(4) Changing the Manganese Liners

(a) Removing the Cone Crusher Feed Box

NOTICE

To change the concave it is necessary to begin by lifting the feed conveyor fully up. Once conveyor is raised the feed box (Item 1, Ref: Figure 9.79) must be removed using the lifting points. It is now possible to lift off the cone upper frame complete with the concave inside.

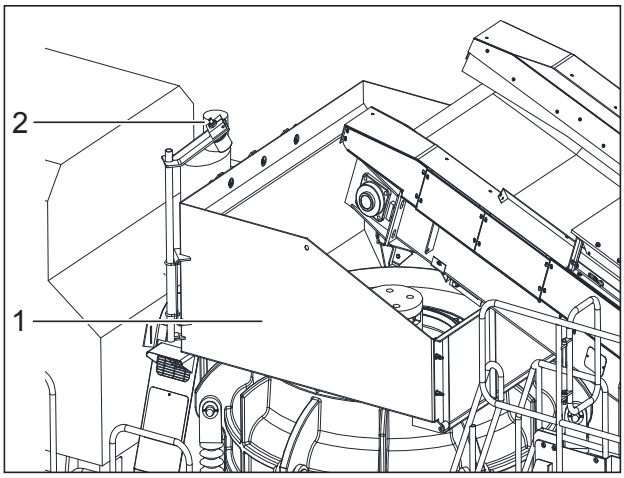

Figure 9.79 - Cone Feed Box

Ensure that the feed box level sensor (Item 2, Ref: Figure 9.79) and the spray bar water hose are disconnected before carrying out the procedure.

PROCEDURE

1. Observe all safety warnings.
2. Shut down the machine and implement the lockout and tag out procedure.
3. With suitable lifting equipment, attach chains to the feed box lifting eyes (Items 1, Figure 9.80) Ensure that the lifting equipment is able to lift 2500 kg's (2.8 US Ton). This weight allows for dirt or excess material in the feed box.

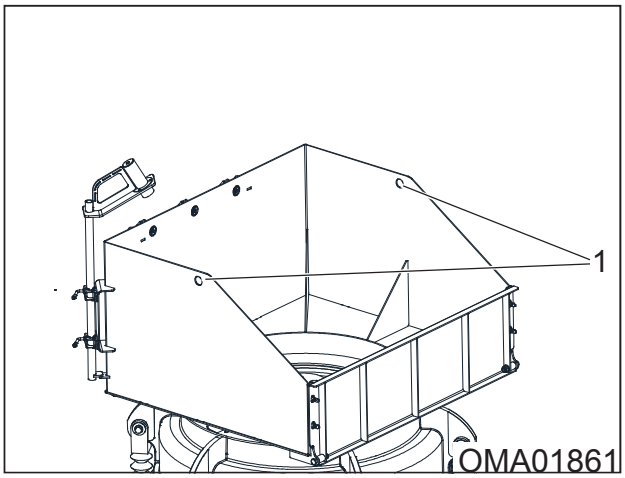

Figure 9.80 - Crusher Feed Box Lifting Eyes

4. Carefully take the slack off the chains.

5. Remove the securing bolts around the base of the feed box (there are 12 in total).
6. Using the lifting equipment carefully raise the feed box off the cone crusher.
7. When assembly is clear of the machine, carefully set it down in a suitable area.

(b) Removing the Upper Frame

NOTICE

To change the concave, it is necessary to lift off the cone upper frame complete with the concave inside. However, the feed box must be removed first to do so.

The hydraulic cylinder clevis pins must be removed from right to left when facing the machine. Doing so avoids disturbing the bearing located against the shoulder inside each lug on the upper frame.

Before lifting the removable parts refer to the cone lifting decal and component weights table for the weights. ("Table 2.2 - Safety Signs" on page 2-9) and ("(1) Cone Crusher Component Weights" on page 3-12)

To easily and safely remove the upper frame, it is essential to first release the wedge ring. The following procedure explains how to do so.

⚠ WARNING

When removing the clevis pins from the hydraulic cylinders, ensure that the hydraulic cyllinder is laid down flat. Failure to do so can result in serious injury.

⚠ DANGER

Ensure that the wedge ring is free when initially lifting off the upper frame assembly. Care must be taken when removing the upper frame, as there is a possibility the wedge ring can re-engage again and cause sudden/violent movement. Ensure that all personnel are located a safe distance from lift.

Under no circumstances attempt to take the load on the lifting equipment at this stage as a serious overload condition can arise.

Do not neglect to ‘lockout’ to prevent the machine being started while maintenance work is being carried out. Failure to do so can result in serious injuries or death.

PROCEDURE

1. Observe all safety warnings
2. Start the engine
3. On the main menu press the crusher setup button (Item 3, Ref: Figure 9.81).

   » *The crusher setup screen (Ref: Figure 9.82) displays.*

Figure 9.81 - Main Menu Screen

4. On the crusher setup screen, increase the gap setting (Item 1, Ref: Figure 9.82) to maximum by pressing the increase gap button (Item 2, Ref: Figure 9.82).

Figure 9.82 - Crusher Setup Screen

5. Close (turn clockwise) the shut off valve (Item 1, Ref: Figure 9.83) to isolate the wedge ring hydraulic circuit from the main hydraulic system.

