Section **1**

General Information

INTRODUCTION

The operation of heavy mining machinery can be hazardous. To ensure safe operation, operators and personnel must be alert, competent, correctly trained, tested and licensed in the principles, capabilities and correct operating and isolation procedures of the machinery.

This manual is designed to provide the MH-40 Shield Hauler operator and service personnel with the proper information regarding the machine's instrumentation, operating controls and general safe working procedures. All operators and service personnel of this machine must be conversant with the information contained within this manual before operating the machine or performing services tasks on the machine.

To ensure safe and efficient operation, the MH-40 Shield Hauler must be adequately maintained by the operators and service personnel. The operator's pre-start inspection procedure contained in Section 6 of the Operator's Manual must be performed. before the machine is returned to active service.

DESCRIPTION

The MH-40 is a 40000 kg high capacity Shield Hauler. It has been designed for lifting and carrying heavy pieces of equipment and machinery in underground coal mines. Its main function is carrying and placing of longwall equipment and shields. The machine comes standard with a set of fork tines and winch for this purpose.

The motive force is provided by a 172 kW Caterpillar 3216 turbocharged four-stroke inline six cylinder flameproof diesel engine package. Flameproofing of the system includes a *wet bath* exhaust conditioning system complete with exhaust and intake flame traps. The start system is pneumatic. The Diesel Control System (DCS) is an intrinsically safe electronic monitoring system. The engine power output is connected to the constant four-wheel drive system via a drive coupling and converter through a four-speed bidirectional power shift transmission to heavy duty axles with liquid cooled Posi-Stop brakes.

The MH-40 Shield Hauler utilises a wet bath exhaust system complete with a exhaust purifier. A removable flame trap for ease of cleaning is fitted on the outlet of the exhaust conditioner housing.

A site specific Risk Assessment is recommended to be conducted before this machine is introduced into service.

SAFETY LABELS AND INSTRUCTIONS

This manual contains important information affecting the safety of personnel and the equipment being used.

The safety instructions and behavioural rules are intended to protect operators from potentially dangerous situations and assist in the safe operation of the trailer and associated equipment.

The following symbols are used with safety instructions and identify varying degrees of hazardous conditions.

The safety instructions associated with these symbols are to be considered the minimum requirements for effective hazard and operational control.

Points in the text marked with this symbol draw attention to immediately impending danger. Possible consequences are very serious or fatal injury.

These points contain information on potentially dangerous situations. Possible consequences are very serious or fatal injury.

This symbol draws attention to potentially dangerous situations. Possible consequences are light to moderately serious injury and machine damage.

Points in the text marked with this symbol draw attention to potentially harmful situations. Possible consequences are damage to machine or equipment in immediate vicinity

Text marked with this symbol contains useful information associated with the machine and its application.

GAUGE COLOUR CODE

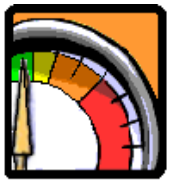
The gauges in the operator's compartment are colour coded to assist the operator to recognise if the temperatures and pressures are within the correct operating parameters.

During normal operation some gauges may, at times, read outside of the indicated *normal* operating range e.g. during normal operation, when the operator applies the brake the brake head pressure gauge will drop below the minimum pressure and indicate that the pressure is too low. This is because the pressure is being released from the brakes to allow the springs to apply the brakes. When the operator releases the brake the gauge should then return to the *green* zone.

RED: The gauge is indicating an unsafe condition. When this occurs the operator should stop the machine and rectify the problem or have service personnel rectify the problem before placing the machine back in service.

ORANGE: The gauge is indicating a temperature or pressure outside of the normal operating range. The operator should closely monitor the gauge and report the problem to service personnel for rectification.

YELLOW: The gauge is indicating a temperature or pressure below the normal operating range. This will not cause immediate damage if operated for short periods. Report to service personnel for rectification if machine continually operates in this area.



GREEN: The gauge is indicating that the temperature or pressure being monitored is within the normal operating range.

GAUGE ALARM PARAMETERS

Brake Head Pressure Gauge

0-11377 kPa	**Red**	Pressure below normal operating range. Needle will register in this area during normal operation of brakes and when park brake is applied. Gauge must return to normal operating range when brakes are released. Premature brake wear may result if operation continued.
11377-12756 kPa	**Green**	Normal operating pressure range.
12756-16000 kPa	**Red**	Pressure too high. Damage to brake units may occur.

Steering Accumulator Pressure Gauge

0-13790 kPa	**Red**	Pressure too low. Steering may become heavy to operate. Needle will drop into this area for a short period when steering is operating.
13790-18616 kPa	**Green**	Normal operating pressure range.
18616-25000 kPa	**Red**	Above normal operating range. Damage to steering components may result if operated for prolonged periods.

Engine Coolant Temperature

0-50°C	Yellow	Coolant temperature too low.
50-104°C	Green	Normal operating temperature range.
104-107°C	Orange	Above normal operating temperature. Engine shutdown imminent.
107-120°C	Red	Above normal operating temperature. Engine should have shutdown. Coolant will be boiling.

Exhaust Gas Temperature

0-140°C	Green	Normal operating temperature range.
140-150°C	Orange	Above normal operating temperature. Engine shutdown imminent.
150-200°C	Red	Above normal operating temperature. Engine should have shutdown.

Engine Oil Pressure

0-100 kPa	Red	Engine oil pressure too low. Engine should have shutdown.
100-600 kPa	Green	Normal operating pressure range.
600-800 kPa	Red	Engine oil pressure too high. Continued operation could result in damage to the engine.

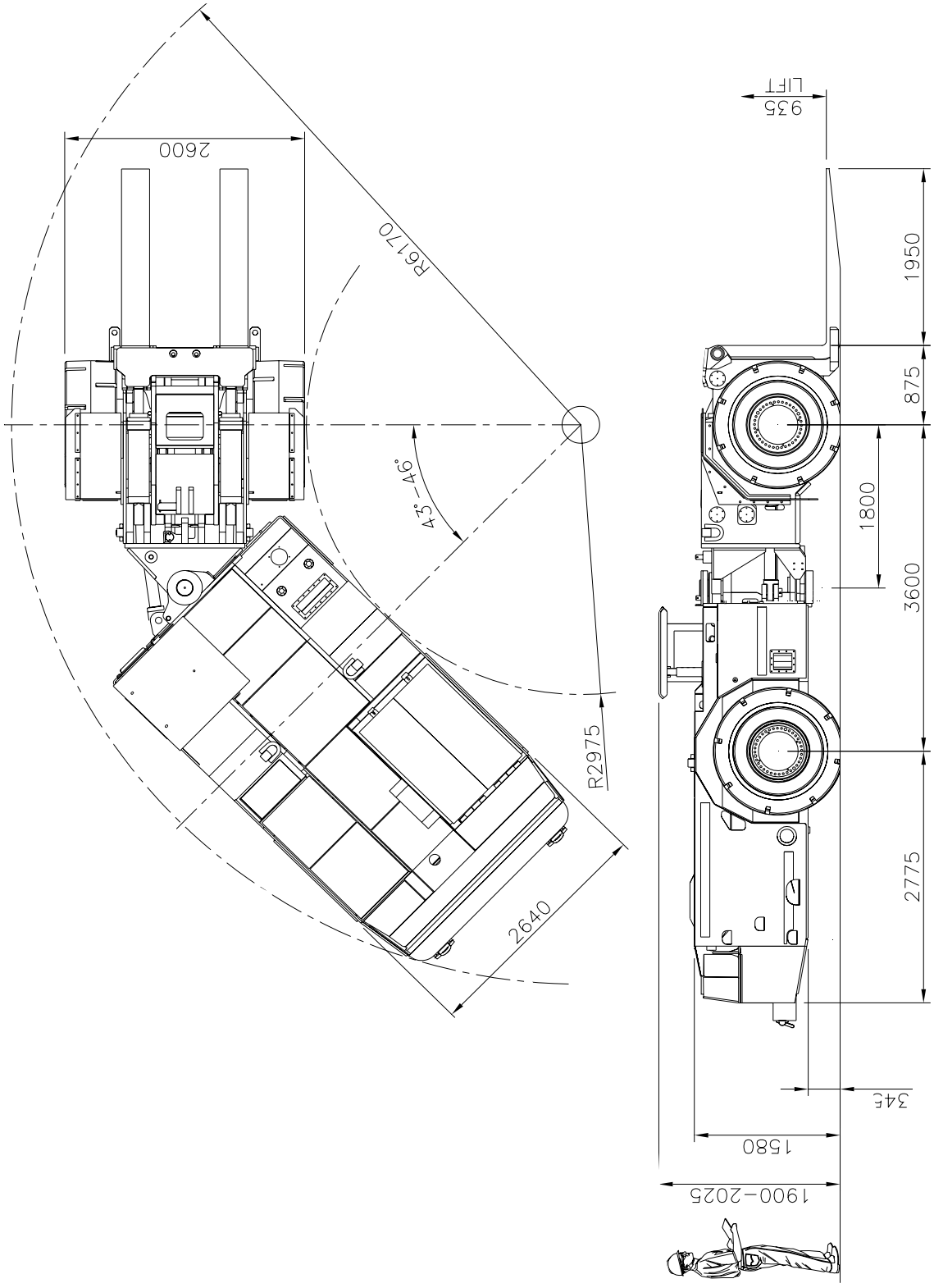
Air Pressure Gauge

0-275 kPa	Orange	Air pressure low. Machine will not start. Machine may shutdown.
275-827 kPa	Green	Normal operating pressure range.
827-1000 kPa	Red	Air pressure too high. Continued long periods of operation could result in damage to the equipment.

Brake Accumulator Pressure Gauge

0-13790 kPa	Red	Pressure too low. Brakes may not fully release. Premature brake wear may result if operated for prolonged periods. Needle may drop into this area for a short period when brakes are operating.
13790-18616 kPa	Green	Normal operating pressure range.
18616-25000 kPa	Red	Above normal operating range. Damage to brake components may result if operated for prolonged periods.

GENERAL ARRANGEMENT



SPECIFICATIONS

All specifications are subject to change without notice. Always consult BUCYRUS to obtain current information before applying critical loads.

Weight

Operating with full fuel and operator	39400 kg

Tractive Effort (standard wheels)

1st gear	430 kN
2nd gear	232 kN
3rd gear	134 kN
4th gear	77 kN

Vehicle Speeds (standard wheels)

	Empty
1st gear	3.5
2nd gear	7.3
3rd gear	12.6
4th gear	21.7

Grade Ability

Front to rear	1:4
Side to side (empty)	1:4
Side to side (laden fully raised)	1:8

Engine

Make/model	Caterpillar 3126 MUI
Displacement	7.2 litre
Maximum power	172 kW @ 2500 RPM

Engine Cooling System

Cooling system	Water based radiator
Cooling fan	Hydraulic driven fan
Water pump	Engine driven
Radiator and fan orientation	Horizontal

Engine Speeds

Low idle	800 RPM
High idle	2600 RPM

Fuel Consumption

At full power	60 litres/hr
Average mine duty	20-40 litres/hr

Start System

Starter motor type	Turbine air start

Intake Air Cleaner

Type/Make	Dry
Elements	Dual (primary and safety)
Flame trap	Intake between turbo and after cooler

Exhaust Conditioner

Type	Wet Scrubber
Make	BUCYRUS
Exhaust filter	Replaceable element
Exhaust flame trap	Wet MA
After treatment	Catalytic exhaust purifier

Exhaust Heat Exchanger Cooling System

Cooling system	Water based radiator
Cooling fan	Hydraulic driven fan
Water pump	Hydraulic driven
Radiator and fan orientation	Horizontal

Transmission

Make/Model	Dana 32000
Speeds, forward/reverse	4

Torque Converter

Make/model	Dana

Axles

Type	Outboard planetary
Front axle make/model	Dana 53R
Rear axle make/model	Dana 53R
Differential type	Bevel gear and pinion
Differential lock type - front	Posi-Torque
Differential lock type - rear	Posi-Torque

Tyres – Standard

Size	1397 diameter x 559 mm
Inflation media	Solid

Hydraulic Systems

Steering	Closed centre 17.30 MPa
Brakes	Closed centre 17.30 MPa
Carry plate lift and tilt	Open centre 21.05 MPa
PTO	Open centre 21.05 MPa
Tank type	Sealed and pressurised
Tank pressure	50 kPa

Hydraulic Filtration

Auxiliary system	
Type	In tank return replaceable with bypass
Rating	10 micron
Steer/brake system	
Type	Inline return replaceable with bypass
Rating	10 micron
Optional PTO	
Type	Inline return replaceable with bypass
Rating	25 micron

Carry Plate Pump

Type	Gear open centre
Nominal output @ 2500 RPM	156 lpm

Fan Pump

Type	Gear open centre
Nominal output @ 2500 RPM	67 lpm

Alternator/HEX Pump

Type	Gear open centre
Nominal output @ 2500 RPM	25 lpm

Steering and Brake Pump

Type	Pressure compensated piston
Nominal output @ 2500 RPM	96 lpm

Cylinders

Type	Double acting
Rods	Hard Chromed
Counterbalance valves	Lift and tilt
Cushion stops	Steering and tilt

Steering

Type	Centre articulated, hydraulic

Steering System

Control valve	Closed centre
Actuation	Orbital
Pressure compensated	17.30 MPa
Crossover relief	19.30 MPa

Accumulator – Brakes

Type	Piston
Quantity x capacity	1 x 2 litre
Operating pre-charge pressure	6.2 MPa

Service Brake

Type	Totally enclosed, liquid cooled Posi-Stop
Make	Dana
Application	Spring applied hydraulic release
Location	Each wheel end

Park Brake

Type	Totally enclosed, liquid cooled Posi-Stop
Make	Dana
Application	Spring applied hydraulic release
Location	Each wheel end

Articulation

Bearing type and size	Pin and spherical bearing (top) bush, (bottom) fully sealed
Bush material	Hardened steel
Pin material	Hardened steel
Degrees of turn either side	45 degree

Oscillation

Type	Dana rear axle mounted trunnion
Bush material	Hardened steel
Pin material	Hardened steel
Up and down from horizontal	6 degree

Seating (Operator)

Type	Cross-seated
Make	BUCYRUS
Suspension	Shock absorption

Canopy

Type	Protective device MDG1

Electrical System

Type	Flameproof
Voltage	12 V
Polarity	Negative ground

Lights

Number/location	STD 2 front, 2 rear
Type	Approved flameproof

Alternator

Drive	Hydraulic
Type	BUCYRUS Flameproof

Pneumatic System

Compressor type	Piston engine gear driven
Air flow	0.50 m³/min @ 1500 RPM
Governed pressure	800 kPa
Relief pressure	830 kPa
Air receiver volume	80 litres

Shutdown System

System type	Bucyrus DCS electronic Intrinsically safe approved

Service Capacities

Hydraulic tank	450 litre
Fuel tank	350 litre
Transmission/converter oil	45 litre
Engine crankcase oil (with filter)	22 litre
Engine cooling system water	72 litre
Axle oil (each)	60 litre
Wet scrubber water reserve	468 litre

Overloading equipment could cause personal injury, death or equipment damage. Due to configuration or options these weights can vary up to 20%. Bucyrus recommends that relevant standards and safety procedures should always be used when operating this machine. Removal of protective canopies, doors, interlocks and structures etc., could cause serious injury of death. Replacement with correctly torqued fasteners is mandatory.

LUBRICATION AND FUEL SPECIFICATIONS

GENERAL

This section provides Bucyrus standard requirements for the use of fuels and lubricants. Consult Bucyrus or relevant fuel and oil suppliers for recommended alternatives.

FUELS

Diesel fuel for underground use shall consist of petroleum hydrocarbons and shall be free of inorganic acids, visible suspended matter or water.

All diesel fuel should conform to the table of requirements listed in this Section.

Diesel fuel may contain additives as indicated on the next page.

The use of speciality *low emission* fuels is not recommended as engine/fuel pump damage and poor engine performance may result.

FUEL SPECIFICATION TABLE

Property	Test Method	Unit	Specified Values
Appearance	Visual Inspection ASTM D4176 Procedure No 2 @ 25°C		Clear and bright Clear and bright
Ash	ASTM D 482 (Notice 1)	% Mass	0.01 max
Carbon Residue	ASTM D 524	% Mass	0.15 max
Cetane Number (Notice 2)	ASTM D 613		45 min
Calc. Cetane Index	ASTM D 4737		45 min
Cloud Pt (Notice 3)	ASTM D 2500	°C	-10 max (0 max Notice 4)
Copper strip	ASTM D 130		1 B max
Density @ 15°C	ASTM D 1298 or ASTM D 4052	kg/L	0.80- 0.83
Distillation 90% rec @	ASTM D 86	°C	290 max (350 max Notice 4)
Flash Point	ASTM D 93	°C	61.5min
Sulphur	ASTM D 129 or ASTM D 2622 or ASTM D 2785	% Mass	0.05 max
Viscosity	ASTM D 445	cSt @ 40°C	1.5- 2.5
Water & Sediment	ASTM D 1796	% Vol	0.05 max

Equivalent IP tests may be used throughout.

