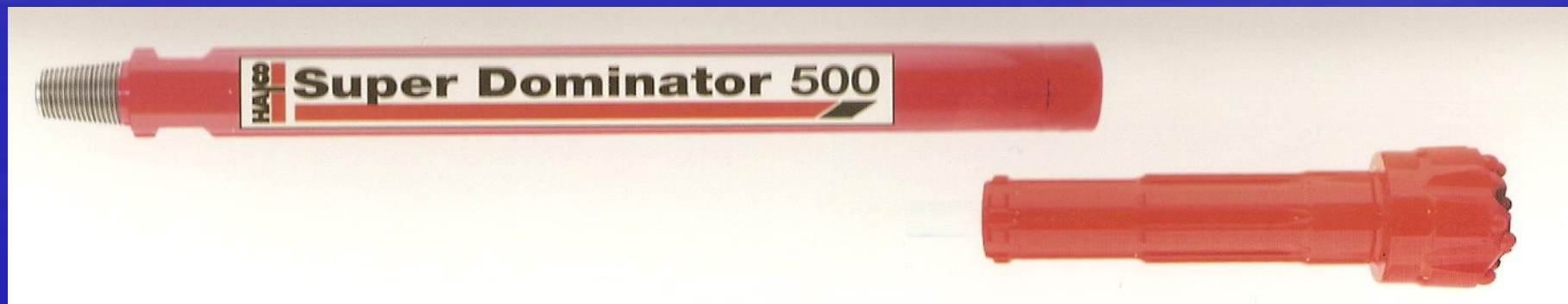


VRTANJE Z UPORABO



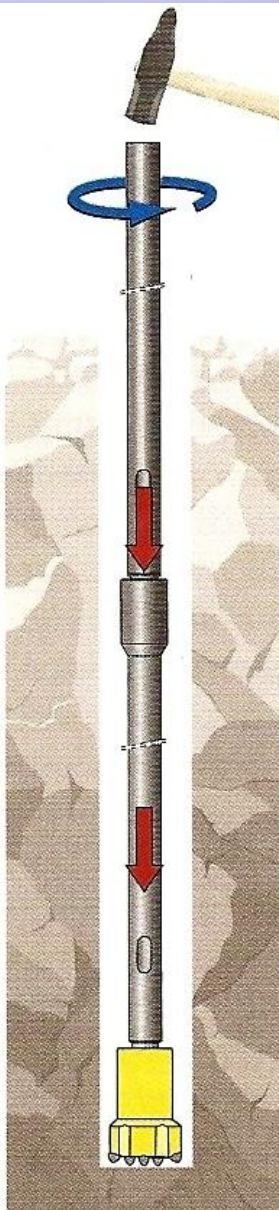
GLOBINSKIH KLADIV

- IZUMITELJ ANDRE STEINUCK OKROG 1950
Maksimalni tlak 12 bar
Dleto križne oblike
- HALCO MACH PREVZAME NADALJNI RAZVOJ
- 50 LET RAZVOJA DO SEDANJE OBLIKE KLADIV
IN DLET
Bradavičasta dleta
Maksimalni tlak do 30 bar
- V SLOVENIJI SE OKROG 2/3 VSEGA VRTANJA
IZVAJA Z GLOBINSKIMI KLADIVI

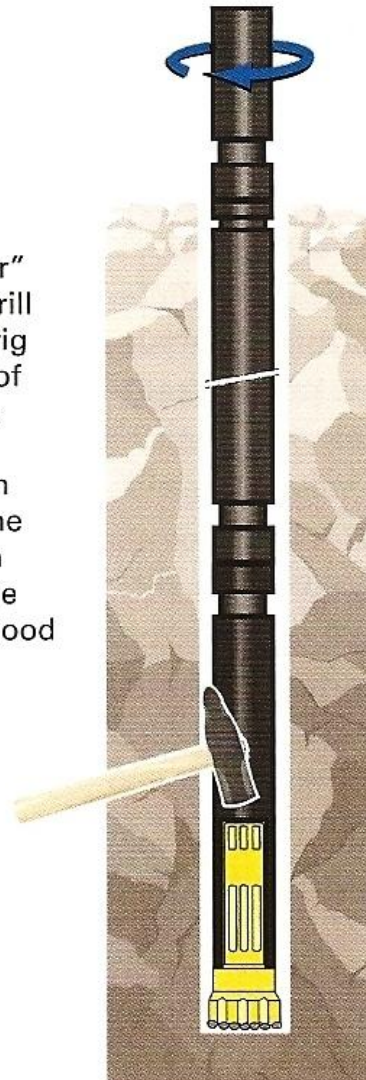
GLAVNE PREDNOSTI

- Širok spekter premerov
- Večja vertikalnost vrtine, čistejša vrtina
- Manjši strošek
- Veliki učinki
- Vrtanje v vseh kameninah (trdih, srednje trdih ali mehkih)

Načini vrtanja



Principle: As the name "tophammer" implies, the rock drill is situated on the rig and works on top of the drill string. The impact energy of the rock drill piston is transmitted to the drill bit in the form of shock waves. The method is fast in good rock conditions.

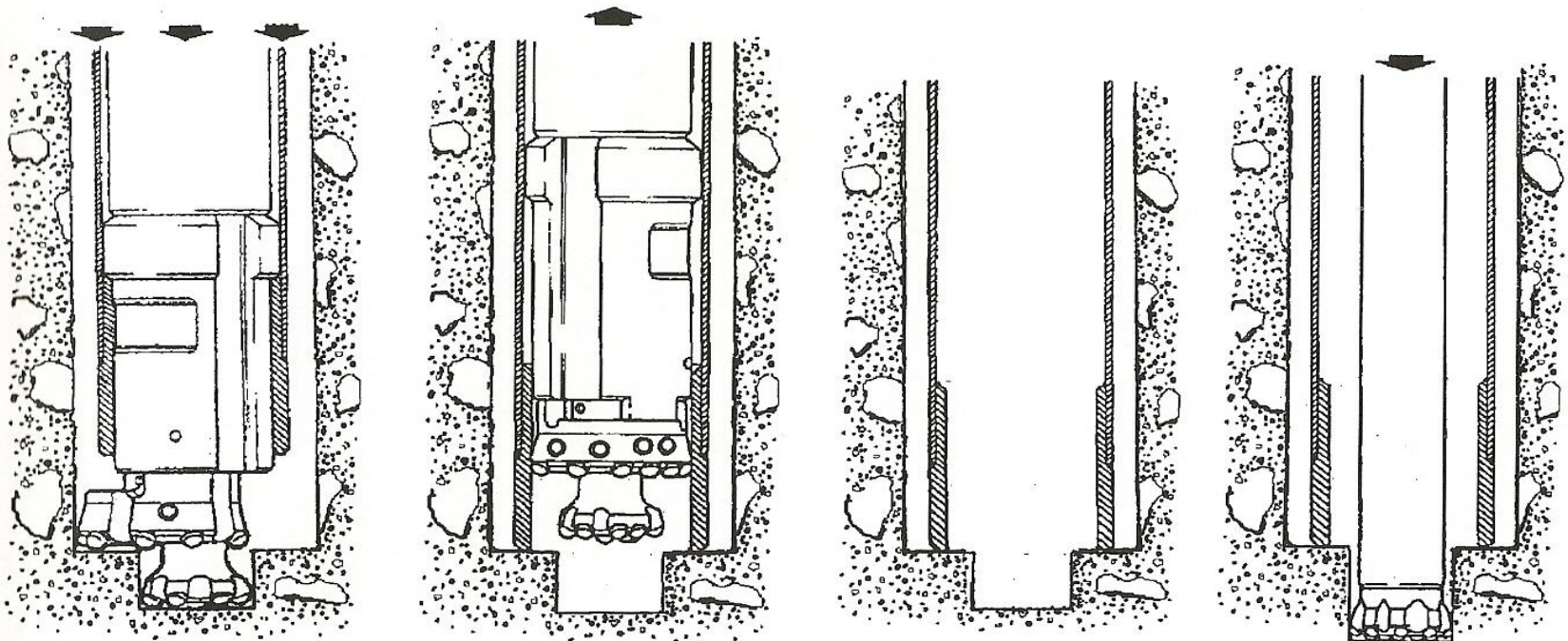


Principle: The hammer is situated down the hole in direct contact with the drill bit. The hammer piston strikes the drill bit resulting in an efficient transmission of the impact energy and insignificant power losses with the hole depth. The method is widely used for drilling long holes, not only for blasting, but also for water wells, shallow gas and oil wells, and for geo-thermal wells. In mining it is also developed for sampling using the reverse circulation technique (RC drilling).

OVERBURDEN-NADPROFILNO VRTANJE

- SLIKA 1: PRECEVLJENI SO NEVEZANI MATERIALI (EKSCENTER NA DLETU JE RAZŠIRJEN IN ZA SABO VLEČE OBLOŽNO KOLONO –SHOE DRIVE SISTEM)
- SLIKA 2: IZVLEK EKSCENTRA
- SLIKA 3: VRTINA JE ZACEVLJENA V RAZSUTIH MATERIALIH
- SLIKA 4: NADALJEVANJE VRTANJA Z KLASIČNIM DTH KLADIVOM

casing.

