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Criteria Sheet for: Plastic Screw Caps

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1. Preliminary note

The Raw Material used for Packaging in Beverage Machinery Industry is critical for the efficiency of the packaging lines and the quality of the product.

The target of this ABMI Criteria sheet is:

- to give manufacturer and users a reference tool to help them carry out the operation of the machine
- to determine the specification of each of the elements and the relevant interfaces
- to give all actors in this business sector a reference document for the establishment of technical documents and quality control procedures
- to facilitate diagnosis in case of malfunctions

The content of this ABMI Criteria Sheet will cover the following items:

1. Geometrical and dimensional accuracy
2. Physical properties
3. Storage and handling conditions
4. Processing and application

All diagrams, pictures and numerical data shown in this document have the intent to illustrate the topic and to facilitate the understanding of the matter. Some data may represent best recommendations from the machinery industry for the procurement of raw material. These values represent common practice at the date of publication.

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2. Specification Criteria of: Plastic Screw Caps

2.1. Introduction

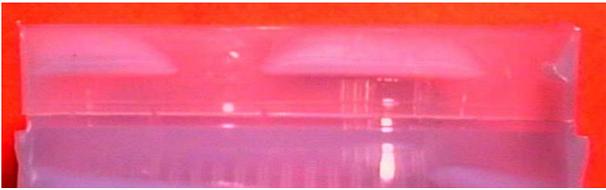
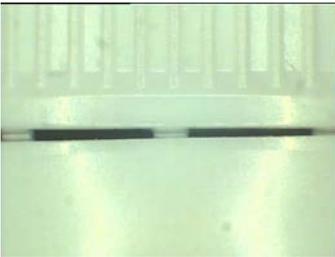
Depending on the filled products:

- Still product
- Carbonated drinks
- Hotfill

There are different plastic cap families, the most common ones are the following:

Flat cap (one piece)	Flat cap (two piece)	Sport caps
		

There are different types of temper bands i.e.:

	slitted	molded
Hook band		 Moulded bridge, no slit at all
Folded band		

Every cap needs to be considered as part of a system consisting of:

- Cap

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- Bottle / Neck
- Product

It's very important to take inconsideration all of them to build an optimal system. It is well known, that every cap is designed for a specific bottleneck.

2.2. Geometrical and dimensional accuracy

The geometrical and dimensional accuracy of the Plastic Screw Caps are very important. In this chapter the Values are explained.

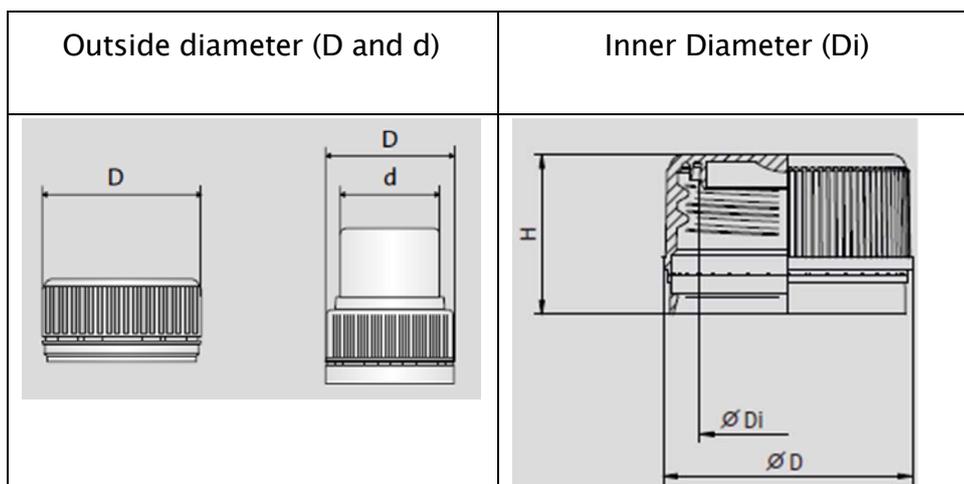
You will find a table with a summary of all parameters at the end of this document in the appendix.

