

Reference: The design of manual handling tasks: revised tables of maximum acceptable weights and forces, Snook, S., and Ciriello, V., *Ergonomics*, Vol. 34, no. 9, 1991.

Maximum acceptable weight of lift for males (kg).

| Width | Distance† | Percent‡ | Floor level to knuckle height | | | | | | Knuckle height to shoulder height | | | | | | Shoulder height to arm reach | | | | | | | | | | |
|-------|-----------|----------|-------------------------------|----|----|----|----|----|-----------------------------------|----|----|----|-----|-----|------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| | | | 1 | 2 | 5 | 30 | 8 | h | 1 | 2 | 5 | 30 | 8 | h | 1 | 2 | 5 | 30 | 8 | h | | | | | |
| 76 | 25 | 90 | 6 | 7 | 9 | 14 | 11 | 13 | 13 | 15 | 17 | 20 | 23 | 25 | 27 | 29 | 31 | 33 | 35 | 37 | 39 | 41 | 43 | 45 | 47 |
| | | 75 | 9 | 11 | 13 | 16 | 19 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 | 63 | 66 | 69 | 72 |
| | | 50 | 12 | 15 | 17 | 22 | 25 | 28 | 32 | 35 | 38 | 41 | 44 | 47 | 50 | 53 | 56 | 59 | 62 | 65 | 68 | 71 | 74 | 77 | 80 |
| | | 25 | 15 | 18 | 21 | 28 | 31 | 34 | 40 | 43 | 46 | 49 | 52 | 55 | 58 | 61 | 64 | 67 | 70 | 73 | 76 | 79 | 82 | 85 | 88 |
| | | 10 | 18 | 22 | 25 | 33 | 37 | 40 | 48 | 51 | 54 | 57 | 60 | 63 | 66 | 69 | 72 | 75 | 78 | 81 | 84 | 87 | 90 | 93 | 96 |
| 51 | 25 | 90 | 6 | 8 | 9 | 13 | 15 | 17 | 20 | 22 | 24 | 27 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | |
| | | 75 | 9 | 11 | 13 | 16 | 19 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 | 63 | 66 | 69 | |
| | | 50 | 12 | 15 | 17 | 22 | 25 | 28 | 32 | 35 | 38 | 41 | 44 | 47 | 50 | 53 | 56 | 59 | 62 | 65 | 68 | 71 | 74 | 77 | |
| | | 25 | 15 | 18 | 21 | 28 | 31 | 34 | 40 | 43 | 46 | 49 | 52 | 55 | 58 | 61 | 64 | 67 | 70 | 73 | 76 | 79 | 82 | 85 | |
| | | 10 | 18 | 22 | 25 | 33 | 37 | 40 | 48 | 51 | 54 | 57 | 60 | 63 | 66 | 69 | 72 | 75 | 78 | 81 | 84 | 87 | 90 | 93 | |
| 25 | 10 | 90 | 8 | 9 | 10 | 14 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | |
| | | 75 | 12 | 13 | 15 | 17 | 20 | 23 | 25 | 28 | 29 | 33 | 35 | 38 | 40 | 43 | 45 | 48 | 50 | 53 | 55 | 58 | 60 | 62 | |
| | | 50 | 16 | 20 | 23 | 30 | 34 | 37 | 42 | 47 | 51 | 55 | 58 | 62 | 65 | 69 | 72 | 75 | 78 | 81 | 84 | 87 | 90 | 93 | |
| | | 25 | 21 | 25 | 29 | 38 | 43 | 47 | 56 | 61 | 65 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 | 101 | 105 | 109 | 113 | 117 | |
| | | 10 | 24 | 29 | 34 | 45 | 51 | 56 | 67 | 73 | 78 | 83 | 94 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | |
| 76 | 51 | 90 | 7 | 8 | 10 | 14 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | |
| | | 75 | 10 | 12 | 14 | 19 | 22 | 25 | 29 | 32 | 35 | 38 | 41 | 44 | 47 | 50 | 53 | 56 | 59 | 62 | 65 | 68 | 71 | 74 | |
| | | 50 | 14 | 16 | 19 | 26 | 29 | 33 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 88 | 92 | 96 | 100 | |
| | | 25 | 17 | 20 | 24 | 33 | 38 | 42 | 51 | 56 | 60 | 64 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 | 101 | 105 | 109 | 113 | |
| | | 10 | 21 | 25 | 29 | 40 | 45 | 49 | 60 | 65 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 | 101 | 105 | 109 | 113 | 117 | 121 | |
