

STOPEMATETM DRILL

OPERATIONS AND SERVICE MANUAL P/N: 5404849 DECEMBER 2013



BOART LONGYEAR



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1.1 Important Safety Information

1.1.1 Hazard Signal Indicators

Warning and Caution indicators are located throughout the manual at specific points of interest, and are intended to alert the reader to the existence and relative degree of a hazard. These notices are given to prevent personal injury, death and/or equipment damage. These indictors must be followed to reduce the possibility of personal injury, damage to the equipment, or improper service. Always heed these notices, and practice common sense when performing any maintenance or repair procedure.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury and death.



"Danger" indicates an imminently hazardous situation which, if not avoided, could result in death.



"Warning" indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury or property damage.



"Caution" indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury and property damage. It may also be used to alert against unsafe practices.

NOTICE

"Notice" is used to draw attention to detailed instructions. These notes are intended to give further important information regarding the machine and/or a step in a procedure.

1.1.2 Safety Guidelines

Read and understand all safety instructions carefully before operating this machine. Failing to follow these instructions may result in serious personal injury or death.

Familiarity and proper training are required for safe operation of this equipment. Failing to follow these instructions may result in serious injury or death. Read the operating instructions and familiarize yourself with the location and proper use of all controls.

Safety is the most important element of any procedure. Preparation is essential to complete a procedure in a safe and efficient manner.

- Keep clear of rotating equipment. Wear proper clothing. Loose or baggy clothing could become tangled in moving parts.
- Be aware that sliding parts can create pinch points, and tilting parts that create crush points.
- Keep guards installed and maintained in good working order.
- Always keep the work area clean.
- Avoid dangerous working environments.
- Do not operate equipment while under the influence of drugs, alcohol, or medication.
- Be aware of the operating zones and recommended areas for safe operation. Keep visitors a safe distance away from the work area.
- Wear personal protective equipment such as a hard hat, safety glasses, and steel-toed work boots.
- Prepare needed parts and materials. Gather the needed parts and materials before beginning the procedure.
- Prepare proper tools and equipment. Always use the correct tool for the job. Improper or homemade tools can cause injury or machine damage.
- Use only Boart Longyear replacement parts. Failure to do so could cause severe damage to the machine or the operator, and may void your warranty.
- ISOLATE all energy sources before servicing equipment.
- Allow machine to cool. Many components can get hot during operation. Be sure to allow enough time for components to cool before beginning service. Use only qualified service technicians.
 Failure to do so could cause severe damage to the machine or the operator, and may void your warranty.
- Never climb on top of the machine.
- Ensure that the drill and accessories fully comply with applicable local safety and health regulations.
- Do not exceed rated capacity of any piece of equipment.



- Do not adjust the hydraulic system before consulting a Boart Longyear Technician.
- Ensure that all commissioning checks and adjustments have been thoroughly carried out before operating the machine.
- Do not change or alter the drill, its components, optional equipment, or accessories without prior approval from Boart Longyear.
- Follow procedures and safety warnings. Service procedures are written to be as safe and efficient as possible. Never take shortcuts. Operate this machine when any person including the operator is under or in the operational envelope of the loading/unloading process.
- Be prepared for emergencies. Accidents can happen, even under the best conditions. Fire extinguishers and first aid kits should be well maintained and easily accessible.
- Read and understand the operations manual and labels affixed to the machine.
- Unauthorised alterations may void the warranty, render the equipment unsafe, or result in decreased performance.
- Before operating any controls, be certain you know what function they control and the ramifications of that function.
- Ensure that all commissioning checks and adjustments have been thoroughly carried out before operating the machine.
- Never attempt to loosen or remove any high-pressure hydraulic line without relieving pressure beforehand.
- Always be sure the machine is on a firm, level surface and will not tip, roll, slide, or fall while operating.
- Never start a unit in need of repair.

1.1.3 Safety Labels

Become familiar with machine safety labels and locations. The following illustrations show safety label locations on the machine.

A name plate is included that lists the model number, serial number, machine weight, and power. Please record the information so that it will be available should the name plate become lost or damaged.



When ordering parts or requesting information, you will always be asked to specify the model number and serial number.

♦ BOART LONGYEAR

PO BOX 330, 1111 MAIN STREET WEST, NORTH BAY, ON PIB 8H6

MACHINE TYPE: UNDERGROUND PERCUSSIVE

LONGHOLE DRILL

MODEL: STOPEMATE

SERIAL NUMBER: PRODUCTION YEAR:

INSTALLED POWER: 22 kW (30 hp)

TOTAL MACHINE WEIGHT: 3800 Kg

MAX. OPERATING AIR PRESS; 7.6 bar @ 16 m3/min

(110 psi @ 575 cfm)

Figure 1-1: Machine Name Plate

Keep clear while drilling. Operator may be drawn into rotating equipment.



Figure 1-2: Danger Decal: Entanglement

Moving parts of the machine have the potential to crush or pinch. Always use extreme caution when near these areas.

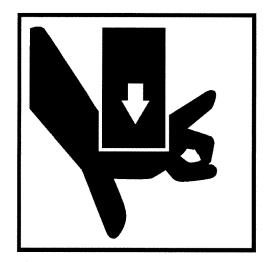


Figure 1-3: Warning Decal: Crush/Pinch Point

Secure tow hitch to towing vehicle prior to disconnecting wheel drives! Ensure safety chains are adequately sized and well secured prior to towing!



Figure 1-4: Warning Decal: Towing

ALWAYS place the mast in the storage position before moving the drill.



Figure 1–5: Warning Decal: Moving the Drill

ALWAYS use an appropriate lifting device at the designated lifting points.



Figure 1-6: Decal: Lift Point

Fill lubricator tank daily.

FILL LUBRICATOR TANK DAILY

WARNING: AIR MUST BE OFF (BALL VALVE CLOSED) PRIOR TO REMOVING FILLER PLUG OR SERIOUS PERSONAL INJURY MAY RESULT

USE ROCKDRILL LUBRICATING OIL SUCH AS: CENTURY 763 SHELL TORCULA 100 ESSO AROX EP 150

AIR PRESSURE REGULATOR MUST BE SET TO 1.5—2.0 BAR (22—30 PSI) FLOW CONTROL TO BE SET SO THIN OIL FILM COATS YOUR GLOVE WHEN HELD NEXT TO THE PROTRUDING STRIKING BAR

Figure 1-7: Warning Decal: Lubricator Filling

1.1.3.1 Personal Protective Equipment (PPE)

- Read and understand manuals
- Wear approved safety glasses
- Wear gloves
- Wear safety boots
- Wear hard hat
- Wear fall arrester when working at heights

Wear hearing protection



Figure 1-8: Decal: Personal Protective Equipment

1.1.4 Inspect Safety Decals/Labels

Safety decals are critical to the safe operation of this machine. Inspect all equipment for any damaged, missing, or unreadable decals. Replace decals as needed before placing the machine back in service.

1.2 Personal Protective Equipment

The following safety decals are used to show possible hazards and safety requirements. This list must be amended to meet your onsite requirements.



Figure 1-9: Approved Hard Hat Required



Figure 1-10: Safety Boots Required



Figure 1-11: Working Gloves Required



Figure 1-12: Hearing Protecting Required



Figure 1-13: Respiratory Protection Required

Respiratory protection is recommended for applications that create dust or when using compressed air for flushing.



Figure 1-14: Safety Glasses Required

Safety glasses are recommended for applications that create dust or when using compressed air for flushing.

This list must be amended to meet YOUR on site requirements.

1.3 Safety Requirements

1.3.1 Safety Precautions



General drilling operations frequently expose people to imminently hazardous situations which, if not avoided, could result in death or serious injury.



Do not attempt to operate the drill rig unless you are fully familiar with all rig controls, gauges, functions and operational sequences. Failure to comply with the detailed instructions contained in the Operating Manual could result in physical injury or death.

The following safety precautions must be observed at all times.

- Always wear an approved helmet, safety shoes or boots, safety glasses, and hearing protection when near an operating drill rig. A respirator may be necessary in dusty operations, assess each situation.
- 2. Keep hands, arms, legs and clothing away from all moving parts of the drill and its accessories. Failure to comply could result in physical injury or even death.
- 3. Always operate the drill rig from the operator's position.
- 4. Make sure all other persons are clear of the drill rig before moving or starting any drilling operation.
- Tram only with the jacks fully retracted, the mast fully retracted and resting on its support bracket. The rockdrill should be centered in the middle of the mast.
- Use extreme caution when tramming or setting up on uneven ground. Always ensure that the stability of the rig is not impaired.
- Drills have many moving components. Keep yourself and all other persons clear of moving drill heads, feed mechanisms, drill strings, and moving tools.



- 8. Know where you are drilling! Make sure you do not drill into any utilities, such as buried electric cables or into other working areas of the mine.
- 9. Use only purpose-made craneage lugs and/or lifting holders when lifting the rig.
- Do not remove or disable protective guards and safety devices under any circumstances.
- 11. Pay particular attention to the accident prevention devices and ensure that they are always fully functional. Defective devices may delay stopping rig functions, and may therefore cause severe personal injury or even death.
- 12. If you must operate the rig in a confined area, consult your occupational health and safety representative to ensure safe drill operations at all times.
- 13. Noise and Vibration levels The A weighted sound power level at the operating position is dBA. Appropriate hearing protection is required while operating the rig.
- 14. Never attempt to move the drill with the mast in the raised position.
- 15. Beware of wet ground conditions when tramming on a slope
- 16. Never allow spectators to stand between the machine and an obstacle when driving.
- 17. Always position yourself to get a clear view when tramming.
- 18. Always use the outriggers and jacks to stabilize the drill rig for drilling.

1.3.2 Specific Safety Instructions for Drilling



Drilling operations frequently expose workers to imminently hazardous situations which, if not avoided, could result in death or serious injury. The following safety instructions must be observed at all times.

- 1. While moving the rig no person should walk alongside, even for short distances.
- 2. Always check that all helpers are well clear of the tramming and swing radius of the drill rig prior to moving or setting up.

- 3. When using level or angle indicator to make the final adjustment of mast angle, only allow helpers to enter the area after the drill mast has been aligned and inclined to the approximate degree required.
- 4. Be sure that all hoses and electrical cables are cleared from the path before moving the drill rig.
- 5. Care must be taken when handling drill rods. They are often cumbersome and heavy.
- 6. Always ensure there are adequate foot holds (mud-sludge).
- 7. Remember that some cleaning solvents used for removal of oil and grease develop dangerous fumes when they vaporize. Be sure to use solvents only in well-ventilated areas.
- 8. The operator must never leave the control panel while drilling is in progress.
- 9. The rig must be secured against inadvertent and unauthorized movement between each operational interval.
- 10. To avoid inadvertent or unauthorized start up once the engine is stopped, ensure the starter key is taken out of the ignition lock and the battery is disconnected, locked and secured.
- 11. If the drill rig is parked on a slope or incline, the wheels must be secured using wedges, in addition to engaging the brakes.

1.3.3 Hazards



Drilling operations frequently expose workers to imminently hazardous situation which, if not avoided, could result in death or serious injury. The following safety requirements must be observed at all times.

1.3.3.1 Hydraulics

The hydraulic components of the drill rig must be checked regularly. Always use original Boart Longyear parts to replace worn components. For safety reasons this specific requirement **must** be complied with.

It applies to

- hydraulic hoses and other components.
- all static and bearing components, e.g. screws, bolts, springs and washers, positioner components, drill mast components and undercarriage components.





NEVER use your hand to find the leak. Hydraulic fluid is hot and can burn the skin. A pinhole leak, under pressure, can inject fluid under your skin, causing poisoning, infection, and threaten life and limb. In the event of a skin puncture or laceration from high pressure hydraulic oil, get the patient to an emergency room for immediate treatment.



Prevent possible injury, NEVER work beneath a suspended load held by an actuator unless properly supported. Failure to properly support the component may result in death or serious injury.

Settings for pressure limiting valves in the hydraulic circuits of the drill rig must only be changed by Boart Longyear approved personnel.

1.3.3.2 Replacement of Worn Parts

Repairs and replacement of worn parts can only be carried out by qualified personnel. Standard maintenance and service intervals must be complied with. If in any doubt, contact your nearest Boart Longyear service center.

1.3.3.3 Safety Devices

The safety devices on the drill rig must only be changed by or with the permission of Boart Longyear approved personnel.

Safety devices and protective equipment incorporated within moving machine components must only be opened, removed, or disabled with the rig's engine stopped and secured against inadvertent or unauthorized start up. (Safety devices include engine covers, lids, caps, doors, gratings and panels.) All safety devices and protective equipment must be reinstalled after completing maintenance service and repairs.

1.3.3.4 Welding

Welding of static and load bearing components on the drill rig is only to be carried out by the manufacturer or by Boart Longyear approved personnel.

1.3.3.5 Operation

The rig functions must be activated only from the control panel.



1.3.3.6 Operating Instructions

Operating instructions must be complied with for all operations, maintenance, service, repairs, and transport.

A copy of the current operating instructions (with all approved amendments) must be retained on the working site.

The contractor is obliged to amend safety regulations to meet local requirements.

1.3.3.7 Danger Zone: 2.5 Meters Around the Rig

Be sure that no one is within the Danger Zone of the drill rig. This is the area around the drill rig, within which persons may be endangered by moving any of its operational components.

The operator can work the rig only if no-one is within the Danger Zone. If someone enters the Danger Zone the operator must immediately give appropriate warning signals. These are usually made with horns, but pre-determined hand signals can be used to warn other people if on-site noise is liable to drown audible signals.

The operator must immediately terminate all operations if other people do not leave the Danger Zone, despite having been warned.

1.3.3.8 Noise and Vibration Levels

The A weighted sound power level at the operating position is dBA. Appropriate hearing protection is required while operating the rig.

1.3.3.9 Transport of Persons

Using the rig to transport persons is strictly forbidden.

1.3.3.10 Stability

The drill rig must only be operated when it is in a stable position. The rig's stability may be impaired by:

- Unsecured ground
- Incorrect drill mast position
- 'Jerky' acceleration and stopping during tramming
- Slewing movements
- Operating on slopes and inclines.



1.3.3.11 Conduct in Case of Fire

The following figure shows proper extinguishing tactics.

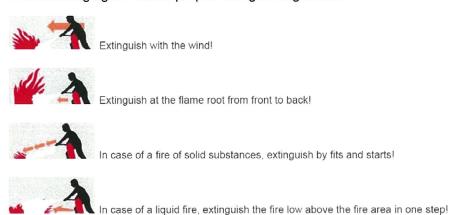


Figure 1-15: Fire Extinguishing Tactics

1.3.3.12 Fire Extinguisher Instructions

The figure below explains the different classifications and related actions.

Fire classifications:



fire classification A

fires with solid substances, mainly of organic nature, which normally cause glowing fires, e.g.: car tyres, wood, coal, some plastics, paper, straw and textiles.



fire classification B

fires of liquid substances or substances becoming liquid, e.g. ether, alcohol, petrol, varnishes, oils, fats, resinous substances, the majority of plastics, tar, waxes.



fire classification C

gas fires, e.g. acetylene, methane, propane, town gas, hydrogen.



fire classification D

metal fires, e.g. aluminium, potassium, lithium, magnesium, sodium and their alloys.

Figure 1–16: Fire Classifications

1.3.3.13 Operation of Stopemate™ Drill Rigs

Independent and unassisted operation and maintenance of the Stopemate $^{\text{TM}}$ drill rig must only be entrusted to persons who:

Are at least 18 years

- Have been instructed in operating and maintaining the drill rig and have demonstrated their ability to the contractor
- Can be expected to perform responsibly and are designated for the job by the contractor

The operator is responsible at all times for the rig operation and must modify procedures to allow for any likely instability and ensure a safe work area.

1.3.3.14 Securing Against Fall

To avoid the danger of falling and crashing, the drill rig must always keep a safe distance from ledges, pits and slopes.

It is the contractor's responsibility to assess the ground bearing capacity and state a safety distance for the rig.

Check the bearing capacity of any structures prior to moving the rig onto them.

1.3.3.15 Signalling

If the operator's vision is impaired during tramming and working, someone must give signals for assistants or the tramming/working area must be cordoned off.

Only reliable persons should be designated to give signals. They must receive instruction and be aware of this responsibility.

Communication must be coordinated and exclusively used between the operator and the signaller.

The signaller's attention must not be diverted by any additional tasks.

1.3.3.16 Working Near Overhead Lines

Unless local or national stipulations require otherwise, the following minimal safety distances must be complied with.

If working near overhead power lines:

Rated Voltage	Proximity
Up to 1000V	1 meter
Above 1KV	3 meters
Above 110KV	4 meters
Above 220KV	5 meters
If rated voltage unknown	5 meters



1.3.3.17 Operational Intervals

The operator must park the drill rig on bearing and level ground, stop the drill rig engine, and secure the equipment against inadvertent or unauthorized movement prior to leaving the drill rig. The drill mast and drill string should be resting on the ground.

The operator must set all operating levers in the neutral position prior to leaving the control panel. Furthermore, the operator must not leave the site if any drill rig tools are not secured.

If the drill rig must be parked on a slope or incline, the wheels must be secured with wedges in addition to the brakes.

Drill rigs should be parked only where they do not impede work place traffic.

These shutdown procedures must be performed before each operational break and at the end of each working day.



Chapter 2: Introduction

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2.1 Using this Manual

This manual describes the Boart Longyear Stopemate[™] drill and outlines its operational and maintenance procedures. It also includes a number of procedural hints.

The purpose of this manual is to furnish the operator with detailed information which will enable him to achieve the maximum operating performance from his drill. It will also give information necessary to perform preventative maintenance and make minor repairs and adjustments.

Read this manual carefully before attempting to operate the drill and keep this book handy at all times for reference when any question arises.

To obtain the utmost in performance and life of the equipment, it should be given regular care and operated in accordance with the instructions.

Note the following:

- Pictures, descriptions, and technical data may not match your drill rig in every aspect.
- This manual is only a general guide to essential operating procedures, safety precautions, etc.
- The procedures described in this manual do not relieve you of your responsibility to exercise caution and common sense.
 - You are the one who is responsible for your personal safety when operating this equipment.
 - You must comply with all safe working procedures and instructions relevant to your drill site at all times!
- The Manual set includes a spare parts catalog depicting and describing the individual components of the rig.

In the interests of its technical development, Boart Longyear reserves the right to modify the drill rig and the data in this manual without prior notification.

Boart Longyear is backed by over 100 years of experience in the design, manufacture and operation of core drilling equipment. Many of the accepted practices in use today were pioneered by Boart Longyear.



2.2 Abbreviations Used in This Document

Abbreviations used throughout this document are outlined below:

Abbreviation	Definition
НМІ	Human Machine Interface
PWM	Pulse Width Modulation – A form of analog control
OCP	Operator Control Panel
MCP	Main Control Panel
LH	Left Hand
RH	Right Hand

2.3 Prior to First Use

Upon arrival of your new Boart Longyear Stopemate $^{\mathsf{TM}}$, a quick inspection should be done.

- Visually inspect the drill for any loose hoses, fittings, bolts, or any damage that may have occurred during shipping.
- Take caution when a loose hose or fitting has allowed oil to leak as this will create a hazard.
- Make sure that any oil leak has not drained the tank too low for proper operation.
- Refer to chapters in this manual for proper and safe movement of this drill.
- Visually inspect all electrical connections.
- Check oil levels and fill with recommended lubricants.

2.4 Ordering and Returning Parts

2.4.1 Ordering Parts

The following procedure will expedite the filling of your parts order, eliminate delays and assure correct replacement parts:

- 1. List the model and serial number of the drill.
- 2. State exact quantity required.
- 3. Specify description and part number as shown in Parts Manual.

4. Specify method of shipment, ie: Parcel Post, Express, Freight; for Overseas shipment, Air Freight, Air Parcel Post, or Ocean Freight.

All parts are priced F.O.B., our factory and a separate charge will be made for transportation and export packing.

2.4.2 Returning Parts

If you wish to return parts whether for repairs, replacement, or warranty, you should communicate the details of the return request in writing with your local Boart Longyear Representative.

In Canada the request can be sent

via email to: orderdeskrga@boartlongyear.com

faxed to: 705-474-2373

The request should reference the model and serial number of the product as well as:

-part number and quantity

-reason for return

Once the return is approved you will be issued an RGA (Return Goods Authorization) number to track your claim.

<u>DO NOT</u> attempt to ship parts until you receive an RGA number and shipping instructions otherwise we have no way to track your claim for returned goods. Boart Longyear will not be held responsible for any parts shipped without a return good authorization number.

- All parts for return are subject to incoming inspection and minimum re-stocking charge of 20% will apply.
- Special, "made to order," or obsolete parts will not be accepted. This includes small items such as nuts, bolts and O-rings.
- All parts must be returned prepaid.

2.5 Limited Warranty

a. Consumables. Boart Longyear warrants for a period of one (1) year after the date of shipment of the consumable products manufactured by it, or the performance of related services, under the Contract, that such consumable products are free from defects in materials and workmanship and such services are performed in a professional and workmanlike manner; provided, however, with respect to consumable products purchased through an authorized Boart Longyear distributor, the warranty period shall commence on the date of purchase by the end-user.

