2

Technological system

Abstract: Technological analysis involves continuous systematic testing of alternative permutations of production and changes of technological operations and a synthesis of future technological processes. Organization of the technological process of sewing and finishing is different for different garments. Each product is different in its own way and requires a different organization of the technological process of sewing and finishing. Well-selected technological operations shorten the time of making garment cases, reduce production costs per unit of product, allowing the flow of product through all stages without the occurrence of bottleneck production, reduce inventory, allow rational use of the machine park and prevent low labour productivity.

Keywords: processes, technological analysis, manufacturing operations, garment.

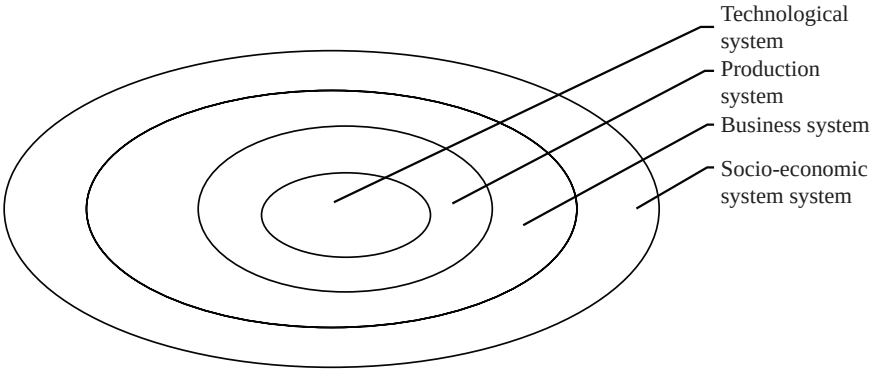
2.1 Technological system

Every production, every organized human labour is a complex system. Technological system is an open dynamic system closely related to the environment. Production technological system is designated as a part of a broader production system (element of the business system). Business system, in organizational terms, can act as a separate entity (company). Business system, beside production system, also contains a system of procurement, sales, distribution of resources, as well as material, energetic, informational and financial flows. Socio-economic system is broader than business system (Figure 2.1).

The basis of technological system is in the process, transforming materials from one form into another, from lower to higher use value, which directly determines the character of the production system (Figure 2.2). Other parts of the production system are

- System of design (construction) of product,
- System maintenance,
- Inventory system,

- Safety at work,
- Transport,
- Quality control.



2.1 Systems.

Fiber ⇨ **Yarn** ⇨ **Fabric, knitted** ⇨ **Clothes**

2.2 Transforming materials from one form into another.

2.2 Technological systems, processes and operations

Technological system usually occurs as a part of a wider system and the result of an integral activity of people in different kinds of work processes.

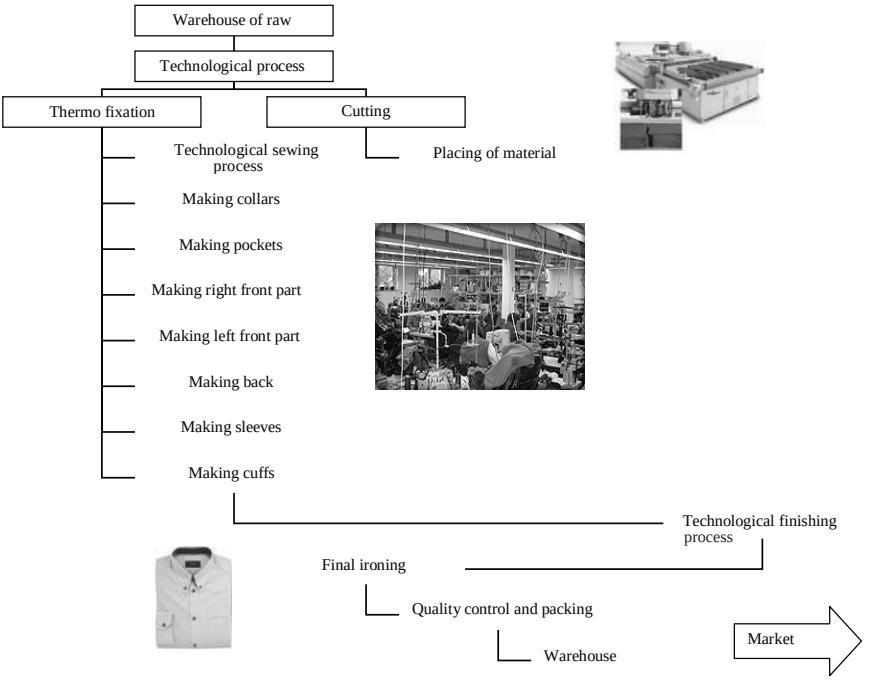
The structure of the technological system is determined by three factors:

(1) Complexity of technology,
(2) Complexity of products and
(3) Management system.

Technological systems by nature are among the artificial, open, dynamic and stochastic systems. Technological systems are studied both in the sphere of production and beyond, so they are mainly divided into production and non-production technological systems.

Production technological systems can be defined as a set of objects (tools, materials, funds for the work, projected technology, human labour and finished products) with the relations that exist between input elements on one side and output elements (finished products) on the other, observed through their attributes (price, quantity and quality). Non-production technological systems occur in all out-production activities of people (education, health, culture, etc.).

