



25.Yıl / Since 1985



diabor<sup>®</sup>

TURK MALI



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*Diabor Diamond - CBN Grinding Wheels*

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## 25. Yıl

1985 yılında faaliyete başlayan Diabor, 25 yıldır üstün kalite ve hizmet anlayışı ile Türkiye ve Dünyadaki önemli sanayi kuruluşlarına kendini kanıtlamıştır.

Müşterimizin ihtiyaçlarını doğru anlamaya önem veriyoruz. İhtiyaçlara en uygun ve doğru çözümü, kaliteden ödün vermeden, çalışma koşullarına uyumlu, ekonomik ve tam zamanında üretmeyi hedefliyoruz.

Satış öncesi teknik desteğimiz satış sonrası da kesintisiz devam eder. Müşterilerimizin kullanım aşamalarını takip ediyoruz. İsteklerini, önerilerini ve uyarılarını dikkate alıp bu konuda gelişen teknolojiler ile birleştirilerek ürünlerin tasarımında (arge ) sürekli geliştirmeler yapıyoruz. Bu sayede müşterilerimize yüksek performanslı ideal Diabor aşındırıcıları üretiriz.

## **Diabor Elmas Borazon Aşındırıcılar Sanayi ve Ticaret Ltd. Şti.**

### **Since 1985**

In general Diabor diamond and CBN wheels are high quality application, help to solve economically and most favourably grinding problems.

Optimum wheel specifications and technical applications, even for similar types of work, are almost always based on hard-earned expectations, there is no easy Formula to follow.

Diameter, thickness and wheel style are usually determined by the machine and the work. Work-piece shape, wheel guards, swing clearances and surface feet per minute are basic factors.

Diabor diamond and CBN wheels are manufactured in a great number of shapes, widths of impregnation, depths of impregnation, bonds, concentrations and gradings.

The most common wheel shapes are illustrated in the following technical sheets. Special shapes are also manufactured according to your requirements.

## **Diabor Diamond - CBN Grinding Ltd.**

## **ELMAS**

- Tungsten Karbür
- Grafit, Elektrokarbon
- Silisyum, Feritler, Porselenler
- Oksid Seramikler, Camlar
- Doğal ve Sentetik Taşlar

## **CBN**

- Yüksek hız çelikleri
- Takım çelikleri
- Krom çelikler
- Özel alaşımlar
- Sıcak iş çelikleri
  
- Elmas ve CBN Diskler
- Elmas ve CBN Delik taşlama Takımları
- Elmas ve CBN Honlama Plaketleri
- Elmas ve CBN Parlatma Pastaları

## **Diamond**

- Tungsten Carbide
- Graphite, Electrocarbon
- Silicium, Ferrits, Porcelain
- Oxide Ceramics, Glass
- Natural and Artificial Stones

## **CBN:**

- High speed steels
- Tool steels
- Chromium Tools
- Special alloys
- Heat treated steels
  
- Diamond and CBN discs Diamond and CBN hole grinding  
Diamond and CBN honing tools Diamond and CBN polishing pastes

## ELMAS

Organik orijinli Karbon minerallerinden başlıcasıdır. Serttir: 10, Öz. A.3.51, Şekil: Kübik, Kırılma Kat.2.5. Ergime N:3845 C Renksiz ve saydam olduğu gibi sarı gri, kırmızı, mavi ve siyah renkte de olabilir. Sürtmekle elektriklenme olmasına karşın, elektriği ve ısıyı iletmez. Saf Karbondur. 770 C da kül bırakmadan yanar. Sanayide kullanılan tipi sentetik olanıdır.

## Elmas Tipleri

### Tabii Elmas:

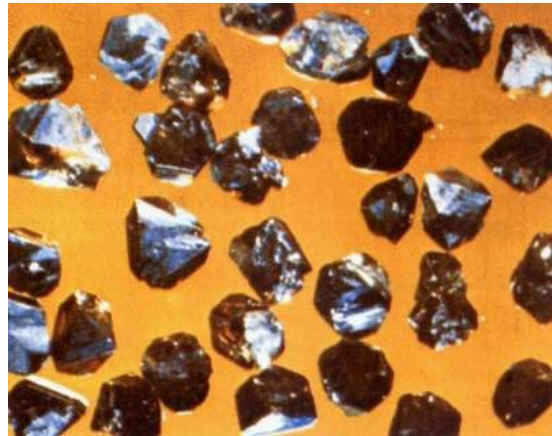
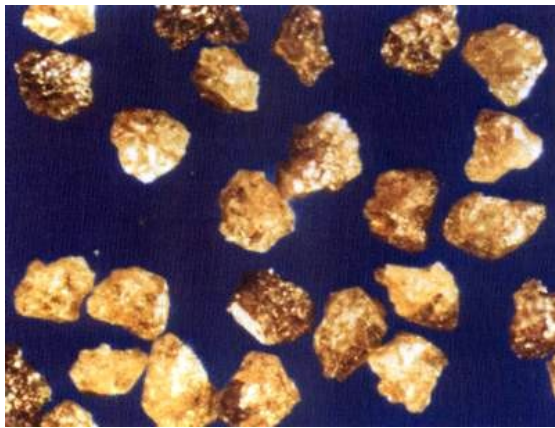
Elektroliz ile kaplamada, ince taşlamalarda kullanılır.

### Sentetik Elmas:

Organik ve Mekanik bağlantılı disklerde her türlü aşındırma işi için kullanılır. Yüzeyi kaplı tipleri mevcuttur. Süper taşlamalar ve parlatma pastaları sentetik elmas ile gerçekleştirilir. Sentetik elmas tiplerinden titanyum,nikel,bakır,gümüş kaplı olanlar kullanılmaktadır.

### Kullanım Alanları

- Karbür Takımlar
- Seramik Taşlama Takımları
- Refrakter Malzemeler
- Doğal ve Sentetik Taşlar
- Grafit-Karbon Malzemeler
- Cam, Kuvars, Porselen Malzemeler
- Güçlendirilmiş Plastikler
- Sert Kaplama Alaşımlar
- Değerli ve Yarı Değerli Taşlar
- Yarı İletken Materyaller
- Cam, Safir



## **CBN (CUBIC-BORON NITRIDE)**

Bor ve Nitrojen elementlerinin kimyasal işlemlerinden elde edilmiş bir aşındırıcı türüdür.

Fiziksel konum, atomik yapı ve kristalleşme özellikleri elmasla büyük benzerlik gösterir.

Yüksek hız çeliği, takım çelikler karbon çelikleri, sert ferro-titanyum alaşımlarının aşındırılmasında çok iyi sonuç verir. Silisyum Karbür ve Koredondan daha sert ve mükemmeldir. Oksijen varlığında CBN 1400 C ye kadar diren gösterir.

### **CBN Tipleri:**

Sentetik elmasa oranla daha farklı akustik elastikiyetli tiplere sahiptir.

Yüzeyi kaplı çeşitleri vardır.

CBN'de de titanyum, nikel, bakır, gümüş kaplı olanlar bu türlerdir.

### **Kullanım Alanları:**

- Yüksek Hız Takım Çelikleri
- Yüksek Alaşım Takım Çelikleri
- Krom Çelikler (%25 Cr)
- Isıl İşlemlenmiş çelikler
- Özel alaşımlar
- Stellite
- Çelik alaşımlar (HRC<sup>3</sup> 58)

## TANE İRİLİĞİ

Aşındırıcının kalitesi kadar iriliği de diskin performansını, kaldırma gücünü, bileme işleminin verimliliğini ve yüzey hassasiyet kalitesini etkiler. Tane iriliği, garantili aşındırma işlemlerinde satıl durumları, aşındırma zamanı ile direkt bağlantılıdır.

Yüzey hassasiyeti ve mükemmel kesim kalitesi için elmasın doğru sınıflandırılması şarttır. İri tanelerle bileme performansı daha fazladır. Küçük taneler ise yüzey hassasiyet kalitesini yükseltir fakat paso kaldırma kapasitesini düşürür.

Tane iriliği seçimini doğru yapmak gerekir. Sipariş anında irilik değeri veremiyorsanız, yapacağınız aşındırma operasyonu ile ilgili detaylı açıklama yapmanız irilik tayini için gerekli ve yararlı olacaktır.

**Dünyada geçerli olan iki irilik standardı vardır.**

A) FEPA (Federation Europeenne des Fabricants de Produits Abrasifs) Standardı.

B) US astm. E-11-70 Standardı

## Elmas ve CBN'in Tane İrilikleri

FEPA STANDART		US MESH	ORTALAMA PÜRÜZLÜLÜK RA	YÜZEY PÜRÜZLÜĞÜ	TAŞLAMA İŞLEMİ
ELMAS	CBN BORAZON				
D181	B181	80-100	0.53	3.5	ÇOK KABA YÜZEY TAŞLAMA
D151	B151	120	0.51		
D126	B107	120-140			KABA YÜZEY TAŞLAMA
D107		140-170	0.40	2.8	
D91		170-200	0.32	2.5	
D76	B76	200-230		2	YARI BİTMİŞ YÜZEY TAŞLAMA
D64	B64	230-270	0.19	1.5	
D54	B54	270-325	0.16	1.2	İNCE TAŞLAMA
D46	46	325-400	0.15	0.9	
D35	B35	400-500	0.13	0.9	ÇOK İNCE TAŞLAMA
MD30					
MD20					
MD7					



ELMAS ve CBN'İN ULUSLARARASI TANE İRİLİKLERİ STANDARDİZASYONU								
Tane Tanımlamaları						Mikron Tane İrilikleri *		
Elmas FEPA-Standart DİABOR Tanımlaması		CBN FEPA-Standart DİABOR Tanımlaması		Elmas +CBN US Standart ASTM-E-11-70		Nominal Mesh büyüklüğü ISO 6106 DIN 848 Part 1 1980	Elmas DİABOR Tanımlaması I	CBN DİABOR Tanımlaması
Dar	Geniş	Dar	Geniş	Dar	Geniş			
D 1181	D1182	B1181	B 1182	16/18	16/20	1180/1000	D 25	B30
D 1001		B1001		18/20		1000/850	D 20	
D 851	D852	B 851	B 852	20/25	20/30	850/710	D 20	
D 711		B 711		25/30		710/600	D 15	
D 601	D602	B 601	B 602	30/35	30/40	600/500	D 7	B 6
D 501		B 501		35/40		500/425	D 3	B 3
D 426	D427	B 426	B 427	40/45	40/50	425/355	D 1	B 1
D 356		B 356		45/50		355/300	D 0,7	
D 301		B 301		50/60		300/250	D 0,25	
D 251	D252	B 251	B 252	60/70		250/212	* Benzer FEPA Standartları M63...M1.0 ile birlikte bulunmaktadır  FEPA= Federaration Europeenne des Fabricants de Produits Abrasifs.	
D 213		B 213		70/80		212/180		
D 181	B 181		80/100		180/150			
D 151	B 151		100/120		150/125			
D 126	B 126		120/140		125/106			
D 107	B 107		140/170		106/90			
D 91	B 91		170/200		90/75			
D 76	B 76		200/230		75/63			
D 64	B 64		230/270		63/53			
D 54	B 54		270/325		53/45			
D 46	B 46		325/400		45/38			
D 35	B 35		400/500					

MİKRON STANDART TANELERİ					
0-1/4	1-2	3-6	8-15	14-20	30-60
0-1/2	1-3	4-8	8-22	15-25	40-50
0-1	1-5	5-7	10-14	20-25	40-60
0-2	2-3	5-10	10-15	20-30	54-80
1/4-1/2	2-4	6-12	10-20	20-40	60-100
1/2-1	2-6	7-10	12-20	22-36	
1/2-3	3-5	8-12	12-22	30-40	

## BAĞLANTI

Elmas ve CBN diskte bağlantı, aşındırıcı taneciklerin gömülü olduğu kısmın tanımıdır. Bir diskte en önemli kısmı teşkil eder. Aşındırıcı ebatları ve kalitesinin yanı sıra bağlantının doğru seçilmesi ve üretilmesinin de diskin performansı ve maliyeti üzerinde büyük ölçüde etkisi vardır. Tane iriliği ve konsantrasyonun yanında bağlantı kendi başına da bileme performansını etkiler. Genelde sert bağlantılı diskler daha uzun ömürlü olurlar.

Paso kaldırma kuvveti ile disk ömrü ters orantılıdır. Paso kaldırma kuvveti azaldıkça, disk ömrü artar. Disk yıpranması olmadan aşındırma yapmak mümkün değildir.

DIABOR, her performansa sahip, ekonomik bağlantı çeşitlerini tatbik etmektedir. Değişik sertliklerde değişik bağlantı maddeleri mevcuttur. Kullanıcı tarafından malzemenin çok iyi tanıtılması ve hakkında bütün teknik detayların iletilmesi sonuç açısından yararlı olmaktadır.

Bağlantı tipleri : 1.Resinoid Bağlantı, 2.Metal Bağlantı, 3. Seramik Bağlantı ve 4. Elektro Kaplama Bağlantı olmak üzere 4'e ayrılmaktadır.

Bizim üretim programımızda Resinoid ve Metal Bağlantı kullanılmaktadır.

### Bağlantı seçimindeki tavsiyeler:

#### a) Yumuşak Bağlantı

- Düşük konsantrasyonlar
- Kuru taşlama
- Isıya duyarlı çalışma alanları
- İnce tane irilikleri
- Geniş taşlama alanları

#### b) Sert Bağlantı

- Sulu taşlama
- Uzun ömür
- Dar taşlama alanları
- Pürüzlü taneler
- Yüksek konsantrasyonlar

### A) RESINOİD (REÇİNE) BAĞLANTI

En ekonomik bağlantı şeklidir. Aşındırma zamanı az, kaldırdığı paso miktarı fazladır. Organik özelliğe sahiptir. Kuru çalışmalar için idealdir. Resinoid bağlantılı diskler yüksek kesim güçleriyle bilenirler. Resinoid bağlantılar orta, ince ve süper ince bilemelerde tercih edilirler. Özellikle paso kaldırmaya uygun bu tip diskler, hem kuru hem de sulu bilemelerde kullanılabilirler. Malzeme kompozisyonu, makine tipi ve çalışma şekillerine göre Fenol Reçine, Poliamid Reçine ve Teflon Reçine gibi sentetik bağlayıcılar özel kimyasal ve mekanik desteklerle birlikte uygun bağlantı modelleri elde edilmektedir.

### B) METAL BAĞLANTI

Organik bağlantıya göre paso kaldırma kabiliyeti daha azdır. Ancak dayanıklılık süreleri fazladır. Bu cins bağlantılı disklerin aşındırma kapasiteleri rezin bağlantılı disklerden bir dereceye kadar daha düşüktür. Aşınmaya karşı olan dirençleri ise bazı durumlarda resinoid bağlantılı disklerden oldukça fazla olduğu için resinoid bağlantılı disklerle yapılamayacak bileme işlemleri için idealdirler. Metal bağlantılı diskler sadece istisnai durumlarda, küçük temas alanları için soğutucu olmadan kullanılabilirler. Çalışma esnasında mutlaka soğutulmalı eğer sulu yağ karışımları tatbik edilecekse 50/1 oranı kullanılmalıdır.

## Farklı Bağlantı Sertliklerinin Sınıflandırılması

## Genel Bağlantı Kullanım Şekilleri

	Yumuşak Bağlantı	Sert Bağlantı
Çalışma Sertliği	Sert	Yumuşak
Konsantrasyon	Düşük	Yüksek
Tane İriliği	İnce	Kaba
Aşındırma Genişliği	Geniş	Dar
Soğutma	Opsiyonel	Genellikle gerekli
Ana Kriterler	Isı ve basınca duyarlı	Çalışma alanında ebatlar için yüksek tolerans gereklidir

## Genel Bağlantı Özellikleri

	Yumuşak Bağlantı	Sert Bağlantı
Aşındırma Oranı	Düşük	Yüksek
Aşındırma Ömrü	Kısa	Uzun
Aşındırma Isısı	Düşük	Yüksek
Kesme	Serbest Kesme	Düşük Agresiflik
Posa Kaldırma Oranı	Yüksek	Düşük
Taşlama Basıncı	Düşük	Yüksek

## Bağlantı Sertliği

L Yumuşak  
N Orta Yumuşak

R Orta Sert  
S Sert

## Tane İriliği – Nominal Boyut

Nominal	Tolerans Mesafesi	Nominal	Tolerans Mesafesi
60	(40/60)	180	(170/200)
80	(60/80)	220	(200/230)
100	(80/100)	240	(230/270)
120	(100/120)	320	(270/325)
130	(120/140)	400	(325/400)
150	(140/170)		

## KONSANTRASYON

Konsantrasyon, bir santimetreküp bağlantı içinde mevcut olan elmas veya CBN'nin karat (1 karat = 0,2gr) biçiminde oranıdır. FEPA standartlarına göre 100 konsantrasyon (C100) , 1 cm<sup>3</sup> bağlantının içinde 4,4 karat elmas bulunduğunu gösterir. Diğer tüm konsantrasyonlar bu orantıya göre belirlenir. Konsantrasyonun kesim kalitesi ve disk ömrü üzerinde önemli bir etkisi vardır. Aynı temas alanında disk ile çalışmada temas edilen yüzey büyük ise alçak konsantrasyon kullanılmalıdır. Küçük ise yüksek konsantrasyon tercih edilmelidir. Sert bağlantılarda yüksek, yumuşak bağlantılarda ise alçak konsantrasyon kullanılmalıdır. Profil ve kenar aşındırmalarında yüksek konsantrasyonun tercih edilmesi önemlidir. Ayrıca konsantrasyon, diskin fiyatını da büyük ölçüde etkilemektedir.

Elmas Konsantrasyonu	Karat / cm <sup>3</sup>	CBN Konsantrasyonu	Karat / cm <sup>3</sup>
C25	1,1	V120	2,2
C30	1,3	V180	3,3
C38	1,65	V240	4,4
C50	2,2	V300	5,5
C75	3,3	V360	6,6
C100	4,4	FEPA Standartlarına göre uygulanan konsantrasyonlar	
C125	5,5		
C150	6,6		
C175	7,7		
C200	8,8		

### Genellikle Uygulanan Konsantrasyonlar :

#### Yüksek Konsantrasyonlar C75...C150/V180...V360

- Profil ve kenar için yüksek gereksinimli kararlılık
- Küçük aşındırıcı kalınlıkları
- Sert Bağlantı

#### Standart Konsantrasyonlar C50...C75/V120...V180

- Yüzey ve silindirik taşlama için düz alanlar
- Büyük aşındırıcı kalınlıkları
- Yumuşak Bağlantı
- İnce Taneler

#### Düşük Konsantrasyonlar C25...C38

- Çok ince tane iriliği ile diskler

## ÇEVRESEL HIZ

Kuru bileme sadece iyi ısı iletkenliğine sahip materyaller üzerinde uygulanabilir. Elmaslı bağlantılarda ısınma elverişli bir soğutucuyla dengelenmelidir. Genelde, CBN daha yüksek bir çevresel hız ile kullanılabilir. Bunun için etkili bir soğutucu ve hassas bir makine gerekmektedir. Böylece disk ömür ve yüzey hassasiyet kalitesi artar.