Supplier may elect to meet either the Cetane Number or the calculated Cetane Index. Calculated Cetane Index is to be based on finished fuel before any Cetane Number improving additives are incorporated.

See Diesel Fuel Relevant Information - Low Temperature Effects.

The specification represents an optimal fuel, based on the control of exhaust contaminates and available refining technology. If commercial considerations prevent the use of fuels meeting the specification, then the alternative values indicated by Notice 4 may allow the use of a slightly modified fuel without severely compromising the health aspects. See also Fuel Additives below.

FUEL ADDITIVES

The range and use of additives varies widely. Most are proprietary products. For fuels containing Cetane Number improves the Calculated Cetane Index (ATSM D 4737) may be unreliable and the Cetane Number, determined by ASTM D 613 should be specified in such cases. Some smoke suppressants may contain copper barium or manganese compounds and associated exhaust emissions may contain measurable amounts of these potentially toxic metals.

Accordingly, suppliers who consider the use of additives advantageous from an exhaust emission control aspect should be encouraged to offer this benefit, provided they advise the amount, nature, purpose and likely affect on exhaust emissions and the health of mineworkers, of additives included in the fuel offered against this specification.

Unless expressly approved in writing by the Mine Management Nominated Representative no additives containing metals or metallic compounds shall be present in the fuel.

DIESEL FUEL RELEVANT INFORMATION

FUEL HANDLING

The most common causes of fuel contamination are condensation (water) and biological matter. Condensation (water) occurs when damp air is drawn into partly filled storage tanks during normal temperature variations. If this phenomenon is likely to occur, appropriate precautions, such as a separate low level water drain should be included in the storage tank, or the tank protected from being strongly heated by direct sunlight, etc. Biological matter may be controlled by ensuring the fuel system does not allow the accumulation of pockets of water; by good housekeeping and regular maintenance; or by the inclusion of anti-fungal or anti-bacterial additives in the fuel. Keeping storage tanks reasonably full also assists.

LOW TEMPERATURE EFFECTS

Fuels with higher alkaline (parrafinic) contents (indicated approximately by lower densities) may be more likely to become cloudy at low temperatures than more aromatic fuels. This is due to the formation of minute wax crystals, which may plug filters. This cloudiness may be minimised by protecting the storage tank from extremely cold conditions (undercover insulated or buried), or by the addition of a Cloud Point depressing additive AS3570-1988, Automotive Diesel Fuel contains a table and figure (pages 5 and 6) which may assist. Cloud Point in itself does not influence emissions, but fuel with a Cloud Point close to minimum ambient temperatures will often contribute to poor engine performance which may lead to increased exhaust contaminants.

EXHAUST EMISSIONS

On combustion in internal combustion engines, all hydrocarbon fuels produce carbon monoxide, carbon dioxide and oxides of nitrogen and particulate matter (soot consisting mainly of carbon, and often minor amounts of other more complex hydrocarbons) with minor amounts of other products such as aldehydes. Those fuels which contain sulphur will also produce oxides of sulphur, while those containing fixed nitrogen will tend to produce more oxides of nitrogen. All these gases are toxic above certain ambient concentrations and some have unpleasant odours. The propensity to produce oxides of sulphur is controlled by specifying a low sulphur content for the fuel. The intent of this specification is to design a fuel with low emissions of these gases and particulates, but the production of exhaust emissions is also a function of engine operating conditions, which vary from engine to engine.

ENGINE MAINTENANCE

This specification has been prepared with the aim of reducing the amount of and modifying the nature of certain components of exhaust emissions. Before operating this machine on any alternative fuel specification a check should be made to see if engine adjustments are necessary to ensure optimal performance is achieved. It should also be recognised that regular maintenance will prolong the time during which emissions will be minimised. In particular, attention to the fuel supply system, especially filters, the injectors, compression maintenance and regular flushing of the exhaust conditioning system should be key components in such a program.

ENGINE OIL

The proper SAE viscosity grade oil is determined by the minimum outside temperature at cold engine start up, and the maximum out engine temperature during the engine operation. Use the minimum temperature column on the chart to determine the oil viscosity to start a *cold soaked* engine. Use the maximum temperature column on the table to determine the oil viscosity for operation at the highest temperature anticipated. In general, use the highest viscosity oil to meet the start up temperature requirement.

TORQUE CONVERTER/TRANSMISSION FLUID

Transmission Fluid Shell Donax TC30 is suitable for use in the Torque Converter and Transmission. Refer to the Fluid Specification Table for the oils which may be used under given conditions.

Do not use Dextron II in the torque converter/transmission.

HYDRAULIC OIL

Use high quality anti-wear hydraulic oil or engine oil for the hydraulic (steering, brakes and attachment actions) system. Referring to the Fluid Specification Table. ISO/VG 68 Oil and SAE 20W-20 Engine Oil both have a viscosity of 300 to 350 SUS at 38°C and therefore fit into these temperature ranges. For colder ambient temperatures, ISO/VG 32 Hydraulic Oil or SAE 10 W Engine Oil (150-200 SUS at 38°C) are better suited. The viscosities given are for use as guidelines only; however, do not use an oil which will exceed 4000 SUS at start up or be less than 80 SUS during operation. Also any oil used must have a viscosity index of no less than 90. Consult your oil dealer or manufacturer for oils that meet these requirements.

Engine oil being used as hydraulic oil must meet Mil-L-46152 or 2014C and API class CC or CD standards. No similar standards have been written for anti-wear hydraulic oil; it is therefore up to the machine owner to ensure that the oil is of a high quality.

GEAR OIL

Use Shell differential oil HP gear oil LS 90 or equivalent SAE90LS oil suitable for limited slip differentials.

MULTI-PURPOSE EP GREASE

Use multi-purpose EP grease, which contains both 1% to 5% molybdenum disulphide conforming to MIL-L-7866, and a suitable corrosion inhibitor. National Lubricating Grease Institute (NLGI) Grade No. 2 is suitable for most temperatures. NLGI No. 1 or No. 0 are suitable for extremely low temperatures.

DRIVE COUPLING GREASE

Shell Stamina RL2 grease is to be only used on the latest engine drive couplings with tapered roller bearings fitted. The distinguishing feature of the drive coupling with these bearings are a conical shaped housing, the other housing has more of a 90° housing with webbing welded to sections.

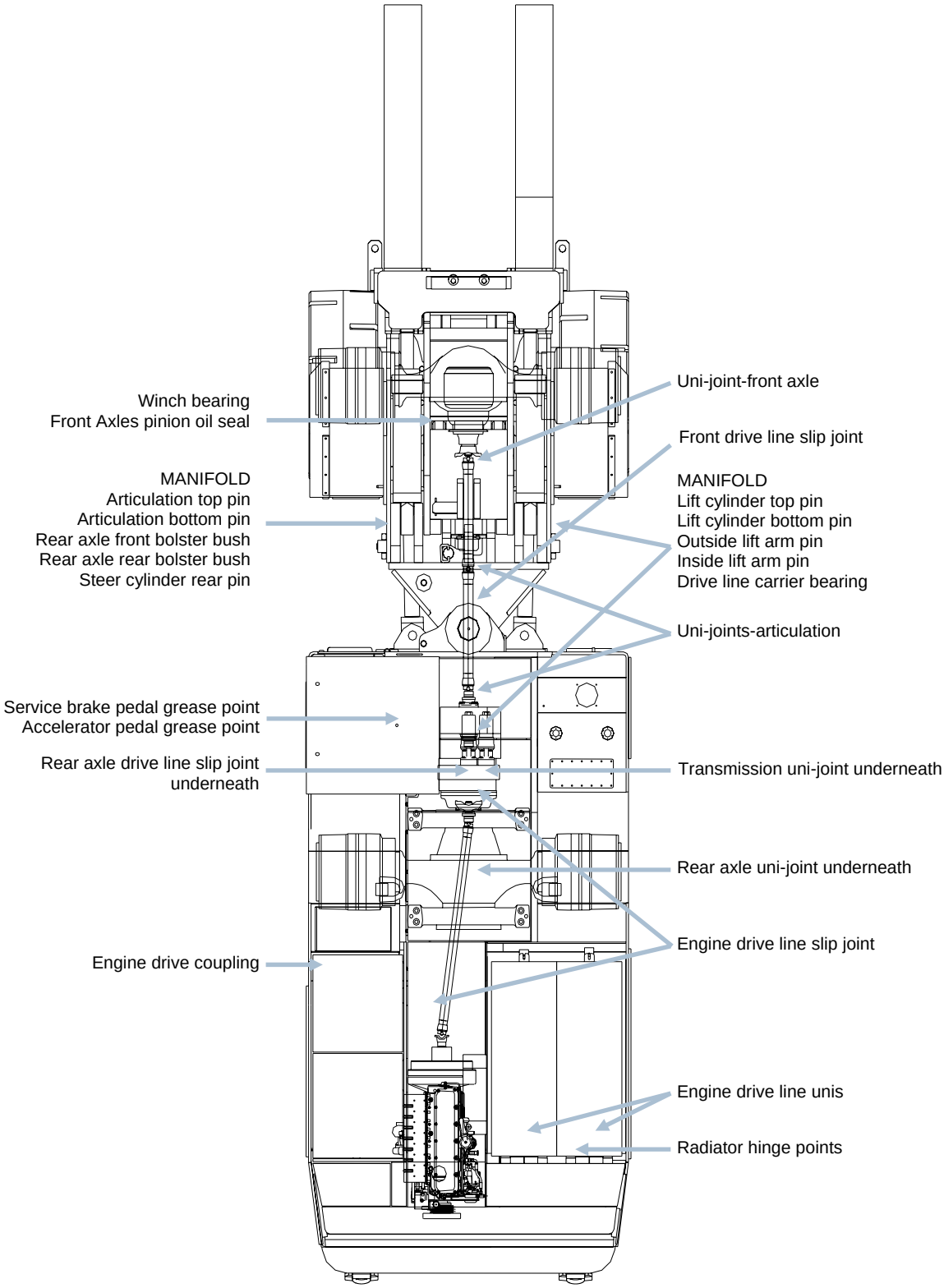
EXHAUST CONDITIONER MAKE UP TANKS

Clean potable water only is to be used for the make up tank water.

FLUID SPECIFICATION TABLE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

GREASE POINT REFERENCE DRAWING



MACHINE ISOLATION

Before commencing work on the machine, it is imperative to ensure the system to be worked on is correctly isolated. This may also require the isolation of other systems that affect the safe completion of the job.

NOTICE

Any site/mine specific isolation procedures override those listed on the following pages. The procedures presented here are the minimum required to perform any work on the machine. Before commencing check with the relevant people regarding any site/mine specific isolation procedures.

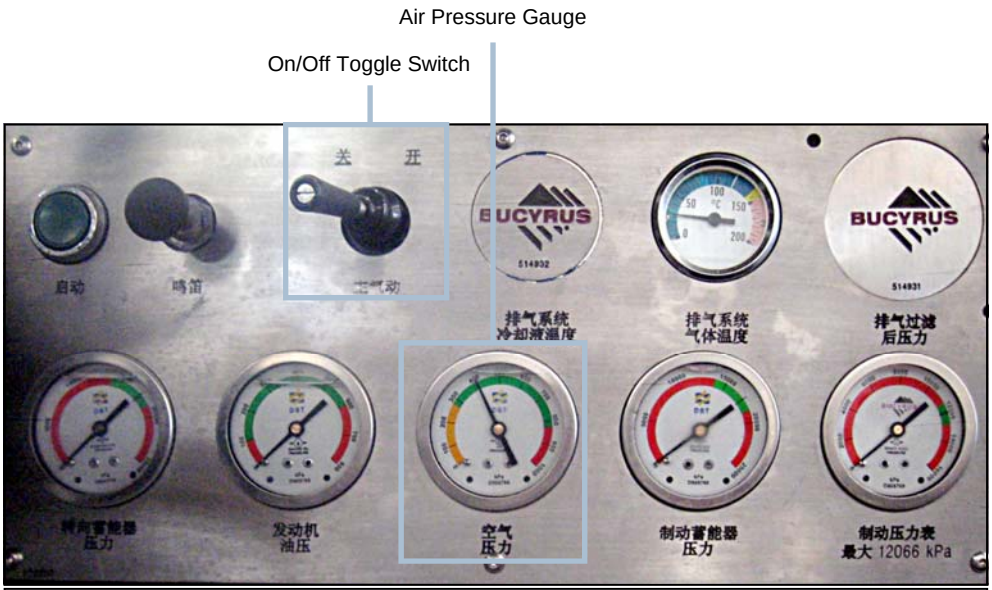
ENGINE ISOLATION

To isolate the engine perform the following procedure:

1. Ensure the area is clear of any obstruction and area is fit for carrying out safe operation and maintenance.
2. Ensure the machine is in a straight line (not articulated).
3. Lower the lift arms to the ground.
4. Select *neutral* on transmission directional control lever.
5. Apply the park brake.
6. Shutdown the engine.
7. Fit a danger tag to the on/off toggle switch.
8. Connect the articulation lock and chock the wheels.
9. Close the main air isolation valve and fit a danger tag (see Pneumatic Isolation).

WARNING

Be careful of hot surfaces when working on or around the machine, allow time for them to cool down.



Right Hand Side Operator's Display Panel

PNEUMATIC ISOLATION

To isolate the pneumatic system perform the following procedure:

1. Ensure the area is clear of any obstruction and area is fit for carrying out safe operation and maintenance.
2. Lower the lift arms to the ground, shutdown the engine, fit a danger tag to the on/off toggle switch, connect the articulation lock and chock the wheels.
3. Locate the main air isolation valve at the driver's side rear of the engine compartment and rotate to the *off* position.
4. Relieve air pressure in the system lines by successively switching the on/off toggle switch until the air pressure gauge reads *zero* when the on/off toggle switch is in the *on* position.

If work is required on the air receiver it will be necessary to remove air pressure from the receiver by actuating the main air drain valve located at the bottom of the air receiver. Stored air pressure will be safely released to the atmosphere. Ensure that the three-way ball valve is not connected to an external pressure source.

Compressed air can be hazardous. Wear suitable personal protective equipment such as safety glasses and hearing protection.

Main Air Manifold

HYDRAULIC ISOLATION

To isolate the hydraulic system perform the following procedure:

1. Ensure the area is clear of any obstruction and area is fit for carrying out safe operation and maintenance.
2. Lower the lift arms to the ground, shutdown the engine, fit a danger tag to the on/off toggle switch, connect the articulation lock and chock the wheels.
3. Depress the attachment quick connects button located in the operator's compartment. This will remove any residual pressure stored in the PTO lines.
4. Observe both steering and brake pressure gauges located in the operator's compartment. These must read zero before undertaking any hydraulic maintenance. The hydraulic system features a steering and brake accumulator automatic bleed circuit which will remove hydraulic pressure from both accumulators once the engine has stopped. This normally takes around 30 seconds. The steering and brake accumulators can also be bled via rotation of the steering wheel and actuation of the brake pedal, once the engine has been shutdown.
5. Remove hydraulic tank pre-charge pressure (50 kPa) by cracking hydraulic tank filler cap.

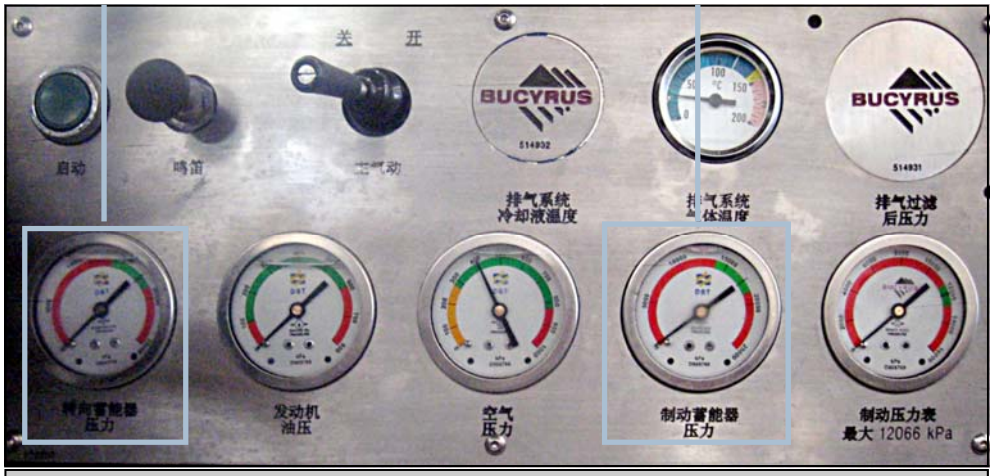
Ensure all loads are mechanically supported before removal of any hydraulic lines. Hydraulic fluid may be hot. Wear personal protective equipment such as safety glasses, long sleeve shirt and gloves.

Always assume there is hydraulic pressure in hydraulic lines or components unless it has been isolated by yourself.

Crack hose end fitting (if pressure is present in line tighten fitting and remove pressure as above) but do not remove till any residual pressure is removed.

