

## Firefighter Anthropometry Data Dictionary

[Measurements are reported in both the Metric system by mm and the English system by inch]

### Measured without Gear (Standing)

- (01) **Acromial height, standing:** The vertical distance between a standing surface and the acromion landmark on the tip of the right shoulder. The subject stands erect looking straight ahead. The heels are together with the weight distributed equally on both feet. The shoulders and upper extremities are relaxed. The measurement is made at the maximum point of quiet respiration.
- (02) **Ankle height, standing** (lateral malleolus, right): The vertical distance is measured between a standing surface and the lateral malleolus landmark on the outside of the right ankle. The subject stands erect with the heels together and the weight distributed equally on both feet.
- (03) **Axilla height, standing:** The vertical distance between a standing surface and the anterior point of the axilla is measured with an anthropometer. The subject stands erect looking straight ahead. The heels are together with the weight distributed equally on both feet. The shoulders and upper extremities are relaxed. The measurement is made at the maximum point of quiet respiration.
- (04) **Calf circumference, standing:** The maximum horizontal circumference of the right calf is measured with a tape. The subject stands erect with the heels approximately 10 cm apart and the weight distributed equally on both feet.
- (05) **Cervicale height, standing:** The vertical distance between a standing surface and the cervicale landmark on the back of the head. The subject stands erect looking straight ahead. The heels are together with the weight distributed equally on both feet. The shoulders and upper extremities are relaxed. The measurement is made at the maximum point of quiet respiration.
- (06) **Chest breadth, standing:** The maximum horizontal breadth of the chest at the level of the right bust point on women or the nipple on men is measured with a beam caliper. The subject stands erect looking straight ahead with the heels together, the weight distributed equally on both feet. The measurement is taken at the maximum point of quiet respiration.
- (07) **Chest circumference, standing:** The maximum horizontal circumference of the chest at the fullest part of the breast is measured with a tape. The subject stands erect looking straight ahead. The shoulders and upper extremities are relaxed. The measurement is taken at the maximum point of quiet respiration.
- (08) **Chest depth, standing:** The horizontal distance between the chest, at the level of the right bust point on women or the nipple on men, and the back at the same level is measured with a beam caliper. The subject stands erect looking straight ahead. The shoulders and upper extremities are relaxed. The measurement is taken at the maximum point of quiet respiration.
- (09) **Crotch height, standing:** Vertical distance from the standing surface to the crotch. Subject stands erect with feet slightly apart.
- (10) **Foot breadth, standing:** The subject stands with the weight distributed equally on both feet. The maximum horizontal distance across the right foot perpendicular to its long axis is measured between the inside and the outside of the foot.

- (11) **Foot length, standing:** The subject stands with the weight distributed equally on both feet. The distance between the back-most point of the right heel and the tip of the longest toe is measured to the long axis of the foot.
- (12) **Functional arm span, standing:** The subject stands erect with the back against a wall. The subject outstretches the arms horizontally at shoulder height. The distance between the tips of the middle fingers of the outstretched arms is measured.
- (13) **Hip circumference, standing:** Maximal horizontal circumference over the buttocks. The subject stands erect with heels together.
- (14) **Knee height, standing:** The vertical distance between a standing surface and the point at knee crease is measured. The subject stands erect looking straight ahead. The heels are together with the weight distributed equally on both feet. The shoulders and upper extremities are relaxed. The measurement is made at the maximum point of quiet respiration.
- (15) **Stature:** Vertical distance from the standing surface to the highest point of the head (vertex). Subject stands erect with feet placed on pre-marked footprints with approximately ten centimeters apart at the inside of the heel and 33 degrees rotation at the toes.
- (16) **Thigh circumference, standing:** Circumference of the right thigh at its juncture with the buttock. The subject stands erect with legs spread apart just enough so that the thighs do not touch.
- (17) **Under bust circumference, standing:** The horizontal circumference of the chest directly below the bust is measured with a tape. The subject stands erect looking straight ahead. The shoulders and upper extremities are relaxed. The measurement is taken at the maximum point of quiet respiration.
- (18) **Vertical trunk circumference, standing:** The subject stands erect looking straight ahead. The arms hang relaxed at the sides, and the feet are shoulder width apart with the weight distributed equally on both feet. The vertical circumference of the torso is measured by passing a tape over the right shoulder, nipple (or most forward point of the bra), through the crotch, and over the most protrusive point of the right buttock. On men, the tape follows the surface contours of the body. On women, it follows the body contours except from the most protrusive point of the bra to the crotch.
- (19) **Waist circumference, standing:** Horizontal circumference of the waist at the level of the center of preferred waist height. The subject stands erect with heels together.
- (20) **Waist height, standing:** The vertical distance between a standing surface and the point at the subject's preferred waist. The subject stands erect looking straight ahead. The heels are together with weight distributed equally on both feet. The shoulders and upper extremities are relaxed. The measurement is made at the maximum point of quiet respiration.
- (21) **Weight:** Weight of the subject. Subject stands on the scale fully erect with weight distributed equally on both feet.

