

<b>SIENA ENGINEERING PVT. LTD.</b> (An ISO 9001:2015 Company) Plot No: 18 A-22 & S-3/3, Sector-III, Pithampur, Dist. Dhar-454775, M.P. Phone: 07292-400209 Fax: 07292-407802	MAINTENANCE MANUAL FOR HIGH CAPACITY DRAFT GEAR ASSEMBLY Specification No. WD-71-BD-51 Rev 1		Doc. No. SEPL/MAN-DG-71/21-22	
			Version No. 00	Revision No. 0
			Effective Date: 01-09-21	
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# SIENA ENGINEERING PVT. LTD.

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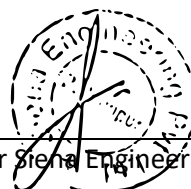
## MAINTENANCE MANUAL

### FOR

### HIGH CAPACITY DRAFT GEAR ASSEMBLY

### SPECIFICATION No.

### WD – 71 – BD – 15 REV 1

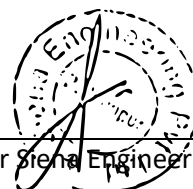


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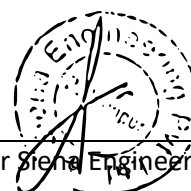
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## **PURPOSE**

The manual has been made for the purpose of inspection and maintenance of the Draft Gear Assembly. The information contained herein is a summary of the maintenance of the Draft Gear manufactured by Siena Engineering Pvt Ltd (SN-710-DG) during POH or on the repair track for any reason.

The essential parts of the Draft Gear are:

Sr No.	Component	Drawing No.	Quantity/Set
1	Draft Gear Housing	SN/710/DG/001	1 Nos.
2	Follower	SN/710/DG/002	1 Nos.
3	Rubber Pad	SN/710/DG/003	6 Nos.
4	Wedge	SN/710/DG/004	1 Nos.
5	Inner Follower	SN/710/DG/005	1 Nos.
6	30° Shoe	SN/710/DG/006	3 Nos.
7	Bore Insert	SN/710/DG/007	3 Nos.
8	Pre-shortner	SN/710/DG/008	3 Nos.



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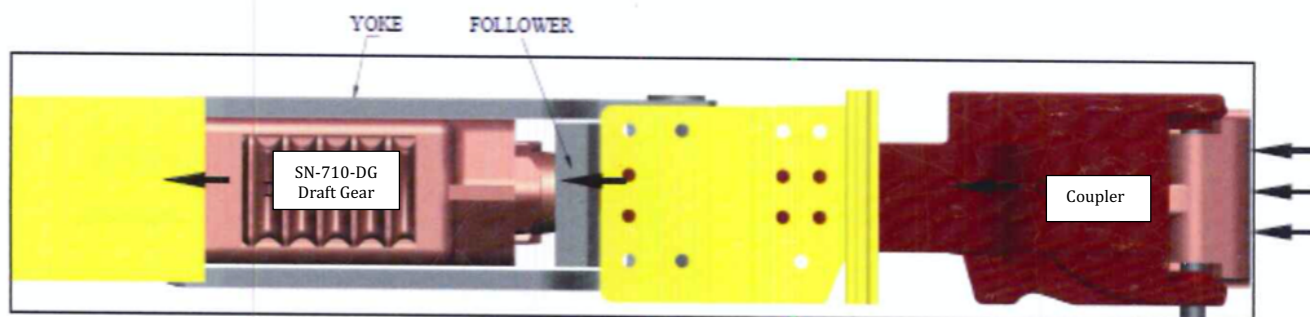
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## **1.0 PRINCIPLE OF OPERATION OF DRAFT GEAR:**

Draft Gear, also known as the heart of the coupler system, works basically on the principle of absorbing the energy and releasing the absorb energy. It absorbs the energy or shock of the equipment coupling together and then is releases this absorb energy giving rebound force which maintains the slack between the wagons. System mainly works using this energy created by the buff and draft forces which is further explained below:

### **1.1 Draft Gear in Buff Position (Pushing):**

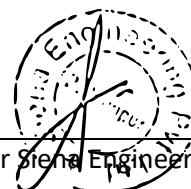
In Buff or Pushing position, the wagon or locomotive is moved by pushing on the coupler. Having the slack between the wagons and in the draft system allows for movement of the equipment without having to move the trains as a solid block. In the illustration shown below, it can be seen that the pushing force on the front of the coupler will cause the end of the coupler shank to make contact with the follower plate which makes contact with the front of the draft gear (Follower). This follower forcing the front the front of the draft gear back, the rear of the draft gear cannot move any further back because of the back stops. The result is the internal components of the draft gear are compressed and act as a shock absorber to the pushing movement.

