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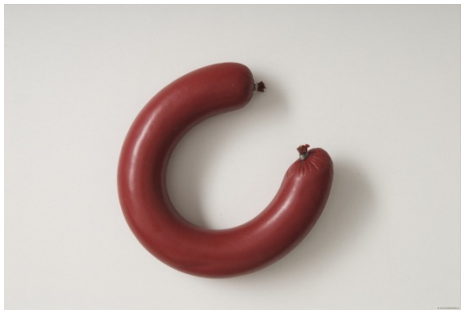
DYPLEX MKo/Rko casing

Process Operating Manual



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1. APPLICATION

This Process Operating Manual describes the process of production of sausages with the use of the **DYPLEX Mko/Rko** casings.

DYPLEX Mko/Rko are multilayer casings (imitating natural guts) made of polyamide, polyolefin, and an adhesive (modified polyethylene) duly approved for use with food products. The quality of the raw materials used for production of the **DYPLEX Mko/Rko** casings is confirmed by Russian and international quality certificates.

The **DYPLEX Mko/Rko** casings are made in accordance with TU 2291-054-27147091-2013 and are intended for production, packaging, long-term storage and sale of all types of semi-smoked, cooked-and-smoked, and cooked sausages made by technologies that involve smoking (smoke-roasting).

The distinctive features of the **DYPLEX Mko/Rko** casings are:

- ring shape
- dynamic permeability, which consists in a substantial increase in the WVTR and the OTR of the casing (up to the level of permeable casings) at temperatures above 60 °C, and a dramatic reduction of the WVTR and the OTR (down to the level of barrier casings) at the temperature of 0-6 °C.

The **DYPLEX Mko/Rko** casings are intended for products sold at retail outlets as whole chubs.

The recommended shelf life for semi-smoked, cooked-and-smoked, and cooked sausages in the **DYPLEX Mko/Rko** casings is not more than 60 days at a temperature between 0 and 6 °C with the relative humidity of the air not exceeding 75 - 78 %.

2. PROPERTIES AND ADVANTAGES

2.1. Specifications of the casing

Table 1

Parameters	Value		Unit measure	Test method	Test conditions
	Mko (outer side of the ring)	Rko (outer side of the ring)			
Thickness	35 ± 3	Not specified because of inhomohene ous surface	µm		Schröder thickness gauge t= 25 ± 2 ^{0}C, humidity =50 ± 5 % RH

Heat shrinkage, MD TD	≥ 10 -	≥ 10 -	%		in water at 70 ^{0}C
WVTR, max.	≤ 60	≤ 60	g/m^2/24 hrs		at 30 ^{0}C, humidity = 90 % RH
OTR, max.	≤ 30	≤ 30	cm^3/m^2 / 24 hrs*atm	DIN 53380	at 25 ^{0}C, humidity.= 0 % RH
Tensile strength, min. MD TD	≥ 18 ≥15	≥ 12 ≥10	kgf/mm^2	GOST 14236-81 (ST SEV 1490-79)	Shimadzu AGS test machine V=100mm/min, 25 ± 2 ^{0}C, humidity =50 ± 5 % RH
Elongation at break, max. MD TD	≤ 150 ≤ 180	≤ 100 ≤ 110	%	GOST 14236-81 (ST SEV 1490-79)	Shimadzu AGS test machine V=100mm/min, 25 ± 2 ^{0}C, humidity =50 ± 5 % RH

2.2. Advantages of the casing

2.2.1. The use of the **DYPLEX Mko/Rko** casings makes it possible to extend the assortment of the products through diversification of the appearance of the sausages (rings, half-rings, festoons, etc.).

2.2.2. Mechanical strength of the casings allows molding of sausages with the use of high-capacity automatic and semi-automatic clippers at high rates of molding;

2.2.3. Permeability to process smoke components at the temperatures used for thermal processing of sausages makes it possible to smoke sausages inside the **DYPLEX Mko/Rko** casings, and

- to impart to the products the desired sensory characteristics (taste, color, aroma);
- to improve microbiological stability of the products through the effect of the process smoke.