| 49 | 51 | 90 | 7 | 9 | 10 | 14 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | |
| | | 75 | 10 | 13 | 15 | 20 | 23 | 25 | 29 | 32 | 35 | 38 | 41 | 44 | 47 | 50 | 53 | 56 | 59 | 62 | 65 | 68 | 71 | 74 | |
| | | 50 | 14 | 17 | 20 | 27 | 30 | 34 | 40 | 44 | 48 | 52 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 88 | 92 | 96 | 100 | |
| | | 25 | 18 | 21 | 25 | 34 | 38 | 42 | 51 | 56 | 60 | 64 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 | 101 | 105 | 109 | 113 | |
| | | 10 | 21 | 25 | 29 | 40 | 45 | 49 | 60 | 65 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 | 101 | 105 | 109 | 113 | 117 | 121 | |
| 25 | 10 | 90 | 8 | 10 | 12 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | |
| | | 75 | 12 | 15 | 17 | 22 | 25 | 28 | 32 | 35 | 38 | 41 | 44 | 47 | 50 | 53 | 56 | 59 | 62 | 65 | 68 | 71 | 74 | 77 | |
| | | 50 | 16 | 20 | 23 | 30 | 34 | 37 | 42 | 47 | 51 | 55 | 58 | 62 | 65 | 69 | 72 | 75 | 78 | 81 | 84 | 87 | 90 | 93 | |
| | | 25 | 21 | 25 | 29 | 38 | 43 | 47 | 56 | 61 | 65 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 | 101 | 105 | 109 | 113 | 117 | |
| | | 10 | 24 | 29 | 34 | 45 | 51 | 56 | 67 | 73 | 78 | 83 | 94 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | |
| 76 | 76 | 90 | 8 | 10 | 12 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | |
| | | 75 | 12 | 14 | 17 | 22 | 25 | 28 | 32 | 35 | 38 | 41 | 44 | 47 | 50 | 53 | 56 | 59 | 62 | 65 | 68 | 71 | 74 | 77 | |
| | | 50 | 16 | 19 | 22 | 30 | 34 | 37 | 42 | 47 | 51 | 55 | 58 | 62 | 65 | 69 | 72 | 75 | 78 | 81 | 84 | 87 | 90 | 93 | |
| | | 25 | 20 | 24 | 28 | 37 | 42 | 47 | 56 | 61 | 65 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 | 101 | 105 | 109 | 113 | 117 | |
| | | 10 | 24 | 29 | 33 | 44 | 50 | 54 | 65 | 71 | 76 | 81 | 92 | 98 | 103 | 108 | 113 | 118 | 123 | 128 | 133 | 138 | 143 | 148 | |
| 34 | 51 | 90 | 9 | 10 | 12 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | |
| | | 75 | 12 | 15 | 18 | 23 | 26 | 28 | 32 | 35 | 39 | 42 | 45 | 48 | 51 | 54 | 57 | 60 | 63 | 66 | 69 | 72 | 75 | 78 | |
| | | 50 | 17 | 20 | 24 | 31 | 35 | 38 | 44 | 49 | 53 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 88 | 92 | 96 | 100 | 104 | |
| | | 25 | 21 | 25 | 30 | 39 | 44 | 48 | 57 | 62 | 66 | 70 | 74 | 78 | 82 | 86 | 90 | 94 | 98 | 102 | 106 | 110 | 114 | 118 | |
| | | 10 | 25 | 30 | 35 | 46 | 52 | 57 | 68 | 74 | 79 | 84 | 95 | 101 | 106 | 111 | 116 | 121 | 126 | 131 | 136 | 141 | 146 | 151 | |
| 25 | 10 | 90 | 10 | 12 | 14 | 18 | 20 | 22 | 24 | 27 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | |
| | | 75 | 15 | 18 | 21 | 26 | 30 | 33 | 38 | 43 | 46 | 49 | 52 | 55 | 58 | 61 | 64 | 67 | 70 | 73 | 76 | 79 | 82 | 85 | |
| | | 50 | 20 | 24 | 28 | 35 | 40 | 44 | 51 | 56 | 60 | 64 | 68 | 72 | 76 | 80 | 84 | 88 | 92 | 96 | 100 | 104 | 108 | 112 | |
| | | 25 | 26 | 30 | 35 | 44 | 50 | 54 | 63 | 69 | 73 | 77 | 81 | 85 | 89 | 93 | 97 | 101 | 105 | 109 | 113 | 117 | 121 | 125 | |
| | | 10 | 29 | 35 | 41 | 52 | 59 | 64 | 75 | 82 | 87 | 92 | 103 | 109 | 114 | 119 | 124 | 129 | 134 | 139 | 144 | 149 | 154 | 159 | |

† Box width (the dimension away from the body) (cm).

‡ Vertical distance of lift (cm).

§ Percentage of industrial population.

