Demonstrate Selecting, Using and Maintaining Various Power Tools Correctly

Skill Number CO-OP15GN103

Full Name: Galen Rafay Kafan **No ID:** 07

Validation Date: 12 Januari 2026 **School:** SMKN 1 Singosari

PERFORMANCE TASK:

Given some power tools, the student is requested to perform the following tasks:

- Selecting, using, maintaining various Power Tools in installation of Engine or other system components.
- Perform close the job by ensuring all systems or conditions is in the standard condition.

Safety and Contamination Control must be applied to this process. All literature will be available.

Prerequisite	Yes	No	N/A	Hints
The student must complete the knowledge assessment. Minimum passing grade 80%.	✓			Score power tools course or subject.

Tasks	Completed			Observation / Hints
	Yes	No	N/A	
Preparation				
Prepare related literature	✓			
Prepare required equipment	✓			
Prepare related tools	✓			
Prepare Safety & Contamination Control equipment	✓			

Tasks	Completed			Observatio
	Yes	No	N/A	
Perform etiquette/manner when starting the job				
Meet the customer / assessor	✓			
Perform etiquette/manner when opening the interaction.	✓			• Perform smile • Introduce Stud
Explain the purpose of Student's activity.	✓			
Ask permission to perform the job.	✓			

Tasks	Completed			Observation / H
	Yes	No	N/A	
Selecting, Using and Maintaining Various Power Tools				
1. Inspect the Power Tool before using	✓			Visual inspection of the Pow wear, cracks, damage
2. Remove and install or disassemble and assemble conducted according to correct procedures	✓			Equipment and tooling are checked for correct, safe, operation and must refer to
3. Tasks completed without damage to equipment and tools	✓			Component and tooling are stored on the right place
4. Equipment and tooling is cleaned and returned to its correct location	✓			Cleaned and stored equip the right place.
5. Work area left clean and tidy	✓			Area cleaned from spills an
Documentation:				
Take picture if needed				

Tasks	Completed			Observation / H
	Yes	No	N/A	
Perform close the job by ensuring all systems or conditions is in the standard condition				
Ensure all systems or conditions are in standard condition.	✓			• Find the improper conditio • Communicate the finding customer/assessor.

Tasks	Completed			Observation / Hints
	Yes	No	N/A	
Reporting				
All relevant documentation completed correctly and approved by customer (if required).	✓			• Completing the Task List • Completing Measurement Form/Related Check Sheet, if required • Create Service Report (SIMS), if required • Create SPR, if required • Documenting the failed or damaged parts, if required • Provide Technical Analysis Report/Failure Analysis Report, if required.

Tasks	Completed		Observation / Hints
	Yes	No	
Safety			
Using APD related to the job	✓		
Follows relevant workplace safety guidelines (tag out, safety equipment)	✓		• Comply with safety regulation that applied on the workplace
State and follow safety precautions	✓		• Create Job Safety Analysis • Student must follow safety procedure refer to service manual or SIS related to job
Serviceman completes job without accident due to incorrect procedure using hand tools.	✓		• Correct working position • Correct hand tool related to the job
Tasks completed without damage equipment and tools	✓		

Tasks	Completed		Observation / Hi
	Yes	No	
Contamination Control			
Environmental Practices &Housekeeping	✓		1. Waste is minimized, wa including sludge; solids wastes are sorted and s for recycling or disposal 2. Packaging of goods rec and reused or disposed recycling 3 Materials that can be re cleaned and stored 4. Waste and scrap is rem workplace procedures 5. All fluids are disposed c accordance with enterp and procedures

Tasks	Completed			Observatio
	Yes	No	N/A	
Perform etiquette/manner after completing the job				
Perform etiquette/manner when closing the communication.	✓			• Perform smile & • Ask permission the interaction.

General Comments

RESULT: **COMPETENT** ☑ **NOT YET COMPETENT** ☐ (please check (√))

	Name	Date	Signature
Student:	Galen Rafay.R.	12 Januari 2026	
Assessor:		26 Januari 2026	
Supervisor:			
Data Recorded:			

Demonstrate Selecting, Using and Maintaining Various Power Tools Correctly

Skill Number CO-OP15GN103

Full Name: Galen Rafay Rafan **No ID:** 07

Validation Date: 26 Januari 2026 **School:** SMKN 1 Singosari

PERFORMANCE TASK:

Given some power tools, the student is requested to perform the following tasks:

- Selecting, using, maintaining various Power Tools in installation of Engine or other system components.
- Perform close the job by ensuring all systems or conditions is in the standard condition.

Safety and Contamination Control must be applied to this process. All literature will be available.