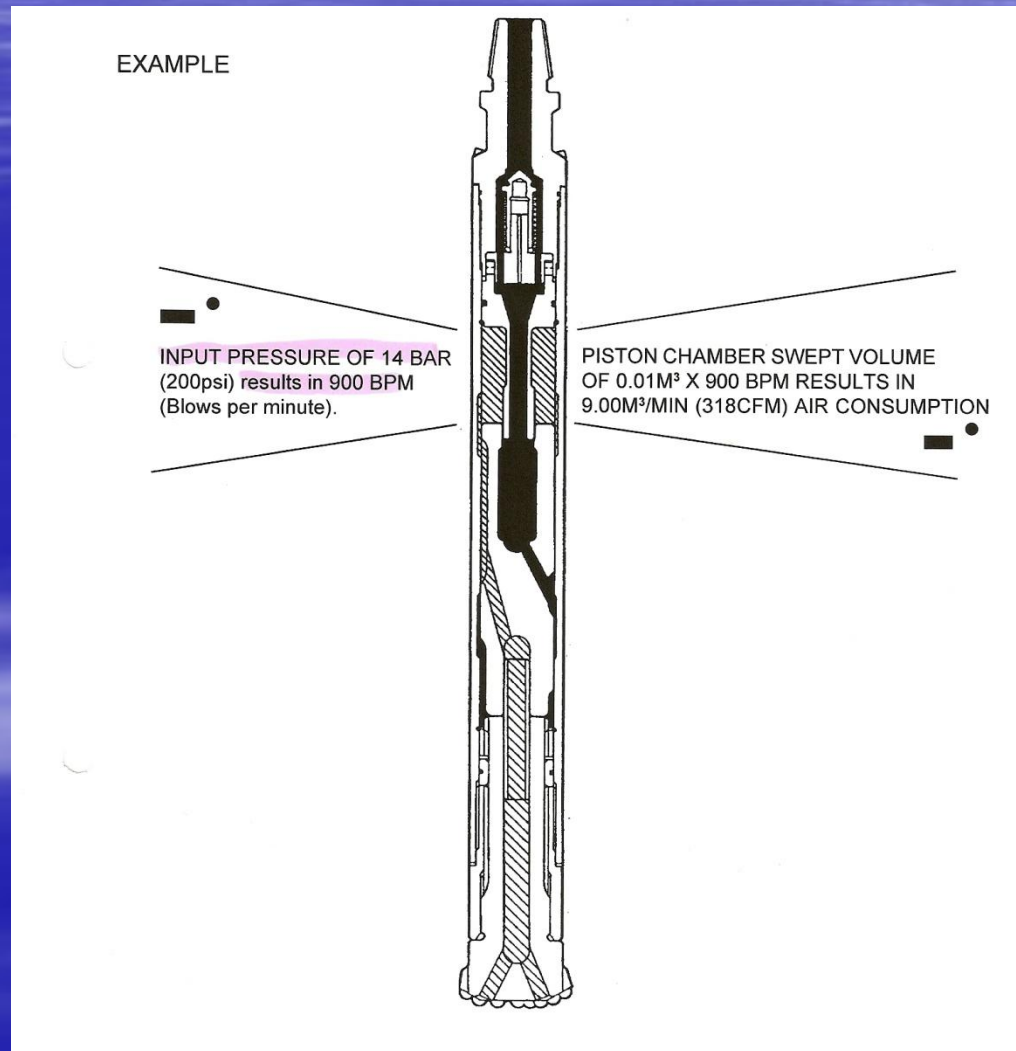


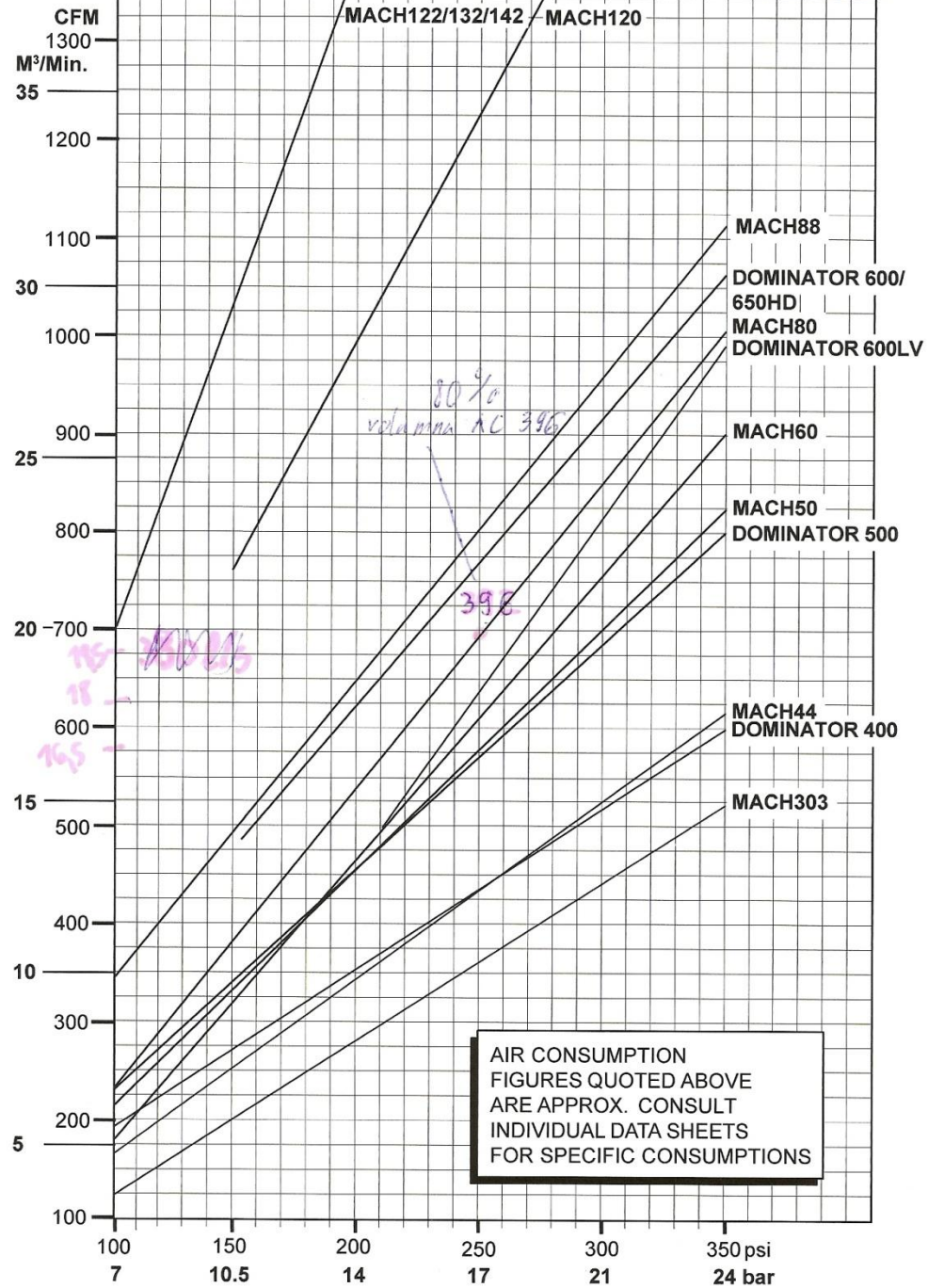
Življenjska doba in stroški

- ŽIVLJENSKA DOBA KLADIVA -10.000 M – APNENCI
- ŽIVLJENSKA DOBA DLETA – 5.000 M – APNENCI
- ŽIVLJENSKA DOBA DROGOVJA 4 ½" – 10.000 M
- STROŠEK VRTANJA FI 165 MM = 3 EUR/M1

VRTANJE SE IZVAJA Z 6"KLADIVOM IN 6 ½" DLETOM

Zračni tlak je primarna sila za zmogljivosti globinskega kladiva. Pritisk določa število udarcev dleta in obenem pogojuje potrebo po količini zraka. Večji je tlak, večja mora biti tudi količina zraka.





			ALTITUDE							
FEET-----SEA			1000	3000	5000	7000	9000	11000	13000	15000
METRES.....LEVEL			305	915	1524	2134	2744	3354	3963	4573
TEMPERATURE										
F°	C°									
-40	-40	0.805	0.835	0.898	0.968	1.043	1.127	1.217	1.317	1.426
-30	-34.4	0.824	0.855	0.920	0.991	1.068	1.154	1.246	1.349	1.460
-20	-28.9	0.844	0.875	0.941	1.014	1.092	1.180	1.275	1.380	1.494
-10	-23.3	0.863	0.895	0.962	1.037	1.117	1.207	1.304	1.411	1.528
0	-17.8	0.882	0.915	0.984	1.060	1.142	1.234	1.333	1.443	1.562
10	-12.2	0.901	0.935	1.005	1.083	1.167	1.261	1.362	1.474	1.596
20	-6.7	0.920	0.954	1.026	1.106	1.192	1.288	1.391	1.506	1.630
30	-1.1	0.939	0.974	1.048	1.129	1.217	1.315	1.420	1.537	1.664
40	4.4	0.959	0.994	1.069	1.152	1.241	1.341	1.449	1.568	1.698
50	10	0.978	1.014	1.091	1.175	1.266	1.368	1.478	1.600	1.732
60	15.6	0.997	1.034	1.112	1.198	1.291	1.395	1.507	1.631	1.766
70	21.1	1.016	1.054	1.133	1.221	1.316	1.422	1.536	1.662	1.800
80	26.7	1.035	1.074	1.155	1.244	1.341	1.449	1.565	1.694	1.834
90	32.2	1.055	1.094	1.176	1.267	1.365	1.475	1.594	1.725	1.868
100	37.8	1.074	1.114	1.198	1.290	1.390	1.502	1.623	1.756	1.902
110	43.3	1.093	1.133	1.219	1.313	1.415	1.529	1.652	1.783	1.936
120	48.9	1.112	1.153	1.240	1.336	1.440	1.556	1.681	1.819	1.970

Vpliv zračnega pritiska in temperature (npr. Vršič)

Za Vršič potrebujemo 25 % večjo količino zraka.

