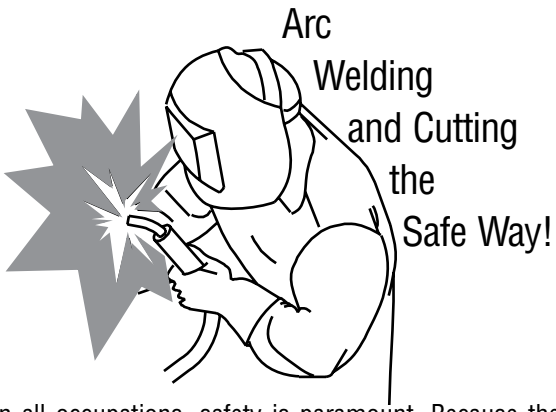
HOBART
FILLER METALS

Topic F.

Welding Process Training Series

Hardfacing

SAFETY



As in all occupations, safety is paramount. Because there are numerous safety codes and regulations in place, we recommend that you always read all labels and the Owner's Manual carefully before installing, operating, or servicing the unit. Read the safety information at the beginning of the manual and in each section. Also read and follow all applicable safety standards, especially ANSI Z49.1, Safety in Welding, Cutting, and Allied Processes.

ANSI Z49.1:, Safety in Welding, Cutting, and Allied Processes is available as a free download from the American Welding Society at: http://www.aws.org

Here is a list of additional safety standards and where to get them.

Safe Practices for the Preparation of Containers and Piping for Welding and Cutting, American Welding Society Standard AWS F4.1, from Global Engineering Documents (Phone: 1-877-413-5184, website: www.global.ihs.com).

National Electrical Code, NFPA Standard 70, from National Fire Protection Association, Quincy, MA 02269 (Phone: 1-800-344-3555, website: www.nfpa.org and www. sparky.org).

Safe Handling of Compressed Gases in Cylinders, CGA Pamphlet P-1, from Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, VA 20151 (Phone: 703-788-2700, website:www.cganet.com).

Safety in Welding, Cutting, and Allied Processes, CSA Standard W117.2, from Canadian Standards Association, Standards Sales, 5060 Spectrum Way, Suite 100, Ontario, Canada L4W 5NS (Phone: 800-463-6727, website: www.csa-international.org).

Safe Practice For Occupational And Educational Eye And Face Protection, ANSI Standard Z87.1, from American National Standards Institute, 25 West 43rd Street, New York, NY 10036 (Phone: 212-642-4900, website: www.ansi.org).

Standard for Fire Prevention During Welding, Cutting, and Other Hot Work, NFPA Standard 51B, from National Fire Protection Association, Quincy, MA 02269 (Phone: 1-800-344-3555, website: www.nfpa.org.)

OSHA, Occupational Safety and Health Standards for General Industry, Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart Q, and Part 1926, Subpart J, from U.S. Government Printing Office, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 (Phone: 1-866-512-1800) (There are 10 OSHA Regional Offices—phone for Region 5, Chicago, is 312-353-2220, website: www.osha.gov).

Booklet, *TLVs, Threshold Limit Values*, from American Conference of Governmental Industrial Hygienists (ACGIH), 1330 Kemper Meadow Drive, Cincinnati, OH 45240 (Phone: 513–742–3355, website: www.acgih.org).

Towing a Trailer – Being Equipped for Safety, Publication from U.S. Department of Transportation, National Highway Traffic Safety Administration, 400 Seventh Street, SW, Washington, D.C. 20590

U.S. Consumer Product Safety Commission (CPSC), 4330 East West Highway, Bethesda, MD 20814 (Phone: 301-504-7923, website: www.cpsc.gov).

Applications Manual for the Revised NIOSH Lifting Equation, The National Institute for Occupational Safety and Health (NIOSH), 1600 Clifton Rd, Atlanta, GA 30333 (Phone: 1-800-232-4636, website: www.cdc.gov/NIOSH).

Prepared by the Miller Electric Mfg. Co. Training Department.

⚠ WARNING

This document contains general information about the topics discussed herein. This document is not an application manual and does not contain a complete statement of all factors pertaining to those topics.