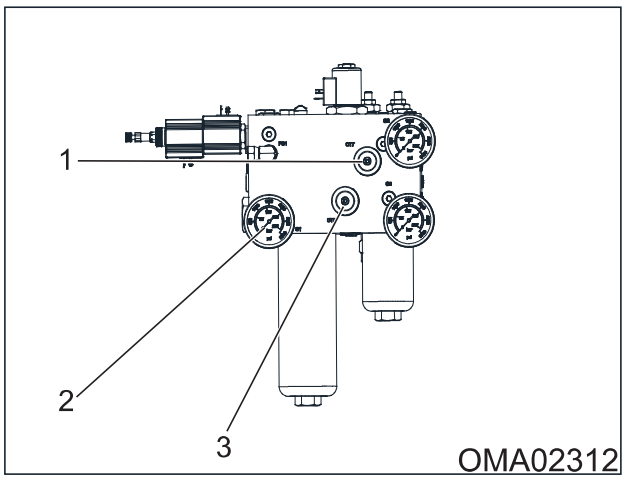

Figure 9.83 - Hydraulic Panel

6. Open (turn anti clockwise) the shut off valve (Item 2, Ref: Figure 9.83) to allow all pressure in the wedge ring circuit to be released thereby removing the loading from the wedge ring.
7. On the crusher setup screen drop the upper frame slightly with the decrease gap button (Item 3, Ref: Figure 9.82) to push the wedge ring down and thus free it from the main frame to provide clearance needed to lift off the upper frame.

   » *The wedge pressure indicated on the pressure gauge drops away to 0-28 Bar (0-400 psi) as the wedge ring frees off.*

8. With suitable lifting equipment (capable of lifting 5260 kg / 5.8 US Ton), connect lifting tackle to the three lifting eyes on the upper frame (Ref: Figure 9.84)

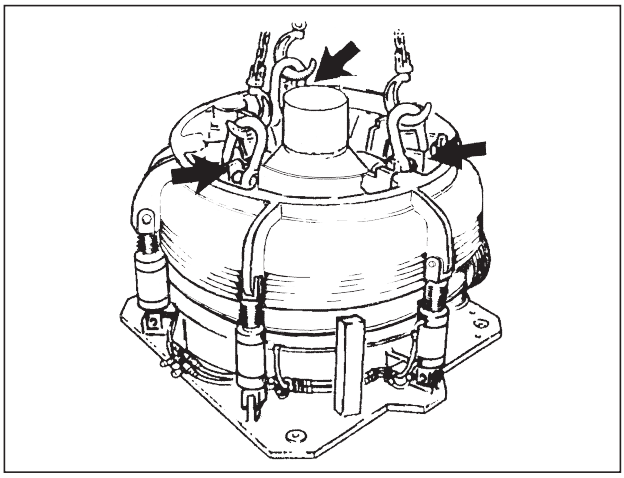

Figure 9.84 - Cone Crusher Lifting Points

9. Space three 5 tonne capacity x 150 mm stroke hydraulic bottle jacks spaced equidistant around the lower rim of the upper frame, extend them equally to take the weight off the clevis pins to aid their removal.
10. With the engine off and the control panel switched on enter the crusher setup mode (Ref: Figure 9.85).

Figure 9.85 - Cone Setup Screen

11. Ensure that there is no residual hydraulic pressure in the upper frame hydraulic cylinder circuit. Do so by pressing the increase and the decrease gap button (Items 1 & 2, Figure 9.85) in quick succession. Perform the button presses until the pressure gauge (Item 1, Figure 9.86) on the hydraulic panel reads zero. (Caution - Pressure gauge (Item 1, Figure 9.86) does not show pressure in the ram bore).

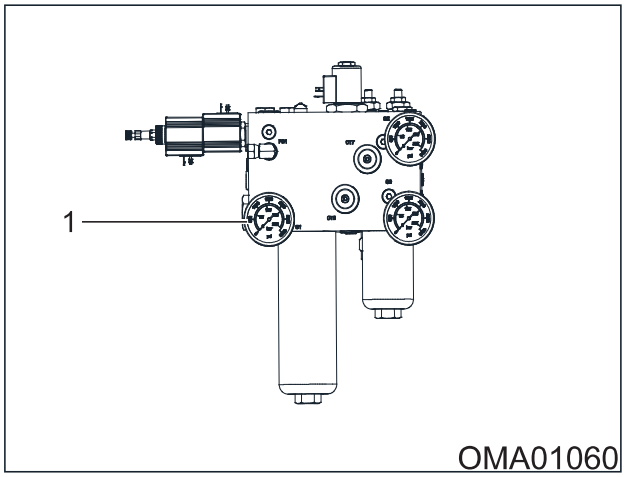

Figure 9.86 - Pressure Gauge

12. Shut down and lockout the machine before proceeding further.
13. Remove the top clevis pin (Item 1, Ref: Figure 9.87) from each hydraulic cylinder (Item 2, Ref: Figure 9.87) and pull each cylinder outwards, allowing them to lie in the rested position.

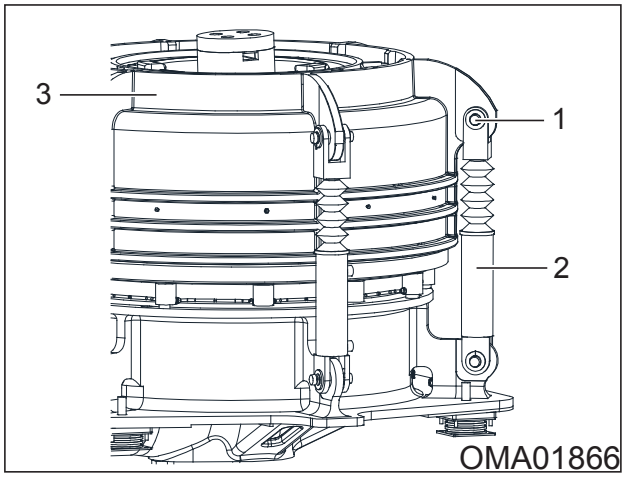

Figure 9.87 - Frame Assembly

14. Lift off the upper frame assembly (Item 3, Ref: Figure 9.87) from the machine. The upper frame must be lifted square. (Support on wooden blocks on the ground).

