

Bucket Lip Review



Review of Whisler 10 Lip System at South American Mine Site.

*Review is based on field inspections of
P&H 2800 and P&H 4100 bucket lips.*

H&L® Tooth Engineering...

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H&L[®] report and comments are
 based on manufacturing of
 Industry Standard Whisler 10
 Adapter Systems.

*Review of P&H 2800 and 4100 Shovels including
 several spare dipper lips, used and new, being
 inspected.*

1.0 H&L Whisler 10 Design

The manufacturing of H&L Whisler 10 Adapters dates back to 1977. This first H&L Whisler 10 installation used H&L horizontal attached 40 series Uniforged[®] Tooth and Adapter replacements. Earliest OEM drawings (1965) set the Whisler 10 standard that continue today, thirty-nine years later.

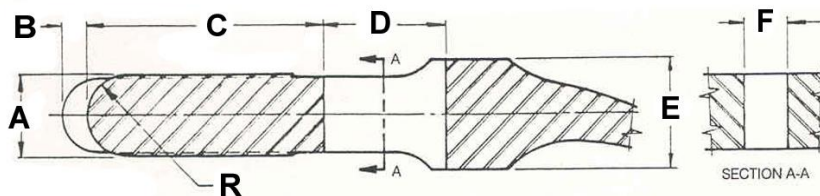
All manufacturers of replaceable teeth, adapters and attachment hardware for Whisler 10 mining products, should reflect established OEM lip standards. Those dimensional requirements are listed below.

H&L Whisler Adapter Lip sizing is based on OEM Manufacturer's drawings:

AmSCO: Lip #GA-38867(1965) - Abex: Gauge #GA-40397(1968)

Bucyrus: Lip #869468K1 and 2(1972), Gauge #G4C-869468(1975)

P&H: Lip #12J704(1967) & 12J849, Gauges G-55639 and G-55766(1975)



Dimensions taken from OEM drawings

Whisler	AMSCO	ABEX	BUCYRUS	P&H
A	5.00" +000-.016	5.00" GAUGE MAX	5.00" +000-.030	5.00" +000-.016
B	1.50"	1.50"	1.50"	1.50"
C	15.00"	15.00"	15.00"	15.00"
D	8.00"	8.00"	8.00"	8.00"
E	6.75" +000-.016	6.75" GAUGE MAX	6.75" +000-.030	6.75" +000-.016
F	2.75"	2.75"	2.75"	2.75"
R	2.50"	2.50"	2.50"	2.50"

2.0 Bearing Surfaces and Gauge requirement

Minimum movement between the Adapter and dipper lip edge is the main objective of the Whisler design. Horizontal movement is controlled by the stabilizer horn of the lip. The contact of the lip and Adapter controls the vertical movement in operation, and dictates the clearances that develop between the two. A snug fit in assembly is preferred. Publication M048.2004 shows the OEM specification requirement of the lip.

H&L produced gauging for Whisler 10 series attachment are constructed to these Industry standards. H&L gauges are manufactured in our forge facility in Tulsa, Oklahoma USA and are certified to reflect OEM requirements for field rebuilding of Whisler attachment dipper lips. For additional information and use of gauge hardware refer to H&L publications M007.2003, M018.2003, M019.2003 and M020.2003 (enclosed).

2.1 H&L Whisler 10 Part Weights

H&L Part Number	Weight in Pounds	Weight in Kilograms
510-TWC-546 Base Adapter	775.0#	351.5kgs
546RXH-R Tooth	205.0#	93.0kgs
546HL Flexhol Insert	1.0#	0.5kgs
546PN Flexhol Steel Pin	2.8#	1.3kgs
10 TWC Transverse Wear Cap	50.0#	22.7kgs
K-510-1 Wedge Key	47.0#	21.3kgs
K-510-9 Clamp Assembly*	55.0#	24.9kgs

**K-510-9 Assembly uses K-1396D replaceable ratchet lock*

2.2 Publication M007.2003

This publication offers Whisler 8, 10 and 12 lip dimensions reported by the bucket manufacturers and are considered industry standard. It also gives an overview in the use of H&L's X-2562-N Whisler attachment hole location gauge. Each Whisler 10 Adapter is forged, Lip coined and precision ground to produce minimum clearances between the Adapter and the dipper lip when assembled. See M029.2003 and M031.2003 showing grinding and gauge assembly at the factory

