

Designing a Jacket for Boys from the Second Growth Group

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Abstract – The characteristic of children of this age group is that there are noticeable changes in the length proportions between the individual parts of the body, the neck lengthens, and the abdomen decreases in volume. Although the jacket for boys is not a typical component of children's clothing, it has its place in their wardrobe. This type of product belongs to the group of upper, shoulder garments, which are usually designed in a semi-fitted silhouette and consist of a back, side and front part. In its essential part, the product resembles the shape and topology of a men's jacket, although it has specific features that are reflected in the algorithm for sizing and building the main structure. In this material, a basic structure of a children's jacket with a double-seamed sleeve for boys of the second height group has been developed. The standard size is 140/68/58.5, (size 34), with allowances for freedom of fit along the main component lines and is without allowances for seams. Its purpose is to model on it various variants of classic woven fabrics.

Keywords – Jacket for boys, boys' size, basic construction, double-stitched sleeves.

I. INTRODUCTION

When designing clothing for children, it must be taken into account that they are in constant motion. This means that appropriate allowances for freedom must be provided so that children can feel comfortable at all times.

A characteristic feature of children's physique is that they have bellies, not a clearly defined waist. Youth clothing is structurally closer to adult clothing. In terms of shape and proportions, children's clothing differs significantly from adult clothing. These differences are primarily due to the unstable and rapidly changing proportions between the individual parts of the child's body. Based on the established age-related changes in the proportions of the child's body, the dimensional characteristics of the typical figures are given in three separate standards.

One unites children up to 3 years of age, i.e. when there is no clearly expressed typical figure for the respective gender. The other two standards cover the typical figures for boys and for boys from 3 to 18 years of age, respectively. Each of them divides children into four groups according to their main dimensional characteristics.

II. PRELIMINARY NOTES

A. Basic Jacket Construction

1. Required Dimensional Characteristics

The basic construction is developed for a standard typical figure, in a classic style and is without seam allowances. For the main construction lines, allowances for freedom are set in advance, percentage-distributed in the three main details - back, side part and front part. The dimensional characteristics for typical figures for boys of the second age

group with height $P = 140.0$ cm are given in Table 1 [1].

Table 1. Jacket size specifications

No.	No. of sign	Name of the feature	Designation	Value, cm
1	13	Neck circumference	O_{SH}	31,3
2	16	Chest circumference – third	$O_{G III}$	68,0
3	18	Waist circumference	O_T	58,5
4	19	Hip circumference	O_H	77,4
5	31	Shoulder width	SH_R	11,4
6	39	Distance from the cervical point to the level of the first chest circumference line, taking into account the protrusion of the shoulder blades	$D_{7G(Z)}$	14,9
7	40	Back length to waistline, taking into account the protrusion of the shoulder blades	$D_{7T(Z)}$	32,6

$$PS_{(LG)} = (6.0 \div 7.0) = 6.5 \text{ cm}; \quad PS_{(LT)} = (5.0 \div 7.0) = 6.0 \text{ cm}; \quad PS_{(LH)} = (2.0 \div 4.0) = 3.5 \text{ cm}$$

Note:

1. The allowances for freedom refer to the semi-circumferential dimensions of the product.

2. The allowances along the waist and hip lines are control and used both in the geometric construction and in the control measurements from the finished drawing.

2. Preliminary Calculations [2]

$$1. \text{ Back length to chest line: } D_{GR(LG)} = D_{7G(Z)} + P_D = 14.9 + (2.0 \div 3.0) = 14.9 + 2.6 = 17.5 \text{ cm.}$$

$$2. \text{ Back length to waistline: } D_{GR(LT)} = D_{7T(Z)} + P_D = 32.6 + (0.0 \div 0.3) = 32.6 + 0.1 = 32.7 \text{ cm.}$$

$$3. \text{ Back length to hip line: } D_{GR(LH)} = 1.5 D_{GR(LT)} = 1.5 \cdot 32.7 = 49.0 \text{ cm.}$$

$$4. \text{ Product length: } D_{IZD} = D_{GR(LH)} + P_D = 49.0 + (10.0 \div 12.0) = 49.0 + 11.0 = 60.0 \text{ cm.}$$

$$5. \text{ Back width along the chest line: } SH_{GR(LG)} = 0.4 C_{G III} + 0.2 P_{S(LG)} = 0.4 \cdot 34.0 + 0.2 \cdot 6.5 = 14.9 \text{ cm.}$$

