

WORKMASTER[®]

WE FIND A WAY — OR MAKE ONE!

GO-M3 Gate Opener



OWNER / OPERATOR MANUAL

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SYMBOLS

The following symbols are found throughout this Owner/Operator Manual to alert the reader to the relative danger that may result from non-observance.



This indicates a situation in which a hazard is imminent and will result in a high probability of serious injury or death.



This indicates a potentially hazardous situation, which could result in minor to moderate injury.



CAUTION

This indicates a potentially hazardous situation or unsafe practice which could result in product or property damaged.



IMPORTANT

This symbol indicates a general statement to assist the user in the operation or maintenance of the equipment.

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I. INTRODUCTION

Fast, safe, and economical unloading of covered hopper cars continues to be a problem at most unloading sites. One of the biggest contributors to this problem is the often time-consuming and difficult job of opening and closing the bottom gates or doors of these hopper cars. Load compaction, weather conditions, age, abuse, or corrosive or gritty bulk materials can combine to prevent gate mechanisms from operating smoothly.

Regardless of cause, the costs associated with the problem are significant. Delays in emptying the hopper cars means slow car turnaround, increased demurrage costs, and interrupted production schedules. Even more importantly, the chance of worker injury is high since at many unloading sites, clumsy or dangerous makeshift tools are used during the "fight" to open a stubborn gate.

To meet our commitment of "**WE FIND A WAY – OR MAKE ONE**", **WORKMASTER** has developed a line of Hopper Car Gate Openers and accessories which provide a safe, efficient, and economical solution to the problem of opening easy, medium, and hard-to-open hopper car gates.

There are pneumatic, electric, and manual units available producing up to 13,000 ft-lbs of torque eliminating the need for "cheater" bars, sledgehammers, jacks, and other improper tools sometimes used on this difficult job.

The **GO-M3** Gate Opener uses a planetary geared action to open or close hopper car gates with a continuous 360° rotation in either clockwise (CW) or counterclockwise (CCW) direction. Input and output rotation directions are the same In/Out, ie, Clockwise input rotation using the ratchet wrench creates clockwise output rotation on the Capstan Drive Fitting. An internal, two-directional (CW/CCW) anti-backlash device prevents the accidental release of stored torque.



The **GO-M3** Gate Opener is a torque multiplier device (1 ft-lb input will produce 18.5 ft-lbs of torque). Operators of this tool must understand there are inherent dangers with its use. There is a high probability of serious injury if there is a sudden release of stored torque which could cause the **GO-M3** Opener, or the tool (eg, a ratchet wrench) used for torque input to spin at a high speed in the reverse direction of operation. The operator must maintain firm hand control of the **GO-M3** during the entire gate opening or closing operations.

The controlled-shear output square drive (**Figure 2**, Item 1, pg 7) protects internal components in the event maximum output capacity is exceeded. This overload-protection feature causes the square drive to fracture when output is 3% to 10% above rated capacity (3,200 ft-lbs). One replacement square drive is included with the **GO-M3**. Additional replacement kits can be ordered from WORKMASTER or your Regional Distributor. See **APPENDIX A: Exploded View**, pg A-1, and **Figure 3**, pg 16.

This Owner/Operator's Manual details the specifications, operation, maintenance, and safe use of the **GO-M3** Manual Hopper Car Gate Opener. Experience demonstrates that total satisfaction with this product depends on attention to detail in operating and maintaining the unit.



IMPORTANT

All persons involved in the operation and maintenance of this equipment should be thoroughly familiar with the contents of this Owner/Operator Manual.

SPECIFICATIONS	
Output Capacity	3,200 lbs-ft
Input Capacity	173 lbs-ft
Gear Ratio	20.25 : 1
Torque Ratio	18.5 : 1
Output Drive Male Square Size	1"
Input Drive Female Square Size	1/2"
Overall Dimensions	Gearbox Ø: 4.06" Height: 6.5" Length: 19.6"
Weight	27.3 lbs w/ Drive Fitting & Ratchet Wrench

II. SAFETY

To prevent injury to yourself or others, and/or damage to equipment, you should adhere to the following basic safety instructions.

1. Carefully read the entire Operator's Guide prior to installing or operating equipment.
2. Always follow proper precautions and use proper tools and safety equipment.
3. Be sure to receive proper training.
4. Always use the equipment and all its components in applications for which they are approved.
5. Be sure to assemble all components correctly.
6. Never use worn, defective or damaged components.
7. Always practice good housekeeping and maintain good lighting around all equipment.
8. Perform Lock-out/Tag-out procedure on all energy sources to the equipment, mounting structure, loading, and discharge systems in accordance with ANSI Standards before installation or maintenance.