(c) Removing the Concave

⚠ WARNING

Wear personal protective equipment.

Lockout machine

Falling hazard.

When gas cutting through the concave it is essential that the correct personnel protective equipment is worn.

NOTICE

The concave ring is held in place in the Upper Frame by a self tightening gun lock arrangement that automatically tightens the manganese steel concave on the concave wedges as the ring stretches under the crushing load.

Before lifting the removable parts refer to the cone lifting decal and component weights table for the weights. ("Table 2.2 - Safety Signs" on page 2-9) and ("(1) Cone Crusher Component Weights" on page 3-12)

The upper frame should be supported on wooden blocks so that there is sufficient space for the concave to be driven out.

PROCEDURE

1. Observe all safety warnings.
2. Following removal of the upper frame, gas cut through the three lugs (Item 2, Ref: Figure 9.88).
3. Drive down and out the old concave with a heavy sledge hammer.
4. Remove the old backing material and dowels (these can be driven out from below) and inspect the lower inside bevelled edge of the upper frame seating where the surface has been ground. Remove any nicks or burrs with a file or grinder. Inspect the ground surfaces of the new concave and remove any nicks or burrs in the same manner.

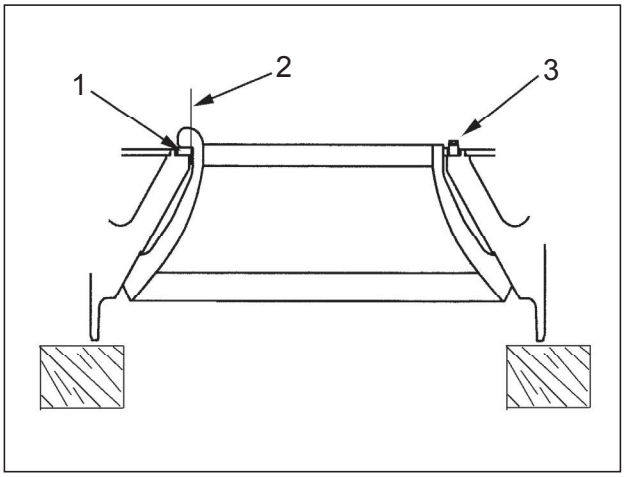

Figure 9.88 - Gas Cutting the Old Concave

1 Concave Wedge
2 Gas Cutting Line
3 Dowel Pin

(d) Mounting the Concave

NOTICE

When supporting the new concave prior to lowering the upper frame on to it, ensure that the supports do not protrude past the sides of the concave (Item 5, Ref: Figure 9.89) and that it is high enough off the ground to allow the upper frame to be fully lowered.

Release agent needs to be applied to the internal surface of the upper frame where it will be in contact with the backing filler to ease separation when the manganese is next changed.

The concave wedges must be inserted evenly so that the concave ring is centrally located within the upper frame.

After mixing, the filler must be poured IMMEDIATELY to ensure complete penetration If there is a gap between the concave wedge and the dowel pin and this cannot be rectified by moving the wedge position, it may be necessary to tighten the wedges and then weld a piece of steel between the wedge and the dowel pin(s).

Before lifting the removable parts refer to the cone lifting decal and component weights table for the weights. ("Table 2.2 - Safety Signs" on page 2-9) and ("(1) Cone Crusher Component Weights" on page 3-12)

⚠ WARNING

Wear personal protective equipment.

Lockout machine.

PROCEDURE

1. Observe all safety warnings.
2. Apply release agent (obtainable from Terex) to the cleaned inner surface of the upper frame.
3. Place the new concave on three wooden blocks (Ref: Figure 9.89) ensuring it is level.

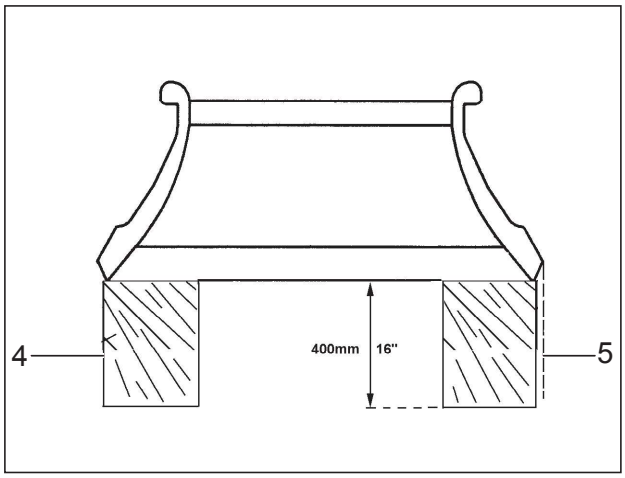

Figure 9.89 - Supporting the New Concave

4. Lift the upper frame over the concave and turn it so that the concave lugs align with the recesses on the upper frame and gradually lower the upper frame until concave lugs pass through the recesses and stop lowering.

5. Rotate the upper frame to the left so that the concave lugs are located approximately 50 mm (2”) past the dowel holes.
6. After rotation, equally locate the concave wedges (Items 1, Ref: Figure 9.90) between the concave lugs (Items 4, Ref: Figure 9.90) and upper frame.