- b. Capital Equipment. Boart Longyear warrants that the capital equipment manufactured by it is free from defects in materials and workmanship for a period equal to the lesser of (i) one (1) year after the date of shipment, or (ii) the initial 1,000 operating hours. Boart Longyear warrants for a period of six (6) months after the performance of related services that such services are performed in a professional and workmanlike manner.
- c. General Terms. Boart Longyear further warrants that, to the extent applicable, as of the date of shipment or performance, all goods manufactured by it and services performed shall conform to the written specifications agreed between the parties. THIS IS BOART LONGYEAR'S ONLY WARRANTY. BOART LONGYEAR MAKES NO OTHER WARRANTY, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. As a condition to Boart Longyear's warranty obligations, Purchaser must:
- (i) contact Boart Longyear and request authorization to return any goods claimed to be defective promptly upon Purchaser's discovery of the alleged defect,
- (ii) upon receipt of an approved authorization code from Boart Longyear, return any goods claimed to be defective under the foregoing warranty, at Purchaser's expense, to the facility designated by Boart Longyear, and
- (iii) with respect to consumable products purchased through an authorized Boart Longyear distributor, the party making the warranty claim must also deliver to Boart Longyear reasonable evidence of the date of purchase. Boart Longyear shall perform its examination of the goods so returned by Purchaser and shall report the results of its examination to Purchaser within thirty (30) days following its receipt of such goods from Purchaser, or, if longer time is required to complete such examination, within such time as would be required through the exercise of reasonable diligence. As a further condition to Boart Longyear's obligations hereunder for breach of warranty, Purchaser shall offer its reasonable cooperation and assist Boart Longyear in the course of Boart Longyear's review of any warranty claim. If requested by Purchaser, Boart Longyear will promptly repair or replace, at Boart Longyear's expense, goods that are confirmed to be non-conforming as a result of Boart Longyear's examination and according to Boart Longyear's warranty as set forth herein. All removal and installation of goods shall be at Purchaser's expense; provided, however, Boart Longyear will reimburse the Customer for an amount equal to the reasonable expenses incurred by the Customer and attributable to the removal and shipment of any defective goods. Boart Longyear

reserves the right to reimburse Purchaser for an amount equal to the purchase price of any defective goods in lieu of providing repaired or replacement goods. Anything contained herein to the contrary notwithstanding, in no event shall Boart Longyear be liable for breach of warranty or otherwise in any manner whatsoever for:



- (i) normal wear and tear; (ii) corrosion, abrasion or erosion; (iii) any goods, components, parts, software or services which, following delivery or performance by Boart Longyear, has been subjected to accident, abuse, misapplication, modification, improper repair, alteration, improper installation or maintenance, neglect, or excessive operating conditions; (iv) defects resulting from Purchaser's specifications or designs or those of its contractors or subcontractors other than Boart Longyear; (v) defects associated with consumable parts or materials, the lifetime of which is shorter than the warranty period set forth in this Section; (vi) defects associated with Purchaser's specifications or designs or those of its contractors or subcontractors other than Boart Longyear; (vii) defects resulting from the manufacture, distribution, promotion or sale of Purchaser's own products; or (viii) accessories of any kind used by the Purchaser which are not manufactured by or approved by Boart Longyear.
- (d) Sourced Goods. If the defective parts or components are not manufactured by Boart Longyear, the guarantee of the manufacturer of those defective parts or components is accepted by the Purchaser and is the only guarantee given to the Purchaser in respect of the defective parts or components. Boart Longyear agrees to assign to the Purchaser on request made by the Purchaser the benefit of any warranty or entitlement to the defective parts or components that the manufacturer has granted to Boart Longyear under any contract or by implication or operation of law to the extent that the benefit of any warranty or entitlement is assignable.

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3.1 General Description/Statement of Use

The Stopemate[™] drill is a high production pneumatic underground blast hole drill. It is capable of drilling a series of holes in a multitude of directions.

The drill system (Rockdrill) is directly coupled to a feed screw to provide thrust and pullback for drilling. It utilizes an independent hydraulic motor for rotation.

A pneumatic rod clamp is installed to grip the drill rods for threading and unthreading operations.

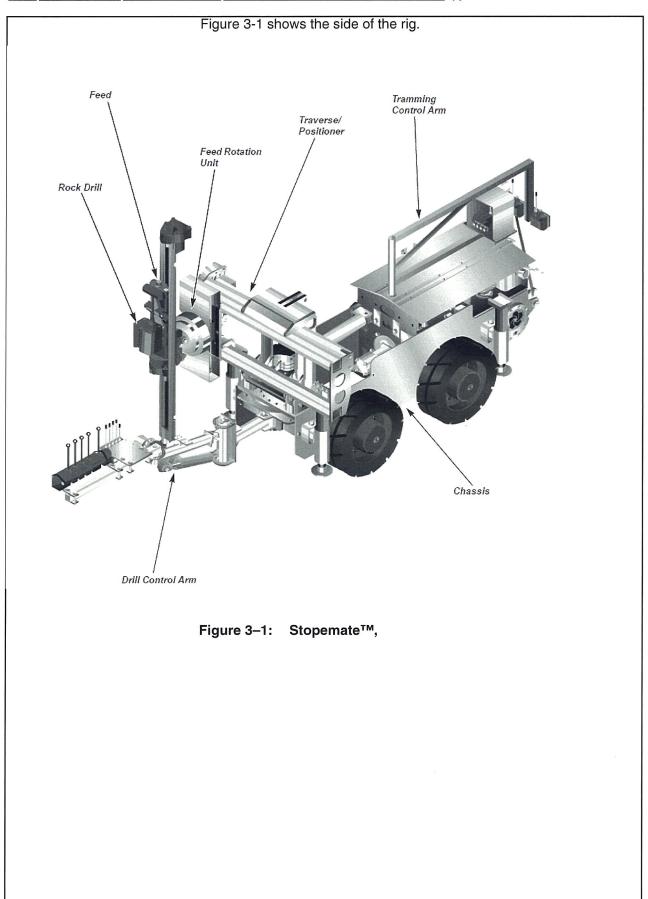
The Stopemate[™] is designed for disassembly into smaller components for cage transport or use in captive stopes. Rig feed positioning and technical details are outlined in the Tech Data (Appendix C).

The drill rig requires a continuous supply of drilling fluid (water) for hole flushing and air for drilling. Stopemate[™] drill depth capacity will vary significantly with hole flushing, hole diameter and direction.

The drill is not designed or intended to be used in an area with a risk of explosive atmosphere or off shore applications with extended exposure to salt water spray.

3.2 General Drill Arrangement

The photos on the following pages show the components of the Stopemate[™] drill rig.



3.3 Decals Used on the Rig

The following decals are used on the Stopemate™ drill rig.

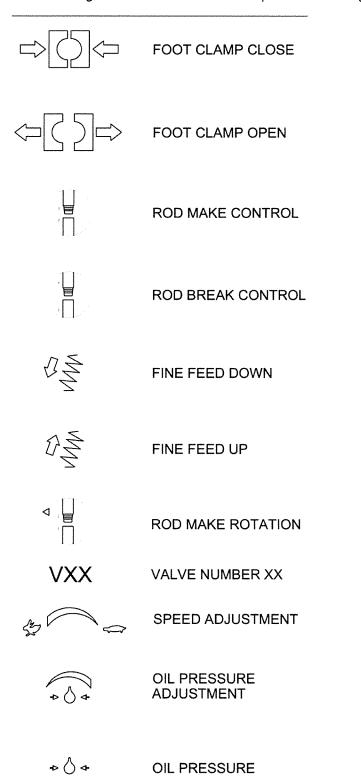


Figure 3-2: Decals Used on the Rig

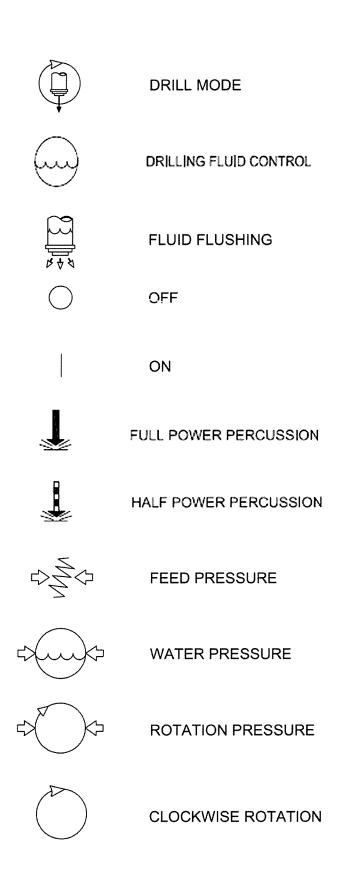


Figure 3-3: Decals Used on the Rig

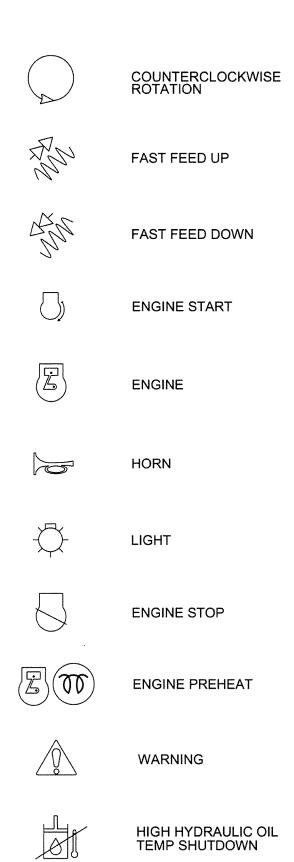


Figure 3-4: Decals Used on the Rig



Figure 3-5: Decals Used on the Rig



3.4 Rockdrill

The Stopemate™ is equipped with the S36IR Rockdrill.



Figure 3-6: S36IR Rockdrill

The standard S36IR is a pneumatic, rotary percussive rockdrill. The rotation is provided by an independent air motor. The S36IR consumes approximately 500 CFM (14 m3/min.) @ 90 psi (6 Bar). The optimum performance occurs at this pressure; however, satisfactory operation will occur at pressures ranging from 60 psi (4 Bar) to 90 psi (6 Bar). Lubrication for the rockdrill is provided by an on board lubricator.



Read and understand the S36IR Rockdrill Manual (refer to Appendix D) before attempting to operate this piece of equipment.

3.5 Rockdrill Positioning System

3.5.1 Drill Feed (Mast)

The feed assembly consists of a steel feed rail with internal ways which guide the S36IR rockdrill. The movement is provided by an air motor driven screw. A pneumatic centralizer mounted on the end of the feed centers the drill steel while collaring as well as holding the coupling when breaking the joint and adding/removing steel.

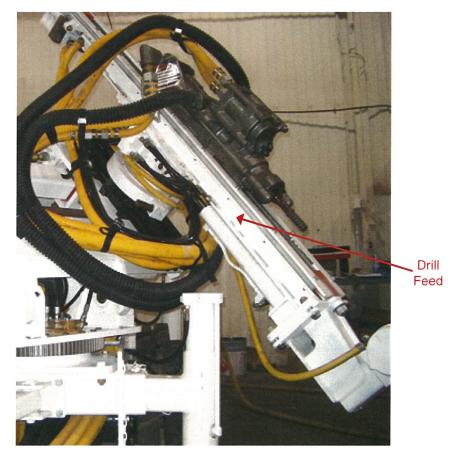


Figure 3-7: Drill Feed

3.5.1.1 Rod Clamp

The rod clamp is a pneumatically-operated device located at the front of the feed assembly. It is used to centralize the drill string when collaring the hole, holding the drill string in position when adding or removing drill



rods, and functions as a rod wrench for making or breaking drill rod joints.



Figure 3-8: Rod Clamp



When extracting the drill string on up hole, do not open the rod clamp until the shank thread is engaged with the coupling secured in the rod clamp. If the rods fall or are dropped, the coupling may split or chip from the impact. Segments could be propelled in any direction at great speed and could cause serious injury to anyone in the vicinity.



The rod clamp jaws must be inspected regularly for any sign of damage and should be replaced immediately if damage has occurred.

3.5.2 Traverse System

The standard positioner includes a hydraulically driven, pivoting traverse. Functions include: side to side shift, hydraulic cylinder actuated dump, hydraulic 360 degree feed positioning and -20 degree to +90 degree pivot. For side shift movement, the traverse utilizes a screw drive identical to the MKV feed. The standard side to side movement is 48" (1.2m), optional traverses include a 36" travel (0.91m), and a 60" (1.5m).

The dump is actuated by one cylinder and covers 45 degrees rear dump to vertical, and 10 degrees forward dump. The pivoting is actuated by a single, double-acting hydraulic cylinder with dual lock valves.



Figure 3-9: Feed Traverse Positioning System

3.5.2.1 Feed Rotation/Swing Unit

The Feed Rotation/Swing Unit provides 360 degrees of feed rotation for fan drilling and 180 degrees of feed swing for increased hole coverage

from one set up. The hydraulic feed rotation is a rotary actuator and has dual external lock valves for safety.



Figure 3-10: Feed Rotation/Swing Unit

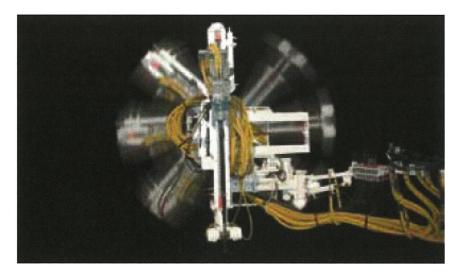


Figure 3-11: Feed Rotation View



3.5.2.2 Dump Actuator

The traverse assembly tilts forward and back through 120 degrees of movement for both hole positioning and feed transport. The traverse tilts using a hydraulic cylinder as shown in figure 3-12.



Figure 3-12: Traverse Dump Actuator

3.6 Power Pack

The powerpack consists of a radial piston air motor directly coupled to a hydraulic pump. The powerpack is used to supply hydraulic power for tramming the drill short distances, positioning the rockdrill/feed system,

and operating the carrier stabilizer jacks. Once the drill is in position, drilling operation is fully pneumatic.



Figure 3-13: Air Motor/Hydraulic Pump

3.6.1 Lubricator (Rockdrill)

An air lubricator is installed on the rig to provide lubricated air to critical sections of the hydraulic rockdrill to prevent wear. It should be refilled at the beginning of every shift. Oil level should be monitored at regular intervals throughout the day. When the oil level approaches the bottom, it is to be refilled.

For detailed instructions for refilling the lubricator, refer to Chapter 4: Operation.



Figure 3-14: Rockdrill Lubricator Fill Point



Always use "Rockdrill Lubricating Oil" to refill the lubricator. Rockdrill Oil was specially developed for this application. Oil types are detailed in the Lubrication Chart located in Chapter 7.



Air must be turned off (ball valve closed) prior to removing filler or serious personal injury may occur.

3.7 Undercarriage

The undercarriage consists of 4 hydraulic wheel motor drives with independent failsafe (SAHR) brakes. The wheel motor housings are pinned in place for ease of replacement. The final drives contain gear oil which must be serviced from time to time according to the rig's maintenance schedule. The final drives can be disengaged for towing; refer to Chapter 4 for more details on towing.



Figure 3–15: Undercarriage

3.8 Controls

3.8.1 Operators Controls (Drilling)

The drilling controls are located in front of the machine on the remote control arm. A five lever valve bank is located on a remote arm, which can be positioned on either side of the traverse assembly. The levers provide proportional control for the rockdrill percussion, the rockdrill

rotation and the rockdrill feed. In addition, two levers provide control for the flushing mediums (air and water) and the centralizer.

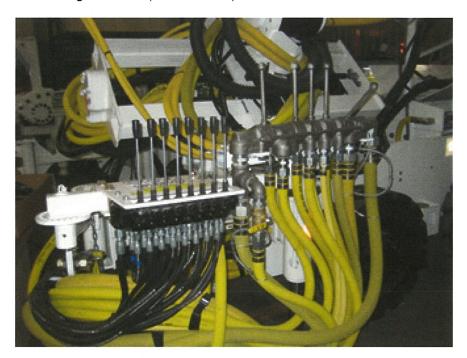


Figure 3-16: Drilling and Set Up Controls on Control Arm

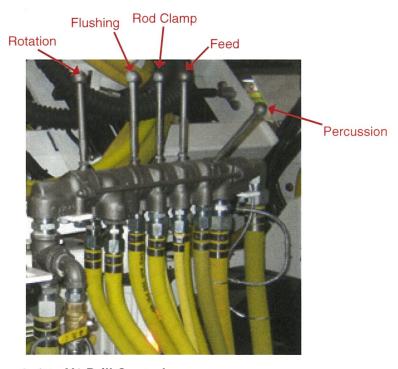


Figure 3-17: V1 Drill Controls

Brief descriptions of the controls are as follows:



1. Rotation Control (Rockdrill)

The rotation control is used to control rockdrill rotation in both forward and reverse.

2. Flushing Control

The flushing control is a 3 position control allowing the operator to flush the hole with water while drilling or air.

3. Rod Clamp Control

The rod clamp control is a 3 position control used to open and close the rod clamp.

4. Feed Control

The feed control is used to control the advance and retraction of the rockdrill while drilling.

5. Percussion Control (Hammer)

The percussion control (rockdrill hammer) is a 3 position control providing the operator with a half power position for collaring the hole and a full power position for drilling.

3.8.2 Drill Rig Set Up Controls

The set up control valve bank V2 is located on the remote drill control arm beside the drill control valve bank. This control valve is used for feed positioning, including:

- Control Arm elevation
- Traverse dump
- Traverse rotate
- Feed slide (side to side on traverse)
- Feed rotation (fan)
- Feed swing
- Feed Crowd
- Feed Stell



Figure 3-18: V2 Set Up Controls

3.8.3 Drill Rig Jack Controls

A four spool control valve V4 is located on a pivoting remote arm attached to the top of the drill hood structure. This valve bank is used to operate the hydraulic jacks and can be moved by the operator to either improve visibility or access in tight operating conditions.

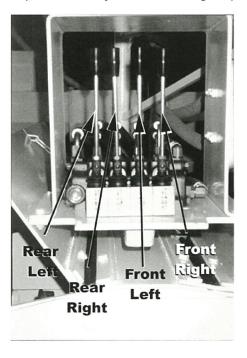


Figure 3-19: V4 Jack Controls

3.8.4 **Drill Tramming Controls**

The tramming is controlled via independent control valves (i.e. one for the left side, one for the right). These valves are mounted on the end of a control arm which pivots through 230 degrees, so the operator can drive the carrier from the rear or from either side.

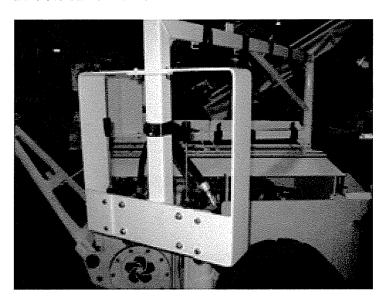


Figure 3-20: Drill Tramming Controls



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4.1 Introduction

The following are recommended guidelines and practices to help prolong the life of your newly obtained Boart Longyear drill.

4.1.1 Safeguards

All operators must be familiar with the equipment and its proper care. If adjustments or repairs are necessary, or if any damage is known, the operator must report the details promptly to an appointed person and must notify the next operator upon changing shifts.

4.1.2 Routine Checks

- Inspection of welds in erecting mechanism for cracks and other signs of deformity.
- Check unit for level and correct placement before erecting operation.
- During drilling operations, it is advisable to make scheduled inspections of all bolted connections to ensure that they are tight.

4.2 Transporting the Drill

4.2.1 Tramming the Drill

The Stopemate[™] can only be trammed by the operator with the main air line connected to the mine supply.



Never attempt to move the drill with the mast in the raised position.

When moving the drill, always follow the safety precautions detailed below.

4.2.1.1 Tramming Controls

Stopemate[™] movement is controlled by two proportional spring centered joysticks located on a pivoting remote arm attached to the top of the drill hood structure.



Figure 4-1: Tramming Controls

The controls can be easily repositioned by the operator on either side of the traverse to aid in drill traverse alignment with surveyed locating lines.

Each joystick controls one side of the Stopemate[™] (i.e. left joystick controls the two wheels on the left side of the carrier, the right joystick controls the two wheels on the right side of the carrier).

The unit operates with 'skid-steer' motion, meaning the unit steers by rotating the wheels on opposing sides of the carrier at different speeds, thereby causing a skidding effect.

Pushing both levers forward completely, the Stopemate[™] will move forward in a straight line at maximum speed. Conversely, pulling both levers back will causes the Stopemate[™] to move in reverse.

As the levers are moved towards their center condition (neutral) the Stopemate $^{\text{TM}}$ speed decreases.

To tram around a gradual curve, the levers are staggered slightly allowing the wheels on one side to turn at a slightly higher speed than the opposite side. The sharper the curve, the more pronounced the difference between the two levers.

To turn with the machine, shift the levers in opposite directions (i.e. left lever pushed forward and right lever pulled back causes the carrier to turn to the right, right lever pushed forward and left lever pulled back causes the carrier to turn to the left).



The Stopemate[™] is equipped with fail-safe braking that releases automatically when the tramming levers are shifted. As well, when the levers are released, they are spring loaded to return to the center (neutral) condition. The brakes will automatically reapply when this occurs.



Tram in safe position - do not position yourself between the Stopemate™ and the direction of travel. Always leave adequate space behind you for escape to avoid being pinned against a wall by the control arm.

Ensure your footing is secure as the Stopemate™ is being moved.

To tram the machine with the traverse aligned with the machine, first rotate the feed to align it parallel with the traverse and dump the traverse back to 45 degrees. Move the feed to the right side of the traverse (right side if you are standing in front of the machine facing the traverse). Now pivot the traverse the full 90 degrees, aligning it with the machine frame. You can now tram the machine with the traverse in this position.

To test the tramming, ensure the positioner is dumped back all the way. If the unit is on the levelling jacks, open the ball valve to power up the hydraulic system and completely retract all four jacks.



The optimal tramming configuration is with the feed centered on the traverse and the traverse dumped back the full 45 degrees. The levelling jacks should also be locked in position and the drill control arm folded up against the front of the machine. If the machine is trammed in any configuration other than this the machine could be unstable and increase the risk of roll over and serious injury.

4.2.2 Towing the Drill

The Stopemate[™] is equipped with a tow hitch and quick release brakes on all four wheels to facilitate quick and easy moves.

While every effort has been made to simplify this process and make it safe, personnel involved with towing must be familiar with safe underground towing practices to ensure safety for themselves, for others and for the equipment.



Before towing, carefully inspect the tow hitch and the connections on both the Stopemate[™] and the towing vehicle to ensure there are no weld cracks and/or metal fatigue cracks. Additionally, all hitches pins, shackles, chains and any other hardware used for the move must be in good condition and rated for the proper load. The Stopemate[™] has a weight of approximately 8,500 lbs.

