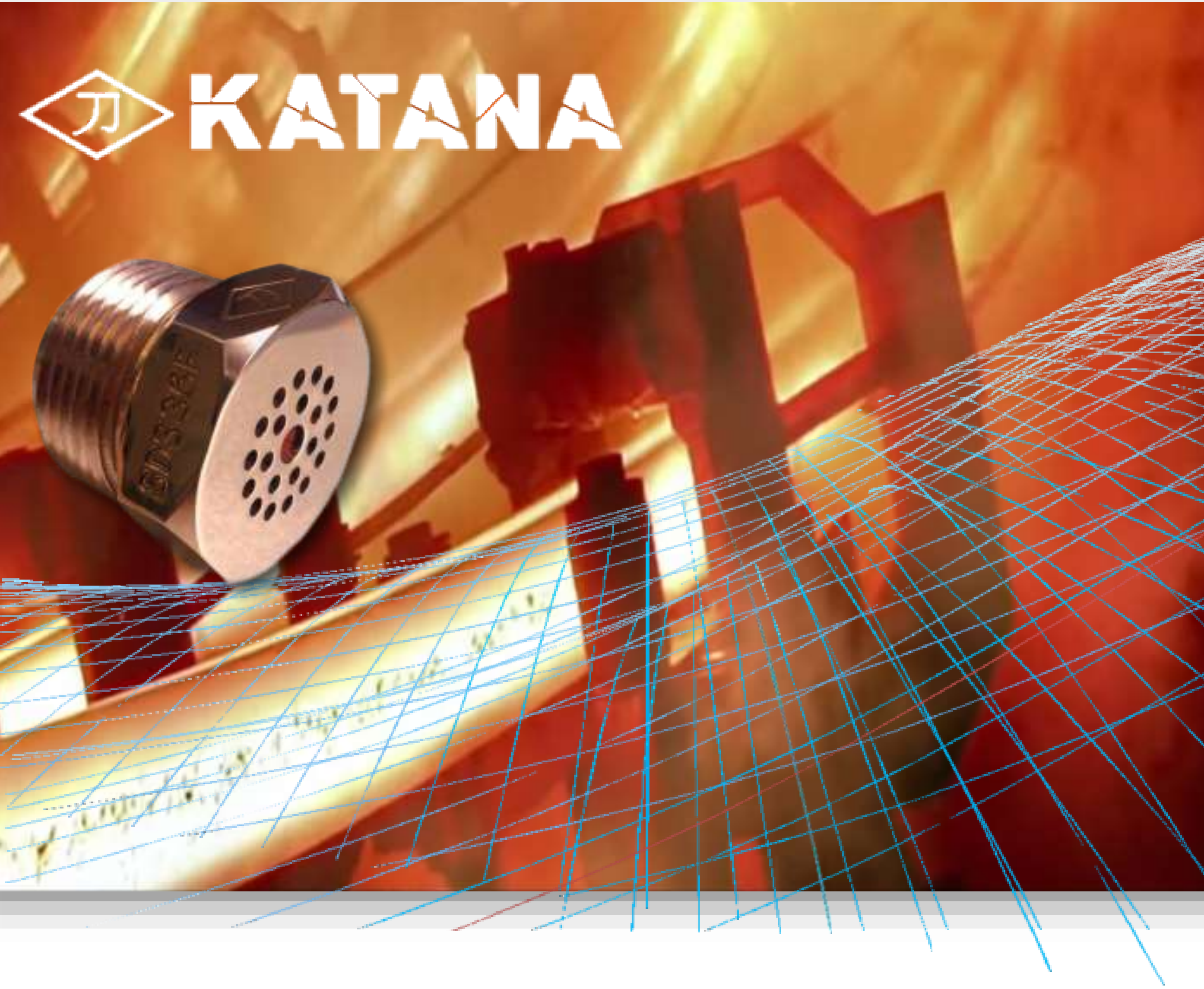


KATANA HEAVY DUTY SDS NOZZLES

KATANA SDS-F Series Nozzle

Katana SDS nozzles are suitable for different environment, to meet the different requirements of customers, can be used for continuous casting billet and slab cutting, steel billet surface cleaning etc.

SDS (Supersonic Gas Deposition) cutting nozzles are used in the steel industry for cutting steel slabs and billets. These nozzles utilize a supersonic gas jet to cut through the steel, offering high precision and efficiency.

Working Principle:

SDS cutting nozzles operate on the principle of using a supersonic gas jet, typically a mixture of oxygen and a fuel gas such as acetylene or propane, to rapidly heat and oxidize the material being cut. This high-velocity jet of gas melts and removes the metal, resulting in a clean cut.

Materials:

SDS cutting nozzles are typically made of durable materials capable of withstanding high temperatures and pressures generated during the cutting process. Common materials include special grade cooper alloy or specialized alloys designed for high-temperature applications.

Design:

These nozzles are designed to optimize the gas flow and achieve the desired cutting performance. They often have specific geometries and internal structures to facilitate efficient gas mixing and acceleration to supersonic speeds.

Applications:

SDS cutting nozzles are primarily used in the steel industry for cutting steel slabs, billets, and other steel products. They are employed in various processes such as steel fabrication, manufacturing of steel structures, and metal recycling.

Advantages:

High cutting precision: SDS cutting offers precise control over the cutting process, enabling intricate shapes and precise dimensions.

High cutting speed: The supersonic gas jet allows for rapid material removal, leading to faster cutting times compared to traditional methods.

Clean cuts: SDS cutting produces smooth, clean cuts with minimal burrs or rough edges, reducing the need for additional finishing processes.

Versatility: SDS cutting can be used with a wide range of steel grades and thicknesses, making it suitable for diverse

applications in the steel industry.

