

## Processing of Duropal XTreme boards

### Introduction

The exciting processing of Duropal XTreme by sawing, milling, grooving and drilling requires the choice of appropriate tools as well as cutting parameters. The wrong choice of tools and the requirements of that application can lead to flanging, inadmissible heating or even fusion of the work piece surface and damages.

In the existing processing guidelines (without this list being exhaustive) corresponding recommendations are being devised for an optimal processing of this board material.

### General processing guidelines

Depending on the processing methods during the processing of Duropal XTreme boards, the guidance values from the list should be taken into account with regard to the selection of cutting velocity ( $v_c$ ) and the tooth feed ( $f_z$ ).

Processing method	Cutting velocity $v_c$ m/s
Sawing	60 – 90
Machining	60 – 80
Milling	50 – 70
Surface milling (router)	10 – 35

Processing method	Tooth feed $f_z$ mm
Sawing	0.02 – 0.12
Machining	0.12 – 0.18
Milling	0.30 – 0.55
Surface milling (router)	0.15 – 0.25

These parameters are in connection with the tool diameter (D), number of teeth (Z), speed (n) and feed rate ( $v_f$ ) in use of the processing machine. The right choice of these factors is responsible for a good processing result.

For the calculation of cutting velocity, tooth feed and feed rate use the the following formulas:

$v_c$  - cutting velocity [m/s]

$$v_c = D \cdot \pi \cdot n / 60 \cdot 1000$$

D – tool diameter [mm]

n – rotational speed of tools [ $\text{min}^{-1}$ ]

$f_z$  – tooth feed [mm]

$$f_z = v_f \cdot 1000 / n \cdot z$$

$v_f$  – feed speed [m/min]

n – rotational speed of tools [ $\text{min}^{-1}$ ]

z – number of teeth

$v_f$  – feed speed [ $\text{m}/\text{min}^{-1}$ ]

$$v_f = f_z \cdot n \cdot z / 1000$$

$f_z$  – tooth feed [mm]

n – rotational speed of tools [ $\text{min}^{-1}$ ]

z – number of teeth

### Cutting material

Basically tools with hard-metal cutting edges (HW) as well as diamond cutting edges (DP-polycrystalline diamonds) can be used. In order to achieve a longer tool life at a high volume of cuts in an industrial production, the use of tools with diamond cutting edges (DP) is recommended.

### Cutting of the boards with circular saw blades

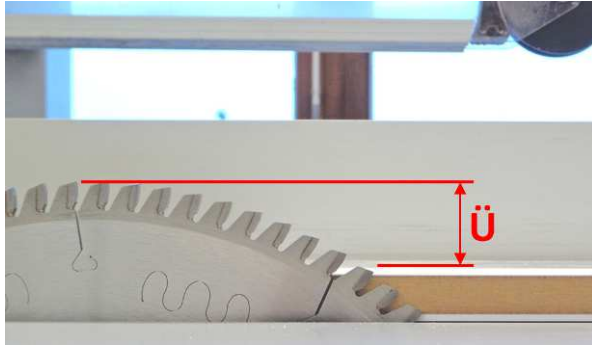
Generally speaking, the following should be noted:

- visible side must be facing upwards
- watch for the right saw blade projection (see the table)
- adjust rotational speed, number of teeth and feed velocity correspondingly
- use of a scoring saw is recommended for clean cuts on the bottom side of the board

According to the saw blade projection, the entrance and exit angles change and thus the cutting edge quality. If the upper edge becomes inaccurate, the saw blade must be set higher. In the case of an unclean cut at the bottom, the saw blade must be set lower. Thus the most optimal height adjustment must be determined.

With sizing saws and panel sizing saws, the following saw blade projections  $\dot{U}$  need to be adjusted depending on diameter D:

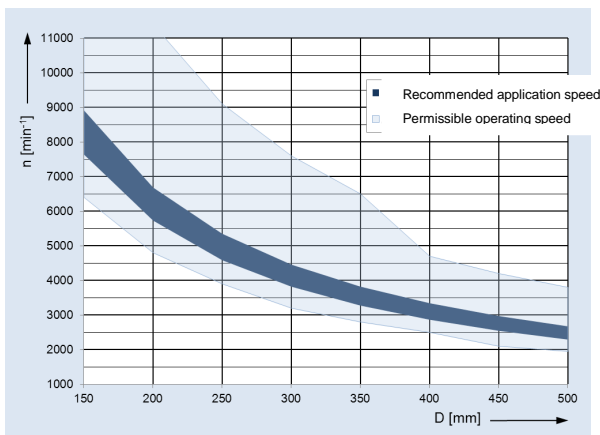
## Processing recommendations Duropal XTreme boards