Steering Accumulator Pressure Gauge

Brake Accumulator Pressure Gauge



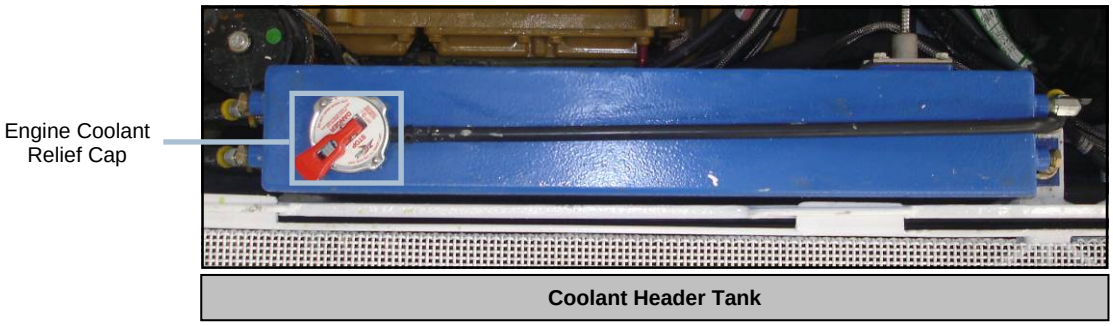
Right Hand Side Operator's Display Panel

ENGINE COOLANT ISOLATION

To isolate the engine cooling system perform the following procedure:

1. Ensure the area is clear of any obstruction and area is fit for carrying out safe operation and maintenance.
2. Lower the lift arms to the ground, shutdown the engine, fit a danger tag to the on/off toggle switch, connect the articulation lock and chock the wheels.
3. Isolate the pneumatic circuit.
4. Locate the header tank relief cap located at the rear of the machine on the driver's side..
5. Remove coolant circuit pressure (105 kPa) by lifting the *red* relief lever on the relief cap and hold up till pressure is released.
6. Slowly remove relief cap with relief lever held in the *up* position.

The coolant fluid will be under pressure and hot (up to 100°C). Always relieve pressure by lifting the relief lever on relief cap before removal. Wear personal protective equipment such as safety glasses, long sleeve shirt and gloves to avoid scalds and burns from hot coolant.



Coolant Header Tank

ELECTRICAL ISOLATION

1. Ensure the area is clear of any obstruction and area is fit for carrying out safe operation and maintenance.
2. Lower the lift arms to the ground, shutdown the engine, connect the articulation lock and chock the wheels.
3. All electrical energy is isolated once the engine has stopped.

The electrical system installed on this machine is approved/certified as explosion protected for use in Australian underground coal mines and may cause an atmospheric explosion if not maintained and used in its approved state. Such equipment is to be inspected and maintained in accordance with the relevant regulatory authorities rules and regulations and the conditions for which the apparatus has been approved.

Isolating the main air isolation valve or completely draining the pneumatic system of air will render the machine unable to be started until it is re-energised.

ARTICULATION ISOLATION

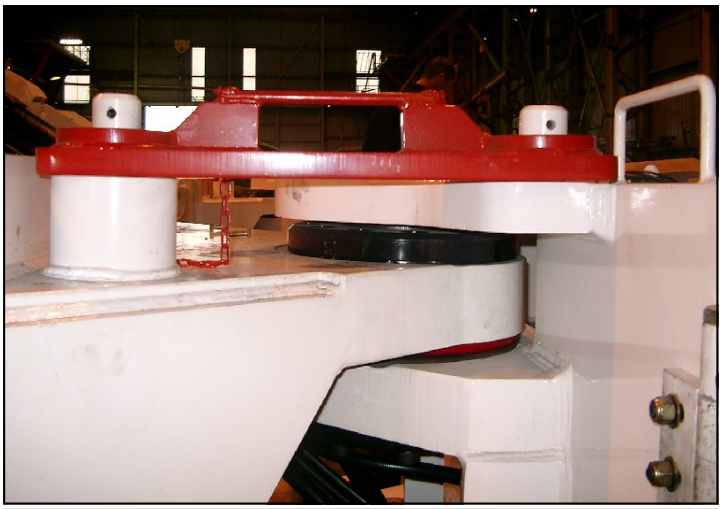
To fit the articulation lock:

1. Ensure the area is clear of any obstructions and area is fit for carrying out safe operation and maintenance.
2. Bring the machine to a stop and manually apply the park brake by depressing the *red* park brake button located in the operator's compartment and isolate the engine.
3. Locate the articulation lock at the articulation area on the driver's side of the machine and remove the locking clamp on the bottom location.
4. Line the articulation lock up with the pin location on the front and rear half of the machine.
5. Install the lynch pin through the retaining hole in the locating pins.

To remove the articulation lock:

1. With the park brake applied, remove the lynch pins from the locating pins.
2. Install articulation lock on the storage location pins and secure it with the lynch pins.

The articulation area of this machine can cause fatal crush injuries if extreme caution is not observed. Always ensure that the park brake is applied and the operator's compartment is vacant when accessing the articulation area to fit or remove the articulation lock. NEVER work in the vicinity of the articulation joint unless the articulation lock has been correctly installed



Articulation Lock in Locked Position

Articulation Lock in Stored Position

LIFT ARM ISOLATION

To install the lift arm lock:

1. Ensure the area is clear of any obstructions and area if fit for carrying out safe operation and maintenance.
2. Remove any load from the fork tines.
3. Park the machine on flat level ground. Ensure the ground is stable.
4. Fit the articulation lock.
5. Raise the lift arms until the locking pin holes on the rear of the lift arm line up with the locking pin hole mounted on the front frame.
6. Remove the lock pin from storage location and install through the aligned holes on the lift arms and front frame.
7. Note that the pin is to be fully inserted into the holes.
8. It is now safe to work under the lift arms.

To remove the lift arm lock:

1. Remove the lock pin from the locating holes and secure in their respective storage locations.
2. Lower the lift arm to the ground.

The lift arms on this machine can cause fatal crush injuries if extreme caution is not observed. Never access or perform work under the lift arms unless the engine has been shutdown, the articulation lock fitted, the park brake applied, and the lift arms have been supported in the raised position.

Lift Arm Lock Installed

Storage Position on Front Guard

EXHAUST CONDITIONER ISOLATION

To isolate the exhaust conditioner perform the following procedure:

1. Isolate the machine.
2. Isolation of the *wet bath* exhaust conditioner is carried out via a valve located between the water inlet hose and the to the conditioner and the shutdown float chamber. The main isolation valve has two positions *closed* and *open*, this regulates the water flow from the make up tanks.

NOTICE

If the exhaust conditioner remains isolated after testing or maintenance to the system and the machine is returned to service it will be purged of water causing the machine to shutdown via the safety system.

***Wet Bath* Exhaust Conditioner**

GENERAL SAFETY AND PRECAUTIONS

GENERAL

This section contains specific safety precautions that shall be followed whilst the machine is being operated or serviced. This list is ***NOT*** all-inclusive and a measure of commonsense should always be applied together with established and ongoing site specific risk assessment and safety procedures.

ONLY TRAINED AND AUTHORISED OPERATORS SHALL OPERATE AND SERVICE THIS MACHINE.

DO NOT: use the machine for any purpose other than its intended use.

DO NOT: for any reason exceed the indicated capacity of the machine.

DO NOT: operate the machine unless all operator checks and scheduled servicing have been performed. Report any damage or faulty operation immediately and do not operate the machine until the fault has been corrected.

DO NOT: tie down or tow equipment such as chains or slings that are not rated for the capacity of the machine and equipment.

DO NOT: operate the machine unless:

- There are no tags attached stating otherwise.
- All covers and guards are correctly installed.
- Personal protective equipment is worn.

DO NOT: start the machine unless:

- There are no tags attached stating otherwise.
- The area around the machine is clear.
- The park brake is applied.
- Transmission is in *neutral*.
- All water and oil levels are checked.
- All site specific checks are completed.

DO NOT: leave the machine unless:

- The machine is parked in a safe place.
- The transmission is in *neutral*.
- The park brake is applied and break head pressure is *zero*.
- The lift arms are lowered.
- The engine is stopped.

DO NOT: work on the machine in low ventilated areas while the engine is running.

ALWAYS: sound the horn before starting the engine to alert anyone who may be around the machine.

ALWAYS: ensure that the operator's compartment door is closed and made secure before operating the machine.

ALWAYS: keep head, body and arms inside the operator's compartment at all times.

ALWAYS: travel at low speeds in congested areas. Slow down while travelling around corners and sound the horn frequently in areas of limited visibility.

ALWAYS: drive carefully, observing all traffic rules and regulations at your colliery and be in full control of the machine at all times.

WARNING

Travelling at high speeds, on cross grades or articulating the machine with raised loads may cause the machine to become unstable.

ALWAYS: follow the correct isolation and tag out procedure before performing any servicing on the machine.

ALWAYS operate carefully and in a responsible manner and observe all Manager's Transport Rules.

ALWAYS refer to site JSA and SOP's prior to towing with the machine.

ALWAYS: ensure sufficient ventilation is available to dilute exhaust gases. As stated on the machine compliance plate.

ALWAYS be aware of the hazard sources on the machine:

- Engine coolant pressure
- Engine coolant temperature
- Engine exhaust temperature
- Rotating radiator fan
- Stored hydraulic pressure
- Stored air pressure (Air receiver)
- Engine oil pressure/temperature
- Transmission oil temperature
- Articulation area
- Lift arm area
- Machine mass

ALWAYS use correct boarding and dismounting procedures:

- Check floor.
- Hold on, step down.
- Three points of contact at all times.
- Board using hand holds only, and not the steering wheel.

ALWAYS drive the machine to suit the conditions, report or rectify any holes and ruts that may cause injury or damage to the equipment.

NEVER operate the machine under unsecured roof.

- Keep your machine clean. A clean machine makes for a safer machine.
- No diesel engine should be operated underground if it is smoky, running unevenly, or if the exhaust system is not in good condition.
- In areas where auxiliary ventilation is used, the operator should make sure fans are operating before starting the machine.
- The engine shall not for any reason be left running unattended underground.
- The engine should not be shutdown from full load and must be allowed to idle for a few minutes before stopping.
- Never operate a machine that you feel is mechanically unsafe.

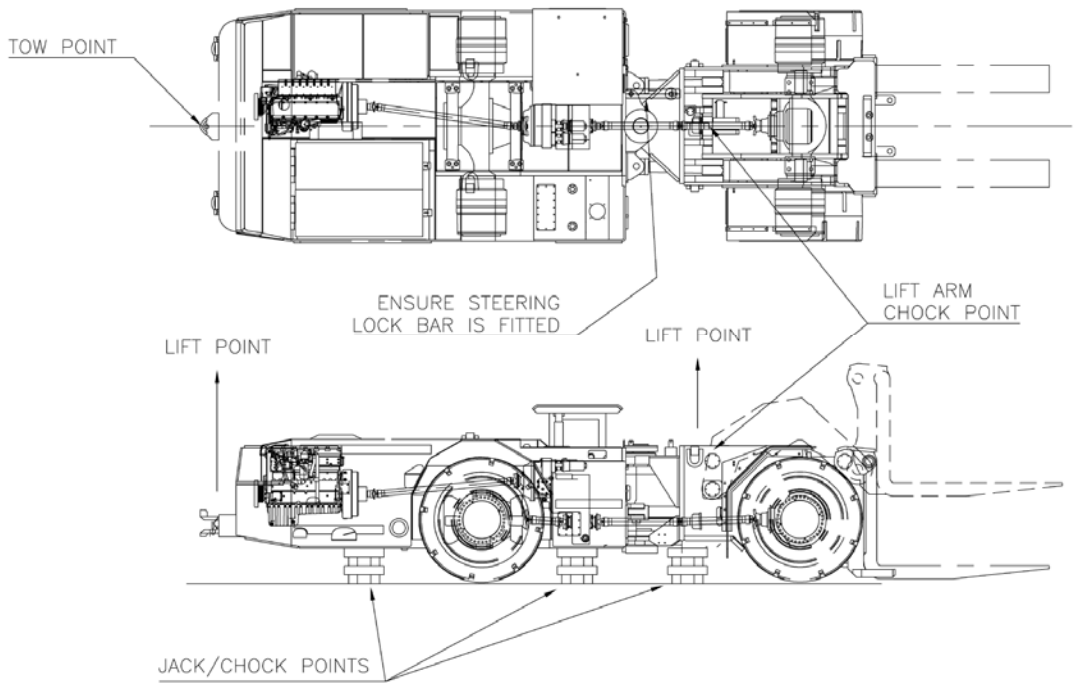
PACKING/SUPPORTING THE MACHINE

To support the machine or to raise the body of the machine perform the following:

1. Remove any loads and lower the lift arms.
2. Park the machine on flat, level ground. Ensure the machine is in a straight line.
3. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in this section - Machine Isolation.
4. Fit the articulation lock.
5. Follow the procedure for isolating the machine hydraulic system.
6. Check that both the steering and brake pressure gauges in the operator's compartment are reading zero pressure.
7. Raise the wheel to be changed with a suitable rated device (e.g. chain block, hydraulic jack, air bag, etc). See diagram for the suitable lifting and support points for the machine's chassis.
8. Place the machine on suitable stands or blocks that will allow the removal of the wheels.

WARNING

Do not rely on the lifting equipment alone to support the machine when working beneath it. The machine MUST be supported by stands or similar.



WARNING

The tyres on the machine are a solid rubber, extreme care should be taken when removing these wheels because of their mass.

NOTICE

These are recommended jacking, chocking, lifting and tow positions for anything outside this scope contact Bucyrus.

MAINTENANCE SCHEDULES

MAINTENANCE INSPECTIONS

- The maintenance inspections are to be carried out by a competent and authorised person.
- Adhere to site specific rules and regulations.
- All faults found are to be rectified before the machine is returned to service, if it is not rectified site tagging procedure is to be followed.

NOTICE

Manufacture and site specific isolation procedures must be followed.

NOTICE

The preventative maintenance inspections are to be used in conjunction with a Job Safety Analysis.

CAUTION

If the job sequence changes a new Job Safety Analysis needs to be completed for the changes. Failure to do so may result in personal injury or equipment damage.

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BUCYRUS Australia
Room and Pillar

Preventative Maintenance Inspection

Job Description: **10 Hour – Daily Off Line Mechanical Inspection**

BUCYRUS MH-40 Shield Hauler

Job No:		**Type:**	**MH-40**
Customer:		**Mine:**	

Technical References

BUCYRUS : MH-40 Service Manual
AS3584-3 : Diesel Engine Systems for Underground Coal Mines-Maintenance

Safety Advice

- Determine which energy source will need isolating before starting work.
- Isolate and tag all forms of energy that could put you at risk.
- Work safely and ensure your actions do not put others at risk.

General Notes

- Use only the correct tools for the job.
- Examine any lifting device is fit for purpose before use.
- While performing service, additional work may be identified, depending on the severity this work may need to be performed immediately. However if the work is of lesser priority it must be documented so it can be planned and scheduled.
- Check infers “look, listen, feel”

References

- Personal Protection Equipment Policies
- OH&S Regulations
- Mine Manager’s Rules
- Isolation and Tagging procedures
- SOPs where relevant

Condition Codes

- No fault found
- Fault found and fixed, record fault and parts used.
- Fault found and not fixed, record fault, parts required (including a full description and Part No.) and the reason why it was not rectified.

Procedure

- Perform activity.
- Indicate condition by placing a tick against the appropriate code.
- Document any comments including any defects found.
- Print name or initial to indicate the activity is complete.
- Print name and sign and date in the “Completed By” table at the end of the service sheet.

SERIAL No.:	PLANT No.:	DATE:

Tick Box ✓

Activity Required	1	2	3	Defects/Comment
Record Hour Meter Reading _____ hrs				
Clean machine completely, pay particular attention to loose material, oil and coal dust.				

1. ENGINE - General

Inspect the complete engine assembly and mounts for damage, any signs of oil, coolant and fuel leaks, looseness and any abnormal vibration, noise and temperature (test drive).				
Inspect the engine for the correct oil level. Top up as required. Indicate litres used.				Ref: Spec 1
If fitted with Hydraulic throttle, inspect throttle fluid reservoir and fill as required. Indicate litres used				Ref: Spec 3
If fitted with cable throttle, inspect condition of cable.				

1.2 ENGINE - Intake

Check the air filter restriction indicator for signs of filter contamination/blockage.				
Check condition of filter housing.				
Check the Primary air filter element and replace if required.				BUCYRUS Part No. 505090
Check Inner air filter element and replace if required.				BUCYRUS Part No. 505089
Check all fasteners, intake joints and brackets of the Shutdown valve for security and tightness				
Check all other intake joints for security and tightness				
Check all air intake hoses, pipes and fittings for damage, leaks and looseness.				

