# Demonstrate Carrying Out Jacking, Blocking and Lifting of Heavy Equipment and Components Safely

**Skill Number CO-OP15GN108**

**Full Name:** Hamzah fathurrahman **SN/SAP ID:** _____

**Job Title:** _____ **Branch/Area:** SMKN 1 Sungai Cari

**PERFORMANCE TASK:**

Given a large machine component, the necessary lifting equipment and lifting chains/slings, the student is to lift and move the component from one location to another. The component is to be correctly supported once placed on the ground or workbench. The component is to be supported in a manner that will enable service work to be carried out.

The student must be able to:

- Selecting tools used and identify SWL correctly
- Jack and block Heavy Equipment correctly and safely
- Lift and support engine or machine component correctly
- Follow service procedure on Service Manual correctly
- Follow standard safety & contamination control procedure related to the job
- Perform communication & etiquette manner

Students are to be given a copy of TCL005 Practical Activity 2 – Student Performance sheet and fill out appropriate areas. It is recommended that Facilitators put questions to students regarding the findings of their inspections and subsequent report. The student will also be required to complete relevant workplace documentation and is to observe the correct safety procedures at all times

Safety and Contamination Control must be applied to this process at all times.

| Prerequisite | Yes | No | N/A | Hints |
|---|---|---|---|---|
| The Student must complete the knowledge assessment. Minimum passing grade 80%. | ✓ | | | Score jacking, blocking, and lifting course or subject. |







| Tasks | Completed Yes | No | N/A | Observation |
|---|---|---|---|---|
| **Preparation** | | | | |
| Prepare related literature<br>Work instructions are used to determine job requirements, including method, process and equipment | ✓ | | | *Practical Activity 1* |
| Job specifications are read and interpreted. Information is accessed from manufacturer/ component supplier specifications and correctly incorporated. | ✓ | | | *Observe if candida to Manufacturer's and/ or service inte* |
| Information is accessed from manufacturer/ component supplier specifications and correctly incorporated | ✓ | | | *Observe if candida to and observing M specifications an intervals* |
| Prepare required equipment | ✓ | | | |
| Prepare related tools<br>Materials, components, equipment and tooling are identified and checked for safe and effective operation | ✓ | | | *Refer to MOD re Material, compon and equipment work are identified, prepared in accord procedures* |
| Prepare Safety & Contamination Control equipment | ✓ | | | |

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

| Tasks | Completed | | | Observation / Hints |
|---|---|---|---|---|
| | Yes | No | N/A | |
| **Visual Check** | | | | |
| Pre-inspection procedures | ✓ | | | *Location of site to move component, personnel in the area, support material available at site* |
| Crane/Lifting apparatus inspection | ✓ | | | *Inspection of crane or lifting apparatus* |
| Lifting equipment | ✓ | | | *Inspection of chains/slings or other lifting apparatus.* |
| Support materials | ✓ | | | *Serviceable and will complete the task safely.* |

| Tasks | Completed | | | Observation / Hints |
|---|---|---|---|---|
| | Yes | No | N/A | |
| **Visual Check** | | | | |
| Site location selected | ✓ | | | Safe and secure area, will not affect other<br>Personnel |
| Supports in place | ✓ | | | Tail rope, if required |
| **Jacking and Blocking** | | | | |
| Jacking procedures | ✓ | | | *Type of load, center of gravity, jacking points, SWL equipment and jacking tool, area ideal for jacking procedure.* |
| Jack conducted | ✓ | | | *Jack in correct position* |
| Blocking procedure | ✓ | | | *Type of blocking that use, SWL, Blocking points.* |
| Blocking conducted | ✓ | | | *Lowered correctly, supports in place, load secured and not moving once placed on ground or bench, jacking tool removed and moved out of the way* |
| Blocking allows for service work to be conducted | ✓ | | | *Job supported to allow work to be conducted.* |
| **Lifting** | | | | |
| Hook up procedures | ✓ | | | *Check as per 10 steps of safe lifting in Student/Facilitator Guide, type of load, center of gravity, hook up points, hook up* |