III. SUPPLIED MATERIALS

Perform the following unpacking and pre-installation procedures prior to preparing unit for operation. Contact **WORKMASTER** or your Regional Distributor if you have questions or problems.

1. Listed below are the items supplied with your **GO-M3** Gate Opener Kit. Verify that you received all the items listed below and inspect all items for signs of damage.
2. If anything is missing or damaged promptly contact **WORKMASTER** or your Regional Distributor.

The **GO-M3** is shipped with its basic components unassembled. The items supplied include:

- ☒ (1) Sturdy Carrying Bag storing 3 individually wrapped components. This carrying bag enables the operator to store and transport the components of **GO-M3** Opener safely and securely.
- ☒ (1) Torque Multiplier Gearbox Head. This device, using planetary gears, enables the operator to multiply the force that he/she applies with the Drive Ratchet by up to eighteen (18) times.
- ☒ (1) Capstan Drive Fitting. The drive fitting has a socket on one end, which slides onto the gearbox head's output drive, and a drive tip, on the opposite end, that is inserted into the railcar's capstan drive socket. Supplied with Pin & Ring Retainer.
- ☒ (1) Torque Reaction Bar. This reaction bar slides onto the gear housing and is secured with a socket head cap screw. It prevents the **GO-M3** head from turning as the operator applies torque with the drive ratchet wrench.
- ☒ (1) Ratchet Wrench (1/2" square drive). This drive ratchet (1/2" square drive) enables the operator to generate the input force easily and rapidly into the gearbox head.
- ☒ (1) Spare 1" square output drive anvil.
- ☒ (1) Allen wrench, 3/32".

IV. PRE-START CHECKLIST

The assembly of the **GO-M3** components can be accomplished within 5 minutes and requires no special tools.

1. Attach the torque reaction bar onto the torque multiplier gearbox head.
 - a. Remove the Socket Head Cap Screw (SHCS) from the arm extension on the gearbox head.
 - b. Slide the torque reaction bar over the arm extension. Align the bar's larger diameter hole with the SHCS hole in the extension arm. Re-install the SHCS to finger tight.
2. The Capstan Drive Fitting is shipped attached to the torque multiplier gearbox head.
3. Note that the 1/2" square drive on the ratchet wrench will slip into the 1/2" square female input drive in the gearbox head, but do not attach at this time.

V. OPENING CAR GATES

1. Inspect and prepare the trackside worksite so that it will accommodate the practical and safe use of the **GO-M3** Gate Opener.



CAUTION

The surface of the unloading site around the hopper car gate must be level, flat, smooth, and unobstructed to provide the firm base which will safely support the **GO-M3**'s Torque Reaction Bar.

2. Using a Capstan Swaging Kit (optional accessory **PN: 33-11120**), clean-out and square-up the capstan socket on the car gate so that the capstan drive fitting on the gearbox head's output drive can be aligned properly, and fully seated in the gate's capstan socket.



IMPORTANT

Regular use of the CAPSTAN SWAGE TOOL will ensure a long-life for your Drive Fitting and your Impactor's Square Drive Anvil. Also, a clean, square Capstan socket will maximize the torque transfer between the **GO-M3** Opener and the Car Gate.

3. Should the railcar's capstan barrel socket be completely worn, use our CAPSTAN RENEW ATTACHMENT, **PN 80-10728**, which slips over the barrel and then pin-locks in place to provide a reusable, perfectly formed female square socket.
4. Disengage the car gate locking mechanism before attempting to open the gate.



CAUTION

Failure to disengage the car gate locking mechanism will damage the gate opener.

5. Inspect the gearbox head and check against the following safety warnings. Refer to **Figure 1**, Items 1, 2, 3, 4, 5, 6.