- 1. Dump the traverse back to the 45 degree position.
- 2. Center the feed on the traverse frame and rotate the feed parallel with the traverse.
- 3. Rotate the traverse 90 degrees to the tram position.
- 4. Swing the feed into the traverse frame.
- Raise the drill control arm and swing into position in front of the traverse. Ensure they are clear of any potential damage when moving or positioning the machine.
- 6. Disconnect air and water supply hoses.
- 7. Ensure brakes are applied on the towing vehicle.
- 8. Remove any items on the machine, which may fall off and cause damage.
- 9. Attach Stopemate[™] to towing vehicle with towbar.
- Attach safety chains between Stopemate[™] and towing vehicle.
 Make sure chains are proper capacity.
- 11. Double-check all connections.
- 12. Disengage wheel brakes (all four wheels) by removing the center mounting plate (2 bolts each) and flipping around so that the nipple is pointing in. This disengages the planetary brakes and allows the wheels to freewheel..

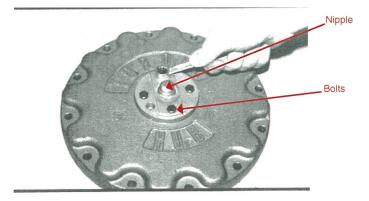


Figure 4-2: Hub Disconnect (Towing)





Never attempt to manually disengage the brakes until the drill rig is securely hitched to the towing vehicle.

- 13. Tow machine no faster than 8km/hr (5mph).
- 14. Exercise particular caution when towing on a grade or on irregular and rough ground.
- 15. When towing is complete, engage wheel drives by removing the center mounting plate and flipping around so that the nipple is pointing out. This engages the planetary brakes and locks the wheels.

4.2.2.1 Moving in a Scoop Tram Bucket



Every effort has been made to ensure the Stopemate™ is rugged enough to withstand hostile underground environments.

Moving the Stopemate[™] in an LHD bucket is not recommended practice. If circumstances dictate the use of a scoop bucket for drill transport, ensure there is a safe working procedure and that the work is carried out by trained personnel.

Every precaution should be taken to ensure the Stopemate[™] is well secured in the bucket and the scoop operator should exercise extreme caution while driving to prevent excessive bouncing and jerky movements.

- Ensure the tramming and auxiliary control pivot arms are centered over, and secured in a position that will prevent them from coming into contact with the scoop tram bucket.
- 2. The rear end of the machine should go into the bucket with the front end hanging out the front of the bucket.
- 3. Secure the front of the machine, to the top of the bucket with chains. This will prevent the machine from bouncing in the bucket while moving.
- 4. After moving the vehicle follow the Pre Start Check List before starting the machine.

4.2.2.2 Parking

When the unit is left unattended (parked).

1. Lower four corner jacks to make contact with ground.



If the planetary wheel motor brakes have been disengaged for towing, lock and tag out the air supply at the 2" ball valve on the inlet to the machine and ensure that the wheels are properly chocked.

2. Ensure air supply is turned off at the machine and at the supply header.

4.2.3 Lifting the Drill



Only trained and qualified personnel are to perform rigging, crane operations, and lift communications. All other personnel are to be stationed safely away from the lift.

We recommend a 'critical lift plan' approved by a certified engineer when lifts are performed under the following circumstances:

- A lift exceeding 80% of the rate load of the crane or lifting device
- A tandem lift where two cranes or lifting devices are used
- Any time the lifted load is to be completed over structures, buildings, vehicles etc
- Lifting within 15' of any overhead power or communications lines.

The crane operator has three main responsibilities.

- 1. Verify the condition of all slings prior to rigging and replace them if worn, frayed, cut, or if heavily soiled with oils or chemicals.
- 2. Verify the condition of shackles that are to be used during the lift. Shackles are to be replace if deformed, show cracks or sharp nicks in the metal.
- Verify the satisfactory condition of all anchorage points. Anchorage
 points are not to be used if deformed, excessively corroded, or
 welding is cracked. Anchorage points are to be designed and
 certified by an engineer.

Where anchorage is to be performed by wrapping or undercarriage slinging, we recommend that the lift plan be approved by a qualified person or performed under the design of a certified engineer.



We further recommend that all lifts above waist height are to be controlled by the use of tag lines by qualified personnel to ensure all personnel are stationed safely away from the lifted load.

Always have a planned escape route during the loading and unloading process, never stand under a suspended load.

Shipping weight of the rig is listed on the drill master serial number decal.

4.2.4 Truck Transport

The transport operator is to verify the truck is rated for the load, and that the load is properly secured using the tie downs provided and all covers are secured in place and loose parts or tools have been properly stowed prior to transport.

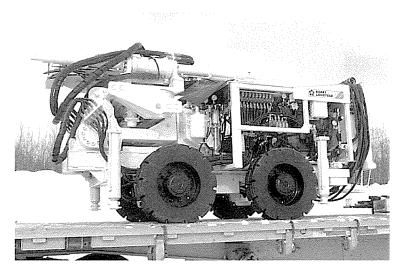


Figure 4-3: Truck Transport

4.3 Configuring the Drill Based on Rod Type

The following components are affected by rod type (diameter) and must be changed prior to starting a new hole with a different rod diameter.

Note: Part numbers are identified in your parts book and or Global Product Catalog for in the hole tools.

4.3.1 Striking Bar (Rockdrill)

The procedure for changing the striking bar is outlined in the Rockdrill maintenance section of this manual. Always insure that the striking bar is changed when any signs of thread wear or galling is present.



Drill air supply must be shut off while this work is in process.

Never place your hand on or near the striking bar with percussion or rotation turned on. Severe personal injury will result.

4.3.2 Rod Clamp Jaws

The standard rod clamp jaws supplied from the factory can accommodate R38, HM38 and HM45 rod couplings. An optional set of jaws are available for R32 Rods.

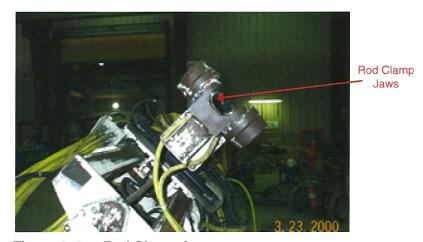


Figure 4-4: Rod Clamp Jaws

Drill rods must be removed before proceeding. The rod clamp must be in the fully opened position.



Drill air supply must be shut off while this work is in process.

4.4 Pre-start Checklist

4.4.1 Inspection of Area

- 1. Scaling
- 2. Check for loose
- 3. Be aware of ground conditions daily
- 4. Keep consumables near but out of the way

4.4.2 Walk Around Vehicle Daily Inspection

Complete a walk around and observe for any damage which may have occurred during transportation of the unit or since the last operation.

- 1. Hoses and fittings for oil leaks.
- 2. Damaged hoses, loose bolts.
- 3. Overall general cleanliness.
- 4. Main air line connection for tightness and ensure air 'wip check' is in place.
- 5. The main hydraulic oil reservoir is full.

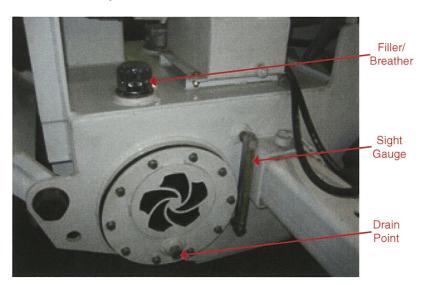


Figure 4-5: Hydraulic Reservoir

6. Check Rockdrill Lubricator.



Figure 4-6: Lubricator Fill Point

- a. Use caution to ensure no dirt is allowed to enter the lubricator. Dirt may cause the lubricator to malfunction or work its way into the rockdrill where it can cause serious rockdrill damage.
- Air lubricator oil level. The rockdrill lubricator reservoir should be filled with rockdrill lubricating oil such as Century 763, Shell Torcula 100, Esso Arox EP 150 or Mobil Almo 527.
- c. Ensure excessive rockdrill oil is not accumulating around the striking bar.

7. Refilling the Lubricator

- Shut off the main air supply to the rig by closing the main ball.
- b. Using an adjustable wrench, crack open the cap on the top of the lubricator. Once all compressed air is bled off, the cap can be removed using an adjustable wrench.



If the sound of compressed air continues without stopping, DO NOT remove the cap. The ball valve may not be completely shut off or may be faulty. Ensure that the air is off and that the trapped air pressure exhausted before removing.

c. Once the cap is removed, the lubricator can be filled to the top using an air lubricant as recommended in the 'Lubricants' section of this manual.



- d. After filling is complete, thread the cap back on and retighten.
- 8. Examine the dump, traverse and rotation unit.
 - e. Inspect the main feed rotation actuator for leaks or excess play.
 - f. Inspect the condition of the feed mount for any signs of cracks.
 - g. Examine the, pivot, crowd, and stell cylinders for leaks, excess wear or damaged rods.
 - h. Examine traverse dump cylinder pins, pivot cylinder pins and main pivot pins for wear or loose bolts. These pins are an expanding style shaft and can be adjusted in theirs mounts to take up wear.
- 9. The slew bearing in the traverse pivot should be greased daily (one shot). For best results the traverse should be in a different position each time it is greased to allow the new grease to travel around the bearing with the movement of the balls. Every 2000 hours, attempt to purge the old grease from the bearing by rotating the traverse 90 degrees at a time and greasing (4 shots) in each position.
- 10. Grease pivot and dump cylinder cylinders rod eye bearings, remote control pivoting arms, feed motor and traverse motor daily 1 shot.
- 11. Inspect the wear pads on the traverse for wear.
- 12. Inspect the hydraulic rod clamp body for cracks or air leaks. Check jaw condition and tighten loose bolts.
- 13. Inspect wheel end assemblies.
 - a. Ensure all studs are in place and are tight. Torque wheel nuts to 180 ft lbs (244 Nm).
 - b. Inspect the wheel drive planetary drives for cracks and damage.
 - c. Inspect the brake disconnect to ensure the brakes are not disconnected (i.e. nipple pointing out).
- 14. Check the Rockdrill housing fit in the feed rail for any excess body wear. Rockdrill striking bar must be centered in the rod clamp or premature striking bar failure can occur.
- 15. Complete the Daily Pre-start Up Inspection sheet.

4.4.3 Rig Set Up

4.4.3.1 Connecting to a Mine Supply

Water Connection

- Locate the closest mine water supply and connect a 1" water line long enough to reach the Stopemate™.
- Before connecting the water line to the Stopemate[™], open the ball valve at the mine water connection and allow the water to free flow to ground for 20-30 seconds to allow any rust and scale which may have accumulated to wash out.
- 3. Connect the water line to the Stopemate[™].



Figure 4-7: Water Connection

Air Connection

 Rust and other particles may be shaken loose by blasting or may have entered the air lines during the opposite shift. Blowing out the air lines before start up is recommended. Secures the hose to the wall, approximately 15m (50ft) from the valve and partially open the valve for 1 to 2 minutes. This should ensure that any potential harmful particles are removed from the air piping supplying the drill.



Exercise caution!! Ensure you have a firm grip on the end of the hose (to avoid whipping) and avoid directing the exhausting air at anything which could be damaged by projecting particles.

2. Connect the main air supply to the connection at the back of the carrier. **Ensure hose WIP checks are properly connected!!!**

Note: The maximum allowable air pressure is 120 psi (8 bar).



Figure 4-8: Main Air Shut Off Valve

- 3. With all levers in their neutral position, slowly open the main ball valve. Observe to make sure that unwanted functions do not engage. If a function engages, close the ball valve.
- 4. Check and make sure there are no air leaks. This could be an indication of an airline rupture or loose fittings. While air leaks are not uncommon underground, they are costly and everyone should do their part to eliminate them.
- 5. Power up the hydraulic system. To start the air motor, open the air motor ball valve located on the drill control arm at the front of the machine.

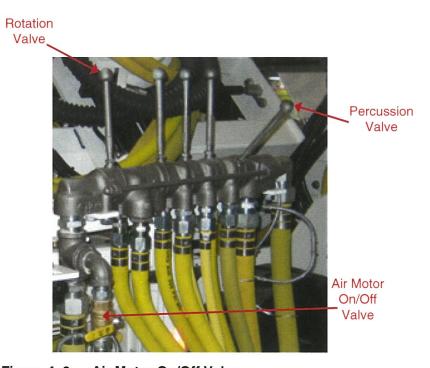


Figure 4-9: Air Motor On/Off Valve

 With the hydraulic system operational, the hydraulic stabilizer jacks can be raised/lowered, the boom dump, traverse plate, rotation unit and remote arm can all be moved. Lower the jacks and raise the machine off the ground.

Note: Look for hydraulic oil leaks during this part of the testing. Check tramming controls for correct direction of rotation. If there is a substantial drop in air pressure from the inlet air to the outlet air, then the air filter element must be replaced.



Figure 4-10: Mine Inlet Air Pressure Gauge

- 7. Test the operation of the rockdrill. Shift the rotation control levers to ensure that the rotation turns in the correct direction. Shift the percussion lever on momentarily to ensure rockdrill is working. Engage the feed control lever to ensure the rockdrill properly travels the length of the feed with no binding or irregularities.
- 8. Test the tramming.
- 9. Drill and Remote Control Inspection

Once drilling has commenced, check and look for air leaks.



4.4.3.2 Positioning the Drill Rig

The Stopemate[™] is equipped with three control groups to complete the set up function.



Figure 4-11: Feed Positioning



The Stopemate[™] is a highly versatile mobile machine. To avoid injury, the highest regard to personal and machine safety must be observed. Some of the potential hazards are prevalent during feed positioning.

Avoid positioning any personnel on either side of the dumping traverse as this is a critical area. These hazards could include mechanical pinch points between moving parts and possible interference of hosing.

Always pay close attention to the position of hoses when preparing to set up or move this piece of equipment.

Report any damaged components. Do not operate the rig if you feel an unsafe condition exists.

Always ensure that no one is close to the drill when setting up or tramming. Leave yourself a place to retreat in case of an emergency

Tram Controls

The tram controls allow the operator to position himself so that he can see the position of the drill.

- 1. Using the tramming controls, position the carrier so that the traverse is lined up with the locating lines, typically painted on the drift side walls.
- 2. With the pivoting traverse the machine can be as much as 20 degrees from perpendicular to the locating lines. The traverse can then be pivoted to align the traverse to the locating lines.

Jack Controls

The jack controls are used to operate the stabilizers (jacks).

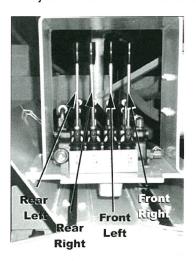


Figure 4-12: Jack Control Valve Bank V4

- With the carrier properly positioned, lower the four stabilizer jacks using the control valve on the pivoting auxiliary control arm to level the carrier. Depending on the ground conditions, it may be necessary to place blocking under the stabilizers.
- 2. Each leveling jack can also be extended outwards from the machine frame. Remove the locating pin, slide the jack to the required position, and re-install the locating pin.
- 3. With the locating pin removed the stabilizer jack can slide completely out of the frame.

Set Up Controls

The set up controls are used for positioning the feed.



Figure 4–13: Set Up Control Valve Bank

1. The traverse pivot was designed to allow for easier set-up for drilling and for tramming through narrow openings. The traverse



can be pivoted 20 degrees to one side and 90 degrees to the opposite side aligning it with the side of the machine.



Keep clear of the traverse assembly when engaging the pivoting action. As the traverse pivots there is the potential of becoming pinched or trapped between the machine frame and the traverse assembly.

- 2. When pivoting the traverse to either side, the bottom of the traverse passes very close to the top of the levelling jacks. Ensure this area is kept clear at all times.
- When pivoting the traverse to align it with the side of the machine ensure the feed does not come in contact with the tires, or the stabilizer jacks.



While pivoting the traverse pay close attention to the hoses to ensure they do not become pinched as the traverse moves.

- 4. When drilling with the traverse aligned with the machine ensure the stabilizer jacks are in the fully extended position outwards from the machine. In this position ensure that any hoses or components are clear of the tires before moving the machine.
- 5. The feed can be hydraulically crowded (advanced or retracted) in either direction if required.
- 6. Rotate the feed to the vertical down drilling position and reverse the rockdrill to the fully retracted position.
- 7. Attach the starter rod and bit to the Rockdrill striking bar

8. With the hydraulic system still powered, set the positioner at the required dump angle. A level indicator should be used against the drill feed to check the angle.

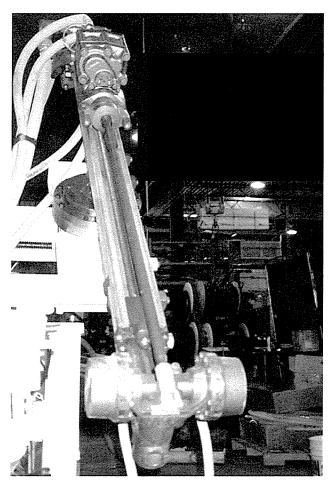


Figure 4-14: Screw Feed

9. Slide the feed on the traverse. Use the control valve mounted on the drill control arm to activate the side to side movement of the feed on the traverse.



10. Set the drill angle using the hydraulic rotation positioner. Release the rotation clamp, rotate to the desired position and retighten the clamp.

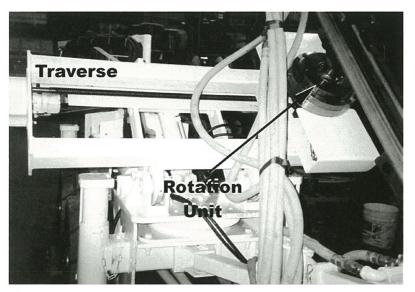


Figure 4-15: Traverse

There is an optional laser, which can be attached to the feed assembly to assist in aligning the carrier.

4.4.3.3 Positioning the Drill Control Arm

- 1. The drill control arm is centered in front of the machine on a pivot, which allows for positioning of the arm on either side of the feed.
- 2. The arm has three hinged joints and a hydraulic cylinder to set the proper working height.
- 3. To position the arm, first move it to one side of the machine and lock it into position by inserting the securing chains into the locking slot on the arm.
- 4. To position the other two sections of the arm remove the locking pin, position the arm and re-insert the locking pin.



Depending on the position of the carrier, when removing the chain or lock pin(s), the drill control arm may move due to gravity or hose stiffness. Ensure that your hands, fingers or any other part of your body are not in an area that could become pinched when positioning the arm.

4.5 Drilling



Never attempt to manually thread or unthread rods from striking bar while rotation is activated! Entanglement hazard. Severe personal injury could occur.



Keep loose clothing away from rotating rods!

Always wear safety glasses!



When extracting the drill string on up hole, do not open the rod clamp until the shank thread is engaged with the coupling secured in the rod clamp. If the rods are dropped or fall the coupling may split or chip from the impact. Segments could be propelled in any direction at great speed and could cause serious injury to anyone in the vicinity.



Check the back for loose and scale regularly— vibration from drilling can cause loose.



If you encounter water draining from cracks when drilling an uphole, it is likely that you are drilling in shattered ground. Immediately stop drilling and contact a mine engineer to investigate. Drilling should not resume until you have received clear instructions that the ground is safe to work under, or until further ground support has been installed.



If, while drilling, there is a hollow sound emanating from the rock, this would indicate that the ground is broken. Immediately stop drilling and contact a mine engineer to investigate. Drilling should not resume until you have received clear instructions that the ground is safe to work under, or until after further ground support has been installed.



4.5.1 Installing a Drill Rod



When putting your first rod on string, it is important to follow the safest procedure. Always think safety.

- 1. Retract the rockdrill fully for downholes.
- 2. Place the male thread of your next rod on top of the coupling in the rod clamp.
- 3. With the feed lever on the control panel, lower the rockdrill down so the striking bar comes down on top of rod joint. Keep fingers well away from striking bar.
- 4. From behind the control panel, rotate thread of striking bar into rod.
- 5. Lower feed as they thread together and as soon as joints are tight, release rod clamp.
- 6. Repeat this process until you have added as many rods as required.

4.5.2 Hole Flushing



NEVER DRILL DRY. The dust you create is breathed by many!

Hole flushing is required to eliminate dust in the drilling process and flush cuttings from the hole. The water can be turned on and off by the driller from the OCP.

4.5.3 Starting the Hole

4.5.3.1 Installing a Casing

- 1. Activate percussion and watch that the feed does not move off degree.
- 2. To avoid rockdrill damage from back hammering and "deviating", carefully drill through overburden using low hammer pressure.



- 3. After drilling just about 2" into solid, recheck dip angle to ensure a good hole.
- 4. Drill casing hole a minimum of 18". In cases of excessive overburden, use the following rule of thumb: "Drill casing hole into solid rock at least the same depth as overburden".
- 5. Clean hole by reaming hole up and down using air & water until collar of casing hole can be seen. Hand muck if necessary. Do not put hands under bits or hammer.
- 6. Use pilot reaming method to collar holes, e.g.: 3- 1/2" hole opener for 3" casing or 4" hole opener for 3-1/2" casing. Ream about 18" deep, using water as you ream.
- 7. Use weight to hold down casing.
- 8. Remove rod from striking bar and insert a casing about 2" longer than reamed length.
- 9. Drive casing down by using a rod or hammer.
- 10. Recheck that your dump angle and dip have not changed.

4.5.3.2 Collaring a Hole

- 1. Close rod clamp around rods leaving enough space to rotate the rod freely.
- 2. Close rod clamp.
- 3. Shift the water flushing lever forward. Water should be spraying out of the end of the bit.
- 4. Engage the rotation to counterclockwise rotation.
- 5. Shift the feed lever forward.
- 6. As the drill bit meets the rock, simultaneously shift the percussion lever to half power.
- 7. If the surface being collared is rough or angled, a gentle, patient approach will be more successful.
- 8. Activate feed on/off until bit is successfully collared.
- 9. For accurate collaring, drill rod to a depth of 61 cm (2 ft) before opening the rod clamp.



4.5.4 Drilling

- Open rod clamp fully.
- 2. The rotation lever should be in the counterclockwise rotation direction.
- 3. Ensure the water flushing is on.
- 4. Shift the percussion lever to full power (completely forward).
- 5. Shift the feed lever forward.

With experience, the sound of the drill will indicate when the feed force needs adjustment.