Saw blade diameter D:	Saw blade projections Ü:
D 250 mm	approx. 5 – 10 mm
D 300 mm	approx. 5 – 10 mm
D 350 mm	approx. 8 – 12 mm
D 400 mm	approx. 8 – 12 mm
D 450 mm	approx. 10 – 15 mm

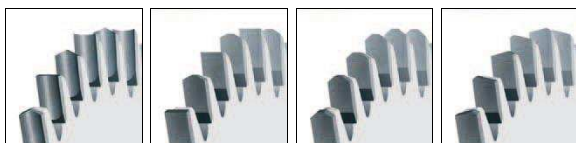
Saw blades with a higher number of teeth can generally be recommended for a good processing quality.

With circular saws, the recommended cutting speed  $v_c$  is at 60 – 80 m/s. With diamond-tipped circular saw blades, the cutting speed can be increased up to  $v_c$  90 m/s.



Speed diagram - depending on circular saw blade diameter

### Recommended saw tooth geometries



Tooth shapes HZ/DZ, FZ/TR and TR/TR are suitable for cutting to size. Tooth shape WZ/FA with special tooth geometry is suitable for cutting to size if higher quality requirements are set for the cut edge.

### Trimming saws

Good cutting results and tool lives are achieved with tooth shapes HZ/DZ and FZ/TR.

Very good top film cutting results are achieved using tooth shape WZ/FA with special tooth geometry; however, a total tool path reduction (tool life) is to be expected.

### Panel cut-to-size saws

Good cutting results and tool paths are achieved with tooth shape TR/TR.

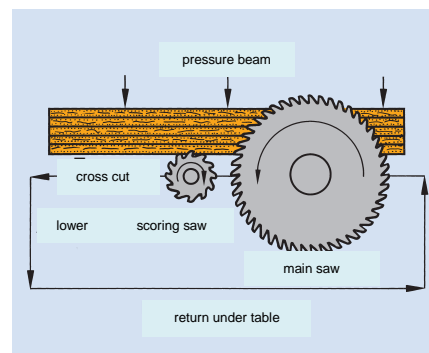
Very good top film cutting results are achieved using tooth shape WZ/FA with special tooth geometry; however, a total tool path reduction (tool life) is to be expected.

### Circular trimming saws and panel cut-to-size saws with scoring unit and pressure bar

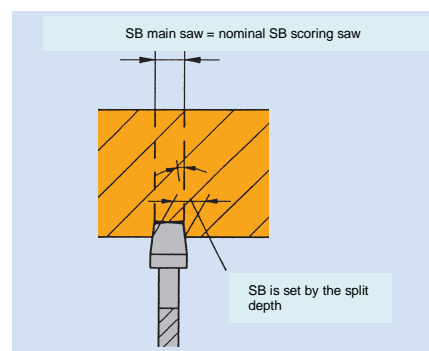
#### Scoring saw blades

With coated work pieces, the use of a scoring saw unit is recommended to achieve a good cutting edge quality at the side of the projected tooth. The cut width of the scoring saw blade shall be adjusted slightly larger than that one of the main saw blade so that the projected tooth of the main saw will no longer touch the cutting edge.

As a secure, flat placement of the work pieces is only ensured with compression tool, split scoring saw blades are used on circular saw benches and dimension saws.



Panel cut-to-size saw with scoring unit and pressure device.



Operating diagram conical scoring saw blade. In case of maintenance of the tools (always sets), the cutting widths must be coordinated.

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### Circular saw blades for panel cut-to-size and circular saw benches (HW tipped)

The following circular saw blades are suitable for cutting to size on bench and panel cut-to-size saws.

D [mm]	SB [mm]	TDI [mm]	BO [mm]	NL	Z	ZF	SW [Degrees]	Leitz ID-No.
250	3,2	2,2	30	COMBI	80	FZ/TR	10	162000
300	3,2	2,2	30	COMBI	96	FZ/TR	10	162002
350	3,5	2,5	30	COMBI	108	FZ/TR	10	162003
220	3,2	2,2	30	COMBI	42	HZ/DZ	10	162004
250	3,2	2,2	30	COMBI	48	HZ/DZ	10	162005
303	3,2	2,2	30	COMBI	60	HZ/DZ	10	162006
350	3,5	2,5	30	COMBI	72	HZ/DZ	10	162007

Other dimensions available, see Leitz-Lexikon

### Circular saw blades for panel cut-to-size saws (HW tipped)

The following Leitz "RazorCut" circular saw blades are suitable for cutting to size on panel cut-to-size saws.

