

PROTECTIVE ELEMENTS

1. BELLOWS

Application

The function of bellows is to protect vital parts of a machine from dirt, water, weathering, greases, etc.

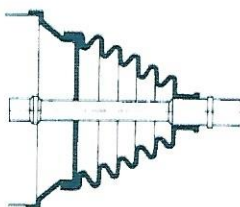
Profile and connecting parts

They consist of the flexible bellows and two connecting parts (Fig. 1). They are mainly designed for specific purposes, so flexible bellows and connecting parts can have very different geometrical configurations and dimensions. Connecting parts can be designed in the form of encapsulated rings, flat flanges, cylindrical collars, etc. (Fig. 2). All flexible parts can consist of two or more convolutions.

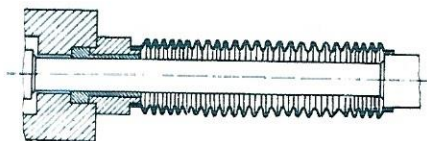
Installation

Bellows are to be tightened to the machine part they protect, and the type of fastening depends on the form of the connecting part. A tubular connecting part with encapsulated ring should have the diameter about 1-2 mm less than the diameter of the machining part to which it is installed, so as to achieve a required contact pressure (fit tightly).

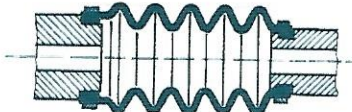
Examples of installation



Bellows protect a machine part with radial movement



Bellows protect a machine part with axial movement



Elastic connection of two machine parts

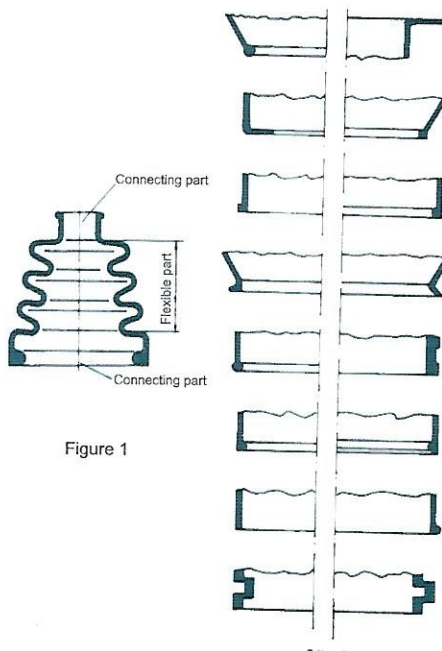


Figure 1

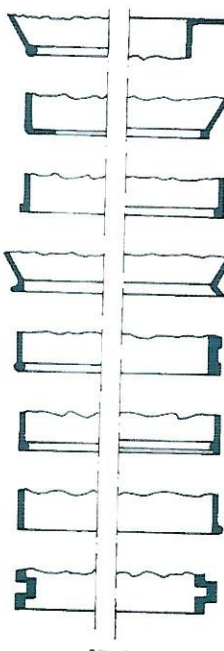


Figure 2

Materials

Which material will be used for manufacture of bellows and other protective elements depends on the application, and the materials used are: natural rubber (NR), acrylonitrile-butadiene-rubber (NBR), styrene-butadiene rubber (SBR), chlorobutadiene rubber (CR), ethylene-propylene-diene-rubber (EPDM), silicone-rubber, and thermoplastics.

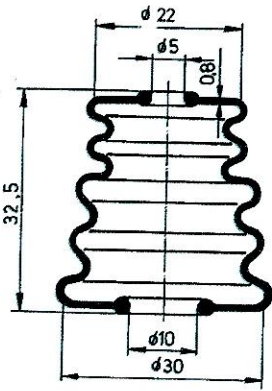
Table 1.

