

Submitted for recognition as an American National Standard

INTERNAL COMBUSTION ENGINES - PISTON RINGS - KEYSTONE RINGS

This document is equivalent to ISO Standard 6624/1.

1. SCOPE AND FIELD OF APPLICATION:

Differences, where they exist, are shown in Appendix A.

This document specifies the essential dimensional features of T, TB, TM, K, KB, and KM keystone piston ring types.

The requirements of this document apply to compression rings for reciprocating internal combustion engines up to and including 200 mm diameter.

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## 2. REFERENCES:

<u>SAE DESIGNATION</u>	<u>ISO* EQUIVALENT</u>	
		INTERNAL COMBUSTION ENGINES - PISTON RINGS
J1588	6621/1	Vocabulary
J1589	6621/2	Measuring principles
J1590	6621/3	Material specifications
J1591	6621/4	General specifications
J1996	6621/5	Quality requirements
		INTERNAL COMBUSTION ENGINES - PISTON RINGS
J1997	6622/1	Rectangular rings
J1998	6622/2 TR	Rectangular rings with narrow ring width
J1999	6623	INTERNAL COMBUSTION ENGINES - PISTON RINGS - SCRAPER RINGS
		INTERNAL COMBUSTION ENGINES - PISTON RINGS
J2000	6624/1	Keystone rings
J2001	6624/2 TR	Half keystone rings
J2002	6625	INTERNAL COMBUSTION ENGINES - PISTON RINGS - OIL CONTROL RINGS
J2003	6626	INTERNAL COMBUSTION ENGINES - COIL SPRING LOADED OIL CONTROL RINGS
J2004	6627 TR	INTERNAL COMBUSTION ENGINES - EXPANDER/SEGMENT OIL CONTROL RINGS

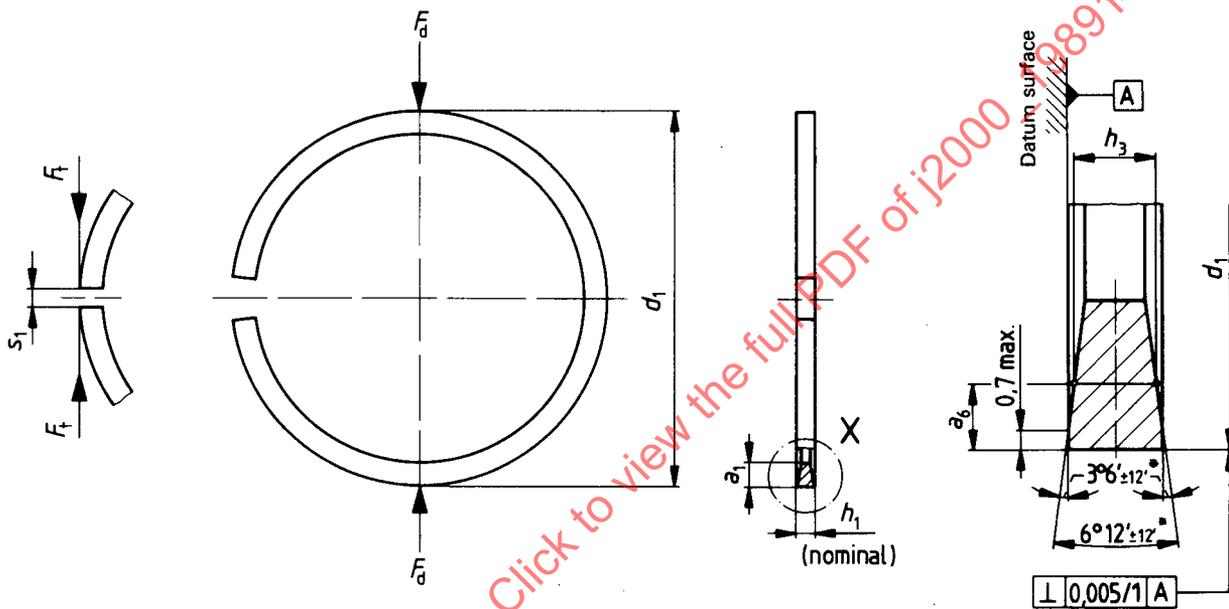
\*TR refers to Technical Report

### 3. RING TYPES AND DESIGNATION EXAMPLES:

#### 3.1 Type T – Straight Faced Keystone Ring 6°:

##### 3.1.1 General Features:

NOTE: See Table 7 for dimensions and forces.



Method A:  $a_6$  ref.,  $h_3$  measured  
Method B:  $h_3$  ref.,  $a_6$  measured

\* Due to manufacturing processing, side angle tolerances are not cumulative.

