

DURATOMIC®

**TECHNICAL GUIDE & INSERT PROGRAMME
FOR STEEL & STAINLESS STEEL TURNING**



TP0500 ^{NEW}

TP1500 • TP2500 • TP3500 • TM2000 • TM4000

SECO 

A FULL RANGE SUPPLIER



SECO GRADES FOR MAXIMUM PRODUCTIVITY IN ALL ISO P AND M MATERIALS

Seco's family of grades provides excellent capability for the widest range of steel and stainless steel applications. TP0500 compliments TP1500, TP2500, and TP3500, all featuring the unique Duratomic coating technology which provides an exceptional combination of wear resistance and edge toughness.

And when it comes to stainless steel machining, we've adapted the Duratomic process to handle the special problems introduced by that class of alloy. TM2000 is designed for high speed machining of stainless alloys and is an ideal choice for those situations where maximum productivity is important. TM4000 is a tougher grade that can handle the roughest cuts.

THE DURATOMIC® RANGE

STEEL:

- TP0500: **Productivity.** Specifically developed for applications demanding excellent tool life under high heat conditions. It can also be used in situations where the time in cut is long or the work materials are relatively hard.
- TP1500: **Wear resistance.** Specially designed to give long and reliable tool life at high temperatures and speeds under stable conditions.
- TP2500: **Versatility.** First choice for general purpose steel turning and also successfully machines stainless steel and cast iron.
- TP3500: **Toughness.** Offers long, predictable tool life in difficult and unstable conditions.

STAINLESS STEEL:

- TM2000: **Productivity.** First choice when the highest productivity is desired.
- TM4000: **Versatility.** First choice when added chipping and fracture resistance is important.



NEW TP0500

THE FASTEST PILE OF CHIPS POSSIBLE

TP0500 was developed specifically for applications requiring a very high degree of heat and wear resistance, especially where the cutting conditions are to be fine-tuned to achieve maximum productivity.

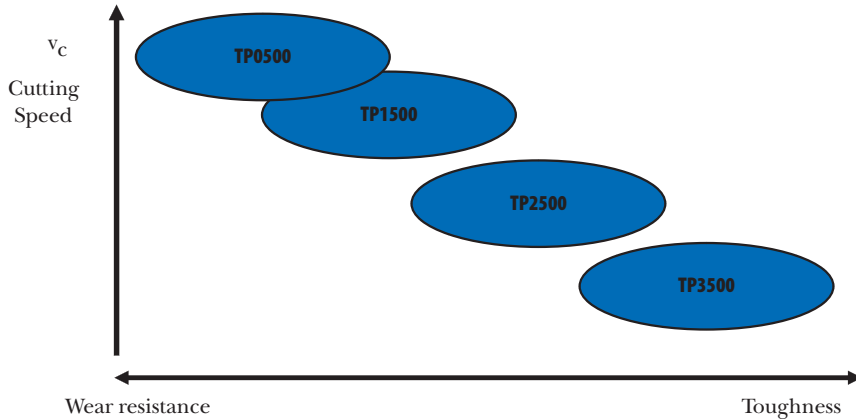
Metallurgically, TP0500 consists of a wear and deformation resistant substrate combined with a Duratomic coating. Practically, this means you get the fastest and most wear resistant grade for steel applications.

- Increased speed capability, even when the time in cut is long
- High metal removal rates, ideal for roughing and semi-roughing operations
- Fewer machine offsets
- Longer times between insert indexes
- Ability to machine harder parts
- Ability to hold tighter tolerances



SECO DURATOMIC® COATED GRADES FOR STEEL MACHINING

No matter what your steel turning need is, Seco has a grade that is well suited for your application.



CODE KEY

T	P	05	00
1	2	3	4

1. Type of Operation T = Turning M = Milling D = Drilling

2. Type of Material P = Steel M = Stainless Steel K = Cast Iron H = Hard Steel S = Superalloy & Titanium Alloy N = Non-ferrous

3. Application Area 05 = Hard 10 = 15 = 20 = 25 = General purpose 30 = 35 = 40 = 45 = 50 = Tough

4. Version

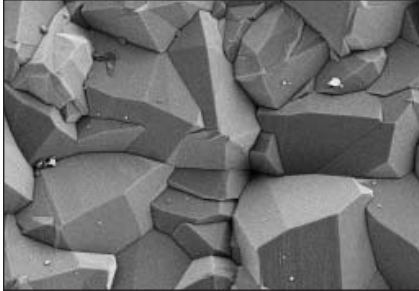
WHAT IS DURATOMIC®?

The Duratomic technology produces a coating that is durable by arranging the aluminum and oxygen atoms in a unique way to provide increased toughness and abrasion resistance. The importance of atomic arrangement can be understood by comparing the properties of graphite and diamond, both of which are made from carbon atoms, but with different structures.

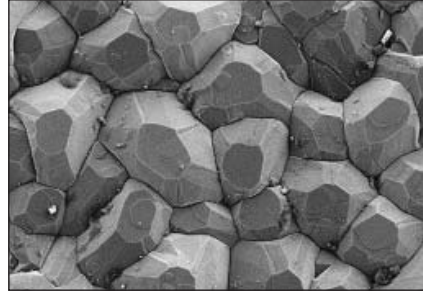


What a difference rearranging a few atoms makes! Above, two very different materials, both made from carbon.

A more precise illustration of Duratomic technology would be a piece of wood which has different properties in different directions. For example, you can readily split wood with the grain. But tilt the wood just a few degrees and splitting it becomes impossible. Aluminum oxide also has directional properties. Adjusting the structure of the coating the right way produces a coating that is 15% tougher and 10% harder than conventional coatings.