The essence of the production technological system is a mutual dependence and interdependence of all elements (or objects of system) while performing the functions of transformation of material from one form into another, more useful form, where its utility output increase under the influence of organized human labour. Figure 2.3 shows the technological process of making shirts for men.



2.3 The technological process of making men's shirts.

Production technological systems are classified according to the following:

(1) Level of investment (of raw materials and simple compounds, drawer, basic compounds, sub-assemblies and complex materials, components and final products),
(2) Type of labour (extractive, processing and synthetic technological processes),
(3) Type of labour and types of activities (agricultural, mining, metallurgical, chemical, metal-processing, textile, pharmaceutical, wood and food),
(4) Dynamics of movement of materials and stability conditions (batch wise or continuous),
(5) Organization of production (mass, serial and unit production),
(6) Order of processes (preparation of raw materials, chemical processing, physical processing and finishing) and

(7) Other criteria (the character of the means of work, production volume, product type, the basic raw materials and the dynamics and type of movement of material in the technological process).

Processes in production are a horizontal division of labour whose task is to make the product. Production process includes everything that happens with the subject from the entry of raw materials in production to the release of finished products. The production process consists of elementary processes: workplaces, quality control, inter phase transport, preventive maintenance of the means of work, preventive work safety, storage and supply of water and energy.

Technological process is part of the production process which refers to the shaping of work case with defined workplaces. Technological process is the linking of technological operations in order to convert the lower use-values into the higher ones together with human activity. Technological operation is a set of direct and ancillary effects on the work piece on one machine, which enables the realization of process. Working operation is a set of all activities that form a finished product.

Operations can be divided into technological and non-technological. Technological operations directly alter the characteristics of objects to get products with new use-value on the basis of these changes. Non-technological operations do not change the characteristics of objects, but are necessary in the production process so the technological process could be done.

2.3 Technological analysis of manufacturing operations

Technological analysis involves continuous systematic testing of alternative permutations of production and changes of technological operations and a synthesis of future technological processes. Optimization of technological system means the ultimate goal of the analysis of technological systems and is an element of his partial analysis.

The main objective of the analysis of technological systems is to improve performance through analysis of process. Technological analysis determines the effect of technological change in operations on the broader changes of technological system, as well as on the performance of certain operations.

Changes in the technological operations are viewed via

- fixed costs of working capital,
- expenditure of human labour,
- appropriate changes in the course and the amount of material and
- changes in all other operations of technological process.

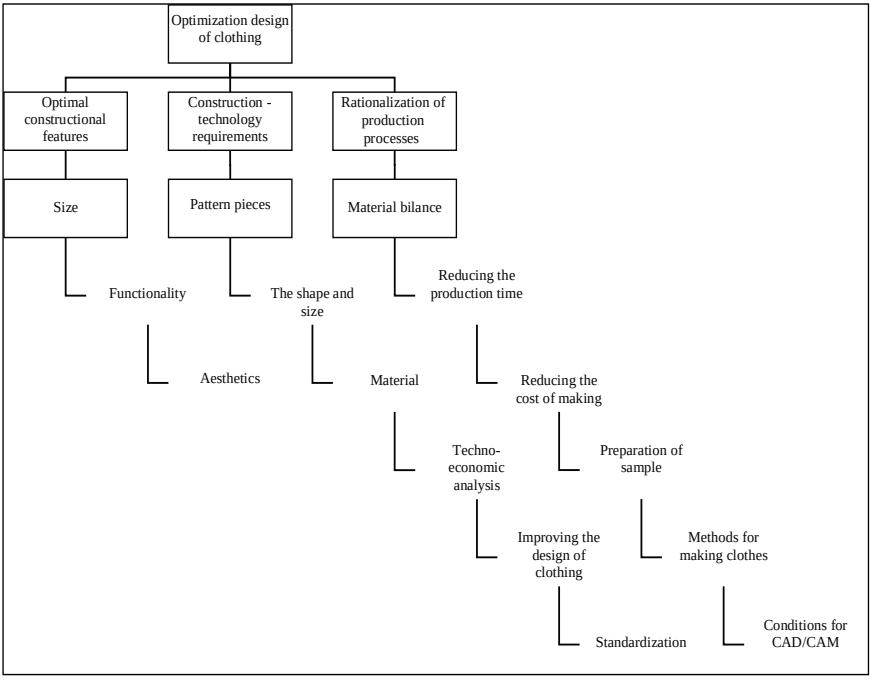
Technological analysis is a specific activity, which aims to introduce the production characteristics of products and potential problems that we are about to have in its production. The greatest number of errors in garment manufacturing, and thus the costs associated with product quality arise in defining garment, developing product and planning of technological process of making clothes. It is believed that 75% of all errors that appear on the product occur in construction preparation. The most common errors in construction preparation are

- pattern pieces do not fit the model,
- bad positioning of pattern pieces,
- unmarked indentation,
- missing of pattern piece,
- adding % due to stretch material,
- deviations in grading,
- ill-cut pattern pieces,
- non-grading of all pattern pieces,
- large consumption of materials,
- pattern pieces not fitting the layout pattern and
- inadequate size of layout pattern.

The manufacturing process is a database of functioning of organizational structures, which requires being technologic. The technologics of product is achieved through such construction of product that ensures an optimal relationship between investment of resources and the achieved quality under the given driving conditions and the absorbing power of markets.