2.3 Publication M018.2003 and M019.2003

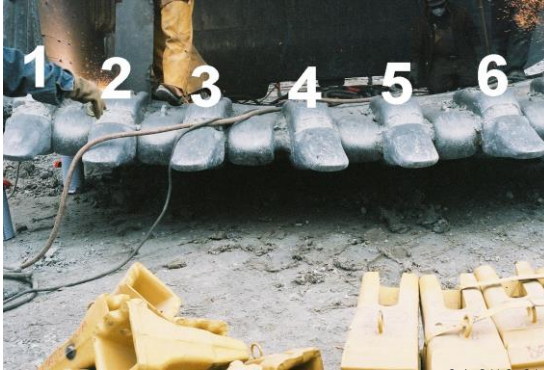
Gauge X-2562-N, checks for proper sizing of the lip attachment hole location. Sheet M018.2003 shows the inspection of a rebuilt Whisler system P&H 2800. This attachment hole does not required at tight tolerance, the 15.00"* as noted as "C" section 1.0 above can vary $\pm .38$ " without any problems being generated in assembly. This dimension effects the wedge key installation. If the dimension is greater then 15.00" the Key will stand above the Adapter with additional length. If the dimension is less then 15.00", the Key will slide further into the Adapter assembly.

**Dipper OEM lip layout, as seen on M048.2003, calls for a 15.00 dimension with a tolerance of $\pm .030$ " - $.000$ ". This tolerance for field repair and installation is not realistic in application.*

2.4 Publication M020.2003 and M048.2004

Lip check gauge, X-2562-V is made to the maximum allowed lip thickness, 5.00" front bearing and 6.75" on the rear pads. Additional lip dimension can be found on our published sheet M048.2004. This is a re-published gauge check guide with directions dated 1977 from an OEM.

3.0 Field Inspection and comments



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04.0110.02

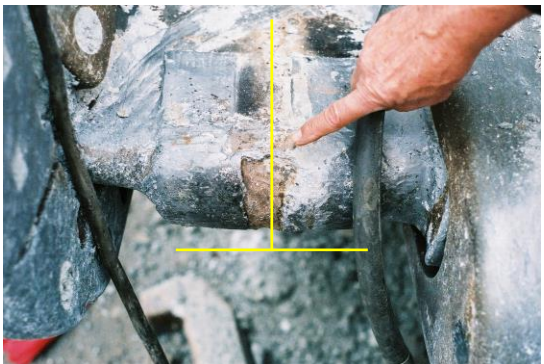
Pictured here is an in-production P&H 4100 dipper bucket with used Esco style Whisler 10 Adapter assemblies. The unit location numbers, looking into the bucket, are left to right 1 to 9 and listed this way through out H&L's report. H&L Whisler 10 Adapter assemblies are located on the ground earmarked for field replacement of Esco Product. Before looking at the lip connections, one can see that the spacing between 3-4-5 are not equal. This indicates that there is most likely horizontal movement between Adapter #4 and in the lip connection number 4. At best condition, the lip horn has failed requiring maintenance replacement or at worst condition, a complete lip overhaul at the attachment connection.



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Gauge X-2562-V maximum lip check and grinding profile. See publications M020.2003 for use. Also see M048.2004 for OEM dimensional review.

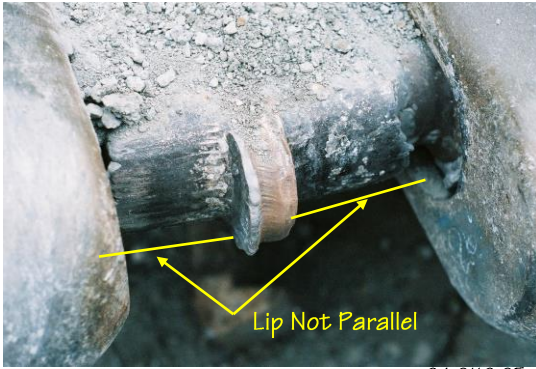
Gauge X-2562-N attachment hole location check. See publication M019.2003 for use.



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Lip location #1:
Stabilizer has broken off at the leading corner radii surfaces. The front radii do not seem to be perpendicular to the mounting hole. Flat bearing surfaces on the front have not been maintained to OEM specification. Bearing surfaces of the rear pad were not checked but show excessive material upsetting. In this condition adapter movement is of major concern.

