

# CORESTA RECOMMENDED METHOD N° 64

## ROUTINE ANALYTICAL CIGAR-SMOKING MACHINE SPECIFICATIONS, DEFINITIONS AND STANDARD CONDITIONS

(November 2005)

### 0. INTRODUCTION

This Method includes the requirements found necessary in the light of knowledge and experience gained with analytical cigar-smoking machines.

### 1. FIELD OF APPLICATION

This Method :

- defines the smoking parameters and specifies the standard conditions to be provided for the routine analytical machine smoking of cigars;
- specifies requirements for a routine analytical smoking machine complying with the standard conditions.

### 2. DEFINITIONS

#### 2.1. *Ambient Conditions*

The whole of the variable parameters physically characterising the conditions in the room and environment in which the analytical smoking is carried out.

#### 2.2. *Butt Length*

The length of unburnt cigar remaining at the moment when the smoking is stopped (where applicable: including filter and/or mouthpiece).

For “V-cut” cigars the length of the “V” is included in the butt length.

Cigars with closed mouth end shall be cut straight at 5 mm from the mouth end. The length of the removed part is not included in the butt length.

#### 2.3. *Restricted Smoking*

The condition that exists when the butt end of a cigar is closed to the atmosphere between successive puffs.

#### 2.4. *Free Smoking*

The condition that exists when the butt end of a cigar is completely exposed to the atmosphere between successive puffs.

**2.5.** *Pressure Drop*

The difference in static pressure between any two points of the pneumatic circuit of a smoking machine which are passed by a current of air at a constant flow rate of  $17,5 \text{ ml sec}^{-1}$ .

**Note :** The term draw resistance has a very similar meaning. To avoid any confusion the term draw resistance is used for cigars, whereas the term pressure drop is used by analogy in the case of the pneumatic circulation in a smoking machine.

**2.6.** *Puff Duration*

The interval of time during which the port is connected with the suction mechanism.

**2.7.** *Puff Volume*

The volume leaving the butt end of a cigar and passing through the smoke trap.

**2.8.** *Puff Number*

The number of puffs necessary to smoke a cigar to a specified butt length.

**2.9.** *Puff Frequency*

The number of puffs in a given time.

**2.10.** *Puff Termination*

The ending of the connection of the port with the suction mechanism.

**2.11.** *Puff Profile*

The flow rate measured directly behind the butt end of a cigar and depicted graphically as a function of time.

**2.12.** *Dead Volume*

The volume which exists between the butt end of a cigar and the suction mechanism.

**2.13.** *Cigar Holder*

The device for holding the mouth end of a cigar during smoking.

**2.14.** *Smoke Trap*

The device for collecting such part of the smoke from a sample of cigars as is necessary for the determination of specified smoke components.

**2.15.** *Port*

The aperture of the suction mechanism through which a puff is drawn and to which is attached a smoke trap.

**2.16.** *Channel*

An element of a smoking machine consisting of one or more cigar holders, one trap and a means of drawing a puff through the trap.

**2.17. *Cigar Position***

The position of a cigar on the smoking machine. In particular it is determined by the angle made by the longitudinal axis of the cigar and the horizontal plane when a cigar is inserted into a cigar holder in an analytical smoking machine.

**2.18. *Mainstream Smoke***

All smoke which leaves the butt end of a cigar during the smoking process.

**2.19. *Sidestream Smoke***

All smoke which leaves a cigar during the smoking process other than from the butt end.

**2.20. *Ashtray***

The device positioned under the cigars in their holders to collect ash falling from the cigars during smoking.

**2.21. *Clearing Puff***

Any puff taken after the cigar has been extinguished, with the same volume as drawn while smoking.

### **3. REFERENCES**

*CORESTA Recommended Method N° 46: 1998*

Atmosphere for conditioning and testing cigars of all sizes and shapes.

*CORESTA Recommended Method N° 47: 2000*

Cigars – Sampling.

*Informative : ISO 3308 – Annex A*

### **4. STANDARD CONDITIONS**

**4.1. *Machine Pressure Drop***

The whole of the flow path between the butt end of the cigar and the suction mechanism shall offer the least possible resistance and its pressure drop shall not exceed 300 Pa.

**4.2. *Puff Duration***

The standard puff duration shall be 1,5 s , with a standard deviation of not greater than 0,05 s for individual puffs.

**4.3. *Puff Volume***

The standard puff volume measured in series with a pressure drop of 1 kPa shall be y ml with a standard deviation for individual puffs not greater than 0,30 ml.