2.2.1. Main dimensions D, d, Di, H,

The main dimensions are:

- Outside diameter (D and d) [mm]
- Inner Diameter (Di) [mm]
- Overall Height (H) [mm]

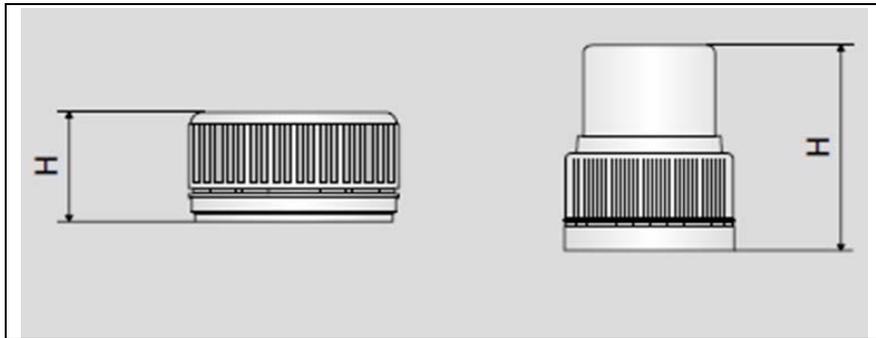
Please refer to the following drawings:



Overall Height (H)

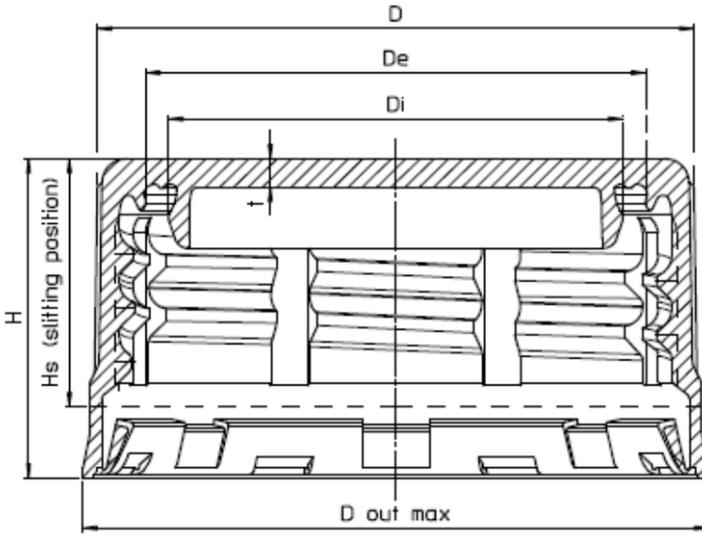
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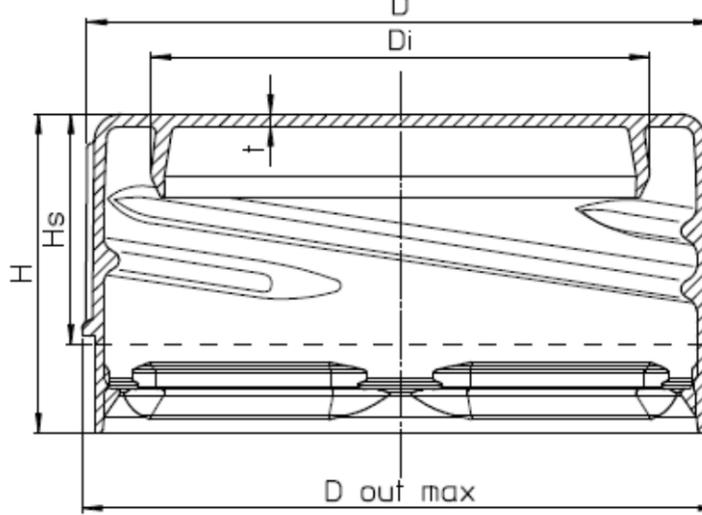


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2.2.2. Example for typical CSD cap