Recommendation: Rebuilding of the lip position should be done prior to any testing.

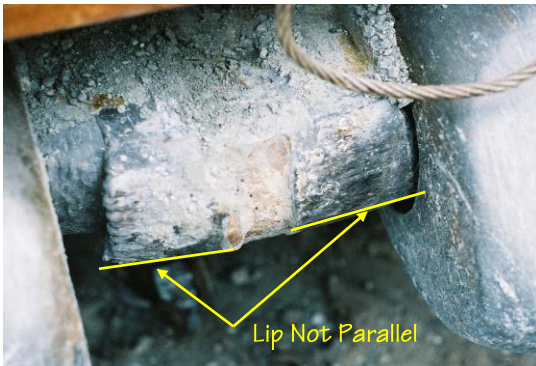


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Lip location #2:

Stabilizer shows contact on both sides of the vertical walls indicating adapter movement in operation. The front radii are not parallel and will not allow a proper adapter connection. Flat bearing surfaces on the front have not been maintained to OEM specification. Bearing surfaces of the rear pad were not checked but show excessive material upsetting. In this condition adapter movement is of major concern.

Recommendation: Rebuilding of the lip position should be done prior to any testing.

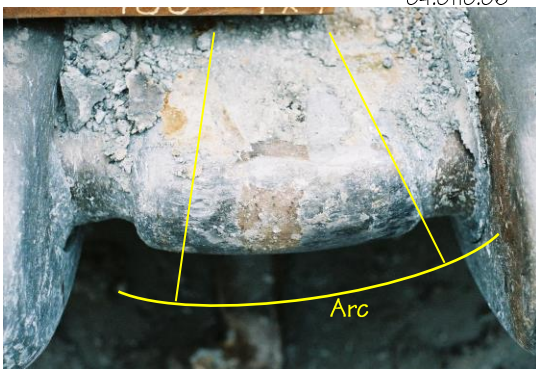


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Lip location #3:

Stabilizer has broken off at the leading corner radii surfaces. The front radii are not perpendicular, improper adapter connection will be the result. Flat bearing surfaces on the front have not been maintained to OEM specification. Dirt fines remain intact at the stabilizer and radii-bearing surface indicating that there has been no contact at any time. Bearing surfaces of the rear pad were not checked but show excessive material upsetting. In this condition adapter movement is of major concern.

Recommendation: Rebuilding of the lip position should be done prior to any testing.

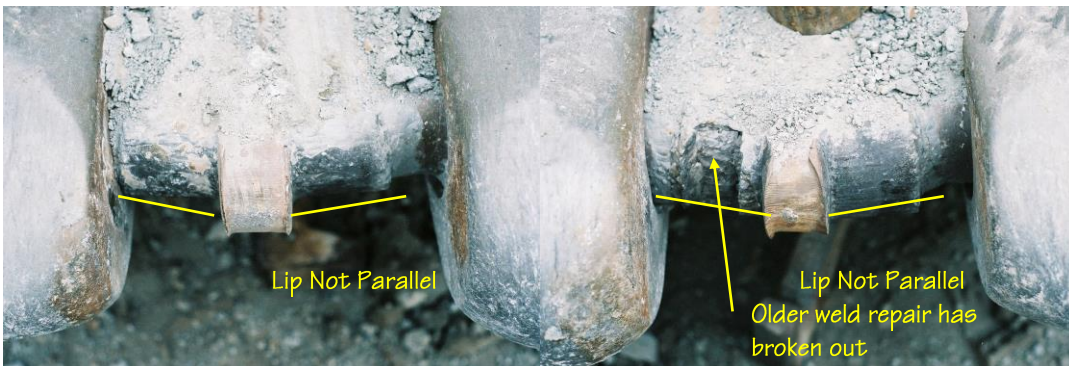


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Lip location #4:

The front radii surface is completely rounded, adapter assembly pivoting from the key/clamp attachment has created lip arcing. Indication of an assembly problem can be seen in picture 04.0110.01 prior to removal of the Wh-10 Assembly. Dirt fines remain intact at the radii-bearing surface indicating very little contact between adapter and the lip.

Recommendation: Rebuilding of the lip position should be done prior to any testing.

