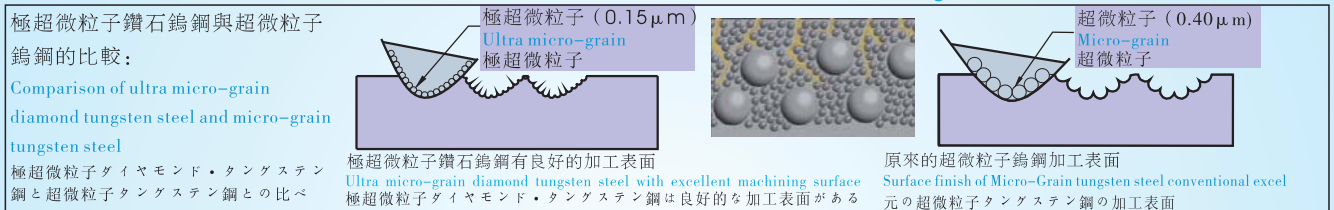
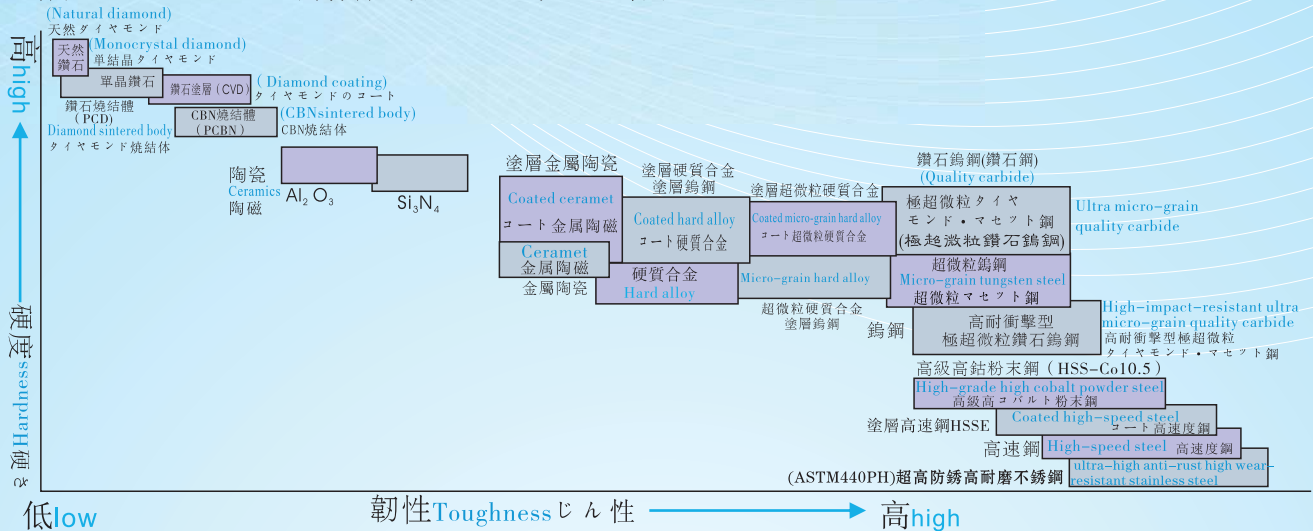


各種刀具材料的特性及ISO公差範圍表:
Table of characteristics and ISO tolerance range for various tooling materials
各種のブレードカット用材料の特性及びISO公差範囲の表

★各種刀具材料的硬度和韌性對照:Hardness and toughness comparison of various tooling materials
各種のブレードカット用材料の硬さとじん性との對照



ISO公差範圍表mm: (Table of ISO tolerance range)

(ISO公差範圍表mm)

