CAST LIP OWNER'S MANUAL

HYDRAULIC SHOVELS

CAST LIP INSTALLATION PROCEDURE

HENSLEY®

MARCH 2011

VERSION 1

REMOVAL OF CAST LIP

STEP 1

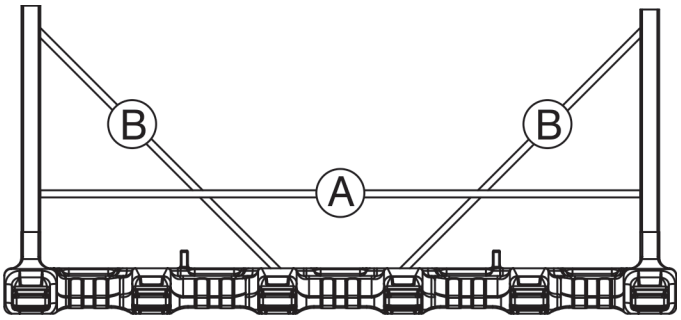


fig. 1-1

Brace clam from cheek plate to cheek plate (A). Brace clam from bucket floor, (just behind back of lip joint), to upper cheek plate on both sides (B). The purpose of the braces is to ensure that the geometry of the clam does not change when the old lip is removed. The size pipe/beam that is currently being used to brace the top or ears of the clam would work well for this bracing (fig. 1.1 - fig. 1.2).

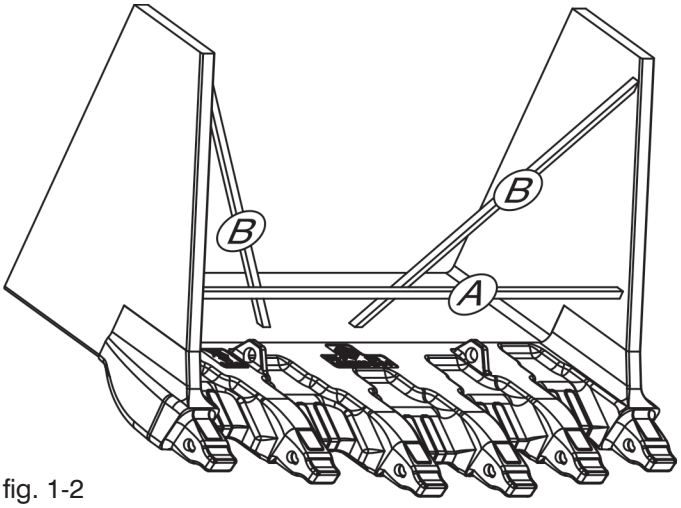


fig. 1-2

STEP 2

Layout cut lines, based on existing welds and verify with dimension taken from new lip.

STEP 3

Use a portable oxy/fuel cutting machine to produce as smooth a cut as possible. Some areas will need to be hand cut or gouged. Remove old lip from clam.

WELD PROCEDURE SPECIFICATION

WELDING PROCEDURE SPECIFICATION (WPS) Yes ☒

Company Name HENSLEY INDUSTRIES
Welding Process (es) GMAW or FCAW
Supporting PQR no. (s) _____

JOINT DESIGN USED
Type: _____
Single ☐ Double Weld ☐
Backing: Yes ☐ No ☐
Backing Material _____
Root Opening _____ Root Face Dimension _____
Groove Angle _____ Radius (J - U) _____
Back Gouging: Yes ☒ No ☐ Method _____

BASE METALS
Material Spec. HENSLEY CAST LIP
Type or Grade CARBON ALLOY CASTING
Thickness: Groove _____ Fillet _____
Diameter (Pipe) _____

FILLER METALS
AWS Specification A5.18 or A5.2
AWS Classification ER70S-6 or E71T-1

SHIELDING
Flux _____ Gas 75% Ar 25% Co^2
Composition N/A
Electrode-Flux (Class) _____ Flow Rate 35 - 40 CFH
Gas Cup Size _____

PREHEAT
Preheat Temp., Min 300°F (150°C)
Preheat Temp., Max 450°F (230°C)
Interpass Temp., Min 300°F (150°C) Max 450°F (230°C)
Note: If no preheat is specified and the base material is below 32°F (0°C) , preheat to 70°F (21°C) and maintain throughout the welding process. Temperature should be measured using an infrared thermometer or a temperature indicating crayon stick.

