

**UNIVERSITY OF BOLTON**

**WESTERN INTERNATIONAL COLLEGE FZE**

**BENG (HONS) MECHANICAL ENGINEERING**

**SEMESTER ONE EXAMINATION 2019/2020**

**GRAPHICAL COMMUNICATION & COMPUTER**  
**MODELLING**

**MODULE NO: AME4065**

Date: Saturday 11<sup>th</sup> January 2020

Time: 1.30pm – 3.30pm

**ASSESSMENT:**

This assessment represents 45% of the total assessment mark for Graphical Communications & Computer Modelling.

**INSTRUCTIONS TO CANDIDATES:**

- Complete the following questions using a pencil for diagrams and pen for written answers. Write your student number below.
- The marks for each question are shown. The total number of marks available is 90. 10 marks of which are allocated for overall neatness, clarity and the use of standard lines.
- If you are unsure of what to do, ask your tutor. Separate the sheets if necessary but replace them in order at the end of the exam.
- BS EN 20286-2 Tolerance Tables are included in this exam paper.
- You have 2.0 hours to complete the test

1	2	3	4	5	6	7	8	9	Neat	Total
3	3	9	12	9	8	14	12	20	10	

Student Number: .....

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1. Write the full form of the following Standard Drawing abbreviation seen on engineering drawings:

- CBORE .....
- MATL .....
- NTS .....

(3 marks)

2. Write the standard abbreviation for the following when required on an engineering drawing:

- Revolution per minute .....
- Pitch Circle Diameter .....
- Specification .....

(3 marks)

3. Using the partially completed figures below, sketch the standard representation for the following features which might appear on an engineering drawing:

- **Diamond Knurl:**

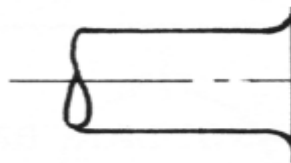


Figure 3(a)

(3 marks)

- **cheese head:**

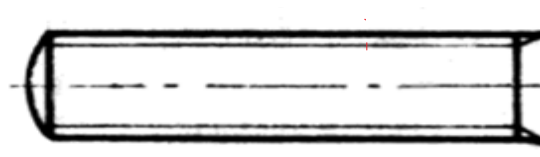


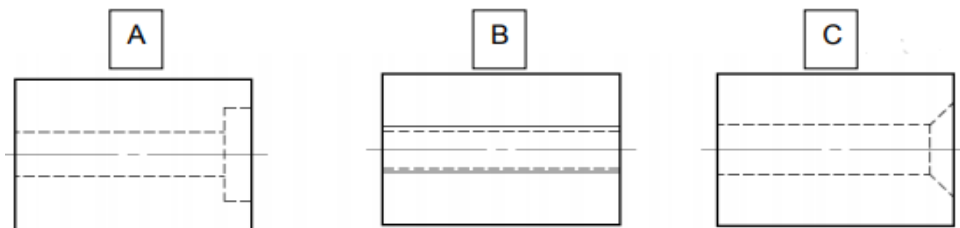
Figure 3(b)

(3 marks)

Question 3 continued over the page

**Question 3 continued.**

- **A countersunk through hole (Tick the right answer)**



(3 marks)

Figure 3(c)

**4.** Drawn below in **figure 4** is a cross-section through a Shaft, Bush Bearing and Housing arrangement. Select fits that allow:

- i) The bush must remain in the Housing.
- ii) The shaft must easily slide and rotate in the bush.