Base polymer	PPT designation	°ShA hardness ± 5	Temperature range °C		Application
NBR	50 NBR 10.1 60 NBR 14.1 70 NBR 14.1	50 60 70	-30	+100	Mineral greases and oils Aliphatic hydrocarbons Mineral transmission fluids Vegetable greases and oils Air Water
	60 NBR 11.2 70 NBR 11.2 80 NBR 11.2	60 70 80	-40 (-50)*	+80	Air and oiled air Lubricant greases based on lithium Water
	70 NBR 11.21	70	-50	+80	Air and oiled air Lubricant greases based on silicon Water
CR	40 CR 07.1 50 CR 09.1 60 CR 10.1 70 CR 11.1	40 50 60 70	-40	+100	Weathering effects, light, ozone Drinking and sea water Freon types 11 and 12
NR	40 NR 14.1 50 NR 14.1 60 NR 14.1	40 50 60	-50	+80	Brake fluids based on glycol Diluted acids and bases Alcohols and water
SBR	60 SBR 14.2 70 SBR 14.2	60 70	-40	+120	Brake fluids, water-alcohol mixture All types of alcohols
EPDM	50 EPDM 10.1	50	-40	+100	Brake fluids Silicone oils and greases Acids and bases Air and ozone effects Water and water steam
	50 EPDM 12.1	50	-40	+130	Phosphorous esters Hot water and water steam Acids and bases Ketones Silicone oils Air and ozone effects
MVQ	70 MVQ 05.1	70	-60	+200 (+230)*	Hot air and inert gases Ozone UV rays Mineral oils with high aniline point

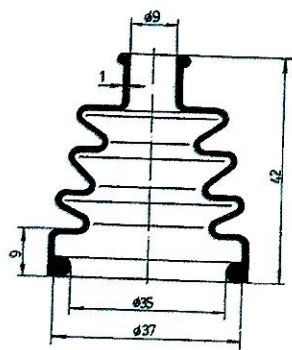
* Possibility of short term application

The materials can be selected by a designer or manufacturer, based on information on operating conditions and technical characteristics