4.5.4.1 Inspection While Drilling

While the drill is in operation, continuously make the following observations:

- 1. Air pressure (stop drilling if there is a sudden drop in air pressure
- 2. Water pressure (stop drilling if there is a loss of water pressure a loss of water pressure will result in poor hole flushing and the potential loss of the drill string due to mudding in the hole).
- 3. Sound of drill (sudden change will indicate a problem or a need to adjust the feed pressure).
- 4. Look for evidence of air oil mist around shank to ensure proper lubrication within the rockdrill. If there is no oil evident around the shank where it protrudes from the water box, immediately stop drilling and locate the problem.

4.5.4.2 Drilling Down Holes and Breakthrough Holes

- 1. When drilling breakthrough holes, always follow breakthrough procedures.
- 2. Install a casing.
- 3. Gauge bits if you will be using more than one bit with blade bits. Use a caliper on button bits, if necessary. The bit with the longer carbide indicates it is newer, and has a larger outside diameter.
- 4. Place the rod into the casing and close the rod clamp.
- 5. Holding rod in closed rod clamp, lower rockdrill to thread rod onto striking bar.
- Turn on water, then rotation.



- 7. When water is seen coming up the casing, slowly allow rod into hole, watching and anticipating jams.
- 8. As there will be small rocks and cuttings in the hole, it might be necessary to apply a little hammer until you reach the bottom of the previously drilled hole.
- 9. Drill rod to completion slowly increasing percussion. You do not need full percussion on first rod.
- 10. To add a rod: (1) stop rotation, (2) stop water, (3) stop hammer, and (4) close rod clamp.
- 11. Reverse feed so weight comes off of rod or coupling.
- 12. Reverse rotation slowly with some reversed feed until striking bar comes free from rod.
- 13. Stop rotation, increase reversed feed and allow rockdrill to climb to top of slide.
- 14. Add next rod on, thread onto drill string by hand to almost tight, holding rod below coupling. As you slowly add feed, lower rockdrill so striking bar comes down onto coupling of added rod.
- 15. Stop feed. Position yourself behind the control panel.
- 16. Apply rotation so striking bar and rod thread together. Thread striking bar onto rod until tight.
- 17. Release rod clamp and turn water on. Rods are still turning.



At no time shall an operator hold the rod while the striking bar is rotating!

- 18. When water is coming up the casing, apply a little feed so there is some pressure on rods.
- Slowly turn hammer on half and then on full keeping your eye on coupling. Apply feed until there is no longer any vibration at coupling.
- 20. You may have to increase rotation or decrease rotation. As you watch the turning coupling, also watch the feed. In time, you will know if the two are turning together.
- 21. Never allow the rods to bounce. Bouncing rods may cause premature striking bar wear. Apply a little more feed as the rods get deeper into the hole.
- 22. When you come to the end of rod length, repeat steps 10 to 21.



- 23. If you are using more than one bit, pull the rods and change bit. DO NOT OVERDRILL BIT.
- 24. The Driller should always be consciously timing each rod. When penetration starts to slow, change bit immediately. Do not wait until bit is flat! Always drill with a sharp bit. The footage that is lost drilling with a non-sharp bit is always greater than footage lost pulling rods to change bits. Organization and timing is what separates the good Drillers from the bad.
- 25. As you come close to breakthrough, flush the hole. Allow the water to come back up and continue drilling. Don't allow too much cuttings in the hole at breakthrough; you may jam your rods.
- 26. At end of shift, always wash off machine and oil up. Clean up any garbage.

4.5.4.3 Collaring and Drilling an Uphole

- 1. Before moving carrier into set up, perform Five Point Safety Check. Add auxiliary lighting where possible to assist in visually inspecting ground conditions. Check scale entire back in immediate area.
- 2. Set up carrier according to Standard Job Procedure.
- Choose proper bit and rod length. Make sure length of first rod on uphole is adequate; this will ensure a good solid collar. If back is high, get a longer rod.
- 4. With the rockdrill at bottom and rod clamp open, use a round rod with a bit and place it on the striking bar. Close the rod clamp.
- 5. Bring bit up to roof or backs and apply snug pressure.
- 6. Place yourself and control panel as far from collaring as possible.
- 7. Turn on the water enough to eliminate dust.
- 8. Turn hammer on about ¼ and apply enough feed so rods don't bounce. Watch for loose and small flying debris.
- 9. Once the bit has cut a notch, apply rotation and more feed.
- 10. Never allow the rods to bounce while collaring, you will break a striking bar or a rod.
- 11. Once collared, stop hammer, stop rotation, stop water and check scale for loose dislodged from collaring. Re-check set-up.
- 12. Resume drilling until required depth is reached. Use minimum feed pressure for minimum of 3 meters.





Maintain continuous visual sweeps of back and walls for loose or possible falls of ground!

13. When adding rods on an uphole, always screw rods into the female end of last rod drilled; or, with rotation in the neutral position, screw rod onto striking bar.

4.5.4.4 Adding Drill Steel

When the rockdrill has completed drilling the entire length of drill steel, move the rotation, percussion and feed levers to neutral, then turn off the water flushing.

- 1. Shift the rod clamp control lever forward to clamp the coupling.
- 2. Shift the rotation lever to turn the rotation clockwise (unthread).
- 3. Shift the feed lever to simultaneously retract the feed. Through the electric circuitry, when unthreading drill steel, the feed operates at reduced pressure to prevent thread binding.
- 4. When the rockdrill striking bar is released from the coupling being held in the rod clamp, shift the rotation lever to neutral. This allows the feed to operate at maximum speed.
- 5. When the rockdrill is at the back of the feed, insert a new length of drill steel between the rockdrill striking bar and the coupling held in the rod clamp.
- 6. Shift the feed lever forward to advance the rockdrill/striking bar until the new length of steel meets the coupling held in the rod clamp.
- 7. Shift the rotation lever forward to begin rotation and the feed lever forward to advance the rockdrill.
- 8. Shift the rod clamp lever to open the rod clamp.
- 9. When the threads at both ends of the new length of drill steel are fully engaged, start the water flushing and engage the percussion.
- 10. Normal drilling will resume.



Pinch Point -- do not hold top of rod when aligning.



4.5.4.5 Rod Pulling



When extracting the drill string on up hole, do not open the rod clamp until the shank thread is engaged with the coupling secured in the rod clamp. If the rods are dropped or fall the coupling may split or chip from the impact. Segments could be propelled in any direction at great speed and could cause serious injury to anyone in the vicinity.

- 1. When the hole has been drilled to the required length, disengage all levers to halt all functions.
- 2. To clean hole, activate air flushing until hole is free of all drill cuttings.
- 3. To loosen rods move the feed lever forward until the drill string is tight against the bottom of the hole.
- 4. With rotation off, engage the percussion to loosen all of the drill string joints. Disengage the percussion when complete.
- Shift the feed lever to retract the rockdrill and pull the drill string out
 of the hole. When the first coupling is centered in the rod clamp,
 shift the feed lever to neutral and clamp the coupling with the rod
 clamp.
- 6. Shift the rotation lever to rotate the rockdrill clockwise and unthread the drill steel from the coupling, while at the same time shifting the feed lever to reverse. Again, through the electric circuitry, when unthreading the drill steel, the feed operates at reduced pressure to prevent thread with the rockdrill (with experience, it will become somewhat predictable). Consequently, usually at least one end of the threaded joint will have to be unthreaded by hand.

Because the drill steel is threaded at both ends, there is no way to predict which end will unthread.



Pinch Point -- do not hold top of rod when aligning.

- 7. When the drill steel is loose, set it in the drill rack. Pay attention to rod rotation in an effort to maximize steel thread life.
- 8. Shift the rotation lever forward to rotate the drill counterclockwise and shift the feed lever to advance the feed until the drill striking bar is engaged with the coupling held in the rod clamp.
- 9. Stop the rockdrill rotation.
- 10. Open the rod clamp.

- 11. Shift the feed lever to retract the rockdrill and pull the drill string out of the hole. When the next coupling is centered in the rod clamp, shift the feed lever to neutral and clamp the coupling using the rod clamp.
- 12. Repeat the above procedure until the entire drill string is removed from the hole.

4.6 Shutting Down the Drill

- Hose machine down. It may be necessary to loosen the accumulated cuttings and muck using a scaling bar. The removal of excess waste material on the Stopemate[™], especially the feed and positioner, will improve component life and minimize unpredictable breakdowns.
- 2. Tighten any loose hose connections.
- 3. Notice of any breakage leave note for cross shift.
- 4. Check hydraulics for leaks, make sure the hydraulic tank is full of hydraulic oil.
- 5. Complete minor repairs.
- 6. Shut water off at header.
- 7. Shut air off at header.
- 8. Note on prints where machine is, how many rods in hole, how many rods on rack.
- 9. Take garbage out of stope with you.
- 10. Put away tools.



Chapter 5: Hydraulic System

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5.1 Hydraulic Module

5.1.1 Hydraulic Reservoir

The hydraulic tank is an integral part of the main frame assembly. The hydraulic tank is equipped with a clean out cover, filler/breather and level gauge.

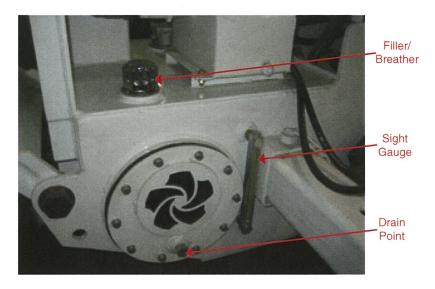


Figure 5-1: Hydraulic Reservoir

5.2 Hydraulic Valves

Refer to the operator's control panel or hydraulic schematic on valve locations where applicable.

Valve Number	Description
V1	Control Valve Bank (Drilling Controls)
V1-01	Valve Section (Rotation)
V1-02	Valve Section (Flushing)
V1-03	Valve Section (Rod Clamp)
V1-04	Valve Section (Feed)
V1-05	Valve Section (Percussion)
V2	Control Valve Bank (Setup Controls)
V2-01	Valve Section (Arm Raise Lower)
V2-02	Valve Section (Traverse Dump)
V2-03	Valve Section (Feed Rotate)
V2-04	Valve Section (Rotation Unit Slide)

Valve Number	Description
V2-05	Valve Section (Traverse Pivot)
V2-06	Valve Section (Feed Crowd)
V2-07	Valve Section (Feed Stell)
V2-08	Valve Section (Feed Swing)
V3	Tramming Valve
V4	Control Valve Bank (Jack Controls)
V4-01	Valve Section (Jack)
V4-02	Valve Section (Jack)
V4-03	Valve Section (Jack)
V4-04	Valve Section (Jack)
V5	Main Relief P1 Circuit
V9	Dual Counterbalance Valve, (Drive Motor)
V10	Dual Counterbalance Valve, Feed Rotation
V11	Double Pilot Operated Check

Table 5-1: Valve Description

5.2.1 V1 Control Valve Bank (Drilling Controls)

V1 Control Valve Bank is a 5 spool pneumatic manually operated control valve located on the control arm assembly. It contains the valve sections that control drill rotation, flushing, rod clamp, feed and drill percussion. Air is supplied by the mine air supply.

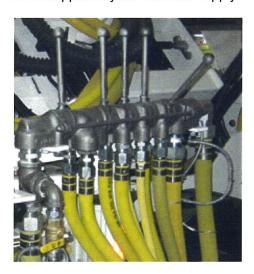


Figure 5–2: V1 Control Valve Bank



5.2.2 V1-01 Valve Section (Rotation)

V1-01 is located in the V1 control valve bank. This section controls the speed and direction of the rockdrill rotation motor M1. This valve section is manually operated 3 position spool with a friction detent to hold it in position.

5.2.3 V1-02 Valve Section (Flushing)

V1-02 is located in the V1 control valve bank. It is a three position control allowing the driller to flush the hole with water or air. This valve section is manually operated 3 position spool with a friction detent to hold it in position.

5.2.4 V1-03 Valve Section (Rod Clamp)

V1-03 is located in the V1 control valve bank. This section controls the speed and direction of the rod clamp function. This valve section is manually operated 3 position spool with a friction detent to hold it in position.

5.2.5 V1-04 Valve Section (Feed)

V1-04 is located in the V1 control valve bank. This section controls the speed and direction of the rockdrill feed function. This valve section is manually operated 3 position spool with a friction detent to hold it in position.

5.2.6 V1-05 Valve Section (Percussion)

V1-05 is located in the V1 control valve bank. This section controls rockdrill percussion. The off position being towards the operator rather than in the center as shown in figure 5-2. This valve section is manually operated 3 position spool with a friction detent to hold it in position.

5.2.7 V2 Control Valve Bank (Setup Controls)

V2 is an 8 spool manually operated proportional control valve located on the remote drill control arm next to the drilling controls. It contains the valve sections that control the drill feed positioning functions including remote arm raise lower control. Oil is supplied by the P1 Primary Pump.



Figure 5-3: V2 Control Valve Bank

5.2.8 V2-01 Valve Section (Arm Raise Lower)

V2-01 is located in the V2 control valve bank. This section controls the speed and direction of hydraulic cylinder A8 used to raise and lower the drill control arm.

5.2.9 V2-02 Valve Section (Traverse Dump)

V2-02 is located in the V2 control valve bank. This section controls the speed and direction of hydraulic cylinder A5 used to tilt the traverse.

5.2.10 V2-03 Valve Section (Feed Rotate)

V2-03 is located in the V2 control valve bank. This section controls the speed and direction of hydraulic rotary actuator A6 used to rotate the drill feed for fan drilling.



5.2.11 V2-04 Valve Section (Rotation Unit Slide)

V2-04 is located in the V2 control valve bank. This section controls the speed and direction of hydraulic traverse motor M4 used to move the feed across the traverse.

5.2.12 V2-05 Valve Section (Traverse Pivot)

V2-05 is located in the V2 control valve bank. This section controls the speed and direction of hydraulic cylinder A6 used to rotate the traverse on its pedestal.

5.2.13 V2-06 Valve Section (Feed Crowd)

V2-06 is located in the V2 control valve bank. This section controls the speed and direction of hydraulic cylinder A2 used to move the feed in its holder.

5.2.14 V2-07 Valve Section (Feed Stell)

V2-07 is located in the V2 control valve bank. This section controls the speed and direction of the Feed Stell Cylinder A9.

5.2.15 V2-08 Valve Section (Feed Swing)

V2-08 is located in the V2 control valve bank. This section controls the speed and direction of the Feed Swing Helac Actuator A3.

5.2.16 V3 Tramming Valve

V3 is located on the tramming control swing arm. This valve (qty. 2) controls the speed and direction of the traction motors (M3) for one side of the drill rig. Motors M3 are connected in series. This valve section is a manually operated spring centered valve.

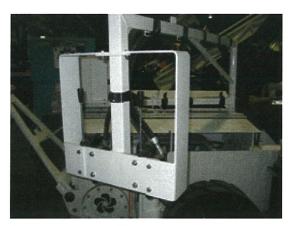


Figure 5-4: V3 Tramming Valves

5.2.17 V4 Control Valve Bank (Jack Controls)

V4 is a 4 spool manually operated control valve located on a swing arm above the rear frame. It contains the valve sections that control the drill jack functions. Oil is supplied by the P1 Primary Pump.

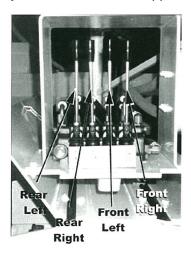


Figure 5-5: V4 Control Valve Bank



5.2.18 V4-01, 02, 03, 04 - Valve Section (Jack)

V4-01 thru 04 are located in the Jack Control Valve Bank V4. These valve sections are a manually operated spring centered type used to extend and retract hydraulic jack cylinders A7.

5.2.19 V5 Main Relief, P1 Circuit

The P1 Pump Main Relief is located in the inlet section of each tramming valve V3.

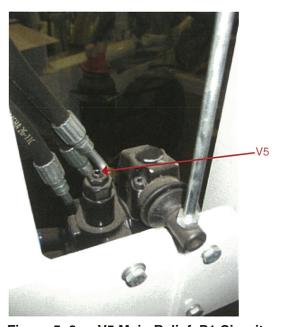


Figure 5-6: V5 Main Relief, P1 Circuit

Adjustment of V5 pressure relief is done using a 4mm hex key and a 13mm open end wrench as shown below. In this case it is set at maximum as the available air pressure in the mine limits the maximum torque the air motor M2 can produce.

If an adjustment is required, loosen the lock nut with the open end wrench and use the hex key to make the adjustment. Turning the hex key in a clockwise direction increases the pressure setting; turning it clockwise decreases the setting. Lock the setting by snugging up the lock nut.



Figure 5-7: V5 Pressure Adjustment

5.2.20 V9 Dual Counterbalance Valve, (Drive Motor)

V9 is located on the inside wall of the lower front drive chassis as shown below. It provides motion control and load holding function for two drive motors (M3) plumbed in series.

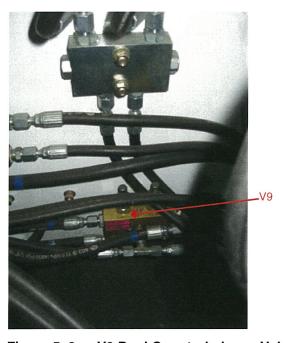


Figure 5-8: V9 Dual Counterbalance Valve



5.2.21 V10 Dual Counterbalance Valve, Feed Rotation

V10 is located on the traverse pedestal as shown below. It provides motion control and load holding function for rotary actuator (A6).



Figure 5-9: V10 Dual Counterbalance Valve

5.2.22 V11 Double Pilot-operated Check

V11 is used in a number of locations on the drill. It is installed to hold an actuator from creeping due to leakage past the control valve spool.

5.3 Counterbalance Valves



Counterbalance valves are load holding devices that may have to be serviced or replaced from time to time. These valves should only be serviced by trained hydraulic service personnel and must be reset to the values stated in the hydraulic schematic. Always ensure that any load locked by a counterbalance valve is properly supported prior to service. Failure to do so could result in equipment damage, personal injury or death.

Never substitute one valve cartridge for another. There are a multitude of cartridge ratios, settings and designs closely matched to the application. Inadvertent substitution could result in equipment damage, personal injury or death.

Never work under a suspended load.

5.3.1 Setting Counterbalance Valves

Some counter balance valves cartridges can be adjusted on the machine but certain applications (such as the mainline hoist) may dictate that a valve be set in a test fixture. Counter balance valve cartridges are available in a multitude of cavity sizes, and the test manifold must match the cartridge being tested. The test fixture must have a pressure supply that can exceed the desired setting of the counterbalance valve cartridge by at least 10%.

The following procedure is a general guideline:

- Ensure load is lowered/securely supported prior to removing the counterbalance valve.
- 2. Clean/wipe away any dirt around the cartridge before removal.
- 3. Remove the valve cartridge and use a suitable method to capture any oil.
- 4. Plug the open valve cavity with a clean lint free cloth.
- 5. Install the clean cartridge into the test manifold.
- 6. Slowly raise the load pressure of the cartridge in the test fixture to the desired value indicated on the hydraulic schematic. If the cartridge relieves pressure at that setting, no further adjustment will be required. If the cartridge fails to relieve the load pressure at the desired setting, re-adjustment or replacement of the valve will be necessary.

5.4 Hydraulic Pumps

Item Number	Description
P1	Main Hydraulic Pump

Table 5-2: Pumps

5.4.1 P1 Primary Hydraulic Pump

The P1 Hydraulic pump is a tandem gear pump design, close coupled to a radial piston air motor (M2). It is only used for drill set up and tramming. A manually operated ball valve is installed on the drill control air inlet as shown below to allow the driller to turn the hydraulics on and

off. The valve should left in the closed position as shown when not in use as it does not need to be running during the normal drilling cycle.

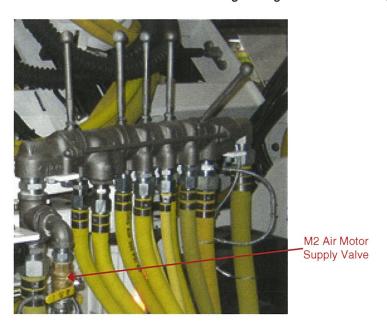


Figure 5-10: P1 Hydraulic Pump/M2 Valve

5.5 Fluid Conditioners and Filters

Item Number	Description
C1	Main Return Filter
C2	Air Inlet Filter
C3	Hydraulic Reservoir Breather

Table 5-3: Fluid Conditioners

5.5.1 C1 Main Return Filter

The return filter on the Stopemate is an in tank design, located at the rear of the machine. A dirt indicator is installed to indicate the condition of the filter element. A hydraulic function (such as a jack or traverse actuator) must be running when checking the gauge, otherwise it will always indicate clean.



Figure 5-11: C1 Main Return Filter

When the indicator drops to the yellow 'CLEAN' zone, it is necessary to replace the filter element. Replacement of the element is described below.

5.5.1.1 Filter Element Change Procedure

- 1. Shut down the hydraulic system by closing the large ball valve on the main air supply feeding to the rig.
- 2. Open and secure the hood.
- 3. Wipe down the return filter cover and housing to remove any dirt that could enter the tank during service

4. Loosen the four M6 hex head bolts on the filter cover using a 10 mm open end wrench and remove the cover.



Figure 5-12: Remove Return Filter Cover

5. Remove the spring and filter element by pulling it straight up.



Figure 5-13: Remove Filter Element

- 6. Replace filter element and reinstall in filter housing.
- 7. Inspect the cover O-ring and replace it if necessary.
- 8. Replace the cover making sure that the cover O-ring seats properly on the filter housing.
- 9. Tighten the four hex head bolts until they are snug. DO NOT over torque these bolts.
- 10. Clean up any oil spills.

5.5.2 C2 Air Inlet Filter

The C2 main air filter is located at the rear of the machine behind the tow bar. The filter housing also acts as a water trap; a small valve located at the bottom of the filter bowl can be left cracked slightly open to continuously purge any water that collects.



Figure 5-14: C2 Air Filter

5.5.2.1 C2 Air Filter Service

The air filter consists of a stainless steel element which can be removed and cleaned. To service, follow these steps:

- 1. Shut off the air inlet by closing the ball valve leading into the lubricator.
- Open the drain valve on the bottom of the air filter to bleed off any pressure. If there is any compressed air left in the circuit it should quickly bleed off. Once all compressed air is bled off, the filter bowl can be removed.



