

BRUSNI ALATI



Industrija Brusnih Alata

Grinding Tool Industry

Member of the Argonauts International Group

GREEN STAR

GRINDING TOOLS





Europe

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Industrija brusnih alata "IBA" A.D. ADA je osnovana 1948. godine pod imenom "8. Mart".

Marta 2010 godine, kompanija je privatizovana i posluje u okviru Argonauts Group (www.agonauts-group.com) kao akcionarsko društvo listirano na beogradskoj berzi. Argonauts Group investira u uspešne kompanije sa ciljem daljeg unapredjenja njihovog poslovanja i podizanja profitabilnosti. Portfolio investicija Argonauts Group može se podeliti na investicije u :

- industrijsku proizvodnju i gradjevinarstvo "IBA" A.D. Ada, Krušik Akumulatori A.D. Valjevo, Hidrotehnika d.o.o. Beograd i manjinski paket u Beograf A.D. Beograd.
- Finansijski sektor, usluge i nekretnine: brokersko dilersko društvo Athena Capital Beograd, Hidrotehnika d.o.o. Beograd, Atalanta Properties Beograd i manjinski paketi u kompanijama Takovo Osiguranje Kragujevac, Credy Bank Kragujevac.

"IBA" A.D. Ada na razvojnem putu ona se bavila proizvodnjom hemijskih proizvoda, kožnog tutkala, briketa za livnice, mlinskih kamenova itd.

1964. godine je izgradjen i pušten u pogon deo za proizvodnju tocila u keramičkom i smolnom vezivu. Ugrađeni kapaciteti omogućuju proizvodnju od oko 1200 tona/god. ovih proizvoda. U standardnom asortimanu se proizvodi oko 6000 vrsta tocila za najrazličitije namene do maksimalnog prečnika od 660 mm. Postojećim asortimanom kao i sopstvenim razvojem nastojimo da pratimo sve oštire zahteve tržišta, kako u pogledu raznolikosti oblika i dimenzija tako i u pogledu novih kvaliteta. Tako ovde možemo navesti proizvodnju najjednostavnijih radioničkih tocila, pa do proizvodnje specijalnih tocila za industrije ležajeva do radne brzine od 80 m/s, impregniranih sa sumporom, superfiniš tocila do granulacije 1000 itd. Naša tehničko-tehnološka služba u svakom momentu stoji na raspolaganju potrebama naših cenjenih potrošača.

Ovaj katalog ima za cilj pored upoznavanja sa proizvodnim programom "IBA" ADA i davanje osnovnih tehničkih uputstava za pravilan izbor tocila za odgovarajuće namene.

U toku 1995. je uveden sistem kvaliteta po standardu JUS ISO 9002, certifikat broj QS2-0009.

Sistem upravljanja kvalitetom je stalno usaglašen sa novijim zahtevima. Danas imamo implementiran sistem obezbeđenje kvaliteta po ISO 9001:2008.

"IBA" A.D. ADA was established in 1948, under the name "8. Mart."

The company was privatized in March 2010 by Argonauts Group (www.agonauts-group.com) and since then is operating as a shareholding company listed on Belgrade Stock Exchange. Argonauts Group is investing in successful companies with the main aim to improve the operations and profitability of invested companies. The Argonauts Group's investment portfolio can be presented as investments in:

- Industrial production and construction :"IBA" A.D. Ada , Krusik Akumulatori A.D. Valjevo, Hidrotehnika Belgrade and minority shareholding in Beograf Belgrade.*
- Financial sector, services and real estate brokerage house Athena Capital Belgrade, Atalanta Properties Belgrade and minority shareholdings in Takovo Insurance Kragujevac and Credy Bank Kragujevac.*

"IBA" A.D. Ada since its founding, it has been involved in the production of chemical products, leather glue, as well as foundry briquette and mill stone manufacture.

In 1964, another part of the company was developed to produce grinding wheels of a ceramic and resin-based mixture. The production capacity reaches about 1200 tonnes/year. In the standard selection, about 6000 grinding wheels, with the maximum diameter of 660 mm, are produced for various uses and purposes. In the present selection and development, we strive to follow the current market's demands for quality and production. We can manufacture the simplest workshop whetstones, but also construct special grinding wheels for the bearing industry, to the working speed of 80 m/s, sulfur-impregnated, or superfinish grinding wheels with ultra fine grains of 1000, etc. Our technical-technological crew is at the valued costumers' service and disposal.

This catalogue aims to introduce the IBA ADA production program, as well as to offer technical instructions on the selection and use of our grinding wheels and whetstones.

IBA ADA has been working with the quality certificate JUS ISO 9002, number QS2-0009 since 1995.

The Quality System Management is always harmonized with their new requirements. Today, we work according to ISO 9001:2008.

OPŠTI PODACI O TOCILIMA I BRUŠENJU

BRUŠENJE

Pod brušenjem se podrazumeva postupak oblikovanja, skidanjem strugotina, pri čemu se sa brušenog predmeta, pomoću brojnih, relativno malih šiljastih abrazivnih zrna sa oštrim ivicama skida strugotina. Prilikom brušenja abrazivna zrna se habaju na radnoj površini tocila. Dužim radom, sile koje dejstvuju na abrazivno zrno porastu, tako da se ona delimično ili potpuno odvajaju iz veze, međutim iza izlomljenih abrazivnih zrna se nalaze netaknuta oštra zrna, tako da se radna površina tocila stalno regeneriše. Ovo se često naziva abrazivnom tehnologijom i obično u pogledu na cilj koji možemo postići možemo je podeliti u tri osnovne grupe:

- održavanje geometrije oblika
- površinska obrada
- razdvajanje materijala.

Rad brušenja i istovremenog habanja se može svesti na tri principijelna uzroka:

1. Habanje abrazivnih zrna usled trenja
2. Mehanički lom abrazivnih zrna (delimično)
3. Uništenje sastava vezivnog sredstva.

BRUSNI ALATI

Brusni alati su pravilna geometrijska tela i predstavljaju aglomerat abrazivnog zrna i veziva koje povezuje abrazivna zrna u jednu celinu sa porama. Abrazivna zrna su uglavnom nepravilnog oblika, po svom obimu poseduju veći broj oštrih reznih ivica koja u kontaktu sa materijalom koji se obradjuje skidaju strugotine. U rezanju učestvuje istovremeno veći broj zrna, te se uzima da je tocilo rezni alat sa više sečiva.

Brusni alati po načinu rada mogu biti:

- ROTIRAJUĆI (ravna, razni oblici, sa drškom itd.)
- NEROTIRAJUĆI (segmenti, turpije, honinzi)

ABRAZIVNI MATERIJALI

Abrazivni materijali su tvrda tela koja posle usitnjavanja imaju zrnasti oblik. Služe da na drugim telima-materijalima, putem neposrednog pritiska i trenja izvrše obradu istih. Tom prilikom se i sami troše. Kao abrazivna sredstva se danas uglavnom koriste veštački materijali, a samo mali udeo imaju prirodni materijali. Od veštačkih abraziva se u klasičnim tocilima koriste korundi i silicijumkarbidi.

GENERAL INFORMATION ABOUT GRINDING AND GRINDING WHEELS

GRINDING

"Grinding" is the action of forming an object by removing shavings from it with the help of a number of relatively small pointed abrasive grains (abrasives) with sharp sides which can be found on the surface of the grinding wheel. While grinding, the abrasive wears out to perform the action. During longer work, the force which acts on the abrasives increases and the grains partly or totally separate from the bond; however, behind the separated abrasives, lays a layer of untouched and sharp grains, and thus, the wheel's active area is regenerated (this is called "dressing"). This is often referred to as "abrasive technology," and according to the goal of our grinding work, it can be divided into three general categories:

- maintaining geometric shape
- surface treatment
- separating material

Grinding and the simultaneous wearing out happen for three reasons:

1. Friction on the abrasives
2. Partial mechanical breakage of the abrasives
3. Destruction of the bonding agent (binder)

GRINDING TOOLS

Grinding tools are geometric bodies and they are made up of abrasives bonded together, forming a circular, porous shape. The abrasives are usually irregularly shaped, and their surface is composed of a number of sharp, cutting edges which come into contact with the material being grinded, thereby cutting a small chip from the workpiece. In this cutting, the abrasive grains' sharp edges work together simultaneously so that the whetstone acts as a cutting tool with many small blades.

Grinding tools can be categorized according to the way they work, as:

- rotating (flat surface, various shapes, mounted wheels, etc.)
- non-rotating (segments, files, hones).

ABRASIVE MATERIALS

Abrasive materials are hard masses which, when cut, have a granular shape. They are used, by the application of pressure and friction, to work on other masses or materials. During this action, the abrasive materials are themselves expended. Most abrasives today are constructed from artificial materials, and only a small amount of these materials consist of natural minerals. Classic whetstones from artificial materials are made of corundum or silicon carbide.

Korundi

Po hemijskom sastavu je Al_2O_3 , sa manje ili više primesa drugih oksida. Razlikujemo ga u više varijanti, počevši od najjednostavnijeg normal-korunda, preko poluplemenitog, pa do plemenitog korunda.

U zavisnosti od legirajućih elemenata postoji takozvani roza, rubin i cirkon korund. Posebnu vrstu čini monokristalni korund.

Glavne karakteristike korunda su:

- mikrotvrdoća od 16000 do 22000 N/mm²
- termička postojanost do 1800° C
- velika tvrdoća i kod dinamičkih opterećenja
- sadržaj Al_2O_3 od 94 do 99,8%

Silicijum-karbidi

Ovaj abrazivni materijal je jedan od najtvrdjih karbida. Po hemijskom sastavu je SiC. Razlikujemo ga u dve osnovne vrste i to: zeleni SiC, koji je tvrdji, i crni SiC, koji je žilaviji. Glavne karakteristike:

- mikrotvrdoća od 26000 do 30000 N/mm²
- termička postojanost do 1400° C
- vrlo krta i oštra zrna

TVRDOĆA I ŽILAVOST ABRAZIVNIH ZRNA

Ove dve osobine abrazivnih zrna su u obrnutoj srazmeri, odnosno što je veća mikrotvrdoća, manja je žilavost i obrnuto.

Corundum

Its chemical structure is Al_2O_3 , with a few more or less oxides. Its variants are differentiated from the simplest normal corundum, through to semi-noble, to noble corundum. Depending on what elements are fused, rose, ruby and zircon corundum can be produced.

The main characteristics of corundum are:

- its microhardness ranges from 16000 to 22000 N/mm²
- its thermal stability reaches 1800° C
- a high hardness even under pressure
- a content of 94% to 99.8% of Al_2O_3

Silicon Carbides

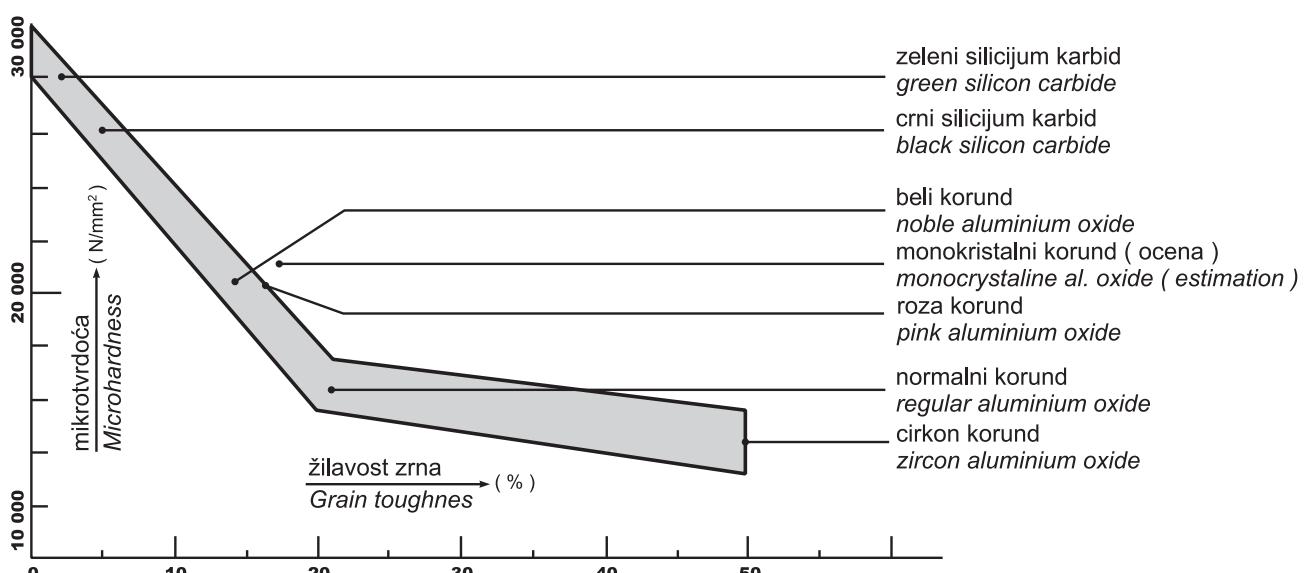
This abrasive material is one of the hardest carbides. Its chemical structure is SiC. Two main groups of SiC can be identified: green, which is harder, and black, which is tougher.

The main characteristics of Silicon Carbide are:

- its microhardness ranges from 26000 to 30000 N/mm²
- its thermal stability reaches 1400° C
- its grains are very brittle and sharp

THE HARDNESS AND TOUGHNESS (GRAIN STRENGTH) OF ABRASIVES

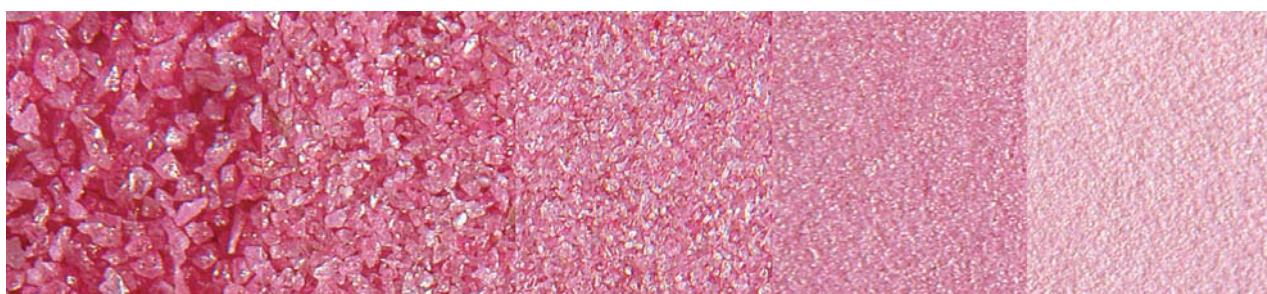
These two characteristics of abrasives are inversely proportional, that is to say, as microhardness increases, toughness decreases.



Specifična površina abrazivnih zrna

Specific Surface of Abrasive Grains

| Nº ZRNA Nº OF GRAINS | PREČNIK ZRNA (µm) GRAIN DIAMETER (µm) | SPEC. POVRŠINA ZA KORUND (cm ² /g) SPECIFIC CORUNDUM SURFACE (cm ² /g) | SPEC. POVRŠINA ZA SiC (cm ² /g) SPECIFIC SiC SURFACE (cm ² /g) |
|-------------------------|--|---|---|
| 6 | 3360 | 6,8 | 8,3 |
| 8 | 2380 | 9,7 | 11,3 |
| 10 | 2000 | 11,5 | 14,0 |
| 12 | 1680 | 13,7 | 16,6 |
| 14 | 1410 | 16,3 | 19,9 |
| 16 | 1190 | 19,3 | 23,5 |
| 20 | 1000 | 23,0 | 28,0 |
| 24 | 710 | 32,4 | 39,4 |
| 30 | 590 | 39,0 | 47,4 |
| 36 | 500 | 46,0 | 56,0 |
| 40 | 420 | 54,8 | 66,6 |
| 46 | 350 | 66,0 | 80,0 |
| 54 | 297 | 78,0 | 94,0 |
| 60 | 250 | 92,0 | 112,0 |
| 70 | 210 | 109,0 | 133,0 |
| 80 | 177 | 130,0 | 162,0 |
| 90 | 149 | 154,0 | 188,0 |
| 100 | 125 | 184,0 | 224,0 |
| 120 | 105 | 219,0 | 266,0 |
| 150 | 88 | 261,0 | 318,0 |
| 180 | 74 | 311,0 | 378,0 |
| 220 | 53 | 434,0 | 527,0 |
| 240 | 44 | 522,0 | 635,0 |
| 280 | 37 | 622,0 | 755,0 |



GRANULACIJA

Veličina abrazivnih zrna je definisana internacionalnim FEPA standardom i označava se brojevima. Broj pokazuje koliko otvora ima na situ kroz koje dotično zrno prolazi na dužini od jednog col-a. Na osnovu ovoga možemo ustanoviti da što je manji broj oznake to je zrno većih dimenzija i obrnuto.

SKRAĆENA OZNAKA GRANULACIJE

F 10 do F 1200

GRIT DESIGNATION

F 10 to F 1200

| | |
|-----------------|------|
| F.....10..... | 2030 |
| F.....12..... | 1705 |
| F.....14..... | 1435 |
| F.....16..... | 1205 |
| F.....20..... | 1015 |
| F.....24..... | 720 |
| F.....30..... | 605 |
| F.....36..... | 510 |
| F.....46..... | 360 |
| F.....54..... | 300 |
| F.....60..... | 255 |
| F.....80..... | 180 |
| F.....100..... | 130 |
| F.....120..... | 110 |
| F.....150..... | 85 |
| F.....180..... | 70 |
| F.....220..... | 60 |
| F.....240..... | 44,5 |
| F.....280..... | 36,5 |
| F.....320..... | 49 |
| F.....360..... | 40 |
| F.....400..... | 32 |
| F.....500..... | 25 |
| F.....600..... | 19 |
| F.....800..... | 14 |
| F.....1000..... | 10 |
| F.....1200..... | 7 |

VEZIVA

Veziva služe za povezivanje abrazivnih zrna u jednu celinu, odnosno u tocilo. Vrste veziva određuju i osnovnu tehnologiju izrade. Vrsta i količina veziva određuju čvrstoću i tvrdoću tocila, odnosno sposobnost brušenja.

"IBA" u svom proizvodnom programu izrađuje tocila u keramičkom i smolnom, odnosno bakelitnom vezivu.

Keramičko vezivo

Ova veziva su na bazi feldspata, raznih glina, kaolina i drugih neorganskih materija. Termička obrada tocila sa keramičkom vezom se vrši na temperaturama od 1200-1320° C. Ova tocila nisu osetljiva na hemijske uticaje i mogu se lagerovati neograničeno dugo.

Smolno vezivo

Koristi se bakelitna smola koja je po svom hemijskom sastavu fenolformaldehidna smola. Ovo vezivo daje tocilu odlična mehanička svojstva. Pogodno je za

GRANULATION

Abrasive grain size is defined by international FEPA standards and is marked by numbers. These values show the number of openings on a sieve through which grains cross. According to these numbers, we can establish that the less the number is, the bigger the grain's size and vice versa.

SREDNJA OZNAKA ZRNA ds50

MEAN DIAMETER (ds50)

| |
|------|
| 2030 |
| 1705 |
| 1435 |
| 1205 |
| 1015 |
| 720 |
| 605 |
| 510 |
| 360 |
| 300 |
| 255 |
| 180 |
| 130 |
| 110 |
| 85 |
| 70 |
| 60 |
| 44,5 |
| 36,5 |
| 49 |
| 40 |
| 32 |
| 25 |
| 19 |
| 14 |
| 10 |
| 7 |

THE BOND MATERIAL (BINDERS)

Binders connect the abrasive grains which form a circular shape and make up the whetstone. The way in which the particles are bonded together also determines the technology of manufacturing. The type and amount of bond material used determine the hardness and density of the wheel, its grinding ability.

In its catalogue of products, IBA produces grinding wheels created with ceramic (vitrified), resinoid and magnesite binders.

Ceramic Binders

This binder is made of Feldspar, various types of clay, argilla (kaolin), and other inorganic materials. The thermal treatment of the wheels made with ceramic binders happens at a temperature between 1200 and 1320 C. These wheels are not chemical-sensitive and they can remain in stock unused for an unlimited time.

Resinoid Binders

Bakelite resin is used, which, by its chemical structure is phenol formaldehyde resin. This binder improves the mechanical characteristics of the whetstone. It is

armiranje, sa staklenim pletivom ili drugim vrstama armature. U poređenju sa keramičkim vezivom manje je osetljivo na nagle promene temperature i udarce, ali je osetljivije na hemijske uticaje i duže skladištenje.

Magnezitno vezivo

Ovo vezivo je na bazi kaustičnog magnezita i magnezijum hlorida. Tako nastala veza bez termičke obrade je tzv. hladna veza.

Veštački brusevi sa magnezitnom vezom su namenjeni za grubo i fino brušenje metala i nemetala. Kvalitet bruseva zavisi od vrste i veličine brusnog zrna i od tvrdoće brusa.

Brus ne podnosi veliko statičko i dinamičko opterećenje. Prilikom transporta treba paziti da se brus mehanički ne oštećeuje.

Magnezitni brusevi su hidroskopni, osetljivi na mraz, zato moraju skladištiti u suvim i zagrejanim prostorijama. Temperatura skladišnog prostora treba da bude na cca. 20° C a relativna vlažnost cca. 50%. Pod i zidovi koji su u blizini bruseva, moraju biti izolirani od vlage. Tokom brušenja za hlađenje obično se koristi voda ili neko drugo sredstvo za hlađenje

Magnezitni brusevi se koriste pri malim brzinama do 25 m/s

STRUKTURA TOCILA

Struktura tocila je jedan empirijski broj, koji nam jednoznačno određuje količinu abrazivnog zrna u jedinici zapremine tocila.

Tocila zatvoreniye strukture sadrže veći procenat abrazivnog zrna po jedinici zapremine, u odnosu na tocila sa otvorenijom strukturom.

Strukture se obeležavaju brojevima od 0-14. Strukturni brojevi preko 10 označavaju visoko porozno tocilo. Kod ovih tocila je poroznost veštački povećana specijalnim dodacima.

TVRDOĆA TOCILA

Tvrdoća tocila se manifestuje kao otpor koji pružaju vezana abrazivna zrna protiv ispadanja iz vezivnih mostova. Označavanje tvrdoće se vrši po takozvanoj Nortonovoj skali slovima abecede. Što je slovna oznaka bliže početku abecede, imamo mekše bruseve, a što je bliže kraju abecede, imamo tvrdje bruseve. Optimalnu tvrdoću ima ono tocilo kod kojega abrazivno zrno isпадa iz vezivnog mosta u momentu kada je postalo nepogodno za izvršavanje svoje osnovne funkcije, brušenja.

Najveći uticaj na tvrdoću ima ideo veziva, granulacija abrazivnih zrna i poroznost.

Merenje tvrdoće tocila se u "IBA" ADA vrši sa tri različita uredjaja i to:

- merenjem E modula "Grindosonic-aparatom"
- peskarenjem "Mackensen"
- utiskivanjem kuglice "Rockwel"

suitable for constructing metal framework with glass thatching or other fittings made of metal. When compared to the ceramic binder, the resinoid binder is less sensitive to sudden temperature changes and physical damage, but it is more sensitive to chemical influences and cannot remain unused in stock for a very long time.

Magnesite Binders

Caustic magnesite and magnesium-chloride are at the base of this binder. This binding without thermal treatment is called cold binding

Grinding tools made from abrasives with magnesite binders are intended for rough and fine grinding of metals and non-metals. The quality of the grindstone depends on the type and size of the abrasive grain and on the hardness of the grindstone.

Grinding wheels cannot withstand a great static and dynamic load. Mechanical damage must be prevented when transporting the grindstone.

Magnesite binders are hydroscopic, that is to say, sensitive to frost. Thus, they must be stored in dry and warm conditions. The temperature of the storage space should be around 20 C, with a relative humidity of 50%. Any floor and wall spaces close to the grinding tools must be isolated from humidity.

Water or some other coolant is usually used during grinding (with stones containing magnesite binders).

Magnesite grindstones are used at lower working speeds up to 25 m/s.

THE STRUCTURE (POROSITY) OF THE GRINDING WHEEL

The structure (porosity) of the whetstone can be expressed as an empirical number which determines exactly the amount of abrasive grains in the given volume of the whetstone.

A more dense structure grinding wheel contains a higher percentage of abrasive grains per volume of the unit, in contrast with one that is more open. Porosity is marked by numbers 0-14. Porosity over 10 is a mark of a highly porous stone. The porosity of these grindstones is artificially increased with added special ingredients.

THE HARDNESS GRADE OF THE GRINDING WHEEL

The hardness of the wheel is proportional to the bond strength with which a single grain is tied in the bond-matrix. The Norton-scale, using the letters of the alphabet, is used to grade the hardness of the stone. Letters towards the beginning of the alphabet denote softer grinding wheels and letters closer towards the end of the alphabet represent harder wheels. The optimum hardness of a wheel is reached when an abrasive grain breaks from its bond in the exact moment it becomes useless to perform its general function – grinding.

The binders, the granulation of the abrasive grain and porosity have the biggest effect on the hardness of a stone. At IBA ADA, the measuring of a grindstone's hardness is done using three different methods:

- by measuring the E-module with the "Grindosonic Apparatus"
- by sanding (using "Mackensen")
- by embedding "Rockwell" pellets

Označavanje kvaliteta tocila

| | | | |
|--|----|---|----|
| 12A | 80 | K | 12 |
| ABRAZIVNO ZRNO ABRASIVE GRAIN | | | |
| 10A normalni korund <i>regular aluminium oxide</i> | | | |
| 11A spec. norm. korund <i>spec. aluminium oxide</i> | | | |
| 12A mešavina 10A i 22A <i>mixture of 10A and 22A</i> | | | |
| 21A plemeniti beli korund-crveno vezivo <i>noble white al. oxide-red binder</i> | | | |
| 22A plemeniti beli korund-belo vezivo <i>noble white al. oxide-white binder</i> | | | |
| 23A plemeniti beli korund-plavo vezivo <i>noble white al. oxide-blue binder</i> | | | |
| 30A poluplemeniti korund <i>semi-noble al. oxide</i> | | | |
| 40A plemeniti roza korund <i>noble pink al. oxide</i> | | | |
| 42A mešavina 22A i 40A <i>mixture of 22A and 40A</i> | | | |
| 60A plemeniti rubin korund <i>noble ruby al. oxide</i> | | | |
| 70A cirkon korund <i>zircon aluminium oxide</i> | | | |
| 71A mešavina 10A i 70A <i>mixture of 10A and 70A</i> | | | |
| 80A plemeniti monokristalni korund <i>noble monocrystalline al. oxide</i> | | | |
| 84A mešavina 80A i 40A <i>mixture of 80A and 40A</i> | | | |
| 10C zeleni silicijumkarbid <i>green silicon carbide</i> | | | |
| 90C crni silicijumkarbid <i>black silicon carbide</i> | | | |

| VELIČINA ZRNA GRAIN SIZE | |
|-----------------------------|---------------------------------------|
| gruba | |
| coarse | 10 12 14 16 20 24 |
| srednja | |
| medium | 30 36 46 54 60 |
| finja | |
| fine | 70 80 90 100 120 150 180 220 |
| vrlo finja | |
| extra fine | 240 280 320 400 500 600 800 1000 1200 |

Pri naručivanju tocila molimo da navedete sledeće podatke:
 -oblik tocila (za nestandardne priložiti crtež);
 -dimenzije u mm. (prečnik x debljina x prečnik otvora);
 -oznaku kvaliteta tocila sa sledećim elementima:
 * vrsta abrazivnog zrna,
 * veličina zrna (granulacija)
 * tvrdoća,
 * struktura,
 * vrsta veziva.
 -radnu brzinu u m/s ili broj obrtaja osovine brusilice u minutama;
 -tip brusilice;
 -vrstu materijala koji se obrađuje, zahtevani kvalitet obrađene površine i tvrdoću materijala.
 Po mogućству molimo da priložite etiketu sa tocila koje ste ranije koristili.
 U slučaju nedostatka etikete molimo uzorak tocila i naziv prethodnog dobavljača.

Grinding Wheel Quality Marking System

| | | |
|--|----------|---|
| V | 4 | S |
| TVRDOĆA HARDNESS | | |
| izuzetno mekani <i>extra soft</i> | C D | |
| vrlo mekani <i>very soft</i> | E F G | |
| mekani <i>soft</i> | H I J K | |
| srednji <i>medium</i> | L M N O | |
| tvrdi <i>hard</i> | P Q R S | |
| vrlo tvrdi <i>very hard</i> | T U V W | |
| izuzetno tvrdi <i>extra hard</i> | X Y Z | |
| STRUKTURA STRUCTURE (Porosity) | | |
| zatvorena <i>dense</i> | 0 1 2 3 | |
| srednja <i>medium</i> | 4 5 6 | |
| otvorena <i>open</i> | 7 8 9 10 | |
| visoko porozna <i>high porosity</i> | 11 12 | |
| VEZIVO BINDER | | |
| keramičko <i>ceramic</i> | V | |
| smolno <i>resinoid</i> | B | |
| smolno ojačano <i>reinforced resin</i> | BF | |
| gumeno <i>rubber</i> | R | |
| gumeno ojačano <i>reinforced rubber</i> | RF | |
| šelak <i>shellac</i> | F | |
| magnezitno <i>magnesite</i> | Mg | |
| poliuretan <i>polyurethane</i> | BE | |
| INTERNA OZNAKA INTERNAL MARK | | |
| 4; 35; 41; 70; 96A | | |
| OZNAKA ZA POSEBAN TRETMAN SPECIAL TREATMENT | | |
| impregirano sa sumporom <i>impregnated with sulphur</i> | | |
| S | | |

When ordering whetstones, please state the following:

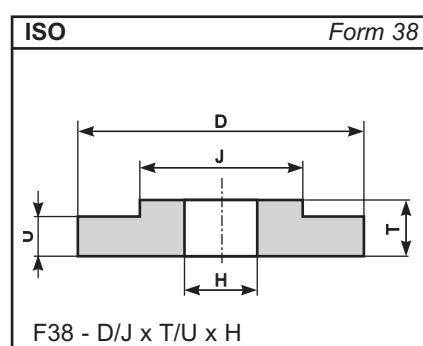
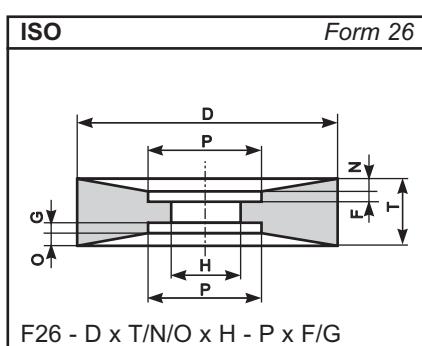
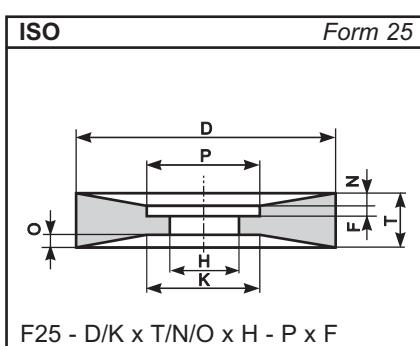
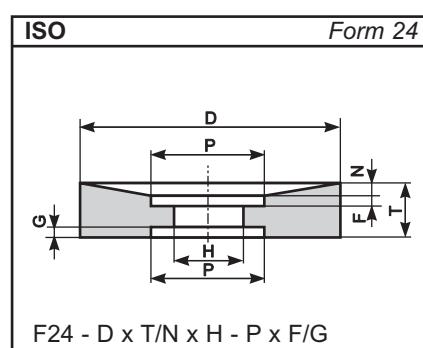
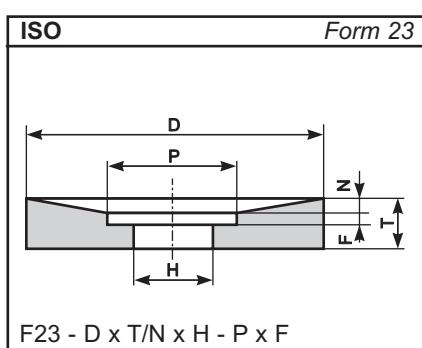
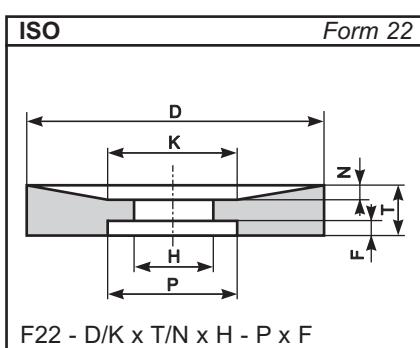
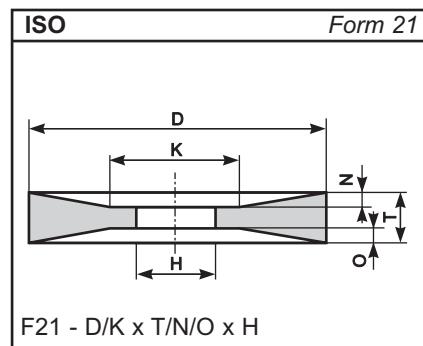
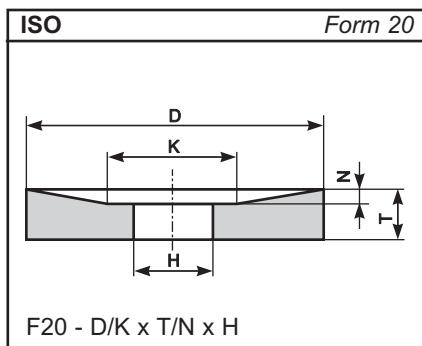
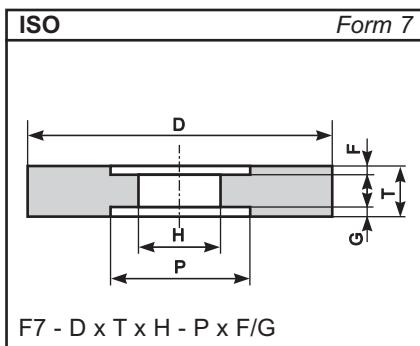
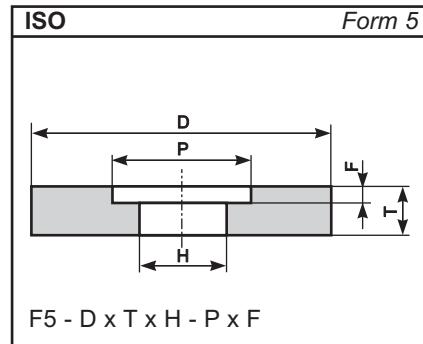
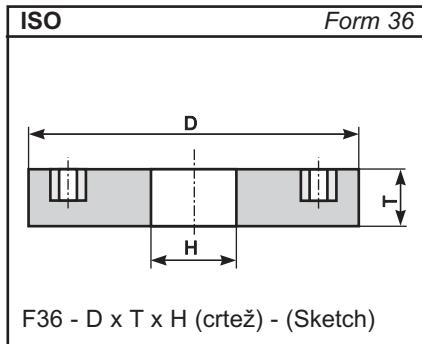
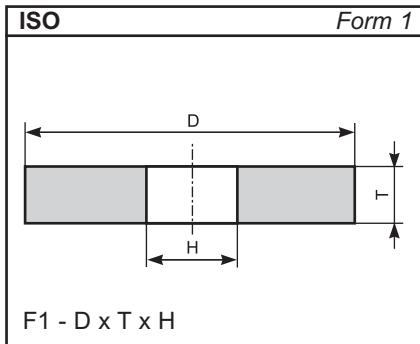
- shape of whetstone (for non-standard shapes, enclose a drawing)
- dimensions in mm (diameter x thickness x diameter of hole)
- specific information about the stone's quality with the following:
 - * kind of abrasive grain
 - * size of grain
 - * hardness of wheel
 - * structure (porosity) of wheel
 - * kind of binder used
- the working speed in m/s or number of shaft-revolutions of the grinding machine in minutes;
- type of grinding machine
- type of material the grinder will be used upon, hardness of the material, wished quality of the grinded surface
- If possible, please include the label of the whetstone, used previously. If this is not possible, please include a sample of the whetstone along with the name of the supplier.