The installation, operation, and maintenance of arc welding equipment and the employment of procedures described in this document should be conducted only by qualified persons in accordance with applicable codes, safe practices, and manufacturer's instructions.

Always be certain that work areas are clean and safe and that proper ventilation is used. Misuse of equipment and failure to observe applicable codes and safe practices can result in serious personal injury and property damage.

Welding Process and Filler Metals Training Series:

Welcome to the Welding Process and Filler Metals Training Series. This training series was developed for the purpose of providing a basic set of educational materials that can be used individually or in a classroom setting.

The topics covered in the series are:

Filler Metals

- Topic A. Introduction To Metals
- Topic B. Tubular Wires
- Topic C. Low Alloy Steel
- Topic D. Stainless Steel
- Topic E. Aluminum
- Topic F. Hard Surfacing

Welding Processes

- Topic 1. Introduction To Welding
- Topic 2. Welding Safety
- Topic 3. Basic Electricity For Welding
- Topic 4. Welding Power Source Design
- Topic 5. Engine Driven Power Sources
- Topic 6. Shielded Metal Arc Welding
- Topic 7. Gas Tungsten Arc Welding
- Topic 8. Gas Metal Arc Welding
- Topic 9. Flux Cored Arc Welding
- Topic 10. Metal Cutting
- Topic 11. Troubleshooting Welding Processes
- Topic 12. Submerged Arc Welding

Please note, this series was not developed to teach the skill of welding or cutting, but rather to provide a foundation of general knowledge about the various processes and related topics.

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A Guide for Selection and Use of Hardfacing Welding Alloys

This manual is designed to help in the understanding, selection and use of hardfacing welding alloys for wear resistant applications. It includes definitions, welding process descriptions, classifications of hardfacing alloys, and the metallurgical and wear characteristics of hardfacing deposits. Among the subjects covered are basic wear factors which can be controlled by hardfacing as well as major industries and applications which can benefit economically by using hardfacing. It also contains information on all McKay surfacing electrodes and wires including chemistries, parameters and deposit characteristics.

The McKay Story

Since the start of the company by James McKay in 1881, McKay has built a reputation for quality, consistency and reliability in the manufacture of various metal products. Starting in 1935, McKay pioneered the development of modern welding consumable products, leading the U.S. in the development of low hydrogen and stainless electrodes. By the onset of WorldWar II, McKay was firmly established in the welding field, supplying millions of pounds of mild and stainless electrodes for use in ship building, tank construction, armor welding, and other defense industries.

McKay's extensive research efforts during the war led it into the business of producing wear-resistant welding products. Since then, nearly 50 years of research, development, and service to thousands of customers have given us a wealth of practical hardfacing knowledge. Today, as a world leader in hardfacing products, McKay's commitment is to make its people and facilities available to help meet your surfacing requirements and solve your wear problems.

In 1992, McKay was acquired by Hobart Brothers Company, a leading manufacturer of welding equipment and filler metals. With the backing and commitment of its new parent company, McKay looks to the future. McKay reveres the accomplishments of the past, but wants to earn the right to be your partner by providing quality products and services into the next century. When your business calls for hardfacing applications, call McKay at 1-800-424-1543.

Hardfacing Definition

Hardfacing is the deposition of a special alloy material on a metallic part, by various welding processes, to obtain more desirable wear properties and/or dimensions. The property usually sought is greater resistance to wear from abrasion, impact, adhesion (metal-to-metal), heat, corrosion or any combination of these factors.

A wide range of surfacing alloys is available to fit the need of practically any metal part. Some alloys are very hard, while others are softer with hard abrasion resistant particles dispersed throughout. Certain alloys are designed to build a part up to a required dimension, while others are designed to be a final overlay that protects the work surface.

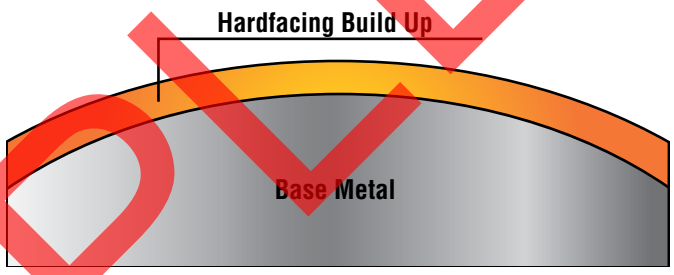

Figure 1 – Hardfacing Build-Up Can Be Used To Return Parts To Their Original Dimensions.