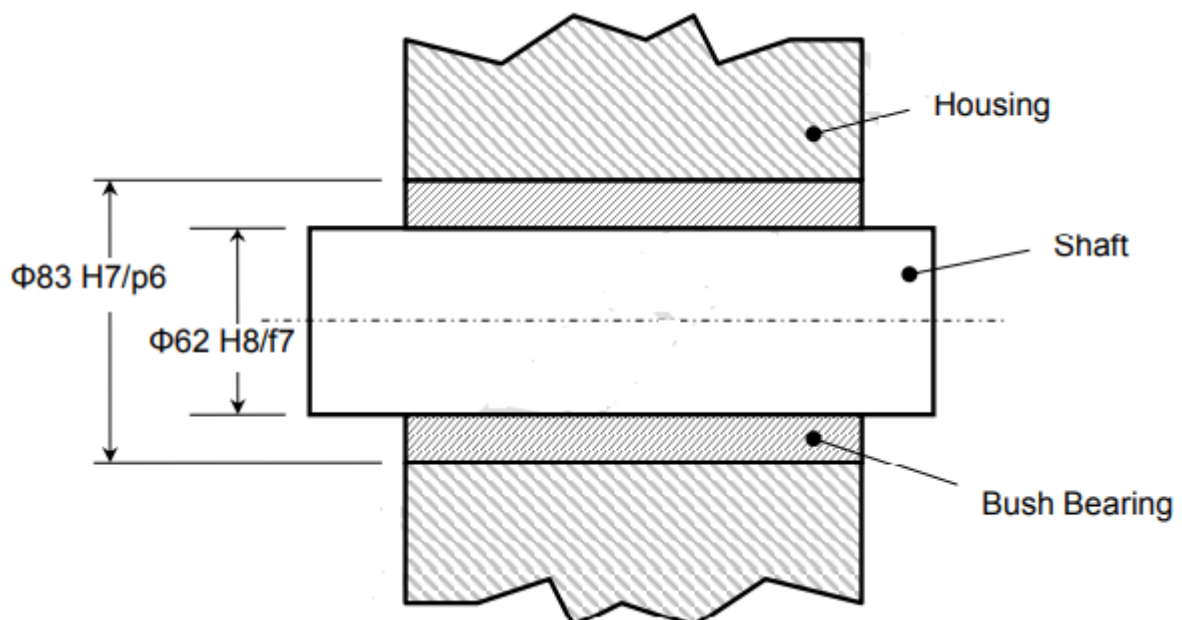


Figure 4

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**Question 4 continued over the page**


**Question 4 continued.**

Using BS EN 20286-2 Tolerance Tables (supplied), complete the following table:


Between Components	Grade of Tolerance	Type of Fit	Limits of Size for:	Size of Tolerance
Bush/Shaft	H8f7		Bush	
			Shaft	
Housing/Bush	H7 p6		Housing	
			Bush	

(12 marks)


5. State name and describe the meaning of the following Geometrical Tolerance symbols:

a.  .....

.....

b.  .....

.....

c.  .....

.....

(3 marks each)

Please turn the page

6. Describe using sketches or words for the below **figure 6**

- I. What the symbols and dimensional information mean.
- II. The significance of the frame and plus/minus coordinate dimensions in the context of this component.