Identification # HI-0712
Revision 0 Date N/A By N/A
Authorized by Hal Battes, CWI & CWE Date 12/31/2007
Type ----Manual ☒ Semi-Automatic ☐
Machine ☐ Automatic ☐

POSITION
Position of Groove _____ Fillet _____
Vertical Progression: Up ☐ Down ☐

ELECTRICAL CHARACTERISTICS
Transfer Mode (GMAW) Short-Ciruiting ☒
Globular ☐ Spray ☐
Current: AC ☐ DCEP ☒ DCEN ☐ Pulsed ☐
Other _____
Tungsten Electrode (GTAW)
Size: _____
Type: _____

TECHNIQUE
Stringer or Weave Bead: STRINGER
Multi-Pass or Single Pass (per side) MULTIPLE PASS
Number of Electrodes _____
Electrode Spacing Longitudinal _____
Lateral _____
Angle _____
Contact Tube to Work Distance _____
Peening PNEUMATIC NEEDLE SCALER
Interpass Cleaning WIRE BRUSH

POSTWELD HEAT TREATMENT
Temp. _____
Time _____

WELDING PROCEDURE

Pass or Weld Layer(s)	Process	Filler Metals		Current		Volts	Travel Speed
		Class	Diam.	Type & Polarity	Amps or Wire Feed Speed		
all	GMAW	ER70S-6	1/16" (1.6mm)	DC+	200 - 300 ipm 225 - 325 amps	24 - 28	12 - 18 ipm
all	FCAW	E71T-1	1/16" (1.6mm)	DC+	200 - 300 ipm 250 - 325 amps	26 - 30	12 - 18 ipm

WELD PROCEDURE SPECIFICATION

General Instructions:

1. Surfaces to be welded should be ground to remove cutting or gouging slag, rust, scale, paint or any other impurities that can affect the quality of the weld.
2. Cut and shape material to be used as runoff tabs, on the open ends, for the starts and stops of the weld. These tabs will be removed and ground smooth upon completion.
3. Check area to be welded for any cracks with a non-destructive test method.
4. Preheat area to be welded per specification listed in this WPS.
5. Tack weld should be a minimum of 2” (50mm) long and deposited on the back of lip joint only.
6. Welding sequence is as follows:
    a. Beginning in the center and working towards the sides, deposit weld on the bottom side until lip begins to pull away from the cheek plates
    b. Manipulate bucket to the digging position and deposit weld on the inside, back of lip joint.
    c. Deposit weld from the cheek plate to the cast lip corners on both sides.
7. Continue this sequence until all joints are filled.
8. Control cooling rate at the completion of the welding process with the use of thermal blankets. Cooling rate should not exceed 35° per hour.
9. Use the air carbon arc gouging process to remove the runoff tabs and grind smooth.

Inspection:

1. Visual inspection shall meet the requirements of AWS14.3 Specification for Welding Earthmoving and Construction Equipment or other suitable specification.
2. Magnetic Particle inspection or Dye Penetrant inspection shall be performed 48 hours after cooling to ambient temperature. Magnetic Particle inspection is preferred.

Additional notes:

1. Much care should be taken with the amount of preheat and Interpass temperatures. Too little or too much can be very detrimental to the base material.
2. Due to the condition of the bucket, actual size of bevels, and other factors unknown at this time, sequence and amount of weld in any one area, may need to be modified.

INSTALLATION OF CAST LIP

BEFORE STARTING INSTALLATION, BE SURE TO READ ALL INSTRUCTIONS THOROUGHLY!

STEP 1

Bevel cheek plates and bucket bottom to create welding grooves for new cast lip.

Bevel cheek plates 63.5mm (2.5”) X 45° on the inside and the outside to allow for a full penetration weld joint. All bevels should be constructed to allow access for the welding process used.

Bucket bottom should be beveled from the inside of the bucket to create a full penetration weld joint. The thicker steel areas in the center of the bucket and on both sides will need to be beveled from both the inside and the bottom side of the bucket to create a full penetration weld joint.