IZNAŠALNA HITROST

- Da zagotovimo ustrezno iznašanje navrtanine potrebujemo iznašalno hitrost med 900 do 1800 m/min oziroma 15 – 30 m/s

Iznašalno hitrost lahko povečamo tudi :

- Z izvlačenjem kladiwa (po kmečko)
- Z uporaba bypass-a (na prelazu s kladivom)
- Z uporabo vrtalnih pen

Formula za iznašalno hitrost

$$VM = \frac{X(m^3) \times 1305096}{DM^2 - dm^2} = \text{iznašalna hitrost v m/min}$$

X=količina pretoka zraka (m³/min – glej tabelo 13)

DM = premer vrtine

Dm=premer drogovja

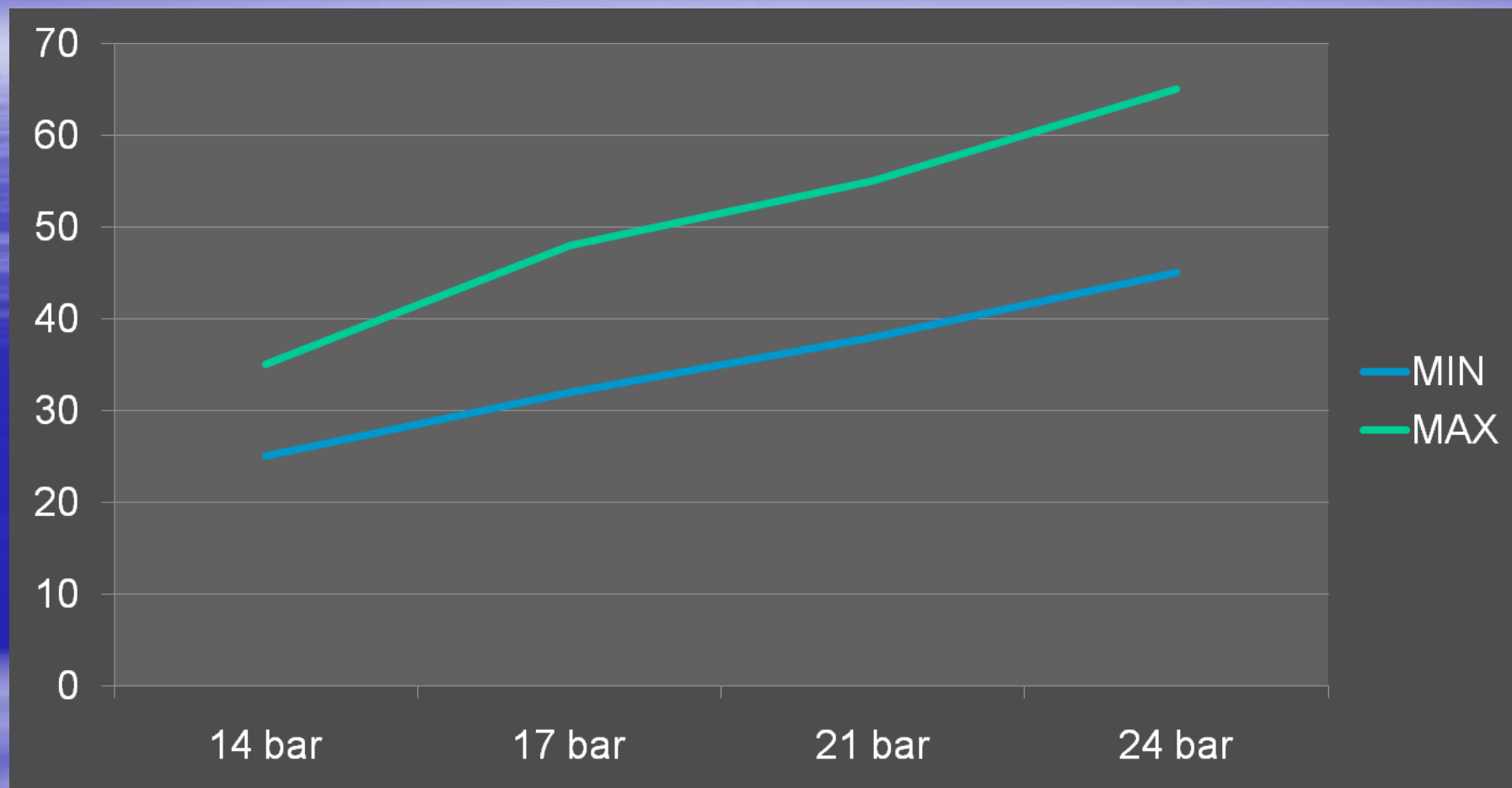
Razmerje tlak, poraba zraka za kladiiva

HALCO MACH

Hammer Model	7 Bar (100 PSI)	10.5 Bar (150 PSI)	12 Bar (170 PSI)	14 Bar (200 PSI)	17 Bar (250 PSI)	24 Bar (350 PSI)
DA265	2.30	3.10	—	—	—	—
Mach 303	3.70	5.40	6.20	7.65	9.90	14.70
Mach 44	4.80	7.00	8.00	9.50	12.00	17.20
Dominator 400	5.20	7.50	8.50	9.90	12.20	17.00
Mach 50	5.70	7.20	8.20	11.00	14.90	23.40
Dominator 500	6.50	8.50	9.90	12.00	15.60	22.65
Mach 60	5.10	7.90	9.10	12.45	16.40	25.50
Dominator 600/650HD	—	9.50	12.00	14.10	19.50	30.00
Dominator 600LV	—	8.90	10.00	13.30	18.10	28.00
Mach 80	6.50	11.30	12.50	14.70	19.50	33.90
Mach 88	9.60	13.90	17.00	18.40	22.65	31.45
Mach 120	—	—	24.35	28.30	35.40	48.10
Mach122/132/142	19.80	29.45	33.40	39.05	48.10	70.80

Razmerje
hitrost v m/min
za vsak m³
zraka, ki gre
skozi kladivo

DRILL BIT DIA.		DRILL TUBE DIAMETER							
		2.1/8" 54mm	2.3/4" 70mm	3" 76mm	3.1/2" 89mm	4" 102mm	4.1/2" 114mm	5" 127mm	5.1/2" 140mm
2.3/4"	70mm	642							
3.1/3"	85mm	295	548	880					
3.1/2"	90mm	254	420	607					
3.15/16"	100mm	180	249	304					
4.1/8"	105mm		208	243	410				
4.1/4"	108mm		188	218	340				
4.1/3"	110mm		177	201	305	751			
4.1/2"	115mm		153	171	240	451			
4.3/4"	120mm		134	148	196	319	907		
5"	127mm		113	123	155	222	407		
5.1/8"	130mm		106	114	142	196	326		
5.1/2"	140mm		87	92	109	138	193	367	
6"	152mm		70	73	83	99	125	179	
6.1/8"	156mm		66	69	78	92	114	158	
6.1/4"	159mm		63	66	74	86	105	140	
6.1/2"	165mm		57	59	66	76	89	115	
6.3/4"	171mm		52	54	59	67	78	96	
7"	178mm				54	60	69	82	105
7.1/2"	191mm				45	49	55	63	90
7.7/8"	200mm				40	43	47	53	62
8"	203mm				38	41	45	51	58
8.1/2"	216mm				33	35	38	42	47
8.7/8"	225mm				30	32	34	37	41
9.5/8"	245mm				24	26	27	29	32
10"	254mm				22	24	25	26	28
11"	279mm				18	19	20	21	22
11.7/8"	300mm				15	16	17	17	18
12.1/4"	311mm				14	15	15	16	16
13"	330mm						13	14	14
14.3/4"	375mm						10	10	11
15"	381mm						10	10	10
17.1/2"	445mm						7	7	7
18.1/2"	470mm						6	6	6
20"	508mm						5	5	5
22"	559mm						4	4	4
24"	610mm						4	4	4



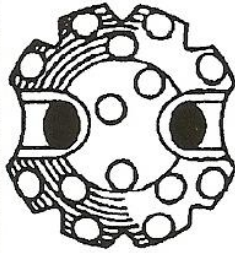
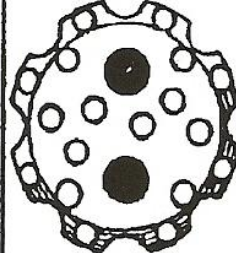
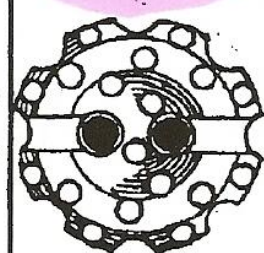
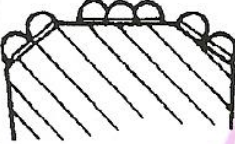
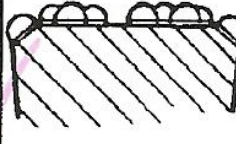
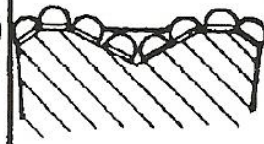
Hitrosti vrtanja v apnencih (m/s)

PRIPOROČENA RAZMERJA

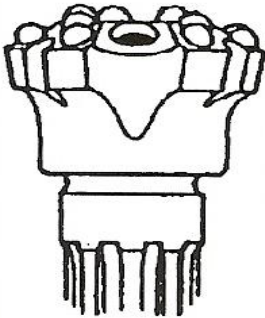
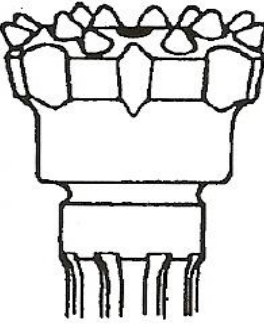
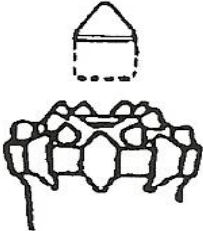
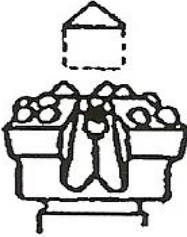
TIP KLADIVA	PREMER DLETA	PREMER KLADIVA	PREMER DROGOVJA
MACH 30	85 – 100 mm	77 mm	70 mm
MACH 40	105 – 120 mm (127)	95 mm	76 – 90 mm
MACH 50	127 – 146 mm (152)	114/118 mm	90 – 114 mm
MACH 60	152 – 168 mm (190)	139/146 mm	114 mm**
MACH 80	203 – 279 mm (300)	182 mm	114 – 168 mm***
MACH 120	311 – 381 mm (444)	273 mm	219 mm***