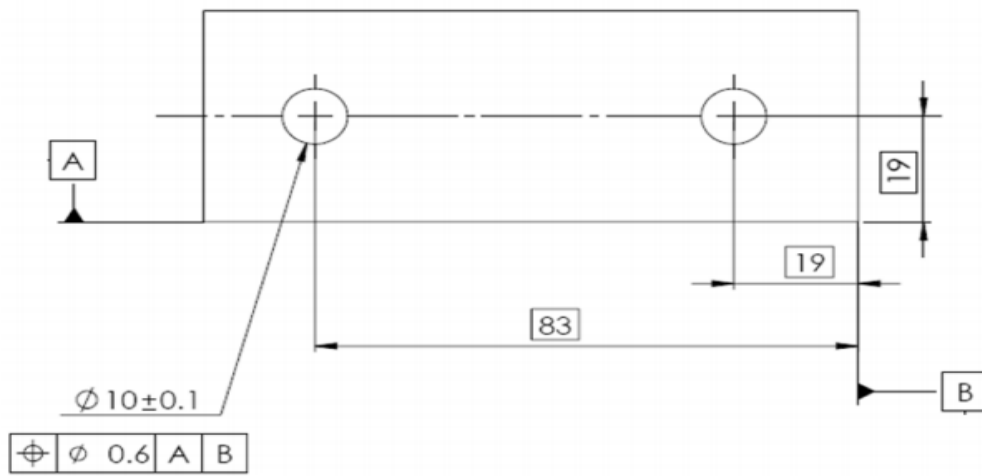


Figure 6

Past Examination

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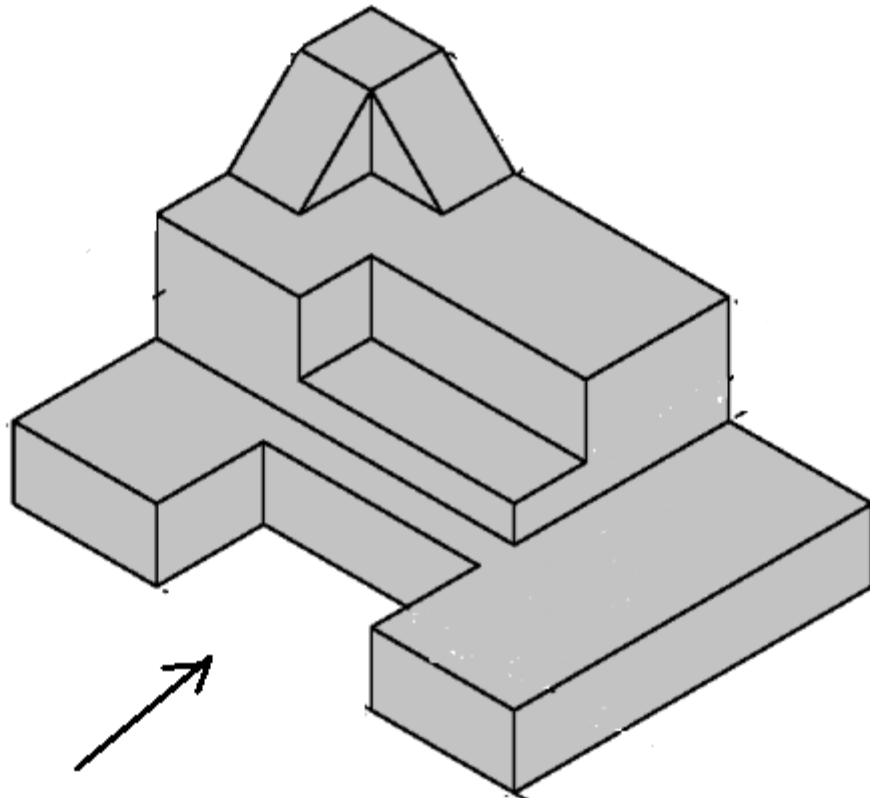
.....

.....

(8 Marks)

**Please turn the page**

7. An isometric drawing of a part is given below in **Figure 7**. The drawing is not to the scale. Use front view (F.V.) shown below with an arrow for drawing reference.



**Figure 7**

Sketch in 1<sup>st</sup> Angle Projection, the Elevation and Plan view of the given drawing in **SHEET Q7** on page 8 with proper projection symbol and student number in title block.

- a) Elevation View

(8 marks)

- b) Plan View

(4 marks)

- c) Student number & Projection symbol

(2 marks)

**(Total 14 marks)**

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**Please turn the page**

8. SHEET Q8 on page 9 shows a partially completed Orthographic drawing section of a Lever. The Plan View is already drawn and the Section View is missing. The cutting plane passes longitudinally through the centre of the web and section plane is given in the Top view of the lever as A-A.

The overall dimensions shown are in mm with section line as A-A. Supply all sectioning information as necessary. Put your student number in the title block.

Sketch using 3<sup>rd</sup> Angle method of projection the following

- a) Dimensioned Front View (6 marks)
- b) Sectioning with the section line A-A (4 marks)
- c) Student number: **1 mark** and Projection symbol: **1 mark** (2 marks)

**(Total 12 marks)**

9. Shown on page 10 is the 'Universal Coupling Parts' drawing, the components that make up a Universal Coupling Assembly. Each part is dimensioned appropriately with two views for reference. (the drawing is in mm):

Using a pencil and setsquares, draw an **assembly drawing** in SHEET Q9 on page 11. Show all the parts assembled in their correct positions and hatched according to drawing conventions.

- a) Completer Front View in good proportion (10 marks)
- b) Sectioning of the assembly drawing (4 marks)
- c) Balloon reference the assembly (2 marks)
- d) Create Part list of the assembly (4 marks)