Clean bevels and all areas to be welded. Weld surfaces must be free from cutting slag and or carbon slag from gouging. Dry, freshly ground, buffed or sanded surfaces provide the best preparation for welding. Check all bevels and surrounding area for cracks with a nondestructive testing method.

STEP 2

Back of lip and lip cheek plates should be ground to remove all paint. The surfaces must be sufficiently clean so that there is nothing that may contain hydrocarbons or other impurities that can adversely affect the strength of the weld.

STEP 3

Position and secure clam as pictured in fig. 3-1. Ideal position would place the cast lip on a horizontal plane, however, it is permissible to have the clam slightly rotated. This position will allow easy installation and alignment of the cast lip with the assistance of an over head crane. Welding on the back of the lip joint can be done in flat or down hand position and it is also an excellent position for achieving the proper preheat.

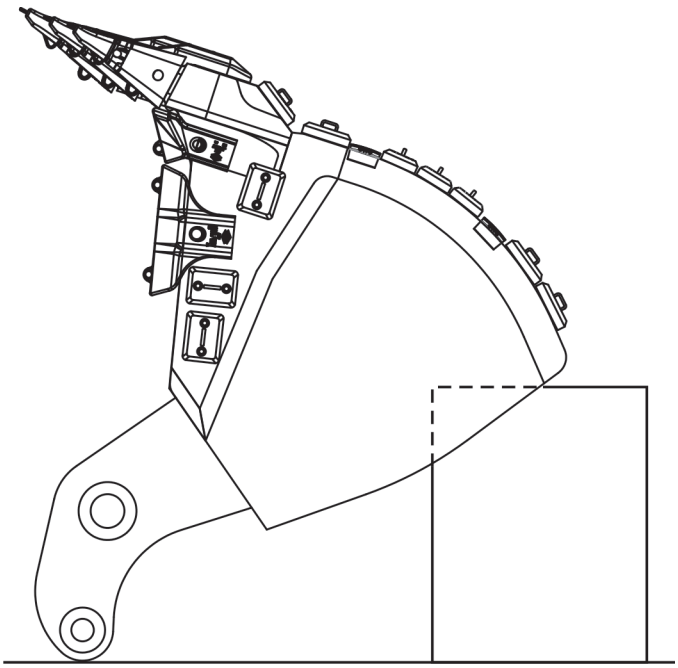


image used for illustrative purposes only

fig. 3-1

INSTALLATION OF CAST LIP

PREHEATING

Preheating is the application of heat to the work piece prior to any welding, cutting, or gouging operation. All cutting and welding processes use a high temperature heat source. These high temperatures exceed the melting point of the base metal. This creates the problem of a traveling high temperature, localized heat source, and the effect that it has on the surrounding base metal.

A large temperature differential causes thermal expansion and contraction, high stresses, hardened areas, and a very small area for hydrogen gasses to escape from the steel. Preheating will reduce the danger of weld cracking, reduce maximum hardness of the heat-affected zone, minimize shrinkage stresses, lessen distortion, and create a larger area for hydrogen gasses to escape from the steel.

The amount of preheat is determined by the type of steels to be joined and the thickness of the steel. The cutting edge and effected areas of the bucket require a preheat temperature of 300^{O}F / 150^{O}C to 450^{O}F / 230^{O}C. It is recommended to preheat the entire cutting edge and the adjoining areas.

The most common method of preheating is by torches or burners utilizing an open fuel gas flame. Open flames are difficult to control precisely. They tend to super heat one area while under heating another. A very effective way of dealing with this temperature differential is the use insulating blankets. The blankets help disperse the heat as well as retain the heat that has been input. Preheating with burners or torches is much more effective when the heat is applied from the bottom side of the work piece with insulating blankets on the topside.

A ceramic element heating system, in conjunction with gas burners, is ideal. This system allows an even and through heat sink when used with insulating blankets and gas burners.

Measure the preheat temperature with a temperature indicating crayon or infrared thermometer from the topside. This will insure that the preheat is not just on the surface of the material, but a complete preheat through the thickness of the materials to be welded. All material within 4” or 100mm of the weld zone must be within specified temperature.