Therefore, it is necessary for the design of technological products to undergo technological analysis, in order to determine and, if it is necessary, to improve the technologics of product, i.e. the suitability for production. It is necessary to observe the possibilities of one's own production facilities. Figure 2.4 show the functional clothing design system that provides high technologics.

While planning of production of each garment a detailed technological analysis needs to be made. The technological preparation consists of analyzing, enhancing and improving of activities related to technological processes, which can be divided into several groups of activities, such as technological analysis of production operations, the selection of machine, montage plans, selection of technological systems, the choice of inter phase transport system, the choice of mounting positions, determining the technological and technical specifications for the programming of machines, work study and workplace design.



2.4 Functional clothing construction systems that provides high technologics.

Modern fashion design requires a small amount of clothing, many colours and patterns, so the production plants daily deal with many work orders, which caused the production of technical documentation to be one of the biggest problems in clothing industry.

Organization of the technological process of sewing and finishing is different for different garments; for each item is different in its own way and requires a different organization of the technological process of sewing. Well-selected technological operations shorten the time of making garment cases, reduce production costs per unit of product, allowing the flow of product through all stages without the occurrence of bottleneck production, reduce inventory, allowing rational use of the machine park, preventing low labour productivity and so on. Therefore, the task of technical preparations is to determine working procedure for the new product, to determine the required time of manufacture, the material normative, and to match the way of making with some details. On the basis of daily capacity, the required number of workplaces should be determined, as well as the number of ordinary and special sewing machines, automatic sewing machines and presses for trim, tables and other tools of work, the number of workers in structure with highly specified load job.

In garment industry, technological process is divided into three phases: cutting, sewing and finishing. Each phase individually requires plans of technological operations. A plan of technological operation (operation sheet) is the basic document in the development of a garment, on the basis of which other technological documentation is made.

After making an operation sheet the recapitulation of a development time is performed, according to the types of machines used for making a garment and time required for manual work to determine the number of necessary funds. Total production time per unit (t_1) is obtained by adding the time of making, following the stages of production:

$$t_1 = t_c + t_s + t_f \qquad [2.1]$$

Where t_c – cutting time,
t_s – time for sewing phase,
t_f – time for finishing phase.

Making plans and technological processes is a complex and responsible job which requires integration of knowledge in order to achieve the optimization of process parameters of production of clothing. Due to the lack of time and professional staff in the garment industry, less technological documentation is rarely made or used. Steady production lines for the production of certain garments are often used, regardless of the size of work orders.

2.3.1 Technological analysis of operations for making men's shirts from denim

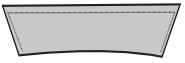
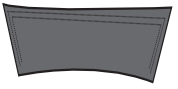
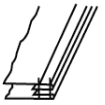
Analysis of technological operations in the process of cutting and sewing men's shirts from denim is given as an example of technological analysis (Figure 2.5). Total production time per unit (t_1) is 3336 s. Time of cutting shirts for men from denim (jeans) is 295 s and time for sewing and finishing phase is 3041 s (Table 2.2). Table 2.1 shows the need for three workers for cutting because total load is 300%.

Table 2.1 Technological operation plan for cutting men's shirts from denim

Name of operation	Means of production	Pr quota/a piece (s)	Norma (piece)	Load (%)
Marking length of cutting layout (marker) after patterns and spreading of material (cutting layers)	Fabric Spreading machine	21	1258	21

Putting of cutting layout on material	Hand makes	4	6600	4
Rough cutting	Straight knife Cutting machine	31	851	32
Fine cutting	Vertical cutter	59	447	60
Numbering, marking of cut pieces	Hand makes	49	538	50
Completing of cut pieces	Hand makes	53	498	54
Control	Hand makes	78	338	79
TOTAL TIME		295 s		

Table 2.2 Technological operation plan for making men's shirts from denim

Name of operation	Means of production	Pr quota/a piece (s)	Norma (piece)	Load (%)
Open bundle and control of cutting pieces	HR	33	800	29
Preparation for sewing collars	HR	16	1520	15
Making collars	OM	40	660	36
				
Turning and shaping collar tops	RR	54	2020	52
Topstitch collar	SM2	40	650	36
				
Cut the tops of collars	HR	10	2500	9
Hem stand collars	OM	22	1200	19
				

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Hem cuff and sewing	OM	21	1230	19
Hem two pockets	OM	14	1800	13

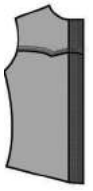
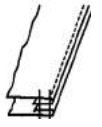

Prepare the cover for pocket for sewing	HR	30	905	26
Sewing covers for pockets	OM	77	340	69


Turning the covers for pockets	HR	42	600	39
Topstitch covers for pockets	SM2	122	210	112


Sewing stand collar on collar	OM	66	400	59


Cutting and turning the stand collar	HR	23	1100	21
Topstitch the stand collar	OM	37	700	34


Sewing yoke on the front part	OM	53	500	47


Topstitch the yoke	SM	42	610	38
				
Pressing the front parts	HR	35	750	31
Closing placket	OM	89	300	78
				
Ironing pockets	SI	20	1300	18
Mark with pattern place for sewing pockets	HR	37	713	33
Sewing pockets	OM	220	120	196
				
Sewing covers for pockets	OM	52	507	46
				
Sewing yoke on back	OM	20	750	31
				

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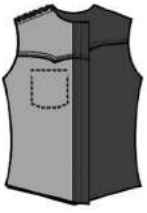
Topstitch the yoke	SM2	80	300	78