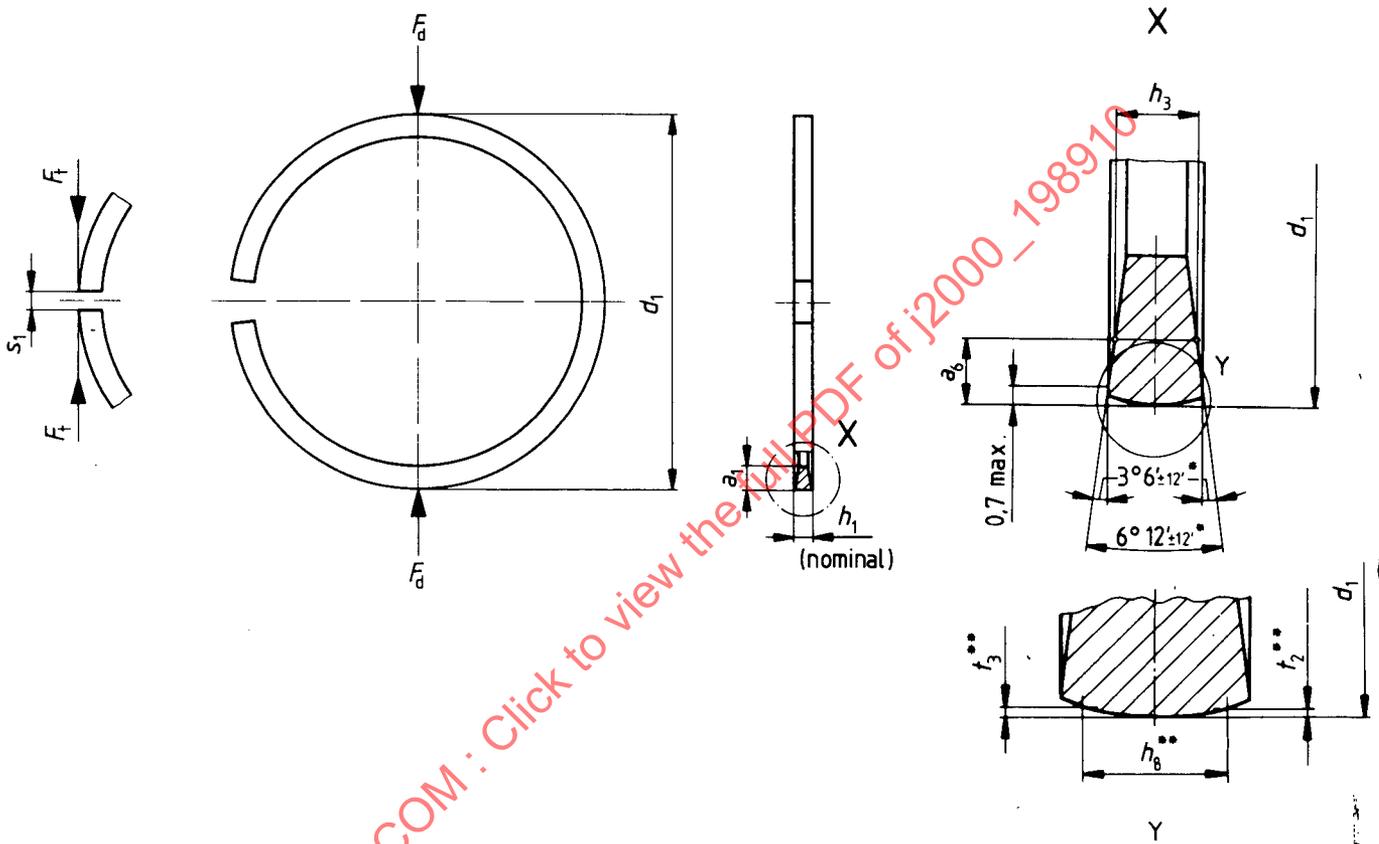
FIGURE 1 - Type T

3.1.2 Designation Example: Designation of a straight faced keystone ring 6°, of  $d_1 = 90$  mm nominal diameter,  $h_1 = 2.5$  mm ring width, made of grey cast iron, non-heat-treated (material subclass 12), general features as shown in Fig. 1, and periphery coated fully faced with chromium, 0.10 mm minimum thickness.

3.2 Type TB - Barrel Faced Keystone Ring 6°:

3.2.1 General Features:

NOTE: See Table 7 for dimensions and forces.



Method A:  $a_6$  ref.,  $h_3$  measured  
 Method B:  $h_3$  ref.,  $a_6$  measured

\* Due to manufacturing processing, side angle tolerances are not cumulative.

\*\* See Table 1.

FIGURE 2 - Type TB

TABLE 1 - Gauge Width ( $h_g$ ) and Barrel Dimensions

Dimensions in millimeters

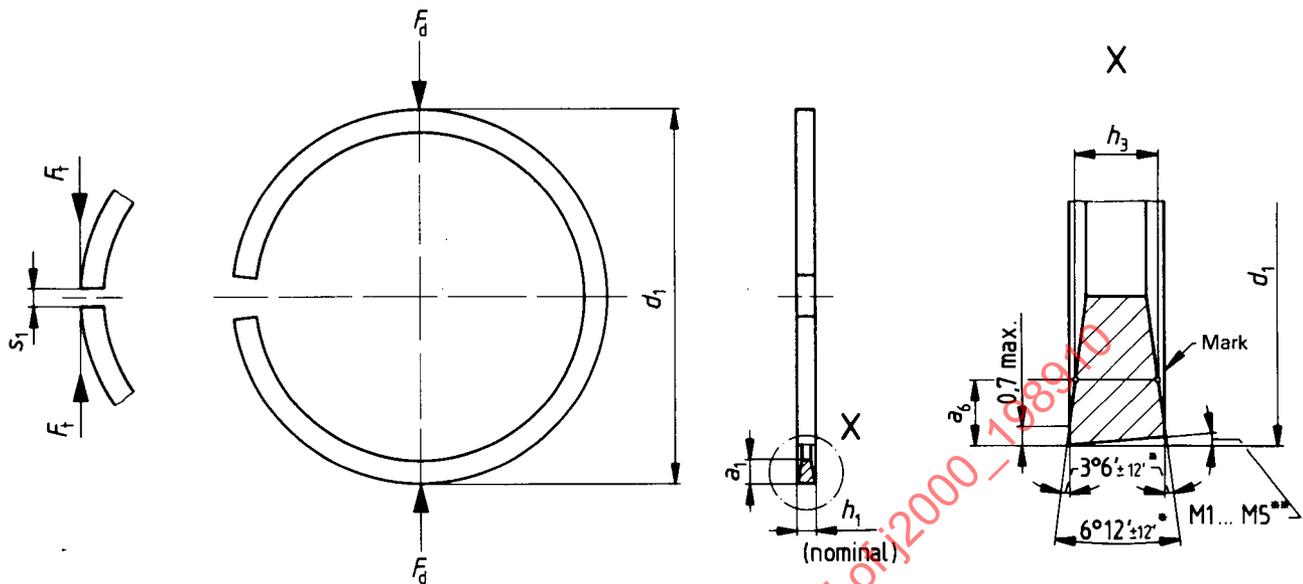
( $h_1$ )	$h_g$	$t_2, t_3$	Maximum peak off center
2.0	1.2	0.002/0.016	0.30
2.5	1.6		0.40
3.0	2.0	0.005/0.020	0.50
3.5	2.4		0.50
4.0	2.8	0.005/0.023	0.60
4.5	3.2		0.60

3.2.2 Designation Example: Designation of a barrel faced keystone ring 6°, of  $d_1 = 90$  mm nominal diameter,  $h_1 = 2.5$  mm ring width, made of spheroidal graphite cast iron, heat-treated martensitic (material subclass 53), general features as shown in Fig. 2, and periphery semi-inlaid coated with molybdenum, 0.2 mm minimum thickness.

3.3 Type TM - Taper Faced Keystone Ring 6°:

3.3.1 General Features:

NOTE: See Table 7 for dimensions and forces.



