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Gearbox Operated Quick Drop Ore Car Mechanism

Revision C

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Section 2 General Information

This manual consists of information, which will be useful in operating and maintaining your Gearbox Operated Quick Drop Ore Car Mechanism[™] equipped cars. It includes operating, maintenance and troubleshooting procedures along with illustrations to assist in identifying various components.

Carefully read and understand the SAFETY PRECAUTIONS SECTION 3 of this manual.

These instructions are issued to supply acceptable methods for the operation, maintenance and troubleshooting of the Gearbox Operated Quick Drop Ore Car Mechanism[™], and to supply safety information to the user, which is in addition to safety, precautions prescribed by the AAR, FRA and individual handling railroads.

It is expressly understood that issuance of these instructions which were prepared in good faith and are believed to be complete and accurate, shall not be construed to mean that Miner Enterprises, Inc. assumes any liability on account of accidents to persons or property involving the Gearbox Operated Quick Drop Ore Car Mechanism[™].

Miner Enterprises is not responsible for car construction or design, including modifications for mechanism application.



Section 3 Safety Precautions

In addition to safety precautions prescribed by the car owner, loading site, unloading site, repair shop and handling railroad, the following safety precautions must be observed whenever a Gearbox Operated Quick Drop Ore Car Mechanism[™] is operated and whenever any maintenance is performed.

- 1. All maintenance, repair, or adjustment must be made on a shop or repair track where the car will not be moved.
- 2. Protective eye and ear wear should be used when doors are operated.
- 3. All personnel must stay clear of the car when the doors are being operated. The doors operate rapidly! This includes the gear housing and main operating lever areas!
- 4. Do not operate the doors manually unless the car has completely stopped moving.
- 5. When operating the doors manually, the operator must keep away from doors and operating mechanism. The operator must also have an assistant on each side of the car to ensure that everyone stands clear of the car doors.
- 6. Do not attempt to force the door system in any way.
- 7. Do not load or move the car unless all door connecting links are locked over center.
- 8. During car construction, doors should always be secured until mechanism is properly adjusted per Adjustment Procedures Section 8 when rolling a car upside down or right side up. (Do not rely on the Mechanism while the railcar is being rotated.)



Section 4

Component Identification

General Description

The Gearbox Operated Quick Drop Ore Car Mechanism was designed and built for single hopper rail cars. The purpose of this device is to rapidly discharge commodity from the railcar. There is one device per hopper car.

Before proceeding with operation or maintenance of the cars equipped with the Gearbox Operated Quick Drop Ore Car Mechanism, carefully read and understand the SAFETY PRECAUTIONS SECTION 3 of this manual.





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Mechanical Component Identification



ITEM	QTY	DESCRIPTION
1	1	MAIN OPERATING SHAFT ASSEMBLY
2	1	AUXILIARY OPERATING SHAFT ASSEMBLY
3	2	VERTICAL CONNECTING LINK
4	1	DOOR OPERATING SHAFT ASSEMBLY (BR)
5	1	DOOR OPERATING SHAFT ASSEMBLY (BL)
6	4	CONNECTING LINK
7	4	DOOR PAD
8	2	COUPLING
9	1	WORM AND WORMWHEEL GEARSET (RH)
10	1	WORM AND WORMWHEEL GEARSET (LH)
11	2	DRIVE TRANSFER ASSEMBLY
12	2	SQUARE TO ROUND COUPLER
13	2	OPERATOR SHAFT, SHORT
14	2	BEARING ASSEMBLY
15	1	CROSS DRIVE SHAFT
16	2	WIDE CAM SAFETY CATCH ASSEMBLY



Section 5 Principle of Operation

General Description

Before proceeding with operation or maintenance of the cars equipped with the Gearbox Operated Quick Drop Ore Car Mechanism, carefully read and understand the SAFETY PRECAUTIONS SECTION 3 of this manual.

The device operating system can be broken down into four major areas.

Device Operating Systems

1. *The Input Shaft Gear Assembly*: Includes the Input Shafts, Bushing, Bearing, Coupler, Spur Gears, Chain, Gear Housing, and other miscellaneous components.



2. *The Gear Reducing System*: Includes the Gear Boxes, Connecting Shaft, and other miscellaneous components.





3. *The Coupling System*: Includes the Couplers, Secondary Catch, and other miscellaneous components.



4. *The Operating Lever System*: Includes the Main Operating Shafts, Connecting Links, Door Operating Shafts, Connecting Links with Pad Plates, Bearings, Eyebolts, and other miscellaneous components.





