MINING EQUIPMENT
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OWNERS MANUAL

MEL SERIES III, 4 TON DIESEL LOCOMOTIVES

THE EQUIPMENT SUPPLIED IS SOLD OR LEASED BY MINING EQUIPMENT LTD. PLEASE CAREFULLY READ THE MAINTENANCE INSTRUCTIONS PRIOR TO PUTTING THE EQUIPMENT INTO SERVICE.

OWNER: _____

MODEL: _____ SERIAL NUMBER: _____

ORDER NUMBER: _____ ENGINE NUMBER: _____

W/O NUMBER: _____ DATE: _____

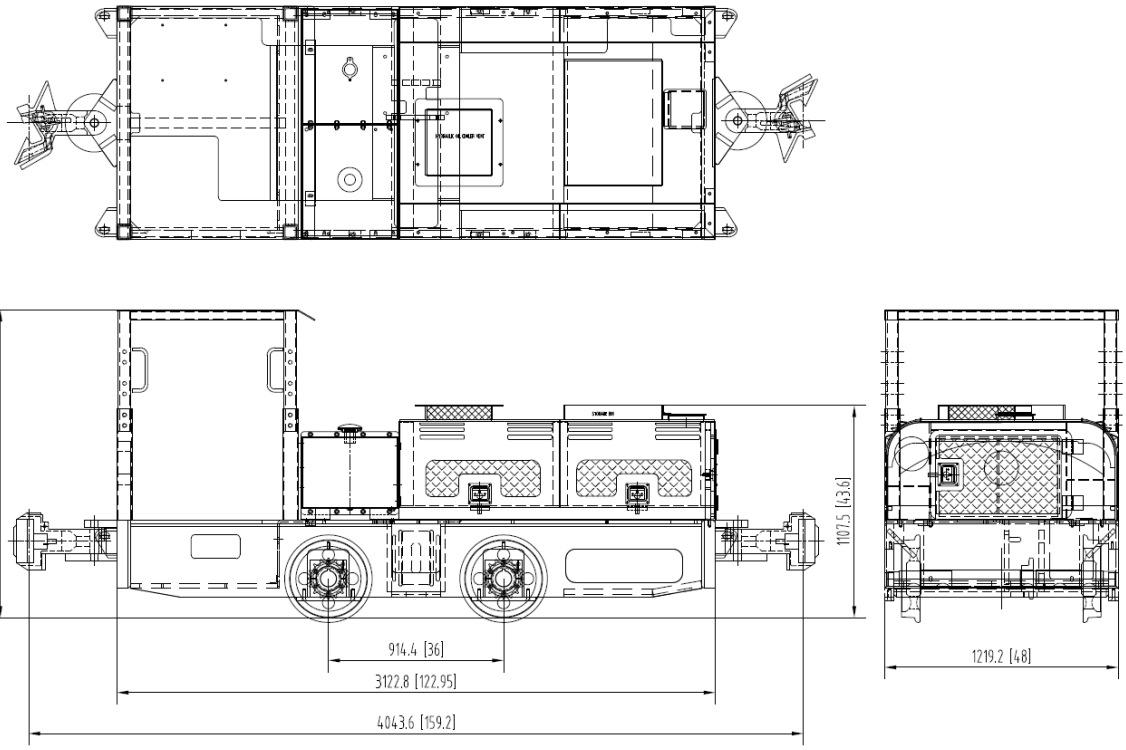
Contents

MINING EQUIPMENT

SECTION 1 – GENERAL INFORMATION: MEL 4 TON SERIES III

The MEL "SERIES III" features the hydrostatic transmission for infinitely variable speeds and dynamic braking ability. The locomotive can be used in underground or surface mining, in tunneling or construction projects.

The locomotive can be built with various engines and drive components, all of which affect speed, power and tractive effort. Haulage capacity is contingent upon locomotive weight, horsepower developed and adhesion factors such as track and roadbed conditions.



