SolidWorks Costing

Template podaci

Tipovi podataka

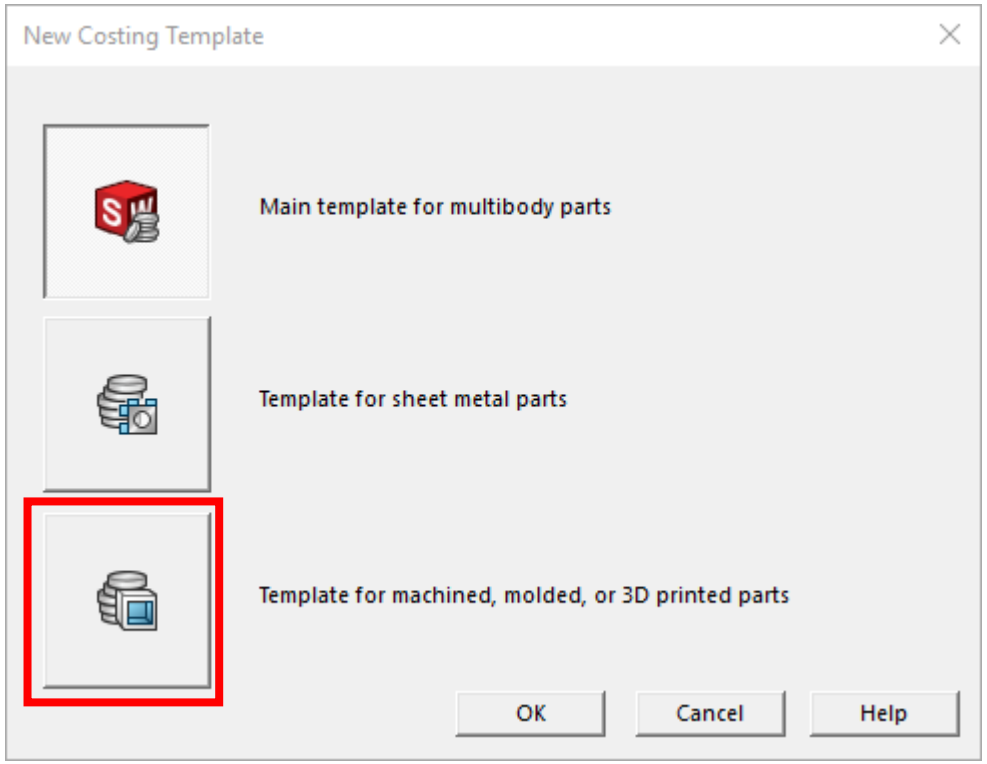
- Definicija materijala
- Definicija karakteristika mašina;
  Definicija se može izvršiti zasebno za svaku mašinu u hali ili pak za grupu mašina (sve glodalice, svi strugovi itd.)
- Definicija operacija obrade

- **U SolidWorks Costing se mogu iz Excel-a import-ovati samo podaci za materijale, sve ostale podatke potrebno je ručno unositi u okviru SolidWorks Costing modula**

Kreiranje novog template-a

- Kliknite na označenu ikonicu (slika desno)

- Kliknite na **Template for machined, molded, or 3D printed parts** (slika desno)
- Zatim kliknite na dugme OK



- Snimite kreirani template klikom na označenu ikonicu (slika desno)

Costing Template Editor

temporary

Machining

- General
- Material
  - Machining
  - Plastic
  - Casting
  - 3D Printing
  - Structural Member
- Machine
- Operations
  - Cut (Plate Stock)
  - Mill
  - Drill
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  - Library Features
  - Custom
- Rules

Template type: Machining process

Units: English Standard

Currency code: USD Currency symbol used in the Costing tool (USD, EUR, GBP, etc.)

Currency name: United States Dollar

Currency delimiter: Period (1.00)

Comma (1,00)

Shop rate: Override individual machine and labor costs with the following shop rate

0.0000 USD/hr

Cost calculation method: Material Removal Rate (MRR)

Default Markup/Discount:

% of Total Cost 0.00% Don't show this value or allow modification in Taskpane

- **General kartica** definiše osnovne parametre template-a
- **Units** – potrebno je odabrati tip jedinica (engleski ili metrički sistem); ako se ne vide obe opcije skrolovati točkićem na mišu
- **Curreny Code** – kodno ime valute (Euro – EUR, Dinar - RSD)
- **Currency Name** – ime valute (Euro, Srpski Dinar, United States Dollar itd.)
- **Currency delimiter –** odnosno decimalni separator. Ovde se definiše da li će zarez (,) ili tačka (.) odvojiti cele brojeve od decimalnog dela
- **Shop rate** – override-uje cenu rada koja se individualno definiše po svakoj mašini i radniku koji je opslužuje (objašnjeno kasnije)
  Shop rate opcijom se praktično definiše fiksna cena rada na nivou cele firme.
- **Default Markup/Discount** – definiše se popust ili „markup“ cena u odnosu na cenu izrade mašinskog dela

  Ukoliko unese pozitivna vrednost, npr. „25“, mašinski deo će biti 25% skuplji.
  Ukoliko se unese negativna vrednost, npr. „-25“, mašinski deo će biti 25% jeftiniji.