2.2.4. Low permeability to oxygen and water vapor at the temperatures of storage of sausages provides for the following advantages of the **DYPLEX Mko/Rko** casings:

- zero losses during the storage of frankfurters and wieners;
- microbiological stability of products during the storage period;

- retardation of the oxidation processes that cause rancidification of fats and changes in the meat product's natural color;
- excellent selling appearance of the finished products (no wrinkles) throughout the shelf life.

2.2.5. Physiological safety - the casings are impervious to microbiological damage, because their formula is inert to the action of bacteria and mold fungi. This facilitates storage of the casings and improves the hygienic characteristics of both the casing itself, and the sausage production.

3. ASSORTMENT

Calibers supplied:
- Dyplex Mko**:** 32 – 80mm;
- Dyplex Rko**:** 32 – 80mm;

Table 2

Ring diameter in Dyplex Mko/Rko

Casing type	Casing caliber, mm	Ring inner diameter, mm
DYPLEX Mko/Rko	32 - 51	9 – 12
	52 - 80	20 - 50

Colors of the **DYPLEX Mko/Rko** casings: clear, smoke, brown, pink, light smoke, light brown, light walnut, dark walnut.

Bespoke colors can be ordered.

The **DYPLEX Mko/Rko** casing can be used for single- or double-sided printing. The number of print colors varies from 1 to 6. CMYK printing is an option.

The flexographic print misalignment with reference to the relative center of the casing is not specified for the **DYPLEX Mko/Rko** casings.

Supply forms:
- rolls;
- shirred sticks.

4. CASING USE TECHNOLOGY

4.1. Storage and transportation of the casing

4.1.1. The casing must be stored in its original packing in dry and clean rooms (at the temperature from 5 ºC to 35 ºC with the relative humidity of the air not exceeding 80%) complying with the sanitary and hygienic standards applicable to the meat processing industry.

4.1.2. It is recommended to open the manufacturer's packing just immediately before use of the casing.

4.1.3. During storage and transportation, the casing should not be exposed to high temperatures or direct sunlight.

4.1.4. If the casing was stored at a subzero temperature, then prior to use hold it in its original packing at room temperature during at least 24 hours.

4.1.5. Never drop the boxes containing the casings or subject them to impacts.

4.1.6. Throughout the technological cycle of production, take care to avoid damage of the casing.

4.2. Preparation of the casing for use

To impart elasticity to the casing and provide for its uniform stuffing, the **DYPLEX Mko/Rko** casings must be pre-soaked. Soak in potable water (SanPiN 2.1.4.1074-01 'Potable Water. Hygienic Requirements for the Quality of Water in Centralized Potable Water Supply Systems. Quality Control') with the temperature of 20-25°C.

Take special care to ensure that water penetrates inside the tube to wet not only the external, but also the internal surface of the casing.

Unshirred casings must be cut into sections of required length before soaking. Keep the spool vertical throughout the unwinding to avoid damaging the ends.

Soak shirred casings without removing the net.

Pre-soaking time:

- not less than 30 minutes for casings cut into lengths;
- not less than 60 minutes for shirred casings.

If too much casing was soaked, remove the leftover casing from the water, drain the excessive water and leave the wet casing away from sources of heat and air drafts. Re-soak and process the casing on the next day.

4.3. Composition of the emulsion

Preparation of the batter for production of semi-smoked, cooked-and-smoked, and cooked sausages shall be done in accordance with the regulatory documents for these products.

During the thermal processing the sausage batter inside the **DYPLEX Mko/Rko** casings may lose from 0.5 to 5% of moisture, therefore the quantity of water to be added to the batter at the stage of cutting shall be determined with regard to this property of the casing.

For the development of new recipes, determine the quantity of the added moisture with regard to the moisture-retaining properties of the additives (emulsifiers, stabilizers, gelling agents, plant proteins, etc.), the raw meat quality, and the technical condition of the equipment, paying special attention to optimal binding of proteins, fats, and water.

All technological measures aimed at increased binding of water (raising the yield) lead to a growth of the pressure in the batter during the thermal processing. Batters with an elevated percentage of meat substitutes tend to swell more. In order to preserve the batter's ability to bind significant amounts of water and to prevent rupture of the casing during the thermal processing, it is recommended to introduce all water-binding additives into the cutter not in a dry form, but in the form of jellies or emulsions.