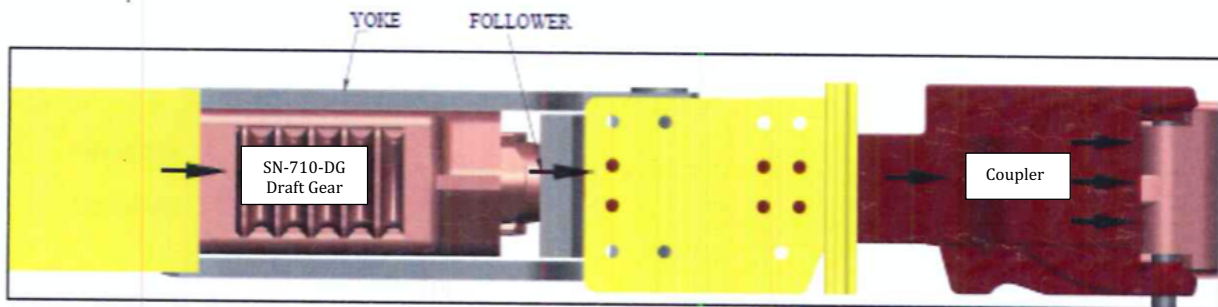


**DRAFT GEAR IN BUFF POSITION FIGURE-1**

### **1.2 Draft Gear in Draft Position (Pulling):**

When moving a group of wagons or a train reach wagon is pulled by the coupler and the internal operation of the draft arrangement must work to allow the draft gear to work like a shock absorber. The coupler is connected to the yoke by a pin. When the coupler is pulled forward, the pin pulls the yoke forward. Inside the yoke is the draft gear and the follower plate. With the yoke pulling the draft gear forward from the backend, the draft gear movement is restricted by the contact of the follower. The follower move forward slightly but is not restricted by the end of striker or lugs. The result is that the draft gear again gets compressed. Thus the draft gear is compressed in both the pushing and pulling action of the coupler.



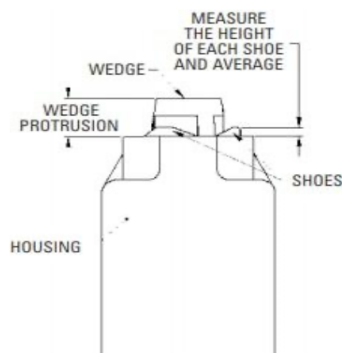


**DRAFT GEAR IN DRAFT POSITION FIGURE-2**

## **2.0 PRE-DISMANTLING INSPECTION / INITIAL INSPECTION:**

1. It is suggested to inspect the draft gear whenever wagons are coming in depot. Because of the very high forces present inside draft gear due to pre-compression of rubber pads, when working with draft gear, personal protection equipment shall be used during the inspection.
2. Draft gear system should be checked visually to determine whether the draft gear is in fully released i.e. in safe condition or unsafe i.e. stuck gear condition. If it is in stuck condition then steps to be followed as mentioned in the Page no. of this document and if it is in fully released condition then the following inspection should be carried out to determine if the draft gear can be used further or should it be condemned.
3. A SN-710-DG Draft Gear removed from a wagon for inspection / repairing purposes is considered to be suitable for service if it is found:
  - 1) The housing is not broken and is without cracks and without bulging.
  - 2) The friction clutch consisting of wedge and shoes is intact
  - 3) The friction clutch is tight
  - 4) Less than 6.5 mm wear in the original metal thickness at the mouth of the friction bore housing contacted by the friction shoes.

If draft gear conforms to the above factors, it will not require any work except pre-shortening which is mentioned in the Page no. 6 of this manual

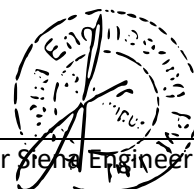


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4. The slack in the draft gear arrangement does not indicate that the draft gear is defective as this condition may be due to worn draft attachment such as yokes, yoke pin, couplers and over-size draft gear pockets. Should this be the case, this parts should be renewed or reworked to return the draft attachments to a like new condition eliminating the free slack.
5. After the examination of the gear applied to the freight car, the device shall be condemned, if it is found that:
  - 1) Broken or split housings, housing with cracks of any length in critical areas or crack 1" or longer anywhere in the housing. Cracks less than 1" in non critical area shall not be considered defects.
  - 2) A bulge in the rear wall of the housing more than 3/16"
  - 3) Broken or cracked parts that bear on the follower at any time during the buff or draft stroke.
  - 4) Splitting or separation of rubber from metal plates.
  - 5) Obvious heat or fire damage to the rubber
  - 6) Installed draft gears with gear length less than specified.

#### 6. **Pre-Shortening:**

1. The assembled SN-710-DG draft gear can used after pre-shortening to facilitate installation in to the yoke and draft gear pocket.
2. Place the gear under a 200 ton open gap press, position the pre0shortening block on the shoes and apply a load.
3. Compress the gear until there is sufficient vertical clearance between the housing and wedge lugs to be able to apply standard powered metal shortner.
4. Attach tap to 3 shortners and using tap lower insert through openings.
5. Verify the pre-shortened length using the Gauge No. SN – DGA – G034



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### **3.0 DIS-MANTLING OF SHOE & WEDGE (CLUTCH COMPONENTS):**

If either the shoes or wedge are broken, the following disassembly procedure can be used to replace the broken components.

- Position the draft gear in the pad removal press, close and lock the safety door and disassemble the pads.
- Take the draft gear out of the fixture and remove the remaining components for inspection.
- Turn the housing upright.