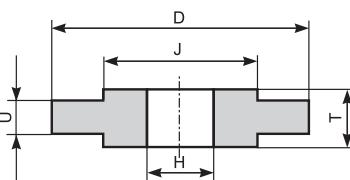
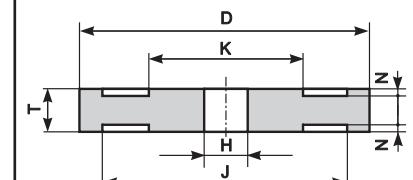
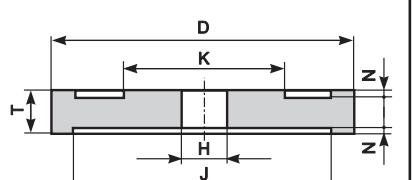
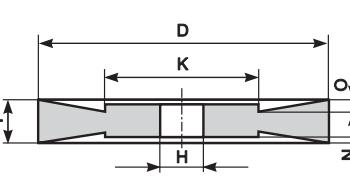
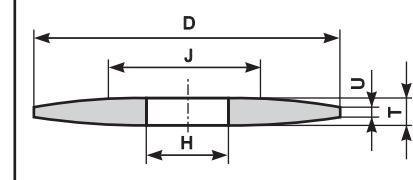
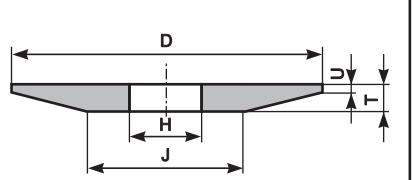
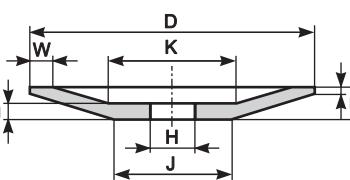
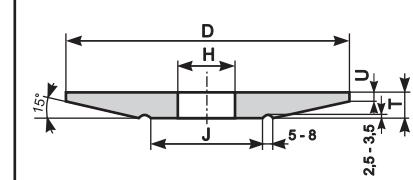
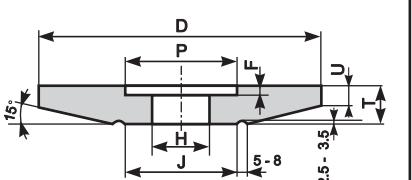
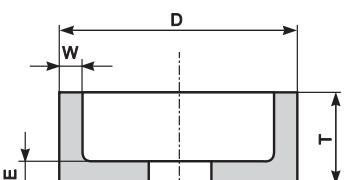
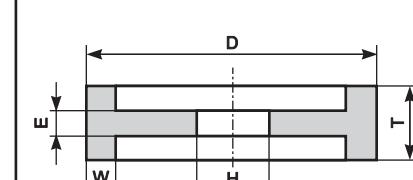
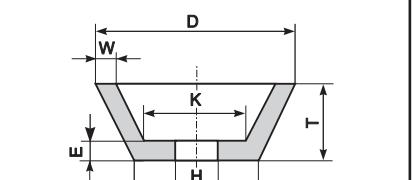
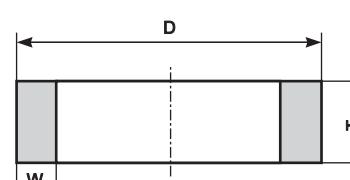
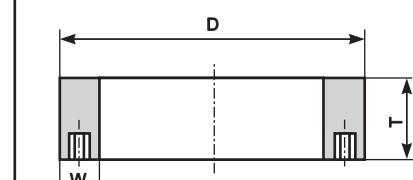
Pregled standardnih oblika

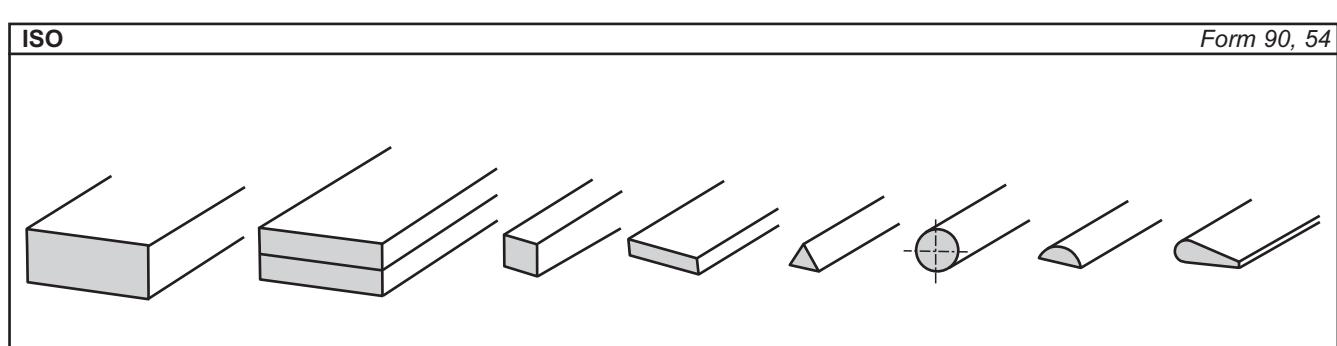
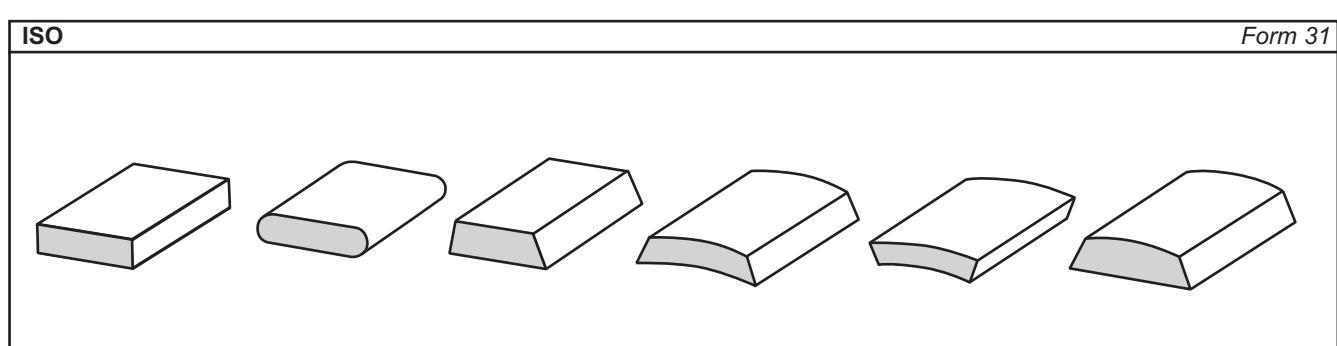
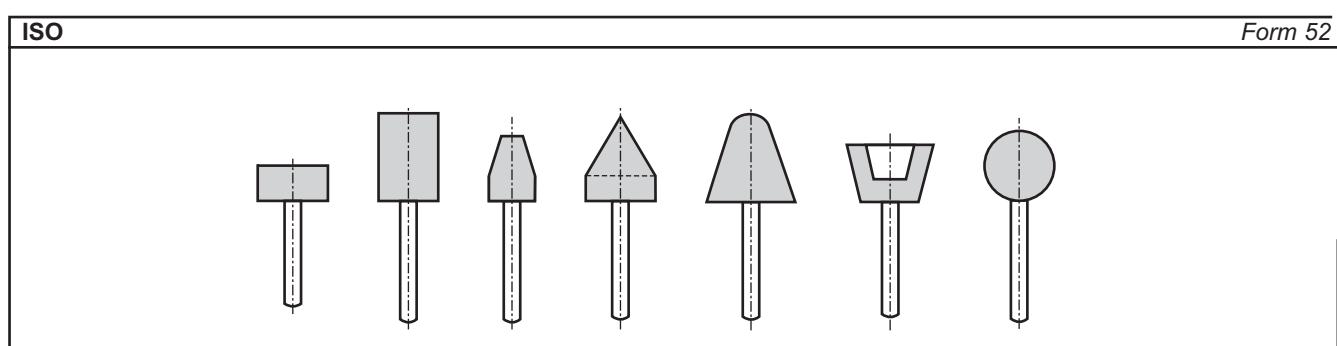
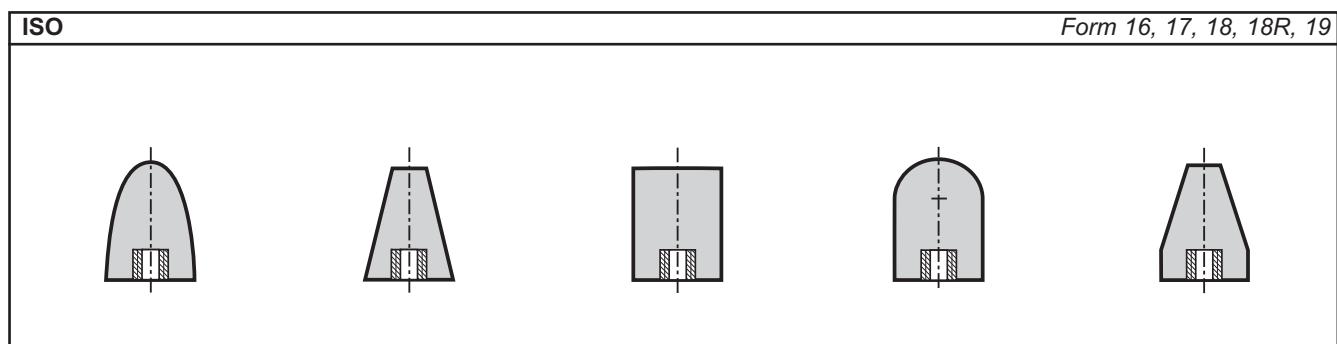
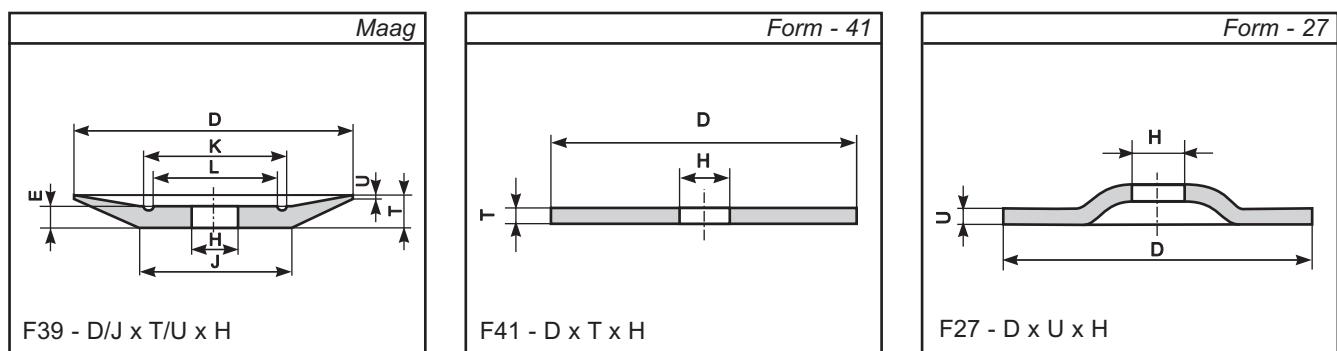
Summary of Standard Shapes

OBLICI TOCILA

RANGE OF SHAPES



| | | | | | |
|---|---|---|-----------------------|------------|-----------------------|
| ISO | Form 39 | ISO | Form 9P | ISO | Form 9PP |
|  |  |  | | | |
| F39 - D/J x T/U x H | 9P - D/K x T x H - J x N/N | 9PP-D/K x T x H - J x N/N | | | |
| ISO | Form 21P | ISO | Form 4 | ISO | Form 3 |
|  |  |  | | | |
| 21P - D/K x T x H - N/0 | F4 - D/J x T/U x H | F3 - D/J x T/U x H | | | |
| ISO | Form 12 | | Klingelnberg 1 | | Klingelnberg 2 |
|  |  |  | | | |
| F12 - D/J x T/U x H - W x E x K | D x T/U x H | D x T/U x H - P x F | | | |
| ISO | Form 6 | ISO | Form 9 | ISO | Form 11 |
|  |  |  | | | |
| F9 - D x T x H - W x E | F6 - D x T x H - W x E | F11 - D/J x T x H - W x E x K | | | |
| ISO | Form 2 | ISO | Form 37 | | |
|  |  | | | | |
| F2 - D x T - W | F37 - D x T - W (Sketch) - (crtež) | | | | |

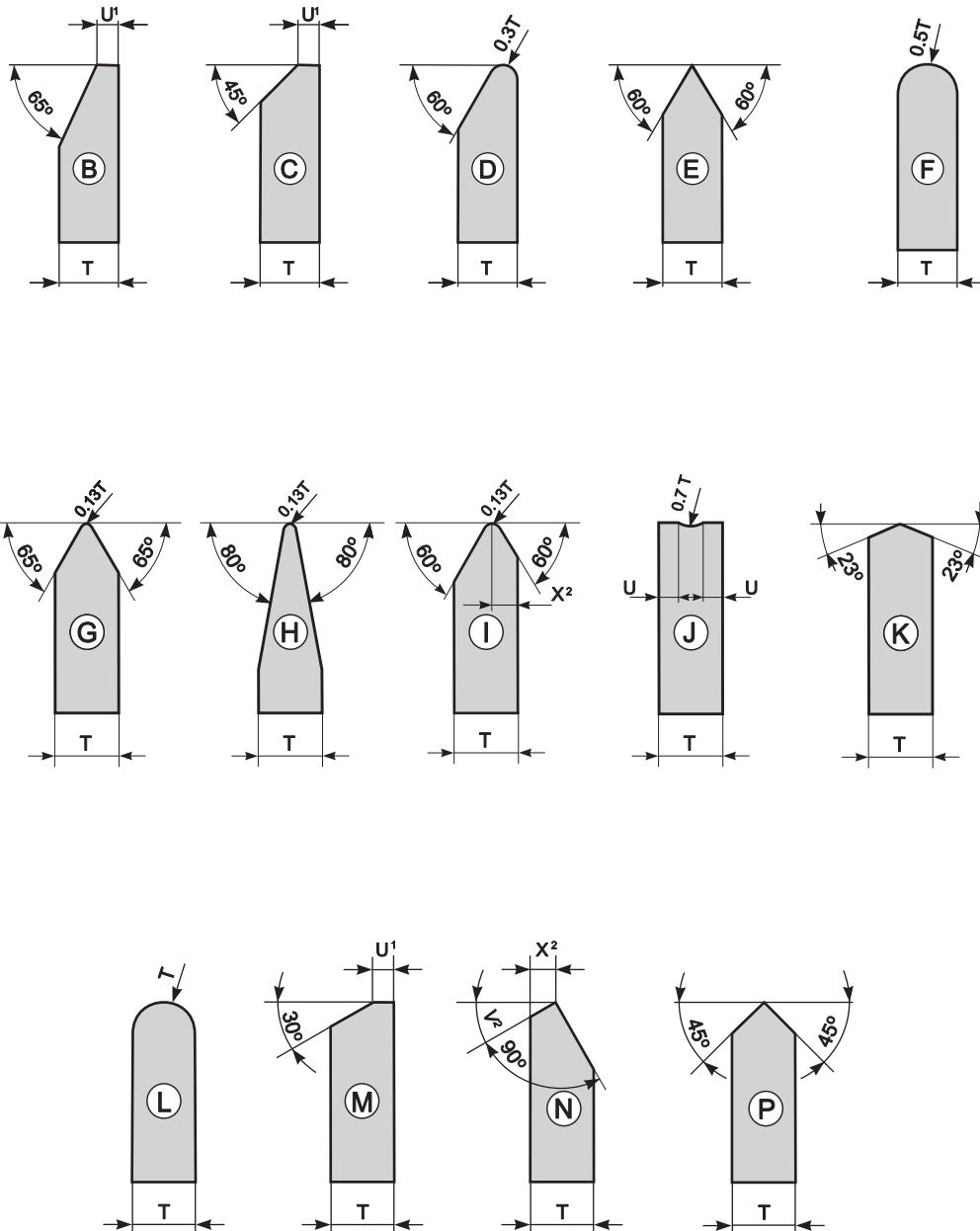


Standardni profili po obodu tocila

Tocila oblika F1, F5, F7, F38 i F39 izrađuju se i profilisana po obodu.

Standard Peripheral Profiles

Forms F1, F5, F7, F38 and F39 can be produced with peripheral shapes.



1. $U1=0,25T$ (ili max. 3mm)
2. $U2=0,33T$
3. $U3$ dimenziju i ugao V treba specifikovati.
Primer za narudžbinu:
Tocilo F1 N (U5 V60) - 600 x 40 x 304,8

1. $U1=0,25T$ (or max. 3 mm)
2. $U2=0,33T$
3. Dimensions $U3$ and angle V must be stated on the order. Other profiles on request.
Ordering example:
grinding wheel F1N (U5 V60) - 600 x 40 x 304,8

RAVNA BRUSNA TOCILA SURFACE GRINDING WHEELS

SPOLJAŠNJE KRUŽNO BRUŠENJE
EXTERNAL CYLINDRICAL GRINDING

BRUŠENJE BEZ ŠILJAKA
CENTERLESS GRINDING

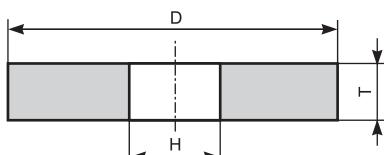
RAVNO BRUŠENJE
SURFACE GRINDING

RUÈNO BRUŠENJE U RADIONICAMA
MANUAL GRINDING IN WORKSHOPS



Dimenzije standardnih oblika tocila

Oblik:
Shape:



Dimensions of Grinding Wheels of Standard Shapes

| T (mm) | 1 | 1,5 | 2 | 4 | 5 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 80 | 100 | 125 | 150 | 160 | 200 | |
|--------|--------|-----|---|---|---|---|---|----|----|----|----|----|---|----|----|----|----|-----|-----|-----|-----|-----|--|
| D (mm) | H (mm) | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | 2,5-3-4 | | | | | | | | | | |
| 10 | | | | | | | | | | | | | 2,5-3-4 | | | | | | | | | | |
| 13 | | | | | | | | | | | | | 2,5-3-4-6 | | | | | | | | | | |
| 16 | | | | | | | | | | | | | 3-4-6-8 | | | | | | | | | | |
| 20 | | | | | | | | | | | | | 4-6-8 | | | | | | | | | | |
| 25 | | | | | | | | | | | | | 6-8-10 | | | | | | | | | | |
| 32 | | | | | | | | | | | | | 8-10-13 | | | | | | | | | | |
| 40 | | | | | | | | | | | | | 8-10-13-16 | | | | | | | | | | |
| 50 | | | | | | | | | | | | | 13-16-20-20 | | | | | | | | | | |
| 63 | | | | | | | | | | | | | 13-16-20-25 | | | | | | | | | | |
| 80 | | | | | | | | | | | | | 10-13-16-20-22,4-25-32 | | | | | | | | | | |
| 100 | | | | | | | | | | | | | 10-13-16-20-22,4-25-32-40-50-50,8-51 | | | | | | | | | | |
| 125 | | | | | | | | | | | | | 10-13-16-20-22,4-25-32-40-50-50,8-51 | | | | | | | | | | |
| 150 | | | | | | | | | | | | | 20-22,4-25-32-40-50-50,8-51-76-76,2 | | | | | | | | | | |
| 175 | | | | | | | | | | | | | 20-22,4-25-32-40-50-50,8-51-76-76,2 | | | | | | | | | | |
| 200 | | | | | | | | | | | | | 20-22,4-25-32-40-50-50,8-51-76-76,2 | | | | | | | | | | |
| 225 | | | | | | | | | | | | | 20-25-32-40-50-50,8-51-76-76,2 | | | | | | | | | | |
| 250 | | | | | | | | | | | | | 20-25-32-40-50-50,8-51-76-76,2 | | | | | | | | | | |
| 300 | | | | | | | | | | | | | 25-30-32-40-50-50,8-51-76-76,2-127 | | | | | | | | | | |
| 350 | | | | | | | | | | | | | 32-35-40-50-50,8-51-76-76,2-127 | | | | | | | | | | |
| 400 | | | | | | | | | | | | | 40-50-50,8-51-76-76,2-127 | | | | | | | | | | |
| 450 | | | | | | | | | | | | | 45-50-50,8-51-76-76,2-127-150-152-152,4-203-203,2 | | | | | | | | | | |
| 500 | | | | | | | | | | | | | 50-50,8-51-76-76,2-127-150-152-152,4-203-203,2 | | | | | | | | | | |
| 600 | | | | | | | | | | | | | 60-76-76,2-127-150-152-152,4-203-203,2-304,8-305 | | | | | | | | | | |
| T (mm) | 1 | 1,5 | 2 | 4 | 5 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 80 | 100 | 125 | 150 | 160 | 200 | |

Primer: tocila prečnika (D) 300 mm izrađuju se debljine (T) 6, 8, 10, 13, 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, i 150 mm, i otvora (H) 25, 30, 32, 40, 50, 50.8, 51, 76, 76.2, i 127 mm.

Primer za narudžbinu: tocilo F1 - 250 x 63 x 76.2

For example: grinding wheels of diameter (D) of 300 mm are produced with a thickness (T) of 6, 8, 10, 13, 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, and 150 mm with holes (H) of 25, 30, 32, 40, 50, 50.8, 51, 76, 76.2, and 127 mm.

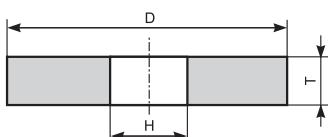
Ordering example: grinding wheel
F1 - 250 x 63 x 76.2

SPOLJAŠNJE KRUŽNO BRUŠENJE

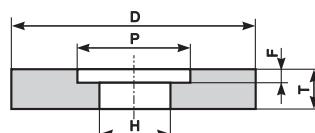
Brušenje među šiljcima

Oblici tocila:

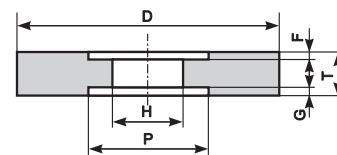
Wheel shapes:



oblik 1
Form 1



oblik 5
Form 5



oblik 7
Form 7

Dimenzijske:
Dimensions:

| D | T | H |
|----------------------------------|--------------------------------|------------------------------------|
| od 250 do 760 from 250 to 760 | od 10 do 125 from 10 to 125 | od 25 do 304,8 from 25 to 304,8 |

Obodne brzine:

- grubo brušenje 25 - 40 m/sek
- srednje fino brušenje 25 - 40 m/sek
- fino brušenje 20 - 32 m/sek
- veoma fino brušenje 25 - 40 m/sek

Primer za narudžbu: Form1 DxTxH

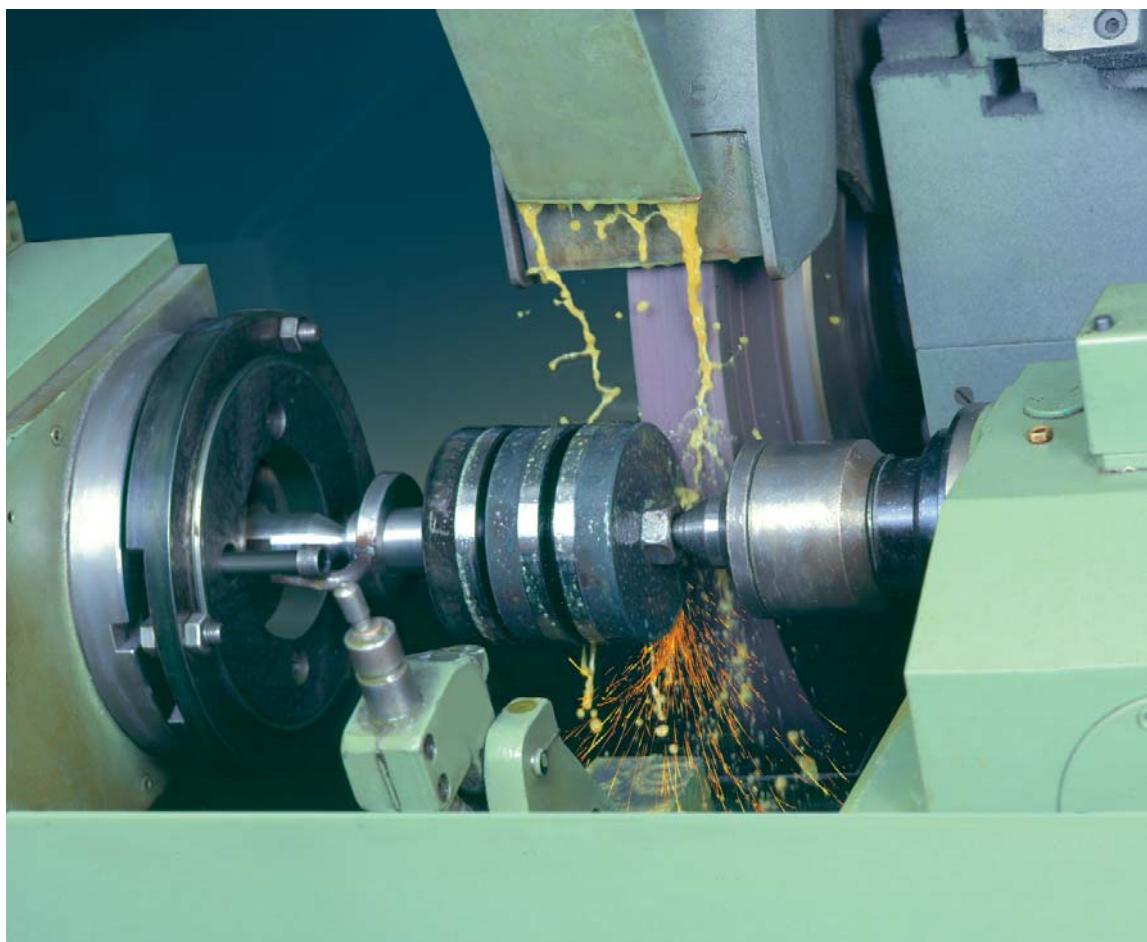
EXTERNAL CYLINDRICAL GRINDING

Grinding between Centers

Peripheral speeds:

- rough grinding (snagging) 20 - 40 m/s
- medium-fine grinding 25 - 40 m/s
- fine grinding 20 - 32 m/s
- very fine grinding 16 - 20 m/s

Ordering example: Form1 DxTxH



Prolazno brušenje

Lap grinding

| Univerzalna upotreba Universal Application | Grubo brušenje Rough Grinding | Srednje fino brušenje Medium-fine Grinding |
|--|--|---|
| Čelik - pretežno nekaljen Steel - mostly unhardened | 21A46L5V | 21A60L5V |
| Čelik - pretežno kaljen Steel - mostly hardened | 21A46K6V | 21A60K6V |

| Specijalna upotreba Specific Application | Grubo brušenje Rough Grinding | Srednje fino brušenje Medium-fine Grinding |
|--|--|---|
| Čelik - nekaljen Steel - unhardened | 12A46M5V 21A46L5V | 21A60K6V 21A80L5V |
| Čelik - kaljen do 63 HRC Steel - hardened to 63 HRC | 22A46K5V 22A60J7V | 22A60J6V 21A80J7V |
| Čelik - kaljen preko 63 HRC Steel - hardened above 63 HRC | 22A60J8V 84A60J8V 10C80K12V | 22A80I5V 84A80J7V 10C80K12V |
| Čelik - tvrdo hromiran Steel - hard chrome-plated | 21A60M5V | 21A80M5V |
| Čelik - nerđajući, otporan na toplotu - nekaljen Steel - stainless, heat resistant - unhardened | 21A54K5V 10C60K12V | 21A60K6V 10C80K12V |
| Čelik - nerđajući, otporan na toplotu - kaljen Steel - stainless, heat resistant - hardened | 60A60J5V 10C80K12V 10C46K5V | 60A80J6V 10C80K12V 22A80J8V |
| Čelik za nitriranje - nenitriran Nitrided steel - unprocessed | 21A46L5V | 21A60L5V |
| Čelik za nitriranje - nitriran Nitrided steel - nitride hardened | 10C54J6V | 10C80J6V 10C80J12V |
| Sivi liv Gray cast iron | 21A46M5V (40A) 84A46J8V 10C46J6V | 21A60L5V (40A) 84A60J8V 10C60J6V |
| Nodularni liv Spheroid cast iron | 10C46J6V (40A) 84A60J8V | 10C60J6V (40A) 84A60J8V |
| Tvrdi metal Tunsten carbide | 10C46J6V | 10C60J6V |
| Obojeni metali i plastika Non-ferrous metals and plastics | 10C46J12V | 10C60J12V |
| Guma - bakelit Rubber - bakelite | 10C36J12V 84A36J12V | 10C60J12V |

Upadno brušenje - upravno i pod ugлом

**Straight and Angle Plunge-cut
Grinding**

| Univerzalna upotreba Universal use | Brušenje Grinding |
|---|--|
| Čelik - nekaljen <i>Steel - unhardened</i> | 21A60L5V 21A60M5V 21A60M5V 21A80L5V 21A80M6V |
| Čelik - mali profili <i>Steel - small profiles</i> | 84A180K6V |
| Čelik - kaljen <i>Steel - hardened</i> | 21A60K7V 21A60L5V 21A80K7V 21A80L5V |

**Brušenje bregastih osovina
Camshaft Grinding**

| Brušenje brega Cam Grinding | Grubo brušenje Rough Grinding | Srednje fino brušenje Medium-fine Grinding |
|---|--|---|
| Čelik - nekaljen <i>Steel - unhardened</i> | 30A46N6V | |
| Čelik - kaljen <i>Steel - hardened</i> | | 21A80K7V |
| Nodularni i temper liv <i>Spheroid and chilled cast iron</i> | 12A36N5V | 21A70K7V |

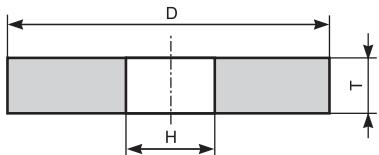
| Brušenje rukavca Bearing grinding | Grubo brušenje Rough Grinding | Srednje fino brušenje Medium-fine Grinding |
|---|--|---|
| Čelik - nekaljen <i>Steel - unhardened</i> | 30A46N6V | |
| Čelik - kaljen <i>Steel - hardened</i> | | 12A70K7V |
| Nodularni i temper liv <i>Spheroid and chilled cast iron</i> | 11A46N6V | 21A60K7V |

**Brušenje kolenastog vratila
Crankshaft grinding**

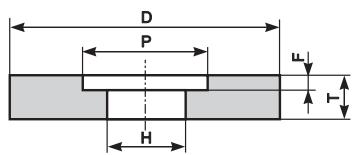
| | Grubo brušenje Rough Grinding | Srednje fino brušenje Medium-fine Grinding |
|--|--|---|
| Čelik <i>Steel</i> | 12A36P5V | 12A54M6V |
| Nodularni liv <i>Spheroid cast iron</i> | 12A36N6V | 21A54M6V |

