

# HARMONY 5-Axis

## HIGH PERFORMANCE SOLUTIONS



**sutton**tools

# HARMONY

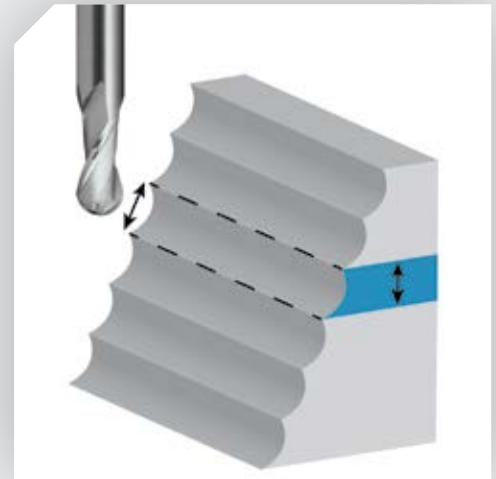
## 5-Axis



## Optimise your 5-Axis Machining

- Up to 90% cycle time savings over Ball Nose Endmills
  - Ideal for finishing of 3D surfaces and Hybrid CNC-3D printing application
  - Less than 10µm profile deviation for high workpiece accuracy
  - Customised solutions available
- 

Ball Nose Endmill



5 Axis - Oval Endmill



5 Axis - Video



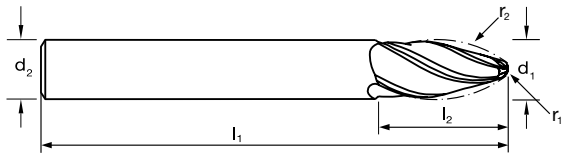
# Harmony 5 Axis Endmills Oval Form

**suttontools** HARMONY 5-Axis

- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm
- Suitable for high-strength materials
- Suitable for HSC finishing

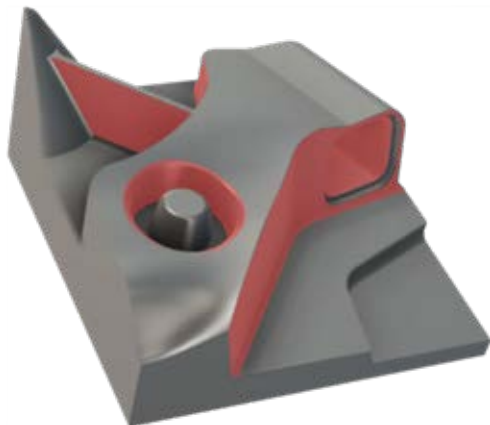
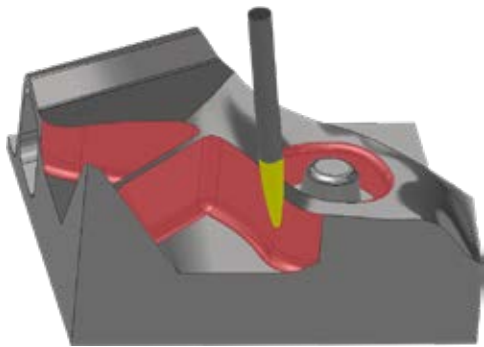


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Catalogue Code	<b>E700</b>
Product Group	B0210
Material	<b>VHM-ULTRA</b>
Surface Finish	<b>AICrN</b>
Sutton Designation	<b>UNI</b>
Geometry	R30
Shank Form (DIN 6535)	HA / HB
Shank Tolerance	h6

Size Ref.	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>	d <sub>2</sub>	z	r <sub>1</sub>	r <sub>2</sub>	Item #
<b>0600</b>	<b>6</b>	62	20.5	6	4	1	100	E700 0600
<b>0800</b>	<b>8</b>	70	22	8	4	1.5	95	E700 0800
<b>1000</b>	<b>10</b>	80	24.5	10	4	2	90	E700 1000
<b>1200</b>	<b>12</b>	93	27	12	4	2	85	E700 1200



Item #	Tilt (z)	Step over max (mm) @ middle angle + 0.2 step down	cusp Height	Fine Step over (Cusp 0.0025mm)	Nom. dia
E700 0600	0-12°(6)	12.6	0.398	1	6
E700 0800	0-13°(6.5)	12.3	0.4	0.97	8
E700 1000	0-15°(7.5)	12	0.402	0.95	10
E700 1200	0-18°(9)	11.6	0.477	0.92	12

ISO	P										M					K					N										S										H											
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41			
<b>E700</b>	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