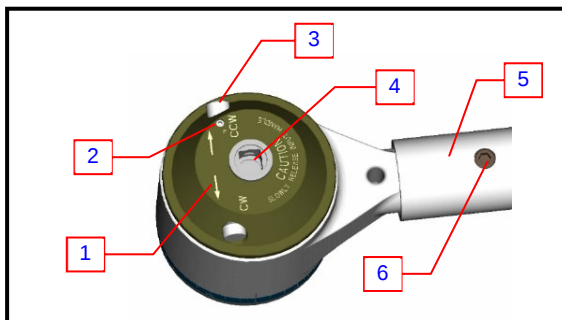


To prevent the accidental release of stored torque, which could result in injury, the Neutral Positioning set screw (**Figure 1**, Item 2) – marked "N" – must be flush with the top of the gearbox housing whenever the **GO-M3** is operated **MANUALLY**.



The selector pawl (**Figure 1**, Item 3) must slide freely between the CW and CCW positions.

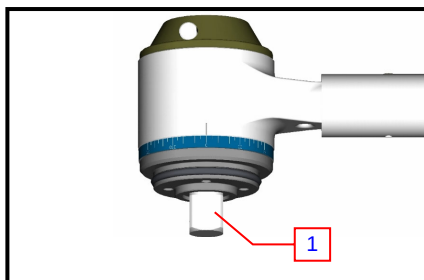
Figure 1: Torque Input Detail



1. Rotational Direction Indicators
2. Neutral Positioning Setscrew (3/32")
3. Selector Pawl
4. 1/2" Female Square Input Drive
5. Torque Reaction Bar
6. Torque Reaction Bar Holding Screw

5. Inspect the output square drive (**Figure 2**, Item 1,) on the gearbox head for visible signs of fatigue or fracture prior to EACH use. Replace if necessary. See **APPENDIX A: Exploded View**, Pg A-1.

Figure 2: Torque Output Detail



1. Controlled-Shear Output Square Drive



Failure of the output square drive, due to fatigue or torque overloading by the operator, could result in an immediate release of stored torque, potentially causing the **GO-M3** to fall from the capstan socket, and injure the operator or other personnel.

6. Check the direction of rotation (CW or CCW) to see that the gearbox head is set (**Figure 1**, Item 1,). Securely set the sliding selector pawl in the appropriate direction based on capstan travel.
7. Firmly seat the Capstan Drive Fitting into the car's capstan socket, and securely position the reaction bar against the ground or a stationary object.



IMPORTANT

When positioning the **GO-M3** gearbox head, be sure the Capstan Drive Fitting is positioned so that the torque reaction bar is at a right angle to the car's capstan socket. Torque reaction creates a rotational force in the opposite direction from which input force (via the ratchet wrench) is applied.



Since reaction torque equals OUTPUT torque, be sure to select an anchor or stationary base point for the Torque Reaction Arm which is sufficient to withstand the torque reaction forces imposed upon the torque reaction bar.

8. Insert the ratchet wrench's 1/2" square drive into the gearbox's 1/2" square input drive, and check the ratchet wrench's direction of rotation: ON for CW, OFF for CCW. Securely set recessed lever to appropriate direction.

9. To turn the Drive Fitting clockwise (operator's perspective), push the Selector Pawl into the CW position and slide the direction knob on the ratchet to ON. **(See Figure 3)**

Figure 3: Clockwise Rotation



10. To turn the Drive Fitting counterclockwise (operator's perspective), push the selector Pawl into the CCW position and slide the direction knob on the ratchet to OFF. **(See Figure 4)**

Figure 4: Counter-Clockwise Rotation



11. Apply force to the ratchet wrench.



IMPORTANT

The preferred method is to pull on a ratchet wrench. Pushing on the ratchet wrench is normally considered dangerous because if slippage or breakage occurs, the operator can strike his/her knuckles. Sometimes, however, this is the only way the tool can be used. If this is the case, use extra caution, eg, wear gloves, use a shorter stroke, etc.



Maintain firm hand control of the **GO-M3** or the ratchet wrench handle during entire opening operation. Sudden release of stored torque could cause the **GO-M3** or ratchet wrench to spin in the reverse direction which could result in serious injury.



Do not exceed the rated capacity of the **GO-M3** (3,200 ft-lbs). Excessive input force (>173 ft-lbs) may result in opener failure which could cause a sudden, uncontrolled release of stored torque.



CAUTION

The **GO-M3** is **NOT** designed to withstand input forces from impact tools. The high shock loads generated by impact tools will damage the gate opener.

12. If the railcar gate will not move, STOP using the **GO-M3** Opener, and notify your Supervisor. Continued application of force will damage the Opener.



Do not use other opening devices (pry bars, come-alongs, etc) to "help" the **GO-M3** Opener.