Prerequisite	Yes	No	N/A	Hints
The student must complete the knowledge assessment. Minimum passing grade 80%.	✓			

Tasks	Completed			Observation / Hints
	Yes	No	N/A	
Preparation				
Prepare related literature	✓			
Prepare required equipment	✓			
Prepare related tools	✓			
Prepare Safety & Contamination Control equipment	✓			

Tasks	Completed			Observation
	Yes	No	N/A	
Perform etiquette/manner when starting the job				
Meet the customer / assessor	✓			
Perform etiquette/manner when opening the interaction.	✓			
Explain the purpose of Student's activity.	✓			
Ask permission to perform the job.	✓			

Tasks	Completed			Observation / Hint
	Yes	No	N/A	
Selecting, Using and Maintaining Various Power Tools				
1. Inspect the Power Tool before using	✓			
2. Remove and install or disassemble and assemble conducted according to correct procedures	✓			
3. Tasks completed without damage to equipment and tools	✓			
4. Equipment and tooling is cleaned and returned to its correct location	✓			
5. Work area left clean and tidy	✓			
Documentation:				
Take picture if needed				

Tasks	Completed			Observation / Hints
	Yes	No	N/A	
Perform close the job by ensuring all systems or conditions is in the standard condition				
Ensure all systems or conditions are in standard condition.	✓			

Tasks	Completed			Observation / Hints
	Yes	No	N/A	
Reporting				
All relevant documentation completed correctly and approved by customer (if required).	✓			

Tasks	Completed		Observation / Hints
	Yes	No	
Safety			
Using APD related to the job	✓		
Follows relevant workplace safety guidelines (tag out, safety equipment)	✓		
State and follow safety precautions	✓		
Serviceman completes job without accident due to incorrect procedure using hand tools.	✓		
Tasks completed without damage equipment and tools	✓		

Tasks	Completed		Observation / Hints
	Yes	No	
Contamination Control			
Environmental Practices &Housekeeping	✓		

Tasks	Completed			Observation / Hints
	Yes	No	N/A	
Perform etiquette/manner after completing the job				
Perform etiquette/manner when closing the communication.	✓			

General Comments

RESULT: COMPETENT ☑ NOT YET COMPETENT ☐ (pleas

	Name	Date	Signature
Student:	Galen Kapay .A.	26 Januari 2026	
Assessor:	Sefiansa TP	26 januari 2026	
Supervisor:			
Data Recorded:			

Trakindo CAT

Nomor Formulir / Form Number	SHE.SHE.FRM.005.R04

ANALISIS LINGKUNGAN KESELAMATAN KERJA / *JOB SAFETY ENVIRONMENT ANALYSIS*

Pekerjaan / *Task*	DA Differential and Bevel Gear	Nomor JSEA / *JSEA Number*		Halaman / *Page*	1	Dari / *Of*	2.

Tanggal Pembuatan JSEA / *Date of JSEA*	12 Januari 2026	Departemen / *Dept*	SERVICE	Tempat Kerja / *Work Location*	WORKSHOP TAB

Disusun Oleh / *Compiled By*	Galen	TTD / Sign		Review Oleh / *Reviewed By*		TTD / *Sign*		Atasan / *Superior*		TTD / *Sign*	

Apakah Anda sudah terlatih untuk melakukan pekerjaan ini ? / *Are you properly trained to complete these task ?* ☑ Ya / *Yes* ☐ Tidak / *No*

Apa yang Anda perlukan untuk memastikan bahwa pekerjaan selesai tanpa adanya kecelakaan kerja ? / *What do you need to ensure this job is completed incident free ?*

Tools yang digunakan sudah sesuai dengan Manual

Siapa yang bertanggung jawab untuk menghentikan pekerjaan jika terjadi perubahan pekerjaan atau gangguan kondisi lingkungan kerja ? / *Who is responsible for Stop Work Authority if change job or workplace distraction could ?*

ABCD-1 (Technician Leader) / Mr. X (Customer)

Apakah Anda memerlukan peralatan LOTO ? / *Are you need LOTO Equipments ?* ☑ Ya / *Yes* ☐ Tidak / *No*

Apakah Anda mengetahui ERP/MERP dari pekerjaan yang sedang dilakukan? ☑ Ya / *Yes* ☐ Tidak / *No* ***Jika tidak, silahkan tambahkan dalam urutan langkah tugas diawal***

Kondisi Lingkungan / *Environmental Conditions*	Cuaca / *Weather*	CERAH	Medan / *Terrain*	RATA

Pengendalian Sumber Bahaya / *Hazardous Energy Control*					
	☐ Listrik / *Electrical*	☑ Gravitasi (Benda jatuh,tertimpa) / *Gravitation (Falling objects, struck down)*	☑ Pneumatik / *Pneumatic*		
	☐ Hidraulik / *Hydraulic*	☑ Mekanis / *Mechanical*	☐ Panas / *Thermal*		

APD yang diperlukan / *Required PPE*					
	☑ Helm / *Safety Helm*	☐ Pelindung Muka / *Face shield*	☑ Kacamata / *Safety Glass*		
	☑ Sarung Tangan / *Hand Gloves*	☐ Pelindung Pernafasan / *Respiratory Protection*	☐ Perlindungan Kejatuhan / *Fall Protection*		
	☑ Sepatu / *Safety Shoes*	☐ Pelindung Telinga / *Hearing Protection*	☐ Lain-Lain / *Other*		

Hal yang perlu dipertimbangan dalam mengidentifikasi bahaya / *These to consider in identify hazards* :

1 **Bahaya Keselamatan** : Kondisi tidak aman yang dapat menyebabkan injury atau kematian seperti terjepit, terpeleset/terjatuh, tertimpa dll.
Safety Hazard : unsafe conditions that can cause injury or even death, such as spill/falls, pinch point, struck by, etc.