Safety Considerations:

Safety is paramount when using SDS cutting equipment due to the high temperatures and pressures involved. Proper training, equipment maintenance, and adherence to safety protocols are essential to prevent accidents and ensure the well-being of operators and bystanders.

Environmental Impact:

While SDS cutting offers advantages in terms of efficiency and precision, it's important to consider its environmental impact. The use of fuel gases like acetylene can generate emissions, and the disposal of waste materials from the cutting process may require proper handling to minimize environmental harm.

General background information:

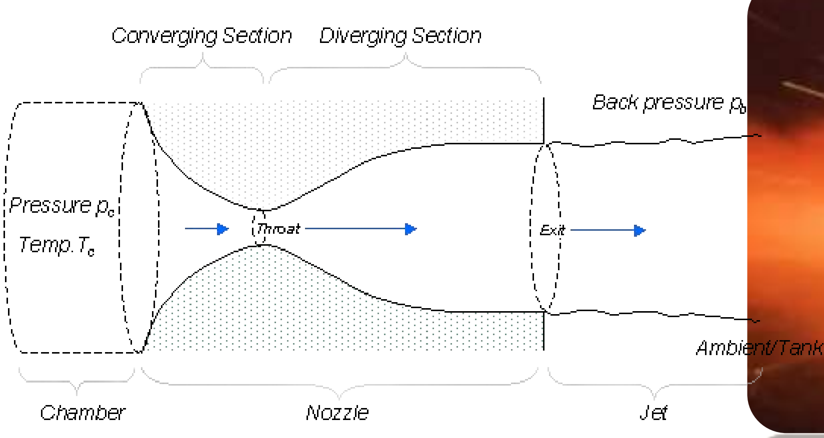
the Laval nozzle, named after the Swedish engineer Gustaf de Laval, which is a specific type of nozzle design used to accelerate fluids to supersonic speeds. While not directly related to SDS cutting nozzles, understanding the principles of a Laval nozzle can provide insight into the technology behind supersonic gas jets, which are utilized in SDS cutting processes. Here's some information about Laval nozzles:

A Laval nozzle is a specially designed duct that allows for the expansion of a compressible fluid (such as a gas) from subsonic to supersonic speeds. It consists of a convergent section followed by a divergent section. The convergent section increases the velocity of the fluid by converging it to a narrower cross-sectional area, while the divergent section further accelerates the fluid to supersonic speeds by gradually expanding the flow.

Laval nozzles are highly efficient in accelerating fluids to supersonic velocities while minimizing losses due to shock waves and turbulence. This efficiency is crucial for achieving the high cutting speeds and precision required in applications such as SDS cutting.

Supersonic Gas Deposition (SGD): In the context of SDS cutting, the supersonic gas jet generated by the Laval-type nozzle is utilized to heat and oxidize the material being cut, facilitating rapid material removal. The nozzle's design plays a significant role in optimizing the gas flow and achieving the desired cutting performance.

In summary, while Laval nozzles are not directly synonymous with SDS cutting nozzles, their principles of fluid dynamics and supersonic flow acceleration are foundational to understanding the technology behind supersonic gas jets used in processes like SDS cutting. The design and efficiency of Laval-type nozzles contribute to the effectiveness and precision of SDS cutting operations in the steel industry.



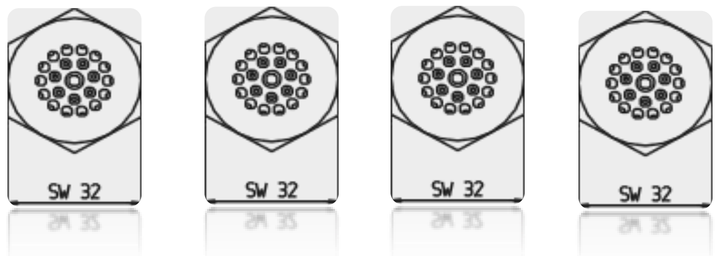
SDS cutting Chart:

Technical specifications of the nozzle SDS-F series cutting Chart:

<table>
<tr><th rowspan="2">Model</th><th rowspan="2">Connection size</th><th rowspan="2">Cutting thickness Up to (mm)</th><th rowspan="2">Kerf (mm)</th><th colspan="3">Pressure (bar)</th><th colspan="3">Consumption (Nm3/h)</th></tr>
<tr><th>Cutting Oxygen</th><th>Heating Oxygen</th><th>Gas</th><th>Cutting Oxygen</th><th>Heating Oxygen</th><th>Gas</th></tr>
<tr><td>15F</td><td>M30x2</td><td>160</td><td>3.5</td><td rowspan="22">9~15</td><td rowspan="22">2~3</td><td rowspan="22">0.6~2</td><td rowspan="5">23~45</td><td rowspan="15">11~19</td><td rowspan="15">13~24</td></tr>
<tr><td>17F</td><td>M30x2</td><td>180</td><td>4.0</td></tr>
<tr><td>19F</td><td>M30x2</td><td>200</td><td>4.0</td></tr>
<tr><td>20F</td><td>M30x2</td><td>210</td><td>4.5</td></tr>
<tr><td>21F</td><td>M30x2</td><td>220</td><td>4.5</td></tr>
<tr><td>22F</td><td>M30x2</td><td>230</td><td>4.8</td><td rowspan="7">27~53</td></tr>
<tr><td>23F</td><td>M30x2</td><td>240</td><td>4.8</td></tr>
<tr><td>24F</td><td>M30x2</td><td>250</td><td>5.0</td></tr>
<tr><td>25F</td><td>M30x2</td><td>260</td><td>5.0</td></tr>
<tr><td>26F</td><td>M30x2</td><td>280</td><td>6.0</td></tr>
<tr><td>28F</td><td>M30x2&M32x2</td><td>300</td><td>6.0</td></tr>
<tr><td>29F</td><td>M30x2&M32x2</td><td>320</td><td>7.5</td></tr>
<tr><td>30F</td><td>M30x2&M32x2</td><td>350</td><td>8.0</td><td rowspan="2">47~58</td></tr>
<tr><td>33F</td><td>M30x2&M32x2</td><td>400</td><td>8.0</td></tr>
<tr><td>36F</td><td>M30x2&M32x2</td><td>520</td><td>8.5</td><td>53~63</td></tr>
<tr><td>40F</td><td>M30x2&M32x2</td><td>600</td><td>13.5</td><td>72~90</td><td rowspan="7">20~30</td><td rowspan="7">18~22</td></tr>
<tr><td>50F</td><td>M32x2</td><td>680</td><td>17.5</td><td rowspan="2">85~120</td></tr>
<tr><td>60F</td><td>M36x2</td><td>720</td><td>21.0</td></tr>
<tr><td>70F</td><td>M36x2</td><td>780</td><td>24.5</td><td rowspan="2">112~130</td></tr>
<tr><td>80F</td><td>M36x2</td><td>820</td><td>28.5</td></tr>
<tr><td>90F</td><td>M36x2</td><td>920</td><td>32.0</td><td>130~140</td></tr>
<tr><td>100F</td><td>M36x2</td><td>1020</td><td>35.5</td><td>145~150</td></tr>
</table>