¶ Italized values exceed 8 h physiological criteria.

Reduce by 15% for no handles

Maximum acceptable weight of lower for males (kg)

| Width | Distance | Percent | Knuckle height to floor level | | | | | | | | Shoulder height to knuckle height | | | | | | | | Arm reach to shoulder height | | | | | | | |
|-------|----------|---------|-------------------------------|----|----|----|----|----|----|----|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|------------------------------|-----|-----|-----|-----|-----|-----|-----|
| | | | One lower | 1 | 2 | 5 | 30 | 8 | 5 | 9 | 14 | 1 | 2 | 5 | 30 | 8 | 5 | 9 | 14 | 1 | 2 | 5 | 30 | 8 | | |
| 75 | 51 | 90 | 8 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | |
| | | 75 | 11 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | |
| | | 50 | 14 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
| | | 25 | 18 | 24 | 28 | 33 | 39 | 46 | 54 | 62 | 70 | 78 | 86 | 94 | 102 | 110 | 118 | 126 | 134 | 142 | 150 | 158 | 166 | 174 | 182 | 190 |
| | 76 | 90 | 9 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | |
| | | 75 | 12 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | |
| | | 50 | 15 | 20 | 23 | 26 | 30 | 34 | 39 | 44 | 49 | 54 | 59 | 64 | 69 | 74 | 79 | 84 | 89 | 94 | 99 | 104 | 109 | 114 | 119 | |
| | | 25 | 20 | 28 | 34 | 41 | 49 | 58 | 67 | 76 | 85 | 94 | 103 | 112 | 121 | 130 | 139 | 148 | 157 | 166 | 175 | 184 | 193 | 202 | 211 | |
| | 25 | 90 | 9 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | |
| | | 75 | 12 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | |
| | | 50 | 15 | 20 | 23 | 26 | 30 | 34 | 39 | 44 | 49 | 54 | 59 | 64 | 69 | 74 | 79 | 84 | 89 | 94 | 99 | 104 | 109 | 114 | 119 | |
| | | 25 | 20 | 28 | 34 | 41 | 49 | 58 | 67 | 76 | 85 | 94 | 103 | 112 | 121 | 130 | 139 | 148 | 157 | 166 | 175 | 184 | 193 | 202 | 211 | |
| 49 | 51 | 90 | 9 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | |
| | | 75 | 12 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | | |
| | | 50 | 15 | 20 | 23 | 26 | 30 | 34 | 39 | 44 | 49 | 54 | 59 | 64 | 69 | 74 | 79 | 84 | 89 | 94 | 99 | 104 | 109 | 114 | 119 | |
| | | 25 | 20 | 28 | 34 | 41 | 49 | 58 | 67 | 76 | 85 | 94 | 103 | 112 | 121 | 130 | 139 | 148 | 157 | 166 | 175 | 184 | 193 | 202 | 211 | |
| | 76 | 90 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | |
| | | 75 | 13 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | | |
| | | 50 | 17 | 23 | 27 | 32 | 37 | 42 | 47 | 52 | 57 | 62 | 67 | 72 | 77 | 82 | 87 | 92 | 97 | 102 | 107 | 112 | 117 | 122 | 127 | |
| | | 25 | 23 | 32 | 39 | 47 | 55 | 63 | 71 | 79 | 87 | 95 | 103 | 111 | 119 | 127 | 135 | 143 | 151 | 159 | 167 | 175 | 183 | 191 | 199 | |
| | 34 | 90 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | |
| | | 75 | 14 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | | |
| | | 50 | 19 | 26 | 31 | 37 | 43 | 49 | 55 | 61 | 67 | 73 | 79 | 85 | 91 | 97 | 103 | 109 | 115 | 121 | 127 | 133 | 139 | 145 | | |
| | | 25 | 24 | 35 | 43 | 52 | 61 | 70 | 79 | 88 | 97 | 106 | 115 | 124 | 133 | 142 | 151 | 160 | 169 | 178 | 187 | 196 | 205 | 214 | | |
| 23 | 90 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | | |
| | 75 | 12 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | | | |
| | 50 | 15 | 20 | 23 | 26 | 30 | 34 | 39 | 44 | 49 | 54 | 59 | 64 | 69 | 74 | 79 | 84 | 89 | 94 | 99 | 104 | 109 | 114 | | | |
| | 25 | 20 | 28 | 34 | 41 | 49 | 58 | 67 | 76 | 85 | 94 | 103 | 112 | 121 | 130 | 139 | 148 | 157 | 166 | 175 | 184 | 193 | 202 | | | |
| 10 | 90 | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | | |
| | 75 | 12 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | | | |
| | 50 | 15 | 20 | 23 | 26 | 30 | 34 | 39 | 44 | 49 | 54 | 59 | 64 | 69 | 74 | 79 | 84 | 89 | 94 | 99 | 104 | 109 | 114 | | | |
| | 25 | 20 | 28 | 34 | 41 | 49 | 58 | 67 | 76 | 85 | 94 | 103 | 112 | 121 | 130 | 139 | 148 | 157 | 166 | 175 | 184 | 193 | 202 | | | |