Brušenje bez šiljaka »Centerless« *Centerless Grinding*

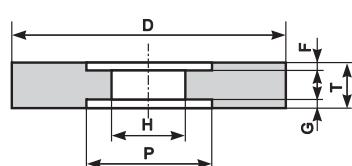
Oblici tocila:
Wheel shapes:



oblik 1
Form 1



oblik 5
Form 5



oblik 7
Form 7

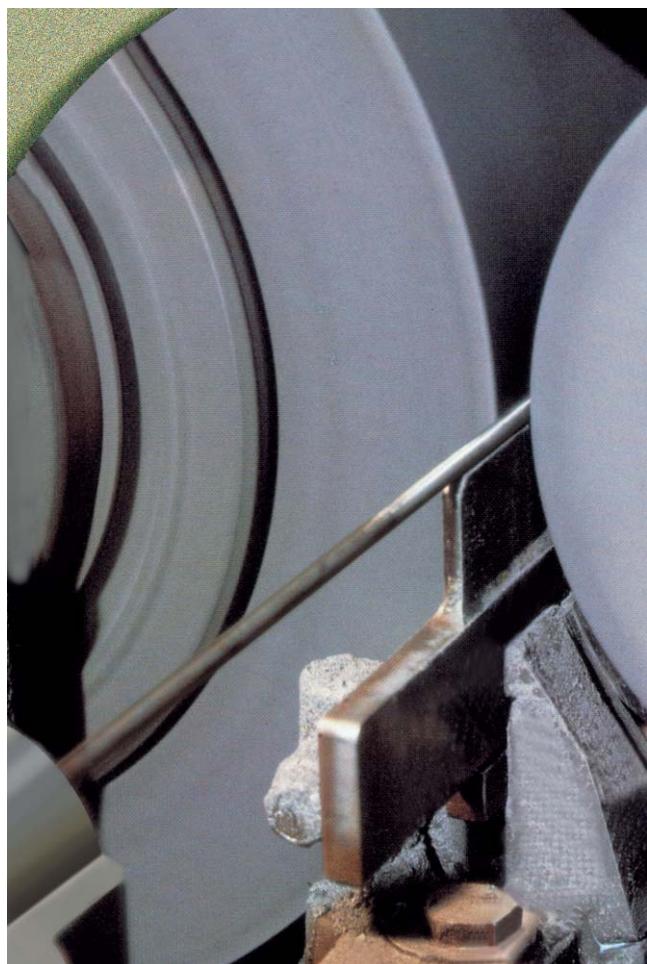
Obodne brzine: 32 - 50 m/sek
Peripheral speeds: 32 - 50 m/sec

Primer za narudžbu:
Ordering example:
Centerless Form1 DxTxH
Centerless Form5 DxTxH - PxH

Dimenzije: - *Dimensions:*

| D | T | H |
|---|---|---|
| od 300 do 760 <i>from 300 to 760</i> | od 25 do 600* <i>from 25 to 600*</i> | od 76 do 304,8 <i>from 76 to 304,8</i> |

* Tocilo debljine 200 mm i veća izrađuju se u više komada
* *Wheels with thickness of 200 mm and greater, prepared in more than one piece.*

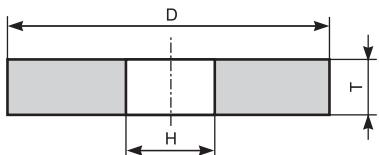


Brušenje bez šiljaka »Centerless« *Centerless Grinding*

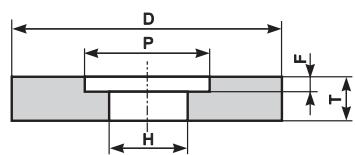
| Univerzalna upotreba <i>Universal use</i> | Tocilo D ≤ 450 <i>Wheel D ≤ 450</i> | Tocilo D ≥ 500 <i>Wheel D ≥ 500</i> |
|--|--|--|
| Čelik - pretežno nekaljen <i>Steel - mostly unhardened</i> | 30AM5V | 12A46M5V |
| Čelik - pretežno kaljen <i>Steel - mostly hardened</i> | 21A60L5V | 21A45L5V |
| Specijalna upotreba <i>Specific use</i> | Tocilo D ≤ 450 <i>Wheel D ≤ 450</i> | Tocilo D ≥ 500 <i>Wheel D ≥ 500</i> |
| Čelik - nekaljen <i>Steel - unhardened</i> | 11A54N4V 11A60N4V | 11A46N4V 11A54K5V |
| Čelik - kaljen do 63 HRC <i>Steel - hardened to 63 HRC</i> | 22A60K6V | 22A54K5V |
| Čelik - kaljen preko 63 HRC <i>Steel - hardened over 63 HRC</i> | 22A60K7V 22A60J7V | 22A60J8V 22A60K7V |
| Čelik - tvrdo hromiran <i>Steel - hard-chrome-plated</i> | 30A60N4V | 12A60N4V |
| Čelik - nerđajući otporan na topotu - nekaljen <i>Steel - stainless and heat resistant - unhardened</i> | 10C60L4V | 10C46K4V |
| Čelik - nerđajući otporan na topotu - kaljen <i>Steel - stainless and heat resistant - hardened</i> | 10C60K5V | 10C54K5V |
| Čelik za nitriranje - nenitiran <i>Nitrided steel - unprocessed</i> | 30A60N4V | 12A54N4V |
| Čelik za nitriranje - nitriran <i>Nitrided steel - nitride hardened</i> | 10C60J5V | 10C60J5V |
| Čelični liv <i>Steel cast</i> | 12A60M5V | 12A54M5V |
| Sivi liv <i>Gray iron cast</i> | 10C60L4V | 10C46L4V |
| Nodularni liv <i>Spheroid cast</i> | 12A60M5V 10C60L4V | 12A54M5V 10C54L4V |
| Tvrdi metal <i>Tungsten carbide</i> | 10C60J5V | 10C54J5V |
| Obojeni metali i plastika <i>Non-ferrous metals and plastics</i> | 10C60L4V 90C60J8V | 90C54J8V 90C60K7V |
| Guma <i>Rubber</i> | 10C60J12V | 10C60J10V |

Ravno brušenje**Obodno ravno brušenje**

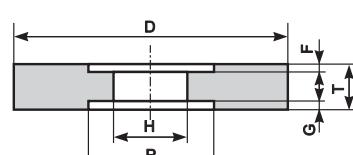
Oblici:
Shapes:



oblik 1
Form 1



oblik 5
Form 5



oblik 7
Form 7

Dimenziije: - Dimensions:

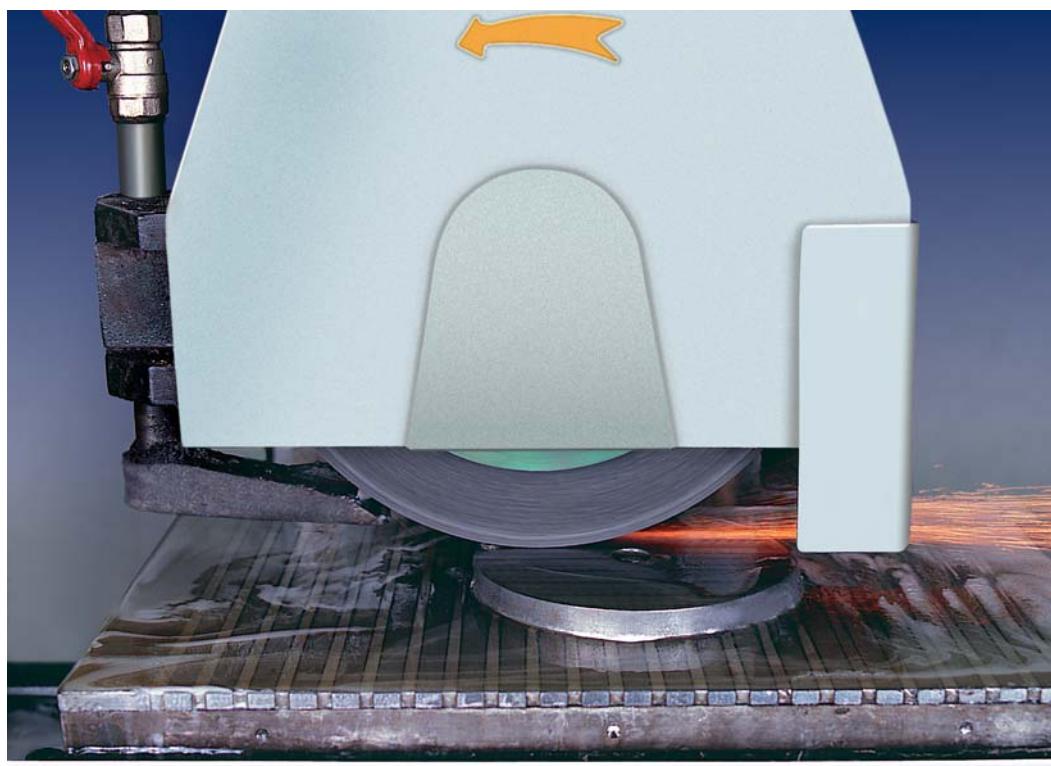
| D | T | H |
|----------------------------------|--------------------------------|------------------------------------|
| od 150 do 760 from 150 to 760 | od 13 do 200 from 13 to 200 | od 20 do 304,8 from 20 to 304,8 |

Obodne brzine:

- univerzalno 25 - 32 m/sek
- čelik 20 - 32 m/sek
- sivi liv 20 - 25 m/sek
- tvrdi metal 16 - 20 m/sek
- obojeni metali 16 - 20 m/sek

Peripheral speeds:

- universal 25 - 32 m/sec
- steel 20 - 32 m/sec
- gray cast iron 20 - 25 m/sec
- tungsten carbide 16 - 20 m/sec
- non-ferrous metals 16 - 20 m/sec



Obodno ravno brušenje

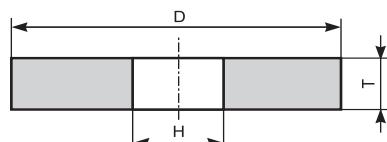
Peripheral Surface Grinding

| Univerzalna upotreba Universal Application | Tocilo D ≤ 450 Wheel D ≤ 450 | Tocilo D ≥ 500 Wheel D ≥ 500 |
|--|---|---|
| Čelik - pretežno nekaljen Steel - mostly unhardened | 21A46J9V | 21A36J8V |
| Čelik - pretežno kaljen Steel - mostly hardened | 21A46I9V | 84A46J10V |

| Specijalna upotreba Specific Application | Tocilo D ≤ 450 Wheel D ≤ 450 | Tocilo D ≥ 500 Wheel D ≥ 500 |
|--|---|---|
| Čelik - nekaljen Steel - unhardened | 21A46J8V 12A46K7V | 21A36K8V 40A46K9V |
| Čelik - kaljen do 63 HRC Steel - hardened to 63 HRC | 22A46J8V 30A46J8V | 22A36J8V 22A46J8V |
| Čelik - kaljen preko 63 HRC Steel - hardened over 63 HRC | 21A46J9V 84A46J12V | 84A46J12V 60A46H8V |
| Čelik - tvrdo hromiran Steel - hard-chrome-plated | 84A60J12V | 60A60I12V |
| Čelik - nerđajući otporan na toplotu - nekaljen Steel - stainless and heat resistant - unhardened | 21A46K8V 21A60J8V | 21A46I9V |
| Čelik - nerđajući otporan na toplotu - kaljen Steel - stainless and heat resistant - hardened | 84A60J10V 84A60I12V | 84A46J10V 84A60I12V |
| Čelik za nitriranje - nenitiran Nitrided steel - unprocessed | 21A46K8V | 21A46J9V |
| Čelik za nitriranje - nitiran Nitrided steel - nitride hardened | 10C60J12V 10C80J12V | 10C60I12V |
| Čelični liv Steel cast iron | 21A46K8V | 21A46I9V |
| Sivi liv Gray cast iron | 10C46J12V 84A46J12V | 10C46J12V 84A46J12V |
| Nodularni liv Spheroid cast iron | 10C46J12V 84A46J12V | 10C46J12V 84A46J12V |
| Tvrdi metal Tungsten carbide | 10C60J12V 10C80J12V | 10C60J12V 10C80J12V |
| Obojeni metali i plastika Non-ferrous metals and plastics | 10C60H8V 10C60J12V | 10C60H8V 10C46J12V |
| Guma Rubber | 10C60I12V | 10C46I12V |

Čišćenje na stabilnim brusilicama

Oblik:
Shape:



Oblik 1:
Form 1:

Dimenzijske:
Dimensions:

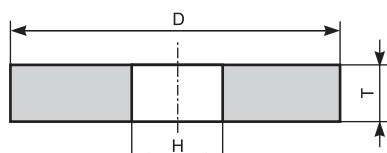
| D | T | H |
|----------------------------------|--------------------------------|--------------------------------|
| od 300 do 750 from 300 to 750 | od 32 do 125 from 32 to 125 | od 30 do 305 from 30 to 305 |

| | 50 m/s | 63 m/s |
|---|------------------------|------------------------|
| Sivi liv do SL 20 Gray cast iron to SL 20 | 90C16S41B 90C16Q41B | 90C16R31B 90C16Q40B |
| Sivi liv preko SL 20 Gray cast iron over SL 20 | 90C16S41B 90C16Q41B | 90C16R31B 90C16Q40B |
| Temper liv pre termičke obrade Chilled cast iron before thermic treatment | 12A16R41B 90C20Q41B | 12A14S42B 90C20P50B |
| Čelik i čelični liv Steel and cast steel | 10A16R41B | 12A14P40B |
| Temper liv posle termičke obrade Chilled cast iron after thermic treatment | 12A16Q40B | 12A14P40B |



Čišćenje na visećim brusilicama

Oblik:
Shape:

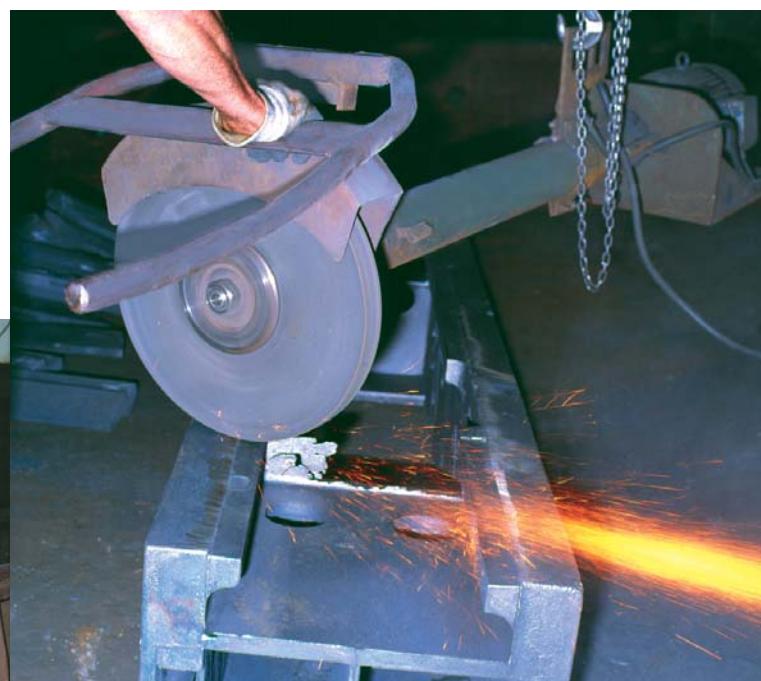


Oblik 1:
Form 1:

Dimenzijske:
Dimensions:

| D | T | H |
|---|-------------------------------------|---------------------------------------|
| od 300 do 600 <i>from 300 to 600</i> | od 10 do 75 <i>from 10 to 75</i> | od 30 do 305 <i>from 30 to 305</i> |

| | 50 m/s | 63 m/s |
|---|------------------------|-----------|
| Sivi i temper liv <i>Gray cast iron to SL 20</i> | 52C16S4B 12A14S42B | 90C16R61B |
| Sivi liv preko SL 20 <i>Gray cast iron over SL 20</i> | 12A14P29B 12A14Q37B | 12A16R31B |
| Temper liv pre termičke obrade <i>Chilled cast iron before thermic treatment</i> | 90C20Q41B 90C16Q40B | 12A14Q40B |
| Čelični liv nelegiran ili niskolegiran <i>Low alloyed steel</i> | 10A16R41B | 12A14P12B |
| Čelični liv visokolegiran <i>High alloyed steel</i> | 12A24R40B | 12A16R40B |



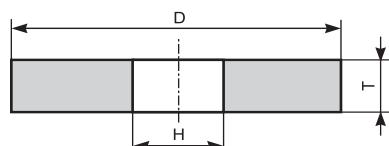
Ručno brušenje u radionicama

Manual Grinding in Workshops

Stabilne brusilice

Bench and Floorstand Grinding Machines

Oblik:
Shape:



Oblik 1:
Form 1:

Dimenzije:
Dimensions:

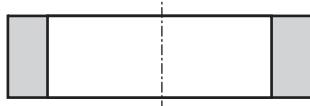
| D | T | H |
|--------------------------------|------------------------------|----------------------------------|
| od 80 do 600 from 80 to 600 | od 10 do 80 from 10 to 80 | od 13 do 76,2 from 13 to 76,2 |

| | Tocilo D ≤ 300 Wheel D ≤ 300 | Tocilo D ≥ 350 Wheel D ≥ 350 |
|---|--|--|
| Univerzalna upotreba Universal use | 11A46N5V | 11A46N5V |
| Čelik i liveno gvožđe Steel and cast steel | 11A24Q4V 11A36P5V 11A46N5V 11A60N4V | 11A20R4V 11A24Q4V 11A36P5V 11A46N5V 11A60N5V |
| Sivi i nodularni lив Gray and spheroid cast iron | 11A24R4V 11A36P5V 11A46N5V 11C24R3V | 11A20R4V 11A36P5V 11A20R3V 11C24R3V |
| Aluminium Aluminium | 10C24R3V | 10C20R3V |

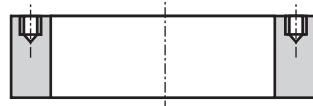
Čeono brušenje

Frontal Grinding

Oblici:
Shapes:



oblik 2
Form 2



oblik 37
Form 37



oblik 6
Form 6

Dimenzije:
Dimensions:

| D | T | W | H |
|----------------------------------|--------------------------------|------------------------------|--------------------------------|
| od 125 do 400 from 125 to 400 | od 63 do 125 from 63 to 125 | od 16 do 40 from 16 to 40 | od 32 do 127 from 32 to 127 |

Obodne brzine:

- univerzalna upotreba 20 - 40 m/sek

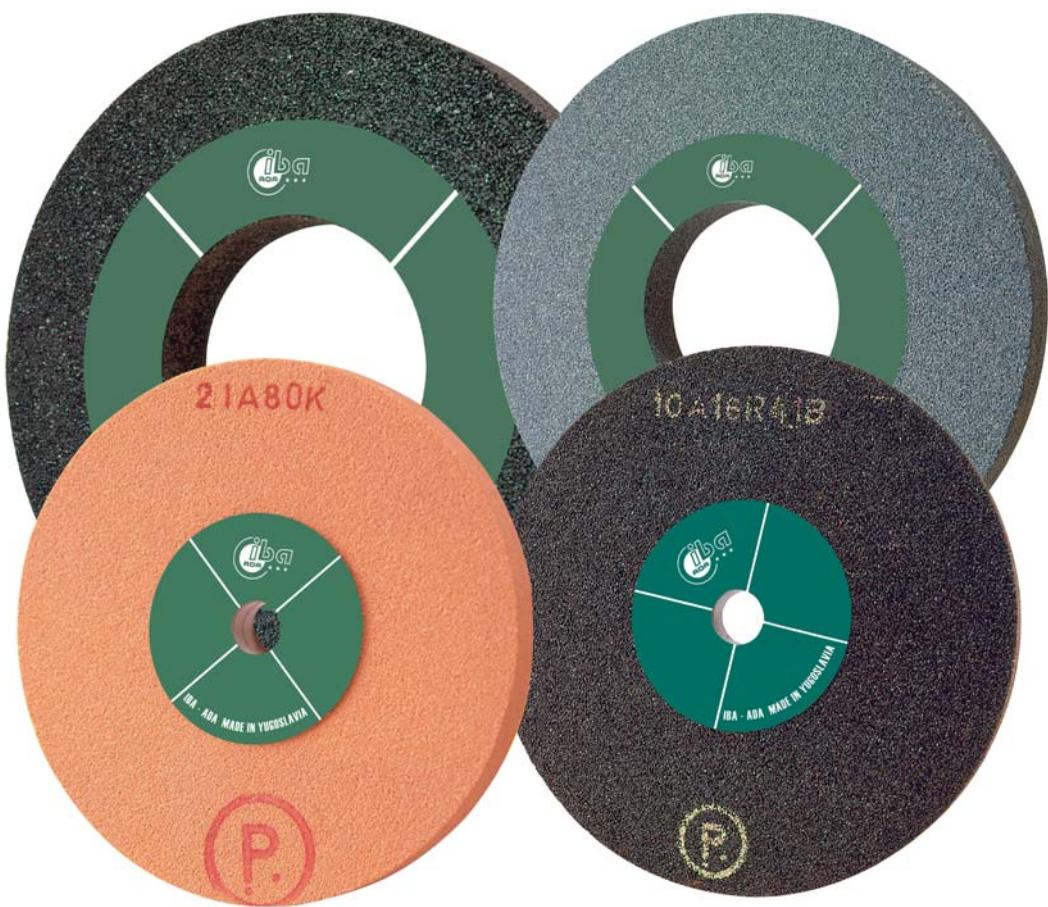
Peripheral speeds:

- universal 20 - 40 m/sec

Čeono brušenje

Frontal Grinding

| Univerzalna upotreba Universal Application | |
|---|------------------------|
| Čelik - pretežno nekaljen <i>Steel - mostly unhardened</i> | 21A46K8V |
| Čelik - pretežno kaljen <i>Steel - mostly hardened</i> | 84A46H12V |
| Specijalna upotreba Specific Application | |
| Čelik - nekaljen <i>Steel - unhardened</i> | 21A36J8V 21A46K8V |
| Čelik - kaljen do 63 HRC <i>Steel - hardened to 63 HRC</i> | 22A46I9V 84A46G12 |
| Čelik - kaljen preko 63 HRC <i>Steel - hardened over 63 HRC</i> | 22A46I10V 84A46G12V |
| Čelik - tvrdo hromiran <i>Steel - hard-chrome-plated</i> | 40A46J11V 84A46J12V |
| Čelik - nerđajući otporan na toplotu - nekaljen <i>Steel - stainless and heat resistant - unhardened</i> | 21A46K8V |
| Čelik - nerđajući otporan na toplotu - kaljen <i>Steel - stainless and heat resistant - hardened</i> | 84A46J12V 90C36J8V |
| Čelik za nitriranje - nenitriran <i>Nitrided steel - unprocessed</i> | 21A46K8V |
| Čelik za nitriranje - nitriran <i>Nitrided steel - nitride hardened</i> | 10C60J12V |
| Čelični liv <i>Steel cast iron</i> | 22A36H8V |
| Sivi liv <i>Gray cast iron</i> | 10C46J12V 22A46I10V |
| Nodularni liv <i>Spheroid cast iron</i> | 10C46J12V 80A46J11 |
| Tvrdi metal <i>Tungsten carbide</i> | 10C46J12V |
| Obojeni metali i plastika <i>Non-ferrous metals and plastics</i> | 10C46J12V 90C36J2V |
| Keramika - porcelan <i>Ceramics - porcelain</i> | 90C20J6B 90C46J5B |
| Teraco pločice <i>Flagstone</i> | 90C20K6B 90C16J6B |



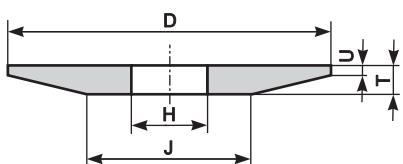
TOCILA ZA BRUŠENJE ALATA, ZUPČANIKA I NAVOJA

**GRINDING WHEELS FOR TOOL SHARPENING, GEAR
AND THREAD GRINDING**



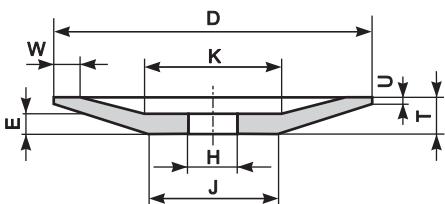


F3-D/JxT/UxH



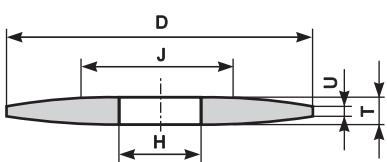
| D | T | H | U | J |
|-----|----|--------|-----|-----|
| 80 | 5 | 13 | 1 | 40 |
| 100 | 6 | 20 | 1,5 | 50 |
| 125 | 7 | 32(20) | 2 | 63 |
| 150 | 8 | 32(20) | 2 | 75 |
| 175 | 10 | 32 | 3 | 85 |
| 200 | 13 | 32 | 3 | 100 |
| 250 | 14 | 32 | 3 | 125 |

F12-D/JxT/UxH-WxExK



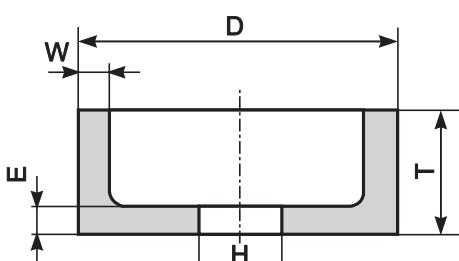
| D | T | H | W | U | E | J=K |
|-----|----|--------|----|-----|----|-----|
| 80 | 10 | 13 | 4 | 2,5 | 6 | 31 |
| 100 | 13 | 20 | 5 | 3,2 | 7 | 36 |
| 125 | 13 | 32(20) | 6 | 3,2 | 7 | 61 |
| 150 | 16 | 32(20) | 8 | 3,2 | 9 | 66 |
| 200 | 20 | 32 | 10 | 3,2 | 12 | 90 |

F4-D/JxT/UxH



| D | T | H | U | J |
|-----|----|--------|---|-----|
| 80 | 8 | 13 | 2 | 35 |
| 100 | 10 | 20 | 2 | 40 |
| 125 | 10 | 32(20) | 2 | 65 |
| 150 | 13 | 32(20) | 2 | 65 |
| 175 | 13 | 32 | 3 | 100 |
| 200 | 16 | 32 | 3 | 100 |
| 250 | 20 | 32 | 4 | 130 |

F6-DxTxH-WxE



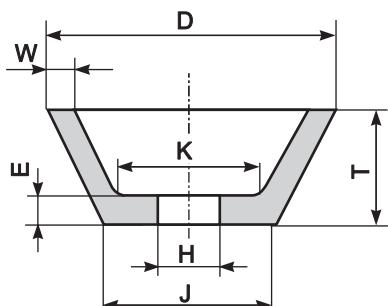
| D | T | H | W | E |
|------|------|---------------------|-----|-----|
| 50 | 32 | 13(10) | 5 | 8 |
| 80 | 40 | 13(20) | 6 | 10 |
| 100 | 50 | 20 | 8 | 10 |
| 125 | 63 | 32(20) | 8 | 13 |
| 150 | 80 | 32(20) | 10 | 16 |
| 175* | 80* | 25*,32*,50.8*,76.2* | 20* | 20* |
| 180 | 80 | 32 | 16 | 16 |
| 200* | 100* | 25*,32*,50.8*,76.2* | 20* | 20* |

* Dimenzije za ručno brušenje gde radni komad ručno vođen

* For manually guided grinding, where the workpiece is guided by hand

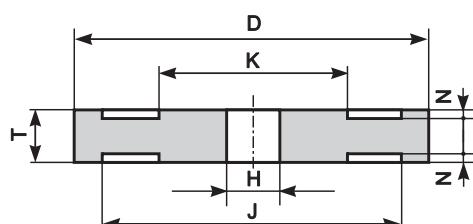


F11-D/JxTxH-WxExK



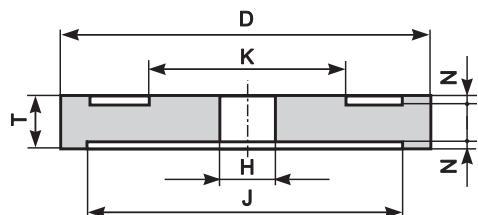
| D | T | H | W | E | J | K |
|-----|-----|--------|----|----|-----|-----|
| 50 | 32 | 13(10) | 4 | 8 | 27 | 22 |
| 80 | 32 | 13 | 6 | 8 | 57 | 46 |
| 100 | 40 | 20 | 8 | 10 | 71 | 56 |
| 125 | 40 | 32(20) | 8 | 10 | 96 | 81 |
| 150 | 50 | 32 | 10 | 13 | 114 | 96 |
| 180 | 50 | 32 | 13 | 13 | 144 | 120 |
| 250 | 140 | 100 | 30 | 38 | 200 | 140 |

F 9P-D/KxTxH-JxN/N



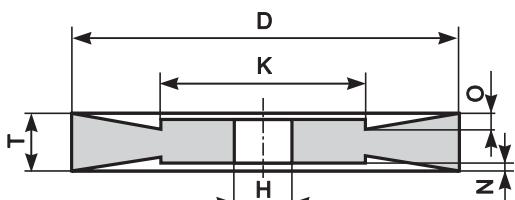
| D | T | H | K | J | N |
|-----|----|--------|----|-----|-----|
| 100 | 10 | 20 | 50 | 94 | 1,5 |
| 150 | 10 | 20 | 70 | 144 | 1,5 |
| 150 | 15 | 20 | 70 | 144 | 2,5 |
| 175 | 20 | 32(20) | 70 | 167 | 3 |
| 175 | 25 | 32(20) | 70 | 163 | 4,5 |

F 9PP-D/KxTxH-JxN/N



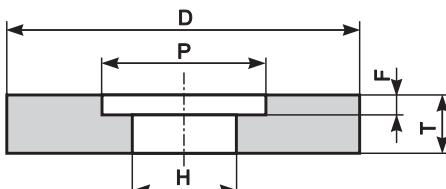
| D | T | H | K | J | N |
|-----|----|--------|----|-----|-----|
| 100 | 10 | 20 | 50 | 94 | 1,5 |
| 150 | 10 | 20 | 70 | 144 | 1,5 |
| 150 | 15 | 20 | 70 | 144 | 2,5 |
| 175 | 20 | 32(20) | 70 | 167 | 3 |
| 175 | 25 | 32(20) | 70 | 163 | 4,5 |

F 21P-D/KxTxH-N/O



| D | T | H | K | N | O |
|-----|----|--------|----|-----|-----|
| 100 | 6 | 20 | 50 | - | 1,5 |
| 100 | 10 | 20 | 50 | 1,5 | 3 |
| 150 | 6 | 20 | 70 | - | 1,5 |
| 150 | 10 | 20 | 70 | 1,5 | 3 |
| 150 | 15 | 20 | 70 | 2,5 | 4,5 |
| 175 | 20 | 32(20) | 70 | 3 | 6 |
| 175 | 25 | 32(20) | 70 | 4,5 | 7,5 |

F5-DxTxH-PxF



| D | T | H | P | F* |
|-----|----|------------|-----|----|
| 150 | 32 | 32(20) | 80 | 16 |
| 175 | 32 | 32 | 90 | 16 |
| 200 | 40 | 32(50,8) | 110 | 20 |
| 250 | 40 | 50,8(76,2) | 150 | 20 |
| 300 | 45 | 76,2 | 150 | 20 |
| 300 | 50 | 76,2 | 150 | 25 |
| 400 | 50 | 127 | 215 | 25 |

* Vrednost F je manja ili jednaka polovini debljine T .

* The value F is taken less than or equal to half thickness T .