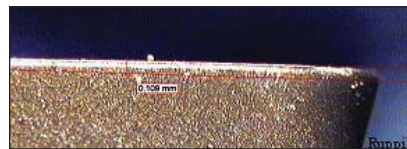


Conventional coating surface
(at high magnification)
Note: rough surface



Duratomic coating surface
(at high magnification)
Note: flat facets on surface

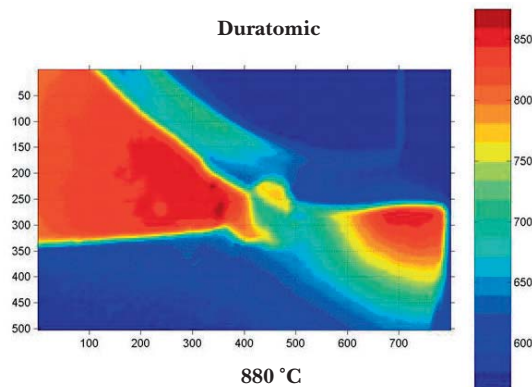
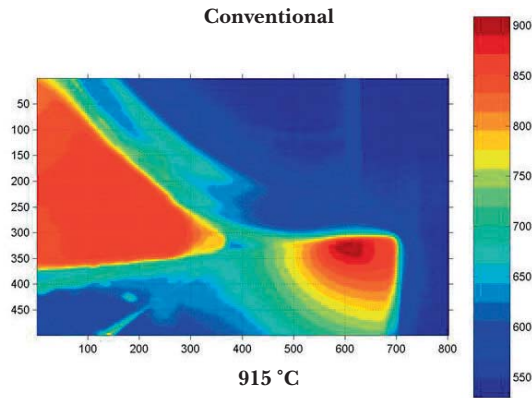
The flat facets on the Duratomic coating resist the formation of built-up edge and improve the surface finish of the component being machined. These benefits are particularly important in stainless steel machining. The hardness and toughness of the Duratomic coating dramatically reduce insert wear.



Identical insert geometry with different surface coating. The insert on the left has a conventional coating; the insert on the right features a Duratomic coating.

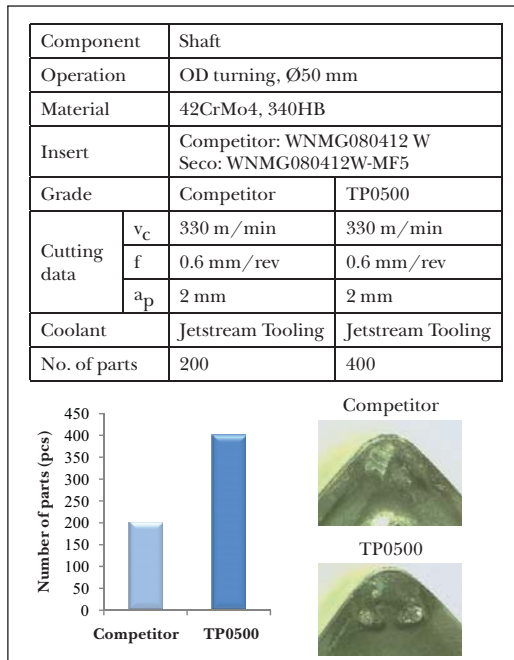
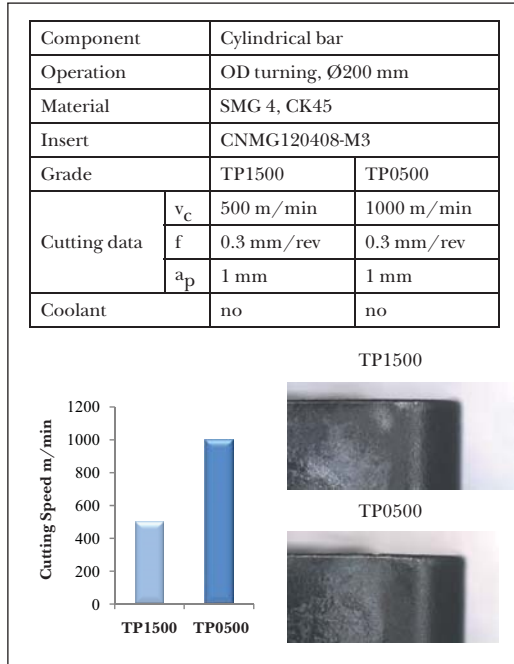
RUN COOLER WITH DURATOMIC®

Another practical result of the unique Duratomic structure is illustrated in these thermal images. Under identical conditions, an insert coated with the Duratomic process runs cooler compared to an identical insert coated with a conventional aluminum oxide coating. This means less crater wear, less deformation of the cutting edge, and longer tool life.



TP0500 TAKES THE HEAT!

TP0500 TEST RESULTS



Cutting Speed

The recommended cutting speeds (m/min) in the tables below are estimated for 15 minutes tool life for Seco Material Groups 1-6 and 12-15, and 10 minutes tool life for Seco Material Groups 8-11.

Tool life also depends on the depth of cut used and the insert nose radius. The cutting speeds in the tables are based on cutting depth 2.5 mm and nose radius 0.8 mm.

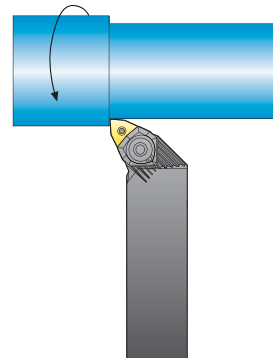
For more accurate recommendations with other combinations of cutting depths and nose radius and other feed rates than those used in the tables, use the Secolor Turning calculator, please see www.secotools.com.