1 Box width (the dimension away from the body) (cm).
 § Vertical distance of lower (cm).
 † Percentage of industrial population.
 ‡ Italicized values exceed 8 h physiological criteria

Reduce by 15% for no handles

Maximum acceptable forces of push for males (kg).

| Height | Percent | 2.1 m push | | 7.6 m push | | 15.2 m push | | 30.5 m push | | 45.7 m push | | 61.0 m push | | | | | |
|--------|---------|------------|------|------------|-------|-------------|------|-------------|-----|-------------|-------|-------------|------|-----|----|----|----|
| | | 6 s | 12 s | 1 min | 2 min | 5 min | 30 h | 8 h | 1 h | 1 min | 2 min | 5 min | 30 h | 8 h | | | |
| 90 | 90 | 20 | 22 | 25 | 25 | 26 | 26 | 31 | 14 | 16 | 21 | 21 | 26 | 12 | 14 | 14 | 18 |
| | 75 | 26 | 29 | 32 | 32 | 34 | 34 | 41 | 18 | 20 | 27 | 27 | 32 | 16 | 18 | 18 | 21 |
| | 50 | 32 | 36 | 40 | 40 | 42 | 42 | 51 | 23 | 25 | 33 | 33 | 40 | 20 | 22 | 22 | 28 |
| | 25 | 38 | 43 | 47 | 47 | 50 | 51 | 61 | 27 | 31 | 40 | 40 | 48 | 24 | 27 | 32 | 34 |
| | 10 | 44 | 49 | 55 | 55 | 58 | 58 | 70 | 31 | 35 | 46 | 46 | 55 | 28 | 31 | 36 | 39 |
| 144 | 90 | 21 | 24 | 26 | 26 | 28 | 28 | 34 | 16 | 18 | 23 | 23 | 28 | 14 | 16 | 16 | 20 |
| | 75 | 28 | 31 | 34 | 34 | 36 | 36 | 44 | 21 | 23 | 30 | 30 | 36 | 18 | 21 | 24 | 26 |
| | 50 | 34 | 38 | 43 | 43 | 45 | 45 | 54 | 26 | 29 | 38 | 38 | 45 | 22 | 26 | 30 | 32 |
| | 25 | 41 | 46 | 51 | 51 | 54 | 55 | 65 | 31 | 35 | 45 | 45 | 54 | 27 | 31 | 36 | 38 |
| | 10 | 47 | 53 | 59 | 59 | 62 | 63 | 75 | 35 | 40 | 52 | 52 | 62 | 32 | 36 | 41 | 44 |
| 95 | 90 | 19 | 22 | 24 | 24 | 25 | 26 | 31 | 13 | 14 | 20 | 20 | 24 | 12 | 14 | 14 | 17 |
| | 75 | 25 | 28 | 31 | 31 | 33 | 33 | 40 | 16 | 19 | 26 | 26 | 31 | 16 | 18 | 18 | 22 |
| | 50 | 31 | 35 | 39 | 39 | 41 | 41 | 50 | 20 | 23 | 32 | 32 | 39 | 20 | 22 | 26 | 28 |
| | 25 | 38 | 42 | 46 | 46 | 49 | 50 | 59 | 25 | 28 | 39 | 39 | 47 | 24 | 27 | 32 | 34 |
| | 10 | 43 | 48 | 53 | 53 | 57 | 57 | 68 | 28 | 32 | 45 | 45 | 54 | 27 | 31 | 36 | 38 |
| 64 | 90 | 19 | 22 | 24 | 24 | 25 | 26 | 31 | 13 | 14 | 20 | 20 | 24 | 12 | 14 | 14 | 17 |
| | 75 | 25 | 28 | 31 | 31 | 33 | 33 | 40 | 16 | 19 | 26 | 26 | 31 | 16 | 18 | 18 | 22 |
| | 50 | 31 | 35 | 39 | 39 | 41 | 41 | 50 | 20 | 23 | 32 | 32 | 39 | 20 | 22 | 26 | 28 |
| | 25 | 38 | 42 | 46 | 46 | 49 | 50 | 59 | 25 | 28 | 39 | 39 | 47 | 24 | 27 | 32 | 34 |
| | 10 | 43 | 48 | 53 | 53 | 57 | 57 | 68 | 28 | 32 | 45 | 45 | 54 | 27 | 31 | 36 | 38 |
| 144 | 90 | 10 | 13 | 15 | 16 | 18 | 18 | 22 | 8 | 9 | 13 | 13 | 16 | 7 | 8 | 8 | 9 |