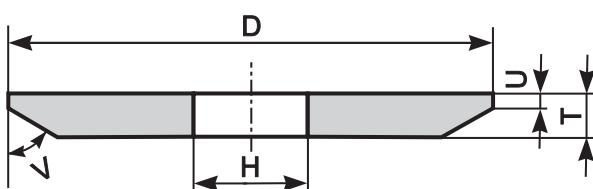
TOCILA ZA OŠTRENJE
TESTERA

Ravno tocilo za oštrenje testera
sa različitom oblikom profila oboda

SAWTOOTH SHARPENING

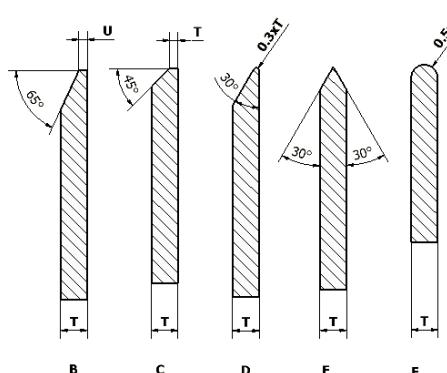
*Straight grinding wheel for saw sharpening
with various peripheral profile.*

F1 - DxTxH - R i oznaka profila
F1 - DxTxH - R and profile label



| D | T | H |
|-----|--------------------------|-------|
| 100 | 2,3,4 | 20 |
| 125 | 2,3,4 | 20 |
| 150 | 3,4,5,6,8,10,13,16 | 20,32 |
| 175 | 3,4,5,6,8,10,13,16 | 20,32 |
| 200 | 3,4,5,6,8,10,13,16,20 | 20,32 |
| 250 | 3,4,5,6,8,10,13,16,20,25 | 32 |
| 300 | 5,6,8,10,13,16,20,25,32 | 32 |

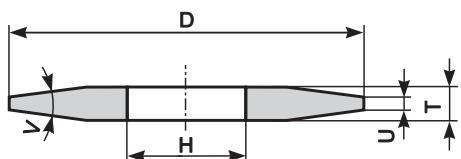
Tocila mogu imati različiti oblik profila oboda. Neki od profila su standardizovani. Najčešće korišćeni profili su:
Grinding wheel can be produced also with various peripheral profile. Some profiles are standardized. Frequently used profiles are:



$U=3,2$ mm ako nije utvrđeno drugačije
 $U=3,2$ mm unless otherwise ordered

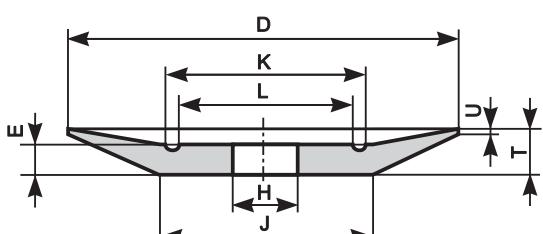


F4 NILES-D/JxT/UxH - V



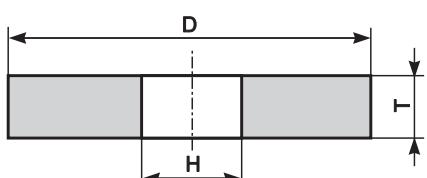
| D | T | H | U | V* |
|-----|-------|----|---|----------|
| 250 | 13 | 51 | 3 | 30°(40)° |
| 250 | 16,20 | 51 | 4 | 30°(40)° |
| 300 | 25 | 90 | 4 | 30°(40)° |
| 300 | 32 | 90 | 5 | 30°(40)° |

F12 MAAG-D/JxT/UxHxLxE



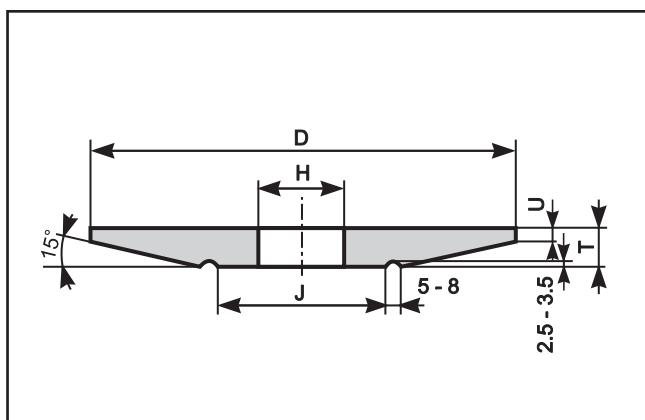
| D | T | H | U | E | J | K | L |
|-----|-------|-------|---------|----|-----|-----|---------|
| 220 | 18,20 | 40,90 | 2,3,4,6 | 16 | 120 | 140 | 105(80) |
| 280 | 25,32 | 40,90 | 4,6,8 | 18 | 120 | 140 | 105(80) |
| 340 | 25 | 40 | 4,8 | 18 | 120 | 140 | 105 |

F1 REISHAUER-DxTxH



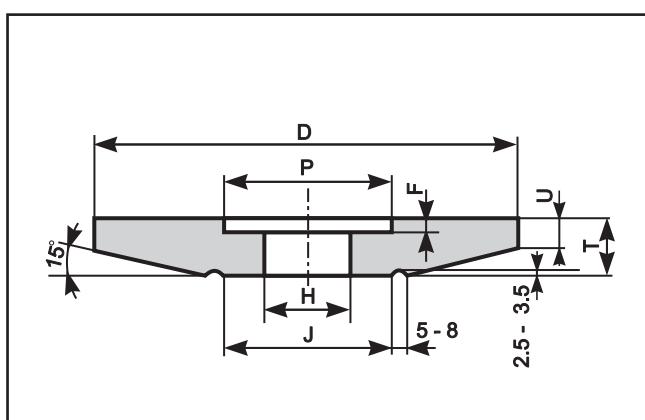
| D | T | H |
|-----|-----|-----|
| 350 | 62 | 160 |
| 350 | 84 | 160 |
| 350 | 104 | 160 |
| 400 | 84 | 160 |
| 400 | 104 | 160 |

F3 KLINGELNBERG 1-DxT/UxH



| D | T | H | U | J |
|----------|----------|----------|----------|----------|
| 250 | 14 | 32 | 3 | 110 |

F3 KLINGELNBERG 2-DxT/UxH-PxF



| D | T | H | U | J | P | F |
|----------|----------|----------|----------|----------|----------|----------|
| 250 | 17 | 32 | 5 | 110 | 100 | 3 |
| 250 | 22 | 32 | 8 | 110 | 100 | 8 |



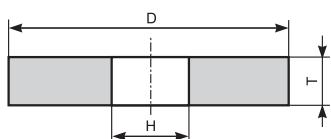
Oštrenje alata

**Oštrenje ručnih alata, strugarskih noževa,
burgija**

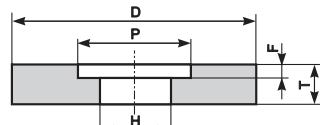
Tool Sharpening

**Hand tool, Turning and Planing Knife,
and Twist Drill Sharpening**

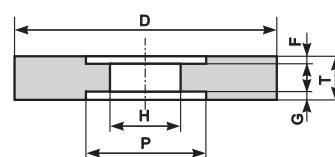
Oblici:
Shapes:



oblik 1
Form 1



oblik 5
Form 5

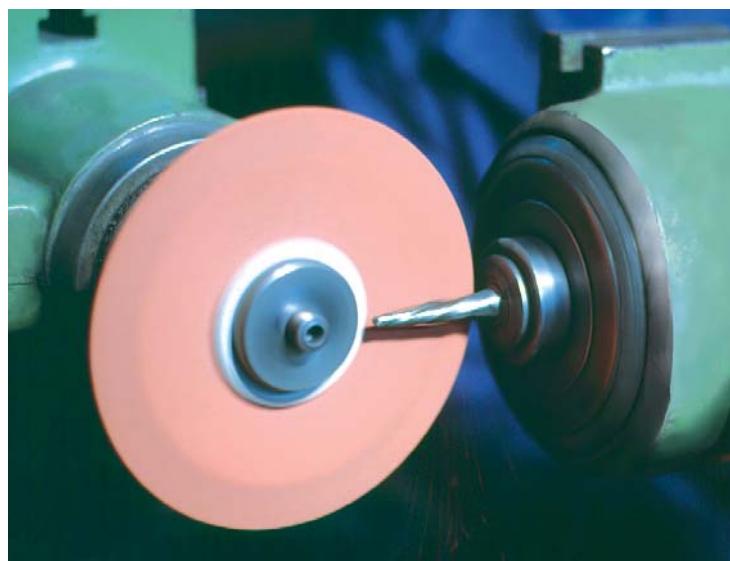


oblik 7
Form 7

Dimenzijske
Dimensions:

| | D | T | H |
|--|---------------------------------------|-----------------------------------|-------------------------------------|
| | od 50 do 350 <i>from 50 to 350</i> | od 6 do 63 <i>from 6 to 63</i> | od 13 do 32 <i>from 13 to 32</i> |
| | | | |

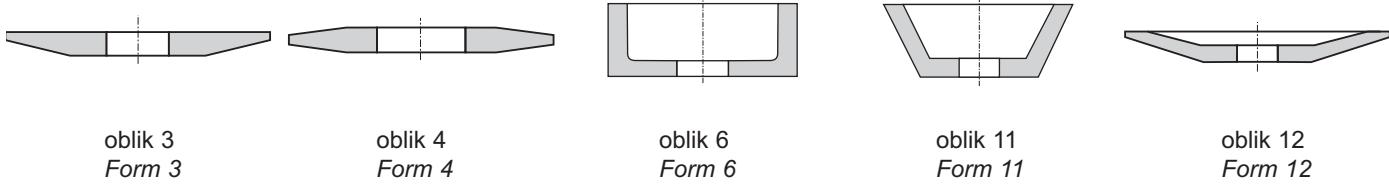
| | ručni alat <i>hand tools</i> | strugarski noževi <i>turning and planing knives</i> | burgije do $\varnothing 10$ <i>drills to Ø10</i> | burgije preko $\varnothing 10$ <i>drills over Ø10</i> |
|--|----------------------------------|--|---|--|
| Alatni čelik <i>Tool steel</i> | 21A46L6V 21A60L5V 21A80L5V | 21A46L6V 21A60L5V 21A80K5V | 21A60L5V 21A80K7V | 21A46L6V 21A60L5V |
| Brzorezni čelik HSS <i>High speed steel HSS</i> | 40A46J9V 40A60J8V 22A80K7V | 60A46J9V 22A60K7V 22A80K7V | 21A60L5V 21A80K7V | 22A46K8V 22A60K7V |
| Tvrdi metali <i>Tungsten carbide</i> | 10C80J5V | 10C46J6V 10C60J6V | 10C60J6V 10C80J5V | 10C46J6V 10C60J6V |



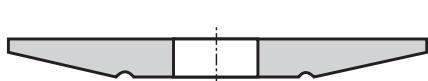
Oštrenje alata za glodanje i provrt

Milling Cutter and Reamer Sharpening

Oblici:
Shapes:



klingelnberg
Klingelnberg



Dimenzijske
Dimensions:

| D | T | H |
|-----------------------|---------------------|----------------------|
| od 40 do 250 | od 5 do 50 | od 13 do 32 |
| <i>from 40 to 250</i> | <i>from 5 to 50</i> | <i>from 13 to 32</i> |

Obodne brzine:

- alatni čelici 25 - 32 m/sek
- brzorezni čelici 25 - 32 m/sek
- tvrdi metali 16 - 20 m/sek

Peripheral speeds:

- tool steel 25 - 32 m/sec
- high speed steel 25 - 32 m/sec
- tungsten carbide 16 - 20 m/sec

| | univerzalna upotreba <i>universal application</i> | specifična upotreba <i>specific application</i> |
|--|--|--|
| Alatni čelik <i>Tool steel</i> | 21A60L5V | 21A46L6V 21A60L5V 21A80L5V |
| Brzorezni čelik HSS <i>High speed steel HSS</i> | 30A60J8V 40A60J8V | 80A46J9V 80A60J8V 80A80J8V |
| Tvrdi metali <i>Tungsten carbide</i> | 10C60J6V | 10C60J6V 10C80J5V |



Brušenje zupčanika

Sistem Maag



Dimenzije:
Dimensions:

| | | | | |
|----------------------|-------|-------|---------|--------|
| tocila D wheel | 220 | 280 | 340 | 400 |
| modul module | 2 - 4 | 3 - 6 | 3,5 - 9 | 4 - 15 |

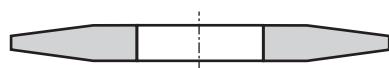
Tooth-flank Grinding

Maag Sistem

| Čelik za poboljšanje <i>Heat-treatable steel</i> | 21A46J9V 4A60J8V 21A80J8V |
|--|-----------------------------------|
| Čelik za cementaciju 55 - 60 HRC <i>Cementation steel 55 - 60 HRC</i> | 21A45H9V 21A60H9V 84A60H9V |
| Alatni čelik - brzorezni HRC 63 <i>Tool and high speed steel HRC 63</i> | 40A60I9V 40A80I9V 40A100I2V |
| Čelik za nitriranje preko 65 HRC <i>Nitrided steel over 65 HRC</i> | C80J12V |

Sistem Niles

Niles System



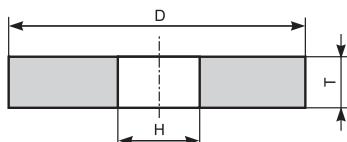
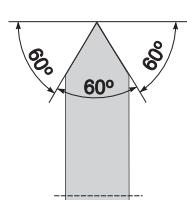
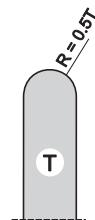
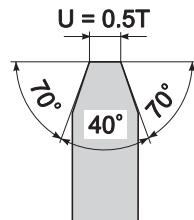
| | modul ≤ 2 module ≤ 2 | modul = 2 - 4 module = 2 - 4 | modul ≥ 4 module ≥ 4 |
|---|-------------------------|---------------------------------|-------------------------|
| Čelik za poboljšanje <i>Heat-treatable steel</i> | 22A100K5V 22A100K7V | 22A70L5V 22A60J5V | 22A54L5V 22A46J5V |
| Čelik kaljen do 63 HRC <i>Steel hardened to 63 HRC</i> | 22A100J5V | 22A70K5V 22A60I5V | 22A54K5V 22A46I5V |
| Čelik kaljen do 63 HRC i brzorezni čelik <i>Steel hardened over 63 HRC and high speed steel</i> | 22A120H5V | 22A70I5V 22A60H5V | 22A54I5V 22A46H5V |
| Čelik nitrirani <i>Nitrided steel</i> | 10C100J4V | 10C80K4V 10C80J4V | 10C60K4V 10C60J4V |

Brušenje navoja

Jednoprofilna tocila

Oblici:

Shapes:

oblik 1
Form 1oblik 1E
Form 1Eoblik 1F
Form 1Foblik 1E sp
Form 1E spDimenzijske:
Dimensions:

| D | T | H |
|-----------------|-------------|-----------------|
| od 250 do 350 | od 4 do 8 | od 150 do 160 |
| from 250 to 350 | from 4 to 8 | from 150 to 160 |

| modul module | konstrukcioni čelik construction steel | alatni i brzorezni čelik tool and high speed steel |
|-----------------|---|---|
| 0,50 - 0,80 | 22A400/500M12 (L8)V | 10C400/500K8V |
| 0,90 - 1,0 | 22A350/400M12V | 10C320/400K8V |
| 1,25 | 22A320M12V | 10C320/400K8V |
| 1,50 | 22A250M12V | 10C280/320K7V |
| 1,75 - 2,0 | 22A200L(M)12V | 10C220/240K7V |
| 2,5 - 3,0 | 22A180L(M)12V | 10C150/180J7V |
| 3,5 - 4,0 | 22A150K(L)12V | 10C120/150J6V |
| 4,5 - 6 | 22A120K12V | 10C120/100J5V |

**TOCILA ZA UNUTRAŠNJE KRUŽNO BRUŠENJE
GRINDING WHEELS FOR INTERNAL CIRCULAR GRINDING**

**TOCILA SA METALNOM DRŠKOM
MOUNTED GRINDING WHEELS**

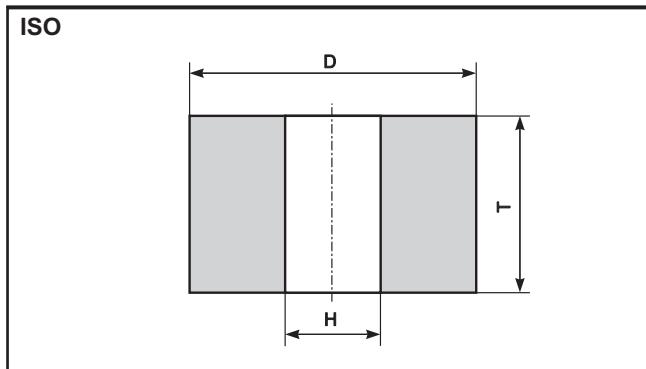
**BRUSNI ČEPOVI SA UGRAĐENOM MATICOM
MOUNTED WHEELS WITH BUILT-IN NUTS**



Ravno tocilo za unutrašnje kružno brušenje.

Straight grinding wheel for internal circular grinding.

F1-DxTxH

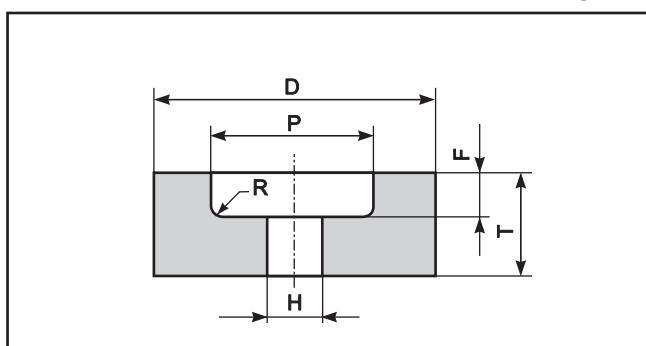


| D | T | H |
|-----|----------------------------|-----|
| 6 | 6 | 2,5 |
| 10 | 6,10,13,16 | 4 |
| 13 | 6,10,13,16,20 | 4 |
| 16 | 6,10,13,16,20 | 6 |
| 20 | 6,10,13,16,20,25,32 | 6 |
| 25 | 6,10,13,16,20,25,32 | 10 |
| 32 | 6,10,13,16,20,25,32,40,50 | 10 |
| 40 | 6,10,13,16,20,25,32,40,50 | 13 |
| 50 | 10,13,16,20,25,32,40,50,63 | 20 |
| 63 | 13,16,20,25,32,40,50,63 | 20 |
| 80 | 20,25,32,40,50,63 | 20 |
| 100 | 20,25,32,40,50,63 | 32 |
| 125 | 25,32,40,50,63 | 32 |
| 150 | 32,40,50,63 | 32 |
| 200 | 32,40,50,63 | 32 |

Jednostrano udubljeno ravno tocilo za unutrašnje kružno brušenje.

Wheel recessed on one side for internal circular grinding.

F5-DxTxH-PxF



| D | T | H | P | F | R _{max} |
|-----|----------|----------|-----|----------|------------------|
| 13 | 13 | 4 | 8 | 6 | 0.3 |
| 16 | 10,16 | 6 | 10 | 4,6 | 0.3 |
| 20 | 13,20 | 6 | 13 | 6,8 | 0.3 |
| 25 | 10,16,25 | 6 ili 10 | 16 | 4,6,10 | 0.3 |
| 32 | 13,20,32 | 10 | 16 | 6,8,12 | 0.3 |
| 40 | 16,25,40 | 13 | 20 | 6,10,15 | 0.3 |
| 50 | 16,25,40 | 20 | 32 | 6,10,15 | 0.3 |
| 63 | 25,40,50 | 20 | 40 | 10,15,20 | 0.3 |
| 80 | 40,50,63 | 20 | 45 | 15,20,25 | 0.3 |
| 100 | 40,50,63 | 32 | 50 | 15,20,25 | 0.3 |
| 125 | 40,50,63 | 32 | 63 | 15,20,25 | 1 |
| 150 | 40,50,63 | 32 | 80 | 15,20,25 | 1 |
| 200 | 50,63 | 32 | 100 | 20,25 | 3.2 |



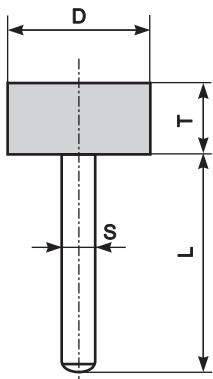
TOCILA SA METALNOM DRŠKOM

MOUNTED WHEELS

Brusni čep cilindrični

Mounted point cylindrical

F 52A DxT-SxL

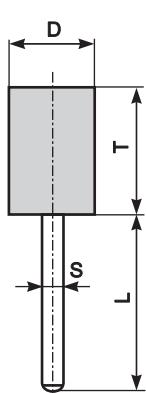


| D | T | S | L |
|----|------------------|--------|----------|
| 10 | 2 | 3, (6) | 30, (40) |
| 12 | 3,6 | 3, (6) | 30, (40) |
| 16 | 3,4,6,8,10,13,16 | 3, (6) | 30, (40) |
| 20 | 3,4,5 | 3, (6) | 30, (40) |
| 20 | 6,10,12,20 | 6 | 40 |
| 25 | 6,10,12,16,20,25 | 6 | 40 |
| 32 | 8,16,20,32 | 6 | 40 |
| 40 | 10,20,30 | 6 | 40 |
| 50 | 12,25,40 | 6 | 40 |
| 63 | 20 | 9 | 40 |

Brusni čep cilindrični

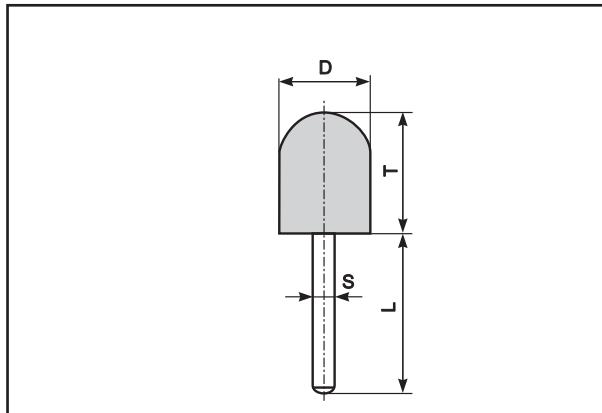
Mounted point cylindrical

F 52B DxT-SxL



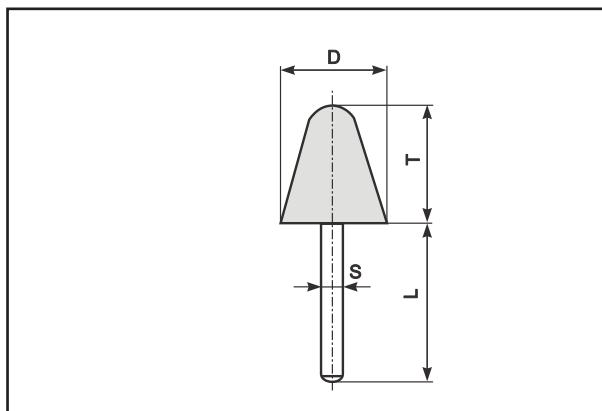
| D | T | S | L |
|----|----------------|--------|----------|
| 3 | 6,8 | 3, (6) | 30, (40) |
| 4 | 8,10 | 3, (6) | 30, (40) |
| 5 | 6,8,10 | 3, (6) | 30, (40) |
| 6 | 8,10,13 | 3, (6) | 30, (40) |
| 8 | 10,13,16 | 3, (6) | 30, (40) |
| 8 | 20 | 6 | 40 |
| 10 | 10,13,20 | 3, (6) | 30, (40) |
| 10 | 25,32 | 6 | 40 |
| 13 | 13,20,25,32 | 6 | 40 |
| 16 | 20,25,32,40,50 | 6 | 40 |
| 20 | 25,32,40,50 | 6 | 40 |
| 20 | 40 | 9 | 40 |
| 25 | 25,32,40,50 | 6 | 40 |
| 25 | 25 | 8 | 40 |
| 25 | 25,32,40 | 9 | 40 |
| 32 | 32,40 | 6 | 40 |
| 32 | 32 | 8 | 40 |
| 32 | 32,40,50 | 9 | 40 |
| 40 | 40 | 6,8,9 | 40 |
| 50 | 50 | 6,8,9 | 40 |

Brusni čep cilindrični - kružni

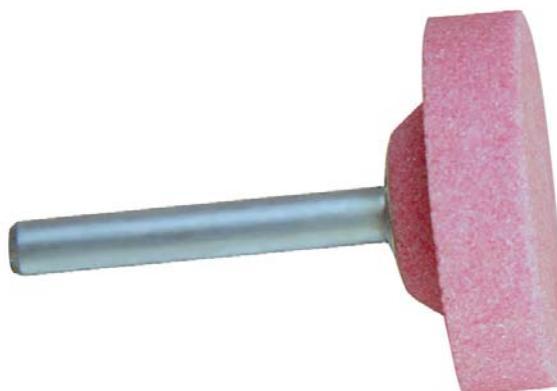
*Mounted point cylindrical - circular***F 52C DxT-SxL**

| D | T | S | L |
|----|----------|--------|----------|
| 3 | 6 | 3, (6) | 30, (40) |
| 5 | 10 | 3, (6) | 30, (40) |
| 8 | 16 | 3, (6) | 30, (40) |
| 12 | 20 | 3, (6) | 30, (40) |
| 16 | 20,25,32 | 6 | 40 |
| 20 | 25 | 6 | 40 |
| 25 | 25,32 | 6 | 40 |
| 40 | 40 | 6 | 40 |

Brusni čep konični - kružni

*Mounted point conical - circular***F 52D DxT-SxL**

| D | T | S | L |
|----|-------------|--------|----------|
| 5 | 8 | 3 | 30 |
| 6 | 10 | 3 | 30 |
| 10 | 10 | 3, (6) | 30, (40) |
| 12 | 12 | 3, (6) | 30, (40) |
| 13 | 20 | 3 | 30 |
| 16 | 16 | 3, (6) | 30, (40) |
| 16 | 25,45 | 6 | 40 |
| 19 | 29 | 6 | 40 |
| 20 | 20,25,32,40 | 6 | 40 |
| 22 | 70 | 6 | 40 |
| 25 | 25,32,45 | 6 | 40 |
| 25 | 70 | 6,8 | 40 |
| 30 | 30 | 6 | 40 |
| 32 | 32,40,50 | 6 | 40 |



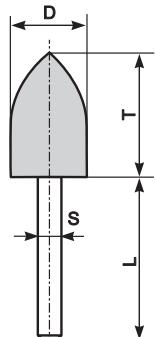
TOCILA SA METALNOM DRŠKOM

MOUNTED WHEELS

Brusni čep zaokruženo - konični

Mounted point rounded - pointed

F 52E DxT-SxL

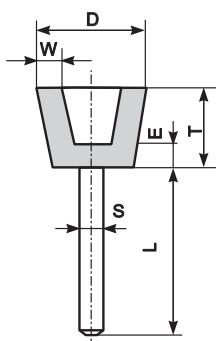


| D | T | S | L |
|----|-------|--------|----------|
| 3 | 6 | 3, (6) | 30, (40) |
| 5 | 10 | 3, (6) | 30, (40) |
| 8 | 15 | 3, (6) | 30, (40) |
| 10 | 20 | 3, (6) | 30, (40) |
| 10 | 32 | 6 | 40 |
| 13 | 20 | 6 | 40 |
| 20 | 20 | 6 | 40 |
| 20 | 32,40 | 6,9 | 40 |
| 25 | 32 | 6 | 40 |
| 25 | 40 | 6,9 | 40 |
| 32 | 40 | 6 | 40 |
| 40 | 40 | 6 | 40 |

Brusni čep lončasti - konični

Mounted point cup shaped - flaring

F 52F DxT-SxL

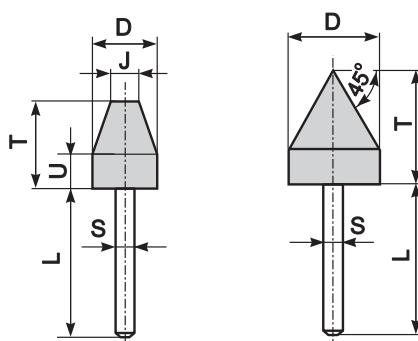


| D | T | S | L |
|----|----|---|----|
| 20 | 16 | 6 | 40 |
| 25 | 20 | 6 | 40 |
| 32 | 25 | 6 | 40 |
| 40 | 32 | 6 | 40 |

Brusni čep konični

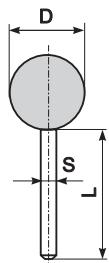
Mounted point conical

F 52G DxT-SxL



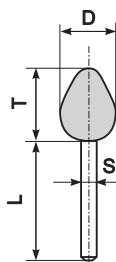
| D | T | S | L |
|-----------------|-------------|-------|----|
| 12 ¹ | 20,25 | 6 | 40 |
| 13 ¹ | 20 | 6 | 40 |
| 16 ¹ | 20,40 | 6 | 40 |
| 18 ¹ | 22 | 6 | 40 |
| 20 ¹ | 20 | 6 | 40 |
| 20 | 25,32,40,63 | 6 | 40 |
| 25 | 32 | 6 | 40 |
| 30 | 30,40 | 6 | 40 |
| 32 | 40 | 6,8,9 | 40 |
| 40 | 30,40 | 6 | 40 |

Brusni čep kugla

*Mounted point ball***F 52H D-SxL**

| D | S | L |
|----|--------|----------|
| 3 | 3, (6) | 30, (40) |
| 5 | 3, (6) | 30, (40) |
| 6 | 3, (6) | 30, (40) |
| 8 | 3, (6) | 30, (40) |
| 10 | 3, (6) | 30, (40) |
| 13 | 3, (6) | 30, (40) |
| 16 | 6 | 40 |
| 20 | 6 | 40 |
| 25 | 6 | 40 |
| 32 | 6 | 40 |
| 40 | 6 | 40 |
| 50 | 9 | 40 |

Brusni čep kap

*Mounted point drop***F 52I DxT-SxL**

| D | T | S | L |
|----|----|---|----|
| 20 | 25 | 6 | 40 |



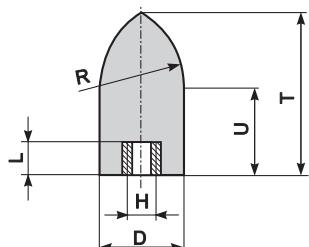
BRUSNI ČEPOVI SA UGRAĐENOM MATICOM

CONE AND PLUG WHEELS WITH INSERTED NUT

Interni standard

Internal standard

F 15 – DxTxH

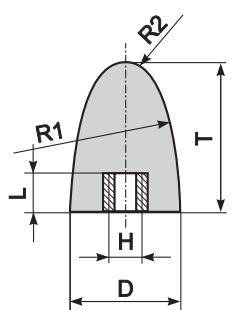


| D | T | H | L | R | U |
|----|-----|-----|----|----|----|
| 40 | 63 | M12 | 20 | 40 | 32 |
| 40 | 80 | M12 | 20 | 48 | 38 |
| 50 | 100 | M12 | 30 | 65 | 51 |
| 76 | 127 | M16 | 30 | 69 | 66 |

Lučno tocilo sa navrtkom

Cones and plugs, tapered roll shaped

F 16 – DxTxH

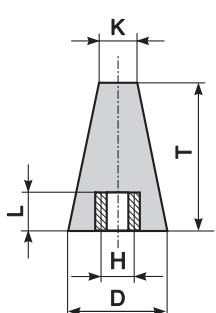


| D | T | H | L | R ₁ |
|----|----|-----|----|----------------|
| 32 | 51 | M10 | 16 | 118 |
| 40 | 63 | M12 | 20 | 190 |
| 45 | 76 | M12 | 25 | 194 |
| 63 | 80 | M16 | 25 | 165 |
| 80 | 80 | M16 | 25 | 150 |

Konično tocilo sa pravim stranicama

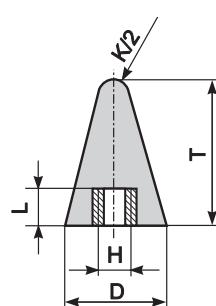
Cones and plugs, tapered straight sides

F 17 – DxTxH

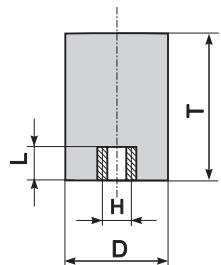
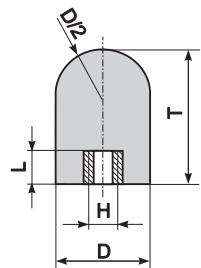


| D | T | H | L | K |
|----|---------|-----|----|----|
| 25 | 51 | M10 | 16 | 10 |
| 32 | 64 | M10 | 16 | 10 |
| 40 | 63 | M12 | 20 | 10 |
| 50 | 80,100 | M12 | 30 | 13 |
| 63 | 100,125 | M16 | 30 | 16 |
| 80 | 80,100 | M16 | 30 | 20 |

F 17R-DxTxH



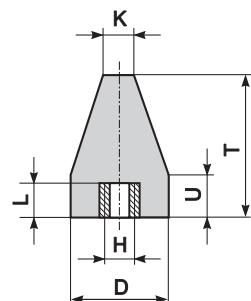
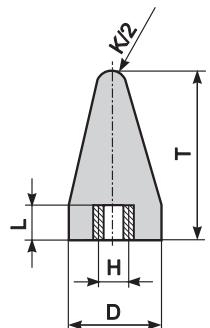
Valjkasto tocilo sa navrtkom

Cones and plugs, cylindrical
F 18-DxTxH
F 18-DxTxH

F 18R-DxTxH


| D | T | H | L |
|----|-------------|----------|-------|
| 25 | 38,50 | M10 | 16 |
| 32 | 40,50,63 | M10 | 16,20 |
| 40 | 40,50,63,80 | M12 | 20 |
| 50 | 50,80,100 | M12, M14 | 20 |
| 63 | 63,80 | M16 | 25 |



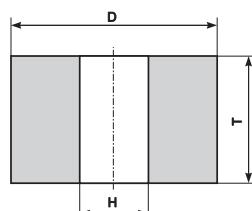
Tocilo sa koničnim vrhom i navrtkom

Cones and plugs, tapered
F 19-DxTxH
F 19-DxTxH

F 19R-DxTxH


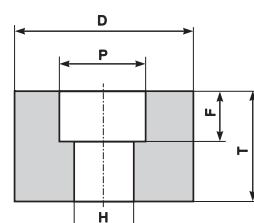
| D | T | H | L | K |
|----|-----------|-----|----|-------|
| 25 | 50 | M10 | 10 | 16 |
| 32 | 50,63 | M10 | 10 | 16 |
| 40 | 63 | M12 | 10 | 20 |
| 50 | 80,100 | M12 | 13 | 25 |
| 63 | 63,80,100 | M16 | 16 | 25,30 |
| 80 | 80,100 | M16 | 20 | 25,30 |

Unutrašnje kružno brušenje***Internal Circular Grinding***

Oblici:
Shapes:



oblik 1
Form 1



oblik 5
Form 5

Obodne brzine:

