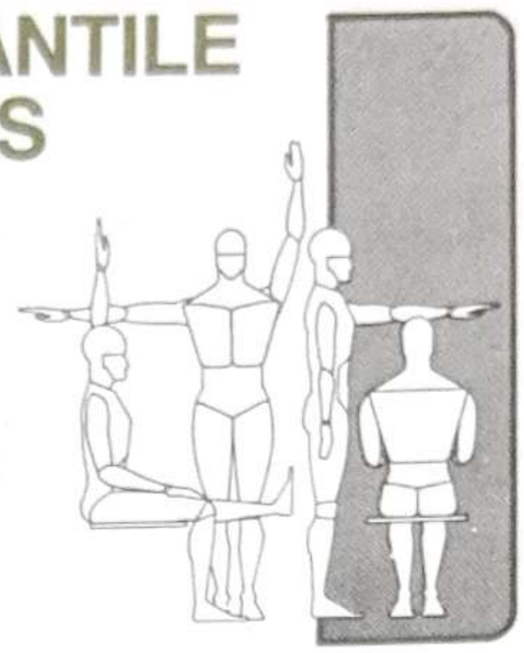


TABLE	4.1 RETAIL SPACE	4.2 FOOD STORES	4.3 HAIR STYLING	SPACE ANTHROPOMETRIC DATA
1A,2B	◪	◪	◪	1 STATURE
1B,3C	◪	◪	◪	2 EYE HEIGHT
1C,3B	◪		◪	3 ELBOW HEIGHT
				4 SITTING HEIGHT ERECT
				5 SITTING HEIGHT NORMAL
1F,3G	◪		○	6 EYE HEIGHT SITTING
1G,3E			◪	7 MIDSHOULDER HEIGHT SITTING
				8 SHOULDER BREADTH
				9 ELBOW-TO-ELBOW BREADTH
				10 HIP BREADTH
				11 ELBOW REST HEIGHT
1L,2H	●			12 THIGH CLEARANCE
1M,2I	●			13 KNEE HEIGHT
1N,2J	◪			14 POPLITEAL HEIGHT
				15 BUTTOCK-POPLITEAL LENGTH
1P,2L	●			16 BUTTOCK-KNEE LENGTH
1Q,3F			●	17 BUTTOCK-TOE LENGTH
				18 BUTTOCK-HEEL LENGTH
				19 VERTICAL REACH HEIGHT SITTING
1T,4F	○			20 VERTICAL GRIP REACH
1U,4E	●	○	○	21 SIDE ARM REACH
1V,4D		○		22 THUMB TIP REACH
1W,6B	●	●	●	23 MAXIMUM BODY DEPTH
1X,6A	●	●	●	24 MAXIMUM BODY BREADTH

Printed in China

The first stores in this country were simply incorporated into the homes of the craftsmen who produced and sold their wares on the premises. The shop was usually located in a front room, with quarters for the family and apprentices at the rear or on another floor. By the 19th century, however, a new breed of enterprising merchants emerged who were primarily interested, not in the production of the product, but in its purchase and resale to others. At first, they too operated from their homes, but the storage requirements for their inventory soon compelled them to take over the entire house for business purposes. Eventually, they outgrew the house as a place of operation and had to relocate in buildings that could be used for warehousing as well as sales. Although sales was essential to their operation, the building's interior still looked and functioned as a warehouse, not the store as it is perceived today. Ambiance, user comfort, store image, display systems, and adjacency planning were not considered. Customer convenience, in terms of building location and design, was traded off for storage space and proximity to transportation arteries. By the turn of the century, some thought was given to the display of merchandise, and stores begn to lose some of the warehouse look. After World War II, as large chain store operations were created, as shopping centers and malls evolved as a new prototype for mercantile space, and as new stores were constructed throughout the country, emphasis was placed on the design of store interiors, based on market research, buying habits, merchandising theory, and customer convenience.

Today the essential function of mercantile spaces, small or large, is to display and sell merchandise. If the quality of the interface between the customer and the interior space is poor, the purpose of that space is defeated. Likewise, if the quality of the interface between the store personnel and that space is not adequate, the effectiveness of the store will be diminished. The points of interface are too numerous to examine thoroughly here, yet among the most obvious are the interface between the customer and the display and between customer, display, and sales personnel. Human dimension and its impact on the quality of that interface will be examined in the drawings on the following pages. The relationship, for example, among fields of vision, eye height, and display is extremely important; the most creative display is worthless if it can only be seen by a small percentage of customers. The height of the counter so that it will accommodate the body sizes of the majority of customers is equally important. The location of shelving within reach of those of both small and large size is another consideration. Clearance adequate to allow comfortable circulation is yet another factor. To be responsive to these considerations requires an understanding of the anthropometric requirements involved.

4.1 RETAIL SPACES

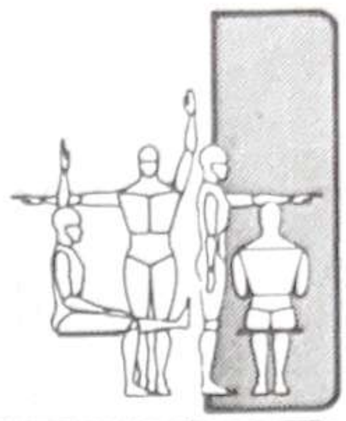


TABLE	DISPLAY	SHOPPING	SELLING	STORAGE	FITTING	WRAPPING	ACTIVITIES / ANTHROPOMETRIC DATA
1A,2B	◐		◐		●	●	1 STATURE
1B,3C	◐	◐		◐			2 EYE HEIGHT
1C,3B		◐	◐			◐	3 ELBOW HEIGHT
1F,3G	◐	◐					6 EYE HEIGHT SITTING
1L,2H		●					12 THIGH CLEARANCE
1M,2I		●					13 KNEE HEIGHT
1N,2J		◐					14 POPLITEAL HEIGHT
1P,2L		●					16 BUTTOCK-KNEE LENGTH
1T,4F			●	○		●	20 VERTICAL GRIP REACH
1U,4E					●		21 SIDE ARM REACH
1W,6B		●	●			●	23 MAXIMUM BODY DEPTH
1X,6A		●	●			●	24 MAXIMUM BODY BREADTH

In an interior environment such as a retail space, where customer convenience and comfort are a matter of corporate policy, the responsiveness of the design to human dimension and body size is extremely critical. The interface between the user and the various types of sales counters and shelf displays, for example, must be of the highest quality. Included among the drawings on the following pages are illustrations of various counter types for use from both seated and standing positions, indicating the anthropometric considerations involved and suggested dimensional clearances for use in making preliminary design assumptions.

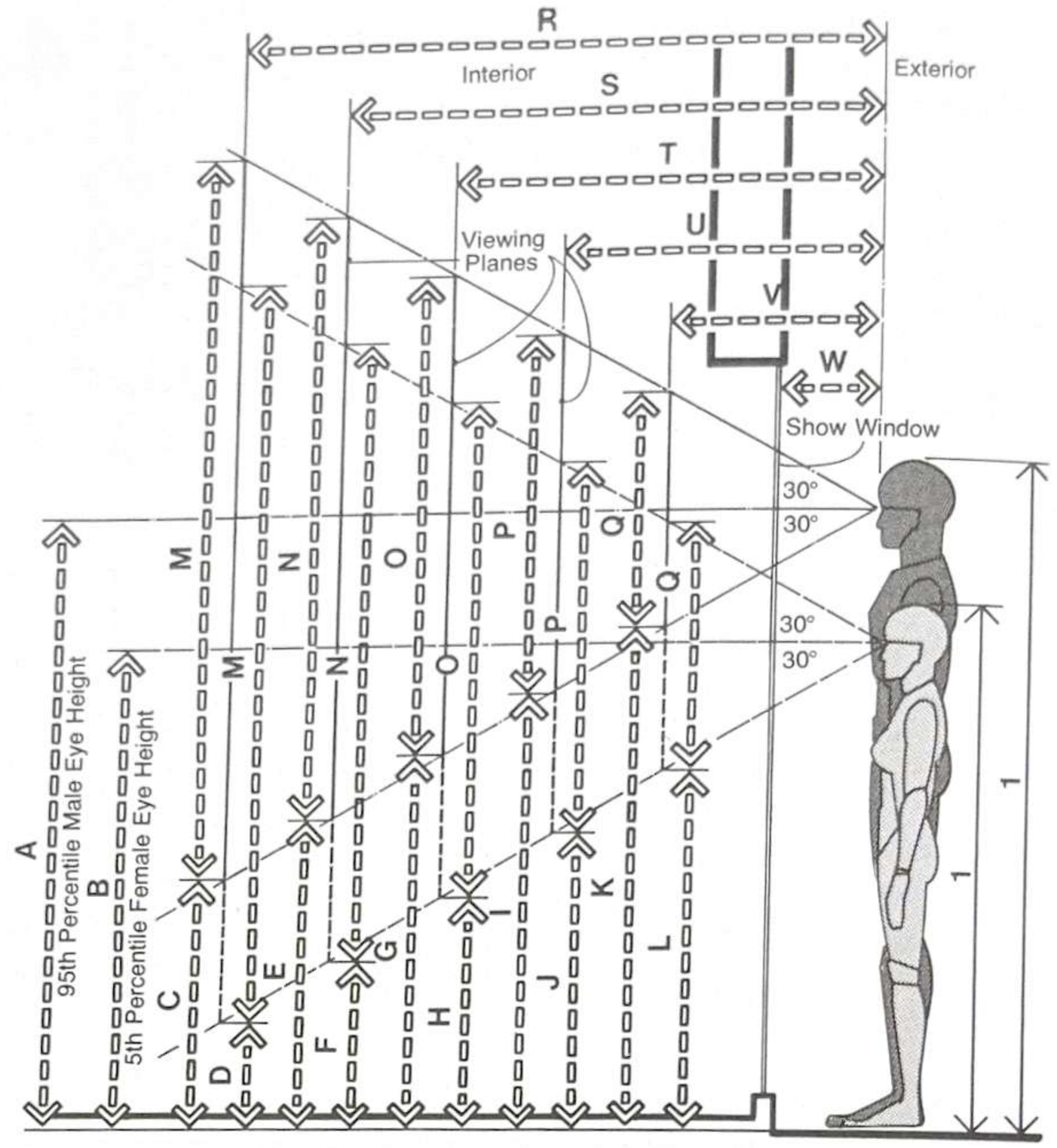
Proper visibility of displays both from within and from without is also crucial to the successful design of a retail space. In this regard, the eye height of the small and large viewer and the geometric implications of human vision must be accommodated. The height of a wrapping counter, the size of a dressing cubicle, the critical dimensions of a shoe department, and circulation around and between merchandise displays must all accommodate users of varying body size. Illustrations of these aspects of retail spaces are also among the drawings included in this section, together with suggested clearances. The anthropometric measurements of significant importance are indicated in the above matrix.

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4.1 RETAIL SPACES

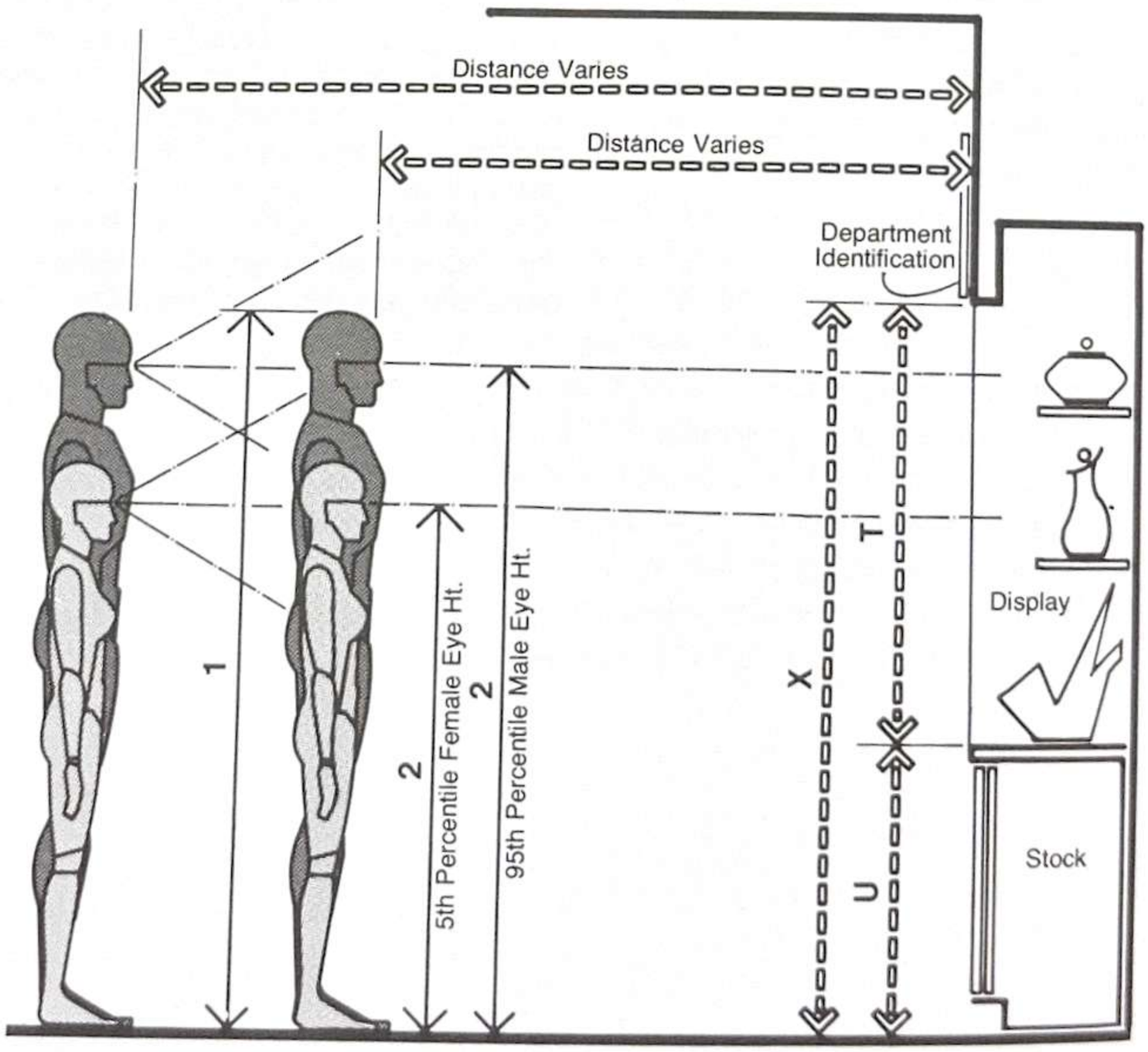
The drawing at the top of the page shows the optimum height of viewing planes located at 12-in, or 30.5-cm, intervals, with the viewer stationed 12 in away from the show window. Two sets of data are presented: one concerns the viewing planes related to a viewer of small body size, and the other, planes related to a viewer of larger body size. The eye level of the former was based on 5th percentile female data and the latter on 95th percentile male data. As in other situations, the diagram should not be taken too literally, since it does not take into account head movement or the scanning capability of the eye, each of which can significantly increase the area that the eye can see. By using the geometric approach implied in the diagram, the size of optimum viewing planes can be established with the viewer in different locations.

The drawing at the bottom explores visual relationships related to interior displays. For further information on visual displays, refer to Section 9.



SHOW WINDOW / OPTIMUM VIEWING PLANES

	in	cm
A	68.6	174.2
B	56.3	143.0
C	27.0	68.7
D	14.7	37.4
E	28.0	71.2
F	28.3	72.0
G	41.5	105.4
H	28.6	72.6
I	47.8	121.5
J	36.3	92.2
K	54.8	139.1
L	42.5	107.8
M	83.1	211.1
N	69.3	175.9
O	55.4	140.8
P	41.6	105.6
Q	27.7	70.4
R	72	182.9
S	60	152.4
T	48	121.9
U	36	91.4
V	24	61.0
W	12	30.5
X	84	213.4

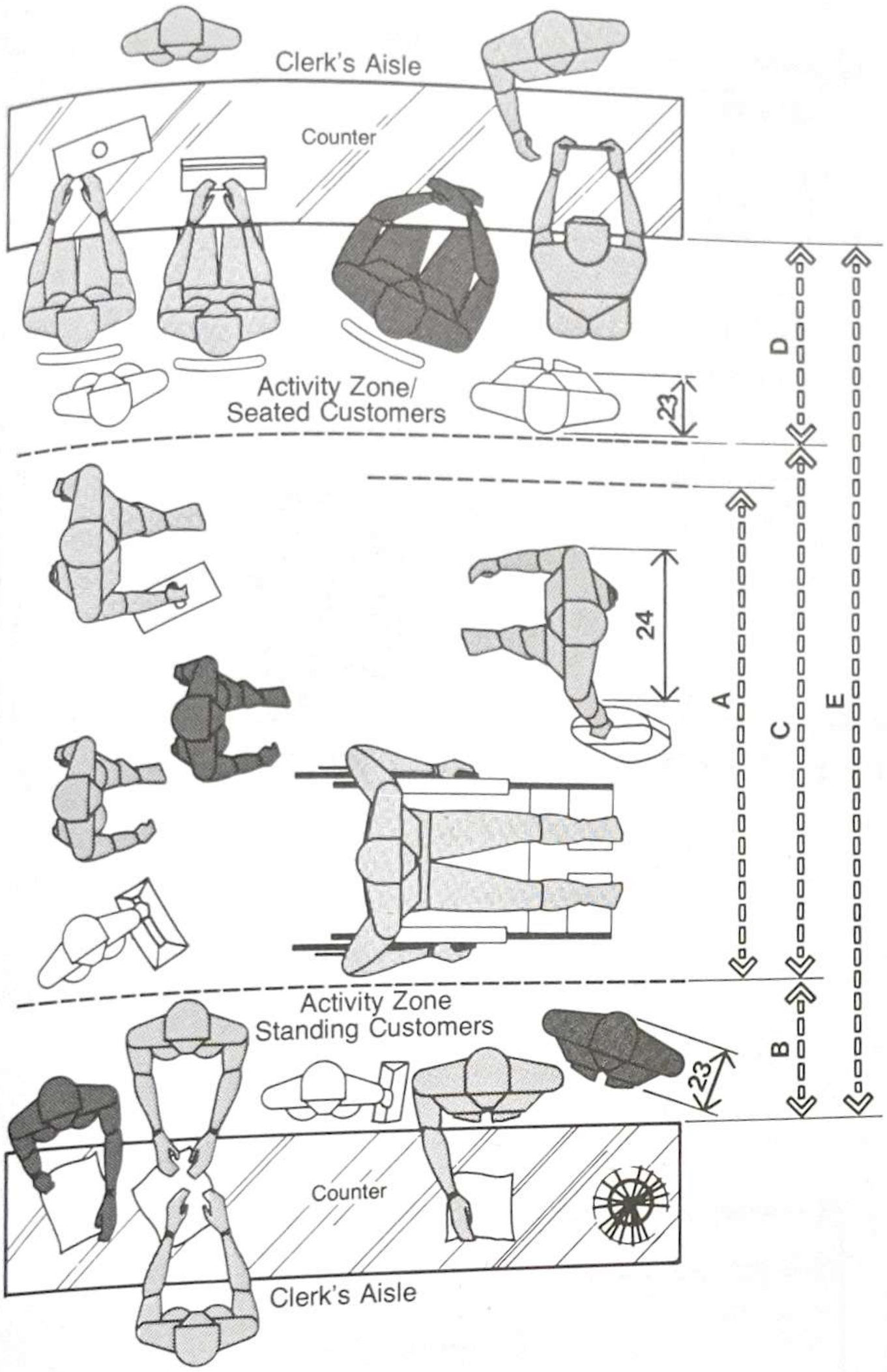


DISPLAY / VISUAL RELATIONSHIPS

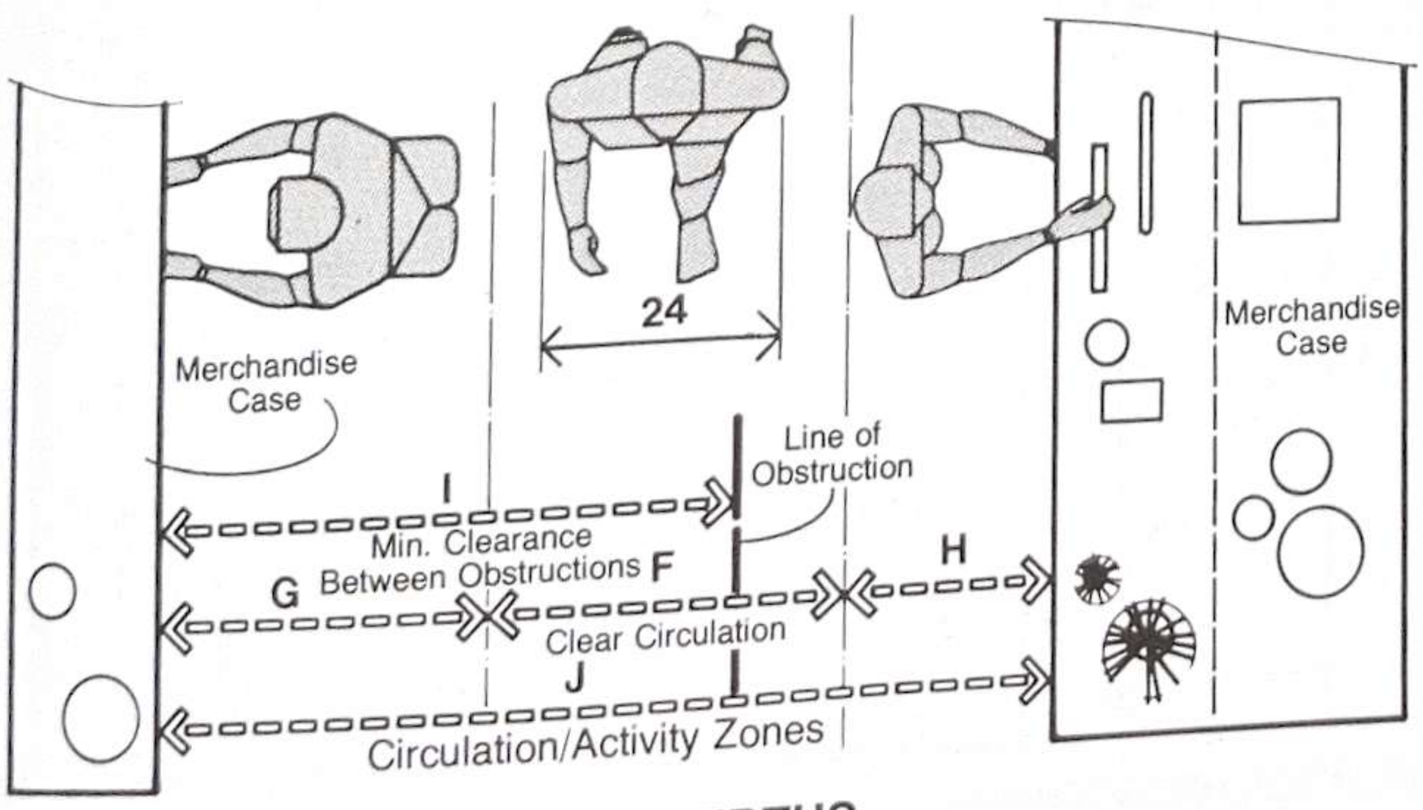
4.1 RETAIL SPACES

The top drawing illustrates the clearances suggested between counters on opposite sides of a main aisle. The total clearance suggested is between 117 and 120 in, or 297.2 and 304.8 cm. This allows an activity zone for standing customers facing the lower counter and a larger activity zone for standing and/or seated customers facing the upper counter, as well as a generous through circulation lane between the two.

The drawing at the bottom of the page illustrates the clearances suggested for a secondary aisle. The clearance in front of the merchandise case at the left takes into consideration a kneeling figure removing merchandise from a low shelf, while the clearance in front of the case on the right is only a minimum of 18 in, or 45.7 cm, which accommodates a person standing parallel to the case, either looking or handling merchandise displayed on the top surface. Although the maximum clearance between cases could be as much as 90 in, or 228.6 cm, a restricted minimum clearance of 51 in, or 129.5 cm, could be used if one is willing to accept some body contact or sidestepping required by a third person to pass between people engaged in activities on either side.



MAIN PUBLIC AISLE WIDTHS



SECONDARY PUBLIC AISLE WIDTHS

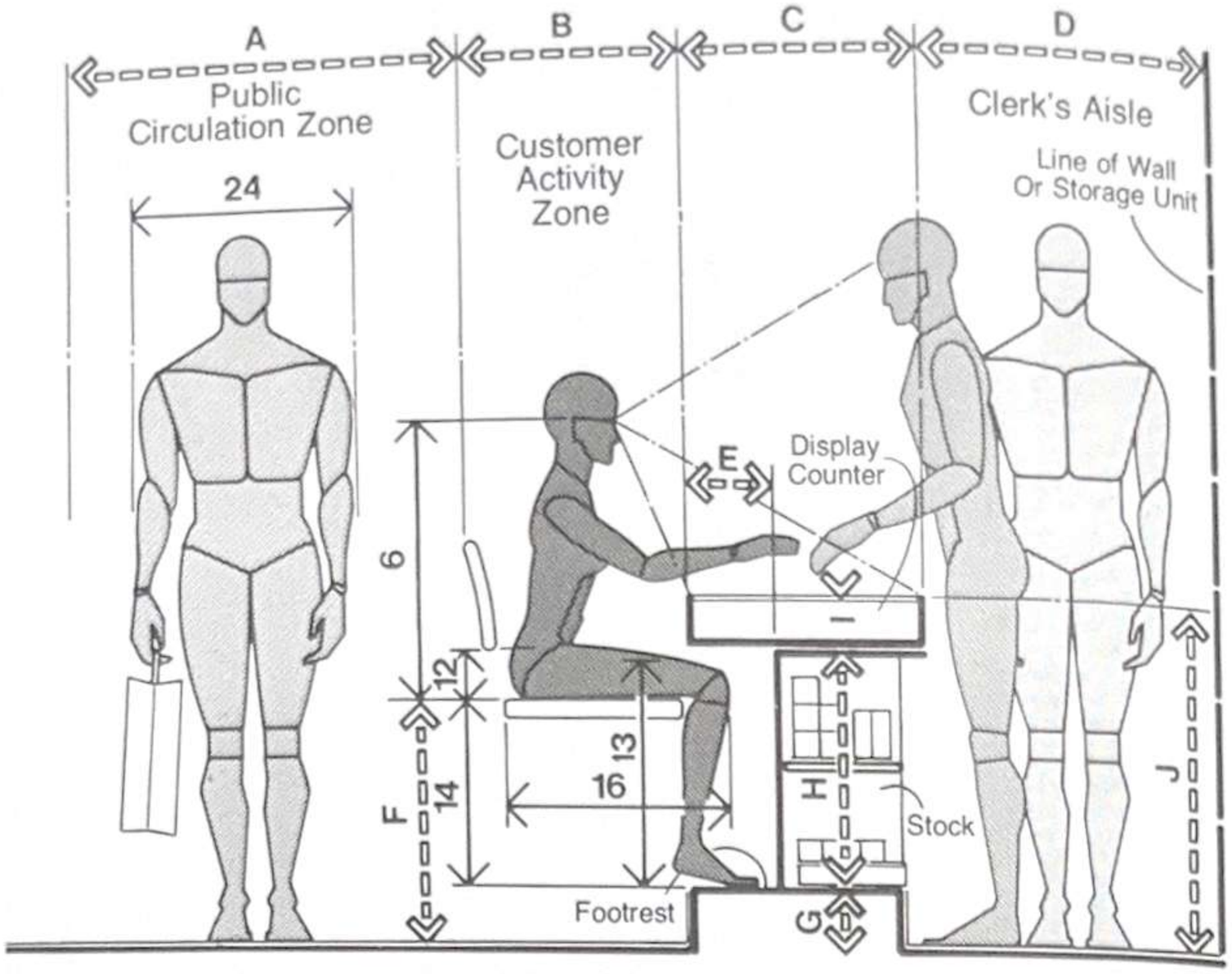
	in	cm
A	66 min.	167.6 min.
B	18	45.7
C	72	182.9
D	26–30	66.0–76.2
E	116–120	294.6–304.8
F	30–36	76.2–91.4
G	18–36	45.7–91.4
H	18 min.	45.7 min.
I	51 min.	129.5 min.
J	66–90	167.6–228.6

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4.1 RETAIL SPACES

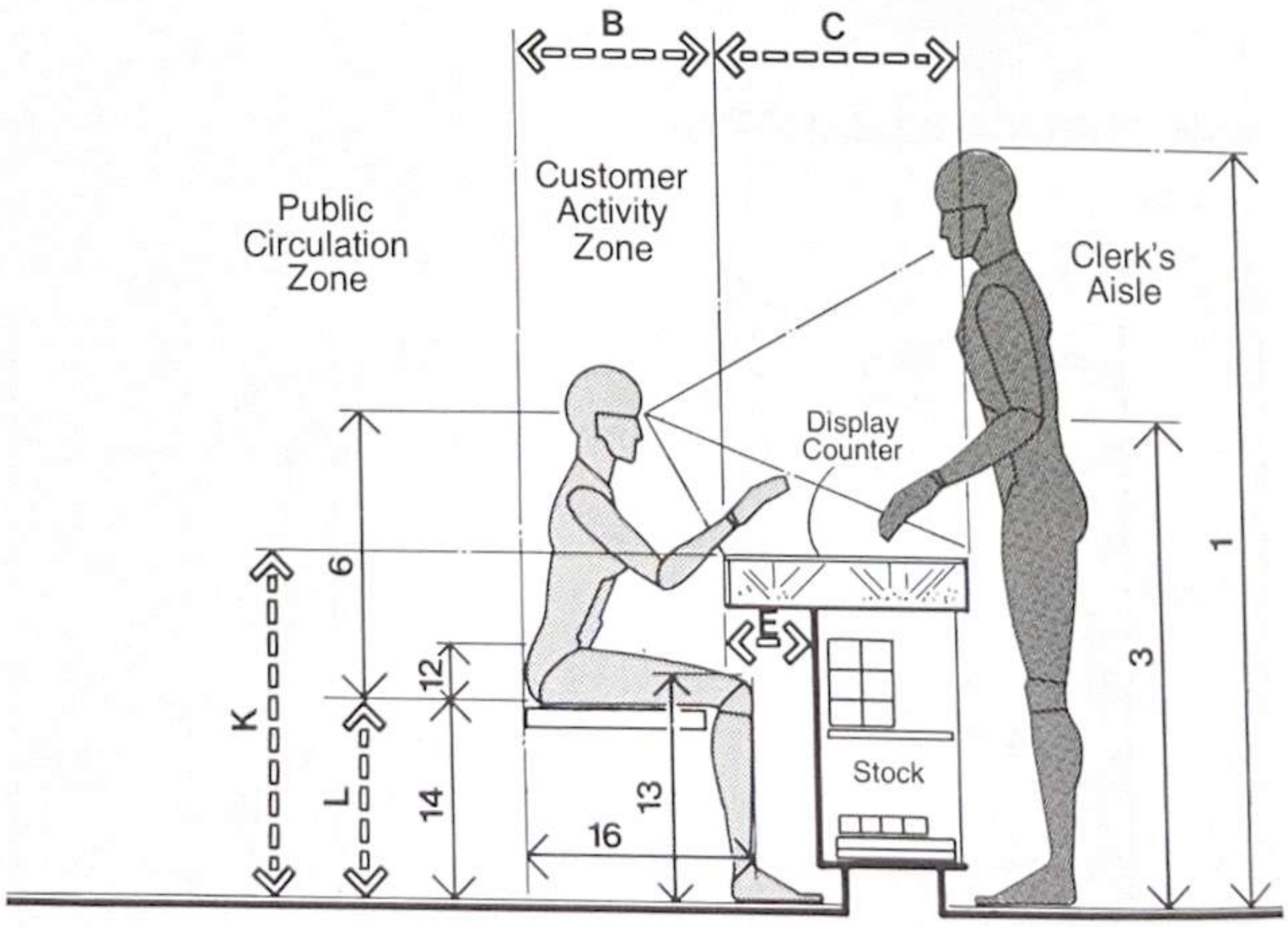
The drawing at the top of the page shows the clearances required for a medium height display counter. The suggested seat height of 21 to 22 in, or 53.3 to 55.8 cm, requires a footrest for the seated customer. The counter height shown will allow the display to be viewed by both the seated customer and the standing sales clerk. The customer activity zone allows adequate space for the chair. Knee height, buttock-knee length, popliteal height, and eye height sitting are all significant human dimensions to consider in the design of counters to be used by a seated customer.

The drawing at the bottom of the page is of a low 30-in, or 76.2-cm, display counter also for use by a seated customer. The anthropometric considerations are the same. Although the counter height is responsive to the anthropometric requirements of the seated customer, it is less than ideal for the standing clerk. For the standing user's optimum comfort, the counter height should be about 2 or 3 in, or 5 to 7.6 cm, below elbow height. This will allow a person to handle objects comfortably on the counter surface or use the counter as support for his or her arms. The 30-in height is too low to permit such use.



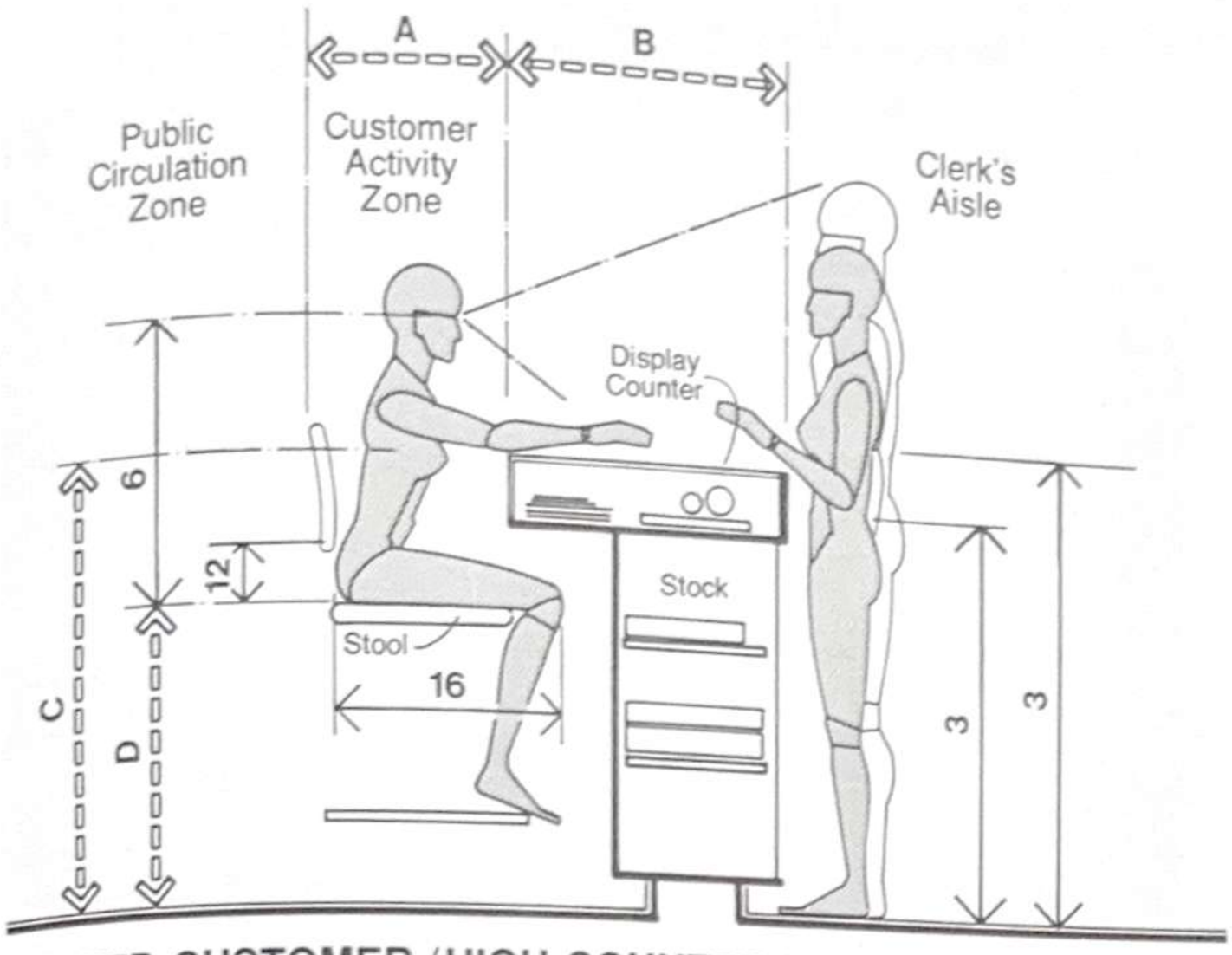
SEATED CUSTOMER / DESIRABLE COUNTER HEIGHT

	in	cm
A	36	91.4
B	26–30	66.0–76.2
C	18–24	45.7–61.0
D	30 min.	76.2 min.
E	10	25.4
F	21–22	53.3–55.9
G	5	12.7
H	23–25	58.4–63.5
I	4–6	10.2–15.2
J	34–36	86.4–91.4
K	30	76.2
L	16–17	40.6–43.2



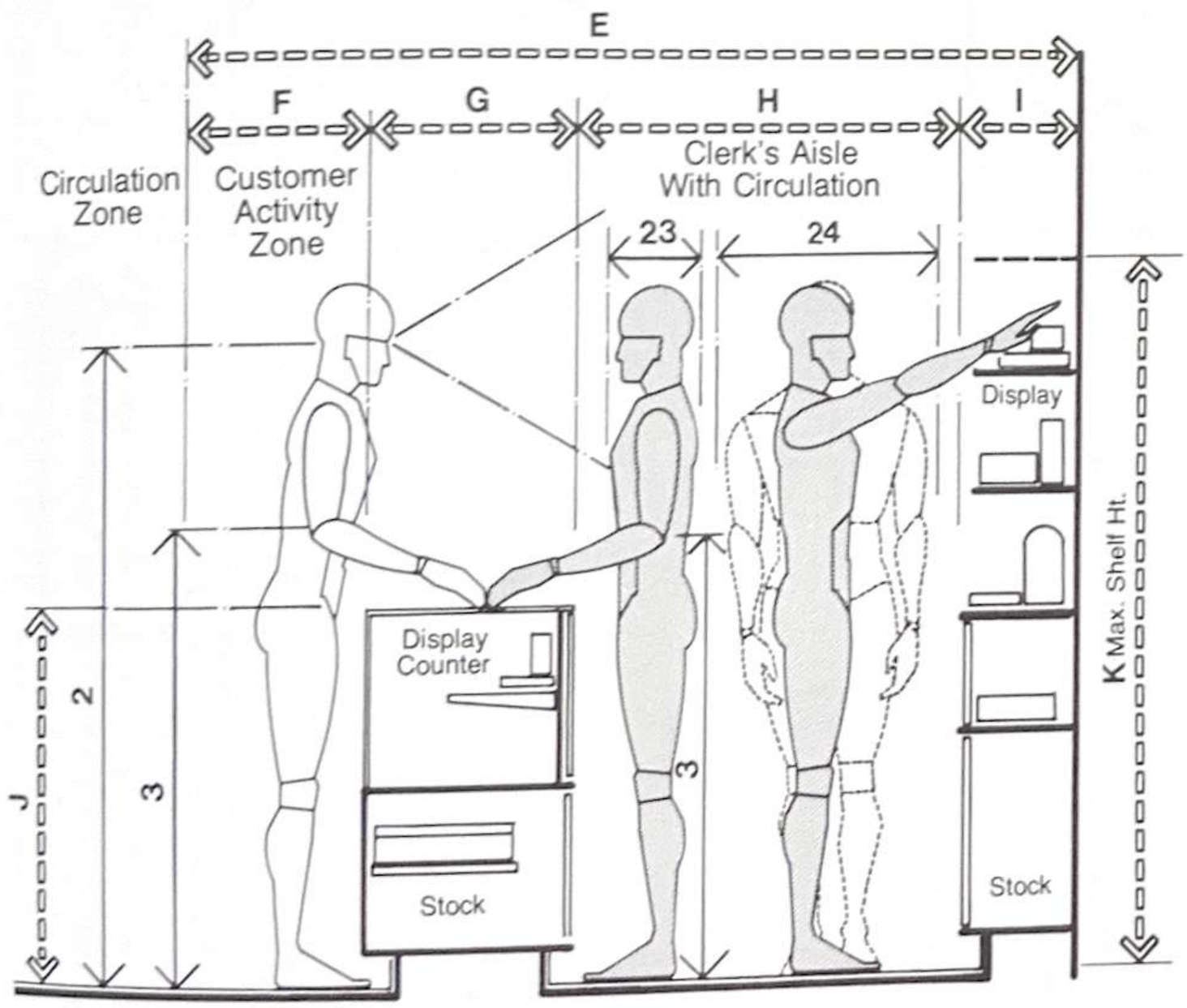
SEATED CUSTOMER / LOW COUNTER HEIGHT

4.1 RETAIL SPACES



SEATED CUSTOMER / HIGH COUNTER HEIGHT

The top drawing shows the clearances involved for a 42-in, or 106.7-cm, high counter to service a seated user. By filling the recess with an additional display, however, the counter can also be used exclusively as a typical sales counter. It should be noted, however, that although sometimes used for special display situations, such a counter height is not recommended. Both the customer and the sales clerk of smaller body size would find coping with such a height uncomfortable anthropometrically, particularly when one considers that the counter would be higher than the elbow height of slightly over 5 percent of the population. From a merchandising viewpoint, where customer convenience is of paramount importance, it would be unwise to exceed 39 to 40 in, or 99 to 101.6 cm, as a counter height. In addition, the smaller sales clerk forced to tend such a counter for extended periods of time could be subjected to severe backaches and pains. Getting on and off a high stool for elderly and disabled people or those of smaller body size can be not only difficult, but hazardous. The bottom drawing illustrates the clearances for a typical sales counter.



TYPICAL SALES AREA / STANDING CUSTOMER

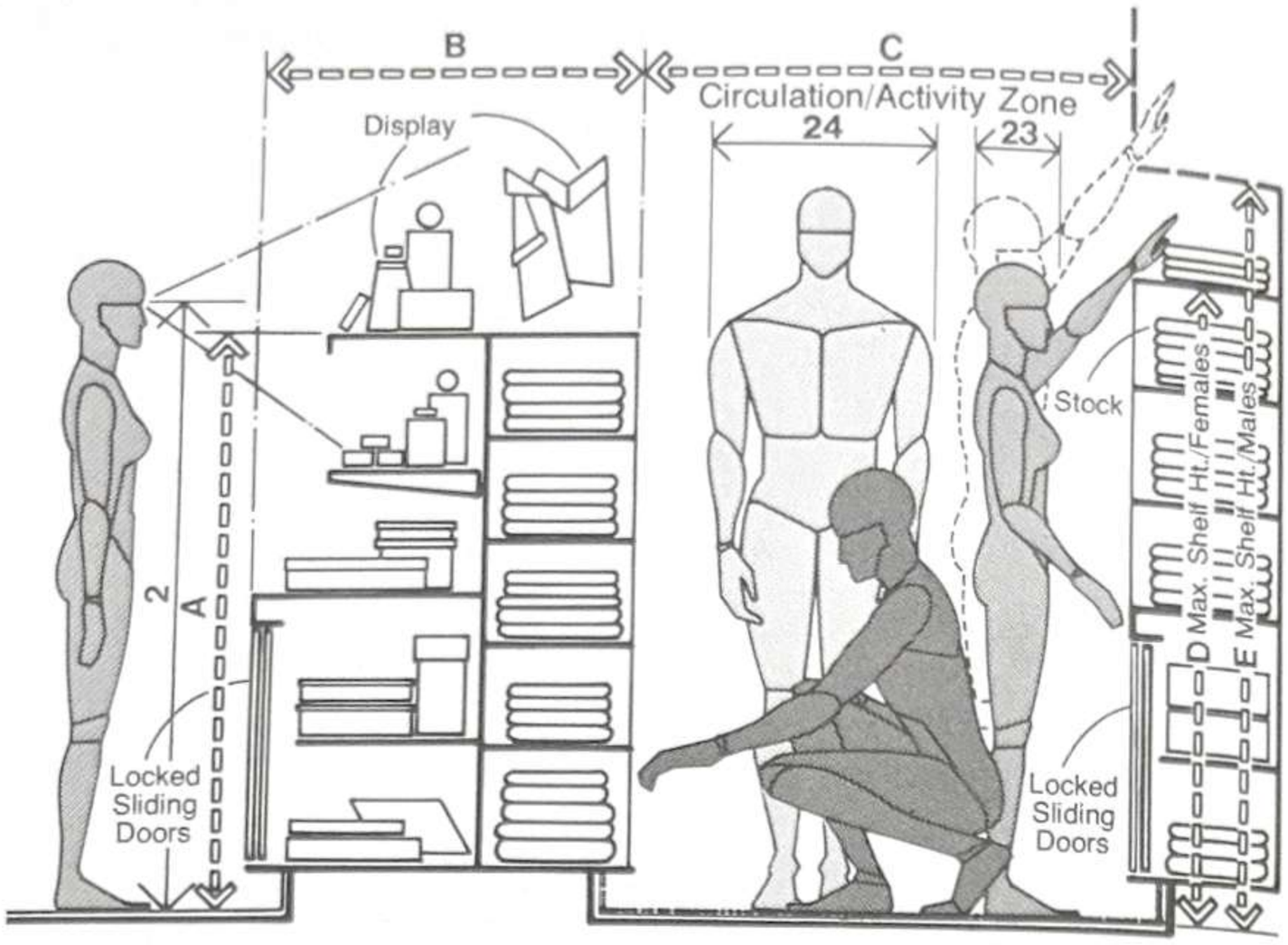
	in	cm
A	26–30	66.0–76.2
B	18–24	45.7–61.0
C	42	106.7
D	28	71.1
E	84–112	213.4–284.5
F	18	45.7
G	18–24	45.7–61.0
H	30–48	76.2–121.9
I	18–22	45.7–55.9
J	35–38	88.9–96.5
K	72	182.9

Printed in China

4.1 RETAIL SPACES

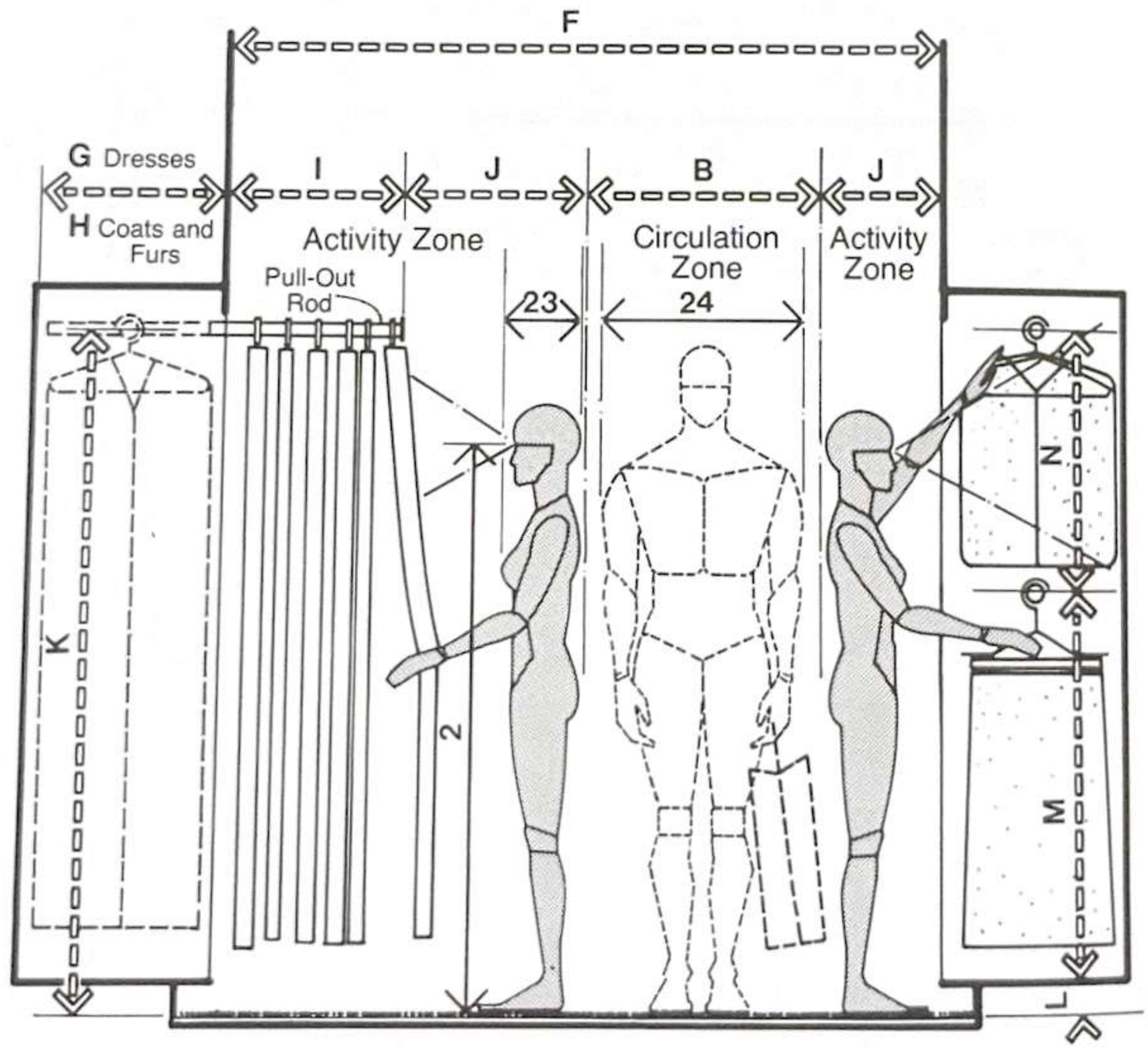
Shelving is probably used more than any other single interior component for the storage and/or display of merchandise. Not only must the merchandise be within reach anthropometrically, but it must be fairly visible as well. The heights established must therefore be responsive to vertical grip reach dimensions as well as to eye height. In establishing height limits, the body size data of the smaller person should be used. Since in retail spaces, departments may cater exclusively to members of one sex or the other, two sets of data are presented. One is based on the body size of the smaller female and the other on the body size of the smaller male. The suggested heights reflect a compromise between reach requirements and visibility requirements.

The drawing at the bottom of the page illustrates the clearances involved in hanging-type merchandise cases. Rod heights should be related not only to human reach limitations, but in certain cases to the sizes of the merchandise displayed. There is usually no conflict in respect to garments.

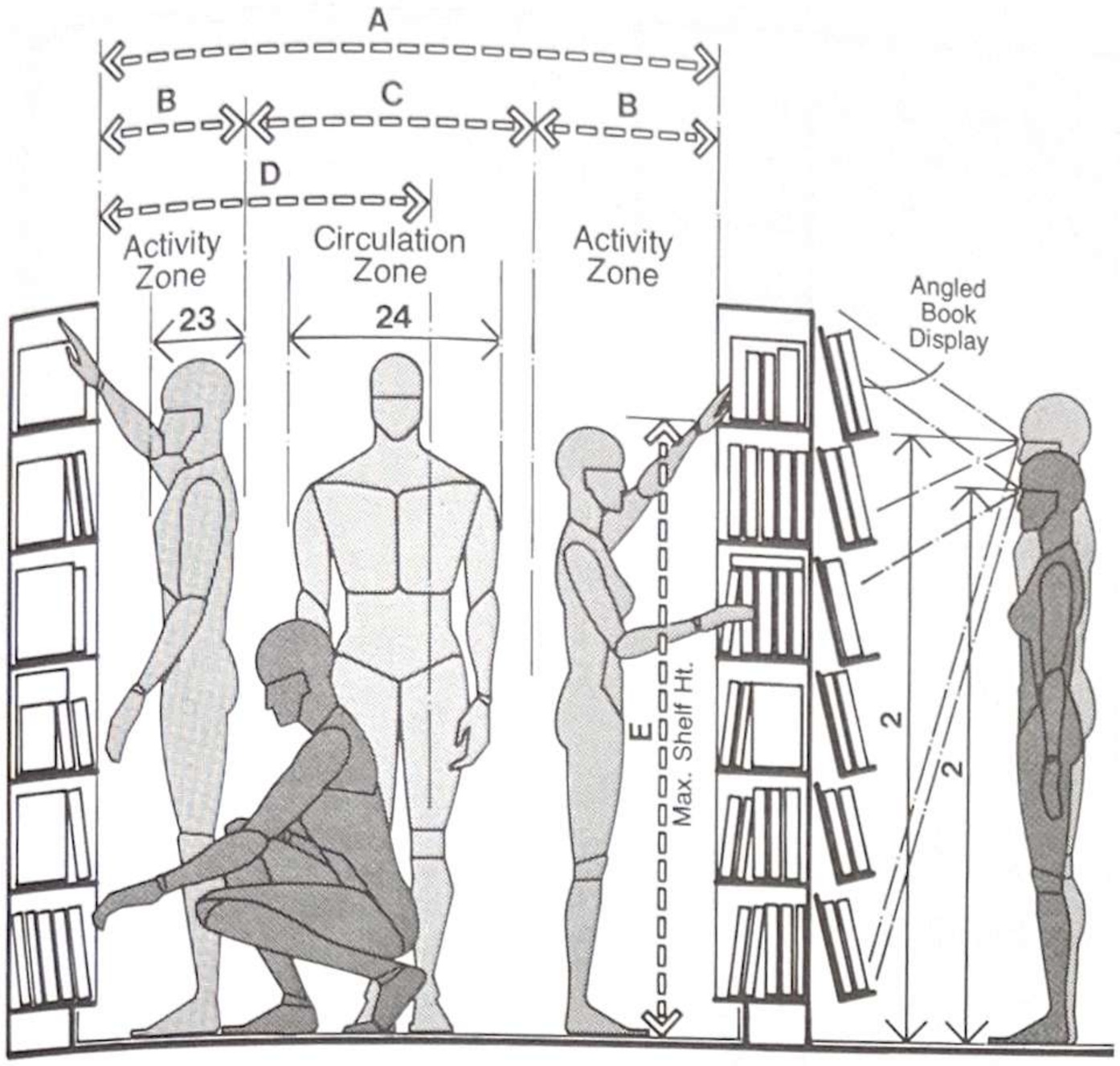


TYPICAL MERCHANDISE CASES

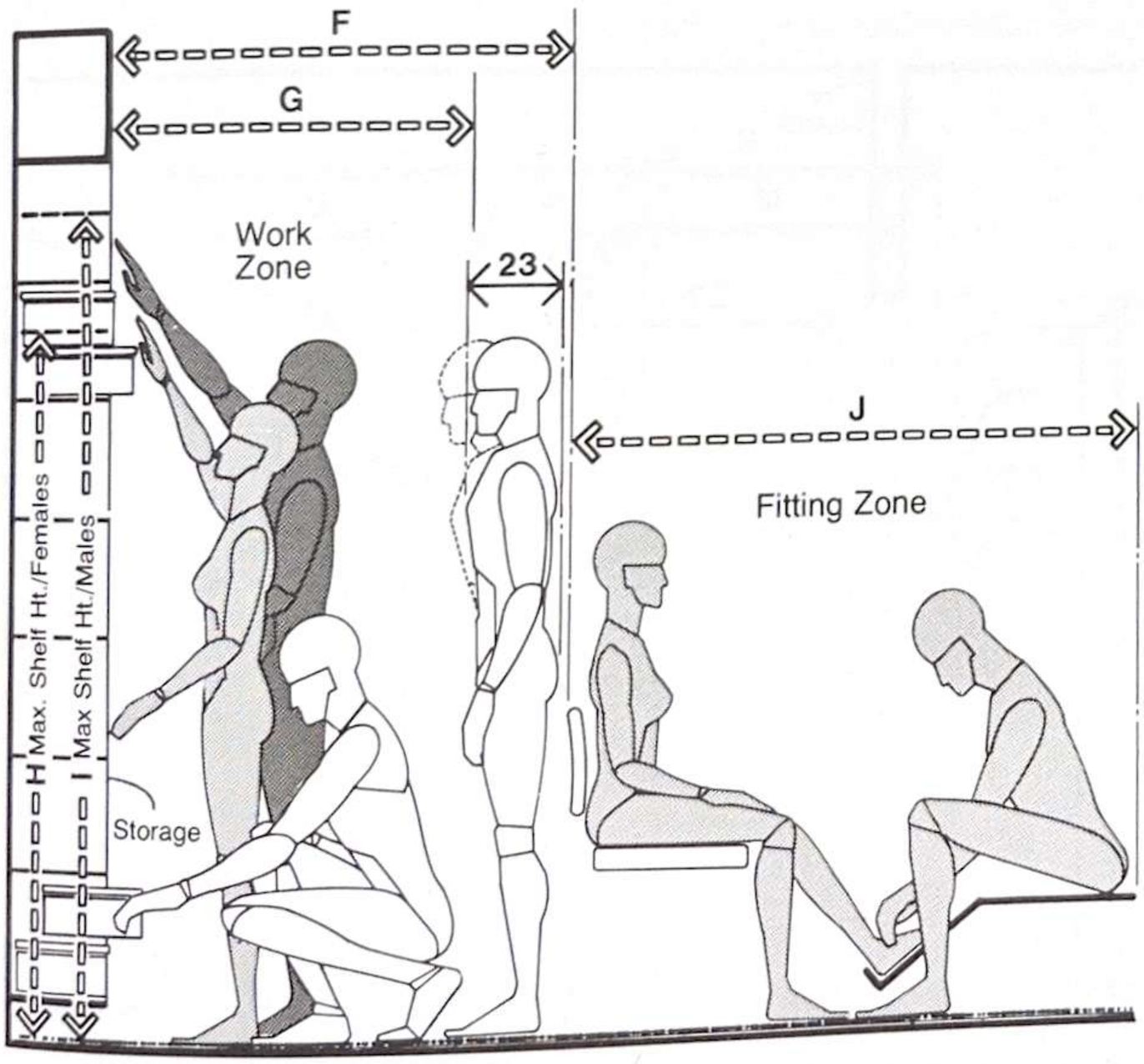
	in	cm
A	48 max.	121.9 max.
B	30–36	76.2–91.4
C	51 min.	129.5 min.
D	66	167.6
E	72	182.9
F	84–96	213.4–243.8
G	20–26	50.8–66.0
H	28–30	71.1–76.2
I	18–24	45.7–61.0
J	18 min.	45.7 min.
K	72 max.	182.9 max.
L	4	10.2
M	42	106.7
N	26 min.	66.0 min.