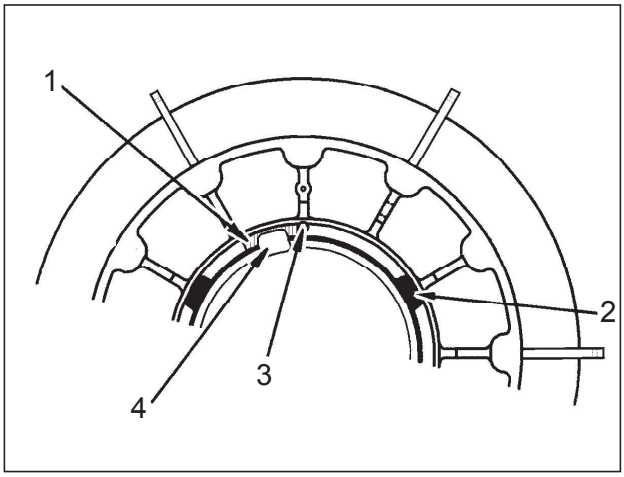

Figure 9.90 - Plan View of the Upper Frame Showing the Correct Wedge Position

7. An estimate should be made of the correct position for the concave wedges and then tapped in slightly to see how the concave settles. If the position does not look correct with respect to the dowel holes then they should be removed and replaced.
8. Also check to see that the concave is evenly seated on the machined surfaces at the bottom and there is an equal depth all around at position 1 (Ref: Figure 9.91).

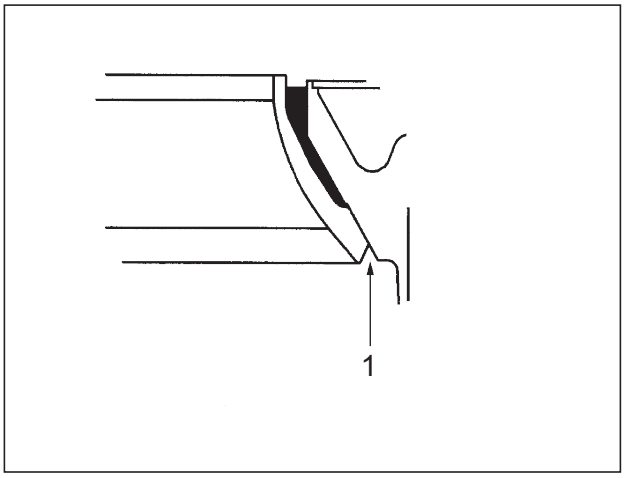

Figure 9.91 - Sectional View of the Concave Showing the Gap Check at Position 1

9. If there is a gap between the two the concave must be properly re-seated. Once the position is satisfactory and the concave is correctly seated, the wedges (Items 1, Ref: Figure 9.90) should be driven fully home.
10. Insert the dowels pins (Item 3, Ref: Figure 9.90) into the holes in the upper frame and drive home.
11. Prepare filler pouring ports with putty by making three weirs around the recesses (Items 2, Ref: Figure 9.90) of the upper frame so the filler cannot leak out.
12. After the weirs are completed prepare the filler (Ref: "(2) Filler Handling" on page 9-110) and pour the correct quantity of mixed filler into each weir by turns.

13. Stop pouring when the filler has reached 12-25 mm (1/2-1”) below the top of the concave. The replacement is now complete. (Refer to "(a) Filler Hardening Time" on page 9-111 for the filler hardening time).

(e) Changing the Mantle

NOTICE

The operation is carried out with the head left in situ. The internal parts of the cone crusher are therefore not disturbed or exposed to harmful dust.

In use all manganese steel will ‘creep’ due to the nature of the material. When creep occurs stress is created in the material which will have to be relieved by suitable cutting of the Mantle. This will be necessary in order to facilitate removal.

Before lifting the removable parts refer to the cone lifting decal and component weights table for the weights. ("Table 2.2 - Safety Signs" on page 2-9) and ("(1) Cone Crusher Component Weights" on page 3-12)

The mantle nut wrench (Item 2, Ref: Figure 9.93) is not to be used as a lifting device. It is to be used to loosen the mantle nut and then removed.

NOTICE

Always change the mantle nut and mantle nut cap as pair, as a mismatch between worn and new parts can lead to fasteners coming loose and rapid initial wear.

(f) Removing the Mantle

⚠ WARNING

Wear personal protective equipment.

Lockout machine.

Falling hazard.

When gas cutting through the concave it is essential that breathing apparatus is worn as when the metal is broken through the backing material gives off toxic fumes.

PROCEDURE

1. Observe all safety warnings.
2. With the Upper Frame removed gas cut round the mantle within 20-30 mm (¾” -1¼”) from the top (Item 1, Ref: Figure 9.92).

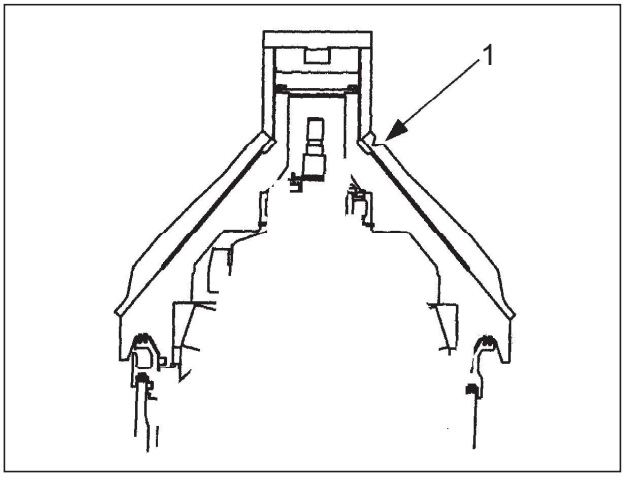

Figure 9.92 - Gas Cutting the Mantle

- (Item 1, Ref: Figure 9.92) Gas cut here.

3. Once the mantle is cut the mantle nut can then be removed by turning clockwise with the mantle nut wrench (Item 2, Ref: Figure 9.93). Ensure that the mantle nut wrench is secure by dropping a suitably sized bolt through the hole in the end of it (Item 1, Ref: Figure 9.93).