General Specifications and Characteristics (hydrostatic)

Weight	4 tons
Gauge	36”
Driven Wheels	4
Wheel Diameter	18”
Length	10 to 14’
Height	50” to 64”
Wheelbase	36”
Width	48”
Engine	Kubota D1803-49
Horsepower	49

Hydrostatic Transmission

The versatile hydrostatic transmission has exceptionally fine inching or car spotting control. A single control lever provides infinitely variable speeds, forward or reverse plus dynamic braking. Rapid reversals can be made without damage to the drive or locomotive. Response is fast and positive. Even relatively unskilled personnel can master the operations in a very short time. Increased productivity results from increased reliability, performance and operator’s satisfaction. Major maintenance problems are eliminated as there are no clutches to slip or wear, and the system has inherent dynamic braking ability thus eliminating wheel and brake shoe wear caused by ordinary brake applications. Long service life is assured by the rugged design. The pump, motor and other components are built to withstand the most severe operation. Engine speed and torque is then selected to match the haulage need.

Drive Chains

Heavy #120 roller chain from the motor to each axle. Provision is made for adjusting tension.

Axles

Heat treated alloy steel.

Axle Bearings

Timken double railway type tapers opposed to take thrust and housed in sealed boxes.

Suspension

One Tec Pac well proportioned, at each axle boxing and designed to compensate for uneven track, to afford easy riding.

Wheels

Cast Steel, profiled and heat treated.

Brakes

Inbuilt dynamic braking operation by the simple, single lever control. No more rapid wear of brake shoes and wheels by frequent brake applications. Spring set disc is applied only in an emergency or for parking.

Frame

Welded type, heavy steel structural shapes and plates torch cut to the correct size and welded together forming a one-piece frame unit. Bumper plates beveled for safety.

Couplers
To match customer's requirements. Coupler height is adjustable.

Sanders
Optional – Sand valves, one for each wheel. Large sandboxes hold an ample supply of sand.

Engine Starter
Heavy duty.

Charging System
Low cut in alternator with voltage regulator. Heavy duty voltmeter.

Lights
One LED on each end of the locomotive, separately controlled by switches.

Battery
Heavy duty, 12 Volt.

Air Cleaner
Dry type.

Fuel Tank
Average- 18 gallon capacity.

Instrument Panel
Gauges, fuses and electrical instruments are enclosed in a cabinet. Gauges consist of a voltmeter, an engine oil temperature gauge, and engine oil pressure gauge and any others considered to be essential.

Fire Suppression
Optional.

Note
These specifications apply to a ME Ltd. locomotive and are subject to change at any time by the manufacturer or remanufacturer. Dimensions can be altered within limits and will vary with the weight and gauge of the locomotive. Other options are available.

GENERAL OPERATION AND MAINTENANCE

The general construction is simple. A variable displacement hydraulic pump is driven by the engine to produce a variable flow of hydraulic fluid under pressure. This flow is conducted through flexible high pressure hose to a hydraulic motor, the output speed of which is in direct ratio to the flow and the output torque in direct ratio to the pressure. The direction of rotation of the output shaft is determined by the position of control lever on the pump.

The hydraulic motor is connected to a drive sprocket which drives both axles by means of sprockets and chains.

The rate of speed is regulated by the volume control of the pump; therefore, only a throttle and pump control lever are required for full operation of your locomotive. Service braking is accomplished hydrostatically. Therefore, only a parking or emergency brake is required.

The recommended method of operation is to leave the pump control in neutral (no flow) position and pre-set the throttle to full engine speed. Then use the pump control lever for all control operations, pushing the lever forward for a forward motion and pulling backward for a backward motion. This lever is spring loaded to return to neutral from any position and should be operated slowly and steadily to get smooth acceleration and deceleration. The operators will soon become adept at the manipulation of this control.

> **Note:** The lever on the pump does not directly control the displacement. It presets a hydraulic valve which in turn controls the fluid flow to hydraulic cylinders which are built into the pump to control displacement, and direction of flow. There is a time lag between movement of lever and actual change of displacement. This time lag provides smooth acceleration and smooth hydrostatic braking.

For very slow locomotive speeds a throttle setting of approximately ½ is permissible. A higher engine speed will provide for a higher maximum locomotive speed. A high engine speed is recommended when heavy train loads are to be handled even though a high locomotive speed is not desired.

