HARDOX®
WELDOX®

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Cutting

Cutting of HARDOX and WELDOX

All known methods of cutting can be used for HARDOX- and WELDOX plate. These steel grades derive their properties from specific heat treatment processes, and the heat input caused by the cutting method used must be taken into account. Consideration should thus be given to the influence on the heat affected zone (HAZ), the risk of cutting cracks, and possible movements of the plate on the cutting table.

Cutting method	Thickness	Cutting speed	Kerf	HAZ	Dim. tolerance
Abrasive water-jet cutting	4–150 mm	8–150 mm/min	1– 3 mm	0 mm	± 0,2 mm
Laser cutting	4–20 mm	600–2200 mm/min	<1 mm	0,4 – 3 mm	± 0,2 mm
Plasma cutting	4–40 mm	1200–6000 mm/min	2– 4 mm	2– 5 mm	± 1,0 mm
Gas cutting	4–150 mm	150–700 mm/min	2– 5 mm	4– 10 mm	± 2,0 mm

Abrasive water-jet cutting

This method can be used for cutting most materials. The cut surface is of very high quality, the kerf is 1–3 mm wide and is not heat affected. Abrasive water-jet cutting is the best method whenever there is risk of cutting cracks occurring, and is therefore recommended for thick wear plate.

Laser cutting

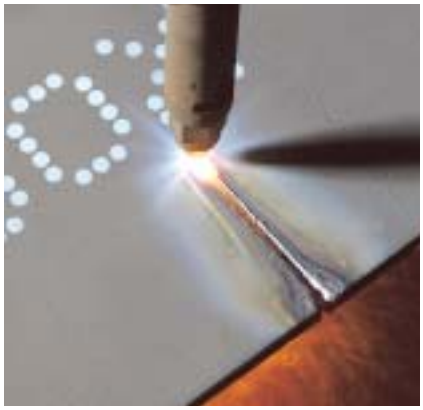
Up to 20 mm thick plate can be cut with the equipment available today. The kerf is less than 1 mm wide, and the HAZ is 0.4–3 mm, depending on the cutting conditions. Complicated profiles can be cut with excellent accuracy.

Laser cutting is a method which is sensitive to the surface of the plate, which can therefore affect productivity.

Plasma cutting

Plasma cutting can be used on up to 40 mm thick plate. The kerf is 2–4 mm and the cut surface is of good quality, but the edges tend to slope. The HAZ is normally 5 mm. The cutting speed is high.

In order to minimize the environmental impact in the form of noise and air pollution, plasma cutting can be carried out under water. This also minimizes movements of the plate.



Gas cutting

Both LP gas and acetylene can be used for cutting HARDOX and WELDOX. The method is the most commonly used and has a wide field of application. It can be employed for all plate thicknesses. The kerf is 2–5 mm wide and the HAZ is 4–10 mm, both of which depend on the plate thickness and the cutting speed.

The dimensional tolerance on thin plate is not particularly good, and tight contours are therefore difficult to cut.

The risk of cutting cracks increases with the plate thickness and hardness. To avoid this, it may be advisable to preheat the plate or reduce the cutting speed.

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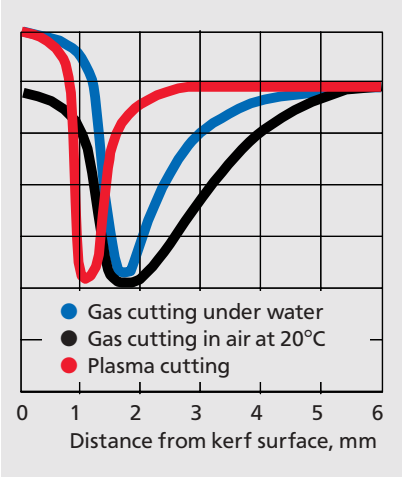
Gas cutting (cont.)

Heat affected zone



Heat affected zone

The various cutting methods involving heat produce a heat affected zone (HAZ) at the kerf. The width of the zone and its effect on hardness depend on various factors:

– **The cutting method** and **the cutting speed** determine the heat input. The higher the heat input, the wider will be the HAZ.

– **When small parts** (**100 x 100 mm**) are being cut, the volume of metal is insufficient to act as a heat sink for the heat supplied. The plate temperature may then be so high that the hardness of the entire part will be lowered.

Recommended workpiece temperatures for gas cutting ▼

Plate grade	Thickness [mm]	Temp. [°C]
HARDOX HiTuf	100 -120 mm	100°C
HARDOX 400	45 - 80 mm	100 - 150°C
HARDOX 400	>80 mm	150 - 200°C
HARDOX 450	45 - 80 mm	100 - 150°C
HARDOX 450	>80 mm	150 - 200°C
HARDOX 500	20 - 40 mm	75 - 100°C
HARDOX 500	>40 mm	100 - 150°C
HARDOX 600	8 - 50 mm	175°C

Preheating – post-heating

The most reliable method of avoiding cutting cracks is to preheat the plate and to maintain the elevated workpiece temperature until cutting has been completed.

Preheating should preferably be carried out by covering the area to be cut with electric heater mats (at least 100 mm on each side of the planned kerf). The recommended workpiece temperature should be reached before cutting is started. The temperature should be checked by measuring on the underside of the plate. A flame can also be used for preheating.

Heating immediately after cutting also reduces the risk of cutting cracks, and the same electric heating mats can be used for this purpose. The soaking time should be at least 5 minutes per mm of plate thickness, but at least 1 hour.

In many cases, it is more practical to extend the cooling period instead of undertaking post-heating. This can be done by insulating the area around the cut surfaces with mineral wool mats.

A reduced cutting speed (20%) also results in preheating of the kerf area, which thus reduces the risk of cutting cracks. In this case, the parts cut out (and any remaining plate) should also be insulated.

Cutting under water

– Both plasma cutting and gas cutting can be carried out under water. In both cases, the width of the HAZ will be reduced.

– Due to the high cooling rate, the hardness of the cut edge will be same or possibly somewhat higher than that of the parent material.

– A reduced cutting speed should be employed when cutting under water.

– Small parts can be cut without the risk of the hardness being reduced.

– The water acts as a coolant and ensures a more uniform plate temperature, which reduces the movement of the plate on the cutting table.

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