VOSTA.LMG

DREDGING TECHNOLOGY

MAINTENANCE MANUAL

VOSTA SC15 CUTTERHEAD

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Contents

1. Introduction

This manual provides information and a step-by-step maintenance guide for the VOSTA LMG SC15-type cutterheads. Please read this manual carefully before starting the maintenance process and follow all recommended instructions.

SC15-type cutterheads are special designed to dredge several types of soil from sand and clay till rock. For dredging sand and clay standard SC15.01 Wide Chisel Teeth are used. For harder soil like hard packed sand VOSTA LMG recommends using standard SC15.02 Narrow Chisel Teeth. For rock VOSTA LMG recommends to use standard SC15.03 Pick Point Teeth.

The main properties of these SC15-type cutterheads are:

- High productivity.
- Long standing-time of the teeth.
- "Tight fitting" of tooth on adapter, which reduces damage caused by hammering.
- Optimum "free-cutting" performance, which means low wear on adapters and cutter blades. This results in low costs for repair and maintenance.
- Using "wing"-type adapters on the plain front edge of the cutter blade results in a 100% protection from wear on this front edge, a high strength, easy welding and a precise and easy positioning of the adapters. For the design of a new cutterhead it means there are hardly any restrictions to adjust the contour pattern for optimum performance of the relative dredge and to meet specific customer requirements.

All the SC15-type teeth fit tight onto the adapters and are secured by a one-piece locking for easy changing.

For optimum efficiency it needs no explaining that thorough maintenance is essential.

VOSTA LMG parts are designed to be installed in accordance with instructions and/or drawings in this manual. It is the responsibility of the customer, including all costs and liabilities connected thereto, to add any alternate materials or to make any additions or modifications to the product without explicit permission or advice of VOSTA LMG.

Technical support
Please contact VOSTA LMG B.V. or a VOSTA LMG representative if you experience any difficulty with the instructions in this manual or if you need any extra information about the VOSTA LMG cutterheads.

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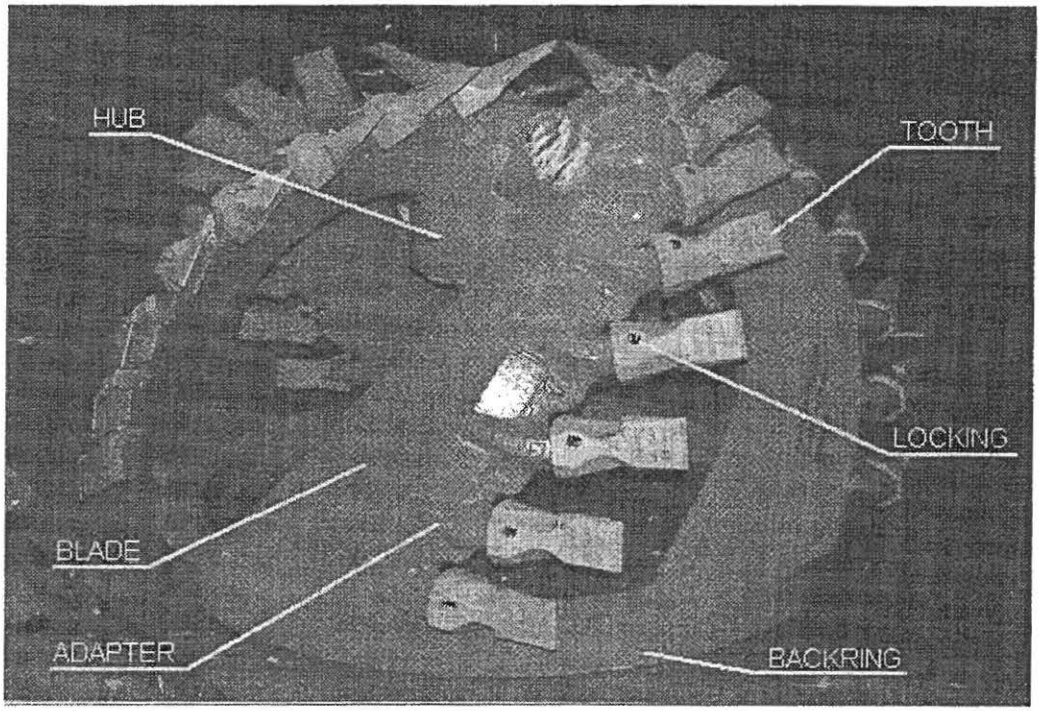
2. Cutterhead parts identification

The picture below shows a typical SC15 cutterhead. The terminology shown in the picture will be used throughout this user manual and can assist when discussing cutter related issues with VOSTA LMG.



SPECIFICATIONS SC15 SYSTEM

VOSTA

Description	Type	Dimensions [mm] A	B	C	Weight [kg]
Teeth					
Wide Chisel	SC15.01	278	109	118	8.5
Narrow Chisel	SC15.02	300	32	118	8.0
Pick Point	SC15.03	300	10	118	8.0
Adapters					
Left Hand Wing	SC15.30	325	255		13.5
Right Hand Wing	SC15.31	325	255		13.5
Weld-on Nose	SC15.36	170	100	104	5.7
Leg	SC15.37	276	87	114	7.0
Locking (C2-V)	SC15.50	74	13.5	29	
Locking Tool	SC15.70				1.3

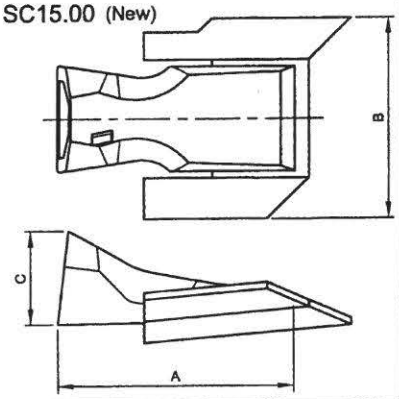
Maximum power: 1600 hp in sand and clay
1000 hp in soft rock

The patented SC15 system is specially designed for use on cutter heads and bucket wheels. The big advantage is the clearance free fit that gives the adapter a much longer lifetime and combines a long wear length with a very compact geometry resulting in lower stresses.