**(Total 20 Marks)**

**Please turn over for Question Sheets**

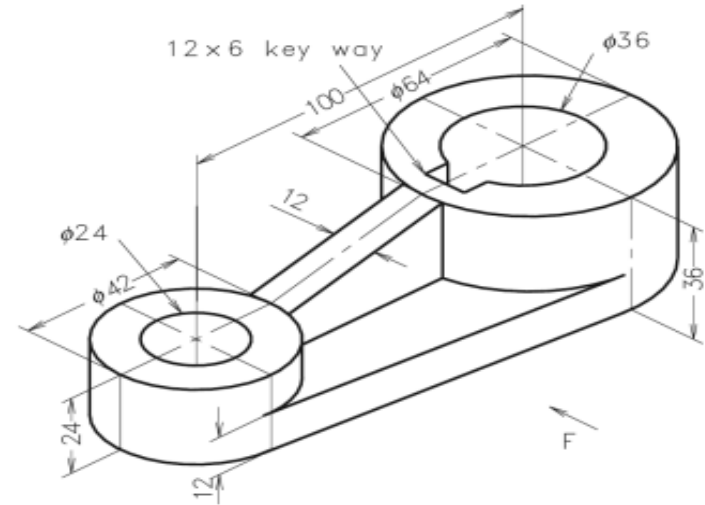
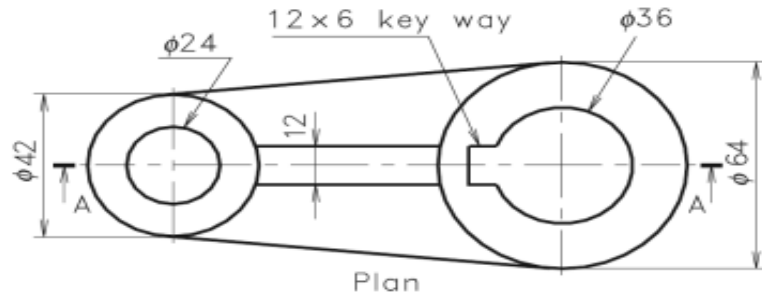
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**SHEET Q7**