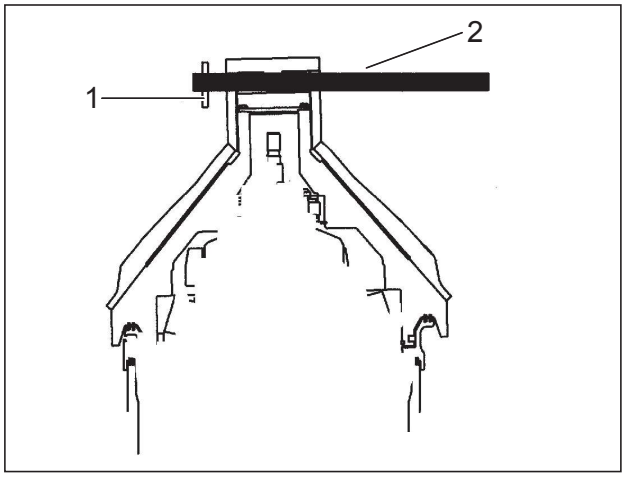

Figure 9.93 - Mantle Nut Wrench Securely Fitted

4. Break loose the fit between the mantle and the cone head. This is best achieved by striking the lower section of the circumference with a hammer then levering the Mantle clear of the cone head.

5. Insert short blocks of wood (Item 2, Ref: Figure 9.94) between the mantle and cone head in three places around the circumference so as to leave a gap through which lifting chains can be placed. Three equally spaced lifting chains (Item 1, Ref: Figure 9.94) should be passed through this gap and the hooks put round the bottom of the mantle and the mantle lifted off.

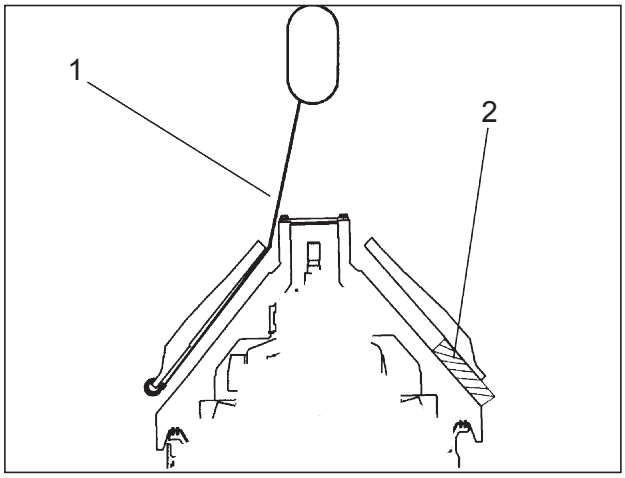

Figure 9.94 - Lifting Chains Correctly Fitted Sections through the Cone Head

6. Remove the old backing material and inspect the cone head seating where the surface has been ground. Remove any nicks or burrs with a file or grinder. Inspect the ground surfaces of the new mantle and remove any nicks or burrs in the same manner.

(g) Mounting the Mantle

NOTICE

After mixing, the filler must be poured IMMEDIATELY to ensure complete penetration.

When the mantle nut is removed, grease the threads on the cone head so any spills when pouring the backing filler can be easily wiped off.

Release agent needs to be applied to the cone head where it will be in contact with the backing filler to ease separation when the manganese is next changed.

Before lifting the removable parts refer to the cone lifting decal and component weights table for the weights. ("Table 2.2 - Safety Signs" on page 2-9) and ("(1) Cone Crusher Component Weights" on page 3-12)

⚠ WARNING

Wear personal protective equipment.

Lockout machine.

Falling hazard.

PROCEDURE

1. Observe all safety warnings.
2. Apply release agent (obtainable from Powerscreen) to the un-machined surface all around the Cone Head (Item 1, Ref: Figure 9.95).

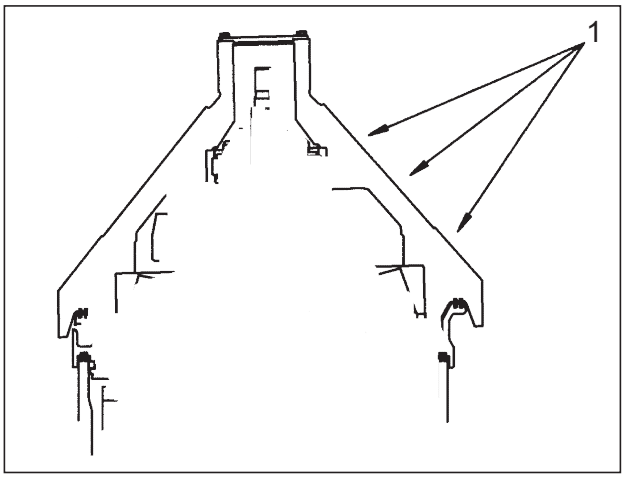

Figure 9.95 - Section through the Cone Head Showing Where to Apply Release Agent

3. Place the new mantle onto the cone head and tighten down the mantle nut by turning counterclockwise with the mantle nut wench (Item 2, Ref: Figure 9.96). It is sufficient to tighten this by hammer blows without having to replace the upper frame and wedge against the concave.