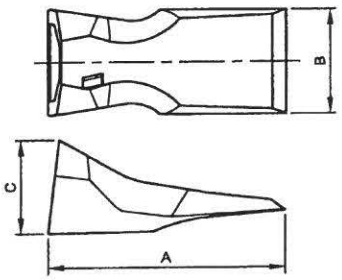
The wing adapters protect the blades and reduce the spill.

The SC15 system is truly multi purpose since all types of teeth can be mounted on the same adapters and the optimum cutting angles are integrated in the design of the different teeth.

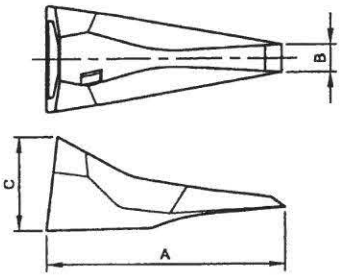
SC15.00 (New)



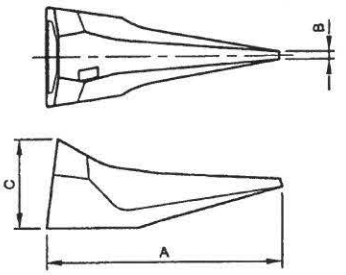
SC15.01



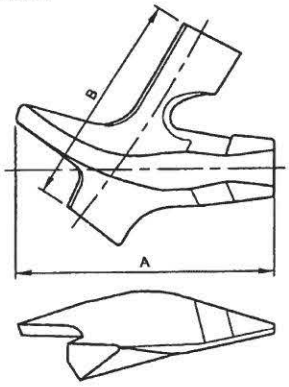
SC15.02



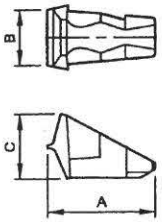
SC15.03



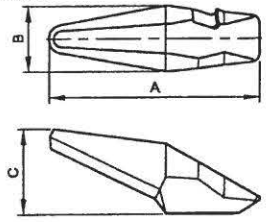
SC15.31



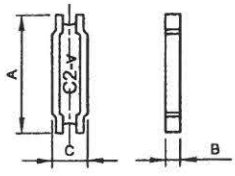
SC15.36



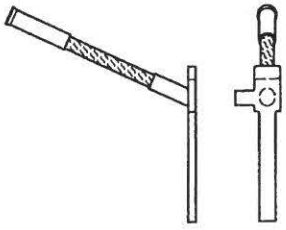
SC15.37



SC15.50



SC15.70



Optional:
- Tungsten carbide cladded teeth
- Roots protection
- Cable guard
- Checking gauges

Remarks:
- Worn out adapters can easily be repaired
- Similar size cutter heads can easily be modified to the SC15 system

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4. Safety

The safety practices described in this manual are meant as guidelines for safe operation under most conditions and are meant to supplement any safety rules and/or laws that may be in force in your area. Your safety and the safety of others results from putting into practice your knowledge of the correct operating procedures.

All persons performing maintenance and welding activities must wear O.S.H.A.-approved head protection, safety glasses, safety shoes, protective clothing and gauntlets suited to the task being performed. Pieces of work must be securely held and supported.

When performing welding activities combustible materials should be removed from the welding area. Welding can cause serious burns, so prevent injury and damage to property by following strict safety measures when welding, gouging or flame cutting. Welding areas have to be provided with proper ventilation and flue gas extractors.

5. Alloys

Cutterhead hub: Low carbon cast steel

Cutterhead blades: Low carbon cast steel

Cutterhead backring: Solid rolled steel

Note: At the clients request the backring of the cutterhead can be provided with wear resistant liners of a make, quality and shape established in mutual consultation.

Adapters: Alloyed cast steel subjected to heat treatment

Note: The material of the cutterhead and the adapters can be welded easily, provided that the welding instructions of this manual are followed with care.

Teeth: High alloy cast steel.

Note: Welding of the teeth is not possible and must not be attempted.

6. Tooth selection chart

The following tooth types are available for SC15:

Type	Description
SC15.00L	Semi Smooth Edge Left Hand
SC15.00R	Semi Smooth Edge Right Hand
SC15.01	Wide Chisel
SC15.02	Narrow Chisel
SC15.03	Pick Point

Tooth type choice in relation to soil type:

Soil Type	SC15.00	SC15.01	SC15.02	SC15.03
Soil with roots	X			
Mud	X	X		
Clay		X		
Sand		X	X	
Cemented sand			X	X
Soft rock				X

Tooth type choice in relation to performance:

Performance	SC15.00	SC15.01	SC15.02	SC15.03
Production	+++	+++	++	+
Penetration	+	++	+++	++++
Strength	+	+	++	+++
Wear life	+++	+++	++	+
Protection	+++	+++	++	+

More + means better performance

Remarks:

- All type of soil can be excavated with only the Wide Chisel and Pick Point teeth. The other types are used to optimize the production and wear life.
- SC15.01 can be hard-faced for increased wear life in loose abrasive soil.
- Contact VOSTA LMG B.V. or a VOSTA LMG representative if left- or right hand semi-smooth edge teeth are required.
- Above tooth selection is based on average cutter dredgers and may vary with actual cutting power and side winch force.

7. Changing cutterhead teeth

Teeth must be replaced when they are worn as is indicated in figure 7.1, or in case they are cracked or broken.