PROJECTION	STU NO.
	TITLE: QUESTION 7
	<small>SHEET 3 OF 4</small>

**Please turn the page**



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**SHEET Q8**

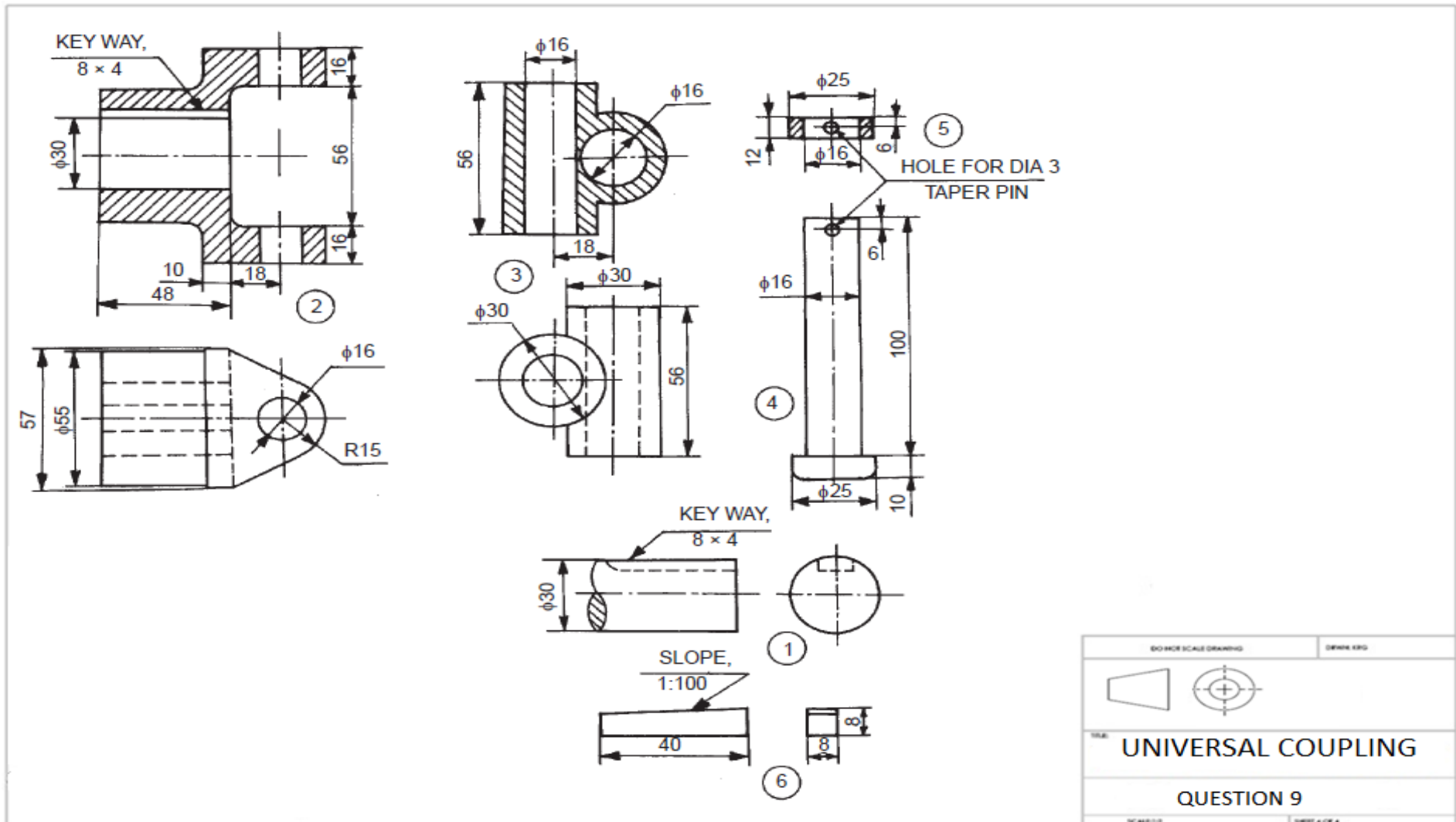


PROJECTION 	STU NO.
	TITLE: <b>QUESTION 8</b>
	SHEET 3 OF 4

Please turn the page


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**UNIVERSAL COUPLING PARTS DRAWING**



Please turn the page

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**SHEET Q9**

DO NOT SCALE DRAWING		DATE: / /
	STUDENT NO:	
TITLE: UNIVERSAL COUPLING		
QUESTION 9 ANSWER SHEET		
SCALE: 1:1	SHEET 4 OF 4	

**Please turn the page for Tolerance Tables**

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### Tolerance Table

ISO Tolerances for Holes (ISO 286-2)																				
Nominal hole sizes (mm)																				
over	3	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355
inc.	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355	400
micrometres																				
E6	+28 +20	+34 +25	+43 +32	+53 +40	+66 +50	+79 +60	+94 +72	+110 +85	+129 +100	+142 +110	+161 +125									
E7	+32 +20	+40 +25	+50 +32	+61 +40	+75 +50	+90 +60	+107 +72	+125 +85	+146 +100	+162 +110	+185 +125									
E11	+95 +20	+115 +25	+142 +32	+170 +40	+210 +50	+250 +60	+292 +72	+335 +85	+390 +100	+430 +110	+485 +125									
E12	+140 +20	+175 +25	+212 +32	+250 +40	+300 +50	+360 +60	+422 +72	+485 +85	+560 +100	+630 +110	+695 +125									
E13	+200 +20	+245 +25	+302 +32	+370 +40	+440 +50	+520 +60	+612 +72	+715 +85	+820 +100	+920 +110	+1 015 +125									
F6	+18 +10	+22 +13	+27 +16	+33 +20	+41 +2	+49 +30	+58 +36	+68 43	+79 +50	+88 +56	+98 +62									
F7	+22 +10	+28 +13	+34 +16	+41 +20	+50 +25	+60 +30	+71 +36	+83 43	+96 +50	+108 +56	+119 +62									
F8	+28 +10	+35 +13	+43 +16	+53 +20	+64 +25	+76 +30	+90 +36	+106 43	+122 +50	+137 +56	+151 +62									
G6	+12 +4	+14 +5	+17 +6	+20 +7	+25 +9	+29 +10	+34 +12	+39 +14	+44 +15	+49 +17	+54 +18									
G7	+16 +4	+20 +5	+24 +6	+28 +7	+34 +9	+40 +10	+47 +12	+54 +14	+61 +15	+69 +17	+75 +18									
G8	+22 +4	+27 +5	+33 +6	+40 +7	+48 +9	+56 +10	+66 +12	+77 +14	+87 +15	+98 +17	+107 +18									
H6	+8 0	+9 0	+11 0	+13 0	+16 0	+19 0	+22 0	+25 0	+29 0	+32 0	+36 0									
H7	+12 0	+15 0	+18 0	+21 0	+25 0	+30 0	+35 0	+40 0	+46 0	+52 0	+57 0									
H8	+18 0	+22 0	+27 0	+33 0	+39 0	+46 0	+54 0	+63 0	+72 0	+81 0	+89 0									
H9	+30 0	+36 0	+43 0	+52 0	+62 0	+74 0	+87 0	+100 0	+115 0	+130 0	+140 0									
H10	+48 0	+58 0	+70 0	+84 0	+100 0	+120 0	+140 0	+160 0	+185 0	+210 0	+230 0									
H11	+75 0	+90 0	+110 0	+130 0	+160 0	+190 0	+220 0	+250 0	+290 0	+320 0	+360 0									