In one puff duration (2.6) not less than 95% of the puff volume shall leave the butt end of the cigar.

The puff volume  $y$  is dependant on the diameter of the cigar ( $x$ ) as follows :

Cigar diameter $x$ (mm)	Puff volume $y$ (ml)
$\leq 12,0$	20
$\geq 12,1$	$y = 0,139 * x^2$

where:  $y$  = puff volume, in ml (to the nearest 1 ml)  
 $x$  = cigar diameter, in mm (to the nearest 0,1 mm)

**Note :** The formula [  $y = 0,139 * x^2$  ] is based on the principle of a constant airspeed of 11,8 cm/s.

#### 4.4. *Puff Frequency*

The standard puff frequency shall be one puff every 40 s with a standard deviation for this time not greater than 0,5 s.

#### 4.5. *Puff Profile*

The puff profile, when measured on an unlit cigar, shall be bell-shaped with a maximum between 0,6 s and 0,9 s from the start of the puff. The increasing and decreasing parts of the profile shall not have more than one point of inflection each.

The maximum flow rate shall be such that, measured with a draw resistance of 1000 Pa :

$$\text{Maximum Flow} = \text{Puff Volume} * 1.05, \text{ with a tolerance of } \pm 15\%$$

At no point should the direction of flow be reversed.

#### 4.6. *Restricted Smoking*

An analytical smoking machine shall be a restricted smoker.

#### 4.7. *Puff Number*

Each individual puff shall be counted and recorded and the puff number rounded off to the nearest one-tenth of a puff based on the puff duration. The clearing puff shall not be included in the puff number.

#### 4.8. *Cigar Holders*

The standard cigar holder shall cover 28 mm, measured from the butt end of the cigar to the supportbar of the cigar holder, and shall be impermeable to smoke components and to air. The standard cigar holder shall be designed to avoid leakage between the cigar and cigar holder.

The cigar holder shall be equipped with a soft breaker plate (end seal) for the purpose of sealing airtight around the butt end of the cigar without increasing the draw resistance.

The construction of the cigar holder is designed to accommodate cigars with a diameter between 6,5 mm and 22,5 mm (see Figure 1). Depending on the diameter of the cigar the best option for bobbin-diameter, sleeve-diameter and end seal-diameter should be selected by the experienced operator : the bobbin-diameter usually will be 1 mm to 2 mm larger than the cigar-diameter, and the corresponding sleeve-diameter shall be selected (see table 1). The end seal diameter shall be selected to accommodate

for the specific head shape of the cigar. Any wrinkling of the cigars must be avoided, as to prevent leakage during machine smoking.

An example of a possible holder is given in the informative Appendices : Figures 2, 3, 4 and 5, together with the corresponding holder construction types.

#### **4.9. *Cigar Position***

The angle formed by the longitudinal axis of the cigar and the horizontal plane shall be as small as possible; it shall not exceed 10° if the centre of the butt end is lower than the centre of the other end and 5° if the centre of the butt end is higher than the centre of the other end.

The cigar holders shall be arranged so that no cigar influences the burning of any other cigar.

#### **4.10. *Ashtray Position***

The ashtray shall be placed in a horizontal plane at least 30 mm below the plane of the axes of the cigars.

### **5. SPECIFICATION FOR THE ROUTINE ANALYTICAL SMOKING MACHINE**

The smoking machine shall comply with the standard conditions (see 4.1 to 4.10) and the following special conditions.

#### **5.1. *Operating Principle and Puff Profile***

The machine shall include a device to draw a fixed volume of air (puff) through a cigar.

**5.1.1.** The machine shall produce a bell-shaped puff profile (see 4.5)

**5.1.2.** The machine shall be a restricted smoker (2.3)

#### **5.2. *Reliability***

The machine shall contain devices to control the puff volume, the puff duration and the puff frequency.

**5.2.1.** The machine shall possess the mechanical and electrical reliability necessary to meet the standard conditions regarding these parameters (see 4.2, 4.3 and 4.4) for prolonged periods.

**5.2.2.** The connecting piping between the smoke trap and the suction source shall offer the least possible resistance to flow. The pressure drop of the total flow path between the butt end of the cigar and the suction source shall not exceed 300 Pa before smoking (see 4.1).

**5.2.3.** The total dead volume (2.12), on any channel, shall not exceed 125 ml.

#### **5.3. *Cigar Holders and Smoke Traps***

The machine shall contain devices for holding the cigar and for trapping the smoke produced.