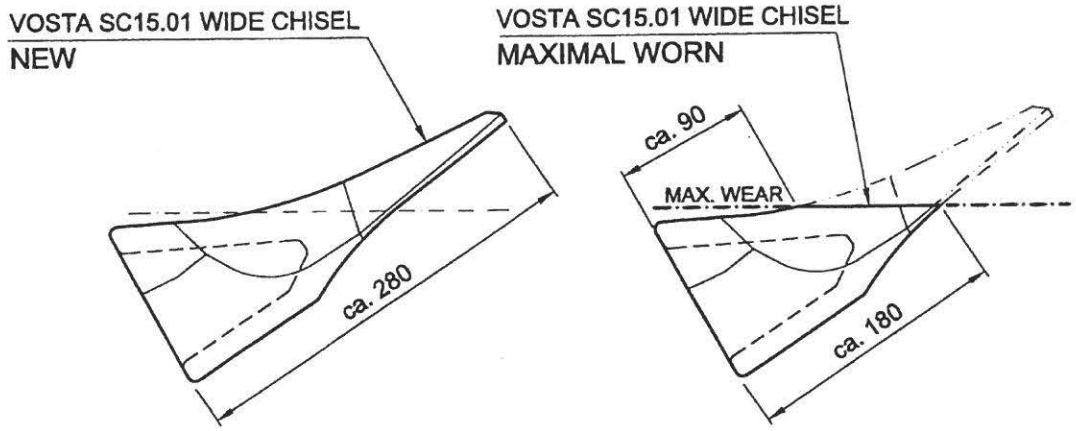


Figure 7.1

Tools required:
- Mild steel hammer (weight 2-4 kg)
- VOSTA locking tool, part no: SC15.70

The basic sequence for replacing a tooth is as follows (see illustration on next page):

1. **Drive out locking.** Drive out the locking using the locking tool and the hammer. Start with the short drift extension of the locking tool, and then use the long drift extension to drive the locking all the way out. It is best to work with a two-person team, one to use the hammer and one to hold the locking tool and to catch the locking.

2. **Remove tooth.** Remove the tooth from the adapter nose. It may be necessary to strike on the sides of the tooth box section to get the tooth free.

3. **Clean surfaces.** Before installing a new tooth, clean the adapter nose surfaces if necessary.

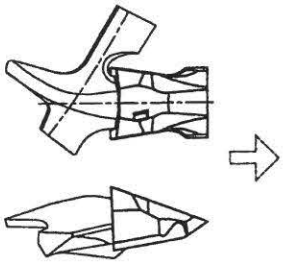
4. **Install new tooth.** Install the new tooth onto the adapter nose. Check the correct installation of the tooth on the adapter

5. **Install locking.** To secure the tooth, install a locking into its recess. Drive the locking in until the end is flush with the edge of the recess in the tooth. Then, using the short drift of the locking tool hit the locking a little bit further until it snaps completely in its recess. Lockings can be reused several times until there is significant tearing of the rubber or the rubber comes off from the steel parts.

VOSTA SC15 SYSTEM: REPLACING TEETH

DISMOUNTING

1



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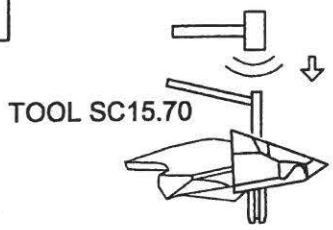

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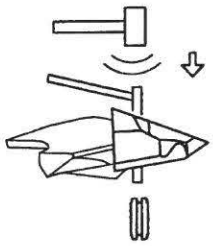

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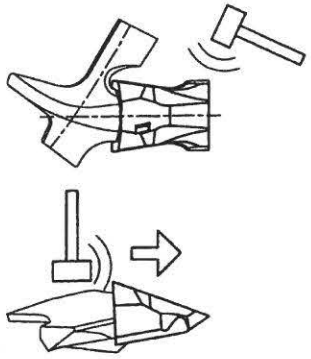

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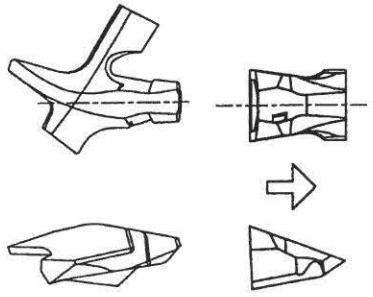

MOUNTING

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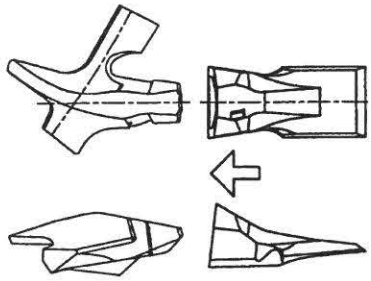

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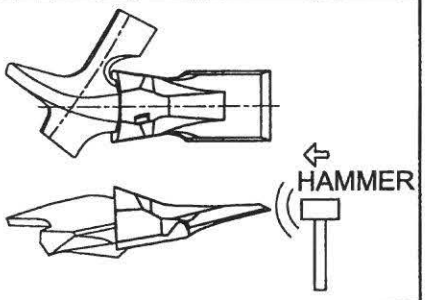

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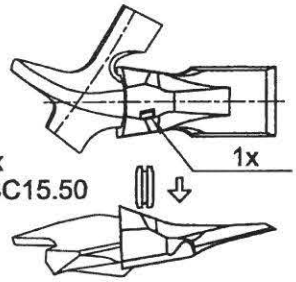

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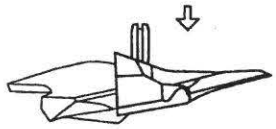

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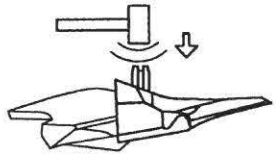

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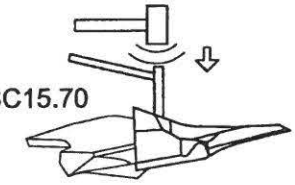

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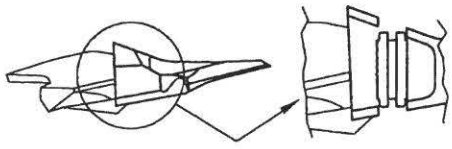

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8. Cutterhead repair

8.1. Description and use of the cutter repair frame

For optimal cutter maintenance and repair it is recommended to use a VOSTA cutter repair frame (figure 8.1). For ordering or price quotation contact VOSTA LMG in Amsterdam.