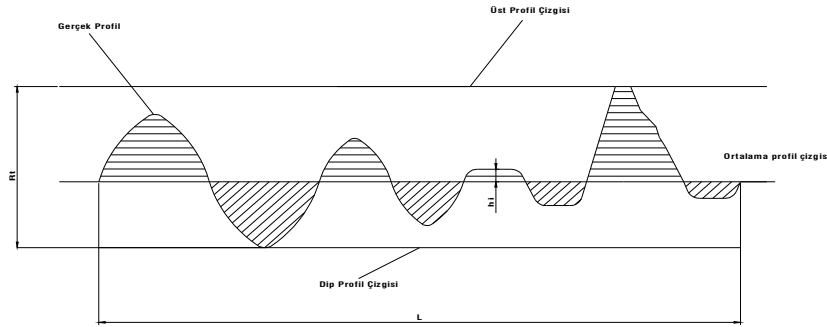
Disk yarıçapı Ø mm	Çevresel Hız (m/s)								
	14	16	18	20	22	24	26	28	30
5									
10	26.750	30.950							
15	17.810	20.390	22.900	25.500	28.000	30.550			
20	13.380	15.280	17.200	19.100	21.000	22.900	24.830	26.800	28.600
25	10.700	12.210	13.750	15.300	16.800	18.340	19.890	21.400	22.900
30	8.910	10.190	11.460	12.740	14.000	15.280	16.550	17.850	19.100
40	6.690	7.640	8.600	9.530	10.500	11.460	12.420	13.390	14.300
50	5.350	6.100	6.870	7.650	8.400	9.150	9.950	10.700	11.470
75	3.550	4.080	4.580	5.100	5.600	6.110	6.630	7.140	7.630
100	2.660	3.060	3.440	3.825	4.200	4.590	4.960	5.350	5.730
125	2.130	2.440	2.750	3.050	3.355	3.670	3.990	4.280	4.580
150	1.770	2.030	2.290	2.550	2.800	3.060	3.310	3.570	3.820
175	1.530	1.750	1.970	2.200	2.410	2.620	2.840	3.060	3.270
200	1.330	1.530	1.720	1.910	2.100	2.290	2.480	2.680	2.860
250	1.070	1.220	1.370	1.530	1.680	1.830	1.990	2.140	2.290
300	980	1.020	1.150	1.270	1.400	1.530	1.650	1.780	1.910
350	760	870	980	1.010	1.200	1.310	1.420	1.530	1.640
400	670	760	860	950	1.050	1.150	1.240	1.340	1.430
500	530	610	690	760	840	910	990	1.070	1.150

Aşındırma İşlemi	Rezinoit Bağlantı		Metal Bağlantı	
	Sulu m/s	Kuru m/s	Sulu m/s	Kuru m/s
TC Taşlaması için Elmas Diskler				
Kesici ve Alet Taşlama	25–35	12–18	12–20	8–12
ID Taşlama	10–20	8–15	10–18	8–12
Yüzey Taşlama	25–35	-	20–30	-
OD Taşlama	25–35	-	20–30	-
HSS Taşlamada CBN Diskler				
Kesici ve Alet Taşlama	25–35	15–20	15–25	10–15
Yüzey Taşlama	30–40	-	15–25	-



## TEKNİK YÜZEY PÜRÜZLÜLÜĞÜ

Herhangi bir imalat metodu ile (talaşlı veya talaşsız şekillendirme) elde edilen yüzeyde giderilmesi imkânsız olan pürüzler kalır. Bu pürüzler; tatbik edilen imalat metoduna göre; gözle görülebilir veya elle hissedilir şekilde olabileceği gibi, hassas elektronik cihazlarla ölçülebilecek büyüklüklerde de olabilirler.



Rt: Azami pürüzlük derecesi [mikron ( 1mm = 0,001mm ) olarak ölçülür.]

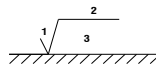
Ra: Ortalama ( aritmetik ) pürüzlük değeri

$$Ra = \frac{1}{L} \int_{x=0}^L |h| dx \quad \text{olarak hesaplanır.}$$

NOT: Pratik olarak Ra = 0,16 ile 0,25. Rt olmaktadır.

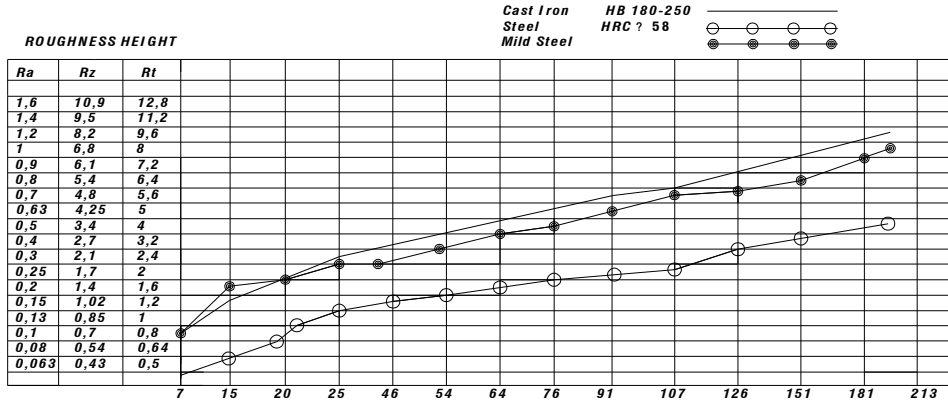
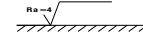
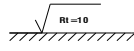
Teknik resim üzerinde yüzey kalitesi aşağıdaki şekilde gösterilir.

1	Ra değeri azalır
2	Yüzeyin karakteri yazılır
3	Ekseriya Rt değeri yazılır



NOT: Bu değerlerden herhangi birinin verilmesi ile yüzey kalitesi belirlenmiş olur.

## Örnek:



## SOĞUTMA İŞLEMLERİ

## Soğutma Solüsyonlarının ve Emülsiyonlarının Özellikleri

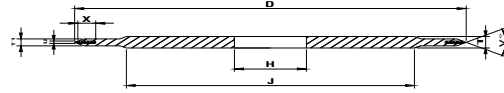
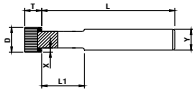
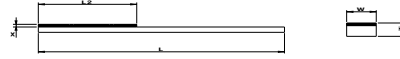
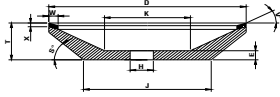
- Vernik ve korozyon risklerinin zararları azalır
- Soğutma yağının dumanı patlamaz
- Mükemmel ısı boşaltma
- Taşlama işlemiyle mükemmel kesme kabiliyeti
- Düşük taşlama basıncı
- Bakteri üremesine karşı temizlik
- Mükemmel soğutma

## Soğutma Yağlarının Özellikleri:

- Daha iyi yüzey kalitesi
- Yüksek paso kaldırma
- Taşlama süresinin kısılması
- Taşlama sürtünmesinin azalması
- Makine için en uygun paslanma koruması
- Çalışma kalitesi
- Taşlama diskinin ömrünün uzaması

## TERMINOLOJİ

FEPA Standartlarına göre uygulanan elmas ve CBN taşlama takımlarını daha iyi anlamak için aşağıdaki terminoloji kullanılmaktadır.

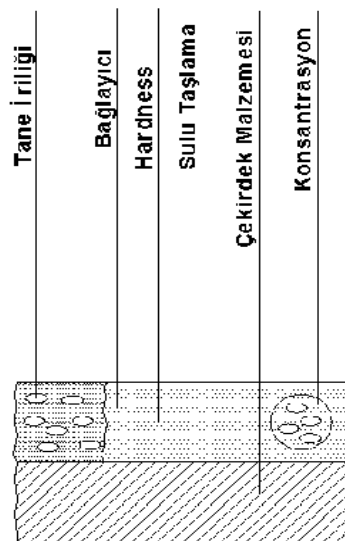
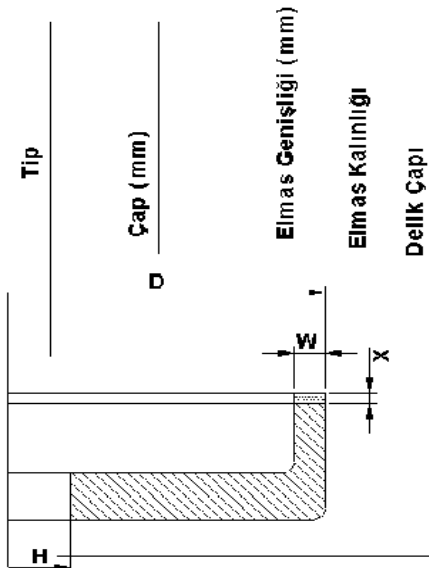


D	Dış Çap	(mm)	S	Gövde Açısı	( <sup>0</sup> )
E	Gövde Alt Kalınlığı	(mm)	T	Kalınlık	(mm)
H	Göbek Çapı	(mm)	U	Elmasın Yüksekliği	(mm)
J	Taban Çapı	(mm)	V	Açı	( <sup>0</sup> )
K	Taban İç Çapı	(mm)	W	Elmas Genişliği	(mm)
L	Boy	(mm)	X	Elmasın Yüksekliği	(mm)
L1	Şaft Uzunluğu	(mm)	Y	Şaft Çapı	(mm)
L2	Elmasın Boyu	(mm)	R	Radyus	(mm)

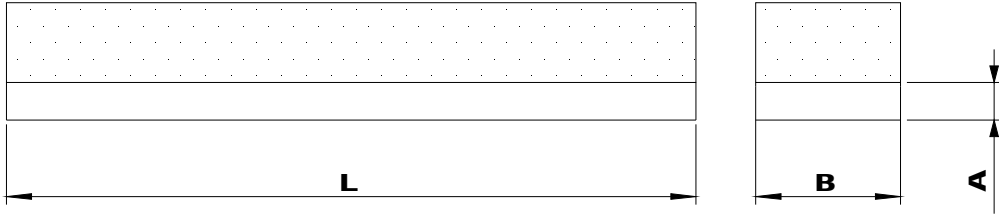
## SİPARİŞ ÖRNEĞİ

6A2 - 125 - 15 - 2 - 20  
6A2 - 125 - 15 - 2 - 20

D126 J C50  
B126 N Y A V120



## ELMAS VE CBN HONLAMA TAŞLARI



### KESME HIZI

Kesme Hızı =  $V_s$

Honlama taşının hız yönü =  $V_a$

Salınım Hızı =  $V_h$

Yaklaşık ayar aralığı	Çalışma esnasındaki hız
$V_s$	52 m/sn
$V_a$	49 m/sn
$V_h$	16 m/sn

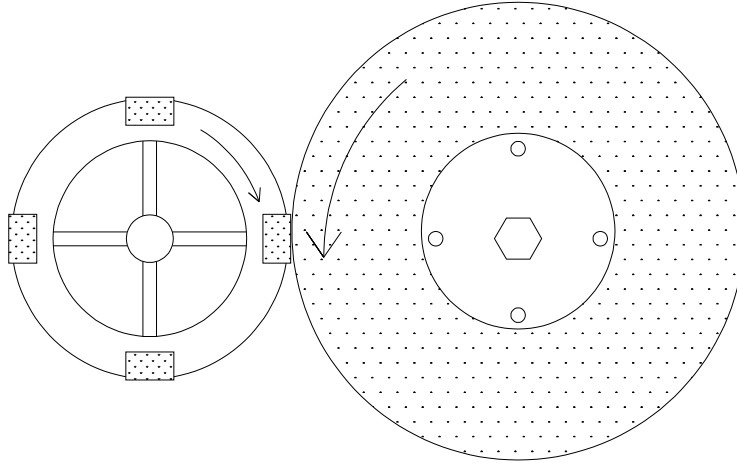
### SOĞUTMA

Honlama taşları genellikle suda çözünen emülsiyonlar ve honlama yağları ile soğutulmaktadırlar.

Akış Hızı: 30–150 ltr/sn

**Resinoid Bağlantı**Çevresel Hız (Elmas/CBN)  $v_w = 7\text{m/s}$ 

Elmas ve CBN honlama uçlarının tane irilikleri	SİC taşlama diskinin belirtilmesi
D15/B 15	400 HB3
D20/B 30	320 HB3
D46/B 46	240 HB3
D64/B 64	180 HB3
D91/B 91	120 HB3
D126/B 126	80 JB3
D151/B 151	80 JB3
D181/B 181	80 JB3



Honlama uçları

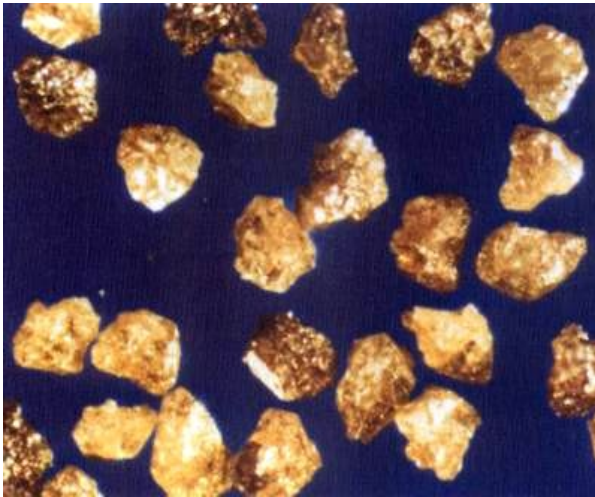
SİC taşlama diski



## THE MATERIALS WHICH CAN BE MACHINED BY DIAMOND & GRINDING WHEELS

### With Diamond

- Hardfacing
- Refractory products
- Gems and semi-precious stones
- Glass, porcelain, quartz
- Plastics, fibre-glass-reinforced plastics
- Ceramic grinding elements
- Carbide metals, also presintered carbide metal tools and construction units
- Natural and artificial stone
- Graphite, carbon



### With boron nitride (CBN)

- High-speed steel tools
- High-alloy tool steels
- Chromium steels (12% Cr) and carburizing steels
- Heat treated steels
- Special alloys

## GRIT SIZES

The definition includes all cutting, grinding and polishing materials of diamond and CBN. The diamond grit sizes are classified in natural and synthetic grain as well as synthetic grain with metal coating.

Synthetic diamond grain with several shapes of grain in kinds of bonds, decisive advantages to grinding ability and life.

In certain bonds, a metal-clad synthetic diamond grain has a better adherence, by this means a premature break-down and dislodging of the diamond particle are avoided. Due to good caloric conductivity of diamond, the produced grinding heat is uniformly transmitted through the metal coat to the resin bond. The bond, surrounding the diamond, does not become too hot, and the adherence of the diamond endures.

Course grits cut faster but produce rougher finishes. Fine grits give fine finishes but cut slower. Grit size selection is a trade-off between removal rate and finish.

It can be seen that FEPA Standart for 'sieve' grit sizes ends with D46/B46 as the finest grit size. The grit series is continued downwards by the 'micron powder sizes' which are classified chiefly by an elutriation CBN grit sizes have only minor effect on workpiece surface process. There is a FEPA Standart in existence for the micron grit sizes; DIABOR Standart uses a different classification with the designations D25. . . D0.25 for diamond and B30...B1 for CBN.

### Features of Grit Sizes in Diamond and CBN

FEPA STANDART		US MESH	AVERAGE ROUGHNES S RA	SURFACE ROUGHNES S	GRINDING OPERATION
DIAMOND	CBN BORAZON				
D181	B181	80-100	0.53	3.5	VERY COARSE SURFACE GRINDING
D151	B151	120	0.51		
D126	B107	120-140			COARSE SURFACE GRINDING
D107		140-170	0.40	2.8	
D91		170-200	0.32	2.5	
D76	B76	200-230		2	SEMIFINISHED SURFACE GRINDING
D64	B64	230-270	0.19	1.5	
D54	B54	270-325	0.16	1.2	FINE GRINDING
D46	46	325-400	0.15	0.9	
D35	B35	400-500	0.13	0.9	VERY FINE GRINDING
MD30					
MD20					
MD7					

$$\text{ABRASIVE QUANTITY} = \frac{\text{Outgoing Excelsior Per Volume cm}^3}{\text{Edge Abrasion Of The Diamond Side Per cm}^3}$$

International Standardization of Grit Sizes for Diamond and Cubic Boron Nitride								
Sieve Grit Designations					Micron Grit Sizes *			
Diamond FEPA-Standart DIABOR designation		CBN FEPA-Standart DIABOR Designation		Diamond +CBN US Standart ASTM-E-11-70		Nominal Mesh size to ISO 6106 DIN 848 Part 1 1980	Diamond DIABOR designations	CBN DIABOR designation
<u>Narrow</u> <u>Wide</u>		<u>Narrow</u> <u>Wide</u>		Narrow	Wide			
D 1181	D1182	B1181	B 1182	16/18	16/20	1180/1000	D 25	
D 1001		B1001		18/20		1000/850	D 20	B30
D 851	D852	B 851	B 852	20/25	20/30	850/710	D 20	
D 711		B 711		25/30		710/600	D 15	
D 601	D602	B 601	B 602	30/35	30/40	600/500	D 7	B 6
D 501		B 501		35/40		500/425	D 3	B 3
D 426	D427	B 426	B 427	40/45	40/50	425/355	D 1	B 1
D 356		B 356		45/50		355/300	D 0,7	
D 301		B 301		50/60		300/250	D 0,25	
D 251	D252	B 251	B 252	60/70		250/212	* Similar FEPA Standart Exists with designations M63...M1.0  FEPA= Federaration Europeenne des Fabricants de Produits Abrasifs.	
D 213		B 213		70/80	212/180			
D 181		B 181		80/100	180/150			
D 151		B 151		100/120	150/125			
D 126		B 126		120/140	125/106			
D 107		B 107		140/170	106/90			
D 91		B 91		170/200	90/75			
D 76		B 76		200/230	75/63			
D 64		B 64		230/270	63/53			
D 54		B 54		270/325	53/45			
D 46		B 46		325/400	45/38			
D 35		B 35		400/500				

MICRON STANDART SIZES					
0-1/4	1-2	3-6	8-15	14-20	30-60
0-1/2	1-3	4-8	8-22	15-25	40-50
0-1	1-5	5-7	10-14	20-25	40-60
0-2	2-3	5-10	10-15	20-30	54-80
1/4-1/2	2-4	6-12	10-20	20-40	60-100
1/2-1	2-6	7-10	12-20	22-36	
1/2-3	3-5	8-12	12-22	30-40	



## BONDS

The bond has a decisive influence on grinding performance, but also on the life and rigidity of the Wheel. The bond determines whether a diamond or CBN wheel grinds cool, with a good grip, with a high stock removal rate and low contact pressure, but with a shorter useful life or harder, with a poorer grip, with a lower stock removal rate and high contact pressure, but with a longer useful life.