13. When the railcar gate is completely opened, STOP applying force with the ratchet wrench.



CAUTION

Stop applying input force the moment the gate reaches its fully opened position. Prolonged ratcheting can cause damage to the gate opener.

14. Release the stored torque in the **GO-M3** Opener. Apply enough input torque with the ratchet wrench to release the built-in anti-backlash device, then push the selector pawl (**Figure 1**, Item 3), into the opposite position, and *slowly* relax stored input torque.

Example: Selector Pawl in CW position when opening the gate. Apply input torque with the ratchet wrench in the CW direction to relieve force on the pawl. While maintaining input torque in the CW direction, slide the pawl firmly into the CCW direction for release and, again, *slowly* relax the stored input torque.



Maintain firm hand control of the ratchet wrench when releasing stored torque from the **GO-M3** Opener, since recoil from stored torque will be experienced. This could cause the **GO-M3** or the ratchet wrench to spin in the reverse direction and result in serious injury.

15. Remove the **GO-M3** opener from the railcar capstan.

16. To close car gates, first re-examine the car's capstan socket. Look for rounded edges, spilling or mushrooming. If needed, re-use the swage tool to square-up the capstan socket.
17. If everything looks good, repeat steps 5 through 15.
18. Re-engage the car gate locking mechanism.

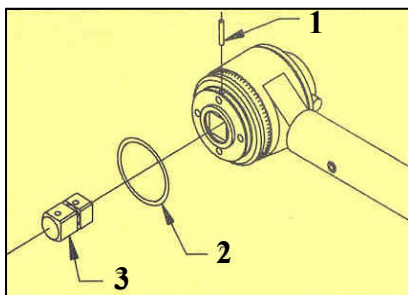
VI. MAINTENANCE AND STORAGE

A. REPLACING THE OUTPUT SQUARE DRIVE

A controlled-shear output square drive (**Figure 2**, Item 1) protects internal components in the event maximum torque capacity is exceeded. This overload-protection feature causes the drive to fracture when output is 3% to 10% above rated output capacity. One replacement drive is included with the **GO-M3**. Additional replacement kits can be ordered from WORKMASTER or your Regional Distributor. Order **PN: #33-M3022, Replacement Square Drive Kit**.

1. Remove the O-ring (**Figure 3**, Item 2) that is on the face of the square drive carrier.
2. Remove the square drive retaining pin (**Figure 3**, Item 1) from the output drive carrier.
3. Pull out the old square drive (**Figure 3**, Item 3).
4. Insert the new square drive (**Figure 3**, Item 3), making certain that the hole in the new square drive is aligned with the hole in the square drive carrier.
5. Insert the new retainer pin (**Figure 3**, Item 1), in the square drive carrier, ensuring that the pin engages the hole in the replacement square drive.
6. Re-attached the O-ring to the square drive carrier.

Figure 5: Replacing Output Square Drive Assembly



1. Retaining Pin
2. O-Ring
3. 1" Output Square Drive

VII. POWERED OPERATION

The process of opening and closing slide gates with the **GO-M3** can be made faster by using a non-impacting power drive.

1. Lock the selector pawl in the neutral position by centering the selector pawl between the CW / CCW range of the travel. **See Figure 1.**
2. Tighten the neutral positioning set screw. When properly positioned. The set screw will be seated in a groove in the selector pawl.