The cutter repair frame consists of a demountable steel structure with a turning table and a contour template suited to the repair frame. The cutterhead will be placed on the turning table. The turning table is provided with an adapter plate, which suits the bottom side of the hub in order to center the cutterhead.

Now the template can be put in its fixed position. The cutterhead can be rotated by hand along the template for positioning the adapters. The turning table is electrically isolated from the frame, so in case of welding the earth cable must be connected directly to the cutterhead. On behalf of easy and economical transport the repair frame can be easy rebuild to compact dimensions.

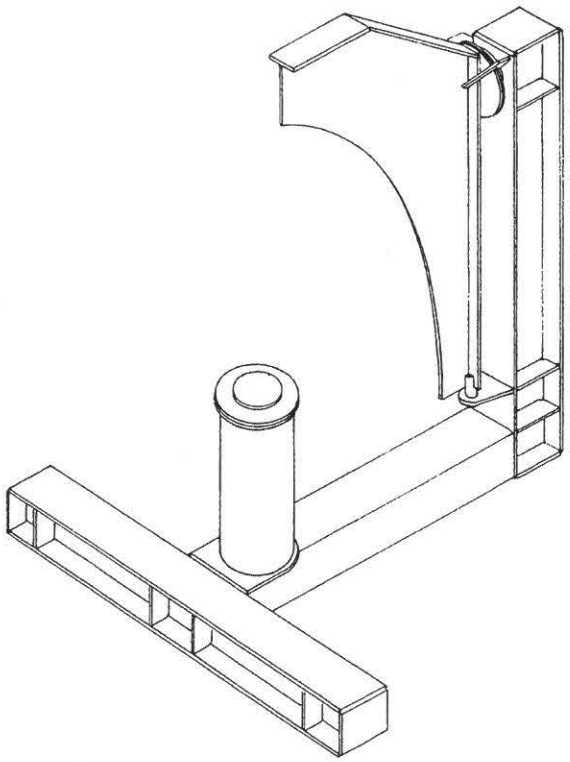


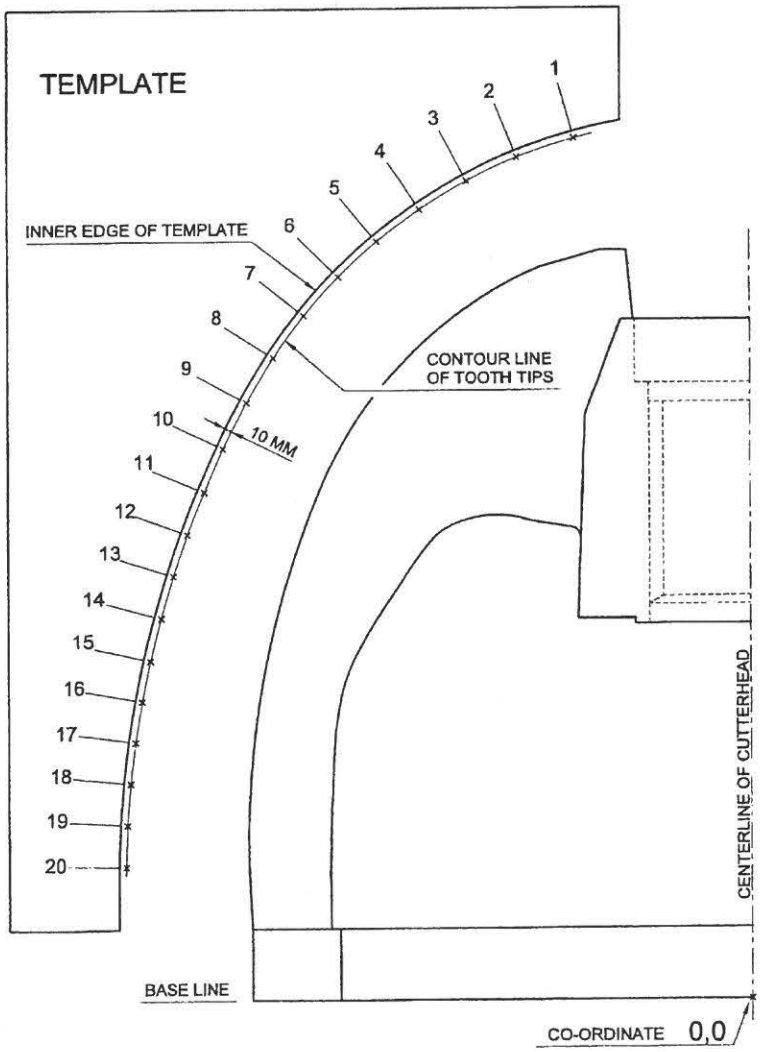
Figure 8.1

8.2. Template for positioning adapters

A contour template is used to ensure a correct positioning in case of changing adapters. A correct positioning means very little wear to cutter blades and adapters and a longer lifetime of the teeth, which is important for an optimal performance of the cutterhead.

The curved, inner edge of the template has been shaped according the contour line along the tooth tips with a clearance of 10 mm. Along this edge the point positions have been marked by means of lines and the corresponding point number.

For positioning adapters see description in this manual under Changing Adapters. For the rest the shape of the template depends on the type of repair frame that is used. VOSTA LMG can supply a cutter repair frame with templates suitable to your cutterheads, which will take care of a high accuracy and a very easy use.