1.3 ENGINE - Fuel System

Inspect all fuel lines/connections/clamps for damage, looseness and any leakage. Change/repair as required.				
Check fuel water separator and drain off any water as required.				
Check fuel level in fuel tank and fill as required. Indicate litres used.				Ref: Spec 6

Activity Required	Tick Box 1	2	3	Defects/Comment
1.4 ENGINE - Cooling System				
Inspect the cooling system header/ expansion tank for the correct coolant level. Top up as required. Indicate litres used.				Ref: Spec 5
Inspect the radiator and cooling system for signs of leakage, blockage, contamination and security.				
Check radiator assemblies and clean if required.				
Inspect the cooling pump drive belt for wear, damage and correct adjustment. Correct tension = 12 to 14mm deflection. Adjust/ replace as required.				BUCYRUS Part No. 504611
Check fan blades and cowl for correct operation and alignment.				
1.5 ENGINE - Exhaust System				
Inspect the exhaust pipes and wet bath for security and signs of leaks / damage.				
Remove flame trap assembly and inspect for contamination and build up. Ensure flame trap assembly is clean prior to re-installation.				
1.6 ENGINE - Exhaust Cooling System				
Inspect the cooling system for signs of leakage, blockage, contamination and security.				
Check alignment and condition of heat exchanger cooling pump, drive coupling and motor.				
2 DRIVETRAIN - Transmission				
Inspect the transmission assembly and mounts for oil leaks, looseness, damage and any abnormal vibration, noise and heat (test drive).				
Check transmission oil level and top up as required. Indicate litres used.				Ref: Spec 2

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
2.1 DRIVETRAIN - Drive Line				
Inspect all drive shaft, slip joints and CV joints for damage, looseness, wear and contamination build up. Clean / tighten as required.				
2.2 DRIVETRAIN - Wheel and Tyres				
Inspect wheel studs / nuts for damage, looseness and any missing. Tighten / replace as required.				
Inspect the tyre assemblies for damage (tears/splits) and wear.				
2.3 DRIVETRAIN - Axles and Planetaries				
Check for any oil leaks.				
Check pinion oil seals				
3 HYDRAULICS				
Check the main hydraulic oil level and fill as required. Indicate litres used.				Ref: Spec 3
Ensure the hydraulic filler cap is secure and sealing.				
Check and record the following gauge pressures: Steering Accumulator pressure (2500 psi / 17250 kPa) Brake Accumulator pressure (2500 psi / 17250 kPa) Brake Head Pressure (1750 psi / 12100 kPa)				
Note: Machine Not To Be Operated if Brake Head pressure is below 1750 psi				
Check the Steering circuit pressure filter indicator, replace filter if required.				BUCYRUS Part No. 501800
Check the Hydraulic Return filter indicator, replace if required				BUCYRUS Part No. 502126
4 PNEUMATICS - Air Receiver				
Drain away all condensation from the air receiver vessel.				
Drain air circuit water trap.				
Inspect the circuit and relief valve for damage, leaks and correct operation.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

4.1 PNEUMATICS - Main Isolation Valve

Inspect the 2-way valve for correct operation, leaks and locking mechanism. Replace/repair as required.				

4.2 PNEUMATICS - Horn

Inspect the air horn and its operating valve for correct operation, abnormal noise (bypass), security and any leaks. Ensure the valve is clearly labelled. Repair as required.				

5 ELECTRICS, INSTRUMENTS and CONTROLS - Operator's Compartment

Ensure compartment is clean of all loose materials, coal, dirt etc.				
Inspect the condition of the operators gauges. Check for correct operation : Brake Head Pressure Brake Accumulator Pressure Steering Accumulator Pressure Engine Water Temperature Engine Exhaust Temperature Transmission Temperature Air Pressure Engine Oil Pressure				
Inspect the operator's seat for physical damage, including cushions and pads.				
Inspect all control devices (pedals, levers, handles, switches etc) for signs of wear damage, and incorrect operation. Repair as required.				
Check door hinges and latches for correct operation. Repair as required.				

5.1 ELECTRICS, INSTRUMENTS and CONTROLS - Electrical System

Check lights for correct operation.				
Check cables, hoses and flameproof joints are secure.				
Check DCS installation for security.				
Check alignment, condition and mounting of alternator, drive coupling and motor.				

6 FRAME RELATED - Canopy

Check for damage, security of fasteners				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

6.1 FRAME RELATED - Guards and Covers

Inspect all guards and covers for security, damage and any missing covers/retainers. Repair or replace as required.				

6.2 FRAME RELATED - Fire Extinguisher

Inspect the fire extinguisher mounting/ holding bracket for security, damage and that the extinguisher is easy to remove and secure when clamped in.				
Check the charge pressure indicator, where fitted, is registering within the operable range and appears to be free and operating correctly.				

6.3 FRAME RELATED - Fire Suppression System—if fitted

Inspect the security of all fittings and components of the fire suppression systems.				
Check the fire suppression bottle for the correct pre-charge. The indicator needle should be in the green zone.				

6.4 FRAME RELATED - Towing Equipment

Check the tow pin and securing chain for damage and replace as required.				
Check the winch assembly for security and damage and repair as required.				
Check the winch rope assemblies for security and damage and replace as required.				BUCYRUS Part No. 502368

6.5 FRAME RELATED - Forks and Cookie Plate

Check the forks for damage and security.				
Check the cookie plate for damage and security.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

7 OPERATIONAL CHECKS - Safety System

Check the transmission neutral start valve for correct operation. Select a gear and check if the engine will attempt to start. Repair as required.				
Check the door interlock system for correct operation, moving in 1st gear slow.				
Perform DCS Low Engine Oil Shutdown with Park brake off. When the engine shuts down ensure Park brake applies.				
Note : Machine Not To Be Put In Operation If Safety Systems Are Not Working				

7.1 OPERATIONAL CHECKS - Hydraulic

Function Test all Hydraulic Operations Steering; left and right Fork Cradle Tilt; forward and back Fork Cradle Lift; raise and lower Winch; in and out (If fitted)				
Inspect all hydraulic cylinders and hosing : Steer cylinder 2 x Tilt Cylinder 2 x Lift Cylinders 2 x Winch motor 1 x				

Comment:

Inspected By:		Date:	
Checked By:		Date:	

MH-40 SHIELD HAULER – LUBRICATION REFERENCE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

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BUCYRUS Australia
Room and Pillar

Preventative Maintenance Inspection

Job Description: **50 Hour – Weekly Off Line Mechanical Inspection**

BUCYRUS MH-40 Shield Hauler

Job No:		**Type:**	**MH-40**
Customer:		**Mine:**	

Technical References

BUCYRUS : MH-40 Service Manual
AS3584-3 : Diesel Engine Systems for Underground Coal Mines-Maintenance

Safety Advice

- Determine which energy source will need isolating before starting work.
- Isolate and tag all forms of energy that could put you at risk.
- Work safely and ensure your actions do not put others at risk.

General Notes

- Use only the correct tools for the job.
- Examine any lifting device is fit for purpose before use.
- While performing service, additional work may be identified, depending on the severity this work may need to be performed immediately. However if the work is of lesser priority it must be documented so it can be planned and scheduled.
- Check infers " look, listen, feel"

References

- Personal Protection Equipment Policies
- OH&S Regulations
- Mine Manager's Rules
- Isolation and Tagging procedures
- SOPs where relevant

Condition Codes

- No fault found
- Fault found and fixed, record fault and parts used.
- Fault found and not fixed, record fault, parts required (including a full description and Part No.) and the reason why it was not rectified.

Procedure

- Perform activity.
- Indicate condition by placing a tick against the appropriate code.
- Document any comments including any defects found.
- Print name or initial to indicate the activity is complete.
- Print name and sign and date in the "Completed By" table at the end of the service sheet.

SERIAL No.:	PLANT No.:	DATE:

Tick Box ✓

Activity Required	1	2	3	Defects/Comment
Record Hour Meter Reading _____ hrs				
Clean machine completely, pay particular attention to loose material, oil and coal dust.				

1. ENGINE - General

Inspect the complete engine assembly and mounts for damage, any signs of oil, coolant and fuel leaks, looseness and any abnormal vibration, noise and temperature (test drive).				
Inspect the engine for the correct oil level. Top up as required. Indicate litres used.				Ref: Spec 1
Check engine breather				
If fitted with Hydraulic throttle, inspect throttle fluid reservoir and fill as required. Indicate litres used				Ref: Spec 3
If fitted with cable throttle, inspect condition of cable.				

1.2 ENGINE - Intake

Check the air filter restriction indicator for signs of filter contamination/blockage.				
Check condition of filter housing.				
Check the Primary air filter element and replace if required.				BUCYRUS Part No. 505090
Check Inner air filter element and replace if required.				BUCYRUS Part No. 505089
Check all fasteners, intake joints and brackets of the Shutdown valve for security and tightness				
Check all other intake joints for security and tightness				
Check all air intake hoses, pipes and fittings for damage, leaks and looseness.				

1.3 ENGINE - Fuel System

Inspect all fuel lines/connections/clamps for damage, looseness and any leakage. Change/repair as required.				
Inspect condition and security of seal in cap for diesel tank manual fill point.				
Check fuel water separator and drain off any water as required.				
Check fuel level in fuel tank and fill as required. Indicate litres used.				Ref: Spec 6

Activity Required	Tick Box 1	2	3	Defects/Comment
1.4 ENGINE - Cooling System				
Inspect the cooling system header/ expansion tank for the correct coolant level. Top up as required. Indicate litres used.				Ref: Spec 5
Check condition of header tank pressure caps and necks.				
Inspect the cooling pump for signs of leakage, wear and security.				
Inspect the radiator and cooling system for signs of leakage, blockage, contamination and security.				
Pressure clean radiator assemblies and check mounts.				
Inspect the cooling pump drive belt for wear, damage and correct adjustment. Correct tension = 12 to 14mm deflection. Adjust/ replace as required.				BUCYRUS Part No. 504611
Check fan blades and cowl for correct operation and alignment.				
1.5 ENGINE - Exhaust System				
Inspect the exhaust pies and wet bath for security and signs of leaks / damage.				
Clean heat exchanger assembly as per Bucyrus's recommended procedure.				BUCYRUS Part No. 508221(Cleaning Solution)
Remove flametrap assembly and inspect for contamination and build up. Ensure flametrap assembly is cleaned prior to re-installation.				
1.6 ENGINE - Exhaust Cooling System				
Inspect the cooling system for signs of leakage, blockage, contamination and security.				
Check alignment and condition of heat exchanger cooling pump, drive coupling and motor.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
2. DRIVETRAIN - Transmission				
Inspect the transmission assembly and mounts for oil leaks, looseness, damage and any abnormal vibration, noise and heat (test drive).				
Check transmission breather				
Check transmission oil level and top up as required. Indicate litres used.				Ref: Spec 2
2.1 DRIVETRAIN - Drive Line				
Inspect all drive shaft, slip joints and CV joints for damage, looseness, wear and contamination build up. Clean / tighten as required.				
2.2 DRIVETRAIN - Wheels and Tyres				
Inspect wheel studs / nuts for damage, looseness and any missing. Tighten / replace as required.				
Inspect the tyre assemblies for damage (tears/splits) and wear. Record the amount of wear, ____%. Replace as required. ODSF ____% ODSR ____% DSF ____% DSR ____%				
2.3 DRIVETRAIN - Axles and Planetaries				
Check for any oil leaks.				
Check levels and fill as required. Indicate litres used. Front Rear				Ref: Spec 4
Check pinion oil seals				
Check differential breathers Front Rear				
2.4 DRIVETRAIN - Brakes				
Check wear measurements on all brake units ODSF ODSR DSF DSR				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
3. HYDRAULICS				
Check the main hydraulic oil level and fill as required. Indicate litres used.				Ref: Spec 3
Ensure the hydraulic filler cap is secure and sealing.				
Check and record the following gauge pressures: Steering Accumulator pressure (2500psi / 17250kPa) Brake Accumulator pressure (2500psi / 17250kPa) Brake Head Pressure (1750psi / 12100kPa)				
Note: Machine Not To Be Operated if Brake Head pressure is below 1750 PSI				
Check the Steering circuit pressure filter indicator, replace filter if required.				BUCYRUS Part No. 501800
Check the Hydraulic Return filter indicator, replace filter if required				BUCYRUS Part No. 502126
4. PNEUMATICS - Air Receiver				
Drain away all condensation from the air receiver vessel.				
Drain air circuit water trap.				
Inspect the circuit and relief valve for damage, leaks and correct operation.				
4.1 PNEUMATICS - Main Isolation Valve				
Inspect the 2-way valve for correct operation, leaks and locking mechanism. Replace/repair as required.				
4.2 PNEUMATICS - Horn				
Inspect the air horn and its operating valve for correct operation, abnormal noise (bypass), security and any leaks. Ensure the valve is clearly labelled. Repair as required.				

	Tick Box ✓			
Activity Required	**1**	**2**	**3**	**Defects/Comment**
5. ELECTRICS, INSTRUMENTS and CONTROLS - Operator's Compartment				
Ensure compartment is clean of all loose materials, coal, dirt etc.				
Inspect the condition of the operators gauges. Check for correct operation: Brake Head Pressure Brake Accumulator Pressure Steering Accumulator Pressure Engine Water Temperature Engine Exhaust Temperature Transmission Temperature Air Pressure Engine Oil Pressure				
Inspect the operators seat for physical damage, including cushions and pads.				
Inspect all control devices (pedals, levers, handles, switches etc) for signs of wear, damage, missing parts and incorrect operation. Repair as required.				
Inspect tilt/lift and implement control valve boots for damage and replace if necessary.				
Check door hinges and latches for correct operation. Repair as required.				
5.1 ELECTRICS, INSTRUMENTS and CONTROLS - Electrical System				
Check Lights for correct operation.				
Check cables, hoses and flameproof joints are secure.				
Check DCS installation for security.				
Check alignment, condition and mounting of alternator, drive coupling and motor.				
6.1 FRAME RELATED - Guards and Covers				
Inspect all guards and covers for security, damage and any missing covers/retainers. Repair or replace as required.				
6.2 FRAME RELATED - Fire Extinguisher				
Inspect the fire extinguisher mounting/ holding bracket for security, damage and that the extinguisher is easy to remove and secure when clamped in.				
Check the charge pressure indicator, where fitted, is registering within the operable range and appears to be free and operating correctly.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

6.3 FRAME RELATED - Fire Suppression System – If Fitted

Inspect the security of all fittings and components of the fire suppression systems.				
Check the fire suppression bottle for the correct pre-charge. The indicator needle should be in the green zone.				

6.4 FRAME RELATED - Lubrication

Lubricate the following grease point. Lubricate until grease is purged from the bushes. Articulation Pillow Block Drive line Cylinder Pins Zone Manifolds 3 x Tilt cylinder pins 4 x Steer cylinder pins 4 x Fork Cradle - Lift arm pivot pins 2 x Winch 1 x Diff Pinion Oil Seals 4 x				Ref: Spec 7

6.5 FRAME RELATED - Towing Equipment

Check the tow pin and securing chain for damage and replace as required.				
Check the winch assembly for security and damage and repair as required.				
Check the winch rope assemblies for security and damage and replace as required.				Wire Rope BUCYRUS Part No. 502368 Kevlar Rope BUCYRUS Part No. 515267

6.6 FRAME RELATED - Forks and Cookie Plate

Check the forks for damage and security.				
Check the cookie plate for damage and security.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

7. OPERATIONAL CHECKS - Safety System

Check the transmission neutral start valve for correct operation. Select a gear and check if the engine will attempt to start. Repair as required.				
Check the door interlock system for correct operation, moving in 1st gear slow.				
Perform DCS Low Engine Oil Shutdown with Park brake off. When the engine shuts down ensure Park brake applies.				
Perform wet bath low water shutdown test.				
Perform Engine Intake Shutdown Valve test. When the engine shuts down ensure engine will not start until Shutdown Valve is reset.				
Note : Machine Not To Be Put In Operation If Safety Systems Are Not Working				

7.1 OPERATIONAL CHECKS - Hydraulic

Function Test all Hydraulic Operations Steering; left and right Fork Cradle Tilt; forward and back Fork Cradle Lift; raise and lower Winch; in and out (If fitted)				
Inspect all hydraulic cylinders, motors and hosing : Steer cylinder 2 x Tilt Cylinder 2 x Lift Cylinders 2 x Winch motor 1 x				

Comment:

Inspected By:		Date:	
Checked By:		Date:	

MH-40 SHIELD HAULER – LUBRICATION REFERENCE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

BUCYRUS Australia
Room and Pillar

Preventative Maintenance Inspection

Job Description: **250 Hour – 3 Months Off Line Mechanical Inspection**

BUCYRUS MH-40 Shield Hauler

Job No:		**Type:**	**MH-40**
Customer:		**Mine:**	

Technical References

BUCYRUS : MH-40 Service Manual
AS3584-3 : Diesel Engine Systems for Underground Coal Mines-Maintenance

Safety Advice

- Determine which energy source will need isolating before starting work.
- Isolate and tag all forms of energy that could put you at risk.
- Work safely and ensure your actions do not put others at risk.

General Notes

- Use only the correct tools for the job.
- Examine any lifting device is fit for purpose before use.
- While performing service, additional work may be identified, depending on the severity this work may need to be performed immediately. However if the work is of lesser priority it must be documented so it can be planned and scheduled.
- Check infers " look, listen, feel"

References

- Personal Protection Equipment Policies
- OH&S Regulations
- Mine Manager's Rules
- Isolation and Tagging procedures
- SOPs where relevant

Condition Codes

- No fault found
- Fault found and fixed, record fault and parts used.
- Fault found and not fixed, record fault, parts required (including a full description and Part No.) and the reason why it was not rectified.