If the sound of compressed air escaping continues without stopping, DO NOT remove the bowl. The ball valve may not be completely shut off or may be faulty. Ensure that the air is off before removing.

 Loosen the main lock ring on the filter bowl by turning counter clockwise. This will release the bowl and allow access to the element.

- 4. Inspect the element for damage. If the element is not damaged, it can be cleaned and reused.
- 5. To clean the element, soak in an ultrasonic cleaner for 15 minutes. If an ultrasonic cleaner is not available, soak the element in a hot soap-water-ammonia solution for 15 minutes. Swish the elements around and blow dry from the inside out.

5.5.3 C3 Hydraulic Reservoir Breather

A hydraulic reservoir breather C3 is located on the top of the main hydraulic reservoir next to the return filter as shown in Figure 5-13.

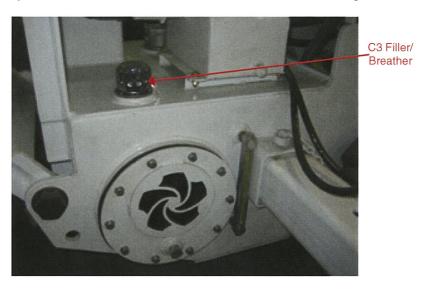


Figure 5-15: Hydraulic Reservoir Breather C3

5.6 Motors

Item Number	Description
M1	Rockdrill Rotation Motor
M2	Main Air Motor - Carrier
МЗ	Wheel Motors
M4	Traverse Motor
M5	Feed Motor

Table 5-4: Motors

5.6.1 M2 Main Air Motor

The Main Air Motor M2 is used to drive the main hydraulic pump. The air motor is a radial piston design and relies on an oil sump for lubrication. An external clear bowl is installed on the side if the carrier frame to provide oil level indication as shown in Figure 5-16.

For filling the motor, the best method is to pour oil directly into the air motor through the filler point shown in Figure 5-17 (do not overfill). It is best to remove the cover on the sight bowl to allow any air to escape during the filling process. The sight bowl can be used as guide when filling for level. It will take some time if the oil is cold. Oil type and quantity is detailed in the lubrication chart located in Chapter 6.



Figure 5-16: Air Motor Oil Level



Figure 5-17: Main Air Motor Fill Point



5.7 Actuators

Item Number	Description
A1	Rod Clamp Cylinders
A2	Feed Crowd Cylinder
A3	Feed Swing Actuator
A4	Feed Rotate Actuator
A5	Traverse Dump Actuator
A6	Traverse Rotate Actuator
A7	Jack Cylinders
A8	Remote Arm Cylinder
A9	Stell Cylinders (Optional)

Table 5-5: Actuators

5.7.1 Rod Clamp Cylinders

The rod clamp consists of two opposed double acting pneumatic cylinders with the rod stems profiled as the clamp jaw. These cylinders take a lot of abuse from percussive hammer action.

Boart Longyear can offer a repair and return service for a number of components on the rig including this cylinder.

5.7.2 Jack Cylinders

The jack cylinders are double acting hydraulic cylinders with integral double pilot operated checks built into the cap end.



Figure 5-18: Jack Cylinders



Chapter 6: General Maintenance

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6.1 Introduction

Cost consciousness and the call for greater efficiencies have led to an ever-increasing use of machinery in the construction industry. This has enabled contractors to dispense with expensive manpower, while at the same time reducing time spent on-site.

This development is clearly shown by fact - machine-related construction costs show a substantially lower increase than labour intensive operations.

Everybody must therefore be interested in further increasing the efficiency of Construction Machinery.

The breakdown of machinery on-site always entails additional costs and loss of precious time.

High availability of machinery and the reduction of downtime requires a well geared system of maintenance.

The aim of planned servicing and maintenance must therefore optimise the availability of machinery and accessories.

6.1.1 Operational Requirements

Maintenance measures are:

□ Regular Service - appropriate measures to maintain nominal machine condition, e.g. cleaning, lubrication, oil changes, and minor adjustments.
 □ Inspection - measures to assess and review the actual condition of the machine.
 □ Preventive Maintenance - exchange of worn, but still used components with the view to forestall greater damage.

☐ Repairs - appropriate measures to restore the nominal condition of

6.1.2 Safety Requirements

machine.

Care, maintenance and service of construction equipment are important processes to help ensure safety at worksites. However, accidents associated with worksite maintenance often occur. This is primarily due to:

☐ Wrongly applied maintenance measures
☐ Lack of operational safety due to inadequate maintenance
All relevant safety at work stipulations must be complied with

Individual stipulations require checks:

☐ When indicated or at specified intervals by Experienced operators/ fitters or specialist experts.

Experienced operators/fitters are persons who, on the basis of their qualification and experience, have adequate knowledge to assess the operational safety of equipment.

Specialist experts are persons who, on the basis of their qualification, experience and competence, have the special knowledge to assess the operational safety of equipment and, if necessary, effect such repairs required to restore the equipment's operational safety.

For the purpose of these care and maintenance instructions this means that:

Care, service and maintenance measures can be carried out by the contractor's personnel.

Structural changes, additions, mountings, adjustment of pressure limiting valves, etc., which modify the equipment's behaviour (and stability) are only to be effected after consulting with and receiving written authorisation from Boart Longyear, and/or under the supervision of a Boart Longyear technical expert.

6.2 Tools and Equipment

Regardless of which system or method is used, make sure that the following tools and equipment are available on-site.

☐ A Tub of Thread Grease and Application Brush



☐ A Wire Brush to clean Thread Sections



☐ A set of Saw Horses of sufficient strength to hold the Drill Rods and Casings, and keep them off the ground



☐ A set of Wrenches of the correct size for all spanner flats on the drill string



☐ A separate Water Line with Nozzle to clean mud and grout from drill rig and tools



- ☐ Two 36" (or larger) Wrenches
- These are handy on any drill site



☐ Shovel, to remove cuttings from the area



☐ Hammer, sometimes necessary to strike the casing to loosen thread connections

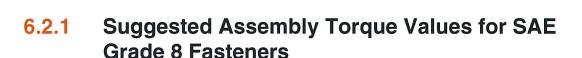


☐ Spirit Level or Angle Indicator for Drill Mast Alignment



☐ Grease Gun with Pressure gauge for Crawler Track tensioning





The following table depicts suggested assembly torque values for SAE grade 8 fasteners.

Size	Dry Ibf•ft (Nm)	Lubricated lbf•ft (Nm)
3/8-16	45 (61.0)	35 (47.5)
3/8-24	50 (67.8)	35 (47.5)
1/2-13	110 (149.1)	80 (108.5)
1/2-20	120 (162.7)	90 (122.0)
5/8-11	220 (298.3)	170 (230.5)
5/8-18	240 (325.4)	180 (244.0)
3/4-10	380 515.2)	280 (379.6)
3/4-16	420 (569.4)	320 (433.9)

Table 6–1: Assembly Torque Values

6.3 Preventive Maintenance

☐ Lower the drill mast onto the mast support.

₩ BOART LONGYEAR	Chapter 6: General Maintenance
	☐ The drill mast must be supported prior to any attempt at cylinder repair.
	☐ Be sure to include a healthy running-in period for new components after all repair and maintenance measures.
	☐ Always maintain recommended operating temperatures and check filters at specified intervals.
	☐ Utmost cleanliness must be observed when removing hoses and fittings.
	□ All trailing hoses from the control panels must be kept under observation to avoid trapping and to pre-empt a failure of abraded hoses.
	☐ The unit must be turned off and all lines de-pressurised by moving the valve levers to and fro. Cylinder load control valve blocks shall be slackened to depressurise before removing any cartridges.

Preventive Maintenance Schedule 6.3.1

The following checklist is a list of service items requiring regular maintenance. Frequency may vary depending on underground operating conditions.

☐ All items on an assembly should be secured against runaway prior to

working on any hydraulic connections or bolt interfaces.

Maintenance Action	Before Each Use	Every 250 Hours	Every 500 Hours	Comments
Visual walkaround inspection	x			
Check for fluid leaks	х			
Check engine oil and coolant level	х			
Check fuel level	х			
Inspect emergency stops		х		Check condition and ensure operation
Inspect fire extinguisher(s)		х		Check condition, have recharged or replaced if needed
Change power unit oil		x		Per lubrication schedule
Change power unit air filter		x		
Change engine oil and filter		X		
Change main pressure filter element			х	Or as indicated on filter indicator

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Maintenance Action	Before Each Use	Every 250 Hours	Every 500 Hours	Comments
Change return filter element			x	Or as indicated on filter indicator
Change hydraulic tank breather			х	
Change hydraulic oil			х	
Change head lube filter		x		
Inspect & clean all radiators		x		
Inspect & clean chuck jaws		Х		
Inspect & clean rod clamp jaws		х		
Inspect chuck gas springs			x	
Inspect all wear material on head			х	

Table 6-2: Maintenance Schedule

6.3.2 Lubrication Chart

RECOMMENDED FLUIDS - STOP Document#5404905 16-Dec-13	STOPEMATE			
		Vol	Volume	
Component	Fluid Type Grade	Litres	US Quarts	
Air Motor Crankoses (M2)	ISO 46 ISO 100 HYDBAII IC OIL	1 1	104	
Rockdrill Lubricator Fill Daily	See Table 2	6	10	
Wheel End Gear Reduction	See Table 3	1.39	1.47	
	Greasing Schedule - (Shots of Grease)	Shots of Grease)		
		Daily	Weekly	For best results the traverse should be in a different position each time it is greased to
FEED ROTATION SLEW BEARING-(1)	See Table 4 - Multi Purpose Grease	1		allow the new grease to travel around the bearing with the movement of the balls. Every
TRAVERSE DUMP CYLINDER BEARINGS (2)	See Table 4 - Multi Purpose Grease	1		2000 hours, attempt to purge the old grease from the bearing by rotating the traverse
TRAVERSE PIVOT CYLINDER BEARINGS (2)	See Table 4 - Multi Purpose Grease	1		90 degrees at a time and greasing (4 shots) in each position.
TRAVERSE DRIVE UNIT (1)	See Table 4 - Multi Purpose Grease		2	
TRAVERSE PIVOT BEARINGS (2)	See Table 4 - Multi Purpose Grease		1	
FEED MOTOR (1)	See Table 4 - Multi Purpose Grease	1		
DRILL CONTROL ARMS (2)	See Table 4 - Multi Purpose Grease		1	
JACK CONTROL SWING ARM (1)	See Table 4 - Multi Purpose Grease		1	
TRAMMING CONTROL SWING ARM (1)	See Table 4 - Multi Purpose Grease		1	
			Table 1	Table 1. Hydraulic Oil
Grade		150 32	150 46	Rig Operating Temperature Range Deg C (Including Cold Start Up)
Imperial Oil	UNIVIS EXTRA UNIVIS N32	NUTO H32	NUTO H46	-40 -30 -20 -10 0 10 20 30 40 50 55
Shell	TELLUS ARCTIC 32	AWMV32	ISOVG46	Severe Service Winter (SSW) All Weather Service (AWS)
Mobil		DTE13M	DTE15M	150 32
				130.46
	Table 2 Rockdrill Oil			
	Century 763			
	RCULA			
	AROX			
	Table 3 Gear Oil			
	API-GL-5			
	no			
	Mobil Mobilube HD 80W90			
	Table 4 - Multi Purpose Grease			
	Imperial Oil Unirex EP 2			
	Chevron Ulti-Plex EP2			
	Mobil Mobilux EP2			
Notes:				
 Do not mix brands of oil, flush completely before changing. Hydraulic system is filled with Shell Tellus H46 from the fac 	anging. the factory			
3 - Liquid volumes are original factory fill quantities only, they are not refill quantities. Refer to Operations and Service Manual for proper procedure to check oil levels	, they are not refill quantities. Refer to Operations	and Service Manual fi	or proper procedure	to check oil levels

Figure 6-1: Lubrication Chart

6.3.3 Rig Pressure Setting Summary

Stopemate™ Pressure Settings				
Function	Valve	Bar	PSI	
P1 Main Relief	V5	214	3100	

Table 6-3: Rig Pressure Setting Summary

6.3.4 Rig Component Weights

Stopemate™ Component Weights	kg
Stopemate™ Shipping Weight	3750
S36IR Rockdrill	120
Rod Clamp	
Feed asm - 4 ft change	
Traverse asm	

Table 6-4: Rig Component Weights

6.4 Wheel Drive Maintenance



Refer to Appendix E for detailed Wheel Drive disassembly and assembly instructions. Parts information is contained in your Stopemate[™] Parts manual.

6.5 S36IR Rockdrill Maintenance

Striking bars can be changed out by the driller without removing the Rockdrill from the feed rail; all other rockdrill repairs must be done in a workshop.



Figure 6-2: S36IR Rockdrill



The S36IR rockdrill weighs 120 kg. Use the lifting points as indicated in the Rockdrill Service Manual.

Always confirm that lifting equipment is properly rated for the load.



Please refer to Appendix D: Rockdrill Service and Maintenance Manual for detailed information on this rockdrill.



6.5.1 Rockdrill Replacement in the Field

The following procedure shows you how to replace a new or rebuilt rockdrill.

- 1. Rotate the feed vertically with the rockdrill at the mid point, striking bar pointing down.
- 2. Remove the exhaust, air, and water hoses from the rockdrill.
- 3. Remove the front rod clamp and front feed screw buffer.
- 4. Reposition the feed to horizontal.
- 5. Run the feed forward until the rockdrill stops moving. Rockdrill should hang in place by the main body guides in the feed frame.



Never position any part of your body under the rockdrill until it is securely attached to a lifting device.

- 6. If no lifting device is available, the S36IR can be removed from the feed in stages: striking bar, rotation motor, and main housing.
- 7. If a lifting device is available, use a load rating sling around the striking bar and rear housing to remove the rockdrill from the feed.
- 8. Install the new rockdrill onto the feed.
- 9. Use the feed screw to draw the rockdrill back to the mid point of the feed.
- 10. Install the front feed screw buffer and rod clamp.
- 11. Blow out the air line to remove any dirt and reconnect the hoses to the rockdrill.
- 12. Fit the required striking bar into the rockdrill (refer to S36IR manual for detailed instructions).
- 13. Ensure that the area is clear and that it is safe to operate the rockdrill.
- 14. Operate drill rotation and check the direction.
- 15. Assemble the drill string and check the rod clamp jaws for correct size and alignment.
- Commence drilling.

6.6 Hydraulic Hose Replacement

- 1. Before removing failed hose, familiarize yourself with the layout of the hose so that you will know how to route the replacement.
- 2. Before loosening the fittings and removing the hose, clean the fittings and the general area surrounding the fittings. It is critical that absolutely NO dirt is allowed to enter the fittings once the hose is removed. Any failure to do so may result in the introduction of contamination which may lead to hydraulic system failure.
- 3. Replace failed hose with same size hose (diameter, length and pressure rating).
- 4. Ensure new hose is completely free of dirt prior to installation (blow out with compressed air).
- 5. Attach hose routed correctly in the required location.
- 6. Tighten fittings. Ensure hose is falling naturally, prior to tightening of fitting.
- 7. Use hose wrap to secure hoses in place.



Figure 6–3: Hydraulic Hoses



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Chapter 7: Troubleshooting

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7.1.6.5

7.1 Fault Finding Tables

7.1.1 No Pressure

7.1.1.1 Symptom: Insufficient Pump Capacity

Probable Cause	Solution	
Air entering suction line	Seal suction line	

7.1.1.2 Symptom: Too High Pump Temperature

Probable Cause	Solution
Pump damaged	Replace/repair
Viscosity of fluid too low	Change hydraulic oil

7.1.1.3 Symptom: Pump RPM too Low or Insufficient Engine Capacity

Probable Cause	Solution
Pump gear box or engine damage	Repair/replace

7.1.1.4 Symptom: Leakage from Pressure to Return Lines

Probable Cause	Solution
Wrong pressure setting	Apply correct pressure
Valve not closing	Clean valve
Blocked by dirt or particles	Assess damage. Repair
Damaged cylinder bore, piston rod or piston seals	Replace damaged components

7.1.2 Flow Low or Pressure Fluctuating

7.1.2.1 Symptom: Valves Sticking

Probable Cause	Solution
Contaminated hydraulic oil	Drain hydraulic oil, clean tank and
	components, then fill with new oil

7.1.2.2 Symptom: Air Enclosure in System Causing Jerky Movements

Probable Cause	Solution
System not properly ventilated	Bleed system

7.1.2.3 Symptom: Valves Knocking

Probable Cause	Solution
Valve seat(s) damaged	Repair or replace

7.1.3 Valves Not Operating Properly

7.1.3.1 Symptom: Valve Spool Wedging

Probable Cause	Solution
Contamination	Remove piston and clean the valve
Hydraulic oil temperature too high	Cool oil to 50°C
No pilot pressure (or insufficient pilot pressure)	Check pilot pressure

7.1.4 Hydraulic Oil Temperature too High

7.1.4.1 Symptom: Insufficient Cooling

Probable Cause	Solution
Cooler motor damaged	Repair/replace
Cooler fins dirty and closed	Clean cooler fins

7.1.4.2 Symptom: Hydraulic Fluid Circulating too Fast

Probable Cause	Solution
Fluid level in tank too low	Replenish hydraulic oil to required level



7.1.4.3 Symptom: Fluid is Dumped to Tank via Valves under Pressure

Probable Cause	Solution
Malfunction of valve caused by dirt or damaged components	Clean and repair or replace damaged components
Pressure setting too low	Adjust to right pressure setting

7.1.5 Noises from Pumps - No Oil Supply

7.1.5.1 Symptom: Pump Rotation in Wrong Direction

Probable Cause	Solution
Suction and pressure line exchanged	Change connections

7.1.5.2 Symptom: Hydraulic Fluid Frothing

Probable Cause	Solution
Fluid level too low	Replenish to level
Wrong hydraulic fluid	Replace with correct hydraulic oil
Air entering suction line	Check and tighten connections
suction line porous	Repair or replace

7.1.5.3 Symptom: Engine Defective

Probable Cause	Solution
Damaged or worn-out	Repair/replace

7.1.5.4 Symptom: Mechanical Vibrations

Probable Cause	Solution
Couplings damaged or misaligned	Repair or align as required
Vibrations caused by swinging hydraulic hoses or lines	Tighten connection or replace

7.1.5.5 Symptom: Cavitation of Pump

Probable Cause	Solution	
Restriction in suction line i.e. partially closed stop-cock	Open stop-cock fully	

Probable Cause	Solution
Hydraulic fluid too cold	Pre-heat oil to required temperature
Damaged tubes or hoses	Replace tubes/hoses

7.1.5.6 Symptom: Pump Defective

Probable Cause	Solution
Damaged or worn-out	Repair/replace

7.1.6 Leakage from Drillhead

7.1.6.1 Symptom: Leakage from Spindle

Probable Cause	Solution
Seal rings Worn	Replace upper and lower rings

7.1.6.2 Symptom: Leakage from Space

Probable Cause	Solution
Case Drain too small	Check if in limits 0.7 to 1.5 L/min.

7.1.6.3 Symptom: Hydraulic Motor

Probable Cause	Solution
Shaft seal worn	Replace hydraulic motor

7.1.6.4 Symptom: Leakage from Water Flushing Head

Probable Cause	Solution
Damaged packing	Replace packing

7.1.6.5 Symptom: Blocked up Flushing Head

Probable Cause	Solution
Damaged bearings	Replace bearings



NOTICE

Do not attempt to repair everything yourself. If you are not fully familiar with the item or do not have the right tools, you may cause greater damage.

It is no disgrace not to be familiar with every machine.

If in doubt, contact the Boart Longyear Service Section.



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Appendix A: Hydraulic Schematic

Please refer to the following location for the Stopemate™ Hydraulic Schematic:

Hydraulic Schematic #3548012



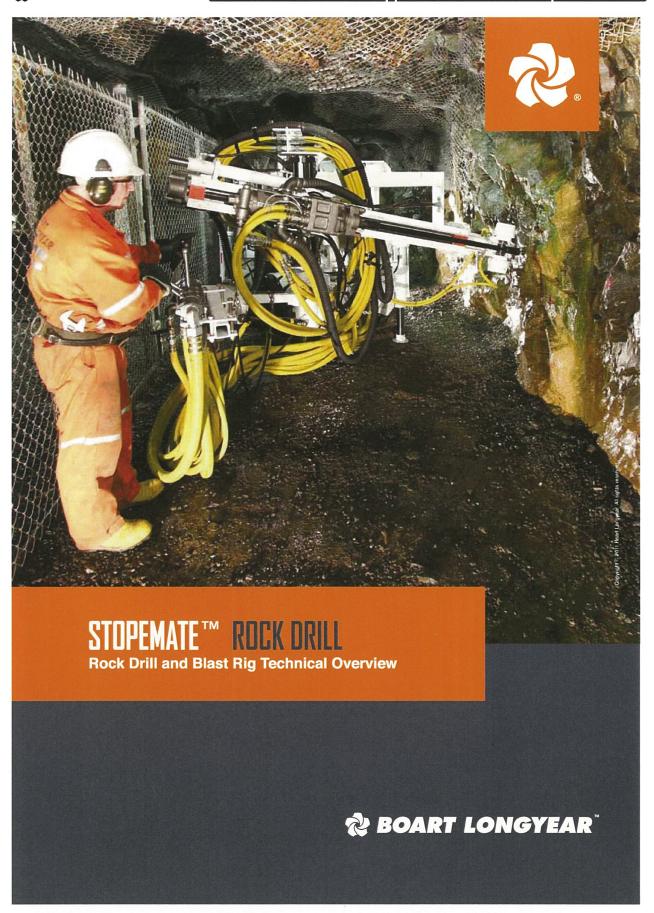
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Appendix B: Technical Specifications



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The StopeMate™ Production Drill is unique by design and created specifically to satisfy the demands of the market for a simple and robust drilling platform that can handle most drilling requirements, especially in tight situations.