8.3. Crack repair

If there are cracks in the blades or in the adapter welds it has to be determined if these cracks follow the weld or if they are going down into the adapter. If a crack follows the weld or is going down into the blade it can be repaired according to the instructions in this manual. If the crack goes down into the adapter then change the adapter (see section 9).

Before repairing any cracks it has to be verified whether climatic conditions and facilities on the site allow for repair there.

Relevant climatic conditions:	air humidity and the availability of a draught-free sheltered spot.
Relevant facilities:	skilled welders and quality of the available equipment.

It is recommended to follow the "dye-check" method to get a detailed impression of the size and the path of a crack.
Before starting with gouging out, first pre-heat the area around the crack according to section 8.4.2. Gouge out the crack and repeat the dye-check to determine whether the crack is fully removed. Grind and carefully clean the obtained groove.

For welding only use the electrodes as specified in section 8.4.
It is recommended to weld stringer beads only, to prevent stresses due to shrinking as much as possible. The welding seam has to be cleaned very carefully after each bead. After the weld has been filled up completely, finally grind to a smooth surface.

8.4. Welding information

To obtain the maximum benefit from the maintenance procedures, adhere to the following recommendations.

For all structural welds where adapters are involved use E 7018-1 low hydrogen electrodes in case of manual metal-arc welding. In case of FCAW semi-automatic welding use ER 70 S-6 wire.

8.4.1. Controlling moisture in Low-hydrogen electrodes

To obtain the best performance from low-hydrogen electrodes purchase them in hermetically sealed packets of limited size. Larger packets may contain electrodes with too much moisture, which can result in under-bead cracking.
Always start to use electrodes from unopened packets. Since electrodes absorb moisture when exposed to air, keep them dry after opening of the packet. In case the humidity of the electrodes is to high they have to be dried according manufacturers instructions.

8.4.2. Welding instructions

Before performing any welding, cutting or air arcing, thoroughly preheat with a torch or electric device:

- At least to 100°C (preferably 150°C) if surrounding air temperature is above 4°C.
- To 175-200°C if surrounding air temperature is 4°C or less.

Check with Tempilstik or similar temperature checking tool. Preheating evaporates the moisture from the steel eliminating hydrogen cracking during welding or arcing.

Do not exceed 280°C interpass temperature.

Welds must be made by welding stringer beads only. Max. wave breadth: 1,1 x diam. of electrode. Remove slag completely and clean welding seam carefully after each bead.

Providing the foregoing procedures have been followed, post-heating after welding is not necessary if the surrounding air temperature is above 4°C. Normal air cool will do. Under colder circumstances it necessary to take care of a controlled cooling down.

9. Changing adapters

Adapters have to be changed in case they are broken, cracked or worn beyond repair. If there are cracks in the adapter welds it has to be determined if these cracks follow the weld or if they are going down into the adapter. If a crack follows the weld it can be repaired as specified in section 8.3 If a crack goes down into the adapter then the adapter has to be changed. To ensure a correct replacement of the adapters it is recommended to use a cutter repair frame with a contour template as described in this manual.

9.1. Removal of a damaged adapter

See figure 9.1

1. Preheat the area of the cutter blade around the adapter to be changed.
2. Apply a "marking weld" behind the tail as indicated.
3. First cut through the adapter tail as indicated. Now you can clearly determine where the front edge of the blade stops and the adapter begins.
4. Remove the adapter by careful flame cutting besides the welds at the adapter side. During the cutting minimize damage to the blade in order to keep a proper surface for mounting the new adapter and to reduce repair time and costs.
5. Remove the remnants of the welds carefully by flame cutting or gouging.
6. Grind the faces of the blade and the adjacent adapters in order to prepare proper welding faces. In case the welding faces are damaged during removal of the adapter they have to be repaired first.

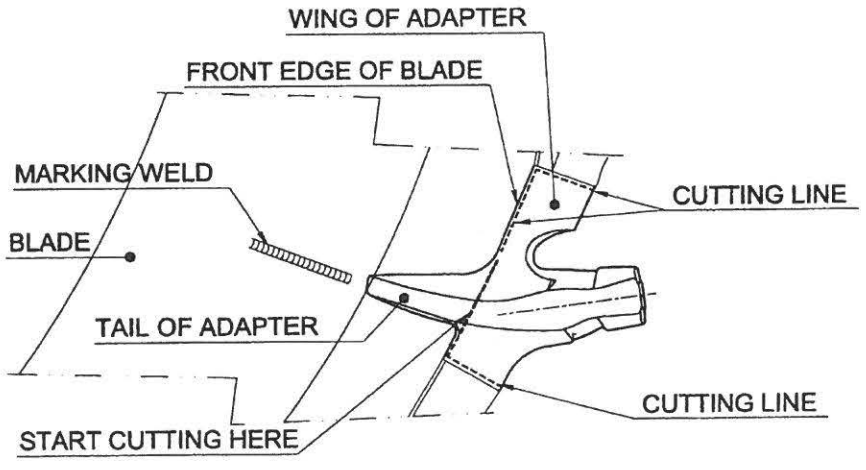


Figure 9.1

9.2. Positioning of a new adapter

See figure 9.2

1. Successive adapters have to be positioned from the back ring to the hub. Depending of the position on the blade it may be necessary to shorten the length of the "wing" of the adapter at bottom- and/or top side to make it fit.

2. Mount a Wide Chisel tooth on the adapter and lock it. For the positioning the adapter-tooth set is held in position to the blade. The adapter is properly positioned if:
   a) The centerline of the tooth is in line with the corresponding line on the contour template.
   b) The welding bevel of the wing is parallel and in line with the welding face at the front of the blade.
   c) The tail fully contacts the corresponding surface on the blade lengthwise and if it is on the same level as the welding mark.

3. After positioning the adapters, the shape of the welding seam will have to be checked and necessarily adjusted for the used welding process.