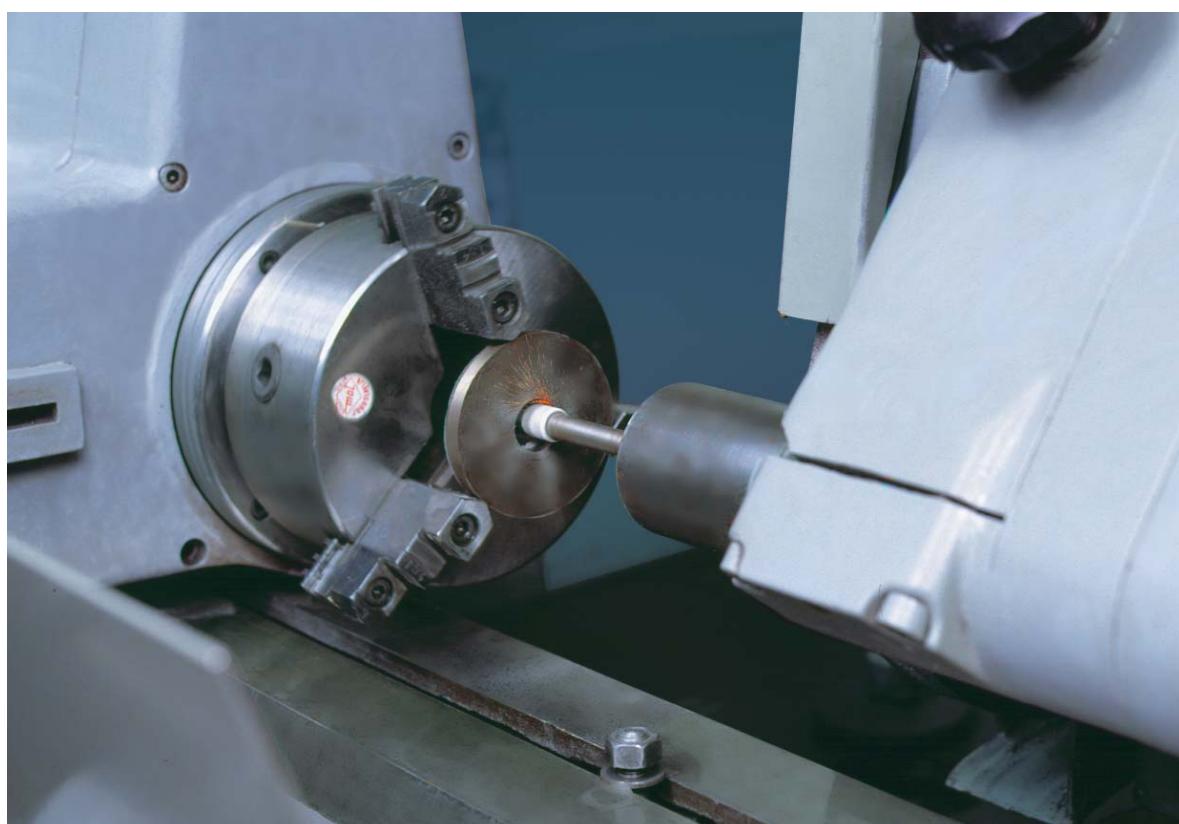
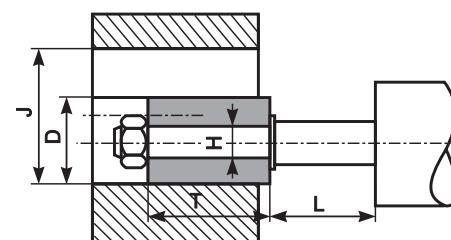
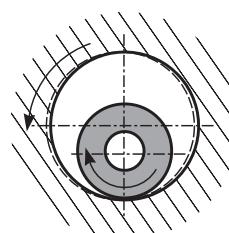
- univerzalna 25 - 40 m/sek
- čelik 16 - 20 m/sek
- tvrdi metal ≥ 16 m/sek
- obojeni metali 16 - 20 m/sek

Dimenzijske:
Dimensions:

| D | T | L | H |
|---|------|----|------|
| odrediti po potrebi <i>per request</i> | 2/3J | 2T | 1/3D |

Peripheral speeds:

- universal 25 - 40 m/sec
- steel 16 - 20 m/sec
- tungsten carbide ≥ 16 m/sec
- non-ferrous metals 16 - 20 m/sec



Unutrašnje kružno brušenje***Internal Circular Grinding***

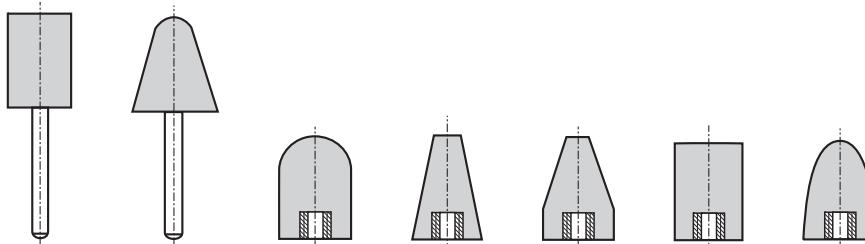
| Univerzalna upotreba <i>Universal application</i> | Tocilo D ≤ 25 <i>Wheel D ≤ 25</i> | Tocilo D ≥ 32 <i>Wheel D ≥ 32</i> |
|---|---|---|
| Čelik - pretežno nekaljen <i>Steel - mostly unhardened</i> | 21A60L6V | 21A46L6V |
| Čelik - pretežno kaljen <i>Steel - mostly hardened</i> | 60A60J8V | 60A60L6V |

| Specijalna upotreba <i>Specific application</i> | Tocilo D ≤ 450 <i>Wheel D ≤ 450</i> | Tocilo D ≥ 500 <i>Wheel D ≥ 500</i> |
|---|---|---|
| Čelik - nekaljen <i>Steel - unhardened</i> | 21A60L5V 40A60K6V | 21A46K8V 40A46L6V |
| Čelik - kaljen do 63 HRC <i>Steel - hardened to 63 HRC</i> | 40A60J8V 22A60I12V | 40A60J12V 22A46J8V |
| Čelik - kaljen preko 63 HRC <i>Steel - hardened over 63 HRC</i> | 40A60J12V 10C60J12V 22A60I6V | 40A60J12V 10C60J12V 22A46I6V |
| Čelik - tvrdo hromiran <i>Steel - hard-chrome-plated</i> | 21A80L5V 21A80K6V | 21A60L5V 21A60J8V |
| Čelik - nerđajući otporan na toplotu - nekaljen <i>Steel - stainless and heat resistant - unhardened</i> | 21A80K7V | 21A60L5V |
| Čelik - nerđajući otporan na toplotu - kaljen <i>Steel - stainless and heat resistant - hardened</i> | 10C60J12V 80A60I12V | 10C6078V 10C60I4V |
| Čelični liv <i>Steel cast iron</i> | 21A60L5V | 21A46L6V |
| Sivi liv <i>Gray cast iron</i> | 10C60I6V | 10C46I6V |
| Nodularni liv <i>Spheroid cast iron</i> | 40A60L5V | 40A46L6V |
| Tvrdi metal <i>Tungsten carbide</i> | 10C80H6V 10C60J12V | 10C60H6V 10C60J12V |
| Obojeni metali i plastika <i>Non-ferrous metals and plastics</i> | 10C60I6V 10C60J10V | 10C46I6V 10C60J10V |

Brušenje tocilima sa metalnom drškom i brusnim čepovima

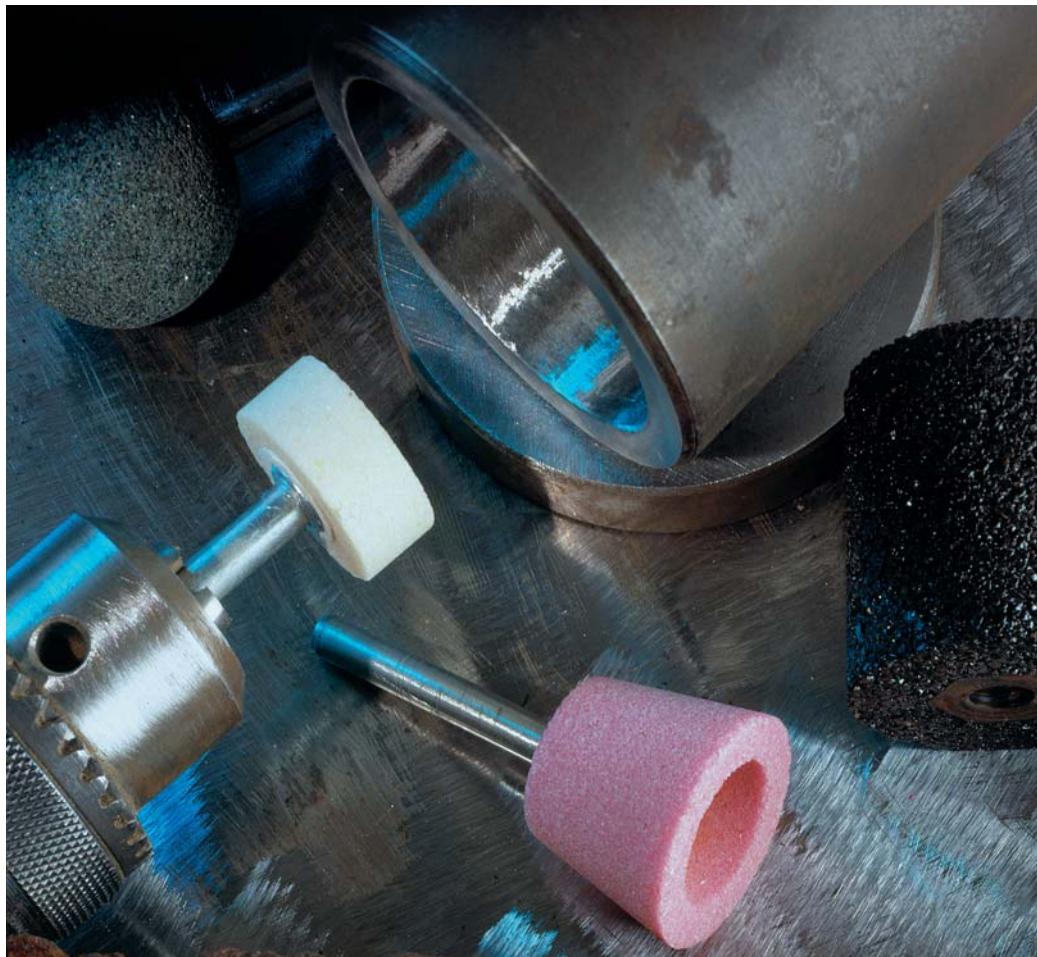
Grinding with Mounted Wheels, Cone and Plug Wheels

Oblici:
Shapes:



Obodne brzine do **50 m/sek**
Peripheral speed to 50 m/sec

| Čelik, čelični liv i nerđajući čelik <i>Steel, cast steel and stainless steel</i> | 10A16R4B 40A24P6V |
|--|----------------------|
| Temper i sivi liv <i>Chilled and gray cast iron</i> | 90C24R4B |
| Nemetali <i>Non-metal materials</i> | 90C36P5V |



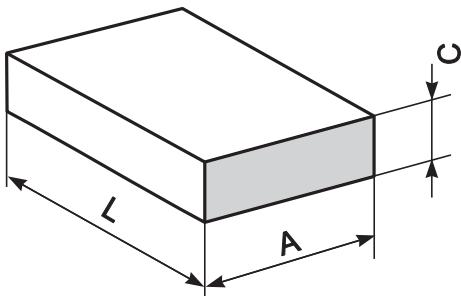




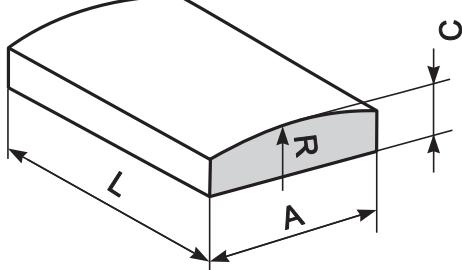
BRUSNI SEGMENTI
GRINDING SEGMENTS

BELEGIJE I BRUSNE TURPIJE
HONING STONES AND ABRASIVE STICKS

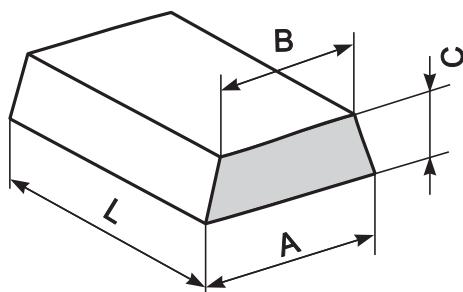
BRUSEVI ZA POLJOPRIVREDU
GRINDING TOOLS FOR AGRICULTURAL USE

F 31A-LxAxC

| L | A | C max |
|----------|----------|--------------|
| 102 | 60 | 50 |
| 120 | 90 | 60 |
| 125 | 50 | 40 |
| 150 | 50 | 60 |
| 150 | 80 | 60 |
| 150 | 90 | 60 |
| 150 | 100 | 60 |
| 160 | 80 | 40 |
| 160 | 120 | 60 |
| 175 | 50 | 40 |
| 200 | 50 | 40 |
| 200 | 80 | 40 |
| 200 | 100 | 50 |
| 200 | 105 | 60 |
| 200 | 120 | 60 |
| 250 | 183 | 60 |
| 300 | 200 | 50 |
| 800 | 400 | 60 |

F 31AR-LxAxC-R

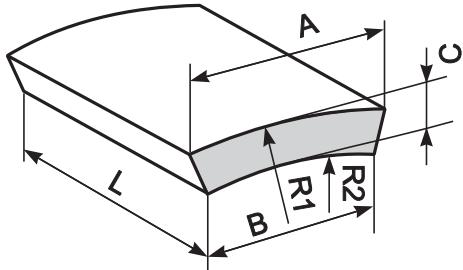
| L | A | C | R |
|----------|----------|----------|----------|
| 55 | 25 | 25 | 115 |

F 31B-LxA/BxC

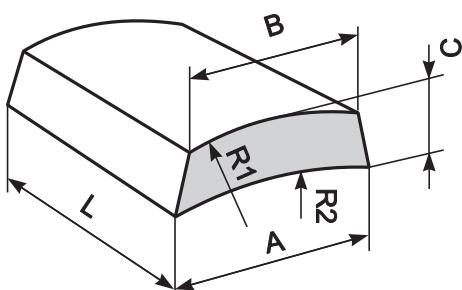
| L | A | B | C |
|----------|----------|----------|----------|
| 60 | 55 | 50 | 15 |
| 100 | 65 | 50 | 30 |
| 110 | 50 | 40 | 20 |
| 150 | 100 | 85 | 35 |
| 150 | 100 | 85 | 40 |
| 165 | 65 | 58 | 20 |
| 250 | 80 | 65 | 80 |

Ostali oblici i dimenziije po dogovoru

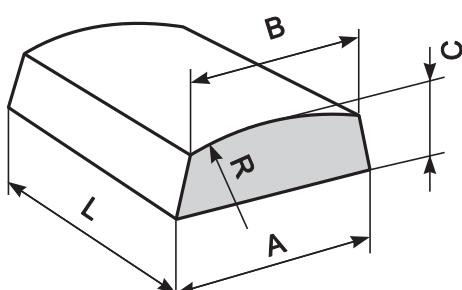
Other shapes and dimensions on request

F 31C-LxA/BxC-R1-R2

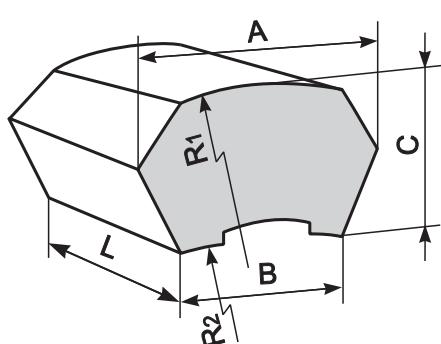
| L | A | B | C | R1 | R2 |
|-----|-----|----|----|-------|-----|
| 110 | 85 | 57 | 25 | 140 | 115 |
| 120 | 77 | 55 | 18 | 125 | 107 |
| 120 | 95 | 72 | 25 | 150 | 125 |
| 140 | 74 | 54 | 20 | 170 | 150 |
| 150 | 72 | 40 | 28 | 150 | 122 |
| 150 | 74 | 39 | 28 | 157,5 | 131 |
| 150 | 100 | 65 | 30 | 155 | 125 |
| 150 | 106 | 68 | 30 | 200 | 170 |

F 31D-LxA/BxC-R1-R2

| L | A | B | C | R1 | R2 |
|-----|----|----|----|-----|-----|
| 68 | 63 | 58 | 20 | 185 | 165 |
| 80 | 75 | 70 | 18 | 150 | 130 |
| 90 | 50 | 45 | 16 | 100 | 76 |
| 100 | 50 | 45 | 20 | 100 | 86 |

F 31DR-LxA/BxC-R

| L | A | B | C | R |
|-----|-------|------|------|-------|
| 102 | 65 | 57 | 25 | 205 |
| 150 | 101,5 | 83,7 | 37,5 | 206,5 |
| 165 | 62 | 55,4 | 20 | 250 |

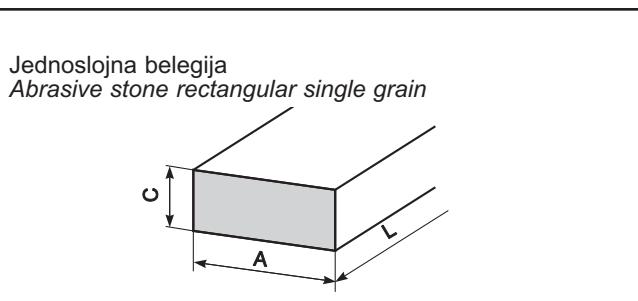
INTERNAL STANDARD-LxA/BxC-R1-R2

| L | A | C | B | R1 | R2 |
|-------|-------|------|-------|-------|-------|
| 100 | 80 | 18 | 70 | 140 | 115 |
| 152,4 | 127 | 38,1 | 114 | 215,9 | 177,8 |
| 210 | 90,5 | 52 | 75 | 254 | 202 |
| 210 | 114,5 | 67,5 | 95 | 330 | 300 |
| 210 | 119 | 55 | 103,5 | 320 | 265 |
| 210 | 145 | 63 | 130 | 400 | 337 |
| 210 | 145 | 63 | 130 | 450 | 387 |

Ostali oblici i dimenzije po dogovoru

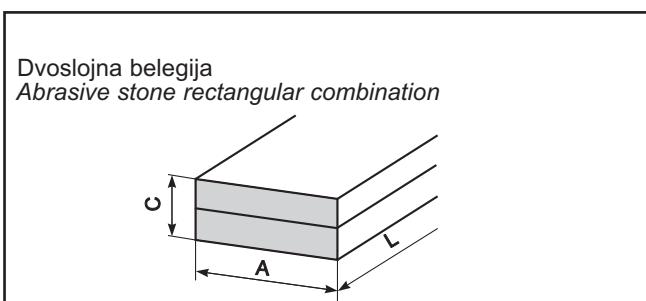
Other shapes and dimensions on request

F 90PR1-LxAxC



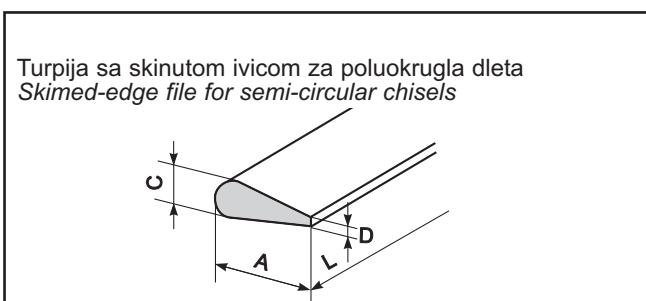
| A | C | L |
|----|----|-----|
| 40 | 20 | 125 |
| 50 | 25 | 150 |
| 50 | 25 | 200 |

F 90KB-LxAxC



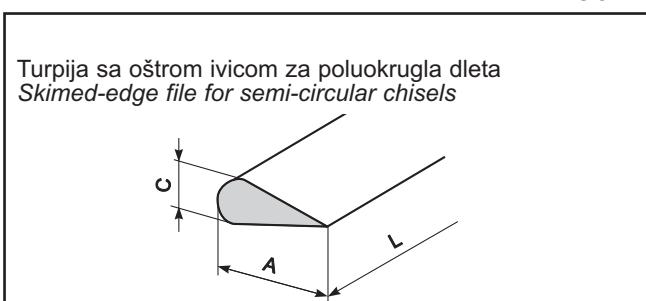
| A | C | L |
|----|----|-----|
| 40 | 20 | 125 |
| 50 | 25 | 150 |
| 50 | 25 | 200 |

F 90DL1-LxAxC/D



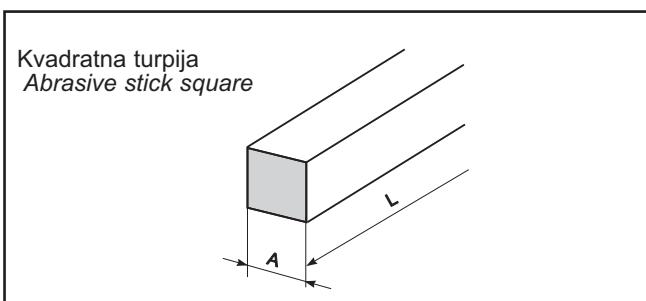
| A | C | D | L |
|----|----|---|-----|
| 45 | 10 | 3 | 100 |
| 25 | 6 | 1 | 100 |

F 90DL2-LxAxC



| A | C | L |
|----|----|-----|
| 45 | 10 | 100 |

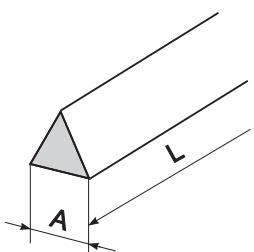
F 90KV-LxA



| A | L |
|----|-----|
| 6 | 100 |
| 8 | 100 |
| 10 | 100 |
| 10 | 150 |
| 15 | 150 |
| 20 | 200 |

F 90TR-LxA

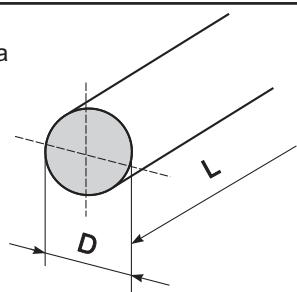
Trouglasta turpija
Abrasive stick triangle



| A | L |
|----|-----|
| 6 | 100 |
| 8 | 100 |
| 10 | 100 |
| 10 | 150 |
| 15 | 150 |
| 20 | 200 |

F 90OK-LxD

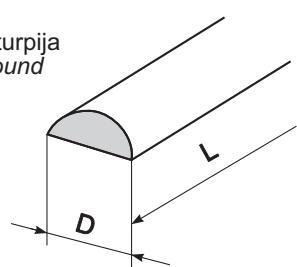
Okrugla brusna turpija
Abrasive stick round



| D | L |
|----|-----|
| 6 | 100 |
| 8 | 100 |
| 10 | 100 |
| 10 | 150 |
| 15 | 150 |
| 20 | 200 |

F 90PO-LxD

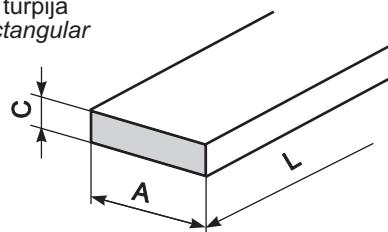
Poluokrugla brusna turpija
Abrasive stick half-round



| D | L |
|----|-----|
| 6 | 100 |
| 10 | 100 |
| 12 | 150 |
| 15 | 150 |
| 20 | 200 |

F 90PR2-LxAxC

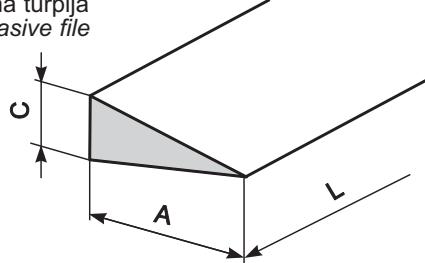
Pravouglja brusna turpija
Abrasive stick rectangular



| A | C | L |
|----|----|-----|
| 6 | 8 | 100 |
| 10 | 5 | 100 |
| 12 | 6 | 150 |
| 30 | 13 | 200 |

F 90NO-LxAxC

Nožasta brusna turpija
Knife-like abrasive file

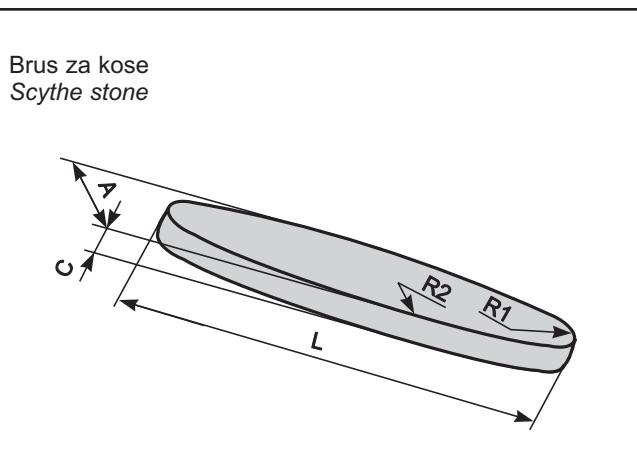


| A | C | L |
|----|---|-----|
| 25 | 3 | 100 |

Ostali oblici i dimenziije po dogovoru

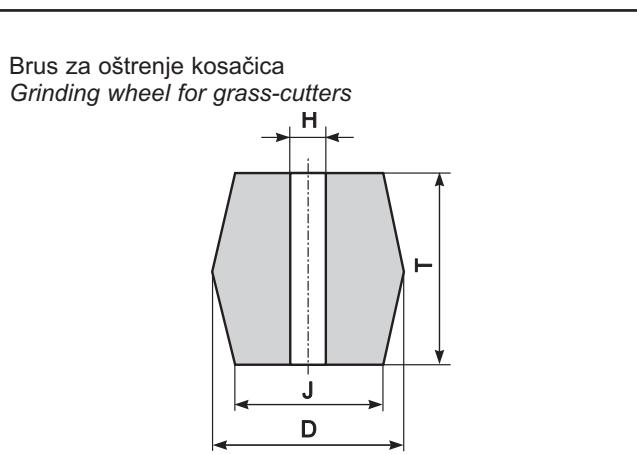
Other shapes and dimensions on request

F 90BK-LxAxC



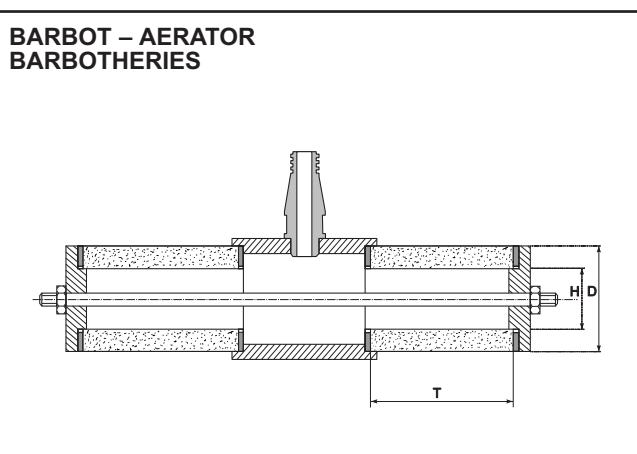
| A | C | L | R1 | R2 |
|----|----|-----|----|-----|
| 35 | 13 | 230 | 5 | 550 |

HTR-D/JxTxH



| D | T | H | J |
|------|----|--------|----|
| 85 | 80 | 16(32) | 60 |
| (90) | 60 | 16(30) | 70 |

BARBOTER F2-DxTxH

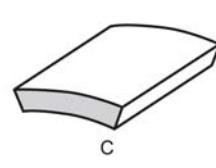
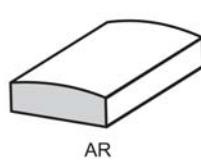
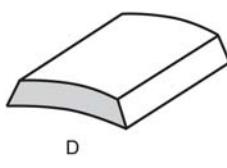
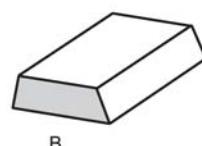
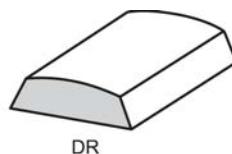
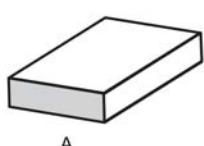


| D | T | H |
|----|-----|----|
| 70 | 100 | 40 |

Brušenje segmentima

Grinding with Segments

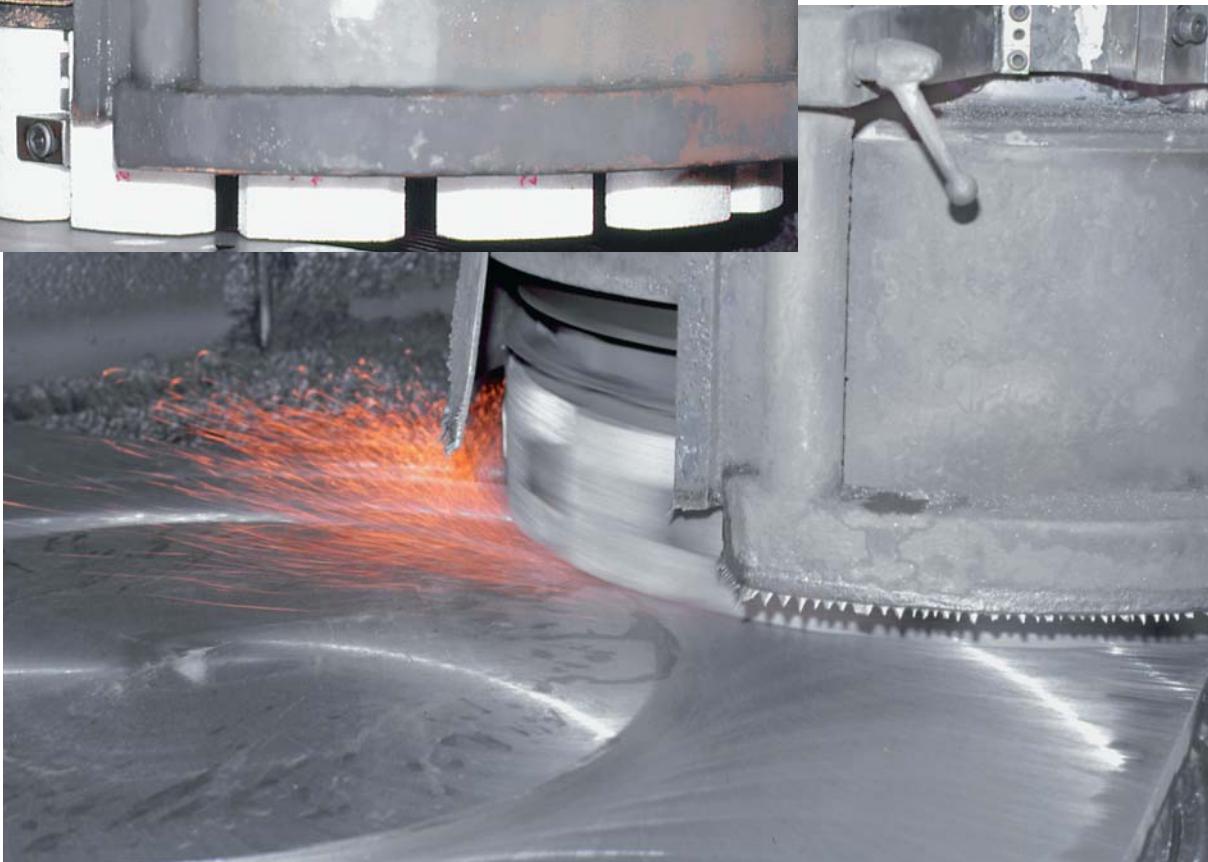
Segmenti:
Segments:



Dimenzijsi:
Dimensions:

| A | B | C | L |
|----------------|----------------|---------------|----------------|
| od 45 do 150 | od 50 do 150 | od 20 do 60 | od 63 do 250 |
| from 45 to 150 | from 50 to 150 | from 20 to 60 | from 63 to 250 |

Peripheral speeds:
- universal 20 - 40 m/sec



Brušenje segmentima

Grinding with Segments

| Univerzalna upotreba <i>Universal Application</i> | |
|---|-----------------------------------|
| Čelik - pretežno nekaljen <i>Steel - mostly unhardened</i> | 21A24K8V |
| Čelik - pretežno kaljen <i>Steel - mostly hardened</i> | 21A36H12V |
| Specijalna upotreba <i>Specific Application</i> | |
| Čelik - nekaljen <i>Steel - unhardened</i> | 21A24K8V 12A30J8V |
| Čelik - kaljen do 63 HRC <i>Steel - hardened to 63 HRC</i> | 21A36H12V 22A46H10V |
| Čelik - kaljen preko 63 HRC <i>Steel - hardened over 63 HRC</i> | 40A36I8V 84A46G10V |
| Čelik - tvrdo hromiran <i>Steel - hard-chrome-plated</i> | 40A46I12V 84A46J12V |
| Čelik - nerđajući otporan na toplotu - nekaljen <i>Steel - stainless and heat resistant - unhardened</i> | 21A24J8V |
| Čelik - nerđajući otporan na toplotu - kaljen <i>Steel - stainless and heat resistant - hardened</i> | 22A30H9V 22A36H9V |
| Čelik za nitriranje - nenitriran <i>Nitrided steel - unprocessed</i> | 21A24J8V |
| Čelik za nitriranje - nitriran <i>Nitrided steel - nitride hardened</i> | 10C544J12V |
| Čelični liv <i>Steel cast iron</i> | 21A24J8V |
| Sivi liv <i>Gray cast iron</i> | 40A24J8V 10C36J12V |
| Nodularni liv <i>Spheroid cast iron</i> | 40A24J8V 10C36J12V |
| Tvrdi metal <i>Tungsten carbide</i> | 10C60H6V |
| Obojeni metali i plastika <i>Non-ferrous metals and plastics</i> | 90C36J8V 10C36H12V |
| Keramika - porcelan <i>Ceramics - porcelain</i> | 10C36J4B 90C46J4B |
| Teraco pločice <i>Flagstone</i> | 90C20N5B 90C46K6B 90C100J6B |

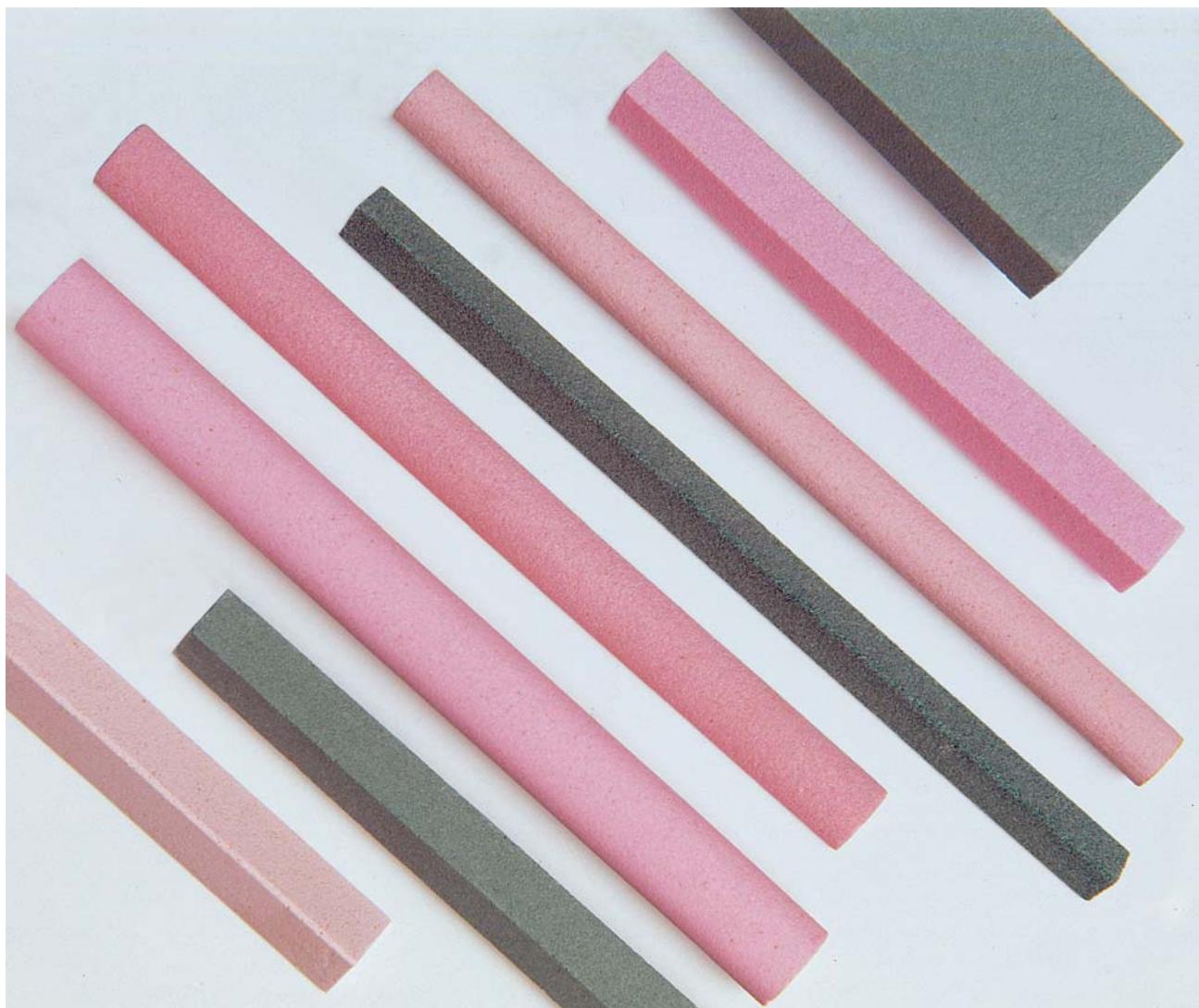
BARBOTERI

Barboteri (Aeratori) se koriste pri intenzivnom uzgoju riba u kaveznom sistemu. Otporni su na mehanička opterećenja, na hemijske uticaje i veoma lako se čiste. Uvedeni vazduh razvijaju u veoma sitne mehuriće velike ukupne površine time obezbeđujući efikasno rastvaranje kiseonika u vodi. U vodi sa obogaćenim kiseonikom postiže se veoma dobar prirast riba i aeracijom se obezbeđuje da hrana lebdi u vodi, znači dolazi do manjeg gubitka.