FILLER MATERIAL

Recommended filler materials:
American Welding Society (AWS) specification A5.18, class ER70S-6 wire for the Gas Metal Arc Welding process (GMAW) or

AWS specification A5.2, class E71T-1 for the Flux Cored Arc Welding process (FCAW). Shielding gas should have a dew point of -40^{O} F. or lower.

AWS specification A5.1, class E7018 stick electrode for the Shielded Metal Arc Welding process, (SMAW), may also be used, although it is not the preferred process.

These AWS specifications may be substituted with an equivalent specification from one of the following organizations:
BS…British Standard issued by the British Standards Association,
CSA…Canadian Standard issued by the Canadian Standards Association,
DIN…West German Standard issued by the Deutsches Institute fuer Normung,
JIS…Japanese Industrial Standard issued by the Japanese Standards Association,
NF…French Standard issued by the Association Francaise de Normalisation.

INSTALLATION OF CAST LIP

STEP 4

Position the cutting edge (using the bucket drawing if available). Insure that the geometry of the cutting edge to the bucket is correct and cross square. After this placement has been confirmed, preheat the lip to 300^{O}F / 150^{O}C to 450^{O}F / 230^{O}C and tack weld into place.

An inter-pass temperature of 300^{O}F / 150^{O}C to 450^{O}F / 230^{O}C must be maintained during this step and throughout the rest of the installation. Readings should be taken at least every half an hour to ensure that the temperature range is maintained.

The first tack weld should be placed in the center of the bucket on the bottom where the cutting edge joins to the basket of the bucket. Deposit a tack weld, every 24" or 600mm, alternating from each side of center, working towards the sides of the bucket. All tack welds should be a minimum of 2" or 50mm long. **DO NOT** tack the check plates to the corner adapters, at this time.

STEP 5

Begin welding the cutting edge to the basket at the bottom side center. Deposit weld equally from the centerline toward the check plates or sides of the bucket, (fig. 5-1). Stringer beads are recommended for higher strength. The use of weave or wash beads should **NOT** be used. Arc strikes should be avoided or ground out. Note: if the weld begins to pull the cutting edge away from the intended plane, stop and proceed to the top side

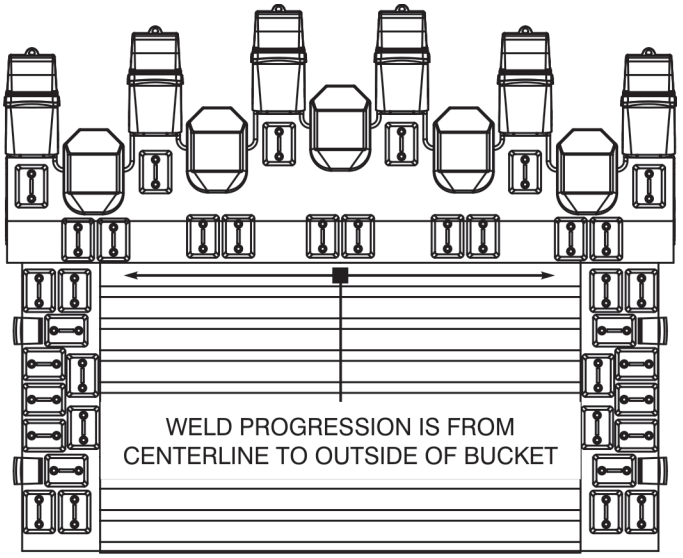


image used for illustrative purposes only

fig. 5-1

STEP 6

Manipulate bucket to the digging position and repeat the procedure used in step 5 on the top side. Continual checks must be made to insure that the "plane" of the cutting edge has not changed from its desired location. The concept is to allow the lip to float prior to locking in the cheek plates. This will reduce residual stresses built up in the back of the lip joint.

Continue this process of depositing weld on the bottom side and then the top side until the weld joints are filled. Alternating the weld from the bottom side to the top side will help maintain the correct plane geometry and also reduce residual stresses.

Note: A tempering or annealing weld pass needs to be deposited to the weldment area that connects the bucket bottom to the cast lip. See page 58 for a description and the purpose of the tempering weld bead.