φ mm	φ ≤ 3	3 < φ ≤ 6	6 < φ ≤ 10	10 < φ ≤ 18	18 < φ ≤ 30	30 < φ ≤ 50	50 < φ ≤ 65	65 < φ ≤ 80
e7	-0.014 -0.024	-0.020 -0.032	-0.025 -0.040	-0.032 -0.050	-0.040 -0.061	-0.050 -0.075	-0.060 -0.090	-0.060 -0.090
e8	-0.014 -0.028	-0.020 -0.038	-0.025 -0.047	-0.032 -0.059	-0.040 -0.073	-0.050 -0.089	-0.060 -0.106	-0.060 -0.106
e9	-0.014 -0.039	-0.020 -0.050	-0.025 -0.061	-0.032 -0.075	-0.040 -0.092	-0.050 -0.112	-0.060 -0.134	-0.060 -0.134
h5	0 -0.004	0 -0.005	0 -0.006	0 -0.008	0 -0.009	0 -0.011	0 -0.013	0 -0.013
h6	0 -0.006	0 -0.008	0 -0.009	0 -0.011	0 -0.013	0 -0.016	0 -0.019	0 -0.019
h7	0 -0.010	0 -0.012	0 -0.015	0 -0.018	0 -0.021	0 -0.025	0 -0.030	0 -0.030
h8	0 -0.014	0 -0.018	0 -0.022	0 -0.027	0 -0.033	0 -0.039	0 -0.046	0 -0.046
h9	0 -0.025	0 -0.030	0 -0.036	0 -0.043	0 -0.052	0 -0.062	0 -0.074	0 -0.074
h10	0 -0.040	0 -0.048	0 -0.058	0 -0.070	0 -0.084	0 -0.100	0 -0.120	0 -0.120
h11	0 -0.060	0 -0.075	0 -0.090	0 -0.110	0 -0.130	0 -0.160	0 -0.190	0 -0.190
h16	0 -0.600	0 -0.750	0 -0.900	0 -1.100	0 -1.300	0 -1.600	0 -1.900	0 -1.900
js14	+0.125 -0.125	+0.150 -0.150	+0.180 -0.180	+0.215 -0.215	+0.260 -0.260	+0.310 -0.310	+0.370 -0.370	+0.370 -0.370
js16	+0.300 -0.300	+0.375 -0.375	+0.450 -0.450	+0.550 -0.550	+0.650 -0.650	+0.800 -0.800	+0.950 -0.950	+0.950 -0.950
k11	+0.060 0	+0.075 0	+0.090 0	+0.110 0	+0.130 0	+0.160 0	+0.190 0	+0.190 0
k12	+0.100 0	+0.120 0	+0.150 0	+0.180 0	+0.210 0	+0.250 0	+0.300 0	+0.300 0
m6	+0.008 +0.002	+0.012 +0.004	+0.015 +0.006	+0.018 +0.007	+0.021 +0.008	+0.025 +0.009	+0.030 +0.011	+0.030 +0.011
m7	+0.012 +0.002	+0.016 +0.004	+0.021 +0.006	+0.025 +0.007	+0.029 +0.008	+0.034 +0.009	+0.041 +0.011	+0.041 +0.011
z9	+0.051 +0.026	+0.065 +0.035	+0.078 +0.042	+0.103 +0.060	+0.140 +0.088	+0.198 +0.136	+0.246 +0.172	+0.284 +0.210
H5	+0.004 0	+0.005 0	+0.006 0	+0.008 0	+0.009 0	+0.011 0	+0.013 0	+0.013 0
H6	+0.006 0	+0.008 0	+0.009 0	+0.011 0	+0.013 0	+0.016 0	+0.019 0	+0.019 0
H7	+0.010 0	+0.012 0	+0.015 0	+0.018 0	+0.021 0	+0.025 0	+0.030 0	+0.030 0
H8	+0.014 0	+0.018 0	+0.022 0	+0.027 0	+0.033 0	+0.039 0	+0.046 0	+0.046 0
H9	+0.025 0	+0.030 0	+0.036 0	+0.043 0	+0.052 0	+0.062 0	+0.074 0	+0.074 0
H10	+0.040 0	+0.048 0	+0.058 0	+0.070 0	+0.084 0	+0.100 0	+0.120 0	+0.120 0
H11	+0.060 0	+0.075 0	+0.090 0	+0.110 0	+0.130 0	+0.160 0	+0.190 0	+0.190 0
P6	-0.006 -0.012	-0.009 -0.017	-0.012 -0.021	-0.015 -0.026	-0.018 -0.031	-0.021 -0.037	-0.026 -0.045	-0.026 -0.045
P7	-0.006 -0.016	-0.008 -0.020	-0.009 -0.024	-0.011 -0.029	-0.014 -0.035	-0.017 -0.042	-0.021 -0.051	-0.021 -0.051
P9	-0.006 -0.031	-0.012 -0.042	-0.015 -0.051	-0.018 -0.061	-0.022 -0.074	-0.026 -0.088	-0.032 -0.106	-0.032 -0.106