Definisanje materijala

Costing Template Editor

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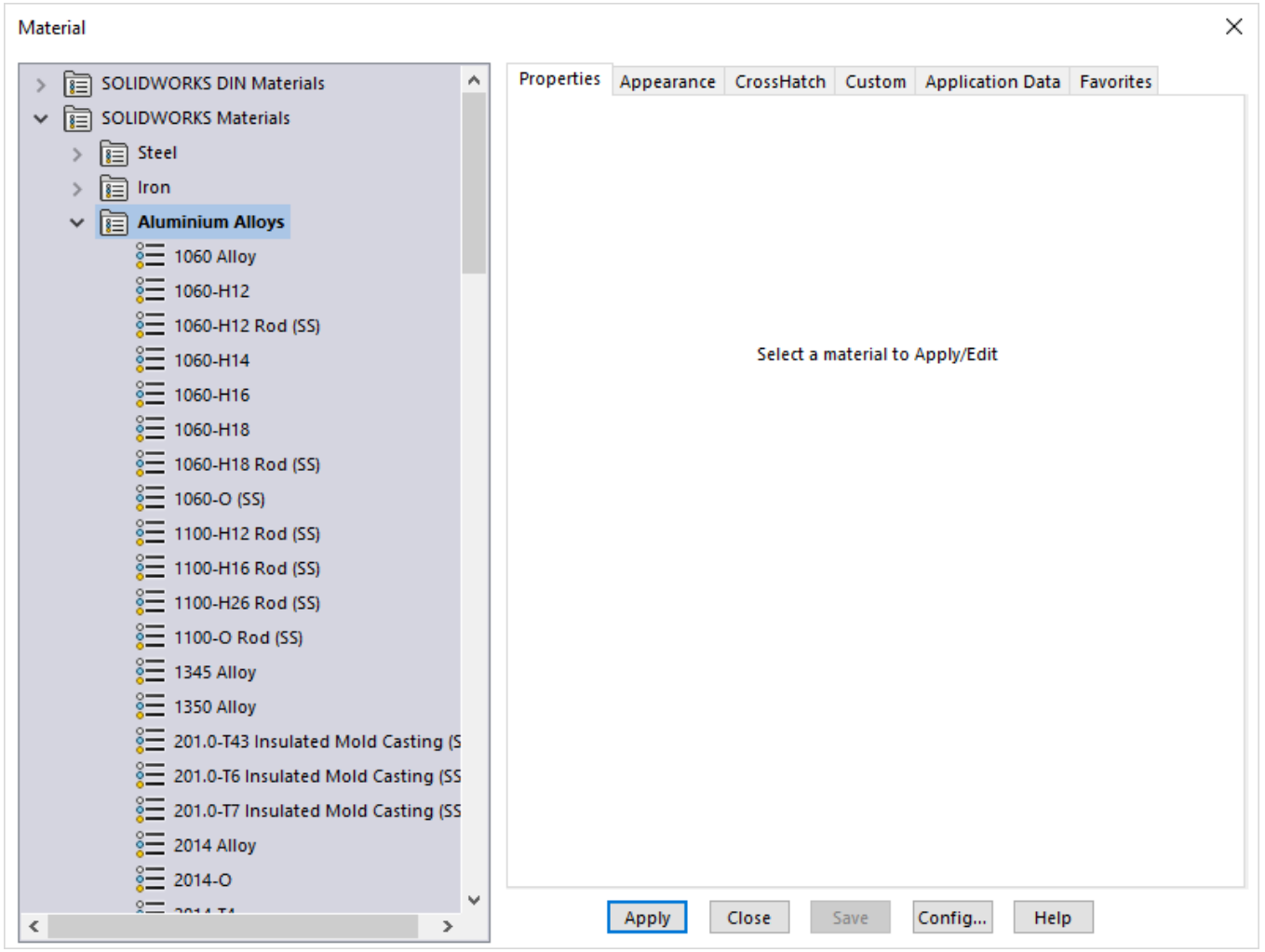
Material:

Imported Row | Update Successful | Import | Export

Filters: All | All | All

	Class	SOLIDWORKS Material	Custom Material	Stock Type	Thickness (mm)	Cost (USD/kg)
1	Aluminium Alloys	6061 Alloy	6061 Alloy	Plate	10.0000	10.1000
2	Aluminium Alloys	6061 Alloy	6061 Alloy	Block		10.1000
3	Aluminium Alloys	6061 Alloy	6061 Alloy	Plate	25.0000	10.1000
4	Aluminium Alloys	6061 Alloy	6061 Alloy	Plate	20.0000	10.1000
5	Aluminium Alloys	6061 Alloy	6061 Alloy	Plate	12.0000	10.1000
6	Aluminium Alloys	6061 Alloy	6061 Alloy	Plate	6.5000	10.1000
7	Aluminium Alloys	6061 Alloy	6061 Alloy	Cylinder		10.1000
8	Copper Alloys	Brass	Brass	Block		24.8200
9	Copper Alloys	Copper	Copper	Block		38.5800
10	Copper Alloys	Copper	Copper	Plate	20.0000	38.5800
11	Copper Alloys	Brass	Brass	Plate	25.0000	24.8200
12	Copper Alloys	Brass	Brass	Plate	20.0000	24.8200
13	Copper Alloys	Brass	Brass	Plate	6.5000	24.8200
14	Copper Alloys	Brass	Brass	Plate	12.0000	24.8200
15	Copper Alloys	Brass	Brass	Plate	10.0000	24.8200
16	Copper Alloys	Copper	Copper	Plate	6.5000	38.5800
17	Copper Alloys	Copper	Copper	Plate	10.0000	38.5800
18	Copper Alloys	Copper	Copper	Plate	12.0000	38.5800
19	Copper Alloys	Copper	Copper	Plate	25.0000	38.5800
20	Copper Alloys	Copper	Copper	Cylinder		38.5800
21	Copper Alloys	Brass	Brass	Cylinder		24.8200
22	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Block		22.0500
23	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Cylinder		22.0500
24	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Plate	6.5000	22.0500
25	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Plate	10.0000	22.0500
26	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Plate	12.0000	22.0500
27	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Plate	20.0000	22.0500
28	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Plate	25.0000	22.0500
29	Steel	Plain Carbon Steel	Plain Carbon Steel	Plate	10.0000	3.1100
30	Steel	Plain Carbon Steel	Plain Carbon Steel	Plate	20.0000	3.1100
31	Steel	AISI 304	AISI 304	Plate	20.0000	21.6100
32	Steel	AISI 304	AISI 304	Plate	25.0000	21.6100
33	Steel	AISI 4340 Steel, annealed	AISI 4340 Steel, annealed	Plate	6.5000	16.0900
34	Steel	AISI 4340 Steel, annealed	AISI 4340 Steel, annealed	Plate	10.0000	16.0900
35	Steel	AISI 4340 Steel, annealed	AISI 4340 Steel, annealed	Plate	12.0000	16.0900
36	Steel	AISI 4340 Steel, annealed	AISI 4340 Steel, annealed	Plate	20.0000	16.0900
37	Steel	AISI 304	AISI 304	Plate	6.5000	21.6100
38	Steel	AISI 304	AISI 304	Plate	12.0000	21.6100
39	Steel	Plain Carbon Steel	Plain Carbon Steel	Plate	12.0000	3.1100
40	Steel	Plain Carbon Steel	Plain Carbon Steel	Plate	25.0000	3.1100
41	Steel	AISI 304	AISI 304	Plate	10.0000	21.6100
42	Steel	Plain Carbon Steel	Plain Carbon Steel	Block		3.1100
43	Steel	AISI 4340 Steel, annealed	AISI 4340 Steel, annealed	Plate	25.0000	16.0900
44	Steel	AISI 304	AISI 304	Block		21.6100
45	Steel	AISI 4340 Steel, annealed	AISI 4340 Steel, annealed	Block		16.0900

- **Class i SolidWorks material** parametri su direktno povezani sa postojećom bazom materijala
- Za pravilan proračun potrebno je u postojeću bazu uneti sve dodatne relevantne materijale
- Naknadne izmene su moguće
- Organizaciju na nivou Master foldera zanemariti („SolidWorks DIN Materials“ nivo na slici desno)
- Organizacija na nivou subfolder-a i materijala je važna (Aluminum Alloys/1060 Alloy)



- **Custom material –** je parametar kojim se može definisati neka zasebna karakteristika materijala (npr. dobavljač) koja utiče na njegovu cenu. Potrebno je napomenuti da se ovaj parametar koristi za referenciranje materijala u nekim operacijama obrade.
- **Stock type** – definiše oblik u kojem se kupuje osnovni materijal. Dostupne su sledeće opcije („Block“, „Cylinder“, „Plate“).
- **Thickness** – definiše debiljinu „Plate“-a (ploče). Nije moguće uneti vrednost ukoliko je Stock Type odabran kao „Block“ ili „Cylinder“.
- **Cost** – cena materijala
- Ukoliko dolazi do promene bilo kog od ovih parametara, u bazi je potrebno napraviti zaseban input materijala (primer ispod)
- Podatke je moguće import-ovati iz *.xlsx (poželjno) ili *.xls tabele. Template tabele u Excel formatu je dostupan desno

Template

Material:

Imported Row | Update Successful | Import | Export

Filters: All | All | All

	Class	SOLIDWORKS Material	Custom Material	Stock Type	Thickness (mm)	Cost (USD/kg)
1	Aluminium Alloys	6061 Alloy	6061 Alloy	Block		15.0000
2	Aluminium Alloys	6061 Alloy	6061 Alloy	Cylinder		15.0000
3	Aluminium Alloys	6061 Alloy	6061 Alloy	Plate	4.0000	15.0000
4	Aluminium Alloys	6061 Alloy	6061 Alloy	Plate	5.0000	15.0000
5	Select Class					

Definisanje mašina

Costing Template Editor

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Machining

	Machines	Mill	Turn	Drill	Machine Cost (USD/hr)	Labor Cost (USD/hr)	Max RPM (rev/min)	Load/Unload Time (min)	Operation Setup Time (min)	Setup Distribution
1	Mill	☑	☐	☑	10.0000	20.0000	15000.0000	5.0000	60.0000	Divided Over Lot Size
2	Drill	☐	☐	☑	10.0000	20.0000	15000.0000	5.0000	60.0000	Divided Over Lot Size
3	Machining Center	☐	☑	☐	20.0000	20.0000	18000.0000	5.0000	60.0000	Divided Over Lot Size
4	*Click to Add*									