(OVERSIZE – PROIZVAJALEC NE ODGOVARJA) *** - ALI VEČ

OBLIKA DLET

HEAD DESIGNS		
CONVEX	FLAT FACE	CONCAVE
		
		
STRONG DESIGN FOR ALL CONDITIONS ESPECIALLY HARD ABRASIVE ROCKS GOOD BALANCE OF FAST DRILLING AND LONG SERVICE LIFE	ALTERNATIVE DESIGN FOR ALL ROCK CONDITIONS ESPECIALLY FRACTURED AND FISSURED ROCKS AND CHANGING FORMATIONS	ALTERNATIVE DESIGN FOR ALL ROCK CONDITIONS PARTICULARLY DEEP HOLE DRILLING CAN PROVIDE IMPROVED HOLE ALIGNMENT AS A RESULT OF THE INVERTED

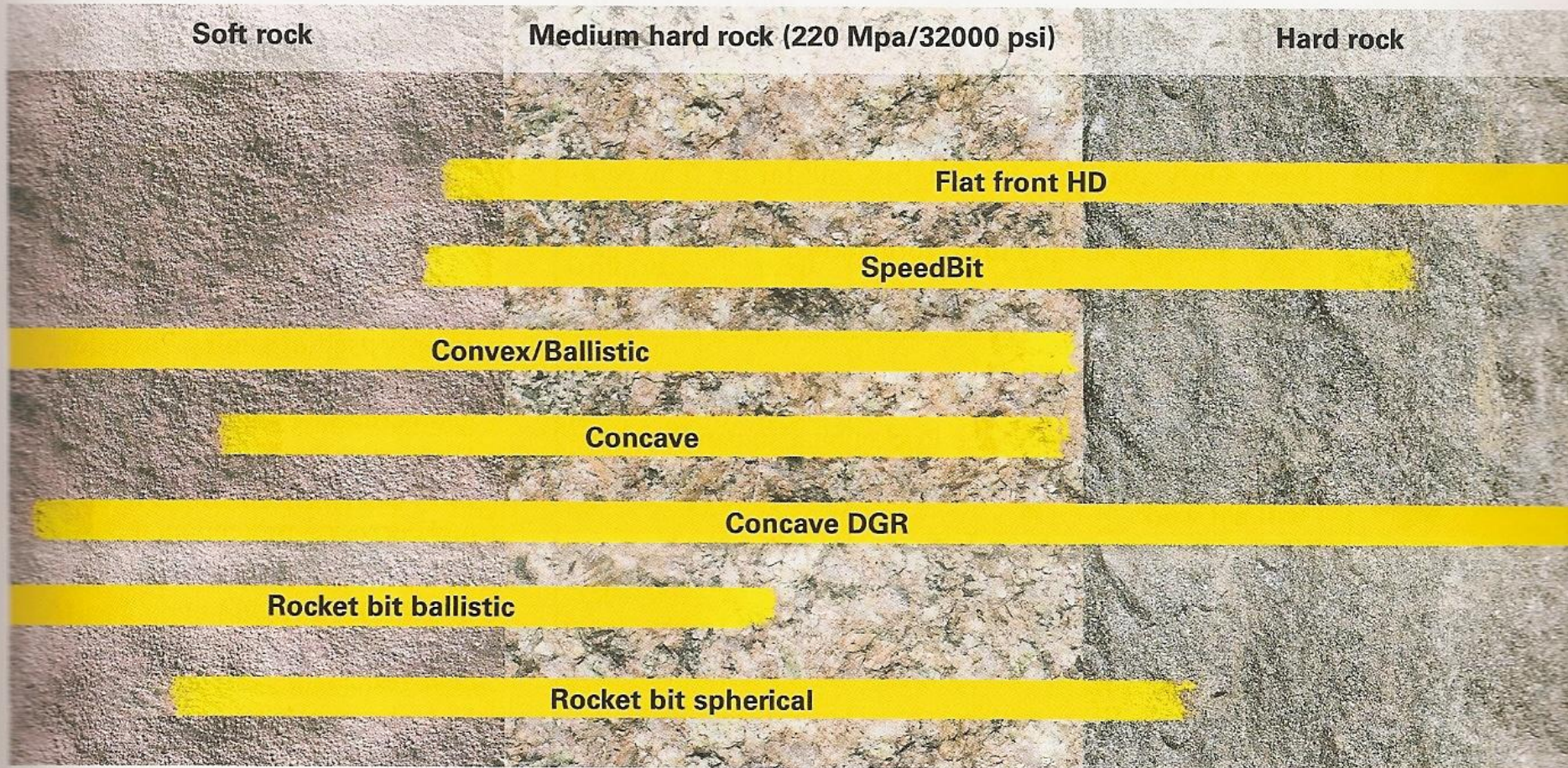
OBLIKA VLOŽKOV

INSERT TYPES		
DOMED INSERTS  	BALLISTIC INSERTS  	SEMI-BALLISTIC 
		CONICAL INSERTS 
STRONG RUGGED SHAPE FOR HIGH PERFORMANCE AND GOOD SERVICE LIFE IN ALL CONDITIONS, PARTICULARLY SUITABLE FOR VERY HARD ABRASIVE ROCKS AND DEEP HOLE DRILLING	SUITABLE FOR SOFT/MEDIUM COMPACT LOW ABRASIVE ROCKS PRODUCING LARGE CUTTINGS NOT SUITABLE FOR BADLY FRACTURED ROCKS	SUITABLE FOR ALL SOFT MEDIUM ROCK CONDITIONS INCLUDING FRACTURED AND FISSURED ROCKS

	Convex/Ballistic front design Convex front with large cutting grooves and ballistic gauge and centre buttons. For soft to medium hard non-abrasive formations. The bit is designed for maximum penetration rate. Also, an alternative in hard abrasive formations, if high penetration rate is called for.
	SpeedBit Flat front design/ballistic centre buttons. Flat front with spherical gauge buttons and ballistic centre buttons. For high penetration in medium hard to hard abrasive formations.
	Flat front design – HD Flat front with large spherical gauge buttons for hard and abrasive formations. Also, front flushing grooves for efficient cuttings removal.
	Concave front design Concave front with spherical buttons Perfect choice for medium hard to hard, less abrasive, fractured formations. Minimizes effect of hole deviation.
	Concave front design – HD Concave front with spherical buttons, with larger gauge buttons. Ideal for medium hard to hard, abrasive and fractured formations.
	Concave DGR front design Concave front with double rows of spherical gauge buttons. Only available for 8 in bits and larger. The reinforced gauge gives superior protection in medium hard to hard, abrasive and fractured formations.