各類硬度換算表:
Conversion table of different kind of hardness
各種の硬さの換算表

◆.材料硬度的近似換算值

Approximate conversion table of material hardness 料高さの近似換算表


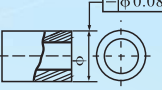



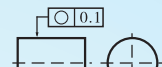



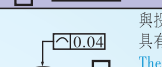



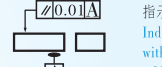

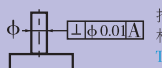

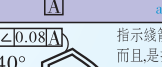

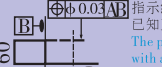



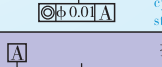

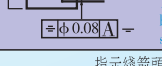

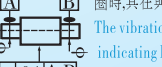
布氏硬度 (HB)				威氏硬度 Vickers hardness (HV)	洛氏硬度 (2) Rockwell hardness ロックウエル硬さ				肖氏硬度 Scleroscope hardness (HS)	抗拉強度 (近似値) (kg/mm ²) (N/mm ²) Tensile strength (approximate value)
φ10球, 3000kgf					洛氏硬度 (2) Rockwell hardness ロックウエル硬さ					
標準球	Haltgren球	碳化鎢球			A刻度載荷 60kgf金剛石 圓錐壓頭 (HRA)	B刻度載荷 100kgf.1 /16" 球 圓錐壓頭 (HRB)	C刻度載荷 150kgf金剛石 圓錐壓頭 (HRC)	D刻度載荷 100kgf金剛石 圓錐壓頭 (HRD)		
Standard ball	Haltgren ball	Carbide tungsten ball								
—	—	—	2200	95.5	—	—	—	—	—	—
—	—	—	2099	93.5	—	83.0	—	—	—	—
—	—	—	2021	93.0	—	82.0	—	—	—	—
—	—	—	1943	92.5	—	81.0	—	—	—	—
—	—	—	1865	92.0	—	80.0	—	—	—	—
—	—	—	1787	91.5	—	79.0	—	—	—	—
—	—	—	1710	91.0	—	78.0	—	—	—	—
—	—	—	1633	90.5	—	77.0	—	—	—	—
—	—	—	1556	90.0	—	76.0	—	—	—	—
—	—	—	1478	89.5	—	75.0	—	—	—	—
—	—	—	1400	89.0	—	74.0	—	—	—	—
—	—	—	1323	88.5	—	73.0	—	—	—	—
—	—	—	1245	88.0	—	72.0	—	—	—	—
—	—	—	1160	87.0	—	71.0	—	—	—	—
—	—	—	1076	86.5	—	70.0	—	—	—	—
—	—	—	1004	86.0	—	69.0	—	—	—	—
—	—	—	940	85.6	—	68.0	76.9	97	—	—
—	—	—	920	85.3	—	67.5	76.5	96	—	—
—	—	—	900	85.0	—	67.0	76.1	95	—	—
—	—	—	767	880	84.7	—	66.4	75.1	93	—
—	—	—	757	860	84.4	—	65.9	75.3	92	—
—	—	—	745	840	84.1	—	65.3	74.8	91	—
—	—	—	733	820	83.8	—	64.7	74.3	90	—
—	—	—	722	800	83.4	—	64.0	73.8	88	—
—	—	—	712	—	—	—	—	—	—	—
—	—	—	710	780	83.0	—	63.3	73.3	87	—
—	—	—	698	760	82.6	—	62.5	72.6	86	—
—	—	—	684	740	82.2	—	61.8	72.1	—	—
—	—	—	682	737	82.2	—	61.7	72.0	84	—
—	—	—	670	720	81.8	—	61.0	71.5	83	—
—	—	—	656	700	81.3	—	60.1	70.8	—	—
—	—	—	653	697	81.2	—	60.0	70.7	81	—
—	—	—	647	690	81.1	—	59.7	70.5	—	—
—	—	—	638	680	80.8	—	59.2	70.1	80	—
—	—	—	630	670	80.6	—	58.8	69.8	—	—
—	—	—	627	667	80.5	—	58.7	69.7	79	—
—	601	—	677	80.7	—	59.1	70.0	—	—	—
—	—	—	601	640	79.8	—	57.3	68.7	77	—
—	578	—	640	79.8	—	57.3	68.7	—	—	—
—	—	—	578	615	79.1	—	56.0	67.7	75	—
—	—	—	555	607	78.8	—	55.6	67.4	—	—
—	—	—	555	591	78.4	—	54.7	66.7	73	210 (2055)
—	534	—	579	78.0	—	54.0	66.1	—	—	206 (2015)
—	—	—	534	569	77.8	—	53.5	65.8	71	202 (1985)
—	—	—	514	533	77.1	—	52.5	65.0	—	195 (1915)
—	—	—	514	547	76.9	—	52.1	64.7	70	193 (1890)
495	—	—	539	76.7	—	51.6	64.3	—	—	189 (1855)
—	495	—	530	76.4	—	51.1	63.9	—	—	186 (1825)
—	—	—	495	528	76.3	—	51.0	63.8	68	186 (1820)
—	—	—	516	75.9	—	50.3	63.2	—	—	182 (1780)
—	477	—	508	75.6	—	49.6	62.7	—	—	178 (1740)
—	—	—	477	508	75.6	—	49.6	62.7	66	178 (1740)