The maximum train load that can be handled at high speed is limited by the power of the diesel engine. It is possible to overload the engine and stall it if an attempt is made to accelerate an excessive train load to a high speed, or to accelerate too fast. The operator will soon learn to sense when the engine is being lugged and he will ease the control handle toward neutral to relieve the load on the engine.

There is a neutral position stop on the pump control hand lever quadrant. To pass this stop going from forward to reverse, or reverse to forward, it is necessary to lift the latch up. If the hand lever is not restrained, it will be returned to neutral by the return spring. This is a “failsafe” feature.

The operator present (deadman) foot valve needs to be held down for locomotive operation. When the foot valve lever is up. The park/emergence brake is set, and pump stroke control is hydraulically pushed to neutral. The engine is reduced to idle.

The operator alert circuit consists of a reset button, warning light, warning buzzer, time on relay, and time off relay. Electrically connected to a green button on the gauge panel that needs to be momentarily pressed every 15 to 45 seconds (user set). If not pressed a light and warning buzzer will come on when they time out. At 5 to 15 seconds (user set) after this the hydraulic pump will go to neutral, the engine will go to idle and the park brake will set.

BRAKING

For normal service braking, it is only necessary to move the pump control lever to neutral position and hold it there. For the quickest stop the lever should be moved to neutral as quickly as possible.

Do not use engine throttle to decelerate locomotive. **Always use the pump control**. This is important because it is necessary to maintain engine speed to prevent cavitations in the motor.

W A R N I N G

Although it is possible to "plug" the controls by moving the control lever past the neutral position before the locomotive has come to a stop, this practice is not recommended and the operator is warned that under certain conditions the engine may be stalled and rotated backwards which would result in damage to the hydrostatic components and the engine. IF engine is stalled with pump in stroke the pump may not return to no stroke (neutral) and it may be necessary to activate the by-passing devices per instructions under "Towing the Locomotive" to allow the engine to be started without building up pressure in the hydrostatic system.

PARKING BRAKE

The parking brake is located on the gauge panel and is labeled.
The parking brake should always be applied when the locomotive is left unattended, especially if it is parked on a grade with the engine stopped.

Your hydrostatic transmission is an effective parking brake when the engine is running, and the charge pump can maintain the volume of trapped fluid in the system. However, when the charge pump is not running normal internal leakage can, in time, result in loss of fluid from the motor cylinders, if the locomotive is parked on a grade.

ENGINE

Your model Kubota engine is identified in your Engine Instruction Manual. Study this manual carefully, as it explains the operation and servicing of the engine.

There are three gauges on the instrument panel which indicate the operating condition of the engine. They are engine oil pressure gauge, one engine temperature gauge, and voltmeter.

Other instruments on the panel which pertain to the engine are, the key switch and start and glow plug switch.

The key switch is the master panel switch. None of the other switches on the panel are effective until this switch is turned on.

This key switch must always be turned on while locomotive is being operated and should always be turned off if locomotive is left unattended.

HYDROSTATIC SYSTEM

The controls of the hydrostatic system are covered under general instructions elsewhere in these sheets.

Specific instructions for servicing the separate components are given in the manufacturer's bulletins furnished. These instructions should be studied carefully to learn the function of and the proper service procedure for each separate component.

There are three gauges on the instrument panel which indicate the operating condition of the hydrostatic components. They are charge pressure gauge, fluid temperature gauge. The charge pressure should read at least 200 PSI with engine running at idle speed and 280-320 PSI with engine speed of 1000 RPM or higher. The charge pressure should always be observed each time the engine is started and if the pressure is less than 200 PSI the engine should be stopped immediately, and the system checked using Sundstrand Bulletin #9454 as a trouble shooting guide.

The fluid temperature should never be allowed to exceed 180 degrees F. under continuous operations.

There is an oil cooler provided in the system to cool the fluid and it would be under the most adverse operating condition only that a high fluid temperature should be experienced.