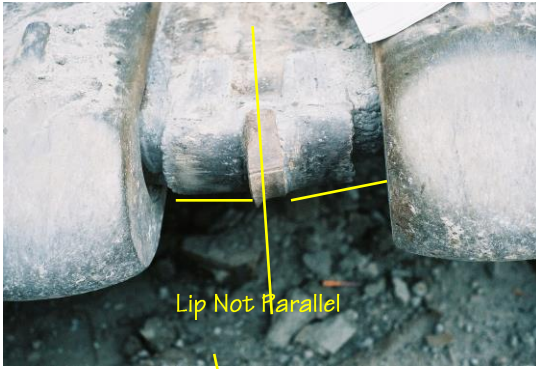


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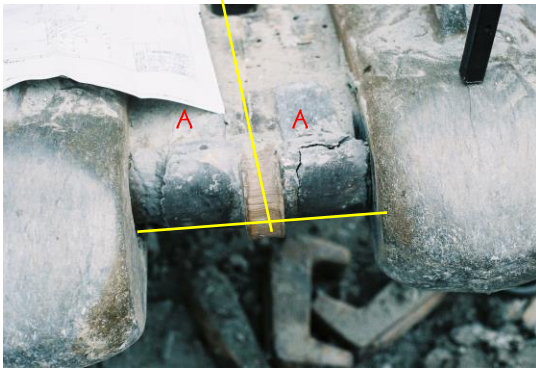
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Lip location #5 and #6: Both stabilizers show contact on either sides. Position #6 has upset lip material on the vertical stabilizer wall indicating massive adapter movement in operation. The front radii are not parallel to each other. Flat bearing surfaces on the front have not been maintained to OEM specification. The rear bearing pads show signs of movement as all other adapter to lip locations.

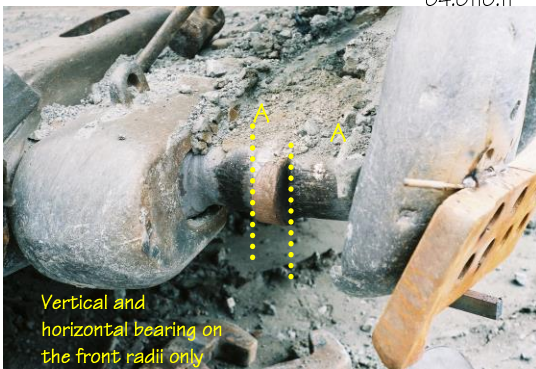
Recommendation: Rebuilding of the lip position should be done prior to any testing.



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04.0110.11



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Lip location #7:

Stabilizer shows contact on both sides of the vertical walls indicating adapter movement in operation. The front radii are not parallel and will not allow a proper adapter connection. Flat bearing surfaces on the front have not been maintained to OEM specification. Flat bearing surfaces of the rear pad were not checked but show excessive material upsetting.

Recommendation: Rebuilding of the lip position should be done prior to any testing.

Lip location #8:

Prior stabilizer repair worked fairly well. Horizontal side movement exists at location #8, but less movement than all others. The previous weld repair seen here has failed and a lip peeling crack starting at the top radius, extending approximately 12” towards the mounting hole on the bottom surface was noted, cracking was created by an improper adapter to lip radii contact. Vertical loads should be transferred into the flat bearing surfaces. The lip bearing surfaces “A” are undersized and did not allow the vertical stabilization of the adapter.

Recommendation: Rebuilding of the lip position should be done prior to any testing.

Lip location #9:

Stabilizer show some contact on both sides of the vertical walls indicating a little adapter movement in operation. The front radii from a prior weld rebuild, shows a little contact near each side of the stabilizer. Flat bearing surfaces on the front are not maintained to OEM specification allowing vertical movement in operation. Flat bearing surfaces was covered with dirt fines, this indicates minimum to no vertical load distribution being placed onto the lip flats noted as “A”.

Recommendation: Rebuilding of the lip position should be done prior to any testing.

4.0 Additional Comments

Spare lips have been repaired many times. Field statements indicate that the repair criteria of the past were fit adapters to the lip edge and weld the lip to hold tight with the wedge key. Little regard to Whisler 10 designed bearing thickness and stabilization or mounting hole location tolerances was present.