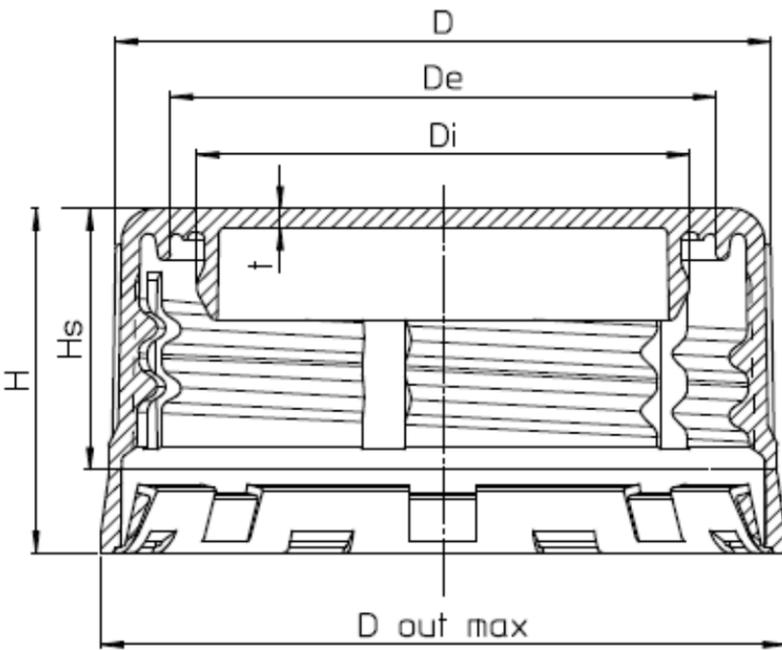
	Dimension name	Symbol
	Top knurl diameter	D
	External sealing diameter	De
	Inner plug diameter	Di
	Outer max diameter	D out max
	Height	H
	Slitting height	Hs
Top panel thickness	t	

2.2.3. Example for typical still product cap

	Dimension name	Symbol
	Top knurl diameter	D
	Inner plug diameter	Di
	Outer max diameter	D out max
	Height	H
	Slitting height	Hs
	Top panel thickness	t

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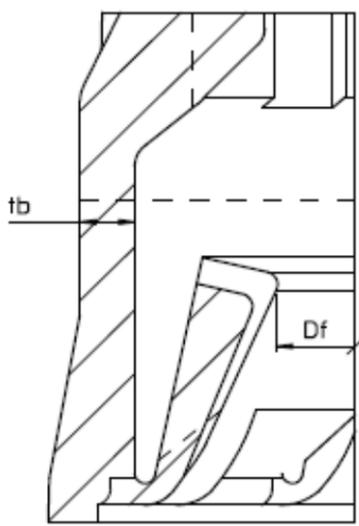
2.2.4. Example for typical Hotfill cap

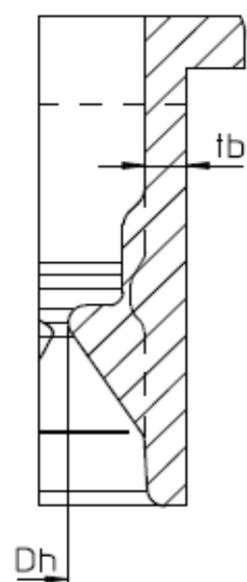
	Dimension name	Symbol
	Top knurl diameter	D
	External sealing diameter	De
	Inner plug diameter	Di
	Outer max diameter	D out max
	Height	H
	Slitting height	Hs
	Top panel thickness	t

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2.3. Temper evident band + bridges

Flap band (folded)	Dimension name	Symbol
	Band thickness	tb
	Flap diameter (after folding)	Df
	Bridge number	nB
	Bridge torque and/or	Bt
	Bridge strength	Bs