BARBOTHERIES (AERATORS)

Barbotheries (aerators) are used in intensive breeding of fish in cage systems. The aerators are resistant to mechanical pressure, chemical reactions and they are very easy to clean. Thanks to the aerators, the injected air forms bubbles with tiny diameters which spread over a large surface of the water. This process assures effective dissolution of oxygen in the water. The breeding of fish in water enriched with oxygen is very successful. Aeration ensures that food will float on the water, thus minimizing the loss of food.





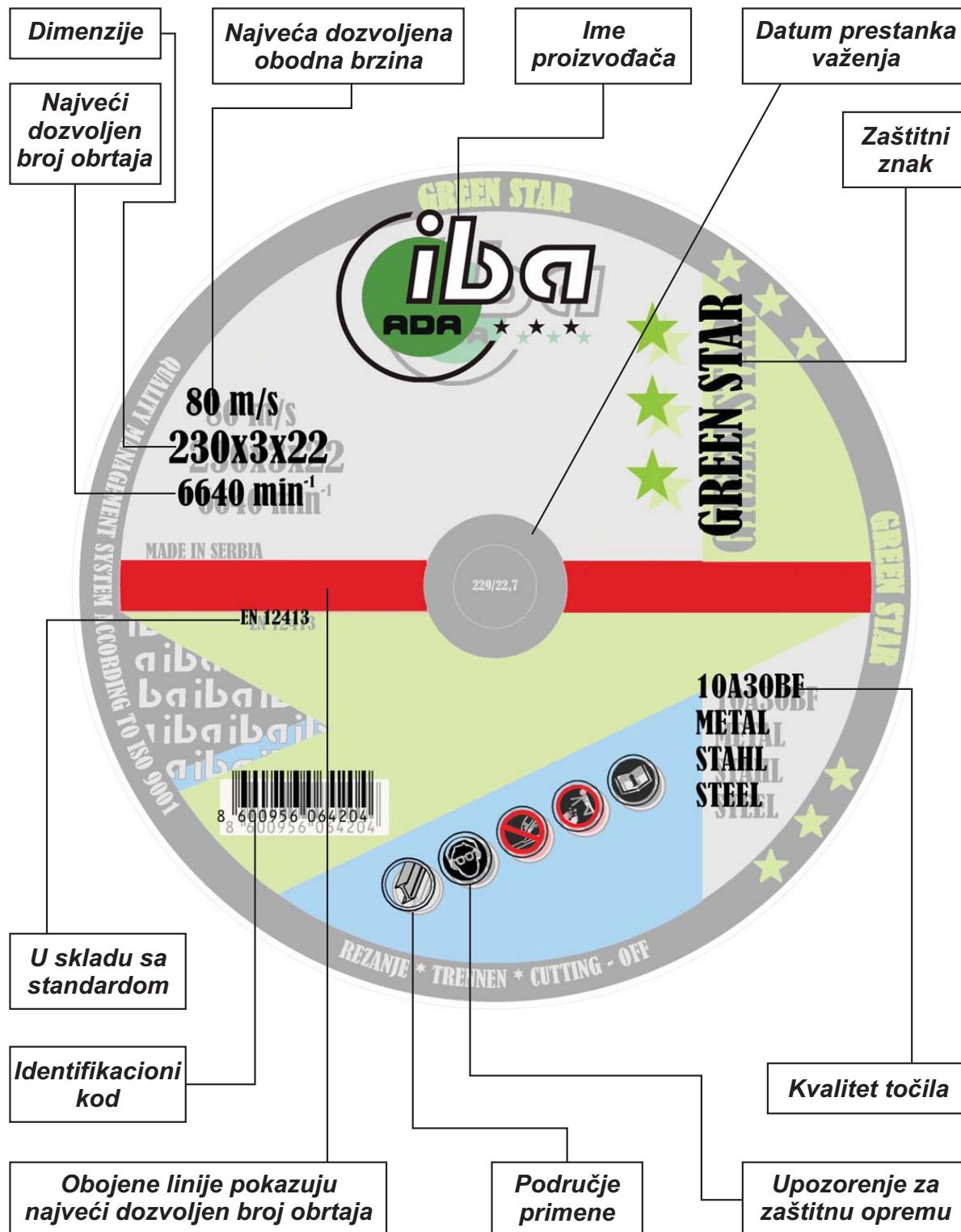
**REZALJKE, ARMIRANI I NEARMIRANI BRUSEVI
CUTTING WHETSTONES, REINFORCED AND
NON-REINFORCED GRINDING TOOLS**

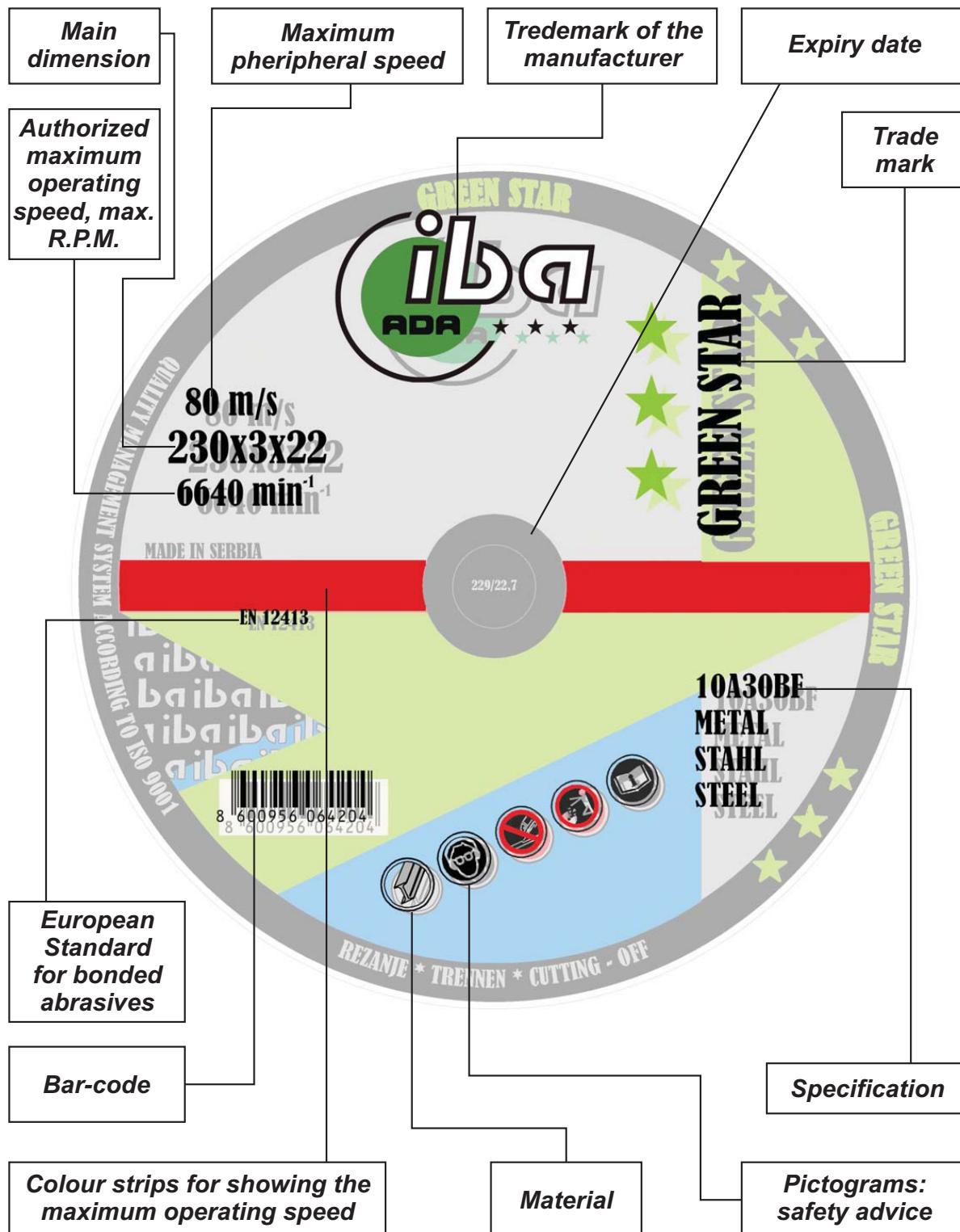
**BRUSNI LONCI
CUP WHEELS**

**BRUSEVI SA MATICAMA
GRINDING TOOLS WITH NUTS**

GREEN STAR

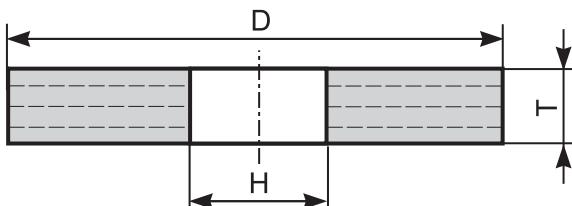






RAVNO TOCILO

Armirano ravno tocilo
Reinforced straight grinding wheel

**F1-DxTxH**
STRAIGHT GRINDING WHEEL

| D | T | H |
|-----|-------------|----------|
| 32 | 10 | 8 |
| 40 | 10 | 10 |
| 50 | 10,13,20 | 10 |
| 63 | 10,13,16,20 | 10 |
| 80 | 10,20,25,32 | 13 |
| 100 | 20,25,32,40 | 16,20 |
| 125 | 20,25,32,40 | 16,20,32 |
| 150 | 20,25,32,40 | 16,20,32 |
| 180 | 20,25,32,40 | 20,32 |
| 200 | 25,32 | 20,32 |

**NEARMIRANE REZNE PLOČE
ZA STABILNE MAŠINE**
Područje primene:

Služe za precizno, kvalitetno sečenje i rezanje. Pogodne su za stabilne mašine, gde je rezna ploča pravilno zaštićena i radi pod kontrolisanim okolnostima; bez uvijanja i bočnog pritiska. Bitno je da sečen komad bude bezbedno pričvršćen. Uopšteno, koristi se u laboratorijama za pripremu uzoraka za ispitivanje, za sečenje strugarsog noževa od tvrdog metala, za sečenje tanjih inox šipki, itd. MAXIMALNA BRZINA UPOTREBE JE 50m/s.

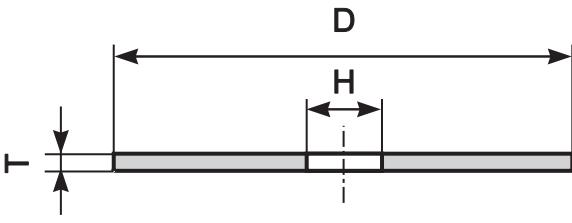
Testirani su u skladu sa međunarodnim standardom EN 12413.

**NON-REINFORCED CUTTING WHEELS
FOR STATIONARY GRINDERS**
Application Areas:

These wheels are used for precise and quality cutting and slicing. They are meant for nonmobile machines, where the plate is properly protected and it operates in a controlled environment, it is flat and without lateral pressure. It is important that the workpiece is securely immobilized and fixed. These wheels are generally used in laboratories for sample testing, for cutting lathe knives out of hard metals, for cutting thinner stainless steel rods, etc. They are easy and safe to use, inexpensive, easily acquired, and good for cutting various metals. THE MAXIMUM PERIPHERAL SPEED OF USE IS 50 m/s.

The wheels are tested according to international standards EN 12413.

Nearmirano tocilo za sečenje
Non-reinforced cutting-off wheel

F41-DxTxH

Najpopularniji kvaliteti su:
The most popular quality are:

- 12A60PB
- 12A80PB
- 12A100PB

Radimo i druge kvalitete,
prema zahtevu kupca

| D | T | | | | | | | | H | |
|-----|-----|-----|-----|-----|------|------|------|---------|------|------|
| | 0.5 | 1.0 | 1.5 | 2.0 | 10.0 | 20.0 | 22.2 | 31.7,32 | 51.0 | 76.2 |
| 40 | X | X | | | | | | | | |
| 50 | X | X | | | | | | | | |
| 60 | X | X | X | | | | X | | | |
| 70 | X | X | X | | | X | X | | | |
| 80 | | X | X | | | | X | | | |
| 100 | X | X | X | X | | | X | X | | |
| 125 | X | X | X | X | | | X | X | | |
| 150 | X | X | X | | | X | X | X | | |
| 175 | | X | X | | | X | X | X | X | |
| 180 | | X | X | | | | X | X | X | |
| 200 | | X | X | | | X | X | X | X | |
| 230 | | X | X | | | | X | X | X | |
| 250 | | X | X | | | X | X | X | X | X |
| 300 | | | X | | | | | X | | |

We also produce other combinations according
to the requests of the costumer.

**ARMIRANA REZNA PLOČA NA STA-
CIONARNIM ILI POKRETNIM MAŠINAMA
ZA ODSECANJE SA PERIFERNOM
BRZINOM OD 80 m/s ILI 100 m/s**

**REINFORCED CUTTING WHEELS ON
STATIONARY OR MOBILE MACHINES
FOR CUTTING AT PERIPHERAL SPEEDS
OF 80 m/s OR 100 m/s**



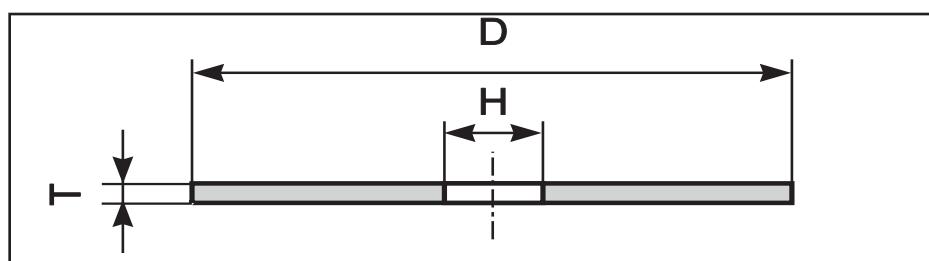
Područje primene:

Ove rezne ploče namenjeni su za odsecanje ili prosecanje radnog komada. Radni komad je čvrsto stegnut ili stabilizovan sopstvenom težinom. Ukoliko je tocilo za sečenje ručno vođen, radni komad je učvršćen i obrnuto. Mašina za odsecanje je nepomična u toku rada.

Application Areas:

These cutting wheels are meant for cutting. The work piece is clamped or stabilized using its own weight. If the grinding wheel is manually operated, the workpiece is fixed and vice versa. The cutting machine is immobile during the operation.

F 41 - DxTxH



| D | T | H | Form | Kvalitet - Quality | | | |
|-----|-----|----------------------------|------|------------------------------|------------------------------|------------------|------------------------------|
| | | | | 10A30RBF ČELIK - STEEL | 10A24NBF ČELIK - STEEL | 29A36QBF INOX | 90C30SBF KAMEN - STONE |
| 300 | 3 | 20,22,23, 25,4,30,32,40 | 41 | X | X | X | X |
| 300 | 3.2 | 20,22,23, 25,4,30,32,40 | 41 | X | X | X | X |
| 300 | 3.5 | 20,22,23, 25,4,30,32,40 | 41 | X | X | X | X |
| 300 | 4 | 20,22,23, 25,4,30,32,40 | 41 | X | X | X | X |
| 350 | 3 | 20,22,23, 25,4,30,32,40 | 41 | X | X | X | X |
| 350 | 3.2 | 20,22,23, 25,4,30,32,40 | 41 | X | X | X | X |
| 350 | 3.5 | 20,22,23, 25,4,30,32,40 | 41 | X | X | X | X |
| 350 | 4 | 20,22,23, 25,4,30,32,40 | 41 | X | X | X | X |
| 400 | 3.5 | 25,4,30,32,40 | 41 | X | | X | X |
| 400 | 4 | 25,4,30,32,40 | 41 | X | | X | X |
| 400 | 5 | 25,4,30,32,40 | 41 | X | | X | X |
| 500 | 5 | 25,4,30,32, 40,50,60 | 41 | X | | X | X |
| 600 | 6.5 | 25,4,30,32, 40,50,60 | 41 | X | | X | X |

Smernice za izbor rezne ploče:
Guide for choicing cutting wheels:



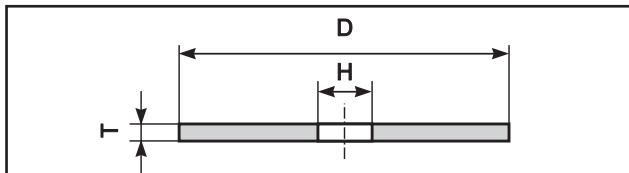
| | | |
|---|---|--|
| 10A30RBF ČELIK - STEEL | Koristi se za opštu upotrebu, za čelike negarantovanog sastava i za niskolegirane čelike. Karakteriše ga dobra rezna sposobnost i dug vek trajanja. | For general use, carbon steel and low-alloy steel. Characterized by great cutting ability and durability. |
| 10A24NBF ČELIK - STEEL | Upotrebljava se za visokolegirane i kaljene čelike. Ima dobru reznu sposobnost, dug vek trajanja, hladan rez. | Used for high-alloy and hardened steel. It has good cutting ability, durability and cold cut. |
| 29A36QBF INOX | Namenjen je za sečenje nerđajućeg čelika, karakteriše ga dobra rezna sposobnost i dug vek trajanja. | Meant for cutting stainless steel. Characterized by good cutting ability and durability. |
| 90C30SBF KAMEN - STONE | Univerzalna upotreba kod sečenja građevinskih materijala: betona, cigla, crepa, mermara, itd. Karakteriše ga dobra rezna sposobnost kod sečenja obojenih metala i sivog liva. | For universal use cutting construction materials: concrete, brick, tile, marble, etc. Characterized by good cutting ability cutting non-ferrous metals and grey cast iron. |
| 90C30LBF GUMA, PLASTIKA - RUBBER, PLASTICS | Sa lakoćom seče gumeni, plastični materijali, ne pregrrevajući materijal. | Cuts rubber and plastics with ease without overheating the material. |

**ARMIRANE REZNE PLOČE
STANDARDNE DEBLJINE, ZA UGAONE
BRUSILICE SA PERIFERNOM BRZINOM
OD 80 m/s I 100 m/s**

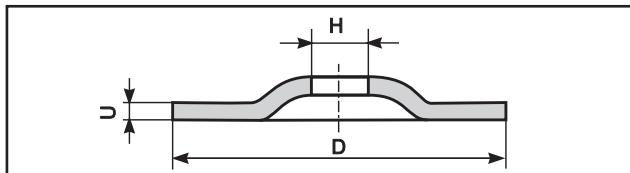
Namenjeni su za odsecanje svih vrsta radnih komada ručnim radnim alatima. Radni komad je nepokretan, a rezna ploča je vođena ručno. Univerzalne su alate za ručne ugaone brusilice. Karakteriše ih odličan učinak pri sečenju i dug životni vek upotrebe. Poseduju visoku reznu sposobnost, lako i brzo sekut, upotrebljavaju kod širokog spektra materijala.



F 41 - DxTxH



F 42 - DxUxH



| D | T (ili U kod F42) | H | Form | Kvalitet - Quality | | | |
|-----|----------------------------|-------|--------|------------------------------|------------------------------|------------------|------------------------------|
| | | | | 10A30SBF ČELIK - STEEL | 10A30WBF ČELIK - STEEL | 29A36QBF INOX | 90C30SBF KAMEN - STONE |
| 100 | 2.5 | 16 | 41 | X | | X | X |
| 100 | 3 | 16 | 41 | X | | X | X |
| 115 | 2.5 | 22.23 | 41, 42 | X | | X | X |
| 115 | 3 | 22.23 | 41, 42 | X | | X | X |
| 125 | 2.5 | 22.23 | 41, 42 | X | | X | X |
| 125 | 3 | 22.23 | 41, 42 | X | | X | X |
| 150 | 2.5 | 22.23 | 41, 42 | X | | X | X |
| 150 | 3 | 22.23 | 41, 42 | X | | X | X |
| 180 | 2.5 | 22.23 | 41, 42 | X | X | X | X |
| 180 | 3 | 22.23 | 41, 42 | X | X | X | X |
| 230 | 2.5 | 22.23 | 41, 42 | X | X | X | X |
| 230 | 3 | 22.23 | 41, 42 | X | X | X | X |
| 230 | 3.2 | 22.23 | 41, 42 | X | X | X | X |



| | | |
|-----------------------------------|--|--|
| 10A30SBF ČELIK - STEEL | Preporučuje se za sečenje lima, cevi, profila od čelika negarantovanog sastava i od hiskolegiranog čelika. | Recommended for cutting sheet metal, pipes, steel of construction material, and low-alloy steel. |
| 10A24NBF ČELIK - STEEL | Tvrda rezna ploča sa izuzetno dugačkim vekom trajanja. | A hard cutting wheel with an extremely long lifeline. |
| 29A36QBF INOX | Na osnovu sastava preporučuje se za sečenje nerđajućeg (inox) materijala, ali i za univerzalnu upotrebu. Tocilo bez sadržaja gvožđa i sumpora. | On the basis of its composition, it is recommended for the cutting of stainless steel but can be used universally. A cutting wheel containing no iron or sulfur. |
| 90C30SBF KAMEN - STONE | Univerzalna upotreba za sečenje građevinskih materijala (beton, cigla, crep, mermer), obojenih metala, plastike, gume. | For universal use cutting construction materials (concrete, brick, tile, marble), non-ferrous metals, plastic, rubber. |

**SUPERTANKE ARMIRANE REZNE
PLOČE ZA UGAONE BRUSILICE
SA PERIFERNOM BRZINOM
UPOTREBE OD 80 m/s**

Prednosti tih rezaljki se najviše ispoljava pri sečenju limova i profila sa tankim zidovima. Karakteristično je za njih:

- povećana produktivnost
- minimalni gubici materijala prilikom sečenja
- dug vek trajanja
- sečena površina je "čista"
- minimalno zagrevanje sečene površine
- brz i tačan rez
- u sastavu bez prisustva Fe+S+Cl

Univerzalni su alati za sečenje konstrukcijskog čelika, nerđajućeg (inox) čelika ili za odlivke.

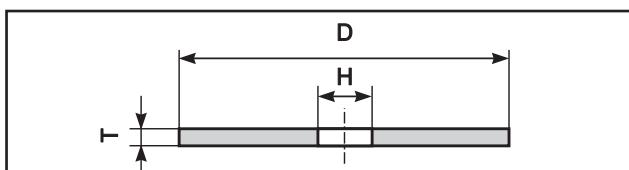
**SUPERTHIN REINFORCED CUTTING
WHEELS FOR ANGLE GRINDERS
WITH A PERIPHERAL SPEED OF 80 m/s**

The advantage of these cutting tools is most evident when used for cutting sheet metal and profiles with thin walls. They are characterized by:

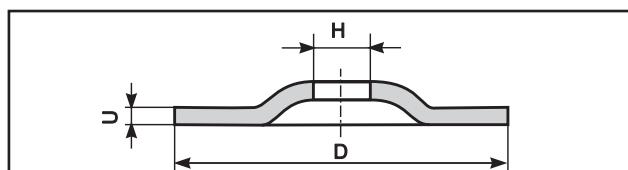
- increased productivity
- minimal loss of material during cutting
- durability
- cut surface is "clean"
- minimal heating of cut surface
- fast and accurate cut
- composition without Fe+S+Cl

These are universal cutting tools for construction steel, stainless steel (inox) or cast iron.

F 41 - DxTxH



F 42 - DxUxH



| D | T (ili U kod F42) | H | Form | Kvalitet - Quality | | | |
|-----|----------------------------|-------|--------|------------------------------|------------------|------------------------------|------------------|
| | | | | 22A60PBF ČELIK - STEEL | 29A60ZBF INOX | 10A30SBF ČELIK - STEEL | 29A36QBF INOX |
| 115 | 1 | 22.23 | 41 | X | X | | |
| 115 | 1.6 | 22.23 | 41 | X | X | | |
| 115 | 2 | 22.23 | 41, 42 | | | X | X |
| 125 | 1 | 22.23 | 41 | X | X | | |
| 125 | 1.6 | 22.23 | 41 | X | X | | |
| 125 | 2 | 22.23 | 41, 42 | | | X | X |
| 150 | 1.6 | 22.23 | 41 | X | X | | |
| 150 | 2 | 22.23 | 41, 42 | | | X | X |
| 180 | 1.5 | 22.23 | 41 | X | X | | |
| 180 | 1.7 | 22.23 | 41 | X | X | | |
| 180 | 2 | 22.23 | 41, 42 | | | X | X |
| 230 | 1.6 | 22.23 | 41 | X | X | | |
| 230 | 1.9 | 22.23 | 41 | X | X | | |
| 230 | 2 | 22.23 | 41, 42 | | | X | X |

| | | |
|---------------------------------------|--|--|
| 22A60PBF ČELIK - STEEL | Za sečenje nelegiranog i niskolegiranog čelika. Karakteriše ga veliki faktor učinka. | <i>For cutting alloy and non-alloy steel. High performance.</i> |
| 29A60ZBF 29A36QBF INOX | Za sečenje nerđajućeg čelika, ali uspešno seče i čelik negarantovanog sastava i niskolegirani čelik. | <i>For cutting stainless steel, but it also cuts steel of unknown composition and low-alloy steel.</i> |
| 10A30SBF ČELIK - STEEL | Za sečenje nelegiranog i niskolegiranog čelika raznih profila. | <i>For cutting non-alloy steel and low-alloy steel of various profiles.</i> |



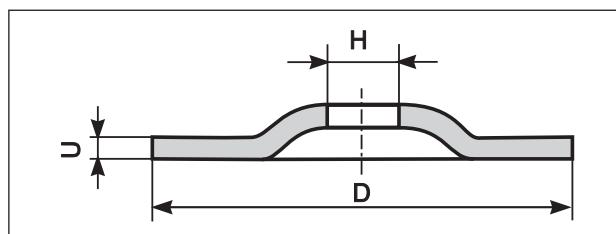
**ARMIRANE BRUSNE PLOČE SA
UDULJENIM DNOM ZA GRUBO
BRUŠENJE NA UGAONOJ BRUSILISI
ZA PERIFERNU BRZINU UPOTREBE
OD 80 m/s I 100 m/s**

Područje primjene:

Ovi brusni alati namenjeni su za grubo brušenje i za obaranje ivica brušenjem svih površina radnog komada ručnim brusilicama. Radni komad je nepokretan a brusilica je ručno vođena.

Imaju:

- široku primenu za raznovrsne materijale (odlivke, razni čelici, kamen, limovi, obojeni metali),
- visok stepen učinka,
- brzinu u radu
- odličnu reznu sposobnost tokom celog rada



**REINFORCED DEPRESSED CENTRE
GRINDING WHEEL FOR DEBURRING
AND FETTLING/SNAGGING ON AN
ANGLE GRINDER WITH OPERATING
SPEED 80 m/s AND 100 m/s**

Application Areas:

These abrasive tools are designed for rough grinding and for taking off edges using handheld grinders. The work-piece is immobilized and the grinder is manually operated.

They are:

- widely-utilized for various materials (cast iron, various kinds of steel, stone, sheet metals, non-ferrous metals)
- high level of efficiency
- ability to work quickly
- excellent cutting ability



| D | U | H | Form | Kvalitet - Quality | | | | | |
|-----|-----|-------|------|------------------------------|------------------------------|------------------------------|---------------------------------------|------------------|-----------------------------|
| | | | | 10A30SBF ČELIK - STEEL | 10A24RBF ČELIK - STEEL | 10A30RBF ČELIK - STEEL | 10A30SBF EXTRA ČELIK - STEEL | 29A36QBF INOX | 90C30SE KAMEN - STONE |
| 115 | 4 | 22.23 | 27 | X | | | | | |
| 115 | 6 | 22.23 | 27 | | X | X | | X | X |
| 115 | 6.5 | 22.23 | 27 | | X | X | | X | X |
| 125 | 4 | 22.23 | 27 | X | | | | X | |
| 125 | 6 | 22.23 | 27 | | X | X | | X | X |
| 125 | 6.5 | 22.23 | 27 | | X | X | | X | X |
| 125 | 8 | 22.23 | 27 | | X | X | | X | X |
| 150 | 4 | 22.23 | 27 | X | | | | X | |
| 150 | 6 | 22.23 | 27 | | X | X | X | X | X |
| 150 | 8 | 22.23 | 27 | | X | X | X | X | X |
| 180 | 4 | 22.23 | 27 | X | | | | X | |
| 180 | 6 | 22.23 | 27 | | X | X | X | X | X |
| 180 | 6.5 | 22.23 | 27 | | X | X | X | X | X |
| 180 | 8 | 22.23 | 27 | | X | X | X | X | X |

| D | U | H | Form | Kvalitet - Quality | | | | | | |
|-----|-----|-------|------|------------------------------|------------------------------|------------------------------|---------------------------------------|------------------|-----------------------------|--|
| | | | | 10A30SBF ČELIK - STEEL | 10A24RBF ČELIK - STEEL | 10A30RBF ČELIK - STEEL | 10A30SBF EXTRA ČELIK - STEEL | 29A36QBF INOX | 90C30SE KAMEN - STONE | |
| 180 | 10 | 22.23 | 27 | | X | X | X | X | X | |
| 230 | 4 | 22.23 | 27 | X | | | | X | | |
| 230 | 6 | 22.23 | 27 | | X | X | X | X | X | |
| 230 | 6.5 | 22.23 | 27 | | X | X | X | X | X | |
| 230 | 8 | 22.23 | 27 | | X | X | X | X | X | |



**10A30RBF
10A30SBF
ČELIK - STEEL**

Za univerzalnu upotrebu, za nelegirane, niskolegirane čelike. Karakteriše ih visok stepen učinka.

For universal use cutting non-alloy or low-alloy steel. Characterized by high performance.

**10A24RBF
ČELIK - STEEL**

Karakteriše ga „hladno“ brušenje, ne pregreva materijal. Brz, sa konstantnim učinkom tokom rada, ima dug vek trajanja.

Characterized by cold grinding; it does not overheat the material. Fast, consistent and constant performance during operation. Excellent durability.

**10A30SBF
EXTRA**

Koristi se u svim granama industrije, gde ekonomičnost na prvom mestu, ima dug vek trajanja i konstantan kvalitet pri brušenju.