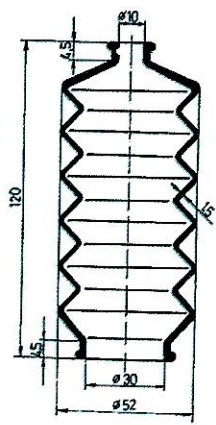
Types of bellows



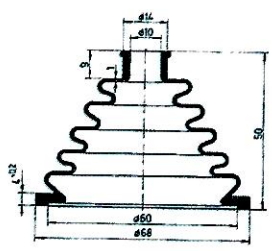
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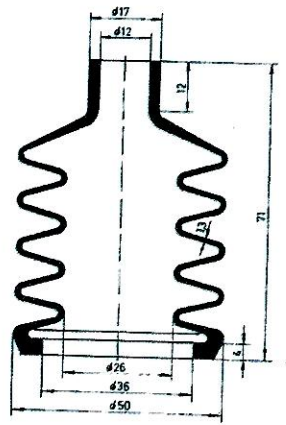
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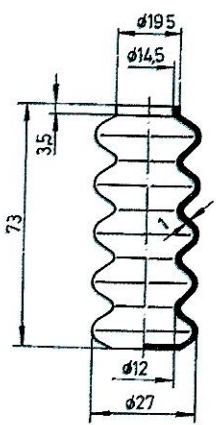
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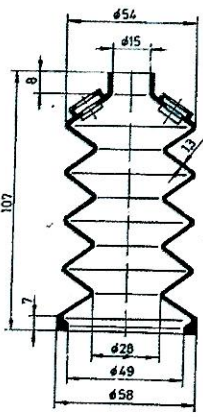
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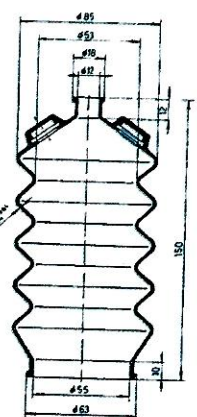
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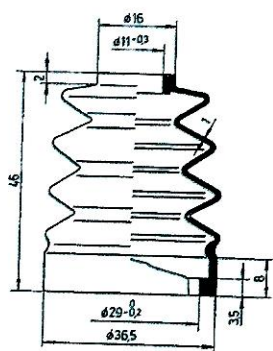
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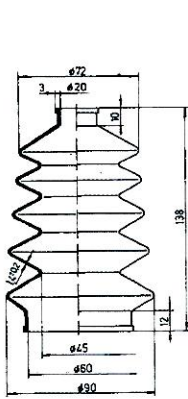
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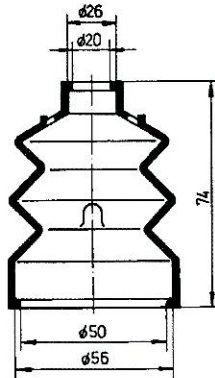
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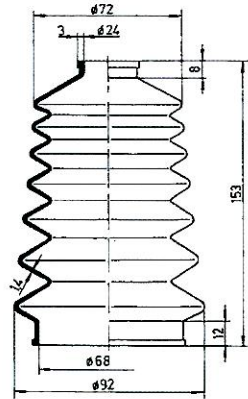
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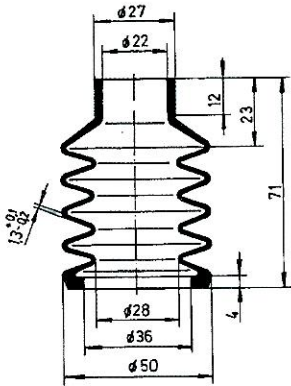
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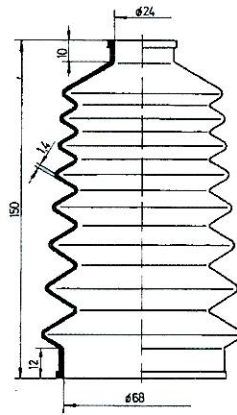
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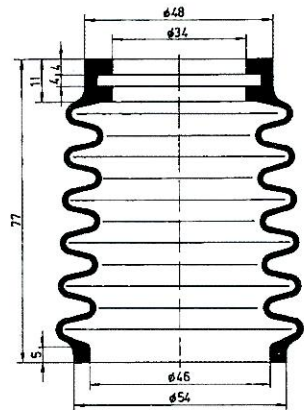
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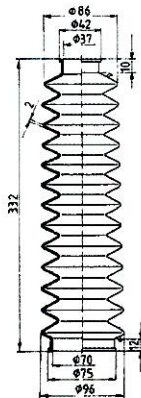
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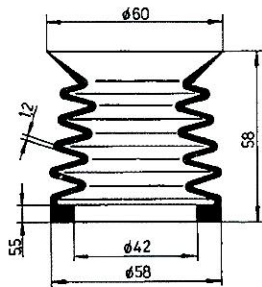
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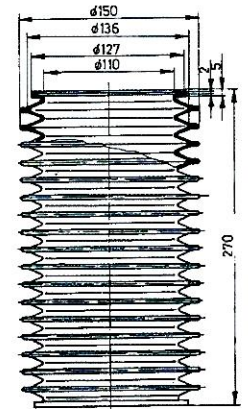
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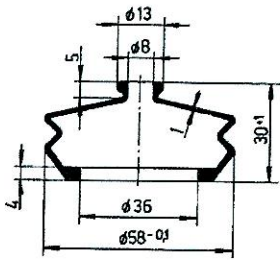
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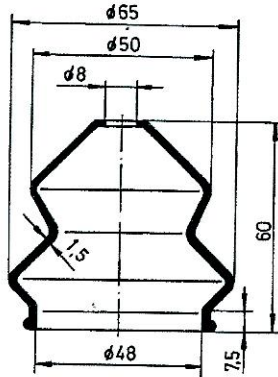