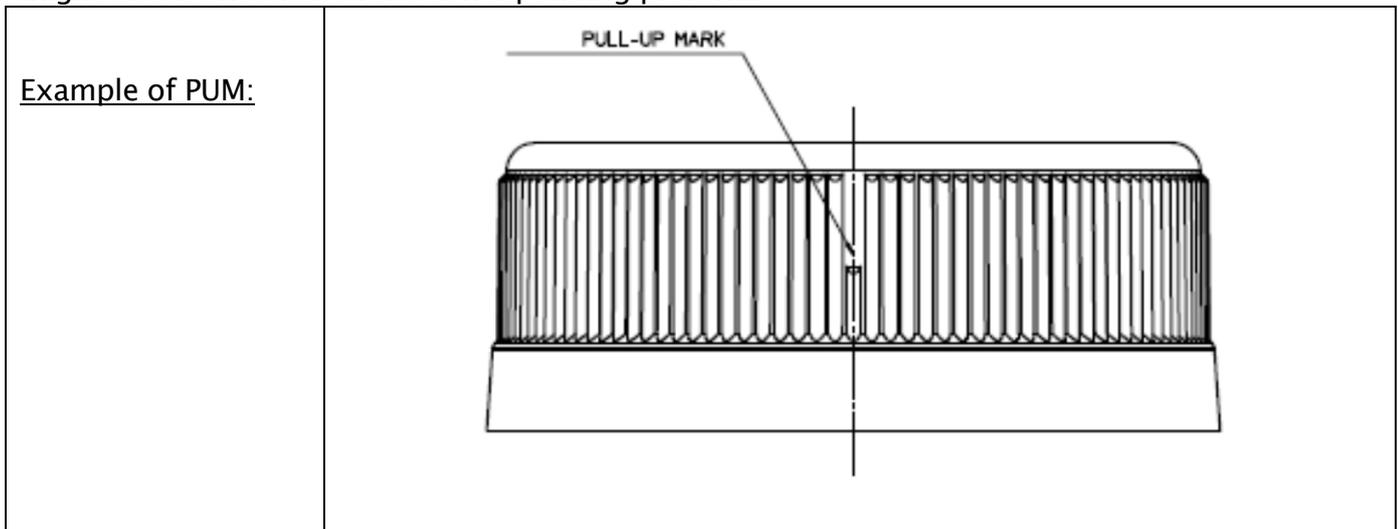
Hook band (not folded)	Dimension name	Symbol
	Band thickness	tb
	Hook diameter	Dh
	Bridge number	nB
	Bridge torque and/or	Bt
	Bridge strength	Bs

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2.4. Pull up mark (PUM) or Locating mark

A pull up mark can help to check the application angle without opening the bottle. A pull up mark might also be needed on the corresponding preform.



Application angle

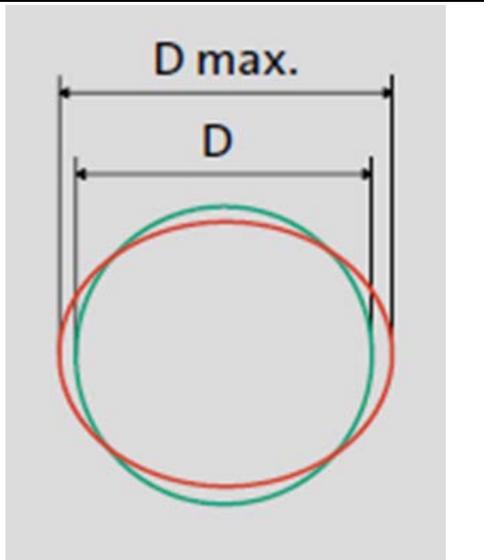
The cap is correctly applied if the specific application angle is respected.

This angle represents the correct amplitude rotation of the cap during application starting from thread engagement. This angle could determine different closing torque if boundaries condition are changing. This means that check parameter for cap application is application angle and not closing torque.