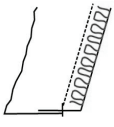
Sewing labels on the yoke	OM	13	1886	12

Sewing shoulders	SMo5	37	700	34



Topstitch the shoulders	SM2	52	507	46

Facing the two sides of the sleeves fly	OM	66	400	59

Sewing sleeves	SMo5	38	694	34
				
Topstitch the sleeves	SM2	35	754	31
				
Attaching sleeves to armholes	SMo5	88	300	78
				
Topstitch the armholes	SM2	132	200	118
				
Sewing underarms seams and side	SMo5	88	300	78
				

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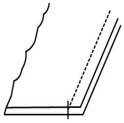
Making cuffs	OM	48	550	43
Turning and shaping cuffs tops	HR	43	610	38
Attaching cuffs on the sleeves	OM	97	270	87

Close the cuffs on the sleeves	OM	66	400	59

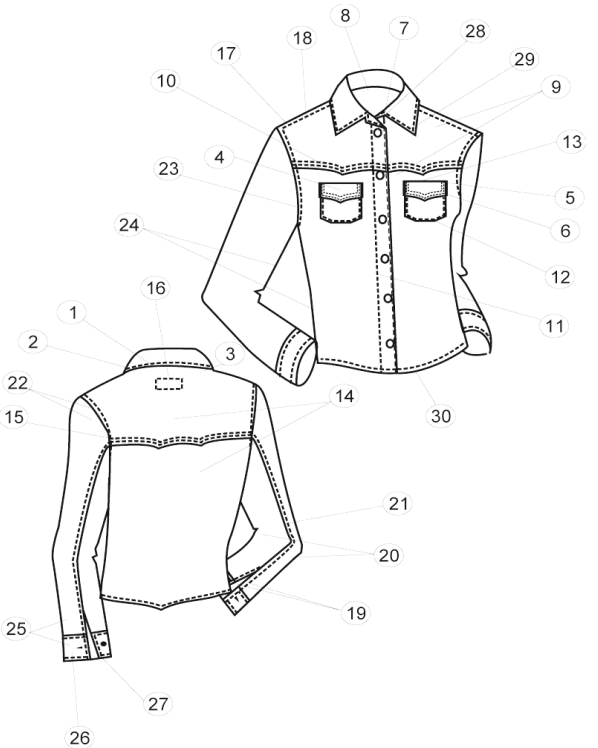

Topstitch the cuffs	OM	66	400	59


Attaching collar to neckline	OM	66	400	59


Close collar	OM	66	400	59
Hem shirt	OM	52	500	47


Sewing ten buttonholes	AUTh	88	300	51

Close shirts at the front (protection when sanding)	OM	52	500	30
Wearing sleeveless shirts (protection of the stoning)	HR	52	500	30
Cutting of thread	HR	264	100	153
Ironing on the shirt ironing machines	Shirt Finisher	132	200	76
Final ironing (cuffs, collar)	SI	32	810	19
Sewing buttons	AUTb	26	1000	15
Putting paper labels	HR	26	100	153
Packaging shirts in the bag	HR	17	1553	10
TOTAL TIME		3037s		



2.5 Men's shirts from denim.

Required number of workers in the process of cutting is provided in the following way:

$$Nw = C_d \times t_1/T = 2.8 \approx 3 \text{ workers} \qquad [2.2]$$

Where, C_d – daily capacity,
t_1 – total production time per unit,
T – working time.

Production line with 27 workers produces (daily capacity) 247 pieces of shirts from denim per day. In the plan of technological operations (Table 2.2) the time of making this operation is given, together with the norm (number of pieces you need to do for the working time 7.5 h), the load of work operations in percentage, and the necessary means of work. Means of work are marked with the following abbreviations:

- Hand makes – HR
- Ordinary sewing machine – OM
- Special sewing machine with two needles – SM2
- Special sewing machines (overloch) with three threads – SMo3
- Special sewing machines (overloch) with five threads – SMo5
- Automatic for making buttonhole – AUTh
- Automatic for button – AUTb
- Steam iron – SI

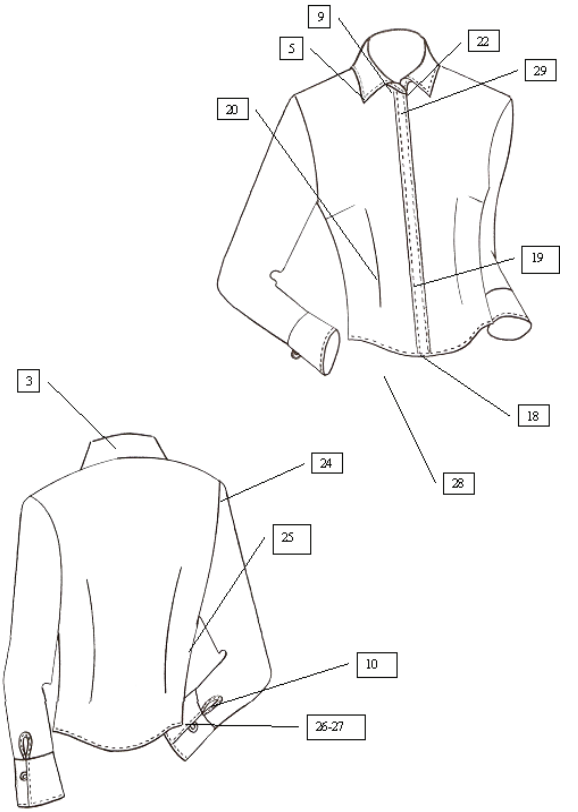
2.3.2 Technological analysis of operations for making women's shirts

Cutting time for women's shirts is 295 s (three workers). Technological operation plan for cutting women's shirts is shown in Table 2.3. Production lines with 29 workers produce 332 shirts per day. Model of women's shirts with positions of some of the operations are shown in Figure 2.6.