HANGING MERCHANDISE CASES



BOOK STORE / DISPLAY AREA



SHOE STORE / FITTING AREA

4.1 RETAIL SPACES

The drawing at the top of the page concerns book and magazine displays and suggests the anthropometric considerations involved. The rationale is essentially the same as that indicated for the general merchandise shelving on the preceding page. In regard to books, however, the question of visibility is even more critical. To perceive the basic form, shape, and color of general merchandise may be sufficient, but for books and magazines, the legibility of printed matter must be taken into account. The distance between the customer and the display, lighting, and angle of sight should all be considered. It is suggested that to supplement the information shown on the drawing, Sections 9.1 and 9.2 also be consulted.

The drawing at the bottom of the page deals with human dimension and the fitting area of a shoe store. The fitting zone clearance should accommodate the body size of the seated customer and that of the sales clerk. The 60 to 66 in, or 152.4 to 167.6 cm, clearance should be viewed as a minimum. The buttock-heel length of the larger person was considered in anthropometrically establishing the clearance dimension. In regard to the workzone, vertical grip reach measurements of the smaller male and female should be used in establishing shelf heights, while maximum body breadth and maximum body depth of the larger person should be considered in establishing clearances.

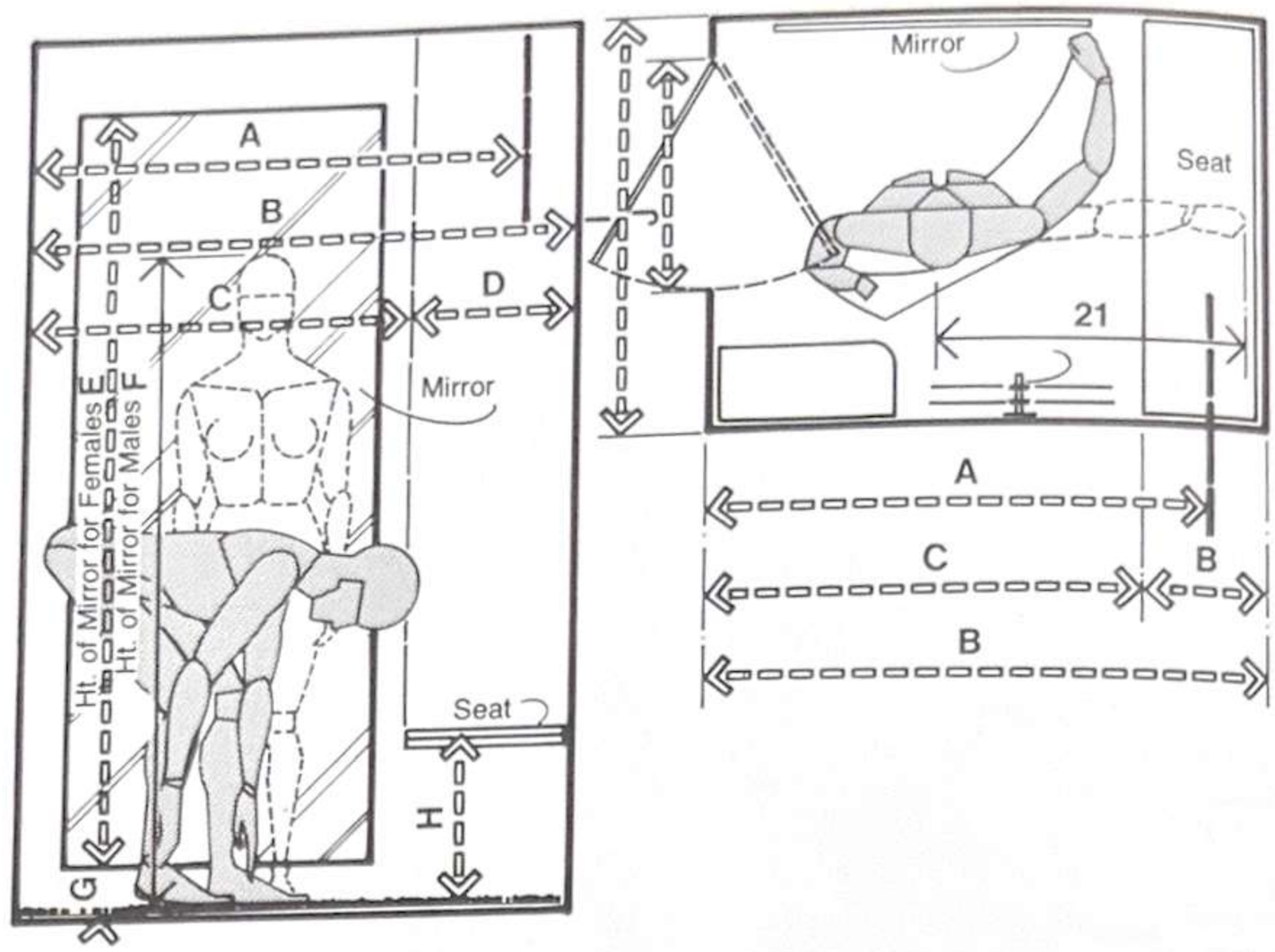
	in	cm
A	66 min.	167.6 min.
B	18 min.	45.7 min.
C	30 min.	76.2 min.
D	36	91.4
E	68	172.7
F	48	121.9
G	36 min.	91.4 min.
H	66	167.6
I	72	182.9
J	60–66	152.4–167.6

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4.1 RETAIL SPACES

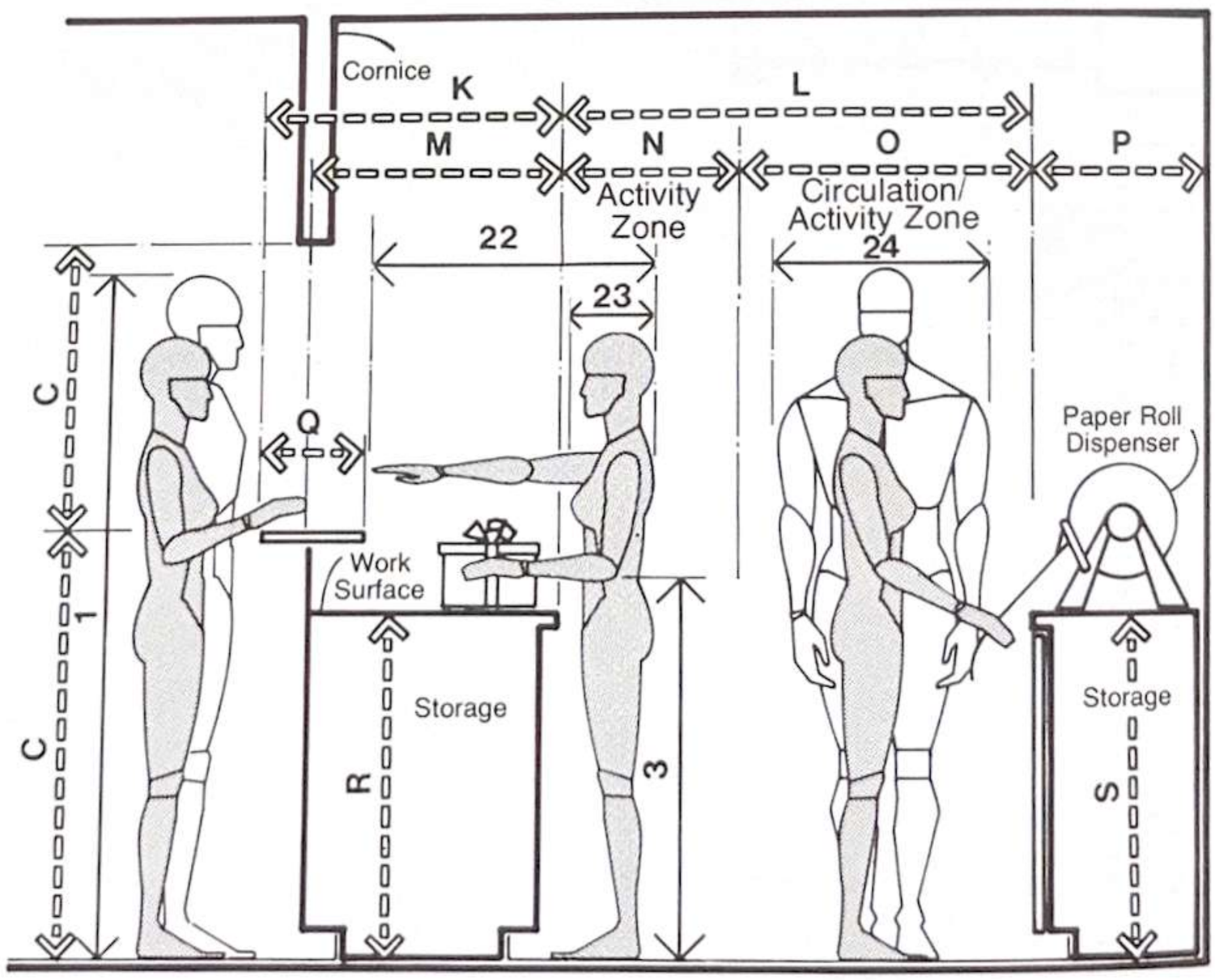
Dressing rooms should accommodate the human body in the various positions a person assumes while in the process of dressing and disrobing. The drawing at the top of the page suggests a room size of 54 to 60 in, or 137.2 to 152.4 cm, by a minimum width of 36 in, or 91.4 cm. Stature, maximum body breadth, minimum body depth, and side arm reach of the larger person should all be considered in determining dressing room size.

The drawing at the bottom of the page illustrates some of the clearances required for a wrapping counter. Given the nature of the activity involved, a counter height of 35 to 36 in, or 88.9 to 91.4 cm, would accommodate the majority of people. Horizontal clearances must accommodate the maximum body depth of the larger person within the activity zone, and the maximum body breadth of the larger person in the circulation zone. Depending on the intensity of the operation and the number of clerks, the circulation and the activity zone can be combined and the clearance between the front and rear counter reduced to 30 in, or 76.2 cm.



DRESSING ROOMS

	in	cm
A	48 min.	121.9 min.
B	54–58	137.2–147.3
C	42	106.7
D	12–16	30.5–40.6
E	68 min.	172.7 min.
F	75 min.	190.5 min.
G	4	10.2
H	16	40.6
I	36 min.	91.4 min.
J	24	61.0
K	29–32	73.7–81.3
L	48	121.9
M	26	66.0
N	18	45.7
O	30	76.2
P	18–24	45.7–61.0
Q	6–10	15.2–25.4
R	35–36	88.9–91.4
S	35	88.9



WRAPPING COUNTER

4.2 FOOD STORES

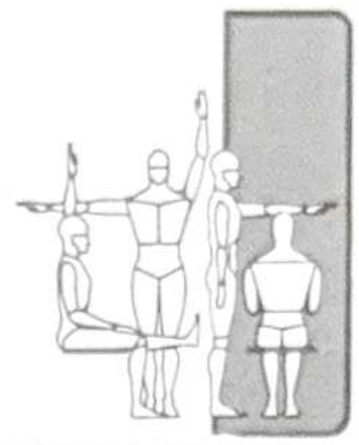


TABLE	DISPLAY	SHOPPING	CHECKOUT	ACTIVITIES / ANTHROPOMETRIC DATA	
1A,2B	◐	◐		1	STATURE
1B,3C	◐	◐		2	EYE HEIGHT
1U,4E		○	○	21	SIDE ARM REACH
1V,4D		○	○	22	THUMB TIP REACH
1W,6B		●		23	MAXIMUM BODY DEPTH
1X,6A		●	●	24	MAXIMUM BODY BREADTH

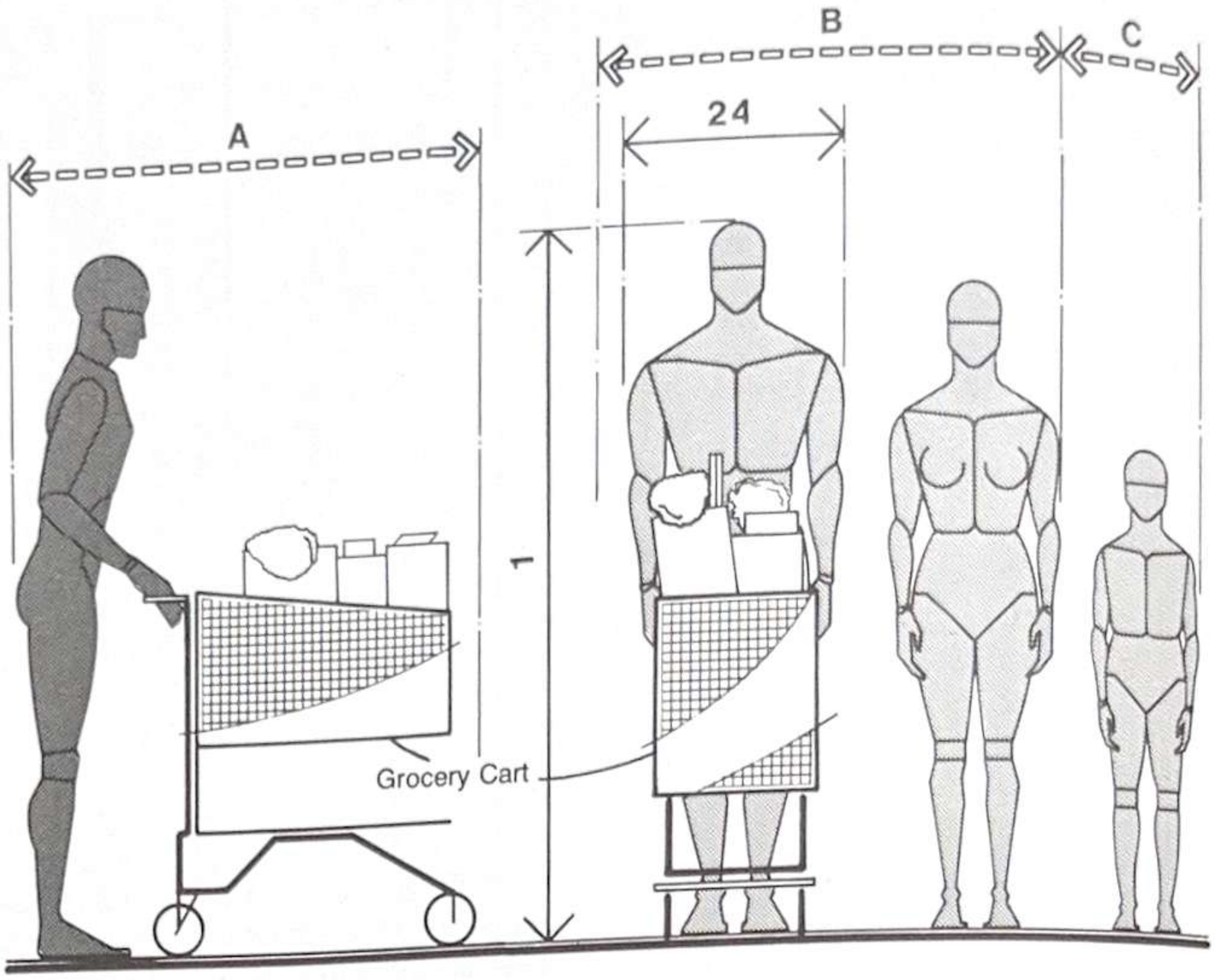
When considering the implication of human dimensions in relation to the design of self-service food stores, the shopping cart should be viewed as an extension of the human figure and the combined measurements as a unit to be accommodated for purposes of establishing necessary clearances. This is more critical in terms of overall length than width considerations, since the maximum body breadth dimension, particularly of those of larger body size, is also sufficient to accommodate the width of the cart itself. Height of shelving for display of merchandise should be responsive to the reach limitations of the smaller shopper, and the display of merchandise should relate to the eye height of the majority of users. Depending on store size and economics, width of aisles should include an activity zone directly adjacent to the merchandise display unit adequate to accommodate a standing or kneeling user, who is scanning shelves, selecting goods, or loading a cart, as well as a circulation zone that could accommodate two lanes of shoppers with carts. Clearances between checkout booths should be adequate to accommodate a wheelchair-bound shopper. The situations discussed are included among the illustrations found on the following pages together with dimensional suggestions for use in making preliminary design assumptions. The anthropometric measurements of major consideration are indicated in the above matrix.

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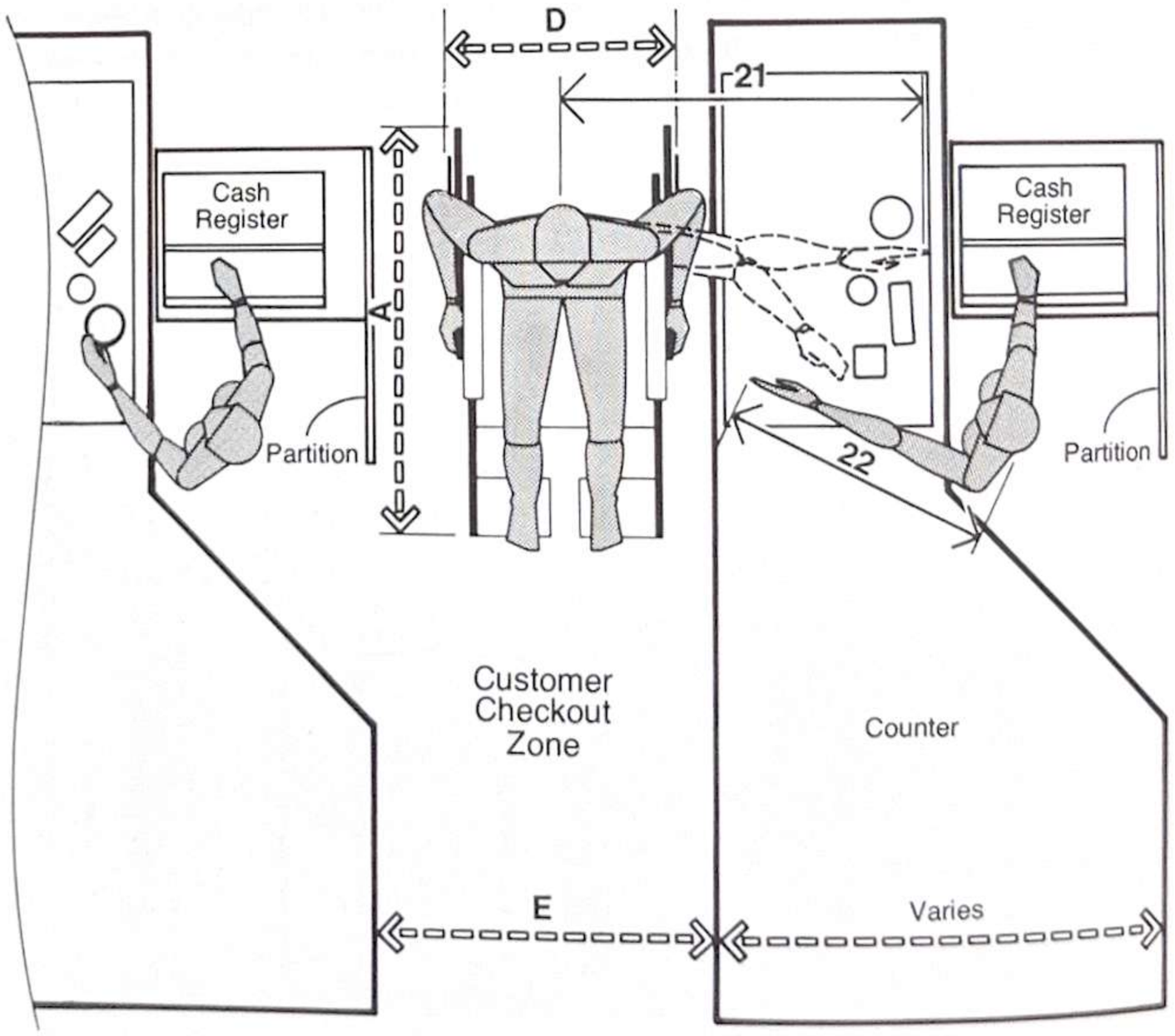
4.2 FOOD STORES

The drawing at the top left shows the overall clearance required by a customer and shopping cart to be about 42 in, or 106.7 cm. The clearance required to accommodate a man and woman abreast is illustrated in the drawing at top right and shown to be 60 in, or 52.4 cm. To allow for a small child, an additional 18 in, or 45.7 cm, should be added. Maximum body breadth is the key body measurement to consider anthropometrically.

The drawing at the bottom of the page illustrates the clearances necessary between typical checkout counters. A clearance of a minimum of 36 in, or 91.4 cm, will accommodate not only the able-bodied customer, but also the wheelchair shopper. The overall dimensions of the wheelchair itself are 25 by 42 in, or 63.5 by 106.7 cm.



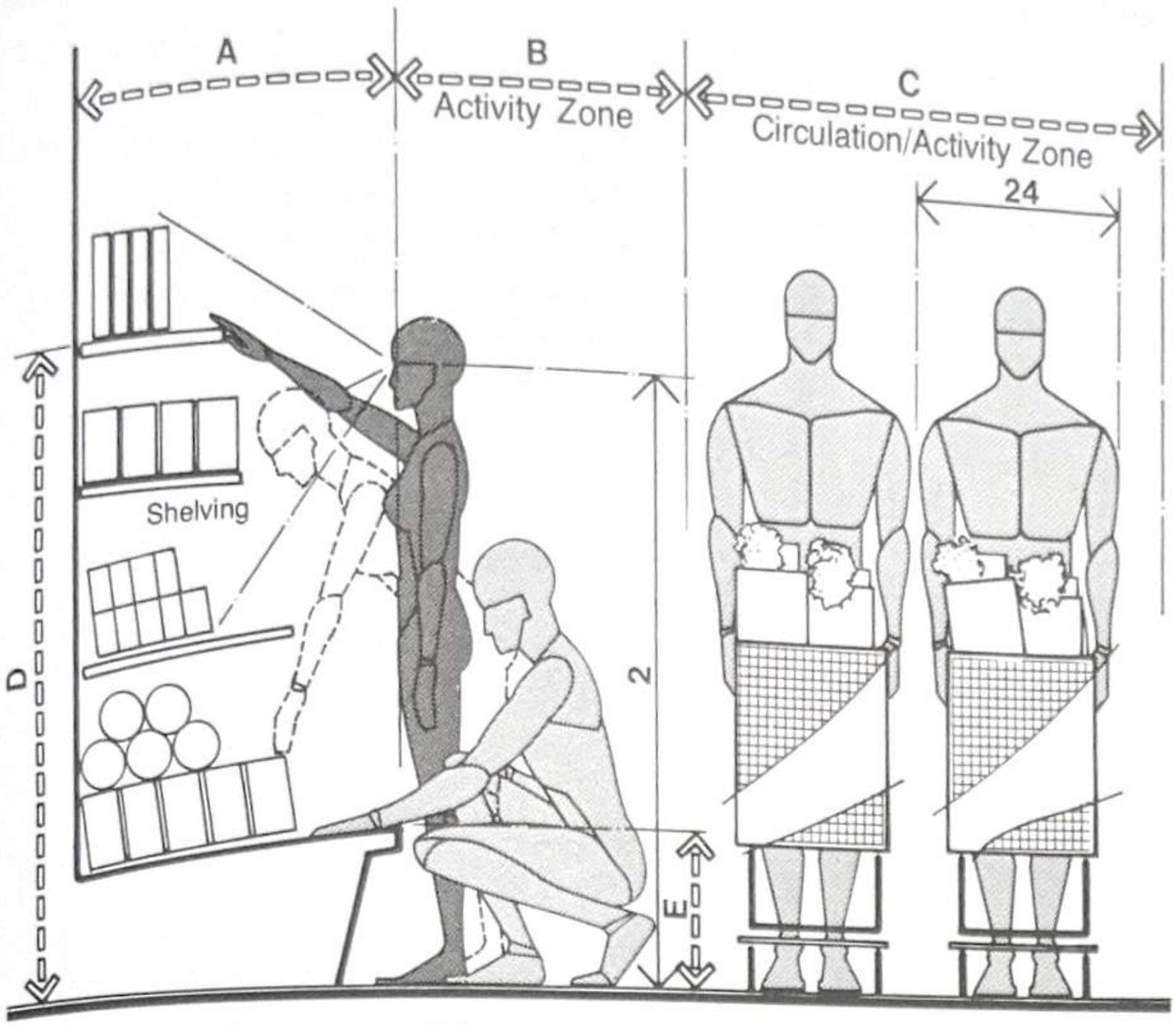
CUSTOMER CLEARANCES



CHECKOUT AREA / WHEELCHAIR CLEARANCE

	in	cm
A	42	106.7
B	60	152.4
C	18	45.7
D	25	63.5
E	36 min.	91.4 min.

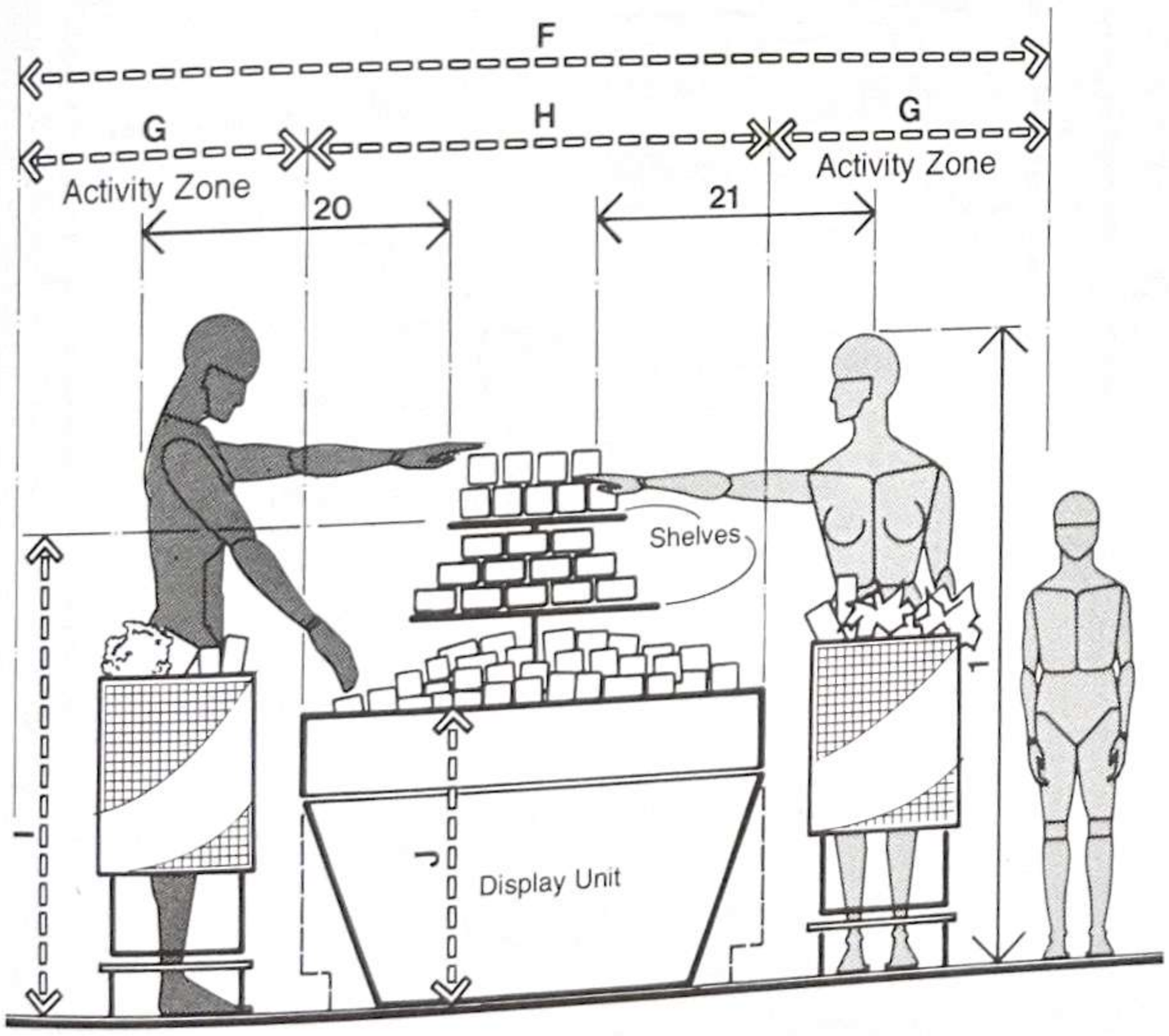
4.2 FOOD STORES



SUPER-SHELVING WITH CIRCULATION

The drawing at the top of the page illustrates the clearances related to a supermarket shelving display. An allowance of a minimum of 36 in, or 91.4 cm, in front of the shelving should be provided to accommodate the kneeling figure. An additional 60 in, or 152.4 cm, will accommodate two shoppers walking abreast.

The drawing at the bottom of the page provides information on clearances required for an island display. A space of 30 in, or 76.2 cm, on either side of the counter should be adequate for shopper activity related to the handling of merchandise on display. Maximum body breadth or cart width, whichever is greater, should be the key dimension. The 30-in dimension accommodates both. It should be noted that this clearance is for the activity zone exclusively. It is assumed in the drawing that circulation will be accommodated outside this zone.



ISLAND DISPLAY

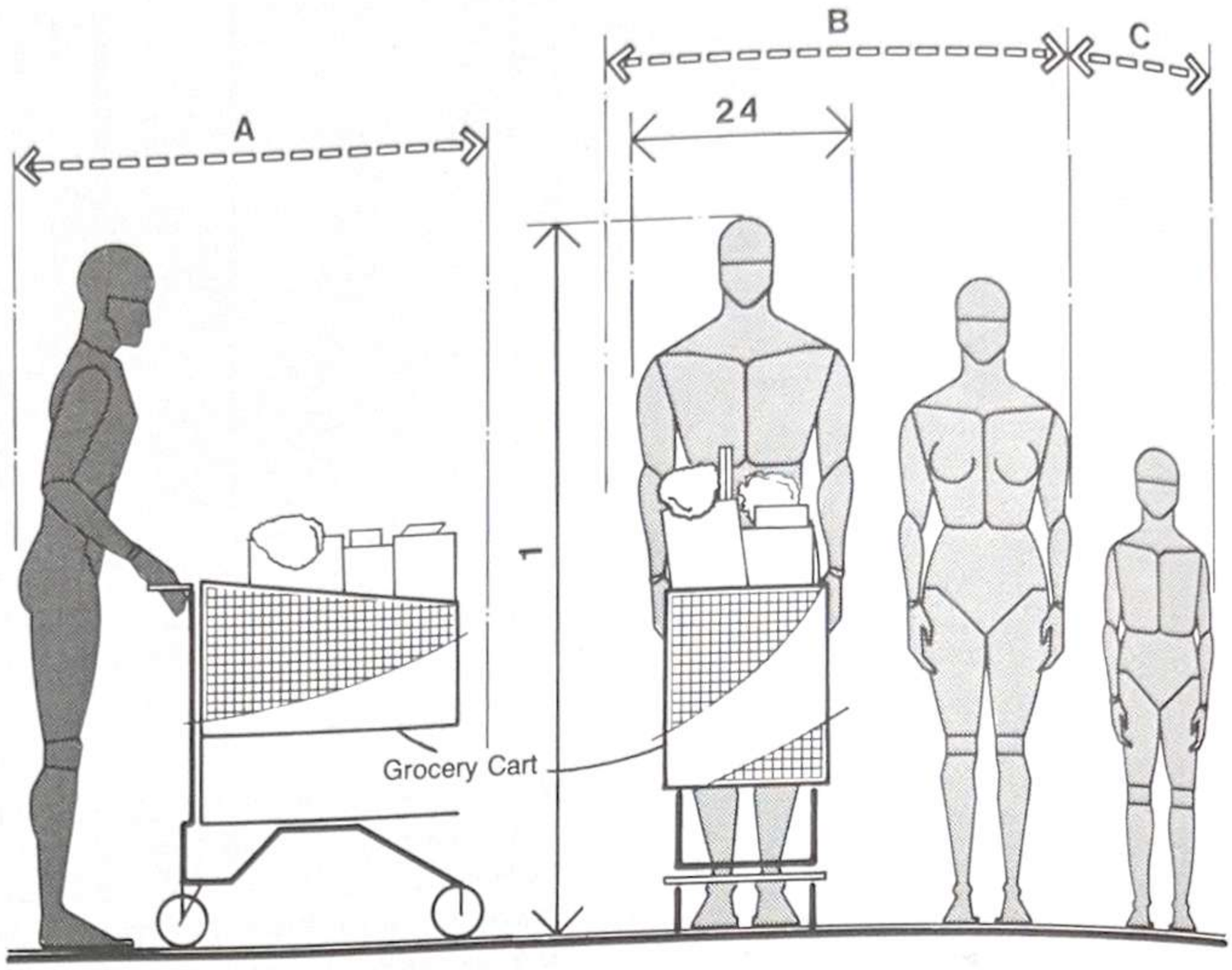
	in	cm
A	32	81.3
B	36 max.	91.4 max.
C	60	152.4
D	63 max.	160.0 max.
E	15 max.	38.1 max.
F	108	274.3
G	30	76.2
H	48	121.9
I	48 max.	121.9 max.
J	30–32	76.2–81.3

Printed in China

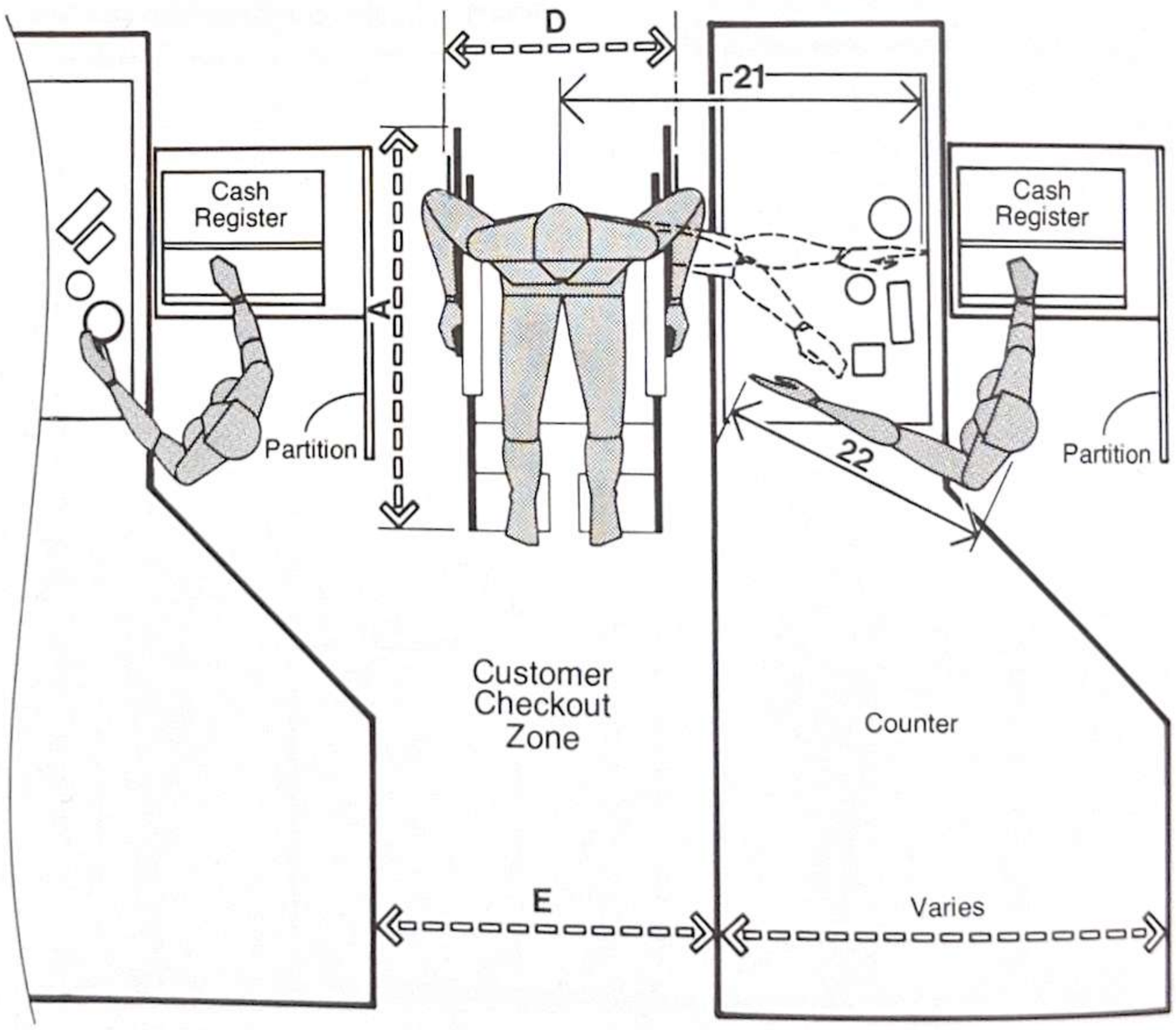
4.2 FOOD STORES

The drawing at the top left shows the overall clearance required by a customer and shopping cart to be about 42 in, or 106.7 cm. The clearance required to accommodate a man and woman abreast is illustrated in the drawing at top right and shown to be 60 in, or 52.4 cm. To allow for a small child, an additional 18 in, or 45.7 cm, should be added. Maximum body breadth is the key body measurement to consider anthropometrically.

The drawing at the bottom of the page illustrates the clearances necessary between typical checkout counters. A clearance of a minimum of 36 in, or 91.4 cm, will accommodate not only the able-bodied customer, but also the wheelchair shopper. The overall dimensions of the wheelchair itself are 25 by 42 in, or 63.5 by 106.7 cm.



CUSTOMER CLEARANCES



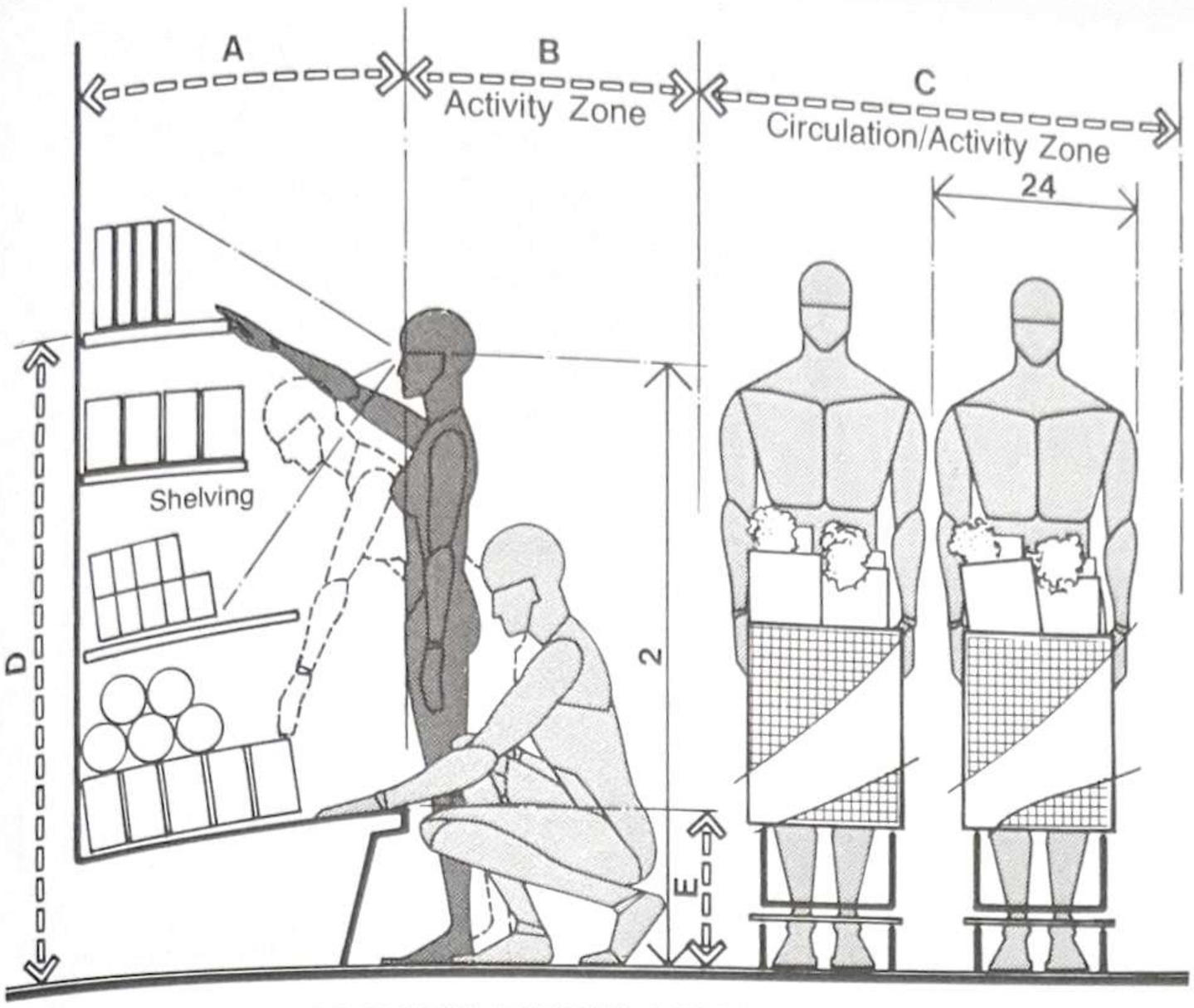
CHECKOUT AREA / WHEELCHAIR CLEARANCE

	in	cm
A	42	106.7
B	60	152.4
C	18	45.7
D	25	63.5
E	36 min.	91.4 min.

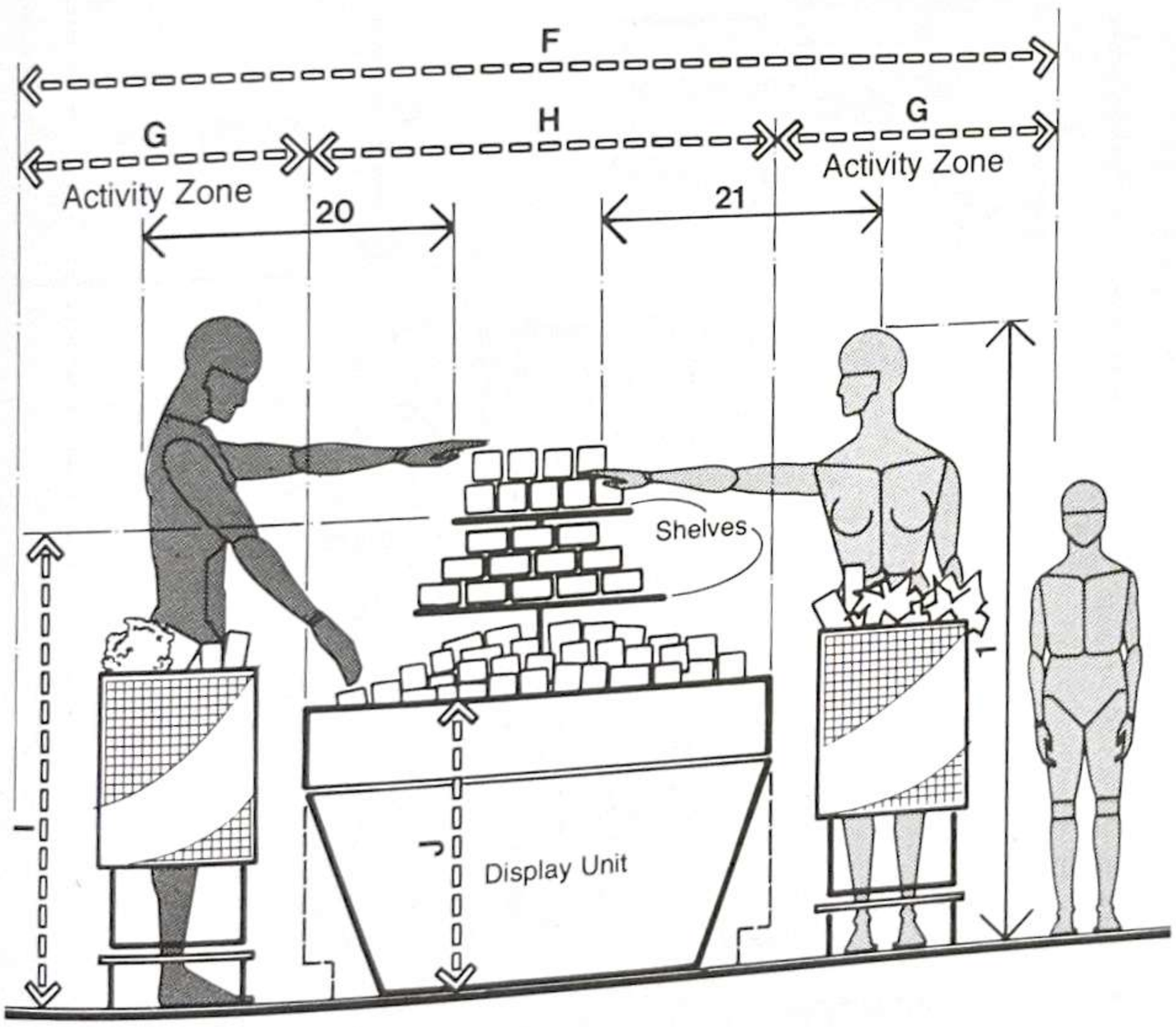
4.2 FOOD STORES

The drawing at the top of the page illustrates the clearances related to a supermarket shelving display. An allowance of a minimum of 36 in, or 91.4 cm, in front of the shelving should be provided to accommodate the kneeling figure. An additional 60 in, or 152.4 cm, will accommodate two shoppers walking abreast.

The drawing at the bottom of the page provides information on clearances required for an island display. A space of 30 in, or 76.2 cm, on either side of the counter should be adequate for shopper activity related to the handling of merchandise on display. Maximum body breadth or cart width, whichever is greater, should be the key dimension. The 30-in dimension accommodates both. It should be noted that this clearance is for the activity zone exclusively. It is assumed in the drawing that circulation will be accommodated outside this zone.



SUPER-SHELVING WITH CIRCULATION



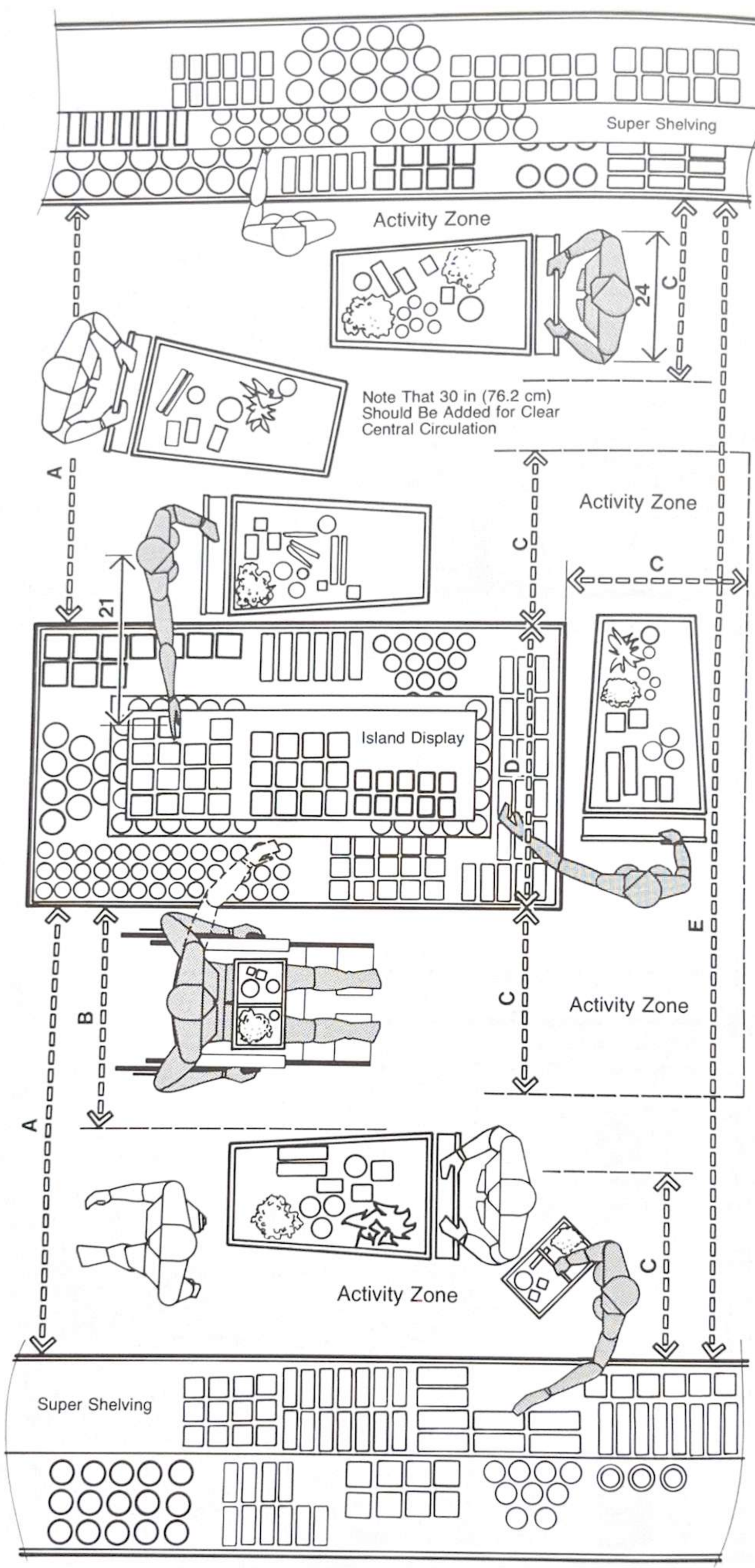
	in	cm
A	32	81.3
B	36 max.	91.4 max.
C	60	152.4
D	63 max.	160.0 max.
E	15 max.	38.1 max.
F	108	274.3
G	30	76.2
H	48	121.9
I	48 max.	121.9 max.
J	30–32	76.2–81.3

ISLAND DISPLAY

Printed in China

4.2 FOOD STORES

The comprehensive drawing here incorporates some of the isolated pieces of information shown on the preceding pages. It also provides minimum clearances between shelving and island displays. As suggested, the 72-in, or 189.9-cm, clearances between food displays are minimum. Although a 72-in clearance accommodates a shopper and cart adjacent to each of the opposing food displays, circulation for a third shopper to pass between them would be restricted. One of the two shoppers on either side would be obligated to move out of the way to permit passage. To accommodate clear central circulation, an additional 30 in, or 76.3 cm, should be added to the 72-in minimum clearance, providing a total clearance between food displays of at least 102 in, or 259 cm.



	in	cm
A	72 min.	182.9 min.
B	36	91.4
C	30 min.	76.2 min.
D	48	121.9
E	192	487.7

AISLE CLEARANCES

4.3 HAIR STYLING

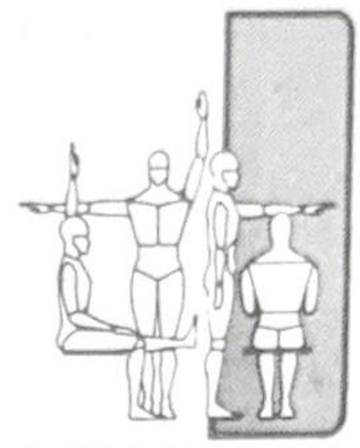


TABLE	STYLING	SHAMPOOING	DRYING	WAITING	CIRCULATION	ACTIVITIES / ANTHROPOMETRIC DATA
1A,2B	●	◑				1 STATURE
1B,3C	●					2 EYE HEIGHT
1C,3B		◑				3 ELBOW HEIGHT
1F,3G	○					6 EYE HEIGHT SITTING
1G,3E		◑				7 SHOULDER HEIGHT SITTING
1Q,3F			●	●		17 BUTTOCK-TOE LENGTH
1U,4E	○					21 SIDE ARM REACH
1W,6B	●				●	23 MAXIMUM BODY DEPTH
1X,6A		●			●	24 MAXIMUM BODY BREADTH

One of the most important considerations in making hair styling spaces responsive to human dimension is that of adjustability. Given the tremendous variability in body size, both in terms of the customer and the stylist and the nature of the activity involved, it is virtually impossible to accommodate the majority of people without some degree of adjustability to compensate for the great variability in body size. The range of adjustment possible in most standard chairs on the market is not great enough. The styling operation, for example, requires the operator to style the hair of the seated customer about the lower head, neck, and shoulder areas. Not only is it essential that the stylist have a clear view of the work area, but in many instances he or she must be able to step back and check for smoothness and level of cut. Even with the chair elevated to its maximum position, the taller stylist must still stoop to perform his work. Until such time that more chairs with a greater range of adjustability become available, the interior designer or architect should explore other ways to make the operation more responsive to the limitations imposed by human dimension and body size.

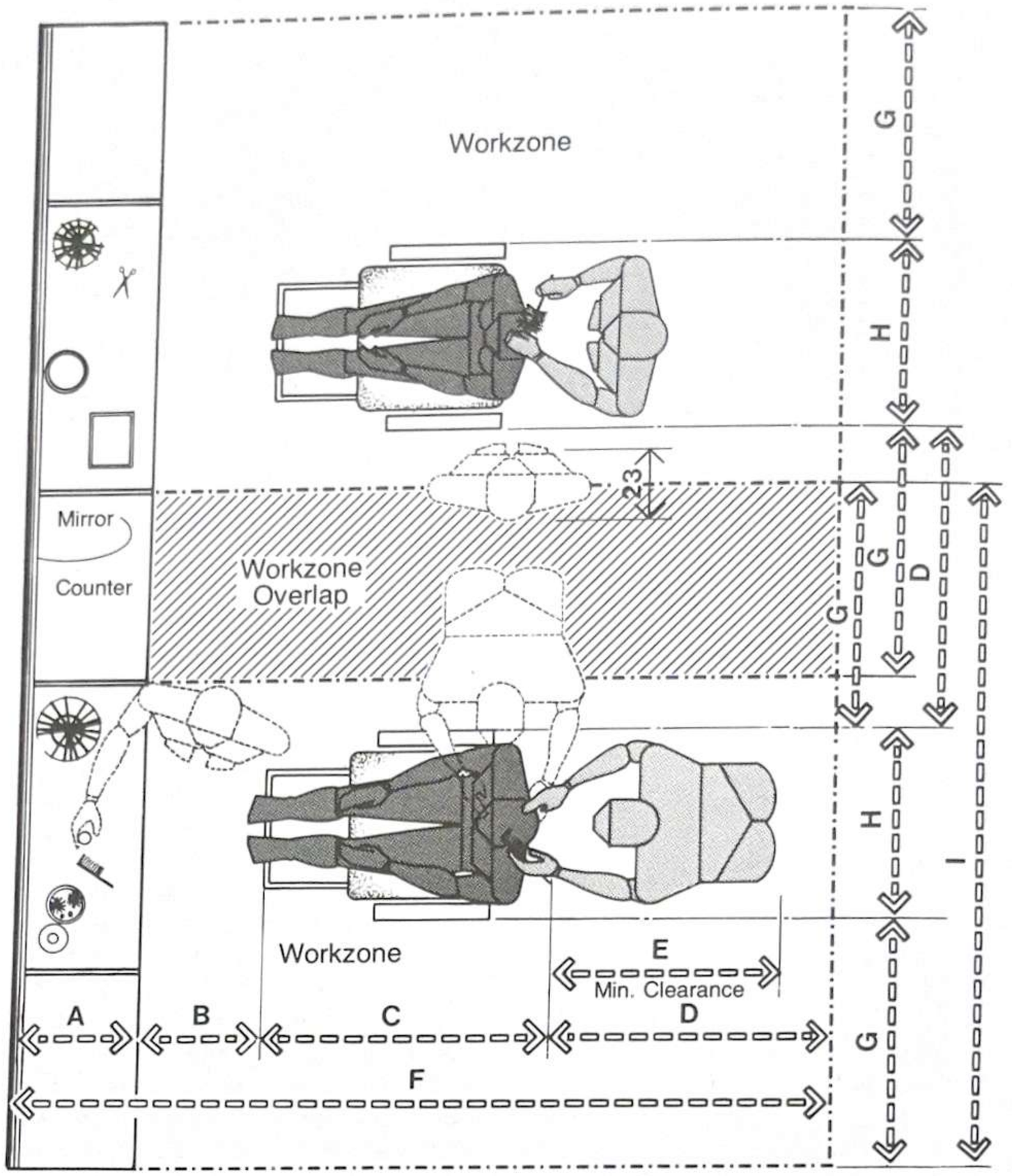
Another area where much improvement is needed is the interface among customer, chair, wash basin, and operator in the typical shampoo station. Since most facilities do not permit comfortable neck flexion, the most critical phase of the interface involves the head and wash basin. Moreover, the hard, although rounded, edge of the basin in direct contact with the back of the neck adds to the discomfort. The quality of the interface could perhaps be improved by building adjustment capability into the chair so that the body may be placed in a more horizontal position. Within the limitations imposed by existing equipment, the drawings on the following pages illustrate some of the typical situations encountered in the design of hair styling spaces. The anthropometric measurements of major concern are indicated in the above matrix.