- 5.3.1.** The cigar holders shall be capable of holding the butt end of the cigar during smoking. The standard conditions relative to the length of butt covered by this device and the air tightness of the seal are given in 4.8.  
Sleeve seals shall be used for attaching cigars.
- 5.3.2.** Devices shall be provided for attaching cigar holders to the machine, so that the cigar holders are held rigidly. A screwed fitting or "O" ring seal is recommended. Rubber tubing is considered to be unsatisfactory.
- 5.3.3.** The cigars to be smoked shall be attached to the ports or the smoke traps by standard cigar holders (see 4.8).
- 5.3.4.** The machine shall be designed to hold the cigars in the standard position (see 4.9).  
The system shall be designed to prevent losses of smoke components between the butt end of the cigar and the smoke trap.
- 5.3.5.** The cigar holders shall be arranged so that the sidestream smoke does not affect cigars smoked in adjacent holders (see 4.9). The distance between the centres of adjacent burning zones shall be at least 60 mm.
- 5.3.6.** When the smoking machine is used for collecting particulate matter it shall be fitted with a glass fibre filter smoke trap, comprising:
- Filter holders made of an airtight, non-hygroscopic and chemically inert material, fitted with end cap seals of the same material, able to contain a filter disc of glass fibre material 1 mm to 2 mm thick. The rough filter surface shall face the oncoming smoke.  
Different designs of smoke trap can meet this requirement. For smoking machines where 1 or 2 cigars are smoked per trap the diameter of the glass fibre filter shall be 55 mm.
  - Filter material which shall retain at least 99,9 % of all particles having a diameter equal to or greater than 0,3 micrometer of a dioctyl phthalate aerosol at a linear air velocity of 140 mm s<sup>-1</sup>. The pressure drop of the filter assembly shall not exceed 900 Pa at this air velocity. The content of binder shall not exceed 5% as mass factor. Polyacrylate and polyvinyl alcohol (PVA) have been found to be suitable binders for this material.  
The filter assembly shall be capable of quantitatively retaining all of the particulate matter in the mainstream smoke produced by the cigar without loss. In addition, the filter assembly shall be chosen so that the increase in pressure drop of the assembly does not exceed 250 Pa when measured after the smoking run.
- 5.3.7.** Depending on the shape of the cigar, each channel shall have a puff termination device linked to a butt length (mark) sensor and a puff counter. When activated by the sensor the device shall prevent any further drawing of air through the cigar.  
Alternatively, when the shape of the cigar does not allow the use of a puff termination device, the smoking shall be stopped manually when the coal reaches the butt mark, preventing any further drawing of air through the cigar.
- 5.3.8.** The machine shall be capable of smoking a wide range of cigars of different lengths,

diameters and cross-sectional shapes while complying with the standard conditions regarding cigar butt lengths.

**5.3.9.** The machine shall be capable of making one clearing puff after the termination of smoking.

**5.4.** *Ambient Conditions*

The temperature and relative humidity of the ambient conditions shall correspond to those specified in CORESTA Recommended Method N° 46 : 1998.

- Temperature:  $22^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Relative humidity:  $(60 \pm 5)\%$

**5.5.** *Puff Counting*

Each port shall have its own puff counter capable of counting to the nearest 0,1 puff (see 4.7).

**5.6.** *Ignition*

Flameless ignition shall be used where possible. The lighters shall light the cigars without either touching or pre-charring the cigar. Lighting of each cigar must be done in such a way that the whole surface of the fire-end of the cigar is burning. It is the operator's decision whether a 2<sup>nd</sup> or 3<sup>rd</sup> or ... n<sup>th</sup> lighting puff is required.

Where – due to the cigar shape – flameless ignition of the cigar is not possible by the standard lighters fitted on the smoking machine, lighting shall be done by means of a handheld electrical lighter or by a conventional gas lighter.

**5.7.** *Smoking Enclosure*

The smoking process shall be carried out in an environment, that allows the removal of sidestream smoke by minimum extraction, to generate a straight vertical smoke plume of approximately 10 cm during set up of the machine.