### **4.0 INSPECTION OF DIS-MANTLED DRAFT GEAR COMPONENTS & ITS REPAIR:**

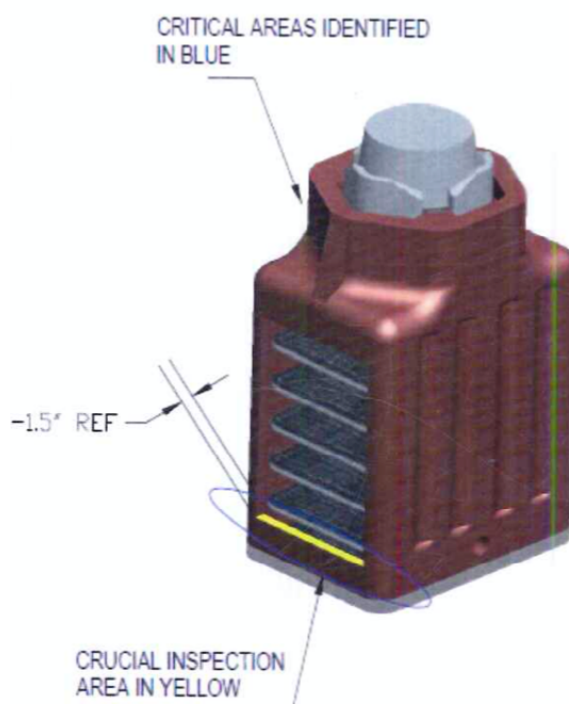
Once the shoe and wedge is removed all the components can be separated out from the draft gear and each individual components shall be inspected as per below:

#### **4.1 Housing:**

Following parameters must be inspected:

- There should be no cracks on the housing
- There must be no broken lugs on the housing
- Check carefully around the housing locking lugs for possible cracks
- There must not be any bottom ridging in the bore
- Bore taper should be smooth and any concavity must not be present
- The inside friction bore walls must be worn equally, and the wall thickness must not be less than 20.6 mm. Sharp edges due to wear must be removed by grinding. Gouged areas can be blended in if they are no more than 1/16" deep and 1" Long in the vertical direction. Replace inserts if they are broken.
- The housing must pass through the box gauge no. SN – DGH – G001
- The rear wall flatness should be checked with Gauge No. SN – DGH – G008
- Maximum bore outside diameter should be checked with gauge no. SN – DGH – G007
- Maximum bore Inside diameter should be checked with gauge no. SN – DGH – G004
- Once the housing is inspected and repaired then it should be suitably marked for proper identification.

- Housing not confirming to above gauges may either be rejected or rectified considering the requirement. Welding may be allowed to renew the worn surfaces and minor casting defects in non-critical areas. All welds should be ground smooth to the surface. Total weld repair on a single housing not the exceed 4" of the total weld length.



- The welding parameters are listed as below:**

Welding shall be carried out using MIG Welding Process. Following shall be the MIG Welding Parameters:

**Machine Parameters:**

DC Amperage: 230A

DC Voltage: 24V

Wire Speed: 11.41 inch/sec max

**Wire Parameters:**

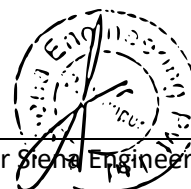
Trade Name: SUN MIG

Specification: AWS ER80S-D2/AWS ER70S-6 Size: Dia0.47".1.2mm

**Shielding Gas Parameters:**

Trade Name: INOX/ Any other available

Composition: Ar85%+C02





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#### **4.2 Shoes:**

In order to reuse the shoes from gears that have been returned from service for reconditioning, it should be shot blasted to remove rust and dirt and to identify following:

- 1) No sharp edges are to be permitted that it could cause cutting and gouging
- 2) No cracks or spalls
- 3) No concave wear on any friction surface
- 4) No greater than 0.8 mm wear on any friction surface
- 5) Apply thickness gauge and flatness gauge no. SN – DGS – G0017 & SN – DGS – G0015
- 6) Replace any shoes that does not meet above requirements.

EXCESSIVE WEAR OR GALLING GREATER THAN .032 DEEP IS NOT PERMITTED



NO SPALLING PERMITTED ON THESE SURFACES



#### **4.3 Wedges:**

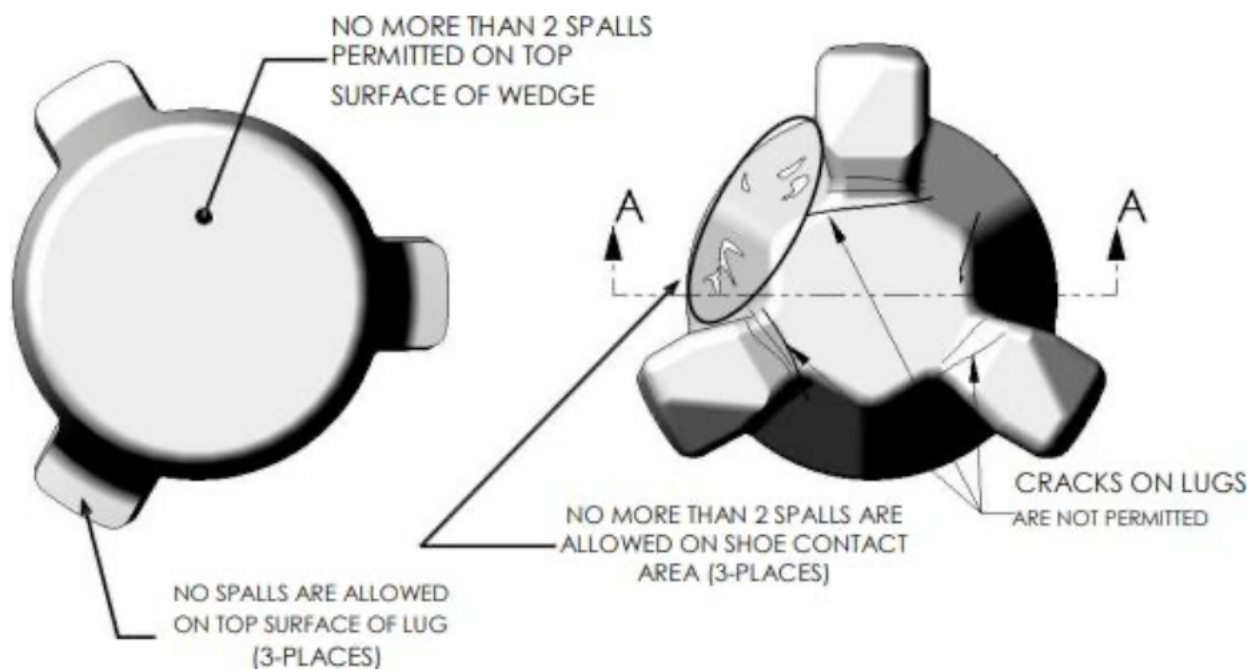
In order to reuse the wedges from gears that have been returned from service for reconditioning, it should be shot blasted to remove rust and dirt and to identify following:

- 1) No sharp edges are to be permitted that it could cause cutting and gouging
- 2) No abnormal wear or any friction surface
- 3) No broken locking lugs
- 4) No indication of any crack on any of the locking lugs.
- 5) No sever cracking or spalling of the carburized case on the friction or the top of the wedge.

Spalls greater than 12.7 mm x 12.7 mm anywhere on the wedge should be scrapped. Wedges that have more than two spalls on the shoe contact area must be scrapped. Wedges having a

spall on the top surface of lug must be scrapped. Wedges having more than two spall on the top surface of wedge must be scrapped.

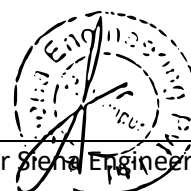
- 6) Apply wedge inspection gauge No. SN – DGW – G0024
- 7) Replace any shoes that does not meet above requirements.



#### **4.4 Inner Follower:**

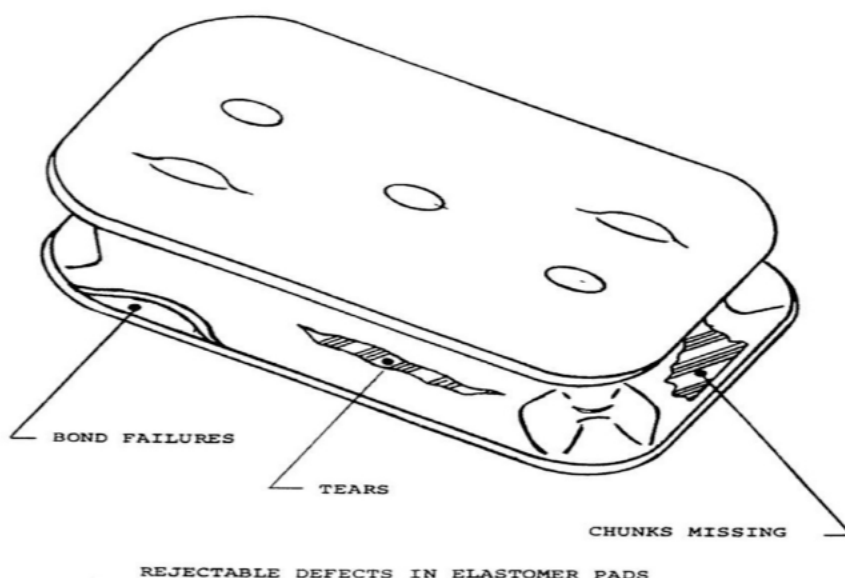
In order to reuse the shoes from gears that have been returned from service for reconditioning, it should be shot blasted to remove rust and dirt and to identify following:

- 1) Sharp edges due to wear must be blended with the surrounding area
- 2) Flatness shall be checked visually
- 3) Followers showing harmful distortions shall be rejected out-rightly
- 4) Flange thickness should be checked with Gauge No. SN – DGF – G0029
- 5) Follower thickness must be checked with gauge no. SN – DGF – G0028



#### **4.5 Rubber Pads:**

- 1) Reject pads which show tears. Missing material chunks, large bond failures or extreme wear into the steel plate edges.
- 2) Pads are gauged and must not be less than 54 mm as measured by a gap gauge at the middle of each side. Apply pad Height Gauge no. SN – DGP – G0030
- 3) Bend (but not broken or cracked) steel plates are acceptable as these will straighten during assembly
- 4) Creases and folds are normal and acceptable for reconditioned gears
- 5) Rubber pads must be full bonded to each of the material



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## 5.0 REASSEMBLY AND TESTING:

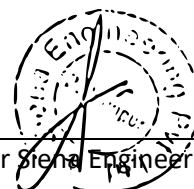
- Only new parts or used parts that pass the inspection mentioned earlier may be used in reconditioned gears.
- Below is a list of parts for each unit.

Sr No.	Component	Drawing No.	Quantity/Set
1	Draft Gear Housing	SN/710/DG/001	1 Nos.
2	Follower	SN/710/DG/002	1 Nos.
3	Rubber Pad	SN/710/DG/003	6 Nos.
4	Wedge	SN/710/DG/004	1 Nos.
5	Inner Follower	SN/710/DG/005	1 Nos.
6	30° Shoe	SN/710/DG/006	3 Nos.
7	Bore Insert	SN/710/DG/007	3 Nos.
8	Pre-shortner	SN/710/DG/008	3 Nos.