Procedure

- Perform activity.
- Indicate condition by placing a tick against the appropriate code.
- Document any comments including any defects found.
- Print name or initial to indicate the activity is complete.
- Print name and sign and date in the "Completed By" table at the end of the service sheet.

SERIAL No.:	PLANT No.:	DATE:

Tick Box ✓

Activity Required	1	2	3	Defects/Comment
Record Hour Meter Reading _____ hrs				
Clean machine completely, pay particular attention to loose material, oil and coal dust.				

1. ENGINE - General

Inspect the complete engine assembly and mounts for damage, any signs of oil, coolant and fuel leaks, looseness and any abnormal vibration, noise and temperature (test drive).				
Drain and refill engine oil				Ref: Spec 1
Replace Engine oil filter				BUCYRUS Part No. 503469
Inspect the engine for the correct oil level. Top up as required. Indicate litres used.				Ref: Spec 1
Check engine breather				
If fitted with Hydraulic throttle, inspect throttle fluid reservoir and fill as required. Indicate litres used				Ref: Spec 3
If fitted with cable throttle, inspect condition of cable.				

1.2 ENGINE - Intake

Check the air filter restriction indicator for signs of filter contamination/blockage.				
Check condition of filter housing.				
Check the Primary air filter element and replace if required.				BUCYRUS Part No. 505090
Check Inner air filter element and replace if required.				BUCYRUS Part No. 505089
Check all fasteners, intake joints and brackets of the Shutdown valve for security and tightness				
Check all other intake joints for security and tightness				
Check all air intake hoses, pipes and fittings for damage, leaks and looseness.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
1.3 ENGINE - Fuel System				
Inspect all fuel lines/connections/clamps for damage, looseness and any leakage. Change/repair as required.				
Inspect condition and security of seal in cap for diesel tank manual fill point.				
Replace Primary fuel filter				BUCYRUS Part No. 503467
Replace Secondary fuel filter				BUCYRUS Part No. 506604
Check fuel water separator and drain off any water as required.				
Check fuel level in fuel tank and fill as required. Indicate litres used.				Ref: Spec 6
1.4 ENGINE - Cooling System				
Inspect the cooling system header/ expansion tank for the correct coolant level. Top up as required. Indicate litres used.				Ref: Spec 5
Check condition of header tank pressure caps and necks.				
Inspect the cooling pump for signs of leakage, wear and security.				
Inspect the radiator and cooling system for signs of leakage, blockage, contamination and security.				
Pressure clean radiator assemblies and check mounts.				
Inspect the cooling pump drive belt for wear, damage and correct adjustment. Correct tension = 12 to 14mm deflection. Adjust/ replace as required.				BUCYRUS Part No. 504611
Check fan blades and cowl for correct operation and alignment.				
1.5 ENGINE - Exhaust System				
Inspect the exhaust pipes and wet bath for security and signs of leaks / damage.				
Remove flametrap assembly and inspect for contamination and build up. Ensure flametrap assembly is cleaned prior to re-installation.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
1.6 ENGINE - Exhaust Cooling System				
Inspect the cooling system for signs of leakage, blockage, contamination and security.				
2. DRIVETRAIN - Transmission				
Inspect the transmission assembly and mounts for oil leaks, looseness, damage and any abnormal vibration, noise and heat (test drive).				
Check transmission breather				
Check transmission oil level and top up as required. Indicate litres used.				Ref: Spec 2
2.1 DRIVETRAIN - Drive Line				
Inspect all drive shaft, slip joints and CV joints for damage, looseness, wear and contamination build up. Clean / tighten as required.				
2.2 DRIVETRAIN - Wheels and Tyres				
Inspect wheel studs / nuts for damage, looseness and any missing. Tighten / replace as required.				
Inspect the tyre assemblies for damage (tears/splits) and wear. Record the amount of wear, ____%. Replace as required. ODSF ____% ODSR ____% DSF ____% DSR ____%				
2.3 DRIVETRAIN - Axles and Planetaries				
Check for any oil leaks.				
Check levels and fill as required. Indicate litres used. Front Rear				Ref: Spec 4
Check pinion oil seals				
Check differential breathers Front Rear				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
2.4 DRIVETRAIN - Brakes				
Check wear measurements on all brake units ODSF ODSR DSF DSR				
3. HYDRAULICS				
Check the main hydraulic oil level and fill as required. Indicate litres used.				Ref: Spec 3
Ensure the hydraulic filler cap is secure and sealing.				
Check and record the following gauge pressures: Steering Accumulator pressure (2500psi / 17250kPa) Brake Accumulator pressure (2500psi / 17250kPa) Brake Head Pressure (1750psi / 12100kPa)				
Note : Machine Not To Be Operated if Brake Head pressure is below 1750 PSI				
Check the Steering circuit pressure filter indicator, replace filter if required.				BUCYRUS Part No. 501800
Check the Hydraulic Return filter indicator, replace filter if required				BUCYRUS Part No. 502126
4. PNEUMATICS - Air Receiver				
Drain away all condensation from the air receiver vessel.				
Drain air circuit water trap.				
Inspect the circuit and relief valve for damage, leaks and correct operation.				
Replace Air compressor filter.				BUCYRUS Part No. 503715
4.1 PNEUMATICS - Main Isolation Valve				
Inspect the 2-way valve for correct operation, leaks and locking mechanism. Replace/repair as required.				
4.2 PNEUMATICS - Horn				
Inspect the air horn and its operating valve for correct operation, abnormal noise (bypass), security and any leaks. Ensure the valve is clearly labelled. Repair as required.				

Activity Required	Tick Box 1	2	3	Defects/Comment

5. ELECTRICS, INSTRUMENTS and CONTROLS - Operator's Compartment

Ensure compartment is clean of all loose materials, coal, dirt etc.				
Inspect the condition of the operators gauges. Check for correct operation : Brake Head Pressure Brake Accumulator Pressure Steering Accumulator Pressure Engine Water Temperature Engine Exhaust Temperature Transmission Temperature Air Pressure Engine Oil Pressure				
Inspect the operators seat for physical damage, including cushions and pads.				
Inspect all control devices (pedals, levers, handles, switches etc) for signs of wear damage, and incorrect operation. Repair as required.				
Inspect tilt/lift and implement control valve boots for damage and replace if necessary.				
Check door hinges and latches for correct operation. Repair as required.				
Inspect and clean under dash.				
Drain Safety System air circuit water trap.				

5.1 ELECTRICS, INSTRUMENTS and CONTROLS - Electrical System

Check Lights for correct operation.				
Check cables, hoses and flameproof joints are secure.				
Check DCS installation for security.				
Check alignment, condition and mounting of alternator, drive coupling and motor.				

6. FRAME RELATED - Canopy

Check for damage, security of fasteners				

6.1 FRAME RELATED - Guards and Covers

Inspect all guards and covers for security, damage and any missing covers/retainers. Repair or replace as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
6.2 FRAME RELATED - Fire Extinguisher				
Inspect the fire extinguisher mounting/ holding bracket for security, damage and that the extinguisher is easy to remove and secure when clamped in.				
Check the charge pressure indicator, where fitted, is registering within the operable range and appears to be free and operating correctly.				
6.3 FRAME RELATED - Fire Suppression System – If Fitted				
Inspect the security of all fittings and components of the fire suppression systems.				
Check the fire suppression bottle for the correct pre-charge. The indicator needle should be in the green zone.				
6.4 FRAME RELATED - Lubrication				
Lubricate the following grease point. Lubricate until grease is purged from the bushes. Articulation Pillow Block Drive line Cylinder Pins Zone Manifolds 3 x Tilt cylinder pins 4 x Steer cylinder pins 4 x Fork Cradle - Lift arm pivot pins 2 x Winch 1 x Diff Pinion Oil Seals 4 x				Ref: Spec 7
Lubricate the engine drive coupling				Ref: Spec 8
6.5 FRAME RELATED - Towing Equipment				
Check the tow pin and securing chain for damage and replace as required.				
Check the winch assembly for security and damage and repair as required.				
Check the winch rope assemblies for security and damage and replace as required.				Wire Rope BUCYRUS Part No. 502368 Kevlar Rope BUCYRUS Part No. 515267
Check the winch gearbox and planetary oil levels.				Ref: Spec 8 and 9
6.6 FRAME RELATED - Forks and Cookie Plate				
Check the forks for damage and security.				
Check the cookie plate for damage and security.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

7. OPERATIONAL CHECKS - Safety System

Check the transmission neutral start valve for correct operation. Select a gear and check if the engine will attempt to start. Repair as required.				
Check the door interlock system for correct operation, moving in 1st gear slow.				
Perform DCS Low Engine Oil Shutdown with Park brake off. When the engine shuts down ensure Park brake applies.				
Perform wet bath low water test.				
Perform Engine Intake Shutdown Valve test. When the engine shuts down ensure engine will not start until Shutdown Valve is reset.				
Note : Machine Not To Be Put In Operation If Safety Systems Are Not Working				

7.1 OPERATIONAL CHECKS - Hydraulic

Function Test all Hydraulic Operations Steering; left and right Fork Cradle Tilt; forward and back Fork Cradle Lift; raise and lower Winch; in and out (If fitted)				
Inspect all hydraulic cylinders and hosing : Steer cylinder 2 x Tilt Cylinder 2 x Lift Cylinders 2 x Winch motor 1 x				

Comment:

Inspected By:		Date:	
Checked By:		Date:	

MH-40 SHIELD HAULER – LUBRICATION REFERENCE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

BUCYRUS Australia
Room and Pillar

Preventative Maintenance Inspection

Job Description: **500 Hour – 6 Months Off Line Mechanical Inspection**

BUCYRUS MH-40 Shield Hauler

Job No:		**Type:**	**MH-40**
Customer:		**Mine:**	

Technical References

BUCYRUS : MH-40 Service Manual
AS3584-3 : Diesel Engine Systems for Underground Coal Mines-Maintenance

Safety Advice

- Determine which energy source will need isolating before starting work.
- Isolate and tag all forms of energy that could put you at risk.
- Work safely and ensure your actions do not put others at risk.

General Notes

- Use only the correct tools for the job.
- Examine any lifting device is fit for purpose before use.
- While performing service, additional work may be identified, depending on the severity this work may need to be performed immediately. However if the work is of lesser priority it must be documented so it can be planned and scheduled.
- Check infers " look, listen, feel"

References

- Personal Protection Equipment Policies
- OH&S Regulations
- Mine Manager's Rules
- Isolation and Tagging procedures
- SOPs where relevant

Condition Codes

- No fault found
- Fault found and fixed, record fault and parts used.
- Fault found and not fixed, record fault, parts required (including a full description and Part No.) and the reason why it was not rectified.

Procedure

- Perform activity.
- Indicate condition by placing a tick against the appropriate code.
- Document any comments including any defects found.
- Print name or initial to indicate the activity is complete.
- Print name and sign and date in the "Completed By" table at the end of the service sheet.

SERIAL No.:	PLANT No.:	DATE:

Tick Box ✓

Activity Required	1	2	3	Defects/Comment
Record Hour Meter Reading _____ hrs				
Clean machine completely, pay particular attention to loose material, oil and coal dust.				

1. ENGINE - General

Inspect the complete engine assembly and mounts for damage, any signs of oil, coolant and fuel leaks, looseness and any abnormal vibration, noise and temperature (test drive).				
Drain and refill engine oil				Ref: Spec 1
Replace Engine oil filter				BUCYRUS Part No. 503469
Inspect the engine for the correct oil level. Top up as required. Indicate litres used.				Ref: Spec 1
Check engine breather				
If fitted with Hydraulic throttle, inspect throttle fluid reservoir and fill as required. Indicate litres used				Ref: Spec 3
If fitted with cable throttle, inspect condition of cable.				

1.2 ENGINE - Intake

Check the air filter restriction indicator for signs of filter contamination/blockage.				
Check condition of filter housing.				
Check the Primary air filter element and replace if required.				BUCYRUS Part No. 505090
Check Inner air filter element and replace if required.				BUCYRUS Part No. 505089
Check all fasteners, intake joints and brackets of the Shutdown valve for security and tightness				
Check all other intake joints for security and tightness				
Check all air intake hoses, pipes and fittings for damage, leaks and looseness.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
1.3 ENGINE - Fuel System				
Inspect all fuel lines/connections/clamps for damage, looseness and any leakage. Change/repair as required.				
Inspect condition and security of seal in cap for diesel tank manual fill point.				
Replace Primary fuel filter				BUCYRUS Part No. 503467
Replace Secondary fuel filter				BUCYRUS Part No. 506604
Check fuel water separator and drain off any water as required.				
Check fuel level in fuel tank and fill as required. Indicate litres used.				Ref: Spec 6
1.4 ENGINE - Cooling System				
Inspect the cooling system header/ expansion tank for the correct coolant level. Top up as required. Indicate litres used.				Ref: Spec 5
Check condition of header tank pressure caps and necks.				
Inspect the cooling pump for signs of leakage, wear and security.				
Inspect the radiator and cooling system for signs of leakage, blockage, contamination and security.				
Pressure clean radiator assemblies and check mounts.				
Inspect the cooling pump drive belt for wear, damage and correct adjustment. Correct tension = 12 to 14mm deflection. Adjust/ replace as required.				BUCYRUS Part No. 504611
Check fan blades and cowl for correct operation and alignment.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
1.5 ENGINE - Exhaust System				
Inspect the exhaust pipes and wet bath for security and signs of leaks / damage.				
Remove flametrap assembly and inspect for contamination and build up. Ensure flametrap assembly is cleaned prior to re-installation.				
Measure flamepath gaps around the flametrap after assembly. Gap to be < 0.2mm				
1.6 ENGINE - Exhaust Cooling System				
Inspect the cooling system for signs of leakage, blockage, contamination and security.				
2. DRIVETRAIN - Transmission				
Inspect the transmission assembly and mounts for oil leaks, looseness, damage and any abnormal vibration, noise and heat (test drive).				
Check transmission breather				
Replace transmission filter element				2x BUCYRUS Part No. 501471
Check transmission oil level and top up as required. Indicate litres used.				Ref: Spec 2
2.1 DRIVETRAIN - Drive Line				
Inspect all drive shaft, slip joints and CV joints for damage, looseness, wear and contamination build up. Clean / tighten as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
2.2 DRIVETRAIN - Wheels and Tyres				
Inspect wheel studs / nuts for damage, looseness and any missing. Tighten / replace as required.				
Inspect the tyre assemblies for damage (tears/splits) and wear. Record the amount of wear, ____%. Replace as required. ODSF ____% ODSR ____% DSF ____% DSR ____%				
2.3 DRIVETRAIN - Axles and Planetaries				
Check for any oil leaks.				
Check levels and fill as required. Indicate litres used. Front Rear				Ref: Spec 4
Check pinion oil seals				
Check differential breathers Front Rear				
2.4 DRIVETRAIN - Brakes				
Check wear measurements on all brake units ODSF ODSR DSF DSR				
3. HYDRAULICS				
Check the main hydraulic oil level and fill as required. Indicate litres used.				Ref: Spec 3
Ensure the hydraulic filler cap is secure and sealing.				
Check and record the following gauge pressures: Steering Accumulator pressure (2500psi / 17250kPa) Brake Accumulator pressure (2500psi / 17250kPa) Brake Head Pressure (1750psi / 12100kPa)				
Note : Machine Not To Be Operated if Brake Head pressure is below 1750 PSI				
Replace Steering circuit pressure filter				BUCYRUS Part No. 501800
Replace Hydraulic Return filter				BUCYRUS Part No. 502126

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
4. PNEUMATICS - Air Receiver				
Drain away all condensation from the air receiver vessel.				
Drain air circuit water trap.				
Check governor setting.				
Inspect the circuit and relief valve for damage, leaks and correct operation.				
Replace Air compressor filter.				BUCYRUS Part No. 503715
4.1 PNEUMATICS - Main Isolation Valve				
Inspect the 2-way valve for correct operation, leaks and locking mechanism. Replace/repair as required.				
4.2 PNEUMATICS - Horn				
Inspect the air horn and its operating valve for correct operation, abnormal noise (bypass), security and any leaks. Ensure the valve is clearly labelled. Repair as required.				
5. ELECTRICS, INSTRUMENTS and CONTROLS - Operator's Compartment				
Ensure compartment is clean of all loose materials, coal, dirt etc.				
Inspect the condition of the operators gauges. Check for correct operation : Brake Head Pressure Brake Accumulator Pressure Steering Accumulator Pressure Engine Water Temperature Engine Exhaust Temperature Transmission Temperature Air Pressure Engine Oil Pressure				
Inspect the operators seat for physical damage, including cushions and pads.				
Inspect all control devices (pedals, levers, handles, switches etc) for signs of wear damage, and incorrect operation. Repair as required.				
Inspect tilt/lift and implement control valve boots for damage and replace if necessary.				
Check door hinges and latches for correct operation. Repair as required.				
Inspect and clean under dash.				
Drain Safety System air circuit water trap.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
5.1 ELECTRICS, INSTRUMENTS and CONTROLS - Electrical System				
Check Lights for correct operation.				
Check cables, hoses and flameproof joints are secure.				
Check DCS installation for security.				
Check alignment, condition and mounting of alternator, drive coupling and motor.				
6. FRAME RELATED - Canopy				
Check for damage, security of fasteners				
6.1 FRAME RELATED - Guards and Covers				
Inspect all guards and covers for security, damage and any missing covers/retainers. Repair or replace as required.				
6.2 FRAME RELATED - Fire Extinguisher				
Inspect the fire extinguisher mounting/ holding bracket for security, damage and that the extinguisher is easy to remove and secure when clamped in.				
Check the charge pressure indicator, where fitted, is registering within the operable range and appears to be free and operating correctly.				
6.3 FRAME RELATED - Fire Suppression System – If Fitted				
Inspect the security of all fittings and components of the fire suppression systems.				
Check the fire suppression bottle for the correct pre-charge. The indicator needle should be in the green zone.				
6.4 FRAME RELATED - Lubrication				
Lubricate the following grease point. Lubricate until grease is purged from the bushes. Articulation Pillow Block Drive line Cylinder Pins Zone Manifolds 3 x Tilt cylinder pins 4 x Steer cylinder pins 4 x Fork Cradle - Lift arm pivot pins 2 x Winch 1 x Diff Pinion Oil Seals 4 x				Ref: Spec 7
Lubricate the engine drive coupling				Ref: Spec 8

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

6.5 FRAME RELATED - Towing Equipment

Check the tow pin and securing chain for damage and replace as required.				
Check the winch assembly for security and damage and repair as required.				
Check the winch rope assemblies for security and damage and replace as required.				Wire Rope BUCYRUS Part No. 502368 Kevlar Rope BUCYRUS Part No. 515267
Check the winch gearbox and planetary oil levels.				Ref: Spec 8 and 9

6.6 FRAME RELATED - Forks and Cookie Plate

Check the forks for damage and security.				
Check the cookie plate for damage and security.				