4.4. Molding of sausage products

The **DYPLEX Mko/Rko** casings are intended for use with automatic and semi-automatic stuffing and clipping equipment, but are also suitable for manual tying.

Never puncture the chubs (perforate the casing). The casing will burst, if punctured.

The ratio between the stuffed caliber to the nominal caliber of the casing is an important factor for the correct use of the casing.

The **DYPLEX Mko/Rko** casings should be filled with sausage emulsion with **10–12%** overstuffing.

The recommended overstuffing relative to the nominal caliber may, however, be somewhat reduced or increased depending on the batter consistence and temperature, the stuffing pressure, and the conditions of cooling after thermal processing. E.g., if the batter has a good binding ability or swelling capacity, it is recommended to reduce overstuffing of the casing relative to the nominal caliber to avoid rupture.

Compliance with these recommendations ensures a good appearance of the finished products, increases the holding capacity of the casing, and reduces the risk of water or fat pockets.

When using shirred casings, make sure that the stuffing horn diameter is appropriate for the inner diameter of the shirred stick: the stick must freely fit the stuffing horn, and the difference between the inner diameter of the stick and the outer diameter of the horn must be as small as possible to mitigate any structural changes in the batter matrix.

Table 3

Diameter of the Dyplex Mko/Rko casing, mm	Shirring tube diameter, mm	Recommended outer diameter of the stuffing horn, mm
32 – 34	21	18
35 - 39	24	18, 20
40 - 42	26	20, 22
43 - 46	28	22, 24
47 - 57	32	24, 28
58 – 69	40	28, 36
70 – 79	52	36, 48
80	61	48

The ring-shaped **DYPLEX Mko/Rko** casing is processed with the use of automatic and semi-automatic clippers equipped with a string feeder and a special receiver tray for the sausage rings. The string length between the sausage ends is adjusted by means of the string feeder. However, if the string feeder is not included in the standard delivery set, this should not be a problem for processing of the ring-shaped casings. The string can be fed manually.

When manual clippers are used, the string is fed into the clipper working zone from the side of the shirred stick and clipped together with the casing.

When the casing is put over the horn, it must be positioned in such a way as to prevent the resulting rings twisting into the working parts of the clipper, and to guide them into the receiver tray.

The clip must securely hold the ends of the chub, without damaging the casing. Observe the recommendations of the clipping equipment manufacturer to ensure tightness of clipping. See Table 4 for recommendations on selection of the clips for the **DYPLEX Mko/Rko** casings.

Recommended clip types

Table 4

Caliber	POLY-CLIP		ALPINA	TECHNOPACK		COMPO	CORUND
	Clip interval 15 interval 18	Clip series S	Clip interval 15 interval 18	Clip series E	Clip series G	Clip series B, BP	
32 - 40	15-7-5×1.5 18-7-5×1.75 15-8-5×1.75	625 628 735	15 /7-5×1.5 18 /7-5×1.75 15 /8-5×1.5	210 410	175 370	B 1, BP 2	XE210 XE 220 2.5x13.6x14
45 - 50	15-7-5×1.5 15-8-5×1.75 18-7-5×1.5	628 735	15 /7-5×1.5 15 /8-5×1.5 18 /7-5×1.75	210 410	175 370	B 2, BP 2	XE 210 2.5x13.6x14
55 - 60	15-7-5×1.5 15-8-5×1.75 18-7-5×1.5	628 632 735	15 /7-5×1.5 15 /8-5×1.75 18 /7-5×1.75	210 410	175 370	B 2, BP 2	XE 220 2.5x13.6x14 2.5x13.6x15
65 - 70	15-8-5×1.5 18-7-5×1.5	628 632 735	15 /8-5×1.75 18 /7-5×1.75	210 220 410	175 370	B 2, BP 2	XE 220 2.5x13.6x15
75 - 80	15-9-5×1.75 18-9-5×2.0	632 638 735 844	15 /9-5×1.75 18 /9-5×2.0	220 410 420	175 200 370	B 2, BP 2 B3, BP3	XE 220 2.5x13.6x15 2.5x13.6x16

4.5. Thermal processing

Thermal processing of cooked, cooked-and-smoked, and semi-smoked sausages in the **DYPLEX Mko/Rko** casings can be performed in heat chambers of different types, but the best results are achieved in universal programmable heat chambers.