INSTALLATION OF CAST LIP

STEP 7

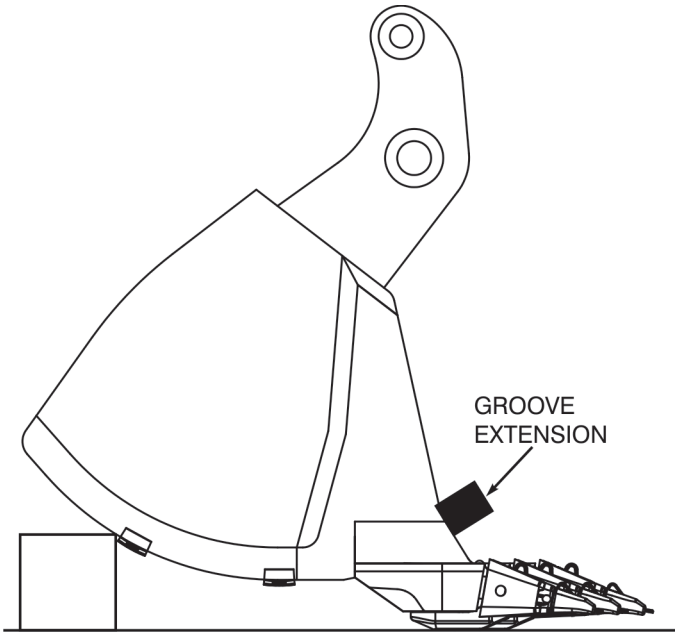


fig. 7-1 image used for illustrative purposes only

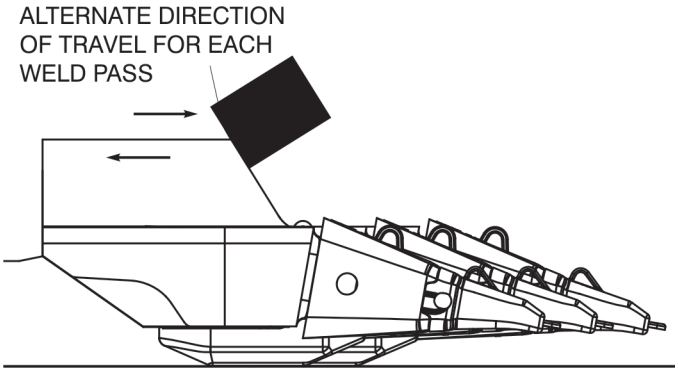


fig. 7-2 image used for illustrative purposes only

Cast lip corner/cheek plate joint: Establish preheat (300°F / 150°C to 450°F / 230°C) of cast lip corner and cheek plate area. Install 'groove extensions' at the front edge of the cast lip/check plate joint (fig 7-1). See page 56 for description of groove extensions.

Deposit root pass joining the inside of cast lip and the inside of the cheek plate, on both sides (fig. 3-1). Back gouge the root pass from the outside of the bucket. Grind all gouged surfaces to remove all carbon slag and impurities. Re-establish preheat temperature (300°F / 150°C to 450°F / 230°C).

Deposit root pass on the outside of each of the cast lip corner/cheek plate weld joints. Alternate weld passes from the outside of each cheek plate to the inside of each cheek plate for each weld layer.

Alternate the direction of travel, front to back - back to front of bucket for each weld pass, utilizing the groove extensions, as shown in fig. 7-2.

Continue process until weld joints are completely filled.

Note: Final weld pass should not be adjacent to the cast lip. See page 58 for a description and the purpose of the tempering or annealing weld pass.

INSTALLATION OF CAST LIP

STEP 8

Manipulate clam on its back as pictured (fig. 8-1). Establish preheat (300^{O}F / 150^{O}Cto 450^{O}F / 230^{O}C) of cast lip corner andcheek plate area at the back of the lip. Install 'groove extensions' on the bottom edge of the cast lip/cheek plate joint (fig. 8-2). See page 56 for description of groove extensions.

Deposit root pass joining the inside back of cast lip and the inside of the cheek plate on both sides. Back gouge the root pass from the **OUTSIDE** of the bucket. Grind all gouged surfaces to remove allcarbon slag and impurities. Re-establish preheat temperature (300^{O}F / 150^{O}C to 450^{O}F / 230^{O}C).