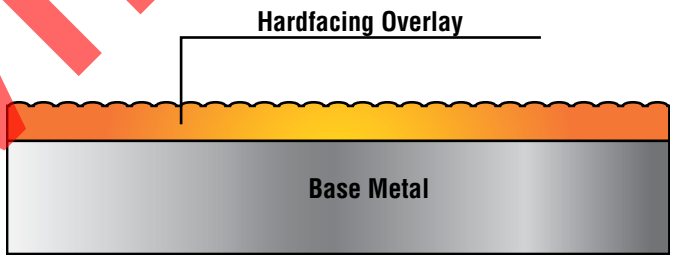

Figure 2 – Hardfacing Overlay Can Be Used To Give Parts Additional Resistance To Wear.

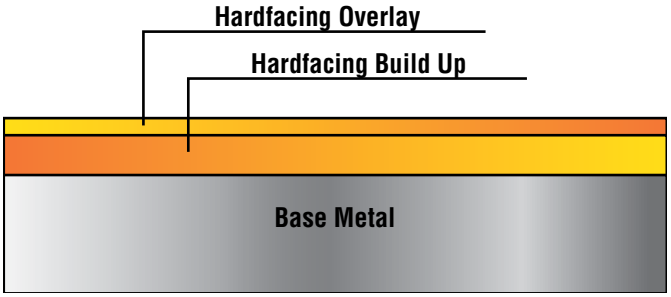

Figure 3 – Hardfacing Overlay And Build-Up Can Be Used Together To Rebuild Parts To Size And Give Them Additional Resistance To Wear.

Reasons for Hardfacing

Companies Use Hardfacing Products For The Following Reasons:

- Reduced costs – Hardfacing a worn metal part to a like new condition is usually 25 - 75% of the cost of a replacement part.
- Prolonged equipment life – Hardfacing extends life 30%-300%, depending upon application, as compared to that of a non-surfaced part.
- Reduced downtime – Because parts last longer, fewer shutdowns are required to replace them.
- Reduced inventory of spare parts – There is no need to keep numerous spare parts when worn parts can be rebuilt.

Uses for Hardfacing

There Are Two Main Areas Where Hardfacing Is Used:

- **Rebuilding worn metal parts to their original dimensions**.
  This is accomplished with build-up or with build-up and overlay. In both cases, the rebuilt part is usually superior to the original part. Worn parts that remain basically sound can be surfaced again and again provided that correct procedures are used.
- **Protecting new metal parts against the loss of metal.**
  Hardfacing overlay is used on both new and/or original equipment where the part is most susceptible to wear. The higher alloy overlay offers much better wear resistance than that of the original base material. This usually increases the work life of the component up to two or more times that of a part which is not surfaced. Although the added hardfacing material may add to the price of the equipment, usually a less expensive base material may be used.

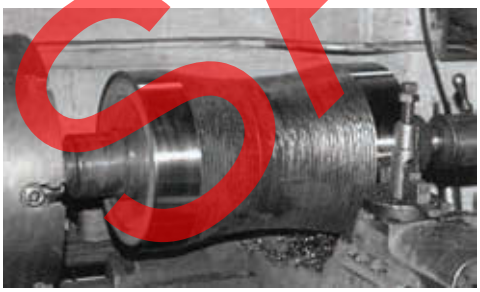

Figure 4 – BUILD-UP - Steel Mill Roll Rebuilt To Original Dimension. It Is Being Machined Prior To Service.

Figure 5 – BUILD-UP - Worn Rail End Rebuilt Past Original Dimensions-It Will Be Ground Prior To Service.

Figure 6 – OVERLAY - Bucket Lip Hardfaced As Preventive Maintenance.

Figure 7 – OVERLAY - Replacement Dragline Bucket Tooth Hardfaced As New Equipment.