Method A:  $a_6$  ref.,  $h_3$  measured  
 Method B:  $h_3$  ref.,  $a_6$  measured

\* Due to manufacturing processing, side angle tolerances are not cumulative.

\*\* See Table 2.

FIGURE 3 - Type TM

TABLE 2 - Taper

Taper	Uncoated and coated rings (molybdenum or chrome)	
		Tolerance <sup>1</sup>
M1	10'	+50' 0
M2	30'	+60' 0
M3	60'	
M4	90'	
M5	120'	

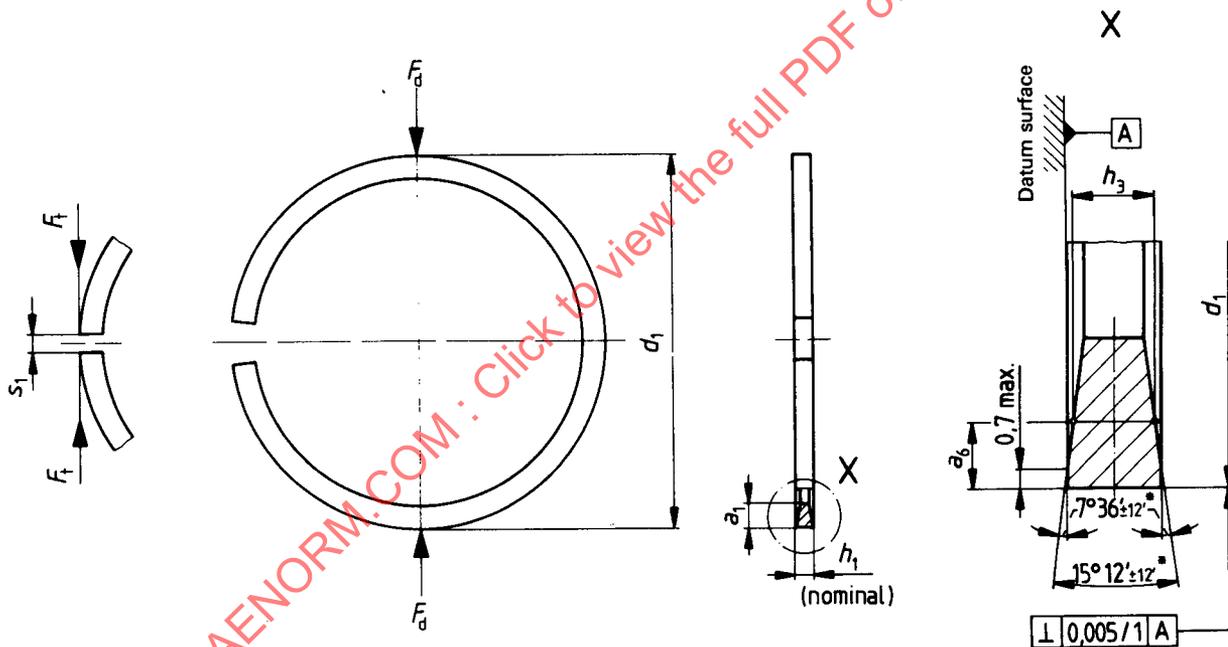
<sup>1</sup>For coated rings with tapered periphery not ground, the tolerance shall be increased by 10' (for example: M3 = 60' : +70'<sub>0</sub>).

3.3.2 Designation Example: Designation of a taper faced M1 = 10' keystone ring 6°, of  $d_1 = 90$  mm nominal diameter,  $h_1 = 2.5$  mm ring width, made of grey cast iron, heat-treated (material subclass 22), general features as shown in Fig. 3, and phosphated all over.

3.4 Type K – Straight Faced Keystone Ring 15°:

3.4.1 General Features:

NOTE: See Table 8 for dimensions and forces.



Method A:  $a_6$  ref.,  $h_3$  measured  
Method B:  $h_3$  ref.,  $a_6$  measured

\* Due to manufacturing processing, side angle tolerances are not cumulative.

