

Hyper DuAl SP

Dry cutting at 300 m/min

Hyper DuAl GP

Suitable in all conditions from dry to wet

DuAl EX

Great performance without coating after regrinding

DuAl VX

High value performance in a wide range of standard hob applications

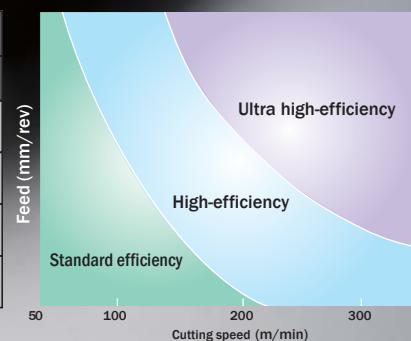
Suitable in most conditions from 300 m/min high-speed dry cutting to wet cutting



Selection Chart

Four coatings available to support various applications

	Wet Cutting (oil or water soluble)	Dry Cutting		
		Standard efficiency cutting	High-efficiency cutting	Ultra high-efficiency cutting
Re-grinding and Re-coating (full coating)				Hyper DuAl SP
		Hyper DuAl GP		
Specifications for Re-grinding (no coating on cutting face)		DuAl EX		
		DuAl VX		



Suitable for most situations from 300 m/min high-speed dry cutting to wet cutting

- **Improved coating quality** needed for hobbing by optimizing deposition process and design components of coatings
- **Four coatings are available** depending upon the application
 Hyper DuAl SP hob [*Special Performance*]
 Hyper DuAl GP hob [*General Purpose*]
 DuAl EX hob [*Exceed: Surpasses competitors*]
 DuAl VX hob [*Value Extreme: Optimize benefits*]
- Coatings designed to combine the superior thermal shock resistance, chipping resistance, and wear resistance of new HSS-Co material (FMH, FMH-VX) for outstanding performance.



Dry Hobbing

Comparison of Coating Performance

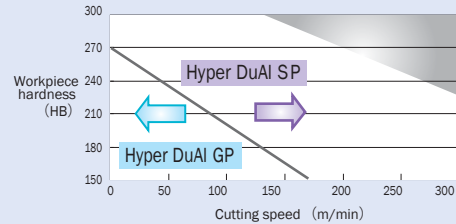
	DuAl VX (For regrind only)	DuAl EX (For regrind only)	Hyper DuAl GP (For regrind and recoating)	Hyper DuAl SP (For regrind and recoating)
Wear resistance	●	○	○	○
Toughness	●	●	○	○
Heat resistance	△	●	○	○
Adhesion	○	○	○	○
Applications	Wet & Dry	Wet & Dry	General purpose wet and dry	High-Speed dry
Hardness	2300 ~ 2500	2300 ~ 2500	2400 ~ 2600	2500 ~ 2700
Oxidation temp.	850°C	950°C	1100°C	1150°C

○ = Excellent ● = Good △ = Fair

How to use for Hyper DuAl SP and GP

- Hyper DuAl SP: Improves performance against cratering and premature progression
- Hyper DuAl GP: Improves performance against cratering and secondary flank wear

<Example> How to use depending on hardness of workpiece



Features of Coatings

- Specialized coating for hobs has the improved coating properties you need for hob work
- Coating provides excellent consistency in a variety of work conditions

Comparison of performance of Hyper DuAl GP and Hyper DuAl SP (coating on cutting face)

Cutting Conditions	Cutting speed	160m/min		250m/min		
	Feed amount	2.6mm/rev Climb (47T)		3mm/rev Climb (54T)		
	Maximum chip thickness	0.4mm		0.4mm		
	Cutting fluid	Dry		Dry		
Cutting Length	Same performance between GP and SP				Great performance of GP with high speed conditions	
DuAl EX vs.	Hyper DuAl GP		Hyper DuAl SP			
	V=160m/min	V=250m/min	V=160m/min	V=250m/min		
	2.6	2	3.1	5.2		

- Hyper DuAl GP: 2.6x tool life compared to DuAl EX under conventional cutting conditions
- Hyper DuAl SP: Performance better in tougher conditions (From 3.1x→5.2x compared to DuAl EX)

Hyper DuAl SP

Hyper DuAl SP (For Regrinding and Recoating)

