FOUNDRY SOLUTIONS

Electroplated Diamond Wheels for Ductile and Gray Iron Grinding

DIAFORZ™

The Power of Diamond

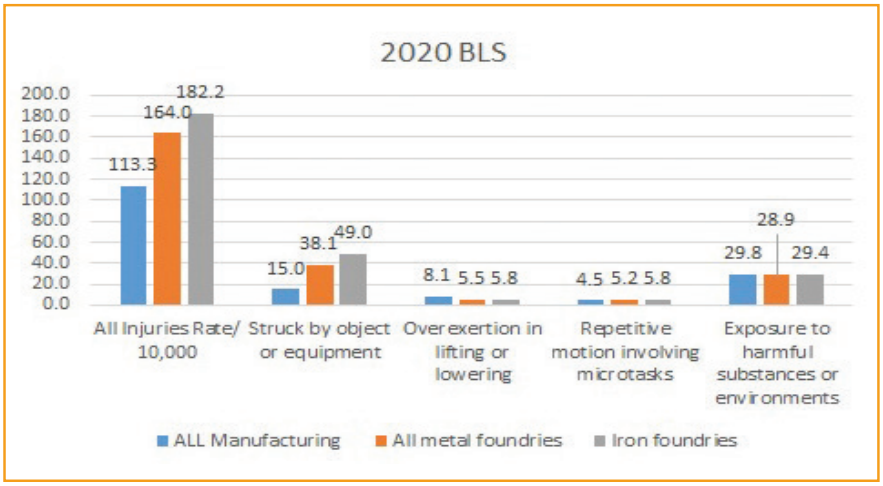
Engis®

Environmental, Health and Safety:

The use of grinding tools has historically been accompanied with hazards during their use in iron foundries.

Engis DiaForz diamond wheels provide relief from operator injury, respiratory exposure, and operator fatigue.

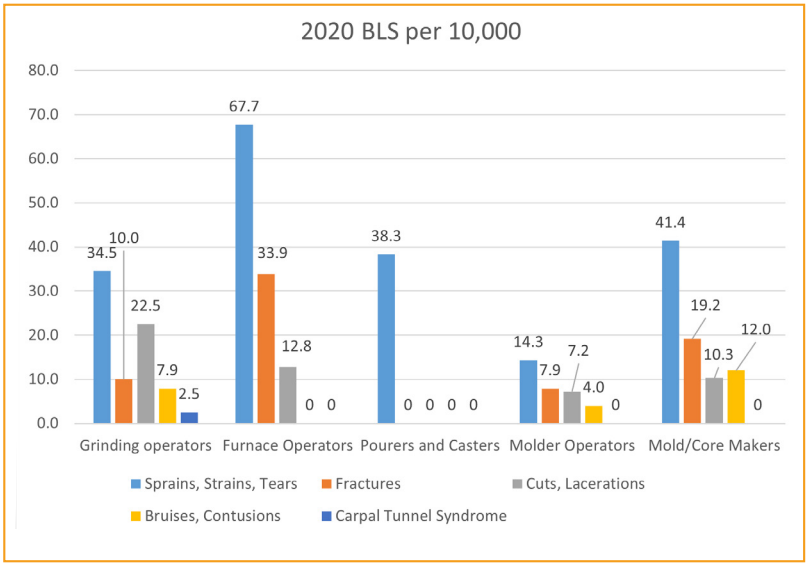
Used on robots and hand grinders, Engis diamond wheels are lightweight, free from hazardous discharge, and reduce the highest rate of wheel breakage in the industry.



EHS Benefits:

Health and Safety:

- Reduces 99% of operator risk of injury and lost time
- Eliminates breakage risk from abuse or over-speeding
- Eliminates respiratory hazard of discharge
- Contributes to a clean workspace
- Lighter weight provides better ergonomics and less fatigue