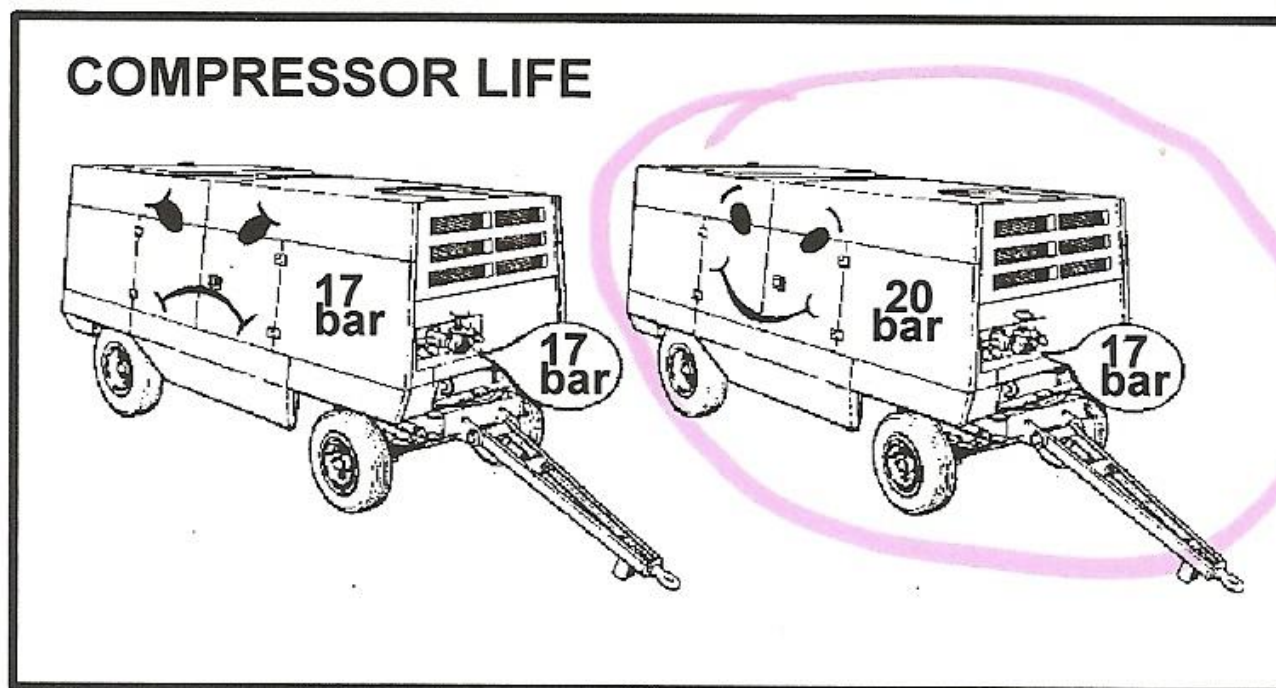


Oblika dleta je odvisna trdote



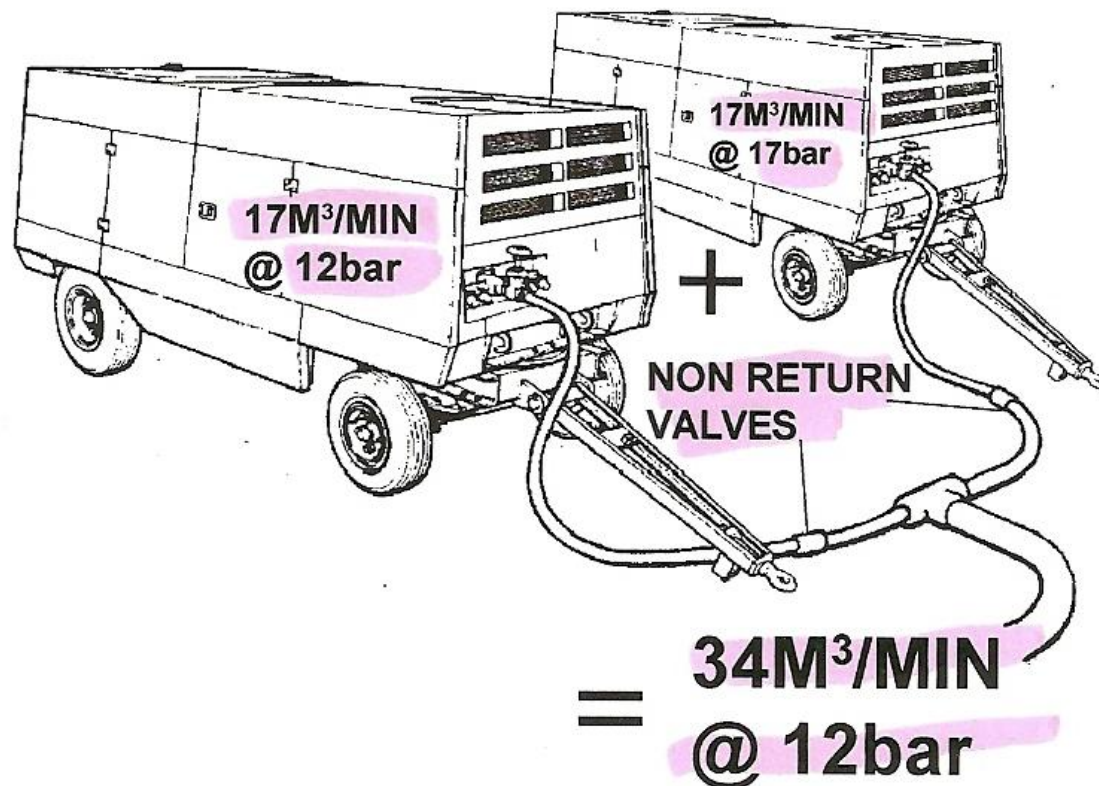
ŽIVLJENSKA DOBA - KOMPRESORJA

COMPRESSOR SELECTION Cont./.....



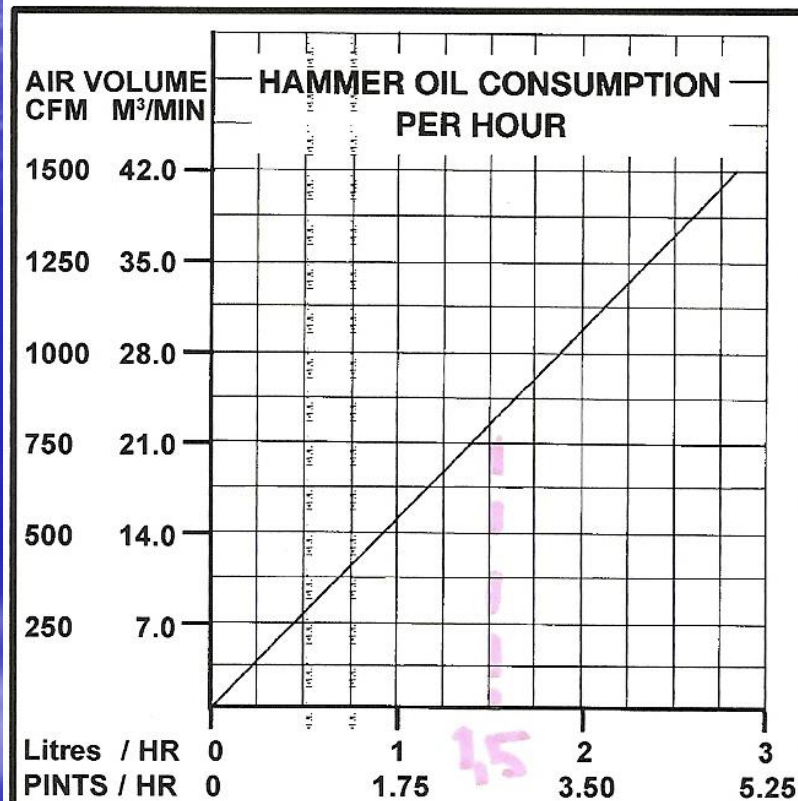
VEZAVA KOMPRESORJEV

MULTIPLE COMPRESSORS



MAZANJE KLADIV

LUBRICANTS



DTH hammers need - per hour -

- 1/3rd of imp.pint of oil per 100 CFM of air consumed.

or

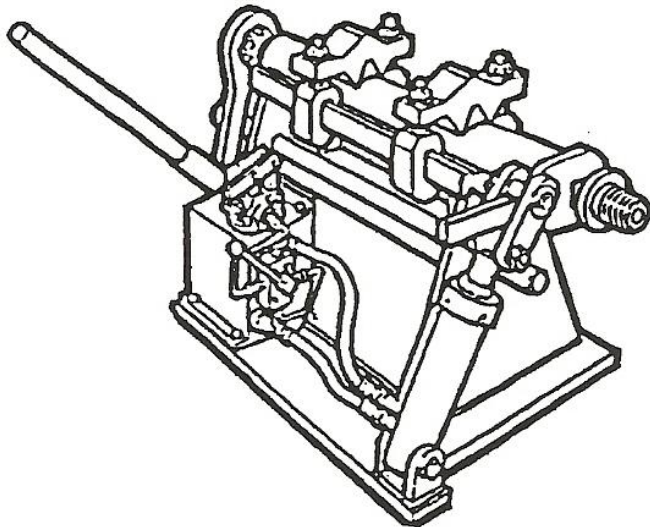
- 0.20L of oil per 3M³/Min of air consumed