### Recommendations for bond selection

#### a) Soft Bond:

- low concentrations
- dry grinding
- workpieces sensitive to heat
- fine grits
- wide grinding coatings

#### b) Hard Bond:

- *wet grinding*
- *long working life*
- *narrow grinding coatings*
- *rough grains*
- *high concentrations*
- *long working life*

In consideration of the operating conditions applied both have to be match to each other in such a way that the abrasive grits are held in the bond as long as they still have or generate edges. When the grits are worn and become unusable as an abrasive, they have to be released from the bond. If the grinding wheel adapted in this way it gives the highest performance, low wear and reduced grinding forces. If the worn grit remain in the bond too long, the grinding wheel loses its cutting ability. And also if the bond wears faster than the abrasive grits or it doesn't hold them long enough the abrasive grits can't be used with the highest performance and the service life of the grinding wheel is reduced. There are 4 types of bonds. The bond can be resin, sintered metal, ceramic or galvanic bond. In our production programme we use 2 kinds of bonds.

#### A) RESIN BOND:

Grinding wheels in resin bond are much free-cutting and therefore they are preferably used as diamond wheels for grinding of hard metal or hard metal steel combinations or as CBN wheels for super-speed steels. They excel by high cutting capacity and a grinding process, careful for the material. Resin bonded wheels are, however, more susceptible to high thermal and mechanic stress than metal bonded wheels. For diamond B51-B52-B53-B73-B74-B42. For CBN B51-B54-B53-B75-B76-B42.

#### B) SINTERED METAL BOND:

The high bond hardness produces finer surface finishes, but lower stock removal rates than resinoid bonded wheels. For this reason, metallic bonds are mainly used where rigidity of the coating is required, e.g. profile grinding, repairing precision tools without special rough grinding, and for small contact areas causing particular wear, and glass. M 112 + for carbide, M 856 M30 and M 31 for glass.

## General Features of Different Bond Hardness Ratings

### General Bond Applications

	Softer Bond	Harder Bond
Workpiece Hardness	Harder	Softer
Concentration	Lower	Higher
Grit Size	Fine	Coarse
Grinding Width	Wide	Narrow
Coolant	Optional	Usually required
Major Criteria	Heat and pressure sensitive workpieces	High dimensional tolerance requirement for workpiece

### General Bond Characteristics

	Softer Bond	Harder Bond
Grinding Ratio	Lower	Higher
Wheel Life	Shorter	Longer
Grinding Temperature	Lower	Higher
Cutting Action	Free Cutting	Less Aggressive
Material Removal Rate	Higher	Lower
Grinding Pressure	Lower	Higher

## Bond Hardness

L Soft      R Medium Hard      N Medium Soft      S Hard

## Type of Abrasive

<b>D</b>	<b>Natural Diamond</b>
<b>CD</b>	<b>Nickel Coated Man-made Diamond</b>
<b>MD</b>	<b>Man-made Diamond</b>
<b>CDC</b>	<b>Copper Coated Man-made Diamond</b>
<b>CBN</b>	<b>Boron Nitride</b>

## Grit Size – Nominal size

Nominal	Tolerance Range	Nominal	Tolerance Range
60	(40/60)	180	(170/200)
80	(60/80)	220	(200/230)
100	(80/100)	240	(230/270)
120	(100/120)	320	(270/325)
130	(120/140)	400	(325/400)
150	(140/170)		



## CONCENTRATION

The concentration specifies the proportion of diamond or CBN in the abrasive layer. As a general rule for the selection of the appropriate concentration, a high concentration can be recommended for small areas and coarse grits and a low concentration is advisable for large contact areas and fine grits. The difference of density of CBN in comparison with diamond is only unimportant so that for a concentration of 100, the content of abrasive grain also amounts to %25 volume of bond. The concentration influences in a high degree, the grinding performance and the life of a tool as well as the surface quality and dimensional accuracy of the material to be machined.

The choice of the concentration depends on the type of grinding wheels(shape,grit,sizes,bond), the working conditions and the requirements(cutting ability,life,dimensional stability)

**The concentration designations are as follows:**

Concentration	Carat / cm <sup>3</sup>	VolumeRelated Concentrations in Per Cent	VolumeRelated Concentrations in Per Mil
25	1,1	V6	V60
38	1,65	V9	V90
50	2,2	V12	V120
75	3,3	V18	V180
100	4,4	V24	V240
125	5,5	V30	V300
150	6,6	V36	V360
175	7,7	V42	V420
200	8,8	V48	V480

These are the generally applied for selection of concentration:

### Higher Concentrations C75...C125/V180...V300;

- High requirements for profile and edge stability
- Small abrasive layer thicknesses
- Hard bond
- Creep feed grinding

### Standart Concentrations C50...C75/V120...V180

- Straight wheels for surface and cylindrical grinding
- Cup wheels,e.g. for tool grinding
- Larger abrasive layer thicknesses
- Soft bond
- Finer grit

### Low Concentrations C25...C38

- Cup wheels with extremely wide rim widths
- Wheels with extremely fine grit size

**PERIPHERAL SPEED**

Wheel peripheral speed is very influential on the performance and life of diamond and CBN wheels as well as on the quality aspect of the grinding operation. We recommend to select wheel diameter and spindle speed with the correct wheel peripheral speed which is fundamental for the economy of a grinding job.

Wheel diameter r Ø mm	Peripheral Speed (m/s)								
	14	16	18	20	22	24	26	28	30
5									
10	26.750	30.950							
15	17.810	20.390	22.900	25.500	28.000	30.550			
20	13.380	15.280	17.200	19.100	21.000	22.900	24.830	26.800	28.600
25	10.700	12.210	13.750	15.300	16.800	18.340	19.890	21.400	22.900
30	8.910	10.190	11.460	12.740	14.000	15.280	16.550	17.850	19.100
40	6.690	7.640	8.600	9.530	10.500	11.460	12.420	13.390	14.300
50	5.350	6.100	6.870	7.650	8.400	9.150	9.950	10.700	11.470
75	3.550	4.080	4.580	5.100	5.600	6.110	6.630	7.140	7.630
100	2.660	3.060	3.440	3.825	4.200	4.590	4.960	5.350	5.730
125	2.130	2.440	2.750	3.050	3.355	3.670	3.990	4.280	4.580
150	1.770	2.030	2.290	2.550	2.800	3.060	3.310	3.570	3.820
175	1.530	1.750	1.970	2.200	2.410	2.620	2.840	3.060	3.270
200	1.330	1.530	1.720	1.910	1.100	2.290	2.480	2.680	2.860
250	1.070	1.220	1.370	1.530	1.680	1.830	1.990	2.140	2.290
300	980	1.020	1.150	1.270	1.400	1.530	1.650	1.780	1.910
350	760	870	980	1.010	1.200	1.310	1.420	1.530	1.640
400	670	760	860	950	1.050	1.150	1.240	1.340	1.430
500	530	610	690	760	840	910	990	1.070	1.150

Grinding Operation	Resin Bond		Metal Bond	
	Wet m/s	Dry m/s	Wet m/s	Dry m/s
Diamond Wheels for TC grinding				
Tool and Cutter Grinding	25–35	12–18	12–20	8–12
ID Grinding	10–20	8–15	10–18	8–12
Surface Grinding	25–35	-	20–30	-
OD Grinding	25–35	-	20–30	-
CBN Wheels in HSS grinding				
Tool and Cutter Grinding	25–35	15–20	15–25	10–15
ID Grinding	15–25	10–20	12–20	10–15
Surface Grinding	30–40	-	15–25	-
OD Grinding	30–40	-	15–25	-

## **COOLANT LUBRICATION**

### **Characteristics of Coolant Lubricants-Emulsions and Solutions**

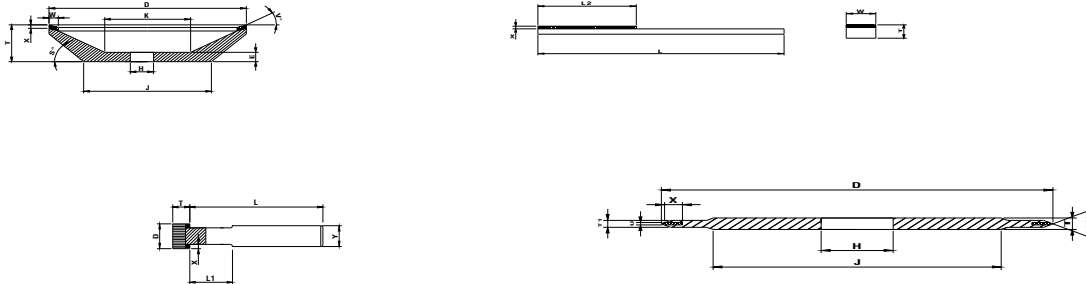
- Risk of varnish and corrosion damages
- Coolant lubricant mist can't detonate or explode
- Excellent heat discharge
- Great cutting ability by increased grinding friction
- Low grinding pressure
- Due to rapid ageing by bacteria and fungal attack utmost care and cleanliness is required
- Excellent cooling

### **Characteristics of Coolant Lubricants-Oils**

- Better surface quality
- Higher material removal rate
- Reduced grinding times
- Reduced grinding friction
- Optimal corrosion protection for the machine
- Workpiece quality improvement
- Reduced wear of the grinding wheel

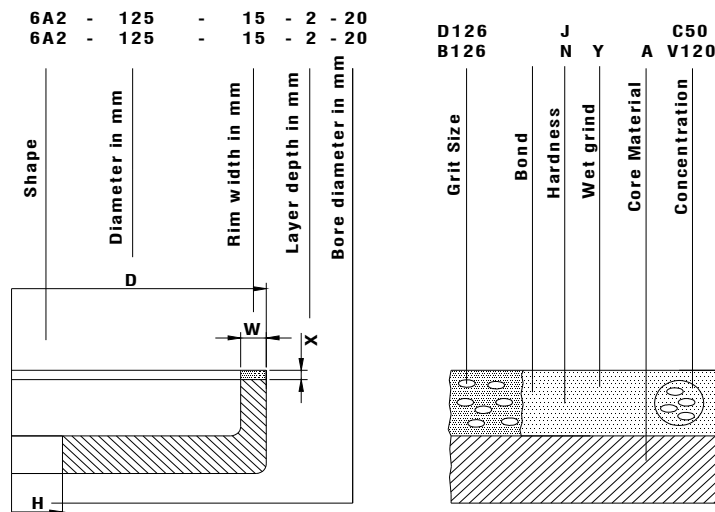
**TERMINOLOGY**

We use the terminology for unification and better understanding according to FEPA Standards for diamond and CBN grinding tools.

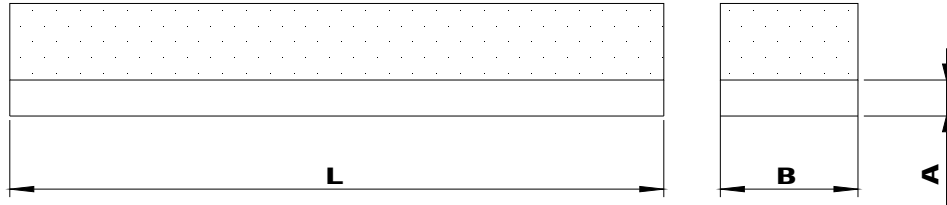


D	<b>Outside Diameter</b>	(mm)	S	<b>Angle of Body</b>	( <sup>0</sup> )
E	<b>Thickness at Bore</b>	(mm)	T	<b>Overall Thickness</b>	(mm)
H	<b>Bore Diameter</b>	(mm)	T1	<b>Reduced Hun Thickness</b>	(mm)
J	<b>Hub Diameter</b>	(mm)	U	Thickn.of diam.section (when <T or T1)	(mm)
K	<b>Inside Recess Diameter</b>	(mm)	U1	<b>Reduced width of diamond selection</b>	(mm)
L	<b>Overall Length</b>	(mm)	V	<b>Face Angle</b>	( <sup>0</sup> )
L1	<b>Length of Shaft</b>	(mm)	W	<b>Rim Width</b>	(mm)
L2	<b>Lenght of of Diamond Selection</b>	(mm)	X	<b>Depth of Diamond Selection</b>	(mm)
R	<b>Radius</b>	(mm)	Y	<b>Shaft Diameter</b>	(mm)

**ORDER DATA**



**DIAMOND & CBN TOOLS FOR HONING**



**CUTTING SPEED**

Cutting Speed =  $V_s$

Rotation speed of the honing head =  $V_a$

Oscillation Speed =  $V_h$

Approximate setting range	Typical speeds in practice
$V_s$	52 m/min
$V_a$	49 m/min
$V_h$	16 m/min

**COOLANT**

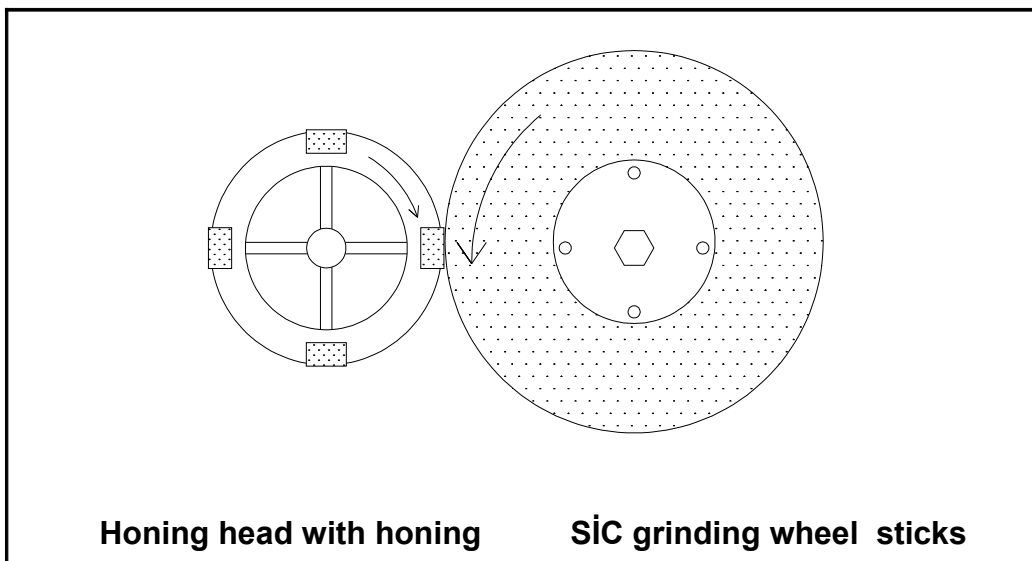
The honing process normally uses honing oils on a mineral oil base, and water –soluble emulsions.

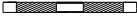
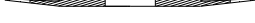
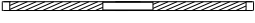
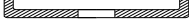

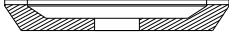



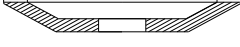

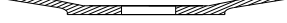
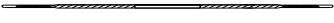








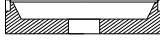

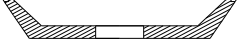
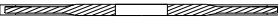
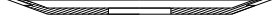
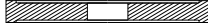

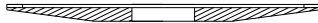
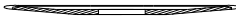
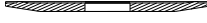
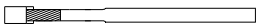


Flow per bore: 30–150 ltr/min.

**RESIN BOND**

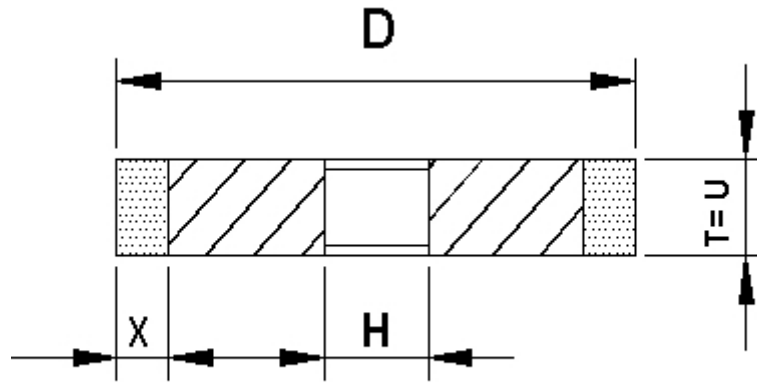
Peripheral speed (Diam./CBN)  $v_w = 7\text{m/s}$

Grit Size of diamond and CBN honing sticks	Specification of SiC grinding wheel
D15/B 15	400 HB3
D20/B 30	320 HB3
D46/B 46	240 HB3
D64/B 64	180 HB3
D91/B 91	120 HB3
D126/B 126	80 JB3
D151/B 151	80 JB3
D181/B 181	80 JB3



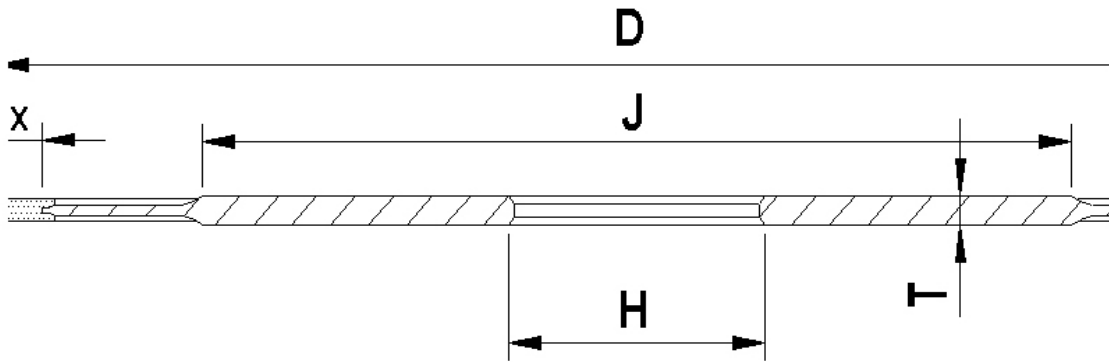
TYPE	PAGE	FORM-SHAPE	TYPE	PAGE	FORM-SHAPE
1A1			4BT9		
1L1			6A2		
14A1			11A2		
1A1R			12A2		
1F1R			12A2D		
14A1R			12A2		
14F1R			12V2		
1E6Q			12C2		
14E6Q			12V4		
14EE1			12V5		
14F1			6A9		
1FF1			11V9		
14U1			12V9		
9A3			4C2		
4A2			4C2		
12A9			1A8W 1A1W		
4ET9			FGH		