備注/Remark 1N/mm² = 1Mpa

幾何公差的圖示方法

Illustration method of geometric tolerance

◆幾何學公差之種類和記號 Type and mark(s) of geometric tolerance

公差的種類 Type of tolerance	記號 Mark	公差的域的定義 Definition of tolerance zone	圖示例的解釋 Note to illustration
形狀公差 Form tolerance	真直度公差 Straightness	 表示公差域的數值前方,附有代號 ϕ 時,是指此一公差域,直徑的圓筒中的領域。 When there is symbol ϕ in front of the numerical value that expresses tolerance zone, it means this tolerance zone, the area in the cylinder with diameter of t	 表示圓筒直徑的尺寸加有公差的截框時,其圓筒軸線須是在直徑0.08mm的圓筒內。 If the tolerance frame is after the diameter of the cylinder, it means the axial line of the cylinder could have 0.08mm tolerance
	平面度公差 Flatness	 公差域是夾持的相距距離之兩個平均的平面間的領域 Tolerance zone: area enclosed by two average planes with a distance of t	 此一表面須在相距的二個平行的平面之間。 This surface must be between two parallel planes with a distance of t
	真圓度公差 Roundness	 對象的平面的公差域是相距距離的2個同心圓之間的領域。 Object plane's tolerance zone is area which two concentric circles with a distance of t	 任意軸直角斷面的外周必須是在同一平面上相距的兩個同心圓之間。 The circumference of right-angle section of any axis must be between two concentric circles with a distance of t in the same plane
	圓筒度公差 Cylindricity	 公差域是相距的二個同軸圓筒面間的領域 Tolerance zone is area in which two coaxial cylinder plane with a distance of t	 對象面必須在相距0.1mm的二個同軸圓筒面之間 Object plane must be between two coaxial cylinder surfaces with a distance of 0.1mm
	線的輪廓度公差 Line profile	 公差域是中心位於理論上正確輪廓線上,直徑圓的二個包圍線之間,所夾持的領域。 Tolerance zone is area enclosed by two profile lines of a circle with a diameter of t when the center is in the theoretically correct contour line	 與投影面平行的任意截面上對象的輪廓必須是中心位於具有理論上正確輪廓面上,直徑0.04mm圓的二個包圍線之間。 The contour of the object in any section that is parallel with projective surface must be between two profile lines of a circle with a diameter of 0.04mm when the center is in the theoretically correct contour plane.
	面的輪廓度公差 Surface profile	 公差域是中心位於理論上正確輪廓面上,直徑球體的二個包圍面之間,所夾持的領域。 Tolerance zone is area enclosed by two profile planes of a sphere with a diameter of t when the center is in the theoretically correct contour line	 對象的面必須是在中心位於理論上具有正確輪廓面上,直徑0.02mm球體之二個包圍面之間 Object plane must be between two profile planes of a sphere with a diameter of 0.02mm when the center is in the theoretically correct contour plane
姿勢公差 Orientation tolerance	平行度公差 Parallelism	 公差域是與已知(datum)平面平行、相距的二個平行平面間所夾持的領域。 Tolerance zone is area enclosed by two parallel planes with a distance of t and parallel with datum plane	 指示線箭頭的指示面,必須是與已知平面的平行,而且在指示線箭頭方向相距0.01mm二個平面之間。 Indication surface of indicating line arrow must be parallel with datum surface, and be between two planes with a distance of 0.01mm in the direction of indicating line arrow
	垂直度公差 Perpendicularity	 表示公差數值前面加有代號 ϕ 時,此一公差域是與已知平面垂直,直徑的圓筒內的領域。 When there is symbol ϕ in front of the numerical value that expresses tolerance zone, this tolerance zone is area in the cylinder with a diameter of t that is perpendicular with the datum plane	 指示線箭頭指示的圓筒軸線,必須是與已知平面相垂直,直徑0.01mm的圓筒內。 The cylinder axis indicated by indicating line arrow must be perpendicular with datum surface and in the cylinder with a diameter of 0.01mm.