Maschine	D [mm]	SB [mm]	TDI [mm]	BO [mm]	NL	Z	ZF	SW [Degrees]	Leitz ID-No.
Höfer, Panhans	300	4,4	3,2	30	COMBI	60	TR/TR	15	69104
HolzHer, Panhans, Schelling	350	4,4	3,2	30	COMBI	72	TR/TR	15	69109
Holzma	350	4,4	3,2	60	2/14/100	72	TR/TR	15	69135
Homag	350	4,4	3,2	75	-	72	TR/TR	15	69110
Selco	355	4,4	3,2	80	2/9/130 + 4/19/120	72	TR/TR	15	69111
Giben	380	4,4	3,2	50	4/13/80	72	TR/TR	15	69138
Holzma	380	4,8	3,5	60	2/14/100 + 2/14/125 + 2/19/120	72	TR/TR	15	69114
Selco	400	4,4	3,2	80	2/9/130 + 4/19/120	72	TR/TR	15	69118
Gabbiani/SCM	400	4,4	3,2	80	4/9/100 + 2/14/110 + 2/7/110	72	TR/TR	15	69133
Selco	430	4,4	3,2	80	2/9/130 + 4/19/120	72	TR/TR	15	69121
Scheer, Schelling	450	4,4	3,2	30	2/13/94 + COMBI	72	TR/TR	15	69122
Holzma	450	4,8	3,5	60	2/14/125 + 2/19/120	72	TR/TR	15	69125
Schelling	460	4,4	3,2	30	2/13/94	72	TR/TR	15	69126

Other dimensions available, see Leitz-Lexikon

Cutting a panel to size with circular saw blades is generally to be considered as pre-machining. To produce a decor edge with optimum surface and chip-free for edging, the saw cut must be finished using a cutter or joint cutter, as described in the next chapter.

### Circular saw blade for cutting to size HPL laminate panels (approx. 0.8 mm) and faced boards without finishing

An optimum finish saw cut in the top (facing) film is achieved with the following Leitz "BrillianceCut" circular saw blades. However, a reduced tool path is to be expected. The workpieces produced in this way can be used further directly without any additional work operations.

Machine	D [mm]	SB [mm]	TDI [mm]	BO [mm]	NL	Z	ZF	SW [Degrees]	Leitz ID-No.
Altendorf, Martin, Striebig	303	3,5	2,5	30	COMBI	60	TR/TR	10	161028
HolzHer, Panhans, Schelling	350	4,4	3,2	30	COMBI	72	WZ/FA	15	161029
Holzma	350	4,4	3,2	60	2/14/100	72	WZ/FA	15	161030
Holzma	380	4,8	3,5	60	2/14/100 + 2/14/125 + 2/19/120	84	WZ/FA	15	161031
Panhans, Schelling	400	4,4	3,2	30	COMBI	72	WZ/FA	15	161032
Scheer, Schelling	450	4,4	3,2	30	COMBI	72	WZ/FA	15	161033
Holzma	450	4,8	3,5	60	2/14/125 + 2/19/120	72	WZ/FA	15	161034

Other dimensions available, see Leitz-Lexikon

## Spindle moulder and milling machines on continuous systems

For processing Duropal XTreme boards, cutter heads with HW exchangeable knives or diamond-tipped mills are ideally suited. To create nick-free edges at the top layers of the board, joining tools with alternating axle angle shall be used. The use of jointing cutters with a bigger axial angle is particularly advantageous (>30°). The use of Leitz jointing cutters - system "EdgeExpert" with an axial angle up to 54° is particularly recommended. Sizing tools with a higher number of teeth (Z) compared to standard tools tend to offer a better cutting quality. Furthermore it is also essential to ensure a slight linear machining between 0.7 to 2.0 mm to reduce the tool wear.

When working with hand-fed spindle moulders, only tools with the marking "MAN" or "BG-Test" may only be used. Furthermore, for safety reasons, the speed range indicated on the tool may not be exceeded or reduced. The tools for manual feeding may only be used conventionally.

For perfect milling results, the use of tools with high radial accuracy is particularly advantageous as well as

The application parameters for joining must be chosen to have a tooth feed  $f_z$  between 0.25 – 0.65 mm.

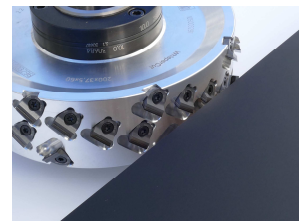
the balance quality which is achieved by the use of centering cut surfaces like hydro tensioning systems, HSK-units or shrink systems.