Sized to fit:

- Able to tram through a 1.27 x 1.9 m (4.17 x 6.25 ft) opening with pivoting traverse feature
 Back height drilling can be as low as 2.44 m (8 ft) —
- based on a 1 m (3 ft) rod change
- Can fit into most cages with no disassembly



For more information on the StopeMate™ Production Drill scan with a QR code reader on your smart phone.



PRODUCTIVITY THROUGH SAFE, RELIABLE AND TRUSTED DESIGN

POSITIONING SYSTEM

A key feature of the StopeMate is the ability to drill a complete drop raise pattern from a single position, ensuring parallel holes which is a critical consideration in longhole drilling, where straight holes mean less dilution and more productivity.

Boart Longyear is the first company to incorporate the optional Helac Positioning System into our longhole production drills. The design of this positioning system gives you both the flexibility and smooth operation to drill along a 360° radius with extreme accuracy. The traverse can also easily pivot more than 180° in a very tight space - without • Fully pneumatic operation - ideal for captive ever moving the carrier.

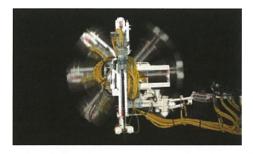
S36 IR ROCK DRILL

The driving force behind the StopeMate is the S36 Independent Rotation Pneumatic Rock Drill, a powerful 114 mm (4.49 in) diameter bore drifter-type drill designed for deep hole drilling. In favourable ground conditions, the S36 IR can drill 37 m (122 ft).

With that kind of power and mobility, the StopeMate is the "go-to" rig for everything from fan drilling, pillar recovery and narrow vein parallel drilling to ring drilling, service holes, drop raises and cable bolting.



- areas and narrow vein mining
- · Modular design with efficient dismantling and reassembly - it can be transported rapidly, even into captive areas, decreasing move time and increasing productivity
- Consistent, high performance drilling regardless of varying operator skill levels or conditions decreased maintenance costs with routine maintenance being done in the stope and increased time between scheduled preventive maintenance





Delivering high productivity drilling and low cost in a compact package.

Compact

· Ideal for narrow vein applications

· Easily hoisted through standard man way skip compartments

Simple

· Low maintenance cost

Versatile

· Fits more drilling patterns than any other platform on the market



TECHNICAL INFORMATION

IR Rock Drill Specification:			
Hydraulic Powerpack (Air Operated)	Metric	U.S.	
Radial Piston Air Motor	22 kW	30 hp	
Tandem gear pump	68 L/min	18 gpm	
Return oil filter	10 micron		
Main reservoir	98 liters	26 gallons	
Oil lubricator (rock drill) Secan F61	9 liters	2 gallon	

	Metric	U.S.
Air flow @ 90 psi	16 m³/min	575 cfm
Water Flow	38 L/min	10 gpm

Carrier	
4 wheel skid steer	
Gradeability - 30%	
4 wheel independent drive and braking (SAHR) system	
Solid rubber tires on steel rims	
Motion control valving for precise control, even over rou	ugh terrain
Quick disconnect brakes for easy towing	

Drill Positioner				
		Metric	U.S.	
Dump - +10° to -45° movement via hydraulic cylinder c/w lock valve and mechanical expanding pivot pins				
Traverse -	Traverse - side to side travel 1.219 m 48 in			
adjustable pads to compensate for wear				
movement via hydraulic motor driven feed screw				
heavy duty rotation slew bearing driven by hydraulic cylinder for 90° traverse rotation			cylinder for 90° traverse rotation	
Rotation -	dual hydraulic rack and p	inion rotary actuator c/w m	anual locking system for 360° rotation	
Optional H	HELAC® feed positioner fo	r increased flexibility and a	ccuracy	



Stabilizers		
4 hydraulic cylinders	Metric	U.S.
Stroke	0.38 m	15 in
Lift to the control of the control o	0.18 m	7 in

MKV series feed assembly c/w:	Steel feed with stainless steel wear guides and rotary screw drive
	Integral cushions at end of travel
	Pneumatic opposed piston type centralizer
	Manual feed crowd

Controls
Direct acting feed positioning controls
Pivoting tramming control arm

Noise Suppression

Standard Dual exhaust, muffler and exhaust on controls rerouted

Rock Dril

S36IR - see S36IR Hydraulic Rock Drill Tech Data

Options		
Traverse travel (center line to center line)	.76 m, .91 m, 1.52 m	30 in, 36 in, 60 in
Laser hole alignment system		

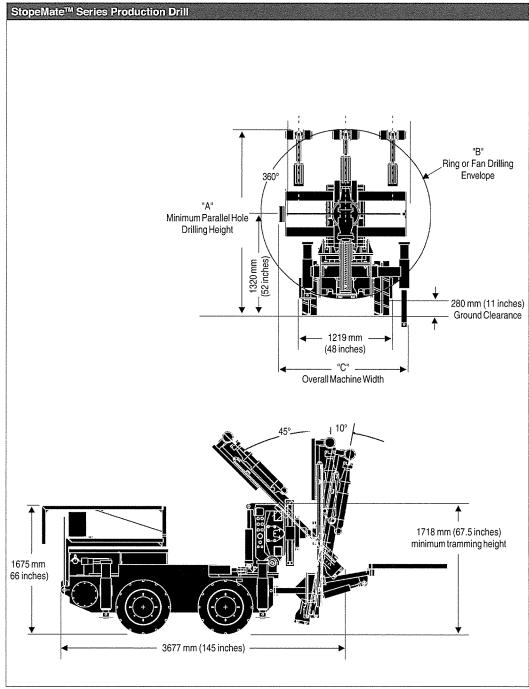
DIMENSIONS AND WEIGHTS

Overall Weight: 37650	verall Weight: 37650 kg (8250 lb)	
	Metric	U.S.
Raise Transport - Unde	rcarriage (largest module only)	
Length	2794 mm	110 in
Width	1220 mm	48 in
Height	813 mm	32 in
Weight	1795 kg	3950 lb
Cage Transport - Trave	rse Rotates 90° to reduce width for	cage transport

Minimum Parallel Hole Drilling Height			
	Metric	U.S.	"A"
Drill Steel Size	1.22 m Rod Change (Standard)	4 ft	2743 mm (108 in)
Water Flow	0.91 m Rod Change	3 ft	2438 mm (96 in)
	1.52 m Rod Change	5 ft	3048 mm (109 in)

Ring or Fan Drilling Envelope			
	Metric	U.S.	"B"
Drill Steel Size	1.22 m Rod Change (Standard)	4 ft	2463 mm (97 in)
	0.91 m Rod Change	3 ft	2247 mm (88 in)
	1.52 m Rod Change	5 ft	2769 mm (109 in)

	Overall	Center to Center Drill Movement
Standard Traverse	1677 mm (66 in)	1219 mm (48 in)
Optional Traverse	1219 mm (48 in)	761 mm (30 in)



Note: Dimensions and weights may vary depending on options and should be checked before crating or lifting.



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ROCK DRILL AND BLAST DRILLING PRODUCTS



Percussive Bits



Percussive Rods



StopeMaster™ Drill

www.BoartLongyear.com · ASX: BLY

Jan 2012



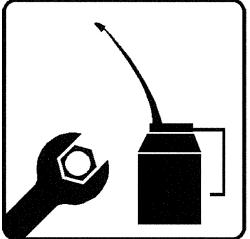
Appendix C: Rockdrill Manual

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S36 ROCKDRILL

Parts, Operations and Service Manual





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Certificate of Performance

This certificate is supplied with each drill and is signed by the assembly mechanic assuring that the product has been tested and meets Boart Longyear's quality standards. It lists the drills actual test results at the time of assembly. The card also describes the start up and lubrication procedures and a brief health and safety notice.

	EUMATIC ROCKDRILLS
PE	RFORATRICES PNEUMATIQUES
Roc	kdrill Model / Modèled ep erforatrice:
Seri	al Number / Numéro des érie:
CFN	1 (ft³/min) / Pied cube-minute:
Torq	ue / Torsion:
Leg	Function / Fonction de la Jambe
	embled / Tested By: té / Testép ar: Date:
Plea	se see reverse side / Veuillez consulter le verso. BOART LONGYEAR ***



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Introduction General Information Standard Warranty 5 Ordering Parts 6 Returning Parts 6 Chapter 2 Rockdrill Repair Shop Chapter 3 **Exploded Diagram and Parts List** Exploded View 10 Parts List 11 Chapter 4 **Maintenance Procedures** Assembly Guide 16 Chapter 5 **Testing Procedures** Testing 19 Water Testing Procedure 19 Startup and Lubrication Procedures 20 Chapter 6 **Troubleshooting Guides** Chapter 7 Drilling Rod Pulling 26

Chapter 1

NOTE: We are continuously updating our product literature to provide you with the most current technical information available. Portions of this literature may contain information that may not be exactly representative of the current configuration of Boart Longyear products. Contact your nearest Boart Longyear representative for information on the latest product improvements and manual revisions.

Rev 1/2014

4



CHAPTER 1

Introduction and General Information

The purpose of this manual is to furnish the Service Technician with detailed information which will enable him to achieve the maximum operating performance from the drill. Parts Lists, with corresponding views to aid in ordering parts, are furnished.

Boart Longyear Inc. is backed by over 100 years of experience in the design, manufacture and operation of Percussive Drilling equipment. Many of the accepted practices in use today were pioneered by Boart Longyear.

To obtain the utmost in performance and life of the equipment, it should be given regular care and operated in accordance with the instructions.

Ensure proper safety apparel is worn when servicing the equipment.

Ensure a quality lubricant is used and consumption amounts are sufficient.

Inspect and replace worn front end and chuck parts promptly.

Ensure the drill is being operated correctly to avoid steel and drill rod misalignment.

Check conditions of hoses and connections for contaminants and keep the bolts on the drill tight.

Read this manual carefully before attempting to operate this equipment and keep this book handy at all times for reference when any questions arise.

Standard Warranty

Boart Longyear Inc. makes no warranty that the products sold hereunder shall be merchantable or that such products shall be fit for any particular purpose and there are no warranties expressed or implied made by Boart Longyear Inc. except its following standard warranty.

Boart Longyear Inc. warrants each product, and accessory equipment sold by it (except items not manufactured by Boart Longyear Inc. such as power units, pumps, and other trade accessories sold with, attached to, or operated with Boart Longyear drills or other products) to be free from defects in material and workmanship under normal use and service for 90 days from date of use, but not to exceed 6 months from the date of shipment from a Boart Longyear Inc. factory. The obligation of this warranty being limited to the replacement or repair at a Boart Longyear Inc. facility in Ontario, Canada, or at a point designated by it, of such parts as shall appear to it upon inspection at such point to have been defective in material or workmanship at the time sold, providing that the part or parts claimed defective are returned to inspection point, transportation charges prepaid.

This warranty applies only to new and unused products and accessory equipment which after shipment from the Boart Longyear factory, have not been altered, changed or repaired in any manner.

Exclusion of Liability for Consequential Damage

It is further agreed by the purchaser that in no event shall Boart Longyear be liable for increased costs, loss of profits or goodwill or any special, indirect, incidental, or consequential damages whatsoever.



CHAPTER 1

Introduction and General Information

Ordering Parts

The following procedure will expedite the filling of your parts order, eliminate delays and assure correct replacement parts:

- 1. List the model and serial number of the drill.
- 2. State exact quantity required.
- 3. Specify description and part number.
- 4. Specify method of shipment, i.e. parcel post, express, freight; for overseas shipment: air freight, air parcel post, or ocean freight.

All parts are priced FOB our factory and separate charges will be made for transportation and export packing.

Returning Parts

If you desire to return parts, whether for repairs, replacement, or warranty, contact our order desk with the following information: quantity, part numbers, model and serial number of the product, as well as the reason for requesting return.

Boart Longyear Inc. P.O. Box 330, 1111 Main Street West North Bay, Ontario Canada P1B 8H6

Phone: (705) 474-2800 Fax: (705) 474-2373

DO NOT ship parts until authorized and shipping instructions are received.

All parts returned must be shipped prepaid.

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CHAPTER 2 Rockdrill Repair Shop

Before you start you will need a clean workshop area equipped with all the usual fitters' tools, work benches, component cleaning tanks and a hydraulic press. You will also need a steam cleaner outside the workshop. Your work shop should consist of the following items:

- Work Bench 91,4 cm x 213,4 cm (36" x 84")
 c/w air bulkhead (optional)
- 15,2 cm (6") Vice (not swivel) mounted on the corner of the bench
- 10,2 cm to 20,3 cm (4" to 8") Chain Vice mounted on opposite corner of bench
- Steel block for press two 7,6 cm x 7,6 cm x 45,7 cm (3" x 3" x 18") and two 5,1 cm x 7,6 cm x 45,7 cm (2" x 3" x 18") with slider stop bars
- · Cleaning Tank
- · Bench Grinder (optional)
- · Belt Grinder c/w piston support
- · Torch Set c/w tanks
- · Welder M/C (optional)
- · Parts Cabinet eight drawer
- · Electric Rewind Extension Cord
- · Lighting over work bench

Your tools should include:

- Torque Wrench with 12,7 mm (1/2") drive (up to 250 ftlbs)
- Impact Wrench 12,7 mm (1/2") drive
- Pipe Wrench 61 cm (24")
- Pipe Wrench 30,5 cm (12")
- · Pick Set
- · Mechanic's Hammer
- · Clamp c/w swing and dump
- · Guide Shell 61 cm (24")
- · Repair Tags and Report Sheets

Appendix C: Rockdrill Manual



CHAPTER 2

Rockdrill Repair Shop



CHAPTER 3 Exploded Diagram and Parts List

S36 Rockdrill

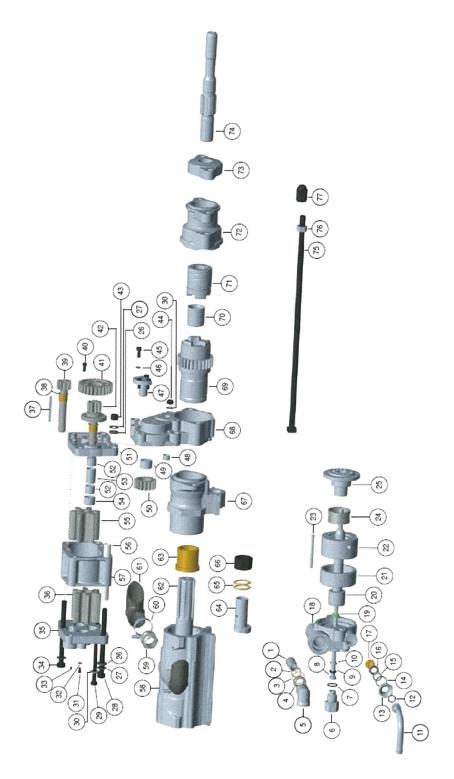
Please refer the following 2 pages for the detailed parts list breakdown and corresponding exploded view.





CHAPTER 3 Exploded Diagram and Parts List

S36 Rockdrill - Exploded View



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CHAPTER 3 Exploded Diagram and Parts List

S36 Rockdrill - Parts List

Ref.	Part Number	Qty	Description		
1	5601089	1	STEM, AIR		
2	5603732	1	O-RING		
3	5602017	1	WASHER, COPPER		
4	5601090	1	NUT, AIR STEM		
5	5602423	1	FITTING, AIR STEM		
6	5602425	1	PLUG, WATER TUBE		
7	5603787	1	O-RING		
8	5604104	1	TUBE, WATER 14mm		
9	5602031	1	SEAL, 14mm WATER TUBE		
10	5604100	1	SLEEVE,11mm WATER TUBE		
11	5602427	1	STEM, WATER		
12	5603790	1	O-RING		
13	5602967	1	NUT, WATER STEM		
14	5603735	1	O-RING		
15	5602015	1	WASHER, RUBBER THRUST		
16	5602999	1	WASHER, RUBBER		
17	5604217	1	PAD, THRUST WATER		
18	5602453	1	BACKHEAD, S36		
19	5607579	1	SEAL, RIFLE BAR		
20	5603284	1	BAR, DUMMY RIFLE		
21	5601634	1	SPACER, S36 BACKHEAD		
22	5609751	1	BOX, VALVE		
23	5604077	1	PIN, LOCATING		
24	5603541	1	VALVE, S36		
25	5607694	1	PLUG, VALVE		
26	5604757	4	WASHER, FLAT		
27	5601562	10	WASHER, SPRINK DISC		
28	5604061	2	BOLT, HEX M16 X 180		
29	5603501	2	BOLT, HEX M12 X 250		
30	5601561	4	WASHER, SPRING DISC		
31	5600806	3	C/SCR, SH M6 X 8		
32	5601565	3	WASHER, SPRING DISC		
33	5600906	1	SCREW, SET		
34	5603507	3	BOLT, HEX M16 X 220		
35	5602954	1	PLATE, BACK		
36	5602961	1	ROTOR, GEAR		
37	5602915	1	KEY, ROTOR		
38	5601879	2	BUSHING, FLANGED		

Ref. Part Number Qty Description 39 5602189 1 PINION, DRIVE 40 5602008 8 C/SCR, M8 X 18 41 5602186 1 GEAR, REDUCTION 42 5602738 1 PINION, GEAR COMPOUND 43 5603216 5 NUT, M16 NYLOCK 44 5603212 2 NUT, M12 NYLOCK 45 5602610 4 C/SCR, M10 X 25 46 5605544 4 WASHER, M10 NORD LOCK 47 5602416 1 SHAFT, IDLER GEAR 48 5602574 1 DOWEL, HOWEL 49 5603260 1 BEARING, NEEDLE ROLLER 50 5603503 1 GEAR, IDLER 51 5603258 2 BEARING, NEEDLE ROLLER 52 5603258 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585	D-6	Deut Nouelteau	04	Dd-tt
40 5602008 8 C/SCR, M8 X 18 41 5602186 1 GEAR, REDUCTION 42 5602738 1 PINION, GEAR COMPOUND 43 5603216 5 NUT, M16 NYLOCK 44 5603212 2 NUT, M12 NYLOCK 45 5602610 4 C/SCR, M10 X 25 46 5605544 4 WASHER, M10 NORD LOCK 47 5602416 1 SHAFT, IDLER GEAR 48 5602574 1 DOWEL, HOWEL 49 5603260 1 BEARING, NEEDLE ROLLER 50 5603503 1 GEAR, IDLER 51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROLLER 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 <th></th> <th></th> <th><u>-</u></th> <th></th>			<u>-</u>	
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42 5602738 1 PINION, GEAR COMPOUND 43 5603216 5 NUT, M16 NYLOCK 44 5603212 2 NUT, M12 NYLOCK 45 5602610 4 C/SCR, M10 X 25 46 5605544 4 WASHER, M10 NORD LOCK 47 5602416 1 SHAFT, IDLER GEAR 48 5602574 1 DOWEL, HOWEL 49 5603260 1 BEARING, NEEDLE ROLLER 50 5603503 1 GEAR, IDLER 51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROLLER 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602		***************************************		
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45 5602610 4 C/SCR, M10 X 25 46 5605544 4 WASHER, M10 NORD LOCK 47 5602416 1 SHAFT, IDLER GEAR 48 5602574 1 DOWEL, HOWEL 49 5603260 1 BEARING, NEEDLE ROLLER 50 5603503 1 GEAR, IDLER 51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROTOR 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 56032960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270	43	5603216		NUT, M16 NYLOCK
46 5605544 4 WASHER, M10 NORD LOCK 47 5602416 1 SHAFT, IDLER GEAR 48 5602574 1 DOWEL, HOWEL 49 5603260 1 BEARING, NEEDLE ROLLER 50 5603503 1 GEAR, IDLER 51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROTOR 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5602414	44	5603212	2	NUT, M12 NYLOCK
47 5602416 1 SHAFT, IDLER GEAR 48 5602574 1 DOWEL, HOWEL 49 5603260 1 BEARING, NEEDLE ROLLER 50 5603503 1 GEAR, IDLER 51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROTOR 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414	45	5602610	4	C/SCR, M10 X 25
48 5602574 1 DOWEL, HOWEL 49 5603260 1 BEARING, NEEDLE ROLLER 50 5603503 1 GEAR, IDLER 51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROTOR 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE, LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 <	46	5605544	4	WASHER, M10 NORD LOCK
49 5603260 1 BEARING, NEEDLE ROLLER 50 5603503 1 GEAR, IDLER 51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROTOR 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 <	47	5602416	1	SHAFT, IDLER GEAR
50 5603503 1 GEAR, IDLER 51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROTOR 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE, LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5603000	48	5602574	1	DOWEL, HOWEL
51 5605593 1 COVER, FRONT 52 5603258 2 BEARING, NEEDLE ROTOR 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5603260 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5603206 1 CYLINDER, FRONT 68 5603000	49	5603260	1	BEARING, NEEDLE ROLLER
52 5603258 2 BEARING, NEEDLE ROTOR 53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582	50	5603503	1	GEAR, IDLER
53 5601872 1 SPACER, ROTOR 54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR,EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1	51	5605593	1	COVER, FRONT
54 5603259 2 BEARING, NEEDLE ROLLER 55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR,EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725	52	5603258	2	BEARING, NEEDLE ROTOR
55 5602960 1 ROTOR, KEYED 56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR, EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1	53	5601872	1	SPACER, ROTOR
56 5604068 2 SLEEVE. LOCATING 57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR,EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1	54	5603259	2	BEARING, NEEDLE ROLLER
57 5601585 1 HOUSING, ROTOR 58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR,EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1	55	5602960	1	ROTOR, KEYED
58 5602278 1 CYLINDER, S36 59 5601397 2 ADAPTOR,EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 <td< td=""><td>56</td><td>5604068</td><td>2</td><td>SLEEVE. LOCATING</td></td<>	56	5604068	2	SLEEVE. LOCATING
59 5601397 2 ADAPTOR,EXHAUST 60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT	57	5601585	1	HOUSING, ROTOR
60 5602491 2 CLAMP, EXHAUST 61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	58	5602278	1	CYLINDER, S36
61 5602211 2 DEFLECTOR, EXHAUST 62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	59	5601397	2	ADAPTOR,EXHAUST
62 5603270 1 PISTON, S36 63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	60	5602491	2	CLAMP, EXHAUST
63 5607732 1 LINER, CYLINDER WASHER 64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	61	5602211	2	DEFLECTOR, EXHAUST
64 5602414 1 NUT, FEED SCREW 65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	62	5603270	1	PISTON, S36
65 5602576 1 WASHER, LOCK 66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	63	5607732	1	LINER, CYLINDER WASHER
66 5602113 1 NUT, FEED SCREW NUT 67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	64	5602414	1	NUT, FEED SCREW
67 5602950 1 CYLINDER, FRONT 68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	65	5602576	1	WASHER, LOCK
68 5603000 1 HOUSING, REDUCTION 69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	66	5602113	1	NUT, FEED SCREW NUT
69 5605582 1 CHUCK, GEAR 70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	67	5602950	1	CYLINDER, FRONT
70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	68	5603000	1	HOUSING, REDUCTION
70 5601640 1 BUSHING, CHUCK 71 5602725 1 JAW, CHUCK 72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	69	5605582	1	CHUCK, GEAR
72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	70	5601640	1	
72 5608594 1 HEAD, FRONT 73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	71	5602725	1	JAW, CHUCK
73 5603268 1 PLATE, LOCKING 74 N/A 1 SHANK, ASSORTED 75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	72		1	
75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING	73	5603268	1	PLATE, LOCKING
75 5604058 2 ROD, SIDE 76 5604215 2 NUT, SIDE ROD LOCKING		N/A		, , , , , , , , , , , , , , , , , , ,
76 5604215 2 NUT, SIDE ROD LOCKING	75			
		5604075	2	NUT, SIDE ROD DOMED

Appendix C: Rockdrill Manual



CHAPTER 3

Exploded Diagram and Parts List



Maintenance Routine

Periodic examination and stripping of rockdrills is essential for good operation and to ensure optimum life for the components. We recommend that rockdrills are serviced on a call up basis every 20 shifts or one month, which ever is shorter, when in regular use and that a record is kept for every machine.