2 **Bahaya Fisik** : Listrik, Api/ledakan, Kebisingan, Radiasi, Panas, Tekanan, Terjepit, Tersandung/Terjatuh, Tertimpa, Getaran.
Physical Hazards : Electrical, Fire/Explosion, Noise, Radiations, Thermal, Pressure, Pinch Point, Slips/Falls, Struck by, Vibration.

3 **Bahaya Kimia** : Terhirup, terkena kulit, injeksi, tertelan, terserap.
Chemical Hazards : Inhalation, skin contact, injection, ingestion, absorption.

4 **Bahaya Biologi** : Patogen yang ditularkan melalui darah, jamur, tanaman/serangga/hewan.
Biological Hazards : bloodbone pathogens, mold, Plant/Insect/Animals

5 **Bahaya Ergonomi** : Gerakan berulang-ulang, beban yang berlebihan, Postur Janggal, Durasi kerja, Desain area kerja.
Ergonomic Hazards : Repetitions, Forcefull extention, Awkward Posture, Duration , Work area desain.

6 **Bahaya Organisasi** : stres atau bahaya terkait dengan masalah tempat kerja yang menyebabkan efek jangka panjang atau pendek, beban kerja yang berat dan kekerasan ditempat kerja.
Organizational hazards: stressors or hazards associated with workplace issues that cause long or short term effects heavy workloads, stressful interactions and workplaces violence.

No	Urutan Dasar Langkah Tugas / *Job Steps* (*Maksimum 15 Langkah / *Maximum 15 Steps*)	Bahaya Yang Terkait / *Potential Hazard(s)*	Tindakan Perbaikan / *Recommended Action*
1	Walk Around Inspection	1.1 Tersandung tatakan Differential	1.1.1 Hati-hati saat bekerja
			1.1.2 Gunakan Safety shoes
2.	Prepare tools	2.1 Jari terjepit rak tool box	2.1.1 perhatikan titik potensi jepit
			2.1.2 berhati-hati saat mengambil tool
			2.1.3 Gunakan safety Glove
		2.2 Kaki terjepit roda tool box	2.2.1 hati-hati saat memindahkan tool box
			2.2.2 Gunakan APD yang sesuai.
		2.3 tools berdebu	2.3.1 bersihkan dengan majun.
3.	Doing Disassemble Differential	3.1 jari terjepit komponen	3.1.1 perhatikan potensi titik jepit
			3.1.2 perhatikan kontak fisik terhadap komponen
			3.1.3 Gunakan safety Gloves.
		3.2 Jari tergores komponen	3.2.1 Fokus saat bekerja
			3.2.2 Gunakan safety Gloves
		3.3 tools tergelincir dari tangan	3.3.1 pegang tool dengan erat
			3.3.2 pegang tool dengan kuat
			3.3.3 Gunakan Safety Gloves.
		3.4 tools terkontaminasi	3.4.1 tempatkan tool di tempat bersih
			3.4.2 Bersihkan dengan majun

Trakindo CAT

Nomor Formulir / *Form Number*	SHE.SHE.FRM.005.R03

ANALISIS LINGKUNGAN KESELAMATAN KERJA / JOB SAFETY ENVIRONMENT ANALYSIS

Pekerjaan / *Task*	D4 Differential and bevel Gear	Nomor JSEA / *SEA Number*		Halaman / *Page*	2.	Dari / *Of*	2.

No	Urutan Dasar Langkah Tugas / *Job Steps*	Bahaya Yang Terkait / *Potential Hazard(s)*	Tindakan Perbaikan / *Recommended Action*
4.	Doing assembly Differential	4.1 mata terkena oli	4.1.1 berhati - hati saat melakukan pekerjaan
			4.1.2 gunakan safety glasses.
		4.2 Oli tercecer	4.2.1 bersihkan menggunakan absorbent pad.
		4.3 Bahaya ergonomi	4.3.1. Gunakan metode pengangkatan yang benar
		4.4 tangan terkena oli	4.4.1 perhatikan tangan saat memalu
			4.4.2 Hati - hati saat memalu
			4.4.3 Gunakan safety Glover.
5.	House Kepping.	5.1 tools terkontaminasi	5.1.1 lap dengan white towel
		5.2 tools berantakan	5.2.1 rapikan tools sesuai tempatnya.

Bukti sosialisasi / *Evidence of socialization* :

No	Nama / *Name*	TTD / *Sign*
1	Galen Kapay Rapan	
2	Hamzah - F.	
3	Merryana Aderia. C.	
4		
5		

No	Nama / Name	TTD / Sign

No	Nama / Name	TTD / Sign

Bagian Dari / *Part Of*	SHE.SHE.SOP.003.R04

19/03/2024 **Differential and Bevel Gear (Front and Rear) - Disassemble (M0082513-30)**

SMCS - 3256, 3258

i10135287

Disassembly Procedure

Table 1

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	1U-7502	Repair Stand	1
B	439-3938	Link Bracket As	2
C	456-4371	Lever Hoist	1
D	1P-5546	Crossblock	1
E	6V-3160	Double Acting Cylinder	1
F	1P-0520	Driver Group	1
H	6V-4070	Spanner Wrench	1
J	8B-7551	Bearing Puller	1
K	5F-7343	Bearing Puller Gp	1

Start By:

a. Remove the front or rear differential assembly. Refer to Differential and Bevel Gear (Front and Rear) - Remove and Install.