There were no signs of the machine manufacturer guidelines for Whisler 10 adapter mounting or lip repair requirements. Spare buckets for P&H 2800 and 4100 was in the maintenance yard awaiting rebuild. Their condition is no better or worse than the P&H 4100 that was in use.

Lip thickness was larger than the maximum allowed by P&H print. This new lip requires grinding prior to placement.



Note the perpendicular alignment between the stabilizer/mounting hole and the radii surface on each side of the stabilizer. THIS IS A GOOD ALIGNMENT.

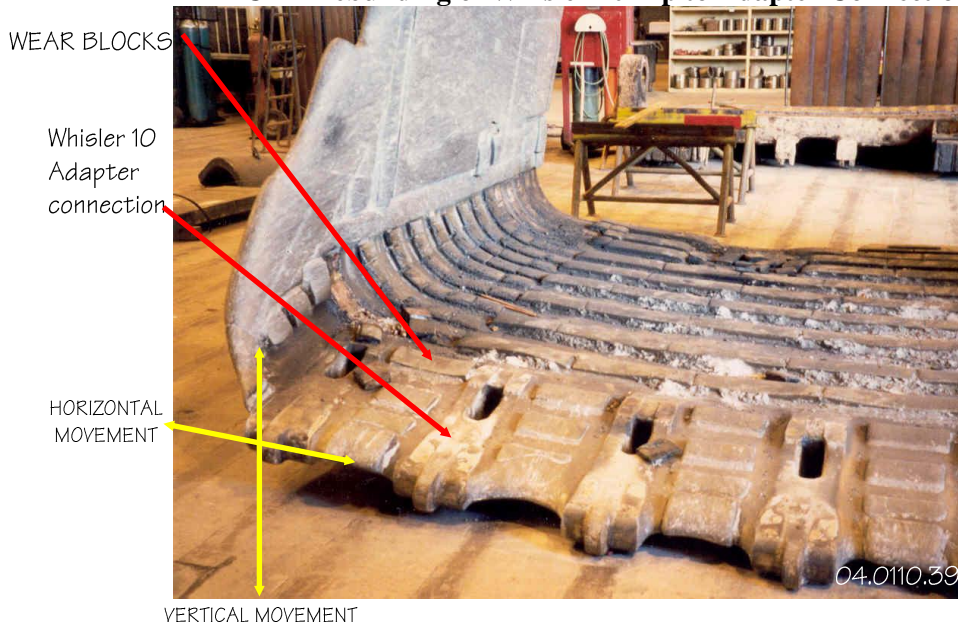
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Further evidence that the OEM has not offered additional maintenance rebuild information is mine maintenance personnel had purchased a new spare P&H 2800-bucket lip for installation. When we checked this new lip to the factory requirement (X-2562-N Gauging) we found that the flat bearing surfaces were all over the maximum allowable tolerance that all manufacturers specify, including P&H (reference P&H gauge drawings G-55639 and G-55766 from 1975).

5.0 Recommended Weld Rebuilding of Whisler 10 Lip

TYPICAL Rebuilding of Whisler 10 Lip to Adapter Connection.



Shown here is a typical rebuilding of a Whisler 10 adapter system from a mine site in Arizona, USA.

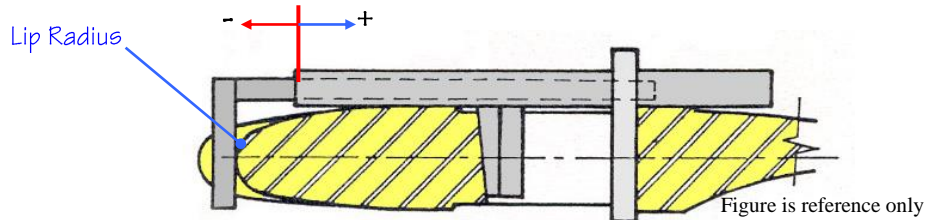
Mine maintenance personnel elected to not use lip shrouding provided by the OEM. Instead, they weld into position wear blocks that are replaced during scheduled shop maintenance. Increased weld time is involved, but overall downtime has been reduced by not requiring precision fit of the shroud positions during maintenance.