Tables of technical specifications of routine and widely used

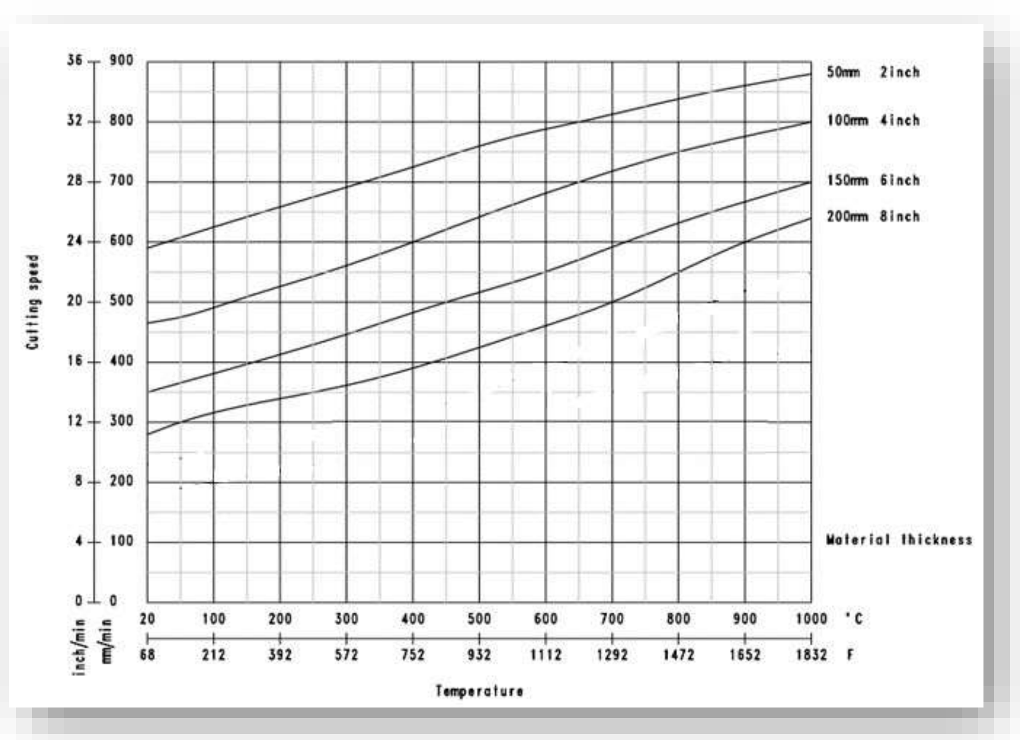
	SDS 20	SDS 26	SDS 33	SDS 36



Model	SDS 20 F	SDS 26 F	SDS 33 F	SDS 36 F
CUTTING THICKNESS RANGE (mm)	*50 - 200*	*50 - 300*	*50 - 400*	*50 - 500*
PRESSURE CUTTING (bar)	*10-12*	*10-12*	*8-12*	*8-10*
NOZZLE DISTANCE (mm)	*100~150*	*100~150*	*100~150*	*100~150*
CUTTING WIDTH Or Kerf (mm)	*4.5*	*6.0*	*8.0*	*8.5*

MAIN CHARACTERISTICS	
CUTTING THICKNESS RANGE	50-200 mm
Oxygen pressure range	8-12 (bar)
Gas pressure range	0.6-2 (bar)
Cutting kerf	4-5 mm
Noise level (1.5m distance)	100-106 (dB)