The manufacturers should choose their individual thermal processing modes, because the equipment capacity is all important in this process.

The optimal smoking temperature for the **DYPLEX Mko/Rko** casings is 65 – 75 °C, with the duration of smoking not less than 30 minutes. Adjustment of the temperature and duration of smoking controls the thermal processing losses, the thickness of the resulting crust, as well as the color and taste of the product.

We recommend the classical thermal processing, which includes the stages of curing, reddening (heating of the product), drying (color formation), smoking, and cooking:

- heating occurs at moderate temperatures (45 – 50 ºC) to provide for a slow coagulation of proteins and redistribution of heat throughout the volume;

- drying should start at a temperature of 50 – 55 ºC and relative humidity of 15 – 20% for evaporation of moisture off the surface of the casing to facilitate diffusion of the smoke substances into the product. As the drying cycle progresses, the temperature is gradually raised to 60 – 65 °C. At this stage the batter protein coagulates and the 'protein crust' is formed;
- the next stage is smoking at a temperature of about 65 - 75 °C. At this stage the crust further consolidates, and its coloring occurs under the effect of the smoke components;
- cooking is done at the air humidity of 100% and the temperature of 75 – 80 °C until the product is ready for consumption (72 ºC in the core during 10 - 15 minutes); cooking can be combined with smoking.

After completion of the cooking process, it is recommended to carry out a short drying during 5-10 minutes at the temperature of 65 °C.

Examples of thermal processing modes for semi-smoked and cooked-and-smoked sausages in the **DYPLEX Mko/Rko** casings.

The following mode is suitable for the casing calibers 40, 45, 50 and 50.

For the calibers from 60 to 80, the heating time (the first processing stage) must be increased in proportion to the caliber increase, to avoid grey rings and water/fat pockets.

No.	**Stage**	**Temperature, °C**	**Time, min**	**Humidity, %**
1	Heating	50	30	40
2	Drying 2	55	10	0
3	Smoking	65	30	50
4	Drying 2	65	10	01
5	Smoking	70	30	60
6	Drying 2	70	10	01
7	Smoking	75	30	70
8	Cooking	78	until ready	99
9	Drying 2	70	10	01

No.	**Stage**	**Temperature, °C**	**Time, min**	**Humidity, %**
1	Heating	50	30	40
2	Drying 2	55	10	0
3	Smoking	65	20	50
4	Drying 2	65	10	01
5	Smoking	70	30	60
6	Drying 2	70	10	01
7	Smoking	75	40	70
9	Cooking	78	until ready	99
10	Drying 2	70	10	01

Examples of thermal processing modes for cooked sausages in the **DYPLEX Mko/Rko** casings

The following mode is suitable for the casing calibers 55 - 65.

Stage No.	Process	External temperature	Humidity	Time, min
1	Intensive drying	55	0	0:20
2	Intensive drying	65	0	0:10
3	Smoking	70	50	0:25
4	Intensive drying	75	0	0:15
5	Smoking	75	30	0:35
6	Intensive drying	80	0	0:20
7	Cooking	78	100	0:00
8	Cooking	75	100	0:05
9	Intensive drying	70	0	0:10
10	Intensive drying	0	0	0:03
11	End of process	0	0	0:01

4.6. Cooling

Upon completion of the thermal processing, the sausage chubs in the **DYPLEX Mko/Rko** casings must be immediately cooled. Cooling can be carried out under running water or shower, or by means of sprayers with timing devices, until the chub core temperature is down to 25 – 35 °C.

Cold air cooling is not allowed. Exclude any exposure of the finished products to air drafts until completely cooled, because this may cause wrinkles on the surface.

4.7. Transportation and storage of sausage products

Transportation and storage of the sausage products in the **DYPLEX Mko/Rko** casings shall be in accordance with the regulatory documentation for such products (GOST, TU).

5. MANUFACTURER'S GUARANTEES

5.1. The Manufacturer guarantees conformity of the casing with the requirements of the Specifications subject to compliance with the required conditions of transportation and storage at the user's warehouse, and preservation of the integrity of the original packing.

5.2. The shelf life of the casing is 3 years from manufacture.

6. APPENDICES

There are no appendices to this document.

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