	傾斜度公差 Angularity	 公差域依規定角度,與已知平面呈傾斜,相互間相距距離的二個平行平面間所夾持的領域 Tolerance zone is area enclosed by two parallel planes with a distance of "t" and inclined with datum plane by a specified angle.	 指示線箭頭指示的面,必須是理論上與已知平面A呈正確的40°傾斜,而且是指示線的箭頭方向相距0.08mm距離的二個平行平面間。 The surface indicated by indicating line arrow, must be theoretically 40° inclined from datum plane A, and be between two parallel planes with a distance of 0.08 in the direction of indicating line arrow.
位置公差 Tolerance in position	位置度公差 Position	 公差域以對象點的理論上正確位置(以下稱「正位置」)的中心之直徑圓之中或球體內的領域。 Tolerance zone is the area in a circle or sphere with a diameter of t with theoretically correct position (hereinafter referred to as "positive position") as the center.	 指示線箭頭指示的點,必須是與已知直線A相距60mm,已知直線B相距100mm之正位置為中心,直徑0.03mm的圓內 The point indicated by indicating line arrow, must be in the circle with a diameter of 0.03mm with the positive position that is 60mm from datum straight line A and 100mm from datum straight line B as the center.
	同軸度公差及同心度公差 Concentricity	 表示公差數值前面,加有代號 ϕ 時,此一公差域是與已知軸線一致軸線之直徑的圓筒中的領域 When there is symbol ϕ in front of the numerical value that expresses tolerance zone, this tolerance zone is area in the cylinder with a diameter of t that is parallel with the datum axis line	 指示線箭頭指示的軸線,必須是在以已知軸,直線A為軸線,直徑0.01mm的圓筒內。 The axis indicated by indicating line arrow, must be in the cylinder with a diameter of 0.01mm with datum axial straight line A as axis
	對稱度 Symmetry	 公差域是與已知中心平面呈對稱配置,彼此相距的二個平行平面間所夾持的領域。 Tolerance zone is the area symmetry with the datum plane, and enclosed by two parallel planes with a distance of "t".	 指示線箭頭指示的中心面,必須是以已知的中心平面A呈對稱為0.08mm間隔,而且呈平行的二個平面之間。 The center plane indicated by indicating line arrow must be between two parallel planes with a distance of 0.08mm and symmetric with datum center plane A.
振動公差 Vibration tolerance	圓周振動公差 Circular runout	 測定實施表面(測定表面) Measure implementation surface (measure surface) 公差域是與已知軸線呈垂直的任意測定平面上具有與已知軸線一致的中心,並且在半径方向相距距離的二個同心圓之間的領域。 Tolerance zone is area between two concentric circles with a distance of t in the direction of radius and has the same center with datum axial straight line in any measured plane perpendicular with datum axial straight line	 指示線箭頭指示的圓筒面半径方向的振動,是已知軸線A-B的回轉圓時,其在與已知軸線呈垂直的任意測定平面上,不會超過0.1mm。 The vibration in the direction of cylinder plane radius indicated by indicating line arrow is in any measured plane perpendicular with datum axial straight line when datum straight line A-B rotates a round and it will not exceed 0.1mm
	全振動公差 Total runout	 附公差表面 Tolerance surface attached 公差域是具有與已知軸線一致的軸線,在半径方向相距距離的二個同心圓筒間的領域 Tolerance zone is area between two coaxial cylinders with a distance of t in the direction of radius and has the same axis with datum axial straight line	 指示線箭頭指示的圓筒面半径方向的完全振動,在已知軸線A-B的回轉圓筒部分時,圓筒表面上的任意點不會超過0.1mm。 The complete vibration in the direction of cylinder plane radius indicated by indicating line arrow, when in datum straight line A-B's rotating cylindrical part, any point on cylinder surface will not exceed 0.1mm

