CIGWELD

FACE TO FACE WITH HARDFACING

5 QUESTIONS TO ASK TO GET THE JOB DONE!

Selecting the appropriate hardfacing alloy can be an intimidating experience. However, learning to ask the right questions will help you make the decision that's best for your application.

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QUESTION 1: WHAT IS THE MODE OF WEAR?

Most hardfacing issues relate to metal-to-metal wear, impact wear, impact and abrasive wear, straight abrasive wear, and abrasive wear accompanied by corrosion or high temperatures.

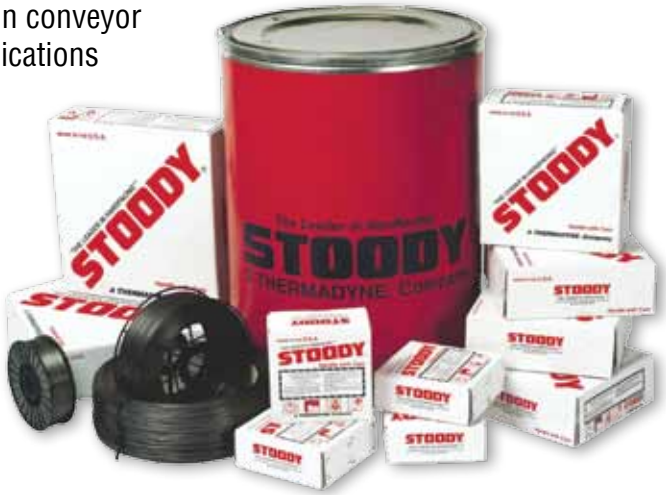
Metal-to-metal wear is caused by the friction generated when two metal surfaces rub against each other while rotating under a load. Galling sometimes is present, which is the transfer of metal between the two components. This type of wear is found mostly in applications involving shaft sleeves, bearing surfaces, and track idlers found on earthmoving tractors.

Impact wear is found where a medium is subjected to reduction through a crushing operation. In rock crushing, for example, solid particles of rock are brought in contact with metal hammers, rolls, or bowls. This impact causes the deformation of the base metal, reducing the efficiency of the equipment's wear components. Normally, a work-hardening manganese-type buildup product is used for this type of repair.

The most common form of wear is impact in combination with abrasive wear. In this type of application, the component comes in contact with solid and fine particles. Such applications include bucket teeth, trenching tools, and agricultural parts.

Straight abrasive wear is pretty rare but generally occurs in conveyor chutes, sand processing components, or earth-tilling applications where metal loss is caused by metal-to-earth contact. Impact is not a huge concern as the particles of the medium being moved or tilled are generally small.

The final category is wear accompanied by corrosion and even high temperature. Applications include hot forging dies, digester rotors, food processing components, and plastic extrusion equipment.



QUESTION 2: WHAT IS THE BASE METAL?

A number of techniques can be used in the field to identify base metal.

• The first is a spark test, which involves using a grinding wheel to identify the metal by the color of the spark. Carbon steel and 300/400 series stainless steels yield a yellow to white spark that travels a far distance away from the component before hitting the ground. On the other hand, cast-iron sparks are dark orange or amber and the spark drops off more quickly to the floor.

• In a magnet test, a strong pull suggests a carbon steel, 400 series stainless, or cast iron. A weak pull suggests a 300 series stainless alloy.

• By pressing a file against the metal, you can get a general idea of the base metal. Mild steel and other common grades of low alloy steel score easily. Cast iron is more difficult to scratch.

• Have a sample of the metal analyzed.

• Ask the OEM. They have the material specifications on all of their wear parts.

The preferred method is simply to read the equipment manual or contact the OEM for the precise information. Why is this important? All metals react differently when welded. Cast irons require a great deal of caution due to their crack sensitivity. Manganese steels must never be allowed to reach 200oC degrees or they will transform and become brittle. High-carbon steels require pre-heat according to the amount of carbon present in the base metal. Specific information is available from all hardfacing manufacturers in the form of heat-treat charts and preheat recommendations.

QUESTION 3: WHAT ALLOY SHOULD I USE?

The type of wear that your component is exposed to generally determines the type of hardfacing alloy you need. Below is a general selection guide for matching mode of wear with the appropriate alloy.

• **Metal-to-metal wear.** Tool steel typically is recommended for metal-to-metal wear because of its excellent high-temperature characteristics (frictional heat). It also can be machined and provides some wear resistance. Most hardfacing alloys are not specified because they cannot be machined and commonly form cross checks, or small stress relieving cracks.

• **Impact.** The recommended alloy for impact wear, depending on the base metal, is a manganese-bearing alloy. Manganese alloys will work-harden when subjected to repetitive impact. Hardfacing alloys with high hardness are normally not specified since they are brittle and prone to spalling under severe impact.

• **Impact with abrasion.** Many alloy families are available including high-alloy manganese products and various hardfacing alloys. Suppliers recently evolved the compositions to offer both good impact resistance accompanied by better wear resistance.

- **Straight abrasion.** High-alloy filler metals are used, which vary by cost and performance. In this category, the end user is not worried about impact or the hardfacing spalling. Straight abrasion is the only concern.

- **Abrasion accompanied by high temperature or corrosion.** Cobalt- and nickel-based alloys offer improved proprieties because of their chemical composition. Generally, high-cobalt bearing alloys are used in high temperature applications, while nickel-based alloys are used where corrosion is more prevalent.

QUESTION 4: WHICH WELDING PROCESS AM I USING?

Now that you have an idea about the wear, the base metal, and the alloy you wish to use on your specific application, you should confirm which welding process you will use to make the repair. Hardfacing repair alloys are available for every commonly used welding process (GMAW, SMAW, FCAW, and GTAW). Likewise, any of the processes will achieve satisfactory results.

QUESTION 5: WHAT ALLOY DIAMETER SIZE ALLOY DO I NEED?

The last item to consider is the alloy diameter and packaging. This depends on the process, your equipment, and the material to be welded. For example, small or thin pieces of metal require less heat input and typically a smaller-diameter consumable. Obviously, if you have a combination power supply/wire feeder, you will not have the ability to weld large spools and high amperage (large diameter) products. None of these issues should be perceived as barriers since products are available in diameters from 0.8mm to 3.2mm for wires and 2.5 to 6mm for electrodes. Hardfacing alloys come in packages from 5 kg boxes to 270 kg continuous-feed drums.

Hopefully, this general discussion will encourage you to consider hardfacing to repair and extend the life of your components subjected to wear. Most manufacturers have product specialists to assist you in the selection of alloys. They also offer a number of tools such as wall charts, selection guides, and pocket brochures.

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