Table 2.3 Technological operation plan for cutting women's shirts

Name of operation	Means of production	Pr quota/a piece (s)	Norma (piece)	Load (%)
Spreading material	Hand makes	36	750	44.3
Spreading nonwoven interlining	Hand makes	13	2077	16.0
Rough cutting (without front parts)	Straight knife Cutting machine	11	2455	13.5
Fine cutting (with front parts)	Vertical cutter	28	964	34.4

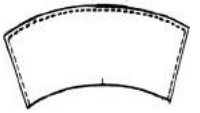
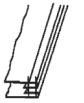
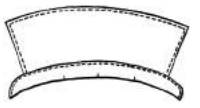
Numbering and marking of cut pieces	Hand makes	22	1227	27.1
Fusing interlining with collar	Fusing machine	34	794	41.8
Thermal bonding interlining with cuff	Fusing machine	45	600	55.3
Completing of cut pieces	Hand makes	25	794	41.8
Control	Hand makes	30	900	36.9
TOTAL TIME		244 s		



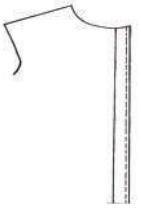
2.6 Women's shirt.

Technological operation plan for the production of women's shirts is shown in the Table 2.4.

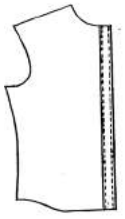
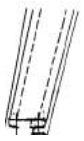
Table 2.4 Technological operation plan for making women's shirts

Name of operation	Means of production	Pr quota/ a piece (s)	Norma (piece)	Load (%)
Making collars	OM	54	500	66.4
				
Turning and shaping collar tops	HM	40	675	49.2
Ironing collar	SI	62	435	76.3
Topstitch the collar (0,5cm)	OM	43	628	52.9
				
Hem stand collar	OM	21	1286	25.8
Sewing stand collar on collar	OM	54	500	66.4
Turning and shaping stand collar tops	HM	40	675	49.2
Topstitch the stand collar	OM	18	1500	22.1
				
Placing strips on the sleeve	SM	58	466	71.2
				
Hem cuffs	OM	39	692	48.0
Sewing cuffs with long side	OM	10	2700	12.3
Ironing cuffs with long side	SI	45	600	55.3
Making loop for button	SM	59	458	72.5
Sewing cuffs with short side with putting loop for button	OM	53	509	65.2

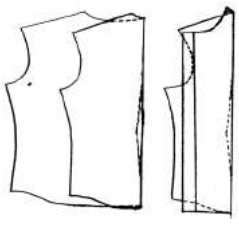
Turning cuffs	HM	40	675	49.2
Ironing placket	SI	75	360	92.2
Sewing placket on front parts	OM	40	675	49.2




Topstitch the placket for 0,5cm	OM	65	415	80.0

Sewing darts on front parts and back and sewing bust darts	OM	80	338	98.2




Sewing shoulders	SMo5	27	1000	33.2
Attaching stand collar to neckline	OM	145	186	178.5


Closing stand collar	OM	61	443	74.9
Attaching sleeves	SMo5	54	500	66.4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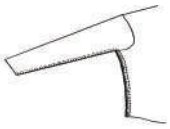
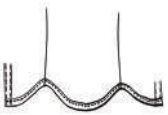
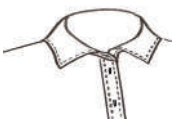
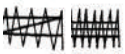
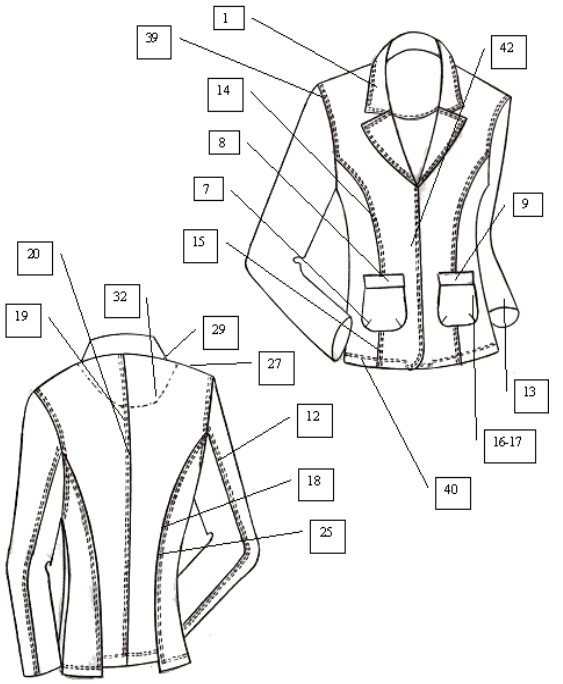
Sewing side seams and sleeves with label	SMo5	45	600	55.3
				
Attaching cuffs	OM	125	216	153.7
Topstitch the cuffs for 0,5cm	OM	133	203	163.5
				
Hem	OM	93	290	114.5
				
Marking and sewing seven buttonholes	AUTh	75	360	92.2
				
Marked place for button	HM	61	443	74.9
Sewing seven button	AUTb	98	276	120.3
Ironing	Finisher	309	87	381.6
Control	HM	140	193	172.0
Mount the hanger	HM	10	2700	12.3
Buttoning	HM	62	435	76.3
Putting paper labels	HM	10	2700	12.3
TOTAL TIME		2344s		

The technological documentation shows that the total production time per unit (t_1) is 2588 s.