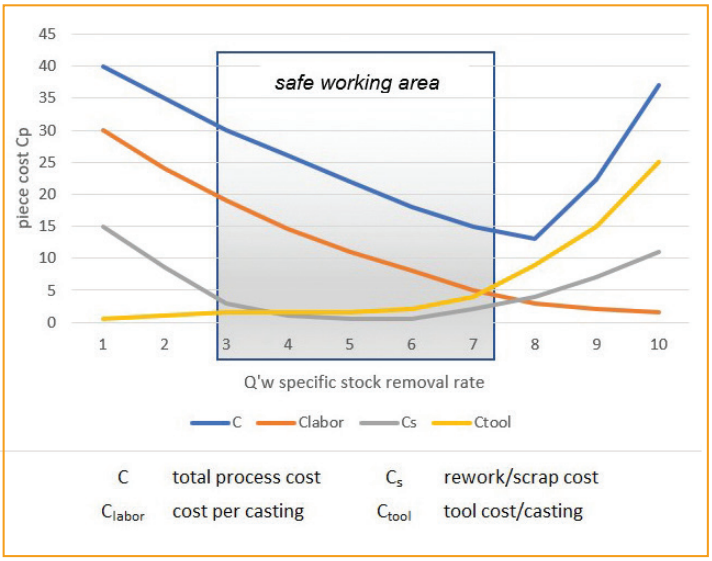


Environmental:

- No particulate discharge from the wheels
- 100% inert material
- Eco-friendly disposal impact
- Reduces dust collection tonnage – up to 150# per wheel

Post-Processing of Castings:

The cost of post-processing iron castings can amount up to 45% of the total casting manufacturing cost. To remain competitive, grinding and cut-off foundry operations must be as efficient and cost-effective as possible.



Over the past few years there have been large investments in the modernization and automation of the handling, molding, core production and smelting processes. These operations drive up to 80% of the post-processing cost; this cost can be mitigated by reducing or eliminating sources of error at these preceding production stages.

The next step in foundry operations is the reduction of labor and cleaning costs and increasing through-put in the cleaning and grinding operations.

Finding this optimized process is the job of Engis engineering.

Managing Costs:

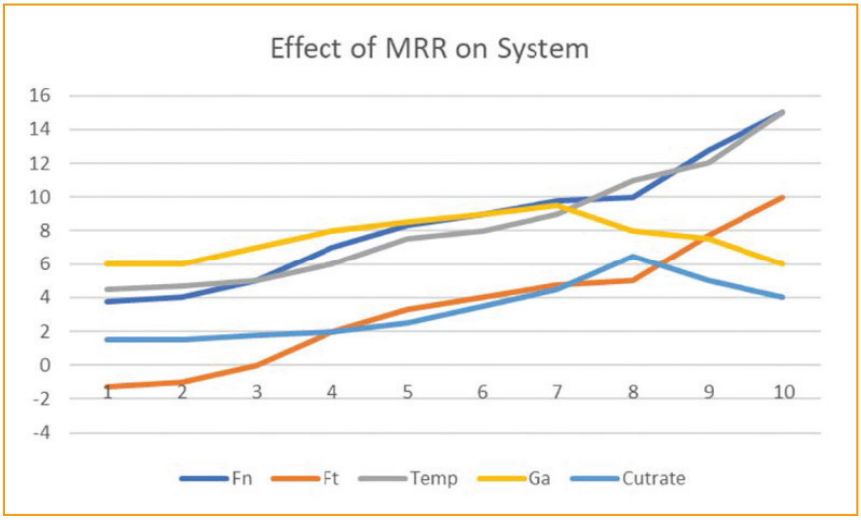
The goal of post-processing is to remove unwanted material from the casting in the most efficient manner. The factor determining the rate at which this is done is known as the Material Removal Rate (MRR). This is accomplished by managing the effects of the grinding parameters on the system.

Iron castings are produced by pouring molten ferrous alloy into a mold either by pressurized or unpressurized means.

The precision of the patterns and cores, combined with the quality of the molding process, can highly impact the amount and cost of cleaning the casting after pour.

The resultant casting will have seams, risers, gates, and other blemishes to clean.

Utilizing the power of diamond, Engis engineering has developed industry leading technical solutions to grind castings.



Cut-Off Grinding:

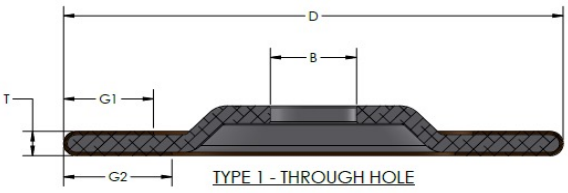
Cut-off grinding is the most widely used metal cutting process for the removal of gates and risers.

Equal or higher stock removal rates are achieved with cut-off grinding than with alternative machining processes such as turning.