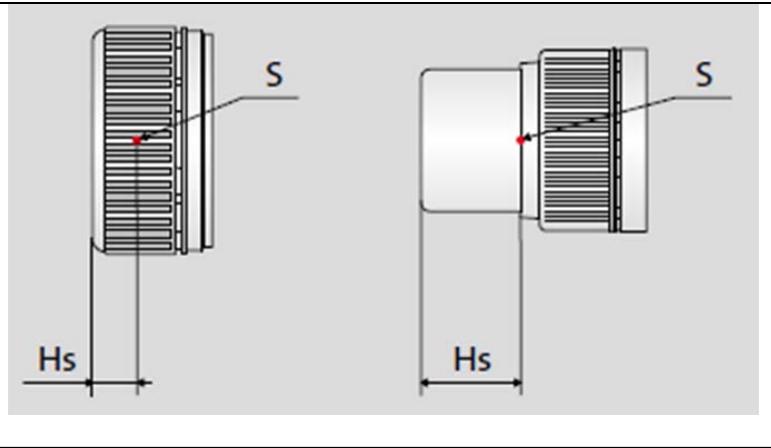
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2.5. Ovality (O)

<p>The ovality is defined as the difference between the maximum outer diameter measured and the theoretical diameter on the drawing.</p> <p>Ovality O [mm] = D_{max} [mm] - D [mm]</p>	
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2.6. Height of centre of gravity (Hs)

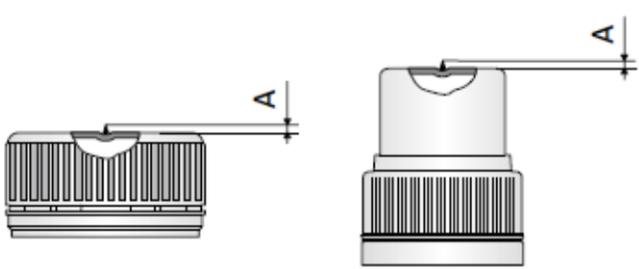
<p>The Height of centre of gravity is defined as the distance between the top of cap and its centre of gravity in mm.</p>	
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2.7. Size of protrusion sprue (A)

In case the caps are produced by injection the protrusion sprue dimensions must not exceed certain limits.

<p>Protruding sprue A</p> 	<p>The size of protrusion sprue (A) is defined as the distance between its top and the top of the cap.</p> <p>No other protrusion or injection threads allowed</p>
<p>Non fully finished caps</p>	<p>Inadmissible</p>
<p>Moulding burrs</p> <p>Moulding burrs protruding beyond the geometry of the cap (from the joint face of the mould) or other protruding non-specified sprues.</p>	<p>Inadmissible</p>

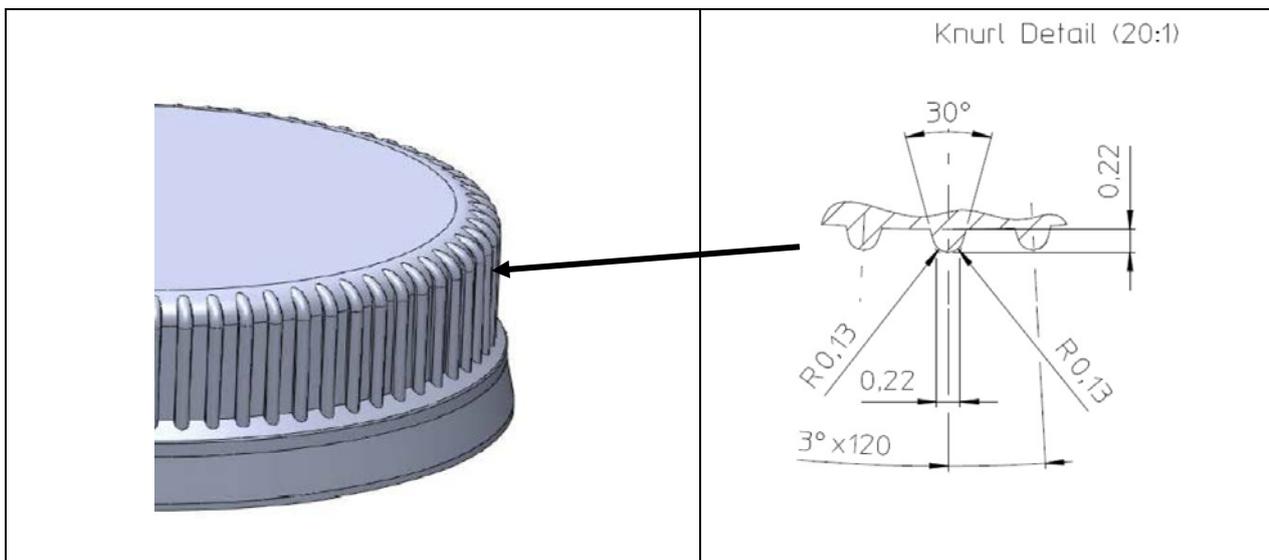
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3. Physical properties