## APPENDICES

Figure 1: Basic Dimensions of Cigar Holder Arrangements

Table 1: Recommended Bobbins, Sleeves and Buffer Washers

Figure 2: Example of Holder Assembly for Cigars  $\varnothing$  6.5 to 16.49 mm (Construction Type 2 for ventilated cigars)

Figure 3: Example of Holder assembly for Cigars  $\varnothing$  16.5 to 22.49 mm (Construction Type 2 for ventilated cigars)

Figure 4: Example of Trap Assemblies for Cigars  $\varnothing$  6.5 to 16.49 mm and  $\varnothing$  16.5 to 22.5 mm

Figure 5: Example of Trap & Holder Assemblies for Cigars  $\varnothing$  6.5 mm to 16.49 mm and  $\varnothing$  16.5 to 22.5 mm (Construction Type 2 for ventilated cigars)

### Holder Construction Types :

Cigar Holder Construction Type 1 ( 1 seal / bobbin / 2 seals / endseal ) is to be used for unventilated cigars.

Cigar Holder Construction Type 2 ( 2 seals / bobbin / 1 seal / endseal ) is to be used for ventilated cigars (see figures 2, 3 and 5)

Transcription of some references used in figures 2 and 3:

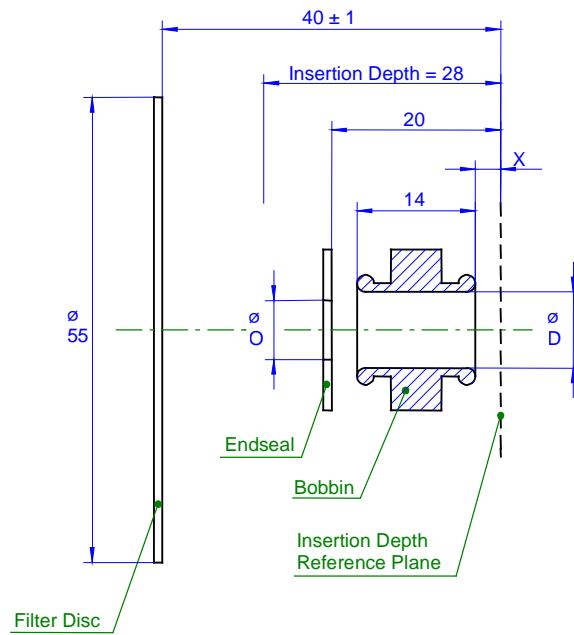
N° 1 = Bobbin

N° 4 = Seal

N° 6 = Endseal

N° 8 = Sleeve

**Figure 1 - Basic Dimensions of Cigar Holder Arrangements**



All Dimensions in [mm]

Diameter D and O and  
Dimension X according to Table 1

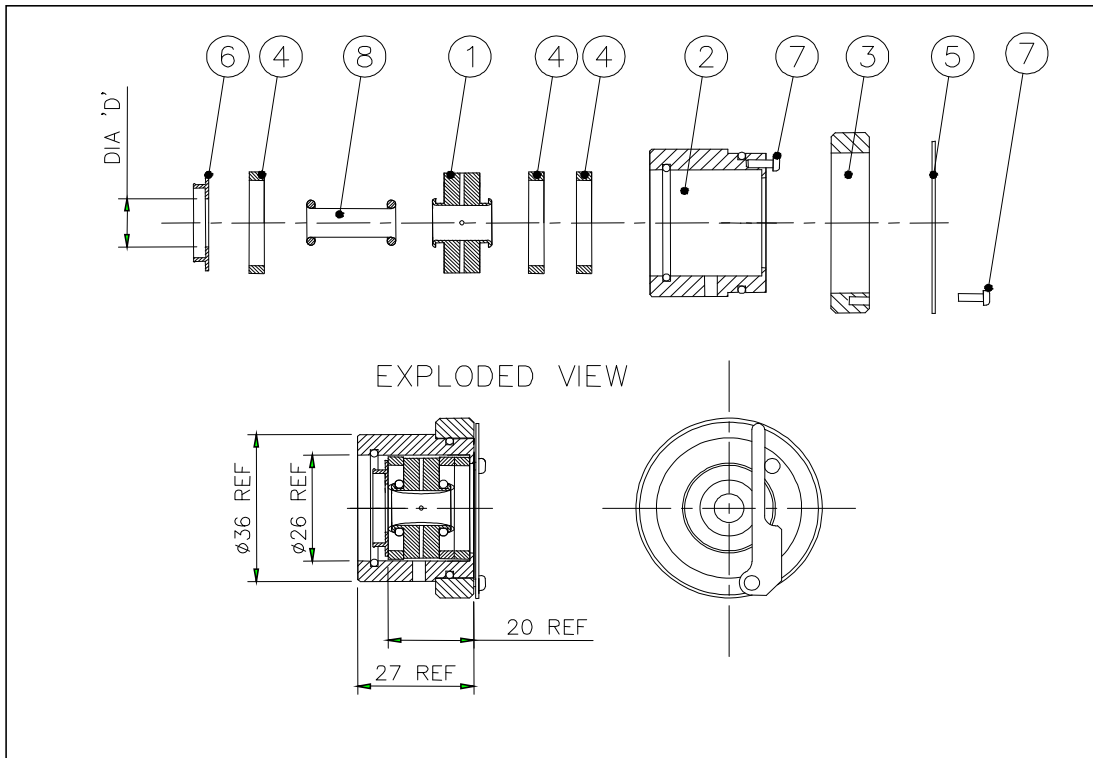
**Table 1 : Recommended Bobbins, Sleeves and Buffer Washers**