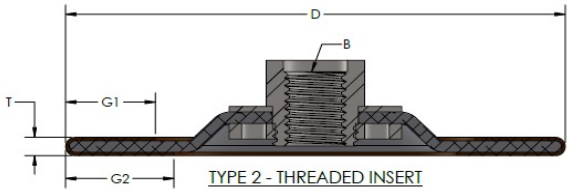
Demands of cut-off grinding:

- High G-ratios
- Straight cuts
- Smooth cutting surface
- Short cut-off times
- Minimal wheel thickness
- No or minimal heat in the work piece
- High wheel peripheral speeds
- High level of safety

Standard Types for Hand Guided Cut-off Grinding:



TYPE 1 - THROUGH HOLE



TYPE 2 - THREADED INSERT

Type Number	Size	Grit	Shape	Speed	Core	Weight
	D x T x B	Full Wrap, both sides				Pounds
T27S30-18-38TD	3 x 1/8 x 3/8	30/40	T27	18,080	Steel	0.31
T27S40-18-38TD	4 x 1/8 x 3/8	30/40	T27	15,280	Steel	0.55
T27A45-18-58CD	4-1/2 x 1/8 x 5/8-11	20/30	T27	13,580	AL	0.49
T27A45-18-78TD	4-1/2 x 1/8 x 7/8	20/30	T27	13,580	AL	0.26
T27A50-18-58CD	5 x 1/8 x 5/8-11	20/30	T27	13,580	AL	0.55
T27A50-18-78TD	5 x 1/8 x 7/8	20/30	T27	13,580	AL	0.33
T27A70-18-58CD	7 x 1/8 x 5/8-11	20/30	T27	8,600	AL	0.93
T27A70-18-78TD	7 x 1/8 x 7/8	20/30	T27	8,600	AL	0.70
T27A90-18-58CD	9 x 1/8 x 5/8-11	20/30	T27	6,600	AL	1.42
T27A90-18-78TD	9 x 1/8 x 7/8	20/30	T27	6,600	AL	1.19

Horizontal Grinders — Cutting and Notching

Type Number	Size	Grit	Shape	Speed	Core
1FF1S30-18-14TD	3 x 1/8 x 3/8	30/40	1FF1	18,080	Steel
1FF1S30-18-38TD	4 x 1/8 x 3/8	30/40	1FF1	15,280	Steel
1FF1S40-18-14TD	4 x 1/8 x 1/4	30/40	1FF1	19,100	Steel
1FF1S40-18-38TD	4 x 1/8 x 3/8	30/40	1FF1	19,100	Steel
1FF1S40-18-58TD	4 x 1/8 x 5/8	30/40	1FF1	19,100	Steel

“Snagging” or Grinding Castings:

Snagging is the removal of flashes, burrs, gates, risers, and casting faults on the surface. These are holes in the casting skin, clusters, sand inclusion points and cracks or fissures. After cut-off grinding this is the second most prevalent form of grinding.

This encompasses the general means used by all foundries with either portable, stationary, or automatic “fettling” machines. The surfaces treated by snagging are usually flat or in some cases a “notch” or crevice.

Operator safety, fatigue and productivity are greatly impacted by the method and choice of grinding wheel used.

What demands are made of a snagging wheel

- High G-ratio
- Good surface
- Good cut rate (free cutting)
- No or minimal heating of the work piece
- Good edge stability
- High level of safety

Standard Types for Hand Guided Snag Grinding:

Type Number	Size	Grit	Shape	Speed	Core	Weight
T27A30-14-38TD	3 x 1/4 x 3/8	30/40	T27	18,080	AL	0.15
T27A40-14-58TD	4 x 1/4 x 5/8	30/40	T27	15,280	AL	0.27
T27A45-14-58CD	4-1/2 x 1/4 x 5/8-11	20/30	T27	13,580	AL	0.59
T27A45-14-78TD	4-1/2 x 1/4 x 7/8	20/30	T27	13,580	AL	0.36
T27A50-14-58CD	5 x 1/4 x 5/8-11	20/30	T27	13,580	AL	0.69
T27A50-14-78TD	5 x 1/4 x 7/8	20/30	T27	13,580	AL	0.46
T27A70-14-58CD	7 x 1/4 x 5/8-11	20/30	T27	8,600	AL	1.18
T27A70-14-78TD	7 x 1/4 x 7/8	20/30	T27	8,600	AL	0.95
T27A90-14-58CD	9 x 1/4 x 5/8-11	20/30	T27	6,600	AL	1.82
T27A90-14-78TD	9 x 1/4 x 7/8	20/30	T27	6,600	AL	1.59

Portable Grinding of Castings:

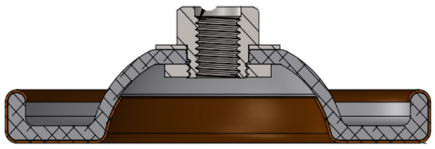
Portable grinding is also considered snagging, but inclusive of a wider variety of methods and tools.