- Place the housing on the assembly fixture horizontally keeping pocket B upside.
- Place the wedge in position, resting on the inside of the housing lugs. Set three shoes into position between the wedge and bore surface. Tap the bottom of each shoe, if necessary to ensure proper seating install the top follower.

Note : Rotate the follower 180 degree from its originally applied position to distribute the wear on the shoe support surface.

- Lubricate the following surfaces before installing the pads:
  - The pad side of the follower
  - Both the plates of the pad that are replaced in the bottom of the housing.
  - The inner sidewalls of the housing.
  - The pad plate that rests on the bottom of the assembly fixture.
  - The top plate of the stack in the assembly fixture, which bears against the vertical arm.
- Install six pads in a pre-compression fixture. Put the compressed pack over pocket B and insert the pads in the housing under 200T Hydraulic press. Check the alignment with Gauge No. SN – DGA – G034



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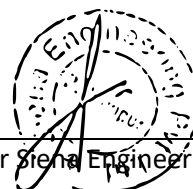
## 7. Hammer Test:

A final check should be made under 27000 lbs carrying out official capacity test as laid down out in AAR M 901 E. Draft Gears which does not meet specified requirements shall be disassembled to determine the cause of failure and necessary corrective action is taken accordingly.

## 8. Pre Shortening:

Place the Gear under a 200 on gap press, position the pre-shortening block, on the shoes and apply a load compress the gear until there is sufficient vertical clearance between the housing and wedge lugs to be able to apply standard powered metal shortener. Attach tap to 3 shorteners (18mm sintered powder metal cube) using tap lower insert through openings.

Apply Gauge No. SN – DGA – G034 to check Draft Gear length after pre-shortening.



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## 6.0 FINAL INSPECTION:

After passing the hammer test and pre shortening each gear shall be checked by a Quality Assurance Inspector for the characteristics.

### A. Pre Shortening Inserts.

1. One insert per lug.
2. Contact with both wedge and housing lugs.
3. Inserts must be intact.

### B. Forgings

1. Proper components and relationship
2. No broken pieces
3. No cracks on the wedge lug.
4. Clutch must be tight.

### C. Housing

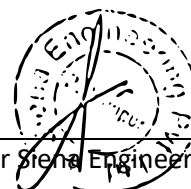
1. No visible cracks allowed
2. Repair tag must be properly marked and securely fastened to the housing where applicable.
3. Weld repairs must be ground smooth.
4. Torch marks are unacceptable
5. Mild gouges less than 1.6mm deep in the bore on the lugs, from the assembly operation, are allowable. If, however, gouged metal is trapped behind the shoes, it must be removed. If gouges are deeper that draft gear shall be rejected.

### D. Gauges

Each Gear must meet the following gauge:

1. Pre-shortened length (Gauge No. SN – DGA – G034)
2. Box Gauge No. SN – DGA – G001

The inspector will stamp the letter "P" on the repair tag after the latter "RT" to signify acceptance of the unit.

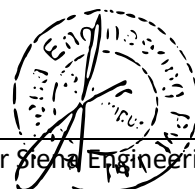


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## 7.0 GAUGES LIST:

Sr No.	Gauge Description	Gauge Drawing No.
1	Housing Top Bore OD Gauge	SN – DGH – G007
2	Housing Top Bore ID Gauge	SN – DGH – G006
3	Housing Box Gauge	SN – DGH – G001
4	Housing Lug Clearance Gauge	SN – DGH – G002
5	Inner Follower Thickness Gauge	SN – DGF – G028
6	Inner Follower Overall Thickness Gauge	SN – DGF – G027
7	Inner Follower Thickness Gauge for Bottom Flange	SN – DGF – G029
8	Shoe Thickness Gauge	SN – DGS – G017
9	Wedge Trim Diameter Gauge	SN – DGW – G024
10	Rubber Pad Height Gauge	SN – DGP – G030
11	Pre-Shortened Draft Gear Length Gauge	SN – DGA – G034



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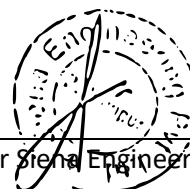
# STUCK DRAFT GEAR PROCEDURE MANUAL