Used in all fields of industries where lowering cost is a concern. Very durable and great quality of grinding.

**29A36QBF
INOX**

Predviđen je za brušenje nerđajućeg (inox) čelika, a uspešno može upotrebiti i za opštu namenu. Karakteriše ga odlična rezna sposobnost, univerzalnost pri upotrebi, visok stepen učinka.

Created for grinding stainless steel and can be used successfully for general purposes. Characterized by excellent cutting ability, universal use, and great grinding performance.

**90C30SBF
KAMEN - STONE**

Uspešno se koristi za brušenje betona, cigle (građevinske materijale), kao i za nemetale i obojene metale (aluminijum, bakar, itd.)

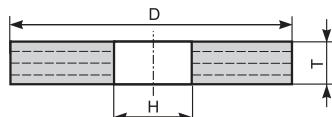
Successfully used for grinding concrete, brick (construction materials), as well as for grinding non-metallic and non-ferrous metals (aluminium, copper, etc.)



Čišćenje odlivaka ručnim brusilicama

Oblik:

Shape:



Oblik 1:
Form 1:

Dimenzijske:

Dimensions:

| D | T | H |
|---------------------------------------|-------------------------------------|-------------------------------------|
| od 32 do 200 <i>from 32 to 200</i> | od 15 do 25 <i>from 15 to 25</i> | od 20 do 22 <i>from 20 to 22</i> |

| Obojeni metali <i>Non-ferrous metals</i> | 90C16S41B |
|---|--|
| Sivi liv preko SL 20 <i>Steel and cast steel</i> | 10A24R31BF za 50 m/sek 10A24R41BF za 63 m/sek 10A24S41BF za 80 m/sek |
| Visokolegirani i brzorezni čelici <i>High-alloyed and high speed steel</i> | 10A24R31BF za 50 m/sek |

| Nerđajući čelik <i>Stainless steel</i> | 10A24O41B 10A24541BF |
|--|--------------------------|
| Temper i sivi liv pre termičke obrade <i>Chilled and gray cast iron before thermic treatment</i> | 90C24S32BF 90C16P30BF |
| Temper i sivi liv posle termičke obrade <i>Chilled and gray cast iron after thermic treatment</i> | 12A24R31B 12A14R3BF |

BRUSNI LONCI

CUP WHEELS

LONČASTO TOCILO SA UMETCIMA SA NAVOJEM ZA GRUBO BRUŠENJE NA UGAONOJ BRUSILICI

Područje primene:

Namenjeni su za brušenje velikih površina sa ručnim radnim alatima.

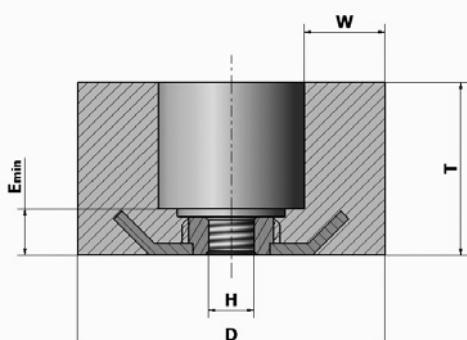
Koristi se u livnicama, za odstranjivanje ulivnog sistema, razdelne linije, itd. Možemo postići veoma visok učinak odstranjivanja viška materijala, zahvaljujući velikoj kontaktnoj površini između brusa i brušenog komada, što još možemo poboljšati izborom grube granulacije abrazivnog zrna. Zbog njihovog različitog sastava, oni nisu samo pogodni za rad na čeliku i odlivku, nego za rad na kamenu (prirodni, veštački), betonu, itd.

MAKSIMALNA PERIFERNA BRZINA UPOTREBE JE 50 M/S.

Lončasto tocilo sa umetcima sa navojem za grubo brušenje na ugaonoj brusilici

Straight cup wheel with thread inserts for deburring and fettling/snagging on an angle grinder

F6 – DxTxH - WxE



STRAIGHT CUP WHEEL WITH THREAD INSERTS FOR DEBURRING AND FETTLING/SNAGGING ON AN ANGLE GRINDER

Application Areas:

These wheels are created for grinding large surfaces using a hand grinder.

They are used in foundries for removing excess material, etc. A high level of achievement of removing excess material can be reached using this wheel, thanks to the large contact area between the cup wheel and the workpiece. The work can be further improved by choosing a coarse granulation abrasive grain for the wheel.

As a result of the diversity in their composition, these wheels are suitable not only for working on steel and cast iron, but also on stone (natural or artificial), concrete, etc.

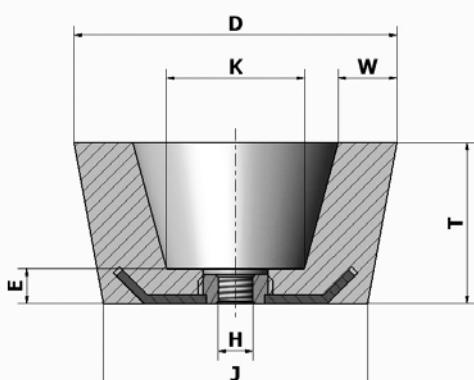
THE MAXIMUM PERIPHERAL SPEED OF USE IS 50 M/S.

| D | T | H | W | E _{min.} |
|-----|----|------------|------|-------------------|
| 80 | 45 | 22.23(M14) | 20 | 12 |
| 100 | 45 | 22.23(M14) | 27.5 | 12 |
| 120 | 65 | M20 | 35 | 25 |

Konično lončasto tocilo sa umetcima sa navojem za grubo brušenje na ugaonoj brusilici

Taper cup wheel with thread inserts for deburring and fettling/snagging on an angle grinder

F11 – D/JxTxH-WxExK



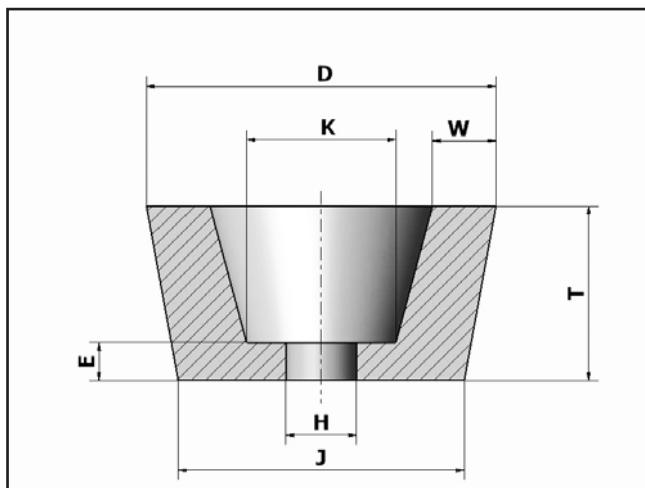
| D | T | H | J | K | W | E _{min.} |
|---|---|---|---|---|---|-------------------|
|---|---|---|---|---|---|-------------------|

Konično lončasto tocilo bez umetaka sa navojem

za grubo brušenje na ugaonoj brusilici

Taper cup wheel without thread inserts for deburring and fettling/snagging on an angle grinder

F11 – D/JxTxH - WxExK



| D | T | H | J | K | W | E _{min.} |
|-----|----|-------|----|----|----|-------------------|
| 110 | 55 | 22.23 | 90 | 47 | 20 | 12 |
| 110 | 45 | 22.23 | 90 | | 22 | 10 |
| 130 | 55 | 22.23 | 90 | 50 | 32 | 12 |



Najpopularniji kvaliteti su:
Most Popular Models:

| | | |
|---|-----------|---|
| ELEKTRO KORUND <i>ELECTRO CORUNDUM</i> | 10A16QBF | Za grubo brušenje kod obrade metala i u livnicama. <i>For snagging in metalworking shops and foundries.</i> |
| | 10A24QBF | |
| | 10A30QBF | |
| SILICIJUM KARBID <i>SILICON CARBIDE</i> | 90C16MBF | Za brušenje-poliranje prirodnog-veštačkog kamena, betona, itd. <i>For grinding-polishing of natural-artificial stone, concrete, etc.</i> |
| | 90C30LBF | |
| | 90C60LBF | |
| | 90C120KBF | |
| | 90C220IBF | |

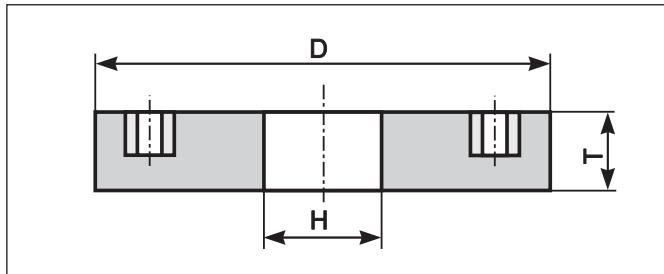


RAVNO ČEONO BRUŠENJE SA UMETNUTIM NAVRTKAMA

Ravno tocilo sa umetnutim navrtkama za ravno čeono brušenje

Disc wheel, with inserted nuts for face surface grinding

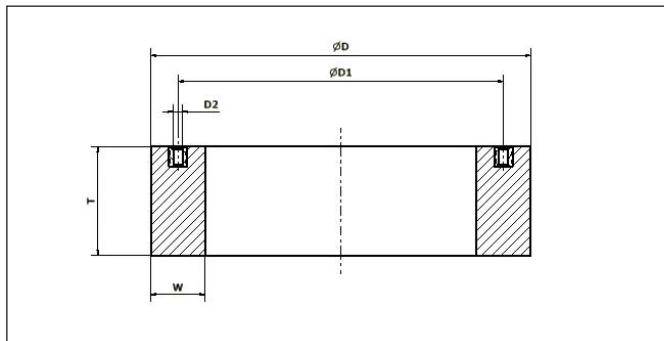
F36 – DxTxH - umetci inserts



Obručasto tocilo sa umetnutim navrtkama ($W \leq 0,17D$) za ručno čeono brušenje

Cylinder wheel with inserted nuts for face surface grinding

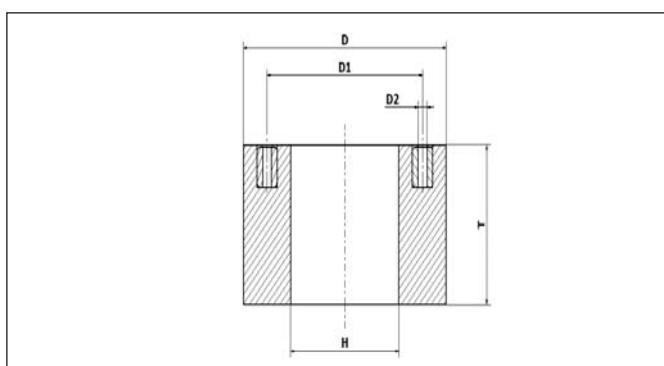
F37 – DxTxW - umetci inserts



Ravno tocilo sa umetnutim navrtkama za grubo brušenje na vertikalnoj brusilici

Disc wheel with inserted nuts for deburring and fettling

F36 – DxTxH



| D | T | H | Red umetaka | Osnovni prečnik | Broj otvora |
|-----|-------------|-----|-------------------|--------------------------|--------------------|
| | | | Row of inserts | Pitch circle diameter | Number of holes |
| 350 | proizvoljan | 200 | 1 | 265 | 8 M10 |
| 400 | proizvoljan | 196 | 1 | 300 | 24 M10 |
| 400 | 55 | 250 | 1 | 320 | 12 M10 |
| 600 | proizvoljan | 20 | 1 | 210 | 6 na at 60° M16 |
| | | | 2 | 370 | 6 na at 60° M16 |
| | | | | 530 | 12 na at 30° M16 |
| 600 | proizvoljan | 139 | 1 | 203.2 | 6 na at 60° 3/8" |
| | | | 2 | 330.2 | 6 na at 60° 3/8" |
| | | | 3 | 457.2 | 6 na at 60° 3/8" |
| | | | 4 | 558.8 | 12 na at 30° 3/8" |
| 600 | 70,80 | 305 | 1 | 370 | 6 na at 60° M16 |
| | | | 2 | 530 | 12 na at 30° M16 |
| 660 | proizvoljan | 50 | 1 | 204 | 6 na at 60° M10 |
| | | | 2 | 406 | 6 na at 60° M10 |
| | | | 3 | 609 | 12 na at 30° M10 |

| D | T | W | D1 | Broj otvora Number of holes | D2 |
|-----|-------------|-----|-------|--------------------------------|-----|
| 300 | 60,100 | 50 | 234.5 | 4 | M10 |
| 380 | proizvoljan | 70 | 324 | 10 | M10 |
| 500 | proizvoljan | 75 | 457 | 24 | M10 |
| 500 | 80,100,110 | 47 | 455 | 24 | M10 |
| 600 | 50 | 100 | 560 | 16 | M16 |

| Dmm | Tmm | H _{max} .mm | D1 | Raspored umetaka Insert layout | D2 |
|-----|-------|----------------------|------|-----------------------------------|-----|
| | | | | Broj otvora Number of holes | |
| 125 | 63 | 55 | 90.6 | 4 na at 90° | M8 |
| 125 | 60 | 57 | 89.5 | 4 na at 90° | M8 |
| 150 | 79 | 80 | 115 | 6 na at 60° | M8 |
| 170 | 105 | 90 | 130 | 4 na at 90° | M8 |
| 178 | 30 | 76 | 130 | 4 na at 90° | M10 |
| 200 | 63,80 | 100 | 159 | 4 na at 90° | M10 |
| 200 | 63,80 | 127 | 165 | 4 na at 90° | M10 |
| 250 | 100 | 127 | 200 | 6 na at 60° | M8 |

Brusevi su testirani na sigurnost prema EN 12413 certifikatom. Za bezbednost su odgovorni proizvođač brusne mašine, proizvođač brusnog alata i korisnik. Pri upotrebi brusnog alata, potrebno je koristiti lična zaštitna sredstva: zaštitne naočare, rukavice, kožnu kecelju, zaštitne cipele.

Sledite sledeće sigurnosne instrukcije:

- Pred montažu detaljno pregledajte brus. Oštećene brusne ploče ne smeju se montirati.
- Obavezno upotrebljavati zaštitni poklopac, koji mora odgovarati tipu brusilice i propisu. Na stabilnim brusilicama ugao otvora poklopca ne sme biti veći od 65°.
- Pravilno montirajte brus. Prečnik otvora mora tačno odgovarati prečniku osovine.
- Isprobajte brus bez opterećenja. Svaka brusna ploča sa spoljnjim prečnikom iznad 100 mm mora se pre upotrebe - u prisustvu stručnjaka ispitati do maksimalne dozvoljene brzine u praznom hodu i to:
 - kod ručnih brusilica 1/2 min.
 - kod ostalih brusilica 1 min.
- Taj test se može izvesti tek posle izvršenih sigurnosnih mera, i kada je pričvršćen zaštitni poklopac.
- Uzimajte u obzir maksimalnu dozvoljenu brzinu brusa.
- Bruseve upotrebljavajte pod uslovima koje propisuje proizvođač.
- Upotrebljavajte kartonske podmetače za meko prihvatanje brusa.
- Pri promeni brusa obavezno isključite motor mašine i sačekajte da se brus zaustavi.

Brusne proizvode skladištitи u prikladnom prostoru. Smolno vezani brusevi postepeno gube od svoje kvalitetne osobine. Vezivo postaje krhko. Proces se ubrzava ako skladištenje nije odgovarajuće. Skladišni prostor mora biti suv, provetren, bez većih temperaturnih promena (temp. između 10°C i 30°C) maksimana relativna vlažnost 70%, čuvati od uticaja rastvarača koji nepovoljno utiču na čvrstoću smolno vezanih bruseva. Bruseve čuvati od mraza! Pri odgovarajućem skladištenju brus sadrži svoje fizičke osobine do dve godine. Mesto skladištenja neka bude što bliže mestu upotrebe, kako bi se sprečila mehanička oštećenja brusa, a zimi kondenzacija vlage prilikom transporta. Tanke brusne ploče kao i rezaljke čuvati na ravnoj podlozi, da ne bi došlo do njihovog krivljenja. Takav način skladištenja ne važi samo za nov, nego i za već upotrebljen brusni alat.

The quality and safety of all products are confirmed with a DSA certificate. The manufacturer of the grinding machine, the manufacturer of the grinding tool and the user of the grinding equipment all share responsibility and liability for safety. When using grinding tools, it is necessary to wear and use personal safety equipment such as protective goggles, gloves, leather aprons and protective shoes.

The following safety instructions should be followed closely:

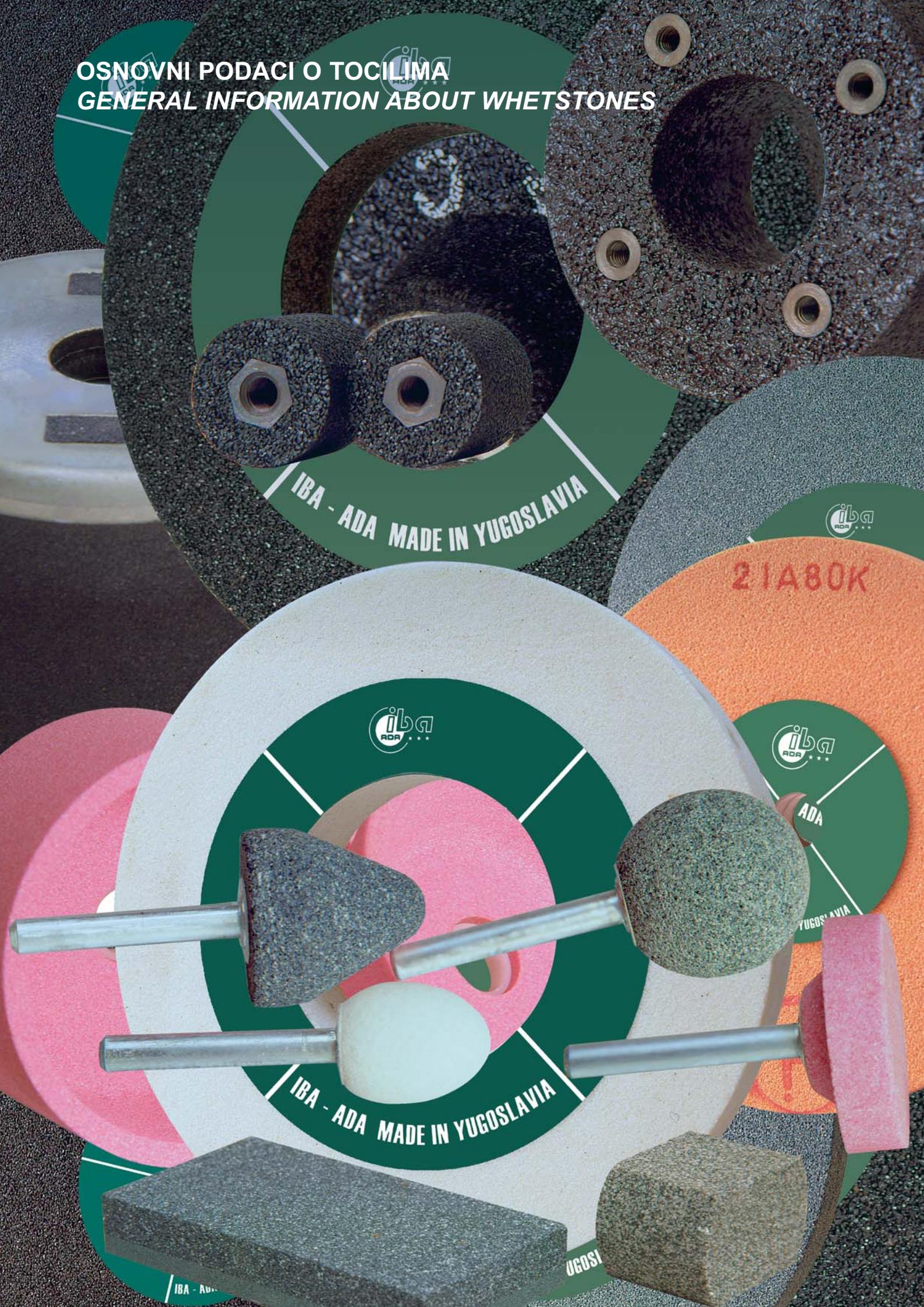
- *Before installation, check the grinding tool carefully. Do not use damaged grinding tools.*
- *The use of a wheel guard is obligatory and the guard must match the type of grinding machine used, it also must be in accordance with relevant laws and safety regulations. The angle of the wheel guard hole must not exceed 65 degrees on floorstand grinding machines.*
- *Ensure that the grinding tool is installed correctly. The diameter of the hole must match the diameter of the axis.*
- *Test the grinding tool unloaded. Before use, grinding tools with external diameters above 100 mm must be tested in the presence of an expert at the maximum allowed idle speeds, precisely:*
 - 30 seconds in the case of manual grinding machines
 - 60 seconds in the case of other types of grinding machines

This test should be done only after the necessary safety measures have been taken and the wheel guard has been attached.

- *Do not operate the tool above the recommended maximum speed.*
- *Instructions provided by the manufacturer must be closely followed.*
- *A cardboard pad should be used to tighten the grinding tool.*
- *Ensure that the grinding machine is turned off and the grinding tool has stopped running completely before attempting to change it.*
- *Store grinding tools in the suggested, appropriate storage areas. Over time, resinoid bonded grinding stones lose their effectiveness as the bonds weaken. This process is accelerated if the wheel is not stored appropriately. Storage places must be dry, well-ventilated, without great fluctuations in temperature (between 10 and 30 degrees C). The maximum relative humidity should be 70% and the wheels should be protected from chemicals or solvents that could affect the hardness of the resinoid bonded tools.*
- *Protect grinding tools from frost.*

If properly stored, the grinding tool will remain effective for up to two years. The storage place of grinding tools should be as close to the place of use as possible, to prevent mechanical damage and damage from condensation and humidity in winter that could occur during transportation. Keep thin grinding tools and cutting whetstones flat to prevent deformation. This way of storing should not be reserved just for new and unused grinding tools, but also for ones already used.

OSNOVNI PODACI O TOCILIMA
GENERAL INFORMATION ABOUT WHETSTONES



Oznake na tocilima i etiketama

Na tocilu, propratnom listu ili etiketi moraju biti navedeni sledeći podaci:

- ime proizvođača
- dimenzije
- kvalitet tocila (oznaka zrna, tvrdoća, struktura, vrsta veziva)
- najveći dozvoljen broj obrtaja (min -1)
- najveća dozvoljena obodna brzina (m/s)
- upozorenja

The Marking on IBA Grinding Wheels

The following information must be found on grinding wheels or on the labels attached to grinding wheels:

- the name of the manufacturer
- the dimensions
- the composition of the wheel (quality, grain size, hardness, structure (porosity), binder type)
- the maximum operating speed (min -1)
- the maximum peripheral speed (m/s)
- instructions
- barcode

„IBA“ A.D. Ada - Member of Argonauts International Group
24430 Ada, Krajška 27/a e-mail: iba@ibaada.co.rs
Tel.: +381(024)853-313 Fax: +381(024)853-428

RN:2559/09 Datum:12.02.10 ISO 525

Dimenzija: 350X50X127 F-1

Kvalitet: 21A46K6VV41

Maksimalna dozvoljena brzina

| | | |
|----------|------------|--------|
| Mašinski | 2184 l/min | 40 m/s |
| Ručno | 1911 l/min | 35 m/s |

Provereno po EN 12413

Rok upotrebe: NEOGRANIČENO

ETIKETA JE ATEST KVALITETA TOCILA



8 600 956 250 119

„IBA“ A.D. Ada - Member of Argonauts International Group
24430 Ada, Krajška 27/a e-mail: iba@ibaada.co.rs
Tel.: +381(024)853-313 Fax: +381(024)853-428

Nº:2559/09 Date:12.02.10 ISO 525

Dimension: 350X50X127 F-1

Quality: 21A46K6VV41

Maximum operating speed

| | | |
|---------|------------|--------|
| Machine | 2184 l/min | 40 m/s |
| Hand | 1911 l/min | 35 m/s |

Tested by EN 12413

Expiration date: UNLIMITED

LABEL IS THE CERTIFICATE OF THE WHEEL QUALITY



8 600 956 250 119

Tocila koja mogu raditit sa povećanim obodnim brzinama obeležana su dijagonalnom linijom jednom od sledećih boja:

- plava za 50 m/s
- žuta za 63 m/s
- crvena za 80 m/s
- zelena za 100 m/s
- zelena i plava za 125 m/s

Grinding wheels for increased peripheral speeds are marked with a diagonal stripe of various colours:

- blue for 50 m/s
- yellow for 63 m/s
- red for 80 m/s
- green for 100 m/s
- green and blue for 125 m/s

Smernice za izbor kvaliteta

Opšta uputstva

Kod izbora kvaliteta tocila moramo uzeti u obzir mašinu za brušenje, predmet koji se obrađuje, režim rada i stručnost radnika.

Obično polazimo od:

a) Karakteristika predmeta obrade

- materijal - kvalitet
- tvrdoća
- čvrstoća
- termička obrada
- dimenzije
- oblik
- oblik površina (površine sa prekidima, žljebovima itd.)
- dodatak za brušenje
- stepen kvaliteta površina pre obrade
- zahtevan stepen kvaliteta površina posle obrade;

b) Način brušenja

- brušenje spoljnih cilindričnih površina
- brušenje unutrašnjih cilindričnih površina
- brušenje ravnih površina
- ručno brušenje

c) Uslova rada

- vrsta mašine za brušenje i njeno tehničko stanje
- obodna brzina tocila
- način i brzina dodavanja
- dubina rezanja
- veličina kontaktnih površina između tocila i predmeta obrade
- način hlađenja
- vrsta i način izravnavanja tocila.

Vidimo da se tocilo bira na osnovu konkretnе operacije brušenja, pa zato preporuke, iznete u ovom Priručniku, treba da služe kao vodič, odnosno osnovna orientacija. U većini slučajeva zadovoljavaju, ali uopšte ne mogu zameniti tehnološke postupke za proces brušenja.

Kod izbora kvaliteta tocila preporučujemo vođenje računa o sledećim načelima:

- za brže skidanje materijala - grublja tocila
- za tvrdi materijal - mekša tocila
- za žilav materijal - mekša, gruba, eventualno porozna tocila
- za materijal koji je osetljiv na zagrejavanje - mekša, gruba tocila otvorene strukture
- za izprekidane površine - tvrda tocila
- kod veće kontaktne površine između tocila i predmeta obrade - mekša i grublja tocila otvoreniye strukture.

Guide to Quality Choice

General Information for Choosing the Right Wheel

For choosing the proper grinding wheel for the costumer, the following factors should be taken into consideration:

- the type of grinding machine the wheel is needed for
- the type of material being processed
- the working method
- the skill of the operator

Some general starting points:

a) Characteristics of the object being worked upon:

- type of the material - quality
 - solidness
 - hardness
 - thermic treatment
- dimension
- shape
- surface (edges, grooves, etc.)
- supplements for grinding
- quality of the surface prior to grinding
- required quality of the surface after grinding

b) Type of grinding:

- external cylindrical grinding
- internal cylindrical grinding
- surface grinding
- grinding on portable grinders

c) Working conditions:

- type of grinding machine and its condition
- peripheral speed of the grinding wheel
- manner and speed of adding material
- cutting-off depth
- size of the contact point between the wheel and the object worked upon
- manner of cooling
- manner and method of dressing of the wheel

The grinding operation dictates the appropriate choice of grinding wheel. For this reason, instructions in this chapter should serve as basic orientation for the user. These instructions are in most cases sufficient, but they cannot replace technological procedures for the process of grinding.

When choosing a grinding wheel, the following basic principles are suggested:

- for quick grinding off of materials – coarser grinding wheels
- for hard materials – softer wheels
- for tough materials – softer, coarse and porous grinding wheels
- for heat-sensitive materials – softer coarse grinding wheels with an open structure
- for broken surfaces - harder grinding wheels
- for instances when the contact surface between the grinding wheel and the material is larger – softer, coarse, open structure grinding wheels

TEHNIČKE INFORMACIJE

KONTROLA TOCILA

Završnu kontrolu tocila delimo na:

- a) kontrolu sigurnosti tocila
- b) kontrolu kvaliteta tocila (tvrdoća, balansiranost, dimenzije).

Kontrolu sigurnosti tocila vršimo po ISO i EN standardima i uz vođenje računa o FEPA (Federacije evropskih proizvođača abraziva) normama.

Propisane norme moraju uvažavati i proizvođač i korisnik tocila.

ODGOVORNOST PROIZVOĐAČA TOCILA

- garancija faktora sigurnosti tocila
- ispitivanje tocila kod povećane obodne brzine
- ispitivanje tocila kod povećane obodne brzine do raspada tocila (test destrukcije)
- označavanje oblika, dimenzija, dozvoljene radne brzine i kvaliteta na propratnom listu, etiketi ili tocilu
- odgovarajuće pakovanje tocila.

Za oštete u transportu pravilno pakovanih tocila proizvođač ne odgovara.

ODGOVORNOST KORISNIKA TOCILA

- propisno skladištenje tocila
- pregled tocila pre montaže zbog eventualnih oštećenja za vreme transporta (proba na zvuk)
- pravilna montaža i balansiranje tocila
- pravilna priprema mašine za brušenje
- ispitivanje tocila bez opterećenja (prazan hod)

PROBA NA ZVUK

Tocila obično pakujemo u kartonsku ambalažu ili drvene sanduke i šaljemo na paletama. Ambalaža omogućuje bezbedan transport, ali svejedno moramo paziti da se prilikom pretvara sanduci i kutije ne bacaju. Naročitu pažnju obraćamo na tocila u keramičkom vezivu, koja su po lomljivosti slična porcelanu i zato iziskuju još posebno pažljivo rukovanje.

Po prijemu u skladište, a posebno neposredno pre montiranja na mašinu za brušenje neophodno je izvršiti vizuelni pregled tocila i proba na zvuk.

TECHNICAL INFORMATION

GRINDING WHEEL TESTING

The final testing of grinding wheels can be divided into these categories:

- a) safety testing
- b) quality testing (hardness, balance, size)

The safety of the grinding wheel is tested according to ISO and EN standards along with the consideration of FEPA (Federation of European Producers of Abrasives) regulations.

The prescribed norms must be respected by both the manufacturer and the user of the grinding wheels.

RESPONSIBILITY OF THE GRINDING WHEEL MANUFACTURER

- safety warranty of the grinding wheel
- testing of the wheel at higher peripheral speeds
- testing of the wheel at a higher peripheral speed to the wheel's disintegration (destruction test)
- marking the shape, dimension, maximum permissible operational speed and quality of the wheel on an attached rectangular or circular label or on the grinding wheel
- proper packing of grinding wheels

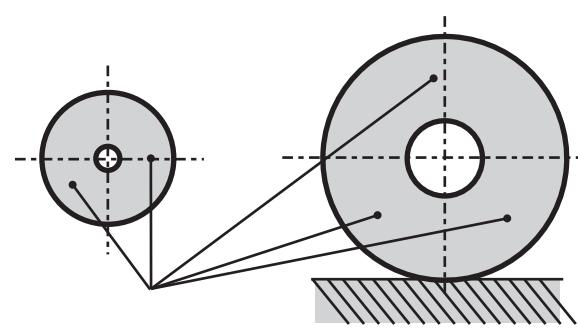
The manufacturer is not responsible for damage caused transportation of properly packed grinding wheels.

RESPONSIBILITY OF THE GRINDING WHEEL USER

- proper storage of the wheel
- testing of the wheel before mounting it for checking for damage caused by transportation of the wheel (sound test)
- mounting and balancing the wheel properly
- preparing the grinding machine properly
- testing of the grinding wheel without loading it (neutral run)

SOUND TEST

Grinding wheels are generally packed in cardboard or wooden boxes and shipped on pallets.



Mesta udaranja
Points of tapping

Time otkrivamo eventualne naprslane, koje su posledica neadekvatnog transporta.

Proba na zvuk se izvodi na taj način što se tocilo u slobodno visećem položaju ovlaž udara malim drvenim čekićem ili sličnim predmetom. Neoštećeno tocilo pri udaru daje jasan, a oštećeno tupi zvuk. Tocila u bakenitnom vezivu nemaju tako jasan zvuk kao tocila u keramičkom vezivu.

MONTAŽA TOCILA

Kada se operator uverio da tocilo nije oštećeno i verifikuje njegove karakteristike (tip, dimenzije, maksimalna dozvoljena obodna brzina, maksimalni dozvoljeni broj obrtaja, kvalitet,) može otpočeti sa montažom tocila na mašinu.

Najpre mora očistiti prirubnicu, kontrolisati njihovo stanje, paralelnost ravnih strana prirubnica, uveriti se da su kartonski podmetači čisti i debeljine 0,3-0,8 mm, proveriti da li je minimalni zazor između otvora tocila i osovine u granicama tolerancije (H=11, 12, 13). Uopšte nije dozvoljeno montiranje tocila na osovinu sa pritiskom. Naime tocilo se za vreme rada zagreva, što izaziva dodatne napone, koji mogu da dovedu do razletanja tocila.