Principle of Operation

The device is operated mechanically using a wayside rotary operator. The operator is attached to the Operator Shaft Assembly. The Operator Shaft Assembly is connected to the Drive Shaft via spur gears and chain. The Drive Shaft is rotated by the rotation of the Operator shaft Assembly.

The Drive Shaft rotates the right- and left-hand Worm Gear Assemblies. The Worm Gear Assemblies reduce the rotation by 14 to 1 and increase the rotational force six times.

The Worm Gear Assemblies rotate the Couplings. The couplings are used to separate the rotation of the Worm Gear Assemblies from the Operating Lever Assembly during opening. Once the primary lock is unlocked in the Operating Lever Assembly, the Couplings allow the doors to swing open freely. The coupling reengages the Worm Gear Assembly to the Operating Lever Assembly during closing of the doors and locking of the primary lock.







Section 6

Operating Instructions

Mechanical Operation

This mechanism requires the use of a wayside rotational operator which should not exceed (1230) lb-ft. The location of interface between the wayside rotational operator and the mechanism is on either side of the A end of the car.

Opening Doors

When standing on the right side of the car rotate the operator counterclockwise to open.



When standing on the left side of the car rotate the operator clockwise to open.



Rotate operator until both doors open. If both doors cannot be seen, continue rotating the operator three (3) complete revolutions after the closest door opens.



Closing Doors

When standing on the right side of the car rotate the operator clockwise to close.



When standing on the left side of the car rotate the operator counterclockwise to close.



Stop the rotation of the operator once the lock indicators are aligned.





Section 7 Installation Instructions

General Description

Before proceeding with operation or maintenance of the cars equipped with the Gearbox Operated Quick Drop Ore Car Mechanism, carefully read and understand the SAFETY PRECAUTIONS SECTION 3 of this manual.

To complete the installation, it will be critical to obtain the most appropriate version of required drawings. Drawings required to complete this installation are:

- 1.) Miner Enterprises General Arrangement
- 2.) Application Drawing

The installation instructions are meant to be used as a guide to install the mechanism to the car. The drawings will have precedence over the text in these instructions in any discrepancies between the two.



Mechanical Installation Instructions

Mount the Main Operating Shaft Assembly and the Auxiliary Shaft Assembly, using Miner Enterprises General Arrangement, and Application Drawing.



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Mount the Door Operating Shaft Assemblies and the Bearing Plate Assembly, using Miner Enterprises General Arrangement, and Application Drawing.





Mount the Gear Mounting Brackets provided by the car builder using Miner Enterprises General Arrangement, and Application Drawing.





Mount the Worm Gear Assemblies, Coupling, and all components of the Gear Housing Assembly using Miner Enterprises General Arrangement, and Application Drawing.





Pre-adjust and install Connecting Links and Door Pads, using Miner Enterprises General Arrangement, and Application Drawing.



Pre-adjust and install Safety Catch Blade and Locking Plate, using Miner Enterprises General Arrangement, and Application Drawing.





Apply high quality multi-purpose anti-splatter grease to all grease fittings using Miner Enterprises General Arrangement, and Application Drawing.

Properly adjust the Ore Car according to the procedures proscribed in Mechanism Adjustments SECTION 8.

- Ensure all cotter pins are properly bent over.
- Ensure all bolts and nuts are properly secured either, using LockTite[®], lock washers, or tack welds where appropriate.

Check to make sure that the primary lock is engaged. (See Section 9 for detailed inspection procedures)





Section 8 Adjustment Procedures

General Description

Before proceeding with operation or maintenance of the cars equipped with the Gearbox Operated Quick Drop Ore Car Mechanism, carefully read and understand the SAFETY PRECAUTIONS SECTION 3 of this manual.

First, determine through visual inspection as outlined in SECTION 9 if adjustment is required.

The Gearbox Operated Quick Drop Ore Car Mechanism has two points for adjustment:

The Vertical Connecting Links located on both sides of the car. The adjustments of these links are used to time the two sides of the mechanism to lock simultaneously.

• <u>Note</u>: Timing of the mechanism is always set for the two sides to lock simultaneously. The mechanism is allowed to unlock separately.





The Door Connecting Links attached to the doors. The adjustments of these links are used to center the two doors and to create the appropriate closing force.

 <u>Note</u>: The closing force on the doors should be set between 1400lbs and 1500lbs (700ftlbs-750ftlbs).