Cigar Diameter [mm]			Recommended Bobbin internal Diameter (Ref. D) [mm]			Recommended Sleeve Diameter [mm]			Endseal internal Diameter (Ref. O)
6,5	-	7,5	8,5	or	9,5	4,5	or	5,0	to be selected by the operator to accommodate the headshape of the cigar
7,5	-	8,5	9,5	or	10,5	5,0	or	5,5	
8,5	-	9,5	10,5	or	11,5	5,5	or	6,0	
9,5	-	10,5	11,5	or	12,5	6,0	or	7,0	
10,5	-	11,5	12,5	or	13,5	7,0	or	8,0	
11,5	-	12,5	13,5	or	14,5	8,0	or	9,0	
12,5	-	13,5	14,5	or	15,5	9,0	or	10,0	
13,5	-	14,5	15,5	or	16,5	10,0	or	11,0	
14,5	-	15,5	16,5	or	17,5	11,0	or	12,0	
15,5	-	16,5	17,5	or	18,5	12,0	or	13,0	
16,5	-	17,5	18,5	or	19,5	13,0	or	14,0	
17,5	-	18,5	19,5	or	20,5	14,0	or	15,0	
18,5	-	19,5	20,5	or	21,5	15,0	or	16,0	
19,5	-	20,5	21,5	or	22,5	16,0	or	17,0	
20,5	-	21,5	22,5	or	23,5	17,0	or	18,0	
21,5	-	22,5	23,5	or	24,5	18,0	or	19,0	

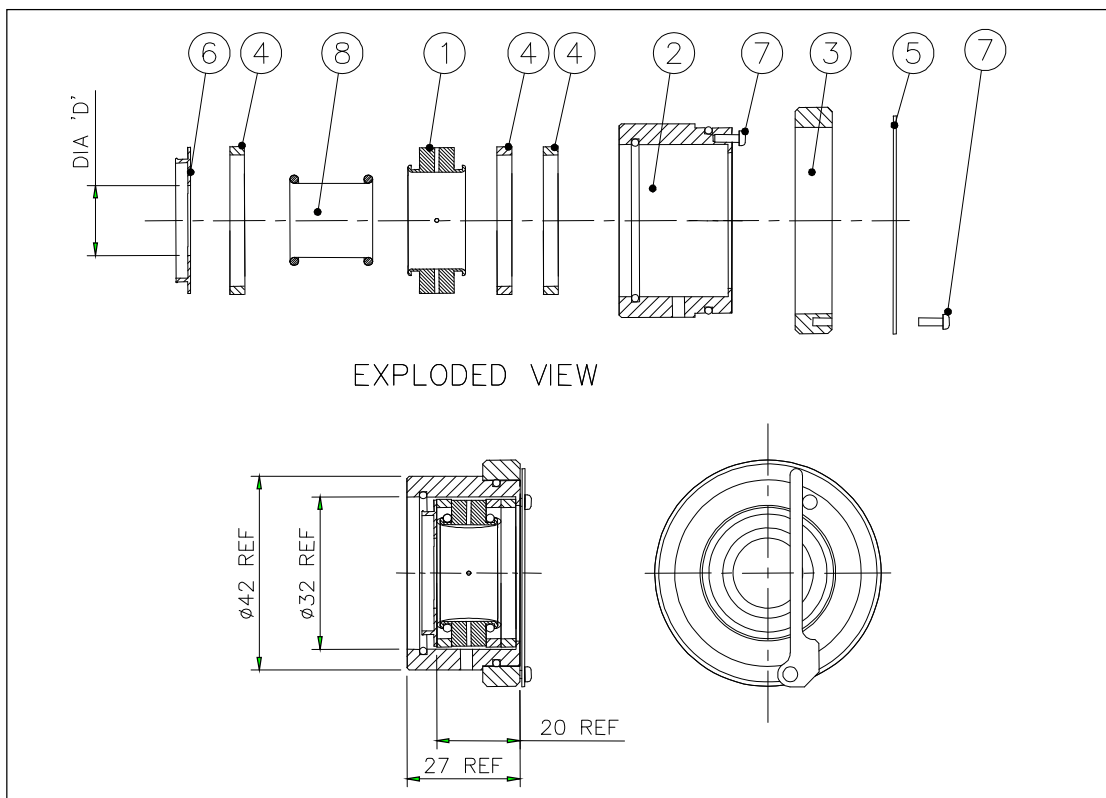
X = 5,5 ± 0,5 mm for ventilated cigars  
X = 2,0 ± 0,5 mm for non ventilated cigars