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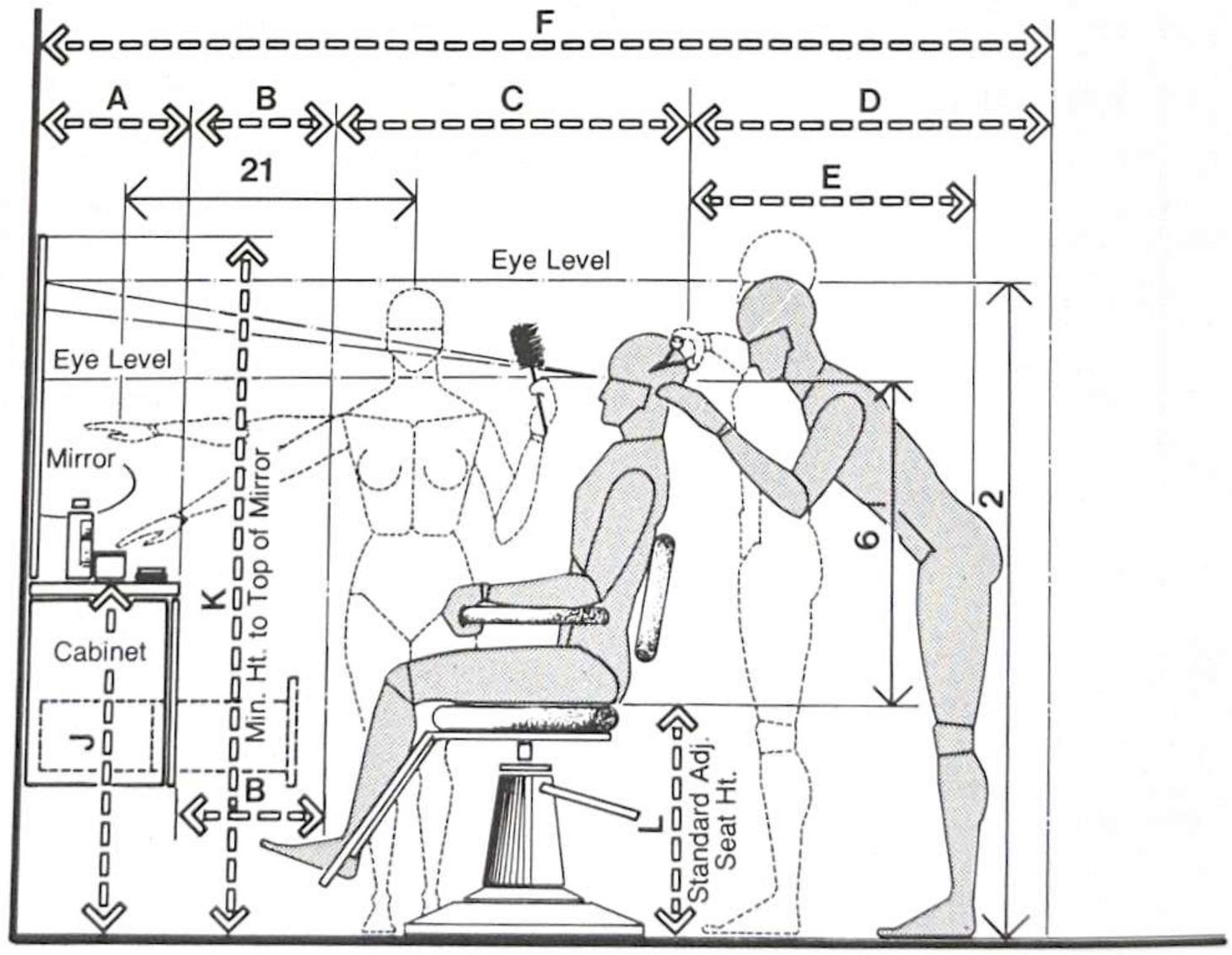
4.3 HAIR STYLING

A plan view showing two styling stations and required clearances is shown in the drawing at the top of the page. To accommodate the seated customer and provide for circulation and appropriate movement of the hair stylist, a space of 95 to 105 in, or 241.3 to 266.7 cm, deep and 83 to 87 in, or 210.8 to 221 cm, wide is required for each station. To conserve floor space, however, it is suggested that the spaces required for the individual styling stations overlap each other by 24 in, or 61 cm. The area of overlap is used as a shared activity zone.

The bottom drawing shows the styling station in elevation. It should be noted that despite the adjustability of the chair, the range of movement does not allow the chair to be elevated high enough to permit the stylist to work around the lower head and neck area without stooping.



STYLING STATIONS



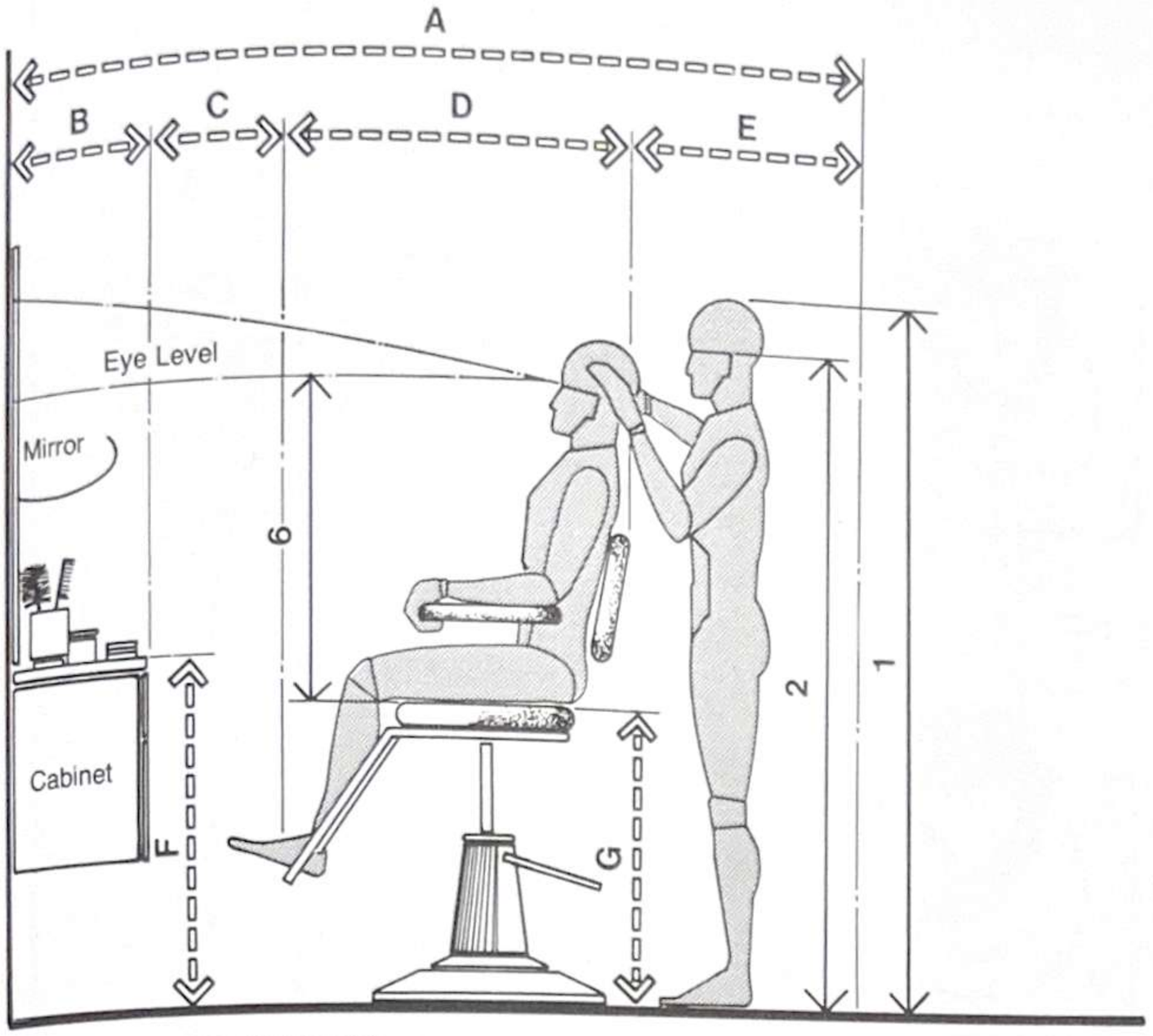
STYLING STATION/ STANDARD ADJUSTABLE CHAIR HEIGHTS

	in	cm
A	16–18	40.6–45.7
B	15 min.	38.1 min.
C	29–36	73.7–91.4
D	36	91.4
E	30 min.	76.2 min.
F	96–105	243.8–266.7
G	30	76.2
H	23–27	58.4–68.6
I	83–87	210.8–221.0
J	34–36	86.4–91.4
K	68 min.	172.7 min.
L	19.5–25	49.5–63.5

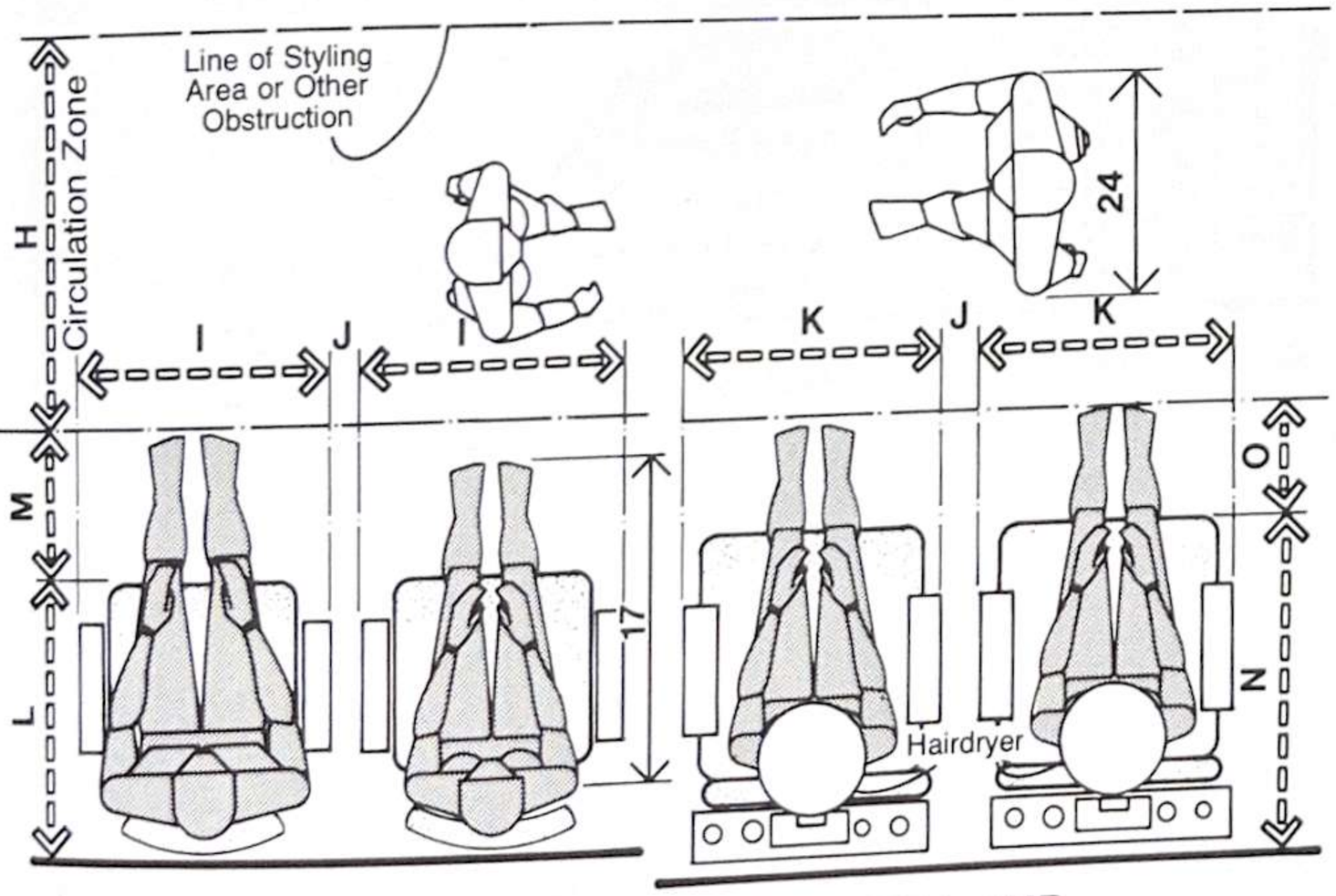
4.3 HAIR STYLING

The drawing at the top of the page illustrates a proposed styling chair with an adjustability range of 24 to 36 in, or 61 to 91.4 cm. Such a range, not presently available, would enable the stylist, especially one having a large stature, to trim the back of the head comfortably without having to stoop.

The drawing at the left on the bottom of the page illustrates the clearances required for the waiting area. A minimum clearance of 37 in, or 94 cm, from the wall will accommodate the seated customer. This dimension includes an allowance of 12 in, or 30.5 cm, to accommodate leg projection beyond the edge of the front of the seat. A space of 36 in, or 91.4 cm, is adequate for one-lane circulation in front of the seating. For one person to pass another within the 36-in circulation zone will, however, require one or the other to step aside.



STYLING STATION/ OPTIMUM ADJUSTABLE CHAIR HEIGHTS



WAITING AREA AND CIRCULATION/ CLEARANCES

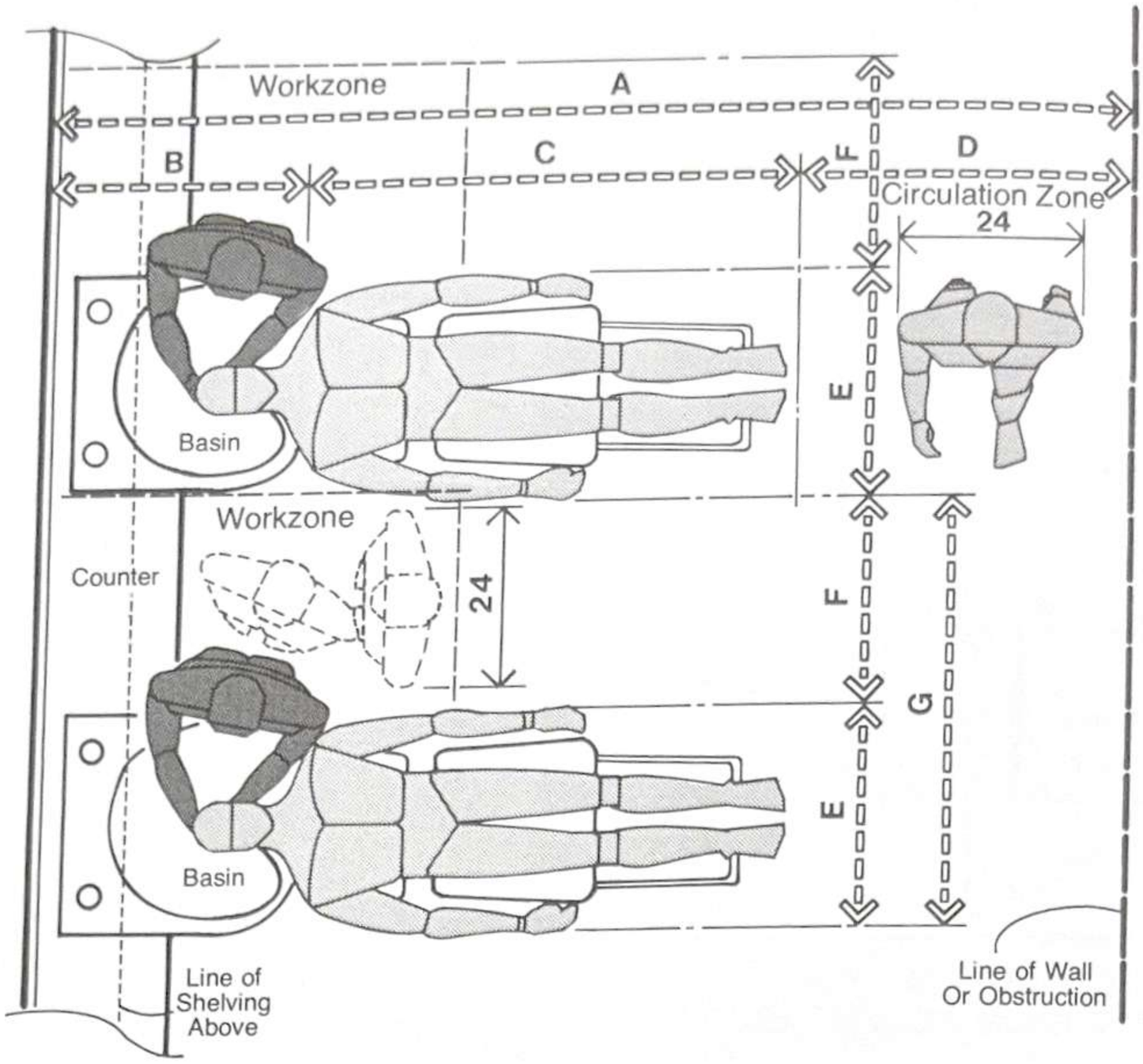
DRYING AREA AND CIRCULATION/ CLEARANCES

	in	cm
A	84–93	213.4–236.2
B	16–18	40.6–45.7
C	15 min.	38.1 min.
D	29–36	73.7–91.4
E	24	61.0
F	34–36	86.4–91.4
G	24–36	61.0–91.4
H	36	91.4
I	23–27	58.4–68.6
J	4 min.	10.2 min.
K	24–27	61.0–68.6
L	25–28	63.5–71.1
M	12	30.5
N	31–36	78.7–91.4
O	10	25.4

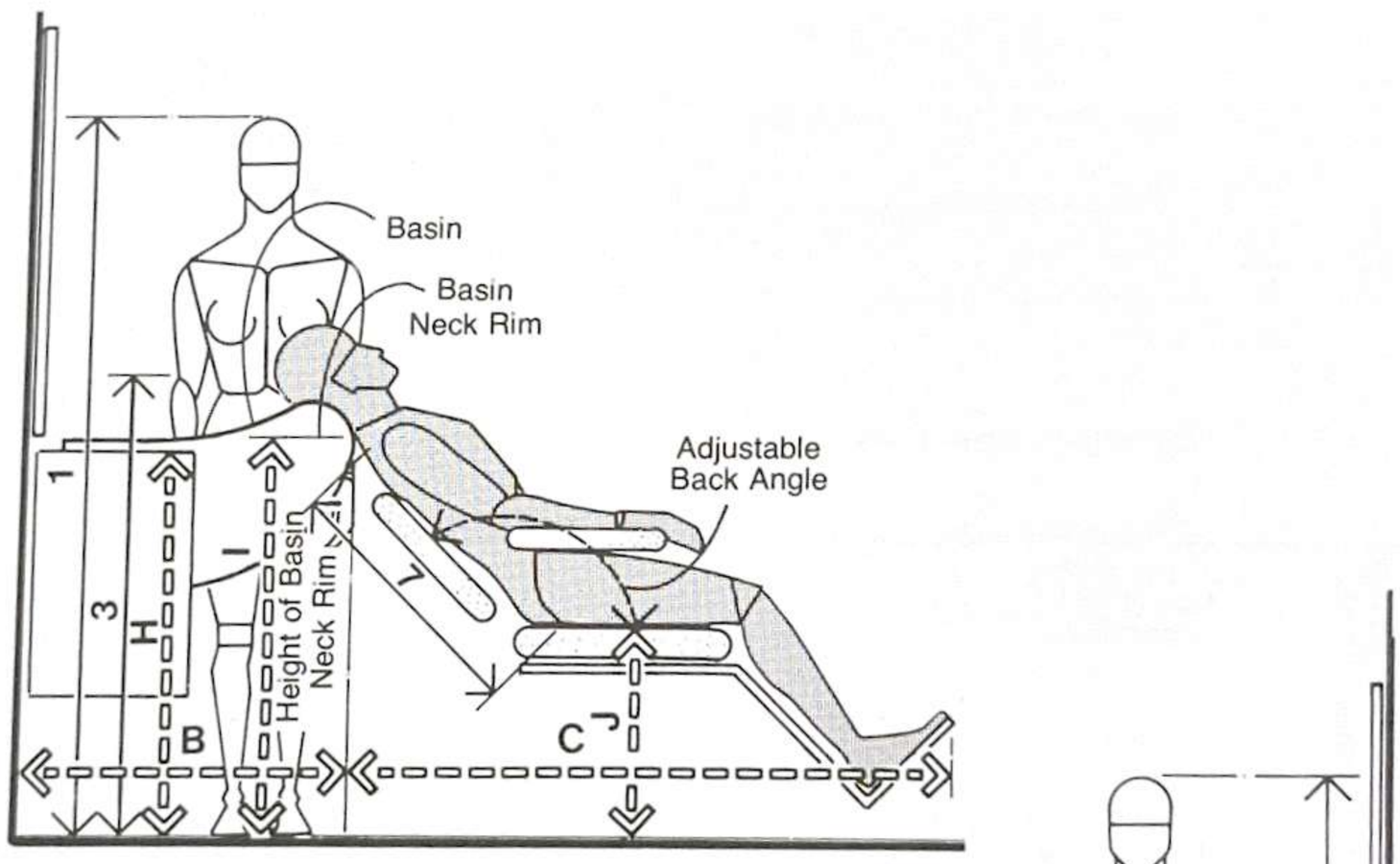
4.3 HAIR STYLING

The drawing at the top of the page shows a plan view of a shampoo station. A minimum of 82 in, or 208.3 cm, from the wall is required to accommodate the basin and the seated user with feet extended. A space of 24 in, or 61 cm, between chairs is adequate to accommodate a person while engaged in the shampooing activity.

The drawings at the center and the bottom of the page show the shampoo station in elevation. The center drawing illustrates the chair in use by a male customer, while the bottom drawing illustrates the chair in use by a female customer. The clearances shown in each drawing are about the same. It should be noted, however, that since the body size of the larger female is smaller than the body size of the larger male, the clearance from the wall required in the shampoo station exclusively catering to women could be a few inches smaller. Since the difference is minimal, it would be more practical to allow sufficient clearance to accommodate the male customer of larger body size. However, in situations where space may be extremely tight, the small clearance required for the female could be helpful in conserving space. Of greatest importance anthropometrically is that the chair have maximum flexibility in terms of both seat height and backrest angle to ensure a comfortable body fit or interface between the back of the neck and the basin.

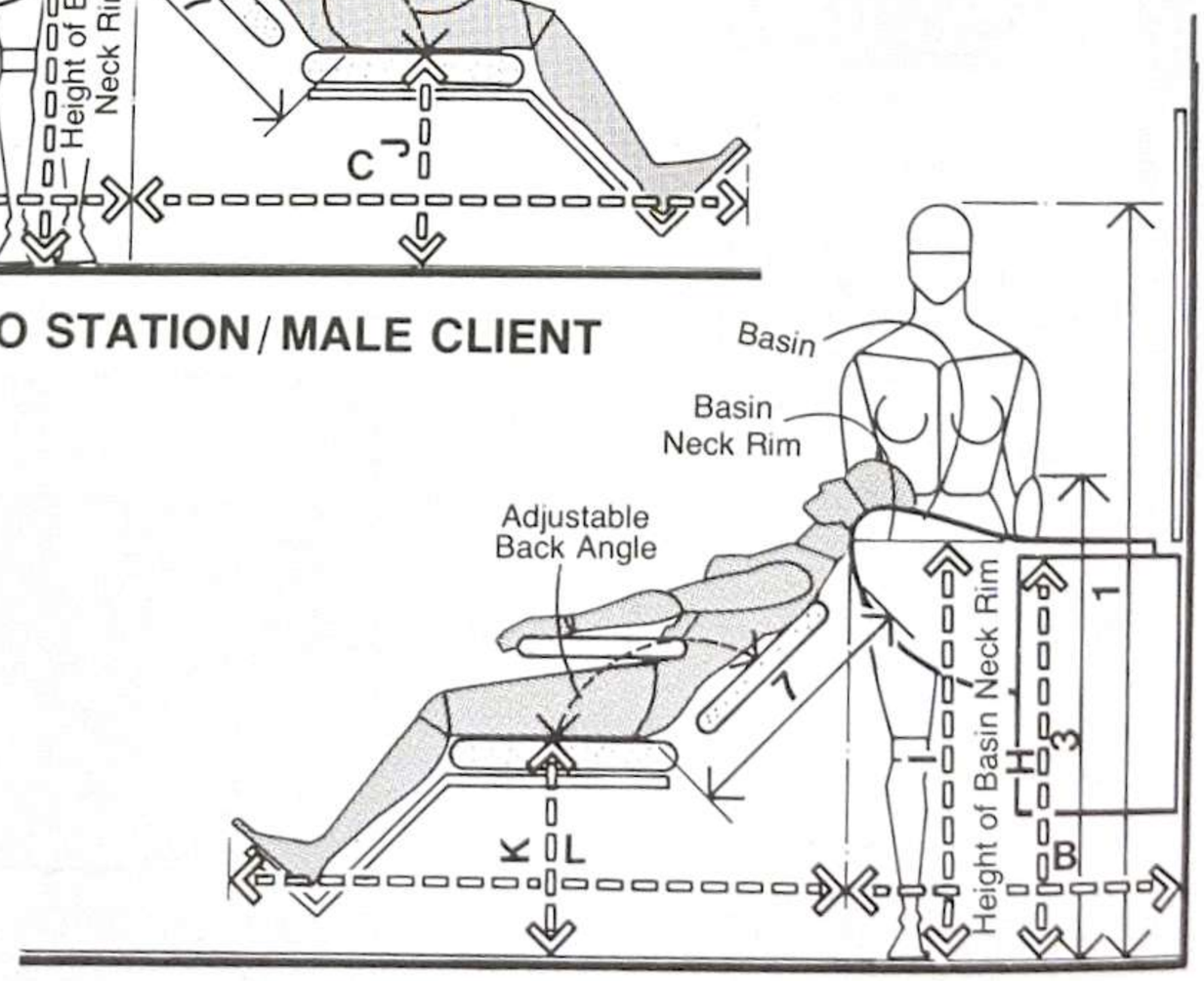


SHAMPOO STATIONS



SHAMPOO STATION/MALE CLIENT

	in	cm
A	118–126	299.7–320.0
B	28–30	71.1–76.2
C	54–60	137.2–152.4
D	36	91.4
E	24–28	61.0–71.1
F	24	61.0
G	48–52	121.9–132.1
H	34	86.4
I	35	88.9
J	17–18	43.2–45.7
K	18–19	45.7–48.3
L	52–58	132.1–147.3



SHAMPOO STATION/FEMALE CLIENT

5 EATING AND DRINKING SPACES

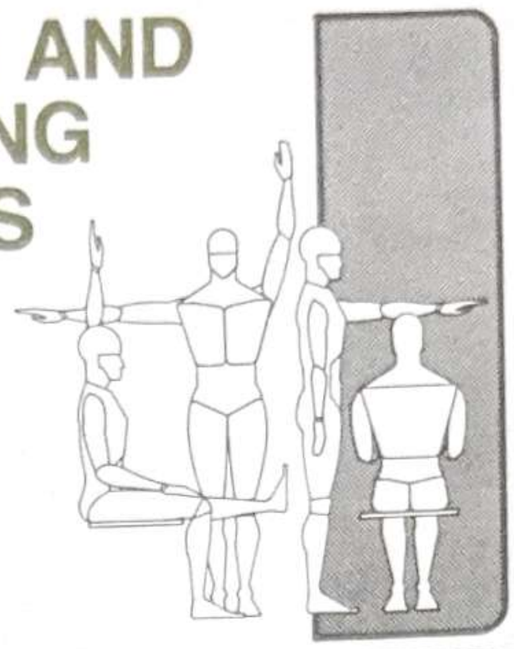


TABLE	5.1 BARS	5.2 FOOD COUNTERS	5.3 DINING SPACES	SPACE / ANTHROPOMETRIC DATA
1A,2B	◪			1 STATURE
1B,3C	◪			2 EYE HEIGHT
				3 ELBOW HEIGHT
1D,2C			●	4 SITTING HEIGHT ERECT
				5 SITTING HEIGHT NORMAL
1F,3G			●	6 EYE HEIGHT SITTING
				7 MIDSHOULDER HEIGHT SITTING
				8 SHOULDER BREADTH
				9 ELBOW-TO-ELBOW BREADTH
				10 HIP BREADTH
				11 ELBOW REST HEIGHT
1L,2H	●	●	●	12 THIGH CLEARANCE
1M,2I	●	●	●	13 KNEE HEIGHT
1N,2J	◪	◪	◪	14 POPLITEAL HEIGHT
1O,2K			◪	15 BUTTOCK-POPLITEAL LENGTH
1P,2L	●	●	●	16 BUTTOCK-KNEE LENGTH
				17 BUTTOCK-TOE LENGTH
				18 BUTTOCK-HEEL LENGTH
				19 VERTICAL REACH HEIGHT SITTING
				20 VERTICAL GRIP REACH
1U,4E		○		21 SIDE ARM REACH
1V,4D	○		○	22 THUMB TIP REACH
1W,6B	●	●	●	23 MAXIMUM BODY DEPTH
1X,6A	●	●	●	24 MAXIMUM BODY BREADTH

Printed in China

It has been estimated that somewhere in the vicinity of 46 million people in the U.S. eat out daily, with a median per capita expenditure of more than $3.50. As leisure time increases and the emerging so-called leisure ethic becomes more firmly entrenched as a way of life, as the number of single men and women continues to increase, as more women return to the labor market, and as family incomes increase, the amount of time and money spent eating outside the home will become even greater.

The eating and drinking establishment is a necessity for some, a luxury for others, and to many, perhaps, a brief escape from boredom or loneliness. However, despite its raison d'etre or the contrasts in ambiance that may exist among the neighborhood tavern, the singles bar, and the elegant gourmet restaurant, the anthropometric requirements of the user remain the one constant in the design equation. The quality of the interface between the customer and the various elements of the interior space determine the level of user comfort and, in many cases, the eventual success or failure of the establishment.

The diagrams and text on the following pages deal with those human dimensions that relate to the design of bars, food counters, dining areas, and other elements that constitute typical eating and drinking spaces. The anthropometric requirements of those who work in these spaces are also explored. In addition, the problems of the wheelchair-bound patron are examined, particularly in terms of general accessibility and interface with the table.

5.1 BARS

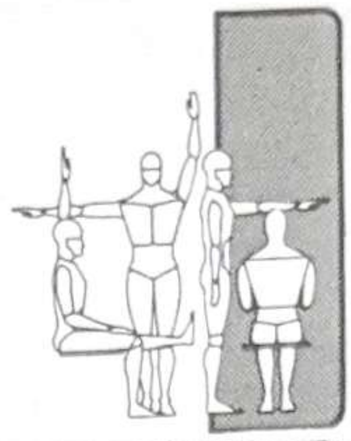


TABLE	SERVICE	DRINKING	CIRCULATION	ACTIVITIES / ANTHROPOMETRIC DATA
1A,2B		◑		1 STATURE
1B,3C		◑		2 EYE HEIGHT
1L,2H		●		12 THIGH CLEARANCE
1M,2I		●		13 KNEE HEIGHT
1N,2J		◑		14 POPLITEAL HEIGHT
1P,2L		●		16 BUTTOCK-KNEE LENGTH
1V,4D	○			22 THUMB TIP REACH
1W,6B	●	●	●	23 MAXIMUM BODY DEPTH
1X,6A	●	●	●	24 MAXIMUM BODY BREADTH

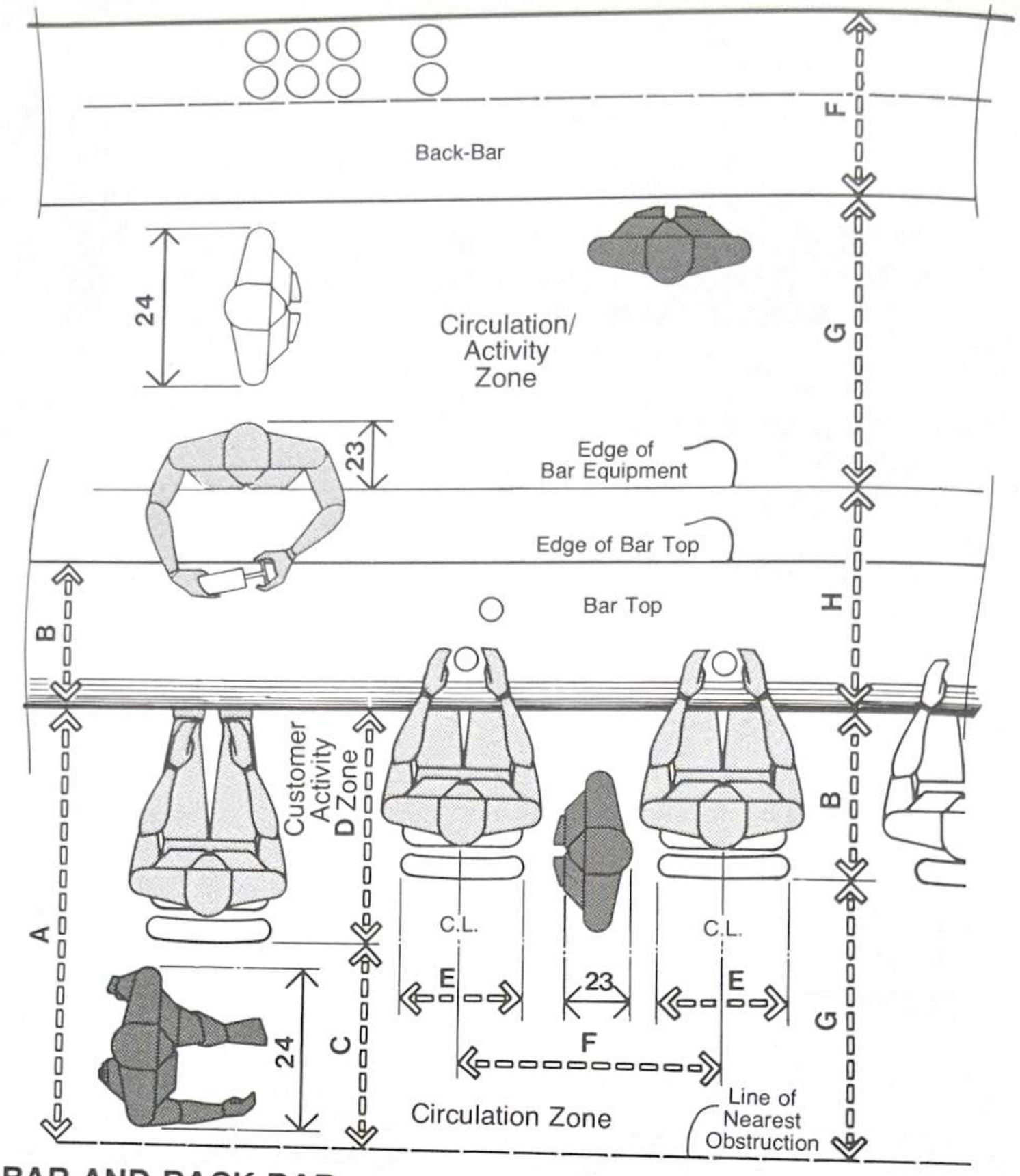
The drawings on the following pages illustrate in plan and section the considerations that should make the design of bars more sensitive to human body size. Clearances and other dimensional data for use in making preliminary design assumptions are also indicated. The anthropometric measurements of major concern are indicated in the matrix above.

In earlier sections of the book, it was stated that anthropometry can serve as an extremely helpful tool in the design process if used within the larger perspective of all the other human factors that impact on that process, such as the many psychological, sociological, and cultural factors that the designer must also take into account. It seems particularly appropriate while dealing with the subject of bar design to reiterate the concept that in fitting the designed environment to the body, clearances and space also have more sophisticated and subtle implications. The clearances allowed for seating at the bar, for example, could in many instances ensure an ideal body fit between patron and bar and at the same time negate the very reason for the particular drinking place or tavern. The greater the seating density and the closer the seats, the greater the degree of social interaction. A singles bar, for example, whose seating arrangement was overly conservative and tended to insulate patrons from each other would obviously not be very successful. However, there are many situations where intense social interaction between patrons is, as a matter of policy or personal preference, not a desirable objective, nor would the patrons frequenting such places necessarily feel at ease under such conditions.

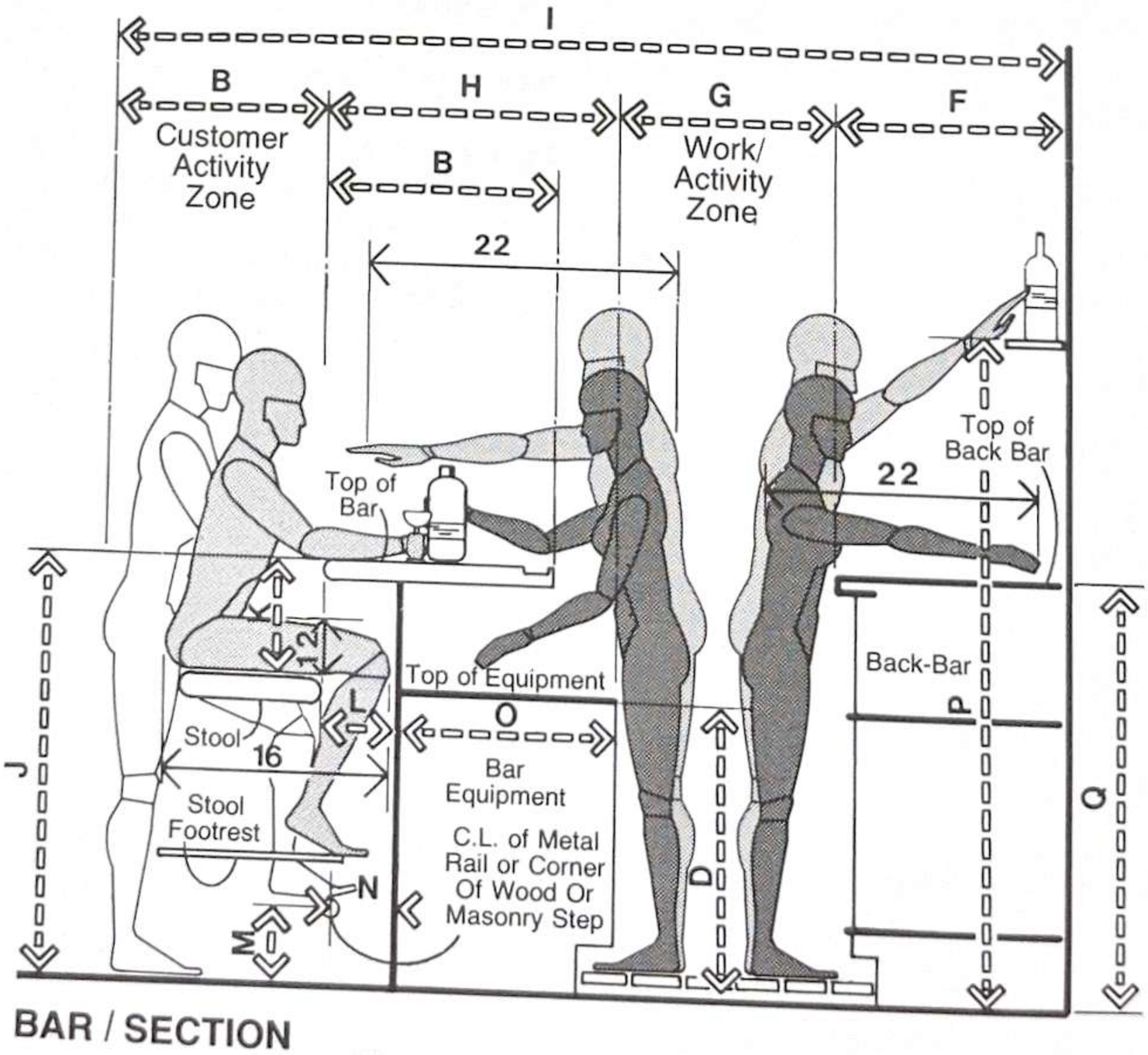
5.1 BARS

The distance between bar and back-bar should allow adequate workspace. A minimum of 36 in, or 90 cm, should provide space for one bartender to serve and another to circulate behind him. Maximum body depth and maximum body breadth are the primary anthropometric considerations in establishing clearance. A one-bartender operation would require a 30-in, or 75-cm, clearance.

In regard to bar stools, clearance between the stool seats is more critical than center line spacing, and it should allow patrons of larger body size a comfortable side approach and departure from the stool without body contact with the next person. A 12-in, or 30-cm, wide stool on 24-in, or 61-cm, centers, which is quite common, will allow only less than 5 percent of male users access to the stool without disturbing the next patron, while a 30-in, or 75-cm, spacing will accommodate 95 percent of the users. The tradeoff, however, would be the loss of two seats for every 120 in, or 300 cm, of bar length. A spacing of 12-in stools on 28-in, or 70 cm, centers is suggested as a compromise. The ultimate decision is an individual one and must reconcile human factors with economic viability.



BAR AND BACK-BAR

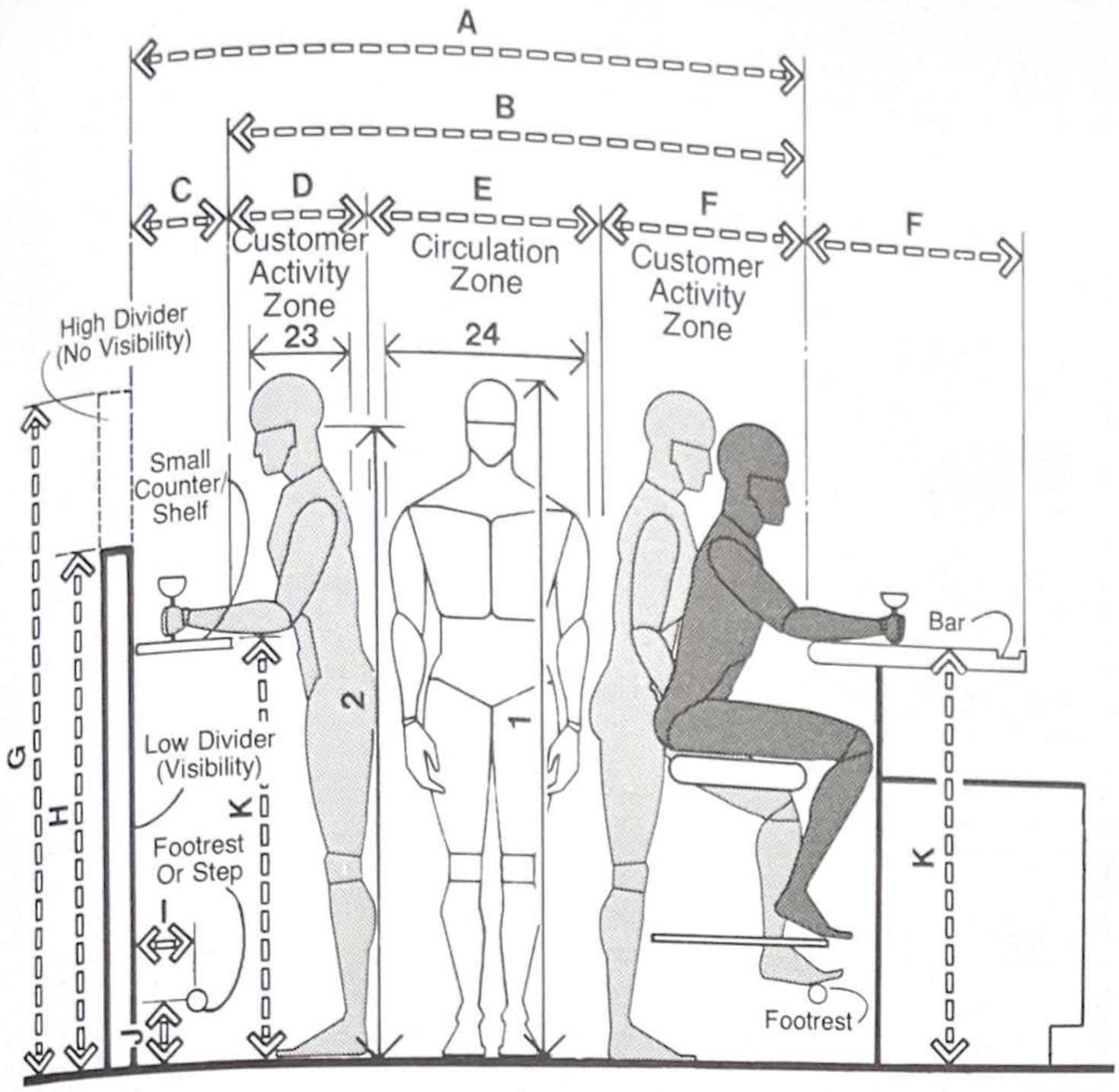


BAR / SECTION

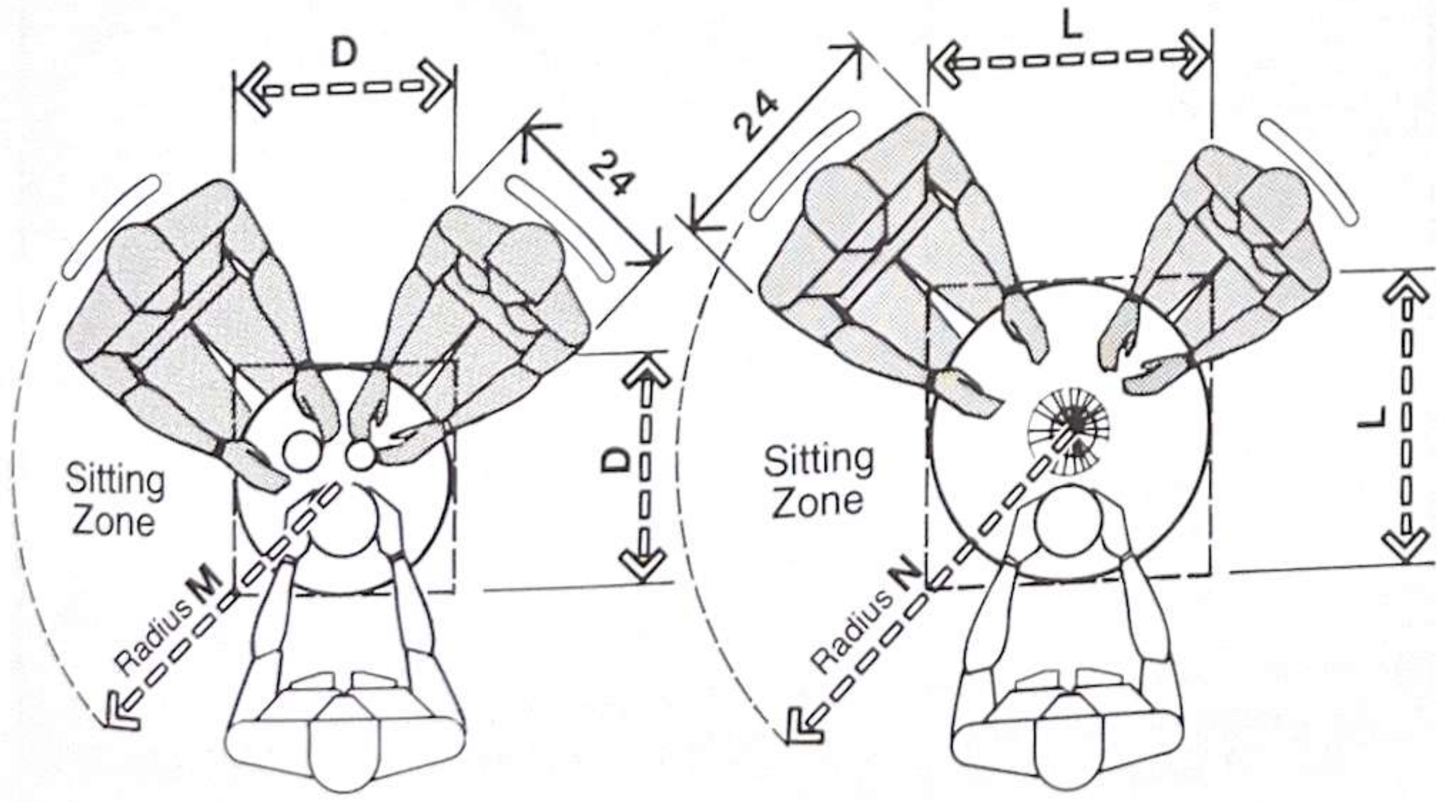
	in	cm
A	54	137.2
B	18–24	45.7–61.0
C	24	61.0
D	30	76.2
E	16–18	40.6–45.7
F	24–30	61.0–76.2
G	30–36	76.2–91.4
H	28–38	71.1–96.5
I	100–128	254.0–325.1
J	42–45	106.7–114.3
K	11–12	27.9–30.5
L	6–7	15.2–17.8
M	7–9	17.8–22.9
N	6–9	15.2–22.9
O	22–26	55.9–66.0
P	60–69	152.4–175.3
Q	36–42	91.4–106.7

5.1 BARS

To ensure proper circulation and interface, adequate clearances in front of the bar are illustrated in the top drawing. A customer activity zone of 18 to 24 in, or 45.7 to 61.0 cm, should be provided to allow for seating, standing, and access, in addition to a general circulation zone of at least 30 in, or 76.2 cm. If a supplementary drinking surface or shelf is provided, a smaller activity zone of 18 in is suggested in front of the shelf. The shelf can be 10 to 12 in, or 25.4 to 30.5 cm, deep. The bottom drawing shows suggested clearances for 18 or 24 in cocktail tables.



BAR / CLEARANCES PUBLIC SIDE



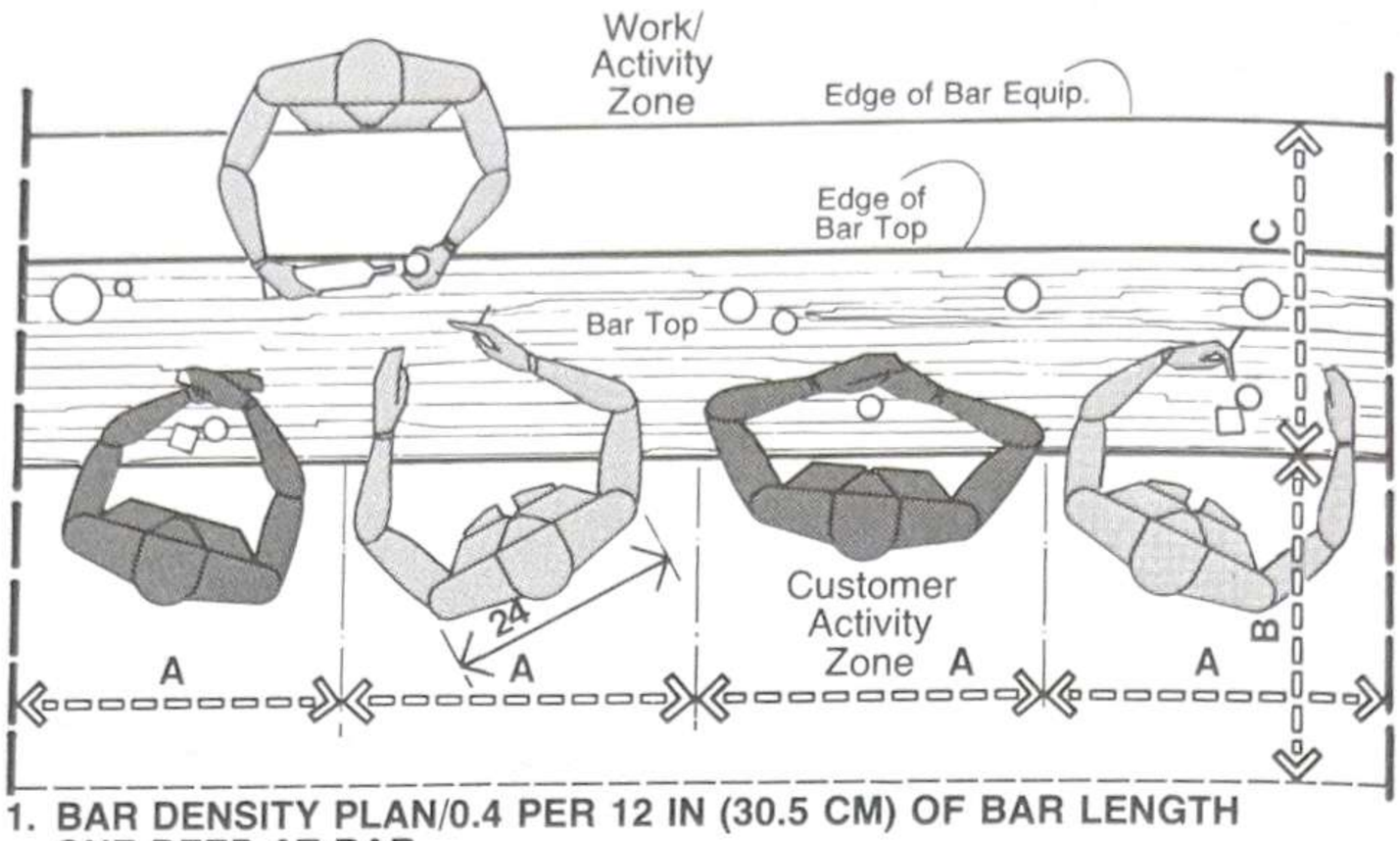
COCKTAIL TABLES / SEATING FOR TWO

	in	cm
A	76–84	193.0–213.4
B	66–72	167.6–182.9
C	10–12	25.4–30.5
D	18	45.7
E	30	76.2
F	18–24	45.7–61.0
G	76	193.0
H	54–56	137.2–142.2
I	6–9	15.2–22.9
J	7–9	17.8–22.9
K	42–45	106.7–114.3
L	24	61.0
M	29–33	73.7–83.8
N	32–36	81.3–91.4

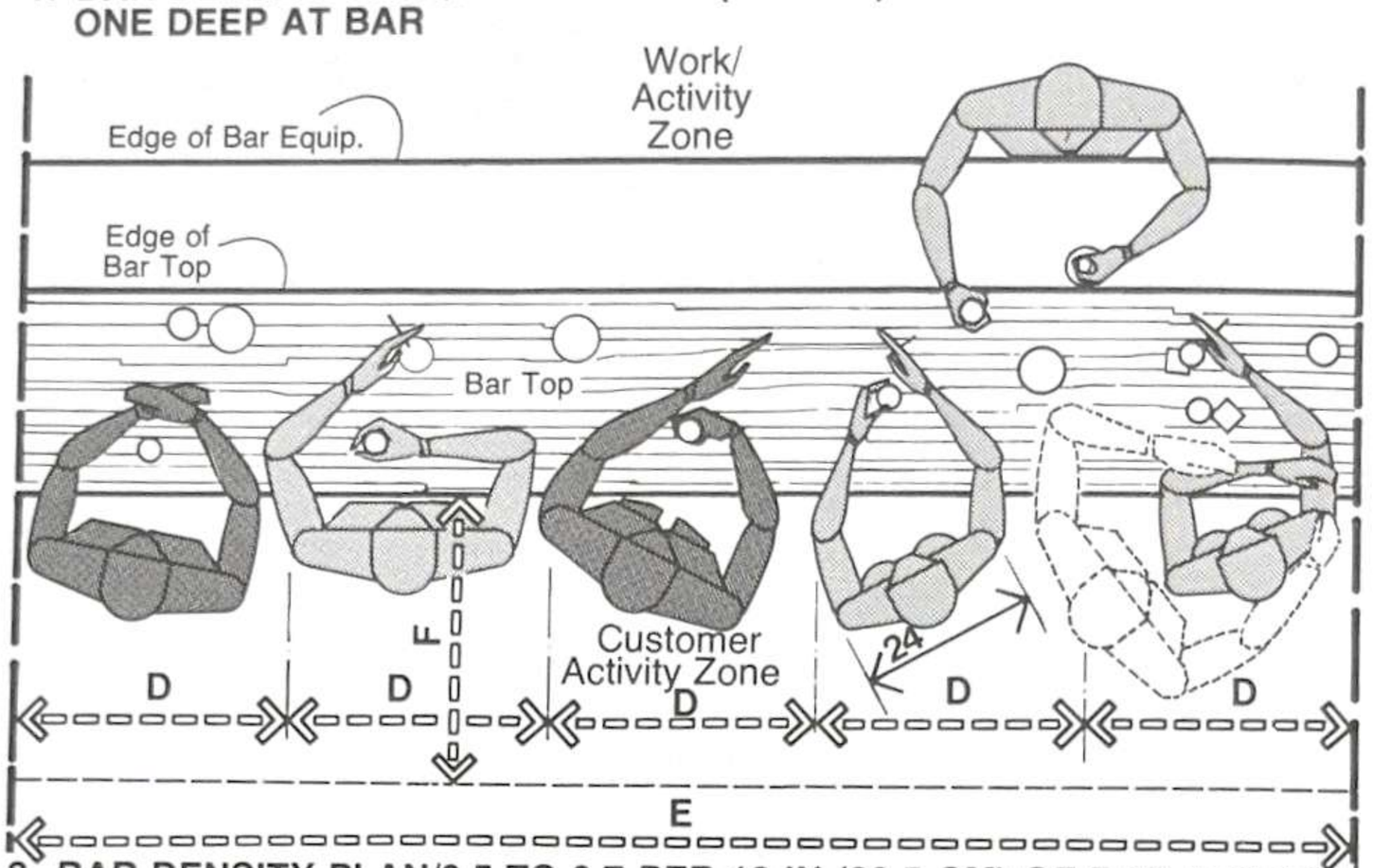
5.1 BARS

Bar seating is a classic example where hidden dimensions, as well as anthropometric factors, must be considered in determining seat spacing. Cultural differences, for example, may dictate proximity between patrons. In one instance closeness may cause discomfort for patrons, and in another case it may be desirable. The density of people and the spacing of seats also impact on social interaction; the greater the density, the greater the probability of such interaction. The drawings, however, deal essentially with the anthropometrics involved and the possible density models. The top drawing illustrates a low-density situation, based on one seated or standing patron per 30 in, or 76.2 cm, of bar length. Such a density model would preclude body contact, allow comfortable changes in body position, and ensure relative privacy.

