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|------------------------------------|---|---|--|
| TS-16-01.2012 | TECHNICAL SPECIFICATION METAL CLOSURES TWIST OFF (for glass jars type Twist off) |  |  |
| Validity from/to: 01.12.2012r.- | | | |
| Page 1/3 | PRODUCER: ALIANS-DN, LTD 6000 Stara Zagora, Bulgaria 17 B, P.Evtimij blv. | tel/fax: +359 42 981788 e-mail: alianscaps@gmail.com www.alians-dn.bg | |
| Version: 06 | | | |

Twist-Off (TO) belong to the group of metal vacuum closures, which form a hermetical seal on a suitable jar container immediately after the capping process.

1. DEFINITION

This specification is applied to metal lug closures type TO designed to close standard glass jars (not deep), with PVC inner sealing ring (plastisol) to provide vacuum.

METAL CLOSURES (LUG CAPS) TWIST OFF

Produced by electrolytic tinplate (metal sheets), covered both sides with coating/varnishing materials. Print on top is an option.

There are 4 - 8 lugs (depends on the shape and diameter,) formed into a closure curl.

Vacuum provided by inner PVC ring (universal compound), which creates sealing during the thermal process. Due to the glass thread pitch, a defined spring tension forms in the closure lug. That ensures a firm conjunction between closure and glass.

Temperature Resistance: for pasteurization (max 105° C/60 minutes), sterilization (121° C/60min, optional 131° C/60 min). Information is written on the label.

TO closures meet Regulation (EC) No. 1935/2004 for materials and articles intended to come into contact with food.

Profiles:

- RTS (Regular Twist off with step- shape of the groove)
- RSB (Regular Twist off with a vacuum click button)
- RTO (Regular Twist off)
- RTB (Regular Twist off with vacuum button)

2. TECHNICAL DATA

2.1. Metal specification:

| |
|---|
| • Standard EN 10202:2011 –Cold reduced tin-mill products. Electrolytic tinplate and electrolytic chromium/chromium oxide coated steel. |
| • Thickness: 0,15-0.17 mm; (TO 53-82); Thickness: 0,19-0.21 mm; (TO 100-110); |
| • Temper/Annealing: TH 580-620; DR (double reduced); |
| • Tin coating upside/downside (gr/m ²) min 1.5/1.5 (standard 2.8/2.8); |
| • Surface: Fine Stone; Stone; Passivation: standard 311; Oiling: standard DOS; |
| • Coating/Lacquering (g/m ²) - by recommendation of producers (TDS). Optimized film weight; |
| • Sheet size: max 100cm x100 cm; |
| • Closures comply with legislation CEE directive 94/ 62/ CE - in relation to heavy metal contents. |

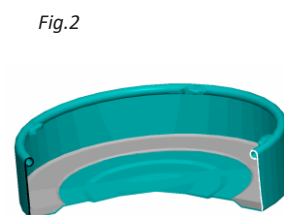
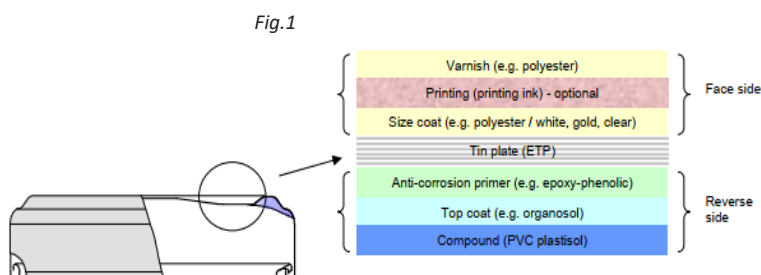
2.2. Chemical composition of tinplate (in %), for TH 620, (tolerance 1% is acceptable) - Table 1:



| C | Si | Mn | Ni | Cr | P | S | Al | Cu | Fe |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------|
| Max 0.08 | Max 0.03 | Max 0.35 | Max 0.08 | Max 0.08 | Max 0.02 | Max 0.02 | Max 0.08 | Max 0.08 | The rest to 100% |

2.3. Coating/Varnishing by Commission Regulation (EC) No. 1895/2005 for restriction of usage of certain epoxy derivatives in materials and articles intended to come into contact with food (Fig.1).