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

1. Apply location marks on all housings and case assemblies for assembly purposes.

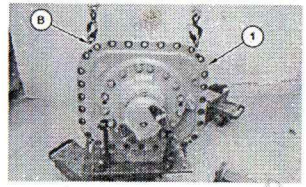

Illustration 1 g03865438

2. Attach Tooling (B) and a suitable lifting device to differential and bevel gear assembly (1). The weight of differential and bevel gear assembly (1) is approximately 322 kg (710 lb).

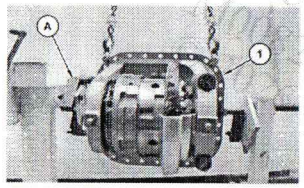

Illustration 2 g03865440

3. Position and place differential and bevel gear assembly (1) onto Tooling (A). Remove Tooling (B) and the suitable lifting device.

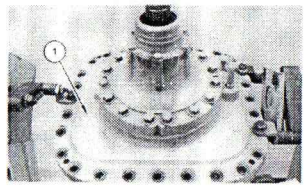

Illustration 3 g03865439

4. Rotate differential and bevel gear assembly (1) by 90 degrees.

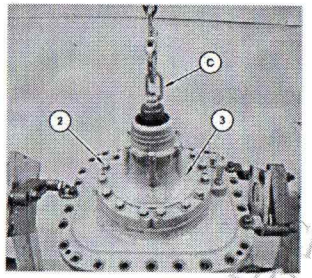

Illustration 4 g03865468

5. Attach Tooling (C) and a suitable lifting device to the yoke. The weight of pinion housing (3) is approximately 75 kg (165 lb). Remove bolts (2).

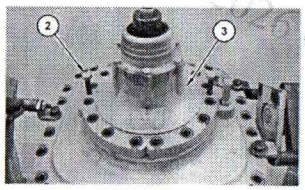

Illustration 5 g03865471

6. Install two bolts (2) in the threaded holes of pinion housing (forcing bolt holes). Tighten two bolts (2) evenly to separate pinion housing (3). Remove pinion housing (3).

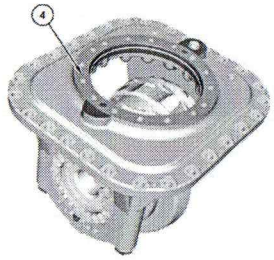

Illustration 6 g03865526

7. Remove shims (4).

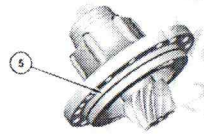

Illustration 7 g03865544

8. Remove O-ring seal (5).

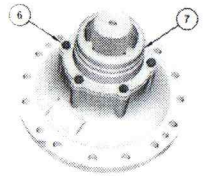

Illustration 8 g03865553

9. Position the pinion housing onto suitable cribbing.

10. Remove bolts (6) and retainer (7).

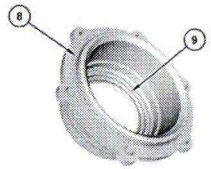

Illustration 9 g03865904

11. Remove O-ring seal (8) and lip seal (9).

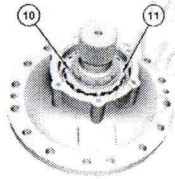

Illustration 10 g03865905

12. Remove retaining ring (10) and locking washer (11).

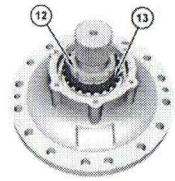

Illustration 11 g03865906

13. Use Tooling (H) (not shown) to remove locknut (12). Remove locknut (12) and notched washer (13).

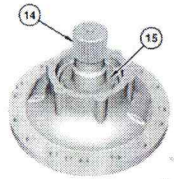

Illustration 12 g03865972

14. Use a suitable press to remove pinion shaft (14) from bearing cone (15).

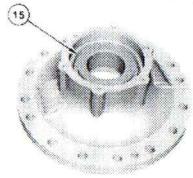

Illustration 13 g03865973

15. Remove bearing cone (15).

Illustration 14 g03865974
Typical Example

16. Use a suitable press and Tooling (J) (not shown) to remove bearing cup (16).

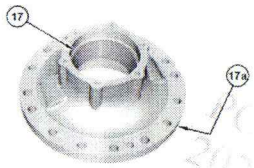

Illustration 15 g03865975

17. Remove bearing cup (17) and bearing cup (17a).

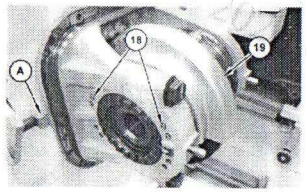

Illustration 16 g03865976

18. Rotate the carrier and differential assembly by 90 degrees on Tooling (A).

19. Remove four bolts (18) and guard (19).

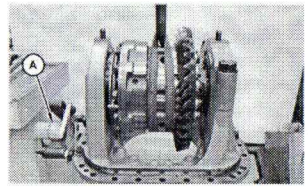

Illustration 17 g03865999

20. Use a suitable lifting device to position the carrier and differential assembly on Tooling (A). The weight of the carrier and differential assembly is approximately 234 kg (516 lb).