7. OPERATIONAL CHECKS - Safety System

Check the transmission neutral start valve for correct operation. Select a gear and check if the engine will attempt to start. Repair as required.				
Check the door interlock system for correct operation, moving in 1st gear slow.				
Perform DCS Low Engine Oil Shutdown with Park brake off. When the engine shuts down ensure Park brake applies.				
Perform wet bath low water test.				
Perform Engine Intake Shutdown Valve test. When the engine shuts down ensure engine will not start until Shutdown Valve is reset.				
Note : Machine Not To Be Put In Operation If Safety Systems Are Not Working				

7.1 OPERATIONAL CHECKS - Hydraulic

Function Test all Hydraulic Operations Steering; left and right Fork Cradle Tilt; forward and back Fork Cradle Lift; raise and lower Winch; in and out (If fitted)				
Inspect all hydraulic cylinders and hosing : Steer cylinder 2 x Tilt Cylinder 2 x Lift Cylinders 2 x Winch motor 1 x				

Comment:

Inspected By:		Date:	
Checked By:		Date:	

MH-40 SHIELD HAULER – LUBRICATION REFERENCE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

BUCYRUS Australia
Room and Pillar

Preventative Maintenance Inspection

Job Description: **1000 Hour – 12 Months Off Line Mechanical Inspection**

BUCYRUS MH-40 Shield Hauler

Job No:		**Type:**	**MH-40**
Customer:		**Mine:**	

Technical References

BUCYRUS : MH-40 Service Manual
AS3584-3 : Diesel Engine Systems for Underground Coal Mines-Maintenance

Safety Advice

- Determine which energy source will need isolating before starting work.
- Isolate and tag all forms of energy that could put you at risk.
- Work safely and ensure your actions do not put others at risk.

General Notes

- Use only the correct tools for the job.
- Examine any lifting device is fit for purpose before use.
- While performing service, additional work may be identified, depending on the severity this work may need to be performed immediately. However if the work is of lesser priority it must be documented so it can be planned and scheduled.
- Check infers " look, listen, feel"

References

- Personal Protection Equipment Policies
- OH&S Regulations
- Mine Manager's Rules
- Isolation and Tagging procedures
- SOPs where relevant

Condition Codes

- No fault found
- Fault found and fixed, record fault and parts used.
- Fault found and not fixed, record fault, parts required (including a full description and Part No.) and the reason why it was not rectified.

Procedure

- Perform activity.
- Indicate condition by placing a tick against the appropriate code.
- Document any comments including any defects found.
- Print name or initial to indicate the activity is complete.
- Print name and sign and date in the "Completed By" table at the end of the service sheet.

SERIAL No.:	PLANT No.:	DATE:

Tick Box ✓

Activity Required	1	2	3	Defects/Comment
Record Hour Meter Reading _____ hrs				
Clean machine completely, pay particular attention to loose material, oil and coal dust.				

1. ENGINE - General

Inspect the complete engine assembly and mounts for damage, any signs of oil, coolant and fuel leaks, looseness and any abnormal vibration, noise and temperature (test drive).				
Drain and refill engine oil				Ref: Spec 1
Replace Engine oil filter				BUCYRUS Part No. 503469
Inspect the engine for the correct oil level. Top up as required. Indicate litres used.				Ref: Spec 1
Check engine breather				
If fitted with Hydraulic throttle, inspect throttle fluid reservoir and fill as required. Indicate litres used				Ref: Spec 3
If fitted with cable throttle, inspect condition of cable.				

1.2 ENGINE - Intake

Check the air filter restriction indicator for signs of filter contamination/blockage.				
Check condition of filter housing.				
Check the Primary air filter element and replace if required.				BUCYRUS Part No. 505090
Check Inner air filter element and replace if required.				BUCYRUS Part No. 505089
Check all fasteners, intake joints and brackets of the Shutdown valve for security and tightness				
Check all other intake joints for security and tightness				
Check all air intake hoses, pipes and fittings for damage, leaks and looseness.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
1.3 ENGINE - Fuel System				
Inspect all fuel lines/connections/clamps for damage, looseness and any leakage. Change/repair as required.				
Inspect condition and security of seal in cap for diesel tank manual fill point.				
Replace Primary fuel filter				BUCYRUS Part No. 503467
Replace Secondary fuel filter				BUCYRUS Part No. 506604
Check fuel water separator and drain off any water as required.				
Check fuel level in fuel tank and fill as required. Indicate litres used.				Ref: Spec 6
1.4 ENGINE - Cooling System				
Inspect the cooling system header/ expansion tank for the correct coolant level. Top up as required. Indicate litres used.				Ref: Spec 5
Check condition of header tank pressure caps and necks.				
Inspect the cooling pump for signs of leakage, wear and security.				
Inspect the radiator and cooling system for signs of leakage, blockage, contamination and security.				
Pressure clean radiator assemblies and check mounts.				
Inspect the cooling pump drive belt for wear, damage and correct adjustment. Correct tension = 12 to 14mm deflection. Adjust/ replace as required.				BUCYRUS Part No. 504611
Check fan blades and cowl for correct operation and alignment.				

Activity Required	Tick Box 1	2	3	Defects/Comment
1.5 ENGINE - Exhaust System				
Inspect the exhaust pies and wet bath for security and signs of leaks / damage.				
Remove flametrap assembly and inspect for contamination and build up. Ensure flametrap assembly is cleaned prior to re-installation.				
Measure flamepath gaps around the flametrap after assembly. Gap to be < 0.2mm				
1.6 ENGINE - Exhaust Cooling System				
Inspect the cooling system for signs of leakage, blockage, contamination and security.				
2. DRIVETRAIN - Transmission				
Inspect the transmission assembly and mounts for oil leaks, looseness, damage and any abnormal vibration, noise and heat (test drive).				
Check transmission strainer				
Check transmission breather				
Drain and refill Transmission oil				Ref: Spec 2
Replace transmission filter element				2x BUCYRUS Part No. 501471
Check transmission oil level and top up as required. Indicate litres used.				Ref: Spec 2
2.1 DRIVETRAIN - Drive Line				
Inspect all drive shaft, slip joints and CV joints for damage, looseness, wear and contamination build up. Clean / tighten as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
2.2 DRIVETRAIN - Wheels and Tyres				
Inspect wheel studs / nuts for damage, looseness and any missing. Tighten / replace as required.				
Inspect the tyre assemblies for damage (tears/splits) and wear. Record the amount of wear, ____%. Replace as required. ODSF ____% ODSR ____% DSF ____% DSR ____%				
2.3 DRIVETRAIN - Axles and Planetaries				
Check for any oil leaks.				
Drain, flush and refill front and rear Axle and wheel end oils				Ref: Spec 4
Check levels and fill as required. Indicate litres used. Front Rear				Ref: Spec 4
Check pinion oil seals				
Check differential breathers Front Rear				
2.4 DRIVETRAIN - Brakes				
Check wear measurements on all brake units ODSF ODSR DSF DSR				
3. HYDRAULICS				
Check the main hydraulic oil level and fill as required. Indicate litres used.				Ref: Spec 3
Ensure the hydraulic filler cap is secure and sealing.				
Check and record the following gauge pressures: Steering Accumulator pressure (2500psi / 17250kPa) Brake Accumulator pressure (2500psi / 17250kPa) Brake Head Pressure (1750psi / 12100kPa)				
Note: Machine Not To Be Operated if Brake Head pressure is below 1750 PSI				
Replace Steering circuit pressure filter				BUCYRUS Part No. 501800
Replace Hydraulic Return filter				BUCYRUS Part No. 502126

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
4. PNEUMATICS - Air Receiver				
Drain away all condensation from the air receiver vessel.				
Drain air circuit water trap.				
Check governor setting.				
Inspect the circuit and relief valve for damage, leaks and correct operation.				
Replace Air compressor filter.				BUCYRUS Part No. 503715
4.1 PNEUMATICS - Main Isolation Valve				
Inspect the 2-way valve for correct operation, leaks and locking mechanism. Replace/repair as required.				
4.2 PNEUMATICS - Horn				
Inspect the air horn and its operating valve for correct operation, abnormal noise (bypass), security and any leaks. Ensure the valve is clearly labelled. Repair as required.				
5. ELECTRICS, INSTRUMENTS and CONTROLS - Operator's Compartment				
Ensure compartment is clean of all loose materials, coal, dirt etc.				
Inspect the condition of the operators gauges. Check for correct operation : Brake Head Pressure Brake Accumulator Pressure Steering Accumulator Pressure Engine Water Temperature Engine Exhaust Temperature Transmission Temperature Air Pressure Engine Oil Pressure				
Inspect the operators seat for physical damage, including cushions and pads.				
Inspect all control devices (pedals, levers, handles, switches etc) for signs of wear damage, and incorrect operation. Repair as required.				
Inspect tilt/lift and implement control valve boots for damage and replace if necessary.				
Check door hinges and latches for correct operation. Repair as required.				
Inspect and clean under dash.				
Drain Safety System air circuit water trap.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
5.1 ELECTRICS, INSTRUMENTS and CONTROLS - Electrical System				
Check Lights for correct operation.				
Check cables, hoses and flameproof joints are secure.				
Check DCS installation for security.				
Check alignment, condition and mounting of alternator, drive coupling and motor.				
6. FRAME RELATED - Canopy				
Check for damage, security of fasteners				
6.1 FRAME RELATED - Guards and Covers				
Inspect all guards and covers for security, damage and any missing covers/retainers. Repair or replace as required.				
6.2 FRAME RELATED - Fire Extinguisher				
Inspect the fire extinguisher mounting/ holding bracket for security, damage and that the extinguisher is easy to remove and secure when clamped in.				
Check the charge pressure indicator, where fitted, is registering within the operable range and appears to be free and operating correctly.				
6.3 FRAME RELATED - Fire Suppression System – If Fitted				
Inspect the security of all fittings and components of the fire suppression systems.				
Check the fire suppression bottle for the correct pre-charge. The indicator needle should be in the green zone.				
6.4 FRAME RELATED - Lubrication				
Lubricate the following grease point. Lubricate until grease is purged from the bushes. Articulation Pillow Block Drive line Cylinder Pins Zone Manifolds 3 x Tilt cylinder pins 4 x Steer cylinder pins 4 x Fork Cradle - Lift arm pivot pins 2 x Winch 1 x Diff Pinion Oil Seals 4 x				Ref: Spec 7
Lubricate the engine drive coupling				Ref: Spec 8

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

6.5 FRAME RELATED - Towing Equipment

Check the tow pin and securing chain for damage and replace as required.				
Check the winch assembly for security and damage and repair as required.				
Check the winch rope assemblies for security and damage and replace as required.				Wire Rope BUCYRUS Part No. 502368 Kevlar Rope BUCYRUS Part No. 515267
Drain and refill the winch gearbox and planetary oils. Check levels on completion.				Ref: Spec 8 and 9

6.6 FRAME RELATED - Forks and Cookie Plate

Check the forks for damage and security.				
Check the cookie plate for damage and security.				

7. OPERATIONAL CHECKS - Safety System

Check the transmission neutral start valve for correct operation. Select a gear and check if the engine will attempt to start. Repair as required.				
Check the door interlock system for correct operation, moving in 1st gear slow.				
Perform DCS Low Engine Oil Shutdown with Park brake off. When the engine shuts down ensure Park brake applies.				
Perform wet bath low water rest.				
Perform Engine Intake Shutdown Valve test. When the engine shuts down ensure engine will not start until Shutdown Valve is reset.				
Note : Machine Not To Be Put In Operation If Safety Systems Are Not Working				

7.1 OPERATIONAL CHECKS - Hydraulic

Function Test all Hydraulic Operations Steering; left and right Fork Cradle Tilt; forward and back Fork Cradle Lift; raise and lower Winch; in and out (If fitted)				
Inspect all hydraulic cylinders and hosing : Steer cylinder 2 x Tilt Cylinder 2 x Lift Cylinders 2 x Winch motor 1 x				

Comment:

Inspected By:		Date:	
Checked By:		Date:	

MH-40 SHIELDER HAULER – LUBRICATION REFERENCE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

BUCYRUS Australia
Room and Pillar

Preventative Maintenance Inspection

Job Description: **2000 Hour – 2 Yearly Off Line Mechanical Inspection**

BUCYRUS MH-40 Shield Hauler

Job No:		**Type:**	**MH-40**
Customer:		**Mine:**	

Technical References

BUCYRUS : MH-40 Service Manual
AS3584-3 : Diesel Engine Systems for Underground Coal Mines-Maintenance

Safety Advice

- Determine which energy source will need isolating before starting work.
- Isolate and tag all forms of energy that could put you at risk.
- Work safely and ensure your actions do not put others at risk.

General Notes

- Use only the correct tools for the job.
- Examine any lifting device is fit for purpose before use.
- While performing service, additional work may be identified, depending on the severity this work may need to be performed immediately. However if the work is of lesser priority it must be documented so it can be planned and scheduled.
- Check infers " look, listen, feel"

References

- Personal Protection Equipment Policies
- OH&S Regulations
- Mine Manager's Rules
- Isolation and Tagging procedures
- SOPs where relevant

Condition Codes

- No fault found
- Fault found and fixed, record fault and parts used.
- Fault found and not fixed, record fault, parts required (including a full description and Part No.) and the reason why it was not rectified.

Procedure

- Perform activity.
- Indicate condition by placing a tick against the appropriate code.
- Document any comments including any defects found.
- Print name or initial to indicate the activity is complete.
- Print name and sign and date in the "Completed By" table at the end of the service sheet.

SERIAL No.:	PLANT No.:	DATE:

Tick Box ✓

Activity Required	1	2	3	Defects/Comment
Record Hour Meter Reading _____ hrs				
Clean machine completely, pay particular attention to loose material, oil and coal dust.				

1. ENGINE - General

Inspect the complete engine assembly and mounts for damage, any signs of oil, coolant and fuel leaks, looseness and any abnormal vibration, noise and temperature (test drive).				
Drain and refill engine oil				Ref: Spec 1
Replace Engine oil filter				BUCYRUS Part No. 503469
Inspect the engine for the correct oil level. Top up as required. Indicate litres used.				Ref: Spec 1
Check engine breather				
If fitted with Hydraulic throttle, inspect throttle fluid reservoir and fill as required. Indicate litres used				Ref: Spec 3
If fitted with cable throttle, inspect condition of cable.				

1.2 ENGINE - Intake

Check the air filter restriction indicator for signs of filter contamination/blockage.				
Check condition of filter housing.				
Check the Primary air filter element and replace if required.				BUCYRUS Part No. 505090
Check Inner air filter element and replace if required.				BUCYRUS Part No. 505089
Check all fasteners, intake joints and brackets of the Shutdown valve for security and tightness				
Check all other intake joints for security and tightness				
Check all air intake hoses, pipes and fittings for damage, leaks and looseness.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
1.3 ENGINE - Fuel System				
Inspect all fuel lines/connections/clamps for damage, looseness and any leakage. Change/repair as required.				
Inspect condition and security of seal in cap for diesel tank manual fill point.				
Replace Primary fuel filter				BUCYRUS Part No. 503467
Replace Secondary fuel filter				BUCYRUS Part No. 506604
Check fuel water separator and drain off any water as required.				
Check fuel level in fuel tank and fill as required. Indicate litres used.				Ref: Spec 6
1.4 ENGINE - Cooling System				
Inspect the cooling system header/ expansion tank for the correct coolant level. Top up as required. Indicate litres used.				Ref: Spec 5
Check condition of header tank pressure caps and necks.				
Inspect the cooling pump for signs of leakage, wear and security.				
Inspect the radiator and cooling system for signs of leakage, blockage, contamination and security.				
Pressure clean radiator assemblies and check mounts.				
Inspect the cooling pump drive belt for wear, damage and correct adjustment. Correct tension = 12 to 14mm deflection. Adjust/ replace as required.				BUCYRUS Part No. 504611
Check fan blades and cowl for correct operation and alignment.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

1.5 ENGINE - Exhaust System

Inspect the exhaust pipes and wet bath for security and signs of leaks / damage.				
Remove flametrap assembly and inspect for contamination and build up. Ensure flametrap assembly is cleaned prior to re-installation.				
Measure flamepath gaps around the flametrap after assembly. Gap to be < 0.2mm				

1.6 ENGINE - Exhaust Cooling System

Inspect the cooling system for signs of leakage, blockage, contamination and security.				