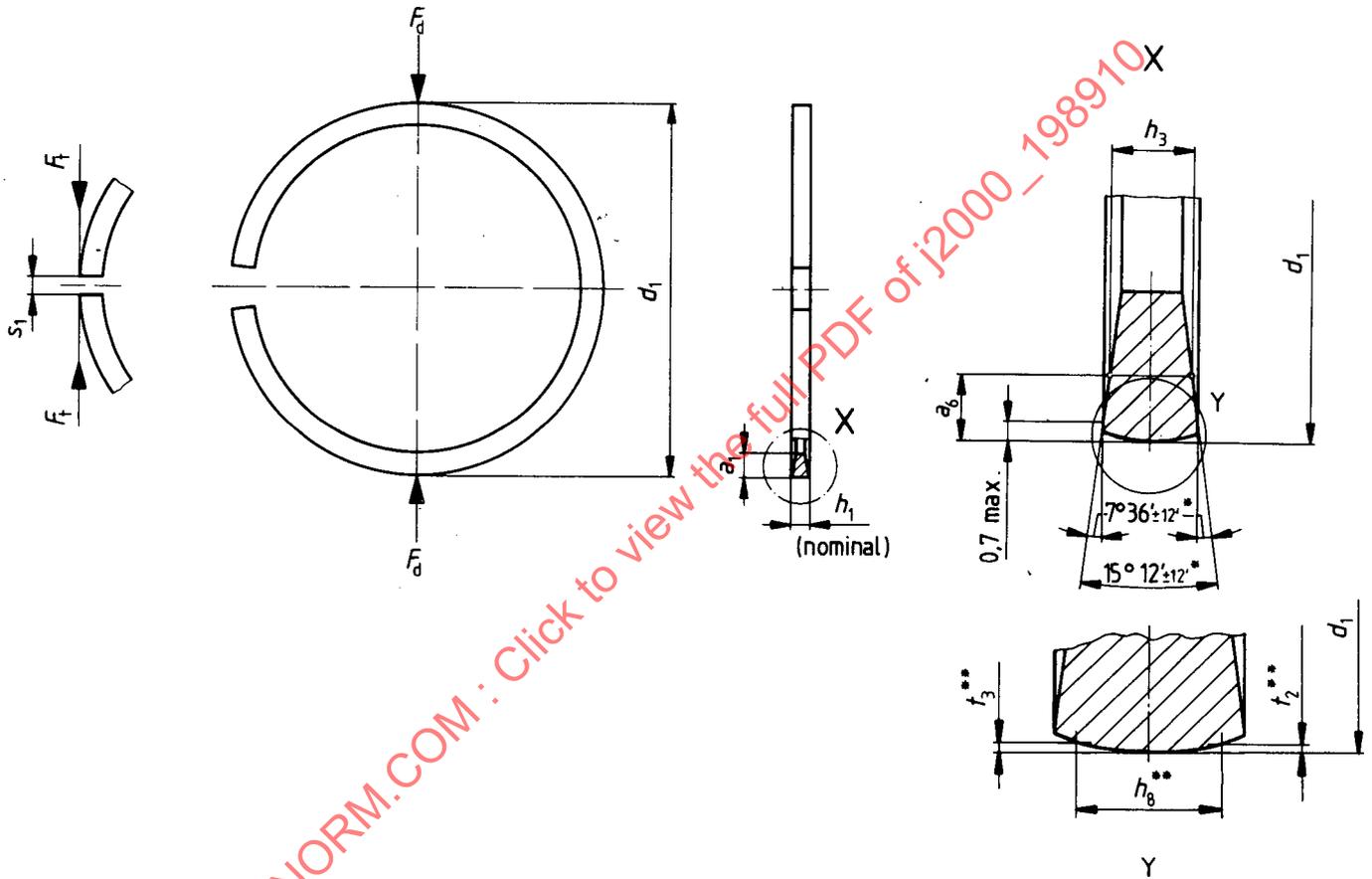
FIGURE 4 – Type K

3.4.2 Designation Example: Designation of a straight faced keystone ring 15°, of  $d_1 = 90$  mm nominal diameter,  $h_1 = 2.5$  mm ring width, made of carbide cast iron, heat-treated martensitic (material subclass 32), general features as shown in Fig. 4, and ferroxide coated.

3.5 Type KB – Barrel Faced Keystone Ring 15°:

3.5.1 General Features:

NOTE: See Table 8 for dimensions and forces.



Method A:  $a_6$  ref.,  $h_3$  measured  
 Method B:  $h_3$  ref.,  $a_6$  measured

\* Due to manufacturing processing, side angle tolerances are not cumulative.

\*\* See Table 1.

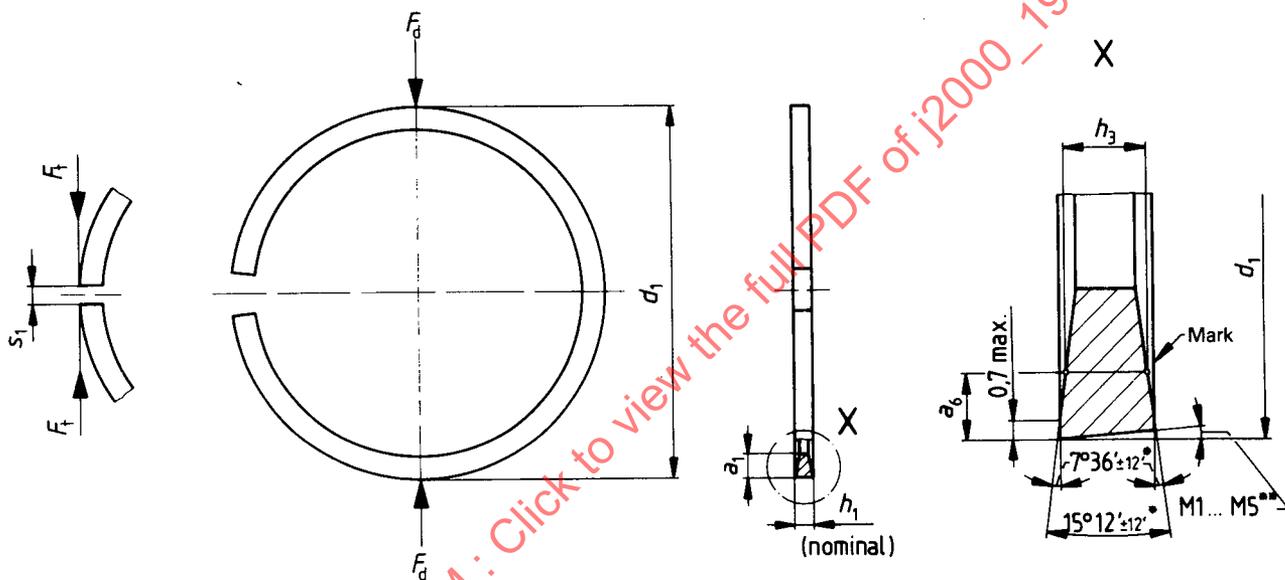
FIGURE 5 – Type KB

3.5.2 Designation Example: Designation of a barrel faced keystone ring 15°, of  $d_1 = 90$  mm nominal diameter,  $h_1 = 2.5$  mm ring width, made of malleable cast iron, heat-treated pearlitic (material subclass 41), general features as shown in Fig. 5, and periphery fully faced, coated with molybdenum, 0.2 mm minimum thickness.

### 3.6 Type KM – Taper Faced Keystone Ring 15°:

#### 3.6.1 General Features:

NOTE: See Table 8 for dimensions and forces.



Method A:  $a_6$  ref.,  $h_3$  measured  
 Method B:  $h_3$  ref.,  $a_6$  measured

\* Due to manufacturing processing, side angle tolerances are not cumulative.

\*\* See Table 2.

FIGURE 6 – Type KM

3.6.2 Designation Example: Designation of a taper faced M1 = 10' keystone ring 15°, of  $d_1 = 90$  mm nominal diameter,  $h_1 = 2.5$  mm ring width, made of grey cast iron, non-heat-treated (material subclass 12); general features as shown in Fig. 6.

## 4. COMMON FEATURES:

## 4.1 T, TB, TM or K, KB, KM Rings - Inside Chamfered Edges (KI): (See Fig. 7.)

NOTE: See Table 3 for dimensions.