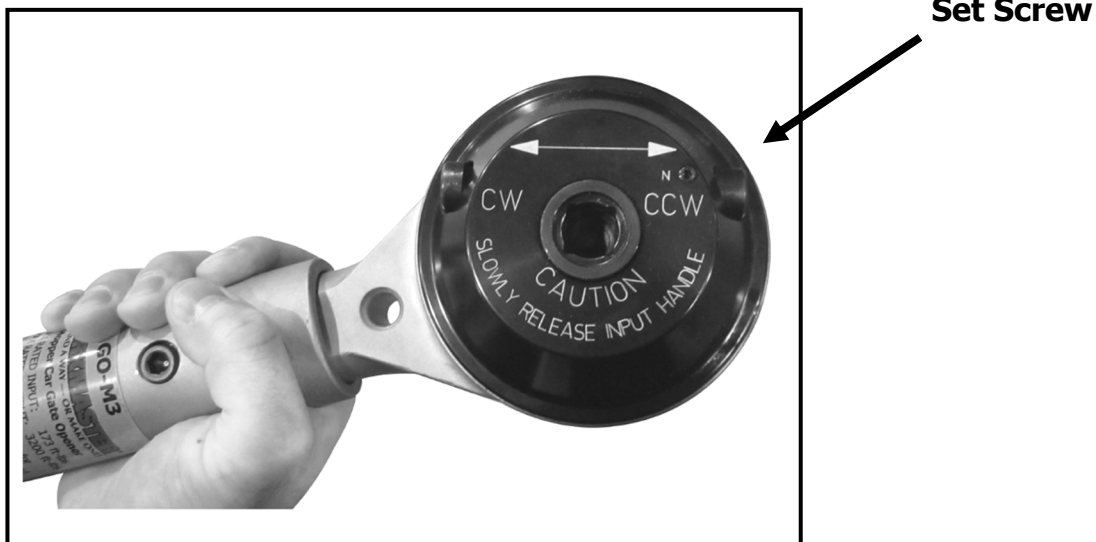


IMPORTANT

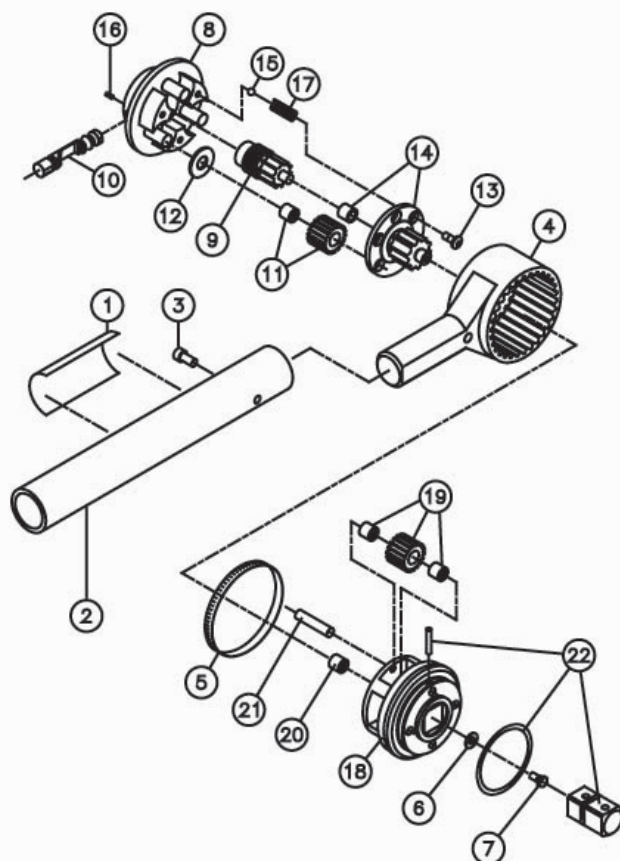
Verify that CW and CCW directions have been disengaged by spinning the gear head in either direction with no gear engagement.

3. Verify that the power drive is set to deliver no more than the maximum allowable input torque – 173 lbs-ft.

Figure 6: Neutral Position



APPENDIX A: EXPLODED VIEW



IT NO.	PART #	DESCRIPTION	QTY
1	33-20046	Decal, Name/Data	1
2	33-M3002	Reaction Bar	1
3	33-M3003	Socket Head Cap Screw	1
4	33-M3004	Ring Gear	1
5	33-M3005	Protractor	1
6	33-M3006	Spacer	1
7	33-M3007	Hex Head Cap Screw	1
8	33-M3008	Assy, Input End	1
9	33-M3009	Input Pinion	1
10	33-M3010	Selector Pawl	1
11	33-M3011	Assy, Input Planet w/Brg	3
12	33-M3012	Thrust Race	3
13	33-M3013	Button Head Cap Screw	3
14	33-M3014	Assy, Secondary Pinion w/Brg	1
15	33-M3015	Ball	1

IT NO.	PART #	DESCRIPTION	QTY
16	33-M3016	Nylon Cup Set Screw	1
17	33-M3017	Spring	1
18	33-M3018	Gear Cage	1
19	33-M3019	Assy, Output Planet w/Brgs	4
20	33-M3020	Bushing	4
21	33-M3021	Dowel Pin	4
22	33-M3022	Kit, Square Drive	1
NOT SHOWN			
	33-01210	Capstan Drive Fitting; Includes Pin & O-Ring	1
	33-M3025	Ratchet Wrench	1

APPENDIX B: TORQUE ASSIST KIT

WORKMASTER's Torque Assist Kit (PN: **GO-TA**) is used in conjunction with the **GO-M3**. The **GO-TA** greatly reduces the input effort needed to achieve the **GO-M3's** full 3,200 ft-lb output. Along with the supplied speed handle, the **GO-TA** helps decrease worker fatigue and increase productivity.