2. DRIVETRAIN - Transmission

Inspect the transmission assembly and mounts for oil leaks, looseness, damage and any abnormal vibration, noise and heat (test drive).				
Check transmission strainer				
Check transmission breather				
Drain and refill Transmission oil				Ref: Spec 2
Replace transmission filter element				2x BUCYRUS Part No. 501471
Check transmission oil level and top up as required. Indicate litres used.				Ref: Spec 2

2.1 DRIVETRAIN - Drive Line

Inspect all drive shaft, slip joints and CV joints for damage, looseness, wear and contamination build up. Clean / tighten as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

2.2 DRIVETRAIN - Wheels and Tyres

Inspect wheel studs / nuts for damage, looseness and any missing. Tighten / replace as required.				
Inspect the tyre assemblies for damage (tears/splits) and wear. Record the amount of wear, ____%. Replace as required. ODSF ____% ODSR ____% DSF ____% DSR ____%				

2.3 DRIVETRAIN - Axles and Planetaries

Check for any oil leaks.				
Drain, flush and refill front and rear Axle and wheel end oils				Ref: Spec 4
Check levels and fill as required. Indicate litres used. Front Rear				Ref: Spec 4
Check pinion oil seals				
Check differential breathers Front Rear				

2.4 DRIVETRAIN - Brakes

Check wear measurements on all brake units ODSF ODSR DSF DSR				

Activity Required	Tick Box 1	2	3	Defects/Comment
3. HYDRAULICS				
Check the main hydraulic oil level and fill as required. Indicate litres used.				Ref: Spec 3
Ensure the hydraulic filler cap is secure and sealing.				
Check Main relief pressure and reset as required: Main relief pressure: 2988psi / 20.6MPa				
Check Accumulator pressures and recharge as required: Accumulator pressures: 900psi / 6.2MPa				
Flow test Brake/Steer pump: Pump Capacity: 98.8 lpm @ 2600 rpm				
Check and record the following gauge pressures: Steering Accumulator pressure (2500psi / 17250kPa) Brake Accumulator pressure (2500psi / 17250kPa) Brake Head Pressure 1750psi / 12100kPa)				
Note : Machine Not To Be Operated if Brake Head pressure is below 1750 PSI				
Replace Brake head hoses and fittings				
Replace Steering circuit pressure filter				BUCYRUS Part No. 501800
Replace Hydraulic Return filter				BUCYRUS Part No. 502126
4. PNEUMATICS - Air Receiver				
Drain away all condensation from the air receiver vessel.				
Drain air circuit water trap.				
Check governor setting.				
Inspect the circuit and relief valve for damage, leaks and correct operation.				
Replace Air compressor filter.				BUCYRUS Part No. 503715
4.1 PNEUMATICS - Main Isolation Valve				
Inspect the 2-way valve for correct operation, leaks and locking mechanism. Replace/repair as required.				
4.2 - PNEUMATICS - Horn				
Inspect the air horn and its operating valve for correct operation, abnormal noise (bypass), security and any leaks. Ensure the valve is clearly labelled. Repair as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
5. ELECTRICS, INSTRUMENTS and CONTROLS - Operator's Compartment				
Ensure compartment is clean of all loose materials, coal, dirt etc.				
Inspect the condition of the operators gauges. Check for correct operation : Brake Head Pressure Brake Accumulator Pressure Steering Accumulator Pressure Engine Water Temperature Engine Exhaust Temperature Transmission Temperature Air Pressure Engine Oil Pressure				
Inspect the operators seat for physical damage, including cushions and pads.				
Inspect all control devices (pedals, levers, handles, switches etc) for signs of wear damage, and incorrect operation. Repair as required.				
Inspect tilt/lift and implement control valve boots for damage and replace if necessary.				
Check door hinges and latches for correct operation. Repair as required.				
Inspect and clean under dash.				
Drain Safety System air circuit water trap.				
5.1 ELECTRICS, INSTRUMENTS and CONTROLS - Electrical System				
Check Lights for correct operation.				
Check cables, hoses and flameproof joints are secure.				
Check DCS installation for security.				
Check alignment, condition and mounting of alternator, drive coupling and motor.				
6. FRAME RELATED - Canopy				
Check for damage, security of fasteners				
6.1 FRAME RELATED - Guards and Covers				
Inspect all guards and covers for security, damage and any missing covers/retainers. Repair or replace as required.				

Activity Required	Tick Box 1	2	3	Defects/Comment
6.2 FRAME RELATED - Fire Extinguisher				
Inspect the fire extinguisher mounting/ holding bracket for security, damage and that the extinguisher is easy to remove and secure when clamped in.				
Check the charge pressure indicator, where fitted, is registering within the operable range and appears to be free and operating correctly.				
6.3 FRAME RELATED - Fire Suppression System – If Fitted				
Inspect the security of all fittings and components of the fire suppression systems.				
Check the fire suppression bottle for the correct pre-charge. The indicator needle should be in the green zone.				
6.4 FRAME RELATED - Lubrication				
Lubricate the following grease point. Lubricate until grease is purged from the bushes. Articulation Pillow Block Drive line Cylinder Pins Zone Manifolds 3 x Tilt cylinder pins 4 x Steer cylinder pins 4 x Fork Cradle - Lift arm pivot pins 2 x Winch 1 x Diff Pinion Oil Seals 4 x				Ref: Spec 7
Lubricate the engine drive coupling				Ref: Spec 8
6.5 FRAME RELATED - Towing Equipment				
Check the tow pin and securing chain for damage and replace as required.				
Check the winch assembly for security and damage and repair as required.				
Check the winch rope assemblies for security and damage and replace as required.				Wire Rope BUCYRUS Part No. 502368 Kevlar Rope BUCYRUS Part No. 515267
Drain and refill the winch gearbox and planetary oils. Check levels on completion.				Ref: Spec 8 and 9
6.6 FRAME RELATED - Forks and Cookie Plate				
Check the forks for damage and security.				
Check the cookie plate for damage and security.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
7. OPERATIONAL CHECKS - Safety System				
Check the transmission neutral start valve for correct operation. Select a gear and check if the engine will attempt to start. Repair as required.				
Check the door interlock system for correct operation, moving in 1st gear slow.				
Perform DCS Low Engine Oil Shutdown with Park brake off. When the engine shuts down ensure Park brake applies.				
Perform wet bath low water shutdown test.				
Perform Engine Intake Shutdown Valve test. When the engine shuts down ensure engine will not start until Shutdown Valve is reset.				
Note : Machine Not To Be Put In Operation If Safety Systems Are Not Working				
7.1 OPERATIONAL CHECKS - Hydraulic				
Function Test all Hydraulic Operations Steering; left and right Fork Cradle Tilt; forward and back Fork Cradle Lift; raise and lower Winch; in and out (If fitted)				
Inspect all hydraulic cylinders and hosing : Steer cylinder 2 x Tilt Cylinder 2 x Lift Cylinders 2 x Winch motor 1 x				

Comment:

Inspected By:		Date:	
Checked By:		Date:	

MH-40 SHIELD HAULER – LUBRICATION REFERENCE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

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BUCYRUS Australia
Room and Pillar

Preventative Maintenance Inspection

Job Description: **5000 Hour – 5 Yearly Off Line Mechanical Inspection**

BUCYRUS MH-40 Shield Hauler

Job No:		**Type:**	**MH-40**
Customer:		**Mine:**	

Technical References

BUCYRUS : MH-40 Service Manual
AS3584-3 : Diesel Engine Systems for Underground Coal Mines-Maintenance

Safety Advice

- Determine which energy source will need isolating before starting work.
- Isolate and tag all forms of energy that could put you at risk.
- Work safely and ensure your actions do not put others at risk.

General Notes

- Use only the correct tools for the job.
- Examine any lifting device is fit for purpose before use.
- While performing service, additional work may be identified, depending on the severity this work may need to be performed immediately. However if the work is of lesser priority it must be documented so it can be planned and scheduled.
- Check infers " look, listen, feel"

References

- Personal Protection Equipment Policies
- OH&S Regulations
- Mine Manager's Rules
- Isolation and Tagging procedures
- SOPs where relevant

Condition Codes

- No fault found
- Fault found and fixed, record fault and parts used.
- Fault found and not fixed, record fault, parts required (including a full description and Part No.) and the reason why it was not rectified.

Procedure

- Perform activity.
- Indicate condition by placing a tick against the appropriate code.
- Document any comments including any defects found.
- Print name or initial to indicate the activity is complete.
- Print name and sign and date in the "Completed By" table at the end of the service sheet.

SERIAL No.:	PLANT No.:	DATE:

Tick Box ✓

Activity Required	1	2	3	Defects/Comment
Record Hour Meter Reading _____ hrs				
Clean machine completely, pay particular attention to loose material, oil and coal dust.				

1. ENGINE - General

Inspect the complete engine assembly and mounts for damage, any signs of oil, coolant and fuel leaks, looseness and any abnormal vibration, noise and temperature (test drive).				
Drain and refill engine oil				Ref: Spec 1
Replace Engine oil filter				BUCYRUS Part No. 503469
Inspect the engine for the correct oil level. Top up as required. Indicate litres used.				Ref: Spec 1
Check engine breather				
If fitted with Hydraulic throttle, inspect throttle fluid reservoir and fill as required. Indicate litres used				Ref: Spec 3
If fitted with cable throttle, inspect condition of cable.				

1.2 ENGINE - Intake

Check the air filter restriction indicator for signs of filter contamination/blockage.				
Check condition of filter housing.				
Check the Primary air filter element and replace if required.				BUCYRUS Part No. 505090
Check Inner air filter element and replace if required.				BUCYRUS Part No. 505089
Check all fasteners, intake joints and brackets of the Shutdown valve for security and tightness				
Check all other intake joints for security and tightness				
Check all air intake hoses, pipes and fittings for damage, leaks and looseness.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
1.3 ENGINE - Fuel System				
Inspect all fuel lines/connections/clamps for damage, looseness and any leakage. Change/repair as required.				
Inspect condition and security of seal in cap for diesel tank manual fill point.				
Replace Primary fuel filter				BUCYRUS Part No. 503467
Replace Secondary fuel filter				BUCYRUS Part No. 506604
Check fuel water separator and drain off any water as required.				
Check fuel level in fuel tank and fill as required. Indicate litres used.				Ref: Spec 6
1.4 ENGINE - Cooling System				
Inspect the cooling system header/ expansion tank for the correct coolant level. Top up as required. Indicate litres used.				Ref: Spec 5
Check condition of header tank pressure caps and necks.				
Inspect the cooling pump for signs of leakage, wear and security.				
Inspect the radiator and cooling system for signs of leakage, blockage, contamination and security.				
Pressure clean radiator assemblies and check mounts.				
Inspect the cooling pump drive belt for wear, damage and correct adjustment. Correct tension = 12 to 14mm deflection. Adjust/ replace as required.				BUCYRUS Part No. 504611
Check fan blades and cowl for correct operation and alignment.				

Activity Required	Tick Box 1	2	3	Defects/Comment
1.5 ENGINE - Exhaust System				
Inspect the exhaust heat exchanger for security and signs of leaks / damage.				
Remove flametrap assembly and inspect for contamination and build up. Ensure flametrap assembly is cleaned prior to re-installation.				
Measure flamepath gaps around the flametrap after assembly. Gap to be < 0.2mm				
1.6 ENGINE - Exhaust Cooling System				
Inspect the cooling system for signs of leakage, blockage, contamination and security.				
2. DRIVETRAIN - Transmission				
Inspect the transmission assembly and mounts for oil leaks, looseness, damage and any abnormal vibration, noise and heat (test drive).				
Check transmission strainer				
Check transmission breather				
Drain and refill Transmission oil				Ref: Spec 2
Replace transmission filter element				2x BUCYRUS Part No. 501471
Check transmission oil level and top up as required. Indicate litres used.				Ref: Spec 2
2.1 DRIVETRAIN - Drive Line				
Inspect all drive shaft, slip joints and CV joints for damage, looseness, wear and contamination build up. Clean / tighten as required.				

Activity Required	Tick Box 1	2	3	Defects/Comment
2.2 DRIVETRAIN - Wheels and Tyres				
Inspect wheel studs / nuts for damage, looseness and any missing. Tighten / replace as required.				
Inspect the tyre assemblies for damage (tears/splits) and wear. Record the amount of wear, ____%. Replace as required. ODSF ____% ODSR ____% DSF ____% DSR ____%				
2.3 DRIVETRAIN - Axles and Planetaries				
Check for any oil leaks.				
Drain, flush and refill front and rear Axle and wheel end oils				Ref: Spec 4
Check levels and fill as required. Indicate litres used. Front Rear				Ref: Spec 4
Check pinion oil seals				
Check differential breathers Front Rear				
2.4 DRIVETRAIN - Brakes				
Check wear measurements on all brake units ODSF ODSR DSF DSR				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
3. HYDRAULICS				
Check the main hydraulic oil level and fill as required. Indicate litres used.				Ref: Spec 3
Ensure the hydraulic filler cap is secure and sealing.				
Remove, re-seal and test the Service brake valve				
Check and record the following gauge pressures: Steering Accumulator pressure (2500psi / 17250kPa) Brake Accumulator pressure (2500psi / 17250kPa) Brake Head Pressure (1750psi / 12100kPa)				
Note : Machine Not To Be Operated if Brake Head pressure is below 1750 PSI				
Replace Steering circuit pressure filter				BUCYRUS Part No. 501800
Replace Hydraulic Return filter				BUCYRUS Part No. 502126
4. PNEUMATICS - Air Receiver				
Drain away all condensation from the air receiver vessel.				
Drain air circuit water trap.				
Check governor setting.				
Inspect the circuit and relief valve for damage, leaks and correct operation.				
Replace Air compressor filter.				BUCYRUS Part No. 503715
4.1 PNEUMATICS - Main Isolation Valve				
Inspect the 2-way valve for correct operation, leaks and locking mechanism. Replace/repair as required.				
4.2 PNEUMATICS - Horn				
Inspect the air horn and its operating valve for correct operation, abnormal noise (bypass), security and any leaks. Ensure the valve is clearly labelled. Repair as required.				
4.3 PNEUMATICS - Brake valves				
Replace the Park/Emergency Brake valve				BUCYRUS Part No. 500438
Replace the Park Brake Air Pilot valve				BUCYRUS Part No. 502103

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
5. ELECTRICS, INSTRUMENTS and CONTROLS - Operator's Compartment				
Ensure compartment is clean of all loose materials, coal, dirt etc.				
Inspect the condition of the operators gauges. Check for correct operation : Brake Head Pressure Brake Accumulator Pressure Steering Accumulator Pressure Engine Water Temperature Engine Exhaust Temperature Transmission Temperature Air Pressure Engine Oil Pressure				
Inspect the operators seat for physical damage, including cushions and pads.				
Inspect all control devices (pedals, levers, handles, switches etc) for signs of wear damage, and incorrect operation. Repair as required.				
Inspect tilt/lift and implement control valve boots for damage and replace if necessary.				
Check door hinges and latches for correct operation. Repair as required.				
Inspect and clean under dash.				
Drain Safety System air circuit water trap.				
5.1 ELECTRICS, INSTRUMENTS and CONTROLS - Electrical System				
Check Lights for correct operation.				
Check cables, hoses and flameproof joints are secure.				
Check DCS installation for security.				
Check alignment, condition and mounting of alternator, drive coupling and motor.				
6. FRAME RELATED - Canopy				
Check for damage, security of fasteners				
6.1 FRAME RELATED - Guards and Covers				
Inspect all guards and covers for security, damage and any missing covers/retainers. Repair or replace as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
6.2 FRAME RELATED - Fire Extinguisher				
Inspect the fire extinguisher mounting/ holding bracket for security, damage and that the extinguisher is easy to remove and secure when clamped in.				
Check the charge pressure indicator, where fitted, is registering within the operable range and appears to be free and operating correctly.				
6.3 FRAME RELATED - Fire Suppression System – If Fitted				
Inspect the security of all fittings and components of the fire suppression systems.				
Check the fire suppression bottle for the correct pre-charge. The indicator needle should be in the green zone.				
6.4 FRAME RELATED - Lubrication				
Lubricate the following grease point. Lubricate until grease is purged from the bushes. Articulation Pillow Block Drive line Cylinder Pins Zone Manifolds 3 x Tilt cylinder pins 4 x Steer cylinder pins 4 x Fork Cradle - Lift arm pivot pins 2 x Winch 1 x Diff Pinion Oil Seals 4 x				Ref: Spec 7
Lubricate the engine drive coupling				Ref: Spec 8
6.5 FRAME RELATED - Towing Equipment				
Check the tow pin and securing chain for damage and replace as required.				
Check the winch assembly for security and damage and repair as required.				
Check the winch rope assemblies for security and damage and replace as required.				Wire Rope BUCYRUS Part No. 502368 Kevlar Rope BUCYRUS Part No. 515267
Drain and refill the winch gearbox and planetary oils. Check levels on completion.				Ref: Spec 8 and 9
6.6 FRAME RELATED - Forks and Cookie Plate				
Check the forks for damage and security.				
Check the cookie plate for damage and security.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
7. OPERATIONAL CHECKS - Safety System				
Check the transmission neutral start valve for correct operation. Select a gear and check if the engine will attempt to start. Repair as required.				
Check the door interlock system for correct operation, moving in 1st gear slow.				
Perform DCS Low Engine Oil Shutdown with Park brake off. When the engine shuts down ensure Park brake applies.				
Perform wet bath low water shutdown test.				
Perform Engine Intake Shutdown Valve test. When the engine shuts down ensure engine will not start until Shutdown Valve is reset.				
Note : Machine Not To Be Put In Operation If Safety Systems Are Not Working				
7.1 OPERATIONAL CHECKS - Hydraulic				
Function Test all Hydraulic Operations Steering; left and right Fork Cradle Tilt; forward and back Fork Cradle Lift; raise and lower Winch; in and out (If fitted)				
Inspect all hydraulic cylinders and hosing : Steer cylinder 2 x Tilt Cylinder 2 x Lift Cylinders 2 x Winch motor 1 x				