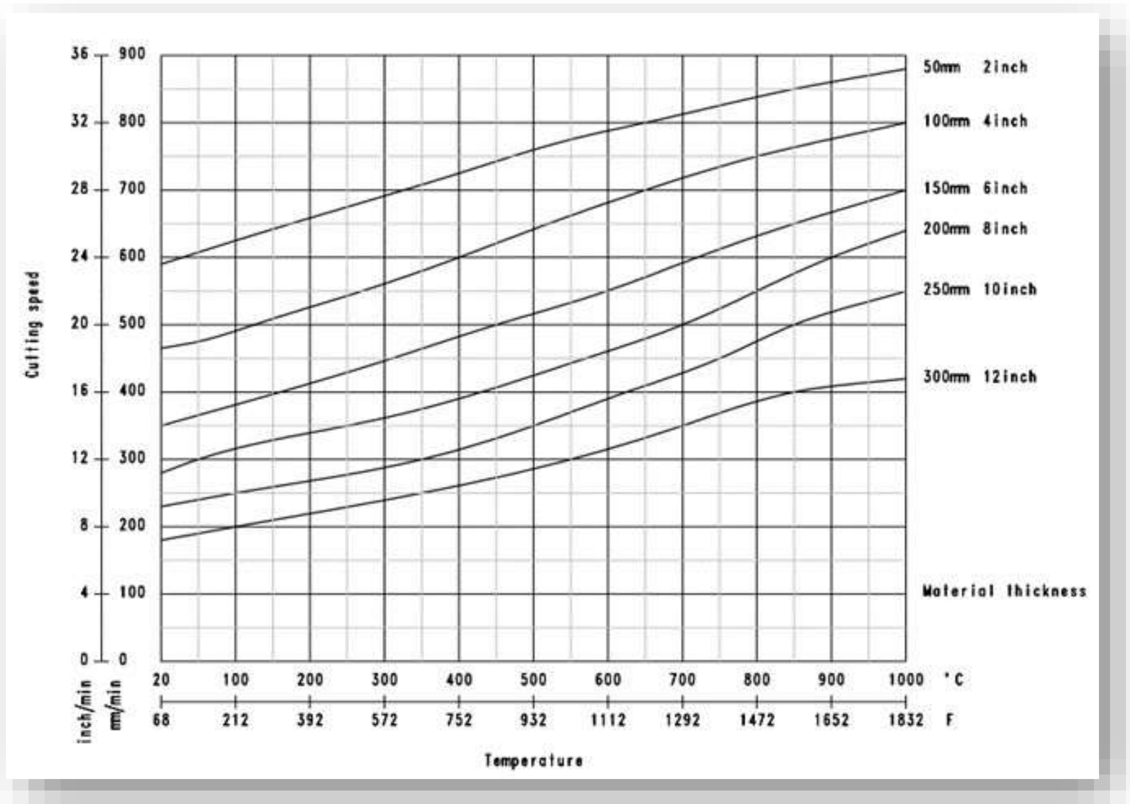
Optimized pressures and consumptions SDS 20 F											
fuel	pilot flame		Heating						Cutting	
	Natural gas	Propane gas	Natural gas		Propane gas		Coke oven gas			
	Nm³/ h	Nm³/ h	bar	Nm³/ h	bar	Nm³/ h	bar	Nm³/ h	bar	Nm³/ h
Oxygen	4.0	4.0	2.5	14	2.5	22	3	25	12	45
Gas	1.2	0.5	1.5	17	0.8	7.5	2	23		



The Above diagrams indicate the cutting speed depending on material thickness and material temperature with a carbon equivalent of max. 0.3%. Homogeneous material microstructure, proper pressure adjustment and purity of oxygen of min. 99.5 % is assumed.

MAIN CHARACTERISTICS	
CUTTING THICKNESS RANGE	50-300 mm
Oxygen pressure range	8-10 (bar)
Gas pressure range	0.6-2 (bar)
Cutting kerf	5-6 mm
Noise level (1.5m distance)	100-106 (dB)

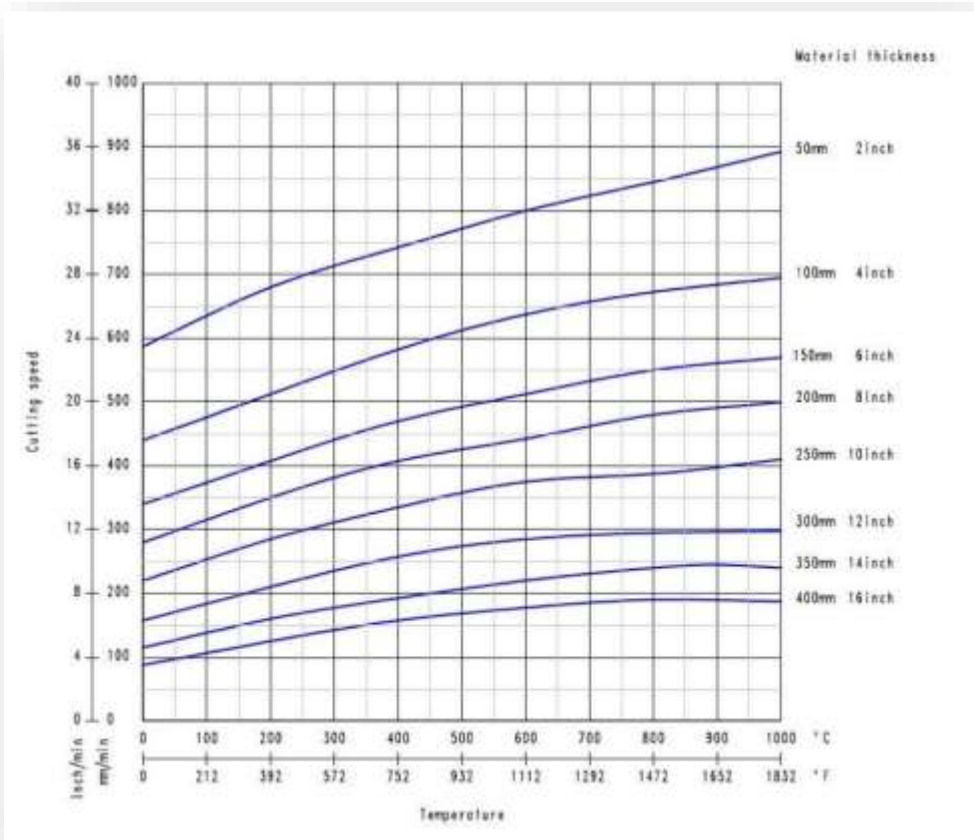
Optimized pressures and consumptions SDS 26 F										
fuel	pilot flame		Heating						Cutting	
	Natural gas	Propane gas	Natural gas		Propane gas		Coke oven			
	Nm³/ h	Nm³/ h	bar	Nm³/ h	bar	Nm³/ h	bar	Nm³/ h	bar	Nm³/ h
Oxygen	4.2	4.2	2.5	14	2.5	22	3	25	10	52
Gas	1.3	0.6	1.5	17	0.8	7.5	2	23		