## Joining

Tool examples:



DP-jointing cutter *WhisperCut*



DP- *WhisperCut EdgeExpert*



DP-jointing cutter fixed



DP-jointing cutter *EdgeExpert*

Dimensions DxBxBO [mm]	Speed n [min <sup>-1</sup> ]	Num bers of teeth Z	Feed speed v <sub>f</sub> [m/min]	Tool variants - Leitz ID-no. (LL = left-hand rotation; RL = clockwise rotation)			
				HW re- versible blades	DP- Whisper- Cut	DP fixed milling cutters	Machine
100x56x30 100x43x30	12000	3	10 – 18	LL 24692 RL 24691	LL 90885 RL 90886		Brandt, IMA, Stefani, SCM
125x43x30	9000	3	10 – 15	LL 24685 RL 24685	LL 75627 RL 75627		HOMAG, Biesse, ...
125x43x30	9000	3	10 – 15		LL 192094 RL 192095		IMA
125x43x30	9000	4	15 – 20			LL 192052 RL 192053	IMA, Biesse, HOMAG
180x43x35	6000	4	15 – 20			LL 90841 RL 90842	IMA, HOMAG
180x43x35	6000	6	15 – 20			LL 192056 RL 192057	IMA, HOMAG
180x34x35	6000	8	20 – 25			LL 192060 RL 192061	IMA, HOMAG
200x16-30x35	6000	4	10 – 15			LL 192010 RL 192010	KAL, Double-end tenoners.
200x16-30x35	6000	6	15 – 20			LL 192011 RL 192011	KAL, Double-end tenoners
200x16-30x35	6000	8	20 – 25			LL 192066 RL 192066	KAL, Double-end tenoners
200x16-30x35	6000	10	30 – 35			LL 192108 RL 192109	KAL, Double-end tenoners.

Other cutter heads and milling cutters with other dimensions and number of teeth available, see Leitz lexicon or on request

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### Formatting – Cutters for throughfeed machines

Diamond compact hogs are recommended which cause less friction and cutting pressure. Particularly suitable is the type Leitz Diamaster DT PLUS mounted on hydro clamping element for highest radial and axial runout and excellent machining quality and tool life.



Leitz DP compact hogger Diamaster DT PLUS

The cutting speed  $v_c$  is 80 m/s at the usual speed of  $n$  6000  $\text{min}^{-1}$  and diameter  $D$  250 mm. Application parameters and number of teeth of the cutters should be chosen so that the tooth feed is between  $f_z$  0,12 – 0,18 mm.

Dimensions DxSBxB0 [mm]	Speed n [ $\text{min}^{-1}$ ]	Number of teeth Z	Feed speed $v_f$ [m/min]	DP-compact hogger <i>Diamaster DT PLUS</i> mounted on hydro clamping element for spindle HF40 (Leitz ID-no.)		Machine type
250x10x60	6000	24	15 – 25	LL 190312	RL 190313	Edge banding machine, double end tenoner
250x10x60	6000	36	25 – 40	LL 190316	RL 190317	Edge banding machine, double end tenoner
250x10x60	6000	48	40 – 55	LL 190320	RL 190321	Edge banding machine, double end tenoner
250x10x60	6000	60	55 – 60	LL 190324	RL 190325	Edge banding machine, double end tenoner

Further cutters with other number of teeth, hole and cutting edge geometry available, see Leitz-lexicon

### Scrapers on edge banding machines

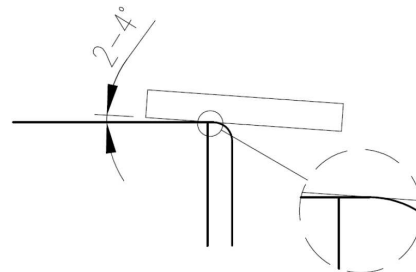
Scrapers on edge banding machines are to be set so that the scraper doesn't touch the coar board material and damage the protection foil.

#### Flat scrapers

Flat scrapers should preferably have a slanted position from the edge to the board of 2-4° and doesn't touch the protection foil and decor layer.

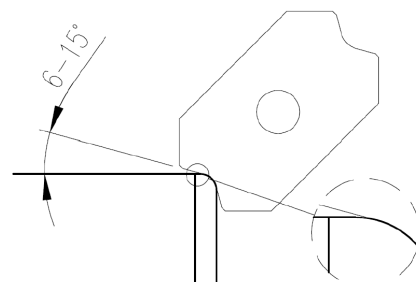
### Groove machining

For optimum edge quality for groove machining, tools with a high tooth number (large number of teeth) should preferably be chosen. The tooth feed ( $f_z$ ) should be within the range from 0.03 – 0.06 mm for machining in down-cut (GLL)



#### Profile scrapers

Profile scrapers are equipped with a profile outlet and can be used without any problems for the post-treatment of Duropal XTreme boards. In order to avoid eventual damages at the protection foil or decor layer, scrapers with an enlarged profile outlet of up to 15° are recommended.