2.3.3 Technological analysis of operations for making women's denim jacket

Production line with 47 workers produces 293 women's denim jackets per day (Figure 2.7). Cutting time is 369 s (four workers). Technological operation plan for the cutting women's denim jacket is shown in Table 2.5.



2.7 Women's denim jacket.

Table 2.5 Technological operation plan for cutting women's denim jacket

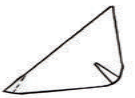
Name of operation	Means of production	Pr quota/ a piece (s)	Norma (piece)	Load (%)
Marking length of cutting layout after patterns; spreading matherial	Hand makes	37	730	40.2
Planing of cutting layout on matherial	Hand makes	15	1800	16.3
Rough cutting	Straight Knife Cutting Machine	55	491	59.7
Fine cutting	Vertical Cutter	31	871	33.6
Sreading elastic bar	Hand makes	15	1800	16.3
Rough cutting elastic bar	Vertical Cutter	5	5400	5.43

(Continued)

Numbering and marking of cut pieces	Hand makes	129	209	140
Completing of cut pieces	Hand makes	35	771	38
Control	Hand makes	47	574	51
TOTAL TIME		369 s		

Technological operation plan for the production of women's denim jacket is shown in Table 2.6.

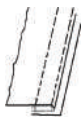
Table 2.6 Technological operation plan for the production of women's denim jacket

Name of operation	Means of production	Pr quota/a piece (s)	Norma (piece)	Load (%)
Sewing collar	OM	65	415	70.6
				
Cutting and turning collar	HM	40	675	43.4
Ironing middle collar seam	SI	25	1080	27.1
Hem front fuse and double bend	OM	50	540	54.3
Ironing fuse behind the neck	SI	21	1286	22.8
Sewing hangers for fuse	OM	8	3375	8.68
Sewing dart on pockets	OM	60	450	65.1
				
Sewing elastic bar on pockets	SMo5	21	1286	22.8
				
Topstitch the pockets	OM	62	435	67.4
				
Sewing sleeves	SMo5	59	458	64
Topstitch the sleeves	OM	145	186	158
Sewing side seam on sleeves	SMo5	59	458	64

Hem sleeves	OM	181	149	197


Sewing front parts	SMo5	54	500	58.6


Topstitch the front parts	OM	62	435	67.4

Drawing position	HM	35	771	38
Sewing pockets	OM	420	64	458


Overloch seam on back	SMo3	60	450	65.1


Sewing back	SMo5	21	1286	22.8

(Continued)

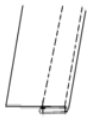
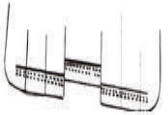
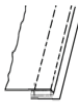

Topstitch the back	OM	39	692	42.3


Sewing back with side parts to fly	OM	43	628	46.7


Closing fly on the back with formation hem	OM	92	293	100
Topstitch the back hem	OM	54	500	58.6
Closing fly on the side to hem	OM	92	293	100
Sewing shoulders	SMo5	27	1000	29.3
Topstitch the shoulders on back	OM	77	351	83.5


Attaching collar	OM	63	429	68.3


Seaming front fuse with back fuse	OM	9	3000	9.77

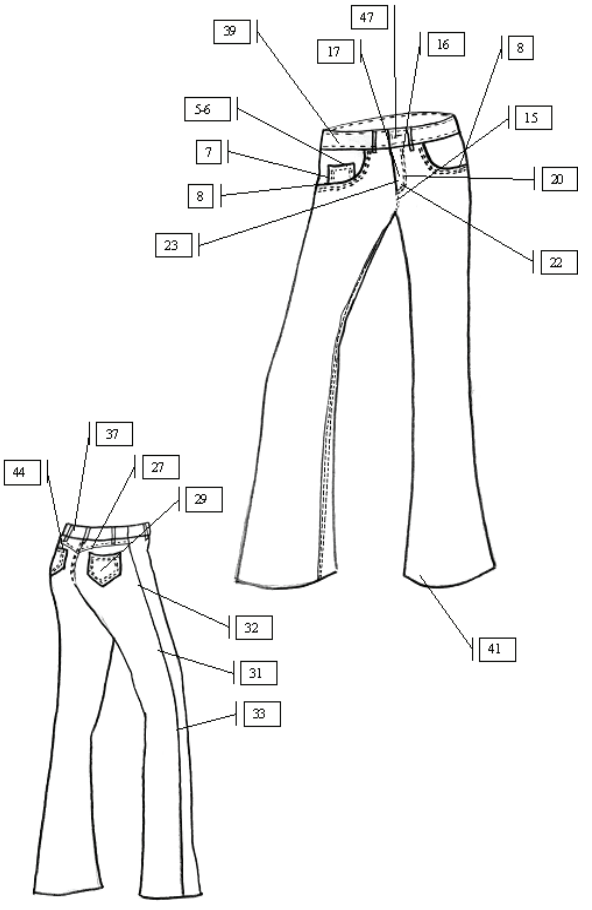
				
Sewing fuse on back	OM	51	529	55.4
				
Topstitch the fuse	OM	91	297	98.7
Topstitch the collar, lapel to end front fuse on hem	OM	312	87	337
Sewing the side seam with label	SMo5	54	500	58.6
Topstitch the back	OM	62	435	67.4
Attacking sleeves	OM	185	146	201
Placing strips on the armholes	OM	497	54	543
Sewing armholes	OM	298	91	322
				