(see Figure 1)  
(see Figure 1)

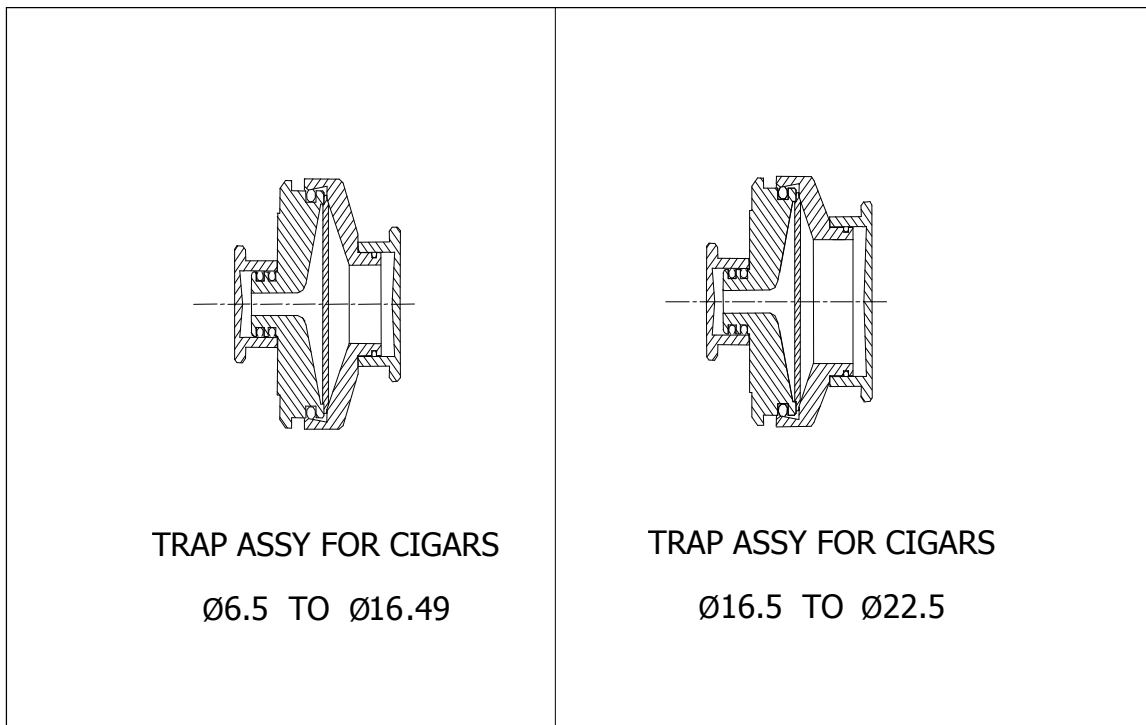
**Figure 2 - Example of Holder Assembly for Cigars  $\varnothing$  6.5 to 16.49 mm (Construction Type 2 for ventilated cigars)**



**Figure 3 - Example of Holder assembly for Cigars  $\varnothing$  16.5 to 22.49 mm (Construction Type 2 for ventilated cigars)**



**Figure 4 - Example of Trap Assemblies for Cigars  $\varnothing$  6.5 to 16.49 mm and  $\varnothing$  16.5 to 22.5 mm**



**Figure 5 - Example of Trap & Holder Assemblies for Cigars  $\varnothing$  6.5 mm to 16.49 mm and  $\varnothing$  16.5 to 22.5 mm (Construction Type 2 for ventilated cigars)**