The maintenance of any rockdrill always follows the same set pattern; external clean, strip down, clean parts, inspect, replace, rebuild and test. Sophisticated measuring equipment used to accurately gauge the wear on components is often not available. Consequently, wear is gauged by simple, but effective work shop practices.

Dismantling Procedure Reference Exploded View and Parts List on pages 10 and 11.

- Clean the outside of the machine to remove excess oil and dirt.
- 2. Remove side rod nuts Ref. 77 and remove the fronthead locking plate Ref. 73.
- Remove the lock nuts Ref. 76. as the rod is removed.
- 4. Remove the chuck Ref. 69 from inside the fronthead Ref. 72
- 5. The fronthead may now be removed.
- The chuck gear Ref. 69 may now be removed from the front cylinder Ref. 67 complete with chuck bushing Ref. 70.
- 7. The rotation drive assembly can be removed from the machine as a major sub-unit.
- 8. The motor assembly can be removed from the mounting plate by unscrewing the seven bolts Ref. 28, 29 and 34 and removing them complete with the plain and spring washers.
- 9. The motor may be opened by separating the end plates Ref. 35 and 51 from the housing Ref. 57 after the locating tubes are removed. The main drive rotor Ref. 55 is keyed to the drive pinion Ref. 39 with a plain key Ref. 37. This pinion runs on needle roller bearings and a flanged bushing located in the motor end plates (ref 54 & 38).
- 10. The other air motor rotor Ref. 36 runs on needle bearings Ref. 52 carried by the compound gear pinion shaft Ref. 42 and separated by the spacer Ref. 53. The compound gear can be slid out of the rotor to remove the components.
- 11. The compound gear pinion runs in a needle roller bearing Ref. 54 and flange bushing Ref 38 located in the motor end plates. The bearing in the back plate 35 may be removed by unscrewing set screw Ref. 33 and tapping the bearing out with a small drift through the opened hole.
- The compound gear Ref. 41 can be removed from the pinion by unscrewing the eight cap screws Ref. 40.



- 13. The idler gear Ref. 50 is carried on a shaft Ref. 47 secured to the reduction housing by four cap screws Ref. 45. If the screws are removed, the shaft may be withdrawn and the gear allowed to drop out of the housing complete with its bearing Ref. 49.
- 14. From the back of the machine the backhead Ref. 18 may be removed complete with the water tube Ref. 8 and fittings. Be careful not to bend or damage the water tube if it is not removed from the backhead initially.
- 15. Remove the water tube from the backhead by unscrewing the plug Ref. 6 and pushing the tube from the front. The water tube seal Ref. 9 should be removed.
- 16. Remove the backhead spacer Ref. 21 and the dummy rifle bar Ref. 20 with its seal Ref. 19.
- 17. The valve assembly may now be removed completely by pushing the piston Ref. 62 up the bore and if necessary hammering on the end of the piston with a copper mallet and suitably shaped drift. The valve box locating pin Ref. 23 will come out with the assembly.
- 18. The piston may now be removed from the cylinder.
- 19. The valve box assembly may be dismantled, by driving the plug Ref. 25 out of the valve box. This may be done easily by fitting a suitable punch into the centre hole. Hammering on the punch will drive the valve plug out of the valve box Ref. 22. The valve Ref. 24 may then be lifted off the plug.
- 20. The air stem Ref. 1 and the other air inlet fittings may be removed from the backhead by unscrewing the air stem nut Ref. 4.
- 21. The water stem Ref. 11 may be removed from the backhead by unscrewing the nut Ref. 13. Make sure that the internal components, the thrust pad Ref. 17, thrust washer Ref. 15 and rubber Ref. 16 are not lost.

- 22. The front cylinder Ref. 67 need only be removed from the cylinder when either of these components is to be replaced. If the front cylinder is tight, insert the piston the wrong way round into the cylinder and push it down the bore until it contacts the front cylinder. Press on the end of the piston with a hydraulic press to separate the front cylinder from the main cylinder.
- 23. The feed nut Ref. 64 can be removed from the front cylinder by unscrewing the nut Ref. 66.
- 24. The front cylinder liner Ref. 63 should be pressed out of the front cylinder if it is to be replaced. This can be done with the front cylinder still installed by turning the cylinder on end and pressing the liner out using a suitable punch.
- 25. The chuck bushing Ref. 70 should be pressed out of the chuck from the rearward side.



Inspection of Components

1. Backhead

- Check that the water tube is of the correct type, and the water tube seals are in good condition. Replace if they are damaged.
- Check air stem and nut, excessive wear on the bearing surfaces of these components will result in the loss of air pressure to the machine. Replace one or both if necessary.

2. Piston

 Check the striking face of the piston, it should be flat, square to the axis and smooth. When it is dished by up to 1mm max. it may be refaced square by grinding to restore a flat surface. This grinding must be done with care and with adequate cooling. A maximum of 2mm can be removed in these refacing operations. Ensure that the radius on the end of the spline is restored to prevent damage to the chuck nut.

3. Cylinder and Front Cylinder

- The wear between the piston, cylinder and front cylinder liner should be checked. Insert the piston in the cylinder and pull the stem rapidly forward from the front end, the piston should bounce on the air cushion. If it does not, check again with a new piston and replace the front cylinder liner if necessary to restore this cushion. The wear between the cylinder and piston should not exceed 0.2mm (0.008"). Check the cylinder with a new piston and the piston in a new cylinder, replace as necessary.
- If fitted, check the feed nut. This should be replaced when the threads in the bore of the nut are worn to half their original thickness. Make sure the new nut is correctly assembled and tightened. The tab washer should be correctly fitted and locked on the nut.

4. Valve Box Assembly

 This should be cleaned and checked for burrs on faces and bearing surfaces. Any burrs should be carefully removed. When reassembled the valve must be able to move freely inside the box and over the plug.
 Wear in the valve may be checked by blocking off the kicker port in the side of the flange on the valve with a finger. The free movement of the valve in the assembly should be restricted by the air trapped beneath the valve.

5. Chuck and Bushing

- The chuck will not normally show excessive wear, the clearance between the chuck and the front cover should not exceed 1.0mm (0.040").
 The chuck should be discarded when it has worn 2.5mm (0.100") at the worst point. The chuck insert should be discarded when it has worn 1mm (0.040") oversize on the diameter.
- Excessive wear of the chuck insert will allow damage to other components, particularly the piston and striking bar. New inserts should be pressed into place - never hammered. The thrust pad should be replaced when the wear on the striking bar locating face exceeds 2mm (0.080").

6. Rotation Drive

The air motor components should have a long and trouble free life.

- Check the gear teeth in the rotation motor and on the outside of the chuck gear. Any slight burrs or surface damage should be cleaned off to prevent further damage. Replace the gears if the teeth are worn 50% or more.
- The needle roller bearing in the idler gear should have good life as long as it is adequately lubricated. Check to make sure the idler gear runs freely and true, if not, the bearings need replacement.
- Check the shafts to ensure minimal wear to prevent misalignment and binding. The main rotors and end plates may be checked for burrs or rubbing marks and these should be cleaned off.
- The rotors should run freely on the needle roller bearings, if they do not, the bearings should be checked and replaced if necessary.



Assembly Guide

Before commencing assembly:

All components should be washed in a solvent and carefully dried by blowing or wiping with clean cloths. Each component should be lubricated with rockdrill oil as it is assembled. Reassemble carefully, do not 'drive' components that should be pressed together. Make sure sliding and rotating components are carefully aligned to avoid jamming.

- 1. Press the chuck bushing Ref. 70 into the front of the chuck gear Ref. 69.
- Press into place the front cylinder liner Ref. 63 using the piston as a guide.
- 3. The feed nut Ref. 64 should be assembled into the front cylinder. Push the nut into place from the rear of the machine making sure that the flat on the flange lines up with the cylinder wall. Fit the lock washer Ref. 65 and the nut Ref. 66 on the threaded portion of the nut.
- Insert the piston Ref. 62 into the rear of the cylinder.
- 5. Assemble the valve box. Carefully fit the valve Ref. 24 over the plug Ref. 25 and valve making sure the groove for the dowel is correctly aligned. When the box Ref. 22 engages the plug, press the two components together until the flange of the plug meets the front face of the box. It is important to check that the valve can move freely inside the box. If it does not move freely something is wrong and should be checked.
- Insert the valve assembly into the rear of the cylinder using the locating pin Ref. 23 to make sure the ports line up inside.
- 7. Fit the dummy rifle bar Ref. 20 into the bore of the valve assembly with the seal Ref. 19 making sure it is fitted into the recess at the rear.
- 8. Fit the backhead spacer Ref. 21 into the rear of the cylinder making sure it is located squarely on the rear of the valve assembly and the dowel.

9. Rotation motor and drive sub assembly:

- (a) Fit the needle roller bearings Ref. 54 into the back plate. Fit the flange bushings Ref. 38 into the front plates.
- (b) Push the drive pinion Ref. 39 through the left hand bore in the motor front plate Ref. 51 when looking from the rear.
- (c) Fit the keyed rotor Ref. 55 and its key Ref. 37 to the drive pinion.
- (d) Assemble the compound gear Ref. 41 onto the compound gear pinion Ref. 42 using the eight cap screws.
- (e) Fit the compound gear pinion through the right hand bore in the motor front plate from the front.
- (f) Assemble the needle roller bearings Ref. 52 and the spacer Ref. 53 on the pinion shaft.
- (g) Fit the air motor housing Ref. 57 over the rotors and assemble the back plate Ref. 51 into the ends of the shafts Ref. 39 and 42.
- (h) Attach the assembled motor to the reduction housing by means of the seven bolts and nuts. Make sure the locating sleeve Ref. 56 is fitted correctly over bolts. Spring washers are fitted beneath both the head of all the bolts, and under the nuts.
 - In addition spacer washers are fitted beneath the spring washers on the two large lower bolts Ref. 26.
- (i) Tighten all the nuts Ref. 43 to a torque of 110 Nm and Ref. 44 to a torque of 80 Nm.
- (j) If the idler gear Ref. 50 is to be reassembled hold the gear with its bearing Ref. 49 already fitted into place inside the housing. The shaft Ref. 47 should be pushed into the housing from the front and through the bore of the bearing inside the gear. The shaft is secured with the screws and washer.
- Fit the assembled air motor and reduction housing over the front cylinder Ref. 67 already fitted into the main cylinder Ref. 58.

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- 11. Insert the chuck assembly Ref. 69 into the front cylinder bore and engage the gear teeth on the chuck with the idler gear.
- 12. The front cover Ref. 72 can now be fitted into the front bore of the reduction housing.
- 13. The chuck Ref. 71 should be fitted into the fronthead making sure that the dog drive at the rear end is correctly located with the dogs on the chuck gear.
- The backhead Ref. 18 may now be fitted over the spacer and locating pin, push it firmly into position.
- 15. Insert the side rods Ref. 75 through the lugs in the backhead and down the machine. Fit the lock nuts Ref. 76 over the threads between the two lugs on the fronthead. Make sure the head of the side rod is located correctly on the lug of the backhead.
 - The lock nuts should be screwed lightly against the front cover and locked together. They are only intended to prevent the machine coming apart when the main nuts are removed.
- 16. Fit the correct striking bar Ref. 74 into the front of the machine and attach the fronthead locking plate Ref. 73 with the nuts Ref. 77. Tighten the nuts evenly to a torque of 260 Nm (200 ft•lbs).
- 17. The water tube Ref. 8 should be fitted into the backhead. Make sure it is the correct type for the striking bar being used and that the rubber Ref. 9 is in good condition and pushed into place beneath the flange. Push the tube into the machine until it is seated. The water tube plug Ref. 6 should be screwed into place making sure the O-ring Ref. 7 is correctly fitted.
- 18. The air inlet stem Ref. 1 can be assembled into the air inlet bend Ref. 5 making sure the nut Ref. 4 is in place first. Always use a new copper washer Ref. 3 when replacing the air stem.

- 19. The assembly should be screwed into the threaded bore in the backhead making sure the O-ring Ref. 2 and the copper washer Ref. 3 are in place.
- 20. The water stem should now be fitted. The stem thrust pad Ref. 17, the stem rubber seal Ref. 16 and the stem thrust washer Ref. 15 should be fitted to the inside. The stem nut. Ref. 13 should be fitted over the stem taking care that the Orings Ref. 12 and 14 are in place. The nut may then be threaded into the threaded hole in the backhead.

Appendix C: Rockdrill Manual



CHAPTER 4

Maintenance Procedures



CHAPTER 5
Testing Procedures

Testing S36 Rockdrill

NOTE: Always check that the reassembled rockdrills operate properly before they leave the workshop.

A test bench facility with 90 psi air connection is required.



- 1. Apply a small amount of oil into air inlet prior to air hook up.
- Install proper striking bar into drill and torque side rod nuts to specification.
- 3. Clamp down drill in aluminum slide.
- Slowly turn on air supply to ensure proper operation of rockdrill. DO NOT operate rockdrill wide open on bench test.

Water Testing Procedure

- 1. Connect water and turn on.
- Check for water leaks around water inlet. Ensure water is not leaking into the body of the rockdrill.



CHAPTER 5 Testing Procedures

Startup and Lubrication Procedures

1. Keep dirt out of the lubricator:

When filling or fitting a lubricator bottle, no dirt must be allowed to enter the air passages or the lubricator reservoir.

A WARNING Ensure your air supply is turned off before servicing.

2. Clearing hoses:

Before attaching the air hose to the machine, clear the hose of dirt. To do this, hold the open end of the air hose firmly and point in a safe direction. Rapidly open and close the air supply valve to blow dirt out of the air hose and hose fittings. (maximum of 5 seconds blow). Flush out the water line before connecting to the drill.

3. Hose attachments:

Ensure that the hoses and fittings used are compatible, in good condition and securely fastened. Remove the dust caps. Ensure that oil is flowing from the lubricator through the air hose before attaching to the rockdrill. Fit the water hose. The machine is now ready to run.

4. Running:

Open throttle and allow the drill to idle for 1 minute so oil can be distributed throughout the drill internally. Oil should be visual on the outside at the fronthead and striking bar. Water should flow out of the striking bar or through the steel if it is fitted. The drill is now ready for work.

5. Lubrication:

Use only genuine rock drill lubricant which is available from selected reputable suppliers. Check that the grade of lubricant used is suitable for the application. Ensure that the line lubricator bottle is full at the start of each shift and kept topped up during extended periods of use. Check and refill twice each shift.

Rockdrill Lubricating Oil

- Ultramar Ultrarok 100
- Century 763
- Shell Torcula 100
- Esso Arox EP 150
- Mobil Almo 527

Lubricators should be checked and serviced at regular intervals. They should be thoroughly cleaned and the feed jets checked for blockages.

CHAPTER 6 Troubleshooting Guides

Problem	Reason	Repair Procedure
Will not start	Air line supply blocked	Check for blockage
	Piston stuck - no air blowing	 Cylinder dented, rotation jammed, fronthead seized
	Frozen exhaust parts	 Install moisture trap in air line and after compression surface check rubber seal at end of water tube Check water tube for cracks
	Damaged or tight front cylinder	 Hone or ream front cylinder liner to proper fit and check cushion
Erratic or sluggish operation	Rockdrill oil too heavy for ambient temperature	Change type of oil - preferably mineral based
	 Too much oil flowing from lubricator - check lubricator setting 	Reset lubrication
	Machine heating up	 Check lubricator hose length and lubricator setting
	Dirt in machine	 Disassemble, clean, check for damage - use clean oil in lubrication. Check for oil rotted hose. Cover and place drill in clean place when blasting and moving
	Broken parts	 Make certain all parts are operating freely
	Main valve sticking	Check for dirt, burrs, or nicks
Drill lacks power but sounds good	improper striking bar position	Check striking bar length
		Check chuck insert condition
	Worn or broken piston	 Check piston for wear and proper length
	 Plugged kinked hose or air screen 	• Clean
	Low air pressure	Check air lines and valves - min 90 psi
	Lack of oil	 Front of cylinder and front cylinder will be warm
	Loss of fronthead cushion	 Worn piston - replace and check for outer flange wear
		 Worn front cylinder liner- check and replace if necessary



CHAPTER 6

Troubleshooting Guides

Problem	Reason	Repair Procedure
	Cylinder damaged	Replace
	Damaged chuck	Replace
	Damaged fronthead	Replace
Slow drill speed	Low air pressure	Should be 90 psi or better
	 Plugged air screen in lubricator or air hose 	• Clean
	 Cuttings not being removed from hole (poor flushing) 	 Check water tube. Check plugged drill steel (blow down steel in water puddle). Check water pressure
	 Improper alignment in hole 	Keep drill steel centred in hole
	 Bit not gauged properly 	• Check
	 Buttons or blades missing in bits 	• Check
	Piston worn	Replace
	 Machine not assembled properly, side rods loose, 	Tighten to 200 ft•lbs, replace or repair
Drill freezing	Excessive moisture in air	Drain air lines - install moisture traps (DO NOT HIT CYLINDER)
	Broken or cracked water tube	Replace
	 Leaky water tube seal 	• Replace
Bogging	Broken or cracked water tube	Replace
	 Excessive moisture in air supply 	Blow air lines, install moisture traps
	Too much oil	Check lubricator adjustment
	 Water leaking around water tube seal 	Change water tube seal
Piston chipped or broken	Damaged striking bar face	Reface piston so that axis is at right angles to striking face
		Inspect/replace striking bar



Appendix C: Rockdrill Manual

CHAPTER 6 Troubleshooting Guides

Problem	Reason	Repair Procedure
Bronze cuttings in drill	 Lack of lubrication 	 Use proper rockdrill oil Check lubricator for proper setting Check lubricator hose length
	 Rough or damaged piston 	Replace or use fine grindstone to smooth parts
Excessive wear of parts	Faulty lubrication	Replace necessary parts
		Inspect lubricator
	Dirt in drill	Inspect lubricator screen
Broken Striking Bar	Incorrect rockdrill alignment while drilling	
	 Worn front locking plate 	
	 Worn centralizer jaws 	

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Appendix C: Rockdrill Manual



CHAPTER 6

Troubleshooting Guides

warning Never leave the machine unattended without the rods coupled to the rockdrill striking bar. If the air pressure in the centralizer cylinder is lost, the clamping power will be lost and the drill string can fall out of or into the hole.



Collaring

- 1. Engage rotation to counterclockwise direction.
- Shift the water flushing lever forward. Water should be spraying out of the end of the bit.
- Gradually shift the feed lever forward, close the centralizer to stabilize the drill rod.
- 4. As the drill bit meets the rock, gradually shift the percussion lever.
- If the surface being collared is rough or angled, a gentle, patient approach will be more successful.
- It may require several attempts back and forth with the feed before the hole is successfully collared.

Drilling

- The water flushing lever should be completely forward.
- The rotation lever should be in the counterclockwise rotation direction.
- 3. Increase rotation speed to match drill bit requirements. Adjust the rotation control to give a rotation speed of about 100 150 rpm. This rotation speed should be adjusted to give the best penetration speed generally faster for small holes and softer rock and slower for larger holes and very hard rock. Keep the drill string oscillating slightly at all times while drilling.
- 4. Shift the percussion lever completely forward.

 Shift the feed lever forward. The amount of movement on the feed lever will dictate the force behind the drilling bit. With experience, the sound of the drill will indicate when the feed thrust needs adjustment.

NOTE: Underfeeding will result in overheating of the drill string couplings, reducing component life.

Overfeeding can result in hole misalignment.

ACAUTION Periodically check the air escaping around the striking bar to confirm that it is receiving adequate lubrication. There should be a fine mist of oil exhausting during normal operation. Poor or non-existent oil flow will cause extensive damage in a very short period of time.

Adding Steel

- When the rockdrill has completed drilling the entire length of drill steel, move the rotation, percussion and feed levers to neutral, and turn off the water flushing.
- 2. Shift the centralizer control lever forward to clamp the coupling.
- 3. Pull the rotation lever toward you to turn the rotation clockwise.
- Pull the feed lever toward you to simultaneously retract the feed. This prevents thread binding.
- When the rockdrill striking bar is released from the coupling being held in the centralizer, pull completely back on the feed lever to quickly retract the rockdrill while bringing the rotation lever to neutral.
- When the rockdrill is at the back of the feed, insert a new length of drill steel/coupling between the rockdrill striking bar and the coupling held in the centralizer.