In the event that the temperature reaches over 180 degrees F. it is suggested that the control handle be moved toward neutral **BUT NOT INTO NEUTRAL** and that the engine be operated at approximately ½ throttle. This will keep the fluid circulating in the system and allow it to be cooled while the load is reduced.

If the fluid filter condition indicator nears the red lined portion of the gauge when the fluid is warm, this is warning that the filter element needs changing. Use only genuine replacements element providing 10 micron filtration.

The reservoir was filled at the factory with approximately 10 gallons of Conoco Super Hydraulic #46 hydraulic fluid.

NOTE: This fluid was used by Mining Equipment, Ltd. for the initial fill because it was recommended as a suitable fluid for this application and because of its wide distribution. There are other fluids on the market which are also suitable.

The proper level of the fluid in the reservoir is approximately 1" below the top of the site glass. The filler cap contains an air filter to keep particulate matter out of the reservoir as it breathes due to varying fluid temperature. There is an access plate over the filler cap to protect it from the elements and this plate should always be replaced if removed for any reason.

The fluid filter is located near the reservoir and there is a shut off valve in the piping between the filter housing and the reservoir. This valve may be closed when changing filter elements to prevent excessive loss of fluid, but it **MUST BE OPENED** before attempting to start engine.

For long hydrostatic component life, it is necessary that the fluid be kept clean; therefore, be very careful not to allow any contaminant to enter the system when changing filter element.

CHAIN DRIVE COMPONENTS

The final drive shaft is driven by the hydraulic motor which has a splined output shaft which fits an internal spline in the end of the final drive shaft. This is a greased spline engagement since it is in the same housing as the large heavy duty bearing carrying the shaft. This bearing housing and the bearing housing on the other end of the shaft were filled at the factory to the proper level with Mobilplex EP #1 bearing lubricant. If a yearly check of this lubricant is desired the following procedure should be followed.

For the large bearing nearest the motor there are two 1/8" pipe plugs, one on the front side of the housing and one on the rear. After carefully washing the exterior of the housing remove both pipe plugs and install a grease fitting in port on front of housing. Pump Mobilplex EP #1 grease through this fitting until it comes out of the rear port. Use the same procedure for the other housing, pumping grease through the lowest port until it comes out the highest port. All pipe plugs should be reinstalled. Do not leave grease fitting installed.

The axle drive chains are lubricated by means of chain oilers. These oilers should be kept filled with oil and the flow adjusted so the chains always show a liberal coating of oil.

The chains were adjusted for proper tension at the factory, but they should be checked frequently and not allowed to become excessively loose.

Chain tightness and adjustment is made by moving the axles and this is done by means of the adjusting screws located at each axle boxing location. The proper adjustment is when the chain has a total up and down movement of approximately 1" to 1-1/2" measured in the center of the span. If top and bottom span of chain are both loose, add the movement of each to obtain this measurement. Care should be taken to keep the drive parallel with each other and at 90 degrees to center line of chains. Allow 1/64 clearance between each slide and axle bearing boxing. The clearance between ears on each axle bearing boxing and slides should be approximately 3/32 to provide 3/16 total end motion of axle. As wear occurs add shims between slides and frame to obtain this correct clearance.

BATTERY

Check water level every two weeks and keep filled to approximately 3/8" above plates with clean distilled water. Do not overfill.

Check the specific gravity occasionally. It should read 1.250 or higher for a fully charged battery.

TOWING THE LOCOMOTIVE

If the locomotive must be towed with a dead engine for any reason the following instructions must be followed:

Engaging the Bypass Function

The bypass function is performed by the multi-function valve cartridges. The prime mover should be shut down when opening or closing the bypass valves.

The bypass valves on both of the multi-function valves must be opened to engaged the bypass function.

1. Using a

Frame Size	Wrench Size
newer 030 - 100	1-1/16 inch
130 - 250	1-3/8 inch
	T002 272E

wrench on the middle sized hex of the multi-function valve cartridge, and a

Frame Size	Wrench Size
newer 030 - 100	1-1/4 inch
130 - 250	1-5/8 inch
	T002 273E

wrench on the large hex to prevent rotation of the cartridge assembly, rotate the middle hex three revolutions counterclockwise to open the bypass valve. **Do not rotate more than 3-1/2 revolutions, as additional rotation will permit external leakage.**

2. For units with an MDC-type control, prior to moving the vehicle or otherwise causing the motor shaft to turn, move the control handle of the manual displacement control on the pump to the maximum full forward position. Hold the handle in this position during bypass valve operation.