**P** Steel **M** Stainless Steel **K** Cast Iron **N** Non-Ferrous Metals **S** Titanium & Super Alloys **H** Hard Materials
 ● Optimal ○ Effective

# Harmony 5 Axis Endmills Barrel Form

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**HARmony 5-Axis**



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- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm
- Suitable for high-strength materials
- Suitable for HSC finishing



Catalogue Code

Product Group

Material

Surface Finish

Sutton Designation

Geometry

Shank Form (DIN 6535)

Shank Tolerance

**E701**

**B0210**

**VHM-ULTRA**

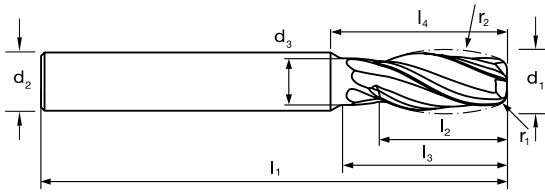
**AlCrN**

**UNI**

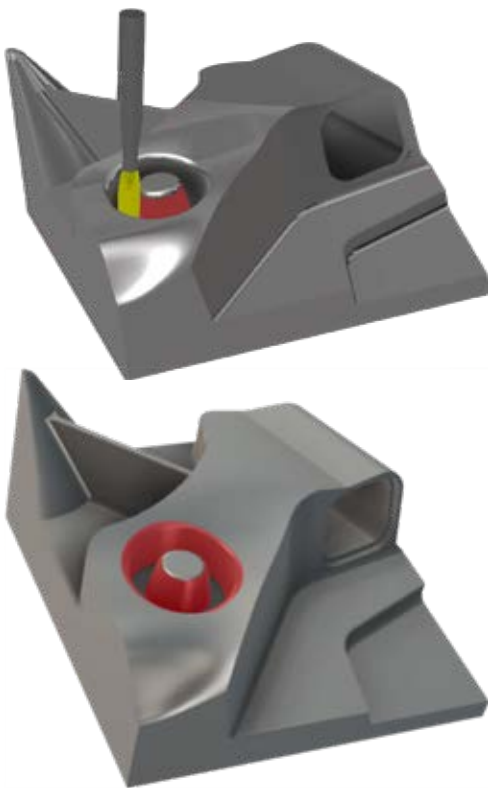
R30

HA

h6



Size Ref.	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	d <sub>2</sub>	d <sub>3</sub>	z	r <sub>1</sub>	r <sub>2</sub>	Item #
1000	10	60	21.5	36	30	10	8	4	1	60	E701 1000
1200	12	70	23	36	36	12	10	4	1	70	E701 1200



Item #	Tilt (z)	Step over max (mm) @ middle angle + 0.2 step down	cusp Height	Fine Step over (Cusp 0.0025mm)	Nom. dia
E701 1000	-4° -7°	9.75	0.398	0.77	10
E701 1200	-3° -6°	10.6	0.404	0.84	12

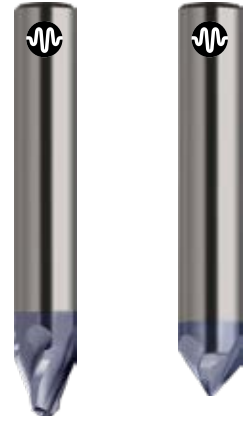
ISO	P								M					K					N						S						H																						
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41				
E701	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

**P** Steel **M** Stainless Steel **K** Cast Iron **N** Non-Ferrous Metals **S** Titanium & Super Alloys **H** Hard Materials

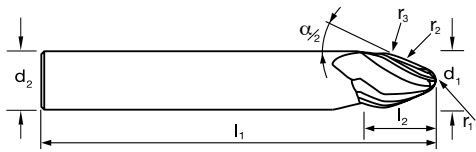
● Optimal ○ Effective

# Harmony 5 Axis Endmills Taper Form

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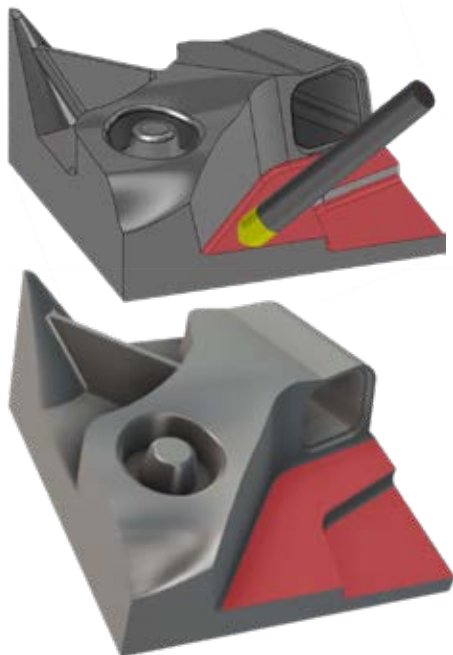


- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm
- Suitable for high-strength materials
- Suitable for HSC finishing



Catalogue Code	E702	E703
Product Group	B0210	B0210
Material	VHM-ULTRA	VHM-ULTRA
Surface Finish	AiCrN	AiCrN
Sutton Designation	UNI	UNI
Geometry	R30	R30
Shank Form (DIN 6535)	HA	HA
Shank Tolerance	h6	h6

Size Ref.	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>	d <sub>2</sub>	z	r <sub>1</sub>	r <sub>2</sub>	r <sub>3</sub>	$\alpha/2$	Item #	Item #
<b>0618</b>	<b>6</b>	60	8	6	4	0.5	250	3	18°	E702 0618	
<b>1218</b>	<b>12</b>	90	14.5	12	4	2	500	3	18°	E702 1218	
<b>1209</b>	<b>12</b>	90	14.5	12	4	2	500	3	9°	E702 1209	
<b>1618</b>	<b>16</b>	90	16	16	4	3	1000	4	18°	E702 1618	
<b>1627</b>	<b>16</b>	90	16	12.5	4	3	1000	4	27°	E702 1627	
<b>0845</b>	<b>8</b>	80	3.5	8	3	1.5	180	1	45°		E703 0845
<b>0863</b>	<b>8</b>	80	2.4	8	3	1.5	180	1	63°		E703 0863
<b>0872</b>	<b>8</b>	80	1.9	8	3	1.5	180	1	72°		E703 0872
<b>0881</b>	<b>8</b>	80	1.4	8	3	3	180	1	81°		E703 0881
<b>1245</b>	<b>12</b>	120	4.5	12	5	2	220	1	45°		E703 1245
<b>1263</b>	<b>12</b>	120	3.5	12	5	2	220	1	63°		E703 1263
<b>1272</b>	<b>12</b>	120	2.5	12	5	2	220	1	72°		E703 1272
<b>1281</b>	<b>12</b>	120	1.4	12	5	4	220	1	81°		E703 1281



Item #	Tilt (z)	Step over max (mm) @ middle angle + 0.2 step down	cusp Height	Fine Step over (Cusp 0.0025mm)	Nom. dia
E702 0618	18°	7.5	0.0563	1.58	6
E702 1218	18°	12.8	0.0819	2.24	12
E702 1209	9°	25.5	0.325	2.24	12
E702 1618	18°	16	0.064	3.16	16
E702 1627	27°	10.8	0.0292	3.16	16
E703 0845	45°	3.7	0.019	1.34	8
E703 0863	63°	3.1	0.0133	1.34	8
E703 0872	72°	3	0.0125	1.34	8
E703 0881	81°	2.55	0.009	1.34	8
E703 1245	45°	6.1	0.0243	1.48	12
E703 1263	63°	5.1	0.0296	1.48	12
E703 1272	72°	4.9	0.0273	1.48	12
E703 1281	81°	4.6	0.024	1.48	12

ISO	P										M				K				N								S								H																	
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41			
E702 / E703	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	P	M	K	N	S	H																																														

● Optimal ○ Effective

# Harmony 5 Axis Endmills Lens Form

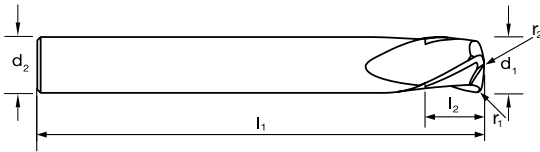
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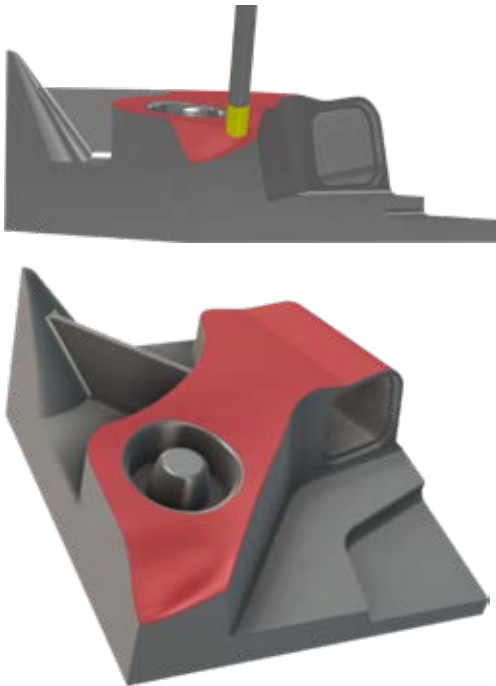
Scan for more info