Cutting

	Default	Machines	Machine Cost (USD/hr)	Labor Cost (USD/hr)	Load/Unload Time (min)	Operation Setup Time (min)	Setup Distribution
1	◉	Water Jet	20.0000	25.0000	5.0000	60.0000	Divided Over Lot Size
2	○	Plasma	10.0000	25.0000	5.0000	60.0000	Divided Over Lot Size
3	○	Laser	20.0000	25.0000	5.0000	60.0000	Divided Over Lot Size
4		*Click to Add*					

End Cutting

	Default	Machines	Machine Cost (USD/hr)	Labor Cost (USD/hr)	Load/Unload Time (min)	Operation Setup Time (min)	Setup Distribution
1	◉	End cut machine	10.0000	10.0000	10.0000	10.0000	Divided Over Lot Size
2		*Click to Add*					

Plastic Injection Molding

	Default	Machines	Machine Cost (USD/hr)	Labor Cost (USD/hr)	Load/Unload Time (min)	Operation Setup Time (min)	Setup Distribution
1	◉	Plastic Machine	20.0000	20.0000	5.0000	30.0000	Divided Over Total Quantity
2		*Click to Add*					

Die Cast Molding

	Default	Machines	Machine Cost (USD/hr)	Labor Cost (USD/hr)	Load/Unload Time (min)	Operation Setup Time (min)	Setup Distribution
1	◉	Casting Machine	20.0000	20.0000	5.0000	30.0000	Divided Over Total Quantity
2		*Click to Add*					

3D Printing

	Default	Machines	Printer X (mm)	Printer Y (mm)	Printer Z (mm)	Feed Rate (mm/sec)	Layer Height (mm)	Machine Cost (USD/hr)	Labor Cost (USD/hr)	Load/Unload Time (min)	Operation Setup Time (min)	Setup Distribution
1	◉	3D Printing Machine...	200.0000	200.0000	200.0000	45.0000	0.2600	1.5000	1.5000	5.0000	15.0000	Divided Over Total Quantity
2	○	Desktop 3D Printer	139.7000	139.7000	139.7000	15.0000	0.2000	2.0000	0.0000	5.0000	10.0000	Divided Over Total Quantity
3	○	Mid-Size 3D Printer	284.4800	152.4000	152.4000	80.0000	0.3400	2.0000	0.0000	0.0000	10.0000	Divided Over Total Quantity
4		*Click to Add*										

Machining

- Postoje dva pristupa pri definisanju mašine, ali i celog quote-ovanja cene proizvoda:
  1. Određivanje cene komada po svakoj mašini, dodeljivanje operacije po svakoj mašini prisutnoj u proizvodnom pogonu

  Prednosti

  Najtačnije određivanje cene izrade proizvoda.

  Mane

  Zbog velikog broja različitih mašina sam unos podataka u SolidWorks Costing bazu može biti obiman posao, a i sam proces quote-ovanja u okviru SolidWorks Costing-a može biti komplikovaniji.

  2. Grupisanje mašina u grupe (glodalice, strugovi), dodeljivanje operacija grupi mašina koje mogu da izvrše tu vrstu obrade

  Prednosti

  Brži unos podataka u SolidWorks Costing bazu, kao i lakši rad u okviru SolidWorks Costing modula.

  Mane

  Manja tačnost quote-ovanja.

- **Machines** – ime mašine
- **Mill, Turn, Drill** – označiti koju vrstu operacija mašina može izvršiti
- **Machine Cost (USD/hr)** – cena radnog sata mašine (amortizacija mašine)
- **Labor Cost (USD/hr)** – cena radnog sata operatera za mašinom
- **Max RPM (rev/min)** – maksimalan broj obrtaja mašine (broj obrtaja/minutu). Dovoljno je uneti kataloški parametar mašine
- **Load/Unload Time (min) –** vreme potrebno za postavljanje pripremka (osnovnog komada) na mašinu (u minutima)
- **Operation Setup Time (min) –** vreme potrebno za pripremu mašine (postavljanje alata, pribora itd.) (u minutima)

- **Setup Distribution** – definiše kako se vrši priprema mašine

  Osnovni parametri:

  Total Quantity: 1000 parts

  Parts per lot: 200

  Number of lots: Total Quantity/Parts per lot=1000/200=5

  Operational setup time: 100 min

  - **Divided over total quantity –** vreme pripreme (Operational setup time) podeljeno je na celu proizvedenu količinu

    Setup time per part= Operational setup time/Total Quantity =100/1000=0.1 min/part

    Pogodno je u slučajevima kada se odjednom proizvode svi delovi.

  - **Divided over lot size –** vreme pripreme (Operational setup time) podeljeno je po lot-ovima.

    Setup time per part=(Operational setup time/Total Quantity)*Number of lots=(100/1000)*5=0.5 min/part

    Pogodno je u slučajevima kada se serije proizvode u razmacima (npr. na svakih mesec dana)

  - **Applied once per part –** vreme pripreme (Operational setup time) se primenjuje za svaki deo zasebno

    Setup time per part = Operational setup time = 100 min

    U slučajevima kada se proizvodi 1 deo, ili pak kada je u pitanju izuzetno specijalizovana proizvodnja.

Cutting

- Ovde se definišu sve mašine za sečenje materijala (npr. water jet)
- **Default –** definiše se koja je mašina default-na

Svi ostali podaci su poznati iz Machining kartice.