21. Rotate the carrier and differential assembly an additional 90 degrees on Tooling (A).

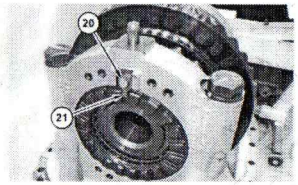

Illustration 18 g03866003

22. Remove bolt (20) and lock (21). Repeat for the opposite side.

24/10/2023 **Differential and Bevel Gear (Front and Rear) - Assemble (M0082513-30)**

SMCS - 3256, 3258 i10016954

Assembly Procedure

Table 1

Required Tools			
Tool	**Part Number**	**Part Description**	**Qty**
A	1U-7502	Repair Stand	1
B	439-3938	Link Bracket As	2
C	456-4371	Lever Hoist	1
D	1P-5546	Crossblock	1
H	6V-4070	Spanner Wrench	1
L	-	Grease	-
M	9S-8864	Plate	1
	5P-8715	Forcing Bolt	1
N	350-7768	Electric Hydraulic Pump Gp ((115 V)	1
	350-7769	Electric Hydraulic Pump Gp (230 V)	1
	478-3993	Torque Wrench	1
P	9U-5017	Torque Wrench	1
R	8T-5096	Tool Group	1

NOTICE

Keep all parts clean from contaminants.

Contaminants may cause rapid wear and shortened component life.

Illustration 1 g03868985

1. Install D-ring seal (27b) and D-ring seal (27c) in clutch piston (27a). Apply a liberal amount of Tooling (L) to D-ring seal (27b) and D-ring seal (27c).

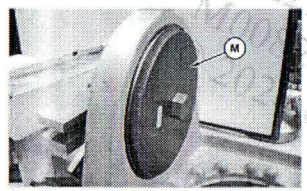

Illustration 2 g03866988

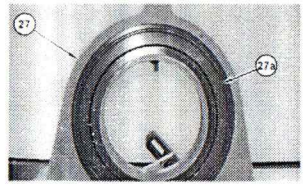

Illustration 3 g03866237

2. Use Tooling (M) to install clutch piston (27a) into carrier assembly (27).

g03866237

Illustration 4 g03866231

3. Install roll pins (47) into bevel gear (48).

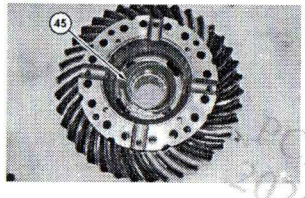

Illustration 5 g03866175

4. Install thrust washer (45).

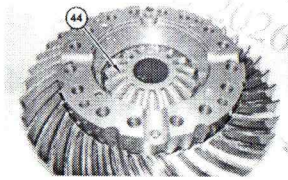

Illustration 6 g03866169

5. Lubricate gear (44) with the lubricant that is being sealed. Install gear (44). Make sure that gear (44) turns freely.

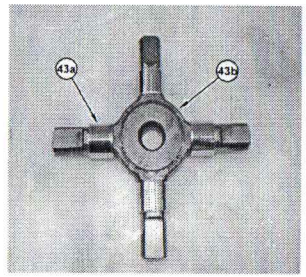

Illustration 7 g03870010

6. Lubricate spider (43b) with the lubricant that is being sealed. Lubricate bearing sleeves (43a) with the lubricant that is being sealed. Install bearing sleeves (43a) on spider (43b).

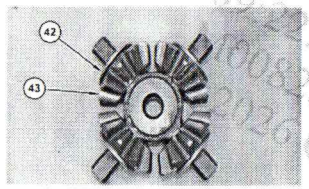

Illustration 8 g03866131

7. Lubricate gears (43) and thrust washers (42) with the lubricant that is being sealed. Install gears (43) and thrust washers (42). Make sure gears (43) turn freely.

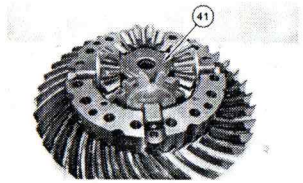

Illustration 9 g03866124

8. Install spider gear assembly (41).

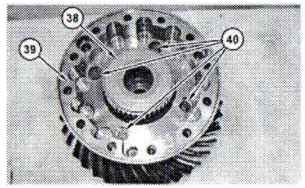

Illustration 10 g03866119

Note: Align the housing to the orientation as marked during the disassembly.

9. Align and install housing (39). Lubricate gear (38) with the lubricate that is being sealed. Install gear (38) and bolts (40). Make sure that gear (38) turns freely.

10. Perform the following procedure to control preload accurately and backlash setting:

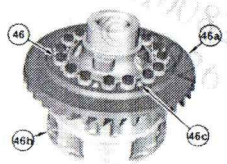

Illustration 11 g03870566

Note: Do not install all bolts (46) until the following procedure is completed.

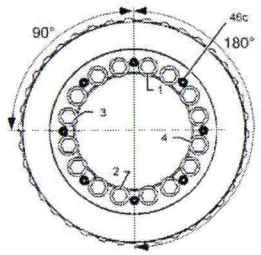

Illustration 12 g03870679

a. Raise bevel gear (46a) to a temperature between 70° C (158° F) and 120° C (248° F). Install bevel gear (46a) to differential case (46b).

b. Install spring pins (46c) to align bevel gear (46a) to differential case (46b).

c. Install four bolts (46) as indicated by callouts (1) through (4) in Illustration 12. To seat bevel gear (46a) to differential case (46b), tighten four bolts (46) in the pattern that is indicated by callouts (1) through (4). Tighten four bolts (46) to a minimum torque of 70 N·m (52 lb ft).

d. Install remaining bolts (46) loosely (a minimum of one to two revolutions).

e. Confirm bevel gear (46a) is seated in differential case (46b).

f. Allow bevel gear (46a) to cool to a temperature of 30° C (86° F) or less.

g. Loosen four initially tightened bolts (46) as indicated in illustration 12.

h. Tighten bolts (46) to a final torque of 95 ± 10 N·m (70 ± 7 lb ft). Turn bolts (46) an additional 180 degrees ± 10 degrees.