- Highly efficient finishing
- Form tolerance  $\pm 0.01$  mm
- Suitable for high-strength materials
- Suitable for HSC finishing



Catalogue Code	<b>E704</b>
Product Group	B0210
Material	<b>VHM-ULTRA</b>
Surface Finish	<b>AlCrN</b>
Sutton Designation	<b>UNI</b>
Geometry	R30
Shank Form (DIN 6535)	HA
Shank Tolerance	h6

Size Ref.	d <sub>1</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	d <sub>2</sub>	d <sub>3</sub>	z	r <sub>1</sub>	r <sub>2</sub>	Item #
<b>0400</b>	<b>6</b>	62	4	-	-	4	-	3	0.25	6	E704 0400
<b>0600</b>	<b>6</b>	62	6	-	-	6	-	3	0.5	10	E704 0600
<b>0800</b>	<b>8</b>	68	8	-	-	8	-	3	0.75	15	E704 0800
<b>1000</b>	<b>10</b>	80	10	-	-	10	-	3	1	20	E704 1000
<b>1200</b>	<b>12</b>	93	12	-	-	12	-	3	1.25	25	E704 1200



Item #	Tilt (z)	Step over max (mm) @ middle angle + 0.2 step down	cusp Height	Fine Step over (Cusp 0.0025mm)	Nom. dia
E704 0400	-	3.05	0.4165	0.24	4
E704 0600	-	3.95	0.4066	0.32	6
E704 0800	-	4.85	0.4029	0.39	8
E704 1000	-	5.6	0.4	0.45	10
E704 1200	-	6.25	0.3969	0.5	12

ISO	P										M					K					N					S					H																				
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	12	13	14.1	14.2	14.3	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37.1	37.2	37.3	37.4	37.5	38.1	38.2	39.1	39.2	40	41		
E704	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

P Steel 
 M Stainless Steel 
 K Cast Iron 
 N Non-Ferrous Metals 
 S Titanium & Super Alloys 
 H Hard Materials

● Optimal 
 ○ Effective



# Harmony 5 Axis Endmills Speeds & Feeds

**suttontools** HARMONY 5-Axis



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ISO	VDI	Material Group	Sutton
P	A	Steel	N
M	R	Stainless Steel	VA
K	F	Cast Iron	GG
N	N	Non-Ferrous Metals, Aluminiums & Coppers	Al W
S	S	Titaniums & Super Alloys	Ti Ni
H	H	Hard Materials (≥ 45 HRC)	H

^ VDI 3323 material groups can also be determined by referring to the workpiece material cross reference listing. Refer to main index of this section.