Coating and drying technology are timely and technologically separated. Passing the substances from top to reverse is practically not possible. Food contact is protected, not risk for contamination;

- **External protection (Top):** Size coat (polyester): Gold, Clear, colored Enamels in combination with Polyester transparent overprint varnishing, for stable, flexible and resistible external protection, compatible with conventional and UV inks;
- **Internal protection (Reverse):** System of anticorrosion primer size and adhesive varnish (organozol, BPA NI); food grade;



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2.4. Sealing ring: PVC compound (plastisol) by EU Regulation No 10/2011- for plastic materials intended to come into contact with food (fig.2).

TO equipped with sealant aligned to the requirements of the respective sealing and thermal conditions. The compounds differ in their mechanical properties, and lubricants, which contributes to the opening torque of the final package. The sealant is introduced into a ring-shaped channel in the closure seal area. The choice of the suitable compound is in relation to the closure diameter. Alians-DN uses PVC plastisols on DOTP base, without phthalates and Bisphenol A.

Plastisol and Varnishing system comply with the follow requirements:

- Specific migration of primary aromatic amine (PAA) contents – are in the limit of detection 0,01mg/kg of food;
- Specific migration of metal ions contents - by the restriction limits listed in the Annex II of Reg. EU No 10/2011;
- Overall migration limit: Max 60 mg/kg of food (or 10 mg/dm² of food contact surface), with specification of the food content.

3. SHAPE, SIZE, TECHNICAL DATA, PACKING

Fig. 3

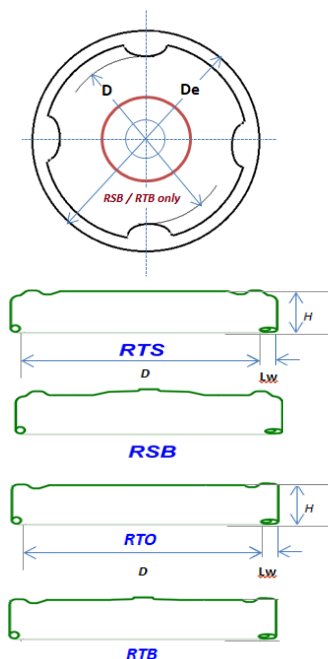


Table 2

| Cap diam (mm) | mm | | | | | Average weight (g/cap) | Cap Composition(%) | | | Packing | | | | |
|----------------|-------------------------|------------------------------------|--------------------|----------------|--------------|------------------------|--------------------|---------|------------|----------|-------------|----------|---------------|----------------|
| | H (finished cap height) | D (internal diameter between lugs) | De (external diam) | Lw Lug (width) | Lug (height) | | Metal | Coating | PVC gasket | Pcs /box | Boxes /pall | Box size | Gross kg /box | Gross kg /pall |
| Φ110 (RSB) | 15.70-16.30 | 105.90-106.60 | 113.20 +0.05 | 3.45-3.70 | 14.70-15.00 | 28.05 +0.7 | 88 | 2 | 10 | 270 | 36 | 40x40x40 | 10 | 370 |
| Φ100 (RTS/RSB) | 13.30-13.90 | 96.60-97.00 | 103.43 +0.05 | 3.25-3.60 | 12.30-12.60 | 20.8 +0.5 | 88 | 2 | 10 | 360 | 36 | 40x40x40 | 10 | 370 |
| Φ82 (RTS/RSB) | 10.30-10.90 | 78.10-78.60 | 85.14 +0.05 | 3.20-3.65 | 9.30-9.70 | 12.5 +0.5 | 88 | 2 | 10 | 700 | 36 | 40x40x40 | 10 | 370 |
| Φ77 (RTS/RSB) | 9.30-9.90 | 72.95-73.46 | 80.05 +0.05 | 3.20-3.65 | 8.60-8.25 | 11.25 +0.2 | 88 | 2 | 10 | 900 | 36 | 40x40x40 | 12 | 445 |
| Φ66 (RTS/RSB) | 9.30-9.90 | 61.90-62.75 | 69.25 +0.05 | 3.20-3.65 | 8.25-8.70 | 8.8 +0.2 | 88 | 2 | 10 | 1250 | 36 | 40x40x40 | 12 | 445 |
| Φ63 (RTS/RSB) | 9.30-9.90 | 59.30-59.95 | 66.40 +0.05 | 3.20-3.65 | 8.25-8.70 | 8.1 +0.2 | 88 | 2 | 10 | 1300 | 36 | 40x40x40 | 12 | 445 |
| Φ58 (RTO/RTB) | 9.30-9.90 | 53.20-53.80 | 60.22 +0.05 | 3.20-3.65 | 8.25-8.70 | 7.2 +0.2 | 88 | 2 | 10 | 1500 | 36 | 40x40x40 | 13 | 480 |
| Φ53 (RTS/RSB) | 9.30-9.90 | 49.20-49.80 | 56.27 +0.05 | 3.20-3.65 | 8.25-8.70 | 6.1 +0.1 | 88 | 2 | 10 | 1800 | 36 | 40x40x40 | 13 | 480 |