Definisanje oepracija

Costing Template Editor

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Filters: All | All | All | All

	Class	Custom Material	Machine	Thickness (mm)	Time per Cut Length (sec/mm)
1	Aluminium Alloys	6061 Alloy	Water Jet	6.5000	0.20
2	Aluminium Alloys	6061 Alloy	Water Jet	10.0000	0.33
3	Aluminium Alloys	6061 Alloy	Water Jet	12.0000	0.45
4	Aluminium Alloys	6061 Alloy	Water Jet	20.0000	0.72
5	Aluminium Alloys	6061 Alloy	Water Jet	25.0000	1.00
6	Aluminium Alloys	6061 Alloy	Plasma	6.5000	0.03
7	Aluminium Alloys	6061 Alloy	Plasma	10.0000	0.09
8	Aluminium Alloys	6061 Alloy	Plasma	12.0000	0.17
9	Aluminium Alloys	6061 Alloy	Plasma	20.0000	0.36
10	Aluminium Alloys	6061 Alloy	Plasma	25.0000	0.55
11	Aluminium Alloys	6061 Alloy	Laser	6.5000	0.05
12	Aluminium Alloys	6061 Alloy	Laser	10.0000	0.15
13	Copper Alloys	Brass	Water Jet	6.5000	0.45
14	Copper Alloys	Brass	Water Jet	10.0000	0.79
15	Copper Alloys	Brass	Water Jet	12.0000	1.18
16	Copper Alloys	Brass	Water Jet	20.0000	1.97
17	Copper Alloys	Brass	Water Jet	25.0000	3.03
18	Copper Alloys	Copper	Water Jet	6.5000	0.44
19	Copper Alloys	Copper	Water Jet	10.0000	0.69
20	Copper Alloys	Copper	Water Jet	12.0000	0.97
21	Copper Alloys	Copper	Water Jet	20.0000	1.54
22	Copper Alloys	Copper	Water Jet	25.0000	2.15
23	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Water Jet	6.5000	0.05
24	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Water Jet	10.0000	0.08
25	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Water Jet	12.0000	0.12
26	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Water Jet	20.0000	0.19
27	Plastics	Delrin 2700 NC010, Low Viscosity Acetal Copolymer (SS)	Water Jet	25.0000	0.26
28	Steel	AISI 304	Water Jet	6.5000	0.61
29	Steel	AISI 304	Water Jet	10.0000	0.97
30	Steel	AISI 304	Water Jet	12.0000	1.36
31	Steel	AISI 304	Water Jet	20.0000	2.16
32	Steel	AISI 304	Water Jet	25.0000	3.01
33	Steel	AISI 304	Plasma	6.5000	0.04
34	Steel	AISI 304	Plasma	10.0000	0.11
35	Steel	AISI 304	Plasma	12.0000	0.20
36	Steel	AISI 304	Plasma	20.0000	0.40
37	Steel	AISI 304	Plasma	25.0000	0.61
38	Steel	AISI 304	Laser	6.5000	0.02
39	Steel	AISI 304	Laser	10.0000	0.04
40	Steel	AISI 304	Laser	12.0000	0.06
41	Steel	AISI 304	Laser	20.0000	0.10
42	Steel	AISI 304	Laser	25.0000	0.20
43	Steel	AISI 4340 Steel, annealed	Water Jet	6.5000	0.63
44	Steel	AISI 4340 Steel, annealed	Water Jet	10.0000	1.00
45	Steel	AISI 4340 Steel, annealed	Water Jet	12.0000	1.40
46	Steel	AISI 4340 Steel, annealed	Water Jet	20.0000	2.22

- **Kartica Cut (Plate Stock)** služi za definisanje operacija inicijalnog sečenja pločastih materijala. Ovu operaciju moguće je koristiti samo u slučajevima kada je početni materijal “Plate”.
- **Class** – klasa materijala
- **Custom Material** – tačan materijal se definiše na osnovu „Custom material property“
- **Machine** – tip mašine na kojoj se vrši sečenje limene ploče (referencira mašine iz kartice Machine)
- **Thickness (mm)** – debljina ploče koja se seče
- **Time per Cut Length (sec/mm)** – vreme potrebno za sečenje jednog (1) milimetra (mm) materijala

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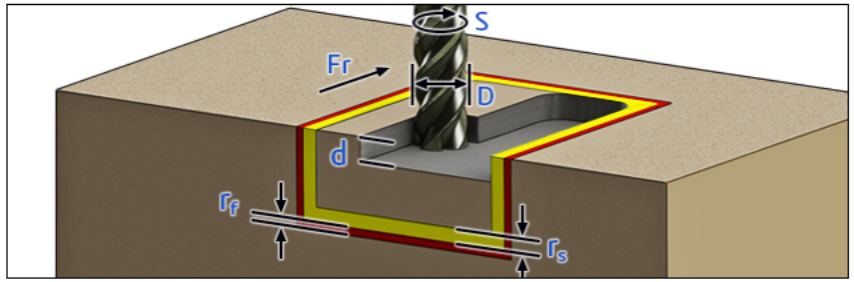

D: Diameter of Tool (mm)
Fr: Feed (mm/rev)
S: Surface Speed (m/min)
d: Depth of Cut (mm)
r: Stock Allowance (mm)
rs: semi-finishing offset
rf: finishing offset
MRR: Material Removal Rate (m^3/min)

MRR = (S/3.14)*(Fr/1000)*(d/1000)