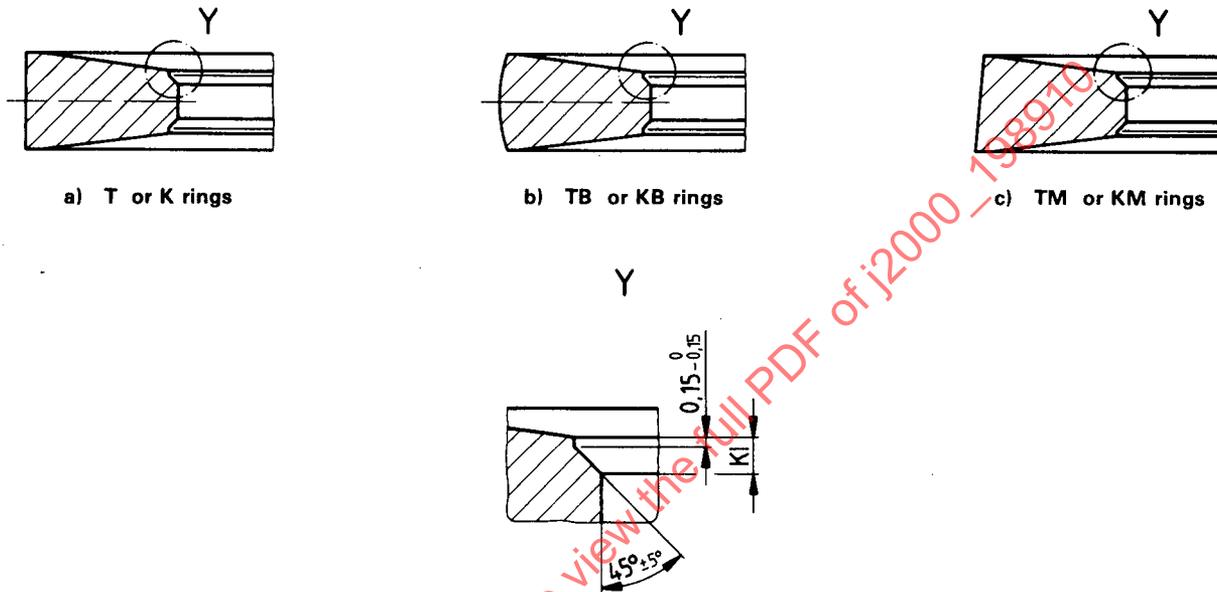


FIGURE 7 - Inside Chamfered Edges (KI)

TABLE 3 - KI Dimensions

Dimensions in millimeters

$d_1$	KI
$70 < d_1 < 125$	$0.3 \pm 0.15$
$125 < d_1 < 175$	$0.4 \pm 0.15$
$175 < d_1 < 200$	$0.6 \pm 0.20$

4.2 T, TB, TM or K, KB, KM Rings - Coating Configuration:

NOTE: See Table 4 for dimensions.

4.2.1 Uncoated Rings: (See Fig. 8.)

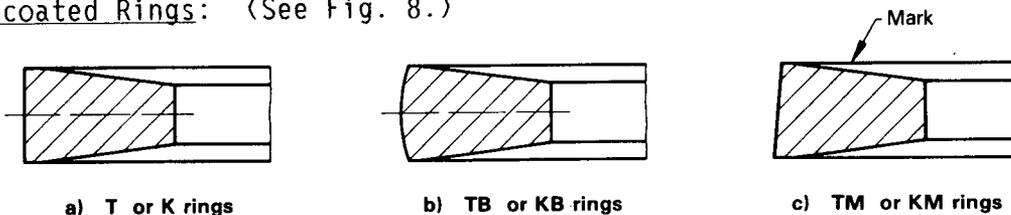


FIGURE 8 - Uncoated Rings

4.2.2 Coated Rings (Chromium or Molybdenum): (See Figs. 9-11.)

4.2.2.1 Fully Faced:

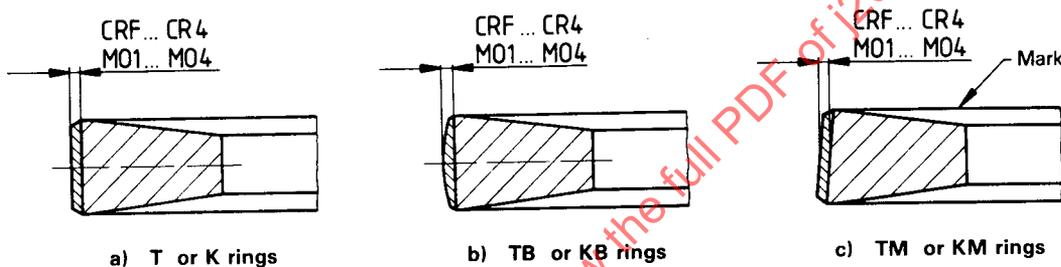


FIGURE 9 - Fully Faced Rings

4.2.2.2 Semi-Inlaid:

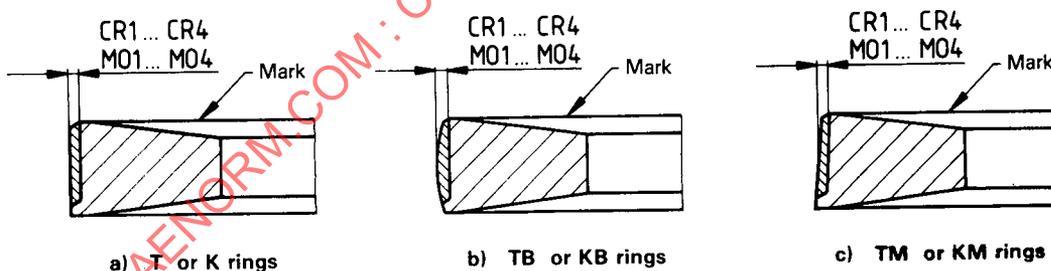


FIGURE 10 - Semi-Inlaid Rings

4.2.2.3 Inlaid:

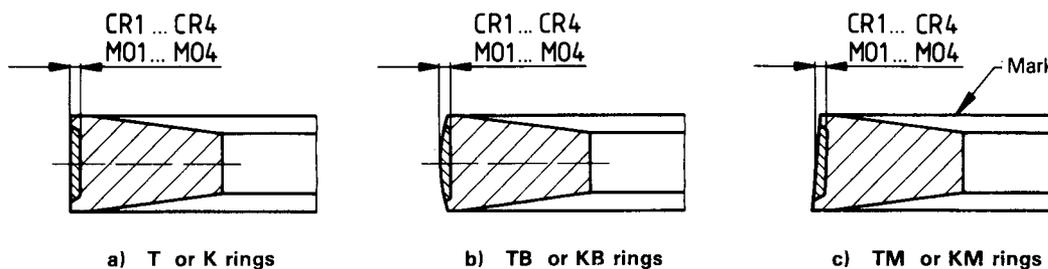


FIGURE 11 - Inlaid Rings

TABLE 4 - Layer Thickness

Dimensions in millimeters

Chromium	Molybdenum	Thickness min.
CRF	-	0.005
CR1	MO1	0.05
CR2	MO2	0.10
CR3	MO3	0.15
CR4	MO4	0.20

5. FORCE FACTORS:

The tangential and diametral forces given in Tables 7 and 8 shall be corrected when additional features and/or materials other than grey cast iron with a modulus of elasticity of 100 000 MPa are being used.