Up to double the amount of oil is required when used with water injection

At temperatures below 5°C oil with an antifreeze additive may be required

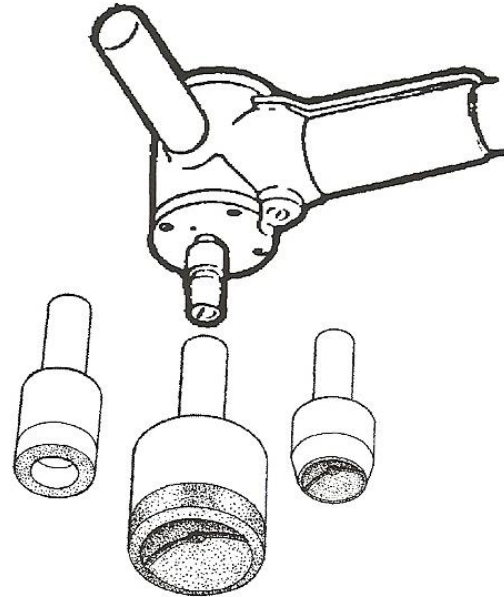
OPREMA ZA VZDRŽEVANJE

HAMMER STRIPPING BENCH

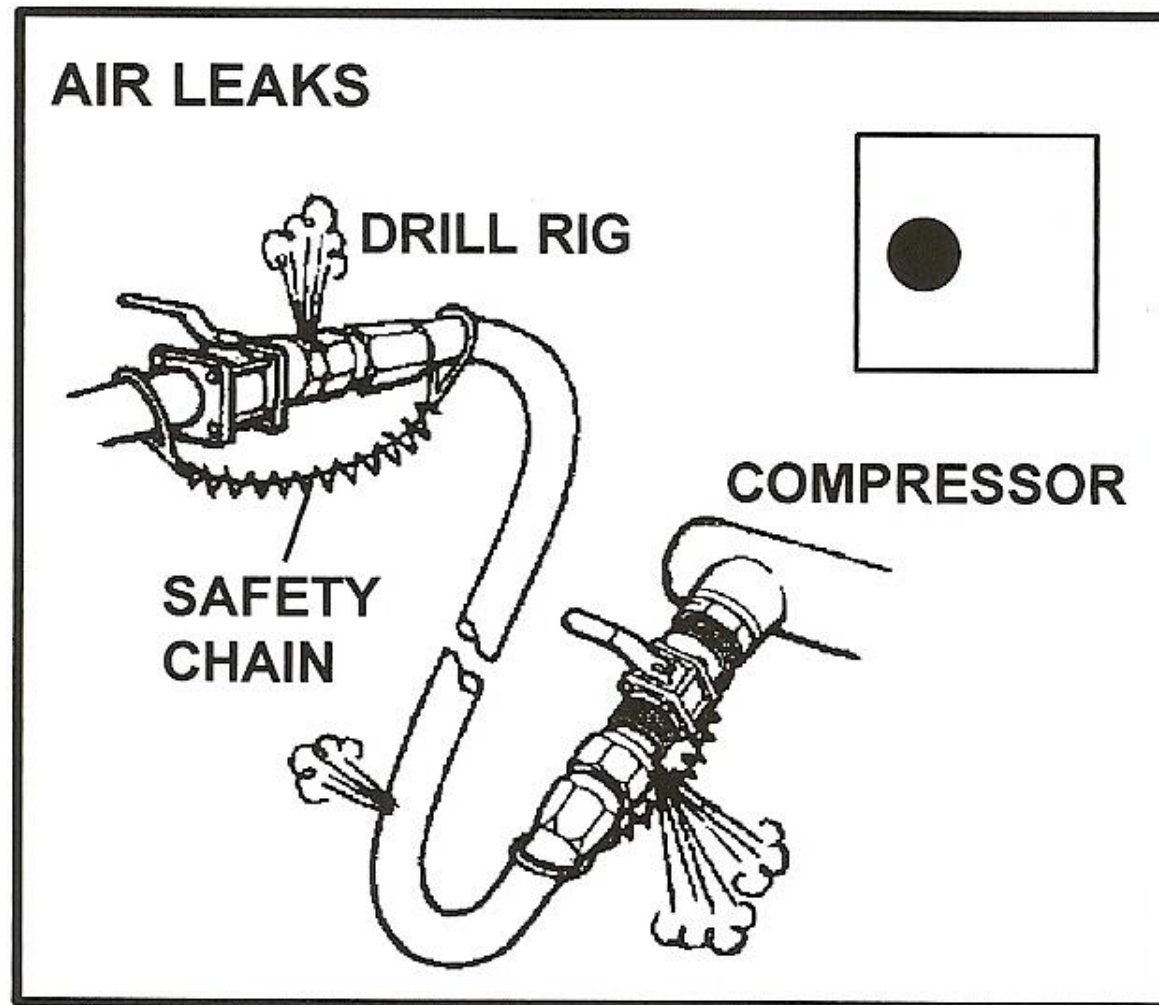


hammers.

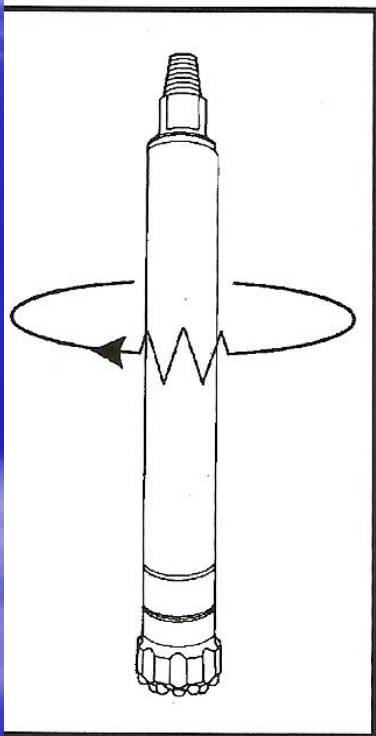
BIT GRINDING EQUIPMENT



VARNOST PRI DELU



PRIPOROČEN NAVOR



Drill Bit Dia.

Torque (Recommended)

105 mm (4.1/8")

50KGM (360 Ft/Lbs)

127 mm (5")

120KGM (865 Ft/Lbs)

165 mm (6.1/2")

250KGM (1800 Ft/Lbs)

200 mm (7.7/8")

300KGM (2170 Ft/Lbs)

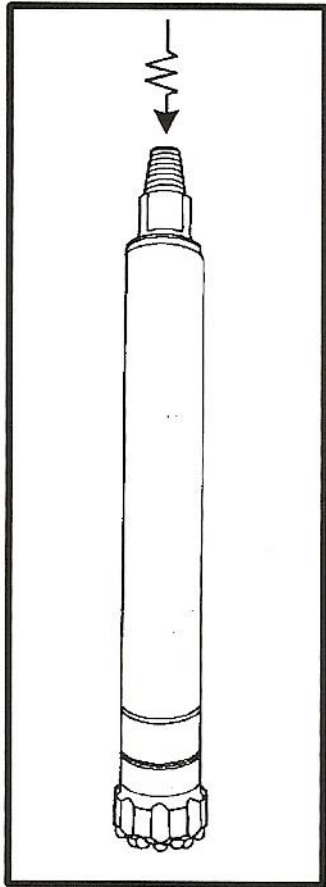
300 mm (11.7/8")

350KGM (2530 Ft/Lbs)

445 mm (17.1/2")

425KGM (3075 Ft/Lbs)

POTISNA SILA – PULL DOWN

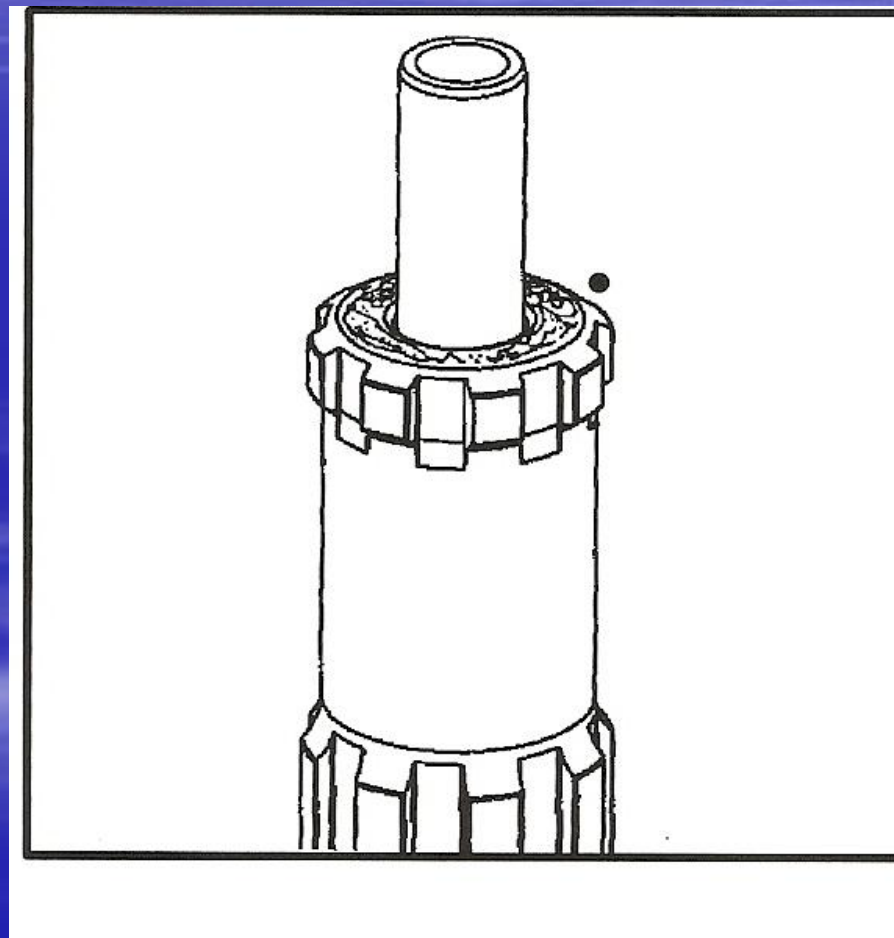
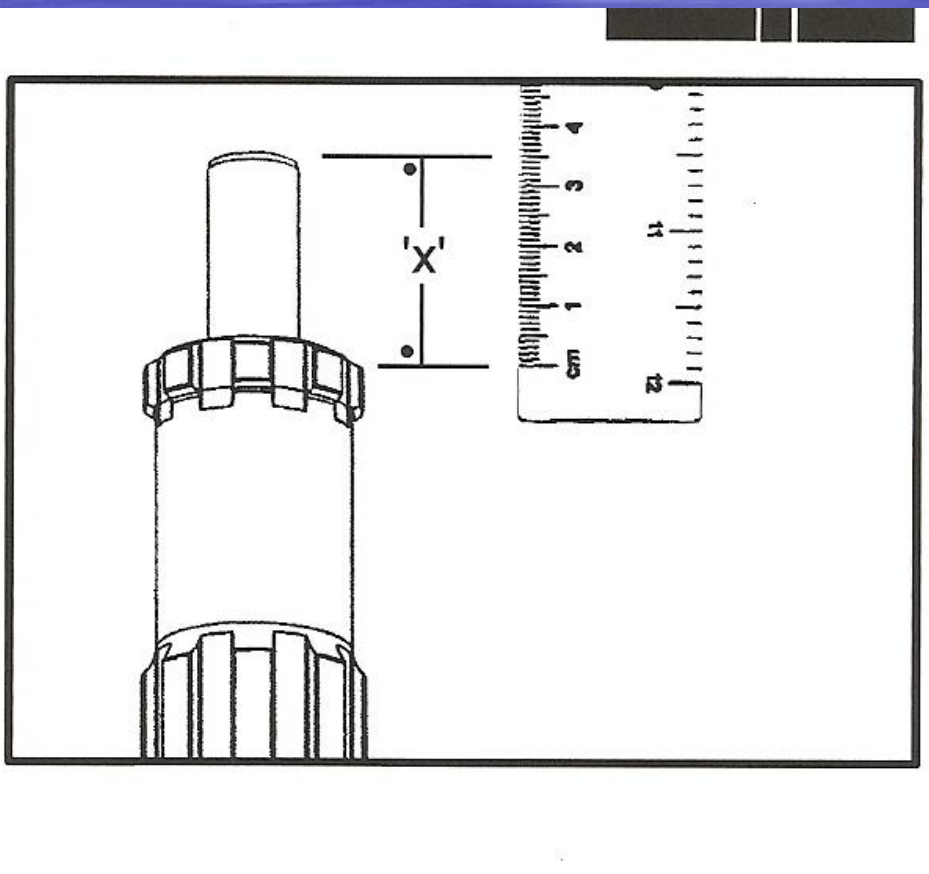