| | 75 | 13 | 17 | 21 | 22 | 24 | 25 | 30 | 10 | 13 | 17 | 18 | 21 | 10 | 11 | 13 | 15 |
| | 50 | 17 | 22 | 27 | 28 | 31 | 32 | 38 | 13 | 16 | 22 | 23 | 28 | 12 | 14 | 17 | 19 |
| | 25 | 21 | 27 | 33 | 34 | 38 | 40 | 47 | 16 | 20 | 28 | 29 | 34 | 15 | 18 | 21 | 24 |
| | 10 | 25 | 31 | 38 | 40 | 45 | 46 | 54 | 19 | 23 | 32 | 33 | 39 | 18 | 21 | 24 | 28 |
| 95 | 90 | 10 | 13 | 16 | 17 | 19 | 19 | 23 | 8 | 10 | 13 | 13 | 16 | 7 | 8 | 8 | 9 |
| | 75 | 14 | 18 | 22 | 22 | 25 | 26 | 31 | 11 | 13 | 17 | 18 | 21 | 9 | 11 | 13 | 15 |
| | 50 | 18 | 23 | 28 | 29 | 33 | 34 | 40 | 14 | 17 | 22 | 23 | 28 | 12 | 14 | 17 | 19 |
| | 25 | 22 | 28 | 34 | 35 | 40 | 41 | 49 | 17 | 21 | 27 | 29 | 34 | 15 | 18 | 21 | 24 |
| | 10 | 26 | 33 | 40 | 41 | 46 | 48 | 57 | 20 | 24 | 32 | 33 | 39 | 17 | 20 | 24 | 27 |
| 64 | 90 | 10 | 13 | 16 | 16 | 18 | 19 | 23 | 8 | 10 | 12 | 13 | 15 | 7 | 8 | 8 | 9 |
| | 75 | 14 | 18 | 21 | 22 | 25 | 26 | 31 | 11 | 13 | 17 | 17 | 21 | 9 | 11 | 12 | 14 |
| | 50 | 18 | 23 | 28 | 29 | 33 | 34 | 40 | 14 | 17 | 22 | 23 | 28 | 12 | 14 | 17 | 19 |
| | 25 | 22 | 28 | 34 | 35 | 40 | 41 | 49 | 17 | 21 | 27 | 29 | 34 | 15 | 18 | 21 | 24 |
| | 10 | 26 | 33 | 40 | 41 | 46 | 48 | 57 | 20 | 24 | 32 | 33 | 39 | 17 | 20 | 24 | 27 |
| 144 | 90 | 10 | 13 | 15 | 16 | 18 | 18 | 22 | 8 | 9 | 13 | 13 | 16 | 7 | 8 | 8 | 9 |
| | 75 | 13 | 17 | 21 | 22 | 24 | 25 | 30 | 10 | 13 | 17 | 18 | 21 | 9 | 11 | 13 | 15 |
| | 50 | 17 | 22 | 27 | 28 | 31 | 32 | 38 | 13 | 16 | 22 | 23 | 28 | 12 | 14 | 17 | 19 |
| | 25 | 21 | 27 | 33 | 34 | 38 | 40 | 47 | 16 | 20 | 28 | 29 | 34 | 15 | 18 | 21 | 24 |
| | 10 | 25 | 31 | 38 | 40 | 45 | 46 | 54 | 19 | 23 | 32 | 33 | 39 | 18 | 21 | 24 | 28 |
| 95 | 90 | 10 | 13 | 16 | 17 | 19 | 19 | 23 | 8 | 10 | 12 | 13 | 15 | 7 | 8 | 8 | 9 |
| | 75 | 14 | 18 | 22 | 22 | 25 | 26 | 31 | 11 | 13 | 17 | 18 | 21 | 9 | 11 | 12 | 14 |
| | 50 | 18 | 23 | 28 | 29 | 33 | 34 | 40 | 14 | 17 | 22 | 23 | 28 | 12 | 14 | 17 | 19 |
| | 25 | 22 | 28 | 34 | 35 | 40 | 41 | 49 | 17 | 21 | 27 | 29 | 34 | 15 | 18 | 21 | 24 |
| | 10 | 26 | 33 | 40 | 41 | 46 | 48 | 57 | 20 | 24 | 32 | 33 | 39 | 17 | 20 | 24 | 27 |
| 64 | 90 | 10 | 13 | 16 | 16 | 18 | 19 | 23 | 8 | 10 | 12 | 13 | 15 | 7 | 8 | 8 | 9 |
| | 75 | 14 | 18 | 21 | 22 | 25 | 26 | 31 | 11 | 13 | 17 | 17 | 21 | 9 | 11 | 12 | 14 |
| | 50 | 18 | 23 | 28 | 29 | 33 | 34 | 40 | 14 | 17 | 22 | 23 | 28 | 12 | 14 | 17 | 19 |
| | 25 | 22 | 28 | 34 | 35 | 40 | 41 | 49 | 17 | 21 | 27 | 29 | 34 | 15 | 18 | 21 | 24 |
| | 10 | 26 | 33 | 40 | 41 | 46 | 48 | 57 | 20 | 24 | 32 | 33 | 39 | 17 | 20 | 24 | 27 |