$$6. \text{ Width of the side part along the chest line: } SH_{STR CH(LG)} = 0.2 C_{G III} + 0.2 P_{S(LG)} = 0.2 \cdot 34.0 + 0.2 \cdot 6.5 = 8.1 \text{ cm.}$$

$$7. \text{ Width of the front along the chest line: } SH_{PR CH(LG)} = 0.4 C_{G III} + 0.6 P_{S(LG)} = 0.4 \cdot 34.0 + 0.6 \cdot 6.5 = 17.5 \text{ cm.}$$

$$8. \text{ Back width at waist line: } SH_{GR(LT)} = 0.35 C_T + 0.3 P_S = 0.40 \cdot 29.25 + 0.3 \cdot 6.0 = 13.5 \text{ cm.}$$

$$9. \text{ Width of the side part along the waist line: } SH_{STR CH(LT)} = 0.20 C_T + 0.2 P_{S(LT)} = 0.20 \cdot 29.25 + 0.2 \cdot 6.0 = 7.0 \text{ cm.}$$

$$10. \text{ Width of the front part along the waist line: } SH_{PR CH(LT)} = 0.40 C_T + 0.5 P_{S(LT)} = 0.4 \cdot 29.25 + 0.5 \cdot 6.0 = 14.7 \text{ cm.}$$

$$11. \text{ Width of the back along the hip line: } SH_{GR(LH)} = 0.30 C_H + 0.35 P_{S(LH)} = 0.35 \cdot 38.7 + 0.35 \cdot 3.5 \approx 14.8 \text{ cm.}$$

$$12. \text{ Width of the side part along the hip line: } SH_{STR CH(LH)} = 0.20 C_H + 0.15 P_{S(LH)} = 0.20 \cdot 38.7 + 0.35 \cdot 3.5 = 9.0 \text{ cm.}$$

$$13. \text{ Width of the front along the hip line: } SH_{PR CH(LH)} = 0.45 C_H + 0.20 P_{S(LH)} = 0.45 \cdot 38.7 + 0.30 \cdot 3.5 = 18.4 \text{ cm.}$$

14. Neck width: $SH_{VRIZV} = 0.2 O_{SH} + P_S = 0.2 \cdot 31.3 + (0.3 \div 0.5) = 6.26 + 0.34 = 6.6 \text{ cm}$.

15. Neck height: $V_{VRIZV} = 1/3 SH_{VRIZV} - (0.3 \div 0.5) = 1/3 \cdot 6.6 - 0.4 = 2.2 - 0.4 = 1.8 \text{ cm}$.

3. Geometric construction

The three main details of the children's jacket can be built separately, in combination, or in an assembly drawing, as in this particular case (Fig. 1).

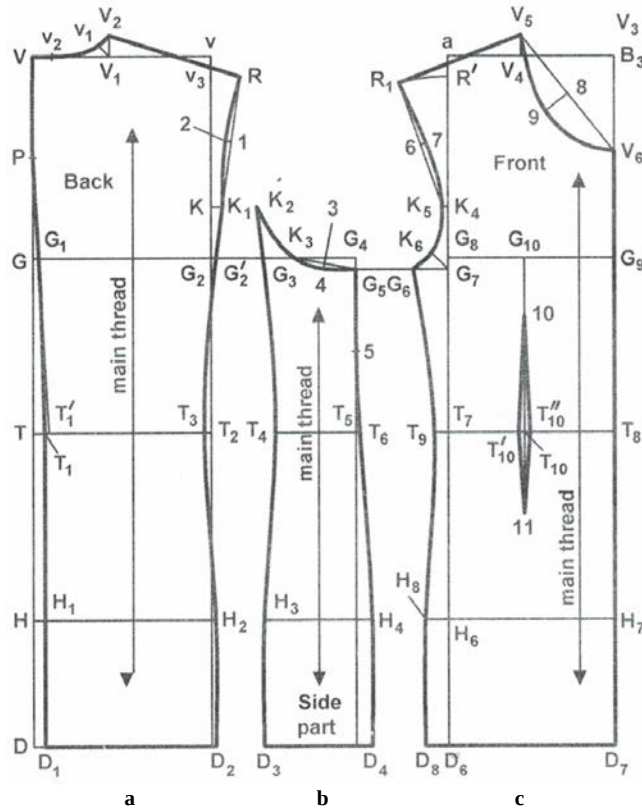


Fig.1 Drawing of the main structure

3.1. Geometric construction of the back (Fig. 1.a)

$V - G = D_{GR(LG)} = 17.5 \text{ cm}$; $V - P = 0.5 D_{GR(LG)} = 0.5 \cdot 17.5 = 8.75 \text{ cm}$; $V - T = D_{GR(LT)} = 32.7 \text{ cm}$; $V - H = D_{GR(LH)} = 49.0 \text{ cm}$; $V - D = D_{IZD} = 60.0 \text{ cm}$; $T - T_1 = 1.0 \text{ cm}$; $T_1 - T_1' = (0.4 \div 0.6) = (0.4) \text{ cm}$; straight line $P - T_1' \Rightarrow G_1$; smooth line VPG_1T_1 .