4. Grind and clean the welding seams.

5. Fix the adapter by means of firm tack welds as indicated on figure 9.2.

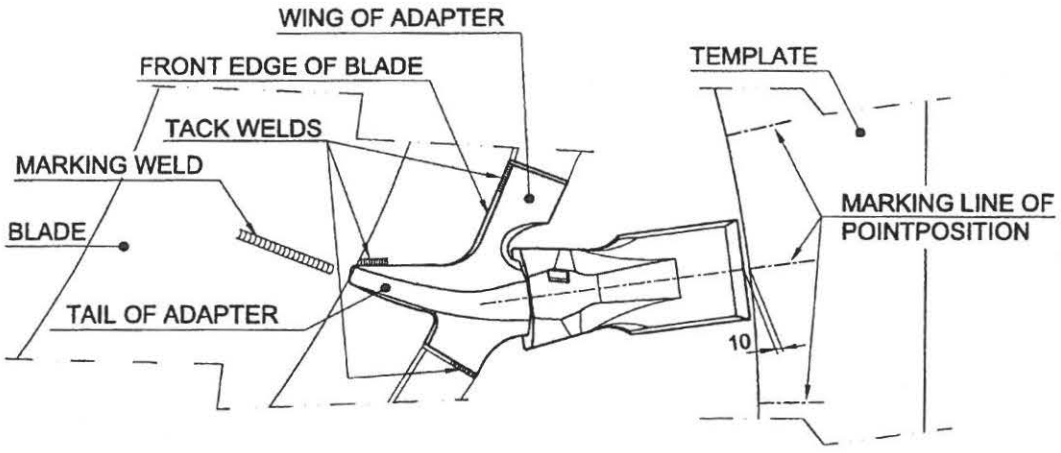


Figure 9.2

9.3. Adapter welding

All welding seams must be dry and free from rust, dirt, oil, paint, etc. Preheat and weld the adapters observing the welding instructions as described in section 8.4 and the following procedure.

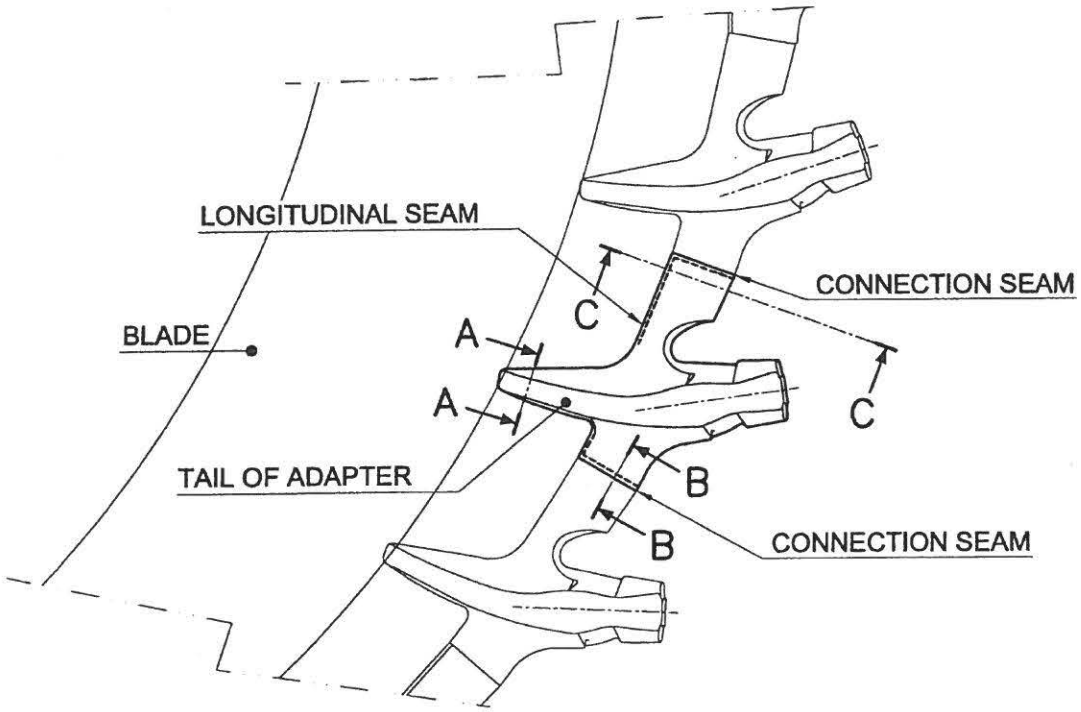


Figure 9.3

9.3.1. Sequence of welding

1. Weld the tail of the adapter. See figure 9.4. For sequence of stringer beads see cross section A-A. Complete the welds around the tail of the adapter.