Caution
"Tow" at extremely low speeds and for short distances only.
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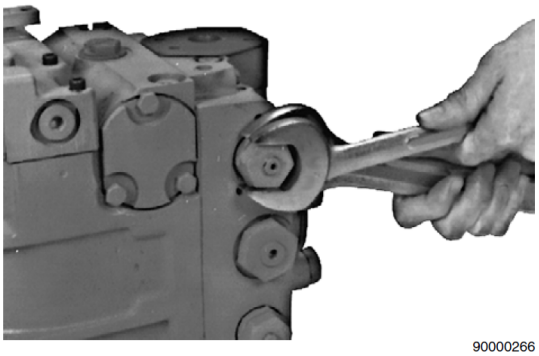
3. To close the bypass valve, rotate the middle hex clockwise until it is seated. Then torque the middle hex.

Frame Size	Torque
newer 030 - 100	41 Nm (30 lbf•ft)
130 - 250	100 Nm (75 lbf•ft)
	T002 274E



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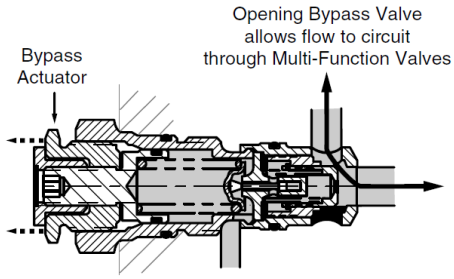
Loosening and Rotating Bypass Hex on Multi-Function Valve



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Multi-Function Valve with Bypass Function Engaged

The hydrostatic system includes a high-pressure bypass valve, thus creating an effective bypass route for the hydraulic fluid, allowing it to bypass the pump when the locomotive is being towed and the motor is acting as a pump. This device is located in the hydraulic pump. It will be recognized as a high-pressure ball valve. To tow locomotive chock the wheels or connect to another locomotive. Then you will need to apply 180 psi hydraulic pressure to release the parking brake springs from external source.

W A R N I N G

When moving the locomotive in this manner there is no charge pressure and no cooling of the fluid; therefore, it is extremely important that the rate of movement be very slow. (No faster than 3 MPH). A higher speed may cause cavitations in the motor and an excessive build up of heat in the fluid. Every few hundred feet, stop and check fluid temperature by feeling the relief valve block. If it is uncomfortably warm, let it cool before proceeding.

To tow locomotive at a higher rate of speed or for a longer distance it is suggested that the drive chains be removed.

THINGS TO DO EACH DAY

Check engine lubricating oil.
Check all fluid lines for leaks.
Check tension of belts.
Check tension of chains.
Check level of hydraulic fluid in reservoir.
Oil axle boxing slides.
Fill chain oilers.
Turn knob on bottom of fuel filter with water trap counterclockwise and drain off fuel to remove sediment and water as needed.

GENERAL CARE

After a new locomotive has been in service a week or so, check all bolts for tightness.

Keep locomotive clean, lubricated and adjusted.

The life of the hydrostatic components depends upon the type and condition of the fluid in the system. Always use a suitable fluid and be extra careful not to allow any contaminant to enter the system.

W A R N I N G

In cold weather when the hydraulic fluid is cold and has high viscosity the engine should be run no faster than idle RPM until a little heat is built up in the fluid.

The system charge pump is direct driven by the main pump shaft it operates at engine speed and at high speed with heavy fluid, a pressure higher than that recommended may occur in the main pump housing due to resistance in lines and cooler.
Also, the hydraulic fluid filter may be subjected to an undue suction which may damage the filter element.