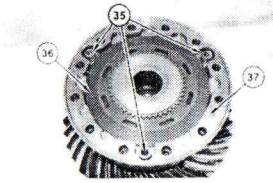

Illustration 13 g03866114

⚠ WARNING

Improper assembly of parts that are spring loaded can cause bodily injury.

To prevent possible injury, follow the established assembly procedure and wear protective equipment.

11. Thoroughly coat eight separator plates (37) and eight friction discs (36) with the lubricant that is being sealed.
12. First install bottom separator plate (37), then install one friction disc (36). Continue in this way until you install the last friction disc (36) at the top.
13. Install springs (35).

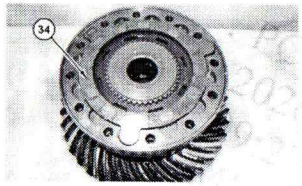

Illustration 14 g03866103

14. Install thrust plate (34).

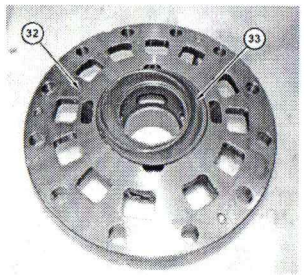

Illustration 15 g06637152

15. Lubricate thrust washer (33) with the lubricant that is being sealed. Install thrust washer (33) on back side of top clutch housing (32).

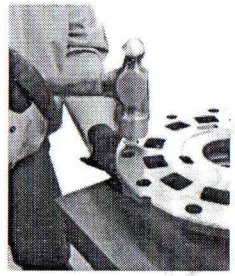

Illustration 16 g06783402

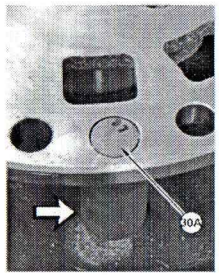

Illustration 17 g06783403

16. Lower the temperature of dowels (30A). Use a suitable hammer to install dowels (30A). Support the housing when installing the dowels.

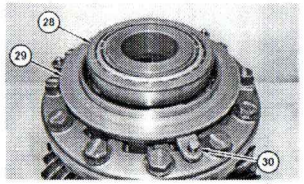

Illustration 18 g06789571

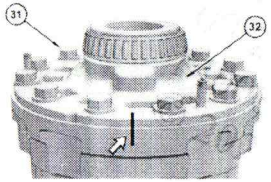

Illustration 19 g06637164

17. Install thrust ring (29).

18. Install O-ring seals (30) and bearing cup (28).

Note: Align the housing to the orientation as marked during the disassembly.

19. Align and install top clutch housing (32).

20. Install bolts (31). Tighten bolts (31) to a torque of 270 ± 40 N·m (200 ± 30 lb ft).

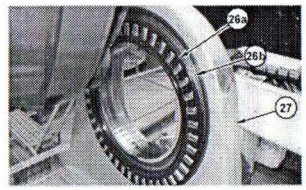

Illustration 20 g03866235

21. Install bearing race (26b). Install bearing (26a) on to carrier assembly (27).

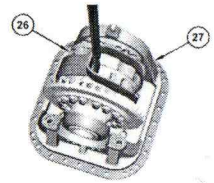

Illustration 21 g03866038

22. Use a suitable lifting device to install differential assembly and bevel gear (26) in to carrier assembly (27). The weight of differential assembly and bevel gear (26) is approximately 115 kg (254 lb).

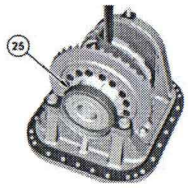

Illustration 22 g03866037

23. Install bearing cup (25).

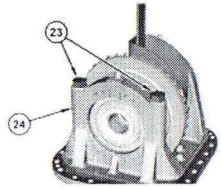

Illustration 23 g03866014

24. Install bearing cap (24). Tighten bolts (23) to a torque of 70 N·m (50 lb ft).

Note: This torque is the initial torque for bolts (23).

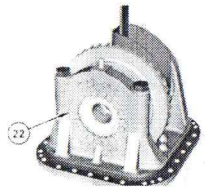

Illustration 24 g03866009

25. Install adjusting ring (22). Repeat for the opposite side. Ensure that adjusting rings (22) turn freely.

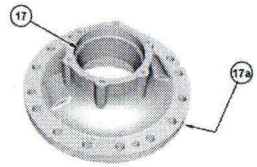

Illustration 25 g03865975

26. Install bearing cup (17) and bearing cup (17a).

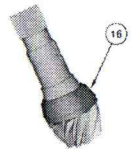

Illustration 26 g03865974

27. Raise the temperature of bearing cone (16). Install bearing cone (16) on pinion shaft (14).

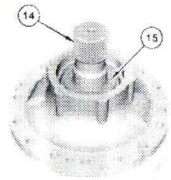

Illustration 27 g03865972

28. Install bearing cone (15). Install pinion shaft (14).

29. Perform the following Steps for setting backlash:

a. Secure the pinion housing in a suitable holding fixture.