Filters: All | All | All | All | All

	Class	Custom Material	Machine	Tool Type	Surface Finish	D (mm)	Fr (mm/rev)	S (m/min)	d (mm)	r (mm)	Comments
1	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	5.0000	0.4000	65.0000	1.0000		
2	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	5.5000	0.4000	70.0000	1.0000		
3	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	6.0000	0.1000	70.0000	1.0000		
4	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	6.5000	0.1000	70.0000	1.0000		
5	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	7.0000	0.1000	70.0000	1.0000		
6	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	7.5000	0.1000	75.0000	1.0000		
7	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	8.0000	0.1000	75.0000	2.0000		
8	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	8.5000	0.1000	75.0000	2.0000		
9	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	9.0000	0.1000	75.0000	2.0000		
10	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	9.5000	0.1000	75.0000	2.0000		
11	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	10.0000	0.1000	75.0000	2.0000		
12	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	10.5000	0.1000	80.0000	2.0000		
13	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	11.0000	0.1000	80.0000	2.0000		
14	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	11.5000	0.1000	80.0000	2.0000		
15	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	12.0000	0.1000	80.0000	2.0000		
16	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	12.5000	0.1000	80.0000	2.5000		
17	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	13.0000	0.1000	80.0000	2.5000		
18	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	13.5000	0.1000	80.0000	2.5000		
19	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	14.0000	0.1000	80.0000	2.5000		
20	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	14.5000	0.1000	80.0000	2.5000		
21	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	15.0000	0.1000	80.0000	2.5000		
22	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	15.5000	0.1000	80.0000	2.5000		
23	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	16.0000	0.1000	80.0000	2.5000		
24	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	16.5000	0.1200	80.0000	3.0000		
25	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	17.0000	0.1200	80.0000	3.0000		
26	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	17.5000	0.1200	80.0000	3.0000		
27	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	18.0000	0.1200	80.0000	3.0000		
28	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	18.5000	0.1200	80.0000	3.0000		
29	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	19.0000	0.1200	80.0000	3.0000		
30	Steel	Plain Carbon Steel	Mill	Flat End Mill	Roughing	19.5000	0.1200	80.0000	3.0000		

- **Kartica Milling** služi za definiciju operacija glodanja
- **Class** – klasa materijala
- **Custom Material** – tačan materijal se definiše na osnovu „Custom material property“
- **Machine** – tip mašine na kojoj se vrši obrada glodanjem (sprega sa Machines karticom)
- **Tool Type** – tip glodala koji vrši obradu. Nije moguće kreirati novi tip glodala, već se koriste postojeći: Flat End Mill, Ball End Mill, Face Mill, Chamfer Mill
- **Surface finish** – ovde se vrši odabir kvaliteta obrađene površine. Nije moguće kreirati nivo tip obrađene površine već se koriste postojeće: Roughing, Semi-Finishing, Finishing.
- Parametri D(mm), Fr(mm/rev), S(m/min), d(mm), r(mm) su vizuelno objašnjeni
- Mogu se takođe dodati komentari

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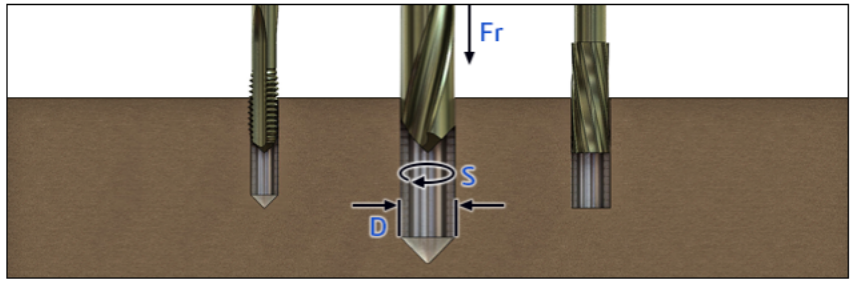

D: Diameter of Tool (mm)
Fr: Feed (mm/rev)
S: Surface Speed (m/min)
MRR: Material Removal Rate (m^3/min)

MRR = S*(Fr/1000)*(d/1000)

Filters: All | All | All | All

	Class	Custom Material	Machine	Tool Type	D (mm)	Fr (mm/rev)	S (m/min)	Comments
1	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	15.0000	0.0000	0.0000	
2	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	15.5000	0.0000	0.0000	
3	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	16.0000	0.0000	0.0000	
4	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	16.5000	0.0000	0.0000	
5	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	17.0000	0.0000	0.0000	
6	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	17.5000	0.0000	0.0000	
7	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	18.0000	0.0000	0.0000	
8	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	18.5000	0.0000	0.0000	
9	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	19.0000	0.0000	0.0000	
10	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	19.5000	0.0000	0.0000	
11	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	20.0000	0.0000	0.0000	
12	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	20.5000	0.0000	0.0000	
13	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	21.0000	0.0000	0.0000	
14	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	21.5000	0.0000	0.0000	
15	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	22.0000	0.0000	0.0000	
16	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	22.5000	0.0000	0.0000	
17	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	23.0000	0.0000	0.0000	
18	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	23.5000	0.0000	0.0000	
19	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	24.0000	0.0000	0.0000	
20	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	24.5000	0.0000	0.0000	
21	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	25.0000	0.0000	0.0000	
22	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	25.5000	0.0000	0.0000	
23	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	30.0000	0.0000	0.0000	
24	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	35.0000	0.0000	0.0000	
25	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	40.0000	0.0000	0.0000	
26	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	45.0000	0.0000	0.0000	
27	Aluminium Alloys	6061 Alloy	Mill	Boring Tool	50.0000	0.0000	0.0000	
28	Aluminium Alloys	6061 Alloy	Mill	Carbide Drill	1.0000	0.0500	12.0000	
29	Aluminium Alloys	6061 Alloy	Mill	Carbide Drill	1.5000	0.0500	12.0000	