Adjustment Procedures

To complete the adjustments, it will be critical to obtain from Miner Enterprises the most appropriate version of required drawings. Drawings required to complete this installation are:

Miner Enterprises General Arrangement

Application Drawing

The adjustment instructions are meant to be used as a guide. The drawings will have precedence over the text in these instructions in any discrepancies between the two.



Adjust the Door Connecting Links to allow the doors to close and lock with a maximum three (3") inch gap between the door lips.





Adjust the Vertical Connecting Links to 32.00" per the Application Drawing, and apply to car.





Rotate the Couplers against the Shear Pins such that the Couplers are holding the pin/shaft/doors in a closed and locked position.





Rotate the Worm Gear Boxes independently to ensure that the 2 $\frac{1}{2}$ " square drives are uniform with each other and matches the square shaft on the Coupler.





Adjust the Vertical Connecting Links as required to line up the Couplers and the Worm Gear Boxes.

Using a torque wrench on the Input Shaft measure the torque required to close and lock the doors.

- If the closing torque is less then 700ftlbs: Lengthen the Door Connecting Links on both sides of the car by turning the eyebolts out.
- If the closing torque is greater then 750ftlbs: Shorten the Door Connecting Links on both sides of the car by turning the eyebolts in.





Center the doors along the length of the car by adjusting the Door Connecting Link length.

- To move the doors toward the left side of the car: Shorten the Door Connecting Links on the left sides of the car and lengthening the Door Connecting Links on the right side.
- To move the doors toward the right side of the car: Shorten the Door Connecting Links on the right sides of the car and lengthening the Door Connecting Links on the left side.



After all adjustments are complete, cycle mechanism seven times and re-check all inspection points as prescribed in The Gearbox Operated Quick Drop Ore Car Mechanism Inspection Procedures SECTION 9.

After door adjustment is complete verify that all cotter pins are in place and secured.



Section 9 Inspection Procedures

General Description

Before proceeding with operation or maintenance of the cars equipped with the Gearbox Operated Quick Drop Ore Car Mechanism, carefully read and understand the SAFETY PRECAUTIONS SECTION 3 of this manual.

The mechanism has two major areas that require inspection:

- 1.) General component inspection.
- 2.) Door Operating Assemblies Serves to open and close the doors and provide the primary locking means to hold the doors closed.



General Component Inspection

Check for damaged welds and components. (Inspect before each loading and after each unloading.)

Contact Miner Enterprises for assistance in replacing damaged or missing components.

Check for missing or damaged pins, washers or cotter pins. (Inspect before each loading and after each unloading.)

Contact Miner Enterprises for assistance in replacing damaged or missing components.

Check for damaged or missing bolts. (Inspect before each loading and after each unloading.)

Contact Miner Enterprises for assistance in replacing damaged or missing components.

Check Worm Gear Box for damages. Apply high-grade multi-purpose grease (Inspect and apply grease once per year.)



Contact Miner Enterprises for assistance in replacing damaged or missing components.

Check Door Pad for damages. (Inspect once per year.)



Contact Miner Enterprises for assistance in replacing damaged or missing components.





Door Operating Assembly Inspection



Check over center condition of Door Operating Shaft Assembly and Connecting Links. (Check before each loading and after each unloading)



Refer to Adjustment Procedures SECTION 8 for assistance in properly adjusting the mechanism.



Apply high-grade multi-purpose grease according to Application Drawing (Once per year.)





Section 10 Trouble Shooting

General Description

Before proceeding with operation or maintenance of the cars equipped with the Gearbox Operated Quick Drop Ore Car Mechanism, carefully read and understand the SAFETY PRECAUTIONS SECTION 3 of this manual.

Emergency procedures if doors close but do not lock

This procedure is to be used only in situations when trained personnel are not available to assist in the locking of the door mechanism, and when the car must be moved a short distance (less than 1000yd).

If doors close but do not lock open the doors and reattempt to close and lock doors.

If doors close but still do not lock, reopen doors to ensure material is clear from doors and reclose.

If doors close but still do not lock. Leave doors in closed position.



Using minimum ½ in. high strength chain, fasten the doors in the closed position.

Attach the chain around the top shaft between the bearing and the Adjustable Vertical Connecting Link.



Fasten the chain around the horn of the Lever below the Adjustable Vertical Connecting Link. Ensure chain is snug.



Move car to safe location.

Use trained personnel to remove chain, close and lock doors.