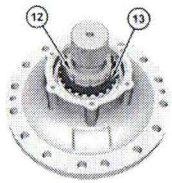

Illustration 28 g03865906

b. Install notched washer (13) and locknut (12). Tighten locknut (12) until you attain a rolling torque of 0.67 to 1.35 N·m (6 to 12 lb in).

Note: Rotation of the pinion is critical to achieve a proper seating of all the components.

c. Rotate the pinion several times to ensure that the bearings are fully seated.

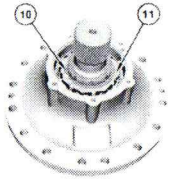

Illustration 29 g03865905

d. Install locking washer (11) so the tabs line up with the notches on the notched washer. Locking washer (11) has eight different positions to align the tabs with the notches in the notched washer. If locking washer (11) does not fully align with the notched washer, position locking washer (11) so that locking washer (11) is very close to fitting into the

notches of the notched washer. Tighten the locknut until locking washer (11) fits into the notches of the notched washer.

e. Measure the rolling torque again to confirm that the rolling torque is still 0.67 to 1.35 N·m (6 to 12 lb in).

f. If the rolling torque is still 0.67 to 1.35 N·m (6 to 12 lb in), then install retaining ring (10) into the groove of the locknut that is closer to the locking washer. Make sure that retaining ring (10) is fully seated in the groove.

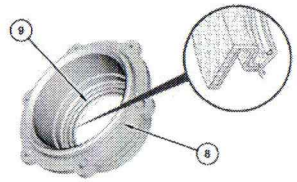

Illustration 30 g06550667

30. Install lip seal (9) with the spring facing up. Lubricate lip seal (9) with the lubricant that is being sealed. Install O-ring seal (8).

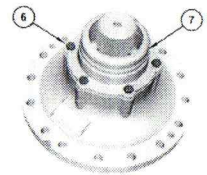

Illustration 31 g03865553

31. Install retainer (7) and bolts (6).

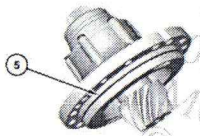

Illustration 32 g03865544

32. Install O-ring seal (5).

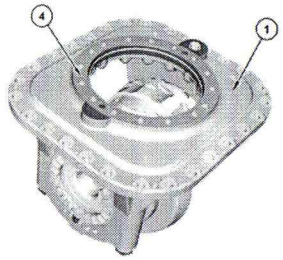

Illustration 33 g03867030

33. Rotate and reposition differential and bevel gear assembly (1) by 90 degrees.

Note: Use the original shims (4) or provide new shims (4) that are the same thickness as the original shims that were removed.

Note: If original shims (4) are not available, then install 80 percent of the new shim pack. In this case, you will be required to adjust the thickness of shims (4) after you determine the tooth contact pattern.

34. Install shims (4) in the differential and bevel gear assembly (1).

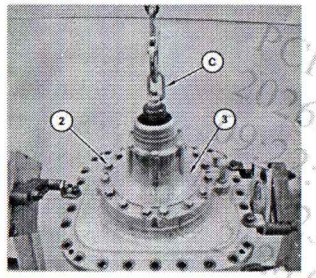

Illustration 34 g03865468

35. Attach suitable Tooling (C) and a suitable lifting device to the yoke. The weight of pinion housing (3) is approximately 75 kg (165 lb).

36. Install pinion housing (3) and bolts (2). Tighten bolts (2) to a torque of 270 ± 40 N·m (199 ± 30 lb ft).

37. Perform the following procedure to set bearing end play and to set backlash of the bevel gear.

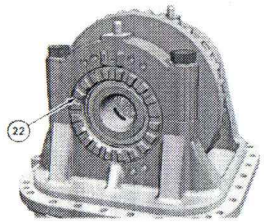

Illustration 35 g06588826

a. The bearing cups have adjusting rings (22). Adjusting rings (22) are used for setting the bearing end play and for setting the back lash of the bevel gear.

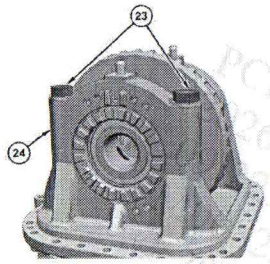

Illustration 36 g06588626

b. Ensure that bolts (23) for bearing caps (24) are tightened to a torque of 70 N·m (50 lb ft).

c. Move both adjusting rings to a position that maintains gear backlash, but not a tight gear mesh. Make sure to maintain a slight bearing end play.