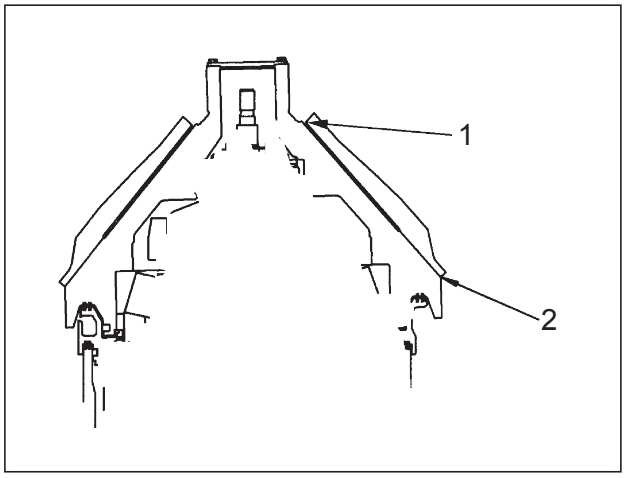

Figure 9.96 - Section through the Cone Head Showing Correct Filler Level

4. The mantle nut is tightened to align the mantle and seat it firmly on the cone head at position 1 (Ref: Figure 9.96). Now the Mantle Nut needs to be released so that the filler can be poured. Release the Nut by turning CLOCKWISE with the Mantle Nut Wrench.
5. Prepare the filler (Ref: "(2) Filler Handling" on page 9-110) and pour the correct quantity of mixed filler at the top of the Mantle making sure it is equally distributed all round.
6. When the filler reaches 15 mm from level 2 (Ref: Figure 9.96) stop pouring, fit the Mantle Nut and first lightly tighten using the Mantle Nut Wrench. Fully tighten by hitting the wrench with a hammer in a COUNTERCLOCKWISE direction. The replacement is now complete. (Refer to "(a) Filler Hardening Time" on page 9-111 for the filler hardening time).

(h) Replacing the Upper Frame

NOTICE

Whilst the upper frame is off the machine for the renewal of the manganese wearing parts, take the opportunity of examining the condition of the internal liner plates, frame and counter shaft arm shields and replace if necessary.

Also, clean out any solidified debris and generally check around the machine for any faults which need to be rectified.

Clean the contact face all around the Wedge Ring and apply a coating of fresh lubricant (MOLY-BENTONE MP Standard Grade grease). DO NOT OVER GREASE. Make sure this is not contaminated with dirt or grit prior to replacing the upper frame.

The clevis pins must be inserted from right to left when facing the machine. Doing so, avoids disturbing the bearing located in it's required position against the shoulder inside each lug of the upper frame.

Before lifting the removable parts refer to the cone lifting decal and component weights table for the weights. ("Table 2.2 - Safety Signs" on page 2-9) and ("(1) Cone Crusher Component Weights" on page 3-12)

PROCEDURE

1. Observe all safety warnings.
2. Using the suitable lifting equipment that was used to remove the upper frame, lower over the machine whilst taking care to line up the anti rotation stop on the upper frame with the guide post. Hold in a suspended position with the crane with a gap between the mantle and concave.
3. Start the engine.
4. On the main menu screen press the crusher setup button (Item 3, Ref: Figure 9.97).

   » *The crusher setup screen (Ref: Figure 9.93) displays.*

Figure 9.97 - Main Menu Screen

5. On the crusher setup screen press the increase and decrease gap buttons (Items 1 & 2, Ref: Figure 9.98) to increase or decrease the gap (as appropriate). Only one cylinder will respond at any one time. Toggling between the buttons, line up and insert each of the six clevis pins in turn.

Figure 9.98 - Crusher Setup Screen

6. Secure with the washers and split pins.
7. Detach the suitable lifting equipment and replace the feed box.
8. Reconnect the level sensor and the water pipe on the feed box.
9. Take steps to restore the wedge ring pressure by returning to the crusher hydraulic system. Open the shut off valve (Item 1, Ref: Figure 9.99) to revert to the operating position.

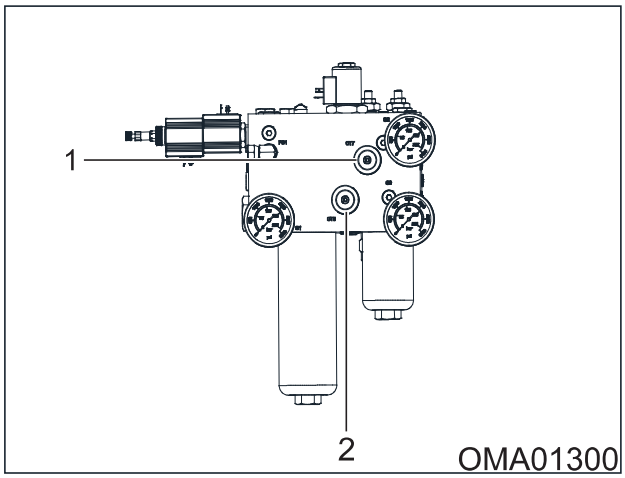

Figure 9.99 - Main Menu Screen

10. Close the shut off valve (Item 2, Ref: Figure 9.99) to revert to the operating position.
11. Do not operate the machine for at least 12 hours to allow the filler to set (Ref: "(a) Filler Hardening Time" on page 9-111).
12. It is necessary to reset the wear indicator and set the zero position for the new liners.

(5) Wear Calibrations

NOTICE

The maximum liner wear that is permitted is approximately 50 mm, when it reaches 50 mm the liners MUST be changed. It is good practice to 'Zero' the cone crusher every morning to account for any wear from the previous day. It is also recommended that the adjustment cylinder mounting pin centers are measured on a daily basis (Ref: "(1) Guidance for Changing the Manganese Mantle and Concave" on page 9-107). Perform the measurement when the crusher is in the metal to metal position.

The cone must not be running during this procedure. Ensure that there is no stone lodged in the crushing chamber.

If wear calibration needs performed refer to "(d) Crusher Re-metal Procedure" on page 9-139.

(a) Cone Crusher Controls Layout

NOTICE

The cone crusher is controlled from the built-in PLC within the control panel. The layout, functions, and displays are described on the following pages.

PROCEDURE

1. Observe all safety warnings.
2. Start the engine.
3. On the main menu screen press the crusher setup button (Item 3, Ref: Figure 9.100).