Stock Allowance: 0.05-0.3mm 0.05-0.2mm 0.05-0.2mm 0.05-0.2mm

ISO	VDI <sup>3323</sup>	Material	Condition	HB	N/mm <sup>2</sup>	Common Grades	Vc (m/min)	Fz (mm/t)*do	Vc (m/min)	Fz (mm/t)*do	Vc (m/min)	Fz (mm/t)*do	Vc (m/min)	Fz (mm/t)*do		
P	1	Steel - Non-alloy, cast & free cutting	~ 0.15 %C	A	125	440	1020, S1214L	200	0.008	200	0.008	200	0.007	280	0.008	
	2		~ 0.45 %C	A	190	640	1045	190	0.007	190	0.007	190	0.007	250	0.007	
	3			QT	250	840		180	0.007	180	0.007	180	0.006	240	0.007	
	4		~ 0.75 %C	A	270	910	1055, 1060	160	0.006	160	0.006	160	0.005	210	0.006	
	5			QT	300	1010		150	0.006	150	0.006	150	0.005	200	0.006	
	6	Steel - Low alloy & cast < 5% of alloying elements		A	180	610	4140, 4340	180	0.007	180	0.007	180	0.006	240	0.007	
	7			QT	275	930		180	0.007	180	0.007	180	0.006	240	0.007	
	8			QT	300	1010		150	0.006	150	0.006	150	0.005	200	0.006	
	9			QT	350	1180		150	0.006	150	0.006	150	0.005	200	0.006	
	10	Steel - High alloy, cast & tool		A	200	680	A2, H13 (SKD61), D2	180	0.007	180	0.007	180	0.006	240	0.007	
	11			HT	325	1100		150	0.006	150	0.006	150	0.005	200	0.006	
	12	Steel - Corrosion resistant & cast	Ferritic / Martensitic	A	200	680	SS430, 431, 440C	140	0.005	140	0.005	140	0.004	160	0.005	
	13		Martensitic	QT	240	810		130	0.005	130	0.005	130	0.004	150	0.005	
M	14.1	Stainless Steel	Austenitic	AH	180	610	303, 304, 316	80	0.005	80	0.005	80	0.004	120	0.005	
	14.2		Duplex		250	840	321, 341	80	0.005	80	0.005	80	0.004	120	0.005	
	14.3		Precipitation Hardening		250	840	15-5Ph, 17-4Ph	40	0.004	40	0.004	40	0.003	60	0.004	
K	15	Cast Iron - Grey (GG)	Ferritic / Pearlitic		180	610	GG10, GG20, GG30, GG40	200	0.008	200	0.008	200	0.007	300	0.007	
	16		Pearlitic		260	880		200	0.008	200	0.008	200	0.007	300	0.007	
	17	Cast Iron - Nodular (GGG)	Ferritic		160	570	GGG40, GGG50	180	0.007	180	0.007	180	0.006	270	0.006	
	18		Pearlitic		250	840		180	0.007	180	0.007	180	0.006	270	0.006	
	19		Ferritic		130	460		180	0.007	180	0.007	180	0.006	270	0.006	
20	Cast Iron - Malleable	Pearlitic		230	780	GGG60, GGG70	180	0.007	180	0.007	180	0.006	270	0.006		
N	21	Aluminum & Magnesium - wrought alloy	Non Heat Treatable		60	210		420	0.007	420	0.007	420	0.006	420	0.007	
	22		Heat Treatable	AH	100	360	Al7075	420	0.006	420	0.006	420	0.005	420	0.006	
	23	Aluminum & Magnesium - cast alloy ≤12% Si	Non Heat Treatable		75	270	Al5183	380	0.006	380	0.006	380	0.005	550	0.008	
	24		Heat Treatable	AH	90	320	ADC10	380	0.006	380	0.006	380	0.005	550	0.008	
	25	Al & Mg - cast alloy >12% Si	Non Heat Treatable		130	460	ADC12	270	0.005	270	0.005	270	0.004	400	0.005	
	26	Copper & Cu alloys (Brass/Bronze)	Free cutting, Pb > 1%		110	390		180	0.008	180	0.008	180	0.006	270	0.008	
	27		Brass (CuZn, CuSnZn)		90	320	CuZn, CuSnZn	180	0.008	180	0.008	180	0.006	270	0.008	
	28		Bronze (CuSn)		100	360	CuSn	170	0.007	170	0.007	170	0.005	250	0.007	
	29	Non-metallic - Thermosetting & fiber-reinforced plastics						600	0.013	600	0.013	600	0.011	700	0.013	
	30	Non-metallic - Hard rubber, wood etc.						-	-	-	-	-	-	-	-	
S	31	High temp. alloys	Fe based	A	200	680		30	0.004	30	0.004	30	0.003			
	32			AH	280	950		30	0.004	30	0.004	30	0.003			
	33		Ni / Co based	A	250	840	Inconel 625	30	0.004	30	0.004	30	0.003			
	34			AH	350	1180	Inconel 718	30	0.004	30	0.004	30	0.003			
	35			C	320	1080	Inconel 718	30	0.004	30	0.004	30	0.003			
	36	Titanium & Ti alloys	CP Titanium		400 MPa			100	0.006	100	0.006	100	0.005	150	0.006	
	37.1		Alpha alloys			860 MPa			80	0.005	80	0.005	80	0.004	120	0.005
	37.2			A	960 MPa		TiAl6V4	80	0.005	80	0.005	80	0.004	120	0.005	
	37.3		AH	1170 MPa		80		0.005	80	0.005	80	0.004	120	0.005		
	37.4		Beta alloys	A	830 MPa			80	0.005	80	0.005	80	0.004	120	0.005	
37.5		AH	1400 MPa		60	0.005	60	0.005	60	0.004	90	0.005				

Condition: A (Annealed), AH (Age Hardened), C (Cast), HT (Hardened & Tempered), QT (Quenched & Tempered)  
do (Diameter Optimal)

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