$G_1 - G_2 = SH_{GR(LG)} = 14.9 \text{ cm}$; $V - V_1 = SH_{VRIZV} = 6.6 \text{ cm}$; $V_1 - V_2 = V_{VRIZV} = 1.8 \text{ cm}$; $V_1 - v_1 = 0.5 V_{VRIZV} + 0.4 = 0.5 \cdot 1.8 + 0.4 = 1.3 \text{ cm}$ and V_1V_1 is the bisector of angle VV_1V_2 ; $V - v_2 = 0.25 SH_{VRIZV} = 0.25 \cdot 6.6 = 1.65 \text{ cm}$; smooth line $Vv_2v_1V_2$.

$b - b_3 = 0.05 D_{GR(LG)} = 0.05 \cdot 17.5 = 0.9 \text{ cm}$; straight line $B_2 - b_3 - R = SH_{R(GR)} = SH_R + P_D = 11.4 + (0.4 \div 0.6) = 11.4 + 0.5 = 11.9 \text{ cm}$.

$G_2 - K = 0.25 D_{FR(LG)} = 0.25 \cdot 17.5 = 4.4 \text{ cm}$; $K - K_1 = (0.8 \div 1.2) = 1.0 \text{ cm}$; $R - 1 = 0.5 (R - K_1)$; $1 - 2 = (0.4 \div 0.6) = (0.5) \text{ cm}$ and $1,2 \perp RK_1$; smooth line $R2K_1$; $T_2 - T_3 = (0.5 \div 0.7) = (0.6) \text{ cm}$; $H_1 - H_2 = SH_{GR(LH)} = 14.8 \text{ cm}$; $(D_1 - D_2 = H_1H_2)$; smooth line $K_1T_3H_2D_2 \Rightarrow G_2'$.

3.2. Geometric construction of the side part (Fig. 1.b)

A smooth line is drawn $K_2G_3T_4H_3D_3$, mirrored to the smooth line $K_1T_3H_2D_2$, relative to an arbitrary vertical line, standing to the right of point D_2 at a distance separating the back from the side, equal to approximately 4.0 cm; $G_3 -$

$G_4 = SH_{STRCH(LG)} = 8.1 \text{ cm}$; $G_4 - G_5 = 1.0 \text{ cm}$; $G_3 - K_3 = 1/3 SH_{STRCH(LG)} = 1/3 \cdot 8.1 = 2.7 \text{ cm}$; straight line $K_3 - G_5$; $K_3 - 3 = 0.5 K_3G_5$; $3 - 4 = 0.5 \text{ cm}$ and $3,4 \perp K_3G_5$; smooth line $K_2K_34G_5$.

$H_3 - H_4 = D_3 - D_4 = SH_{STRCH(LH)} = 9.0 \text{ cm}$; $G_5 - 5 = 0.5 G_5T_5$; smooth line $G_5H_4D_4 \Rightarrow T_6$.

3.3. Geometric construction of the front part (Fig. 1.c)

$G_5 - G_6 =$ distance for separating the front from the side part, for example 5.0 cm; $G_6 - G_7 = 0.2 SH_{PRCH(LG)} - 0.5 = 0.2 \cdot 17.5 - 0.5 = 3.0 \text{ cm}$; $G_7 - G_8 = 1.0 \text{ cm}$; $G_8 - G_9 = SH_{PRCH(LG)} - G_7G_8 = 17.5 - 3.0 = 14.5 \text{ cm}$.