   » *The crusher setup screen appears (Ref: Figure 9.101).*

Figure 9.100 - Main Menu Display Screen

4. Use the corresponding button on the control panel to select the displayed icons. The table ("Table 9.7 - Icon Descriptions" on page 9-133) gives icon descriptions.

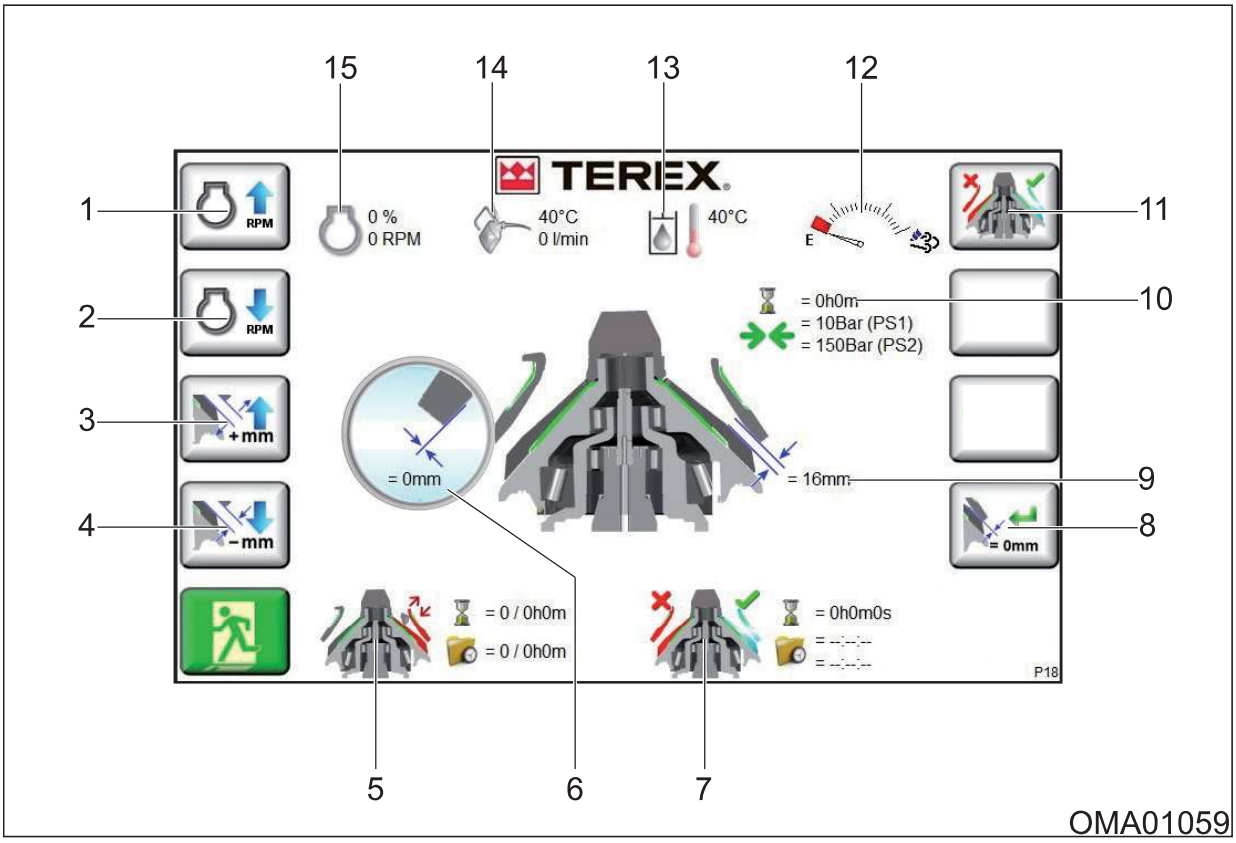

Figure 9.101 - Crusher Settings Screen

Table 9.7 - Icon Descriptions

No:	Description	No:	Description
1	Increase Engine Speed	9	Current Gap
2	Decrease Engine Speed	10	Hours Run and Wedge/Cylinder Pressure
3	Increase Gap	11	New Manganese
4	Decrease Gap	12	Urea Level
5	Tramp Count/Total Number of Tramp Counts and Times	13	Hydraulic Oil Temperature
6	Liner Wear Value	14	Lube Oil Temperature and Litres per Minute
7	New Manganese Hours Run	15	Percentage on Engine Load/Engine Speed
8	Manual Set Zero		

(b) Setting the Crusher Gap Setting

PROCEDURE

1. Observe all safety warnings
2. Start the engine.
3. On the main menu screen (Ref: Figure 9.102), press the machine operation button (item 1).

Figure 9.102 - Main Menu Screen

4. On the machine operation screen (Ref: Figure 9.103), press the crusher settings button (Item 1).

Figure 9.103 - Machine Operation Page

5. Using the increase or decrease gap buttons (Items 1 & 2, Ref: Figure 9.104) raise or lower the upper frame to the required gap setting. When satisfied with the gap press the confirm button (Item 3, Ref: Figure 9.104).

Figure 9.104 - Crusher Setting Screen

(c) Crusher Zero Set Point

NOTICE

The crusher must not be in operation for this procedure

PROCEDURE

1. Observe all safety warnings.
2. Start the engine.
3. On the main menu display screen (Ref: Figure 9.105), press the crusher setup button (Item 3).

Figure 9.105 - Main Menu Screen

4. On the crusher setup screen press and hold the increase gap button (Item 1, Ref: Figure 9.106) until the upper frame has reached its maximum height.

Figure 9.106 - Crusher Setup Screen

5. Visually check inside the crushing chamber and ensure that it is free from debris between the concave and mantle. If debris is visible, shut down the machine and implement the lockout procedure and remove safely. Proceed to the next step when able to do so.