This includes the processes used by all foundries to clean cavities, seams, blemishes (cosmetic defects), and otherwise “non-flat” areas of the casting (shoulders, bores, radius, and hard to reach areas).

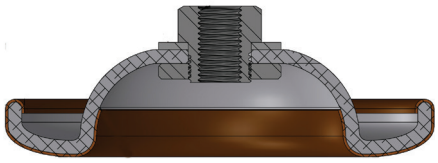
Angle grinders, straight grinders (in-line grinders) and flexible shafts:

- Mounted points
- Tungsten carbide burrs
- Shape 1
- Cup wheels (Shape 11 and Shape 6)

Type Number	Size	Shape	Grit	Speed	Core
HS48486-1	6 x 2 x 5/8-11	T11	20/30	7,260	AL
T11A60-20-58CD	6 x 2-1/16 x 5/8-11	T11	20/30	7,260	AL
1FF1S20-14-38TD	2 x 1/4 x 3/8	1FF1	30/40	25,465	Steel
1FF1S30-14-38TD	3 x 1/4 x 3/8	1FF1	30/40	20,370	Steel
1FF1S40-14-38TD	4 x 1/4 x 3/8	1FF1	30/40	15,280	Steel



HS48486-1



T11A60-20-58CD

Automatic Grinding:

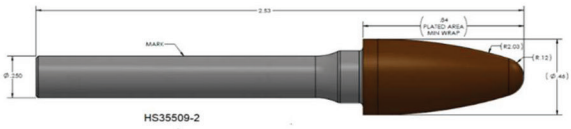
Although automatic grinding can take many formats due to the wide number of manufacturers making equipment, we see mainly three types of systems.

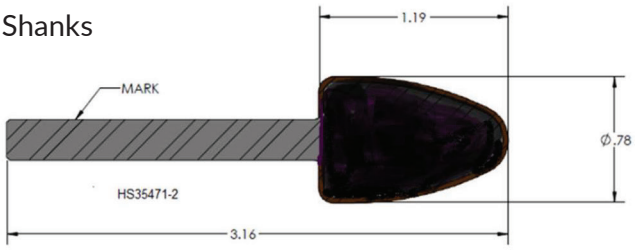
- Grinding with a robotic arm containing a grinding spindle brings the wheel to the workpiece. Some of these systems will have a tool changer allowing for the machine to change the wheel type during the cycle. (Often performed on larger or smaller castings fixtured with multiple castings in a single cycle.)
- A robotic arm brings the casting to a stationary grinding wheel. (These will usually be smaller castings).
- A moving fixture brings the casting to a semi-stationary spindle holding the grinding wheel. (These are typically larger castings).

De-Burring Tools

DiaForz diamond plated burrs for hand grinding operations offer significant advantages over standard solid carbide burrs for foundry applications. Not only do they cut faster, but they can last up to five times longer than carbide burrs....this means a lower overall cost to your foundry.