| | | | | |
|---|---|---|---|---|
| | | | | *points checked, hooks, hook-up secu* |
| Lift conducted | ✓ | | | *Checked security points, load lifted sli center of gravity, twisted, kinked, bind and not jerky, lift stra down - no angle on* |
| Load moved to chosen site | ✓ | | | *Minimum distance of to complete ta personnel considere of the load controlled* |
| Load lowered and supported | ✓ | | | *Lowered correctly, place, load secure moving once placed or bench, lifting tack and moved out of the* |
| Support allows for service work to be conducted | ✓ | | | *Job supported to al be conducted.*<br>*Use of Tools and Eq* |

| Tasks | Completed | | | Observation / |
|---|---|---|---|---|
| | Yes | No | N/A | |
| **Use of Tools and Equipment** | | | | |
| Tests and adjustments carried out according to manufacturer's specifications and procedures | ✓ | | | |
| Service is completed without damage to equipment and tools | ✓ | | | *Tooling is che serviceability and found unserviceable* |
| Equipment and tooling is cleaned and returned to its correct location | ✓ | | | *Unserviceable equip tooling is tagged identified in accor workshop requireme* |
| Work area left clean and tidy | ✓ | | | |

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

| Tasks | Completed | | Observation / Hints |
|---|---|---|---|
| | Yes | No | |
| **Safety** | | | |
| Using PPE related to the job | ✓ | | |
| Follows relevant Workplace Safety Guidelines (LOTO, Safety Equipment) | ✓ | | • Comply with safety regulation that applied on the workplace |
| State and follow Safety Precautions | ✓ | | • Create Job Safety Analysis<br>• Student must follow safety procedure refer to service manual or SIS related to job |
| Student completes job without accident due to incorrect procedure using hand tools. | ✓ | | • Correct working position<br>• Correct hand tool related to the job |
| Tasks completed without damage equipment and tools | ✓ | | |







| Tasks | Completed | | Observation / Hint |
|---|---|---|---|
| | Yes | No | |
| **Contamination Control** | | | |
| Environmental Practices & Housekeeping | ✓ | | 1. *Waste is minimized, waste including sludge; solids an wastes are sorted and stor recycling or disposal*<br>2. *Packaging of goods receiv and reused or disposed of*<br>3. *Materials that can be reuse cleaned and stored*<br>4. *Waste and scrap is remove workplace procedures*<br>5. *All fluids are disposed of in with enterprise policies and* |

| Tasks | Completed | | | Observation |
|---|---|---|---|---|
| | Yes | No | N/A | |
| **Perform etiquette/manner after completing the job** | | | | |
| Perform etiquette/manner when closing the communication. | ✓ | | | • Perform smile & g<br>• Ask permission to the interaction. |

**General Comments**

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

| | Name | Date | Signature |
|---|---|---|---|
| **Serviceman:** | Hamzah Fatharrahman | 27 Januari 2026 | |
| **Assessor:** | Setiawan TO | 28/1/2026 | |
| **Supervisor:** | | | |
| **Data Recorded:** | | | |

# Demonstrate Carrying Out Jacking, Blocking and Lifting of Heavy Equipment and Components Safely

**Skill Number CO-OP15GN108**

**Full Name:** Hamzah Fatharahman **SN/SAP ID:** _____

**Job Title:** _____ **Branch/Area:** SMKN 1 Singosari

**PERFORMANCE TASK:**

Given a large machine component, the necessary lifting equipment and lifting chains/slings, the student is to lift and move the component from one location to another. The component is to be correctly supported once placed on the ground or workbench. The component is to be supported in a manner that will enable service work to be carried out.

The student must be able to:

- Selecting tools used and identify SWL correctly
- Jack and block Heavy Equipment correctly and safely
- Lift and support engine or machine component correctly
- Follow service procedure on Service Manual correctly
- Follow standard safety & contamination control procedure related to the job
- Perform communication & etiquette manner

Students are to be given a copy of TCL005 Practical Activity 2 – Student Performance sheet and fill out appropriate areas. It is recommended that Facilitators put questions to students regarding the findings of their inspections and subsequent report. The student will also be required to complete relevant workplace documentation and is to observe the correct safety procedures at all times

Safety and Contamination Control must be applied to this process at all times.