SECTION 2- HYDRAULIC SYSTEM

OVERVIEW:

A variable displacement hydraulic pump is driven by the engine to produce a variable flow of hydraulic fluid under pressure. This flow is conducted to a hydraulic motor, the output speed of which is in direct ratio to the flow and the output torque in direct ratio to the pressure. The direction of rotation of the output shaft is determined by the position of control lever on the pump.

The hydraulic motor drives both axles by means of sprockets and chains. The rate of speed is regulated by the volume control of the pump. The lever on the pump does not directly control the displacement. The lever presets a hydraulic valve which in turn controls the fluid flow to hydraulic cylinders which are built into the pump to control displacement and direction of flow.

PREVENTATIVE MAINTENANCE:

- Check hydraulic fluid level in reservoir daily
- Change hydraulic filters every 500 service hours
- Change hydraulic oil every 1500 service hours
- If for any reason, the system is suspected to have contamination, flush and change all filters and oil.

For the Sundstrand service manual, Char-lynn motor final drive assembly drawing HS 1023 and hydraulic schematic drawing see attached appendixes.

SECTION 3- ENGINE

OVERVIEW:

The MEL 4 ton locomotive is supplied with a Kubota diesel engine.

There are three gauges on the instrument panel which indicate the operating condition of the engine. They are engine oil pressure gauge, engine temperature gauge and voltmeter.

The key switch is the master panel switch. None of the other switches or gauges on the panel are effective until this switch is turned on. This key switch must always be turned on while the locomotive is being operated and should always be turned off if the locomotive is left unattended.

PREVENTATIVE MAINTENANCE:

- Check engine oil and hydraulic fluid levels daily
- Change motor oil and filter every 250 hours
- Change fuel filter as needed or every 500 hours
- Change or clean air filter as needed
- Change hydraulic filter every 500 hours
- Change hydraulic oil every 1500 hours

The Kubota operation manual in Appendix G should help the user become familiarized with the operation of the Kubota engine.

Be sure to keep your stock of spares replenished. You are strongly advised to use only genuine Kubota spares since these are new components taken from the current production and hence subjected to the same rigid Kubota quality control. Your orders should include the following identification data:

1. Engine model (e.g. D1803-49)
2. Engine serial number
3. Part number
4. Quantity

SECTION 4-CATALYTIC EXHAUST

The locomotive is supplied with a CleanDIESEL Converter from CleanAir Systems. This device uses an advanced catalyst technology to "convert" up to 90% of the harmful diesel exhaust gases, such as carbon monoxide and hydrocarbons, into harmless carbon dioxide and water vapor.

PREVENTATIVE MAINTENANCE:
If the diesel engine is allowed to idle for long periods of time, the converter may accumulate deposits of soot. These deposits can block the effectiveness of the converter and gradually reduce the engine's power. The converter can be removed and cleaned. See instructions in Appendix C of this manual.

SECTION 5 - BRAKES

Service braking is provided by inbuilt dynamic braking. A single control lever provides infinitely variable speeds plus dynamic braking. Dynamic braking eliminates rapid wear of brake shoes and wheels by frequent brake applications. Brake shoes are applied only in an emergency or for parking. The parking brake is located in the gauge panel and is labeled.

This parking brake should always be applied when the locomotive is left unattended, especially if it is parked on a grade with the engine stopped.

The hydrostatic transmission is an effective parking brake when the engine is running, and the charge pump can maintain the volume of trapped fluid in the system. However, when the charge pump is not running normal internal leakage can, in time, result in loss of fluid from the motor cylinders, if the locomotive is parked on a grade.

PREVENTATIVE MAINTENANCE:

- Test park brake daily
- Inspect drive chains daily

Replace parking brake when it cannot hold the locomotive on maximum grade with maximum load.

SECTION 6- ELECTRICAL SYSTEM

OVERVIEW:

The MEL 4 ton locomotive utilizes a 12 volt DC electrical system. The batteries are 12 volt batteries.

The water level in the batteries should be checked every 2 weeks. Fill to approximately 3/8" above plates with clean distilled water. Do Not overfill. Check the specific gravity at the change of each season. It should read 1.25 or higher for a fully charged battery.

PREVENTATIVE MAINTENANCE:

- Check water bi-monthly
- Check specific gravity occasionally.