- **Kartica Drill** služi za definisanje operacija bušenja
- **Tool Type** – tip burgije koji vrši obradu. Nije moguće kreirati novi tip burgije, već se koriste postojeće: HSS Drill, Carbide Drill, Carbide Reamer, Boring Tool, Tapping Tool.
- Parametri D(mm), Fr(mm/rev), S(m/min) su vizuelno objašnjeni
- Mogu se takođe dodati komentari
- Svi ostali parametri su prethodno objašnjeni

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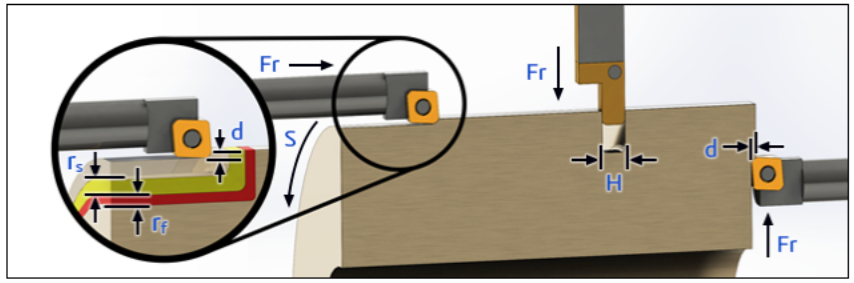

Fr: Feed (mm/rev)
S: Surface Speed (m/min)
H: Tool Size (mm)
d: Radial Depth of Cut (mm)
r: Stock Allowance (mm)
rs: semi-finishing offset
rf: finishing offset
MRR: Material Removal Rate (m^3/min)

Turning : MRR=(S*Fr/1000*d/1000)
Grooving: MRR=(S*Fr/1000*H/1000)/2
Facing : MRR=(S*Fr/1000*d/1000)/2

Filters: All | All | All | All | All

	Class	Custom Material	Machine	Tool Type	Surface Finish	H (mm)	Fr (mm/rev)	S (m/min)	d (mm)	r (mm)	Comments
1	Steel	Plain Carbon Steel	Machining Center	OD Turning	Roughing	0.7500	0.1500	105.0000	0.5000	0.8000	
2	Aluminium Alloys	6061 Alloy	Machining Center	ID Turning	Semi-Finishing	0.7500	0.3500	185.0000	2.0000	0.9000	
3	Copper Alloys	Copper	Machining Center	OD Turning	Roughing	19.0500	0.5080	180.0000	2.0320	7.6200	
4	Steel	Plain Carbon Steel	Machining Center	OD Turning	Semi-Finishing	0.7500	0.0700	105.0000	0.4000	0.8000	
5	Steel	Plain Carbon Steel	Machining Center	OD Turning	Finishing	0.7500	0.0250	135.0000	0.2500	0.8000	
6	Steel	Plain Carbon Steel	Machining Center	ID Turning	Roughing	0.7500	0.1500	105.0000	0.5000	0.4000	
7	Steel	Plain Carbon Steel	Machining Center	ID Turning	Semi-Finishing	0.7500	0.0700	105.0000	0.4000	0.4000	
8	Steel	Plain Carbon Steel	Machining Center	ID Turning	Finishing	0.7500	0.0250	135.0000	0.2500	0.1000	
9	Steel	Plain Carbon Steel	Machining Center	Facing	Roughing	0.7500	0.8000	150.0000	6.0000	0.0800	
10	Steel	Plain Carbon Steel	Machining Center	Facing	Semi-Finishing	0.7500	0.3500	150.0000	6.0000	0.0800	
11	Steel	Plain Carbon Steel	Machining Center	Facing	Finishing	0.7500	0.3000	150.0000	6.0000	0.0800	
12	Steel	Plain Carbon Steel	Machining Center	OD Grooving	Roughing	0.7500	0.2000	125.0000	2.0000	0.0500	
13	Steel	Plain Carbon Steel	Machining Center	OD Grooving	Semi-Finishing	0.7500	0.2000	125.0000	2.0000	0.0500	
14	Steel	Plain Carbon Steel	Machining Center	OD Grooving	Finishing	0.7500	0.2000	125.0000	2.0000	0.0500	
15	Steel	Plain Carbon Steel	Machining Center	ID Grooving	Roughing	0.7500	0.4000	125.0000	6.0000	0.0400	
16	Steel	Plain Carbon Steel	Machining Center	ID Grooving	Semi-Finishing	0.7500	0.3500	125.0000	6.0000	0.0400	
17	Steel	Plain Carbon Steel	Machining Center	ID Grooving	Finishing	0.7500	0.3000	125.0000	6.0000	0.0400	
18	Steel	Plain Carbon Steel	Machining Center	Face Grooving	Roughing	0.7500	0.4000	125.0000	2.0000	0.0400	
19	Steel	Plain Carbon Steel	Machining Center	Face Grooving	Semi-Finishing	0.7500	0.3500	125.0000	2.0000	0.0400	
20	Steel	Plain Carbon Steel	Machining Center	Face Grooving	Finishing	0.7500	0.3000	125.0000	2.0000	0.0400	
21	Aluminium Alloys	6061 Alloy	Machining Center	ID Turning	Roughing	0.7500	0.3500	185.0000	2.0000	0.9000	
22	Aluminium Alloys	6061 Alloy	Machining Center	ID Turning	Finishing	0.8200	0.0500	185.0000	0.8000	0.8900	
23	Aluminium Alloys	6061 Alloy	Machining Center	OD Turning	Roughing	0.8200	0.3500	185.0000	2.0000	0.8900	
24	Aluminium Alloys	6061 Alloy	Machining Center	OD Turning	Semi-Finishing	0.8200	0.3500	185.0000	2.0000	0.8900	
25	Aluminium Alloys	6061 Alloy	Machining Center	OD Turning	Finishing	0.8200	0.0500	185.0000	0.8000	0.8900	
26	Aluminium Alloys	6061 Alloy	Machining Center	Facing	Roughing	0.8200	0.1250	58.0000	2.0000	0.8900	
27	Aluminium Alloys	6061 Alloy	Machining Center	Facing	Semi-Finishing	0.8200	0.5000	58.0000	1.2000	0.8900	
28	Aluminium Alloys	6061 Alloy	Machining Center	Facing	Finishing	0.8200	0.5000	58.0000	1.2000	0.8900	
29	Aluminium Alloys	6061 Alloy	Machining Center	OD Grooving	Roughing	0.8200	0.2500	58.0000	2.0000	0.8900	
30	Aluminium Alloys	6061 Alloy	Machining Center	OD Grooving	Semi-Finishing	0.8200	0.5000	58.0000	1.2000	0.8900	