Reference	CNMG120408-M5 $a_p = 2.5 \text{ mm}$ $\kappa_r = 95^\circ$ $r_c = 0.8 \text{ mm}$											
Seco Material Group No.	CVD coated grades											
	TP0500			TP1500			TP2500			TP3500		
	Feed rate, f (mm/rev)			Feed rate, f (mm/rev)			Feed rate, f (mm/rev)			Feed rate, f (mm/rev)		
	0.20	0.40	0.80	0.20	0.40	0.80	0.20	0.40	0.80	0.20	0.40	0.80
1	965	685	365	835	615	425	720	500	320	480	365	240
2	820	580	310	710	520	360	610	425	275	405	305	200
3	675	480	255	585	430	300	505	350	225	335	255	165
4	575	410	220	500	370	255	430	300	190	285	215	140
5	480	340	180	415	305	215	360	250	160	240	180	120
6	420	300	160	365	270	185	315	220	140	210	160	105
8	-	-	-	-	-	-	370	230	95	320	185	80
9	-	-	-	-	-	-	290	180	75	250	145	60
10	-	-	-	-	-	-	235	150	60	205	120	50
11	-	-	-	-	-	-	175	110	45	155	85	35
12	-	-	-	-	-	-	490	340	220	-	-	-
13	-	-	-	-	-	-	430	300	190	-	-	-
14	-	-	-	-	-	-	360	250	160	-	-	-
15	-	-	-	-	-	-	300	210	135	-	-	-

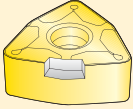

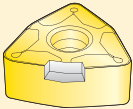

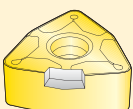

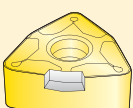
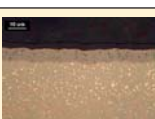
General Turning Ver. 1.1

Reference	CNMG120408-M5 $a_p = 2.5 \text{ mm}$ $\kappa_r = 95^\circ$ $r_c = 0.8 \text{ mm}$					
Seco Material Group No.	CVD coated grades					
	TM2000			TM4000		
	Feed rate, f (mm/rev)			Feed rate, f (mm/rev)		
	0.20	0.40	0.80	0.20	0.40	0.80
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	335	220	115	270	175	95
9	265	175	90	210	140	75
10	215	140	75	175	115	60
11	160	105	55	130	85	45
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	-	-	-
15	-	-	-	-	-	-

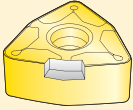

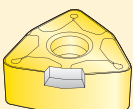

General Turning Ver. 1.1



Steel grades - First choice

<p>TP0500</p> 		<p>First choice when maximum productivity under stable conditions is desired. Incorporates the Duratomic coating technology.</p>
<p>TP1500</p> 		<p>Intended for general turning of steel and alloyed steel. The high wear resistance offers high speed capability.</p>
<p>TP2500</p> 		<p>Intended for a wide range of turning applications in both steels and stainless steels. Also a good choice for cast iron. The wear resistance and edge strength together with the high versatility make the grade the first choice in a large number of applications.</p>
<p>TP3500</p> 		<p>First choice for rough or intermittent turning in steels and stainless steels as well as general turning of stainless steels.</p>

Stainless Steel grades - First choice

<p>TM2000</p> 		<p>First choice for continuous cuts in stainless steels, particularly when extended time in cut is required. Utilizes the Duratomic coating process.</p>
<p>TM4000</p> 		<p>First choice for rough or intermittent turning in stainless steels. Utilizes a thin Duratomic coating process.</p>

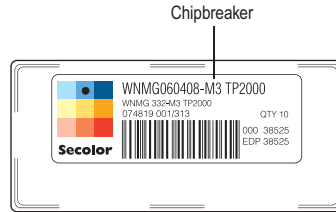


Chipbreaker overview

The chipbreakers are designed to control the chips when turning long chipping materials. The chipbreaker designations describe the application area as follows:

Letter: F = Finishing
M = Medium
R = Roughing

Digit: 1 = For low feed rates and easy conditions
9 = For high feed rates and rough conditions



Type of Operation ↑	RR						RR6			RR9
	R				R4	R5	R6	R7	R8	
	MR			MR3	MR4		MR6	MR7		
	M	M1		M3	M4	M5				
	MF	MF1	MF2	MF3	MF4	MF5				
	F	F1	F2							
	FF	FF1								
		1	2	3	4	5	6	7	8	9
		Edge strength/feed rate →								

Chipbreaker Programme

	-FF1	Chipbreaker for negative inserts. Used to achieve a very fine finish when turning steel and stainless steel. Machining range: $f = 0.08-0.30$ mm/rev, $a_p = 0.2-3.0$ mm.
	-MF1	Chipbreaker intended for machining stainless steel, superalloys and titanium alloys. Type ..GG insert has a sharp, precision ground edge. Type ..MG insert has a lightly honed cutting edge for increased strength. MF1 is intended for use in semi-finishing and finishing applications. Machining range: $f = 0.08-0.30$ mm/rev, $a_p = 0.2-3.5$ mm.
	-MF2	First choice for finishing with negative inserts. Suitable for chip control at depths of cut down to 0.25 mm, provided that the feed rate is in excess of 0.25 mm/rev. Good capacity for medium rough machining. Machining range: $f = 0.10-0.40$ mm/rev, $a_p = 0.2-3.0$ mm.