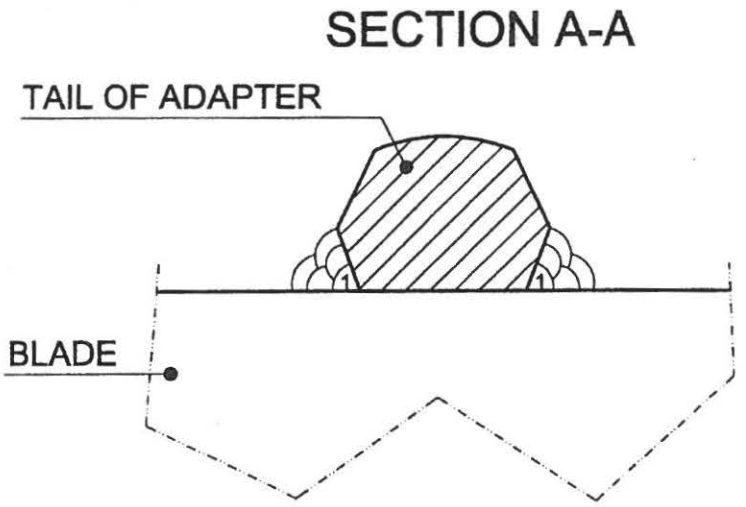


Figure 9.4

2. Weld 2 layers in the connection seams of the wings at the inner side of the cutter blade as shown in figure 9.5.

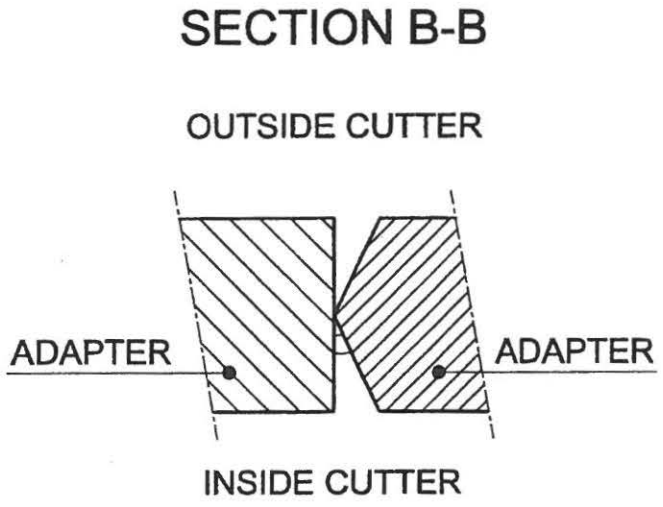


Figure 9.5

3. Weld the longitudinal seams between the wing and the cutter blade as shown in figure 9.6.
   Start with layer 1 and 2 in the seam at the inner side of the blade.
   Then weld layer 3, 4, 5 and 6 in the seam at the outer side of the blade.
   Then complete the weld at the inner side of the blade (layer 7 – layer n).
   Finally complete the weld at the outer side of the blade.

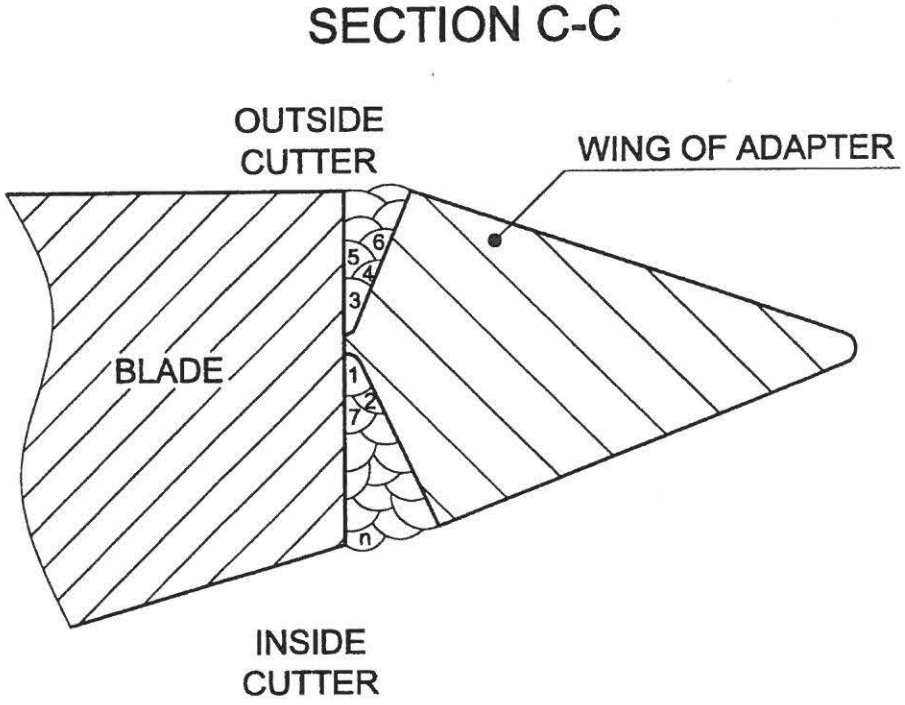


Figure 9.6

4. Complete the connection welds between the wings at the inner side of the cutter blade is shown in figure 9.7.

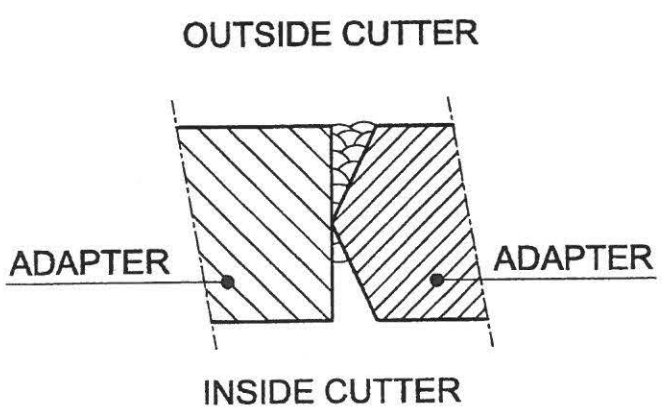


Figure 9.7

5. Complete the connection welds between the wings at the outer side of the cutter blade is shown in figure 9.8

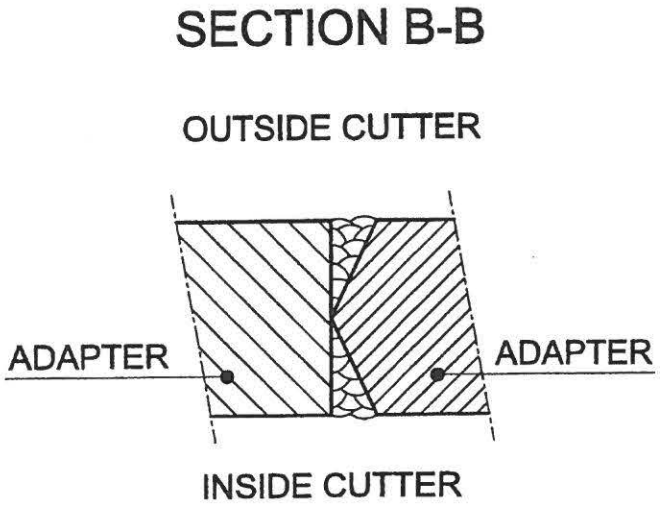


Figure 9.8

10. Repairing adapter noses

When clearance appears in the fitting of tooth on adapter it is recommended to rebuild the contact surfaces of the adapter. Rebuild the contact surfaces according to the following procedures, in order to avoid loss of teeth and heavy damaged irreparable adapter noses.