- **Kartica Turn** služi za definisanje operacija struganja
- **Tool Type –** praktično definiše tip operacije na strugu. Ne mogu se dodati novi unosi u ovu karticu, tako da su trenutno dostupni:
  - **OD Turning –** Outer diameter turning (struganje spoljnog prečnika)
  - **ID Turning –** Internal diameter turning (struganje unutrašnjeg prečnika)
  - **Facing** (uklanjanje materijala sa čeone površine materijala – ravne površine)
  - **OD Grooving** – Outer diameter grooving
  - **ID grooving –** Internal diameter grooving
  - **Chamfer/Fillet** – obrada fillet-a ili chamfer-a na ivicama
- Parametri H(mm), Fr(mm/rev), S(m/min), d(mm), r(mm) su vizuelno objašnjeni
- Mogu se takođe dodati komentari
- Svi ostali parametri su prethodno objašnjeni

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Filters: All | All | All

	Class	SOLIDWORKS Material	Machine	Meters Per Minute (MPM)
1	Aluminium Alloys	6061-T6 (SS)	End cut machine	0.5500
2	Aluminium Alloys	6063-T5	End cut machine	0.4600
3	Steel	AISI 304	End cut machine	0.6700
4	Steel	Galvanized Steel	End cut machine	0.7800
5	Steel	Plain Carbon Steel	End cut machine	0.8400
6	Select Class			

- **Kartica End Cut** služi za definisanje operacija finalnog sečenja
- **Meters per minute (MPM)** parametar definiše brzinu sečenja u metrima po minuti
- Svi ostali parametri su prethodno objašnjeni

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	Operation	Selection Type	Cost	Units	Setup Cost	Setup Distribution	Always Include
1	Painting	Face	0.0001	USD/mm^2	10.0000	Divided Over Lot Size	No
2	Annodize	Face	0.0001	USD/mm^2	10.0000	Divided Over Lot Size	No
3	Inspection	Part	0.0000	USD/Part	5.0000	Applied Once Per Part	No
4	Mill	Part	0.0000	USD/Part	20.0000	Divided Over Lot Size	No
5	Drill	Part	0.0000	USD/Part	10.0000	Divided Over Lot Size	No
6	Waterjet	Part	0.0000	USD/Part	20.0000	Divided Over Lot Size	No
7	Laser	Part	0.0000	USD/Part	20.0000	Divided Over Lot Size	No
8	Plasma	Part	0.0000	USD/Part	10.0000	Divided Over Lot Size	No
9	*Click to Add*						

- **Kartica Custom** se koristi za definisanje operacija koje ne čine deo tradicionalne mašinske obrade
- Ovde se npr. mogu definisati operacije farbanja, korozione zaštite mašinskog dela itd. Takođe se može definisati i sama cena kreirane operacije
- **Operation** – ime operacije
- **Selection Type** – koji parametar je relevantan za kvantifikovanje cene operacije. Ne mogu se dodati novi parametri default-no su dostupni:
  - **Part**
  - **Weight**
  - **Face**
  - **Edge**
  - **Stroke**
  - **Time**
  - **Volume**

- **Cost** – cena operacije (direktno zavisi od parametra **Units**)
- **Units** – definiše se jedinica kvantifikovanja Cost parametra. Odabir jedinica direktno zavisi od parametra **Selection Type**
- **Always Include** – definiše da li će se custom operacija automatski dodeliti svakom delu koji se analizira u okviru SolidWorks Costing-a. Dostupne su opcije No i Yes
- Ostali parametri su već poznati