Chipbreaker Programme

	-MF3	Chipbreaker with positive cutting rake angle intended for moderately difficult stainless steel. The MF3 is also intended for light roughing in relatively soft, "lacky" steel and difficult to machine stainless steel if the depth of cut is limited. MF3 can also be used for finishing of cast iron. Machining range: $f = 0.2\text{--}0.4$ mm/rev, $a_p = 1\text{--}4$ mm.
	-MF4	Chipbreaker intended for medium/finishing of stainless steel, very open and highly positive geometry. Machining range: $f = 0.15\text{--}0.50$ mm/rev, $a_p = 0.5\text{--}4.0$ mm.
	-MF5	Chipbreaker intended for medium finishing of steel and stainless steel at high feeds. Very easy cutting and open geometry. Machining range: $f = 0.2\text{--}0.8$ mm/rev, $a_p = 0.2\text{--}2.7$ mm.
	-M3	First choice for medium-rough machining and also the most versatile Seco chipbreaker. In most cases, it is the only chipbreaker needed. Offers the best useful life and best chipbreaking in a wide range of cutting data and workpiece materials. Suitable for precision forged and cast workpieces (NNS or Near Net Shape workpieces) as regards both chip control and edge strength. Machining range: $f = 0.15\text{--}0.50$ mm/rev, $a_p = 0.5\text{--}5.0$ mm.
	-M5	First choice for roughing by means of double-sided inserts. Intended for demanding operations at high feed rates in steel, stainless steel and cast iron. Combines high edge strength with comparatively low cutting forces. Machining range: $f = 0.3\text{--}0.7$ mm/rev, $a_p = 1.5\text{--}7.0$ mm.
	-MR4	The MR4 has a negative T-land, which gives extremely high edge strength. The chipbreaker is intended for more difficult machining applications on superalloys and titanium alloys, such as intermittent cuts and the machining of parts with raw surface. Machining range: $f = 0.15\text{--}0.50$ mm/rev, $a_p = 1.5\text{--}7.0$ mm.
	-MR6	Chipbreaker for medium and medium roughing of steel. Very easy cutting and open geometry. Double and single-sided. Machining range: $f = 0.25\text{--}0.80$ mm/rev, $a_p = 0.9\text{--}5.0$ mm.
	-MR7	The strongest chipbreaker for double-sided inserts. The MR7 is suitable for high feed rates and depths of cut that normally require a single-sided insert. The chipbreaker has a wide negative T-land, which gives high edge strength. Machining range: $f = 0.35\text{--}0.90$ mm/rev, $a_p = 1.5\text{--}7.0$ mm.
	-R4	Chipbreaker for single-sided inserts. It has a positive cutting edge which gives low cutting forces. Machining range: $f = 0.2\text{--}0.6$ mm/rev, $a_p = 2\text{--}10$ mm.
	-R5	Chipbreaker for single-sided inserts. Recommended for medium-roughing of steel. Machining range: $f = 0.3\text{--}1.0$ mm/rev, $a_p = 2\text{--}12$ mm.
	-R6	Chipbreaker for single-sided inserts. Recommended for medium-roughing of stainless steel. Machining range: $f = 0.25\text{--}0.70$ mm/rev, $a_p = 2\text{--}10$ mm.
	-RR6	A very easy-cutting chipbreaker for single-sided inserts. Recommended for roughing of stainless steel and steel. Machining range: $f = 0.3\text{--}1.0$ mm/rev, $a_p = 2\text{--}12$ mm.
	-R7	A strong but easy-cutting chipbreaker for single sided inserts. The R7 is well suited for intermittent machining of both stainless and ordinary carbon steel. Machining range: $f = 0.4\text{--}1.0$ mm/rev, $a_p = 2\text{--}12$ mm.

Chipbreaker Programme

	-FF1	Chipbreaker for positive inserts. Used to achieve a very fine finish when turning steel and stainless steel. Machining range: $f = 0.05\text{--}0.30\text{ mm/rev}$, $a_p = 0.2\text{--}2.0\text{ mm}$.
	-F1	A versatile chipbreaker for positive inserts. Positive geometry with sharp cutting edge gives easy-cutting properties. Suitable for high feed rates at fine depths of cut on precision forgings and castings. Machining range: $f = 0.1\text{--}0.5\text{ mm/rev}$, $a_p = 0.2\text{--}3.0\text{ mm}$. Machining in bar automatics, for instance: $f = 0.08\text{--}0.25\text{ mm/rev}$, $a_p = 1\text{--}3\text{ mm}$.
	-F2	Chipbreaker for positive inserts. Ensures safe chip flow on finishing and medium roughing in steel and stainless steel. Machining range: $f = 0.15\text{--}0.40\text{ mm/rev}$, $a_p = 0.8\text{--}5.0\text{ mm}$.

Supplementary Chipbreaker Programme

	-R8	A very strong chipbreaker for single-sided inserts. The R8 is intended for high feed rates when machining castings and forgings of austenitic stainless steel. Machining range: $f = 0.35\text{--}0.80\text{ mm/rev}$, $a_p = 2\text{--}12\text{ mm}$.
	-RR9	Extremely strong chipbreaker for single-sided negative inserts, for use at high feed rates. Suitable for difficult castings and forgings and for austenitic stainless steel. Machining range: $f = 0.5\text{--}1.2\text{ mm/rev}$, $a_p = 2.5\text{--}15.0\text{ mm}$.
	-57	Chipbreaker for single-sided roughing inserts. Recommended for roughing operations on steel at high feed rates and high depth of cut. Machining range: $f = 0.45\text{--}1.10\text{ mm/rev}$, $a_p = 2\text{--}12\text{ mm}$.
	-UX	Chipbreaker for negative inserts. Positive cutting rake with sharp edge. Low cutting force. Suitable for slim components. Machining range: $f = 0.2\text{--}0.4\text{ mm/rev}$, $a_p = 1.0\text{--}6.0\text{ mm}$.

Chipbreaker Programme, High Feed inserts (wiper radius)

	W-F1	A versatile chipbreaker for positive inserts. For finishing machining of steel, stainless steel and cast iron giving good surface finish. Suitable for high feed rates at small depth of cut. Machining range: $f = 0.05\text{--}0.50\text{ mm/rev}$, $a_p = 0.25\text{--}3.00\text{ mm}$.
	W-MF2	First choice for finishing with negative inserts. Chipbreaker suitable for finishing machining of steel, stainless steel and cast iron at high feed rates giving good surface finish. Machining range: $f = 0.05\text{--}0.60\text{ mm/rev}$, $a_p = 0.25\text{--}4.00\text{ mm}$.
	W-MF5	Chipbreaker intended for medium finishing of steel at high feed. The geometry is very open and highly positive. Machining range: $f = 0.2\text{--}0.8\text{ mm/rev}$, $a_p = 0.2\text{--}2.7\text{ mm}$.
	W-M3	Versatile chipbreaker for high feed finishing and medium-roughing machining of steel, stainless steel and cast iron. Operates in a wide application area. Gives a good surface finish even at high feeds. Machining range: $f = 0.2\text{--}0.9\text{ mm/rev}$, $a_p = 0.5\text{--}6.0\text{ mm}$.
	W-R7	A strong easy cutting chipbreaker for single sided inserts. Intended for the highest feeds when medium-roughing and roughing machining of steel, stainless steel and cast iron. Gives a good surface finish even at the higher feeds. Machining range: $f = 0.4\text{--}1.2\text{ mm/rev}$, $a_p = 2.0\text{--}9.5\text{ mm}$.