Sustained forces*

Initial forces†

* Vertical distance from floor to hands (cm).
 † Percentage of industrial population.
 ‡ The force required to get an object in motion.
 § The force required to keep an object in motion.
 ¶ Italicized values exceed 8 h physiological criteria.

Maximum acceptable forces of pull for males (kg).

| Height | 2.1 m pull | | | 7.6 m pull | | | 15.2 m pull | | | 30.5 m pull | | | 45.7 m pull | | | 61.0 m pull | | |
|--------|------------|------|--------|------------|-----|-----|-------------|-----|-----|-------------|-----|-----|-------------|-----|-----|-------------|-----|-----|
| | 6 s | 12 s | 15 min | 1 s | 2 s | 3 s | 1 s | 2 s | 3 s | 1 s | 2 s | 3 s | 1 s | 2 s | 3 s | 1 s | 2 s | 3 s |
| 90 | 14 | 16 | 18 | 18 | 16 | 17 | 18 | 21 | 13 | 15 | 15 | 12 | 13 | 15 | 10 | 10 | 11 | 10 |
| 75 | 17 | 19 | 22 | 20 | 20 | 21 | 21 | 26 | 16 | 18 | 19 | 14 | 16 | 19 | 12 | 12 | 14 | 12 |
| 50 | 20 | 23 | 26 | 18 | 24 | 25 | 26 | 31 | 19 | 21 | 22 | 24 | 24 | 29 | 15 | 16 | 19 | 24 |
| 25 | 24 | 27 | 31 | 21 | 28 | 29 | 30 | 36 | 22 | 25 | 26 | 28 | 28 | 33 | 17 | 19 | 22 | 28 |
| 10 | 26 | 30 | 34 | 21 | 31 | 33 | 33 | 40 | 24 | 28 | 29 | 31 | 31 | 38 | 20 | 22 | 25 | 31 |
| 90 | 19 | 22 | 25 | 15 | 23 | 24 | 24 | 29 | 18 | 20 | 21 | 23 | 23 | 28 | 14 | 16 | 18 | 23 |
| 75 | 23 | 27 | 31 | 19 | 21 | 28 | 29 | 36 | 22 | 25 | 26 | 28 | 33 | 33 | 17 | 19 | 22 | 28 |
| 50 | 28 | 32 | 36 | 23 | 26 | 33 | 35 | 42 | 26 | 29 | 31 | 33 | 40 | 38 | 20 | 23 | 27 | 33 |
| 25 | 33 | 37 | 42 | 26 | 3 | 39 | 41 | 49 | 30 | 34 | 36 | 38 | 46 | 45 | 24 | 27 | 31 | 38 |
| 10 | 37 | 42 | 48 | 30 | 33 | 43 | 46 | 56 | 33 | 38 | 41 | 43 | 52 | 50 | 27 | 30 | 35 | 43 |
| 90 | 22 | 25 | 28 | 18 | 20 | 26 | 27 | 33 | 20 | 23 | 24 | 26 | 31 | 30 | 16 | 18 | 21 | 26 |
| 75 | 27 | 30 | 34 | 21 | 24 | 31 | 33 | 40 | 24 | 28 | 29 | 31 | 32 | 38 | 19 | 22 | 25 | 31 |
| 50 | 32 | 36 | 41 | 25 | 29 | 37 | 40 | 48 | 29 | 33 | 35 | 37 | 45 | 43 | 23 | 26 | 30 | 37 |
| 25 | 37 | 42 | 48 | 30 | 34 | 44 | 46 | 56 | 34 | 39 | 41 | 43 | 52 | 50 | 27 | 30 | 35 | 43 |
| 10 | 42 | 48 | 54 | 33 | 38 | 49 | 52 | 63 | 38 | 43 | 46 | 49 | 59 | 57 | 30 | 34 | 39 | 49 |
| 90 | 8 | 10 | 12 | 6 | 8 | 10 | 11 | 12 | 7 | 8 | 9 | 10 | 11 | 13 | 6 | 7 | 8 | 9 |
| 75 | 10 | 13 | 16 | 8 | 10 | 13 | 14 | 16 | 9 | 10 | 12 | 14 | 17 | 16 | 7 | 9 | 10 | 11 |
| 50 | 13 | 16 | 20 | 10 | 13 | 16 | 17 | 20 | 11 | 13 | 14 | 15 | 20 | 20 | 9 | 11 | 12 | 14 |
| 25 | 15 | 20 | 24 | 12 | 15 | 20 | 23 | 28 | 13 | 15 | 17 | 18 | 24 | 24 | 11 | 13 | 15 | 17 |
| 10 | 17 | 22 | 27 | 14 | 17 | 22 | 23 | 29 | 14 | 17 | 19 | 20 | 28 | 27 | 12 | 14 | 17 | 19 |
| 90 | 10 | 13 | 16 | 8 | 10 | 13 | 14 | 16 | 9 | 10 | 12 | 14 | 17 | 17 | 7 | 9 | 10 | 12 |
| 75 | 13 | 17 | 21 | 11 | 13 | 17 | 18 | 20 | 11 | 14 | 15 | 18 | 22 | 21 | 10 | 11 | 13 | 15 |
| 50 | 16 | 21 | 26 | 13 | 17 | 21 | 22 | 26 | 14 | 17 | 19 | 23 | 27 | 26 | 12 | 14 | 16 | 18 |
| 25 | 19 | 26 | 31 | 16 | 20 | 26 | 27 | 31 | 17 | 20 | 22 | 26 | 32 | 32 | 14 | 17 | 19 | 22 |
| 10 | 22 | 29 | 36 | 18 | 23 | 29 | 31 | 36 | 19 | 23 | 26 | 27 | 30 | 31 | 16 | 19 | 22 | 25 |
| 90 | 11 | 14 | 17 | 9 | 11 | 14 | 15 | 17 | 9 | 11 | 12 | 13 | 15 | 18 | 8 | 9 | 11 | 12 |
| 75 | 14 | 19 | 23 | 11 | 14 | 19 | 22 | 26 | 12 | 14 | 16 | 17 | 19 | 23 | 10 | 12 | 14 | 16 |
| 50 | 17 | 23 | 28 | 14 | 18 | 23 | 24 | 28 | 15 | 18 | 20 | 21 | 24 | 28 | 13 | 15 | 17 | 20 |
| 25 | 20 | 27 | 33 | 17 | 21 | 27 | 28 | 33 | 18 | 21 | 24 | 25 | 28 | 33 | 15 | 18 | 21 | 24 |
| 10 | 23 | 31 | 38 | 19 | 24 | 31 | 32 | 38 | 20 | 24 | 27 | 28 | 33 | 39 | 17 | 20 | 24 | 27 |