Tolerance Table continued over the page

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**Tolerance Table continued**

<b>J6</b>	+5 -3	+5 -4	+6 -5	+8 -5	+10 -6	+13 -6	+16 -6	+18 -7	+22 -7	+25 -7	+29 -7								
<b>J7</b>	+6 -6	+8 -7	+10 -8	+12 -9	+14 -11	+18 -12	+22 -13	+26 -14	+30 -16	+36 -16	+39 -18								
<b>J8</b>	+10 -8	+12 -10	+15 -12	+20 -13	+24 -15	+28 -18	+34 -20	+41 -22	+47 -25	+55 -26	+60 -29								
<b>JS6</b>	+4 -4	+4.5 -4.5	+5.5 -5.5	+6.5 -6.5	+8 -8	+9.5 -9.5	+11 -11	+12.5 -12.5	+14.5 -14.5	+16 -16	+18 -18								
<b>JS7</b>	+6 -6	+7.5 -7.5	+9 -9	+10.5 -10.5	+12.5 -12.5	+15 -15	+17.5 -17.5	+20 -20	+23 -23	+26 -26	+28.5 -28.5								
<b>JS8</b>	+9 -9	+11 -11	+13.5 -13.5	+16.5 -16.5	+19.5 -19.5	+23 -23	+27 -27	+31.5 -31.5	+36 -36	+40.5 -40.5	+44.5 -44.5								
<b>K6</b>	+2 -6	+2 -7	+2 -9	+2 -11	+3 -13	+4 -15	+4 -18	+4 -21	+5 -24	+5 -27	+7 -29								
<b>K7</b>	+3 -9	+5 -10	+6 -12	+6 -15	+7 -18	+9 -21	+10 -25	+12 -28	+13 -33	+16 -36	+17 -40								
<b>K8</b>	+5 -13	+6 -16	+8 -19	+10 -23	+12 -27	+14 -32	+16 -38	+20 -43	+22 -50	+25 -56	+28 -61								
<b>M6</b>	-1 -9	-3 -12	-4 -15	-4 -17	-4 -20	-5 -24	-6 -28	-8 -33	-8 -37	-9 -41	-10 -46								
<b>M7</b>	0 -12	0 -15	0 -18	0 -21	0 -25	0 -30	0 -35	0 -40	0 -46	0 -52	0 -57								
<b>M8</b>	+2 -16	+1 -21	+2 -25	+4 -29	+5 -34	+5 -41	+6 -48	+8 -55	+9 -63	+9 -72	+11 -78								
<b>N6</b>	-5 -13	-7 -16	-9 -20	-11 -24	-12 -28	-14 -33	-16 -38	-20 -45	-22 -51	-25 -57	-26 -62								
<b>N7</b>	-4 -16	-4 -19	-5 -23	-7 -28	-8 -33	-9 -39	-10 -45	-12 -52	-14 -60	-14 -66	-16 -73								
<b>N8</b>	-2 -20	-3 -25	-3 -30	-3 -36	-3 -42	-4 -50	-4 -58	-4 -67	-5 -77	-5 -86	-5 -94								
<b>P6</b>	-9 -17	-12 -21	-15 -26	-18 -31	-21 -37	-26 -45	-30 -52	-36 -61	-41 -70	-47 -79	-51 -87								
<b>P7</b>	-8 -20	-9 -24	-11 -29	-14 -35	-17 -42	-21 -51	-24 -59	-28 -68	-33 -79	-36 -88	-41 -98								
<b>P8</b>	-12 -30	-15 -37	-18 -45	-22 -55	-26 -65	-32 -78	-37 -91	-43 -106	-50 -122	-56 -137	-62 -151								
<b>R6</b>	-12 -20	-16 -25	-20 -31	-24 -37	-29 -45	-35 -54	-37 -56	-44 -66	-47 -69	-56 -81	-58 -83	-61 -86	-68 -97	-71 -100	-75 -104	-85 -117	-89 -121	-97 -133	-103 -139
<b>R7</b>	-11 -23	-13 -28	-16 -34	-20 -41	-25 -50	-30 -60	-32 -62	-38 -73	-41 -76	-48 -88	-50 -90	-53 -93	-60 -106	-63 -109	-67 -113	-74 -126	-78 -130	-87 -144	-93 -150