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	CCMT 060202-F1		■	■	■		■
	CCMT 060202-F2		■	■	■		■
	CCMT 060202-FF1			■			
	CCMT 060204-F1		■	■	■	■	■
	CCMT 060204-F2		■	■	■		■
	CCMT 060204-FF1			■			
	CCMT 060204W-F1		■	■			
	CCMT 060208-F1		■	■	■		■
	CCMT 060208-F2		■	■	■		■
	CCMT 090304-F2			■			
	CCMT 09T302-F1		■	■	■		■
	CCMT 09T302-F2		■	■			
	CCMT 09T304-F1		■	■	■	■	■
	CCMT 09T304-F2		■	■	■		■
	CCMT 09T304-FF1			■			
	CCMT 09T304W-F1		■	■			
	CCMT 09T308-F1		■	■	■	■	■
	CCMT 09T308-F2		■	■	■	■	■
	CCMT 09T308W-F1		■	■			
	CCMT 09T308W-F2		■				
	CCMT 09T312-F2		■				
	CCMT 120404-F1			■	■		
	CCMT 120404-F2		■	■			
	CCMT 120404W-F1			■			
	CCMT 120408-F1		■	■	■		
	CCMT 120408-F2		■	■	■	■	■
	CCMT 120408W-F1			■			
	CCMT 120412-F1			■			
	CCMT 120412-F2		■	■	■		
	CCMT 160508-F2			■			■
	CCMT 160512-F2						■
	CNMG 090304-M3		■				
	CNMG 090308-M3		■	■			
	CNMG 120404-FF1			■			
	CNMG 120404-M3		■	■	■		
	CNMG 120404-M5		■	■	■		
	CNMG 120404-MF1					■	■
	CNMG 120404-MF2		■	■	■		
	CNMG 120404-MF3				■		
	CNMG 120404-MF4					■	■
	CNMG 120404W-MF2		■	■			
	CNMG 120408-FF1		■				
	CNMG 120408-M3	■	■	■	■		
	CNMG 120408-M5	■	■	■	■	■	■
	CNMG 120408-MF1					■	■
	CNMG 120408-MF2		■	■	■		
	CNMG 120408-MF3				■		
	CNMG 120408-MF4					■	■
	CNMG 120408-MF5		■	■	■	■	■
	CNMG 120408-MR6		■	■	■		
	CNMG 120408-MR7		■	■	■		■
	CNMG 120408W-M3	■	■	■	■		
	CNMG 120408W-MF2		■	■			
	CNMG 120408W-MF5		■	■			
	CNMG 120412-M3	■	■	■	■		
	CNMG 120412-M5	■	■	■	■	■	■
	CNMG 120412-MF2		■	■			

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	CNMG 120412-MF3					■	
	CNMG 120412-MF4			■		■	■
	CNMG 120412-MF5	■	■	■	■		
	CNMG 120412-MR6		■	■	■		
	CNMG 120412-MR7		■	■	■		■
	CNMG 120412W-M3		■	■			
	CNMG 120416-M3		■	■			
	CNMG 120416-M5		■	■	■		
	CNMG 120416-MF4					■	■
	CNMG 120416-MF5		■	■			
	CNMG 120416-MR6		■	■	■		
	CNMG 120416-MR7		■	■	■		
	CNMG 120608-MR6		■	■			
	CNMG 120612-MR6		■	■	■		
	CNMG 120616-MR6		■	■	■		
	CNMG 160608-M3		■	■	■		
	CNMG 160608-M5		■	■	■		
	CNMG 160608-MF4					■	■
	CNMG 160608-MR7					■	
	CNMG 160612-M3		■	■	■	■	
	CNMG 160612-M5	■	■	■	■	■	■
	CNMG 160612-MF4					■	■
	CNMG 160612-MR6		■	■	■		
	CNMG 160612-MR7	■	■	■	■		■
	CNMG 160616-M3		■	■	■		
	CNMG 160616-M5	■	■	■	■	■	■
	CNMG 160616-MR6		■	■	■		
	CNMG 160616-MR7	■	■	■	■		■
	CNMG 160624-MR6		■	■	■		
	CNMG 160624-MR7		■				
	CNMG 190608-M3		■	■	■		
	CNMG 190608-M5		■	■	■		
	CNMG 190608-MR7				■		
	CNMG 190612-M3		■	■	■		
	CNMG 190612-M5	■	■	■	■		
	CNMG 190612-MF4					■	■
	CNMG 190612-MR6		■	■	■		
	CNMG 190612-MR7	■	■	■	■		■
	CNMG 190616-M3			■	■		
	CNMG 190616-M5	■	■	■	■		■
	CNMG 190616-MR6		■	■	■		
	CNMG 190616-MR7	■	■	■	■		■
	CNMG 190624-MR6		■	■			
	CNMG 190624-MR7		■	■			
	CNMG 250924-MR4					■	
	CNMG 250924-MR7		■	■	■		
	CNMM 120408-R4		■	■	■		
	CNMM 120408-R6			■	■		
	CNMM 120408-RR6			■	■		
	CNMM 120408W-R4		■				
	CNMM 120412-R4	■	■	■	■		
	CNMM 120412-R6				■		
	CNMM 120412-RR6				■	■	
	CNMM 120412W-R4		■	■			
	CNMM 120416-R4		■	■	■		
	CNMM 160612-MR6		■	■	■		
	CNMM 160612-R4	■	■	■	■		