Deposit root pass on the outside of each of the back of the cast lip corner/cheekplate weld joints. Alternate weld passes from the outside of each cheek plate to the inside of each cheek plate for each weld layer.

Alternate the direction of travel, bottom to top - top to bottom of the bucket for each weld pass utilizing the groove extensions (fig. 8-2). Continue this process until weld joints are completely filled.

Note: Final weld pass should not be adjacent to the cast lip. See page 58 for a description and the purpose of the annealing weld pass.

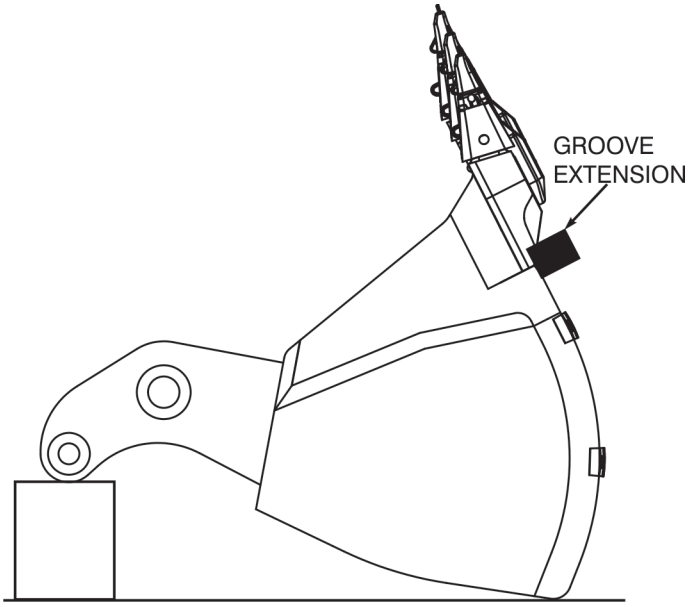


image used for illustrative purposes only

fig. 8-1

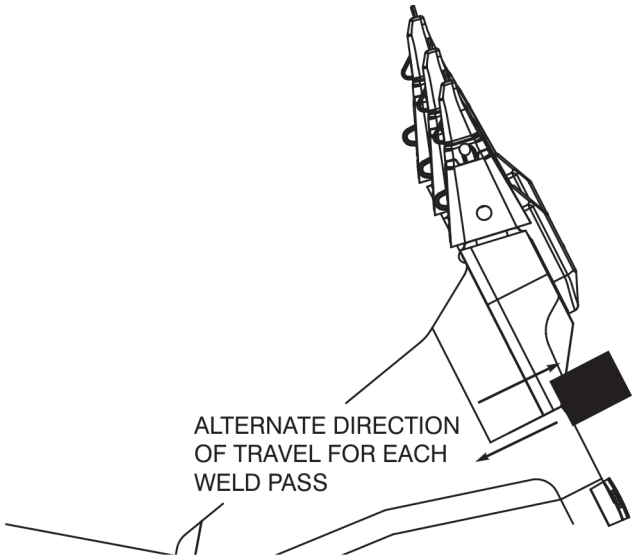


image used for illustrative purposes only

fig. 8-2

WELD FINISHING / TESTING

Grind blend the front edge of the cast lip/cheek plate joint. The joint should be smooth and the edges ground so that no sharp edges are present.