For common features, the multiplier correction factors given in Tables 5 and 6 and the force correction factors given in SAE J1591 shall be used.

The factors of Table 6 have been calculated with mean coating thickness.

TABLE 5 - Force Correction Factors for T, TB, TM, K, KB, and KM Rings With Feature KI

KI	Taper M2 or M3	Taper M4 or M5	KI and taper M2 or M3	KI and taper M4 or M5
0.96	0.98	0.96	0.94	0.92

TABLE 6 - Force Correction Factors for Coated T, TB, TM, K, KB, and KM Rings (Fully Faced, Semi-Inlaid and Inlaid Types)

CRF	CR1	CR2/MO1	CR3/MO2	CR4/MO3	MO4
1	0.94	0.91	0.88	0.85	0.83

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6. DIMENSIONS:

TABLE 7 - Dimensions of T, TB, TM Keystone Rings 6°

Dimensions in millimeters

Nominal diameter $d_1$	Radial wall thickness "regular"		Nominal value of ring width ( $h_1$ )		Method A		Method B		Closed gap $s_1$	Tangential force $F_t, N$			Diametral force $F_d, N$				
	$a_1$	Tolerance	Column		$a_6$ (ref.)	Measured value $h_3$		$h_3$ (ref.)		Measured value $a_6$	For $h_1$ shown in column		Tolerance	For $h_1$ shown in column		Tolerance	
			1	2		1	2				1	2		1	2		
70	2,90	±0,15 Within a ring: 0,15 max.	2,0	2,5	1,5	1,832 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,332 0 -0,024 For phosphated PO surface: +0,01 -0,024	1,82	2,32	0,20	+0,20 0	9,9	12,6	±30% if $F_t < 10N$ ±20% if $F_t > 10N$	21,3	27,1	±30% if $F_d < 21,5N$ ±20% if $F_d > 21,5N$
71	2,95											10,1	12,9		21,7	27,7	
72	3,00											10,3	13,2		22,1	28,4	
73	3,05											10,5	13,4		22,6	28,8	
74	3,10											10,7	13,7		23,0	29,5	
75	3,15	±0,15 Within a ring: 0,15 max.	2,0	2,5	1,5	1,832 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,332 0 -0,024 For phosphated PO surface: +0,01 -0,024	1,82	2,32	0,25	+0,09 -0,22	10,9	13,9	±30% if $F_t < 10N$ ±20% if $F_t > 10N$	23,4	29,9	±30% if $F_d < 21,5N$ ±20% if $F_d > 21,5N$
76	3,15											10,6	13,6		22,8	29,2	
77	3,20											10,8	13,9		23,2	29,9	
78	3,25											11,0	14,1		23,7	30,3	
79	3,30											11,3	14,4		24,3	31,0	
80	3,35											11,5	14,7		24,7	31,6	
81	3,40											11,7	15,0		25,2	32,3	
82	3,40											11,4	14,6		24,5	31,4	
83	3,45											11,6	14,9		24,9	32,0	
84	3,50											11,8	15,2		25,4	32,7	
85	3,55	±0,15 Within a ring: 0,15 max.	2,0	2,5	1,5	1,832 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,332 0 -0,024 For phosphated PO surface: +0,01 -0,024	1,82	2,32	0,25	+0,09 -0,22	12,0	15,4	±30% if $F_t < 10N$ ±20% if $F_t > 10N$	25,8	33,1	±30% if $F_d < 21,5N$ ±20% if $F_d > 21,5N$
86	3,60											12,2	15,7		26,2	33,8	
87	3,65											12,5	16,0		26,9	34,4	
88	3,65											12,2	15,6		26,2	33,5	
89	3,70											12,4	15,9		26,7	34,2	
90	3,75	±0,20 Within a ring: 0,20 max.	2,5	3,0	2,0	2,278 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,778 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,27	2,77	0,30	+0,25 0	16,1	19,6	±30% if $F_t < 10N$ ±20% if $F_t > 10N$	34,6	42,1	±30% if $F_d < 21,5N$ ±20% if $F_d > 21,5N$
91	3,80											16,3	20,0		35,0	43,0	
92	3,85											16,6	20,3		35,7	43,6	
93	3,90											16,9	20,6		36,3	44,3	
94	3,90											16,5	20,2		35,5	43,4	
95	3,95											16,8	20,5		36,1	44,1	
96	4,00											17,1	20,9		36,8	44,9	
97	4,05											17,3	21,2		37,2	45,6	
98	4,10											17,6	21,5		37,8	46,2	
99	4,15											17,9	21,9		38,5	47,1	
100	4,15	±0,20 Within a ring: 0,20 max.	2,5	3,0	2,0	2,278 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,778 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,27	2,77	0,30	+0,30 0	17,5	21,4	±30% if $F_t < 10N$ ±20% if $F_t > 10N$	37,6	46,0	±30% if $F_d < 21,5N$ ±20% if $F_d > 21,5N$
101	4,20											17,7	21,7		38,1	46,7	
102	4,25											18,0	22,0		38,7	47,3	
103	4,30											18,2	22,3		39,1	47,9	
104	4,30											17,9	21,9		38,5	47,1	
105	4,35											18,1	22,2		38,9	47,7	
106	4,40											18,3	22,5		39,3	48,4	
107	4,40											18,0	22,0		38,7	47,3	
108	4,45											18,2	22,3		39,1	47,9	
109	4,50											18,4	22,6		39,6	48,6	
110	4,55	±0,20 Within a ring: 0,20 max.	2,5	3,0	2,0	2,278 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,778 0 -0,024 For phosphated PO surface: +0,01 -0,024	2,27	2,77	0,35	+0,30 0	18,6	22,8	±30% if $F_t < 10N$ ±20% if $F_t > 10N$	40,0	49,0	±30% if $F_d < 21,5N$ ±20% if $F_d > 21,5N$
111	4,55											18,2	22,4		39,1	48,2	
112	4,60											18,5	22,7		39,8	48,8	
113	4,65											18,7	22,9		40,2	49,2	
114	4,70											18,9	23,2		40,6	49,9	
115	4,70	18,6	22,8	40,0	49,0												
116	4,75	18,8	23,1	40,4	49,7												
117	4,80	19,0	23,4	40,9	50,3												
118	4,80	18,7	22,9	40,2	49,2												
119	4,85	18,9	23,2	40,6	49,9												

This table is shown in ISO format. Commas represent decimal points.