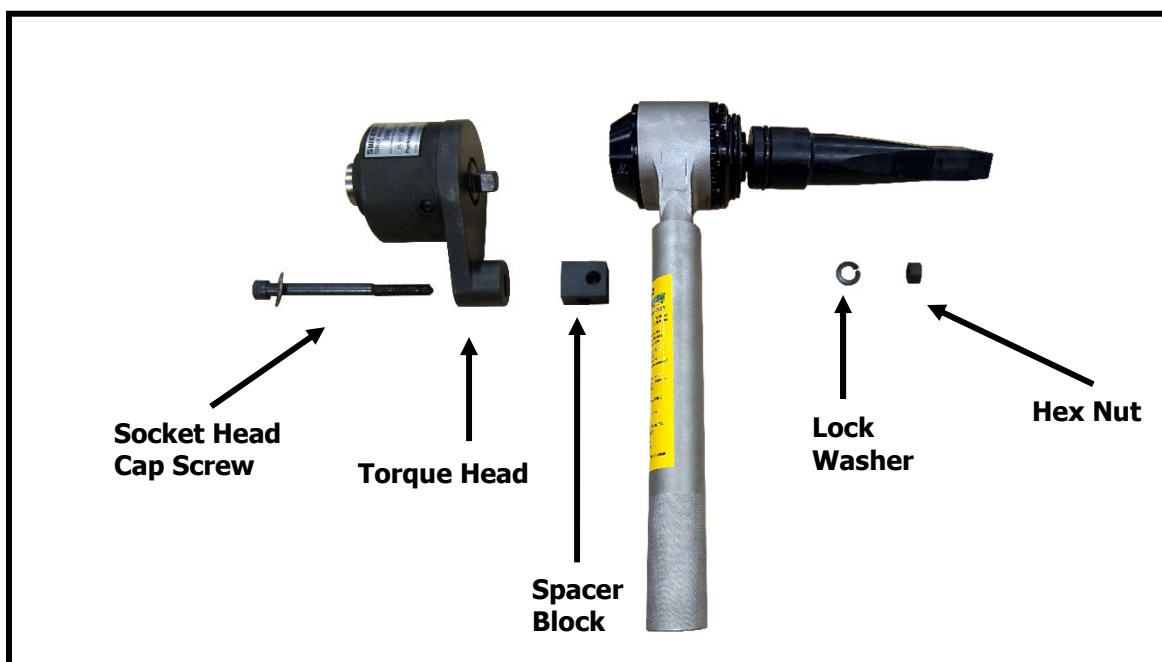
Attaching the GO-TA

1. Insert the GO-TA's output square drive into the female input square on the **GO-M3**.
2. Insert the supplied socket head cap screw through the **GO-TA's** frame, spacer block and **GO-M3's** gear box head.
3. Place lock washer over cap screw and tighten the hex nut to a torque of 30 to 35 ft-lbs.



CAUTION

Check the connection between the **GO-TA** and the **GO-M3** and tighten, if necessary, prior to each use.



Operating the GO-TA

1. If using a power-driven non-impacting input, eg, Air Ratchet, be sure the **GO-M3**'s selector pawl is locked in the neutral position. See **SECTION VIII** of this Owner/Operator Manual.



Do not use an impacting tool on the input of the **GO-TA**.

2. If using the supplied Speed Handle, insert the handle's square drive into the female input square of the **GO-TA**.
3. Although the **GO-TA** is capable of continuous 360° rotation in either clockwise or counterclockwise direction, the **GO-M3**'s selector pawl must be set in the appropriate desired direction.