#### **Measured without Gear (Seated)**

- (22) **Acromion breadth, sitting:** The subject sits erect on a flat surface looking straight ahead. The upper arms are hanging relaxed at the sides with the forearms and hands on the thighs. The breadth measurement is from the right acromion to the left acromion.

- (23) **Acromion-grip length, sitting:** The subject sits erect with back against a flat surface. The right arm is extended straight ahead while a dowel rod is held vertically in it. The horizontal measurement is taken from the right acromion to the top middle point of the dowel rod.
- (24) **Acromion height, sitting:** The subject sits erect on a flat surface looking straight ahead. The vertical distance is measured between the sitting surface and the tip of the right shoulder (acromion).
- (25) **Acromion-wrist length, sitting:** The subject sits erect with back against a flat surface. The right arm is extended straight ahead while a dowel rod is held vertically in it. The horizontal measurement is taken from the right acromion to the most lateral point (radial styloid) of the right wrist.
- (26) **Bideloid breadth, sitting:** The subject sits erect on a flat surface looking straight ahead. The upper arms are hanging relaxed at the sides with the forearms and hands on the thighs. The maximum horizontal distance is measured between the outside of the upper arms at the level of the deltoid muscle and as low as the level of the elbows.
- (27) **Bitragion arc length, sitting:** The surface distance from right to left tragion across the most superior point in the head measured with a tape measure.
- (28) **Buttock-knee length, sitting:** The subject sits erect on a flat surface looking straight ahead. The thighs are parallel, and the feet are in line with the thighs on a surface adjusted so that the knees are bent 90 degrees. The horizontal distance is measured from the most protrusive point of the right buttock to the most forward point of the right knee.
- (29) **Elbow height, sitting:** The subject sits erect on a flat surface looking straight ahead. Upper arms hang freely downwards and forearms are horizontal. The vertical measurement is taken from the horizontal sitting surface to the lowest bony point of the elbow.
- (30) **Elbow-wrist length, sitting:** The subject sits erect with back against a flat surface. The right arm is extended straight ahead while a dowel rod is held vertically in it. The horizontal measurement is taken from the right elbow to the most lateral point of the right wrist.
- (31) **Functional leg length, sitting:** The calculated sum of the buttock-knee length seated measurement and the popliteal height seated measurement.
- (32) **Grip strength, sitting:** The subject squeezes the dynamometer (a force measuring instrument) with their predominant hand using his/her maximum force.
- (33) **Head arc length, sitting:** Surface length along contours of head from glabella to nuchal measured with a tape measure.
- (34) **Head circumference, sitting:** Maximum circumference of the head above the attachment of the ears to the head, just above the ridges of the eyebrows, and around the back of the head.
- (35) **Hip breadth, sitting:** The subject sits erect on a flat surface. The maximum horizontal breadth across the hips or thighs is measured.
- (36) **Knee height, sitting:** The subject sits erect on a flat surface. The thighs are parallel, and the feet are in line with the thigh on a surface adjusted so that the knees are bent at 90 degrees. The vertical distance is measured between the foot surface and the top of the right knee.