Hem	OM	195	138	212
				
Sewing two buttonholes	AUTh	30	900	32.6
				
Sewing two button	AUTb	16	1688	17.4
Cutting of thread	HM	180	150	195

(Continued)

Ironing	HM	245	110	266
Control	HM	145	186	157
Mount the hanger	HM	6	4500	6.51
Buttoning	HM	9	3000	9.77
Putting paper labels	HM	8	3375	8.68
TOTAL TIME		4263 s		

2.3.4 Technological analysis of operations for making women's trousers

Production line with 28 workers produces 294 pieces of women's trousers per day (Figure 2.8). Time needed for cutting is 347 s (three employees). Technological operation plan for the cutting women's trousers is shown in Table 2.7.



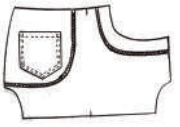
2.8 Women's trousers.

Table 2.7 Technological operation plan for the cutting of women's trousers

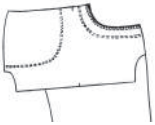
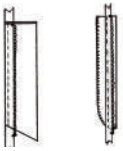
Name of operation	Means of production	Pr quota/a piece (s)	Norma (piece)	Load (%)
Marking length of cutting layout after patterns; spreading material	Hand makes	45	600	39
Planing of cutting layout on material	Hand makes	17	1588	14.74
Rough cutting front and back legs	Straight knife Cutting machine	47	574	40.77
Fine cutting	Vertical cutter	24	1125	20.8
Marking length of cutting layout for interlining for pocket ; spreading interlining for pocket	Hand makes	17	1588	14.74
Fine cutting interlining for pocket	Vertical cutter	7	3857	6.067
Numbering, marking of cut pieces	Hand makes	116	233	100.4
Completing of cut pieces	Hand makes	32	844	27.73
Control	Hand makes	42	643	36.39
TOTAL TIME		347 s		

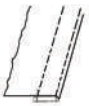
Technological operation plan for the production of women's trousers is shown in Table 2.8.

Table 2.8 Technological operation plan for the production of women's trousers from denim

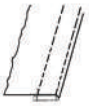
Name of operation	Means of production	Pr quota/a piece (s)	Norma (piece)	Load (%)
Hem watch pocket	OM	10	2520	9.3
Ironing watch pocket	SI	20	1260	18.6
Making position for watch pocket	HM	10	2520	9.3
Sewing watch pocket	SM2	52	485	48.2
				
Sewing in-pocket on pocket bag	OM	45	560	41.8

(Continued)

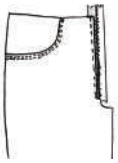
Sewing lacket on pocket bag	OM	53	475	49.3
Sewing pocket bag	SMo5	40	630	37.1
				
Topstitch hole of pocket	SM2	133	189	123.8
				
Closing pocket bag	SMo5	44	573	40.8
Turning pocket bag	HM	6	4200	56
Topstitch pocket bag	OM	23	1096	21.4
Sewing pocket bag with front part (leg)	OM	43	586	39.9
				
Overloch seam on fly	SMo3	12	2100	11.1
Turning on half and overloch seam on underlap	SMo3	10	2520	9.3
Overloch seam front parts in part of underlap	SMo3	30	840	27.9
				
Sewing zipper on fly (3,5cm and 3cm)	OM	38	663	35.3
				
Sewing fly on left front part	OM	50	504	46.4

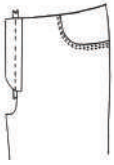
Topstitch on part of fly	OM	60	420	55.7
Making position for topstitch on fly	HM	10	2520	9.3
Topstitch with part of fly	SM2	33	764	30.6

Sewing underlap with zipper	OM	30	840	27.9
Sewing right front part on underlap and sewing part under fly	OM	60	420	55.7



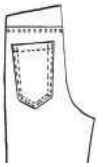
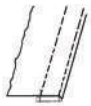
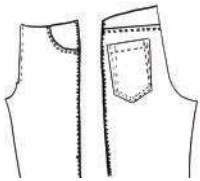

Closing front part under fly	OM	45	560	41.8

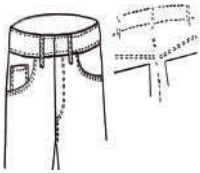



Hem on back pocket	OM	55	458	51.1
Market position for embroidery on back pocket	HM	45	560	41.8
Embroidery on back pocket	OM	95	265	88.3
Ironing back pocket	SI	65	388	60.3
Sewing yoke with back part	SMs	60	420	55.7


Market position for back pocket	HM	60	420	55.7

(Continued)