## Machining on CNC stationary machines

### Formatting and joining with routers

For the machining on surface milling cutters and machining centres, solid carbide cutters (VHW) are most appropriate or preferably diamond-tipped (DP) shank cutters.

To create nick-free edges at the top layers of the board, DP routers with spiral cutting edge arrangement and alternating axle angle have to be used. The use of routers with a bigger axial angle is particularly advantageous (>30°). When treating Duropal XTreme boards, the use of the Leitz router Diamaster "EdgeExpert" with a bigger axial angle up to 50° for best edge quality as for example for the no-joint edge processing is recommended.

Sizing tools with a higher number of teeth (Z) compared to standard tools tend to offer a better cutting quality. Pre-milling of the work pieces is recommended to reduce the tool wear by slight linear machining (between 0.5 to 2.0 mm) of the finish processing.

Please make sure that there is a good workpiece clamping on the machine. To support the vacuum suction system, additional mechanical clamps can be

used. Stable and stiff shrink clamping chucks can be recommended, type Leitz ThermoGrip® for the highest concentricity and balance for perfect cutting quality. A good machining result can only be obtained in case of sufficient stiffness of the machine as for example on portal machines.



#### Application data:

##### Speed

n 18.000 – 24.000 min<sup>-1</sup>

##### Feed speed

v<sub>f</sub> 8 – 10 (Z2) und 14 – 18 (Z3) m/min

v<sub>f</sub> 20 – 24 m/min (Z2 Nesting)

##### Tooth feed

f<sub>z</sub> 0.15 – 0.25 mm

f<sub>z</sub> 0.40 – 0.60 mm (Nesting)

#### Shank cutter DP-tipped

Dimensions D x NL x S [mm]	Number of teeth Z	Sense of rotation	Type	Leitz ID-no.
16 x 28 x 20	2 + 2	RL	Diamaster PRO	191042
20 x 28 x 20	2 + 2	RL	Diamaster Quattro	91235
20 x 28 x 20	3 + 3	RL	Diamaster PLUS <sup>3</sup>	191051
12 x 24 x 12	2 + 2	RL	Diamaster PRO, Nesting	191060
20 x 32 x 20	2 + 2	RL	Diamaster Quattro EdgeExpert	191071
20 x 48 x 25	2 + 2	RL	Diamaster Quattro EdgeExpert	191072
25 x 30 x 25	3 + 3	RL	Diamaster PLUS <sup>3</sup> EdgeExpert	191073
25 x 35 x 25	3 + 3	RL	Diamaster PLUS <sup>3</sup> EdgeExpert	191074
25 x 48 x 25	3 + 3	RL	Diamaster PLUS <sup>3</sup> EdgeExpert	191075

Other dimensions available, see Leitz lexicon or on request



Machining examples



## Drilling

Due to the surface quality of the overlay, frills tend to expand/flange at the edge and to slight ausfransen fraying. Therefore, in general only sharp drill bits with a free-cutting bit geometry should be used.

Drilling on the backing side is possible without tears. Hard metal tipped or preferably solid hard metal (VHW) spiral, dowel hole and hinge drill bits are recommended for drilling.

On CNC machining centres, use of the drill bit in the main spindle is recommended instead of in the drilling jig due to the higher stability and possibility of drilling with higher speeds.

### Dowel hole drill

Speed  $n$  [ $\text{min}^{-1}$ ] 4000 – 6000  
Feed rate  $v_f$  [ $\text{m}/\text{min}$ ] 0.5 - 2

### Through-hole drill

Speed  $n$  [ $\text{min}^{-1}$ ] 4000 – 6000  
Feed rate  $v_f$  [ $\text{m}/\text{min}$ ] 0.5 – 1

### Hinge drill

Speed  $n$  [ $\text{min}^{-1}$ ] 3000 – 4500  
Feed rate  $v_f$  [ $\text{m}/\text{min}$ ] 0.5 - 2

## Tool lives

Tool lives are dependant on a multitude of factors. Therefore no standard statements or rights can be derived from these guidelines. The details about the tools and processing parameters are recommended guidelines. Machine- or process-related constellations can lead to different application parameters.

An optimum adaptation of machinery, tool and material as well as customer-specific requirements can only be taken onsite and only mutually with a Leitz application engineer.

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