- (37) **Neck circumference, sitting:** Horizontal circumference of the neck above the laryngeal prominence measured with a tape measure.
- (38) **Nuchal height, sitting:** The subject sits erect looking straight ahead. The vertical distance is measured between the seated plane and the most protrusive point of the nuchal.
- (39) **Popliteal height, sitting:** The subject sits erect on a flat surface. The thighs are parallel, and the feet are in line with the thighs on a surface adjusted so that the knees are bent 90degrees. The vertical distance is measured between the foot surface and the lowest point of the bottom of the thigh at the juncture with the calf behind the knee (popliteal fossa).
- (40) **Sitting height:** The subject sits erect on a flat surface looking straight ahead with the head in the Frankfort plane. The vertical distance is measured between the sitting surface and the top of the head.

#### **Measured in Gear (Standing)**

- (01) **Boot breadth, standing:** The subject stands with the weight distributed equally on both feet in the turnout gear. The maximum horizontal distance across the right boot perpendicular to its long axis is measured between the inside and outside of the boot.
- (02) **Boot length, standing:** The subject stands with the weight distributed equally on both feet in the turnout gear. The distance between the back-most point of the right heel of the boot and the most anterior part of the boot is measured parallel to the long axis of the foot.
- (03) **Chest depth, standing:** The subject stands erect looking straight ahead in the turnout gear. The horizontal depth of the chest is measured from the front to back at the level of the most protrusive point of the right bra pocket on women or of the right nipple on men.
- (04) **Chest width, standing:** The subject stands erect looking straight ahead in the turnout gear. The arms hang relaxed at the sides. The horizontal breadth of the chest is measured at the level of the nipples on men or the most protrusive point of a bra on women.
- (05) **Overhead reach, standing:** The subject stands erect in turnout gear with the right arm extended overhead to maximum height while left arm is relaxed to the side. The vertical distance between a standing surface and the tip of the right middle finger is measured.
- (06) **Waist depth, standing:** The subject stands erect looking straight ahead in the turnout gear. The feet are shoulder width apart with the weight distributed equally on both feet. The abdominal muscles are relaxed. The maximum horizontal distance is measured between the back and the front of the waist at the level of the greatest indentation.
- (07) **Waist width, standing:** The subject stands erect looking straight ahead in the turnout gear. The arms hang relaxed at the sides, and the heels are together with the weight distributed equally on both feet. The breadth of the torso is measured in the region of the waist at the level of its greatest indentation.
- (08) **Weight in gear:** The subject wears turnout gear including tools in pockets and stands on a scale with the feet parallel and the weight distributed equally on both feet.