1. **Clean and inspect the adapter nose.** Clean the nose thoroughly and examine for cracks. A cracked nose is generally not worth rebuilding.

2. **Weld and grind contact surfaces.** (figure 10.1) Before performing any welding thoroughly preheat the adapter nose till 200°C. Only weld and grind the 4 upper contact-surfaces in order to get a tight fitting again. DO NOT weld the bottom surface because this is used as reference face.
   Filler materials:
   To build up the shape again use ESAB OK 48.00 or equivalent electrodes according to AWS A/SFA 5.1 E 7018 or DIN 1913: E51 53 B10.
   In case of very hard dredging conditions hardface welding is recommended. Then use ESAB OK Selectrod 83.28 or equivalent electrode according to DIN 8555:E 1-350.

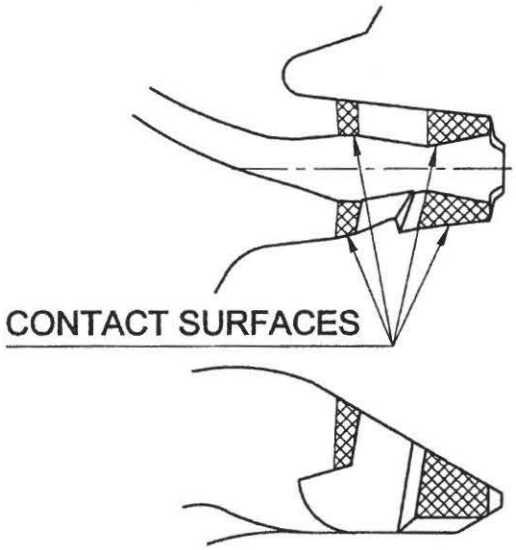


Figure 10.1

3. **Check fitting.** (figure 10.3) Weld and grind until fitting is tight as well as the slot for the locking has the right size. Use a gauge-tooth and chalk or paint to check fitting of the contact surfaces. Use a locking gauge-pin (figure 10.2) for checking the size of the slot. The minimum size is 21 mm, the maximum size is 23 mm.

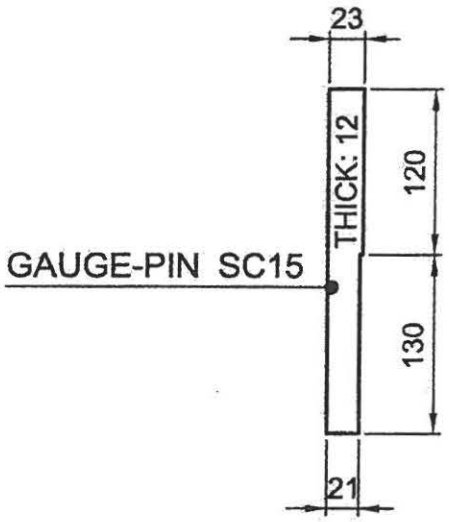


Figure 10.2

The gauge-tooth can be made of a new tooth. Cut out an inspection hole in one of the side surfaces of the tooth to be able to check the clearance between the adapter nose and the corresponding surface inside the tooth.

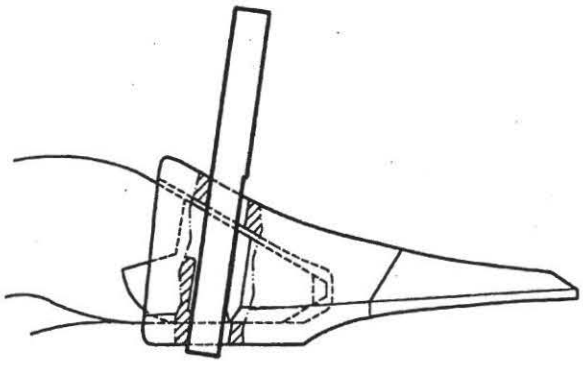


Figure 10.3

4. **Check clearance.** After obtaining a tight fitting on the contact surfaces and the right size of the slot for the locking, the clearance between the front face of the adapter nose and the corresponding surface inside the tooth has to be checked by using a gauge-tooth. The right clearance has to be as indicated in figure 10.4. If necessary weld and/or grind the front surface of the adapter nose to obtain the right clearance.

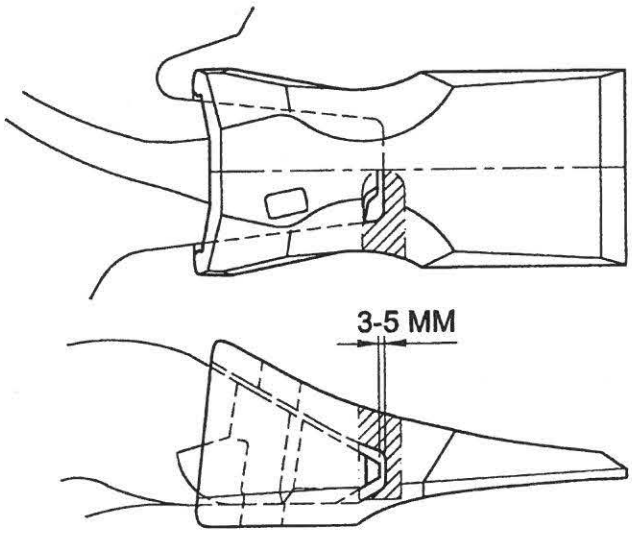


Figure 10.4