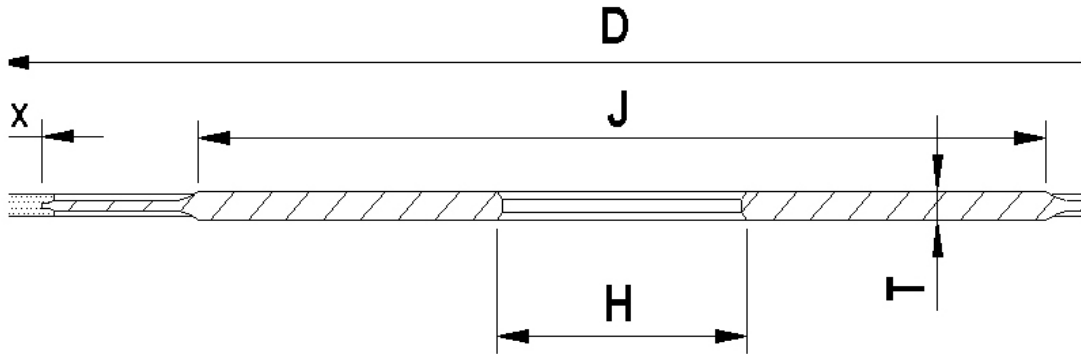


Form D x T x H															D - U - X					
1A1 12 x 10 x 6															12 - 10 - 2					
D	Tmin Tmax	H	X	D	Tmin Tmax	H	X	D	Tmin Tmax	H	X	D	Tmin Tmax	H	X					
10	3	INDICATED ON ORDERS	2	28	3	INDICATED ON ORDERS	2	3	100	5	INDICATED ON ORDERS	2	3	4	30	10	INDICATED ON ORDERS	2	3	4
	15				20					30						40				
12	3		2	30	3		2	3	125	5		2	3	4	350	15		2	3	4
	15				20					30						40				
14	3		2	35	3		2	3	150	5		2	3	4	400	20		2	3	4
	15				20					30						40				
15	3		2	40	4		2	3	175	6		2	3	4	450	20		2	3	4
	15				20					30						40				
16	3		2	45	4		2	3	200	8		2	3	4				2	3	4
	15				20					30										
18	3		2	50	5		2	3	250	10		2	3	4				2	3	4
	15				20					40										
20	3		2	60	5		2	3	300	5		2	3	4				2	3	4
	20				20															
23	3	2	75	5	2	3	350	5	2	3	4			2	3	4				
	20			20																
25	3	2	90	5	2	3	400	5	2	3	4			2	3	4				
	20			20																

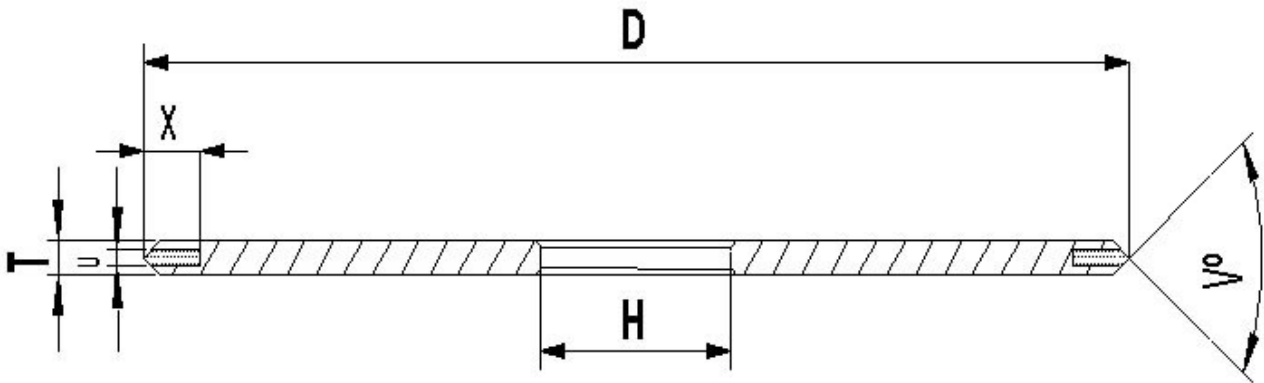
**1A1**



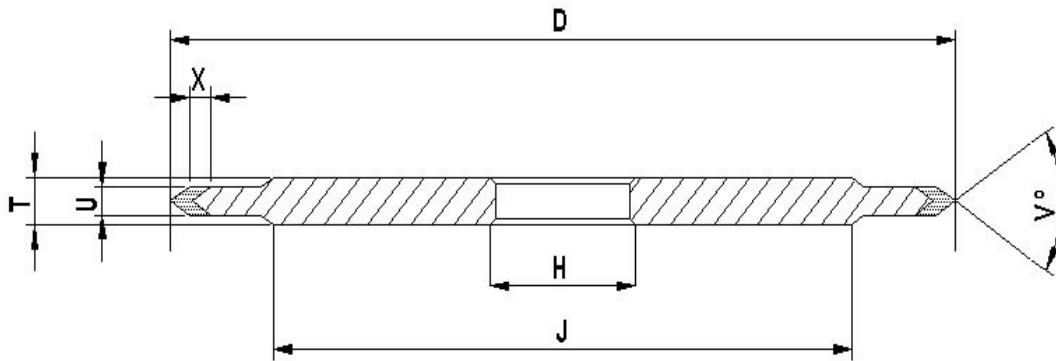
FORM 14A1R																			
D x T x H						D --- U --- X													
75 x 6 x 25,4						75 --- 1 --- 5													
D	T	H	U	X	J	D	T	H	U	X	J								
50	6	INDICATED ON ORDERS	0,8	5	28	80	6	INDICATED ON ORDERS	2,2	5	50								
			1,0																
			1,4																
			1,5																
			1,8																
			2,0																
			2,2																
			2,5																
			2,8																
			3,0																
75	6	INDICATED ON ORDERS	0,8	5	45	100	6	INDICATED ON ORDERS	0,8	5	65								
			1,0																
			1,2																
			1,5																
			1,8																
			2,0																
			2,2																
			2,5																
			2,8																
			3,0																
80	6	INDICATED ON ORDERS	0,8	5	50	125	6	INDICATED ON ORDERS	0,8	5	95								
			1,0																
			1,2																
			1,5																
			1,8																
			2,0																
							INDICATED ON ORDERS		2,2					150	6	INDICATED ON ORDERS	2,2	3	5
									2,5										
									2,8										
									3,0										
1,0																			
<b>14A1R</b>																			



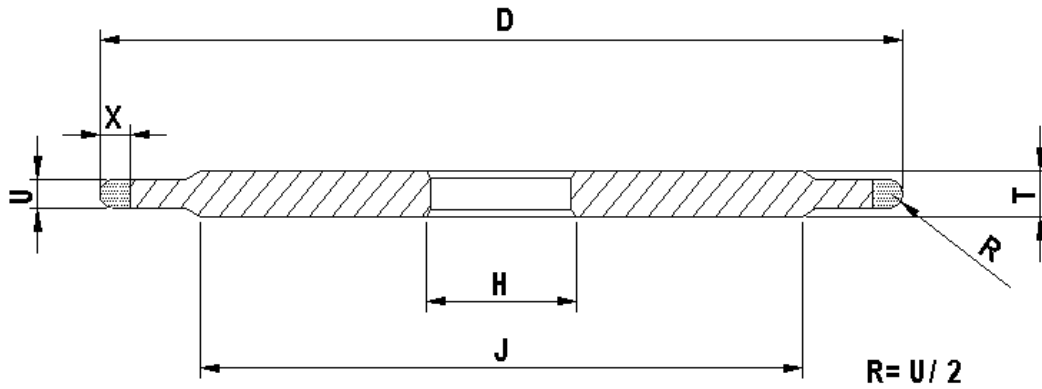
FORM 14A1R													
D x T x H						D --- U --- X							
75 x 6 x 25,4						75 --- 1 --- 5							
D	T	H	U	X	J	D	T	H	U	X	J		
150	6	<i>INDICATED ON ORDERS</i>	1,2	3	5	115	175	8	<i>INDICATED ON ORDERS</i>	3,0	3	5	135
			1,5				1,0						
			1,8				1,2						
			2,0				1,5						
			2,2				1,8						
			2,5				2,0						
			2,8				2,2						
			3,0				2,5						
			0,8				2,8						
1,0	3,0												
1,2	1,5												
1,5	1,8												
1,8	2,0												
2,0	2,2												
2,2	2,5												
2,5	2,8												
2,8	3,0												
175	8		<i>INDICATED ON ORDERS</i>	0,8	3	5	135	250		12	<i>INDICATED ON ORDERS</i>	1,5	3
		1,0		1,8									
		1,2		2,0									
		1,5		2,2									
		1,8		2,5									
		2,0		2,8									
		2,2		3,0									
		2,5		1,5									
		2,8		1,8									
3,0	2,0												
1,5	2,2												
1,8	2,5												
2,0	2,8												
2,2	3,0												
<b>14A1R</b>													



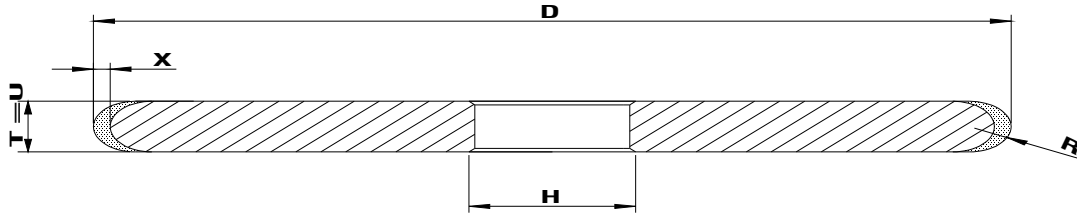
FORM		D x T x H			D --- U --- X/V <sup>0</sup>									
1E6Q		100	x	4	x	20	100	---	2	---	5/45 <sup>0</sup>			
D	T	INDICATED ON ORDERS			U	X	V <sup>0</sup>							
40	4				1	5	3	3	4	6	90			
					2		0	5	5	0				
50	4				1	5	3	3	4	6	90			
					2		0	5	5	0				
75	4				1	5	3	3	4	6	90			
					2		0	5	5	0				
100	4				1	5	3	3	4	6	90			
					2		0	5	5	0				
125	5				1	5	3	3	4	6	90			
		2	0	5	5		0							
150	5	1	5	3	3	4	6	90						
		2		0	5	5	0							
		<b>1E6Q</b>												



FORM D x T x H 14EE1 125 x 6 x 32							D --- U --- X/V° 125 --- 3 --- 2/60°																					
D	T	H	U	X	V°	J	D	T	H	U	X	V°	J															
75	6	INDICATED ON ORDERS	3	3	6	35	150	6	INDICATED ON ORDERS	4	3	6	35	120														
				2,5	5	45					2,5	5	45															
				2	4	60					2	4	60															
				1,5	3	90					1,5	3	90															
			100	6	INDICATED ON ORDERS	4				3	6	35	175		6	INDICATED ON ORDERS	4	3	6	35	140							
										2,5	5	45						2,5	5	45								
										2	4	60						2	4	60								
										1,5	3	90						1,5	3	90								
						125				6	INDICATED ON ORDERS	3					3	6	35	200		10	INDICATED ON ORDERS	5	3	6	35	160
																	2,5	5	45						2,5	5	45	
																	2	4	60						2	4	60	
																	1,5	3	90						1,5	3	90	
150	6	INDICATED ON ORDERS					4	3	6			35		250				INDICATED ON ORDERS	4					3	6	35	200	
								2,5	5			45												2,5	5	45		
								2	4			60												2	4	60		
								1,5	3			90												1,5	3	90		
					INDICATED ON ORDERS		3	3	6			35	120			INDICATED ON ORDERS			5		3			6	35			
								2,5	5			45									2,5			5	45			
								2	4			60									2			4	60			
								1,5	3			90									1,5			3	90			
			<b>14EE1</b>																									

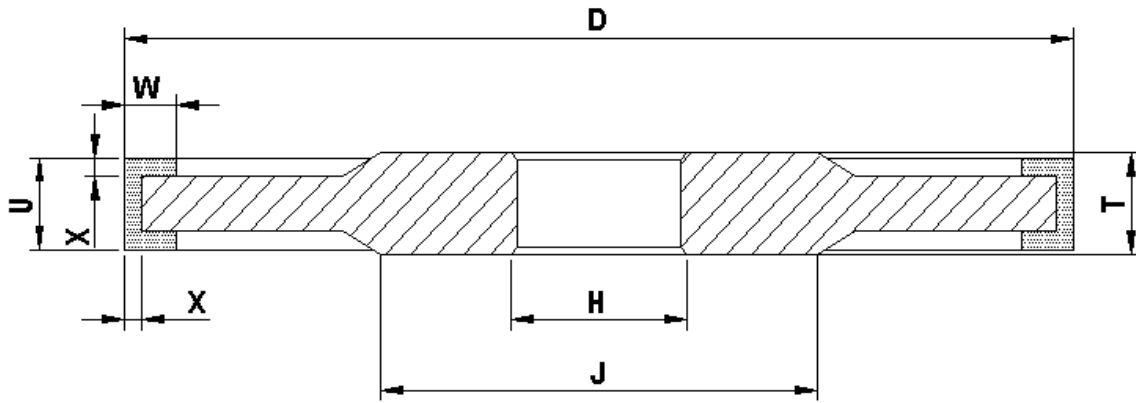


FORM 14F1		D x T x H 100 x 6 x 20	D --- U --- X/R 100 --- 4 --- 2,5/2			
D	T	H	U	X	R	J
40	6	INDICATED ON ORDERS	2	2,5	1	25
			3		1,5	
			4		2	
50	6		2	2,5	1	30
			3		1,5	
			4		2	
			4		2	
60	6		5	5	2,5	36
			6	6	3	
			2	2,5	1	
3	1,5					
4	2					
5	5,5		2,5			
75	6		6	6	3	70
			2	2,5	1	
		3	1,5			
		4	2			
100	6	5	4,5		2,5	100
		2	2,5	1		
		3		1,5		
		4		2		
125	6	5		4,5	2,5	120
		2	2,5	1		
		3		1,5		
		4		2		
150	6	5		4,5	2,5	
		2	2,5	1		
		3		1,5		
		4		2		
<b>14F1</b>						

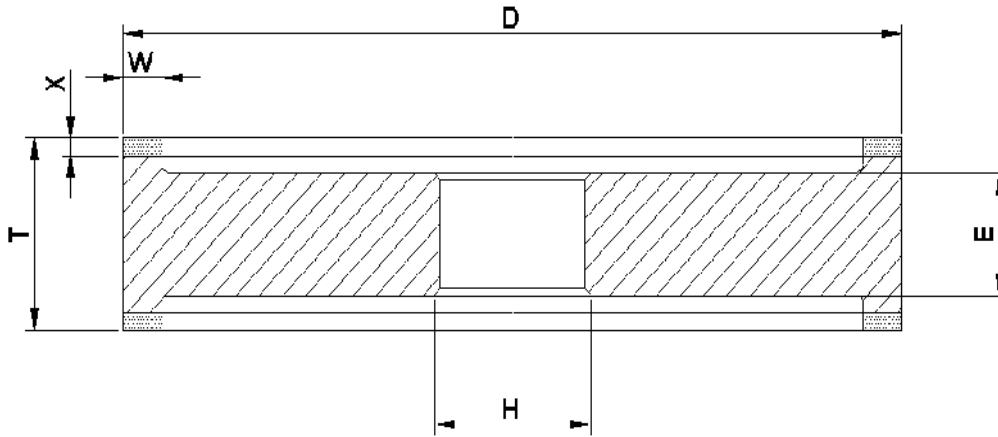


FORM		D x T x H	D --- U --- X/R	
1FF1		125 x 6 x 32	125 --- 6 --- 2/3	
D	T=U	H	X	R
40	4	INDICATED ON ORDERS	2	2
	6			3
	8			4
	10			5
50	4		2	2
	6			3
	8			4
	10			5
75	4		2	2
	6			3
	8			4
	10			5
100	4		2	2
	5			2,5
	6			3
	8			4
	10			5
	12			6
	15			7,5
125	6		2	3
	8	4		
	10	5		
	12	6		
	16	8		
150	6	2	3	
	8		4	
	10		5	
	12		6	
	16		8	
	20		10	
<b>1FF1</b>				

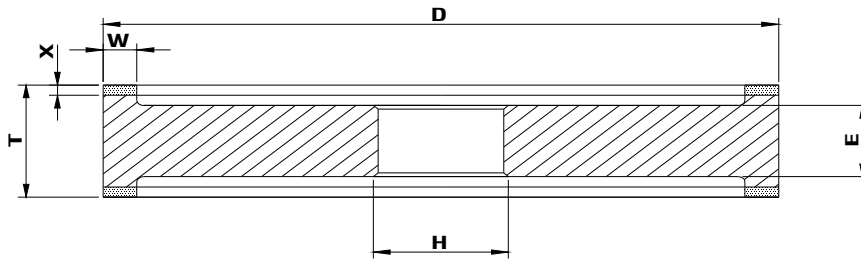




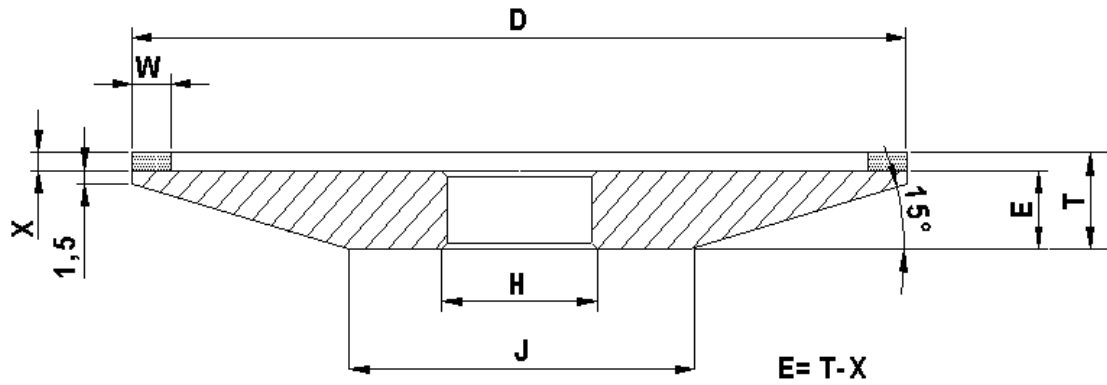
FORM 14U1													
D x T x H							D --- U/W --- X						
125 x 10 x 20							125 --- 8/6 --- 2						
D	T	H	U	W	X	J	D	T	H	U	W	X	J
50	8	INDICATED ON ORDERS	5	4	1,5	30	175	10	INDICATED ON ORDERS	6	6	2	100
	10		6		2			12		8			
	12		8		2			14		10			
75	8		5	1,5	40	200	14	8		6	120		
	10		6	2			16	10		10			
	12		8	2			18	12		10			
100	8		6	6	2	50	250	16		8	6	160	
	10		8					18		10	10		
	12		10					20		12	10		
125	8		6	6	2	65	300	18		8	6	200	
	10		8					20		10	10		
	12		10					22		12	10		
150	8	6	6	2	80	400	20	10	250				
	10	8					22	12		10			
	12	10					24	14		10			
<b>14U1</b>													