The Above diagrams indicate the cutting speed depending on material thickness and material temperature with a carbon equivalent of max. 0.3%. Homogeneous material microstructure, proper pressure adjustment and purity of oxygen of min. 99.5 % is assumed.

MAIN CHARACTERISTICS	
CUTTING THICKNESS RANGE	50-400 mm
Oxygen pressure range	12-15 (bar)
Gas pressure range	0.6-2 (bar)
Cutting kerf	5-8 mm
Noise level (1.5m distance)	100-106 (dB)

Optimized pressures and consumptions SDS 33 F										
fuel	pilot flame		Heating						Cutting	
	Natural gas	Propane gas	Natural gas		Propane gas		Coke oven gas			
	Nm^3/h	Nm^3/h	bar	Nm^3/h	bar	Nm^3/h	bar	Nm^3/h	bar	Nm^3/h
Oxygen	4.5	4.5	2.5	19	2.5	19	3	22	15	54
Gas	1.5	0.7	1.5	21	0.8	9	2	31		



The Above diagrams indicates the cutting speed depending on material thickness and material temperature with a carbon equivalent of max. 0.3%. Homogeneous material microstructure, proper pressure adjustment and purity of oxygen of min. 99.5 % is assumed.

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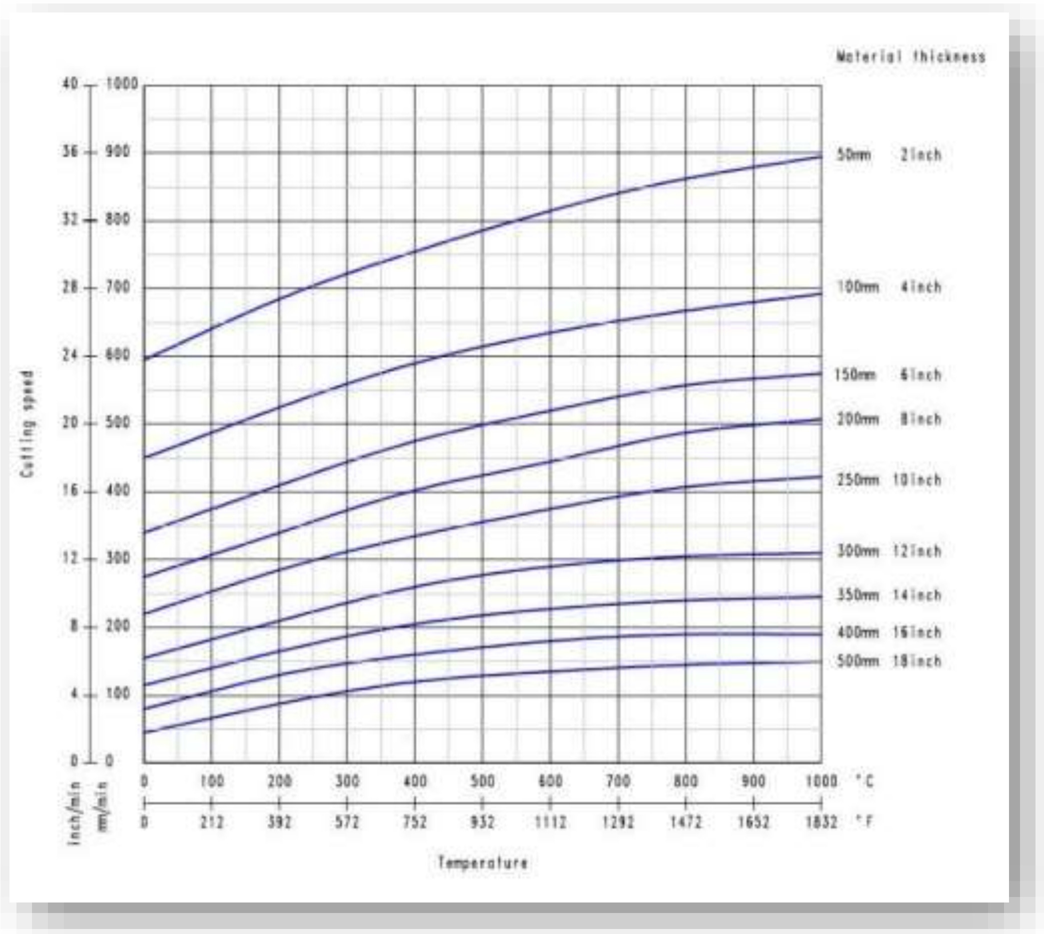
MAIN CHARACTERISTICS	
CUTTING THICKNESS RANGE	50-500 mm
Oxygen pressure range	8-10 (bar)
Gas pressure range	0.6-2 (bar)
Cutting kerf	5-8.5 mm
Noise level (1.5m distance)	98-110 (dB)

Optimized pressures and consumptions SDS 36 F											
fuel	pilot flame		Heating						Cutting	
	Natural gas	Propane gas	Natural gas		Propane gas		Coke oven gas			
	Nm^3/ h	Nm^3/ h	bar	Nm^3/ h	bar	Nm^3/ h	bar	Nm^3/ h	bar	Nm^3/ h
Oxygen	4.5	4.5	2.5	19	2.5	19	3	22	10	58
Gas	1.5	0.7	1.5	21	0.8	9	2	31		



The Above diagrams indicate the cutting speed depending on material thickness and material temperature with a carbon equivalent of max. 0.3%. Homogeneous material microstructure, proper pressure adjustment and purity of oxygen of min. 99.5 % is assumed.