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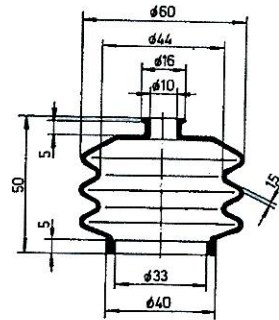
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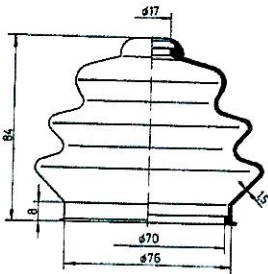
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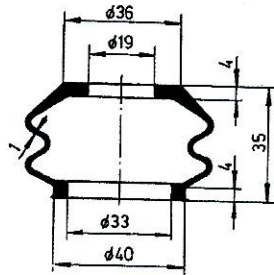
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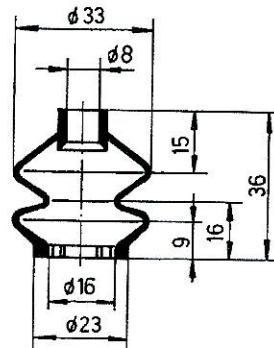
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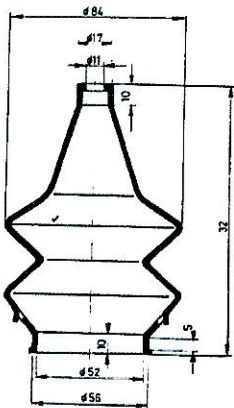
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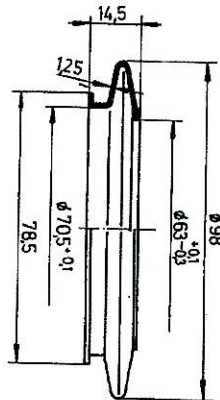
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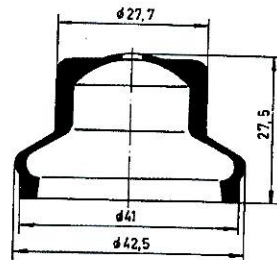
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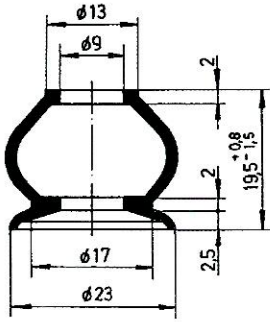
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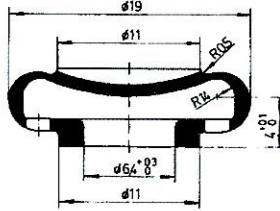
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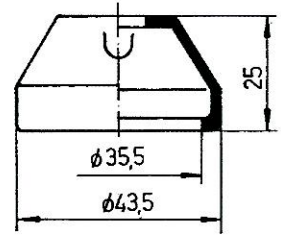
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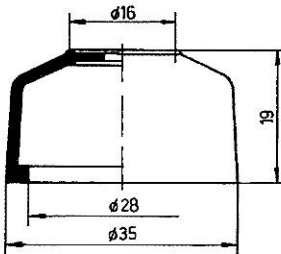
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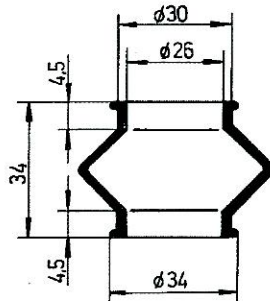
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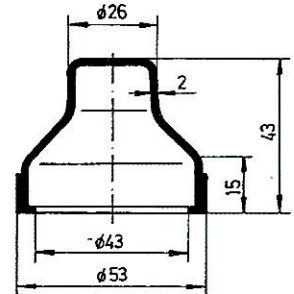
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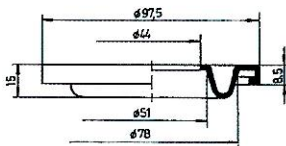
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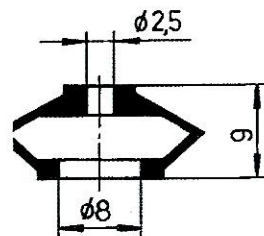
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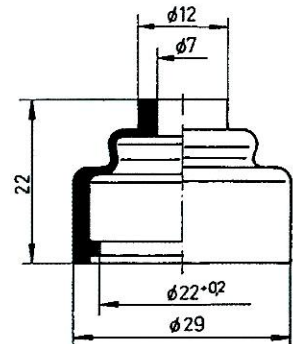
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