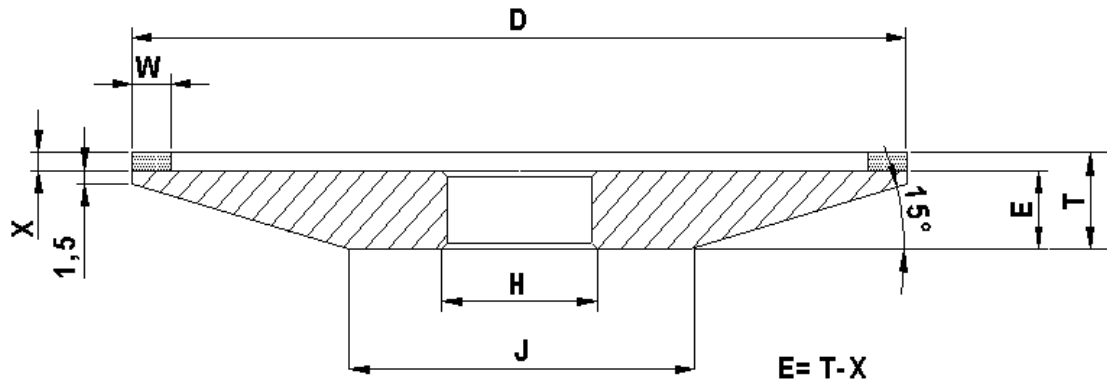
Form D x T x H						D - W - X							
9A3 100 x 22 x 20						100 - 5 - 2							
D	T	H	W	X	E	D	T	H	W	X	E		
50	18	<i>INDICATED ON ORDERS</i>	2	2	3	12	100	22	<i>INDICATED ON ORDERS</i>	8	2	3	12
			3							10			
			4							12			
			5							15			
			6							2			
			8							3			
10	4												
60	20		2	2	3	12	125	22		5	2	3	12
			3							6			
			4							7			
			5							8			
75	20		2	2	3	12	150	25		10	2	3	15
		3	12										
		4	15										
		5	2										
		6	3										
90	22	4	2	3	12	175	30	6	2	3	15		
		6						7					
100	22	2	2	3	12	175	30	8	2	3	15		
		3						10					
		4						12					
		5						2					
		6						3					
<b>9A3</b>													



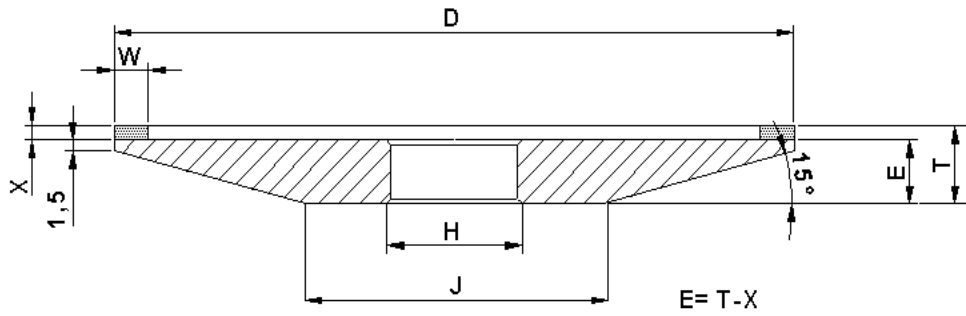
Form 9A3			D x T x H 250 x 30 x 20			D - W - X 250 - 10 - 3							
D	T	H	W	X	E	D	T	H	W	X	E		
175	30	<i>INDICATED ON ORDERS</i>	5	2	3	15	250	30	<i>INDICATED ON ORDERS</i>	3	2	3	23
			6							4			
			8							5			
			10							6			
			12							8			
			15							10			
200	30		2	2	3	15	300	30		15	2	3	23
			3							3			
			4							4			
			5							5			
			6							6			
			8							8			
225	30		10	2	3	15	350	30		15	2	3	28
			2							3			
			3							4			
			4							5			
			6							6			
			8							8			
								10					
<b>9A3</b>													



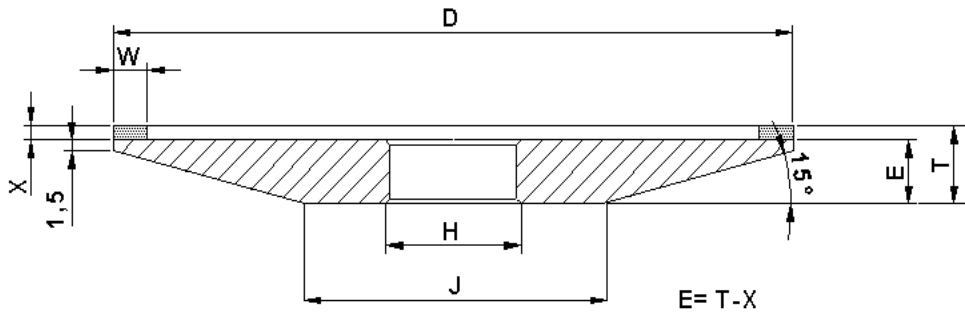
Form D x T x H 4A2 100 x 10 x 20						D - W - X 100 - 4 - 2							
D	T	H	W	X	J	D	T	H	W	X	J		
50	8	<b>INDICATED ON ORDERS</b>	2	2	3	20	100	10	<b>INDICATED ON ORDERS</b>	6	2	3	55
			3							7			
			4							8			
			5							10			
			6							12			
			8							15			
10	2												
60	8		2	2	3	30	125	10		3	2	3	80
			3							4			
			4							5			
			5							6			
75	10		2	2	3	30	150	12		8	2	3	90
			3							10			
			4							12			
			5							15			
			6							20			
			8							2			
90	10		4	2	3	45	150	12		6	2	3	90
		6	7										
100	10	2	2	3	55	150	12	8	2	3	90		
		3						10					
		4						12					
		5						13					
						<b>4A2</b>							



Form D x T x H						D - W - X							
4A2 250 x 23 x 20						250 - 10 - 3							
D	T	H	W	X	J	D	T	H	W	X	J		
150	12	INDICATED ON ODERS	15	2	3	90	200	18	INDICATED ON ORDERS	10	2	3	95
			20							15			
175	15		2	2	3	92	225	20		20	2	3	105
			3							2			
			4							3			
			5							4			
			6							10			
			8							15			
			10							20			
			12							2			
200	18		15	2	3	95	250	23		3	2	3	108
			20							4			
		2	5										
		3	6										
		4	8										
		5	10										
6	15												
8	20												
						<b>4A2</b>							

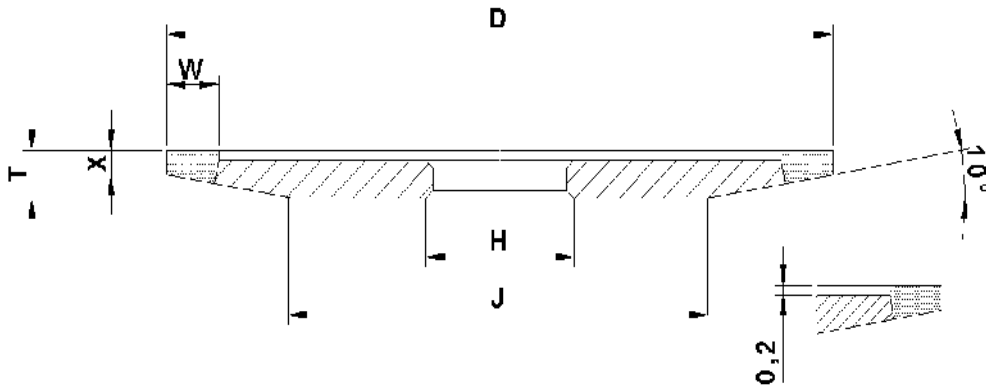


FORM D x T x H D --- W --- X 12A9 125															
x 10	x 20	125		---	5	---	2	D	---	W	---	X	12A9	125	
D	T	H	W	X	K	J	D	T	H	W	X	K	J		
50	8	INDICATED ON ORDERS	2	2	3	34	25	100	10	INDICATED ON ORDERS	6	2	3	76	64
			3			32					7			74	
			4			30					8			72	
			5			28					10			68	
			6			26					12			64	
			8			22					15			58	
			10			18					2			108	
60	8		2	2	3	44	35	125	10		3	106			
			3			42					4	104			
			4			40					5	102			
			5			38					6	100			
			6			36					8	96			
			8			32					10	92			
			10			28					12	88			
75	10	2	2	3	58	40	150	12	2	134	103				
		3			56				3	132					
		4			54				4	130					
		5			52				5	128					
		6			50				6	126					
		8			46				8	122					
		10			42				10	118					
90	10	4	2	3	70	54			6	126					
		6			66				8	122					
		2			84				10	118					
		3			82				12	114					
100	10	4	2	3	84	64			15	108					
		3			82				20	98					
		4			80										
		5			78										
<b>12A9</b>															

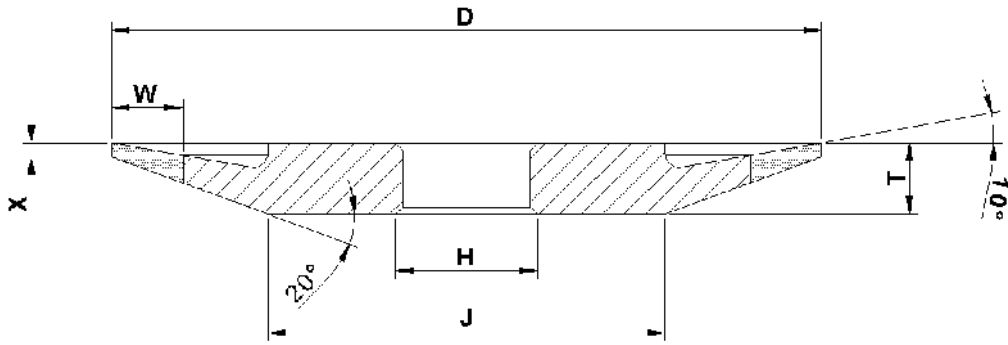


FORM 12A9														
D x T x H							D --- W --- X							
100 x 18 x 20							200 --- 6 --- 2							
D	T	H	W	X	K	J	D	T	H	W	X	K	J	
175	15	INDICATED ON ORDERS	2	2	3	159	111	200	18	INDICATED ON ORDERS	15	2	3	158
			3			157					20			148
			4			155					25			138
			5			153		225	20		3	207		
			6			151					4	205		
			8			147					10	193		
			10			143					15	183		
			12			139		20	173					
			15			133		250	23		2	234		
			20			123					3	232		
2	184	4	230											
200	18	INDICATED ON ORDERS	3	2	3	182	101				5	228		
			4			180					6	226		
			5			178					8	222		
			6			176					10	218		
			8			172					15	208		
			10			168					20	198		
							<b>12A9</b>							

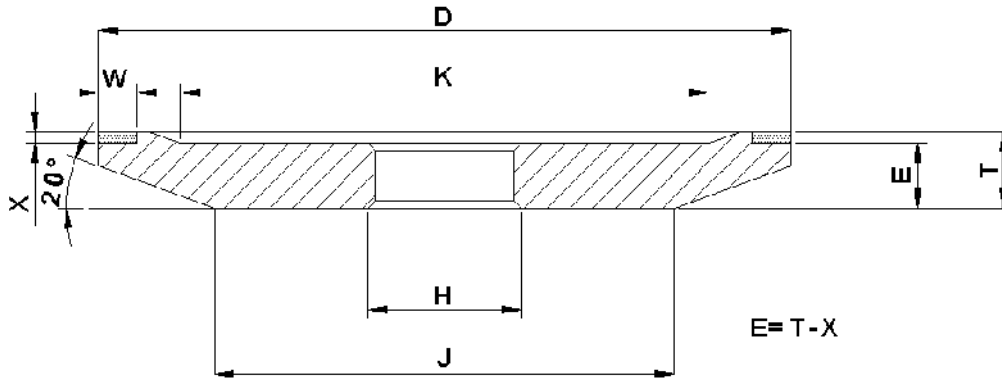




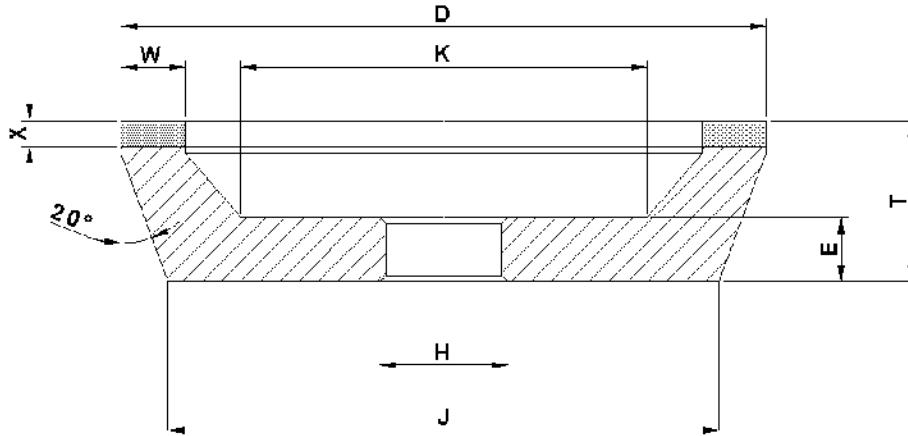
FORM 4ET9														
D x T x H				D --- W --- X										
75 x 6 x 20				75 --- 5 --- 2										
D	T	H	W	X	J	D	T	H	W	X	J			
50	4	<i>INDICATED ON ORDERS</i>	3	1	2	28	125	8	<i>INDICATED ON ORDERS</i>	8	2	3	70	
			4							10				
			5							12				
			6							4				
60	5		8	1	2	26	150	10		10	6	2	3	72
			3								8			
			4								10			
75	6		5	1	2	30	175	12		12	4	2	3	72
			6								8			
			8								10			
			10								12			
90	6		4	1	2	46	200	15		15	4	2	3	64
		6	8											
100	6	7	2	3	56	225	17	17	10	2	3	66		
		8							4					
		10							10					
		12							15					
		4							4					
125	8	5	2	3	70	250	20	20	6	2	3	58		
		6							8					
		7							10					
									15					
											<b>4ET9</b>			



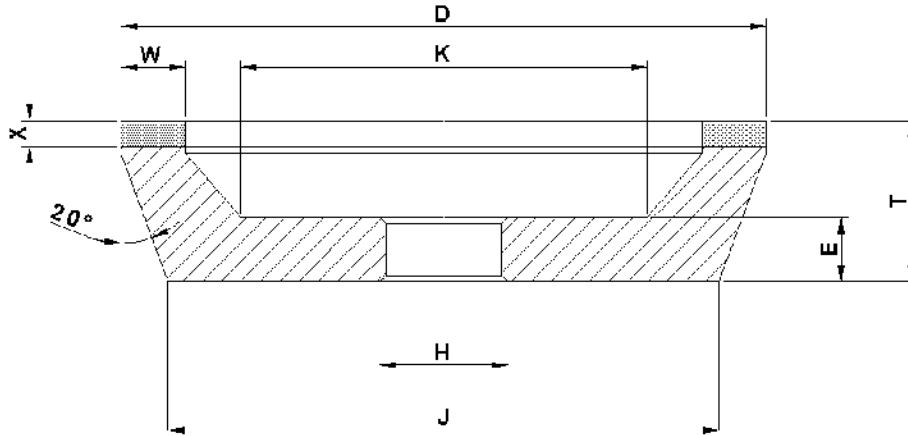
FORM D x T x H 4BT9 125 x 12 x 25			D --- U --- X 125 --- 10 --- 2				
D	T	H	W	X	J		
50	6	INDICATED ON ORDERS	6	1	22		
60	6		6	1	32		
75	8		10	10	1	37	
					2	42	
100	10		10	10	1	50	
					2	56	
125	12		10	10	1	65	
					2	70	
150	14		10	10	2	3	90
175	16		10	10	2	3	102
200	22		10	10	2	3	96
250	22		10	10	2	3	146
					<b>4BT9</b>		



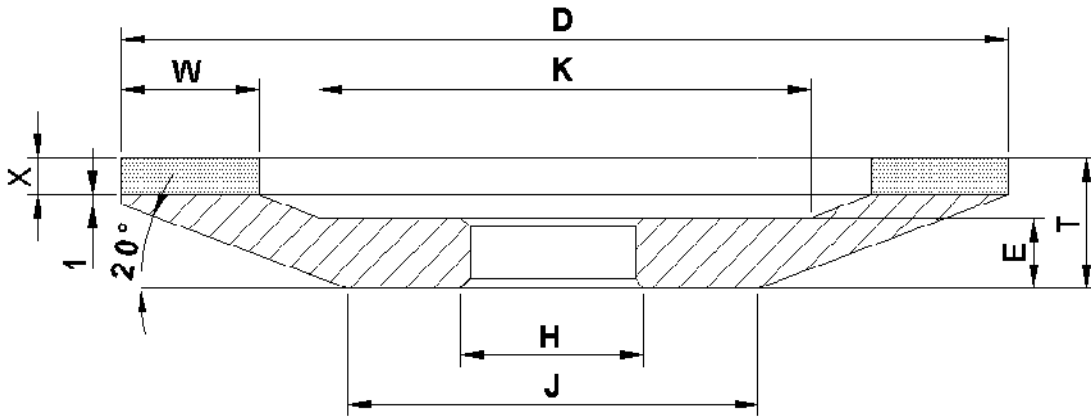
Form		D x T x H				D - W - X									
6A2		150 x 22 x 25				150 - 4 - 2									
D	T	H	W	X			E	D	T	H	W	X			E
50	22	INDICATED ON ORDERS	2	2	3	4	10	100	22	INDICATED ON ORDERS	6	2	3	4	10
			3												
			4												
			5												
			6												
			8												
			10												
			20												
60	22	INDICATED ON ORDERS	2	2	3	4	10	125	22	INDICATED ON ORDERS	2	2	3	4	10
			3												
			4												
			5												
			10												
75	22	INDICATED ON ORDERS	2	2	3	4	10	150	22	INDICATED ON ORDERS	6	2	3	4	10
			3												
			4												
			5												
			8												
			10												
			12												
			15												
20															
90	22	INDICATED ON ORDERS	4	2	3	4	10	150	22	INDICATED ON ORDERS	2	2	3	4	10
			6												
100	22	INDICATED ON ORDERS	2	2	3	4	10	150	22	INDICATED ON ORDERS	6	2	3	4	10
			3												
			4												
			5												
<b>6A2</b>															



FORM		D x T		x H		D		W		X										
11A2		100 x 25		x 20		100		6		2										
D	T	H	W	X	K	J	E	D	T	H	W	X	K	J	E					
50	22	INDICATED ON ORDERS	3			38			100	25	INDICATED ON ORDERS	12			70					
			4			36						15	2	3	4	64	85	10		
			5	2	3	4	34	37				10	20				54			
			6				32						4					111		
			8				28						5					109		
			10				24						6					107		
60	22		3			48			125	25		8			103					
			4	2	3	4	46	47				10	10	2	3	4	99	110	10	
			5				44						12				95			
			3	2	3	4	63	62				10	13				93			
75	22		4			61			150	25		15			89					
			5				59					20				79				
			6				57						4	2	3	4	136	135	10	
			8				53						5				134			
			10				49						6				132			
			12				45						8				128			
90	22		15			39			175	25		10			124					
			20				29					12				120				
		4	2	3	4	76	77	10			13				118					
		6				72					15				114					
100	25	2	2	3	4	88	85	10	175	25	20				104					
		3				86					5	2	3	4	159	145	10			
		4				84					6				157					
		56				82					8				153					
		8				78					10				149					
		10				74					12				145					
<b>11A2</b>																				