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	CNMM 160612-R6						
	CNMM 160612-R7		■				
	CNMM 160612-RR6			■			■
	CNMM 160616-MR6		■	■	■		
	CNMM 160616-R4	■	■	■	■		
	CNMM 160616-R5	■	■	■	■		
	CNMM 160616-R7		■	■	■		
	CNMM 160616-RR6		■	■	■		■
	CNMM 160624-MR6		■	■	■		
	CNMM 160624-R7		■	■	■		
	CNMM 190612-57			■			
	CNMM 190612-MR6			■	■	■	
	CNMM 190612-R4	■	■	■	■		
	CNMM 190612-R6				■		
	CNMM 190612-R7		■	■	■		
	CNMM 190612-RR6				■		■
	CNMM 190616-57			■			
	CNMM 190616-MR6			■	■		
	CNMM 190616-R4	■	■	■	■		
	CNMM 190616-R5	■	■	■	■		
	CNMM 190616-R7		■	■	■		
	CNMM 190616-R8				■		
	CNMM 190616-RR6		■	■	■		■
	CNMM 190616W-R7		■	■	■		
	CNMM 190624-57		■				
	CNMM 190624-MR6		■	■	■		
	CNMM 190624-R4	■	■	■	■		
	CNMM 190624-R5	■	■	■	■		
	CNMM 190624-R7		■	■	■		
	CNMM 190624-RR6		■	■	■		■
CNMM 190624W-R7			■	■			
	DCMT 070202-F1			■	■		
	DCMT 070202-F2		■	■			■
	DCMT 070204-F1		■	■	■	■	■
	DCMT 070204-F2		■	■	■	■	■
	DCMT 070208-F1		■	■	■	■	
	DCMT 070208-F2		■	■	■	■	■
	DCMT 11T302-F1			■	■		
	DCMT 11T302-F2		■	■			
	DCMT 11T302-FF1			■	■		
	DCMT 11T304-F1		■	■	■	■	■
	DCMT 11T304-F2		■	■	■	■	■
	DCMT 11T304-FF1			■	■		
	DCMT 11T308-F1		■	■	■	■	■
	DCMT 11T308-F2		■	■	■	■	■
	DCMT 11T308-FF1			■	■		
	DCMT 11T312-F1		■	■			
	DCMT 150404-F2		■	■	■		
	DCMT 150408-F2		■	■	■		
	DCMT 150412-F2		■	■	■		
		DCMX 11T304W-F1		■	■		
DCMX 11T308W-F1			■	■			
	DNMG 150404-M3		■	■	■		
	DNMG 150404-M5		■	■	■		
	DNMG 150404-MF2		■	■	■		
	DNMG 150404-MF3			■	■		
	DNMG 150404-MF4					■	■

	Part No.	Grade						
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000	
	DNMG 150408-M3		■	■	■			
	DNMG 150408-M5		■	■	■	■		
	DNMG 150408-MF2		■	■	■			
	DNMG 150408-MF3				■			
	DNMG 150408-MF4						■	■
	DNMG 150408-MF5			■	■			
	DNMG 150408-MR6		■	■	■			
	DNMG 150412-M3		■	■	■			
	DNMG 150412-M5		■	■	■	■		
	DNMG 150412-MF2		■	■	■			
	DNMG 150412-MF5		■	■	■			
	DNMG 150412-MR6		■	■	■			
	DNMG 150416-MF5				■			
	DNMG 150604-M3			■	■	■		
	DNMG 150604-M5				■	■		
	DNMG 150604-MF1						■	■
	DNMG 150604-MF2			■	■	■		
	DNMG 150604-MF3					■		
	DNMG 150604-MF4						■	■
	DNMG 150604L-UX							
	DNMG 150604R-UX				■			
	DNMG 150608-M3			■	■	■		
	DNMG 150608-M5	■	■	■	■	■	■	■
	DNMG 150608-MF1						■	■
	DNMG 150608-MF2			■	■	■		
	DNMG 150608-MF3					■		
	DNMG 150608-MF4				■		■	■
	DNMG 150608-MF5	■	■	■	■			
	DNMG 150608-MR6			■	■	■		
	DNMG 150608-MR7			■	■	■		
DNMG 150608L-UX				■				
DNMG 150608R-UX				■				
DNMG 150612-M3		■	■	■	■			
DNMG 150612-M5	■	■	■	■	■	■	■	
DNMG 150612-MF2		■	■	■				
DNMG 150612-MF4						■	■	
DNMG 150612-MF5	■	■	■	■				
DNMG 150612-MR6		■	■	■	■			
DNMG 150612-MR7	■	■	■	■				
DNMG 150616-M3		■	■	■	■			
DNMG 150616-M5	■	■	■	■				
DNMG 150616-MF5			■	■				
DNMG 150616-MR6		■	■	■				
DNMM 150608-R4			■	■	■			
DNMM 150612-R4			■	■	■			
DNMM 150616-R4			■	■	■			
	DNMU 110402-M3			■				
	DNMU 110404-M3		■	■	■			
	DNMU 110404-MF1						■	■
	DNMU 110404-MF2			■	■	■		
	DNMU 110404-MF4						■	■
	DNMU 110404-MF5				■			
	DNMU 110408-M3			■	■	■		
	DNMU 110408-M5			■	■	■		
	DNMU 110408-MF1						■	■
	DNMU 110408-MF2			■	■	■		
DNMU 110408-MF4						■	■	
DNMU 110408-MF5			■	■	■			
DNMU 110412-M3	■	■						

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	DNMU 110412-M5		■				
	DNMU 110412-MF2			■		■	
	DNMU 110412-MF5			■			
	DNMX 110404W-MF2		■	■			
	DNMX 110408W-MF2		■	■			
	DNMX 150608W-M3		■				
DNMX 150612W-M3	■	■					
	LNMX 191940-MF		■	■			
	LNMX 191940-MR		■	■			
	LNMX 301940-MF		■	■			
LNMX 301940-MR		■	■				
	RCMT 0602M0-F1			■			
	RCMT 0602M0-F2		■	■			
	RCMT 0803M0-F1			■			
	RCMT 0803M0-F2		■	■	■		
	RCMT 10T3M0-F1			■	■		
	RCMT 10T3M0-F2		■	■	■		
	RCMT 1204M0-F1		■	■	■		
	RCMT 1204M0-F2		■	■	■		
RCMT 1606M0-F1		■					
RCMT 1606M0-F2		■	■	■			
	RCMX 100300			■	■		
	RCMX 120400		■	■	■		
	RCMX 160600		■				
	RCMX 200600	■	■	■	■		
	RCMX 250700	■	■	■	■		
	RCMX 320900	■	■	■	■		
RNMG 120400-M3		■	■	■			
	SCMT 060204-F2			■			
	SCMT 070308-F2			■	■		
	SCMT 09T304-F1		■	■	■		
	SCMT 09T304-F2		■	■	■	■	■
	SCMT 09T308-F1		■	■	■		
	SCMT 09T308-F2		■	■	■	■	■
	SCMT 09T312-F1				■		
	SCMT 120408-F1			■	■		
	SCMT 120408-F2		■	■	■	■	■
	SCMT 120412-F1		■				
SCMT 250924T-F2			■				
SNMG 090304-MF2			■				