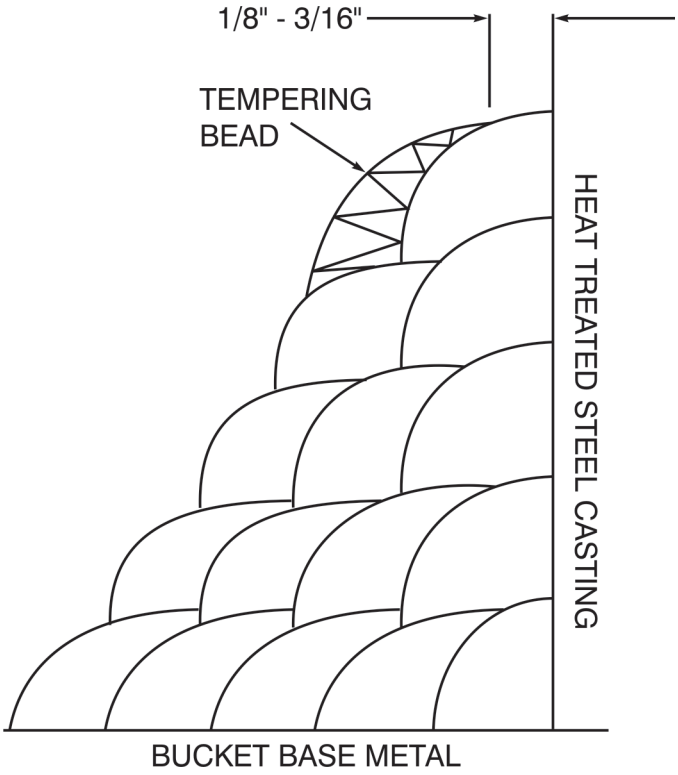
The use of nondestructive testing of the welds and adjacent base metal, is recommended, 48 hours after the completion of all welding of the cast lip to the clam. Magnetic Particle Inspection is the preferred method.

INSTALLATION OF CAST LIP

END OF SHIFT / COMPLETION OF PROJECT

When the welding project has been completed, or at the end of a working shift, the work piece should be covered with an insulating blanket to allow a slow cool down to ambient temperature. A cool down rate of no more than 25°F. or 14°C. per hour is recommended. Easily achieved with insulating blankets.

TEMPERING / ANNEALING BEADS



Tempering or annealing weld pass is used in all weld joints that weld is deposited against the heat-treated steel castings. It is an additional weld pass that is added to the weldment once the weld joint is completely filled.

This weld pass should be deposited 1/8” to 3/16” away from the final weld pass against the casting,

Purpose: The heat from this weld pass tempers or anneals the final weld pass against the casting and the 'Heat Affected Zone', (HAZ), within the casting caused by the weld pass adjacent to the casting.

GROOVE EXTENSIONS

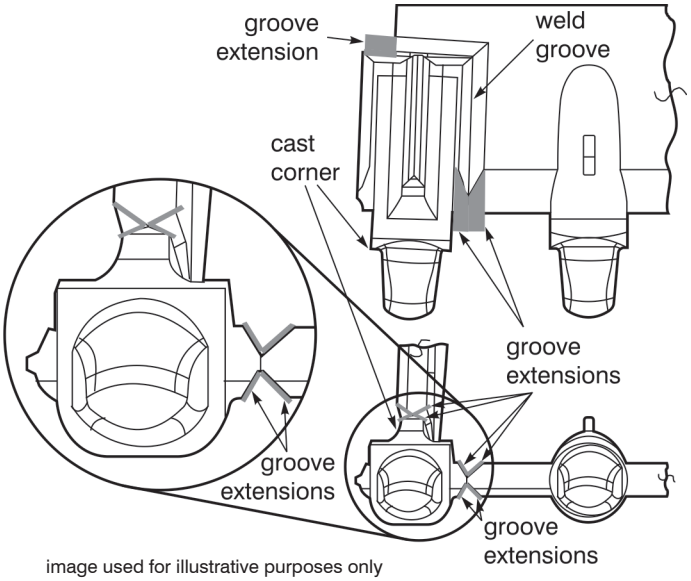


image used for illustrative purposes only

Groove Extensions, commonly referred to as “starter tabs” or “run-off tabs”, are used to keep the starts and stops of the weld passes out of the final weldment. Tabs should be constructed of 1/4" (6mm) thick mild steel (ASTM A36 or equivalent) and extend at least 2" (50mm) beyond the ends of the weld grooves. Tabs will be removed by the air carbon arc gouging process at the completion of the weldment.

SAFETY FIRST: Hensley recommends that you use a soft-faced hammer and ANSI-approved (Z87.1) eye protection while using our products.

Hensley Industries, Inc.
888 406 - 6262 U.S./Canada
+1 972 406 - 6262 all other locations
Hensley Attachments
800 433 - 3144 U.S./Canada
+1 817 477 - 3167 all other locations
www. hensleyind.com