$G_8 - K_4 = G_2K$ (from the back) = 4.4 cm; $K_4 - K_5 = 0.5 \text{ cm}$; $\Gamma_7 - K_6 = 2 G_7G_8 = 2 \cdot 1.0 = 2.0 \text{ cm}$ and Γ_7K_6 bisects the angle $G_6G_7G_8$; $G_9 - V_3 = GV$ from the back; $V_3 - V_4 = SH_{VRIZV} + 1.5 \text{ cm} = 6.6 + 1.5 = 8.1 \text{ cm}$; $V_4 - V_5 = V_{VRIZV} = 1.8 \text{ cm}$; to the right of R , an imaginary horizontal line is drawn $\Rightarrow$ point R' ; with center point G_8 and radius equal to G_8R' to the left of point P' , an arc of a circle is constructed; straight line $V_5 - R_1 = SH_{R(PRCH)} = SH_R = 11.4 \text{ cm}$; $R_1 - 6 = 0.5 R_1K_5$; $6 - 7 = 0.5 \text{ cm}$ and $6,7 \perp R_1K_5$; smooth line $R_17K_5K_6G_6$.

$V_3 - V_6 = V_3V_5$; $V_5 - 8 = 0.5 V_5V_6$; $8 - 9 = 2.5 \text{ cm}$ and $8,9 \perp V_5V_6$; smooth line V_59V_6 .

$T_8 - T_9 = SH_{PRCH(LT)} + P_{SV} = 14.7 + 1.0 = 15.7 \text{ cm}$; $T_8 - T_{10} = 0.5 T_8T_9 = 0.5 \cdot 15.7 = 7.85 \text{ cm}$; $T_{10} - T_{10}' = T_{10} - T_{10}'' = 0.5 P_{SV} = 0.5 \cdot 1.0 = 0.5 \text{ cm}$; $G_{10} - 10 = 1/3 G_{10}T_{10}$; $T_{10} - 11 = (6.0 \div 8.0) = (7.0) \text{ cm}$; $H_6 - H_8 = D_6 - D_8 = 2.0 \text{ cm}$; smooth line $G_6T_9H_8D_9$.

B. Basic Construction of a Jacket Sleeve

Typically, sleeves for this type of product consist of two parts – an inner and an outer. Therefore, the construction of the double-seamed sleeve is discussed here (Fig. 2).

1. Required Dimensional Characteristics [1]

Table 2. Dimensional characteristics for the sleeve

No.	No. of sign	Name of the feature	Designation	Value, cm
1	28	Armpit circumference	O_{MISH}	21,5
2	29	Wrist joint circumference	O_{KIT}	14,2
3	33 – 31	Arm length	D_{RK}	45,4

2. Preliminary Calculations [2]

1. Sleeve depth: $DB_{RAK} = 1/3 O_{RAKIZV} + P_S = 1/3 \cdot 40.4 + (0.4 \div 0.8) \text{ cm} \approx 13.5 + 0.7 = 14.2 \text{ cm}$.

2. Sleeve width: $SH_{RAK} = 0.5 O_{MISH} + P_S = 0.5 \cdot 21.5 + (4.0 \div 6.0) \text{ cm} = 10.75 + 4.75 = 15.5 \text{ cm}$.

3. Sleeve width along the length line: $SH_{RAK(LD)} = 0.5 O_{KIT} + P_S = 0.5 \cdot 14.2 + (4.0 \div 5.0) \text{ cm} = 7.1 + 4.4 = 11.5 \text{ cm}$.

4. Sleeve length: $D_{RAK} = D_{RK} + P_D = 45.4 + (4.0 \div 5.0) \text{ cm} = 45.4 + 4.3 = 49.7 \text{ cm}$.

3. Geometric construction

$A - G = DB_{RAK} = 14.2 \text{ cm}$; $A - D = D_{RAK} = 49.7 \text{ cm}$; $D - D_1 = 1.5 \text{ cm}$; $G - L = 0.5 GD_1 - (0.7 \div 1.0) \text{ cm} = 0.5 \cdot 34.0 - 0.8 = 16.2 \text{ cm}$; $A - A_1 = SH_{RAK} = 15.5 \text{ cm}$; $A_1 - A_2 = 0.5 AA_1 = 0.5 \cdot 15.5 = 7.75 \text{ cm}$; $A - a = a - a_1 = a_1 - A_2 = 1/3 AA_2 = 1/3 \cdot 7.75 = 2.58 \text{ cm}$.