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VERTICAL MOVEMENT

1. Check lip fit with a precision made repair/check gauge. H&L offers two gauge that check two different fits of a Whisler design. Gauge X-2562-N checks for proper hole mounting and X-2562-V for weld and grind fits.
2. Use a soapstone and gauge X-2562-N, mark the gauge and measure the difference between the soapstone mark and gauge line created with part A and part B as noted on publication M018.2003 and M019.2003, dimension should not exceed .240"/6mm in either direction. A smaller (+) or larger (-) wedge Key could be required to assemble the adapter. The rear of the hole can also be checked, a less critical dimension, by measuring the difference of line location of part B and part C.

Note that if the mounting hole alignment exceeds $.380''/10\text{mm}$ in either direction repair for hole location should be done. If a measurement of over $.38''$ to the negative (-) side, welding of the lip radii will be needed to bring the measurement back into factory tolerance. If a measurement of over $.38''$ to the positive (+) side, grinding will be required to match the factory tolerance.



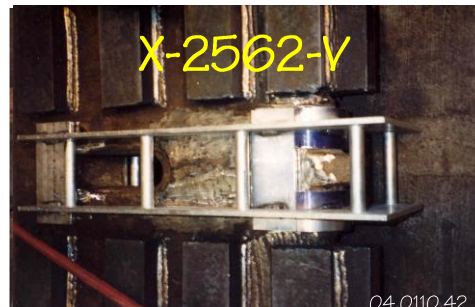
3. With the mounting hole correctly established as note above, the lip bearing pads can be inspected. Front radii and bearing surfaces as well as the rear bearing pads of your lip needs to be checked for excessive wear, this is done by installing gauge #X-2562-V to your lip, see publication M047.2004. Grinding of up-set lip material due to adapter movement prior to placing gauge on the lip areas to be maybe required.
4. When the pad surfaces become greater then the recommended $.080''/2\text{mm}$ clearance limit on the front bearing between lip and check gauge or H&L's recommended $.240''/6\text{mm}$ on the rear pads; maintenance rebuilding should be done. Please note that these clearance dimensions and tolerances as stated are only guidelines, they represent what H&L and OEM's considers a best connection of adapter and lip during operations. These tolerances supply peak performance of the Whisler 10 system. (Note publication M048.2004 and/or see 1.0 of this report for OEM finish grind specifications of new and rebuilt lips.)
5. After determining where and what area of the lip rebuilding is to be done, using gauge # X-2562-V as a guide, weld placement to the lip radii, front and rear bearing pads as needed. Be sure to add enough weld material to all effected areas so that grinding to size can be done. At no time should weld passes remain unground or used in operation without finish grinding. A reminder; OEM specification require the bearing radii, front and rear bearing pads to be within 60% contact between gauge and lip surfaces, referenced on M048.2003.
6. If Required: When mounting hole rebuild is required, position gauge X-2562-N at nominal (align part A to part B to part C) weld the mounting hole front radius as required. Remember that when assembling the wedge Key it must contact the rebuild hole radii completely for proper adapter installation. After completion of any hole rebuilding, re-check the fit by placing X-2562-N onto the lip.

7. Once rebuild is completed and verified with gauges X-2562-N and X-2562-V, bucket and adapter assembling can begin.



Shown here is the same Arizona Whisler 10-bucket lip with rebuilding being completed.

Note that all weld passes have been ground to fit lip gauging, passing the OEM standards that have been established



Pictures show a typical gauge inspection of a rebuild Whisler 10-bucket lip. Work being performed by an Arizona mine maintenance group. This Whisler 10 system does not use wear shrouds between the adapter assemblies, they use weld-on replaceable blocks.

6.0 Conclusion

Maintenance Personnel have been welding, arc removal and grind repairing shovel bucket lips for years. Rebuild work is being performed by mine personnel and qualified technicians, a different rebuild direction is the only thing that is needed. It appears that, in this case, the Whisler 10 precision fit criteria has not been supplied to the mine by the OEM machine manufacturer, nor their current adapter supplier. There is no doubt that if this information had been supplied to Maintenance, their field technicians would have been using that rebuild procedure to increase time between scheduled preventative maintenance.

Minimizing the adapters to bucket lip connection clearances will reduce related field problems in the field, existing fit problems have been created by excessive horizontal and vertical movement of the adapter in operation. A large clearance in fitting between the adapter and lip at the beginning of maintenance cycle will only get larger in operation. This will create accelerated lip distortion and upsetting of lip materials that create increases in field maintenance repairs with shorter cycle times.