## Measured in Gear (Seated)

- (09) **Abdominal breadth, sitting:** The subject sits erect on a flat surface in turnout gear looking straight ahead. The abdominal muscles are relaxed. The horizontal breadth of the torso is measured at the level of the most protrusive point of the gear at the abdomen.
- (10) **Abdominal depth, sitting:** The subject sits erect on a flat surface in turnout gear looking straight ahead. The abdominal muscles are relaxed. The horizontal distance is measured between the back and the most protrusive point of the gear at the abdomen.
- (11) **Acromion-trochanter length, sitting:** The subject sits on a flat surface in turnout gear. The thighs are parallel, and the feet are in line with the thighs on a surface adjusted so that the knees are bent 90 degrees. The contour distance from the right acromion to the left trochanter is measured across the gear.
- (12) **Bideltoid breadth/width, sitting** (Maximum torso breadth): The subject sits erect on a flat surface in turnout gear. The upper arms are hanging relaxed at the sides. The maximum horizontal distance of the turnout gear is measured between the outside of the upper arms at the level of the deltoid muscles and as low as the level of the elbows.
- (13) **Bi-trochanter length, sitting** (curve): The subject sits on a flat surface in turnout gear. The thighs are parallel, and the feet are in line with the thighs on a surface adjusted so that the knees are bent 90 degrees. The maximum distance on the turnout gear from the right trochanter to the left trochanter is measured going above the legs.
- (14) **Buttock-shoe tip length, sitting:** The subject sits on a flat surface in turnout gear. The thighs are parallel, and the feet are in line with the thighs on a surface adjusted so that the knees are bent 90 degrees. The horizontal straight-line distance is measured between the back right buttock and the most anterior part of the boot.
- (15) **Elbow-wrist length, sitting:** The subject sits erect looking straight ahead in turnout gear. The right upper arm is hanging relaxed at the side with the forearm and hand extended horizontally with the palms facing each other. The horizontal distance is measured between the back of the tip of the elbow and the wrist.
- (16) **Eye height, sitting:** The subject sits erect in turnout gear on a flat surface looking straight ahead. The vertical distance is measured between the sitting surface and a corner of the right eye.
- (17) **Grip strength, sitting:** The subject squeezes the dynamometer (a force measuring instrument) with their predominant hand using his/her maximum force while wearing an extrication glove.
- (18) **Hip breadth, sitting:** The subject sits erect on a flat surface in turnout gear. The maximum horizontal breadth of the turnout gear across the hips is measured.
- (19) **Shoulder-elbow length, sitting:** The subject sits erect looking straight ahead in turnout gear, the upper arms hang relaxed at the sides with the forearms and hands extended forward horizontally and the palms facing each other. The vertical distance is measured between the tip of the right shoulder and the underside of the bent elbow.
- (20) **Shoulder-grip length, sitting:** The subject sits erect looking straight ahead in turnout gear. The buttocks and the shoulder blades touch a back rest. The right arm is extended forward horizontally.

The dowel rod is held vertically. The horizontal distance is measured between the (back) wall and the top, middle point of the dowel rod.

- (21) **Thigh clearance, sitting:** The subject sits on a flat surface in turnout gear. The thighs are parallel, and the feet are in line with the thighs on a surface adjusted so that the knees are bent 90 degrees. The vertical distance is measured between the sitting surface and the topmost point of the thigh.

### **Extracted Head-Face and Hand Dimensions**

- (01) **Bigonion breadth:** The straight-line distance between the right and left gonion landmarks on the corners of the jaw is measured calculating point to point distance using 3Dvisualization software.
- (02) **Biinfraorbitale breadth:** The straight-line distance between the right and left infraorbitale landmarks on the bottom edge of the bony eye sockets under the eyes is measured calculating the point to point distance using 3Dvisualization software.
- (03) **Face breadth:** The straight-line distance between the right and left tragion landmarks on the cartilaginous flaps in front of the each ear hole is measured calculating point to point distance using 3D visualization software.
- (04) **Face length:** The straight-line distance between the menton landmark at the bottom of the chin and the sellion landmark on the deepest point of the root of the nose measured as a point to point distance in 3Dvisualization software.
- (05) **Hand breadth:** Breadth of the right hand between the landmarks at metacarpale II and metacarpale V. The fingers are parallel to the long axis of the forearm.
- (06) **Hand length:** Length of the right hand between the distal crease at the wrist and the tip of the middle finger. The middle finger is parallel to the long axis of the forearm.
- (07) **Head breadth:** The maximum horizontal breadth of the head above the attachment of the ears is measured using the virtual calipers in 3D visualization software.
- (08) **Mid-tragion to head top length:** The vertical distance between mid-tragion, as calculated from right and left tragion, to the top of head.
- (09) **Palm breadth:** The palm breadth is the distance between the point to the left of the distal transverse crease and the point to the right of the proximal transverse crease.
- (10) **Palm length:** The length of the palm is measured between the base of the middle finger and the distal crease at the wrist.