Always ensure that rockdrill rotation has come to a complete stop before attempting to add or remove a drill rod.



CHAPTER 7 Drilling

- Shift the feed lever forward to advance the striking bar until the new length of steel is held centered between the rockdrill and the centralizer held coupling.
- 8. Push the rotation lever forward to begin rotation.
- When the threads at both ends of the new length of drill steel are fully engaged, start the water flushing, engage the percussion, and engage the feed.
- 10. Normal drilling will resume.

Rod Pulling

- When the hole has been drilled to the required length, disengage all levers to halt all functions.
- To rid the hole and the drill steel from any left over flushing water, pull back on the flushing lever to blow out the hole with air.
- Move the feed lever forward until the drill string is tight against the bottom of the hole.
- 4. With rotation off, engage the percussion and move the feed lever back and forth several times to loosen all of the drill string joints. Disengage the percussion when complete.
- Pull back on the feed lever to pull the rockdrill and the drill string back. When the first coupling is centered in the centralizer, move the feed lever to neutral and clamp the coupling using the centralizer.
- Pull back on the rotation lever to rotate the rockdrill clockwise and unthread the drill steel from the coupling, while at the same time pulling back slightly on the feed lever to prevent thread binding during uncoupling.
- 7. Because the drill steel is threaded at both ends, there is no way to predict which end will unthread with the rockdrill (with experience, it will become somewhat predictable). Consequently, usually at least one end of the threaded joint will have to be unthreaded by hand.

Always ensure that rockdrill rotation has come to a complete stop before attempting to add or remove a drill rod.

- When the drill steel is loose, remove it and set it aside. Pay attention to rod rotation in an effort to maximize steel thread life.
- Move the rotation lever forward to rotate the drill counterclockwise and advance the feed until the drill striking bar is engaged with the coupling held in the centralizer.
- 10. Open the centralizer.
- 11. Pull back on the feed lever to pull the rockdrill and the drill string back. When the next coupling is centered in the centralizer, move the feed lever to neutral and clamp the coupling using the centralizer.
- 12. Repeat the above procedure until the entire drill string is removed from the hole.



Appendix D: Wheel End Service Instructions

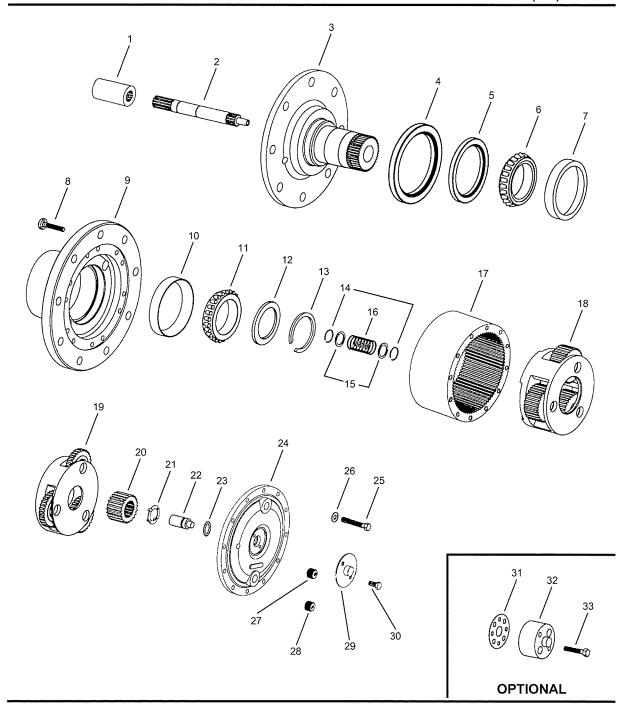


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Power Wheel * Service Manual Model 8 Double Reduction Wheel Drives



PHONE: (260) 925-3200 FAX: (260) 925-4725





IDENTIFICATION

IMPORTANT: All Power Wheel units and kits are shipped with a nameplate that includes the Auburn Gear part number and order code as shown.

Example:



In addition to the nameplate, Power Wheel drives are stamped with an identification number which appears on the cover or hub flange as shown.

Example: 6000236-A-4-9

When ordering parts, the information included on the nameplate or the stamped identification number is necessary to accurately identify the drive and obtain the correct replacement parts. Once this information has been obtained, contact Auburn Gear for the appropriate parts list.

DISASSEMBLY OF POWER WHEEL

STEP 1

Slide the coupling (1) from splines on input shaft (2).

STEP 2

Position the assembly upright on face of spindle (3).

STEP 3

Remove the disengage cover (29) if necessary.

STEP 4

Remove twelve bolts (25) and flat washers (26) and the large cover (24) from the unit. The thrust washer (21) and the disengage plunger (22) usually remains with large cover (24) when it is removed. Remove thrust washer (21), disengage plunger (22) and "O" ring (23) from the large cover (24).

STEP 5

Remove primary sun gear (20) from end of input shaft (2).

STEP 6

Remove the primary carrier assembly (19).

STEP 7

Remove the secondary carrier assembly (18). It may be necessary to remove the ring gear (17) first, if difficulty is encountered removing the carrier.

STEP 8

Remove the input shaft (2) from spindle (3). Remove the retaining rings (14), washers (15), and spring (16) from input shaft (2) only if replacement is required. NOTE: The retaining rings (14), washers (15) and disengage spring (16) are not included in units equipped with a cast iron disengage cover (29).

STEP 9

If not previously removed (see step 7) remove ring gear (17) from hub (9). It may be necessary to strike ring gear (17) with a rubber mallet to loosen from hub (9).

STEP 10

Remove the retaining ring (13) from groove in spindle (3). NOTE: Use a retaining ring expander tool to remove retaining ring (13).

STEP 11

Lift hub (9) from spindle (3). If bearings are not a loose fit, it may be necessary to press spindle (3) from hub (9).

STEP 12

Remove the oil seals (4) and (5) and bearing cones (6 & 11) from hub (9). Inspect bearing cups (7 & 10) in position and remove only if replacement is required.

ASSEMBLY OF POWER WHEEL

STEP 1

Press new bearing cups (7 & 10) in each side of the hub (9). It is recommended that bearing cups (7 & 10) and cones (6 & 11) be replaced in sets.

STEP 2

Assemble bearing cone (6) into cup (7) at seal end of hub (9) and press a new seal (5) into hub (9). Install boot seal (4) on hub (9) if unit is so equipped.

STEP 3

Position spindle (3) upright on bench. Lubricate lips of seals (4) and (5) and lower hub (9) onto spindle (3). Hub (9) should be centered as it is lowered over spindle (3) to prevent seal damage.

STEP 4

Assemble bearing cone (11) over spindle (3) and into bearing cup (10). Replace large thrust washer (12) over spindle end splines and on bearing cone (11).

STEP 5

Select the thickest retaining ring (13) that can be assembled into the ring groove of the splined end of spindle (3) above bearing. Bearing should have from .000 - .006 inches (.00 - .15mm) of end play when proper retaining ring (13) is installed.

STEP 6

For units equipped with the standard spring disconnect or optional quick disconnect, assemble a washer (15), spring (16), a second washer (15), and a retaining ring (14) in the middle grooves of input shaft (2). Install a second retaining ring (14) in groove near small end of input shaft.

STEP 7

Assemble the splined end of the input shaft (2) down into spindle (3).

STEP 8

Assemble the secondary carrier assembly (18) to spindle (3) at splines.

STEP 9

Clean mating surfaces and apply a bead of silicone sealant to face of hub (9) that mates with ring gear (17). (See instructions on sealant package) Assemble ring gear (17) to hub (9) being careful to align bolt holes.

STEP 10

Assemble the primary carrier assembly (19) into the ring gear (17). It will be necessary to rotate carrier to align secondary sun gear (part of primary carrier assembly (19) with planet gear teeth in secondary carrier assembly (18). Assemble primary sun gear (20) over input shaft (2). Rotate primary sun gear (20) to align input shaft (2) to gear splines and gear teeth in primary carrier assembly (19).

STEP 11

Lubricate "O" ring (23) and assemble in groove inside cover hole, push disengage plunger (22) into cover with pointed end facing inside of unit. NOTE: These parts (22 & 23) are not included in units produced with a cast iron disengage cover (29).

STEP 12

For units equipped with the standard spring disengage, assemble the thrust washer (21) with tangs engaged with cover (24). NOTE: A small amount of grease applied to the back side of thrust washer (21) will hold washer in place.

STEP 13

Assemble cover (24) aligning holes of cover and ring gear. Assemble the twelve 3/8-16 x 5 inch grade 8 hex head bolts (25) and flat washers (26). Torque bolts to 45 - 50 lb. ft. (61 - 67 Nm).

2



Appendix D: Wheel End Service Instructions

STEP 14

For units with the standard spring disconnect, assemble the disengage cover (29) with dimpled center protruding out if wheel is to be used to drive the vehicle. Assemble the torque the two 5/16-18 × 3/4 inch bolts (30). Torque bolts to 10 - 20 lb. ft. (13 - 27 Nm). For units equipped with a cast iron disengage cover, position a gasket on face of large cover (24). Assemble the thrust washer (21) to small cover with tangs engaged to grooves of the small

cover. NOTE: A small amount of grease applied to the back side of thrust washer (21) will hold it in place. Apply sealant to four 5/16-18 x 3/4 inch cover bolts (30) and assemble the small cover (29) to large cover (24). Torque these bolts to 15 - 20 lb. ft. (20 - 27 Nm).

STEP 15

Invert the Power Wheel assembly and assemble the coupling (1) with counterbore out to the input shaft (2).

NOTE: When installing a hydraulic motor to the Power Wheel drive it is necessary to place an "O ring or gasket (not supplied by Aubum Gear) between the motor and the planetary drive. "O' ring sizes: SAE A 2-042, SAE B 2-155, SAE C 2-159.

CARRIER ASSEMBLIES

It is recommended that the primary and secondary carrier assemblies (18 & 19) be serviced in their entirety to protect the integrity of the Power Wheel drive.

LUBRICATION RECOMMENDATIONS

<u>IMPORTANT</u>: POWER WHEEL PLANETARY DRIVES ARE SHIPPED WITHOUT LUBRICANT AND MUST BE FILLED TO THE PROPER LEVEL PRIOR TO START UP.

Observe lubrication recommendations given by the original equipment manufacturer. When specific recommendations are not available, use mild extreme pressure lubricant API-GL-5, No. 80 or 90 when filling the Power Wheel under normal temperature ranges between 0 - 120°F (-18 to 49°C). Power Wheel is to be half full of oil when unit is mounted level and horizontal. Use drain and fill plugs located in cover and ring gear. Oil is to be changed after first 50 hours of operation with subsequent changes every 1000 hours or yearly, which ever comes first. If unit is to be operated vertically, if ambient conditions are outside the specified range, or if the oil temperature exceeds 200°F (93°C) contact Aubum Gear for oil and level recommendations.

TOWING VEHICLE

<u>CAUTION</u>: The Power Wheel will not normally be damaged by towing; however, the hydraulic drive components may be damaged unless the Power Wheel is disengaged from the drive motor. Road speeds in excess of 25 MPH should be avoided unless clearly specified to be permissible by the equipment manufacturer.

TO DISENGAGE POWER WHEEL

CAUTION: For units equipped with the standard spring disconnect, assemble the disengage cover (29) with the dimpled center protruding in ward. For units equipped with the optional quick disconnect, push in center plunger of disconnect. For units equipped with a cast iron disengage cover. Remove the four capscrews (30), small cover (29) and sun gear (20). It may be necessary to rock the vehicle to release the load on the sun gear. Turning the sun gear end for end will disengage it from the planetary gears. Replace the cover. Some oil will be lost but need not be replaced until sun gear is replaced in the driving position.

STORAGE

A protective film is applied to the Power Wheel at the factory to prevent rust during shipment. Additional protection may be required if the Power Wheel is to be stored for an extended period of time.

SEALING COMPOUND

Silastic RTV732 sealer and General Electric Silimate RTV No. 1473 or RTV No. 1503 are currently recommended for sealing gasket surfaces. Sealant should be applied in a continuous bead, which should be centered on the surface to be sealed but should move to the inside of the hole at each bolt hole location. For service requirements order Aubum Gear part number 604101.

SPECIFICATIONS

Maximum intermittent output torque	0,000 lb. in. (11,300 Nm)
Maximum input speed	5,000 RPM
Oil capacity	47 oz (1390 ml)

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Appendix D: Wheel End Service Instructions



ITEM NO.	DESCRIPTION*	NO. USED IN ASS'Y.	ITEM NO.	DESCRIPTION*	NO. USED IN ASS'Y.
1	Coupling	1	18	Secondary Carrier Assembly	1
2	Input Shaft	1	19	Primary Carrier Assembly	1
3	Spindle	1	20	Primary Sun Gear	1
4	Boot Seal 604405	1	21	Thrust Washer	1
5	Oil Seal 14-00-044-011	1	22	Disengage Plunger 610801	1
6	Bearing Cone 14-00-133-007	1	23	"O" Ring 614101	1
7	Bearing Cup 14-00-133-006	1	24	Large Cover	1
8	Wheel Bolt	8-10	25	Hex Head Bolt (Grade 8)	12
9	Hub	1	26	Flat Washer	12
10	Bearing Cup 14-00-133-008	1	27	Magnetic Plug 14-00-052-00	2 1
11	Bearing Cone 14-00-133-009	1	28	Pipe Plug	1
12	Thrust Washer	1	29	Disengage Cover	1
13	Retaining Ring Kit 14-05-410-	001 1		Standard Spring Type 14-02- Cast Iron 95-04-109-11	039-005
14	Retaining Ring	2	30	Hex Head Bolt	2-4
15	Washer	2	31	Quick Disconnect Gasket	1
16	Disengage Spring	1	32	Quick Disconnect Assembly	1
17	Ring Gear	1	33	Hex Head Bolt	2
				Disengage Cover Gasket 95-04-121-01 (used with Cast Iro Disengage Cover - not shown in from	

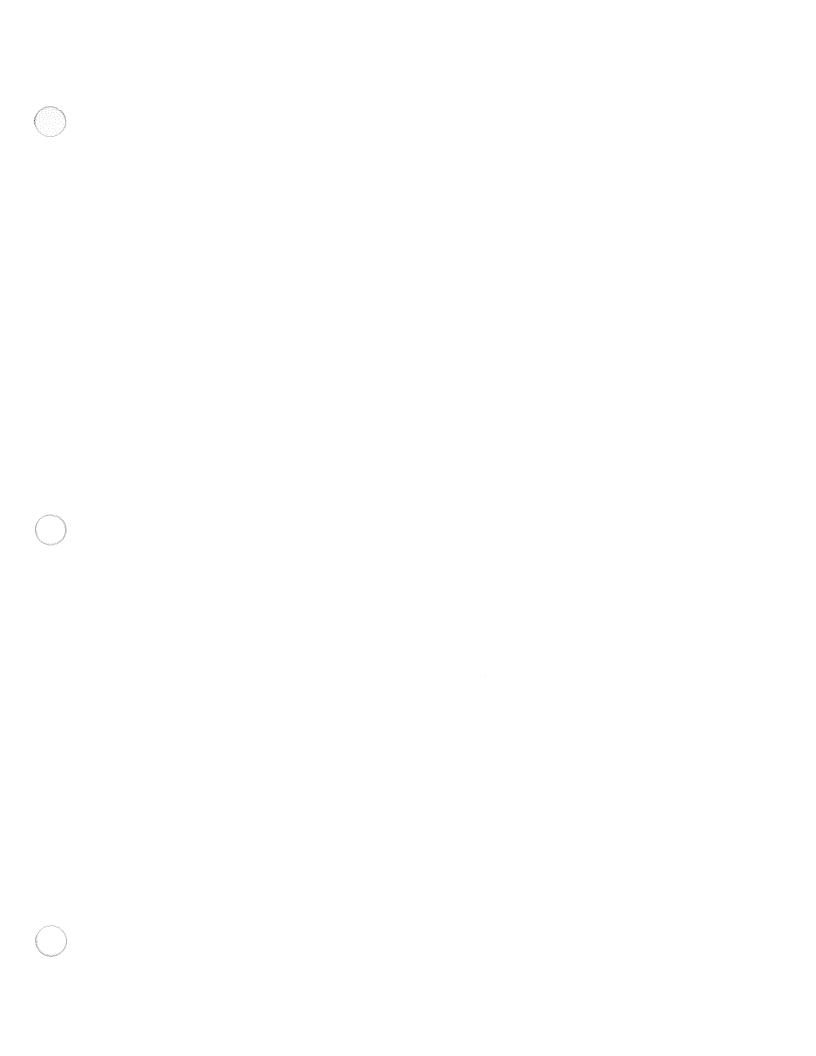
^{*} Contact Auburn Gear with part number and order code of drive to obtain the appropriate parts list. Refer to parts list for the specific part numbers and quantities.

Model 8 Power Wheel® Service Kits

Part No.	Description	Included Items
14-05-410-001	Retaining Ring Kit	13 (6 Retaining Rings)
641011**	Bearing and Seal Kit	5, 6, 7, 10, 11, and 13
641018**	Seal Kit	5 and 13

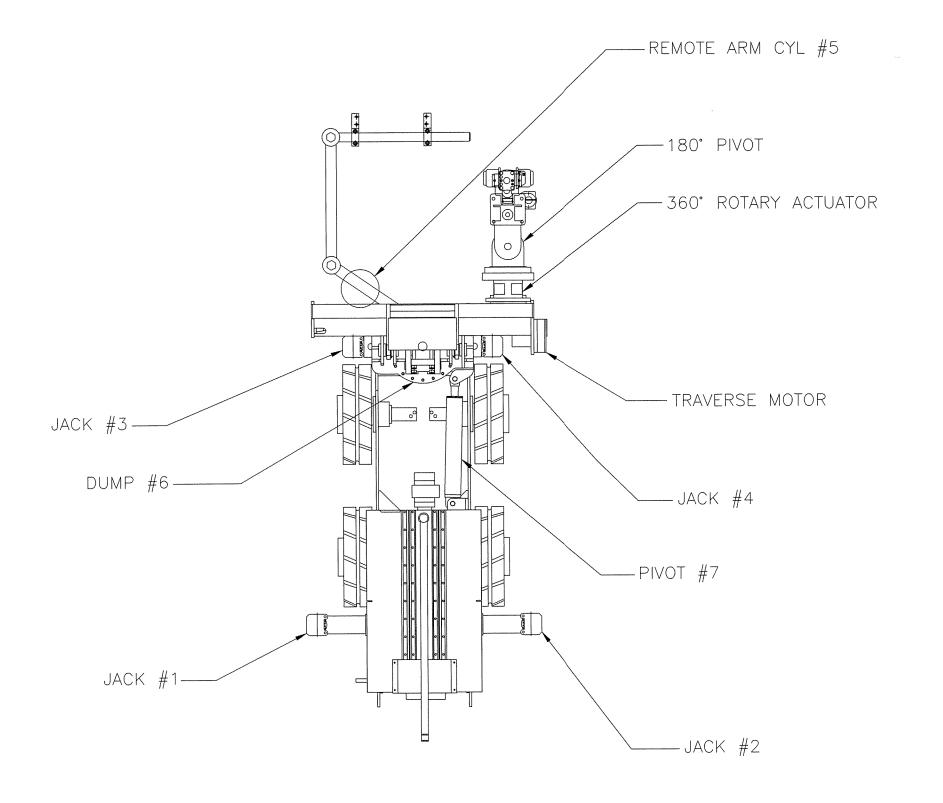
^{**} Indicates kit also includes a tube of sealant, part number 604101.

MH428 - 0495 Power Wheel® is a registered trademark of *Auburn Gear*





PART No. 3548012 © Boart Longyear Inc 2005 ITEM PART No. DESCRIPTION QTY ITEM PART No. DESCRIPTION QTY ITEM



	ITEM	PART No.	DESCRIPTION	QTY
district the second	1	39224	ADAP, HYD STR 6 JIC - 8 ORB	28
	2	36465	ADAP, HYD STR 6 JIC - 6 ORB	30
	3	33171	ADAP, HYD 90°6 JIC — 8 ORB	13
	4			
	5	40254	ADAP, HYD 90° 6 JIC — 8 NPT	2
	6	40079	ADAP, HYD STR 8 JIC - 10 ORB	2
	7	33660	ADAP, HYD STR 6 JIC - 6 ORB	4
	8	33639	ADAP, HYD STR 4 JIC - 6 ORB	4
	9	39021	ADAP, HYD TEE 6 JIC	2
	10	36516	ADAP, HYD BULKHEAD 6 JIC	13
	11	39041	ADAP, HYD STR 6 JIC 8 NPT	28
	12	3670523	HOSE KT	1
	13	3670514	ORIFICE [.027"] #6	2
	14	39511	ADAP, HYD STR 6 JIC 4 ORB	2

NOTES:

HYDRAULIC COMPONENTS SHOWN FOR REFERENCE ONLY. REFER TO ASSEMBLY DRAWING'S FOR COMPONENT INFORMATION. ALL #4 HOSING TO HAVE #6 ENDS.

DO	NOT SC	CALE	GENERA UNLESS (AL SPECIFICA OTHERWISE S	TIONS PECIFIED	on por	ADT LON	ICVE.	A D	USED ON STOPEMATE
			WHOLE No.	.×	.XX	JU DU	art Lon	GIE	AK	
			±1.5 mm	±0.5 mm	±0.12 mm		I			
			6.3	3.2	1.6	DRAWN TERRYH	DATE MM/DD/YY 05/04/04	1:4		
			DIMENSIO DIMENSION	NS SHOWN A	ARE MM. E INCHES.	CHECKED	APPROVED	WEIGHT	Kg	SHEET 1 OF 2
				ES ±0.30,	[0.50*]	DESCRIPTION			PART No).
Α	ISSUED	05/04/04	\ 1	FTD	10	SYSTE	EM, HYDRAULIC		3	548012
ISSUE	ECN No.	DATE MM/DD/YY	M	EIR						