Initial forces[†]

Sustained forces[‡]

‡ Vertical distance from floor to hands (cm).

§ Percentage of industrial population.

† The force required to get an object in motion.

• The force required to keep an object in motion.

Italicized values exceed 8 h physiological criteria

Maximum acceptable weight of lift for females (kg).

| Width† | Distance‡ | Percent‡ | Floor level to knuckle height One lift every | | | | | | | | | | | | Knuckle height to shoulder height One lift every | | | | | | | | | | | | Shoulder height to arm reach One lift every | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------|-----------|----------|---|----|----|----|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|----|--|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| | | | 5 | 9 | 14 | 1 | 2 | 5 | 30 | 8 | 5 | 9 | 14 | 1 | 2 | 5 | 30 | 8 | 5 | 9 | 14 | 1 | 2 | 5 | 30 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 75 | 51 | 90 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | | | | | |
| | | 75 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | | |
| | | 50 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | | |
| 76 | 76 | 90 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | | |
| | | 75 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | |
| | | 50 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 49 | 51 | 90 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | |
| | | 75 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | |
| | | 25 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 34 | 51 | 90 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | |
| | | 75 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| | | 25 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
| 23 | 25 | 90 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| | | 75 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
| | | 25 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 |

† Box width (the dimension away from the body) (cm).
 ‡ Vertical distance of lift (cm).
 § Percentage of industrial population.
 † Indicated values exceed 8 h physiological criteria