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	SNMG 090308-M5			■	■		
	SNMG 090308-MF2		■				
	SNMG 120404-M3		■	■	■		
	SNMG 120408-M3		■	■	■		
	SNMG 120408-M5		■	■	■		■
	SNMG 120408-MF1					■	■
	SNMG 120408-MF2		■	■	■		
	SNMG 120408-MF4					■	■
	SNMG 120408-MR6		■	■	■		
	SNMG 120408-MR7		■	■	■		■
	SNMG 120412-M3		■	■	■		
	SNMG 120412-M5		■	■	■	■	■
	SNMG 120412-MF2		■	■			
	SNMG 120412-MF4					■	■
	SNMG 120412-MR6		■	■	■		
	SNMG 120412-MR7						■
	SNMG 120416-M3		■	■			
	SNMG 120416-M5		■	■	■		
	SNMG 120416-MR6		■				
SNMG 120416-MR7			■				
SNMG 120612-MR6		■	■	■			
SNMG 120616-MR6		■	■				
SNMG 150608-M5				■			
SNMG 150612-M3		■	■				
SNMG 150612-M5		■	■	■		■	
SNMG 150612-MR6		■	■	■			
SNMG 150612-MR7			■	■			
SNMG 150616-M5		■	■	■			
SNMG 150616-MR6		■	■				
SNMG 150616-MR7		■	■	■			
SNMG 150624-MR6		■	■	■			
SNMG 190612-M3			■	■			
SNMG 190612-M5	■	■	■	■	■	■	
SNMG 190612-MR7		■	■	■		■	
SNMG 190616-M3			■				
SNMG 190616-M5	■	■	■	■	■	■	
SNMG 190616-MR7		■	■	■		■	
SNMG 190624-MR7			■				
SNMG 250924-MR7			■	■			
	SNMM 120408-R4	■			■		
	SNMM 120408-RR6						■
	SNMM 120412-R4			■	■		
	SNMM 150612-MR6		■	■	■		
	SNMM 150612-R4			■	■		
	SNMM 150616-MR6		■	■			
	SNMM 150616-R4	■					
	SNMM 150624-MR6		■	■	■		
	SNMM 150624-R7			■			
	SNMM 190612-R4			■	■		
	SNMM 190612-R6				■		
	SNMM 190612-R7			■			
SNMM 190612-RR6						■	
SNMM 190616-56			■				
SNMM 190616-57		■	■				
SNMM 190616-R4	■	■	■	■			

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	SNMM 190616-R5			■			
	SNMM 190616-R6				■		
	SNMM 190616-R7			■	■		
	SNMM 190616-R8				■		
	SNMM 190616-RR6			■	■		■
	SNMM 190624-57	■	■		■		
	SNMM 190624-R4	■			■		
	SNMM 190624-R5			■	■		
	SNMM 190624-R7			■	■		
	SNMM 190624-RR6			■	■		
	SNMM 190624W-R7			■			
	SNMM 250724-56				■		
	SNMM 250724-57		■	■	■		
	SNMM 250724-R7			■	■		
SNMM 250724-RR6			■	■			
SNMM 250724-RR9				■			
SNMM 250924-R7			■	■			
	SPMR 090304-F1			■			
	SPMR 090308-F1			■			
	SPMR 090308-FF1			■			
	SPMR 120304-F1			■			
	SPMR 120308-F1			■			
	SPMR 120308-F2			■			
SPMR 120312-F1			■				
	SPUN 120304			■			
	SPUN 120308			■			
	SPUN 190412			■			
SPUN 190416T			■				
	TCMT 110202-F1				■		■
	TCMT 110204-F1		■	■	■		■
	TCMT 110208-F1		■	■	■	■	■
	TCMT 16T302-F1				■		■
	TCMT 16T304-F1		■	■	■	■	■
	TCMT 16T304-F2		■	■	■	■	■
	TCMT 16T308-F1		■	■	■	■	■
	TCMT 16T308-F2		■	■	■	■	■
	TCMT 16T312-F1				■		■
TCMT 220408-F2		■	■	■			
TCMX 16T308W-F1		■	■				
	TNMG 110304-MF2			■			
	TNMG 160308-M5				■		
	TNMG 160308-MF3				■		
	TNMG 160404-M3		■	■	■		
	TNMG 160404-M5			■	■		
	TNMG 160404-MF1					■	■
	TNMG 160404-MF2		■	■	■		
	TNMG 160404-MF3				■		
	TNMG 160404-MF4					■	■
	TNMG 160404L-UX			■			
TNMG 160404R-UX			■				