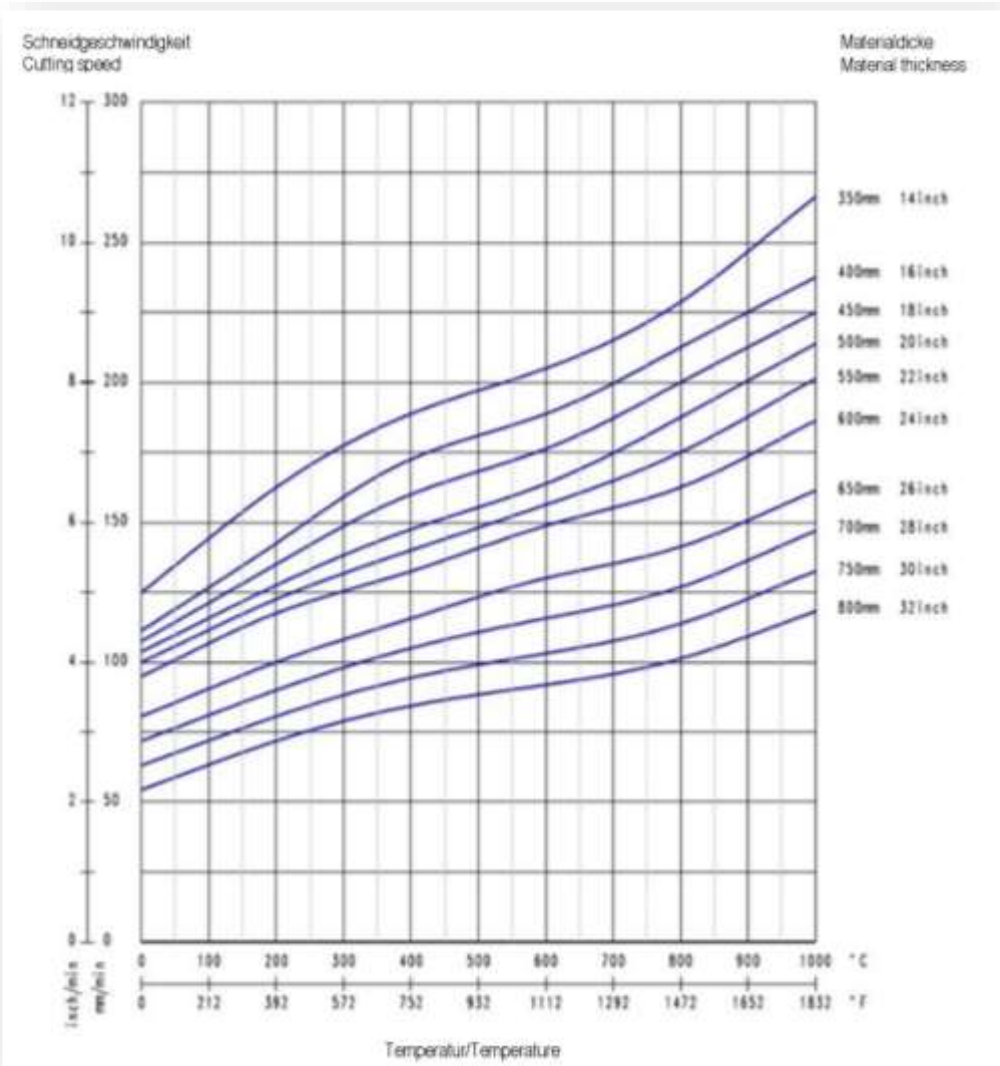
Advice on setting the cutting speed:

In order to get the best results when cutting billets, blooms or slabs (short cutting time smooth surface, sharp edges, small kerf, small bur) the cutting speed must be set to maximum possible value. For a safe cutting procedure, reduced speeds during start (30% of max. speed) and finish (70% of max. speed) of each cut shall always be considered.

Operators often tend to reduce cutting speeds throughout the cut hoping to achieve a safer cutting performance. Instead, this causes a waste of time and utilities as well as reduced quality (bigger kerf, rounder edges, uneven surface).

Optimum cutting speed can be determined using a speed graph provided by the manufacturer of the cutting nozzle where speed curves are shown for each slab/bloom thickness. Much faster cutting speeds are possible with higher material temperature.

In general, speeds given in the graphs include a safety margin, so one should not be afraid to set the speed to the figures given. These graphs normally give cutting speeds for low carbon steel grades (Cequ < 0,3). How to take into consideration other steel grades as well as other alloy components will be explained separately, so stay tuned!



SDS-D Series Nozzle (High-Speed, SUPERSONIC)

Optimized Design:
High-speed SDS cutting nozzles typically feature optimized designs that enhance gas flow characteristics, such as smoother internal surfaces, precision-engineered contours, and efficient gas mixing chambers. These design enhancements help maximize the velocity of the supersonic gas jet, resulting in faster cutting speeds.

Increased Flow Rates:
High-speed SDS cutting nozzles often allow for higher flow rates of the cutting gases (such as oxygen and fuel gas) compared to standard nozzles. The increased flow rates contribute to greater material removal rates and improved cutting efficiency.