Recommended Thrust Capacities

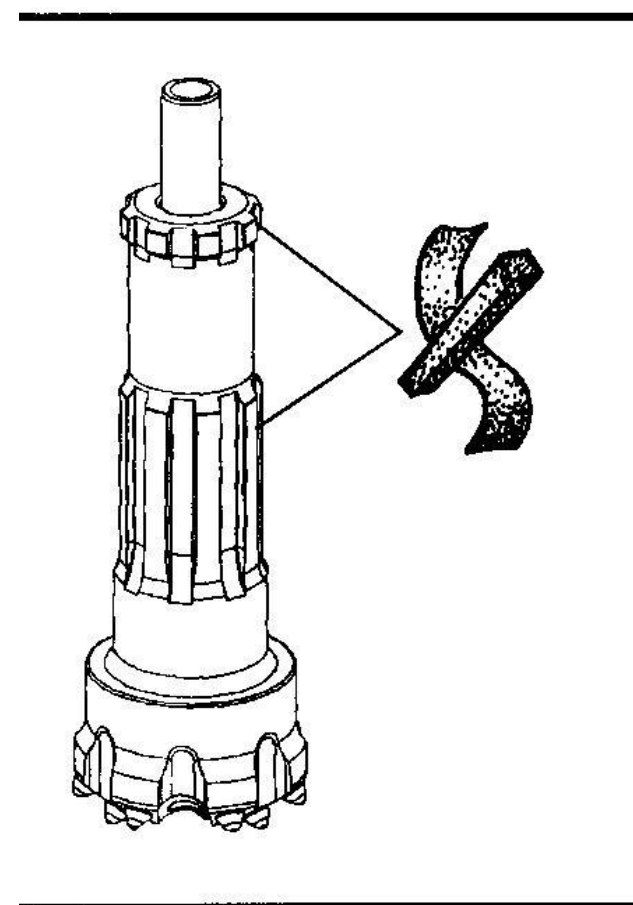
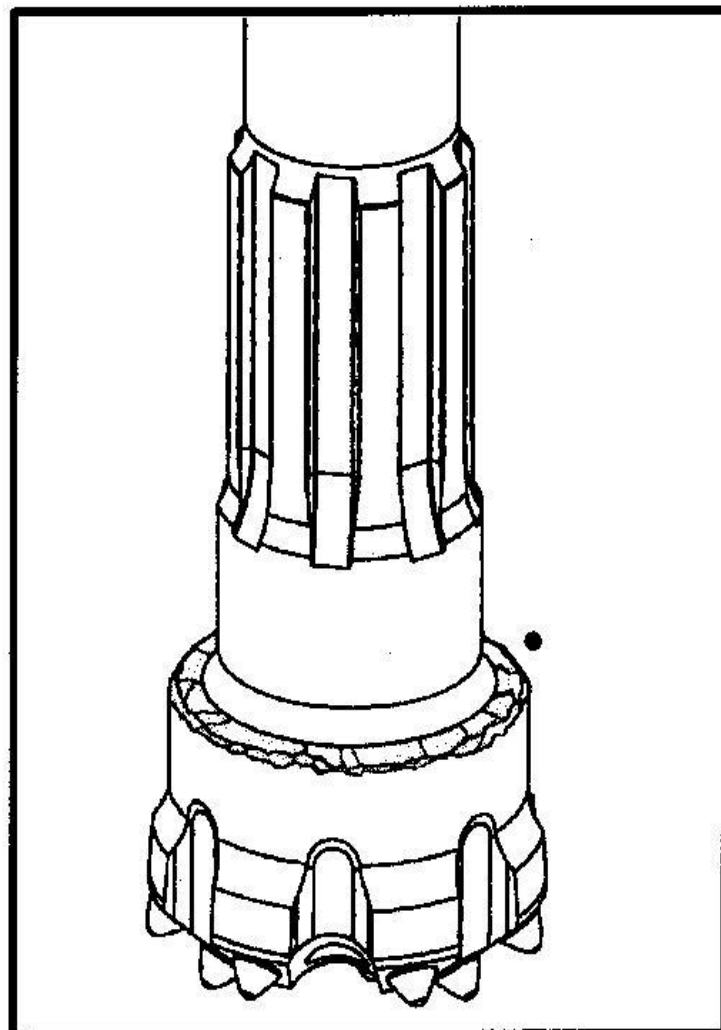
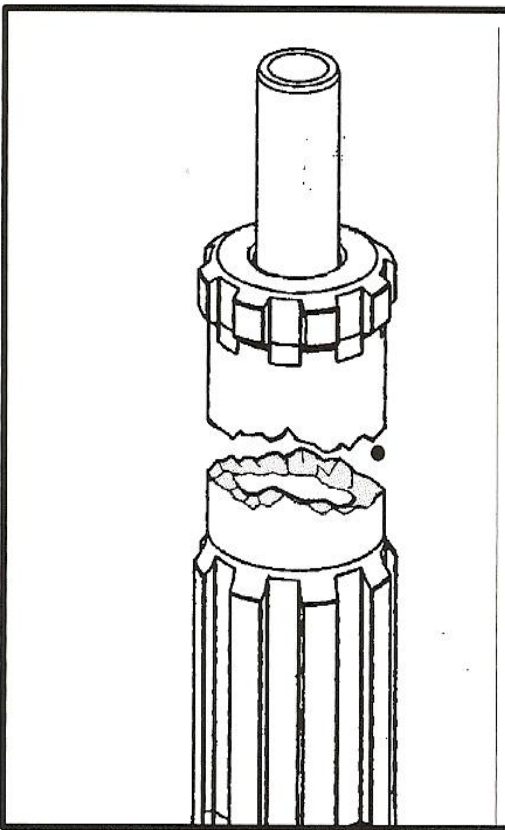
Hammer Size	Min. Thrust	Max. Thrust
3"	150KG (330 Lbs)	300KG (660 Lbs)
4"	250KG (550 Lbs)	500KG (1100 Lbs)
5"	400KG (880 Lbs)	900KG (1980 Lbs)
6"	500KG (1100 Lbs)	1500KG (3300 Lbs)
8"	800KG (1760 Lbs)	2000KG (4400 Lbs)
12"	1600KG (3520 Lbs)	3500KG (7700 Lbs)

When the total weight of the drill string including the weight of the rotary head exceeds the **optimum** thrust level, the drill string should be put in tension by gradually applying holdback as more tubes are added.

Kontrola in vzdrževanje

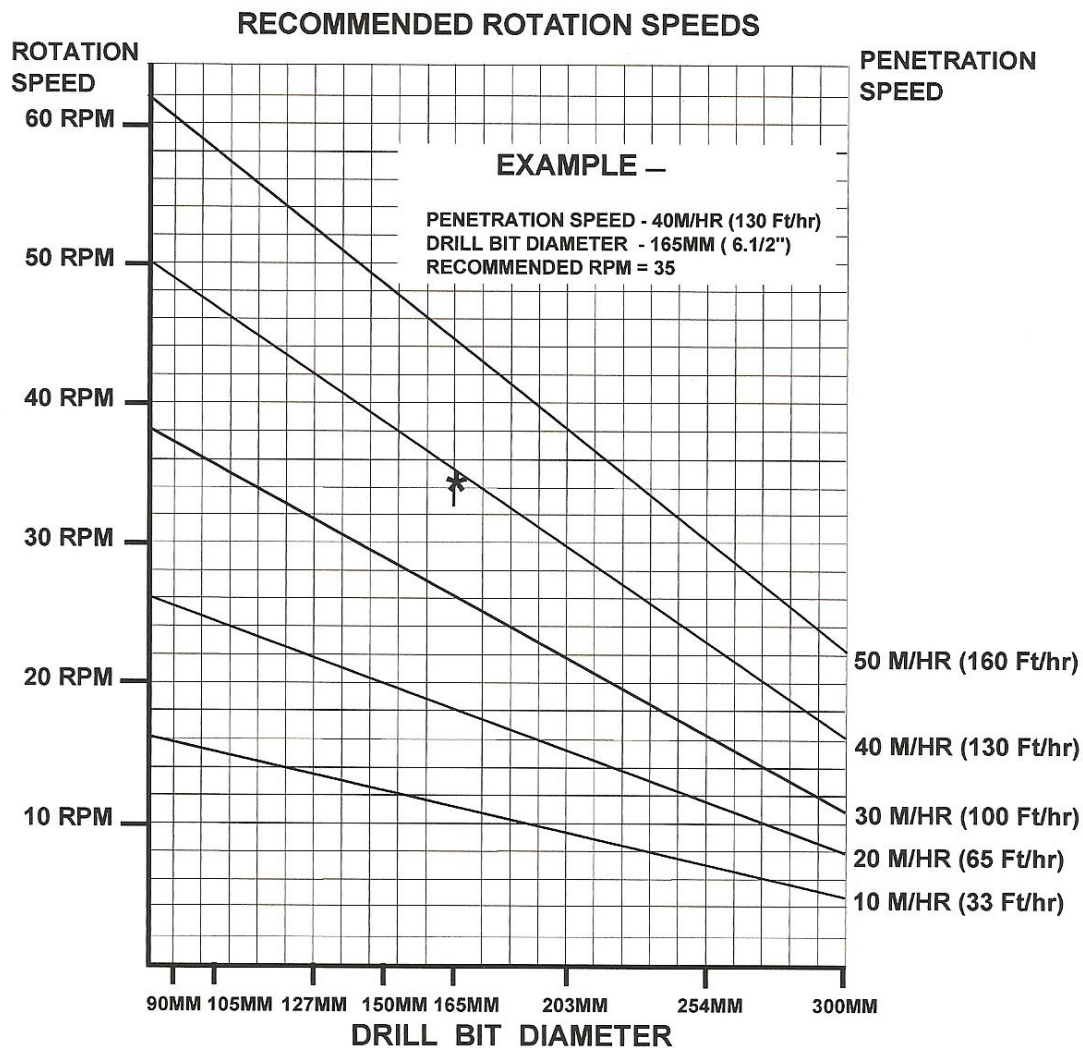


Napake pri vrtanju



ŠTEVILO OBRATOV/PREMER VRTANJA

problem.