DERIVED FROM

AAR MANUAL OF STANDARDS

AND

RECOMMENDED PRACTICE BOOK - BII, RP -101-83, PAGES 57-58



For Siena Engineering Pvt Ltd



<b>SIENA ENGINEERING PVT. LTD.</b> (An ISO 9001:2015 Company) Plot No: 18 A-22 & S-3/3, Sector-III, Pithampur, Dist. Dhar-454775, M.P. Phone: 07292-400209 Fax: 07292-407802	<b>MAINTENANCE MANUAL FOR HIGH CAPACITY DRAFT GEAR ASSEMBLY</b> <b>Specification No.</b> WD-71-BD-51 Rev 1		<b>Doc. No. SEPL/MAN-DG-71/21-22</b>	
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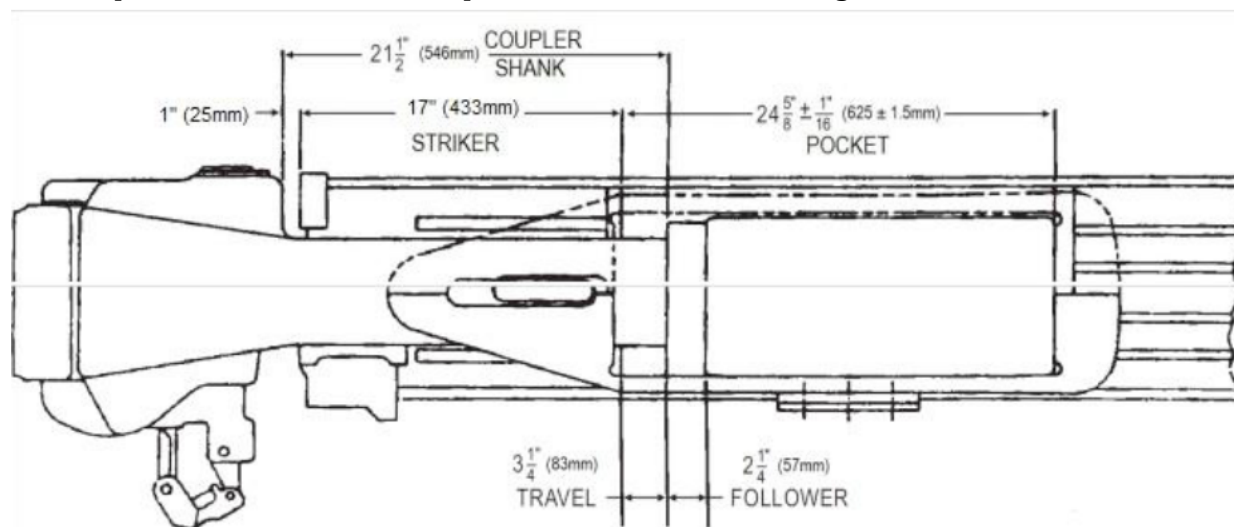
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## 1.0 Scope

The following procedure applies to any stuck draft gear made or refurbished by Siena Engineering Pvt Ltd. This procedure outlines the handling methods recommended when cars are determined to have a stuck draft gear, by visual inspection or as noted.

## 2.0 Identifying A Stuck Draft Gear

Stuck draft gear is a term used to describe a condition where friction or unseen broken parts prevent the components of the friction clutch, still under high force, from returning to their normal fully released position and filling out the draft gear pocket. Any longitudinal gap in excess of 1/4 inch between the gear and the car pocket should be viewed with great caution: a stuck gear is dangerous because the slightest vibration could cause the gear to suddenly release, forcibly propelling the friction components and the follower plate outward. Please see figure below.



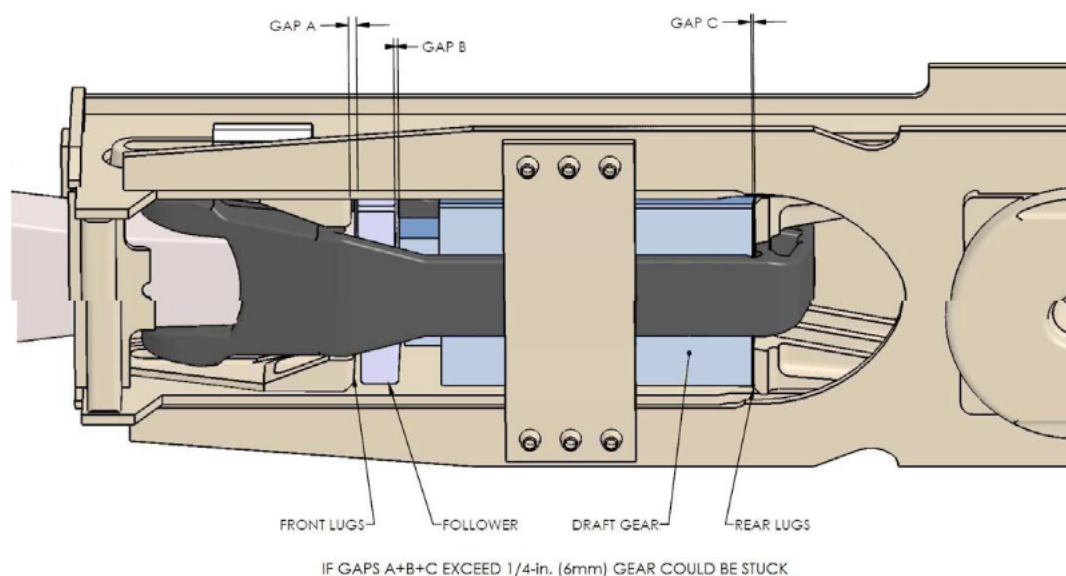
A draft gear is stuck if the gaps add to over 1/4" (6mm) as shown. Properly contain and label the assembly per the following guidelines.

A stuck gear is dangerous because the slightest vibration could cause the gear to suddenly release, forcibly propelling the friction components and the follower plate and coupler outward. If a draft gear is determined to be stuck, immediately report this condition to the supervisor in charge of safety. Keep away from coupler and clear of draft system components. Never attempt to physically check free slack if gear is suspected of being stuck (see 3.2).

### 3.0 RECOMMENDED INSPECTION

If gears are suspected of being in a stuck condition, use extreme caution and verify by visual inspection of gear system per 2.2 below before deferring to standard inspection guideline.