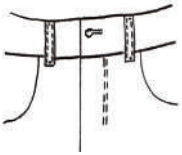
Sewing back pocket	OM	210	120	195
				
Seat seaming	SMs	65	388	60.3
Overloch side seam	SMo3	60	420	55.7
				
Sewing side seam	OM	90	280	83.6
				
Topstitch side seam on back part to the end of pocket bag	OM	40	630	37.1
				
Inseam legs	SMs	180	140	167.1
Making belt loops	SMbl	15	1680	13.9
Cutting belt loops (5cm x15cm)	HM	15	1680	13.9
Sewing belt loops and label	OM	42	600	39
 				
Making belt	SMb	70	360	65



Closing belt	OM	80	315	74.3
Hem legs	OM	120	210	111.4

Making bartack on fly (one)	SMbt	8	3150	7.4
Making bartack on underlap (one)	SMbt	8	3150	7.4
Making bartacks on back pocket (four)	SMbt	20	1260	18.6

Making bartacks on belt loops (ten)	SMbt	75	336	69.6
Making bartacks on belt	SMbt	15	1680	13.9

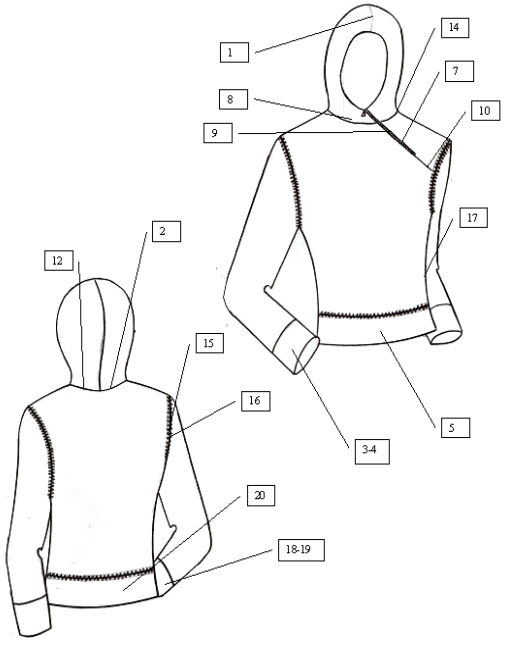


Making rivets on watch pocket and hole of front pocket (six)	PPr	83	304	77
Making metalic button on belt	PPr	7	3600	6.5
Cutting of thread	HM	300	84	278.6
Ironing	Finisher	305	83	281.9
Control	HM	140	180	130
Closed pants	HM	3	8400	2.8
Putting paper labels	HM	10	2520	9.3
TOTAL TIME		3198 s		

A special sewing machine for closed seams (SMs) can be used for the production of a special machine for making belt loops (SMbl), a special machine for making belt (SMb), machine for bartack (SMbt), and pneumatic presses for rivets (PPr).

2.3.5 Technological analysis of operations for making sweat

Production line with 10 workers produces 185 pieces of sweat per day (Figure 2.9). Cutting time for three workers is 443 s. Technological operation plan for the cutting of sweat is shown in Table 2.9.



2.9 Sweat.

Table 2.9 Technological operation plan for cutting sweat

Name of operation	Means of production	Pr quota/a piece (s)	Norma (piece)	Load (%)
Marking length of cutting layout after patterns; spreading matherial	Hand makes	22	1227	15.1
Planing of cutting layout on matherial	Hand makes	4	6750	2.7

Rough cutting: front part, back, sleeves, hood, belt, cuff	Straight knife Cutting machine	32	844	21.9
Fine cutting: front part, back, sleeves, hood, belt, cuff	Vertical cutter	59	458	40.4
Numbering, marking of cut pieces	Hand makes	196	138	134.1
Completing of cut pieces	Hand makes	53	509	36.3
Control	Hand makes	77	351	52.7
TOTAL TIME:		443 s		

Technological operation plan for the sewing and finishing sweat is shown in Table 2.10.

Table 2.10 Technological operation plan for the production of sweat

Name of operation	Means of production	Pr quota/a piece (s)	Norma (piece)	Load (%)
Sewing middle seam internal and external hood (face and inside the hood)	SMo3	31	871	21.2
				
Sewing bar on external hood	OM	18	1500	12.3
				
Sewing cuff with the formation of openings for finger	OM	236	114	162.3
				
Turning cuff	RR	19	1421	13
				
Sewing belt on side	SMo3	5	5400	3.4

(Continued)

				
Turning and bending the belt in half	RR	5	5400	3.4
Sewing shoulder to with shoulder reinforcement	SMo3	16	1688	11
				
Sewing external hood on neck part	SMo3	26	1038	17.8
				
Overloch seam front part for zipper and hole of internal hood	SMo3	17	1588	11.6
				
Sewing front left part with front part from zipper	OM	9	3000	6.2
				
Sewing zipper	OM	182	148	125
Sewing internal and external hood and neck part from the bar	SMo3	392	69	268.1
				
Turning hood	RR	19	1421	13
Closing neck part with bar	OM	75	360	51.4
				
Sewing sleeves	SMo3	46	587	31.5

				
Topstitch on sleeves	SM2	80	338	54.7
				
Side seam, sleeves seam with sewing label	SMo3	49	551	33.6
				
Sewing cuffs	SMo3	31	871	21.2
				
Sewing belt	SMo3	53	509	36.3
				
Topstitch on belt	SM2	72	375	49.3
				
Ironing	PP	135	200	92.5
Control	RR	48	563	32.9
Putting paper labels	RR	8	3375	5.5
TOTAL TIME		1572 s		

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