4. PARAMETERS FOR QUALITY CONTROL

| Description | Parameters |
|---|---|
| 1. General Appearance of TO | Round, flat, smooth surface with teeth underneath. Inner surface – food grade. Color: dense and uniform with gloss. Roughness, uncovered areas and swellings – not intended. Minor injuries and scratches of lacquer coating occurred during the cutting are allowed, without any disturbing the tin coating and teeth. No crevices resulting from the mechanical treatment allowed on the surface and teeth. |
| 2. Printing (optional) | The image (figures/letters) should be clean, equable, with right contours/lines. Visible shifting/declining of image- not allowed. |
| 3. Sealant | Lying properly in the groove, with no overlaps, overburden and pores. |
| 4. Adhesion | The sealant stays properly laying into the canal, not easily to be separated. |
| 5. Thermal and plastic-elastic resistance after heat treatment | No deformations on the surface, no cracks on coating system. Not softened and sticky plastisol. |
| 6. Chemical resistance of lacquer film and sealant after preserving | Possible colour shade differences of the reverse system are either manufacturing process related or depend on the applied coating module itself. The visual aspects are not colour tolerated and have no influence on the general resistance of the closures. TO gets no change in color, flavor, smelling. |
| 7. Organoleptic in model food solutions | Does not change the food smelling, color and taste. |
| 8. Migration: | As per the referred Regulations/norms (EC). Validation by periodical tests in authorized laboratory; |
| - Overall migration in model solutions– A,B, D1; - Specific migration of BPA; - Specific migration of heavy metal contents; - Content of prohibited epoxy derivatives; | |
| 8. Shelf life | 36 months after production |