Enhanced Cooling:
Given the higher velocities and flow rates involved, high-speed SDS cutting nozzles may incorporate features to enhance cooling and thermal management. This ensures that the nozzle remains within safe operating temperatures during prolonged cutting operations, reducing the risk of overheating and premature wear.

Precision and Control:
Despite the higher speeds, high-speed SDS cutting nozzles maintain precision and control over the cutting process. Advanced nozzle designs and manufacturing techniques ensure that the supersonic gas jet remains focused and stable, allowing for accurate cuts and intricate shapes.

Compatibility and Integration:
High-speed SDS cutting nozzles are typically designed to be compatible with existing cutting torches and equipment. This facilitates easy integration into established cutting systems, allowing users to upgrade their capabilities without significant modifications or investments in new equipment.

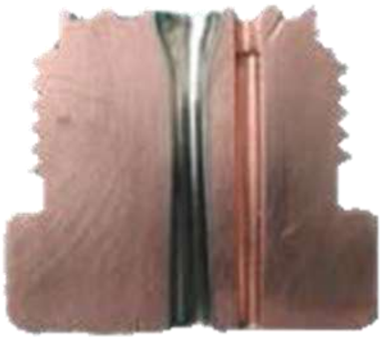
Application Specific:
High-speed SDS cutting nozzles are often tailored to specific applications and cutting requirements. Different models may be available to accommodate various material thicknesses, types of steel, and cutting conditions, ensuring optimal performance across a range of cutting tasks.

Reduced Downtime:
By completing cutting tasks more quickly, high-speed SDS cutting nozzles can help reduce downtime associated with equipment setup, material handling, and production delays. This contributes to overall improved productivity and efficiency in manufacturing operations.

Improved Throughput:
With faster cutting speeds and increased material removal rates, high-speed SDS cutting nozzles enable higher throughput and production capacity. This is particularly beneficial in high-volume manufacturing environments where maximizing output is essential.

Enhanced Precision:
Despite the higher speeds, high-speed SDS cutting nozzles maintain precision and control over the cutting process, allowing for accurate cuts and consistent quality. This ensures that productivity gains are not achieved at the expense of cutting accuracy or finished part quality.

Cost Savings: The efficiency gains associated with high-speed SDS cutting nozzles can lead to cost savings through reduced labor costs, lower energy consumption, and improved resource utilization. Additionally, increased productivity may enable manufacturers to fulfill orders more quickly, potentially capturing additional market opportunities.



Technical specifications of the nozzle SDS-D series Cutting Chart:

The company's latest development is the SUPERSONIC cutting nozzle, which is designed and manufactured based on aerodynamic separation. After on-site use, the cutting speed is significantly improved. The slit width is reduced by 20%. The cutting surface is smooth, and the phenomenon of slag hanging at the lower part of the cutting is greatly improved. The inner wall of the cutting nozzle cavity is plated with chromium and has a long service life.

<table>
<tr><th rowspan="2">Model</th><th rowspan="2">Connection size</th><th rowspan="2">Cutting thickness Up to (mm)</th><th rowspan="2">Kerf (mm)</th><th colspan="3">Pressure (bar)</th><th colspan="3">Consumption (Nm3/h)</th></tr>
<tr><th>Cutting Oxygen</th><th>Heating Oxygen</th><th>Gas</th><th>Cutting Oxygen</th><th>Heating Oxygen</th><th>Gas</th></tr>
<tr><td>17D</td><td>M30x2</td><td>180</td><td>3.0</td><td rowspan="15">10~12</td><td rowspan="15">2~3</td><td rowspan="15">1~2</td><td rowspan="4">26~36</td><td rowspan="14">12~18</td><td rowspan="14">12~23</td></tr>
<tr><td>19D</td><td>M30x2</td><td>200</td><td>3.5</td></tr>
<tr><td>20D</td><td>M30x2</td><td>210</td><td>4.0</td></tr>
<tr><td>21D</td><td>M30x2</td><td>220</td><td>4.0</td></tr>
<tr><td>22D</td><td>M30x2</td><td>230</td><td>4.0</td><td rowspan="7">28~42</td></tr>
<tr><td>23D</td><td>M30x2</td><td>240</td><td>4.5</td></tr>
<tr><td>24D</td><td>M30x2</td><td>250</td><td>4.5</td></tr>
<tr><td>25D</td><td>M30x2</td><td>260</td><td>5.0</td></tr>
<tr><td>26D</td><td>M30x2</td><td>280</td><td>5.0</td></tr>
<tr><td>28D</td><td>M30x2 & M32x2</td><td>300</td><td>5.0</td></tr>
<tr><td>29D</td><td>M30x2 & M32x2</td><td>320</td><td>7.5</td></tr>
<tr><td>30D</td><td>M30x2 & M32x2</td><td>350</td><td>7.5</td><td rowspan="2">30~54</td></tr>
<tr><td>33D</td><td>M30x2</td><td>400</td><td>7.5</td></tr>
<tr><td>36D</td><td>M30x2</td><td>520</td><td>8</td><td>42~57</td></tr>
<tr><td>40D</td><td>M30x2</td><td>600</td><td>9</td><td>65~72</td><td>18~30</td><td>10~22</td></tr>
</table>

SDS-DP Series three- row holes model:
Powder cutting process for cutting stainless steel alloys:

It is difficult to severe cast iron, stainless steel, and others high alloy steels (specially cutting thickness from 400mm to 700mm) using oxy-fuel cutting method. Some metals such as stainless steels react with the cutting oxygen stream to produce refractory oxides having melting point higher than the base material, which tend to prevent further cutting action by the oxygen.