$G - K = 0.25 DB_{PbK} = 0.25 \cdot 14.2 = 3.55 \text{ cm}$; $K - a_2 = 1/3 Ka$; straight line $a_1 - a_2$; $a_2 - a_3 = 0.5 a_2a_1$; straight line $A_2 - a_3$; $a_3 - a_4 = (0.3 \div 0.5) = 0.4 \text{ cm}$ и $a_3a_4 \perp a_1a_2$; $a_3 - 1 = 0.5 a_3A_2$; $1 - 2 = (0.8 \div 1.0) = 0.9 \text{ cm}$ и $1,2 \perp$

A_2a_3 ; $A_1 - a_5 = 0.5 A_1A_2 + 0.7 = 0.5 \cdot 7.75 + 0.7 = 4.575$ cm; $A_1 - K_1 = 1/3 \Delta B_{P_{BK}} + (0.2 \div 0.4) = 1/3 \cdot 14.2 + 0.3 = 5.0$ cm; straight line $a_5 - K_1$ and the straight line is continued to point K_2 , so $K_1 - K_2 = 2.0$ cm.

$a_5 - 3 = 0.5 a_5K_2$; $3 - 4 = (0.3 \div 0.5) = 0.4$ cm и $3,4 \perp a_5K_2$; straight line $A_2 - 3$; $3 - 5 = 0.5 3A_2$; $5 - 6 = (0.8 \div 1.2) = 1.0$ cm and $5,6 \perp 3A_2$; $G - G_2 = 2/3 G_5G_7$ (from the front) $= 2/3 \cdot 3.0 = 2.0$ cm; $G - a_6 = G_7/K_4$ (from the front) $- 0.5$ cm $= 2.0 - 0.5 = 1.5$ cm and Γa_6 is the bisector of angle KG_2 ; smooth line $K_24,6,A_2,2,a_4a_2Ka_6G_2$.

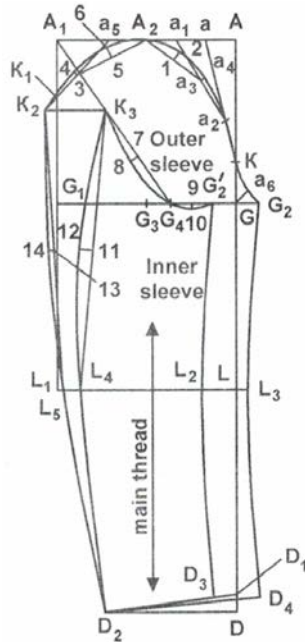


Fig.2 Double-stitched sleeve for a children's jacket

$G_1 - G_3 = A_1A_2 = 7.75$ cm; $G - G_2' = GG_2$; $G_3 - G_4 = 0.5 G_3G_2' - (0.7 \div 0.9) = 0.8$ cm; straight line $A_1 - G_4$; to the right of point K_2 , a horizontal line is drawn $\Rightarrow$ point K_3 ; $K_3 - 7 = 0.5 K_3G_4$; $7 - 8 = (0.7 \div 1.0) = 0.8$ cm and $7,8 \perp K_3G_4$; $G_4 - 9 = 0.5 G_4G_2'$; vertically downwards $9 - 10 = (0.4 \div 0.6) = 0.5$ cm; smooth line $K_38G_410G_2'$.

Straight line $D_1 - D_2 = SH_{RAK(LD)} = 11.5$ cm and point D_2 lies on the horizontal line drawn to the left of point D ; $L - L_2 = D_1 - D_3 = G_4G_2' = 2.0$ cm; smooth line G_2/L_2D_3 ; smooth line $G_2L_3D_4 \parallel G_2/L_2D_3$ (point $G_2' \equiv$ point G_2); $L_1 - L_4 = 2.0$ cm; $L_1 - L_5 = 0.5$ cm; straight lines $K_2 - L_1$ and $K_3 - L_4$; $K_3 - 11 = 0.5 K_3L_4$; $11 - 12 = (1.0 \div 1.5) = 1.2$ cm and $11,12 \perp K_3L_4$; smooth line $K_312L_4D_2$; $K_2 - 13 = 0.5 K_2L_1$; $13 - 14 = (0.4 \div 0.6) = 0.7$ cm and $13,14 \perp K_3L_4$; smooth line $K_214L_5D_2$; straight line $D_2 - D_4$.

III. MAIN RESULTS AND DISCUSSIONS

After the construction of the main structures, in addition to the traditional routine checks, the following measurements are performed:

1. The lengths of the following lines are measured:

a) chest line: the sum of the segments G_1G_2' (from the back) + G_3G_4 (from the side) + $(G_6G_7 + G_8G_9)$ (from the front) must be equal to $C_{GIII} + P_S(LG) + G_2G_2'$;

b) waist line: the sum of the segments $T_1T_3 + T_4T_6 + T_9T_{10}' + T_{10}'/T_8$ should be approximately equal to $C_T + P_S(LT)$ and

c) hip line: the sum $H_1H_2 + H_3H_4 + H_8H_7$ should be equal to $C_H + P_S(LH)$ (for the specific example, $P_S(LH) = 2.0$ cm was obtained). It should be noted that the location of point X_7 is conditional, since depending on the model, the line of the front middle undergoes correction;

d) the shape and length of the line of the neck curve from the front part $L_{VRIZV(PRCH)} = V_59V_6$ is conditional, since the line changes after applying the model;

e) $L_{STRSHEV(KAMSTRCH)} = K_1T_3H_2D_2 = 47.0$ cm; $L_{VRIZV} = VV_2V_1V_2 = 7.1$ cm; $O_{RAKIZV(GR)} = R_2K_1 = 11.5$ cm; $L_{STRSHEV(KAMGARBA)} = K_2G_3T_4H_3D_3 = 47.0$ cm; $O_{RAKIZV(STRCH)} = 11.1$ cm; $L_{STRSHEV(KAMPRCH)} = G_55T_6H_5D_5 = 41.55$ cm; $L_{STRSHEV(KAMSTRCH)} = G_7T_9H_8D_8 = 41.65$ cm; $O_{RAKIZV(PRCH)} = 17.8$ cm; $O_{RAKIZV} = O_{RAKIZV(GR)} + O_{RAKIZV(STRCH)} + O_{RAKIZV(PRCH)} = 11.5 + 11.1 + 17.8 = 40.4$ cm; $L_{VNSHEV(VNRAKAV)} = K_214L_5D_2 = 44.0$ cm; $L_{VNSHEV(VTRRAKAV)} = K_312L_4D_2 = 44.0$ cm; $L_{VATRRAKAV(LD)} + L_{VNSHEV(VTRRAKAV(LD))} = 9.5 + 13.5 = 23.0$ cm; $O_{RAKOV} = O_{VTRAK} + O_{VNSHEV} = 13.9 + 29.5 = 43.4$ cm.

2. Centers are placed on the sleeve curve and the sleeve oval [6] in the following way (Fig.3a and Fig.3b):

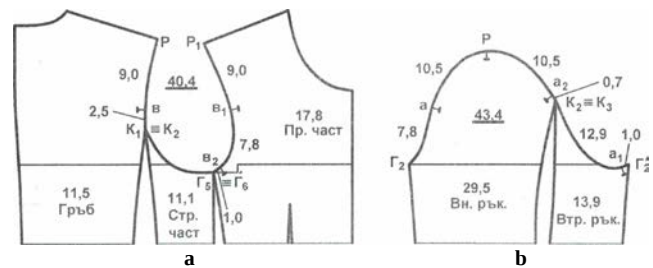


Fig.3 Inserting centers in the sleeve area and sleeve

a) the difference between the circumferences of the sleeve oval and the sleeve curve is calculated: $\Delta = O_{RAKOV} - O_{RAKIZV} = 43.4 - 40.3 = 3.0$ cm.

b) the following distances are measured on the drawings:

– for the sleeve curve (Fig.3a): $R - b = R_1 - b_1 = (8.0 \div 10.0) = (9.0$ cm); $G_5'' - b_2 = 1.0$ cm;

– for the sleeve oval (Fig.3b): $G_2 - a = b_2b_1 = 7.8$ cm; $G_2' - a_1 = G_6b_2 = 1.0$ cm; $K_2 - a_2 = G_5K_1b_1$ (from the sleeve curve) – aK_3 (from the inner sleeve) $= 13.6 - 12.9 = 0.7$ cm; $\therefore a - a_2 = 21.0$ cm; $a - R = 0.5 aa_2 = 0.5 \cdot 21.0 = 11.5$ cm;

– check: $a_2 - R = BR + 0.5 \Delta = 9.0 + 0.5 \cdot 3.0 = 10.5$ cm; $a - R = B_1R_1 + 0.5 \Delta = 9.0 + 0.5 \cdot 3.0 = 10.5$ cm.

IV. CONCLUSION

A variant of sizing and geometric construction of a basic construction of a children's jacket for a standard size of the second age group is proposed.

The main details refer only to the facing fabric and are without seam allowances. All other elements of the facing fabric, the lining of the reinforcing and adhesive inserts are constructed in accordance with the selected model, which is not shown here.

A successful approach has been developed to designate the technologically related segments of the curves of the sleeve curve and the sleeve oval. The necessary additional length in the upper area of the sleeve is achieved by changing the allowances for freedom when sizing it. To

achieve proportionality in the shape of the oval, the ratio between its depth and width must be maintained.

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