TABLE 7 (Continued)

Dimensions in millimeters

Nominal diameter $d_1$	Radial wall thickness "regular"		Nominal value of ring width ( $h_1$ )		Method A		Method B		Closed gap		Tangential force $F_t, N$		Diametral force $F_d, N$						
	$a_1$	Tolerance	Column		$a_6$ (ref.)	Measured value $h_3$		$h_3$ (ref.)	Column	Measured value $a_6$	$s_1$	Tolerance	For $h_1$ shown in column		Tolerance	For $h_1$ shown in column		Tolerance	
			1	2		1	2						1	2		1	2		
120	4,90					2,278	2,778			2,08									
121	4,95					0	0			0									
122	4,95					-0,024	-0,024			-0,22									
123	5,00		2,5	3,0	2,0	For phosphated PO surface: +0,01 -0,024	For phosphated PO surface: +0,01 -0,024	2,27	2,77	For phosphated PO surface: +0,09 -0,22	0,35	+0,30 0	19,1	23,5		41,1	50,5		
124	5,05												19,3	23,8		41,5	51,2		
125	5,05												19,0	23,3		40,9	50,1		
126	5,10												19,2	23,6		41,3	50,7		
127	5,15												19,4	23,9		41,7	51,4		
128	5,20																		
129	5,20												23,4	27,8		50,3	59,8		
130	5,25												23,7	28,1		51,0	60,4		
131	5,30												24,0	28,5		51,6	61,3		
132	5,30												24,2	28,8		52,0	61,9		
133	5,35												23,8	28,3		51,2	60,8		
134	5,40												24,0	28,5		51,6	61,3		
135	5,40					2,724	3,224			2,63			24,3	28,9		52,2	62,1		
136	5,45					0	0			0			23,9	28,4		51,4	61,1		
137	5,50					-0,024	-0,024			-0,22			24,1	28,7		51,8	61,7		
138	5,50					For phosphated PO surface: +0,01 -0,024	For phosphated PO surface: +0,01 -0,024			For phosphated PO surface: +0,09 -0,22	0,40	+0,35 0	24,4	29,0		52,5	62,4		
139	5,55												24,0	28,5		51,6	61,3		
140	5,60												24,3	28,8		52,2	61,9		
141	5,65	±0,20											24,5	29,1		52,7	62,6		
142	5,65	Within a ring:											24,1	28,7		51,8	61,7		
143	5,70	0,20											24,4	29,0		52,5	62,4		
144	5,75	max.	3,0	3,5	2,5			2,71	3,21				24,6	29,3		52,9	63,0		
145	5,75												24,9	29,6		53,5	63,6		
146	5,80												24,9	29,6		53,5	63,6		
147	5,85												25,1	29,9		54,0	64,3		
148	5,85												24,7	29,4		53,1	63,2		
149	5,90												25,0	29,7		53,8	63,9		
150	5,95												24,6	29,3		52,9	63,0		
152	6,00												24,9	29,6		53,5	63,6		
154	6,05					2,724	3,224			2,63			24,8	29,5		53,3	63,4		
155	6,10					0	0			0			25,0	29,8		53,8	64,1		
156	6,15					-0,029	-0,029			-0,26			25,2	30,1		54,2	64,7		
158	6,20					For phosphated PO surface: +0,01 -0,029	For phosphated PO surface: +0,01 -0,029			For phosphated PO surface: +0,09 -0,27	0,50	+0,40 0	25,1	29,9		54,0	64,3		
160	6,25												25,0	29,8		53,8	64,1		
162	6,35												25,4	30,3		54,6	65,1		
164	6,40												25,3	30,2		54,4	64,9		
165	6,40												25,0	29,8		53,8	64,1		
166	6,45												25,2	30,0		54,2	64,5		
168	6,50												25,1	29,9		54,0	64,3		
170	6,60					3,172	3,672			3,20			30,4	35,4		65,4	76,1		
172	6,65					0	0			0			30,3	35,2		65,1	75,7		
174	6,70					-0,029	-0,029			-0,27			30,2	35,1		64,9	75,5		
175	6,75		3,5	4,0	3,0	For phosphated PO surface: +0,01 -0,029	For phosphated PO surface: +0,01 -0,029	3,15	3,65	For phosphated PO surface: +0,09 -0,27	0,60	+0,45 0	30,3	35,2		65,1	75,7		
176	6,80												30,5	35,5		65,6	76,3		
178	6,85												30,4	35,4		65,4	76,1		

This table is shown in ISO format. Commas represent decimal points.

TABLE 7 (Concluded)

Dimensions in millimeters

Nominal diameter $d_1$	Radial wall thickness "regular" $a_1$		Nominal value of ring width ( $h_1$ )		Method A		Method B		Closed gap		Tangential force $F_t$ , N			Diametral force $F_d$ , N							
	Tolerance	Column 1	Column 2	$a_6$ (ref.)	Measured value $h_3$		$h_3$ (ref.)		Measured value $a_6$	$s_1$	Tolerance	For $h_1$ shown in column		Tolerance	For $h_1$ shown in column		Tolerance				
					Column 1	Column 2	Column 1	Column 2				1	2		1	2					
180	6,90											30,3	35,2		65,1	75,7					
182	6,95											30,1	35,1		64,7	75,5					
184	7,05											30,6	35,7		65,8	76,8					
185	7,05	±0,20 Within a ring: 0,20 max.	3,5	4,0	3,0	3,172	3,672			3,20			30,3	35,2		65,1	75,7				
186	7,10					0	0	0			0				30,3	35,2		65,1	75,7		
188	7,15					-0,029	-0,029	-0,27			-0,27				±30% if $F_t < 10N$	30,5	35,5		65,6	76,3	±30% if $F_d < 21,5N$
						For phosphated PO surface: +0,01	For phosphated PO surface: +0,01	For phosphated PO surface: +0,09	3,15	3,65	For phosphated PO surface: -0,27	0,60	+0,45	0	±20% if $F_t > 10N$	30,4	35,4		65,4	76,1	±20% if $F_d > 21,5N$
190	7,20											30,3	35,2		65,1	75,7					
192	7,25											30,1	35,1		64,7	75,5					
194	7,35											30,6	35,7		65,8	76,8					
195	7,35											30,2	35,2		64,9	75,7					
196	7,40											30,5	35,5		65,6	76,3					
198	7,45											30,4	35,4		65,4	76,1					
200	7,50											30,2	35,2		64,9	75,7					

NOTES

<sup>1</sup>For intermediate sizes (for example repair sizes), the radial wall thickness of the next smaller nominal diameter should be applied.