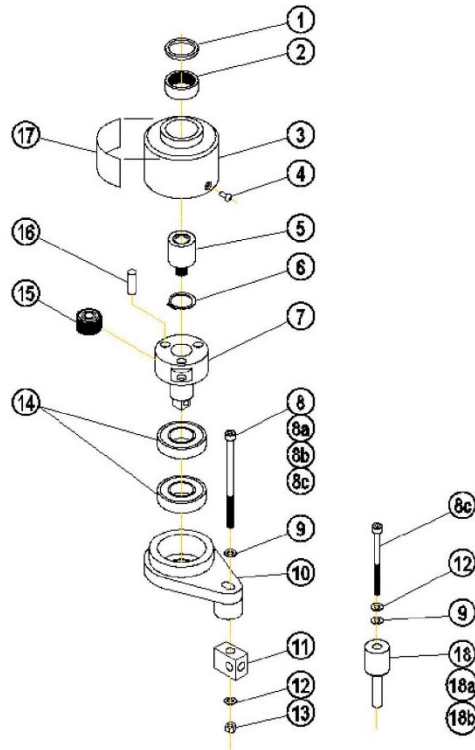


IMPORTANT

When using the **GO-TA** with the **GO-M3**, the total torque ratio equals the resultant of the two torque ratios.

$$\begin{array}{ccccc} 5.2 & & \times & & 18.5 \\ \text{GO-TA} & & & & \text{GO-M3} \end{array} = \begin{array}{c} \mathbf{96.2} \\ \mathbf{COMBINED} \end{array}$$

TORQUE ASSIST EXPLODED VIEW

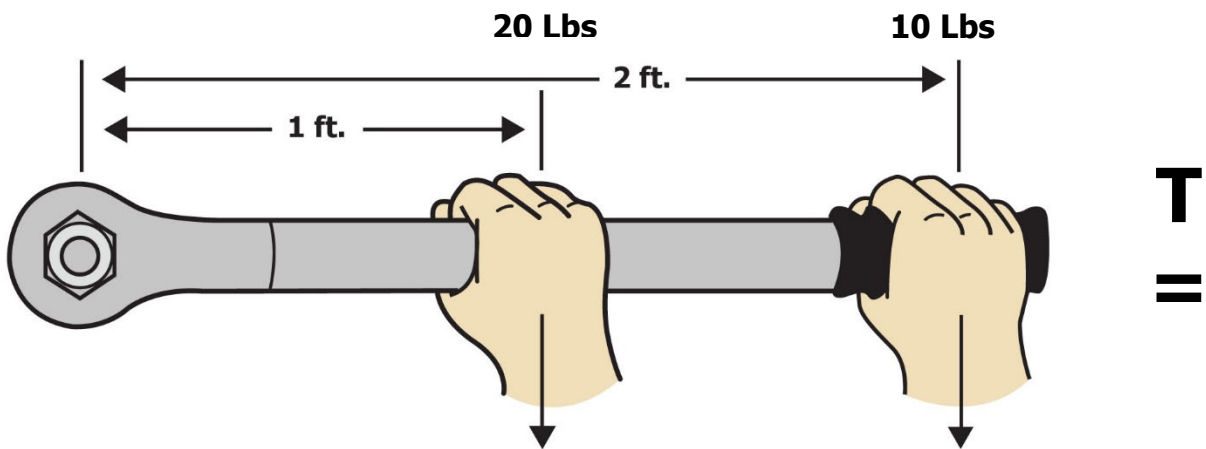


Item #	Part #	Description	Qty
1	33-TA001	Seal	1
2	33-TA002	Bearing, Roller	1
3	33-TA003	Housing	1
4	33-TA004	Screw	3
5	33-TA005	Gear, Input Sun	1
6	33-TA006	Retaining Ring	1
7	33-TA007	Output Drive	1
8	33-TA008	Screw	1
8a	33-TA009	Screw	1
8b	33-TA010	Screw	1
8c	33-TA011	Screw	1
9	33-TA012	Washer	1
10	33-TA013	Reaction Cap	1
11	33-TA014	Bracket Stub	1
12	33-TA015	Lock washer	1
13	33-TA016	Hex Nut	1
14	33-TA017	Ball Bearing	2
15	33-TA018	Output Gear Assembly	3
16	33-TA019	Dowel Pin	3
17	33-TA020	Name Plate	1
18	33-TA021	Reaction Pin	1
18a	33-TA022	Reaction Pin	1
18b	33-TA023	Reaction Pin	1

APPENDIX C: TORQUE

Torque (T) is a "turning" or "twisting" force and differs from tension, which is created by a straight pull. Torque is the result of multiplying the value of the Force (F) applied, by the Distance from the point of application. The same torque result can be achieved with a lower force if the distance from the point of application is increased.

$$T = F \times D$$



$$20 \text{ Lbs} \times 1 \text{ Ft} = 20 \text{ Ft-Lbs}$$

$$T = 10 \text{ Lbs} \times 2 \text{ Ft} = 20 \text{ Ft-Lbs}$$

APPENDIX D: TORQUE MULTIPLIER PRINCIPLE

The following information on Torque Multipliers has been compiled from the *Torque Manual*, published by the Ryeson Corporation. It is being included as an Appendix of the **GO-M3** Railcar Gate Opener Owner/Operator's Manual to provide the operator with the information necessary to gain maximum use from the opener.