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	TNMG 160408-FF1		■	■			
	TNMG 160408-M3	■	■	■	■		
	TNMG 160408-M5	■	■	■	■		■
	TNMG 160408-MF1					■	■
	TNMG 160408-MF2		■	■	■		
	TNMG 160408-MF3				■		
	TNMG 160408-MF4			■	■	■	■
	TNMG 160408-MF5		■	■			
	TNMG 160408-MR6		■	■	■		
	TNMG 160408-MR7		■	■	■		
	TNMG 160408L-UX				■		
	TNMG 160408R-UX				■		
	TNMG 160412-M3		■	■	■	■	
	TNMG 160412-M5	■	■	■	■		
	TNMG 160412-MF2		■	■			
	TNMG 160412-MF4					■	■
	TNMG 160412-MF5		■	■			
	TNMG 160412-MR6		■	■			
	TNMG 160412-MR7		■	■			
	TNMG 220404-M5				■	■	
TNMG 220404-MF2				■			
TNMG 220404-MF3				■			
TNMG 220408-M3			■	■	■		
TNMG 220408-M5	■	■	■	■	■	■	
TNMG 220408-MF2		■	■				
TNMG 220408-MF3				■			
TNMG 220408-MF4					■	■	
TNMG 220408-MR6		■	■	■			
TNMG 220408-MR7		■	■	■			
TNMG 220412-M3		■	■	■			
TNMG 220412-M5	■	■	■	■		■	
TNMG 220412-MF4					■	■	
TNMG 220412-MR6		■	■				
TNMG 220412-MR7					■		
TNMG 220416-M5	■	■	■	■			
TNMG 270608-M5				■			
TNMG 270612-M3				■	■		
TNMG 270612-M5		■	■	■			
TNMG 270612-MR7		■	■	■			
TNMG 270616-M5		■	■	■			
TNMG 270616-MR7		■	■	■			
TNMG 330924-MR7				■	■		
	TNMM 160404-R6				■		
	TNMM 160408-R4				■	■	
	TNMM 160412-R4		■	■			
TNMM 220408-R4		■	■	■			
TNMM 220412-R4		■	■	■			
TNMM 220416-R4		■	■	■			
TNMM 220416-R6				■			
TNMX 160408W-M3		■	■				
TNMX 160412W-M3		■					
	TPMR 110304-F1		■	■		■	
	TPMR 110308-F1			■		■	
	TPMR 160304-F1		■	■		■	
TPMR 160304-F2			■				

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	TPMR 160308-F1		■	■			■
	TPMR 160308-F2			■			
	TPMR 160312-F1			■			
	TPMR 220408-F2			■			
	TPMR 220412-F2			■			
	TPUN 160304			■	■		
	TPUN 160308			■	■		
	TPUN 220404			■			
	TPUN 220408			■	■		
	TPUN 220412			■			
	VBMT 110202-F1			■	■		
	VBMT 110204-F1			■	■		
	VBMT 110208-F1			■			
	VBMT 110302-F1			■	■		
	VBMT 110304-F1			■	■		
	VBMT 110308-F1			■			
	VBMT 160402-F1			■	■		
	VBMT 160404-F1		■	■	■		■
	VBMT 160404-F2		■	■	■	■	■
	VBMT 160408-F1		■	■	■	■	■
	VBMT 160408-F2		■	■	■	■	■
	VBMT 160412-F1		■	■	■		■
	VBMT 160412-F2		■	■	■		■
	VNMG 160404-FF1		■				
	VNMG 160404-M3		■	■	■		
	VNMG 160404-MF2			■			
	VNMG 160404-MF3			■			
	VNMG 160404-MF4			■		■	■
	VNMG 160408-M3		■	■	■		
	VNMG 160408-MF2		■	■			
	VNMG 160408-MF3			■			
	VNMG 160408-MF4			■		■	■
	VNMG 160412-MF2			■			
	VNMG 130404-M3		■	■	■		
	VNMG 130408-M3		■	■	■		
	WCMT 06T308-F1			■			
	WNMG 060402-M3			■			
	WNMG 060404-M3		■	■	■		
	WNMG 060404-MF1			■	■	■	■
	WNMG 060404-MF2		■	■	■		
	WNMG 060404-MF4			■		■	■
	WNMG 060404-MF5			■			
	WNMG 060404W-MF2			■			
	WNMG 060408-M3	■	■	■	■		
	WNMG 060408-M5	■	■	■	■		
	WNMG 060408-MF1			■	■	■	■
	WNMG 060408-MF2		■	■	■		
	WNMG 060408-MF3			■			
	WNMG 060408-MF4			■		■	■
	WNMG 060408-MF5		■	■	■		
	WNMG 060408W-M3		■	■			
	WNMG 060408W-MF2		■	■			
	WNMG 060408W-MF5		■	■			

	Part No.	Grade					
		TP0500	TP1500	TP2500	TP3500	TM2000	TM4000
	WNMG 060412-M3	■	■	■	■		
	WNMG 060412-M5	■		■	■		
	WNMG 060412-MF2			■			
	WNMG 060412-MF4					■	■
	WNMG 060412-MF5		■	■			
	WNMG 060412W-M3		■	■			
	WNMG 080404-M3		■	■	■		
	WNMG 080404-MF1		■	■		■	■
	WNMG 080404-MF2		■	■			
	WNMG 080404-MF4					■	■
	WNMG 080404W-MF2			■			
	WNMG 080408-M3	■	■	■	■		
	WNMG 080408-M5	■	■	■	■	■	■
	WNMG 080408-MF1					■	■
	WNMG 080408-MF2		■	■			
	WNMG 080408-MF3			■			
	WNMG 080408-MF4			■		■	■
	WNMG 080408-MF5	■	■	■	■		
	WNMG 080408-MR6		■	■	■		
WNMG 080408-MR7		■	■	■			
WNMG 080408W-M3	■	■	■				
WNMG 080408W-MF2		■	■				
WNMG 080408W-MF5		■	■				
WNMG 080412-M3	■	■	■	■			
WNMG 080412-M5	■	■	■	■	■	■	
WNMG 080412-MF2		■					
WNMG 080412-MF4			■		■	■	
WNMG 080412-MF5	■	■	■	■			
WNMG 080412-MR6		■	■	■			
WNMG 080412-MR7		■	■	■		■	
WNMG 080412W-M3	■	■	■				
WNMG 080416-M3	■	■	■				
WNMG 080416-M5	■	■	■	■			
WNMG 080416-MF5		■	■				
WNMG 080416-MR6		■	■				
WNMG 080416-MR7		■	■	■			
WNMG 080608-M5					■		
WNMG 080612-M5	■		■	■			
WNMG 080612-MR6		■	■	■			
WNMG 080616-M5	■	■	■	■			
WNMG 080616-MR6		■	■				
WNMG 080408-R6					■		

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