6. Press and hold the decrease gap button (Item 2, Ref: Figure 9.107). While lowering the upper frame observe the pressure gauge (Item 1, Ref: Figure 9.107) on the crusher control block.

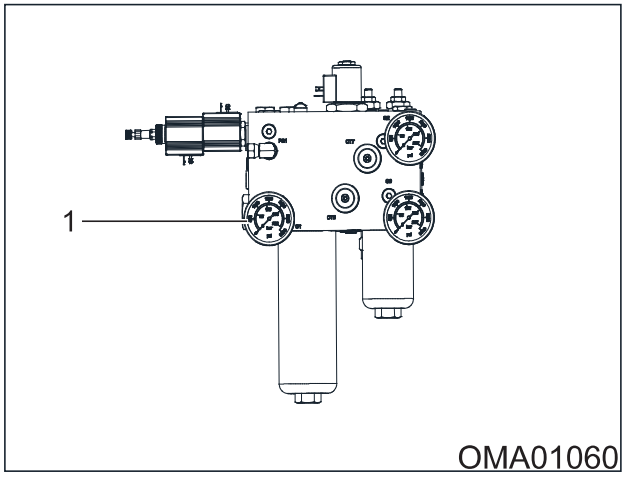

Figure 9.107 - Pressure Gauge

7. While lowering the upper frame the pressure gauge (Item 1, Ref: Figure 9.107) slowly rises to a constant level at first. It then spikes rapidly above this level at the point where the concave comes in to contact with the mantle. At this spike point, release the decrease gap button (Item 2, Ref: Figure 9.107) immediately. Do not allow the pressure to rise more than 10–20 bar (145–290 psi) as it spikes.
8. Press the "set new zero gap" button (Item 1, Ref: Figure 9.108)

» A confirmation screen (Ref: Figure 9.109) displays.

Figure 9.108 - Set New Zero Button

9. On the confirmation screen, press the confirm button (Item 1, Ref: Figure 9.109).

Figure 9.109 - Confirmation Screen

10. On the crusher setup screen (Ref: Figure 9.108) the crusher gap value (Item 2) has changed to zero and the wear value (Item 3) should also change.
11. Fully raise and lower the upper frame again. If the crusher has been zeroed correctly the pressure gauge (Item 1, Ref: Figure 9.107) begins to rise rapidly at the point where the crusher gap is reading 0 mm.

(d) Crusher Re-metal Procedure

NOTICE

The crusher must not be operating for this procedure.

This Procedure is only performed after the manganese has been changed.

PROCEDURE

1. Observe all safety warnings.
2. Start the engine.
3. On the main menu screen press the crusher setup button (Item 3, Ref: Figure 9.110)

Figure 9.110 - Main Menu Screen

4. On the crusher setup screen press the increase gap button (Item 1, Ref: Figure 9.111), and raise the upper frame until it reaches the maximum height.

Figure 9.111 - Crusher Setup Screen

5. While watching the pressure gauge (Item 1, Ref: Figure 9.112) on the crusher control system, press the decrease gap button (Item 2, Ref: Figure 9.111).

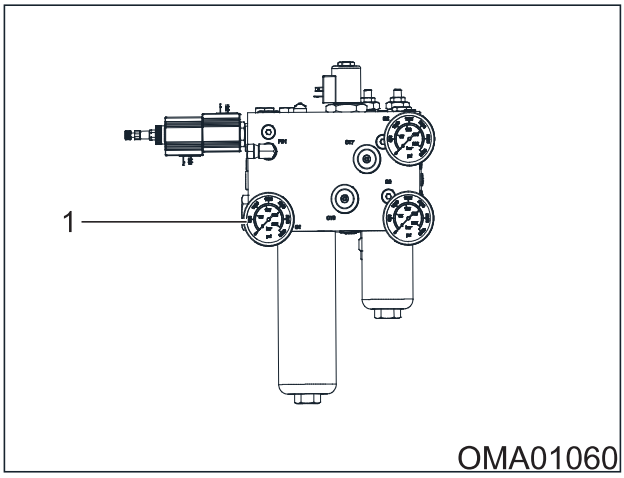

Figure 9.112 - Crusher Control System Pressure Gauge

6. While lowering the upper frame the pressure gauge (Item 1, Ref: Figure 9.112) slowly rises to a constant level at first. It then spikes rapidly above this level at the point where the concave comes in to contact with the mantle. At this spike point, release the decrease gap button (Item 2, Ref: Figure 9.111) button immediately.
7. Do not allow the pressure to rise more than 145-290 psi (10-20 bar) as it spikes.
8. Press the "re-metal/ new manganese" button (Item 3, Ref: Figure 9.111).
9. When prompted enter pass code "1000" to confirm that you want to zero the wear.

10. The cone setup will then appear, press the 'Re-Metal' button (item 3, Ref Figure: 9.110)
11. Select the type of liner installed.
    - For the Standard Liner ('STD') press Item 1, Reference; Figure 9.113
    - For the Heavy Duty Liner ('HD') press Item 2, Reference; Figure 9.113

Figure 9.113 - Cone Liner Screen

12. On the confirmation screen, press the confirm button (Item 1, Ref: Figure 9.113).

    » *The wear value (Item 1, Ref: Figure 9.114) changes to zero.*

Figure 9.114 - Confirmation Screen

13. Fully raise and lower the upper frame again, if the crusher has been zeroed correctly the pressure gauge (Item 1, Ref: Figure 9.112) begins to rise rapidly at the point where the crusher gap and wear indicators (Items 1 & 2, Ref: Figure 9.114) are reading 0 mm.

Figure 9.115 - Wear Value