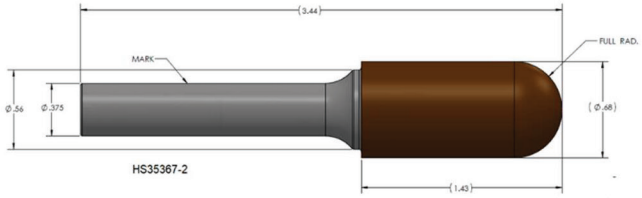
1/4" Shanks

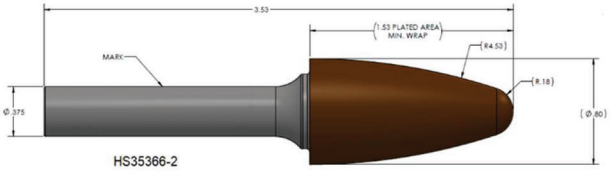




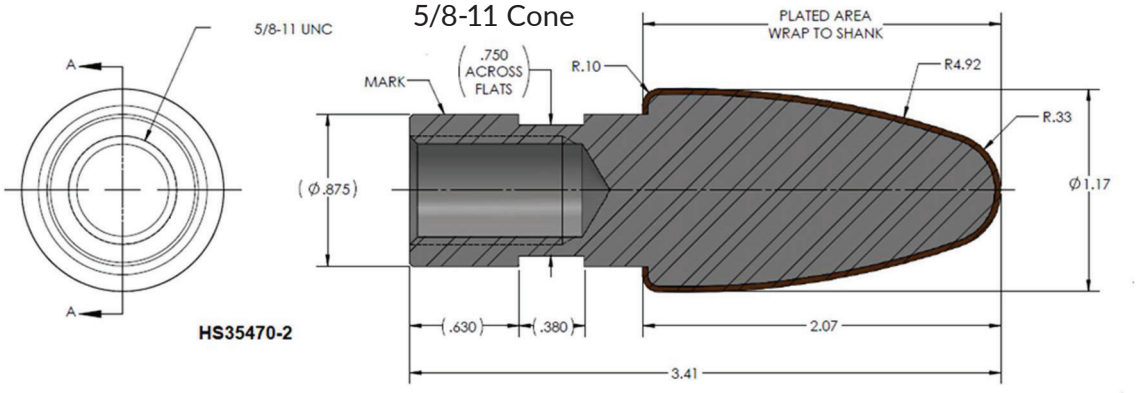
Type Number	Size	Shape	Grit	Speed	Core	Weight
HS35509-2	.390 x 0.800 x .250	Burr	20/30	18,000	ST	0.10
HS35471-2	.715 x 1.125 x .250	Burr	20/30	18,000	ST	0.12
HS35367-2	.670 x 1.400 x .375	Burr	20/30	20,000	ST	0.15
HS35366-2	.730 x 1.500 x .375	Burr	20/30	20,000	ST	0.18
HS35470-2	1.100 x 2.000 x .3" x 5/8-11	Cone	20/30	18,000	ST	0.60

3/8" Shanks





5/8-11 Cone

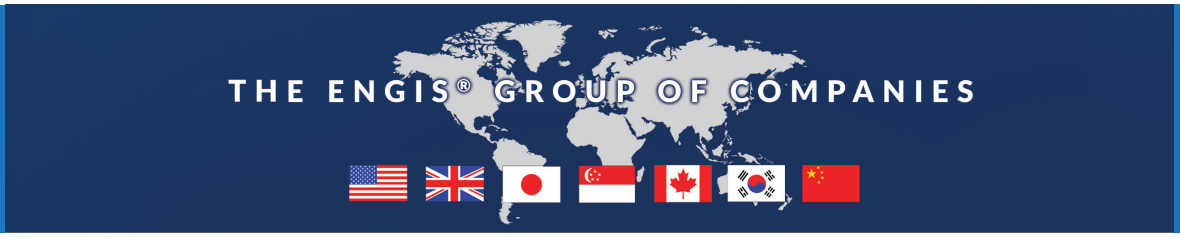


Methods:

Many methods are used to post-treat castings. Each method will have a varied effectiveness and associated cost depending on the casting metallurgy and the process required.

Comparison of these methods:

	Gray Iron (GG) The most common engineering alloy because of its relatively low cost and good machinability.	Ductile Cast Iron Ductile (spheroidal) iron, also called nodular iron, is a material with good moldability and is very ductile.	Malleable Cast Iron Designation "GTS" "GTW" are malleable cast irons that are ductile when cold and are rust resistant.	Chilled Cast Iron Castings which have to remain hard throughout are produced from chilled cast iron.
Cut-Off Grinding	Widely used - Cost effective	Widely used - Cost effective	Widely used - Cost effective	Very good - Cost effective
Can achieve many cuts per hour on gates, risers and large cross sections				
Sawing	Good for large cross-sections	Good for large cross-sections	Not used - Expensive	High cost method
Best on larger work pieces but is inefficient with high number of cuts				
Milling	Good for large cross-sections	Good for large cross-sections	Not used - Expensive	High cost method
Best for heavy stock from flat surfaces but has high tool costs				
Shearing	Not typical - Expensive	Not typical - Expensive	Not typical - Expensive	Not typical - Expensive
Typically only used on large volume runs				
Snagging	Widely used - Cost effective	Small cross sections - Cost effective	Widely used - Cost effective	Small cross sections - Cost effective
Typically used on small cross sections with best results on brittle material				
Flame Cutting	Not typical - Expensive	Not typical - Expensive	Not typical - Expensive	Not used
Used in difficult to access areas but has a high cost and possible casting surface quality risks				



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