<sup>2</sup>For values for  $F_t$  and  $F_d$ , given in Table 7, apply to as cast grey cast iron with a typical modulus of elasticity ( $E_n$ ) of 100 000 MPa. Multiplying factors for materials having a different modulus ( $E_n$ ) are given in SAE J159.

Mean forces are calculated for nominal radial wall thickness ( $a_1$ ) and mean ring width ( $h_1$ ).

<sup>3</sup>For the sole purpose of this document, the assumed average ratio  $F_d/F_t$  is 2.15.

This table is shown in ISO format. Commas represent decimal points.

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TABLE 8 - Dimensions of K, KB, KM Keystone Rings 15°

Dimensions in millimeters

Nominal diameter $d_1$	Radial wall thickness "regular"		Nominal value of ring width ( $h_1$ )		Method A		Method B		Closed gap		Tangential force $F_t$ , N			Diametral force $F_d$ , N				
	$a_1$	Tolerance	Column		$a_6$ (ref.)	Measured value $h_3$		$h_3$ (ref.)		$s_1$	Tolerance	For $h_1$ shown in column		Tolerance	For $h_1$ shown in column		Tolerance	
			1	2		1	2	1	2			1	2		1	2		
80	3,35											12,8	16,0		27,5	34,4		
81	3,40											13,0	16,3		28,0	35,0		
82	3,40											12,7	15,9		27,3	34,2		
83	3,45											12,9	16,2		27,7	34,8		
84	3,50											13,1	16,5		28,2	35,5		
85	3,55					2,097	2,597			0,25		13,3	16,7		28,6	35,9		
86	3,60					0	0					13,5	17,0		29,0	36,6		
87	3,65					-0,029	-0,029					13,7	17,3		29,5	37,2		
88	3,65	±0,15 Within a ring: 0,15 max.	2,5	3,0	1,5	For phos- phated PO surface: +0,01 -0,029	For phos- phated PO surface: +0,01 -0,029	2,10	2,60	For phos- phated PO surface: +0,04 -0,11	0,25		13,4	16,9	±30% if $F_t < 10N$ ±20% if $F_t > 10N$	28,8	36,3	±30% if $F_d < 21,5N$ ±20% if $F_d > 21,5N$
89	3,70												13,6	17,1		29,2	36,8	
90	3,75												13,7	17,3		29,5	37,2	
91	3,80											13,9	17,6		29,9	37,8		
92	3,85											14,1	17,8		30,3	38,3		
93	3,90											14,3	18,1		30,7	38,9		
94	3,90											14,0	17,7		30,1	38,1		
95	3,95											14,1	17,9		30,3	38,5		
96	4,00											14,3	18,2		30,7	39,1		
97	4,05											14,5	18,5		31,2	39,8		
98	4,10											14,7	18,7		31,6	40,2		
99	4,15											14,9	19,0		32,0	40,9		
100	4,15									0,30		18,5	22,5		39,8	48,4		
101	4,20											18,8	22,8		40,4	49,0		
102	4,25											19,0	23,1		40,9	49,7		
103	4,30											19,2	23,3		41,3	50,1		
104	4,30											18,8	22,9		40,4	49,2		
105	4,35											19,0	23,1		40,9	49,7		
106	4,40											19,2	23,4		41,3	50,3		
107	4,40											18,8	22,9		40,4	49,2		
108	4,45					2,463	2,963					19,0	23,2		40,9	49,9		
109	4,50					0	0					19,2	23,5		41,3	50,5		
110	4,55					-0,034	-0,034					19,4	23,6		41,7	50,7		
111	4,55					For phos- phated PO surface: +0,01 -0,034	For phos- phated PO surface: +0,01 -0,034					19,0	23,2		40,9	49,9		
112	4,60											19,2	23,4		41,3	50,3		
113	4,65											19,4	23,7		41,7	51,0		
114	4,70											19,6	24,0		42,1	51,6		
115	4,70	±0,20 Within a ring: 0,20 max.	3,0	3,5	2,0			2,45	2,95	For phos- phated PO surface: +0,04 -0,13	0,35		19,2	23,5	±30% if $F_t < 10N$ ±20% if $F_t > 10N$	41,3	50,5	±30% if $F_d < 21,5N$ ±20% if $F_d > 21,5N$
116	4,75												19,4	23,7		41,7	51,0	
117	4,80												19,6	24,0		42,1	51,6	
118	4,80												19,2	23,5		41,3	50,5	
119	4,85												19,4	23,8		41,7	51,2	
120	4,90											19,6	24,0		42,1	51,6		
121	4,95											19,8	24,3		42,6	52,2		
122	4,95											19,4	23,8		41,7	51,2		
123	5,00											19,6	24,1		42,1	51,8		
124	5,05											19,8	24,3		42,6	52,2		
125	5,05					2,830	3,330					23,9	28,3		51,4	60,8		
126	5,10					0	0					24,1	28,6		51,8	61,5		
127	5,15					-0,034	-0,034					24,3	28,9		52,2	62,1		
128	5,20					For phos- phated PO surface: +0,01 -0,034	For phos- phated PO surface: +0,01 -0,034					24,6	29,2		52,9	62,8		
129	5,20											24,1	28,7		51,8	61,7		
130	5,25											24,3	28,9		52,2	62,1		
131	5,30											24,5	29,2		52,7	62,8		
132	5,30											24,1	28,7		51,8	61,7		
133	5,35											24,3	28,9		52,2	62,1		
134	5,40											24,5	29,2		52,7	62,8		

This table is shown in ISO format. Commas represent decimal points.