- Weight (W) [g] +/- x [g]
- Number of knurls (nK) [#]

Example of knurling:



- Number of threads (nT) [#]
- Number of temper band bridges (nB) [#]
- Strength and stability
Body and tamper band must have the constant strength and stability values

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3.1. Storage and Handling conditions

The storage and handling shall never damage, soil or change the quality of the raw material.

In order to ensure optimal performance, certain precautions are necessary when storing plastic beverage closures prior to use:

Recommended Storage conditions for plastic beverage closures			
#	Requirement		Possible consequence if requirement is not met / remarks
1	Caps have to be stored dust-free		Contaminated caps
2	Direct UV radiation, extraneous odours or taints must be avoided during storage		Caps are not guaranteed to be odour- and taste- neutral
3	Avoid storage in areas of high humidity		Sealing and opening behaviour will be impaired
4	Caps must be delivered carefully packed and the packaging must provide the caps with reliable protection against climatic influences, like temperature influences.		Sealing and opening behaviour will be impaired
5	When using beverage closures during cold periods it is important that the cartons are conditioned for the specified conditioning time (cT) at application temperature (aT) prior to use.		This avoids brittleness and subsequent application problems.
6	The processing temperature of caps must not differ significantly from recommended temperature (see data sheet issued by the cap manufacturer)		Increasing of the fault and reject quota
7	The storage of caps must be shorter than their shelf life time (sT)		Processing problems which can reduce performance
8	Apply first-in-first-out warehousing methods (FIFO)		

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In every case the recommendations of the supplier of the raw material need to be observed.

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3.2. Processing and application

- head pressure / capping top load
- application torque
- application angle
- removal torque after application (zero hours)
- Optional: removal torque after 1 hour in such application i.e. Hotfill
- removal torque after 24 hrs
- temper band breaking torque and/or band breaking strength

Friction values may differ depending on materials and coating. This may influence the closing and removal torque as the application angle must remain constant.

Friction influence could determine different temper band breaking torque so sometimes it's convenient use the band breaking strength. This parameter represents the axial force (perpendicular to cap base) you need to apply to break the temper band.

For units and tolerances please refer also to table at the end of this criteria sheet

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5. Appendix: Table with Technical data

Criteria	Sym- bol	Value	Unit	Toler- -ance	Unit	Remark
Top knurl Diameter	D		mm		mm	Common practice up to: +/- 0.15mm for 1 specific cap and colour. This diameter is measured close to the top of the cap, where its value is the minimum one.
Inner plug Diameter	Di		mm		mm	Common practice up to: +/- 0.15mm for 1 specific cap and colour
Overall Height	H		mm			Common practice up to: +/- 0.2mm for 1 specific cap and colour
Ovality	O		mm			
Height of centre of gravity	Hs		mm			
Size of protrusion sprue	A		mm			
Number of knurls	nK		#			
Number of threads	nT		#			
Number of temper band bridges	nB		#			
Full Thread extension angle	at		°			
Thread pitch			mm			
Weight	W		g			
Ambient temperature	(aT)		°C			
Shelf life time	(sT)		month s			
Application angle	aa		°			
Capping top load	ctl		N			
Application torque	at		Inlbs			
Removal torque after	rt0		Inlbs			

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application (zero hours)						
Removal torque after 1 hour	rt1		Inlbs			
Removal torque after 24 hrs	rt24		Inlbs			
Temper band breaking removal torque	BT		Inlbs			
Temper band breaking strength	BS		N			

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