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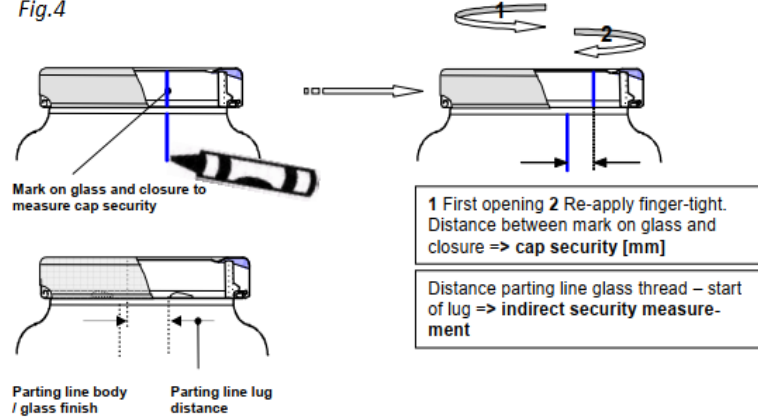
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9. Security Measurement - assessment of the lug tension (after the capping or treatment process) in the case of finishes type standard Twist-Off (Ø53mm – 110mm). The container is marked with a pen by drawing a vertical line on the closure and on the glass. The closure is then turned anti-clockwise, until the vacuum is broken, without lifting it off the container. The closure is then re-tightened (finger-tight) until first resistance is felt. The distance between the new displaced halves of the marking line is the security measurement (mm). The security measurement is expressed as a positive value, when the marking line on the closure is to the **right** of the marking line on the glass.
 The security measurement is expressed as a **negative** value, if the marking line on the closure is to the **left** of the marking line on the glass.
IMPORTANT: Always perform measurement **DIRECTLY** after opening! (Relaxation of the compound will immediately influence the results).

Recommended security values average (mm) – *Table3 :*

| Caps Diameter | After Capping | After sealing (paster, steril) |
|---------------|---------------|--------------------------------|
| 43-58mm | 5.0 | 4.0 |
| 60-70mm | 4.0 | 2.0 |
| 77-110mm | 4.0 | 1.0 |

Fig.4



10. Filling:
 - Excess product during filling may lead to capping problems, increasing the risk of tightness (integrity) loss or subsequent microorganism growth (e.g. mould growth) in the vicinity of the glass finish.
 - Oily contamination of the glass finish or glass body may adversely affect sealing behaviour in the capping machine, as well as the opening torque of the final package.
 - Products containing high percentages of starch or sugar, in the case of excessive filling levels, tend to have high opening torques.
 - Strongly acidic food products can, in case of overfilling, contribute to corrosion problems in the area of the closure curl and lugs.

Recommendations:

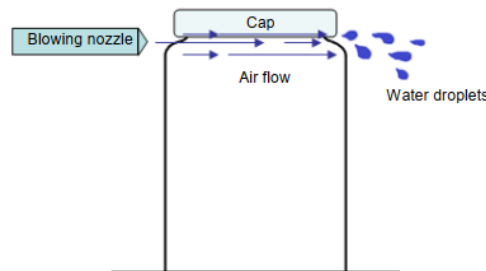
- 1) Clean fill: No overfilling of product over the glass container finish.
- 2) Stable headspace (percentage brimful jar capacity): Compliance with filling tolerances. We recommend headspace between 5-9%, depend on the max temperature of heat treatment, pressure and holding time.
- 3) Avoidance of foam formation during filling. De-aeration of paste products. Alignment of headspace volume with requirements for the heat treatment process.

11. Blowing:
 Since the lug closure consists of tinplate and due to its manufacturing process has an open cut edge in the area of the closure curl, in the event of residual moisture in this area as well as in the highly stressed spots on the lugs, there is an implied risk of corrosion. This can bring about rust particles possibly present being sucked into the package when it is being opened and thus contaminate the product, or cause the formation of rust stains on the glass thread.

Recommendations:

The essential is to adopt suitable drying steps, in order to remove residual process moisture from the area between the glass container finish and the closure curl. Finished packages must not be allowed to remain in the autoclave cage for drying. Placing the cages a slant after the process makes it possible for the water to run off the closures and also reduces the risk of formation of lime deposits. The most effective method of removing the residual moisture is using an air knife system, blowing into the annular space between the closure curl and the container finish, removing remaining water drops (moisture) out of that area.

(Post process moisture removal for finished packages). *Fig.5*



Limitation of the usage, regarding the food solution:

Acid: max 3.5% in a content; max 12 m shelf life of the product/packaged container/.
 Salt: max 3.5% in the same conditions;
 Oil: max 50% in the same conditions;
 NB! For high aggressive fillings (highly protein (beans, peas), spicy, salty and acidity) exceeding above % of limitation, we recommend double inner anti-corrosion protection. This should be considered as a specific request by customer.