3.1 Free slack exceeding 1 in. (25mm) is an indication of a worn or defective coupler shank, coupler yoke connection, yoke, draft gear, follower, or car pocket. Slack is defined as the difference in distance between coupler striking horn and striking casting. Excess slack may be an indication of a stuck draft gear that could cause personal injury. Never attempt to physically check free slack on the coupler without visually verifying that the draft gear is not stuck. If excess slack is suspected, perform visual inspection first as outlined in section 2.2.2 below.



**Figure 3.2: Bottom View of Gear-Sill-Yoke Assembly**

3.2 To avoid personal injury, a visual inspection should be made of the draft gear system to determine if the draft gear is in a "stuck" condition or if any other unsafe or abnormal condition is evident. If an abnormal condition is present, proceed with extreme caution. "Stuck" gear is a term used to describe a condition where abnormal friction or unseen broken parts prevent the components of the friction clutch, still under high force, from returning to their normal fully released position and filling out the draft gear pocket. This inspection applies only to draft gear systems that are not coupled. Certain gaps can be present as shown, if the car is coupled.

See Figure 3.2. GAP A is the distance between the follower and front lugs. GAP B is the distance between the wedge of the draft gear and the follower. GAP C is the distance between the rear lugs and the back of the draft gear housing. Any total longitudinal gap (GAP A+ GAP B+ GAP C) in excess of 1/4 in. (6mm) between the gear, follower, and the car pocket should be viewed with great caution

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3.3 An additional scenario where the gaps could be present as outlined in 2.2.1 or 2.2.2 is in the case of a completely worn out draft gear. If the clutch components are loose (and not wedged into a fixed position) the gear can be removed and replaced as per the maintenance manual.

## 4.0 STUCK DRAFT GEAR PROCEDURE

It is recommended to secure the movable parts of struck draft gear while still in the yoke, so that they cannot release unexpectedly, and disposing of the entire assembly properly. If the draft gear is determined to be in “stuck” condition follow the procedure outlined below.

### 4.1 Safety Precautions

4.1.1 Appropriate personal protective equipment must be worn, including protection for the eyes and ears, to protect from possible injury.

4.1.2 Before working on the draft system, make certain that the wagon is in a protected location, with track lockouts where applicable.

4.1.3 Do not stand or work directly in front of coupler.

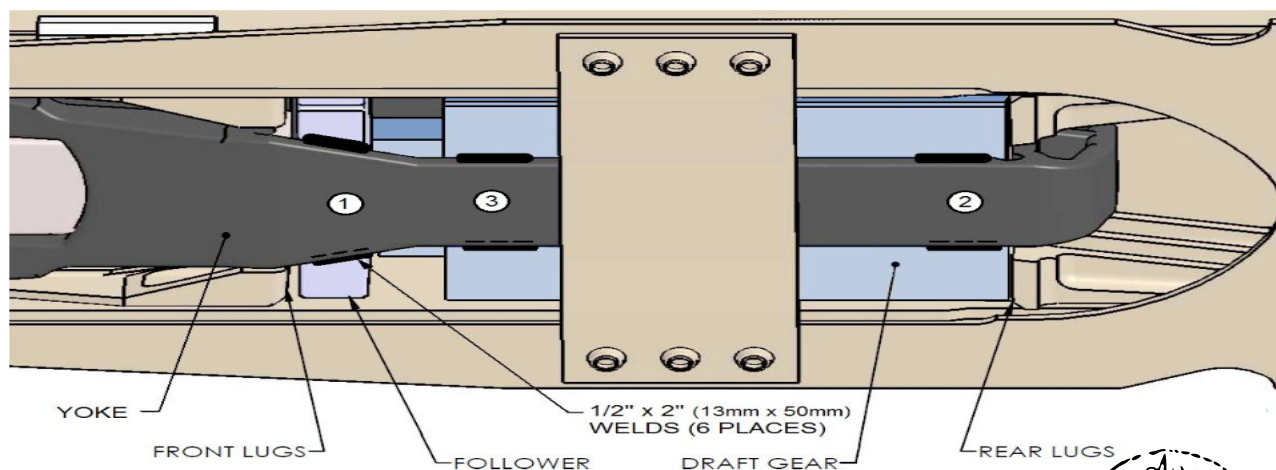
4.1.4 Chock the wheels at the end of the car not being worked on.