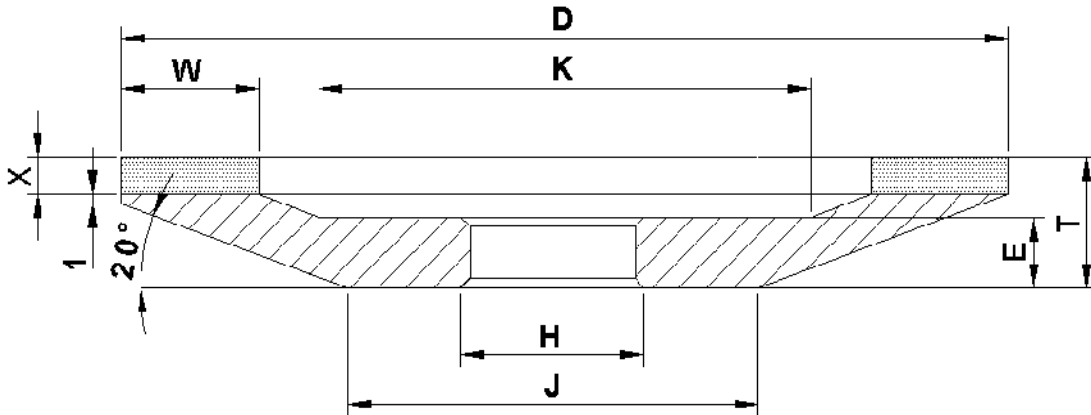


FORM		D x T x H			D --- W --- X				
11A2		175 x 25 x 51			175 --- 15 --- 2				
D	T	INDICATED ON ORDERS	W	X			K	J	E
175	25		15	2	3	4	139	160	10
			20				129		
200	25		5	2	3	4	184	185	10
			6				182		
			8				178		
			10				174		
			15				164		
225	28		20	2	3	4	154	208	10
			10				199		
		15	189						
250	28	20	2	3	4	179	233	10	
		5				234			
		6				232			
		8				228			
		10				224			
<b>11A2</b>									



FORM D x T x H																					
12A2 75 x 10 x 20																					
D	T	H	W	X	K	J	E	D	T	H	W	X	K	J	E						
50	10	INDICATED ON ORDERS	2	2	3	4	24	20	6	INDICATED ON ORDERS	2	2	3	4	68	57	8				
			3				22				3							66			
			4				20				4							64			
			5				18				5							62			
60	10		2	2	3	4	32	29	6		INDICATED ON ORDERS	6	2	3	4	60	57	8			
			3				30					8							56		
			4				28					10							52		
			5				26					12							48		
75	10		2	2	3	4	52	39	6			INDICATED ON ORDERS	13	2	3	4	46	72	9		
			3				50						15							42	
			4				48						20							32	
			5				46						2							82	
90	12		6	2	3	4	44	40	6				INDICATED ON ORDERS	3	2	3	4	80	84	10	
			8				40							4							78
			10				36							5							76
			4				56							6							74
100	14	6	2	3	4	52	45	8	INDICATED ON ORDERS	8				2	3	4	70	84	10		
		10				46				10										66	
		12				42				12										62	
		2				62				13										60	
175	20	3	2	3	4	54	45	8		INDICATED ON ORDERS	15			2	3	4	56	84	10		
		8				50					16									54	
		10				46					20									46	
		2				60					2									98	
175	20	12	2	3	4	42	45	8			INDICATED ON ORDERS	3		2	3	4	96	84	10		
		15				36						4								94	
		2				62						2								98	
		3				60						3								96	
175	20	4	2	3	4	36	45	8				INDICATED ON ORDERS	4	2	3	4	94	84	10		
		2				62							2							98	
		3				60							3							96	
		4				60							4							94	

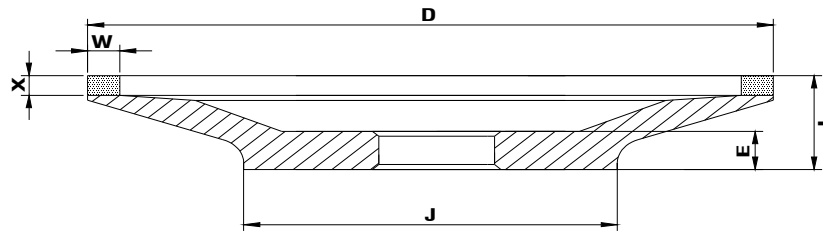
**12A2**



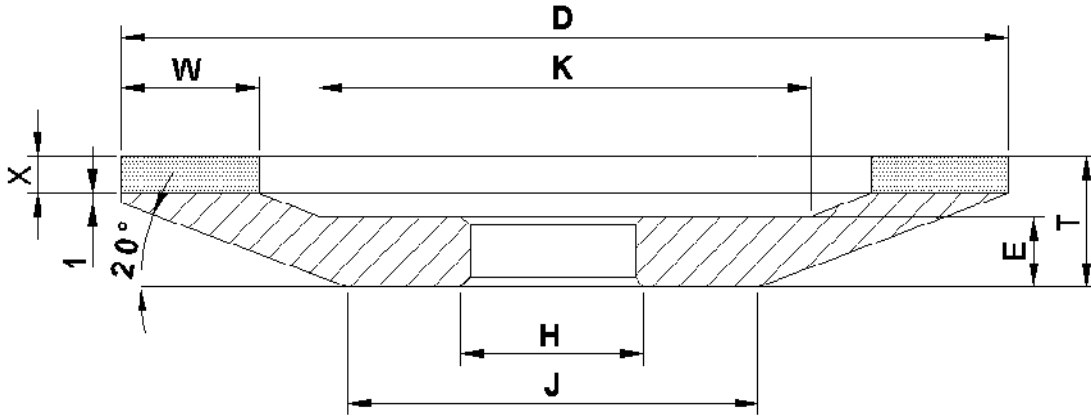
FORM D x T x H										D --- W --- X													
12A2 175 x 20 x 50,8										175 --- 8 --- 3													
D	T	H	W				K	J	E	D	T	H	W				X	K	J	E			
175	20	INDICATED ON ORDERS	2	2	3	4	92	84	10	225	22	INDICATED ON ORDERS	2	2	3	4	156	122	11				
			6				90							3				154					
			8				86							4				152					
			10				82							10				140					
			12				78							15				130					
			15				72							20				120					
			20				62							250	25		2	2	3	4	156	132	13
			200	22	INDICATED ON ORDERS	2	2	3	4				108	100	11	250	25	INDICATED ON ORDERS	3				154
		3					106					4							152				
		4					104					5							150				
		5					102					6							148				
		6					100					8							144				
		8					96					10							140				
		10					92					15							130				
		15					82					22							116				
		16					80					25							110				
		20					72																
										<b>12A2</b>													



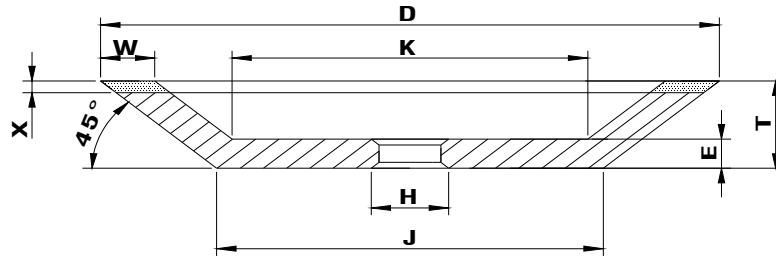
FORM D x T x H									D --- W --- X												
12A2D 75 x 22 x 20									75 --- 5 --- 2												
D	T	H	W		X		K	J	E	D	T	H	W		X		K	J	E		
50	17	INDICATED ON ORDERS	3	2	3	4	30	22	8	100	25	INDICATED ON ORDERS	12	2	3	4	50	56	10		
			4				28						15				44				
			5				26						20				34				
			6				24						125	25	4	2	3	4	91	81	10
			8				20								5				89		
			10				16								6				87		
60	20		3	2	3	4	38	26	10	150	25		8				83				
			4				36						10				79				
			5				34						12				75				
75	22		3	2	3	4	49	37	10				13					73			
			4				47						15				69				
			5				45						20				59				
		6				43			4			2	3	4	120	106	12				
		8				39			5						118						
		10				35			6						116						
		12				31			8						112						
		15				25			10						108						
20				15			12						104								
90	22	4	2	3	4	52	52	10	13					102							
		6				48			15				98								
100	25	3	2	3	4	68	56	10	20					88							
		4				66															
		5				64															
		6				62															
		8				58															
		10				54															
<b>12A2D</b>																					



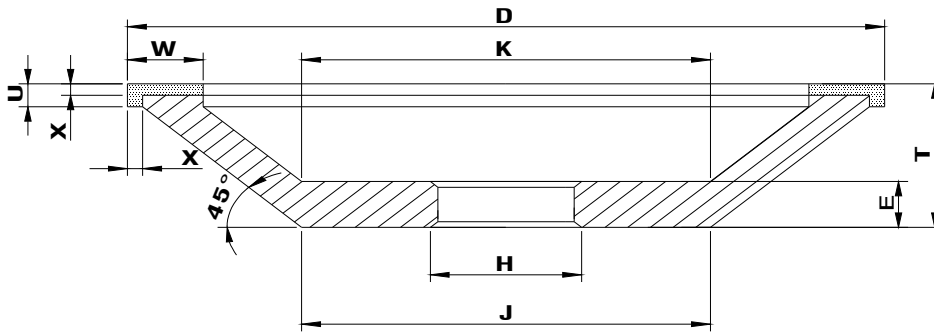
FORM 12A2D		D x T x H 200 x 25 x 50		D --- W --- X 200 --- 10 --- 3					
D	T	INDICTED ON ORDERS	W	X			K	J	E
175	25		5	2	3	4	143	131	12
			6				141		
			8				137		
			10				133		
			15				123		
			20				113		
200	25		5	2	3	4	168	156	12
			6				166		
			8				162		
		10	158						
		15	148						
		20	138						
225	25	10	2	3	4	183	181	12	
		15				173			
		20				163			
250	25	5	2	3	4	218	206	12	
		6				216			
		8				212			
		10				208			
		15				198			
		22				184			
		25				178			
		<b>12A2D</b>							



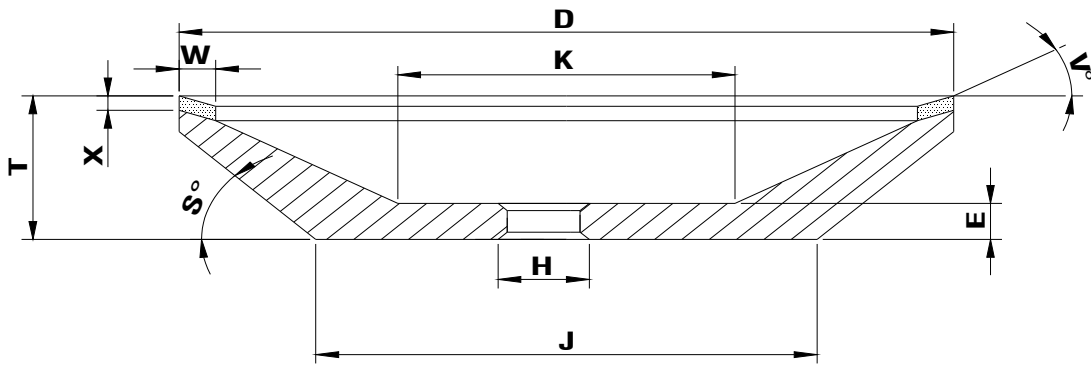
FORM 12A2-99		D x T x H 100 x 19 x 25	D --- W --- X 100 --- 5 --- 2						
D	T	INDICATED ON ORDERS	W	X			J	E	
100	19		4	2	3	4	60	9	
			5						
			6						
125	19		4	2	3	4	70	9	
			5						
			6						
150	19		4	2	3	4	95	12	
			5						
			6						
175	23	5	2	3	4	120	12		
		6							
200	23	5	2	3	4	140	12		
		6							
				<b>12A2</b>					



FORM		D x T x H			D --- W --- X			
12V2		75	x 20	x 20	75	---	5 --- 2	
D	T	INDICATED ON ORDERS	W	X		K	J	E
50	15		5	2	3	20	20	6
			8			14		
75	20		5	2	3	36	34	8
			10			46		
100	25		5	2	3	60	50	10
			6			58		
			8			54		
			10			50		
125	25		5	2	3	82	72	10
		6	80					
		8	76					
		10	72					
150	25	5	2	3	110	98	12	
		8			104			
		10			100			
175	30	8	2	3	104	112	12	
		10			100			
						<b>12V2</b>		

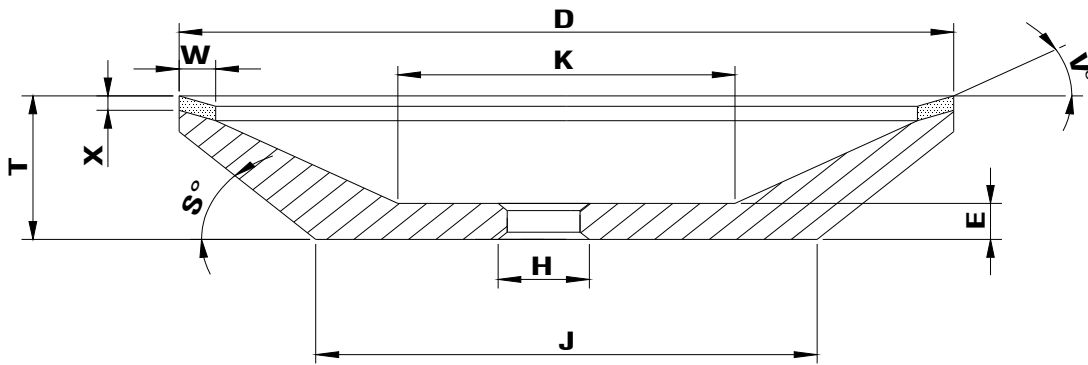


FORM			D x T x H						D --- W/U			--- X					
12C2			125 x 25 x 25						125 --- 6/4			--- 2					
D	T	H	W	U	X	K	J	E	D	T	H	W	U	X	K	J	E
50	26	INDICATED ON ORDERS	5	2	1	26	20	8	150	25	INDICATED ON ORDERS	12	5	2	104	106	12
			6			24						13			102		
			8			20						15			98		
60	20		4	2	1	30	22	8	175	25		5	5	2	143	131	12
			5			28						6			141		
75	22		5	3	2	45	33	10				8			137		
			6			43						10			133		
			8			39						12			129		
			10			35						15			123		
90	22		4	4	2	62	48	10	200	25		5	5	2	168	156	12
			6			58						6			166		
100	25		5	4	2	64	54	10				8			162		
		6			62			10					158				
		8			58			15					148				
		10			54			10			5	2	183	181	12		
		12			50			15					173				
125	25	5	4	2	89	79	10			20			163				
		6			87					5	5	2	218	206	12		
		8			83					6			216				
		10			79					8			212				
		12			75					10			208				
150	25	15			69					15			198				
		5	5	2	118	106	12			22			184				
		6			116					25			178				
		8			112												
			10			108											
<b>12C2</b>																	

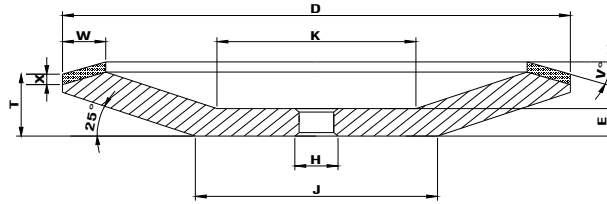


FORM		D	x	T	x	H	D	---	W	---	X/V°
12V4		75	x	22	x	20	75	---	4	---	2/10°
D	T	H	W	X	V°	K	J	S°	E		
75	14	<i>INDICATED ON ORDERS</i>	4	1	10	35	40	30	8		
				2		33	36	25			
				3		41	41	25			
			6	1		34	40	30			
				2		33	36	25			
				3		41	41	25			
			10	1		33	40	30			
				2		33	36	25			
				3		41	41	25			
			22	4		1	20	30		39	45
						2		30		41	
						3		31		43	
	6				1	30		39			
					2	30		41			
					3	33		43			
	10			1	33	39					
				2	35	41					
				3	37	43					
	4			1	30	39					
				2	31	41					
				3	34	43					
			6	1	30	39					
				2	30	41					
				3	33	43					
10	1	30	39								
	2	30	41								
	3	33	43								

**12V4**

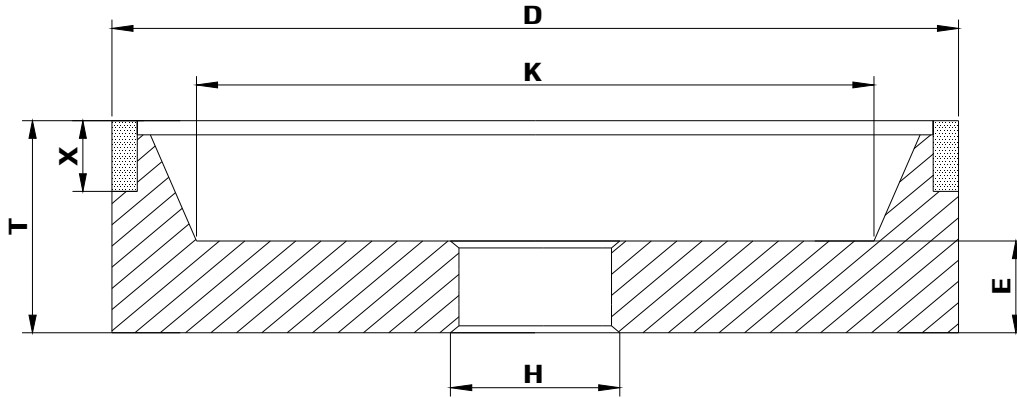


FORM		D x T x H			D --- W --- X/V°						
12V4		125 x 20 x 25			125 --- 6 --- 2/10°						
D	T	INDICATED ON ORDERS	H	W	X	V°	K	J	S°	E	
75	22				10	3	20	30	43	45	8
100	18				4	1	10	57	52	30	10
						2		54	55		
						3		60	58		
					6	1		55	52		
						2		54	55		
						3		59	58		
					10	1		54	52		
						2		57	55		
		3				56		58			
125	20			4	1	10	60	56	25	10	
					2		63	61			
					3		70	65			
				6	1		60	56			
					2		61	61			
					3		69	65			
				10	1		60	56			
					2		60	61			
					3		66	65			
150	20			4	2	10	88	86	25	10	
					3		95	90			
				6	2		86	86			
					3		94	90			
				10	2		86	86			
					3		91	90			
							<b>12V4</b>				