公差域定義欄中使用的線條具有以下的意義: The lines used in definition column of tolerance zone have the following meanings

粗實線或虛線:形體 Thick real line or dashed: form

粗一點虛線:既有資料

Thin one-dot dashed: data available

細實線或虛線:公差域

Thin real line or dashed: tolerance zone

細一點虛線:中心線 Thin one-dot dashed: center line

細二點虛線:補足的投影面或切斷面

Thin two-dot dashed: complementary projective surface or section

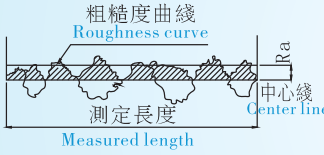
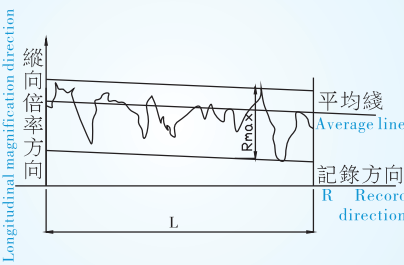
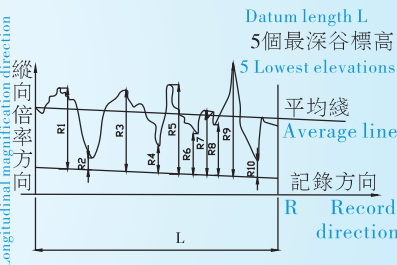
粗二點虛線:形狀對於補足的投影面或切斷面的投影

Thick two-dot dashed: projection of profile to complementary projective surface or fracture surface

表面粗糙度的定義及表示參考

Definition of surface roughness and expression reference

◆.表面粗糙度種類:Type of surface roughness

種類 Type		中心綫平均高度 Average height of center line		最大高度 Max. Height		T點平均高度 Average height at Tpoint			
代號 Symbol		Ra		Rmax		Rz			
最大高度的最大 值表示代號 Expression symbol of maximum value of maximum height		a		s		z			
定義 Definition		<p>取粗糙度曲綫對中心綫的絕對值面積除以基準長度比以微米（μm）為單位。通常通過中心綫粗糙度測定器可直接讀出。</p> <p>Absolute value area of roughness curve to center line is divided by datum length in μm. Usually it can be directly read out via center line roughness measure.</p> 		<p>將基準長從斷面曲綫上抽取一部分，當平行于此部分平均綫的兩條直綫將此抽取部分變狹時，從曲綫縱向倍率方面測量兩直綫之間的距離并用微米表示此值。</p> <p>Take a part of datum length from section curve, when the two straight lines parallel with this part of average line make this taken part narrow, measure the distance between two straight lines from curve's longitudinal magnification direction and express this value in μm.</p> 		<p>將位于基準長從斷面曲綫上抽取的部分平行于平均綫且不橫切斷面直綫到從縱倍率方向測量的最高至五個谷底標高平均值之間的差用微米表示。</p> <p>Take a part of datum length from section curve, parallel with mean line but not to crosscut the section, so the difference from the line to the mean value between 5 peak elevations & 5 lowest elevations measured at curve's longitudinal magnification direction and express this value in μm.</p> <p>R1、R3、R5、R7、R9: 基準長度L Datum length L 5個最山頂標高 5 peak elevations R2、R3、R6、R8、R10: 基準長度L Datum length L 5個最深谷標高 5 Lowest elevations</p> 			
	粗糙度代號 Symbol of roughness	標準系列 Standard series	切斷值 Cutting value (mm)	測定長度 Measured length (mm)	標準系列 Standard series	基準長度 Datum length (mm)	標準系列 Standard series	基準長度 Datum length (mm)	
標準代號和基準長度及粗糙度區分 Differentiation of standard symbol and datum length & roughness	▽▽▽▽	0.013a	0.8	切斷值 倍 以 上 Cutting value > 3 times	0.05s	0.25	0.05z	0.25	
		0.025a			0.1s		0.1z		
		0.05a			0.2s		0.2z		
		0.1a			0.4s		0.4z		
		0.2a			0.8s		0.8z		
	▽▽▽	0.4a			1.6s	0.8	1.6z	0.8	
		0.8a			3.2s		3.2z		
		1.6a			6.3s		6.3z		
	▽▽	3.2a			12.5s	2.5	12.5z	2.5	
		6.3a			25s		25z		
	▽	12.5a			50s	8	50z	8	
		25a			100s		100z		
	-	50a	2.5		200s	25	200z	25	
		100a			400s		400z		