Tolerance Table continued over the page

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**Tolerance Table continued**

ISO Tolerances for Shafts (ISO 286-2)																					
Nominal Shaft Sizes (mm)																					
over	3	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355	
inc.	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355	400	
micrometres																					
<b>a12</b>	-270 -390	-280 -430	-290 -470	-300 -510	-310 -560	-320 -570	-340 -640	-360 -660	-380 -730	-410 -760	-460 -860	-520 -920	-580 -980	-660 -1120	-740 -1200	-820 -1280	-920 -1440	-1050 -1570	-1200 -1770	-1350 -1920	
<b>d6</b>	-30 -38	-40 -49	-50 -61	-65 -78	-80 -96	-100 -119	-120 -142	-145 -170	-170 -199	-190 -222	-210 -246										
<b>e6</b>	-20 -28	-25 -34	-32 -43	-40 -53	-50 -66	-60 -79	-72 -94	-85 -110	-100 -129	-110 -142	-125 -161										
<b>e13</b>	-20 -200	-25 -245	-32 -302	-40 -370	-50 -440	-60 -520	-72 -612	-85 -715	-100 -820	-110 -920	-125 -1015										
<b>f5</b>	-10 -15	-13 -19	-16 -24	-20 -29	-25 -36	-30 -43	-36 -51	-43 -61	-50 -70	-56 -79	-62 -87										
<b>f6</b>	-10 -18	-13 -22	-16 -27	-20 -33	-25 -41	-30 -49	-36 -58	-43 -68	-50 -79	-56 -88	-62 -98										
<b>f7</b>	-10 -22	-13 -28	-16 -34	-20 -41	-25 -50	-30 -60	-36 -71	-43 -83	-50 -96	-56 -108	-62 -119										
<b>g5</b>	-4 -9	-5 -11	-6 -14	-7 -16	-9 -20	-10 -23	-12 -27	-14 -32	-15 -35	-17 -40	-18 -43										
<b>g6</b>	-4 -12	-5 -14	-6 -17	-7 -20	-9 -25	-10 -29	-12 -34	-14 -39	-15 -44	-17 -49	-18 -54										
<b>g7</b>	-4 -16	-5 -20	-6 -24	-7 -28	-9 -34	-10 -40	-12 -47	-14 -54	-15 -61	-17 -69	-18 -75										
<b>h4</b>	-0 -4	-0 -4	-0 -5	-0 -6	-0 -7	-0 -8	-0 -10	-0 -12	-0 -14	-0 -16	-0 -18										
<b>h5</b>	-0 -5	-0 -6	-0 -8	-0 -9	-0 -11	-0 -13	-0 -15	-0 -18	-0 -20	-0 -23	-0 -25										
<b>h6</b>	-0 -8	-0 -9	-0 -11	-0 -13	-0 -16	-0 -19	-0 -22	-0 -25	-0 -29	-0 -32	-0 -36										
<b>h7</b>	-0 -12	-0 -15	-0 -18	-0 -21	-0 -25	-0 -30	-0 -35	-0 -40	-0 -46	-0 -52	-0 -57										
<b>h8</b>	-0 -18	-0 -22	-0 -27	-0 -33	-0 -39	-0 -46	-0 -54	-0 -63	-0 -72	-0 -81	-0 -89										
<b>h9</b>	-0 -30	-0 -36	-0 -43	-0 -52	-0 -62	-0 -74	-0 -87	-0 -100	-0 -115	-0 -130	-0 -140										
<b>h10</b>	-0 -48	-0 -58	-0 -70	-0 -84	-0 -100	-0 -120	-0 -140	-0 -160	-0 -185	-0 -210	-0 -230										
<b>h11</b>	-0 -75	-0 -90	-0 -110	-0 -130	-0 -160	-0 -190	-0 -220	-0 -250	-0 -290	-0 -320	-0 -360										
<b>h12</b>	-0 -120	-0 -150	-0 -180	-0 -210	-0 -250	-0 -300	-0 -350	-0 -400	-0 -460	-0 -520	-0 -570										
<b>j5</b>	+3 -2	+4 -2	+5 -3	+5 -4	+6 -5	+6 -7	+6 -9	+7 -11	+7 -13	+7 -16	+7 -18										
<b>j6</b>	+6 -2	+7 -2	+8 -3	+9 -4	+11 -5	+12 -7	+13 -9	+14 -11	+16 -13	+16 -16	+18 -18										
<b>j7</b>	+8 -4	+10 -5	+12 -6	+13 -8	+15 -10	+18 -12	+20 -15	+22 -18	+25 -21	+26 -26	+29 -28										