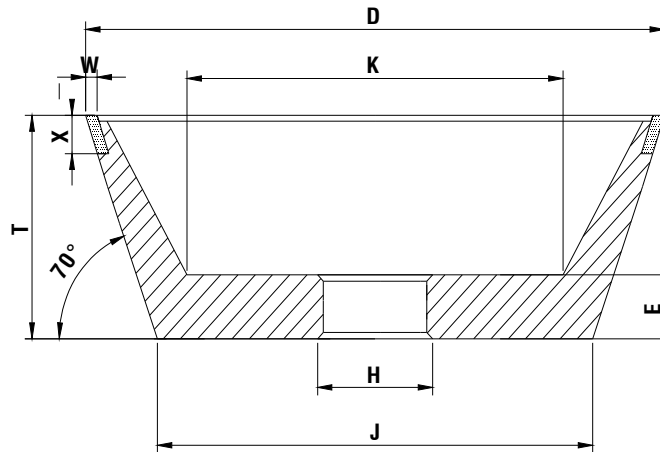


FORM		D x T x H			D --- W --- X/V <sup>0</sup>										
12V4		100	x	18	x	20	100	---	10	---	2/20 <sup>0</sup>				
D	T	H	W	X			V <sup>0</sup>	K	J	E					
75	15	<b>INDICATED ON ORDERS</b>	4	1	2	3	10	45	36	10					
							20								
			10				43								
			20												
			10				41								
			20												
100	16		6	10	1	2	3	10	66	56					10
	18							20							
								10	48						
	20														
125	18		<b>INDICATED ON ORDERS</b>	6	1	2	3	10	84	82					10
								20							
		10		80											
		20													
		10		64											
		20													
150	20	<b>INDICATED ON ORDERS</b>		6	1	2	3	10	100	102	12				
								20							
				10				92							
				20											
				10				88							
				20											
			10	74											
			20												
							<b>12V5</b>								

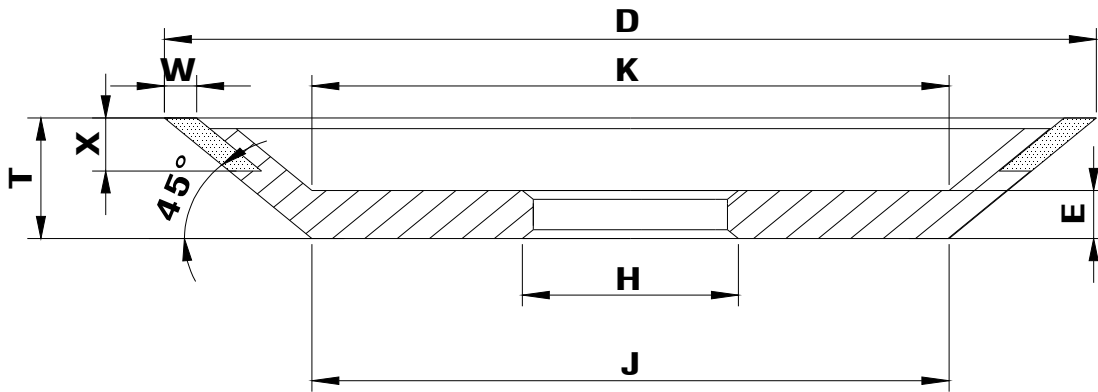




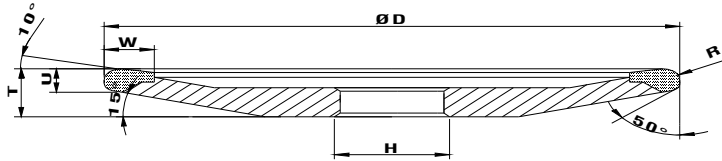
FORM		D x T x H		D --- W --- X									
6A9		100 x 30 x 25		100 --- 3 --- 5									
D	T	H	W	X	K	E	D	T	H	W	X	K	E
50	20	INDICATED ON ORDERS	1,5	5 6 10	35	8	125	30	INDICATED ON ORDERS	4	5 6 10	105	13
			2							5			
			3							1,5			
			4							2			
60	20		1,5		45	8	150	35		3		127	13
			2							4			
			3							5			
			4							2			
75	25		1,5		55	10	175	35		3		152	13
			2							4			
			3							5			
			4							2			
		5	3										
90	25	4	70	10	200	40	4	175	15				
		6					5						
		5					2						
100	30	1,5	80	13	225	40	3	200	15				
		2					4						
		3					2						
		4					3						
125	30	1,5	105	13	250	40	4	225	15				
		2					5						
		3											
										<b>6A9</b>			



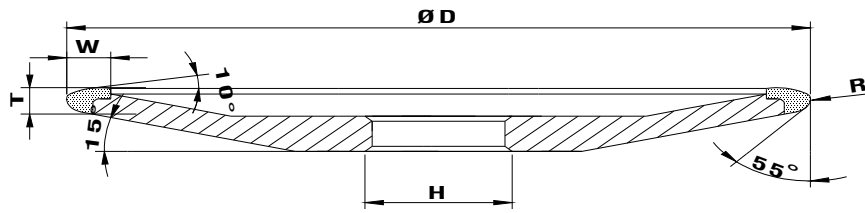
FORM 11V9										
D x T x H		D --- W --- X								
125 x 40 x 25		125 --- 2 --- 10								
D	T	H		X		K	J	E		
50	25	INDICATED ON ORDERS		1,5		23	31	10		
				2					6	10
				3						
75	30			1,5		6	10	40	52	10
				2						
				3						
90	35			1,5		10		45	64	10
				2						
				3						
100	35	1,5		6	10	55	74	10		
		2								
		3								
125	40	1,5		6	10	75	95	10		
		2								
		3								
150	40	1,5		6	10	90	113	10		
		2								
		3								
175	40	1,5		6	10	106	135	15		
		2								
		3								
								<b>11V9</b>		



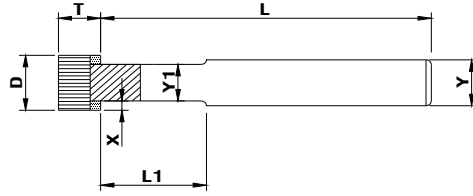
FORM 12V9								
D x T x H		D --- W --- X						
75 x 20 x 20		75 --- 3 --- 6						
D	T	H	W	X	K	J	E	
50	20	<b>INDICATED ON ORDERS</b>	1,5	6	20	30	10	
			2					
			3					
75	20		1,5	6	10	45	34	10
			2					
			3					
100	20		1,5	6	10	65	59	10
			2					
			3					
125	25	1,5	6	10	80	74	10	
		2						
		3						
150	25	1,5	5		96	100	10	
		2						
		3						
		1,5						6
2								
3								
<b>12V9</b>								



FORM 4C2-409 D x T x H 75 x 13 x 20 D --- W --- U/R 75 --- 6 --- 4,4/1,5											
D	T	H	W	U	R	D	T	H	W	U	R
50	8	INDICATED ON ORDERS	4	3,2	1	125	13	INDICATED ON ORDERS	6	4,4	1,5
75	13		4	3,2	1					4,8	1,75
			6	4,4	1,5					5,1	2
				5,9	2,5					5,5	2,25
			4	2,6	0,66					5,9	2,5
				3,9	1,5					6,3	2,75
				5,1	2					6,7	3
				3,6	1					7	3,2
			6	4,4	1,5					7,4	3,5
5,1	2			4,5	1,6						
6,7	3			5,1	2						
4,4	1,5			5,9	2,5						
100	13	INDICATED ON ORDERS	4	3,6	1	150	13	INDICATED ON ORDERS	6	6,5	3
				4,4	1,5					7	3,2
				5,1	2					8,2	4
				5,5	2,2					5,5	2,25
			6	5,9	2,5					6,7	3
				6,7	3					5,9	2,5
				4,4	1,5					6,7	3
				5,1	2					5,9	2,5
					200	12			6,7	3	
<b>4C2</b>											

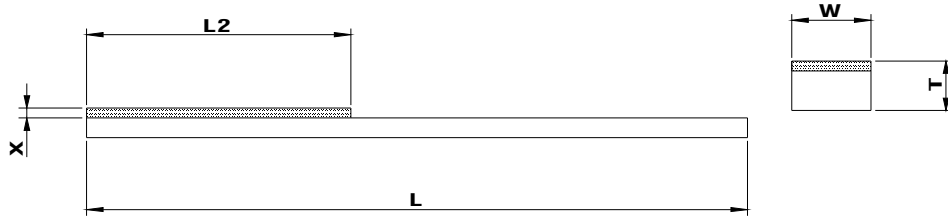


FORM 4C2-2204 D x T x H 100 x 13 x 25 D --- W --- U/R 100 --- 6 --- 6,6/2,5											
D	T	H	W	U	R	D	T	H	W	U	R
50	8	INDICATED ON ORDERS	4	3,7	1	125	13	INDICATED ON ORDERS	6	5,2	1,5
75	8		4	3,7	1					5,5	1,75
			6	6,6	2,5					5,9	2
	13		4	3,2	0,66					6,2	2,25
			6	4,5	1					6,6	2,5
100	13			6	5,2					1,5	6,9
			7,2		3					7,2	3
			4	4,9	1,5					7,5	3,2
				4,5	1					7,9	3,5
			6	5,2	1,5					5,9	2
				5,9	2					7,2	3
				6,6	2,5					8,6	4
		7,2		3	7,2	3					
					175	13	6	7,2	3		
					200	13	8	4	1,5		
<b>4C2</b>											



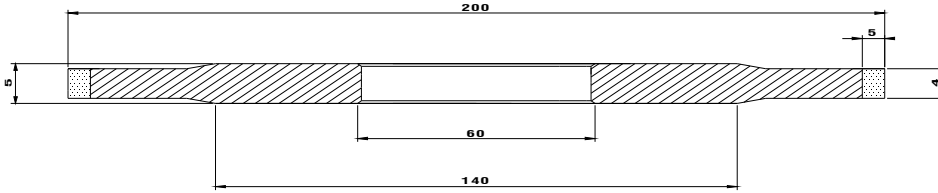
FORM			D	x	T	x	Y	D	---	T	---	X	
1A1W			10	x	10	x	6	10	---	10	---	2	
1A8W			6	x	6	x	6	6	--	6			
D	T	Y	X	L	L1	Y1	D	T	Y	X	L	L1	Y1
3	4	3		45	8	1,7	14	6	6	2	60		
4	5	3		45	8	2		10					
5	5	3		45	8	2		6					
6	4	3		45			15	10	6	2	60		
	6	6		60	10	3		15					
7	8	6			12		16	6	6	2	60		
	4			60	10	3	18	10	6	2	60		
	6	6			12		18	6	6	2	60		
8	8			60	10	4	20	10	6	2	60		
	6	6	2		12	4		6	6	2	60		
9	10	6	2	60	10	5	24	10	6	2	60		
	6	6			15			6	6	2	60		
10	6	6	2	60									
	10												
12	6	6	2	60									
	10												
	12												

**1A8W**  
**1A1W**

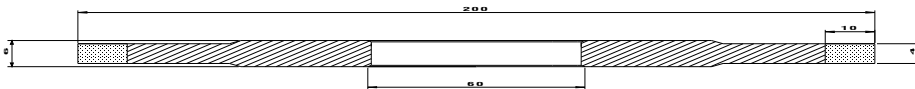


FORM		D	x	T	x	W	L2	---	W	---	X
FHG		140	x	10	x	12	40	---	12	---	2
<i>L</i>	<i>T</i>			<i>W</i>			<i>L2</i>	<i>X</i>			
<b>140</b>	<b>6</b>			<b>6</b>			<b>25</b>	<b>1</b>	<b>2</b>		
				<b>6</b>			<b>40</b>	<b>1</b>	<b>2</b>		
	<b>10</b>			<b>10</b>			<b>25</b>	<b>1</b>	<b>2</b>		
				<b>10</b>			<b>40</b>	<b>1</b>	<b>2</b>		
				<b>12</b>			<b>25</b>	<b>1</b>	<b>2</b>		
				<b>12</b>			<b>40</b>	<b>1</b>	<b>2</b>		
								<b>DBH</b>			