- Dramatically increases the performance when high-efficiency cutting with speeds over 300 m/min and high-hardness material cutting
- Achieve great performance in the toughest conditions



Examples of Ultra-High-Speed Cutting

	DuAl EX	Hyper DuAl GP	Hyper DuAl SP
Shape of wear			
Cutting length	25m	43m	130m
Life ratio vs. DuAl EX	1	1.7	5.2

Hob test conditions	
Workpiece specifications	m2.5×P A16°×N T 54, SCM420H
Hob specifications	φ95×N T 12×3TH, Material is FMH, coating on cutting face
Cutting conditions	V=300m/min, f=3.0mm/rev, Climbing, dry cutting, no shift

Operating life extended 5x over conventional product

Example for High-Hardness Materials

	Competitor (coating for dry cutting)	Hyper DuAl SP
Shape of wear		
Maximum amount of wear	0.36mm	0.06mm

Hob test conditions	
Workpiece specifications	m2×PA15°×NT79, S45C (HB 280)
Hob specifications	φ70×NT12×3TH, coating on cutting face
Cutting conditions	V=110/160 m/min, f=3.0/2.6mm/rev, Climbing, dry cutting, number of cuts is 800

Excellent performance with high-hardness materials

Hyper DuAl GP

Hyper DuAl GP (For Regrinding and Recoating)

- Can be used for both dry and wet cutting
- Suitable in a wide range of materials and cutting methods



Example of High-Speed Wet Cutting

	DuAl EX	Hyper DuAl GP
Shape of wear	 VB 0.22mm	 VB 0.17mm
Cutting length	225m	450m
Life ratio vs. DuAl EX	1	2.0

Hob test conditions	
Workpiece specifications	m2.5×P A15°×N T 40, SCM420H
Hob specifications	φ95×N T 12×3TH, Material is FMH, coating on cutting face
Cutting conditions	V=150m/min, f=2.2mm/rev, Climbing, wet cutting, no shift

Delivers performance increases even when wet cutting

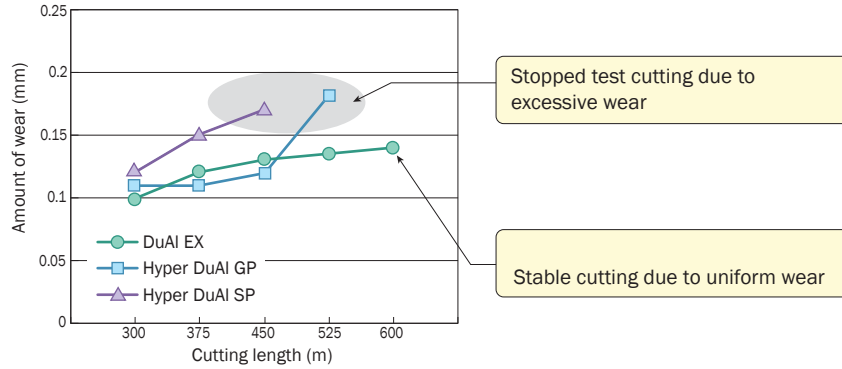
DuAl EX

DuAl EX (For Regrinding Only)

- Can be used for both dry and wet cutting
- Can be used with regrind only
- Great performance in normal cutting applications (cutting speed 60 to 180 m/min), both wet and dry



Comparison of cutting with no coating on cutting face



Hob test conditions

Workpiece specifications	m2.45×PA 15.5°× NT 40, SCr420H
Hob specifications	φ95×NT 12×3 TH, Material is FMH; No coating on cutting face
Cutting conditions	V = 160m/min, f = 2.2mm/rev, Climbing, dry cutting, no shift

DuAl VX

DuAl VX (For Regrinding Only)

- Can be used for both dry and wet cutting
- Supports a wide range of applications for standard hobbing materials



Example of wet cutting

	Conventional (HSS+TiAlN coated)	DuAl VX
Shape of wear		
Maximum amount of wear	0.15mm chipping	0.06mm

Hob test conditions

Workpiece specifications	m2.3×NT47×HA21° LH S53C (250 ~ 300HB)
Hob specifications	φ80×3TH×12T, Material is FMH-VX, no coating on cutting face
Cutting conditions	V=70m/min, f=1.5mm/rev, Climbing, wet cutting number of cuts is 150

Works consistently without chipping

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