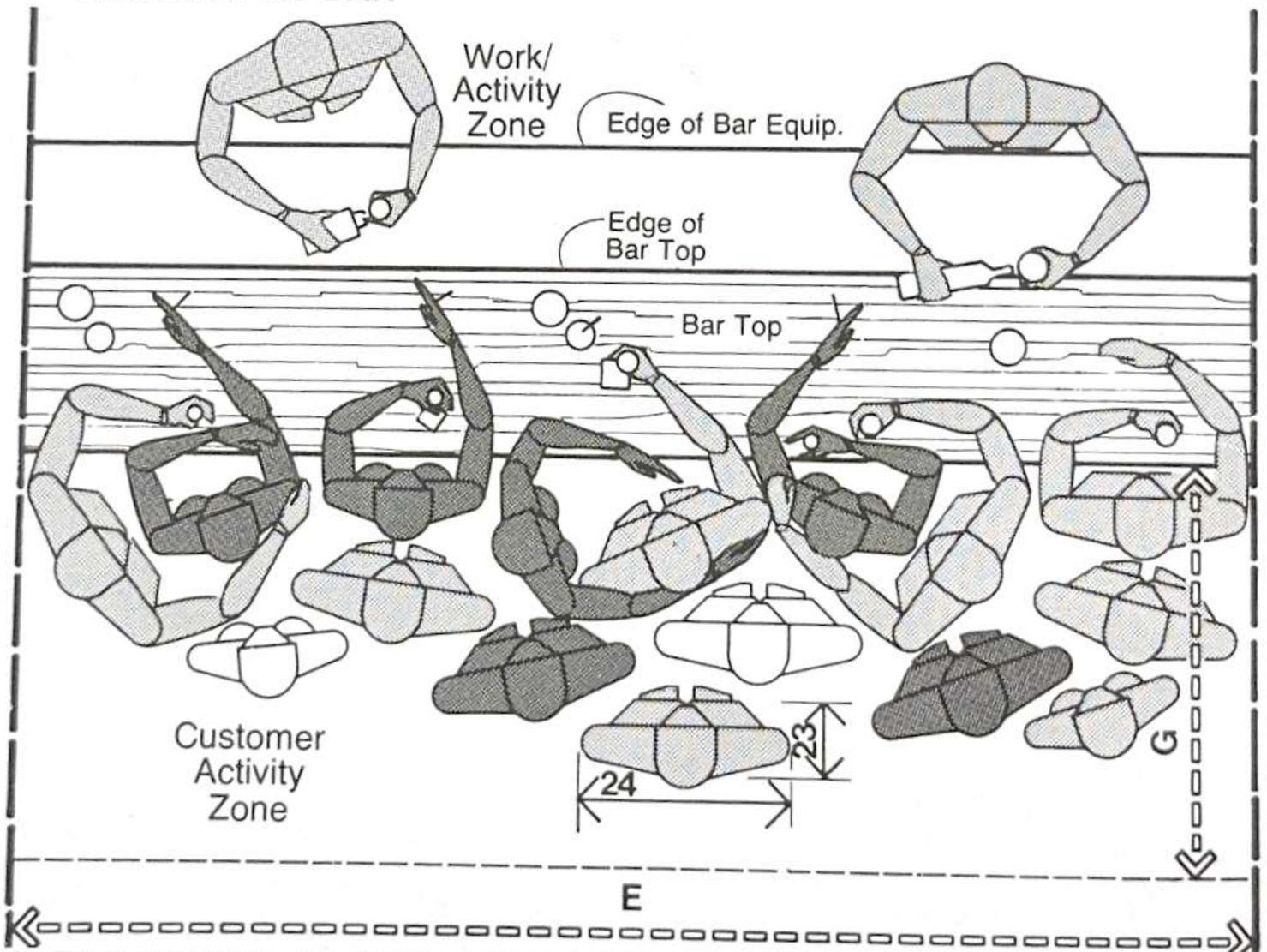
The center drawing illustrates a medium density model, based on 24-in, or 61-cm, spacing; takes occasional pairing into account, as shown by the dotted figure; and allows for occasional body contact and territorial intrusion. The bottom drawing illustrates a high-density model, with patrons standing two to three deep and a density factor of over 1.5 patrons per 12 in, or 30 cm, of bar length.



1. BAR DENSITY PLAN/0.4 PER 12 IN (30.5 CM) OF BAR LENGTH ONE DEEP AT BAR



2. BAR DENSITY PLAN/0.5 TO 0.7 PER 12 IN (30.5 CM) OF BAR LENGTH ONE DEEP AT BAR



3. BAR DENSITY PLAN/1.5 TO 2.0 PER 12 IN (30.5 CM) OF BAR LENGTH TWO TO THREE DEEP AT BAR

BAR DENSITY PLANS

	in	cm
A	30	76–2
B	24–30	61.0–76.2
C	28–38	71.1–96.5
D	24	61.0
E	120	304.8
F	18–30	45.7–76.2
G	36–54	91.4–137.2

5.2 FOOD COUNTERS

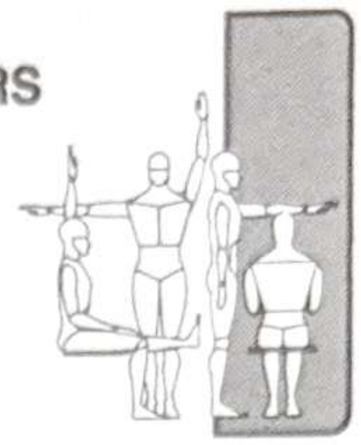


TABLE	SERVICE	EATING	CIRCULATION	ACTIVITIES / ANTHROPOMETRIC DATA
1L,2H		●		12 THIGH CLEARANCE
1M,2I		●		13 KNEE HEIGHT
1N,2J		◑		14 POPLITEAL HEIGHT
1P,2L		●		16 BUTTOCK-KNEE LENGTH
1U,4E			○	21 SIDE ARM REACH
1W,6B	●		●	23 MAXIMUM BODY DEPTH
1X,6A	●	●	●	24 MAXIMUM BODY BREADTH

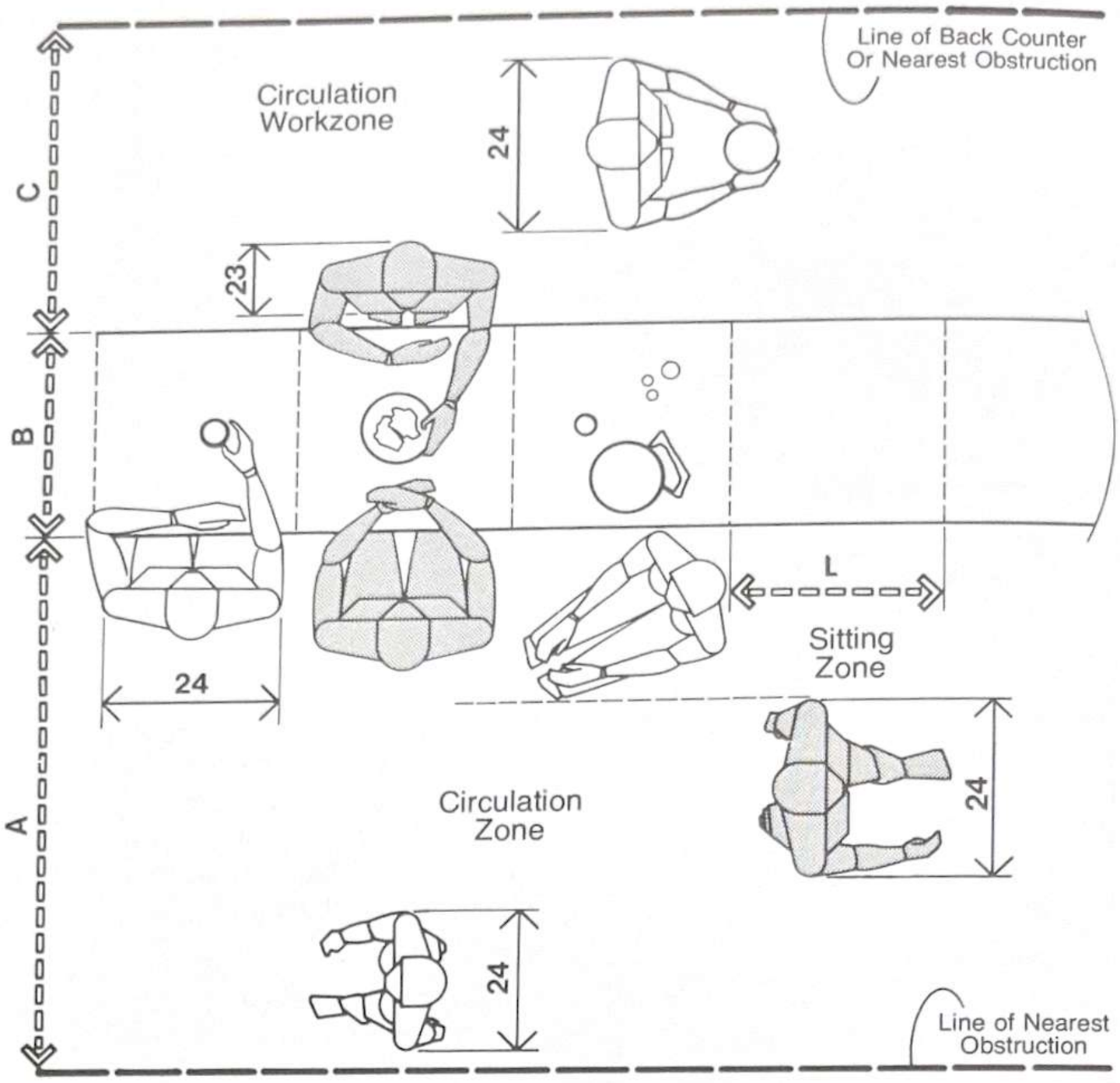
The basic approach to ensuring a proper interface between customer and food counter is similar to that used for a bar. Maximum body breadth and depth should be taken into account in establishing clearances for workspace behind the counter. The height of the shelves and depth of the counters should accommodate the human reach limitations of those of smaller body size, for such clearances will also accommodate those of larger body size.

With respect to the public side of the counter, the relationship between seat height and top of the counter should also accommodate the human body properly. One common error is in the relationship of seat height to footrest in relation to a high counter. In many instances, the footrest is too low to accommodate the feet. The result is that the customer's feet simply dangle above the footrest without coming into contact with its surface. This lack of contact does not provide the body with the stability it requires, so muscular forces must take over in order to maintain equilibrium, causing general discomfort, aches, and pains. As if this were not bad enough, the weight of the dangling foot causes pressure on the underside of the thigh just behind the knee, resulting not only in irritation to the skin but obstruction of the circulation of blood.

These conditions are included among the drawings on the following pages, and suggested clearances and other dimensional data for use in making preliminary design assumptions are indicated. The basic anthropometric body measurements most frequently considered in the design of food counters are indicated in the matrix above.

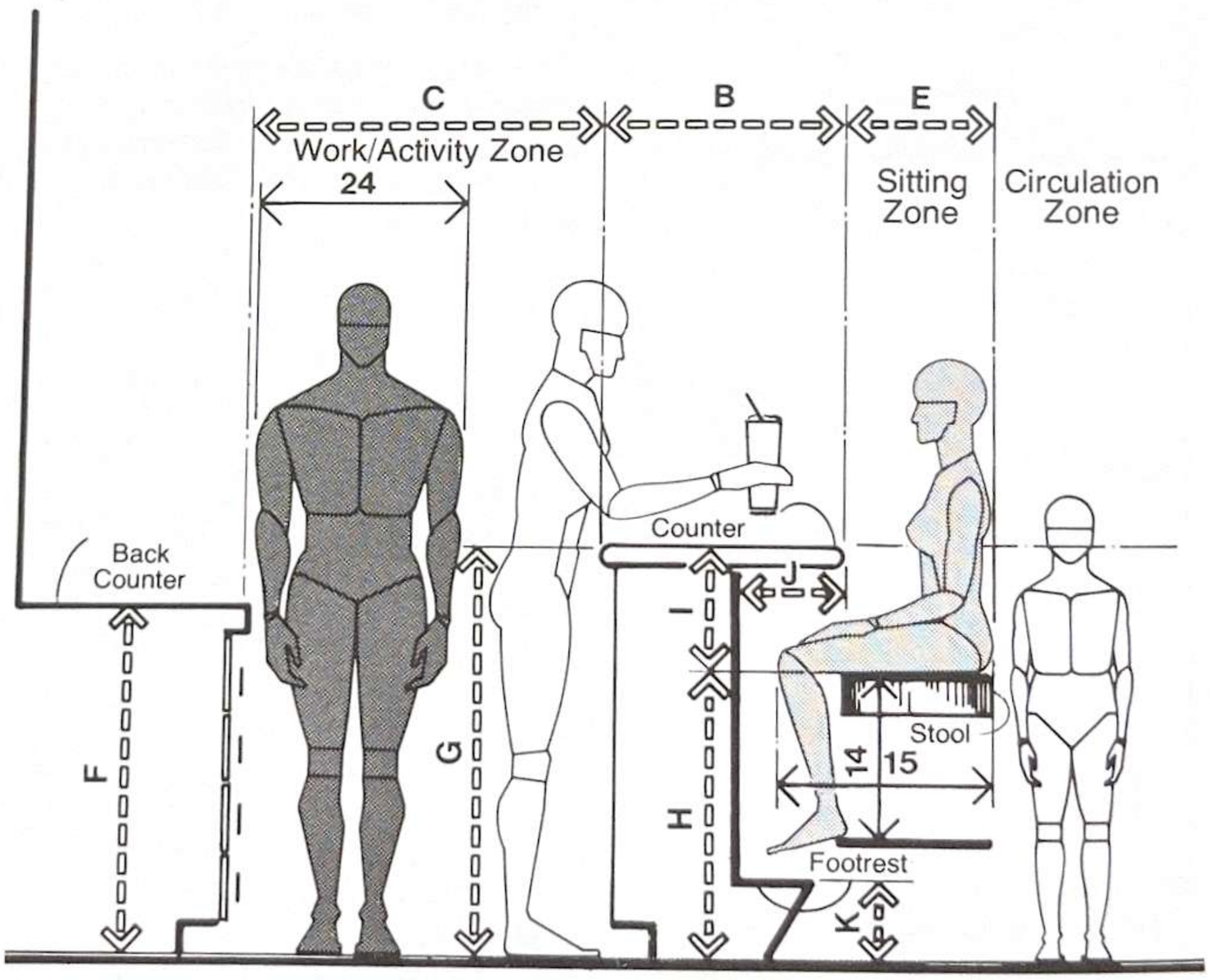
5.2 FOOD COUNTERS

The top drawing shows some of the basic clearances required for a typical counter: 36 in, or 91.4 cm, for workspace behind the counter; 18- to 24-in, or 45.7 to 61 cm, for the counter top; and 60 to 66 in, or 152.4 to 167.6 cm, between the front face of the counter and the nearest obstruction. The bottom drawing shows a section through the counter and back counter. Most counters are about 42 in, or 106.7 cm, in height. The clearance from the top of the seat to the underside of the counter top and the depth of the counter top overhang are extremely important. Buttock-knee length and thigh clearance are the key anthropometric measurements to consider for proper body fit. Footrest heights should take into consideration popliteal height. In most cases this is ignored, and 42-in counters are provided with 7-in, or 17.8-cm, footrests that are 23 in, or 58.4 cm, below the seat surface, which cannot work. The popliteal height of the larger user, based on 99th percentile data, is only about 20 in, or 50.8 cm. Therefore, the feet dangle unsupported several inches above the footrest and the body is deprived of any stability. The footrest shown on the drawing, although higher, only serves a portion of the seated users and is intended primarily for standing patrons. The most logical solution is a separate footrest, integral with the stool.

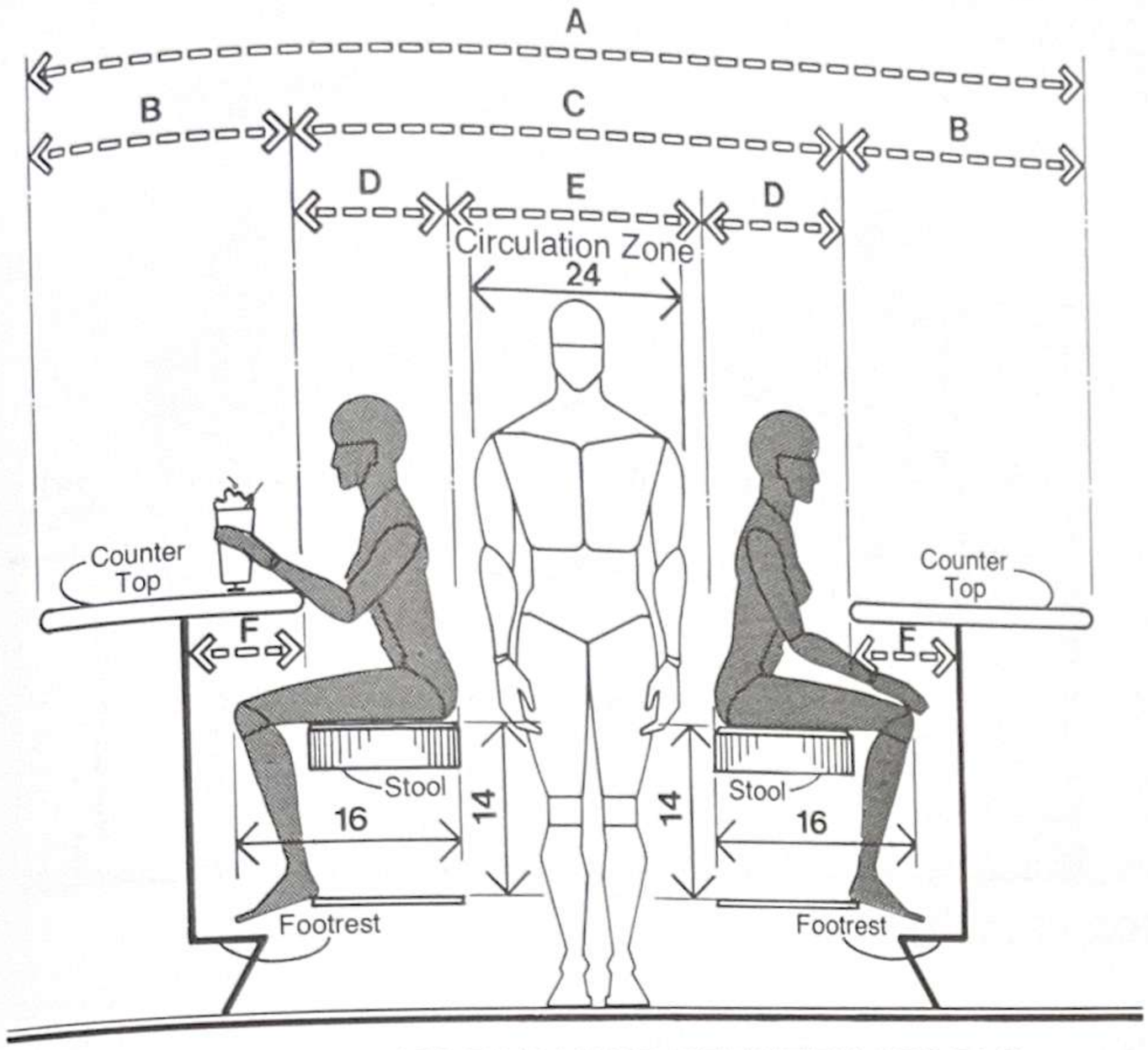


LUNCH COUNTER

	in	cm
A	60–66	152.4–167.6
B	18–24	45.7–61.0
C	36	91.4
D	24	61.0
E	12–18	30.5–45.7
F	35–36	88.9–91.4
G	42	106.7
H	30–31	76.2–78.7
I	11–12	27.9–30.5
J	10	25.4
K	12–13	30.5–33.0



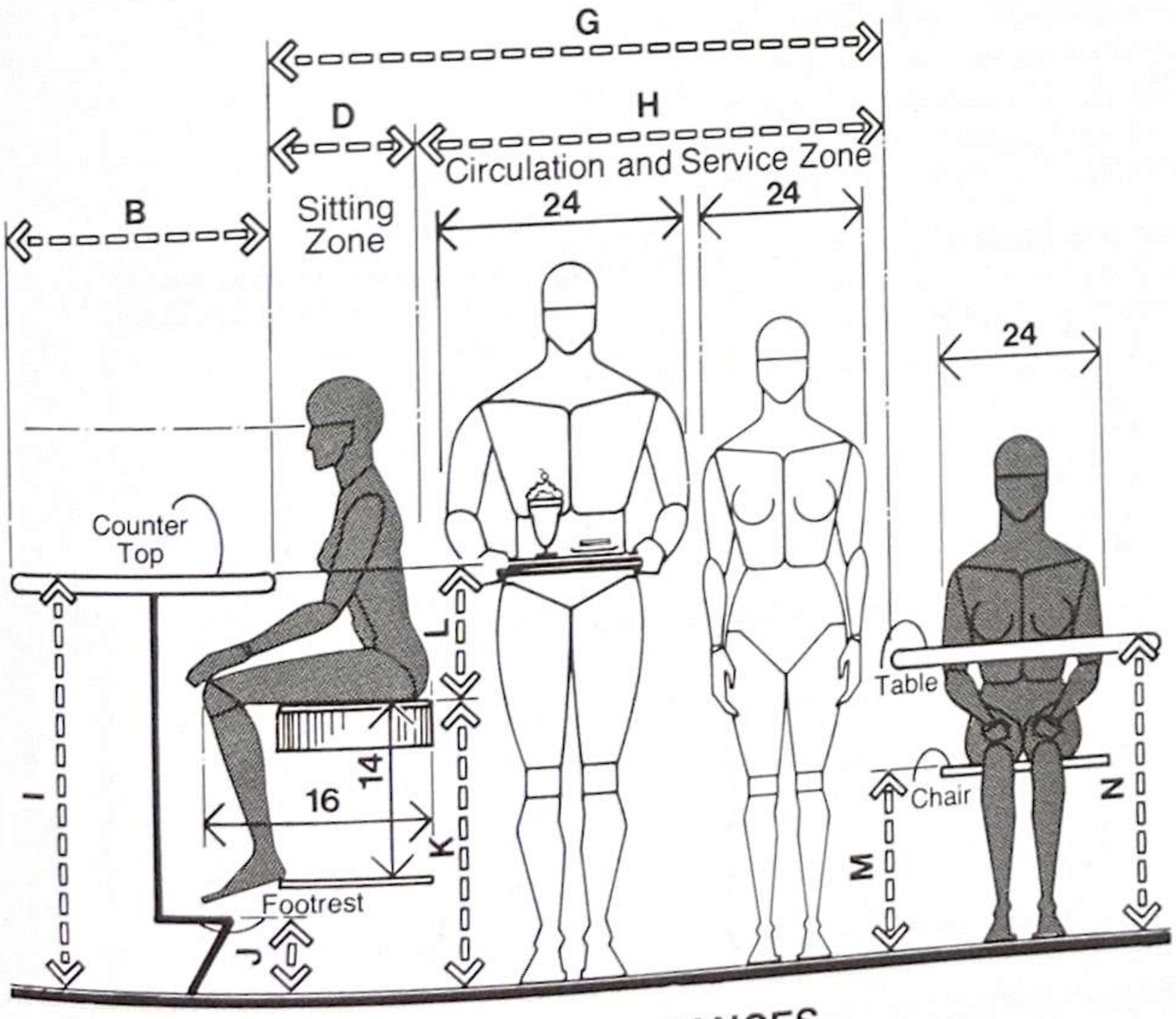
LUNCH COUNTER



LUNCH COUNTERS / CLEARANCE BETWEEN STOOLS

5.2 FOOD COUNTERS

The top drawing illustrates in section clearances required between counters when arranged parallel to each other. This is a rather common situation, with counter layouts in a repetitive U configuration. The overall clearance measured from the front edge of one counter to the other is 60 to 72 in, or 152.4 to 182.9 cm. The clearance between counters allows an activity zone for the seated patron at each counter, in addition to a public circulation zone between stools of 36 in, or 91.4 cm. Maximum body breadth is the anthropometric measurement used in establishing the clearance for circulation. Refer to the drawings on the preceding page for additional information regarding the relationship and body fit of the user to the stool, counter, and footrest, and the anthropometric measurements involved. The drawing at the bottom of the page shows in section the clearances required between a counter and a row of tables—another frequently used arrangement. A minimum clearance of 48 in, or 121.9 cm, between the outside edge of the counter stool and the edge of the table allows for a combined circulation and service zone.



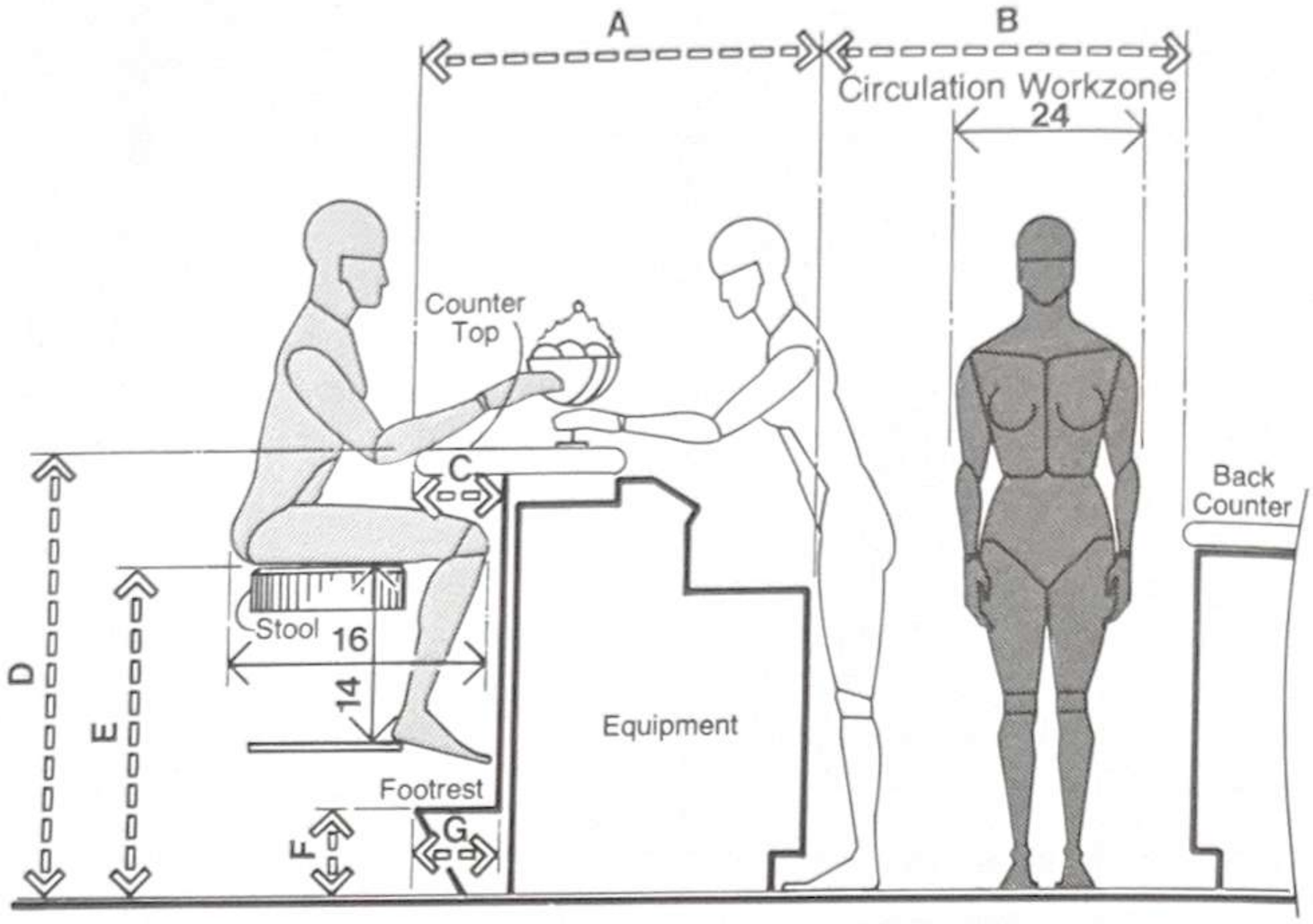
LUNCH COUNTER / TABLE CLEARANCES

	in	cm
A	96–120	243.8–304.8
B	18–24	45.7–61.0
C	60–72	152.4–182.9
D	12–18	30.5–45.7
E	36 min.	91.4 min.
F	10	25.4
G	60–66	152.4–167.6
H	48 min.	121.9 min.
I	42	106.7
J	12–13	30.5–33.0
K	30–31	76.2–78.7
L	11–12	27.9–30.5
M	16–17	40.6–43.2
N	29–30	73.7–76.2

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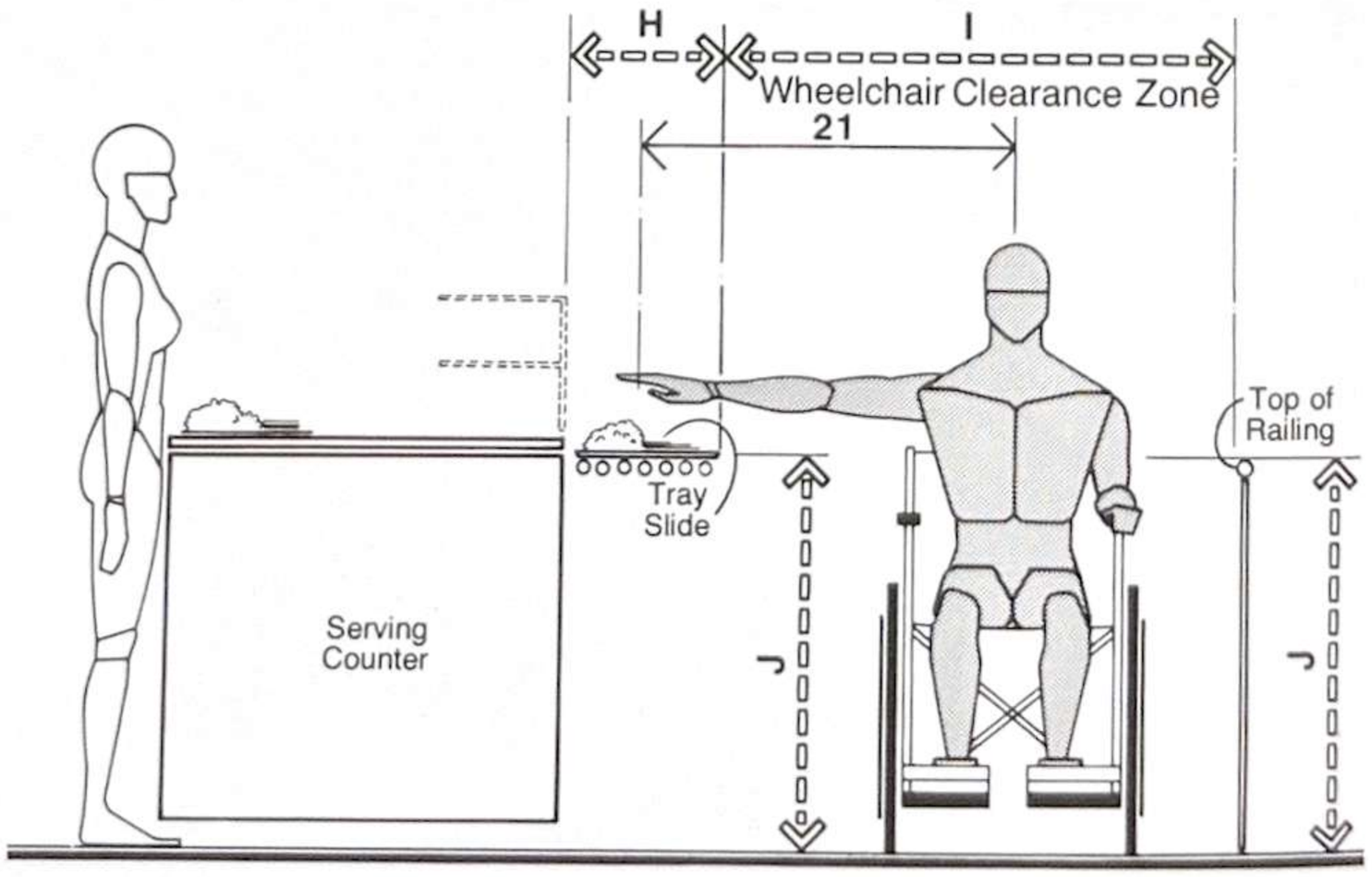
5.2 FOOD COUNTERS

The top drawing shows a section through a typical soda fountain and indicates some of the basic dimensions and clearances involved. A critical consideration in terms of anthropometrics is reach. The counter here, as for a bar, is essentially a partial enclosure, or "skin," for the fountain equipment. It is the depth of this equipment that establishes the location of the counterperson relative to the customer and the counter surface. The depth of the equipment varies with type and manufacture, but is usually about 30 to 32 in, or 76.2 to 81.3 cm. The counter top itself is normally about 18 in, or 45.9 cm, deep. Limiting the overall dimension from the face of the equipment to the customer's side of the counter top, as shown, will keep the counter-top surface within reach of the counterperson. If the counter top is located further away than suggested in the drawing, the designer should verify that reach is not impaired. The bottom drawing shows clearances necessary to make self-service food counters accessible to the wheelchair user. The service lane must be a minimum of 34 in, or 86.4 cm, to accommodate the wheelchair and the food within a 20-in, or 50.8-cm, maximum reach.



SODA FOUNTAIN

	in	cm
A	41–43	104.1–109.2
B	30–36	76.2–91.4
C	10	25.4
D	42	106.7
E	31–32	78.7–81.3
F	12–13	30.5–33.0
G	9	22.9
H	20 max.	50.8 max.
I	34 min.	86.4 min.
J	34 max.	86.4 max.



FOOD SERVICE COUNTERS/WHEELCHAIR ACCESS

5.3 DINING SPACES

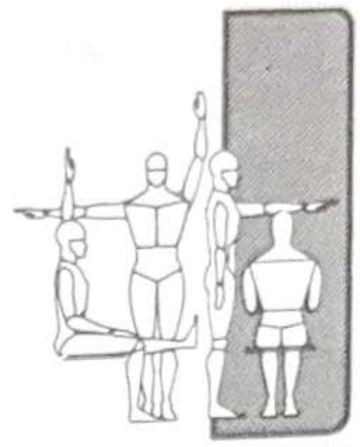


TABLE	SERVICE	DINING	CIRCULATION	ACTIVITIES	ANTHROPOMETRIC DATA
1D,2C		●		4	SITTING HEIGHT ERECT
1F,3G		◒		6	EYE HEIGHT SITTING
1L,2H		●		12	THIGH CLEARANCE
1M,2I		●		13	KNEE HEIGHT
1N,2J		◒		14	POPLITEAL HEIGHT
1O,2K		◒		15	BUTTOCK-POPLITEAL LENGTH
1P,2L		●		16	BUTTOCK-KNEE LENGTH
1V,4D		○		22	THUMB TIP REACH
1W,6B	●	●	●	23	MAXIMUM BODY DEPTH
1X,6A	●	●	●	24	MAXIMUM BODY BREADTH

Proper clearances for circulation and service aisles, adequate knee and thigh space between the top of the seat and the underside of the table, accessibility for the wheelchair-bound person, and adequate clearance around the perimeter of the table are the basic factors to take into account to ensure the proper relationship between human dimension and dining space. These considerations, all fairly straightforward, can be accommodated fairly simply. The proper allowance per individual seated diner along the table perimeter and, by extension, the table size do require additional thought and in some instances individual research.

All too often, however, the standard table size is simply accepted without question as being adequate to accommodate the designated number of seated diners. The design problem is then viewed exclusively in terms of the number of such tables that can be located within the given space. The fact is that most standard tables used in public dining spaces are not adequate to comfortably accommodate the user. In most instances the only factor taken into account in selecting the size of the table is whether its length can accommodate the width of the chair placed in front of it. The space necessary to accommodate the individual diner should take into account several factors: (1) the width of the chair, (2) the maximum body breadth of a diner of larger body size, plus an allowance for the extension of the elbows away from the body, and (3) the size of the place setting.

Among other considerations examined in the drawings on the following pages is the development of an incremental unit to be used in allocating the proper space per diner. Various table sizes are then established, based on optimal and minimal variations of this individual place-setting zone.

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5.3 DINING SPACES

The place setting is made up of a studied arrangement of dinnerware and related accessories. During the dining process, it is transformed into a state of disarray, covering a larger zone of the table than at the beginning. This expanded zone occupies a minimum area of 14 by 24 in, or 35.6 by 61 cm. The first group of drawings figuratively labeled shows these zones in relation to tables of varying depth, but of constant minimal width of 24 in, or 61 cm. The center strips represent the surface available for serving dishes, flowers, etc. If we allow for the intrusion of these elements into contiguous zones, a depth of only 40 in, or 101.6 cm, is adequate for their comfortable placement.

In the lower group of drawings these same zones are applied to a 30-in, or 76.2-cm, width. This is related to the maximum body movement involved in the dining activity. Etiquette aside, a 24-in width will allow the arms of the larger user to project beyond the table into circulation lanes. The authors contend that a 30 by 40 in, or 76.2 by 101.6 cm, table is the optimum size to comfortably accommodate two people. The 30-in dimension corresponds to human body breadth. The 40-in dimension allows sufficient room for place setting and accommodates horizontal reach.

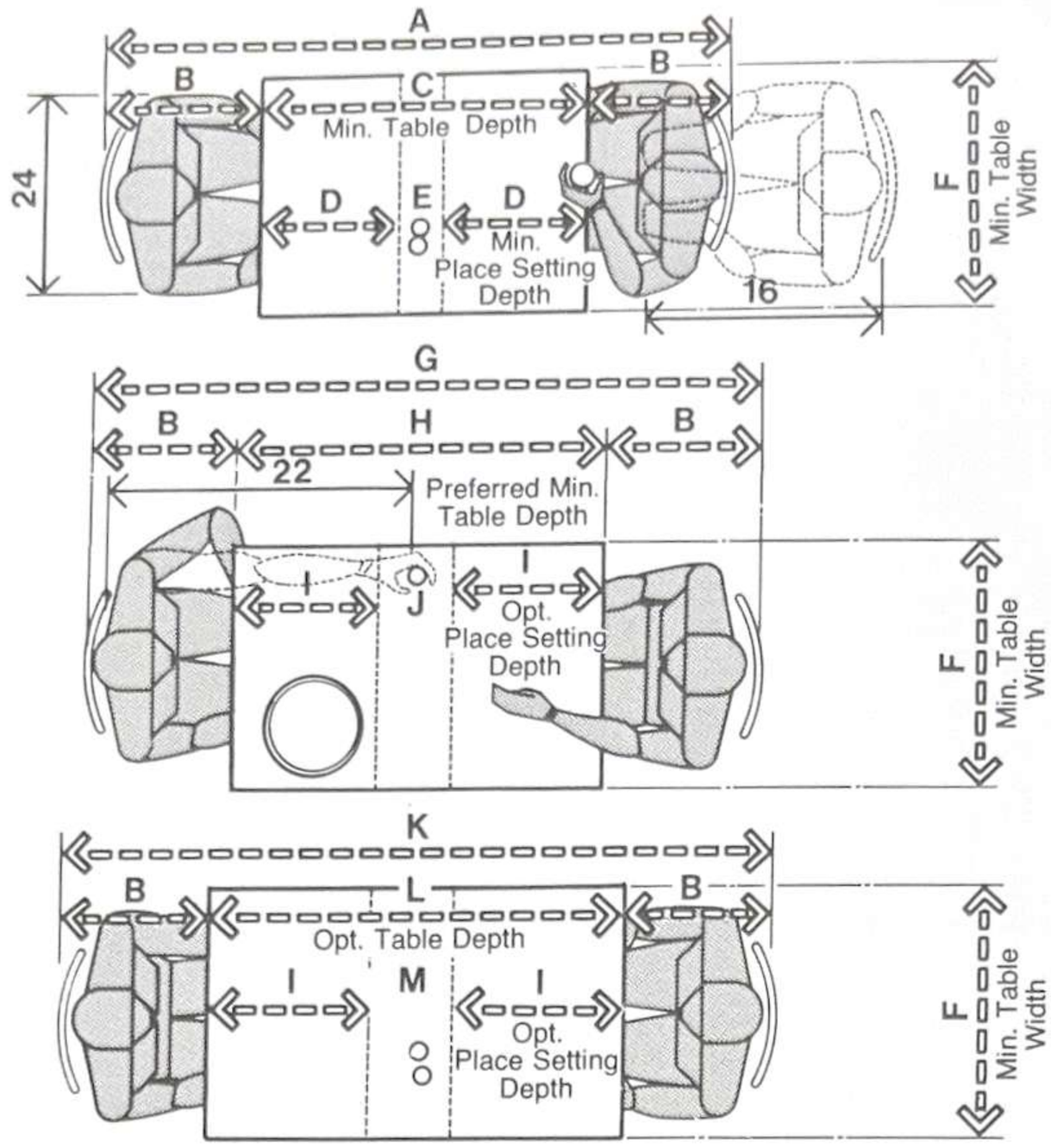


TABLE SIZES/MINIMUM TABLE WIDTH WITH MINIMUM, PREFERRED MINIMUM, AND OPTIMUM TABLE DEPTHS

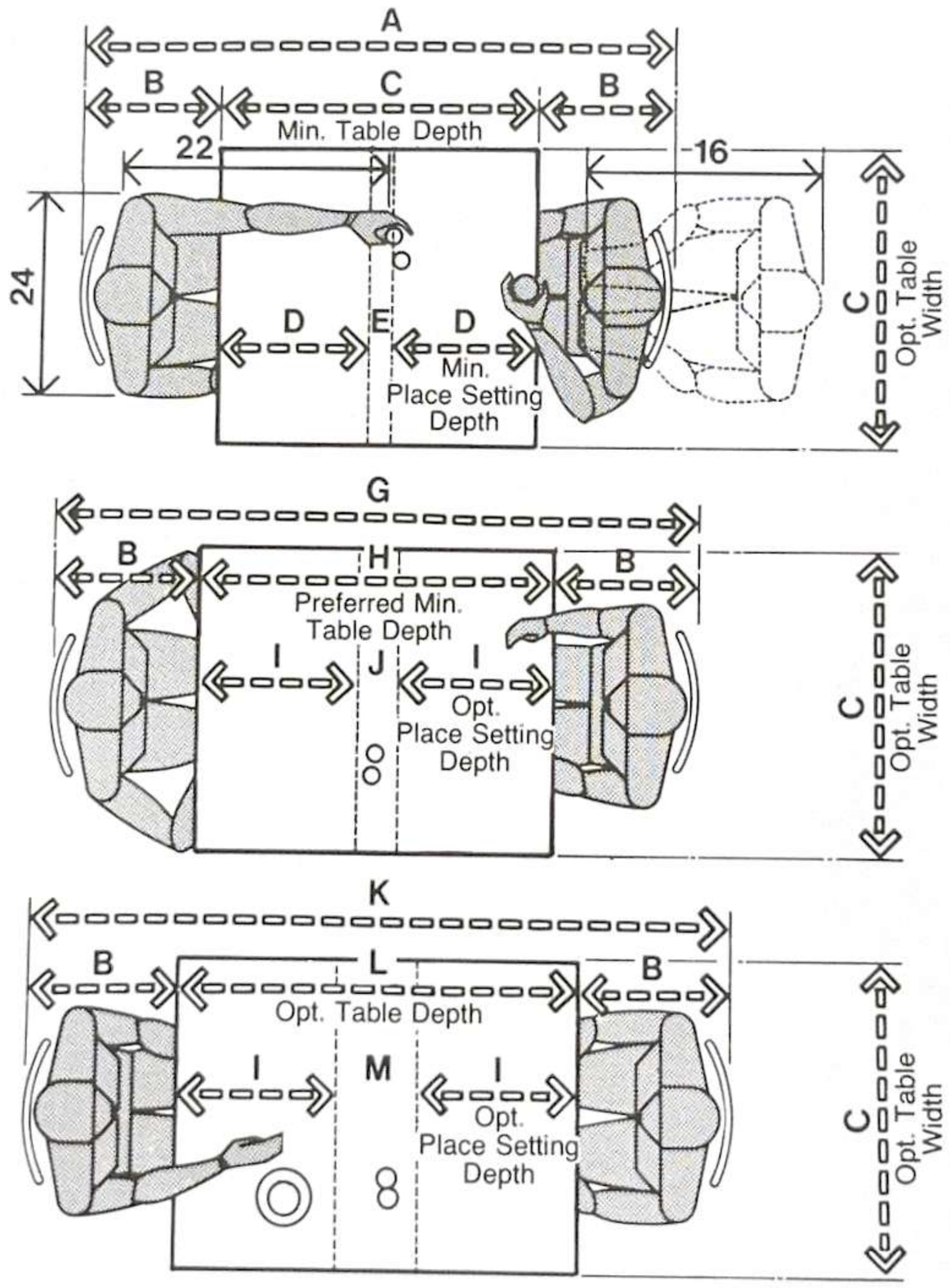
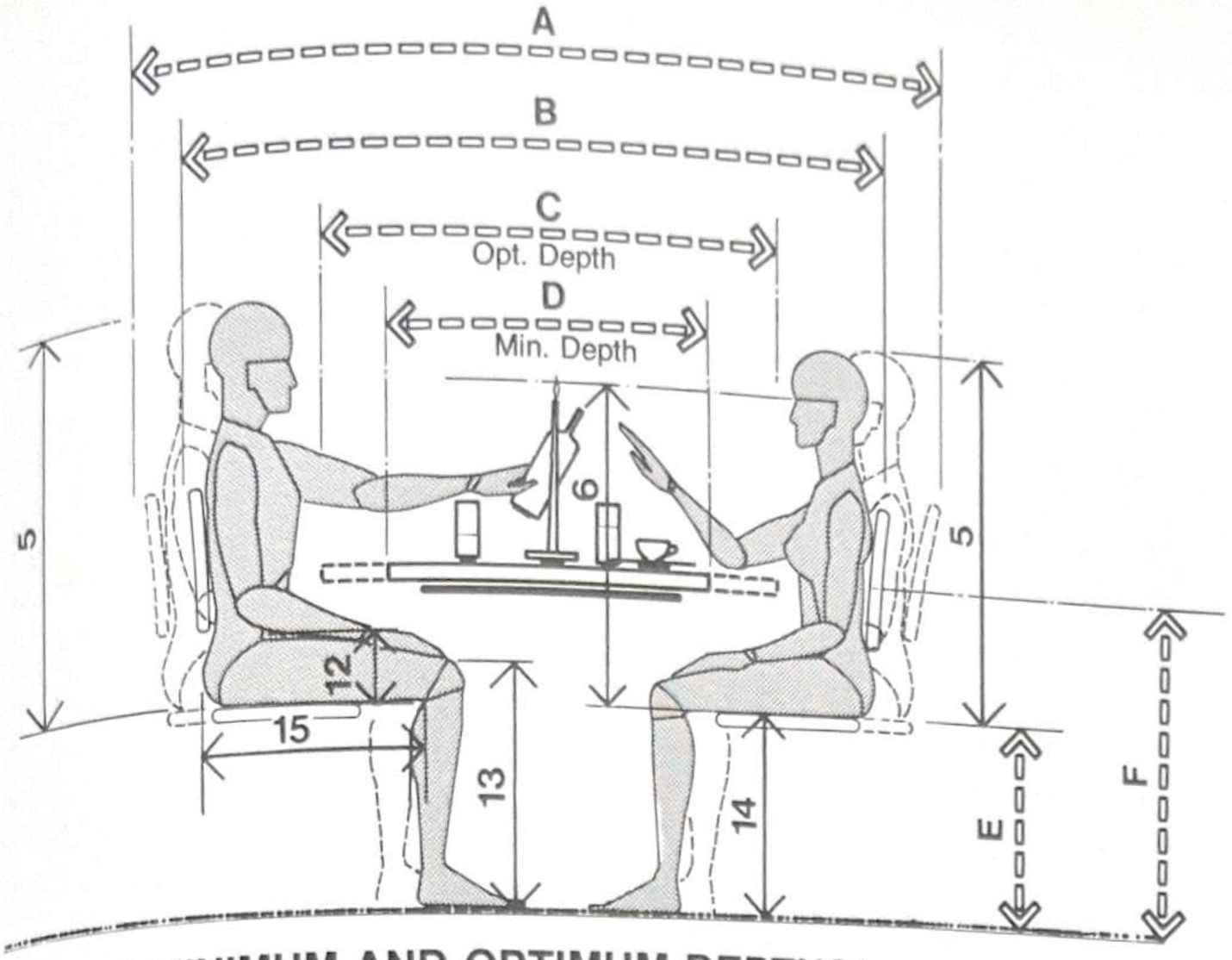


TABLE SIZES/OPTIMUM TABLE WIDTH WITH MINIMUM, PREFERRED MINIMUM, AND OPTIMUM TABLE DEPTHS

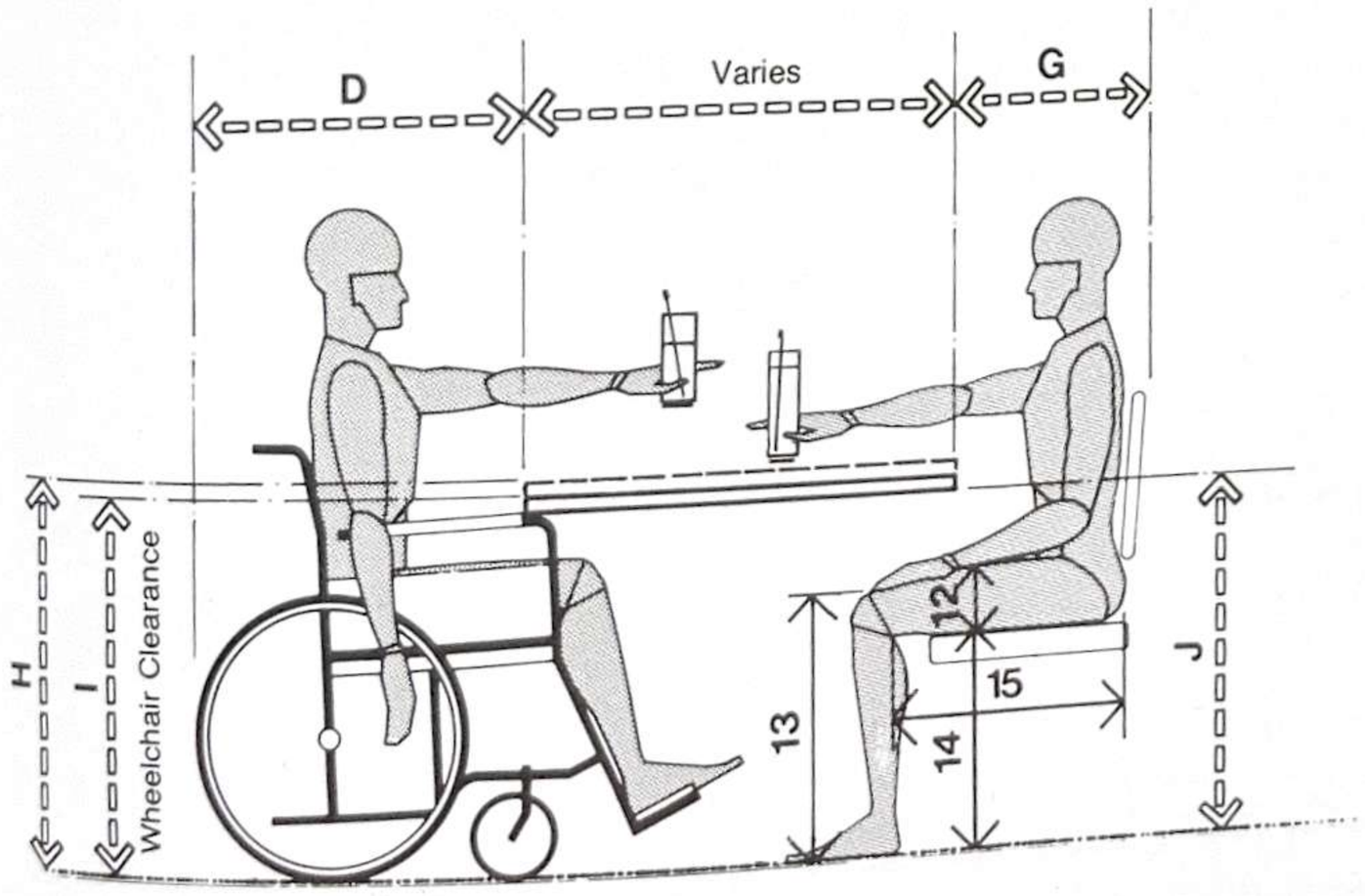
	in	cm
A	66–78	167.6–198.1
B	18–24	45.7–61.0
C	30	76.2
D	14	35.6
E	2	5.1
F	24	61.0
G	72–84	182.9–213.4
H	36	91.4
I	16	40.6
J	4	10.2
K	76–88	193.0–223.5
L	40	101.6
M	8	20.3



TABLES/MINIMUM AND OPTIMUM DEPTHS/
VERTICAL CLEARANCES

5.3 DINING SPACES

Both drawings deal with the height and clearance of dining tables. The top drawing relates to the plans on the preceding page and illustrates a 30- and a 40-in, or a 76.2- and a 101.6-cm, table. The portions of the drawing shown in dotted line reflect the 40-in table. The bottom drawing deals with wheelchair access to a dining table. Clearance from the floor to the underside of the table is critical if the wheelchair-bound diner is to be accommodated. Unfortunately, conflicting requirements, depending on the source consulted, show this dimension to be 29 or 30 in, or 72.5 or 75 cm. The American National Standards Institute (ANSI) indicates the required height of the armrest from the floor to be 29 in, or 72.5 cm. Some state legislation requires 30 in, or 75 cm, to the underside of the table. Unfortunately, a 30-in dimension would place the top of the table surface at about 31 in, or 78.7 cm. Such a height would not comfortably accommodate able-bodied diners of smaller size. To raise the seat height would cause the feet of the smaller user to dangle unsupported, and footrests would be somewhat impractical in a public space. Since armrest heights of many wheelchairs do not, in fact, exceed 29 in, or 72.5 cm, and since most models have removable or adjustable arms, the authors recommend a 29-in clearance, instead of 30 in. Such a dimension will accommodate both handicapped and able-bodied users.