The average individual can pull with a force of about 100 pounds. This is generally considered the maximum reasonable force a man can be expected to pull on a lever and maintain good footing or safety. For example, we will assume that the individual is able to pull at right angles to a lever. If an application demands 200 ft-lbs of torque, the lever arm length must be 2-feet.

The person applying the torque is required to stand farther and farther away from the work as the torque requirement goes up, in order that he may obtain proper leverage. A 2,000 ft-lbs torque application would require that the lever length be 20-feet.

$$2000 \text{ Ft-Lbs} \div 100 \text{ Lbs} = 20 \text{ Ft}$$

For general purpose applications, the longest practical Lever is 5-ft in length and is capable of applying 500 ft-lbs of torque. In applications where special space limitations exist or when torque requirements exceed 500 ft-lbs or when repeat applications with frequency, such as opening/closing hopper gates are the rule, the natural answer is the torque multiplier. Using planetary gears, this device multiplies torque, and at the same time allows a shorter lever to be used.

The **GO-M3** Gate Opener uses a torque ratio of 18.5 : 1. This device then, either multiplies the torque for a given leverage length and force by 18.5, or it will allow $\approx 1/18$ the length of lever to be used. The formula for determining minimum leverage length when using a 18.5 : 1 multiplier is as follows:

Example: Torque Required 3200 ft-lbs

$$3200 \div 100 \div 18.5 = 1.73\text{-feet}$$

$$\mathbf{T \div F \div M = L} \quad \text{where} \quad \begin{array}{ll} \mathbf{T} & = \text{Torque (Ft-Lb)} \\ \mathbf{F} & = \text{Force (Operator) (100 Lbs.)} \\ \mathbf{M} & = \text{Multiplier ratio (18.5)} \\ \mathbf{L} & = \text{Lever Distance (Minimum)} \end{array}$$

A reaction bar is attached to the gear housing of the gate opener. This keeps the unit from turning as torque is applied. As the torque increases at the input, this torque at the output drive also increases as does the force generated by the reaction bar. Since the forces at the reaction bar can be considerable, the device against which the reaction bar rests on the job must be determined as being strong enough to sustain the load. The amount of torque at the reaction bar is the difference between the input and output torque. In the example, the torque at the reaction bar would be 3027 ft-lbs or 3027 lbs one foot away from the center of the gearbox's input drive.

Even though the torque may be considered as being constant at the reaction bar for a given input torque, the pressure exerted by the reaction bar would change in the example depending on the positioning of the load restraining device. This example shows that loads on the bar vary from 3600 lbs at 1/4-foot from center to 450 lbs. at a distance of 2-feet. The formula for determining the force along the reaction bar at any point is as follows:

$$T \div D = F_{rb}$$

where **T** = Torque in ft-lbs
At Reaction Bar
D = Distance from center
On Reaction Bar in feet
F_{rb} = Force
Caused By Reaction Bar

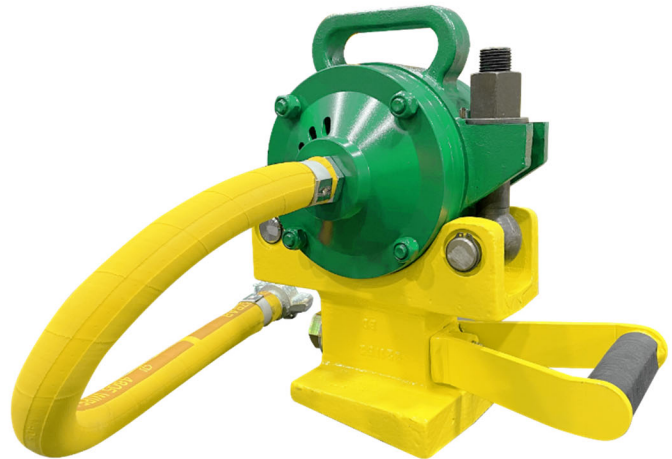
NOTES

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