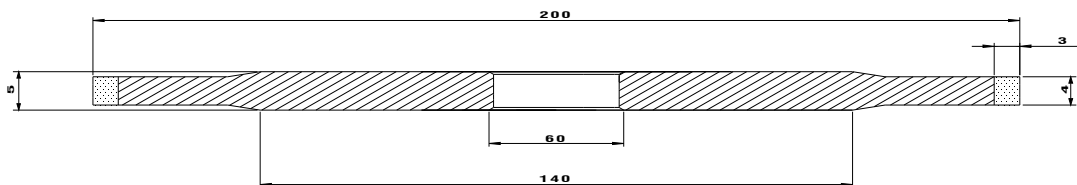
# 14A1



# 14A1-200-4-10-61

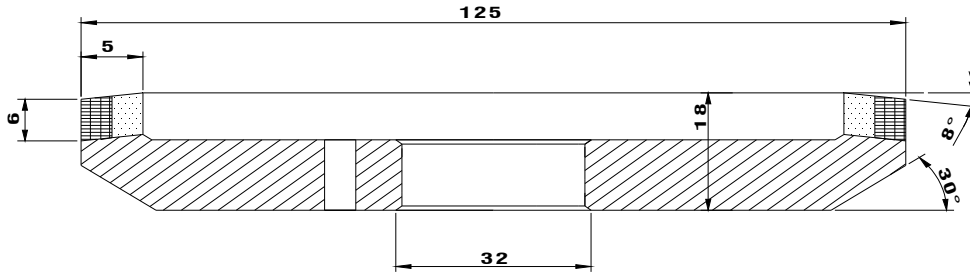


# 14A1-200-4-3-60

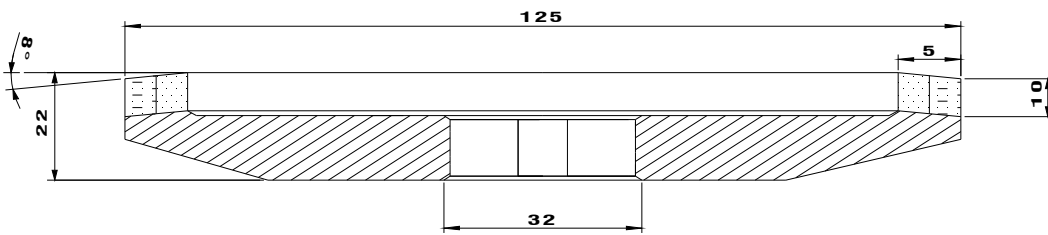




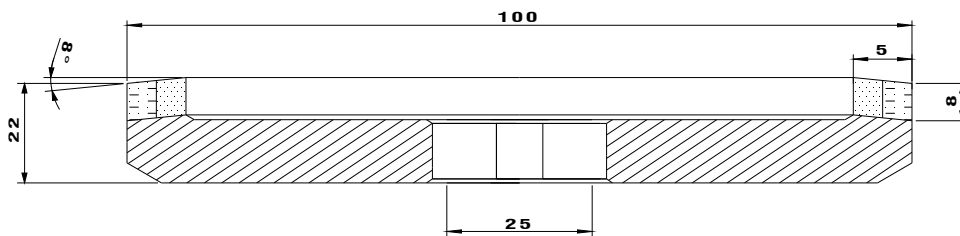
# **BT15**



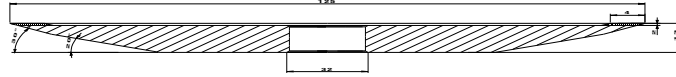
# **6K222**



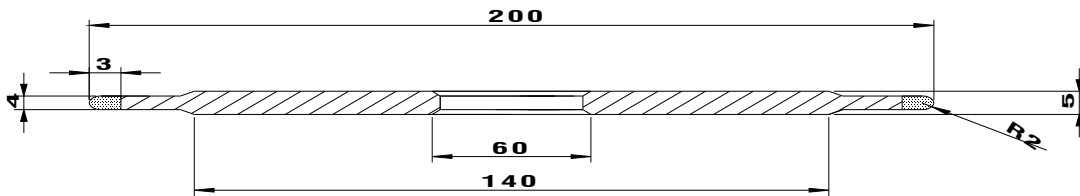
# **6K222**



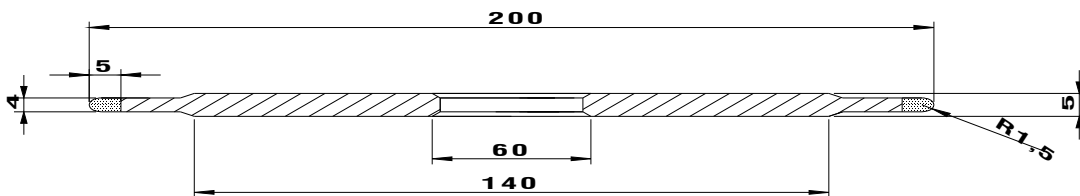
## 2K12V2



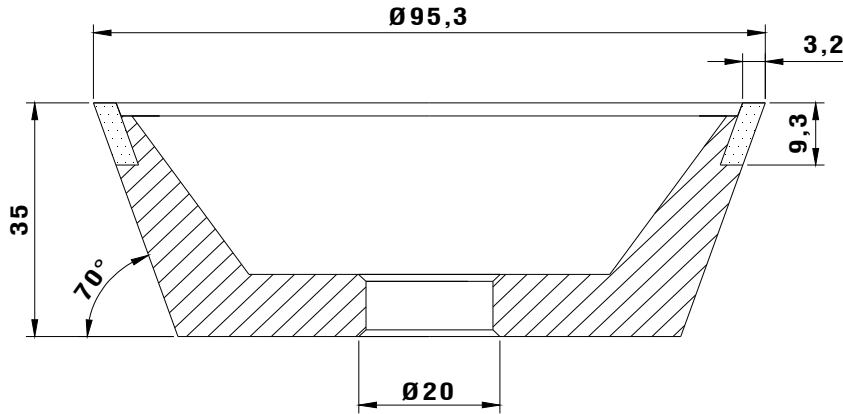
## 14F1



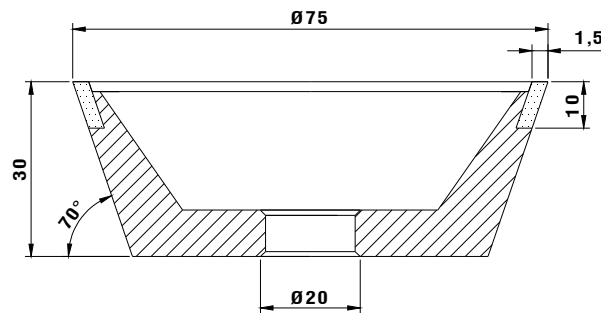
## 14F1



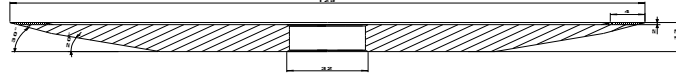
## **11V9-95,3-3,2-9,3-20**



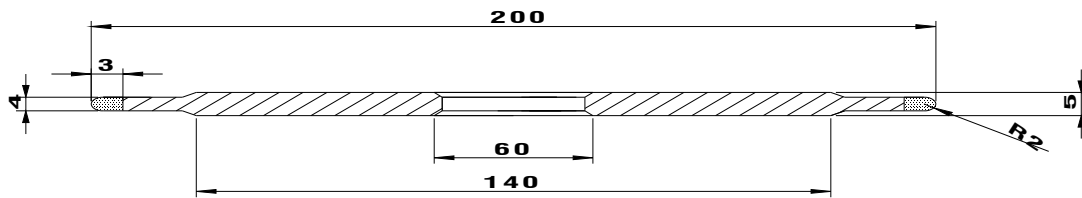
## **11V9-75-1,5-10-20**



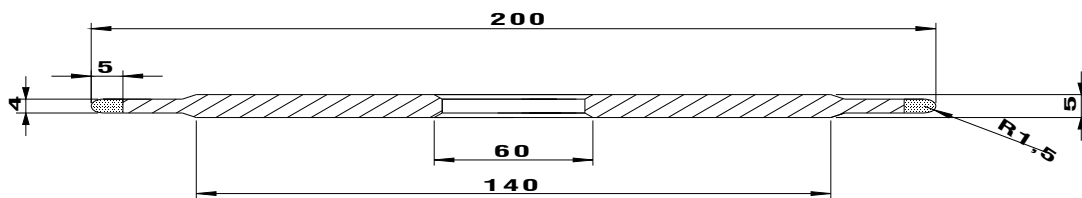
# 2K12V2



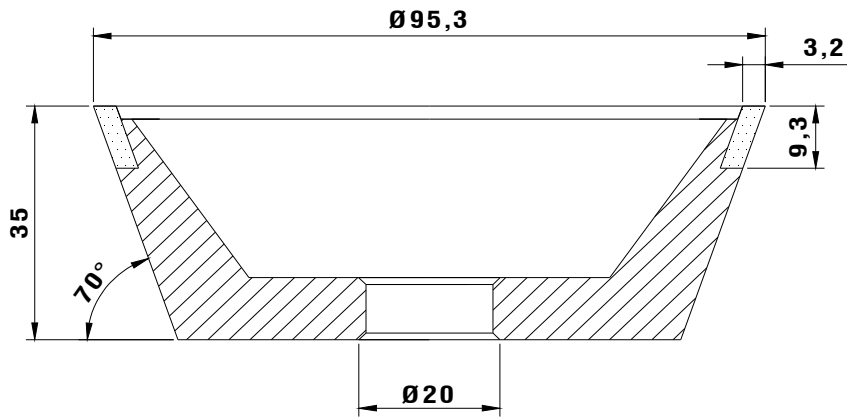
# 14F1



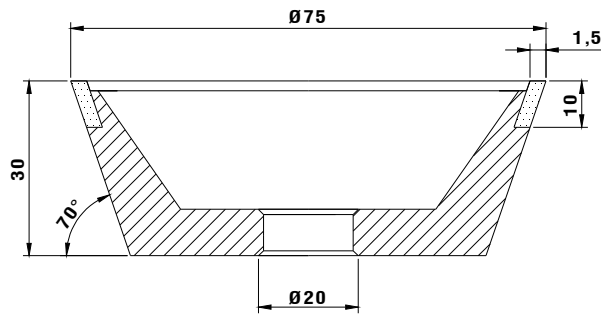
# 14F1



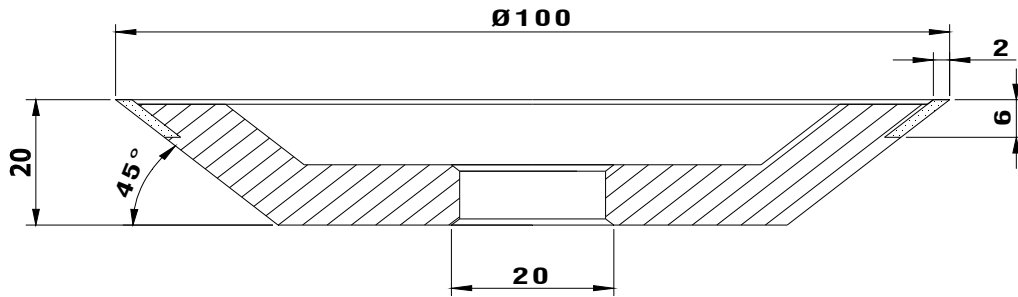
**11V9-95,3-3,2-9,3-20**



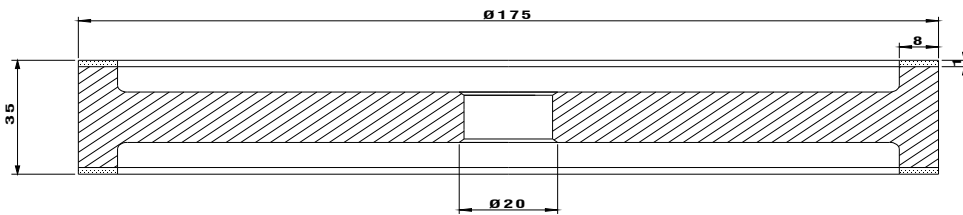
**11V9-75-1,5-10-20**



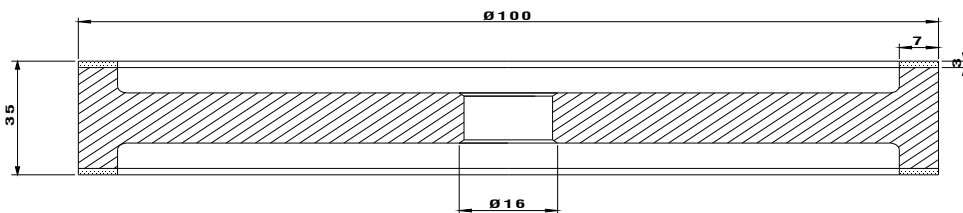
**12V9-100-2-6-20**



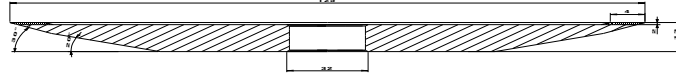
**9A3-175-8-1-35-20**



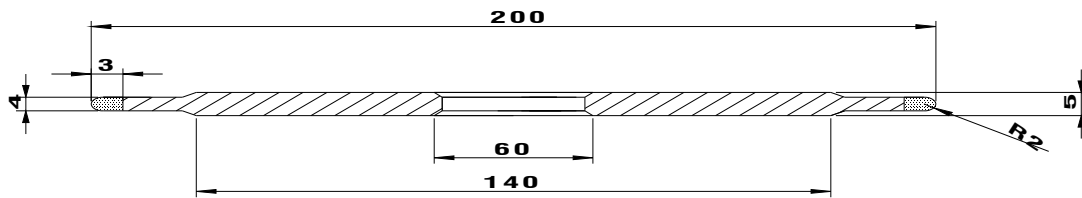
**9A3-100-7-3-16**



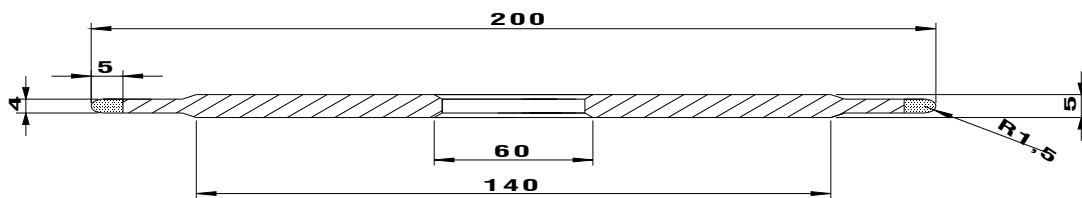
## 2K12V2



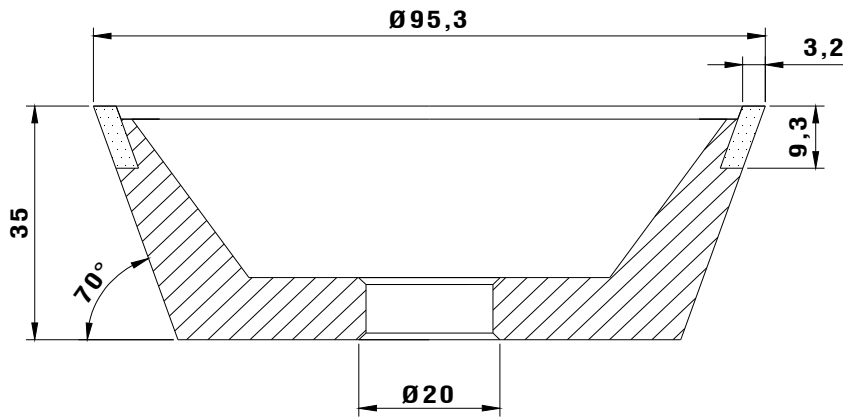
## 14F1



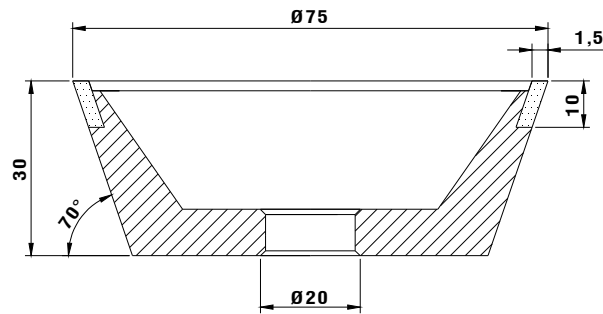
## 14F1



## **11V9-95,3-3,2-9,3-20**

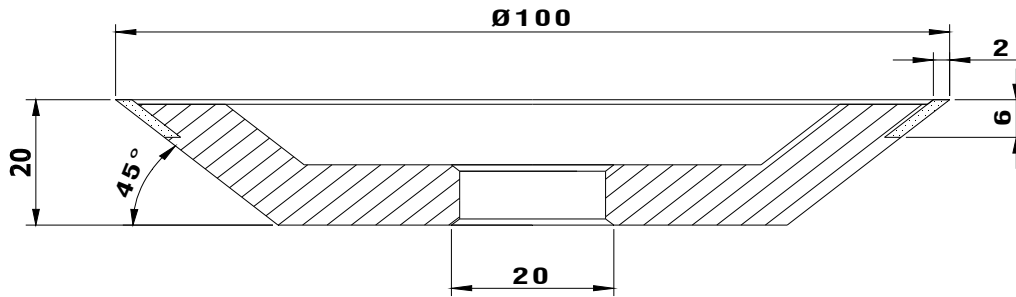


## **11V9-75-1,5-10-20**

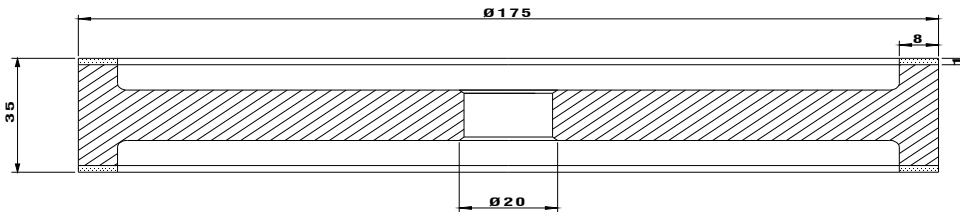




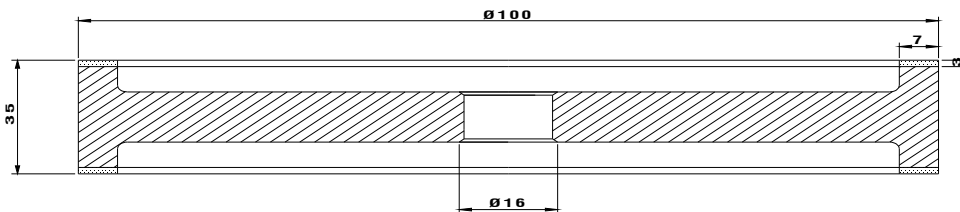
# 12V9-100-2-6-20



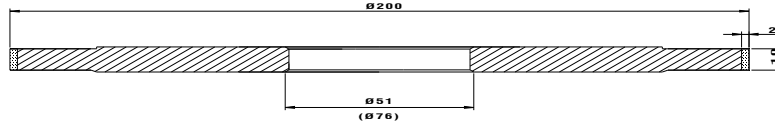
# 9A3-175-8-1-35-20



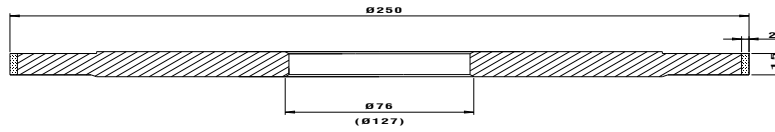
# 9A3-100-7-3-16



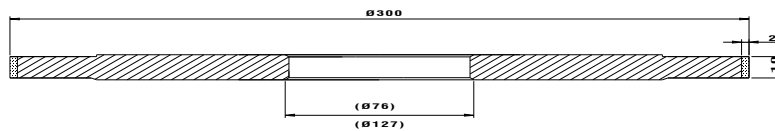
## **1A1-200-10-2-51-(76)**



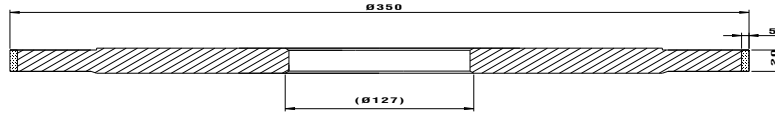
## **1A1-250-15-2-76-(127)**



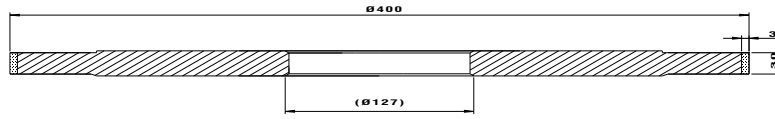
## **1A1-300-10-2-76-(127)**



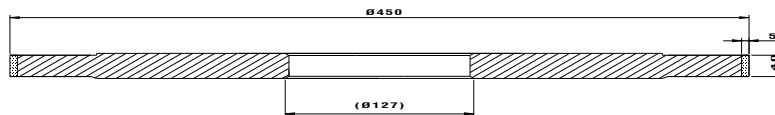
## **1A1-R350-20-5-127**



## **1A1-R400-30-3-127**

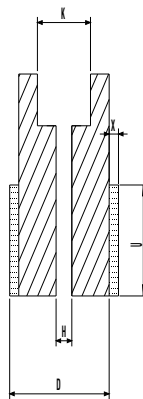
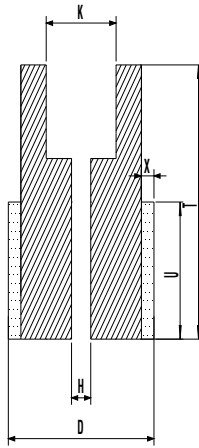
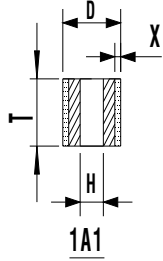


## **1A1-R450-40-5-127**



**ELMAS VE CBN TAŞLAMA TAKIMLARI ( DELİK TAŞLAMA İÇİN )**

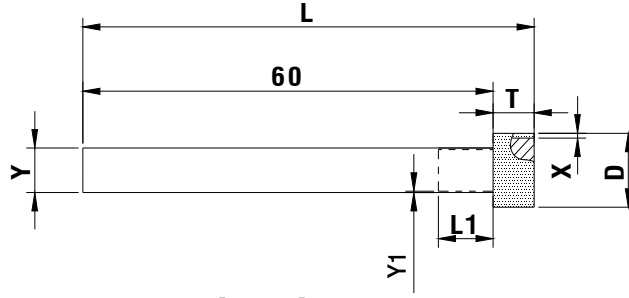
ELMAS C100 CBN V180 – V240



**ELMAS VE CBN TAŞLAMA TAKIMLARI ( DELİK TAŞLAMA İÇİN )**

FORM	D	T	X	H
1A1	10	6	2	İSTEĞE BAĞLI
1A1	10	10	2	
1A1	11	6	2	
1A1	11	10	2	
1A1	12	6	2	
1A1	12	10	2	
1A1	13	6	2	
1A1	13	10	2	
1A1	14	6	2	
1A1	14	10	2	
1A1	15	6	2	
1A1	15	10	2	
1A1	15	15	2	
1A1	16	6	2	
1A1	16	10	2	
1A1	16	15	2	
1A1	17	6	2	
1A1	17	10	2	
1A1	17	15	2	
1A1	18	6	2	
1A1	18	10	2	
1A1	18	15	2	
1A1	20	6	2	
1A1	20	10	2	
1A1	20	15	2	
1A1	22	6	2	
1A1	22	10	2	
1A1	22	15	2	
1A1	24	6	2	
1A1	24	10	2	
1A1	24	15	2	
1A1	25	6	2	
1A1	25	10	2	
1A1	25	15	2	
1A1	27	6	2	
1A1	27	10	2	
1A1	27	15	2	
1A1	30	6	2	
1A1	30	10	2	
1A1	30	15	2	
1A1	32	6	2	
1A1	32	10	2	
1A1	32	15	2	
1A1	35	6	2	
1A1	35	10	2	
1A1	35	15	2	
1A1	40	10	2	
1A1	45	15	2	
1A1	50	10	2	

**ELMAS VE CBN TAŞLAMA TAKIMLARI ( DELİK TAŞLAMA İÇİN )**  
**ELMAS C100 CBN V180 – V300**



**1A1W**

FORM	D	T	X	Y	Y1	L	L1
1A1W	3	6	0,65	3	1,7	66	8
1A1W	4	6	1,15	3	1,7	66	8
1A1W	5	6	1,5	3	2	66	8
1A1W	6	6	1,5	6	3	66	8
1A1W	6	8	1,5	6	3	68	10
1A1W	7	6	2	6	3	66	8
1A1W	7	8	2	6	3	68	10
1A1W	8	6	2	6	4	66	8
1A1W	8	10	2	6	4	70	12
1A1W	9	6	2	6	5	66	8
1A1W	10	6	2	6		66	
1A1W	10	10	2	6		70	
1A1W	12	6	2	6		66	
1A1W	12	12	2	6		72	
1A1W	14	6	2	6		66	
1A1W	15	6	2	6		66	
1A1W	15	15	2	6		75	
1A1W	16	6	2	6		66	
1A1W	18	6	2	6		66	
1A1W	20	6	2	6		66	
1A1W	24	6	2	6		66	