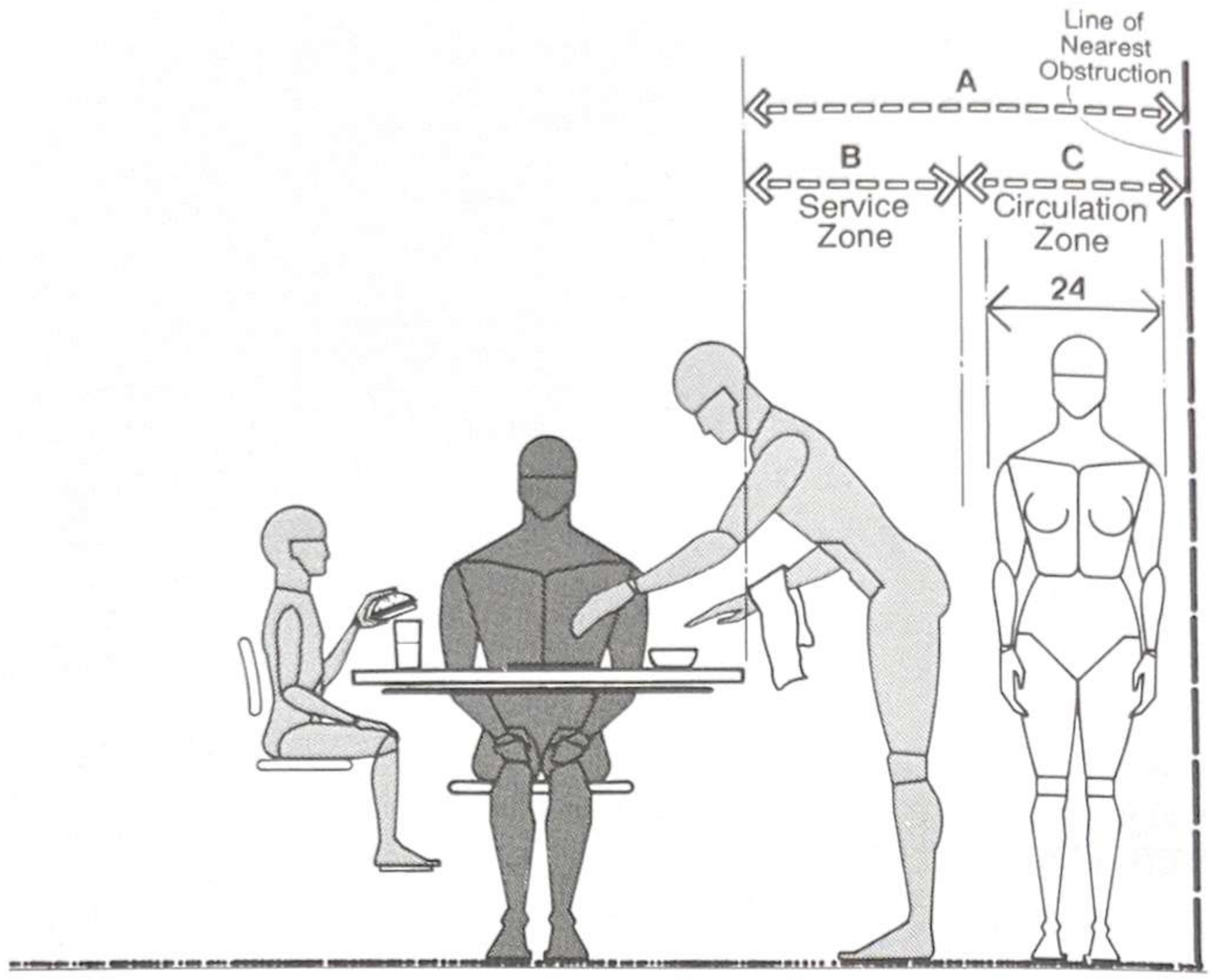
TABLES / WHEELCHAIR CLEARANCE

	in	cm
A	76–88	193.0–223.5
B	66–78	167.6–198.1
C	40	101.6
D	30	76.2
E	16–17	40.6–43.2
F	29–30	73.7–76.2
G	18–24	45.7–61.0
H	31	78.7
I	30 min.	76.2 min.
J	29 min.	73.7 min.

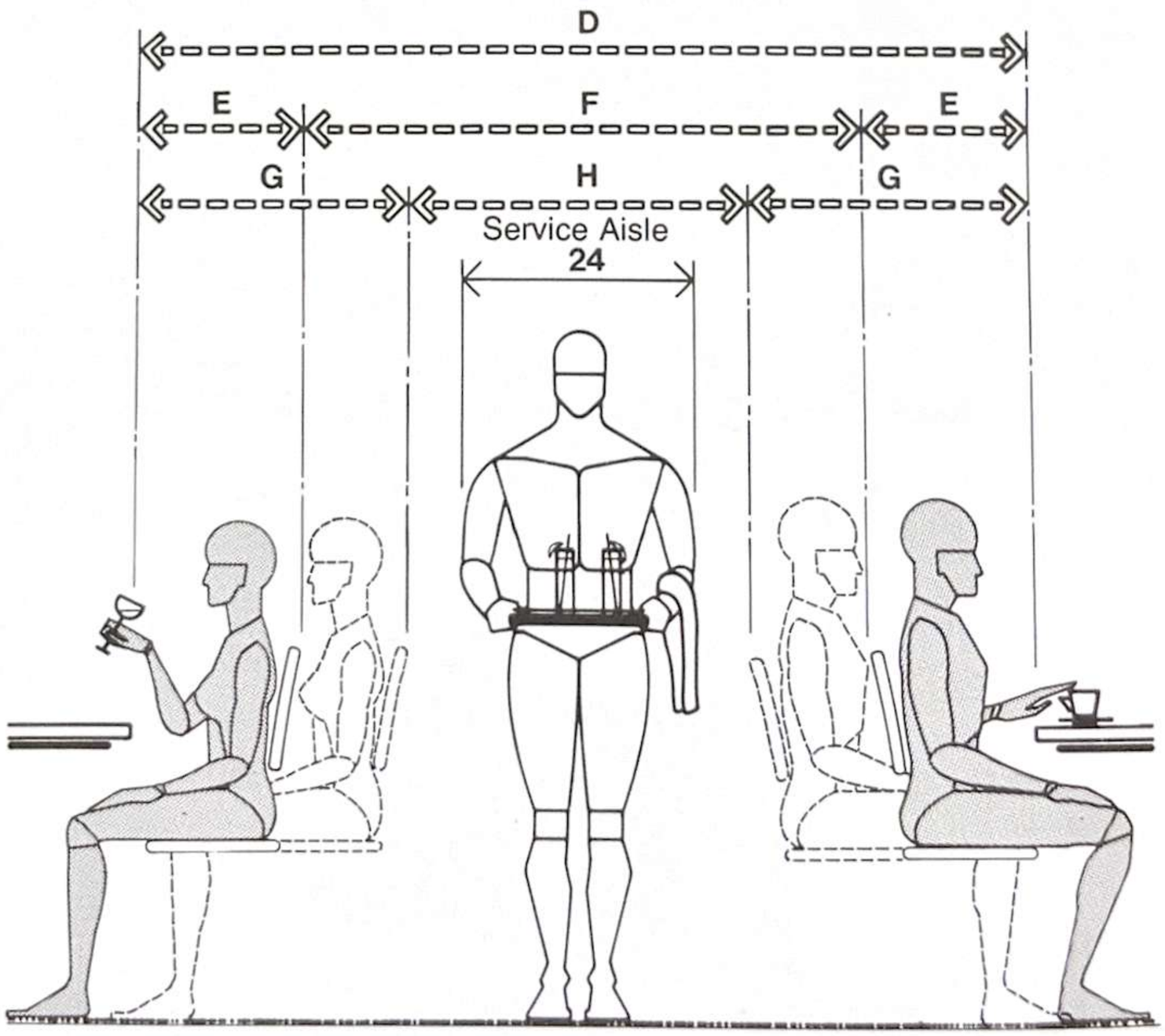
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5.3 DINING SPACES

The top drawing shows minimal clearance for a combined service and circulation aisle in a low-volume operation. It should be noted that the width indicated will not accommodate two lanes. Either the waiter or customer would have to step aside to avoid body contact. In a high-volume operation, with long aisle lengths, such a clearance would be inadequate. The bottom drawing illustrates a situation where chairs abut a service aisle. The drawing is not intended to serve as a standard for aisle clearance, but merely to indicate all factors involved in establishing that clearance, including intrusions of the chairs into the aisle space. The chair may be relocated as many as four times during the course of the meal. At the beginning, it is much closer to the table. Near the end of the meal in an attempt to relax, one may move the chair away from the table about 24 in, or 61 cm. During intimate conversation it may be brought even closer to the table. Finally, in rising from the chair at the conclusion of the meal, its final location may be as much as 36 in, or 91.4 cm, away. If all intrusions are considered, the clearance between tables could total as much as 108 in, or 274.3 cm, which may prove uneconomical. Yet, to ignore the intrusions would be unrealistic. The authors suggest that, as a reasonable compromise, a clearance between tables of 84 in, or 213.4 cm, be used for preliminary design assumptions.

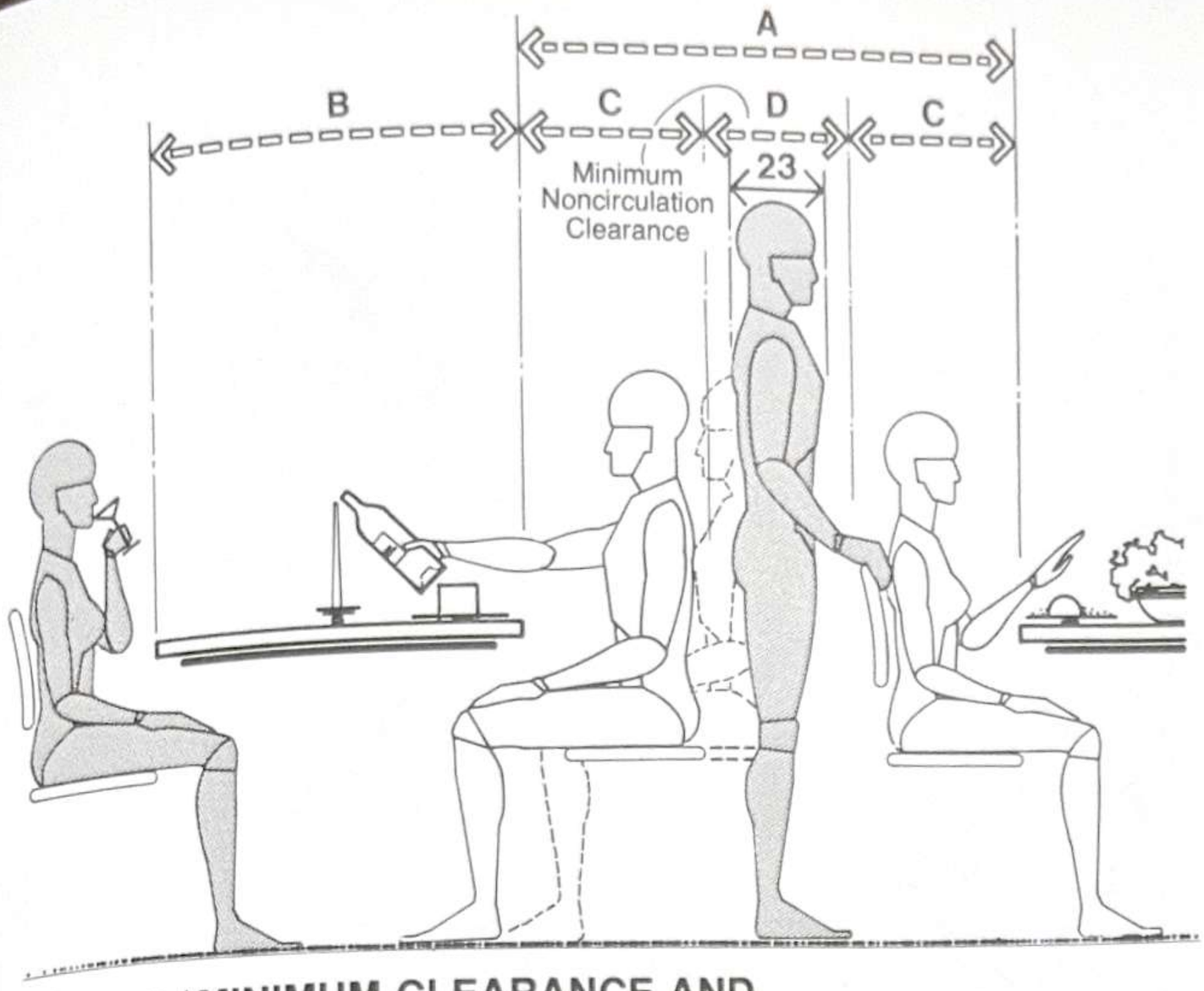


TABLES / CLEARANCE FOR WAITER SERVICE AND CIRCULATION

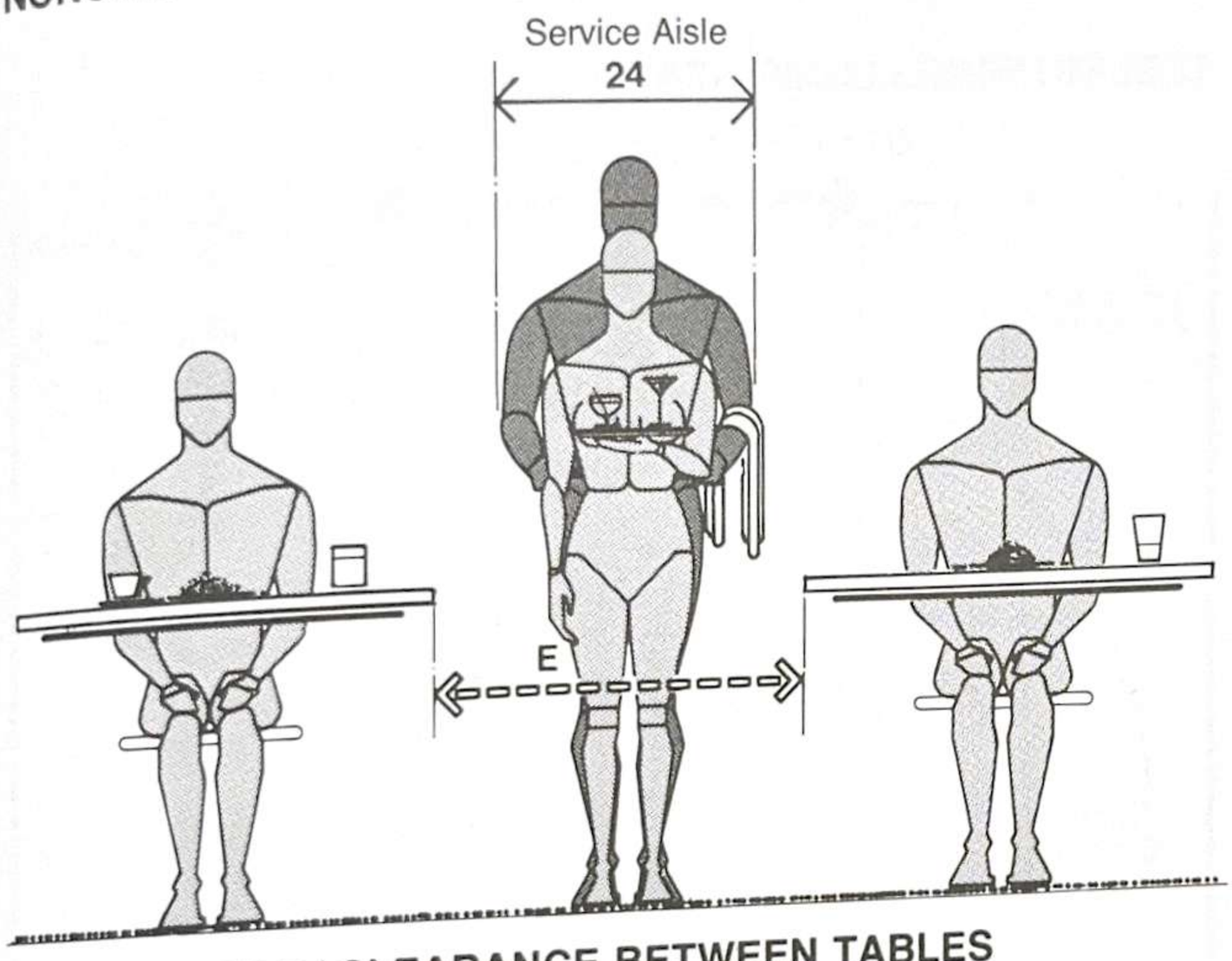


SERVICE AISLE / CLEARANCE BETWEEN CHAIRS

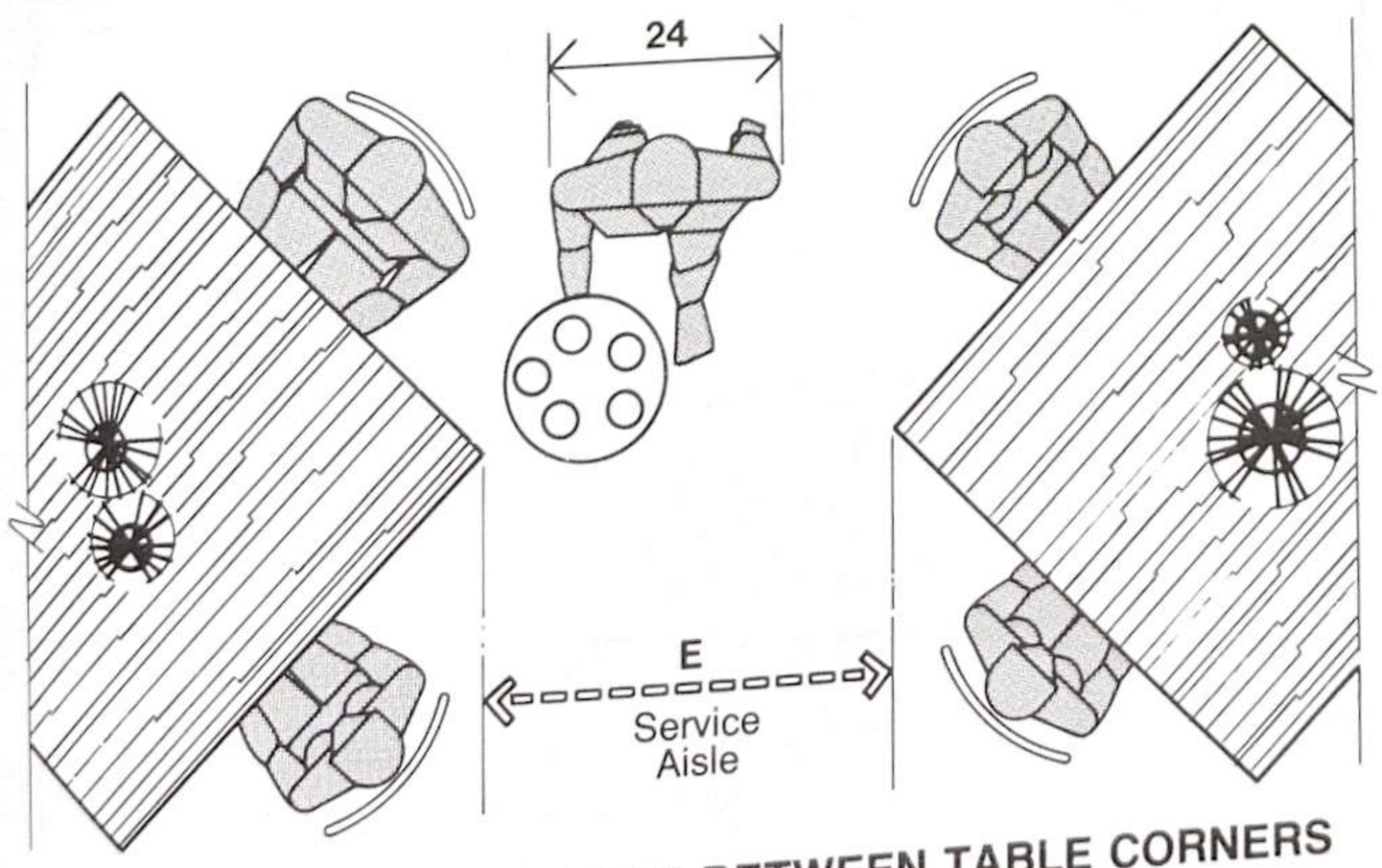
	in	cm
A	48	121.9
B	18	45.7
C	30	76.2
D	96–108	243.8–274.3
E	18–24	45.7–61.0
F	60	152.4
G	30–36	76.2–91.4
H	36	91.4



TABLES / MINIMUM CLEARANCE AND NONCIRCULATION ZONES



SERVICE AISLE / CLEARANCE BETWEEN TABLES



SERVICE AISLE / CLEARANCE BETWEEN TABLE CORNERS

5.3 DINING SPACES

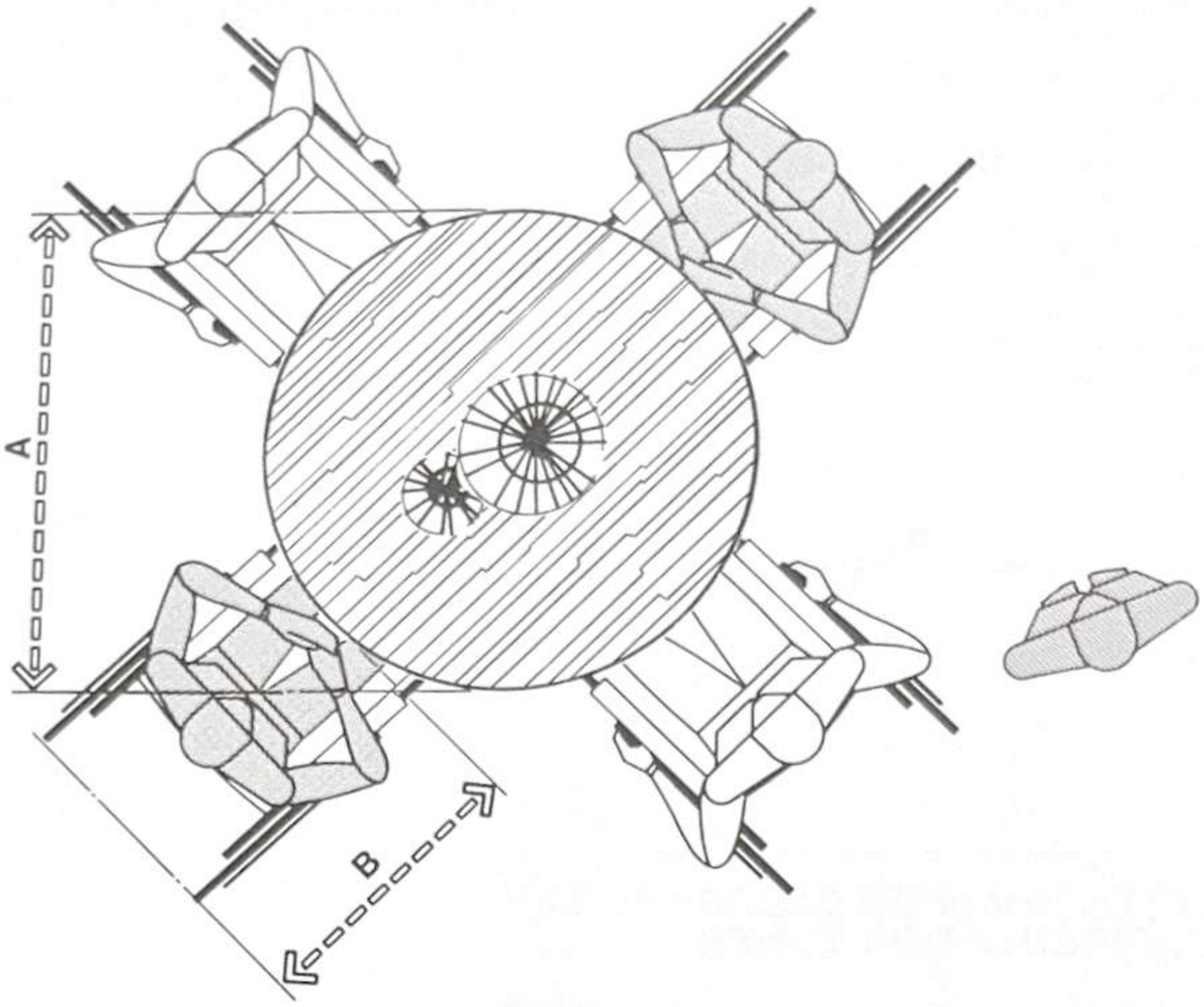
In certain table arrangements, chairs of two adjacent tables may be located back to back and some clearance between them must be provided. This clearance would not be for purposes of public circulation or service, but simply to allow access to the chair. A minimum clearance of 18 in, or 45 cm, from chair to chair, as indicated in the top drawing, or a minimum clearance of 54 in, or 137.2 cm, between tables would be adequate. A 66-in, or 167.7-cm, clearance between tables is preferred. The minimum recommended clearance for a service lane is 36 in, or 91.4 cm, as illustrated in the drawings at the center and bottom. Should the diagonal arrangement in the bottom drawing involve smaller tables, the chairs may project beyond the corners of the table. However, the integrity of the 36-in clearance should be maintained. If the chairs do project, the clearance should be measured between the chairs and not the table corners.

	in	cm
A	54–66	137.2–167.6
B	30–40	76.2–101.6
C	18–24	45.7–61.0
D	18	45.7
E	36	91.4

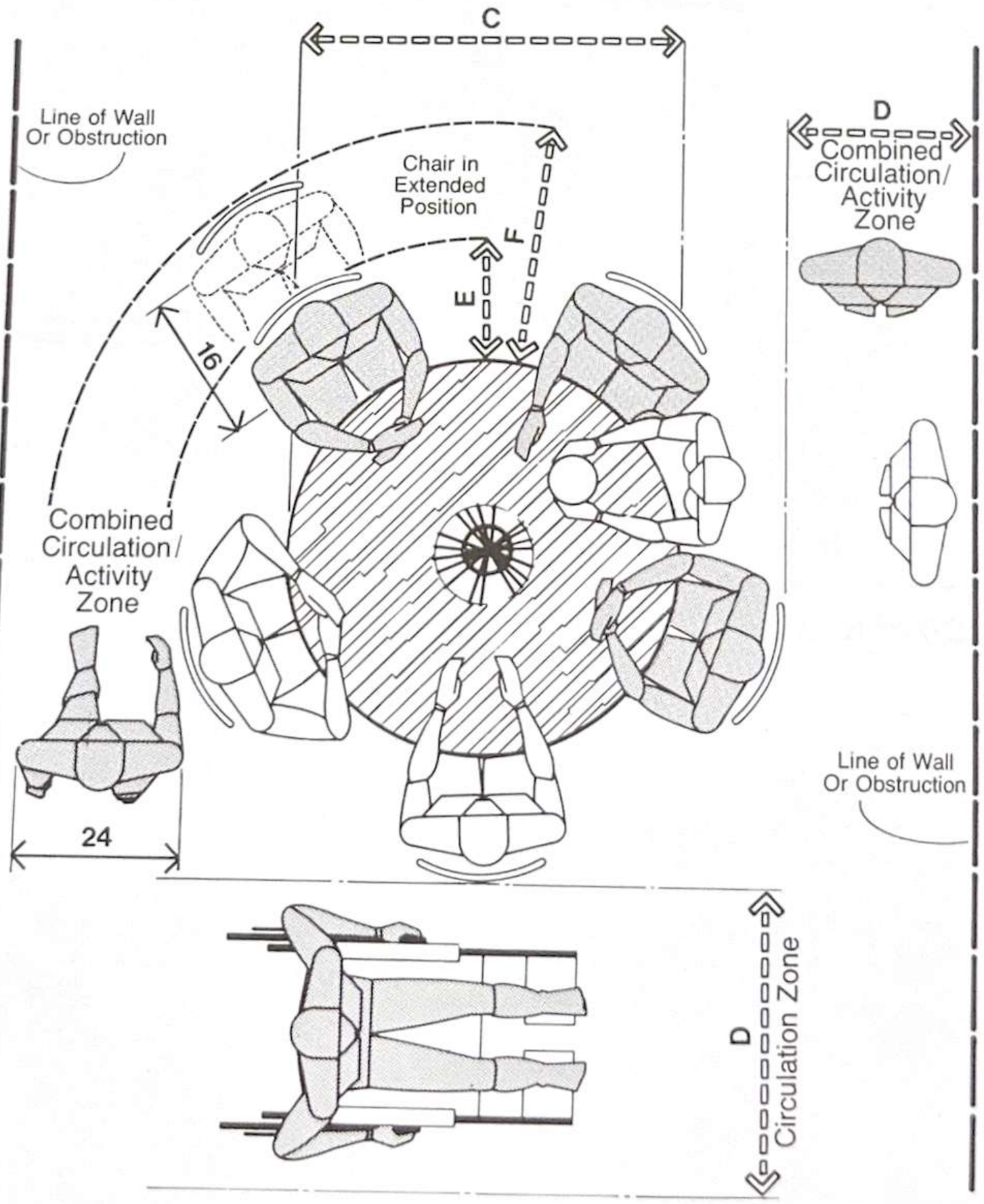
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5.3 DINING SPACES

In planning for wheelchair access, the portion of the chair projecting beyond the table will be between 24 and 30 in, or 61 and 76.2 cm. It is suggested that the larger figure be used for preliminary design assumptions. What is not indicated on the drawing are the clearances required for wheelchair maneuvering to and from the table. Turning radii and other information relating to the maneuverability of the wheelchair are provided elsewhere in this book. The drawing at the bottom of the page indicates the clearances required for chair movement in connection with a round table. It should also be noted that the lane width needed to accommodate a wheelchair should be a minimum of 36 in, or 91.4 cm.



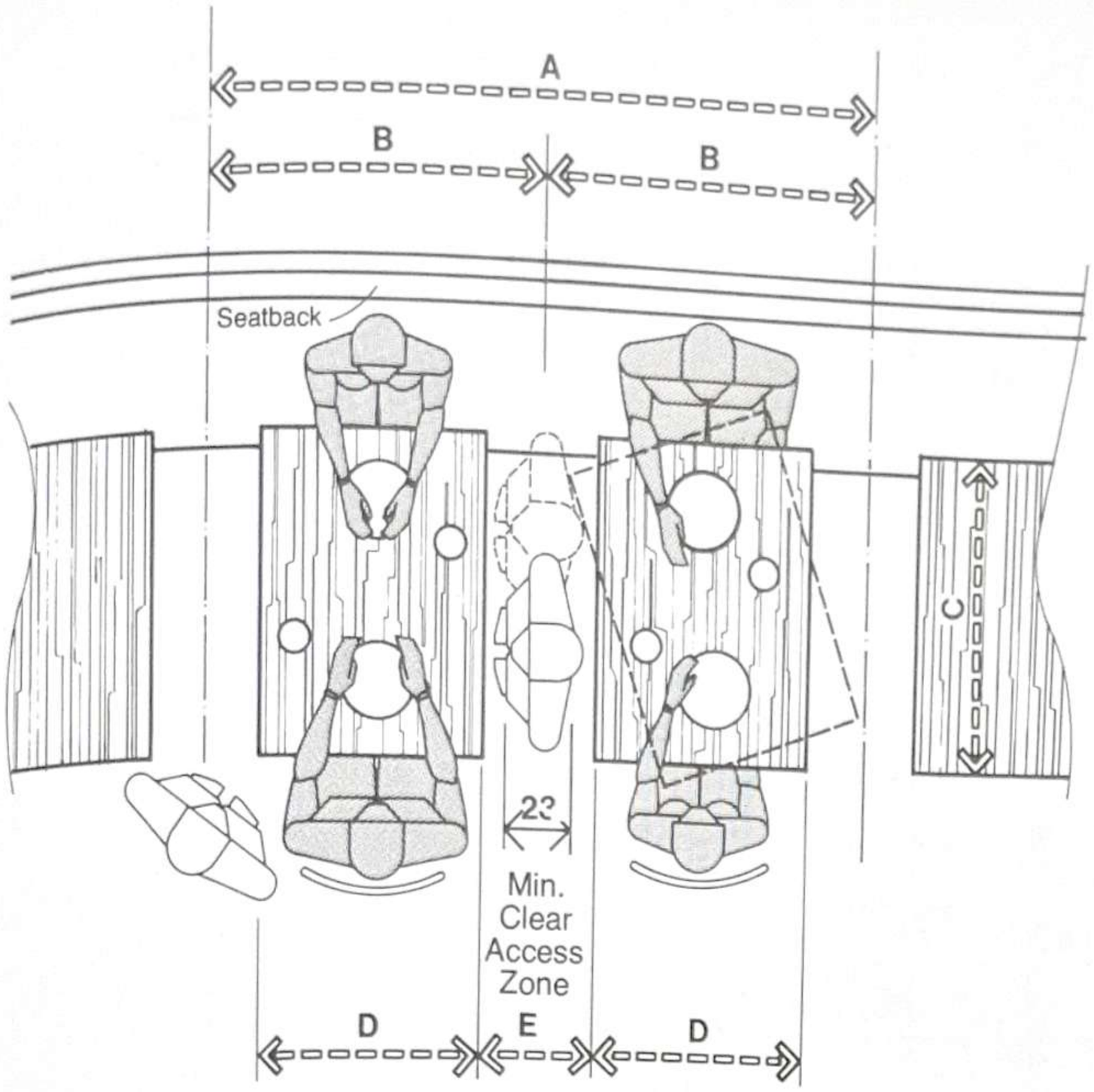
TABLES / WHEELCHAIR SEATING



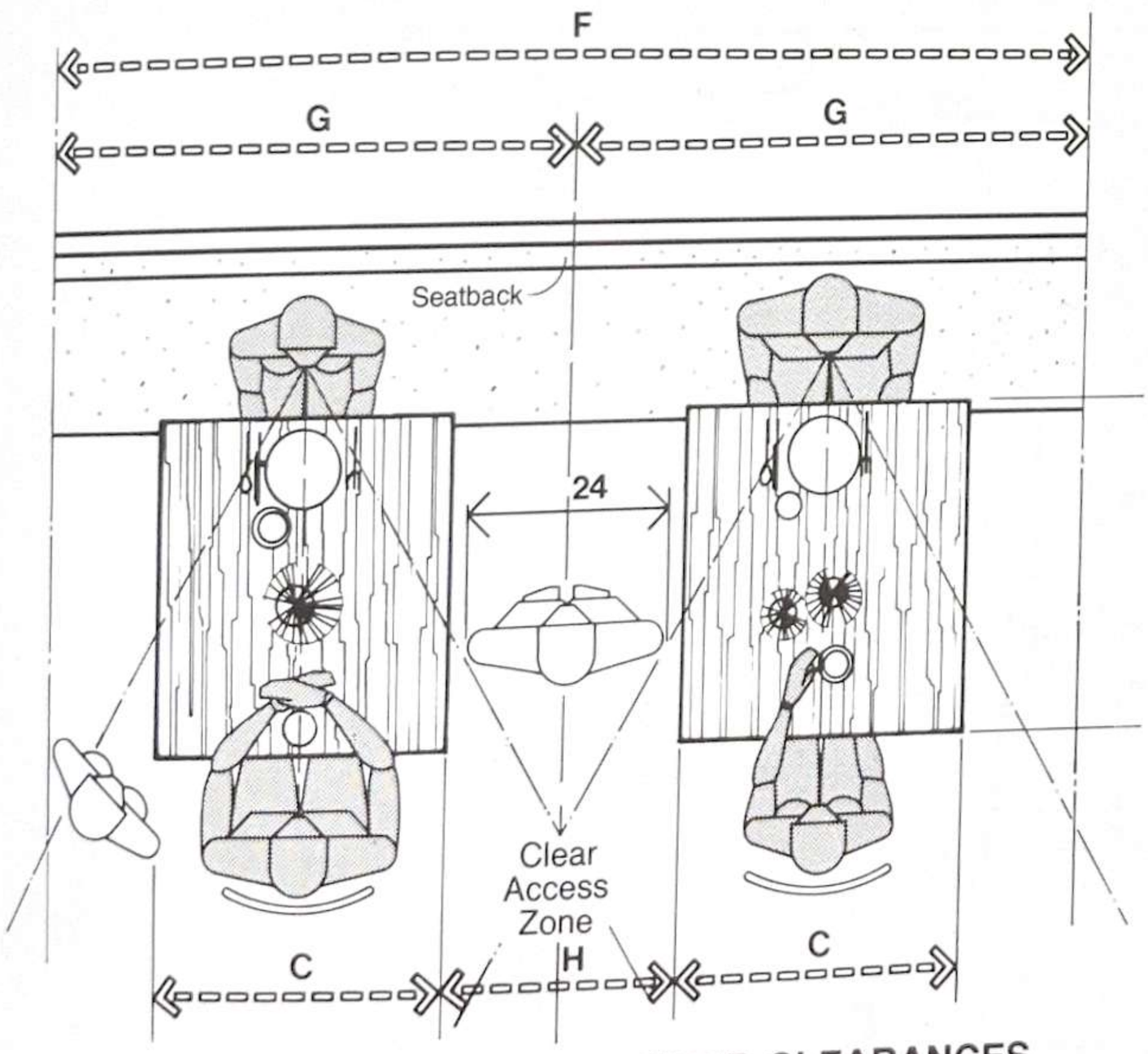
	in	cm
A	48–54	121.9–137.2
B	24–30	61.0–76.2
C	48	121.9
D	36	91.4
E	18–24	45.7–61.0
F	30–36	76.2–91.4

5.3 DINING SPACES

Both drawings illustrate the clearances involved for banquette dining arrangements. One of the more critical considerations is access to the banquette seat. The top drawing indicates a minimum clearance between tables. The maximum body depth of the larger person, based on the 99th percentile data, is 13 in, or 33 cm. Allowing for clothing and body movement in addition to the basic body dimension, it becomes apparent that access to the banquette seat for the larger person may require moving the table. The bottom drawing suggests a 24-in, or 61-cm, clearance between tables, which will permit access without disturbing the table location. That spacing will also provide more privacy for the patrons.



BANQUETTE SEATING / MINIMUM CLEARANCES



BANQUETTE SEATING / RECOMMENDED CLEARANCES FOR ACOUSTIC AND VISUAL PRIVACY

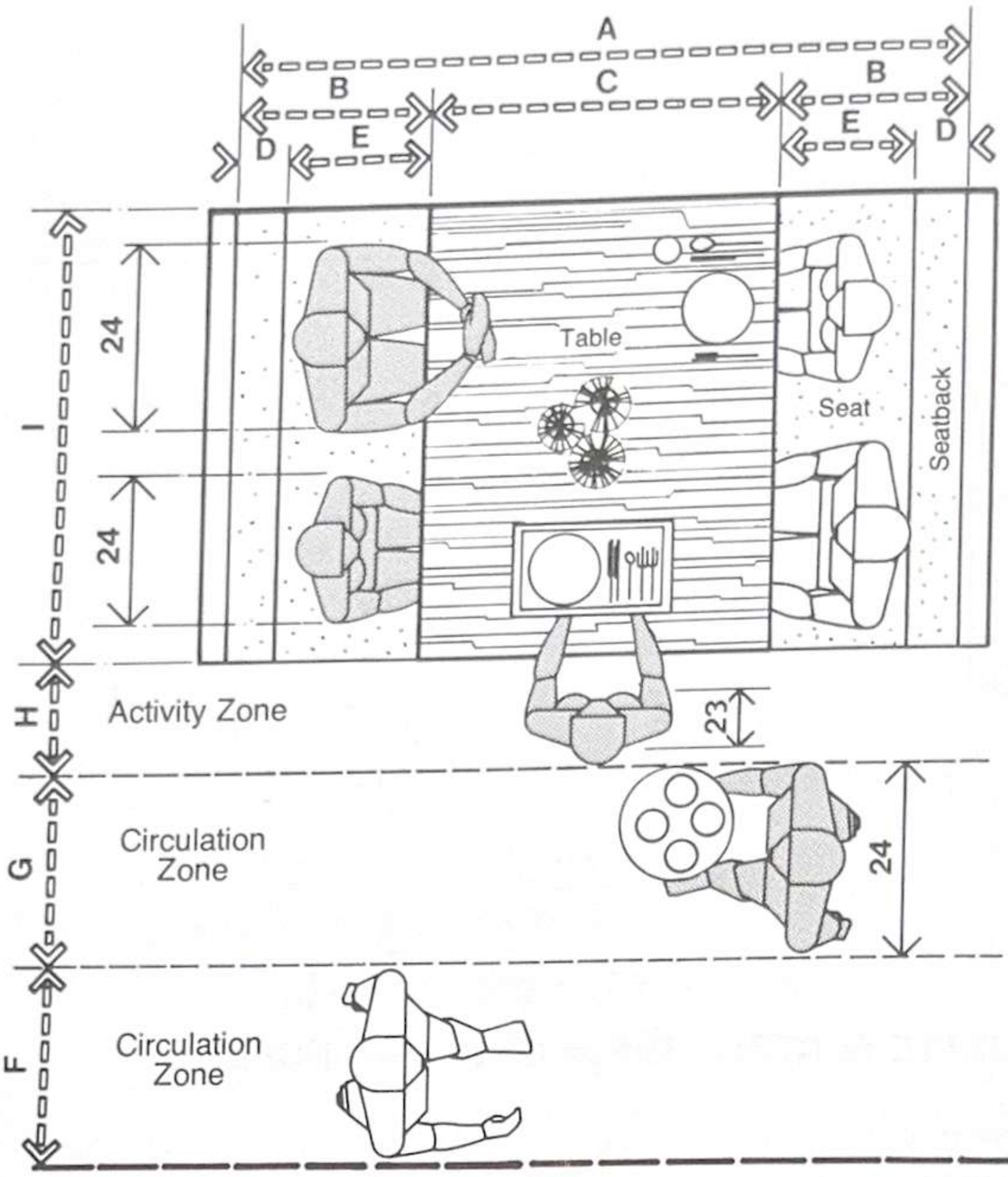
	in	cm
A	72–76	182.9–193.0
B	36–38	91.4–96.5
C	30	76.2
D	24	61.0
E	12–14	30.5–35.6
F	108	274.3
G	54	137.2
H	24	61.0

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5.3 DINING SPACES

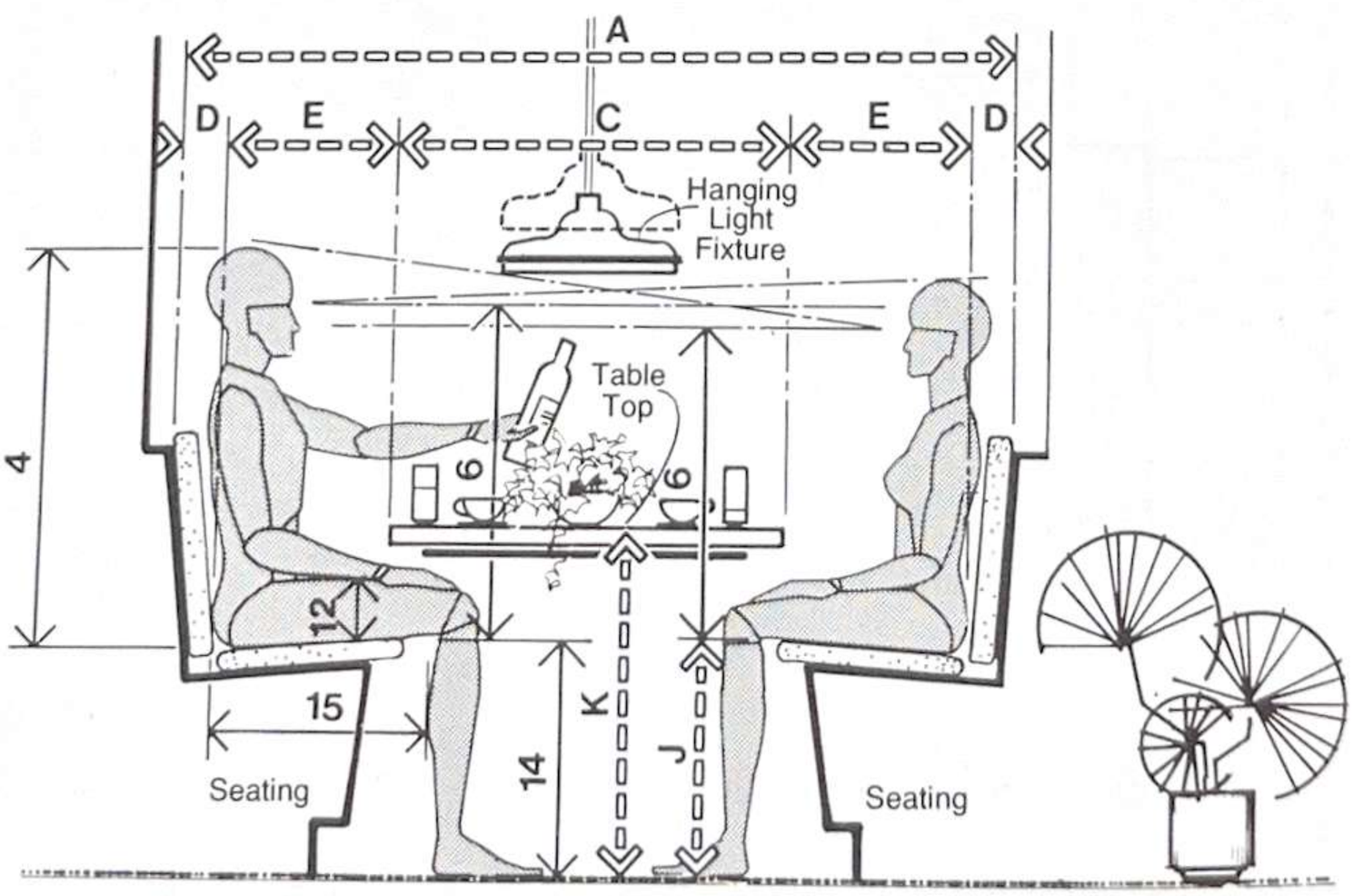
Booths, particularly in situations where both the seating and the table are fixed, provide no margin for individual adjustment. This lack of flexibility makes it essential that the anthropometric aspects of the design be considered closely. The height of the compressed seat should reflect popliteal height data; the depth of the seat, buttock-popliteal length data; the distance from the top of the seat to the underside of the table, thigh clearance data; the height of the booth or that of a hanging light fixture above the table top, eye-height sitting data; and the width of the seat, maximum body breadth data.

Equally important is the relation of human dimensions to the aisle for clearance of public and service circulation. The two drawings illustrate in both plan and section some of the basic anthropometric considerations involved.



BOOTH SEATING AND CIRCULATION CLEARANCES

	in	cm
A	65–80	165.1–203.2
B	17.5–20	44.5–50.8
C	30–40	76.2–101.6
D	2–4	5.1–10.2
E	15.5–16	39.4–40.6
F	30	76.2
G	36	91.4
H	18	45.7
I	48–54	121.9–137.2
J	16–17	40.6–43.2
K	29–30	73.7–76.2



BOOTH SEATING

6 HEALTH CARE SPACES

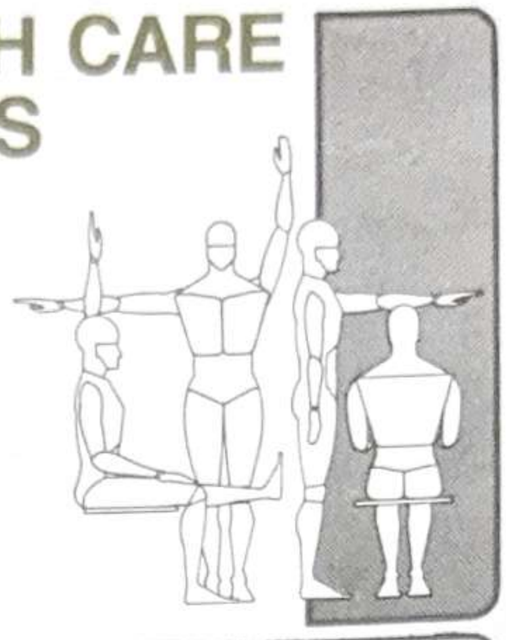


TABLE	6.1 MEDICAL TREATMENT	6.2 DENTAL TREATMENT	6.3 HOSPITAL ROOMS	SPACE / ANTHROPOMETRIC DATA
1A,2B	◐	◐		1 STATURE
1B,3C	◐	◐	◐	2 EYE HEIGHT
1C,3B	◐			3 ELBOW HEIGHT
				4 SITTING HEIGHT ERECT
				5 SITTING HEIGHT NORMAL
1F,3G	◐	◐	◐	6 EYE HEIGHT SITTING
				7 MIDSHOULDER HEIGHT SITTING
				8 SHOULDER BREADTH
				9 ELBOW-TO-ELBOW BREADTH
				10 HIP BREADTH
				11 ELBOW REST HEIGHT
1L,2H		●		12 THIGH CLEARANCE
				13 KNEE HEIGHT
				14 POPLITEAL HEIGHT
				15 BUTTOCK-POPLITEAL LENGTH
1P,2L		●	◐	16 BUTTOCK-KNEE LENGTH
				17 BUTTOCK-TOE LENGTH
				18 BUTTOCK-HEEL LENGTH
1S,4C				19 VERTICAL REACH HEIGHT SITTING
1T,4F				20 VERTICAL GRIP REACH
1U,4E	○			21 SIDE ARM REACH
1V,4D	○	○	○	22 THUMB TIP REACH
1W,6B	●	●	●	23 MAXIMUM BODY DEPTH
1X,6A	●	●	●	24 MAXIMUM BODY BREADTH

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Health care facilities range in sophistication and scope from a modest doctor's or dentist's office to a large hospital complex. Facilities may also include nursing homes, group practices, mental health complexes, drug rehabilitation centers, and medical or dental schools. Demand for health facilities continues to grow, in terms not only of new structures, but also of modernization of existing buildings. Facilities are constantly being retrofitted and added to; and most recently, the recycling and adaptation of buildings, originally intended for other uses, to house health care functions is yet another option taken to meet the growing needs for space.

As in other building types, the anthropometric considerations in the design of health-related interior spaces are extremely important. When the nature of the circumstances surrounding one's brief or extended stay in one of these facilities, whether as patient or visitor, is considered, the quality of the interface between the user and the space takes on greater significance. It is essential also that in terms of the professional and paraprofessional staff, the level of their interface with the work environment be of the highest quality.

All the following situations involve an understanding of human dimension and its impact on the design of interior space: adequate space around a bed for visitor seating and circulation; proper heights and clearances for a nurse's station so that it is responsive to the anthropometric requirements of nurse, patient, and visitor; the placement of the viewing systems so they can accommodate the eye height of the tall and short, seated and standing, male or female viewer; the height of a laboratory or utility table so that it is accessible to those of large or small body size; and clearances necessary to make these spaces accessible to those confined in wheelchairs. The drawings and related text on the following pages examine some of these typical situations and provide the dimensional information necessary for preliminary design assumptions.

6.1 MEDICAL TREATMENT ROOMS

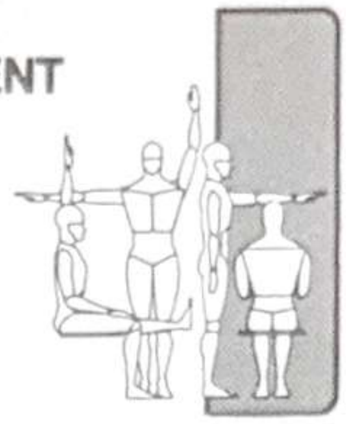


TABLE	EXAMINING	STORAGE	SINK	X-RAY VIEWING	LABORATORY	CIRCULATION
1A,2B			◑			
1B,3C		◑	◑	◑		
1C,3B	◑		◑			
1F,3G				◑	◑	
1U,4E	○					
1V,4D				○		
1W,6B		●				●
1X,6A						●

ACTIVITIES	ANTHROPOMETRIC DATA
1	STATURE
2	EYE HEIGHT
3	ELBOW HEIGHT
6	EYE HEIGHT SITTING
21	SIDE ARM REACH
22	THUMB TIP REACH
23	MAXIMUM BODY DEPTH
24	MAXIMUM BODY BREADTH

The drawings on the following pages explore various elements of the medical treatment room, including the examination tables, laboratory tables, wash basins, and film viewing systems, in terms of the clearances and other dimensional requirements necessary to ensure their responsiveness to human body size. The heights of tables and counters and their relationship to the heights of the seats used with them are illustrated, and appropriate clearances and other dimensional data to ensure a proper body fit are indicated. The drawings also illustrate comparative relationships between the body size of the female and male user in terms of the various interior elements involved. The major anthropometric measurements to be considered are indicated in the matrix above. Perhaps the most interesting element, in terms of the anthropometric considerations, is the wall-mounted film viewing system. In all probability the design approach will also prove applicable to various other medical equipment not included in the drawings. Of particular concern in any kind of viewing system is the eye height of the seated and standing male and female viewer of large and small body size. These data are extremely useful, if not absolutely essential, in establishing the proper height above the floor at which the unit must be located. The critical problem is to establish a height that will accommodate the majority of users, taking into account the significant difference in eye height between people of small and large body size. Of the drawings that follow is a series concerned exclusively with this aspect of human dimension. One interesting observation is that the difference in eye height between that of a viewer of very small body size and that of one of very large body size is almost twice as much when both people are standing than when both are in a seated position.

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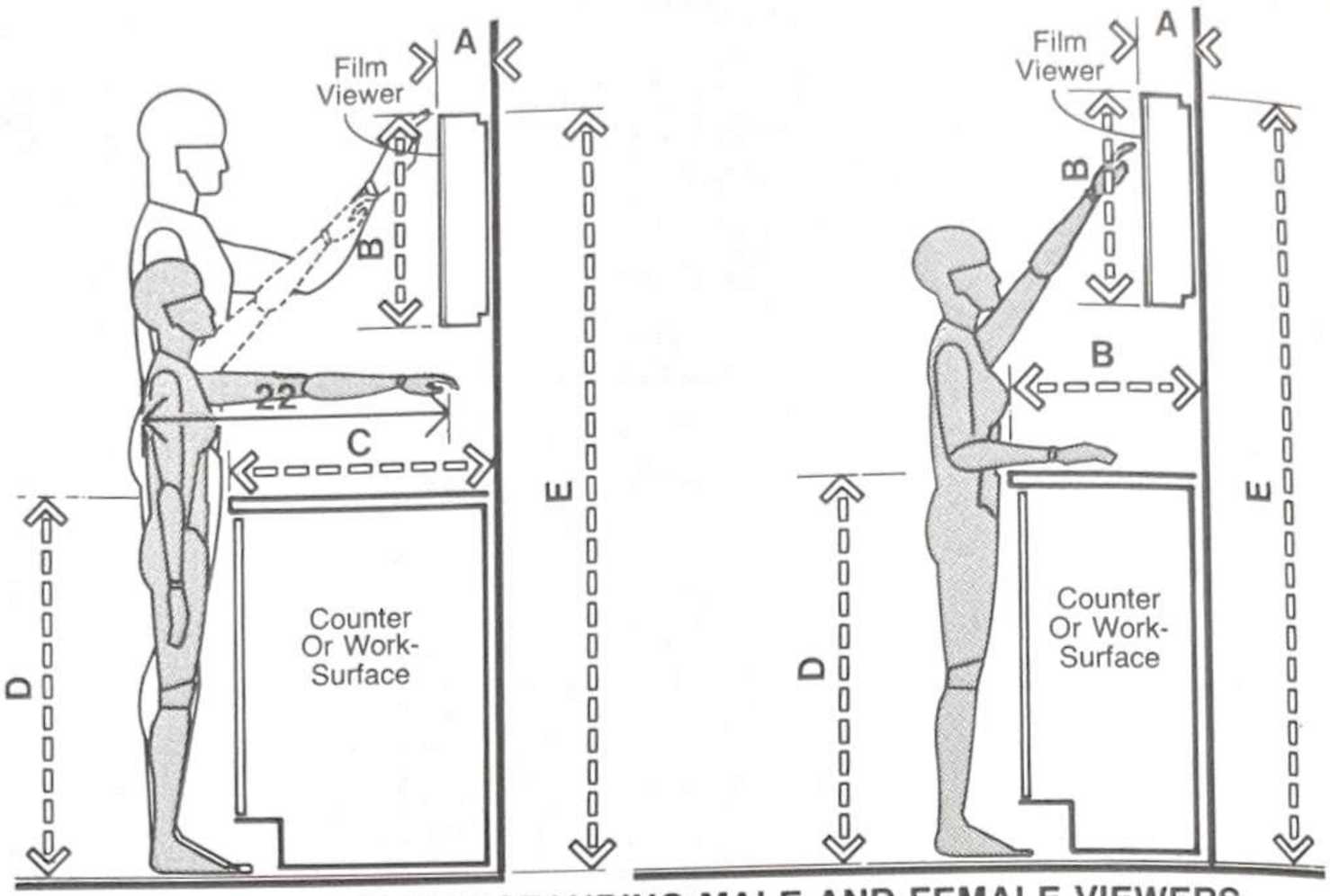
6.1 MEDICAL TREATMENT ROOMS

The principal anthropometric considerations with film viewing systems involve eye height and human reach capability. The two drawings at the top of the page illustrate reach considerations for the tall and the short user. The drawing at the left shows a small female with 5th percentile reach measurements in contrast with a male of larger body size, reaching over a 24-in, or 61-cm, counter top to make contact with the system surface. The 24-in obstruction reduces the effective reach of the smaller user. The drawing at the right shows that reducing the counter depth below the viewing system to 18 in, or 45.7 cm, enables the smaller user to more comfortably reach the system surface.