Tolerance Table continued over the page

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**Tolerance Table continued**

<b>js5</b>	+2.5 -2.5	+3 -3	+4 -4	+4.5 -4.5	+5.5 -5.5	+6.5 -6.5	+7.5 -7.5	+9 -9	+10 -10	+11.5 -11.5	+12.5 -12.5								
<b>js6</b>	+4 -4	+4.5 -4.5	+5.5 -5.5	+6.5 -6.5	+8 -8	+9.5 -9.5	+11 -11	+12.5 -12.5	+14.5 -14.5	+16 -16	+18 -18								
<b>js7</b>	+6 -6	+7.5 -7.5	+9 -9	+10.5 -10.5	+12.5 -12.5	+15 -15	+17.5 -17.5	+20 -20	+23 -23	+26 -26	+28.5 -28.5								
<b>k5</b>	+6 +1	+7 +1	+9 +1	+11 +2	+13 +2	+15 +2	+18 +3	+21 +3	+24 +4	+27 +4	+29 +4								
<b>k6</b>	+9 +1	+10 +1	+12 +1	+15 +2	+18 +2	+21 +2	+25 +3	+28 +3	+33 +4	+36 +4	+40 +4								
<b>k7</b>	+13 +1	+16 +1	+19 +1	+23 +2	+27 +2	+32 +2	+38 +3	+43 +3	+50 +4	+56 +4	+61 +4								
<b>m5</b>	+9 +4	+12 +6	+15 +7	+17 +8	+20 +9	+24 +11	+28 +13	+33 +15	+37 +17	+43 +20	+46 +21								
<b>m6</b>	+12 +4	+15 +6	+18 +7	+21 +8	+25 +9	+30 +11	+35 +13	+40 +15	+46 +17	+52 +20	+57 +21								
<b>m7</b>	+16 +4	+21 +6	+25 +7	+29 +8	+34 +9	+41 +11	+48 +13	+55 +15	+63 +17	+72 +20	+78 +21								
<b>n5</b>	+13 +8	+16 +10	+20 +12	+24 +15	+28 +17	+33 +20	+38 +23	+45 +27	+51 +31	+57 +34	+62 +37								
<b>n6</b>	+16 +8	+19 +10	+23 +12	+28 +15	+33 +17	+39 +20	+45 +23	+52 +27	+60 +31	+66 +34	+73 +37								
<b>n7</b>	+20 +8	+25 +10	+30 +12	+36 +15	+42 +17	+50 +20	+58 +23	+67 +27	+77 +31	+86 +34	+94 +37								
<b>p5</b>	+17 +12	+21 +15	+26 +18	+31 +22	+37 +26	+45 +32	+52 +37	+61 +43	+70 +50	+79 +56	+87 +62								
<b>p6</b>	+20 +12	+24 +15	+29 +18	+35 +22	+42 +26	+51 +32	+59 +37	+68 +43	+79 +50	+88 +56	+98 +62								
<b>r6</b>	+23 +15	+28 +19	+34 +23	+41 +28	+50 +34	+60 +41	+62 +43	+73 +51	+76 +54	+88 +63	+90 +65	+93 +68	+106 +77	+109 +80	+113 +84	+126 +94	+130 +98	+144 +108	+150 +114

**END OF PAPER**