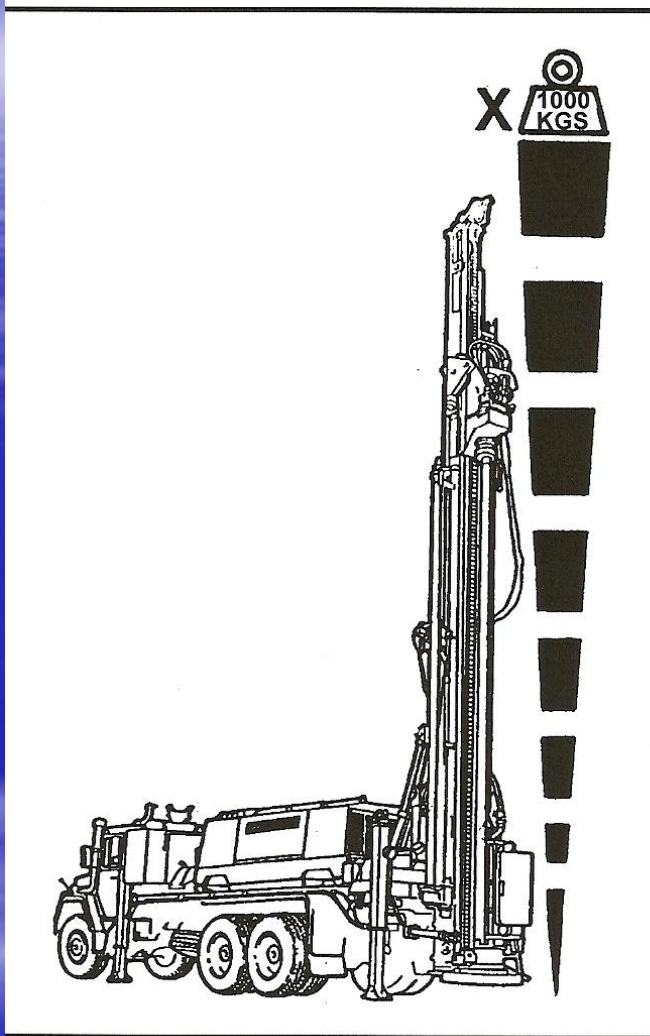


HVALA ZA POZORNOST

- IN SREČNO !!!!

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OMEJITVE PRI GLOBINI VRTANJA



Crawler mounted drill rigs working on quarries or open pit mining applications are generally designed with sufficient lifting power or pullback capability to lift the weight of the drill string from the completed bore hole which on these types of applications rarely exceeds 35 Metres(115ft.) On deep hole applications, such as water well drilling, it is essential that the selected drill rig has sufficient lifting power with a reserve of power (safety factor) for contingencies such as the drill rig's hydraulic system inefficiency, the weight of the rotary head, friction in the bore hole, potential hole collapse etc. The above factors combine to

reduce the amount of lifting power available for drill tubes and consequently the achievable drilling depth with any particular drill rig -

Hydraulic system inefficiency	20%
Weight of rotary head / hammer / drill bit.....	5%
Contingencies for friction / potential hole collapse.....	25%
Total reduction.....	50%

VELIKOST KLADIV/DROGOVJA

Recommended Hammer nominal bit dia./drill tube dia.combination

Nominal Hole Diameter	Hammer Approx. Outside Dia.	Recommended Drill Tube Diameter*	Suitable Halco Hammer Models
70 - 76MM	59MM	54MM	DA265
85MM	77MM	70MM	MACH303
90-100MM	77MM	70-76MM	MACH303
105-108MM	95MM	70-76MM	DOMINATOR 400/MACH44
110-120MM	95MM	76-90MM	DOMINATOR 400/MACH44
127MM	114/118MM	76-90MM	MACH50/DOMINATOR 500**
135-146MM	114/118MM	90-114MM	MACH50/DOMINATOR 500
152MM	139MM	102-114MM	DOMINATOR 600/600LV/MACH60
165-178MM	139/146MM	114MM	DOMINATOR 600/600LV/650HD
203-279MM	182MM	114MM***	MACH80/88
311-381MM	273MM	114MM***	MACH120/122/132
444-508MM	273MM	114MM***	MACH142

* Drill tube diameter should not be too big so as to result in too high up hole velocity

** DOMINATOR 500/127MM (5") dia. bits - subject to drilling conditions

***or as large as possible up to the diameter of the hammer





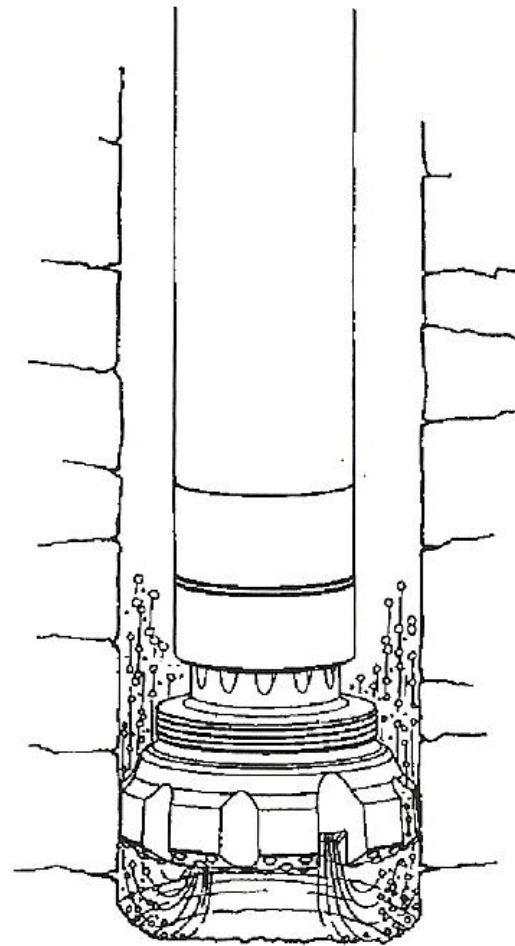
NADPROFILNA DLETA

OVERSIZE DRILL BITS FLUSH REGULARLY

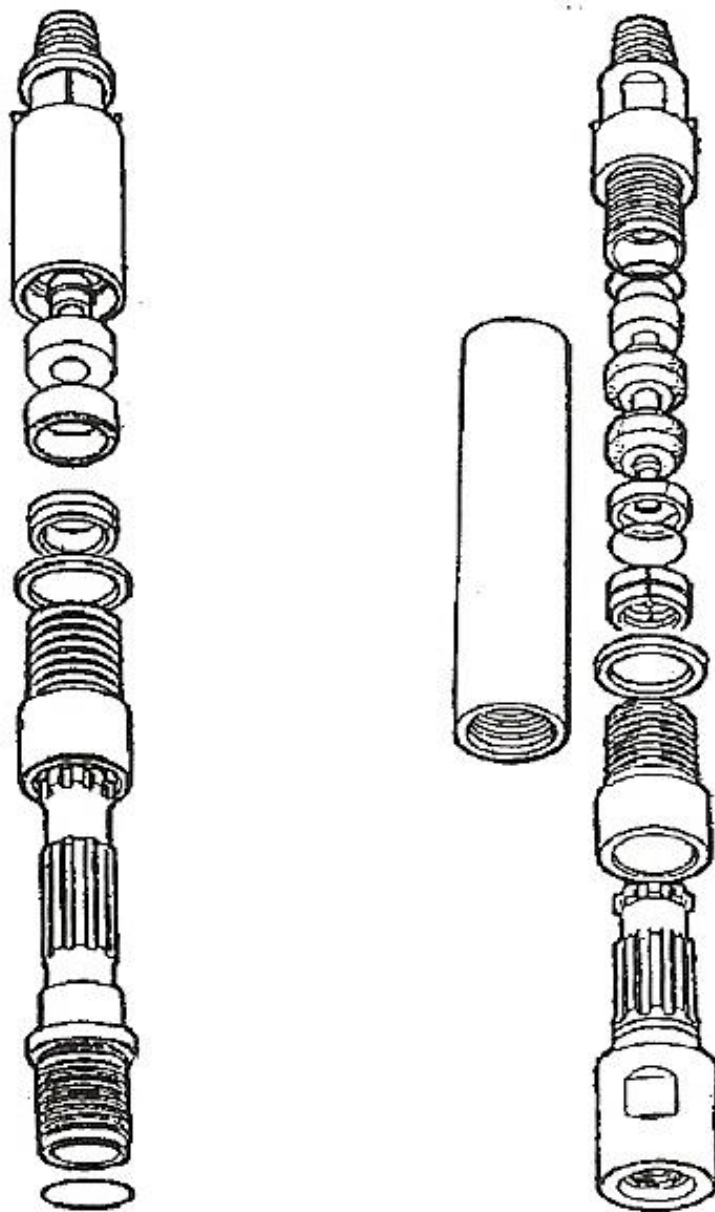
OVERSIZE DIAMETER BITS

HAMMER MODELS	OVERSIZE DIAMETERS
DOMINATOR 400/MACH44	127 - 150 MM
MACH 50/DOMINATOR 500	150 - 165 MM
DOMINATOR 600/600LV/650HD	190 - 300 MM
MACH 80/88	300 - 444 MM
MACH 120/122/132	445 - 610 MM*
MACH 142	559 - 610 MM*

* OR LARGER



SHOCK ABSORBERS



VODA V VRTINI