Maximum acceptable weight of lower for females (kg)

| Width† | Distance‡ | Percent‡ | Knee height to floor level | | | | | | | | Shoulder height to knee height | | | | | | | | Arm reach to shoulder height | | | | | | | |
|--------|-----------|----------|----------------------------|----|----|----|----|----|----|----|--------------------------------|----|----|----|----|----|----|----|------------------------------|----|----|----|----|----|----|----|
| | | | 5 | 9 | 14 | 1 | 2 | 5 | 30 | 8 | 5 | 9 | 14 | 1 | 2 | 5 | 30 | 8 | 5 | 9 | 14 | 1 | 2 | 5 | 30 | 8 |
| 75 | 51 | 90 | 5 | 6 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | 75 | 6 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| | | 50 | 7 | 9 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| 76 | 25 | 90 | 10 | 11 | 13 | 13 | 14 | 14 | 15 | 15 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | |
| | | 75 | 9 | 11 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | |
| | | 50 | 9 | 11 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 75 | 25 | 90 | 6 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| | | 75 | 8 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | |
| | | 50 | 9 | 11 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | |
| 49 | 51 | 90 | 6 | 7 | 7 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| | | 75 | 7 | 8 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | |
| | | 50 | 8 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | |
| 76 | 25 | 90 | 10 | 11 | 13 | 13 | 14 | 14 | 15 | 15 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | |
| | | 75 | 9 | 11 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | |
| | | 50 | 9 | 11 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | |
| 34 | 51 | 90 | 7 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | |
| | | 75 | 9 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | |
| | | 50 | 10 | 13 | 14 | 14 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |
| 25 | 25 | 90 | 8 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | |
| | | 75 | 10 | 12 | 12 | 12 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | |
| | | 50 | 12 | 14 | 14 | 14 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | |

† Box width (the dimension away from the body) (cm).
 ‡ Vertical distance of lower (cm).
 § Percentage of industrial population.
 ¶ Altered values exceed 8 h physiological criteria

Reduce by 15% for no handles

Maximum acceptable forces of pull for females (kg).

| Height† | Percent‡ | 2.1 m pull | | | | | | | | 7.6 m pull | | | | | | | | 15.2 m pull | | | | | | | | 30.5 m pull | | | | | | | | 45.7 m pull | | | | | | | | 61.0 m pull | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|----------|------------|------|-------|-------|-------|--------|-----|-----|------------|------|-------|-------|-------|--------|-----|-----|-------------|------|-------|-------|-------|--------|-----|-----|-------------|-------|-------|--------|-----|-----|-------|-------|-------------|--------|-----|-----|-------|-------|--------|-----|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|----|----|----|----|-----|----|-----|----|----|-----|----|----|----|----|----|-----|-----|----|----|----|-----|-----|-----|----|----|-----|
| | | 6 s | 12 s | 1 min | 2 min | 5 min | 30 min | 1 h | 8 h | 15 s | 22 s | 1 min | 2 min | 5 min | 30 min | 1 h | 8 h | 25 s | 35 s | 1 min | 2 min | 5 min | 30 min | 1 h | 8 h | 1 min | 2 min | 5 min | 30 min | 1 h | 8 h | 1 min | 2 min | 5 min | 30 min | 1 h | 8 h | 2 min | 5 min | 30 min | 1 h | 8 h | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 135 | 90 | 13 | 16 | 17 | 18 | 20 | 21 | 22 | 22 | 23 | 24 | 25 | 26 | 26 | 27 | 28 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 61 | 63 | 65 | 67 | 69 | 71 | 73 | 75 | 77 | 79 | 81 | 83 | 85 | 87 | 89 | 91 | 93 | 95 | 97 | 99 | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 75 | 16 | 19 | 20 | 21 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | |
| | 50 | 19 | 22 | 24 | 25 | 28 | 29 | 32 | 33 | 35 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | | | | | | | |
| 89 | 90 | 14 | 16 | 18 | 19 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| | 75 | 16 | 19 | 21 | 22 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | | |
| | 50 | 19 | 23 | 25 | 26 | 29 | 30 | 33 | 35 | 35 | 37 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | | | | | | | | |
| 57 | 90 | 15 | 17 | 19 | 20 | 22 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| | 75 | 17 | 20 | 22 | 23 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | | | |
| | 50 | 20 | 24 | 26 | 27 | 30 | 30 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | | | | | | | |
| 10 | 90 | 26 | 31 | 34 | 35 | 39 | 40 | 43 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | | | | | | | | | | | | | | | | | | | |
| | 75 | 23 | 27 | 30 | 31 | 35 | 36 | 38 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | | | | | | | | | | | | | | |
| | 50 | 25 | 29 | 32 | 33 | 37 | 39 | 41 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | | | | | | | | | | | | | | | | | | | |

Sustained forces*

Initial forces†

Vertical distance from floor to hands (cm)
 †Percentage of industrial population.
 ‡The force required to get an object in motion.
 §The force required to keep an object in motion.
 ¶The values exceed 8 h physiological criteria