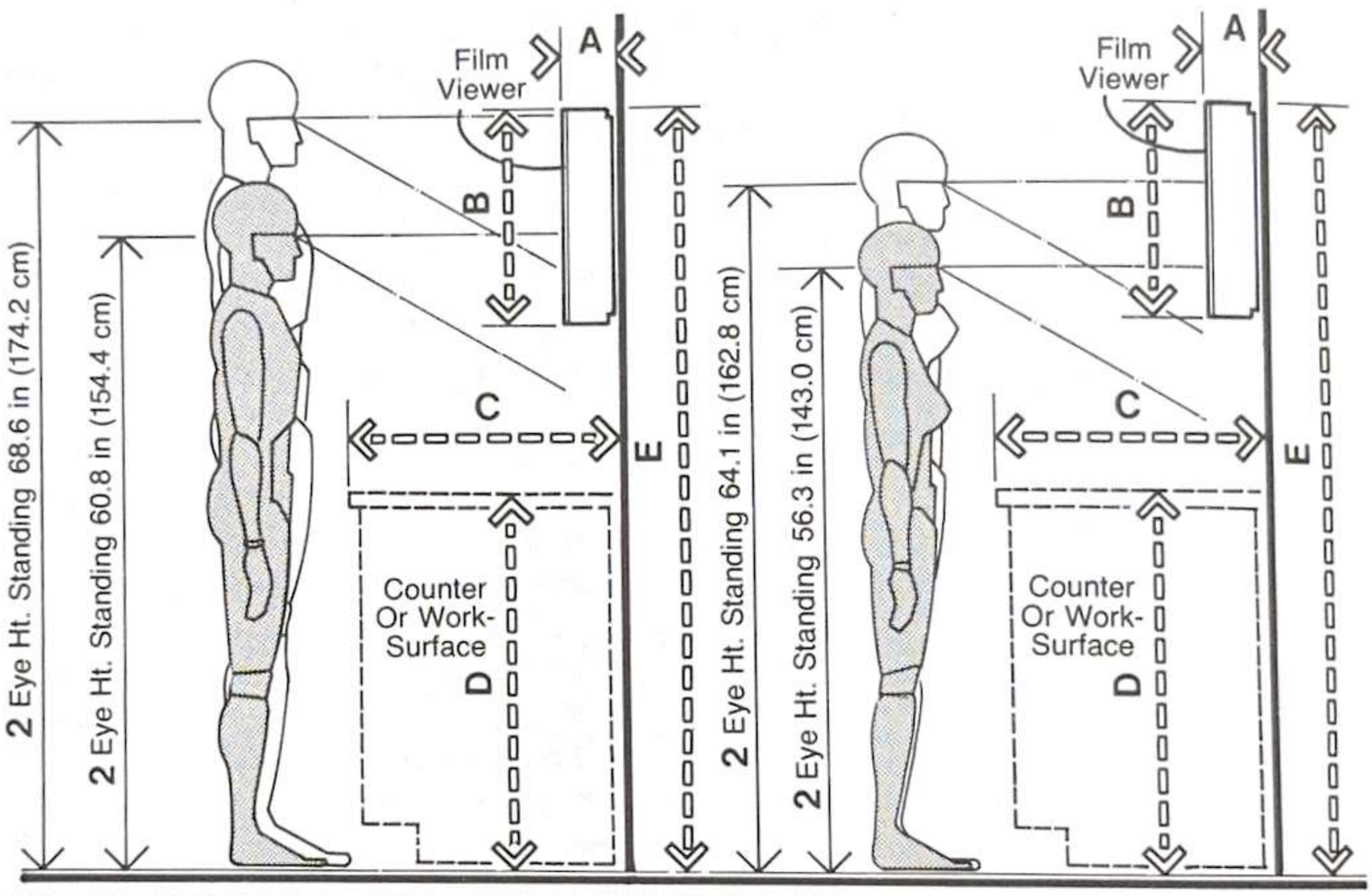
The two drawings at the center of the page illustrate the viewing relationship of the small and large male and female standing viewers to the system. It should be noted that the female of smaller body size has the least comfortable viewing position.

The two drawings at the bottom of the page compare the same pairs of viewers in a seated position with the top of the system located 52.5 in, or 133.4 cm, above the floor. Note how the difference in eye heights between viewers of small and large body size is much less when the viewers are seated than when they are standing.

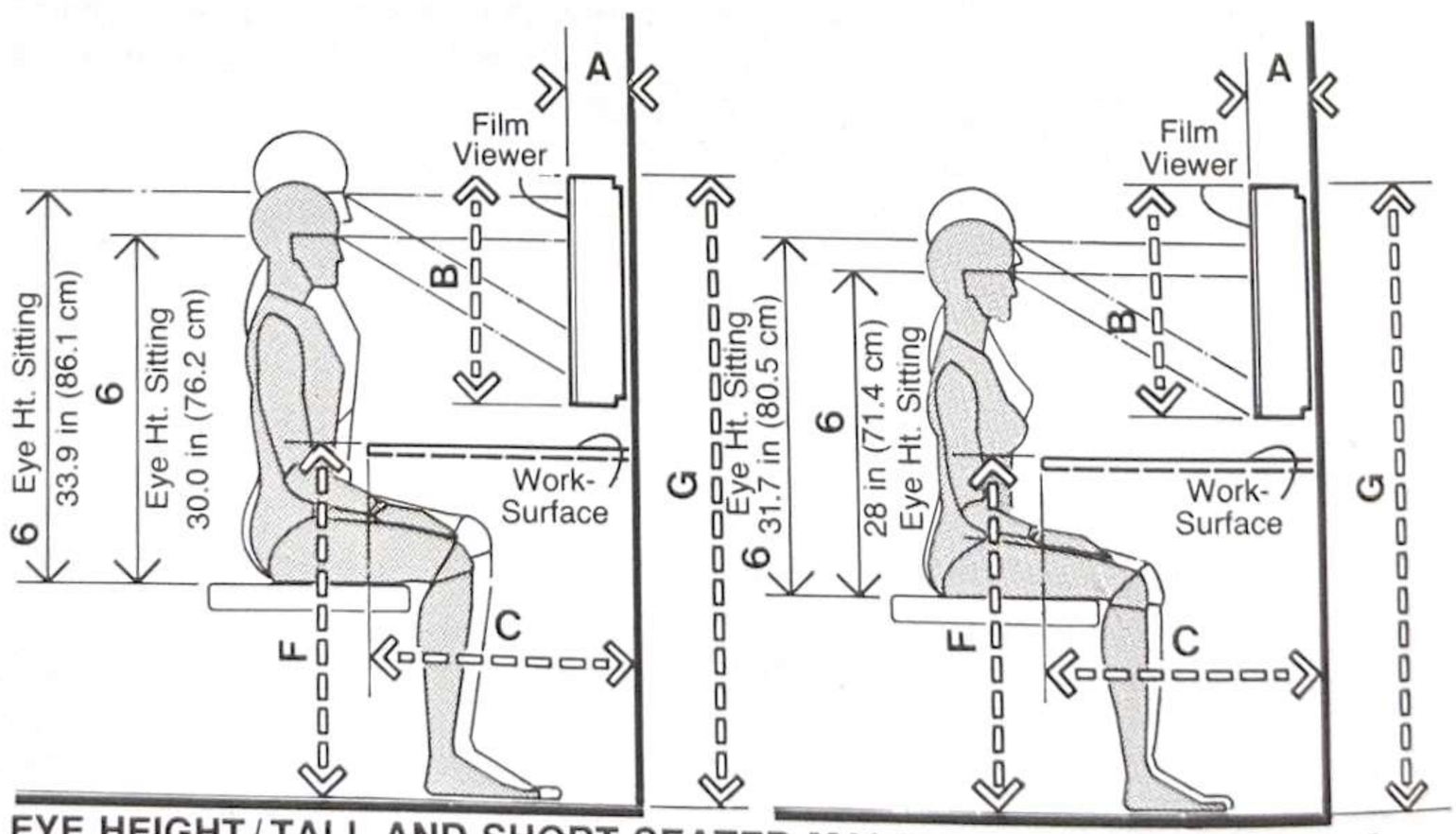
The seated arrangement accommodates the majority of viewers with maximum comfort. For standing viewers a dimension of 72 in, or 182.9 cm, from the top of the system to the floor accommodates most people, but at varying levels of comfort. The smaller viewer may have to rely more heavily on eye and head movement to scan the display.



REACH/ TALL AND SHORT STANDING MALE AND FEMALE VIEWERS



EYE HEIGHT/ TALL AND SHORT STANDING MALE AND FEMALE VIEWERS

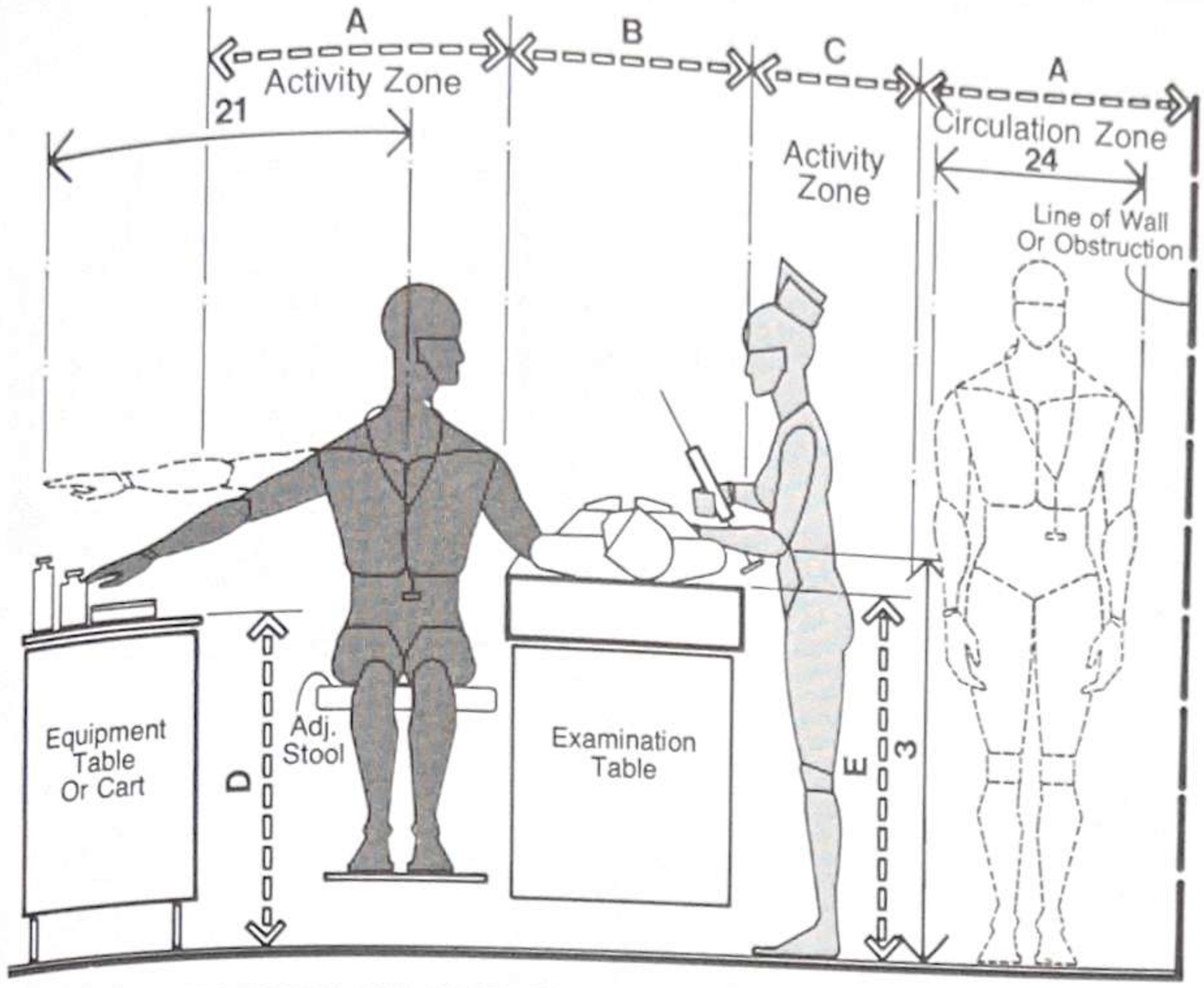


EYE HEIGHT/ TALL AND SHORT SEATED MALE AND FEMALE VIEWERS

	in	cm
A	5–6	12.7–15.2
B	18	45.7
C	24	61.0
D	36	91.4
E	72	182.9
F	30	76.2
G	52.5	133.4

FILM-VIEWING SYSTEMS (FVS)/ANTHROPOMETRIC CONSIDERATIONS

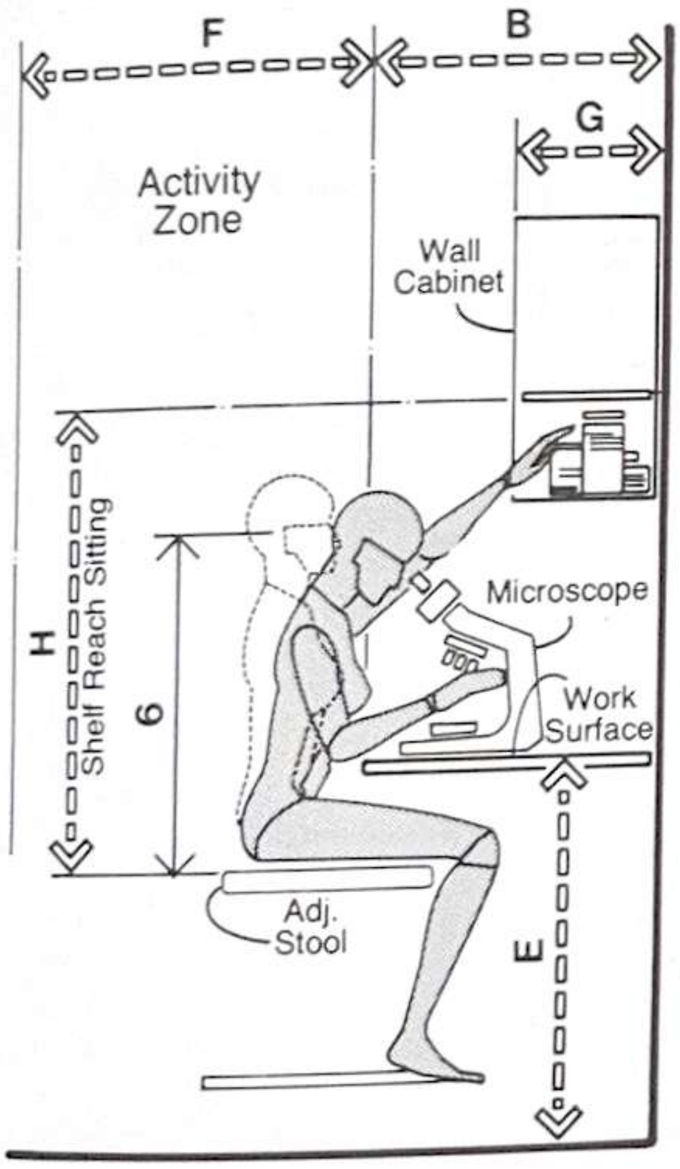
6.1 MEDICAL TREATMENT ROOMS



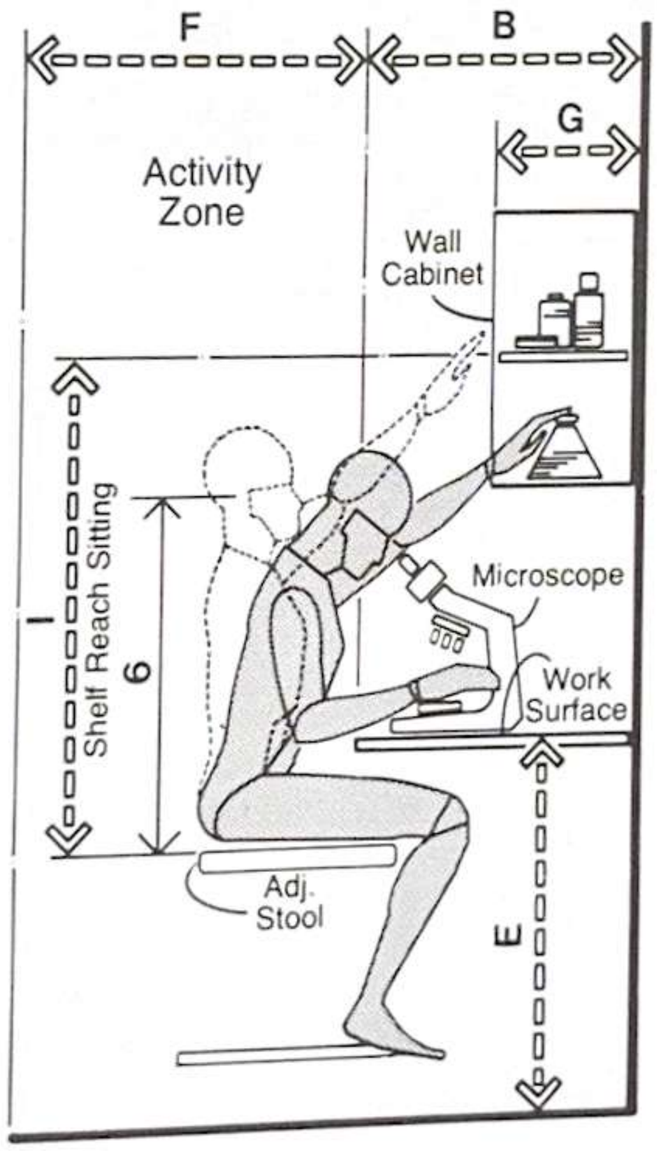
EXAM AREA/REACH AND CLEARANCE

The top drawing illustrates recommended clearances around an examination table. A space of at least 30 in, or 76.2 cm, should be allowed for the doctor to function. If the procedure requires instruments or other nearby apparatus, side arm reach data should be used to establish the additional clearance required for the table or cart involved.

The two drawings at the bottom of the page illustrate the anthropometric considerations involved when planning a small laboratory area. The drawing at the left shows the relationship of a female of smaller body size to the table and the wall cabinet above. The shelf should be anthropometrically within the reach of the smaller person in a seated position. Eye height sitting is also a useful measurement to consider, in relation not only to the microscope, but to the visibility of any displays that might be tacked on the facing wall surface. Within certain limits, the adjustability of the seat can be used to raise and lower the eye level as required to accommodate the height of the microscope above the table surface. The drawing on the right illustrates the same relationships for a male of smaller body size.



LAB AREA/ FEMALE CONSIDERATIONS



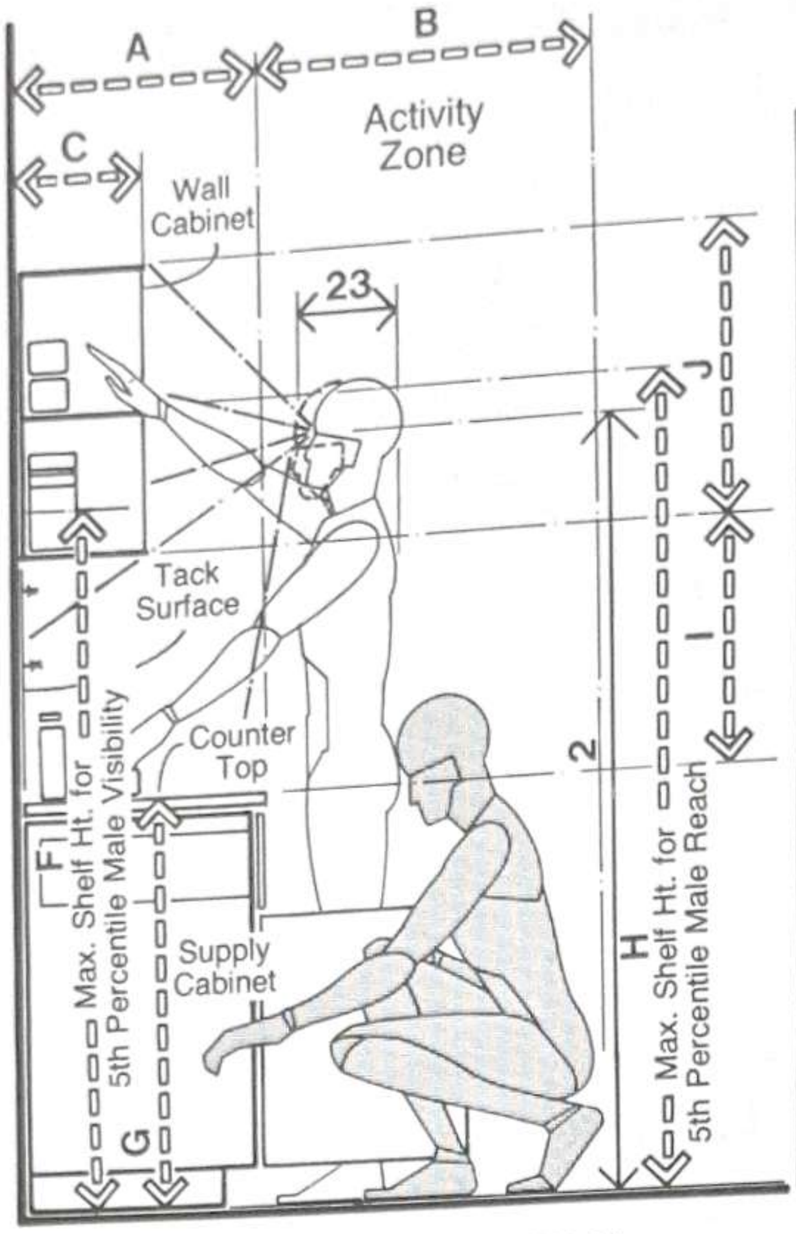
LAB AREA/ MALE CONSIDERATIONS

	in	cm
A	30	76.2
B	24	61.0
C	18	45.7
D	30–36	76.2–91.4
E	34–38	86.4–96.5
F	27	68.6
G	12–15	30.5–38.1
H	39 max.	99.1 max.
I	42 max.	106.7 max.

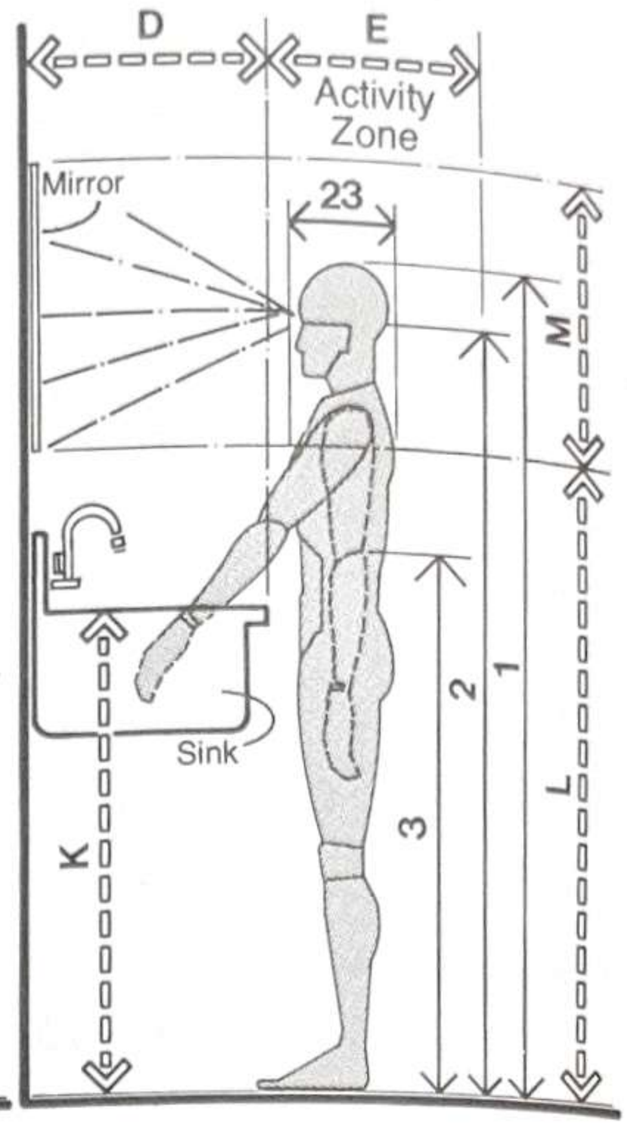
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6.1 MEDICAL TREATMENT ROOMS

The drawing at the top of the page illustrates the relationship of a male user to an instrument and supply cabinet and a wash-up sink. With respect to the former, eye height and reach are the key anthropometric considerations. The material on the shelves should be accessible to the person of smaller body size. Therefore, 5th percentile reach data should be used to establish the height of the shelf above the floor. It is also important that the depth of the wall cabinet and the distance of the bottom of the cabinet from the top of the counter not obstruct the user's vision of the full counter surface. The overall height of the wall cabinet should allow the user, with a minimum degree of eye and head movement, to visually scan the contents of the cabinet with the least amount of discomfort. For the wash-up sink, the anthropometric measurements of greatest significance are eye height, to establish the location of the mirror, and elbow height, to establish the height of the sink. Research has shown that 2 to 3 in, or 5 to 7.6 cm, below the elbow is a comfortable height for the top of the sink. Generally, sinks are located too low, causing the user discomfort and back pain.

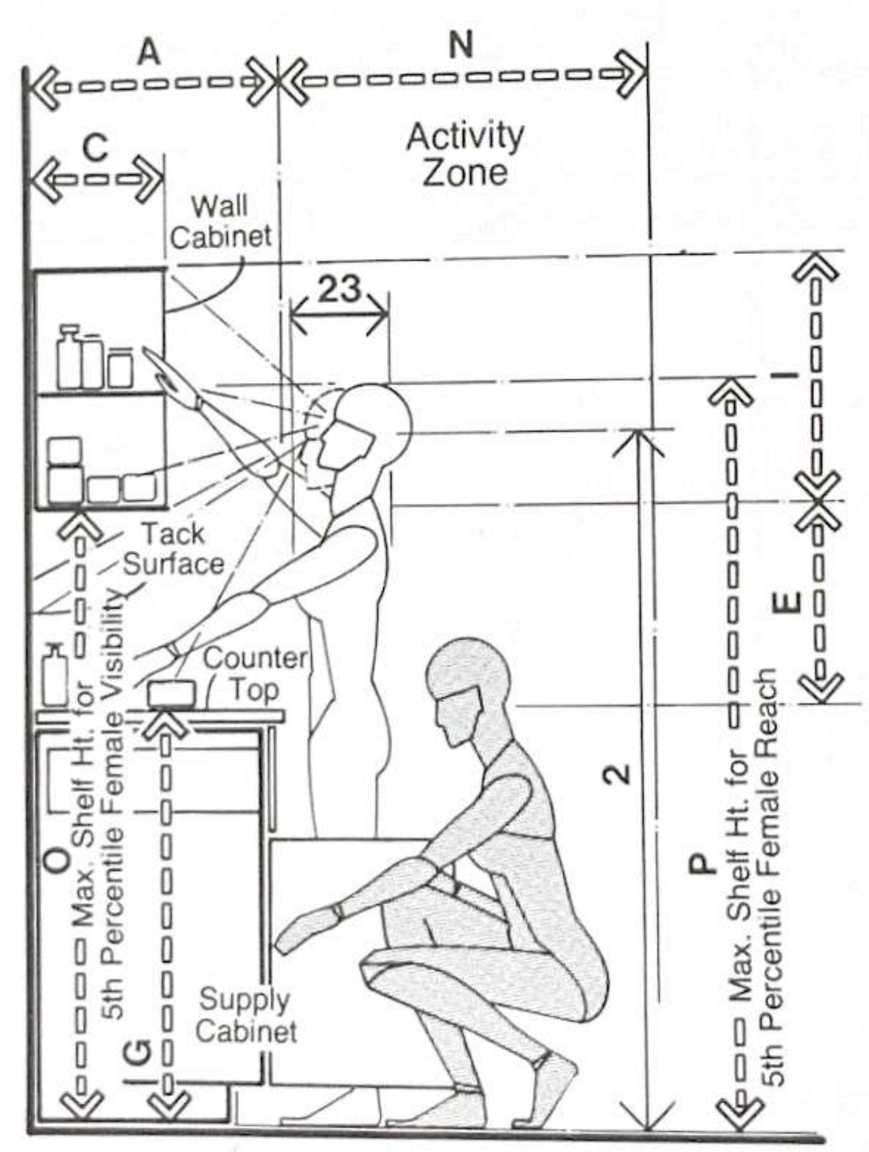


INSTRUMENT AND SUPPLY CABINET / MALE CONSIDERATIONS

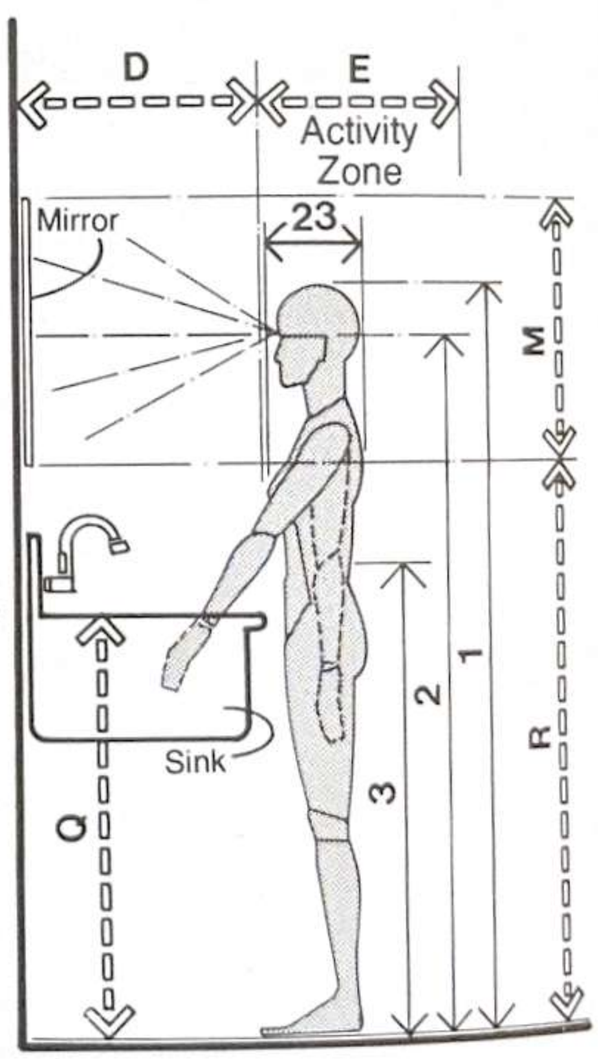


WASH-UP SINK/ MALE CONSIDERATIONS

	in	cm
A	18–22	45.7–55.9
B	36–40	91.4–101.6
C	12–18	30.5–45.7
D	18–21	45.7–53.3
E	18	45.7
F	60 max.	152.4 max.
G	35–36	88.9–91.4
H	72 max.	182.9 max.
I	21	53.3
J	18–24	45.7–61.0
K	37–43	94.0–109.2
L	54 max.	137.2 max.
M	24	61.0
N	30–36	76.2–91.4
O	56 max.	142.2 max.
P	69 max.	175.3 max.
Q	32–36	81.3–91.4
R	48 max.	121.9 max.



INSTRUMENT AND SUPPLY CABINET / FEMALE CONSIDERATIONS



WASH-UP SINK/ FEMALE CONSIDERATIONS

6.2 DENTAL TREATMENT ROOMS

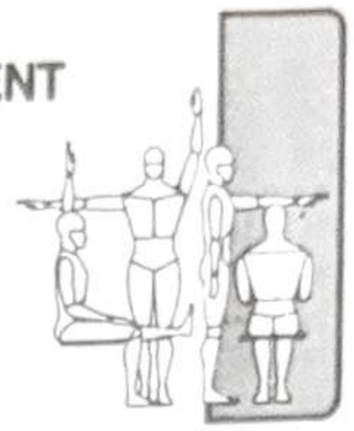


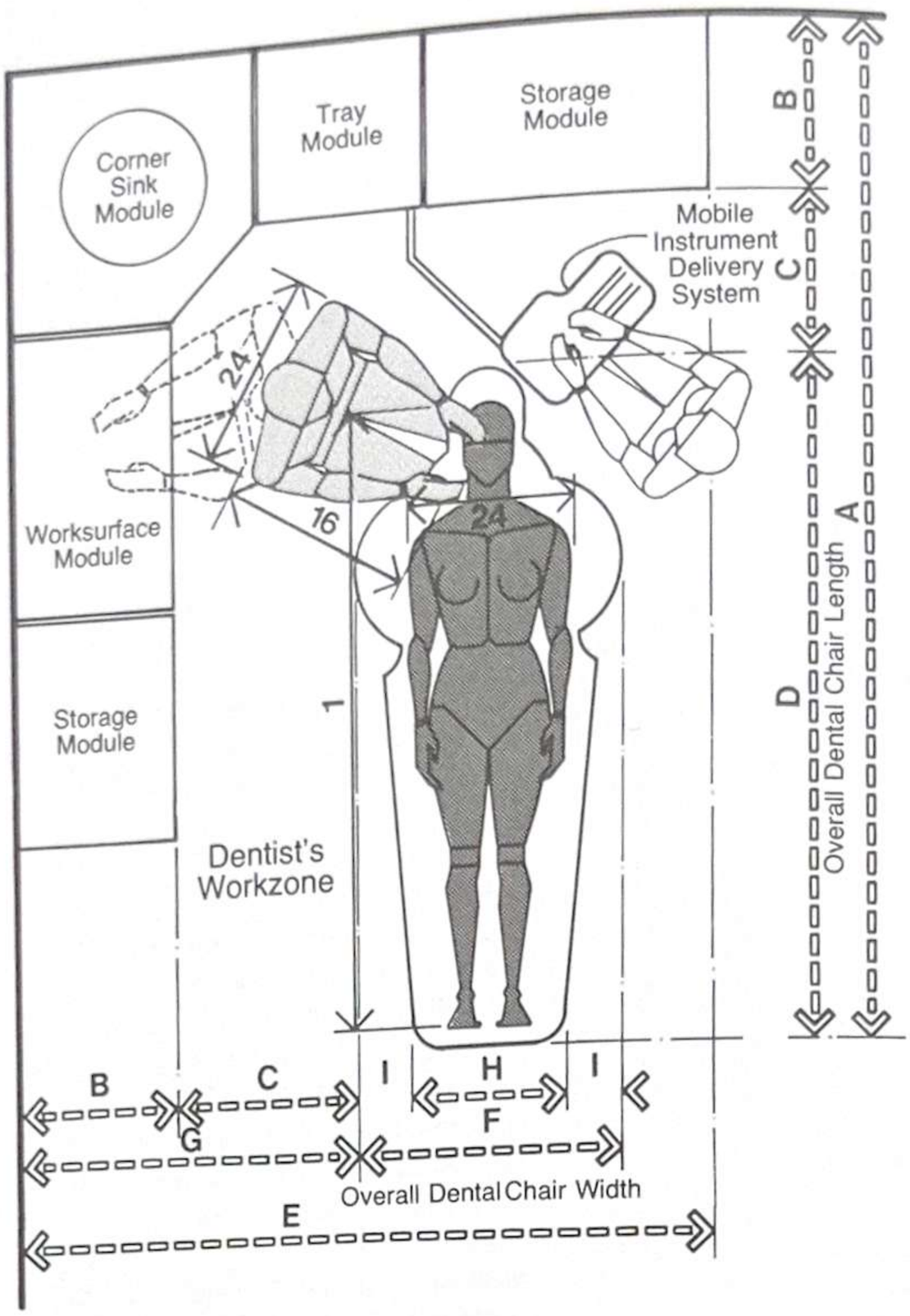
TABLE	TREATMENT	LABORATORY	X-RAY VIEWING	CIRCULATION	ACTIVITIES	ANTHROPOMETRIC DATA
1A,2B	●	◑			1	STATURE
1B,3C	◑	◑			2	EYE HEIGHT
1F,3G	◑		◑		6	EYE HEIGHT SITTING
1L,2H		●	●		12	THIGH CLEARANCE
1P,2L	●		●		16	BUTTOCK-KNEE LENGTH
1V,4D	○				22	THUMB TIP REACH
1W,6B	●	●		●	23	MAXIMUM BODY DEPTH
1X,6A	●			●	24	MAXIMUM BODY BREADTH

Clearances and other dimensional data related to the typical dental treatment room are shown in the drawings on the pages that follow. Included among the drawings are illustrations in both plan and section of laboratory and x-ray spaces as well as the chair area. Of greatest interest anthropometricly is the almost complete range of adjustability in the design of the patient's chair and the dentist's stool, providing the possibility of creating an almost endless number of interface options. The level of sophistication involved demonstrates clearly that the technological capability necessary to apply the concept of adjustability to other interior systems is available. The basic anthropometric considerations of concern to the designer are not the interface between the seated or standing dentist and the seated or standing patient, but between the dentist and/or the paraprofessional and the various support facilities in the dental treatment room. Counters must be of proper height for comfortable and efficient use. If used from a seated position, the distance from the top of the seat to the underside of the counter must be sufficient to accommodate thigh clearance and knee height. The depth of the counter and the location of shelves either above or below should be related to the limitations of reach of the user of smaller body size. Clearance between the dentist's chair and the wall or nearest physical obstruction, should be sufficient to accommodate at the very least the maximum body breadth of the person of large body size.

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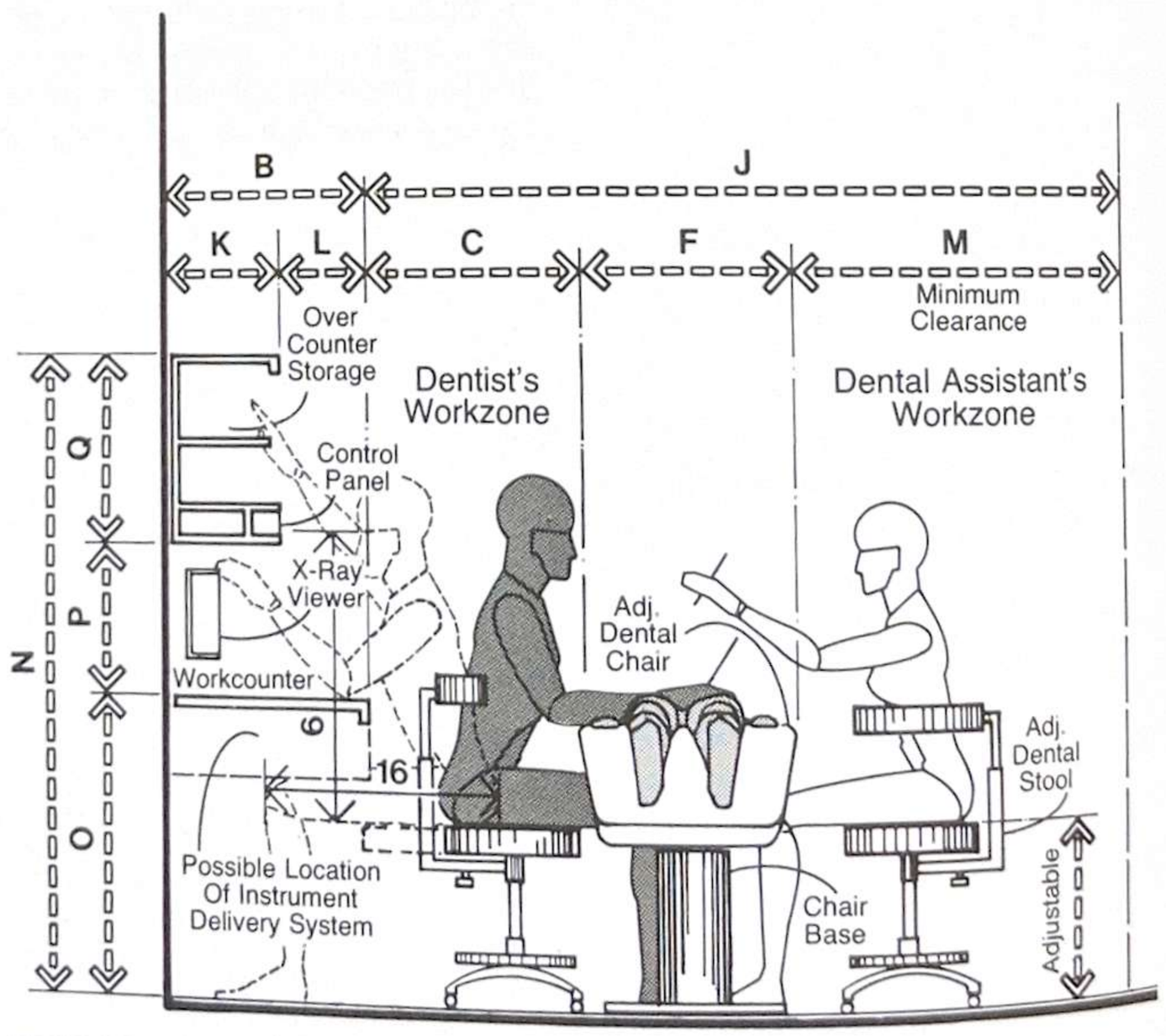
6.2 DENTAL TREATMENT ROOMS

Rapid technological advances in design and fabrication of dental equipment systems have resulted in dental treatment rooms of great compactness and efficiency. In many instances, anthropometric considerations must be reinterpreted to permit a closer interface among dentist, dental assistant, and the dental equipment systems. Shown on this page are the basic anthropometric and dimensional considerations that should prove helpful to the designer in making certain initial design and planning assumptions. In both drawings, the clearance provided between the dental chair and workcounter, referred to as the "dentist's workzone," is of critical importance in terms of optimizing time/motion efficiency. A dimensional range of 18 to 24 in, or 45.7 to 61.0 cm, is recommended; this overrides ordinary circulation zone requirements. Most dentists have their own preferences for the location and type of instrument delivery systems and other related backup components. In addition, the rapidly evolving dental equipment technology mandates that the designer research the latest systems available.

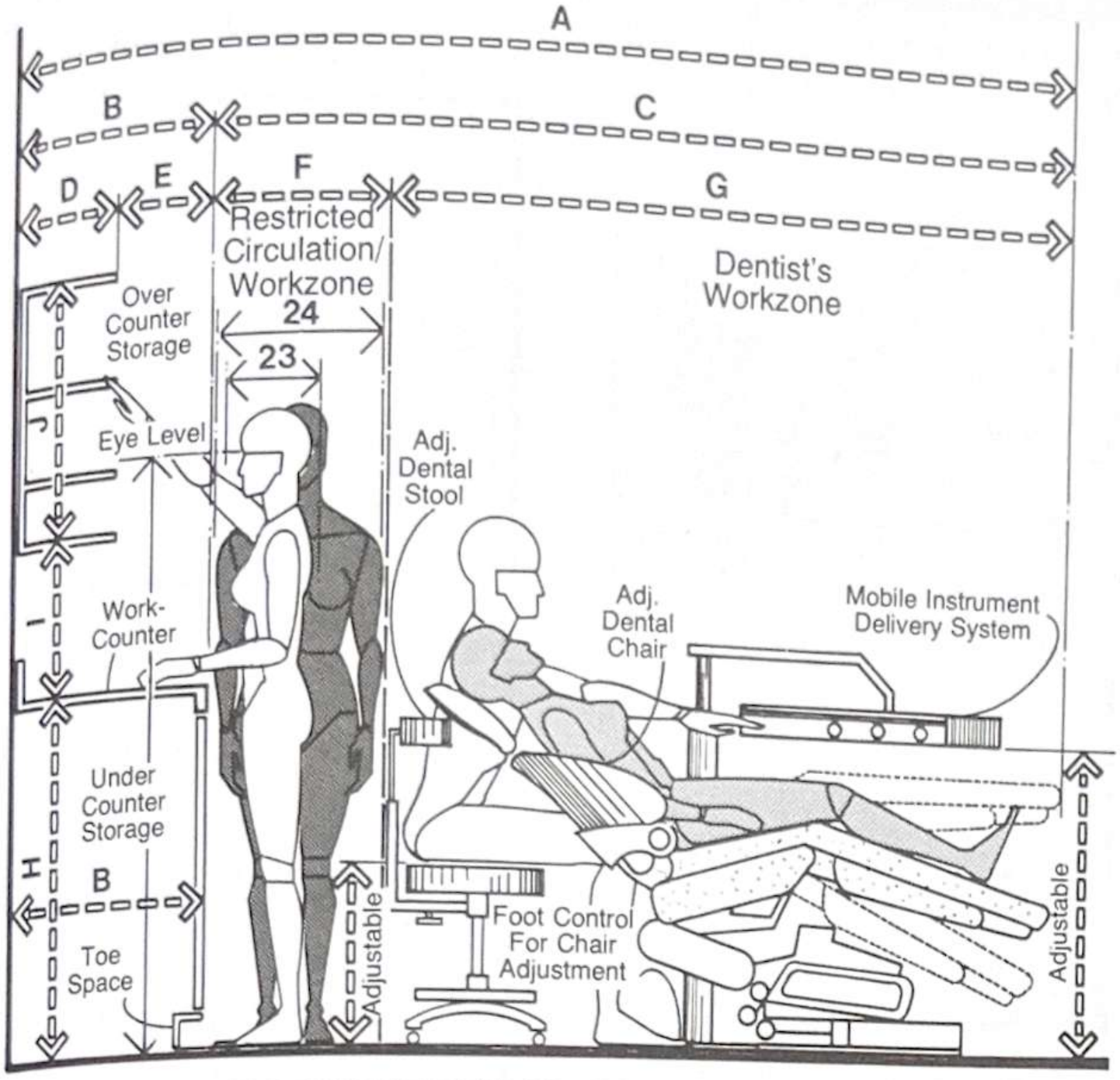


TREATMENT ROOM

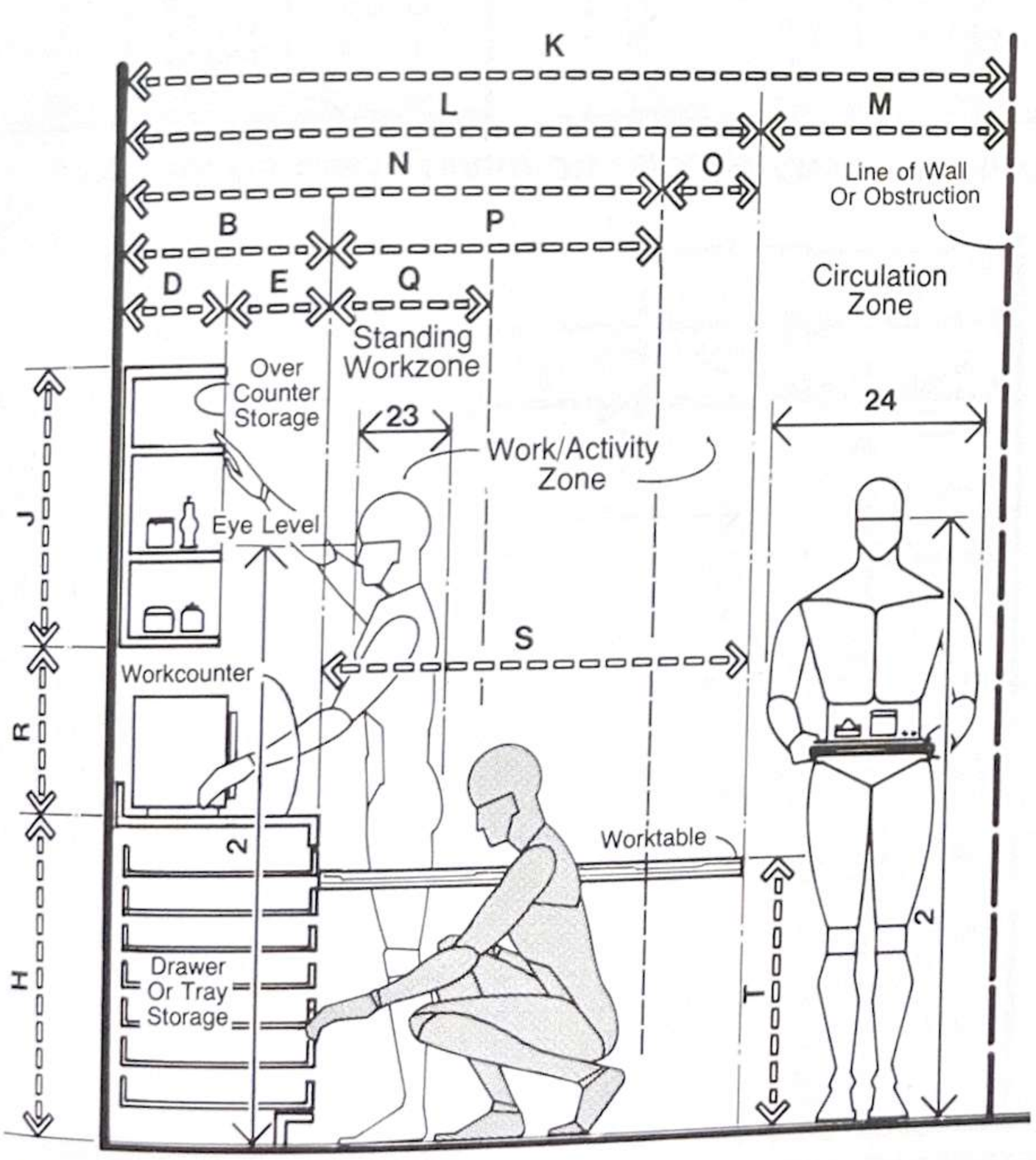
	in	cm
A	104–118	264.2–299.7
B	18–22	45.7–55.9
C	18–24	45.7–61.0
D	68–72	172.7–182.9
E	66–84	167.6–213.4
F	20–26	50.8–66.0
G	36–46	91.4–116.8
H	16–18	40.6–45.7
I	2–4	5.1–10.2
J	74–86	188.0–218.4
K	10–12	25.4–30.5
L	8–10	20.3–25.4
M	36 min.	91.4 min.
N	56–70	142.2–177.8
O	28–30	71.1–76.2
P	12–16	30.5–40.6
Q	16–24	40.6–61.0



TREATMENT ROOM / VERTICAL CONSIDERATIONS



TREATMENT ROOM/ VERTICAL CONSIDERATIONS



LABORATORY

6.2 DENTAL TREATMENT ROOMS

Dental equipment and delivery systems clearly demonstrate the concept of adjustability that might just as readily be applied to other interior systems. In the dental treatment room, the total adjustability of the patient's chair, the dentist's stool, and the mobile delivery system all serve as reinforcement of the primary anthropometric needs. In many instances, the dentist may elect to treat a patient while standing. For that position, it is important to understand the vertical clearances related to wall and cabinet storage. Ease of access in performing the various medical procedures, especially those related to patient treatment, must be of the highest priority. The dental laboratory, as illustrated in the bottom drawing, is one of several basic work environments that must be incorporated into a comprehensive dental work area. While the laboratory can vary in size, depending on the dentist's specialty, prime concern must be for those tasks performed in a standing position. Workcounter, worktable, and overcounter storage height must be closely reviewed. A workcounter height of 36 in, or 91.4 cm, is recommended, while the height of the worktable might fall in the dimensional range of 28 to 30 in, or 71.7 to 76.2 cm.

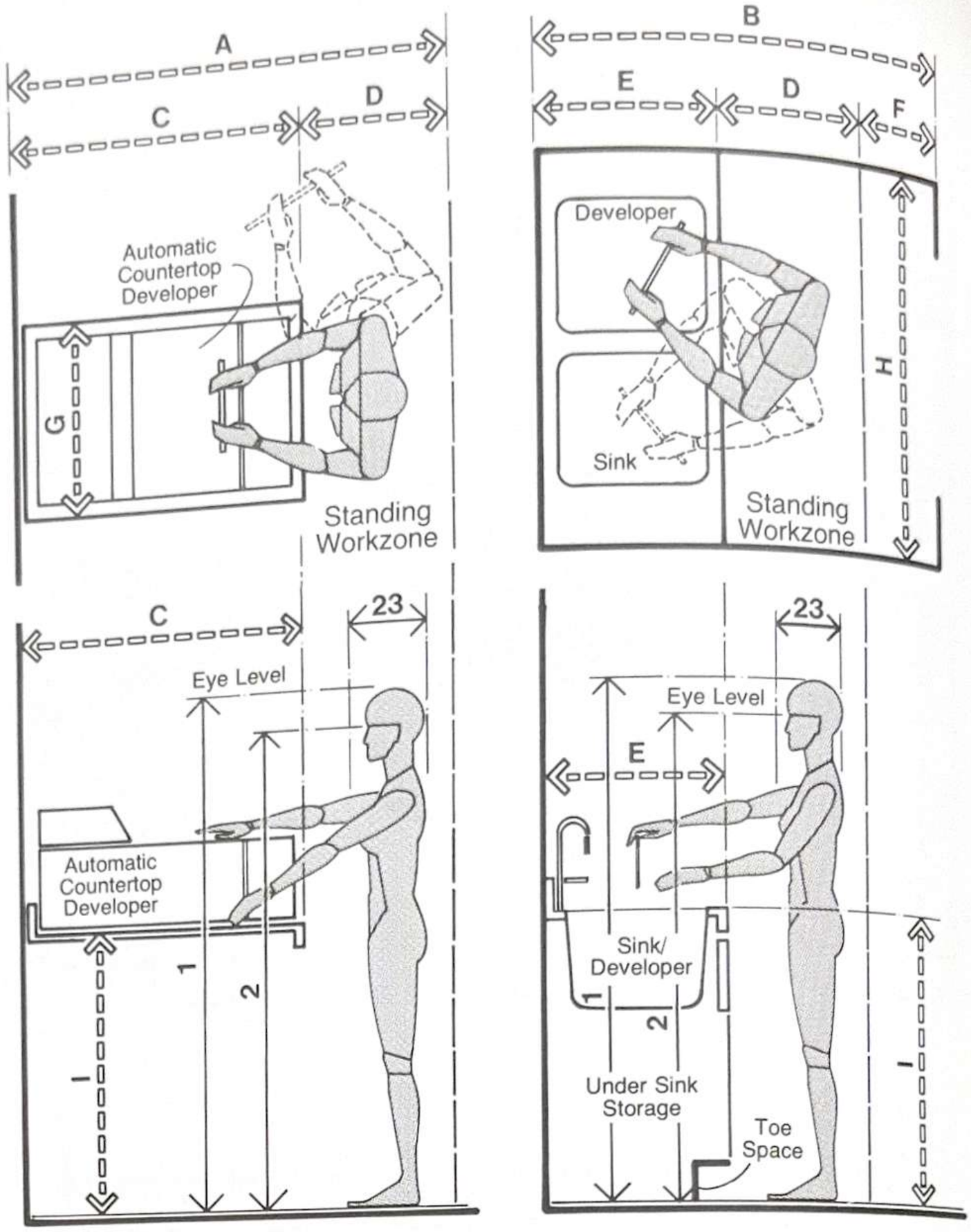
	in	cm
A	104–118	264.2–299.7
B	18–22	45.7–55.9
C	86–96	218.4–243.8
D	10–12	25.4–30.5
E	8–10	20.3–25.4
F	18–24	45.7–61.0
G	68–72	172.7–182.9
H	36	91.4
I	12–16	30.5–40.6
J	16–28	40.6–71.1
K	94–102	238.8–259.1
L	64–72	162.6–182.9
M	30	76.2
N	52–60	132.1–152.4
O	12	30.5
P	34–38	86.4–96.5
Q	18	45.7
R	16–18	40.6–45.7
S	46–54	116.8–137.2
T	28–30	71.1–76.2

6.2 DENTAL TREATMENT ROOMS

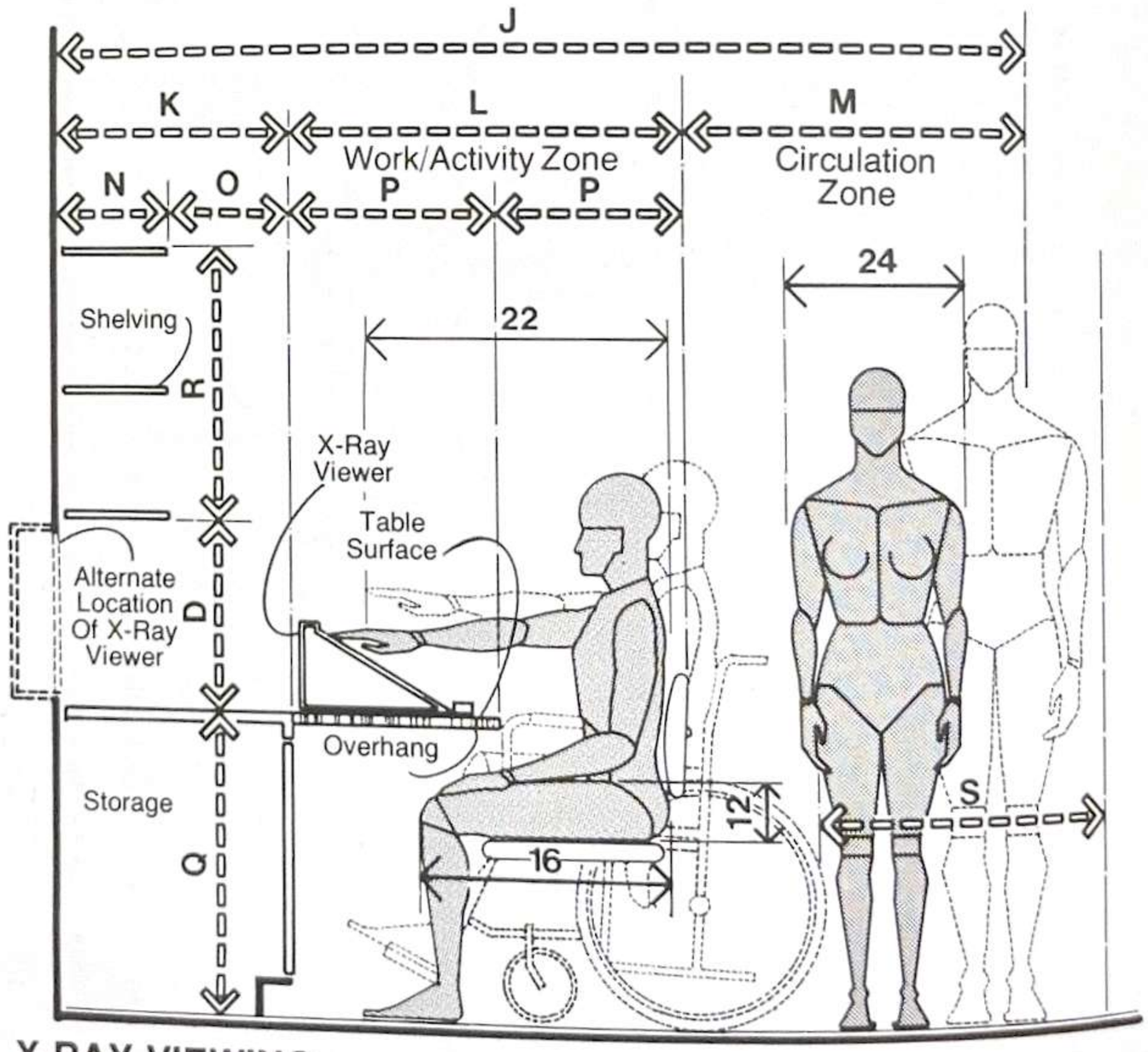
The development of dental x-ray negatives has evolved in recent years from the traditional manual-type sink/developer to more sophisticated automatic counter top developers. In the examples of both of these methods illustrated at the top of the page, the height of the worksurface must be considered. The desired sink/developer worksurface should be 35 to 36 in, or 88.9 to 91.4 cm. The height of the worksurface for an automatic counter top developer should be the same, unless the specific piece of equipment dictates otherwise. In both instances the standing workzone, as determined by maximum body depth, is established at an absolute minimum of 18 in, or 45.7 cm.