Comment:

Inspected By:		Date:	
Checked By:		Date:	

MH40 SHIELD HAULER – LUBRICATION REFERENCE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

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BUCYRUS Australia
Room and Pillar

Preventative Maintenance Inspection

Job Description: **10000 Hour – 10 Yearly Off Line Mechanical Inspection**

BUCYRUS MH-40 Shield Hauler

Job No:		**Type:**	**MH-40**
Customer:		**Mine:**	

Technical References

BUCYRUS : MH-40 Service Manual
AS3584-3 : Diesel Engine Systems for Underground Coal Mines-Maintenance

Safety Advice

- Determine which energy source will need isolating before starting work.
- Isolate and tag all forms of energy that could put you at risk.
- Work safely and ensure your actions do not put others at risk.

General Notes

- Use only the correct tools for the job.
- Examine any lifting device is fit for purpose before use.
- While performing service, additional work may be identified, depending on the severity this work may need to be performed immediately. However if the work is of lesser priority it must be documented so it can be planned and scheduled.
- Check infers " look, listen, feel"

References

- Personal Protection Equipment Policies
- OH&S Regulations
- Mine Manager's Rules
- Isolation and Tagging procedures
- SOPs where relevant

Condition Codes

- No fault found
- Fault found and fixed, record fault and parts used.
- Fault found and not fixed, record fault, parts required (including a full description and Part No.) and the reason why it was not rectified.

Procedure

- Perform activity.
- Indicate condition by placing a tick against the appropriate code.
- Document any comments including any defects found.
- Print name or initial to indicate the activity is complete.
- Print name and sign and date in the "Completed By" table at the end of the service sheet.

SERIAL No.:	PLANT No.:	DATE:

Tick Box ✓

Activity Required	1	2	3	Defects/Comment
Record Hour Meter Reading _____ hrs				
Clean machine completely, pay particular attention to loose material, oil and coal dust.				

1. ENGINE - General

Inspect the complete engine assembly and mounts for damage, any signs of oil, coolant and fuel leaks, looseness and any abnormal vibration, noise and temperature (test drive).				
Drain and refill engine oil				Ref: Spec 1
Replace Engine oil filter				BUCYRUS Part No. 503469
Inspect the engine for the correct oil level. Top up as required. Indicate litres used.				Ref: Spec 1
Check engine breather				
If fitted with Hydraulic throttle, inspect throttle fluid reservoir and fill as required. Indicate litres used				Ref: Spec 3
If fitted with cable throttle, inspect condition of cable.				

1.2 ENGINE - Intake

Check the air filter restriction indicator for signs of filter contamination/blockage.				
Check condition of filter housing.				
Check the Primary air filter element and replace if required.				BUCYRUS Part No. 505090
Check Inner air filter element and replace if required.				BUCYRUS Part No. 505089
Check all fasteners, intake joints and brackets of the Shutdown valve for security and tightness				
Check all other intake joints for security and tightness				
Check all air intake hoses, pipes and fittings for damage, leaks and looseness.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

1.3 ENGINE - Fuel System

Inspect all fuel lines/connections/clamps for damage, looseness and any leakage. Change/repair as required.				
Inspect condition and security of seal in cap for diesel tank manual fill point.				
Replace Primary fuel filter				BUCYRUS Part No. 503467
Replace Secondary fuel filter				BUCYRUS Part No. 506604
Check fuel water separator and drain off any water as required.				
Check fuel level in fuel tank and fill as required. Indicate litres used.				Ref: Spec 6

1.4 ENGINE - Cooling System

Inspect the cooling system header/ expansion tank for the correct coolant level. Top up as required. Indicate litres used.				Ref: Spec 5
Check condition of header tank pressure caps and necks.				
Inspect the cooling pump for signs of leakage, wear and security.				
Inspect the radiator and cooling system for signs of leakage, blockage, contamination and security.				
Pressure clean radiator assemblies and check mounts.				
Inspect the cooling pump drive belt for wear, damage and correct adjustment. Correct tension = 12 to 14mm deflection. Adjust/ replace as required.				BUCYRUS Part No. 504611
Check fan blades and cowl for correct operation and alignment.				

Activity Required	Tick Box 1	2	3	Defects/Comment
1.5 ENGINE - Exhaust System				
Inspect the exhaust heat exchanger for security and signs of leaks / damage.				
Remove flametrap assembly and inspect for contamination and build up. Ensure flametrap assembly is cleaned prior to re-installation.				
Measure flamepath gaps around the flametrap after assembly. Gap to be < 0.2mm				
1.6 ENGINE - Exhaust Cooling System				
Inspect the cooling system for signs of leakage, blockage, contamination and security.				
2. DRIVETRAIN - Transmission				
Inspect the transmission assembly and mounts for oil leaks, looseness, damage and any abnormal vibration, noise and heat (test drive).				
Check transmission strainer				
Check transmission breather				
Drain and refill Transmission oil				Ref: Spec 2
Replace transmission filter element				2x BUCYRUS Part No. 501471
Check transmission oil level and top up as required. Indicate litres used.				Ref: Spec 2
2.1 DRIVETRAIN - Drive Line				
Inspect all drive shaft, slip joints and CV joints for damage, looseness, wear and contamination build up. Clean / tighten as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment

2.2 DRIVETRAIN - Wheels and Tyres

Inspect wheel studs / nuts for damage, looseness and any missing. Tighten / replace as required.				
Inspect the tyre assemblies for damage (tears/splits) and wear. Record the amount of wear, ____%. Replace as required. ODSF ____% ODSR ____% DSF ____% DSR ____%				

2.3 DRIVETRAIN - Axles and Planetaries

Check for any oil leaks.				
Drain, flush and refill front and rear Axle and wheel end oils				Ref: Spec 4
Check levels and fill as required. Indicate litres used. Front Rear				Ref: Spec 4
Check pinion oil seals				
Check differential breathers Front Rear				

2.4 DRIVETRAIN - Brakes

Check wear measurements on all brake units ODSF ODSR DSF DSR				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
3. HYDRAULICS				
Check the main hydraulic oil level and fill as required. Indicate litres used.				Ref: Spec 3
Ensure the hydraulic filler cap is secure and sealing.				
Replace Main relief pressure: Main relief pressure: 2988psi / 20.6MPa				
Re-seal Accumulators and recharge Accumulator pressures: Accumulator pressures: 900psi / 6.2MPa				
Replace Brake/Steer pump				BUCYRUS Part No. 836126
Replace Service brake valve				BUCYRUS Part No. 500139
Check and record the following gauge pressures: Steering Accumulator pressure (2500psi / 17250kPa) Brake Accumulator pressure (2500psi / 17250kPa) Brake Head Pressure (1750psi / 12100kPa)				
Note : Machine Not To Be Operated if Brake Head pressure is below 1750 PSI				
Replace Brake head hoses and fittings				
Replace Steering circuit pressure filter				BUCYRUS Part No. 501800
Replace Hydraulic Return filter				BUCYRUS Part No. 502126
4. PNEUMATICS - Air Receiver				
Drain away all condensation from the air receiver vessel.				
Drain air circuit water trap.				
Check governor setting.				
Inspect the circuit and relief valve for damage, leaks and correct operation.				
Replace Air compressor filter.				BUCYRUS Part No. 503715
4.1 PNEUMATICS - Main Isolation Valve				
Inspect the 2-way valve for correct operation, leaks and locking mechanism. Replace/repair as required.				
4.2 PNEUMATICS - Horn				
Inspect the air horn and its operating valve for correct operation, abnormal noise (bypass), security and any leaks. Ensure the valve is clearly labelled. Repair as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
4.3 PNEUMATICS - Brake valves				
Replace the Park/Emergency Brake valve				BUCYRUS Part No. 500438
Replace the Park Brake Air Pilot valve				BUCYRUS Part No. 502103
5. ELECTRICS, INSTRUMENTS and CONTROLS - Operator's Compartment				
Ensure compartment is clean of all loose materials, coal, dirt etc.				
Inspect the condition of the operators gauges. Check for correct operation : Brake Head Pressure Brake Accumulator Pressure Steering Accumulator Pressure Engine Water Temperature Engine Exhaust Temperature Transmission Temperature Air Pressure Engine Oil Pressure				
Inspect the operators seat for physical damage, including cushions and pads.				
Inspect all control devices (pedals, levers, handles, switches etc) for signs of wear damage, and incorrect operation. Repair as required.				
Inspect tilt/lift and implement control valve boots for damage and replace if necessary.				
Check door hinges and latches for correct operation. Repair as required.				
Inspect and clean under dash.				
Drain Safety System air circuit water trap.				
5.1 ELECTRICS, INSTRUMENTS and CONTROLS - Electrical System				
Check Lights for correct operation.				
Check cables, hoses and flameproof joints are secure.				
Check DCS installation for security.				
Check alignment, condition and mounting of alternator, drive coupling and motor.				
6. FRAME RELATED - Canopy				
Check for damage, security of fasteners				
6.1 FRAME RELATED - Guards and Covers				
Inspect all guards and covers for security, damage and any missing covers/retainers. Repair or replace as required.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
6.2 FRAME RELATED - Fire Extinguisher				
Inspect the fire extinguisher mounting/ holding bracket for security, damage and that the extinguisher is easy to remove and secure when clamped in.				
Check the charge pressure indicator, where fitted, is registering within the operable range and appears to be free and operating correctly.				
6.3 FRAME RELATED - Fire Suppression System – If Fitted				
Inspect the security of all fittings and components of the fire suppression systems.				
Check the fire suppression bottle for the correct pre-charge. The indicator needle should be in the green zone.				
6.4 FRAME RELATED - Lubrication				
Lubricate the following grease point. Lubricate until grease is purged from the bushes. Articulation Pillow Block Drive line Cylinder Pins Zone Manifolds 3 x Tilt cylinder pins 4 x Steer cylinder pins 4 x Fork Cradle - Lift arm pivot pins 2 x Winch 1 x Diff Pinion Oil Seals 4 x				Ref: Spec 7
Lubricate the engine drive coupling				Ref: Spec 8
6.5 FRAME RELATED - Towing Equipment				
Check the tow pin and securing chain for damage and replace as required.				
Check the winch assembly for security and damage and repair as required.				
Check the winch rope assemblies for security and damage and replace as required.				BUCYRUS Part No. 502368
Drain and refill the winch gearbox and planetary oils. Check levels on completion.				Ref: Spec 8 and 9
6.6 FRAME RELATED - Forks and Cookie Plate				
Check the forks for damage and security.				
Check the cookie plate for damage and security.				

Activity Required	Tick Box ✓ 1	2	3	Defects/Comment
7. OPERATIONAL CHECKS - Safety System				
Check the transmission neutral start valve for correct operation. Select a gear and check if the engine will attempt to start. Repair as required.				
Replace the Door interlock valve. Check system for correct operation, moving in 1st gear slow.				BUCYRUS Part No. 500439
Perform wet bath low water shutdown test.				
Perform DCS Low Engine Oil Shutdown with Park brake off. When the engine shuts down ensure Park brake applies.				
Perform Engine Intake Shutdown Valve test. When the engine shuts down ensure engine will not start until Shutdown Valve is reset.				
Note : Machine Not To Be Put In Operation If Safety Systems Are Not Working				
7.1 OPERATIONAL CHECKS - Hydraulic				
Function Test all Hydraulic Operations Steering; left and right Fork Cradle Tilt; forward and back Fork Cradle Lift; raise and lower Winch; in and out (If fitted)				
Inspect all hydraulic cylinders and hosing : Steer cylinder 2 x Tilt Cylinder 2 x Lift Cylinders 2 x Winch motor 1 x				

Comment:

Inspected By:		Date:	
Checked By:		Date:	

MH-40 SHIELD HAULER – LUBRICATION REFERENCE

SPEC.	COMPONENT	CAPACITY (Litres)	LUBRICANT	TEMPERATURE		
				BELOW 0ºC	0-32ºC	ABOVE 32ºC
1	Engine	26	Engine Oil	SAE15W-40 API CD-II (Valvoline - Super Diesel 15W -40 or Equivalent)	SAE40 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)	SAE50 API CD-II (Valvoline - All Fleet Premium 40 or Equivalent)
2	Transmission	40	Mineral Gear Oil	SAE10W CAT TO-4 (Valvoline - Valtorque C4 10W or Equivalent)	SAE30 CAT TO-4 (Valvoline -Valtorque C4 30 or Equivalent)	SAE50 CAT TO-4 (Valvoline - Valtorque C4 50 or Equivalent)
3	Hydraulic	450	Hydraulic	ISO68 (Valvoline - Ultramax HVI 46 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)	ISO68 (Valvoline - Ultramax 68 or Equivalent)
4	Axle / Wheel Ends	60 (Each Axle)	Mineral Gear Oil with Limited Slip Additive	SAE90LS (Valvoline - HP Gear Oil LS SAE90 or Equivalent)		
5	Cooling System	72	Pre-mixed Coolant Conditioner	Ethylene Glycol Antifreeze Inhibitor to GM 6038-M (Valvoline - Heavy Duty Coolant 50 or Equivalent)		
6	Fuel	350	Distillate “Diesel” Fuel	To ASTM D975 (Grades D-1 and D-2) and (AS3584.2 Specifications in Australia)		
7	Lube Points - Drive Line - Pins / Bushes - Door Hinges - Tow Pin - Diff Pinion Oil Seal	As required	Multi-purpose EP Grease	NLGI No. 0 or 1 (Shell - Alvania EP 0/1 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)	NLGI No. 2 (Valvoline - Valplex EP 2 or equivalent)
8	Winch Gearbox	5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
9	Winch Planetary	2.5	Gear Oil	API-GLZ Spec (Valvoline - EPG 220 Gear Lubricant)		
10	Engine Drive Coupling	Refer Service Manual	High Temperature	NLGI no. 2 (Shell Stamina RL2)		

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RECOMMENDED BOLT TORQUE

Torques listed are for plain finish (uncoated) fasteners. Multiply the torque values in the tables by 0.7 when heavily greased fasteners are used ("never-seize" qualifies as heavy greasing).

Metric

Use the following chart to determine torque ranges for metric fasteners. (M)

Recommended Torque Range For Metric Capscrews				
Nominal Size	Class 10.9		Class 12.9	
	(Nm)	(ft-lbs)	(Nm)	(ft-lbs)
M5	7.5	5.5	9	6.6
M6	13	9.6	15	11
M8	30	22	37	27
M10	60	44	72	53
M12	105	77	126	93
M16	255	190	308	227
M20	500	370	600	443
M24	865	640	1038	765
M30	1710	1260	2050	1510
M36	2970	2190	3560	2626

Imperial

Use the following chart to determine torque ranges for imperial fasteners. (UNC)

Recommended Torque Range For Imperial Capscrews				
Nominal Size	Grade 5		Grade 8/Socket Head	
	(Nm)	(ft-lbs)	(Nm)	(ft-lbs)
1/4	9	6.5	13	9.5
5/16	19	14	26	19
3/8	32	24	46	34
7/16	52	38	73	54
1/2	80	60	110	82
9/16	113	83	160	117
5/8	155	115	220	160
3/4	275	203	388	286
7/8	440	325	620	460
1	660	488	930	687
1-1/8	815	600	1320	974
1-1/4	1137	840	1840	1360
1-3/8	1500	1106	2430	1970
1-1/2	1980	1460	3200	2360