### 4.2 Securing and Removal Procedure

4.2.1 If the car has two yoke support plates, remove the front plates only.

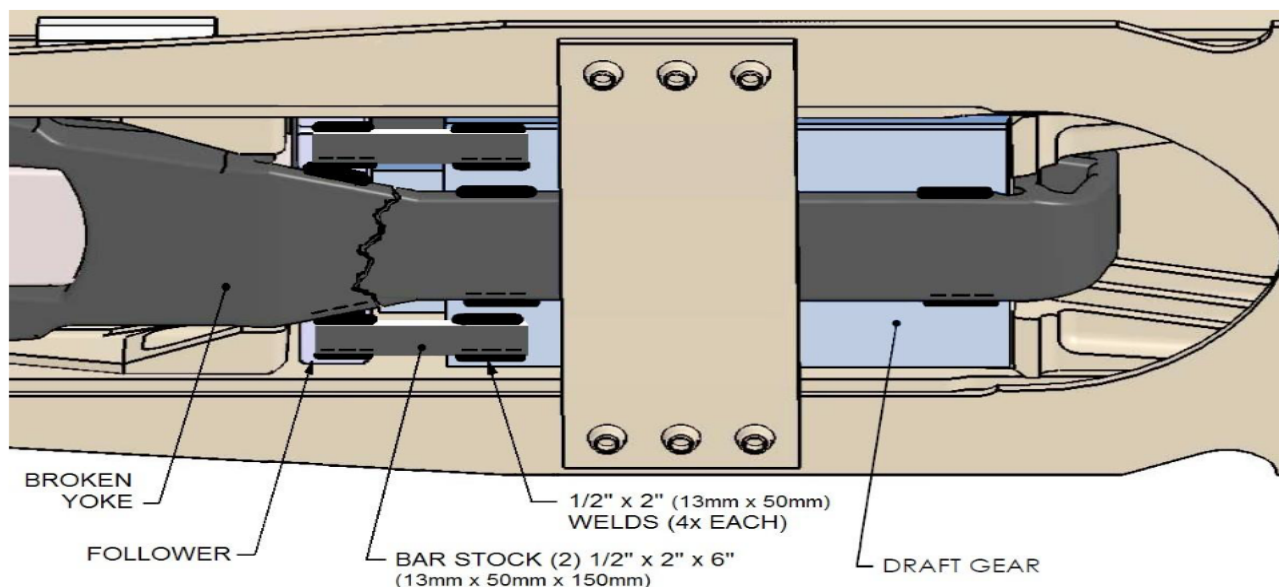
4.2.2 Inspect the yoke and follower for soundness.

4.2.3 Securely weld the follower and then draft gear housing to the lower yoke strap using strong intermittent welds ( see figure 4.2.3a ). If the yoke strap is broken, suitable bar stock should be selected and welded to both the follower and draft gear using or yoke security contain the draft gear ( see figure 4.2.3b).



**Figure 4.2.3a: Welding Yoke to Gear and Follower**

Weld near the clutch area of the housing last, after follower and back of gear are securely welded to yoke. Temperature change near the friction components can cause the clutch components can cause the clutch components to release suddenly.



**Figure 4.2.3b: Broken Yoke**

4.2.4 The coupler can now be removed.

4.2.5 Disconnect the brake rigging from the truck to be rolled out. Jack the car and roll the truck clear of the working area (chock the wheels to prevent unwanted movement)

4.2.6 DO NOT remove the yoke support plate until a lift table or lowering device is placed under the yoke and draft gear, and the yoke strap is supported securely. Draft gears should always be lowered, never dropped.

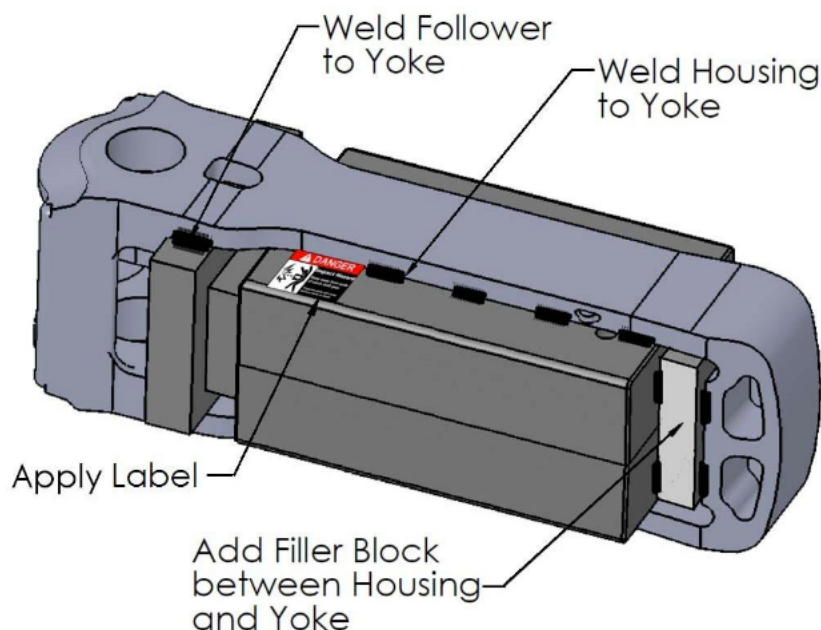
4.2.7 Determine if the key slot is broken or if the yoke will interfere with the coupler carrier as it is lowered.

4.2.8 Position lift-table or other lowering device under the yoke support plate, and use blocking as required to securely support the yoke away from the support plate.

4.2.9 Remove yoke support plate rivets or bolts.

4.2.10 Slowly lower the yoke and gear assembly to the ground as one.

4.2.11 Add a steel spacer block behind draft gear housing to firmly restrict expansion of gear (Fill gap between yoke butt and draft gear rear wall). Add additional shims or filler blocks to take up any longitudinal space. Weld movable parts to the yoke and securely restrain the draft gear from expanding. See Figure 4.2.11 for suggested weld locations and restraining details.



**Figure 4.2.11: Weld Locations**

4.2.12 If any of the rubber appears to be bulging out of the open side of the draft gear, a containment strap or plate at least 1/8" thick must be welded across the opening, after completing 4.2.11, to prevent the possibility of the pads suddenly bursting out of the housing.

4.2.13 Any severe cracks or severe damage should also be handled cautiously. Similar containment straps or plates should be employed to secure the draft gear after containing per 4.2.11.

4.2.14 Only after the draft gear is firmly secured to the yoke and containment components with the front and back of the draft gear solidly supported and secure, should the gear be considered safe for transport or proper disposal.