The drawing at the bottom of the page provides information on alternate methods of viewing x-rays. X-rays may be reviewed either by one or two people at a time or by a larger group of people. The height of the table surface required to accommodate an x-ray viewer should assume a dimensional range from 29 to 31 in, or 73.7 to 78.7 cm. Special attention should be paid to clearance if the user is wheelchair-bound. If the x-ray viewer were placed on a vertical wallsurface to accommodate group viewing, eye height sitting would be the operative anthropometric consideration.

	in	cm
A	52–56	132.1–142.2
B	52–60	132.1–152.4
C	34–38	86.4–96.5
D	18	45.7
E	22–24	55.9–61.0
F	12–18	30.5–45.7
G	24–28	61.0–71.1
H	48 min.	121.9 min.
I	35–36	88.9–91.4
J	84–100	213.–254.0
K	18–22	45.7–55.9
L	36–48	91.4–121.9
M	30	76.2
N	10–12	25.4–30.5
O	8–10	20.3–25.4
P	18–24	45.7–61.0
Q	29–31	73.7–78.7
R	16–24	40.6–61.0
S	30	76.2



DARKROOM AND AUTOMATIC DEVELOPING EQUIPMENT



X-RAY VIEWING

6.3 HOSPITAL ROOMS

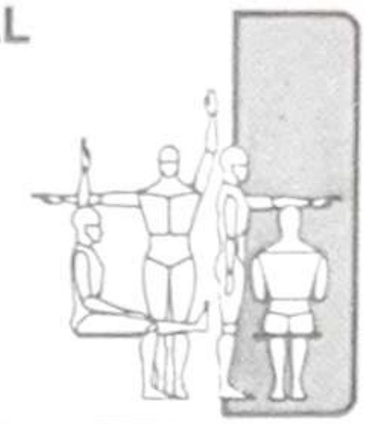


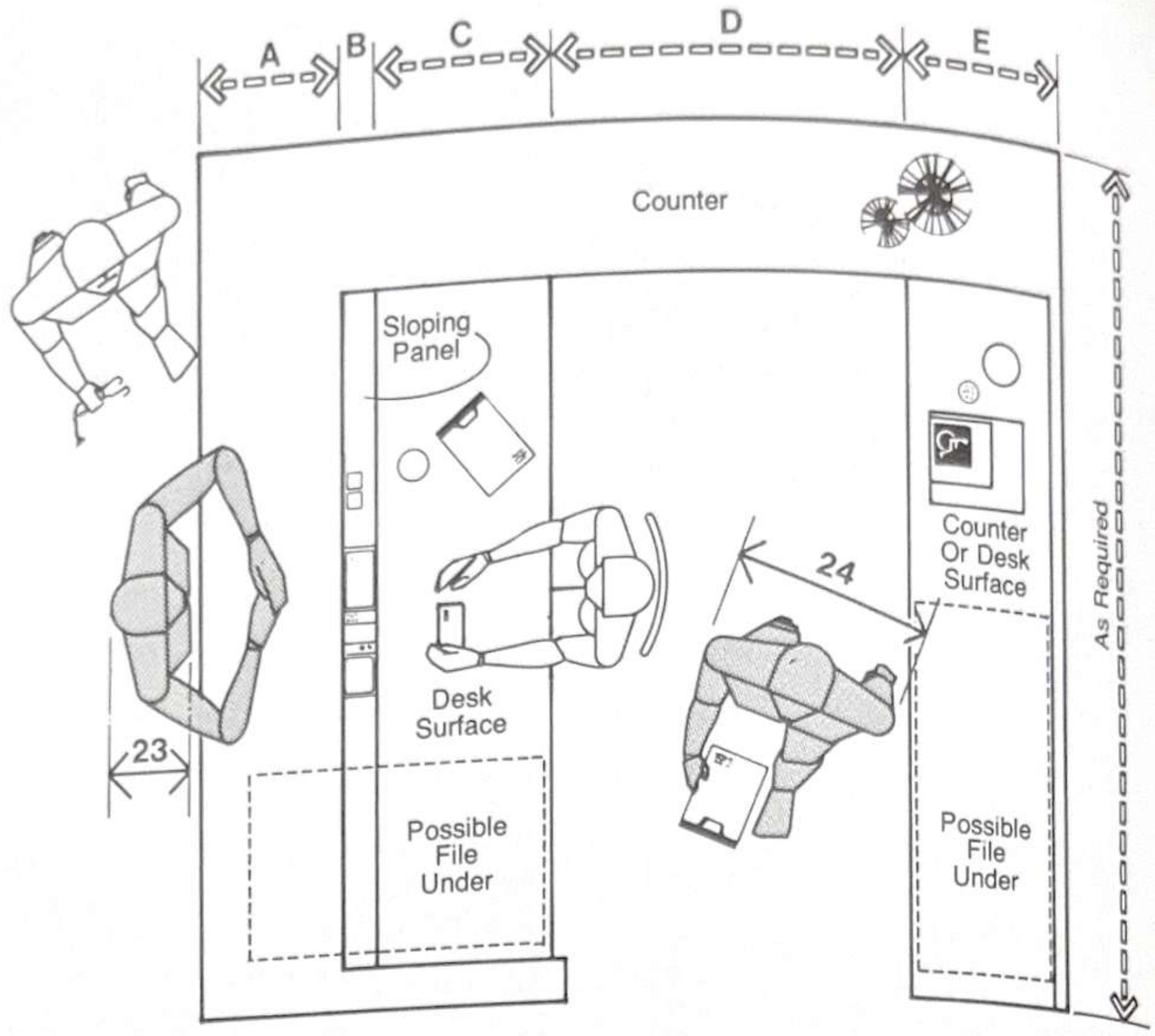
TABLE	NURSING STATION	PATIENT BEDROOM	BEDROOM LAVATORY	CIRCULATION	ACTIVITIES	ANTHROPOMETRIC DATA
1B,3C		◔			2	EYE HEIGHT
1F,3G	◔				6	EYE HEIGHT SITTING
1P,2L		●			16	BUTTOCK-KNEE LENGTH
1V,4D			○		22	THUMB TIP REACH
1W,6B	●	●		●	23	MAXIMUM BODY DEPTH
1X,6A	●	●		●	24	MAXIMUM BODY BREADTH

The diagrams that follow illustrate some of the more obvious anthropometric concepts to be taken into account in the design of patients' rooms and nurses' stations. Of the basic considerations, one that has significant emotional impact on both patient and visitor is seating visitors comfortably around the hospital bed. Unfortunately, in many instances the clear overall depth of the room is not sufficient for such accommodation. The design of nurses' stations must also respond to human dimension and body size. The height of the station on the public side should relate to elbow height. The worksurface on the nurses' side should be desk height. The distance from the top of the seat to the underside of the desk should allow sufficient room for thigh clearance. Files should ideally be within reach of the person of smaller body size. The room must also meet the needs of the person confined to a wheelchair. For this, there should be sufficient space to maneuver the chair and adequate clearance under a lavatory to allow the arms of the chair to pass under the rim of the fixture.

6.3 HOSPITAL ROOMS

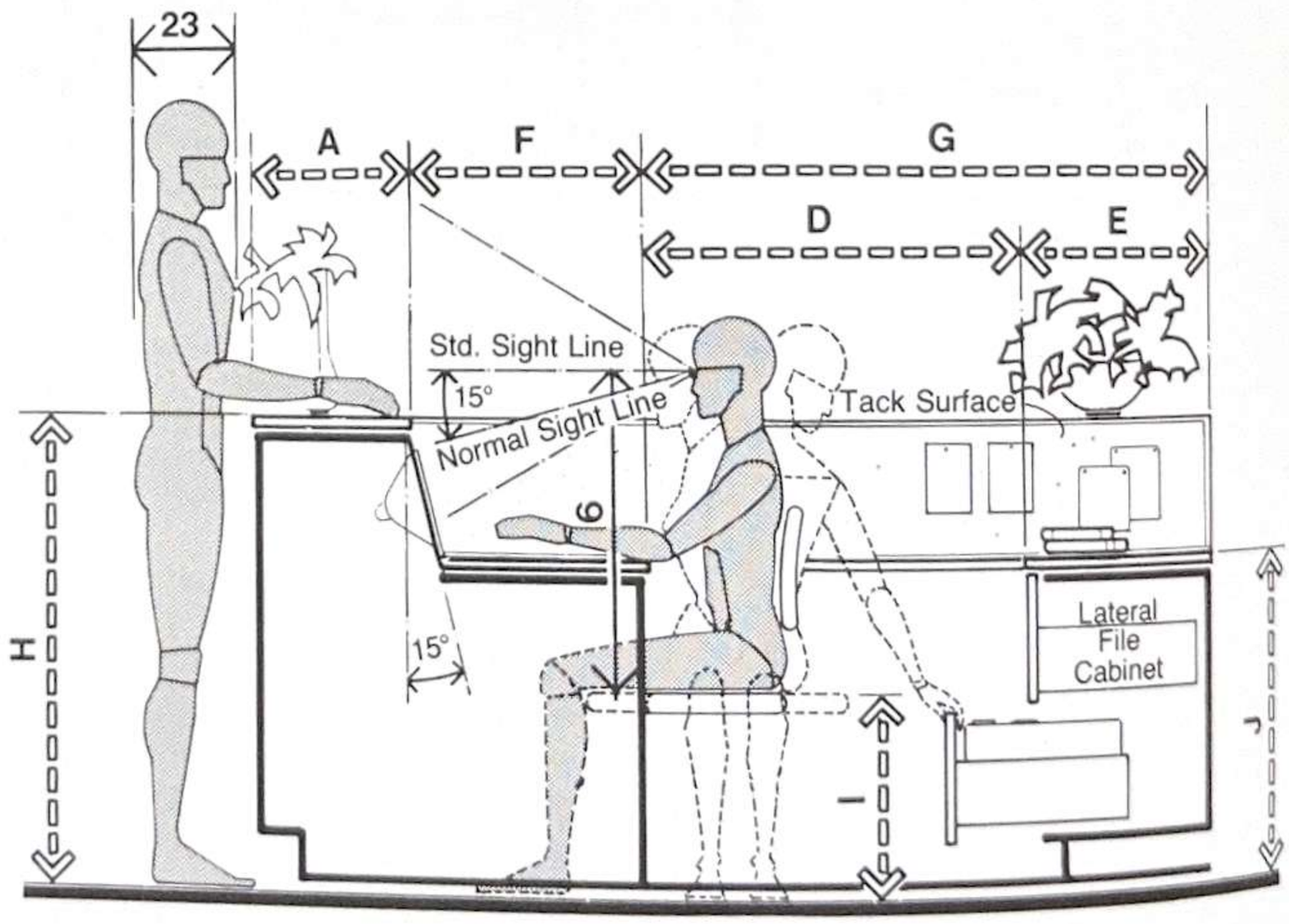
The drawing at the top of the page shows a plan view of a typical nurses' station and the clearances necessary to accommodate the human dimensions involved. A space of 36 in, or 91.4 cm, is a preferred minimum clearance between the desk and back counter. This will allow access to the back counter by a second person while the nurse is engaged at the desk; it also makes the files accessible to the nurse who swivels her chair.

The bottom drawing shows a section through the same station. Anthropometrically, several considerations become apparent. The surface of the rear face of the counter should be sloped slightly. The more the sight line approaches a 90° angle with the display, the clearer the visibility will be. The height of the counter should be comfortable for the visitor and yet not obstruct the vision of the nurse. To ensure the former, 2 to 3 in, or 5 to 7.6 cm, below elbow height should provide a comfortable counter height. For the latter, eye height sitting should be taken into account.



NURSE'S STATION

	in	cm
A	15–18	38.1–45.7
B	3–3.5	7.6–8.9
C	18	45.7
D	36 min.	91.4 min.
E	20	50.8
F	21–21.5	53.3–54.6
G	56 min.	142.2 min.
H	42–43	106.7–109.2
I	15–18	38.1–45.7
J	30	76.2

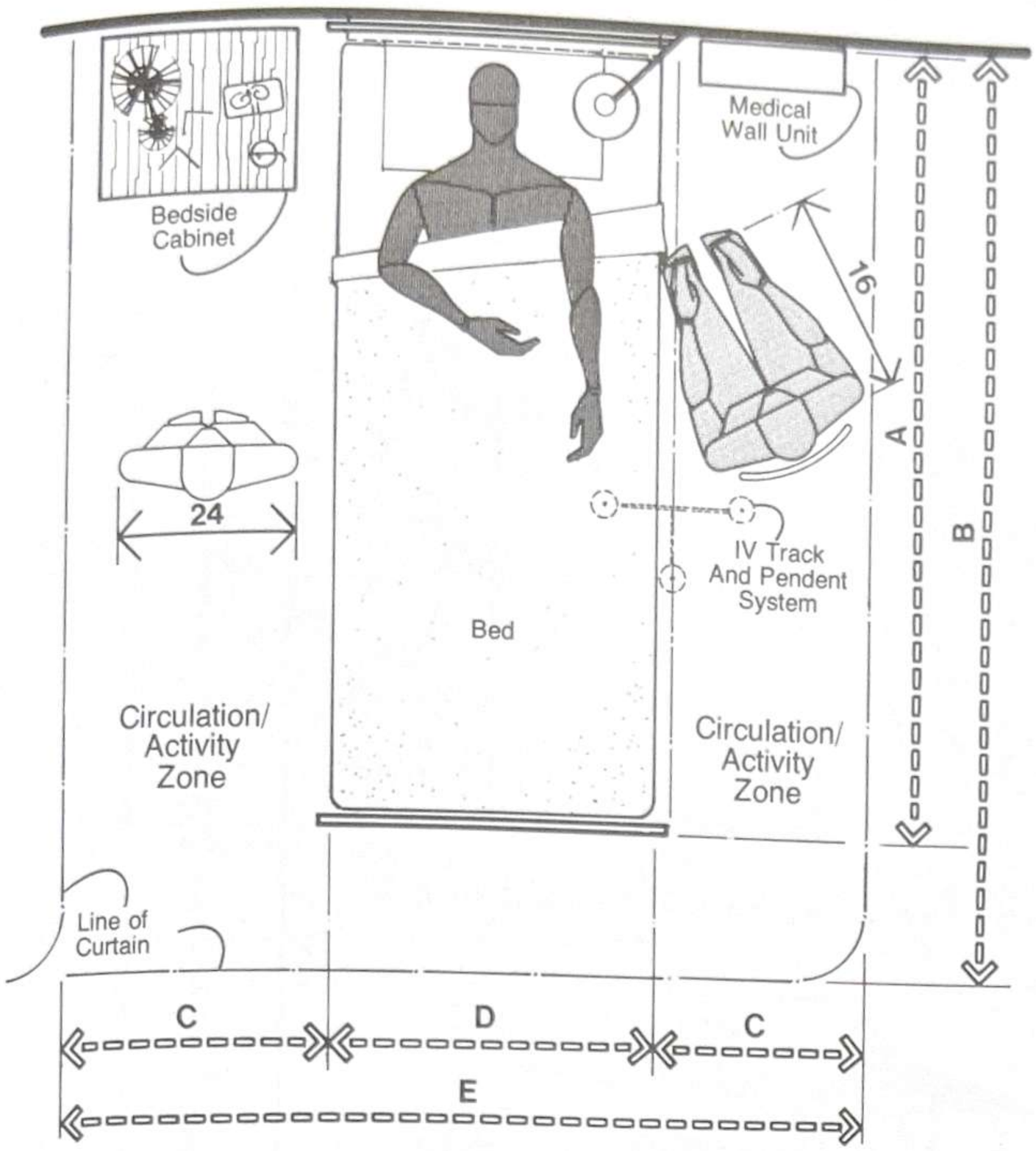


NURSE'S STATION

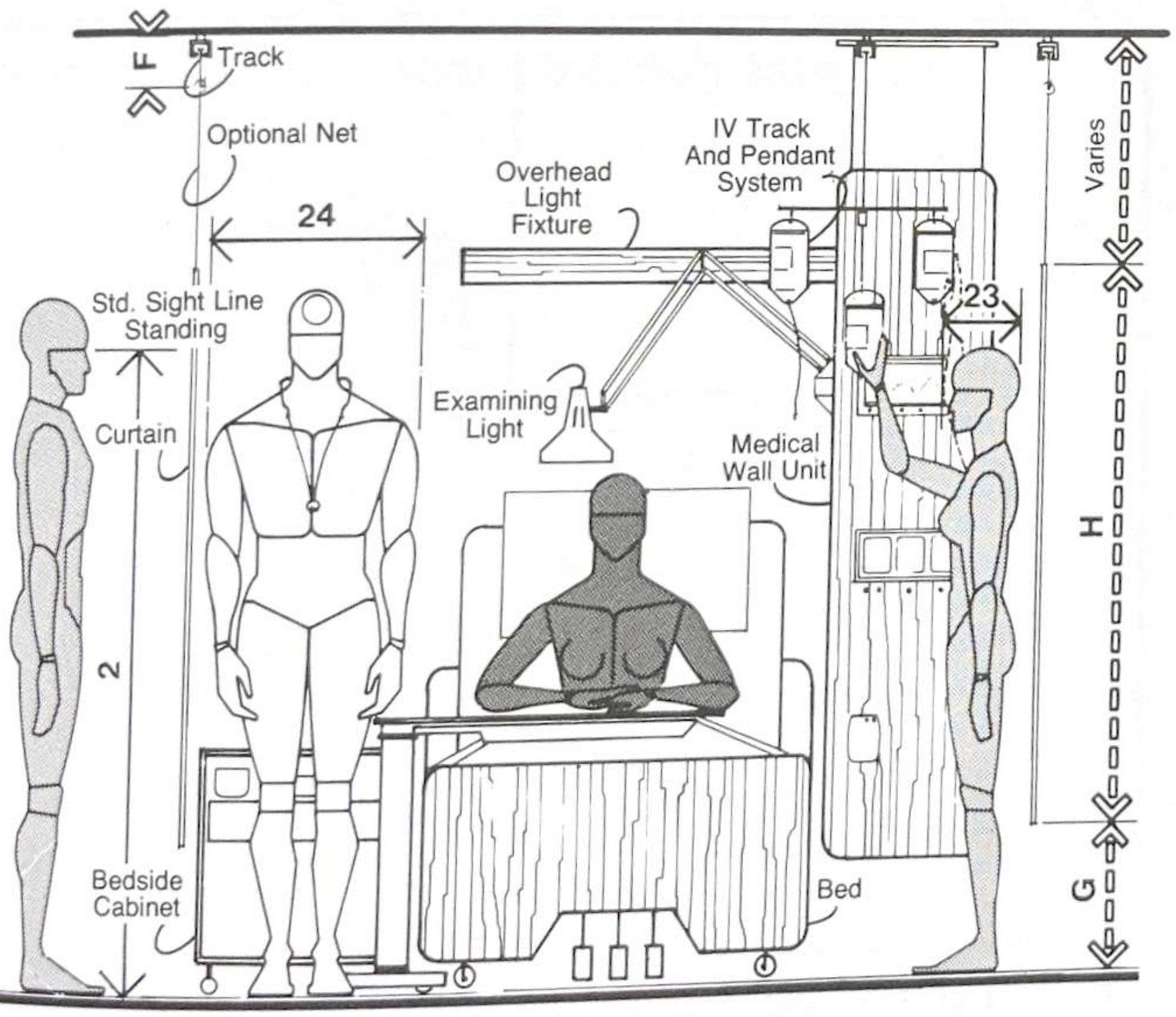
6.3 HOSPITAL ROOMS

The drawing at the top of the page shows recommended clearances around an individual hospital bed. A space of 30 in, or 76.2 cm, will allow for circulation and visitor seating around the bed. This clearance will also be adequate to accommodate a standard medical wall unit on one side and a night table on the other.

The drawing at the bottom shows the cubicle in elevation. The maximum body breadth of the larger user is the principal human dimension to be accommodated anthropometrically for proper clearance between the edge of the bed and the curtain. Since 95 percent of the sample population measured showed a maximum body breadth of 22.8 in, or 57.9 cm, or less, the 30-in clearance should be adequate. To ensure privacy, eye height or stature of the larger person would be the anthropometric measurement to consider in establishing curtain height.



PATIENT BED CUBICLE WITH CURTAINS

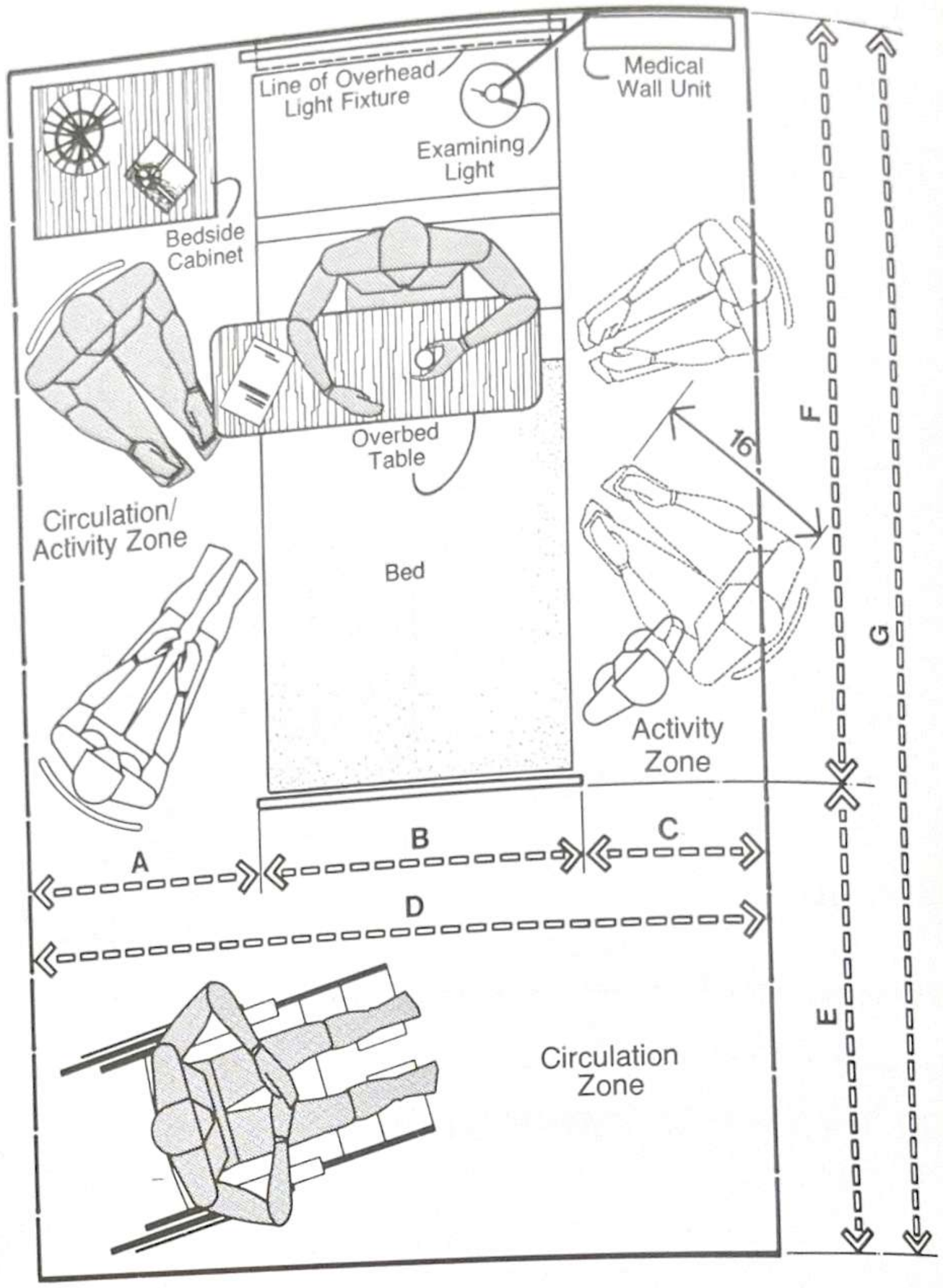


PATIENT BED CUBICLE WITH CURTAINS

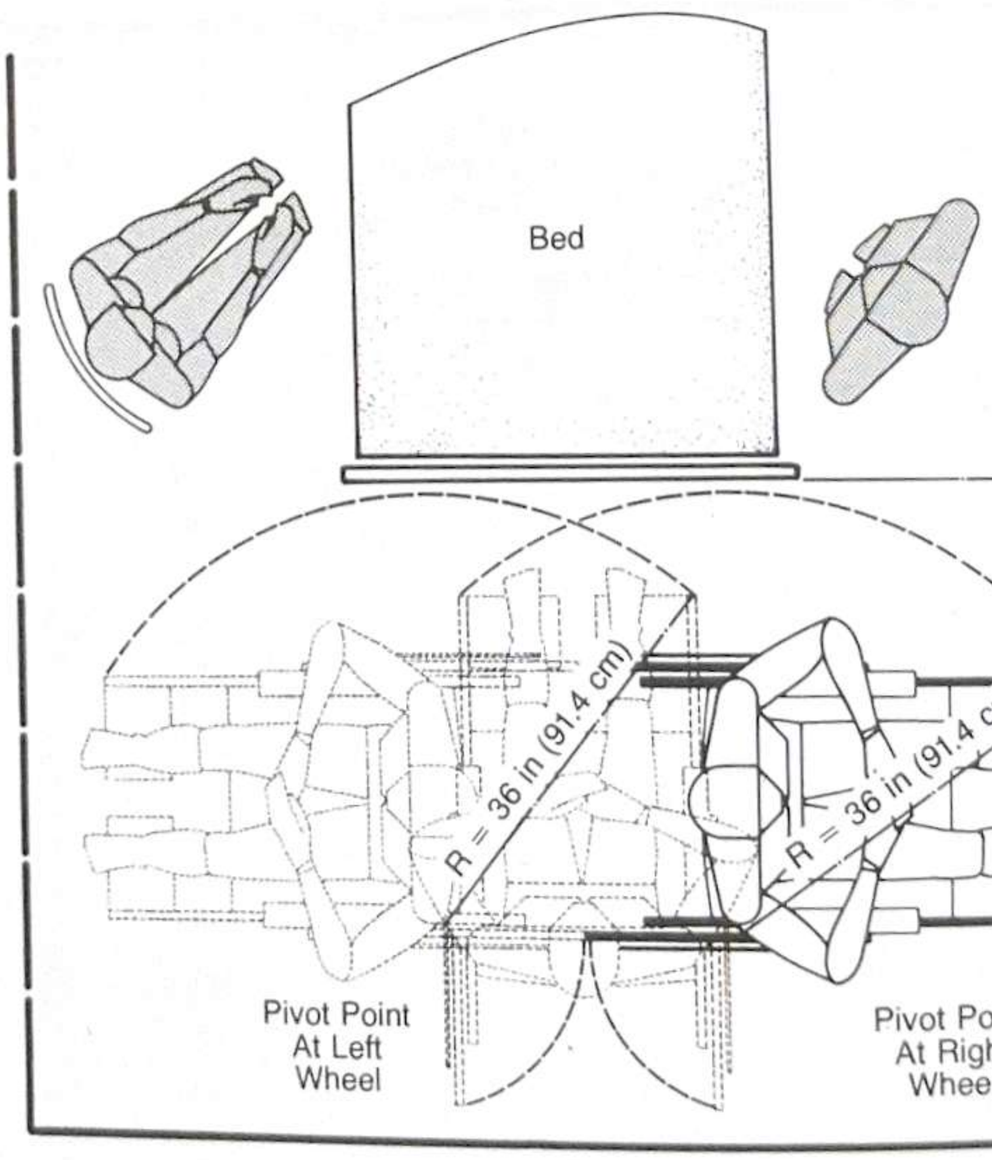
	in	cm
A	87	221.0
B	96	243.8
C	30 min.	76.2 min.
D	39	99.1
E	99 min.	251.5 min.
F	2–3	5.1–7.6
G	15	38.1
H	54 min.	137.2 min.

6.3 HOSPITAL ROOMS

The top drawing is based on a double room having a depth of 15 ft, or 4.57 m, which although not very desirable, is frequently found in existing hospital spaces. Half the depth would allow 90 in, or 228.6 cm, for each bed position. The drawing illustrates that an adequate circulation/activity zone of 30 in, or 76.2 cm, can only be provided on one side of the bed. It should be noted that the seated figures to the right of the bed project into the space allocated for the adjacent bed position, suggesting the need for a shared circulation/activity zone between beds. A preferred minimum clearance depth for a double room should be 16.5 ft, or 5 m, to ensure separate circulation/activity zones on both sides of the bed, as indicated in the drawing on the following page. The bottom drawing indicates the clearance required by a wheelchair user to circulate. Using the right wheel as a pivot point, the wheelchair can change directions within 54 in, or 137.2 cm.



PATIENT BEDROOM



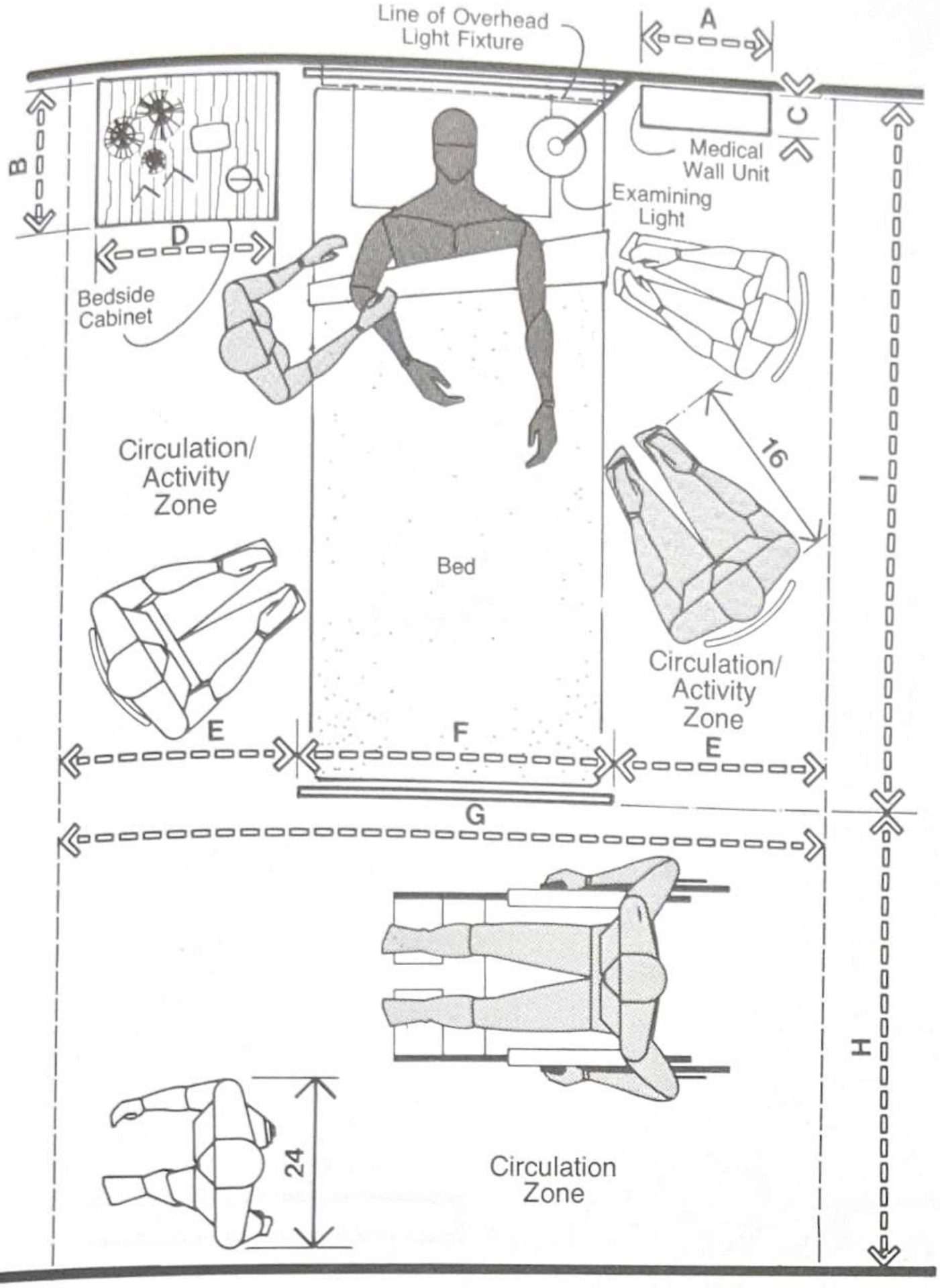
PATIENT BEDROOM / WHEELCHAIR MANEUVERING SPACE

	in	cm
A	30 min.	76.2 min.
B	39	99.1
C	21	53.3
D	90	228.6
E	54	137.2
F	87	221.0
G	140	355.6
H	54 min.	137.2 min.

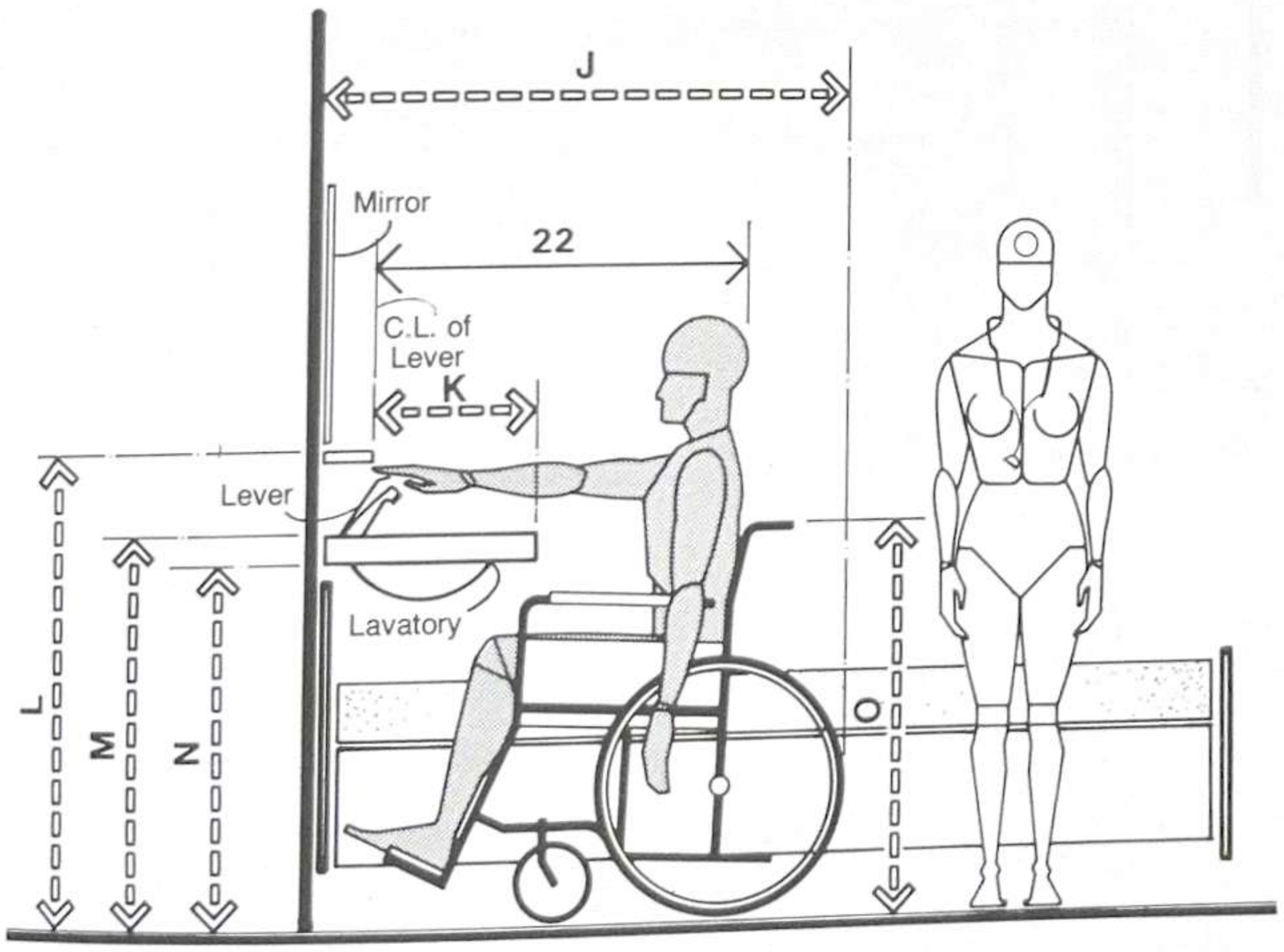
6.3 HOSPITAL ROOMS

The drawing at the top of the page shows the personal area around an individual bed in a double or four-bed arrangement. A preferred depth of 99 in, or 251.5 cm, will allow for a 30-in, or 76.2-cm, circulation/activity zone on both sides of the bed. A space of 96 in, or 243.8 cm, would be the absolute minimum and would require that a few inches of zone space be shared with the personal area of the adjacent bed position.

The drawing at the bottom of the page illustrates the relationship of the wheelchair user to a wall-hung hospital lavatory. It is essential that sufficient clearance be provided to allow the wheelchair to slide partially under the bottom edge of the fixture. For proper access to controls anthropometrically, thumb tip reach should be taken into account. For this, 5th percentile data should be used. If the controls are within reach of the person of small body size, they will also be within reach of those having a larger body size. For further information concerning the interface between the wheelchair user and the lavatory, refer to Section 8.3, Public Bathrooms.



PERSONAL AREA / DOUBLE OR FOUR BEDROOM



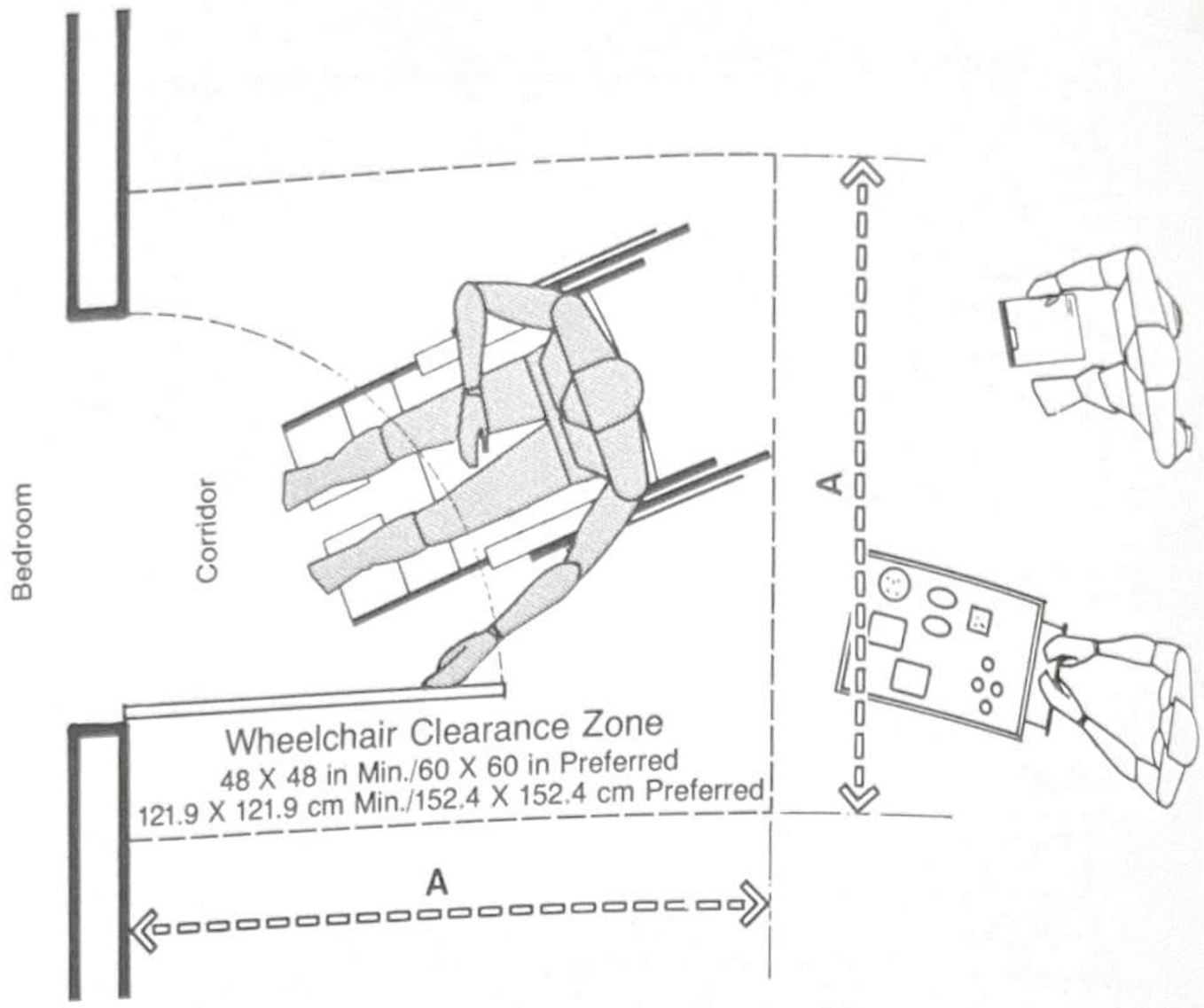
BEDROOM LAVATORY

	in	cm
A	17–18	43.2–45.7
B	18	45.7
C	5–6	12.7–15.2
D	20	50.8
E	28.5–30	72.4–76.2
F	39	99.1
G	96–99	243.8–251.5
H	48–66	121.9–167.6
I	87	221.0
J	48	121.9
K	18 max.	45.7 max.
L	40 max.	101.6 max.
M	34 max.	86.4 max.
N	30 min.	76.2 min.
O	36	91.4

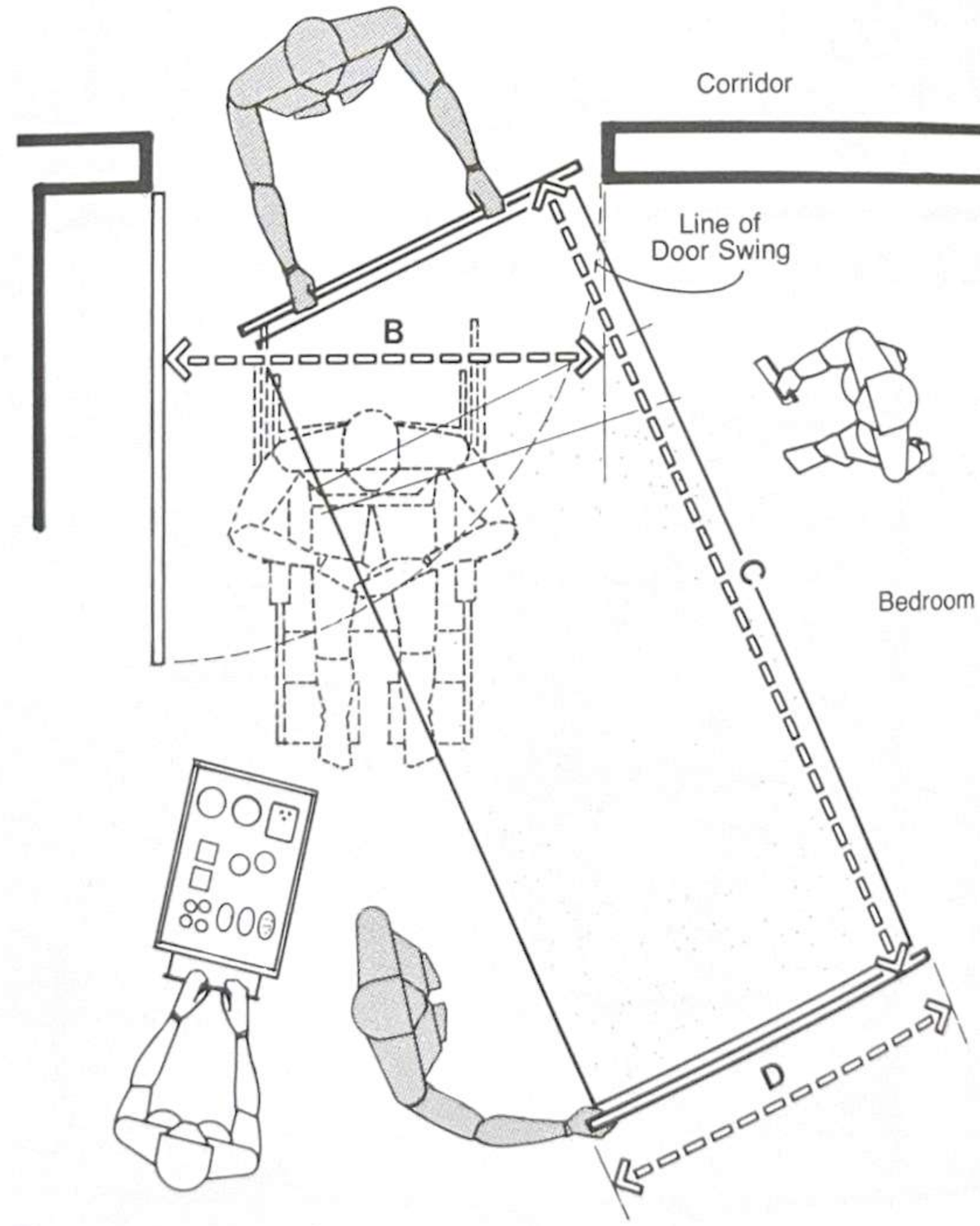
6.3 HOSPITAL ROOMS

The drawing at the top of the page shows the clearances required in front of a hospital room door to accommodate a wheelchair user. An area of 60 by 60 in, or 152.4 by 152.4 cm, is preferred to allow the disabled user to maneuver the wheelchair into an appropriate approach position, open the door, and exit. A wheelchair can also be maneuvered within a 48- by 48-in, or 121.9- by 121.9-cm, area, but such a space allocation is extremely tight and should be viewed as an absolute minimum. Since door openings to hospital rooms are large enough to allow the passage of beds and other relatively wide equipment, the standard door widths are more than adequate to accommodate the wheelchair.

The drawing at the bottom of the page illustrates the door clearance necessary to allow the passage of a standard bed. In broken line, the drawing also indicates the outline of a wheelchair, showing that a door width appropriate for the passage of a bed is more than adequate to accommodate the passage of a wheelchair.



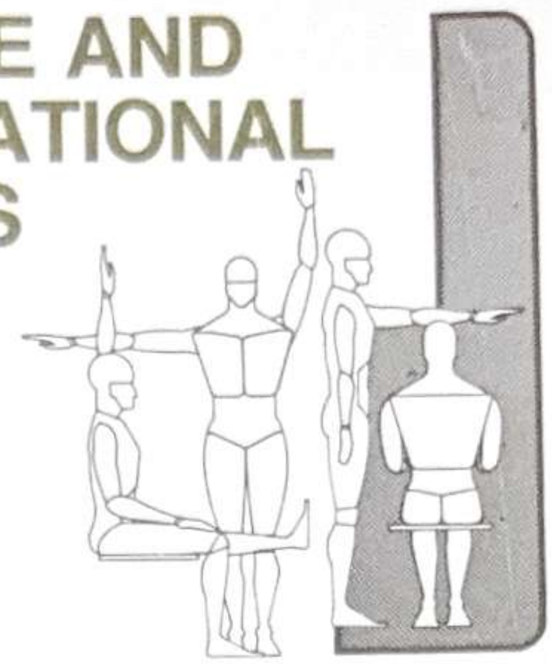
BEDROOM ENTRANCE DOOR



BEDROOM ENTRANCE DOOR

	in	cm
A	60	152.4
B	46–48	116.8–121.9
C	87	221.0
D	39	99.1

7 LEISURE AND RECREATIONAL SPACES



SPACE

TABLE	7.1 EXERCISE ROOMS	7.2 SPORTS AND GAMES	7.3 WORK AND CRAFT	ANTHROPOMETRIC DATA
1A,2B,7B	●	◑	◑	1 STATURE
1B,3C			◑	2 EYE HEIGHT
1C,3B		◑	◑	3 ELBOW HEIGHT
1D,2C	●			4 SITTING HEIGHT ERECT
1E,2D			◑	5 SITTING HEIGHT NORMAL
				6 EYE HEIGHT SITTING
1G,3E	◑			7 MIDSHOULDER HEIGHT SITTING
				8 SHOULDER BREADTH
				9 ELBOW-TO-ELBOW BREADTH
				10 HIP BREADTH
1K,2G			◑	11 ELBOW REST HEIGHT
1L,2H,7F			●	12 THIGH CLEARANCE
				13 KNEE HEIGHT
1N,2J,7H	◑		◑	14 POPLITEAL HEIGHT
1O,2K,7I	◑		◑	15 BUTTOCK-POPLITEAL LENGTH
1P,2L	●			16 BUTTOCK-KNEE LENGTH
				17 BUTTOCK-TOE LENGTH
1R,4B	●			18 BUTTOCK-HEEL LENGTH
				19 VERTICAL REACH HEIGHT SITTING
1T,4F		◑		20 VERTICAL GRIP REACH
1U,4E	●	●	○	21 SIDE ARM REACH
1V,4D	◑		○	22 THUMB TIP REACH
1W,6B	●		●	23 MAXIMUM BODY DEPTH
1X,6A	●	●	●	24 MAXIMUM BODY BREADTH

Rising incomes, shorter work weeks, longer vacations, more holidays, earlier retirement, increased longevity, smaller families, greater affluence, and a host of other socioeconomic factors have resulted in a change in lifestyle and value systems. For many, the so-called work ethic has given way to the emerging leisure ethic. By the year 2000, for example, it has been estimated that over 2 billion people will be traveling and that tourism may well rank among the world's largest industries. Some $160 billion were spent in 1977 on leisure and recreation, and some sources contend that measured by people's spending, leisure time activities have become the nation's number one industry.

This leisure and recreation boom will increase the demand for the design of private and commercial interior spaces to house the various facilities and/or systems. These may range from traditional sports and games to sophisticated exercise and body building equipment and thermally controlled environments. Some may involve intensely vigorous participation, while others may be relatively passive. Other facilities may include arts and crafts and do-it-yourself activities. Some pursuits of the future may be similar to those with which we are familiar today. Many may not. For certain, all will involve human dimension and interior space and the interface between people and the components of that space. The height of a workbench or drawing table for comfortable and practical use, the nature of the exercise equipment, and the anthropometric requirements for the user's interface with that equipment are just a few of the factors that must be considered.

Human body size and dimension are a particularly significant factor in the more physical and active sports. The avid sports fan need not refer to published anthropometric data to tell you that the size of the professional athlete has undergone a dramatic increase over the last forty years. The 176-lb, or 80-kilo, defensive football player, once considered large, is now thought by many to be too small to play as a wide receiver. The tall 73-in, or 185-cm, basketball center of the 1930s is now too short to play the guard position. The Olympic track records of forty and fifty years ago are now being easily broken by women. The size, physical strength, speed skills, training methods, and diet of today's athlete have improved to such an extent that dimensional standards and space requirements that once were adequate must be recalculated.

7.1 EXERCISE AREAS

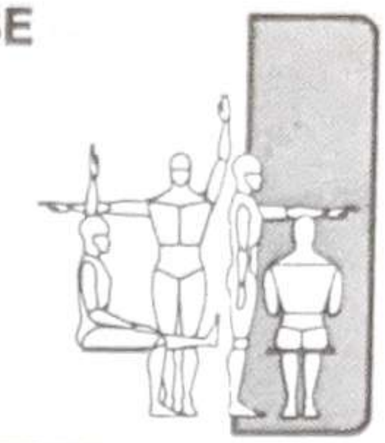


TABLE	EXERCISE	SAUNA	LOCKER ROOM	ACTIVITIES / ANTHROPOMETRIC DATA
1A,2B	●	●		1 STATURE
1D,2C	●			4 SITTING HEIGHT ERECT
1G,3E	◐			7 MIDSHOULDER HEIGHT SITTING
1N,2J		◐	◐	14 POPLITEAL HEIGHT
1O,2K		◐		15 BUTTOCK-POPLITEAL LENGTH
1P,2L	●	●	●	16 BUTTOCK-KNEE LENGTH
1R,4B	●			18 BUTTOCK-HEEL LENGTH
1U,4E	●			21 SIDE ARM REACH
1V,4D	●		○	22 THUMB TIP REACH
1W,6B	●		●	23 MAXIMUM BODY DEPTH
1X,6A	●	●	●	24 MAXIMUM BODY BREADTH

The drive for health and physical fitness has made exercise activities a popular pastime for many and a major business enterprise for others. Some activities require no equipment, while others involve equipment ranging in levels of sophistication and cost from a simple set of fixed-weight dumbbells to precision-engineered nine-station exercise machines costing thousands of dollars. In all situations, however, the spaces designated to house these activities must respond to human dimension. The drawings on the following pages illustrate some of the more fundamental exercise activities and suggest clearances and other dimensional data for use in making preliminary design assumptions. The major anthropometric measurements to consider are indicated in the above matrix.

Saunas and hydrotherapeutic whirlpool equipment are also frequently provided within exercise spaces. A few representative models illustrating the relationship of the human body to the equipment are also included in the drawings in this section.