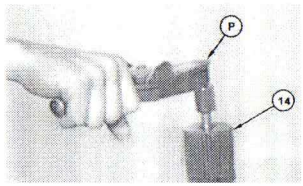

Illustration 37 g03872142

d. Position the differential and bevel gear so that pinion shaft (14) is in a vertical position. Install a suitable bolt in pinion shaft (14). Use Tooling (P) to tighten the bolt until pinion shaft (13) turns.

e. Measure the overall rolling torque of the differential and the pinion shaft. Record that number.

f. Advance the adjusting ring that is next to the bevel gear while you oscillate the bevel gear to a zero backlash position. Then, back off the adjusting ring to the nearest lock position (a maximum of one lug on the adjusting ring).

g. Advance the adjusting ring that is opposite the bevel gear while you rotate the bevel gear set. Monitor the torque that is required to rotate the pinion shaft until a torque is registered over the torque measured in Step 37e .

h. This position is the seated position. Advance the adjusting ring and rotate the bevel gear until the overall rolling torque is 1.20 to 2.48 N·m (11 to 22 lb in) above the rolling torque achieved in Step 29b .

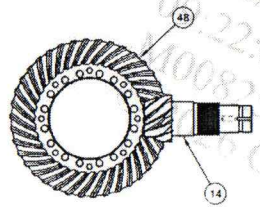

Illustration 38 g03871700

(14) Pinion shaft

i. Measure the backlash in three equally spaced positions around bevel gear (48). If any of the three measurements are not equal to the specified backlash of 0.36 ± 0.12 mm (0.014 ± 0.005 inch), then retract the adjusting rings or advance the adjusting rings equally to preserve the preload. Repeat this Step until the backlash at all three locations is 0.36 ± 0.12 mm (0.014 ± 0.005 inch).

j. Check the tooth contact between the pinion shaft and the bevel gear.

Note: Tip for checking backlash is to hold pinion still while moving gear.

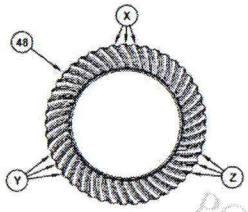

Illustration 39 g03871429

(48) Bevel gear

k. To check the tooth contact between pinion shaft (14) and bevel gear (48), coat bevel gear (48) with a suitable rouge compound in three locations that are 120 degrees apart, as indicated by Locations (X) (Y), and (Z).

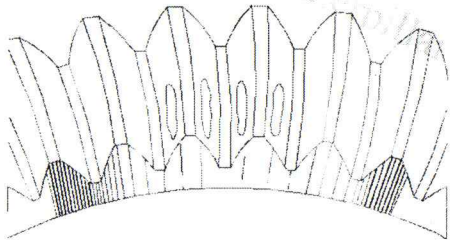

Illustration 40 g02659550

Acceptable tooth contact pattern

l. Rotate the pinion shaft in both directions. The acceptable bevel gear contact pattern percentages are 60 percent from heel for convex, and 55 percent from heel for concave. Refer to Illustration 40.

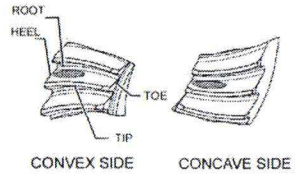

Illustration 41 g03871720

Unacceptable tooth contact pattern

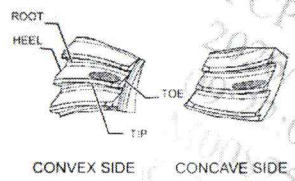

Illustration 42 g03871722

Unacceptable tooth contact pattern

m. Inspect the tooth contact pattern. If the tooth contact pattern appears like the tooth contact pattern in Illustration 41 , then some shims will need to be added and the tooth contact pattern will need to be rechecked. If the tooth contact pattern appears like the tooth contact pattern in Illustration 42 , then some shims will need to be removed.

Note: If the shims are adjusted, repeat Step 33 through Step 37m .

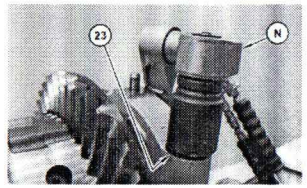

Illustration 43 g03869469

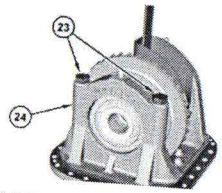

Illustration 44 g03866014

38. Use Tooling (N) to tighten bolts (23) to a torque of 1800 ± 200 N·m (1328 ± 148 lb ft).

Note: After final torque of bolts (23), re-check the gear backlash. Final torque may reduce backlash and take the backlash out of spec.

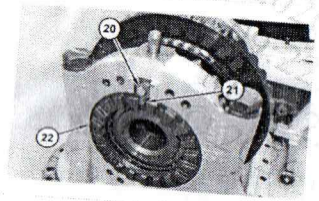

Illustration 45 g03870871

39. Install lock (21) and bolt (20) that secure locking ring (22). Repeat for the other side.

40. The rolling torque for the complete system should not exceed 4 N·m (35 lb in).

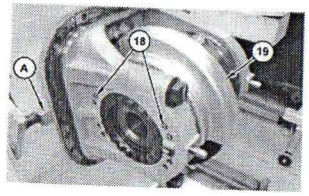

Illustration 46 g03865976
Illustration used for bolt locations.

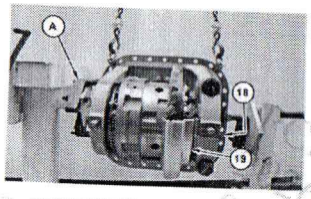

Illustration 47 g07615705

41. Rotate the carrier and differential assembly by 90 degrees on Tooling (A).

42. Install guard (19) and four bolts (18) as shown in Illustration 47 .

End By:

a. Install the front or rear differential and bevel gear. Refer to Differential and Bevel Gear - Remove and Install

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