各種加工法粗糙度的範圍

Roughness range of various machining method

◆各種加工法粗糙度範圍 : Roughness range of various machining method

粗糙度表示 Expression of roughness	0.1-S	0.2-S	0.4-S	0.8-S	1.6-S	3.2-S	6.3-S	12.5-S	25-S	50-S	100-S	200-S	400-S	
加工法 Machining method	粗糙度範圍 μm Roughness range	0.1以下 under0.1	0.2以下 under0.2	0.4以下 under0.4	0.8以下 under0.8	1.6以下 under1.6	3.2以下 under3.2	6.3以下 under6.3	12.5以下 under12.5	25以下 under25	50以下 under50	100以下 under100	200以下 under200	400以下 under400
基準長度・標準值(mm) Standard value of datum length	0.25				0.8			2.5		8		25		
代號 Symbol	無記號或No mark or……													
鍛造 Forging								精密精加工		Precision finish machining				
鑄造 Foundry								精密精加工		Precision finish machining				
衝切件 Die cutting														
熱作壓延 Hot calendaring														
冷作壓延 Cold calendaring														
拉伸 Drawing														
押出 Extrusion														
轉筒式 Rotating drum														
噴砂 Sand blasting														
擠壓 Pressing														
粗糙度代號 Symbol of roughness	▽▽▽▽				▽▽▽			▽▽		▽		—		
正面切削 Face cutting						精密精加工		Precision finish machining						
端面切削 End plane cutting														
仿形車 Contour lathe														
銑床 Milling machine						精密精加工		Precision finish machining						
精加工 Finish machining														
銼刀精加工 Finish machining by file						精密精加工		Precision finish machining						
圓車削 Circular cutting			精密精加工	Precision finish machining		上精加工(high)		中精加工(mid)		粗糙(roughness)				
精加工 Finish machining						上精加工(high)		中精加工(mid)						
銼削 Filing														
銼刀加工 Reamer machining					精密精加工		Precision finish machining							
拉刀 Broaching					精密精加工		Precision finish machining							
剃齒 Gear shaving														
研削 Grinding		Precision finish machining	精密精加工	上精加工(high)		中精加工(mid)		粗糙(roughness)						
珩頭 精加工 honing head			精密精加工											
超精加工 Super finish machining	精密精加工	Precision finish machining												
拋光 Polishing		精密精加工	Precision finish machining											
砂蘭 Emery blue			精密精加工	Precision finish machining										
研磨 Grinding	精密精加工	Precision finish machining												
液體研磨 Liquid honing			精密精加工	Precision finish machining										
拋光 Polishing														
滾壓 Rolling														
放電仿形加工 Spark discharge contour machining														
線切割 Wire cutting														
化學研磨 Chemical grinding					精密精加工		Precision finish machining							
電解研磨 Electrolytic grinding	精密精加工	Precision finish machining												