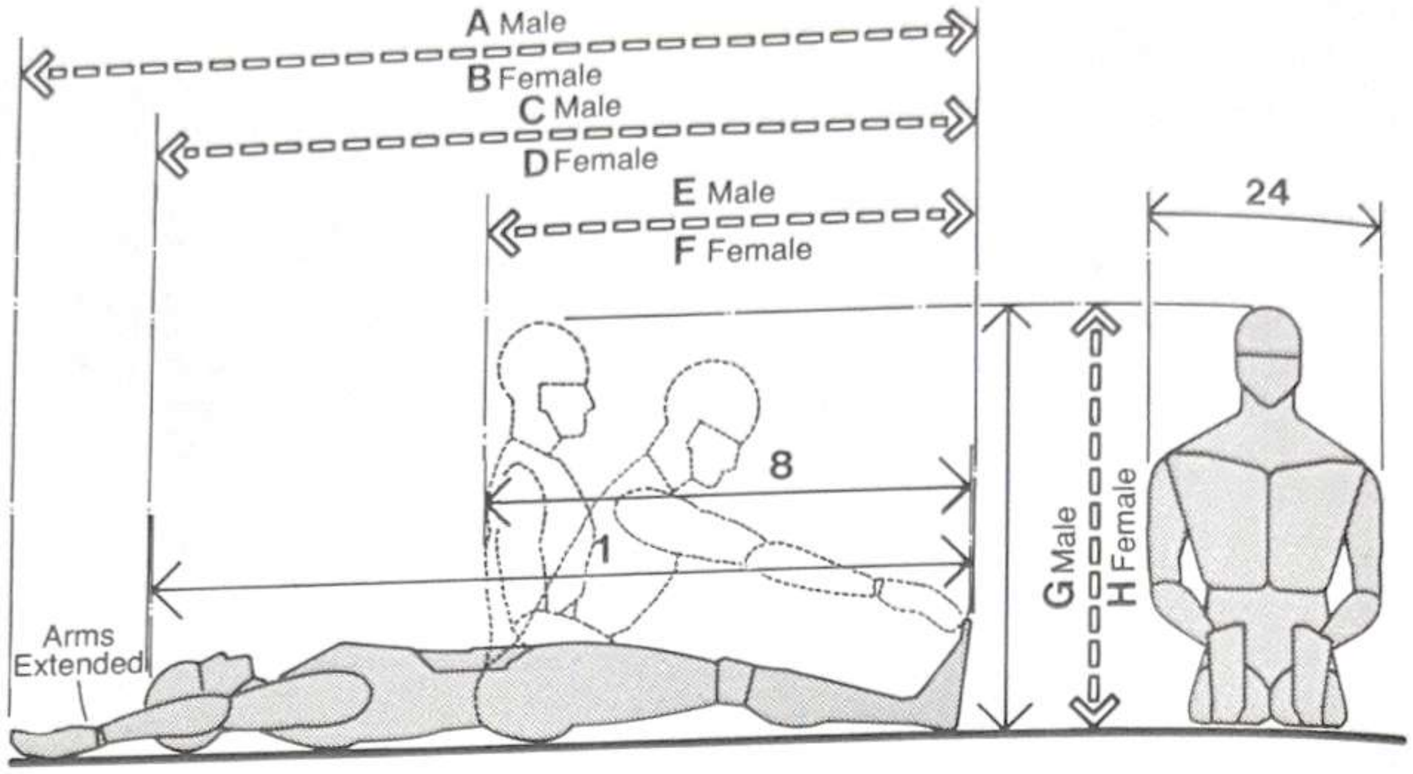
Most exercise spaces also include locker facilities of one type or another and their design must respond to human dimension and body size as well. The height of the benches must conform to the general anthropometric requirements for seating. Of principal concern is the popliteal height of the user. Buttock-heel length and/or buttock-toe length data of the user having a larger body size are useful in determining the extent to which the body of the seated user will project into the space between the edge of the bench and the face of the locker. This dimension plus the maximum body breadth of a larger person can then be used in establishing a comfortable overall clearance between bench and locker for circulation as well as accommodation of the person seated on the bench.

7.1 EXERCISE AREAS

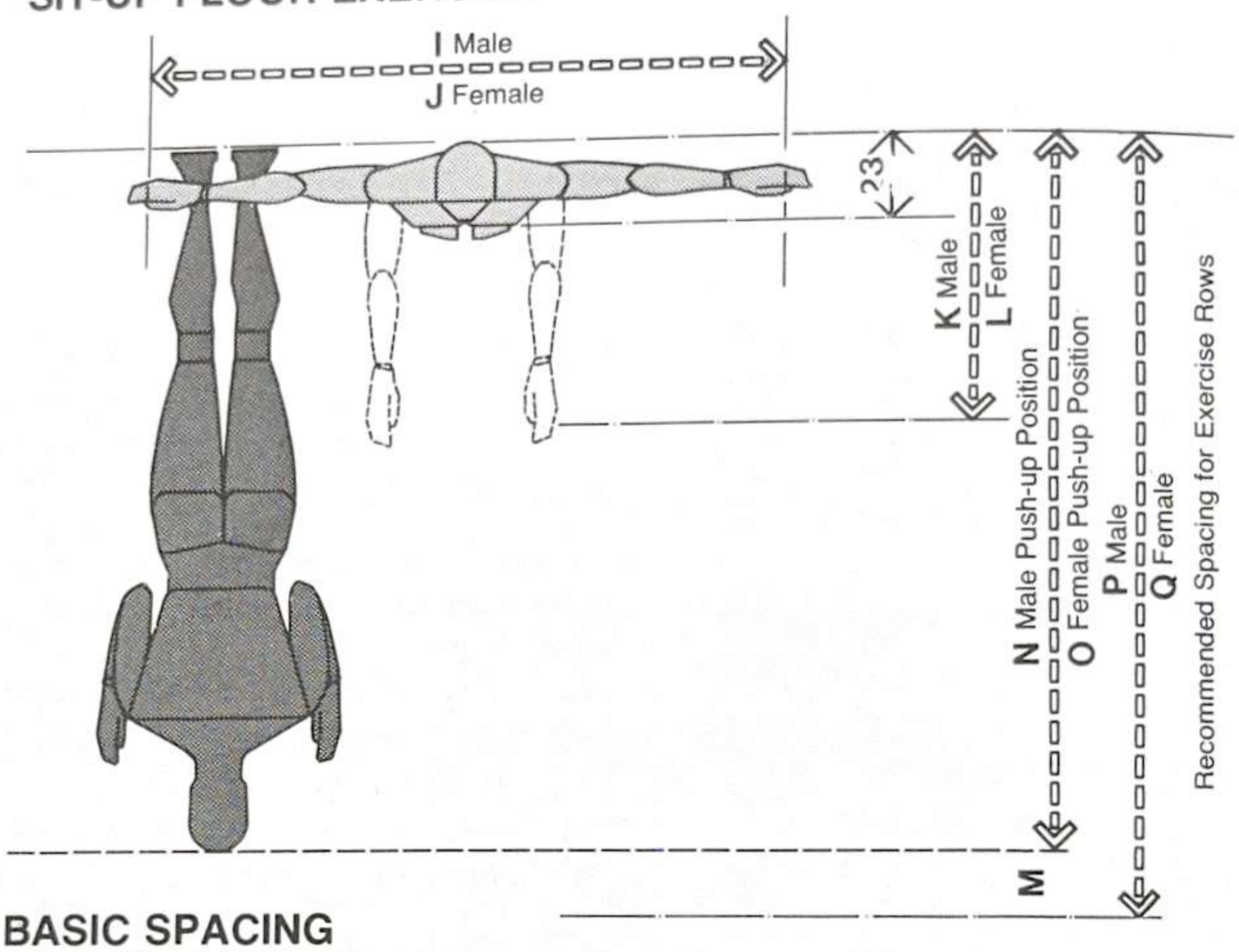
The top drawing indicates in side and front view the clearances required by the human body while engaged in sit-up exercises. Although it is recommended that in establishing clearances, the person of larger body size be used as a model, the ranges shown reflect small and large male and female data. The 5th and 95th percentile vertical grip reach measurements were used as the basis of the dimensions, with an allowance to compensate for the fact that the anthropometric measurement does not quite extend to the tip of the fingers. The authors suggest that even if the design is intended for a particular population of smaller body size, the larger measurements be used. The largest clearance required would be for the large male, and is shown as 91.5 in or 232.4 cm.

The center drawing provides the designer with the dimensional information necessary to establish basic spacing for an exercise class.

The bottom drawing shows the clearance required for push-up exercises. Stature would be the most useful anthropometric measurement to consider.

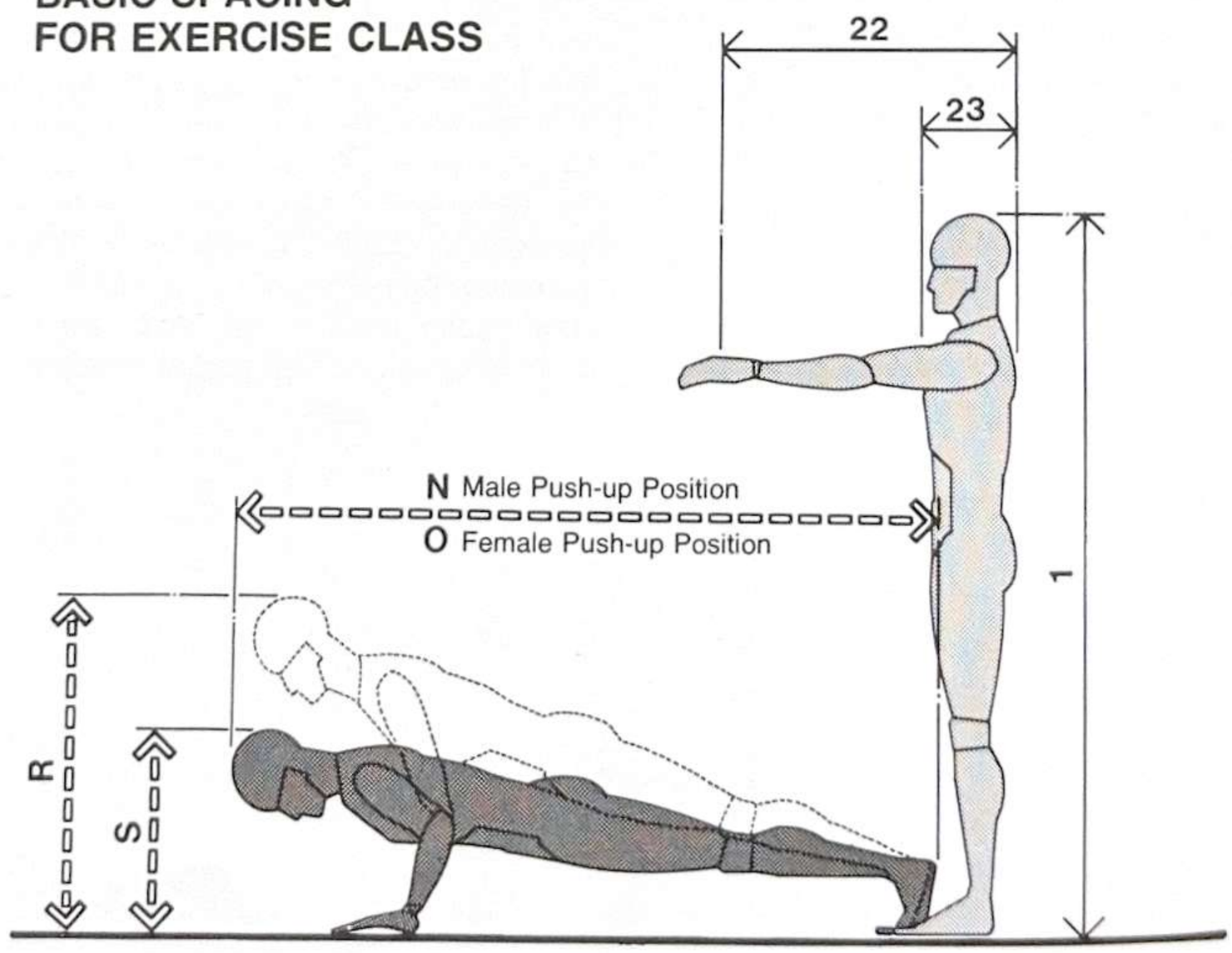


SIT-UP FLOOR EXERCISE

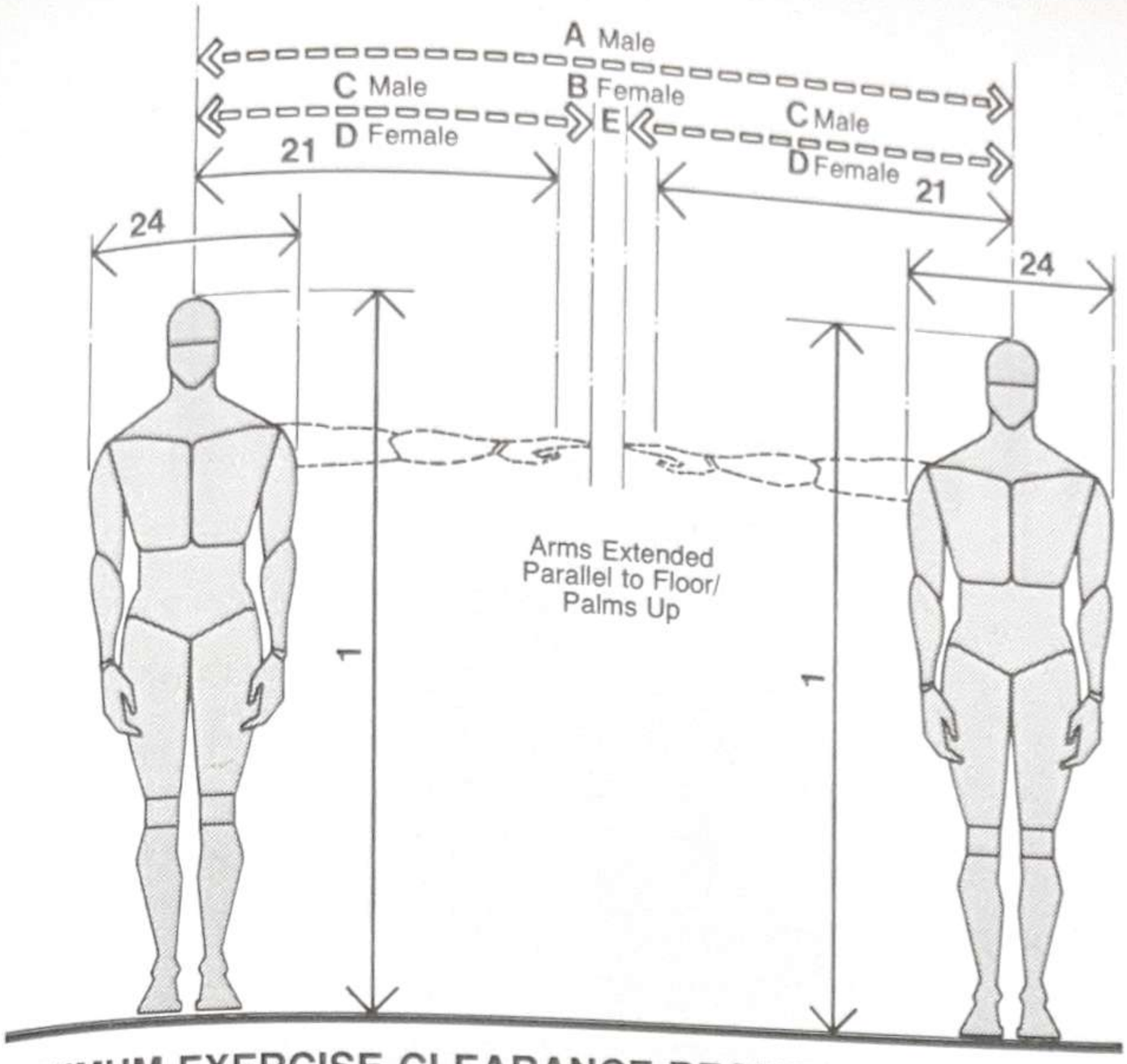


BASIC SPACING FOR EXERCISE CLASS

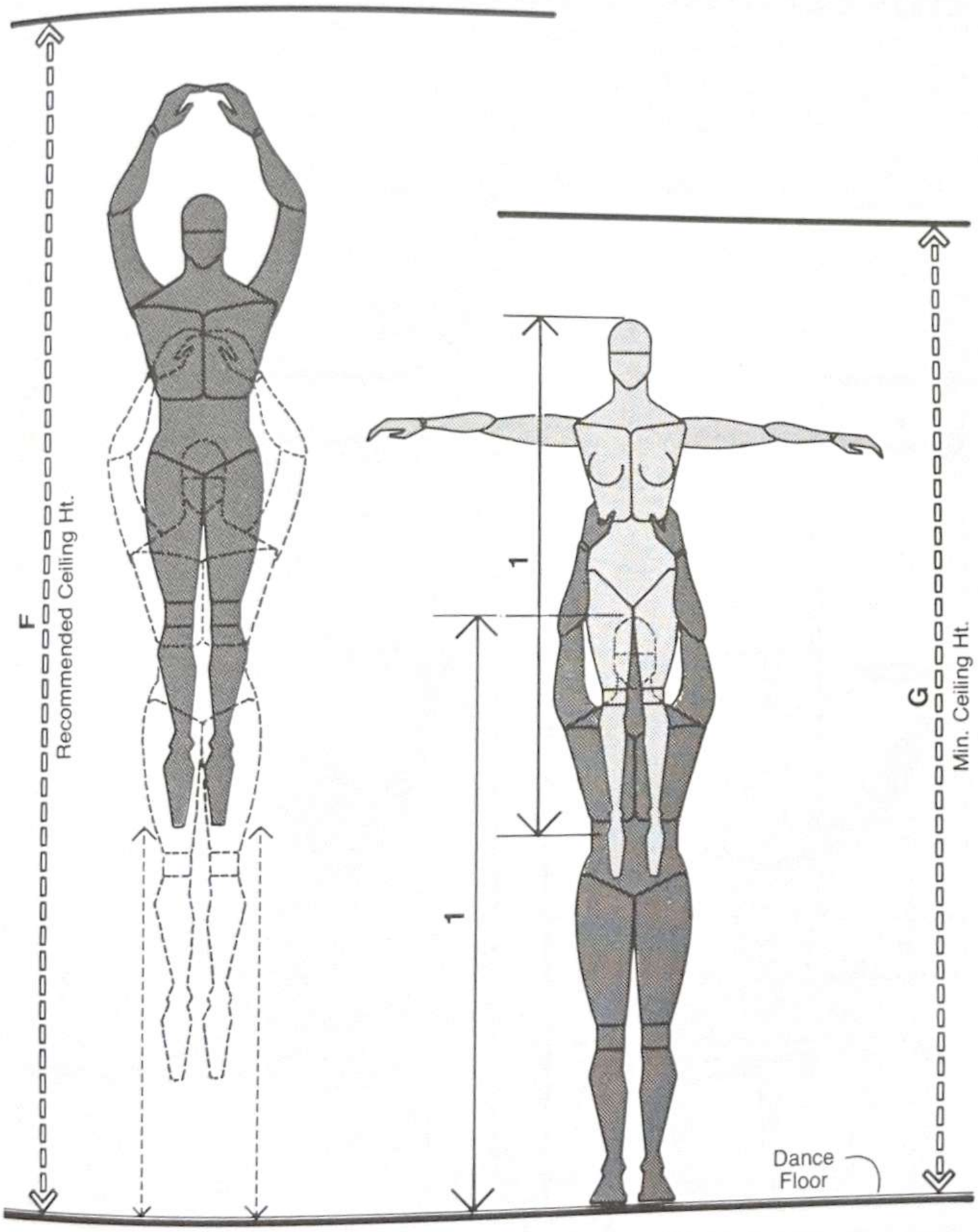
	in	cm
A	80–91.5	203.2–232.4
B	75–87	190.5–221.0
C	65–74	165.1–188.0
D	60–69	152.4–175.3
E	32–37	81.3–94.0
F	27–37	68.6–94.0
G	33.2–38.0	84.3–96.5
H	30.9–35.7	78.5–90.7
I	58–68	147.3–172.7
J	54–76	137.2–193.0
K	29.7–35.0	75.4–88.9
L	26.6–31.7	67.6–80.5
M	6–12	15.2–30.5
N	63–73	160.0–185.4
O	61–67	154.9–170.2
P	79–85	200.7–215.9
Q	73–79	185.4–200.7
R	23–38	58.4–96.5
S	10–16	25.4–40.6



SPACE REQUIREMENTS FOR BASIC PUSH-UP POSITION



MINIMUM EXERCISE CLEARANCE REQUIREMENTS



DANCE AND EXERCISE PRACTICE ROOMS/
CEILING HEIGHT REQUIREMENTS

7.1 EXERCISE AREAS

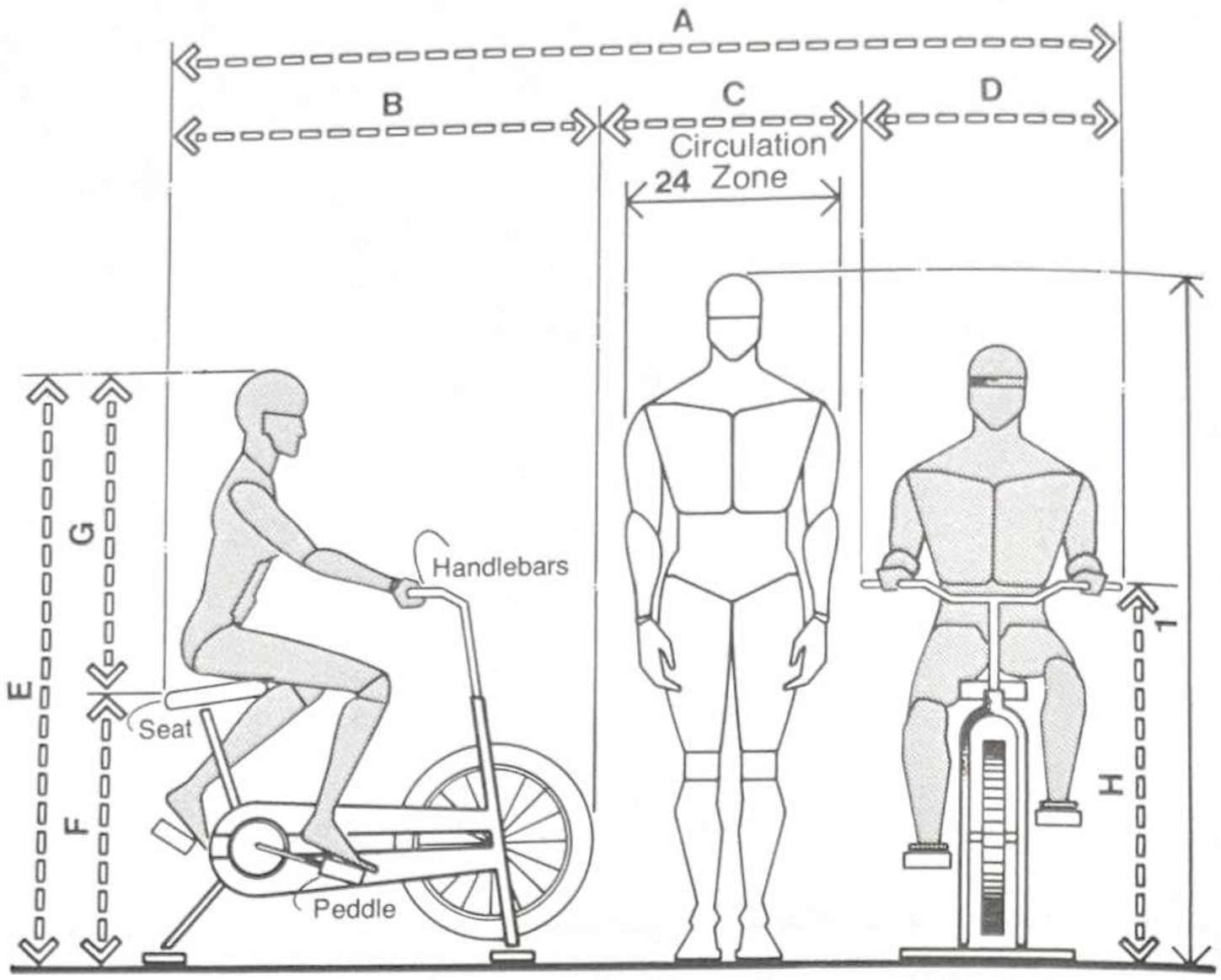
The top drawing should be helpful in establishing minimum center spacing for standing exercises in place. The drawing is not intended as a standard, but rather as a base of reference for preliminary design assumptions. The nature of the particular exercise and the intensity of body movements involved should all be taken into consideration.

Certain exercises require significant head room. Dance and similar activities, for example, require considerable clearance to avoid accidents. The bottom drawing shows only two such possibilities. There are, obviously, many variations. The tables in Part B should provide the necessary data with which to establish clearances appropriate to those variations.

	in	cm
A	65–80	165.1–203.2
B	61–88	154.9–223.5
C	31–37	78.7–94.0
D	29–41	73.7–104.1
E	3–6	7.6–15.2
F	144	365.8
G	120	304.8

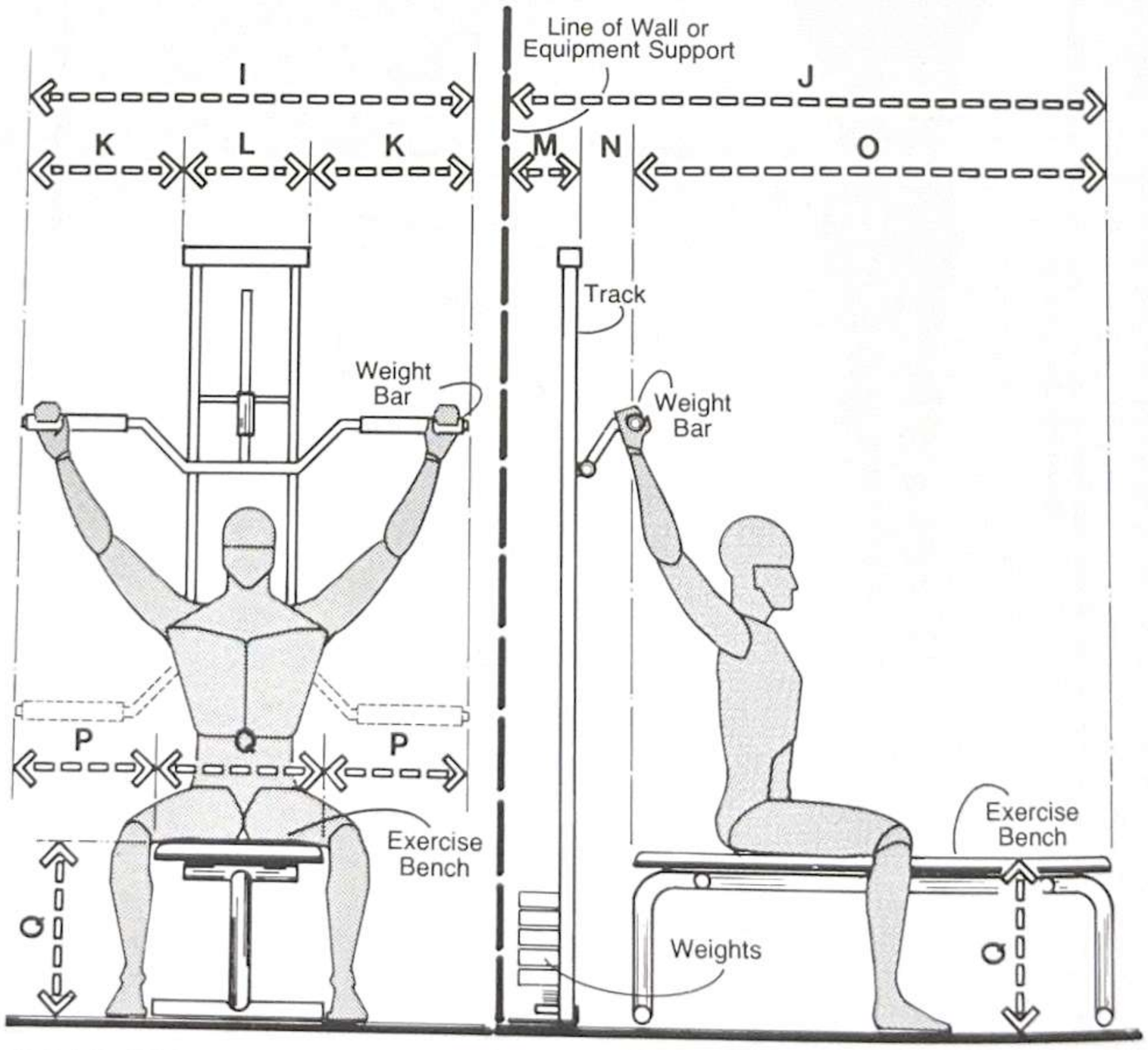
7.1 EXERCISE AREAS

The two corresponding drawings show typical exercise equipment available on the market. The top drawing typifies the classic exercise bicycle and shows some of the clearances required in a commercial installation. The bottom drawing is representative of the many weight-lifting devices presently in use. The front and side views indicate some of the overall dimensions as well as the relationship of the human body to the equipment. Dimensions and general configuration vary with model and manufacturer, but the information shown can be used for making preliminary design assumptions.



EXERCISE BICYCLE

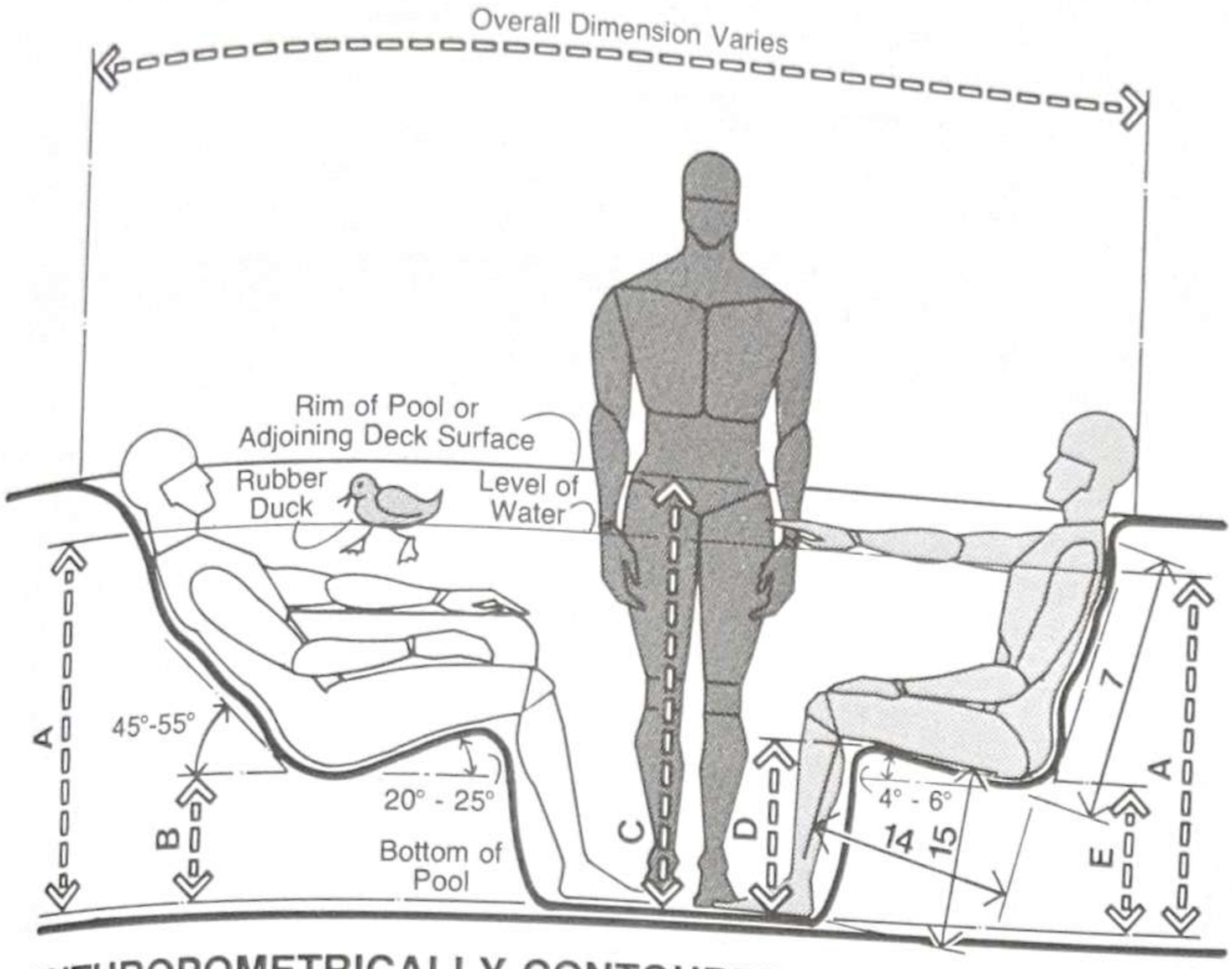
	in	cm
A	83–104	210.8–264.2
B	35–48	88.9–121.9
C	30	76.2
D	18–26	45.7–66.0
E	55–68	139.7–172.7
F	25–30	63.5–76.2
G	30–38	76.2–96.5
H	46	116.8
I	36–48	91.4–121.9
J	58–76	147.3–193.0
K	12–18	30.5–45.7
L	12	30.5
M	6–12	15.2–30.5
N	4–10	10.2–25.4
O	48–54	121.9–137.2
P	9–14	22.9–35.6
Q	18–20	45.7–50.8



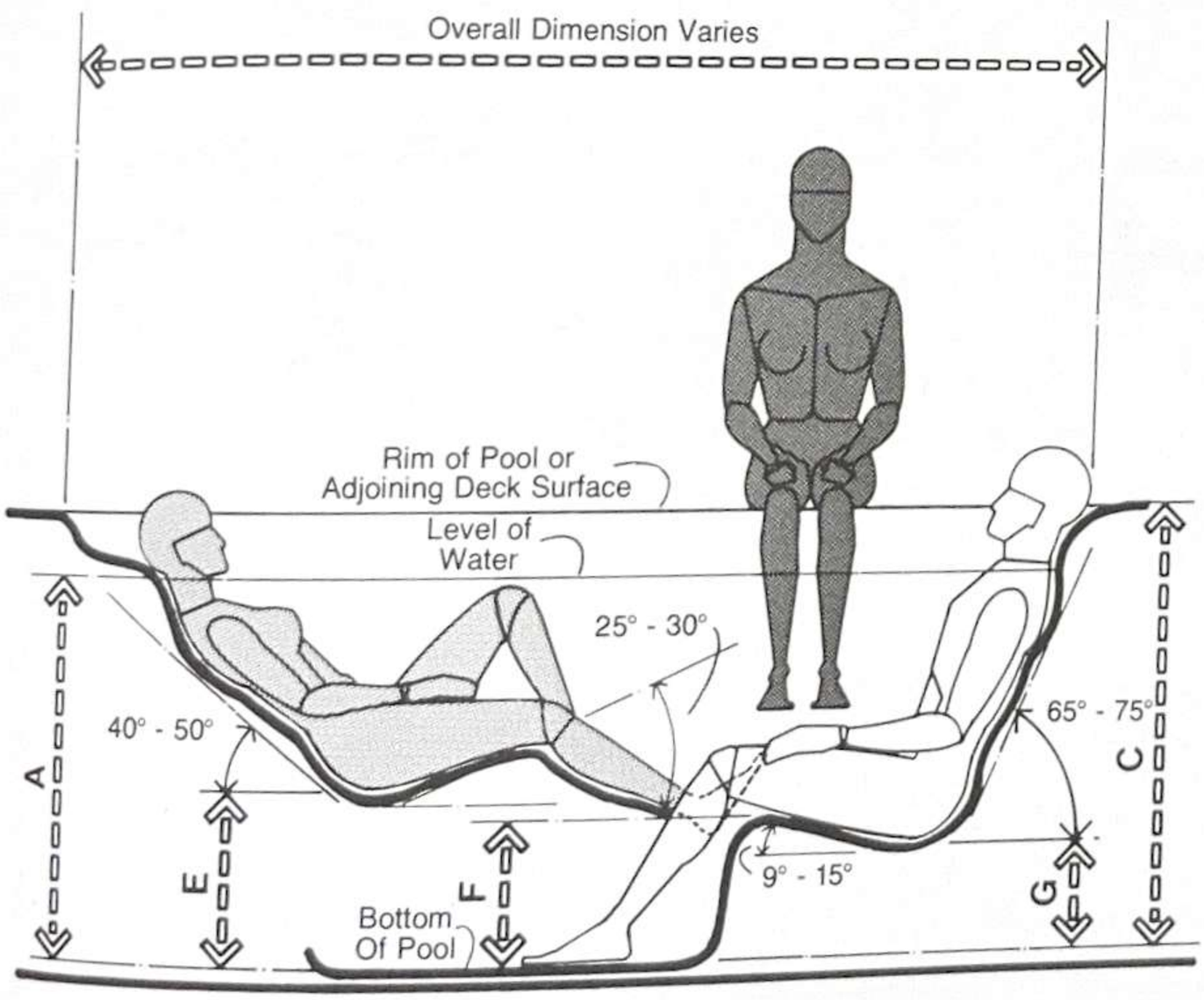
WALL-MOUNTED LATISSIMUS POWER LIFT UNIT

7.1 EXERCISE AREAS

Most hydrotherapy pools provide turbulent hot water massage. Some models, such as the ones shown on this page, have been anthropometrically contoured to provide proper support for the back, particularly in the lumbar region. The pools are manufactured in a variety of profiles to accommodate different body positions. The height of the pools is between 33 and 38 in, or 83.8 and 96.5 cm. The lengths and widths vary with the model.



ANTHROPOMETRICALLY CONTOURED HYDROTHERAPY POOL



ANTHROPOMETRICALLY CONTOURED HYDROTHERAPY POOL

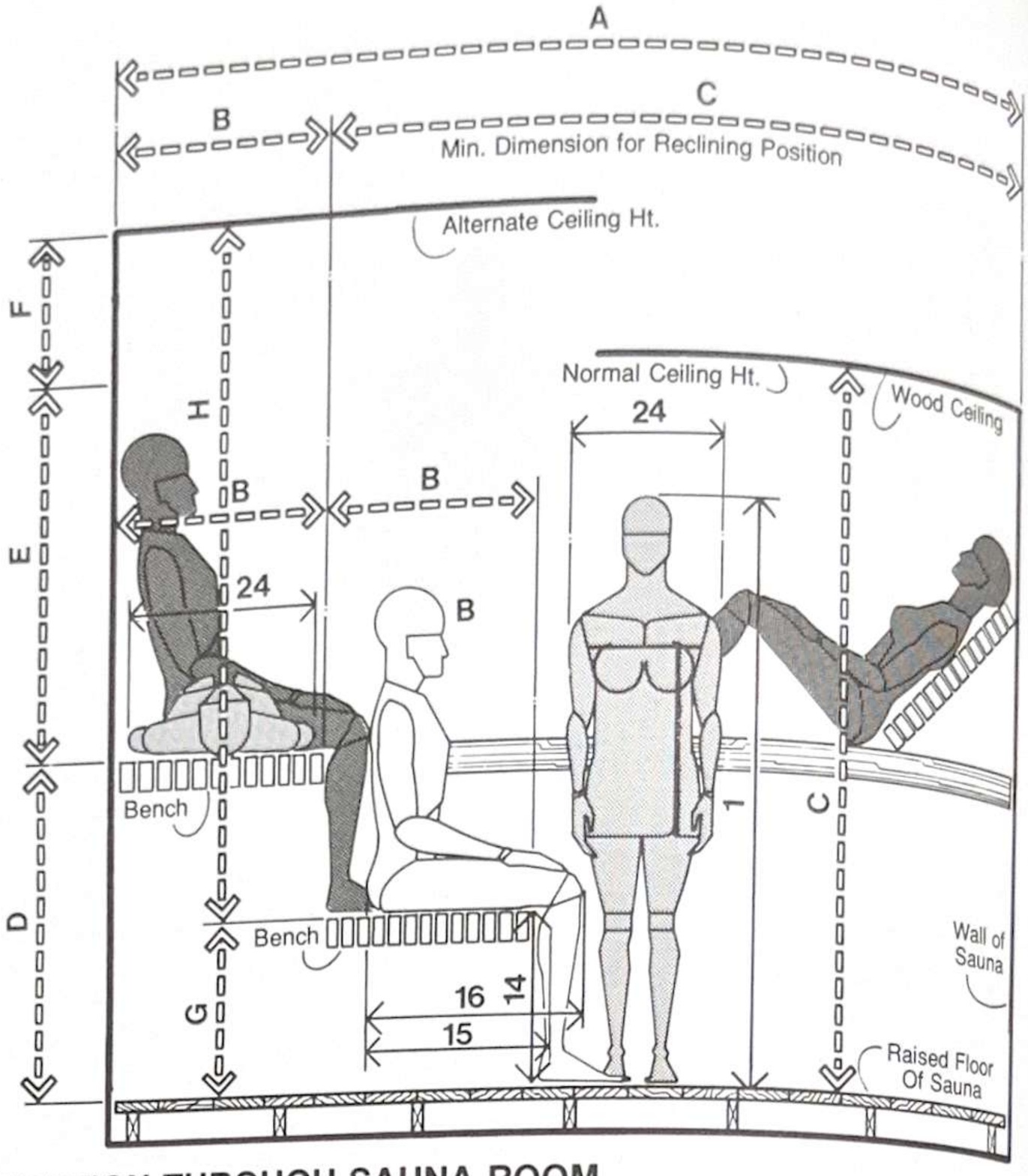
	in	cm
A	33–38	83.8–96.5
B	9–12	22.9–30.5
C	38–44	96.5–111.8
D	13–16	33.0–40.6
E	12–15	30.5–38.1
F	11–14	27.9–35.6
G	8–11	20.3–27.9

7.1 EXERCISE AREAS

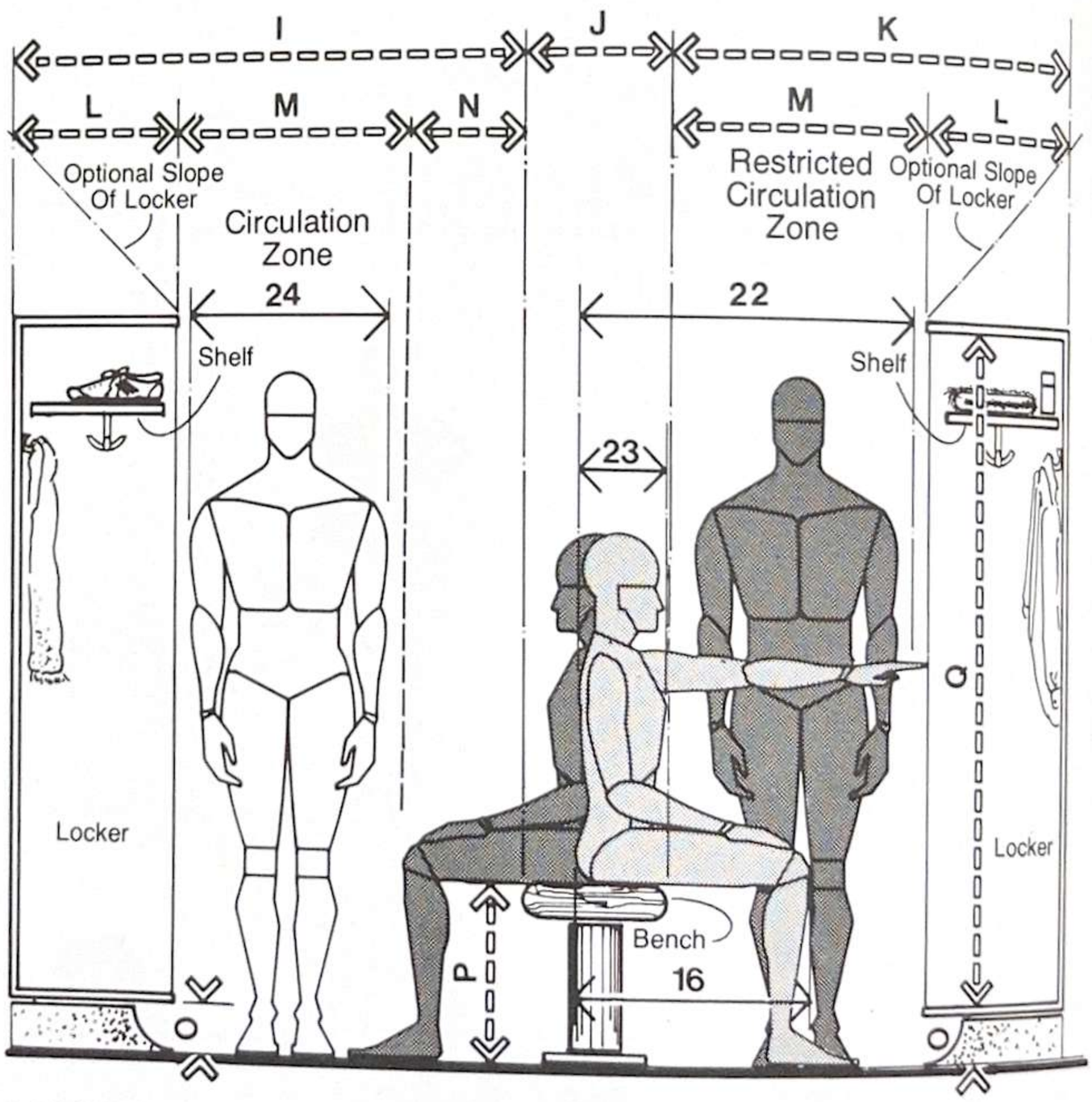
The sauna is essentially a thermal bath using dry heat, unlike the low heat and high humidity of the steam bath. Although there are many complete prefabricated models on the market, the heater units can be purchased separately. It is therefore relatively simple to custom design an individual installation.

The top drawing illustrates some of the critical dimensions involved. Two possible ceiling heights are indicated. The alternate height will allow more comfortable access to the second tier bench, while the normal height will permit installation within the conventional 96-in, or 243.8-cm, ceiling limitations of most residential interior spaces.

The bottom drawing shows a section through a typical locker room. The restricted circulation zone shown at the right would require either the seated or the standing person to move out of the way to avoid body contact. The circulation zone at the left would allow more comfortable passage without body contact.



SECTION THROUGH SAUNA ROOM



LOCKER ROOM

	in	cm
A	108	274.3
B	24	61.0
C	84	213.4
D	36–40	91.4–101.6
E	44–48	111.8–121.9
F	12–14	30.5–35.6
G	18–20	45.7–50.8
H	78 min.	198.1 min.
I	56–64	142.2–162.6
J	12–15	30.5–38.1
K	42–48	106.7–121.9
L	12–18	30.5–45.7
M	30	76.2
N	14–16	35.6–40.6
O	4–6	10.2–15.2
P	14–17	35.6–43.2
Q	60–72	152.4–182.9

7.2 SPORTS AND GAMES

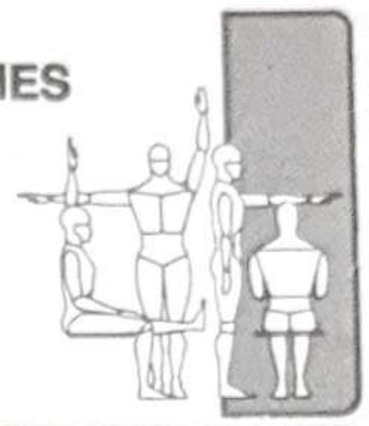


TABLE	TABLE TENNIS	POOL TABLE	BASKETBALL	ACTIVITIES / ANTHROPOMETRIC DATA
1A,2B			◑	1 STATURE
1C,3B	◑	◑		3 ELBOW HEIGHT
1T,4F			◑	20 VERTICAL GRIP REACH
1U,4E	●			21 SIDE ARM REACH
1X,6A		●		24 MAXIMUM BODY BREADTH

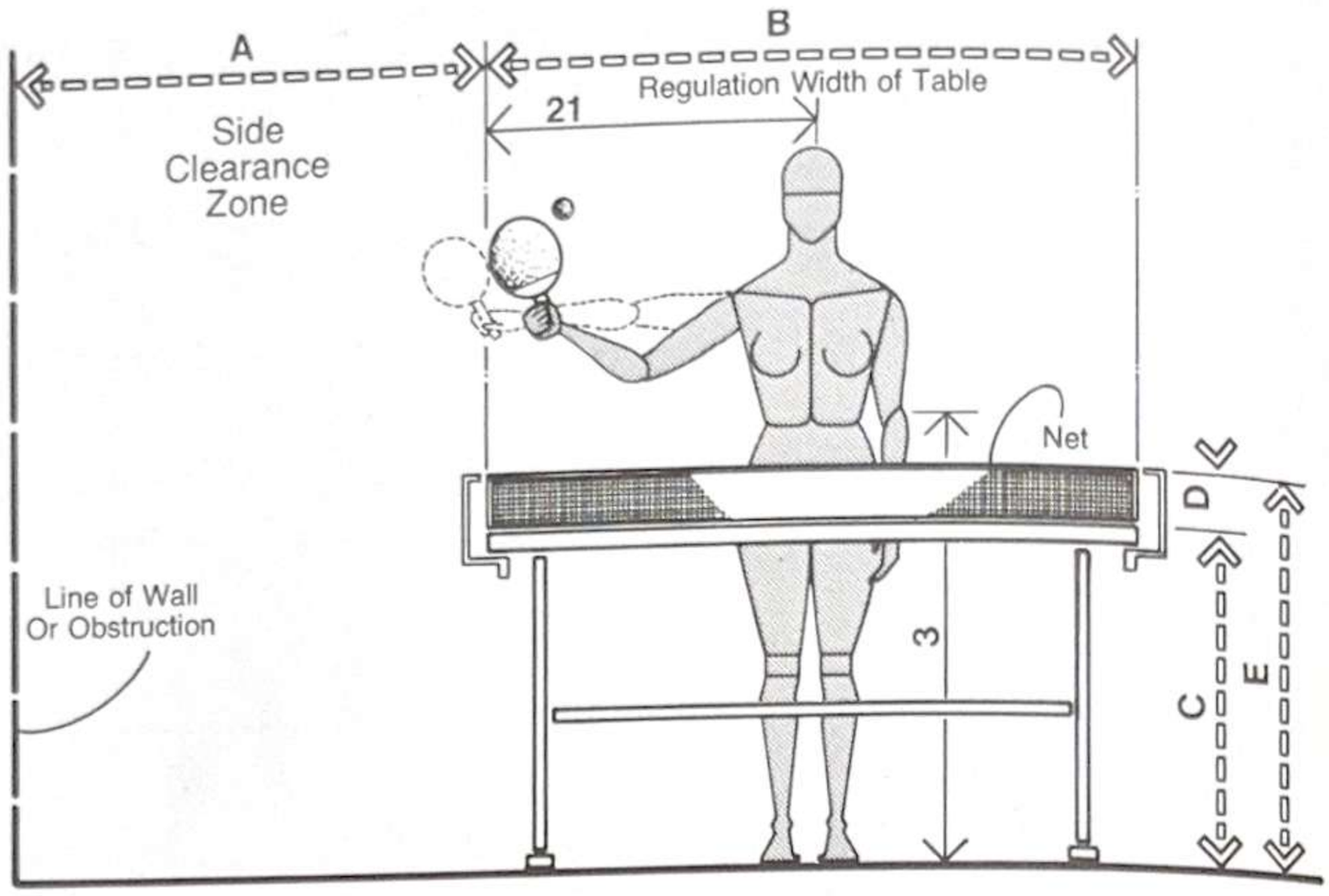
Aside from the basic anthropometric considerations involved to accommodate most sports and game activities, certain of these activities present some unique problems. Can basketball, for example, be truly considered a "sport" if most players must have a 99th percentile stature to participate? A player with a 90th or 95th percentile stature, although possessing skills and agility, would be at an obvious disadvantage for no reason but the body size of his opponent. A tall player may use a stuff shot, since his tremendous height enables him to jump high in the air. With both hand and ball positioned slightly above the rim of the basket, he is then able in one swift downward thrust to literally stuff the ball through the basket. A proposal is presently under consideration to raise the height of the rim to deny the tall player the use of this shot. It is doubtful that Dr. James Naismath, when he conceived the game in 1891, envisioned an 84-in, or 214-cm center, with the ability to forcefully stuff a round ball into a wooden basket. This condition is one of the many explored in the text and the drawings on the following pages. Perhaps the relationships between human dimension and the degree to which it impacts on the intended spirit of competitive sports should be studied across the board in all areas of athletics—surely a novel and interesting investigation for designer and anthropometrist alike.

The present lack of enforceable building code regulations to ensure that the design of interior spaces housing active sports corresponds to human dimension and the dynamics of people in motion constitutes a potential threat to the safety of the participant. There are, for example, no code regulations that establish the minimum space needed between the basketball court boundary lines and the nearest obstruction to allow a player running off the court to reduce his rate of speed to avoid crashing head-on into a wall or other obstacle. Similarly, there are no code requirements establishing minimum clearances between a diving board and any overhead obstruction or between a tennis court baseline and back fence. Nor do minimum ceiling height requirements exist for spaces where a gymnast practices or performs.

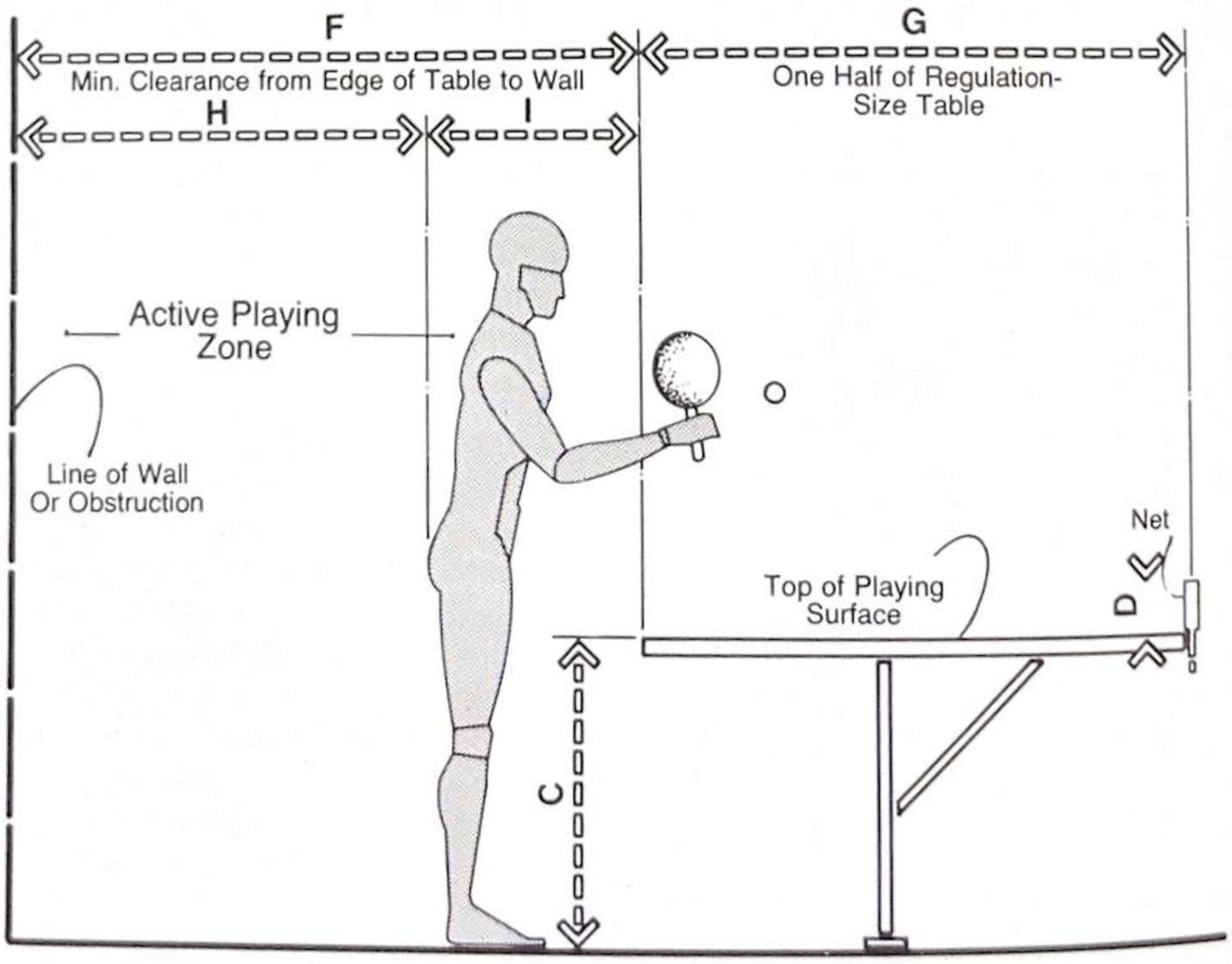
The absence of regulations of the type mentioned not only poses a serious threat to the safety of the users, but it makes both client and designer legally responsible in the event of injury or death if it can be demonstrated that reasonable clearances were not provided. Moreover, in cases where extra-legal guidelines, recommended standards, or simple rules of thumb are the only criteria available, the designer should seriously question and reevaluate them in terms of current published anthropometric data and the nature and character of the materials and physical arrangement of the equipment involved. Included among the drawings on the pages that follow are examples of some of the problems mentioned. The matrix above indicates some of the more relevant anthropometric measurements applicable to spaces used for sports and game activities.

7.2 SPORTS AND GAMES

The top drawing indicates side clearance requirements for a table tennis installation within a residential environment: 48 in, or 121.9 cm, is the absolute minimum, while 72 in, or 182.9 cm, is preferred. The bottom drawing indicates the clearances required at either end of the table. In a close-up position, the player usually functions within 24 to 36 in, or 61 to 91.4 cm, of the edge of the table. An overall clearance between the edge of the table and the wall or nearest physical obstruction—between 84 and 120 in, or 213.4 to 304.8 cm—is suggested. The smaller figure should be regarded as an absolute minimum, and the larger figure as the preferred clearance. The latter, however, may be difficult to provide in terms of the room size required. The extent of clearance is a function of the size of the players and the intensity and skill with which the game is played. What must be considered is not only the space required for low-key volleying but the space required, for example, to chase a strategically placed ball, return it, decelerate, and ultimately stop, all in enough time to avoid colliding into the wall at the rear or side of the playing area.



RESIDENTIAL TABLE TENNIS REQUIREMENTS



RESIDENTIAL TABLE TENNIS REQUIREMENTS/
REAR CLEARANCE ZONE

	in	cm
A	48–72	121.9–182.9
B	60	152.4
C	30	76.2
D	6	15.2
E	36	91.4
F	84–132	213.4–335.3
G	54	137.2
H	60–96	152.4–243.8
I	24–36	61.0–91.4