Other metals such as cast iron and the non-ferrous metals either burn with less heat or they tend to cool the cutting zone to such as extend that it is difficult to start and maintain the cutting action.

owder cutting and powder scarfing processes overcome these difficulties and make it possible to obtain continuous cutting of improved quality in the oxidation-resistant metals.

By injecting iron powder into the flame, a lower melting point eutectic oxide is formed at the cutting interface, where additional iron-oxygen reaction is generated and cutting proceeds in a similar way.

powder is pre-heated as it passes through the pre-heat flames and bursts into flame in the stream of oxygen.

The heat and the fluxing action of the burning iron powder enable the cutting oxygen stream to oxidize the base metal continuously, just as in cutting carbon steel.

Technical specifications of the nozzle SDS-DP series Cutting Chart:

Model	Connection size	Cutting thickness Up to (mm)	Kerf (mm)	Pressure (bar)			Consumption (Nm3/h)		
				Cutting Oxygen	Heating Oxygen	Gas	Cutting Oxygen	Heating Oxygen	Gas
33 DP	M32x2	400	4~6	10~12	3~4	1~2	45~60	20~25	20~23
36 DP	M32x2	520	5~7	10~12	3~4	1~2	50~70	20~25	20~23
40 DP	M32x2	600	7~9	10~12	3~4	1~2	70~90	25~30	23~28
50 DP	M32x2	700	8~10	10~12	3~4	1~2	90~120	25~30	23~28

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SDS-CT Series Nozzle (HEAVY-DUTY)

Heavy Duty Nozzles from special cooper alloy:

Using a special cooper alloy cutting nozzle in continuous casting lines offers several benefits:

Improved Wear Resistance
SDS CT series has enhanced wear properties compared to standard copper, allowing nozzles to last longer under the harsh conditions of continuous casting.

Enhanced Thermal Conductivity
SDS CT series maintains excellent thermal conductivity, which is crucial for managing heat during the casting process. This helps in maintaining optimal temperatures for better flow and quality.

Corrosion Resistance:
SDS CT series provides better resistance to corrosion compared to standard copper, which is important for maintaining performance over time, especially in harsh environments.

Reduced Oxidation:
SDS CT series exhibits better resistance to oxidation, which can lead to longer service life and reduced maintenance needs.

Better Machinability
The alloy is easier to machine, allowing for more precise nozzle designs that can improve flow rates and reduce turbulence in the molten metal.

Improved Flow Characteristics
The design and material properties can lead to smoother and more controlled flow of molten metal, reducing defects in the final product.

Cost-Effectiveness
While initial costs may be higher, the longevity and reduced maintenance needs can lead to lower overall operational costs.

Reduced Contamination
The properties of This type of nozzles help minimize contamination of the molten metal, leading to higher-quality cast products.

Strength:
SDS CT series maintains good mechanical strength, ensuring that the nozzle can withstand the pressures and temperatures associated with cutting operations.

Conclusion
Overall, using SDS CT series cutting nozzles can enhance the efficiency, quality, and reliability of continuous casting operations, making them a valuable choice for manufacturers in the metalworking industry.

⚠ Safety Cautions

- ✓ For safety and best performance, it is important to choose the correct cutting gas, tip size, torch and regulator according to model and instruction.
- ✓ Dangerous to work if gas leakage presents.
- ✓ Ensure the tip and all connections are free from oil and grease due to the high risk of sudden combustion.
- ✓ Clean the seating surface of tip, torch and all gas-oxygen outlets holes from dust, scratches or any other foreign substances
- ✓ To prevent any damage and deformation on tip and torch, it is recommended to use two proper wrench to tighten the tip .
- ✓ Ensure the flame formed properly after the ignition and gas-oxygen pressures are correctly set on regulator as product manual sheet.
- ✓ Because of high temperature causes during use, wearing Protective gloves for any tip handle is Using wrong or defective nozzles and torch can cause overheat and high risk of dangerous flashback
- ✓ For safety reason and to avoid any flashback, it is important to turn off oxygen and gas valve immediately if flame disappears suddenly or hissing sound is heard during cutting operation.
- ✓ Use proper tip cleaner on regular basis for safety, longer life and better performance is recommended.

Technical Recommendation of the national institute of occupation safety and health *(JNIOSH−TR−48:2017)*

KATANA

ご使用に関してのご注意

機器の接続と確認

始業前点検として、ご使用開始前に必ず検知液など でガス漏れのない事を確認してください。
同様に器具の各接続部分に対し、検知液などでガス漏れ点検を行ってからご使用ください。
変形やキ ズの無い、正常な切断火口を正しく取付けてご使用ください。
使用条件にあった圧力の設定を行ってください。
万一不具合のある場合は使用を止め、メーカ指定業 者に修理をご依頼ください。

- 火口の清掃には専用の掃除針をご使用ください。
- 安全にご使用いただくために、下記の事項を必ず お守りください。

火口当り部のキズ、及び先端部のノズル、カバーに芯ぶれのない事を確認の上ご使用ください。
出口孔（予熱酸素孔、切断酸素孔など）が、スパッター等により塞がれていない事をご確認の上ご使用 ください。

Notes on use

Connecting and checking equipment

As a pre-start inspection, make sure that there is no gas leak with the detection liquid before starting use.
In the same way, check the gas leak for each connecting part of the instrument with a detection liquid before use. Use a normal cutting crater with no deformation or scratches. Set the pressure suitable for the operating conditions.
If there is a problem, stop using the product and request repair by a manufacturer specified.

- *Use a special cleaning needle to clean the crater.*
- *For safe use, be sure to observe the following items.*

Check that there are no flaws in the crater area and that there is no cover in the nozzle and cover at the tip.
Check that the outlet holes (preheated oxygen holes, cutting oxygen holes, etc.) are not blocked by spatter.