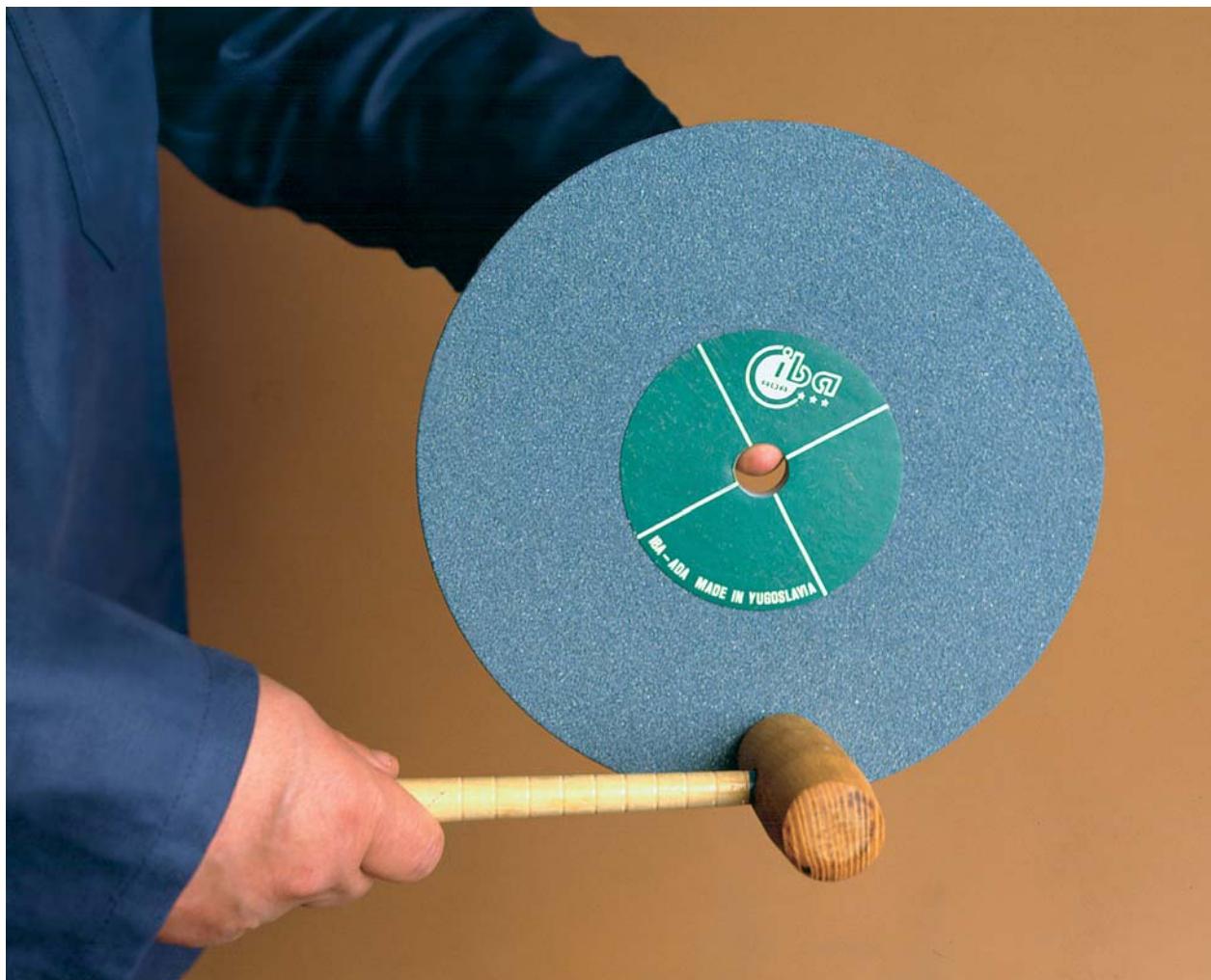
Između prirubnica i tocila operater mora da postavi kartonske podmetače i da stezne matice pritegne ravnomerno. Zatim vrši još balansiranje tocila.

Although the packaging ensures safe transport, boxes must be loaded and unloaded carefully. Special attention must be paid to vitrified grinding wheels which are as fragile as porcelain. Upon receiving and before mounting the grinding wheels, the visual and sound test must be preformed. These tests help reveal any cracks that may have occurred during transportation. The sound test is performed by tapping the grinding wheel lightly with a wooden hammer or another similar object. An undamaged wheel (without cracks) will emit a clear sound, while a damaged one will sound blunt. Resinoid bonded wheels do not emit the same clear sound as the vitrified ones do.

MOUNTING GRINDING WHEELS

Once the grinding wheel and its characteristics (type, dimension, maximum allowed peripheral speed, maximum allowed operating speed, quality) have been checked, it can be mounted onto the grinding machine. The fastening flanges should be cleaned and checked. Cardboard separators should also be clean and their thickness should be between 0.3 – 0.8 mm. The gap between the grinding wheel and the spindle must be between the limits (H=11, 12 or 13).

Applying pressure to the grinding wheel when mounting it to the spindle is not permissible. During grinding the wheel heats up which causes additional tension that could cause the wheel to burst.



Kod preciznog brušenja balansiranost tocila je od velike važnosti i dobri rezultati mogu se postići samo sa besprekorno izbalansiranim tocilom. U zavisnosti od načina brušenja (fino brušenje, grubo brušenje, sečenje) i tipa mašine (stabilna, prenosna), dozvoljena nebalansiranost se kreće u granicama od jednog promila do dva procenta težine tocila (standard FEPA).

POČETAK BRUŠENJA

Pre početka brušenja moramo uzeti u obzir sledeća uputstva:

- podesiti mašinu tako da se tocilo okreće sa maksimalnom radnom obodnom brzinom. Pri tome operator mora biti na bezbednom mestu.
- ostaviti tocilo da se nekoliko minuta okreće
- otvoriti slavinu sredstva za hlađenje
- kontrolisati vibracije
- poravnati tocilo
- prilaz tocila predmetu obrade treba da je postepen, da bi mu omogućili da se polako zagreva; grub prilaz može biti uzrok razletanja tocila.

Pridržavanje ovih uputstava naročito je značajno kod tocila u keramičkom vezivu.

PORAVNAVANJE TOCILA

Kada tocilo izgubi svoj pravilan geometrijski oblik ili svoju sposobnost rezanja, moramo ga poravnati poravnjivačem, dakle, obnavljamo pravilan geometrijski oblik, odnosno profil tocila i time uklanjamo sa njegove radne površine zaobljena (istrošena) brusna zrna.

U zavisnosti od željene preciznosti brušenja poravnavanje tocila vršimo na više načina:

- palicama
 - segmentima
 - točkićima
 - dijamantskim jednozrnim i višezrnim poravnivačima.
- Mašine za precizno brušenje imaju već ugrađene uređaje za poravnavanje.

The user of the wheel must place cardboard separators between the fastening flanges and the grinding wheel and the nuts must be tightened evenly. Following this, the grinding wheel must be balanced. Balancing of the grinding wheel is very important, especially with precise grinding, since only a well-balanced wheel will give great results. The maximum allowed instability of the grinding wheels can be between one thousandth to two percent (according to FEPA standards), depending on the kind of grinding in question (fine or rough grinding, cutting) and the type of grinding machine used (stationary, portable).

STARTING GRINDING

Before starting, the following instructions should be taken into consideration:

- the grinding machine should be set to maximum operating speed, the worker must be in a safe place
- let the wheel run for a few minutes
- open the pipe for the coolant
- control vibration
- the grinding wheel should be trued
- the object to be processed should be exposed to the grinder gradually to ensure slow warming as sudden exposure can lead to the explosion of the grinding wheel

These instructions are especially important and should be followed when using vitrified grinding wheels.

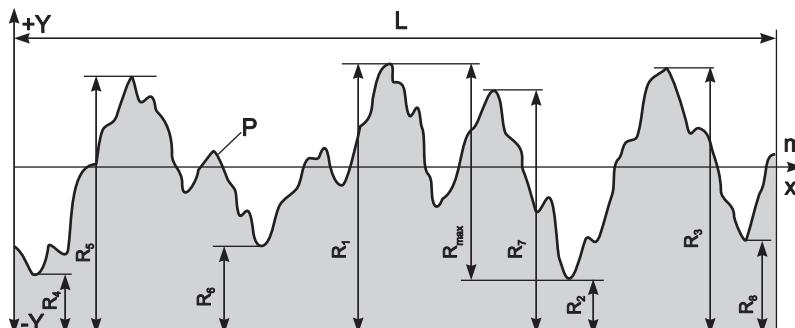
DRESSING GRINDING WHEELS

When the grinding wheel loses its shape or its grinding ability, it should be dressed. Dressing means removing the used abrasive grains from the grinding wheel surface so that a new layer is exposed and ready for grinding or cutting.

Dressing can be done using a few different methods, depending on the required accuracy:

- with abrasive sticks
 - with segments
 - with chilled cast iron wheels
 - with single or multi-point diamond dressing tools
- Grinding machines for precise grinding come with dressing devices already installed and ready for use.*

HRAPAVOST POVRŠINE



SURFACE ROUGHNESS

$$R_a = \frac{1}{L} \int_0^L |y| dx = \frac{(R_1 + R_3 + \dots + R_9) - (R_2 + R_4 + \dots + R_{10})}{5}$$

$$R_t = R_{\max} = R_1 - R_2$$

Hrapavost površine određena je vrednostima R_a i R_t

Surface roughness is determined by values R_a and R_t

p - profil površine m - srednja linija profila
p - surface profile m - average profile line

Hrapavost površine, dobijene u procesu brušenja, najviše zavisi od izbora veličine abrazivnih zrna (zrnoće). Tocila sa grubljjim zrnima imaju veći kapacitet brušenja materijala - veći učinak, ali sa njima dobijamo hrapavije površine. Kod finog brušenja hrapavost površine zavisi još od poravnavanja tocila, njegove tvrdoće, vrste materijala, načina brušenja, oblika tocila i stanja mašine za brušenje.

Ako želimo da odstranimo veće količine materijala i dobijemo visok kvalitet površine, ekonomičnija je upotreba dva tocila, prvog za grubo, a drugog za fino brušenje.

The texture of the surface, achieved by grinding, depends on the choice of grain size for the grinding wheel. Wheels with coarser grains are more efficient but give a coarser texture. With fine grinding, surface texture depends on wheel dressing, hardness, the type of material, manner of grinding, wheel shape and the condition of the grinding machine.

When the user wishes to achieve efficient grinding while maintaining a high quality surface, it is more economic to use two wheels: one for rough, the second for fine grinding.

| R_a μm | R_t μm | stepen hrapavosti class of finish | zrnoća - grain size | | | | | | | |
|------------------------|------------------------|--|---------------------|----|----|----|-----|-----|-----|-----|
| | | | 36 | 46 | 60 | 80 | 120 | 180 | 320 | 500 |
| 5,0 | 1,60 | N7 | | | | | | | | |
| 4,5 | 1,50 | | | | | | | | | |
| 3,5 | 1,10 | | | | | | | | | |
| 2,50 | 0,80 | N6 | | | | | | | | |
| 2,1 | 0,67 | | | | | | | | | |
| 1,7 | 0,54 | | | | | | | | | |
| 1,3 | 0,40 | N5 | | | | | | | | |
| 1,1 | 0,34 | | | | | | | | | |
| 0,88 | 0,27 | | | | | | | | | |
| 0,65 | 0,20 | N4 | | | | | | | | |
| 0,55 | 0,17 | | | | | | | | | |
| 0,45 | 0,14 | | | | | | | | | |
| 0,35 | 0,10 | N3 | | | | | | | | |
| 0,29 | 0,08 | | | | | | | | | |
| 0,24 | 0,07 | | | | | | | | | |
| 0,175 | 0,05 | N2 | | | | | | | | |
| 0,14 | 0,04 | | | | | | | | | |
| 0,11 | 0,03 | | | | | | | | | |
| 0,08 | 0,025 | N1 | | | | | | | | |
| 0,068 | 0,017 | | | | | | | | | |
| 0,053 | 0,014 | | | | | | | | | |
| 0,04 | 0,010 | | | | | | | | | |

Tabela prikazuje zavisnost R_a i R_t kod prolaznog spoljašnjeg kružnog brušenja

Review of dependence R_a and R_t at traverse external cylindrical grinding

Hlađenje

RASHLADNO SREDSTVO

Rashladno sredstvo prvenstveno odvodi toplotu sa predmeta obrade i tocila, a ujedno smanjuje trenje između tocila i predmeta obrade. Zbog korozije čistu vodu ne upotrebljavamo kao rashladno sredstvo. Ali, upotrebljavamo njene emulzije sa mineralnim uljima. Mašine za brušenje su snabdevene uređajima za hlađenje, koji redovno i u dovoljnoj količini dovode rashladno sredstvo. Ovi uređaji ujedno i prečišćavaju - filtriraju rashladno sredstvo. Dobre rezultate možemo dobiti samo kvalitetnim rashladnim sredstvom.

DOVOD RASHLADNOG SREDSTVA

Ako se rashladno sredstvo ne dovodi pravilno, ono ne vrši funkciju hlađenja i čišćenja. Preporučujemo vođenje računa o sledećim načelima:

- celokupnu količinu rashladnog sredstva treba dovesti do mesta brušenja preko dobro postavljenih mlaznica, što bliže mestu brušenja
- ako nam je rashladno sredstvo potrebno samo za čišćenje tocila, svu količinu rashladnog sredstava moramo usmeriti na odod tocila
- dobro hlađenje predmeta obrade i čišćenje tocila postižemo postavljanjem specijalnih mlaznica i odvodnih limova.

Mašine za brušenje često imaju loše postavljene zaštitne poklopcove zatvarače zato radnika koji pravilno postavi protok rashladnog sredstva može ovo da ga prskati i da bi to izbegao, on smanjuje protok, što može da prouzrokuje oštećenje predmeta obrade. Bolje je brusiti suvo nego sa prevelikom količinom dovedenog rashladnog sredstva.

Posle završenog rada tocilo ne sme ostati potopljeno u rashladnom sredstvu jer se prilikom ponovnog stavljanja u pokret može razleteti zbog prevelikog debalansa. Posle završetka rada tocilo treba još neko vreme da se okreće bez dovoda rashladnog sredstva kako bi se iscedilo.

Skladištenje tocila

Odgovarajuće skladištenje tocila neobhodno je zbog bezbednosti u radu sa njima, kako bi se očuvalo njihov kvalitet i manipulacijom ne oštete.

Preporučljivo je tocila skladištitи u specijalno za to konstruisanim regalima i što bliže mestu upotrebe. Moramo izbegavati mesta u blizini transportnih puteva i drugih mesta gde su velike vibracije.

Konstrukcija regala je takva da se na njih mogu stavljati lako i sigurno svi oblici tocila, da uzimanje tocila bude lako i pristupačno sa minimalnom manipulacijom i da preuzimanje jednog ne utiče na stabilnost ostalih.

KERAMIČKA TOCILA

Tocila sa keramičkim vezivom nisu osjetljiva na atmosferske uticaje, ali su zbog svoje krtosti vrlo osjetljiva na udarce. Ovi mogu da prouzrokuju pukotine često nevidljive običnim okom.

Cooling

COOLANT

The cooling agent neutralizes the heat of the work-piece and the grinding wheel while reducing friction. Using water as coolant should be avoided as it causes metal to rust. Water emulsions with mineral oil are often used instead. Grinding machines are equipped with cooling devices that supply the coolant regularly and sufficiently. These devices also act as filters for the coolant. Good results when grinding can only be achieved through the use of a high quality coolant.

COOLING

The coolant should be applied properly for it to cool and clean efficiently. The following suggestions should be taken into consideration:

- *the coolant should be applied to the point of grinding by well-placed nozzles located as close to the grinding point as possible*
- *if the coolant is applied for cleaning purposes only, the flow of the coolant should be directed towards the periphery of the grinding wheel*
- *effective cooling and cleaning effects can be achieved by special nozzles and tin plates*

Grinding machines often have guarding plates located at inconvenient angles that could cause the worker to be splashed by the coolant. To avoid this, the worker may reduce the quantity of the coolant applied, which could lead to the damage of the workpiece. It is better to dry-grind than to grind with an insufficient amount of coolant.

After grinding, the heated wheel should not be left in the coolant as it could become unbalanced. Instead, the worker should let the wheel run for a short time without the coolant to allow it to dry.

Storing Grinding Wheels

Grinding wheels must be handled carefully and stored properly so that they remain effective tools.

They should be stored on shelves as close to the place of their use as possible. Places close to roads with heavy traffic should be avoided due to harmful vibrations. The construction of wooden racks for storing should result in a solid structure that allows for simple and safe handling of grinding wheels so that the removal of one wheel does not affect the others.

VITRIFIED BONDED GRINDING WHEELS

Vitrified bonded grinding wheels are not sensitive to atmospheric pressure and influences but they are very fragile and sensitive to hits or falls. Rough handling or strikes to the wheel can cause tiny cracks that are invisible for the human eye.

BAKELITNA TOCILA

Tocila u bakelitevnom vezivu i ostala tocila koja sadrže veštačke smole vremenom gube svoje kvalitetne karakteristike. Taj proces je brži ukoliko su uslovi skladištenja nepogodni. Prostorija gde su uskladištena tocila treba da bude suva, prosvetrena. Štetne su nagle promene temperature, bliskost izvora toplote i niske temperature (ispod 0° C).

Preporučljivi uslovi skladištenja:

- temperatuta između 10-30° C
- relativna vlažnost ne veća od 70 %.

U ovim uslovima tocila od bakelitnog veziva mogu se skladištiti do dve godine bez znatnih promena fizičkih osobina. Duže skladištenje povećava krtost veziva, a time se smanjuje njihova mehanička čvrstoća.

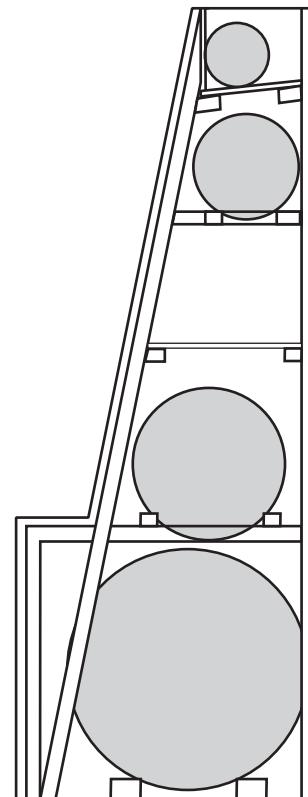
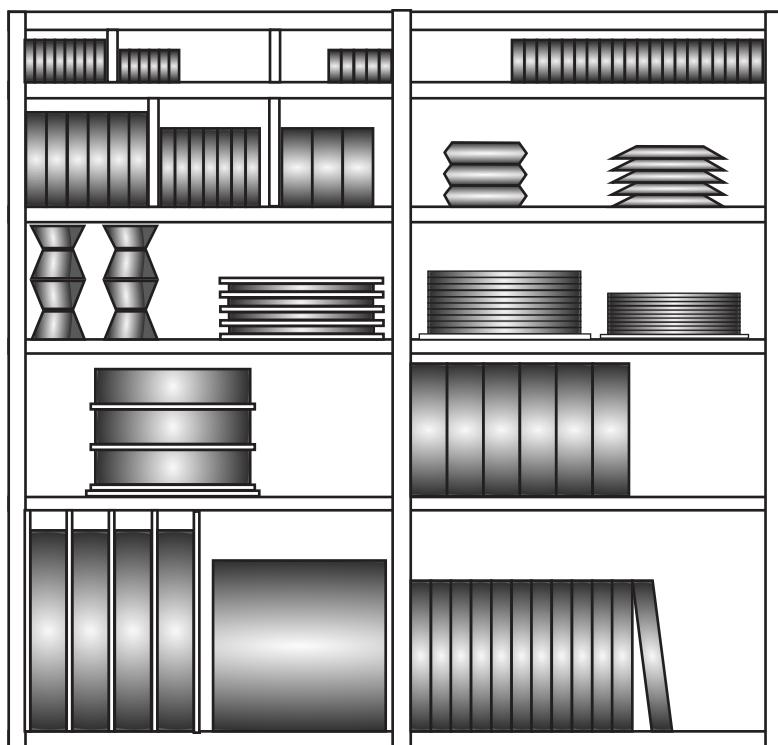
RESINOID BONDED GRINDING WHEELS

Resinoid bonded wheels and other wheels containing artificial resins gradually lose their qualities. This process is accelerated by unsuitable storage conditions. The storage should be dry, aerated and sudden fluctuations in temperature should be avoided. Grinding wheels must not freeze.

Suggested storage conditions include:

- temperature between 10° C and 30° C*
- humidity below 70%*

Under these ideal conditions resinoid bonded grinding wheels can be stored up to two years without changes to their physical properties. Longer storage increases brittleness of the bonds while decreasing the mechanical solidness of the wheel.



Težine brusnih ploča

Za brzo približno izračunavanje težine tocila nezavisno od njihove specifične težine možemo upotrebiti sledeću formulu

$$G=D^2 \times 2T$$

gde je:

G - težina tocila u kg

D - prečnik tocila u dm

T - Debljina tocila u dm

Weight of Grinding Wheels

For quick and approximate calculation of the weight of grinding wheels, independently from specific weight, the following formula can be used:

$$G=D^2 \times 2T$$

where:

G = grinding wheel weight in kg

D = grinding wheel diameter in dm

T = grinding wheel thickness in dm

Približne težine ravnih brusnih ploča u kg

Approximate weights of surface grinding wheels

| D mm | visina tocila (T) u mm - Grinding wheel height (T) in mm | | | | | | | | | | | D mm | |
|---------|--|--------|--------|--------|--------|--------|--------|--------|--------|-------|--------|---------|-----|
| | 3 | 6 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 | 60 | | |
| 10 | 0,0005 | 0,0011 | 0,0018 | 0,0023 | 0,0029 | 0,0036 | 0,0045 | 0,0058 | 0,0072 | 0,009 | | 10 | |
| 20 | 0,0022 | 0,0043 | 0,0072 | 0,0094 | 0,012 | 0,014 | 0,023 | 0,023 | 0,029 | 0,036 | | 20 | |
| 30 | 0,0049 | 0,0098 | 0,0163 | 0,021 | 0,026 | 0,033 | 0,041 | 0,052 | 0,065 | 0,081 | 0,102 | 30 | |
| 40 | 0,0087 | 0,0173 | 0,0289 | 0,038 | 0,046 | 0,058 | 0,072 | 0,092 | 0,116 | 0,144 | 0,182 | 40 | |
| 50 | 0,014 | 0,027 | 0,045 | 0,059 | 0,072 | 0,090 | 0,113 | 0,144 | 0,184 | 0,266 | 0,284 | 50 | |
| 65 | 0,023 | 0,046 | 0,076 | 0,099 | 0,122 | 0,153 | 0,191 | 0,244 | 0,305 | 0,381 | 0,480 | 65 | |
| 75 | 0,0336 | 0,0672 | 0,112 | 0,1456 | 0,1792 | 0,225 | 0,281 | 0,3584 | 0,450 | 0,560 | 0,7036 | 75 | |
| 80 | 0,043 | 0,086 | 0,143 | 0,186 | 0,229 | 0,286 | 0,358 | 0,458 | 0,572 | 0,715 | 0,901 | 80 | |
| 100 | 0,05 | 0,110 | 0,180 | 0,230 | 0,290 | 0,360 | 0,450 | 0,580 | 0,720 | 0,900 | 1,14 | 100 | |
| 125 | 0,08 | 0,17 | 0,28 | 0,37 | 0,45 | 0,56 | 0,71 | 0,90 | 1,13 | 1,41 | 1,78 | 125 | |
| 150 | | 0,24 | 0,41 | 0,53 | 0,65 | 0,81 | 1,02 | 1,30 | 1,62 | 2,03 | 2,56 | 150 | |
| 175 | | 0,33 | 0,55 | 0,72 | 0,88 | 1,11 | 1,38 | 1,77 | 2,21 | 2,76 | 3,48 | 175 | |
| 200 | | 0,43 | 0,72 | 0,94 | 1,16 | 1,44 | 1,81 | 2,31 | 2,89 | 3,61 | 4,55 | 200 | |
| 225 | | | 0,91 | 1,19 | 1,46 | 1,83 | 2,29 | 2,92 | 3,66 | 4,57 | 5,76 | 225 | |
| 250 | | | 1,13 | 1,47 | 1,80 | 2,26 | 2,82 | 3,61 | 4,56 | 5,64 | 7,11 | 250 | |
| 300 | | | | 1,63 | 2,11 | 2,60 | 3,25 | 4,06 | 5,20 | 6,50 | 8,13 | 10,24 | 300 |
| 350 | | | | 2,21 | 2,87 | 3,54 | 4,42 | 5,53 | 7,08 | 8,84 | 11,06 | 13,93 | 350 |
| 400 | | | | 2,89 | 3,76 | 4,62 | 5,78 | 7,22 | 9,24 | 11,56 | 14,45 | 18,20 | 400 |
| 450 | | | | | 3,66 | 4,75 | 5,85 | 7,31 | 9,14 | 11,70 | 14,62 | 18,28 | 450 |
| 500 | | | | | | 5,87 | 7,22 | 9,03 | 11,29 | 14,44 | 18,06 | 22,57 | 500 |
| 600 | | | | | | | | 13,00 | 16,25 | 20,80 | 26,00 | 32,50 | 600 |

Težine u tabeli važe za brusne ploče od korunda u keramičkom vezivu. Za tocila od silicijum karbida težina je za 10% manja od težine iz tabele. Za tocila u bakelitnom vezivu težina je za 15% veća.

Weights in the table are valid for vitrified bonded grinding wheels. The weights of resinoid bonded grinding wheels are higher by 15%. Silicon carbide grinding wheels weigh more by 10%.

Broj obrtaja tocila

Broj obrtaja tocila (min^{-1}) u zavisnosti od prečnika tocila i obodne brzine (m/sek)

Rotational speeds

Rotational speed (min^{-1}) depends on wheel diameter (D) and peripheral speed (m/s).

| D mm | obodna brzina (m/sek) - Peripheral speed (m/sec) | | | | | | | | | | | | |
|---------|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 12 | 16 | 20 | 25 | 32 | 35 | 40 | 45 | 50 | 63 | 80 | 100 | 125 |
| 3 | 76390 | 101860 | 127320 | 195160 | 203720 | 222810 | | | | | | | |
| 6 | 38200 | 50390 | 63660 | 79580 | 101860 | 111410 | 127320 | 143240 | 159160 | 200540 | 554650 | | |
| 8 | 28650 | 38200 | 47750 | 59680 | 76390 | 83560 | 95490 | 107430 | 119370 | 150400 | 190990 | 238730 | |
| 10 | 22920 | 30560 | 38200 | 47750 | 61120 | 66850 | 76390 | 85940 | 95490 | 120320 | 152790 | 190990 | 238730 |
| 13 | 17630 | 23510 | 29380 | 36730 | 47010 | 51420 | 58770 | 66110 | 73460 | 92560 | 117530 | 146910 | 183640 |
| 16 | 14320 | 19100 | 23870 | 29840 | 38200 | 41780 | 47750 | 53710 | 59680 | 75200 | 95490 | 119340 | 149210 |
| 20 | 11460 | 15270 | 19100 | 23870 | 30560 | 33420 | 38200 | 42970 | 47750 | 60160 | 76390 | 95490 | 119340 |
| 25 | 9170 | 12220 | 15280 | 19100 | 24450 | 26740 | 30560 | 34380 | 38200 | 48130 | 61120 | 76390 | 95490 |
| 32 | 7160 | 9550 | 11940 | 14920 | 19100 | 20890 | 23870 | 26860 | 29840 | 37600 | 47750 | 59680 | 74600 |
| 40 | 5730 | 7640 | 9550 | 11940 | 15280 | 16710 | 19100 | 21490 | 23870 | 30080 | 38200 | 47750 | 59680 |
| 50 | 4780 | 6110 | 7640 | 9550 | 12220 | 13370 | 15280 | 17190 | 19100 | 24060 | 30560 | 38200 | 47750 |
| 63 | 3640 | 4850 | 6060 | 7580 | 9700 | 10610 | 12130 | 13640 | 15160 | 19100 | 24250 | 30320 | 37890 |
| 80 | 2870 | 3820 | 4780 | 5970 | 7640 | 8360 | 9550 | 10740 | 11940 | 15040 | 19100 | 23870 | 29840 |
| 100 | 2290 | 3060 | 3820 | 4780 | 6110 | 6680 | 7640 | 8590 | 9550 | 12030 | 15280 | 19100 | 23870 |
| 125 | 1830 | 2440 | 3060 | 3820 | 4890 | 5350 | 6110 | 6875 | 7640 | 9630 | 12220 | 15280 | 19100 |
| 150 | 1530 | 2040 | 2550 | 3180 | 4070 | 4460 | 5090 | 5730 | 6370 | 8020 | 10190 | 12730 | 15920 |
| 175 | 1310 | 1750 | 2180 | 2730 | 3490 | 3820 | 4370 | 4910 | 5460 | 6880 | 8730 | 10910 | 13640 |
| 180 | 1270 | 1700 | 2120 | 2650 | 3400 | 3710 | 4240 | 4775 | 5310 | 6680 | 8490 | 16010 | 13260 |
| 200 | 1150 | 1530 | 1910 | 2390 | 3060 | 3340 | 3820 | 4230 | 4780 | 6020 | 7640 | 9550 | 11940 |
| 230 | 1000 | 1330 | 1660 | 2080 | 2660 | 2910 | 3320 | 3740 | 4150 | 5230 | 6640 | 8300 | 10380 |
| 250 | 920 | 1230 | 1570 | 1910 | 2440 | 2670 | 3060 | 3440 | 3820 | 4810 | 6110 | 7640 | 9550 |
| 300 | 765 | 1020 | 1270 | 1590 | 2040 | 2230 | 2550 | 2865 | 3180 | 4010 | 5090 | 6370 | 7960 |
| 350 | 655 | 875 | 1090 | 1365 | 1745 | 1910 | 2180 | 2455 | 2730 | 3440 | 4370 | 5460 | 6820 |
| 400 | 575 | 765 | 955 | 1195 | 1530 | 1670 | 1910 | 2150 | 2390 | 3010 | 3820 | 4780 | 5970 |
| 450 | 510 | 680 | 850 | 1060 | 1360 | 1485 | 1700 | 1910 | 2120 | 2670 | 3400 | 4240 | 5300 |
| 500 | 460 | 610 | 765 | 955 | 1220 | 1335 | 1530 | 1720 | 1910 | 2410 | 3060 | 3820 | 4780 |
| 600 | 380 | 510 | 640 | 795 | 1020 | 1115 | 1270 | 1430 | 1590 | 2000 | 2550 | 3180 | 3980 |

Proizvodni program

I. TOCILA U KERAMIČKOM I SMOLNOM VEZIVU ZA:

- SPOLJAŠNJE KRUŽNO BRUŠENJE
- BRUŠENJE MEĐU ŠILJCIMA
- CENTERLESS BRUŠENJE
- RAVNO BRUŠENJE
- OBODNO RAVNO BRUŠENJE
- UNUTRAŠNJE KRUŽNO BRUŠENJE
- ČEONO BRUŠENJE I BRUŠENJE SEGMENTIMA
- OŠTRENJE ALATA
- RUČNO BRUŠENJE U RADIONICAMA
- BRUŠENJE NAVOJA
- BRUŠENJE ZUPČANIKA
- BRUŠENJE U LIVNICAMA
- BRUŠENJE SA BRUSNIM ČEPOVIMA
- ČIŠĆENJE NA STABILNIM BRUSILICAMA
- ČIŠĆENJE ODLIVAKA SA RUČNIM BRUSILICAMA
- ČIŠĆENJE SA VISEĆIM BRUSILICAMA
- REZANJE MATERIJALA
- INDUSTRIJE LEŽAJEVA IMPREGIRANA SUMPOROM
- HONOVANJE I SUPERFINIŠIRANJE

II. TOCILA U MAGNEZITNOM VEZIVU

III. AERATORI (BARBOTERI) ZA RIBNJAKE

Production Programme

I. VITRIFIED AND RESINOID BONDED GRINDING WHEELS FOR:

- EXTERNAL CYLINDRICAL GRINDING
- GRINDING BETWEEN CENTERS
- CENTERLESS GRINDING
- SURFACE GRINDING
- PERIPHERAL SURFACE GRINDING
- INTERNAL CIRCULAR GRINDING
- FRONTAL GRINDING AND GRINDING WITH SEGMENTS
- TOOL SHARPENING
- MANUAL GRINDING IN WORKSHOPS
- THREAD GRINDING
- TOOTH-FLANK GRINDING
- GRINDING IN FOUNDRIES
- GRINDING WITH MOUNTED WHEELS
- SNAGGING ON FLOORSTAND GRINDERS
- SNAGGING ON MANUAL GRINDING MACHINES
- SNAGGING ON SWING FRAME MACHINES
- CUTTING-OFF MATERIALS
- BEARING INDUSTRY (IMPREGNATED WITH SULFUR)
- HONING AND SUPERFINISHING

II. MAGNESITE BONDED GRINDING WHEELS

III. BARBOTHERIES (AERATORS) FOR FISH PONDS AND AQUARIUMS

SGS

Certificate CH10/0212

The management system of

"IBA" ADA

Krajiška 27a, 24430 Ada, Serbia



has been assessed and certified as meeting the requirements of

ISO 9001:2008

For the following activities

Production and sale of grinding tools

This certificate is valid from 3 March 2010 until 2 March 2013
and remains valid subject to satisfactory surveillance audits.

Valid subject to satisfactory surveillance adults
Recertification audit due before 18 February 2013

Issue 1 Certified since March 2010

Authorised by

S. Linn Ch. Miller



Accreditation No. SCESm 017

SGS Société Générale de Surveillance SA Systems & Services Certification
Technoparkstrasse 1 8005 Zurich Switzerland
t +41 (0)44 445-16-80 f +41 (0)44 445-16-88 www.sgs.com

Page 1 of 1



The banner consists of a series of graphic elements. It begins with a large, bold letter 'S' in a dark blue-grey color with a fine diagonal hatching pattern. This is followed by a smaller 'G' in the same style. The sequence continues with a pink silhouette of a penguin, a pink flamingo, a pink pelican, a bright orange-red bird, a dark orange-red bird, a dark blue bird with a dotted wing pattern, a light blue bird with a grid-like wing pattern, and finally a large dark grey bird with a textured wing pattern.



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Krajiška 27/a
24430 Ada

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Tel. rukovodilac prodaje: 024/851-223
Tel. komercijalni poslovi: 024/851-140
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024/853-428

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