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







| Tasks | Completed Yes | No | N/A | Observation |
|---|---|---|---|---|
| **Preparation** | | | | |
| Prepare related literature<br>Work instructions are used to determine job requirements, including method, process and equipment<br>Job specifications are read and interpreted. Information is accessed from manufacturer/ component supplier specifications and correctly incorporated.<br>Information is accessed from manufacturer/ component supplier specifications and correctly incorporated | ✓ | | | |
| Prepare required equipment | ✓ | | | |
| Prepare related tools<br>Materials, components, equipment and tooling are identified and checked for safe and effective operation | ✓ | | | |
| Prepare Safety & Contamination Control equipment | ✓ | | | |

| Tasks | Completed Yes | No | N/A | Observation |
|---|---|---|---|---|
| **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 / Hints |
|---|---|---|---|---|
| | Yes | No | N/A | |
| **Visual Check** | | | | |
| Pre-inspection procedures | ✓ | | | |
| Crane/Lifting apparatus inspection | ✓ | | | |
| Lifting equipment | ✓ | | | |
| Support materials | ✓ | | | |

| Tasks | Completed | | | Observation / Hints |
|---|---|---|---|---|
| | Yes | No | N/A | |
| **Visual Check** | | | | |
| Site location selected | ✓ | | | |
| Supports in place | ✓ | | | |
| **Jacking and Blocking** | | | | |
| Jacking procedures | ✓ | | | |
| Jack conducted | ✓ | | | |
| Blocking procedure | ✓ | | | |
| Blocking conducted | ✓ | | | |
| Blocking allows for service work to be conducted | ✓ | | | |
| **Lifting** | | | | |
| Hook up procedures | ✓ | | | |
| Lift conducted | ✓ | | | |
| Load moved to chosen site | ✓ | | | |
| Load lowered and supported | ✓ | | | |
| Support allows for service work to be conducted | ✓ | | | |







| Tasks | Completed | | | Observation / |
|---|---|---|---|---|
| | Yes | No | N/A | |
| **Use of Tools and Equipment** | | | | |
| Tests and adjustments carried out according to manufacturer's specifications and procedures | ✓ | | | |
| Service is completed without damage to equipment and tools | ✓ | | | |
| Equipment and tooling is cleaned and returned to its correct location | ✓ | | | |
| Work area left clean and tidy | ✓ | | | |

| 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 PPE related to the job | ✓ | | |
| Follows relevant Workplace Safety Guidelines (LOTO, Safety Equipment) | ✓ | | |
| State and follow Safety Precautions | ✓ | | |
| Student 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

| | | | |
|---|---|---|---|
| **Serviceman:** | Hanreah Fathurrahman | 27 Januari 2026 | |
| | Name | Date | Signature |
| **Assessor:** | Sefiawan TD | 26/1/2026 | |
| | Name | Date | Signature |
| **Supervisor:** | | | |
| | Name | Date | Signature |
| **Data Recorded:** | | | |
| | Name | Date | Signature |

**Trakindo** CAT

| Nomor Formulir / *Form Number* | SHE.SHE.FRM.005.R04 |
|---|---|

## ANALISIS LINGKUNGAN KESELAMATAN KERJA / *JOB SAFETY ENVIRONMENT ANALYSIS*

| Pekerjaan / *Task* | Lifting Differential | 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* | Hamzah | 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* | Berawan | 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 arround inspection | 1.1. Tersandung ketarikan differential | 1.1.1 Hati-hati saat bekerja. |
| | | | 1.1.2. Gunakan Safety Shoes |
| 2 | Prepare tool | 2.1 Tertimpa Pallet | 2.1.1 Hati hati saat memindahkan pallet |
| | | | 2.1.2 Gunakan APD sesuai |
| 3 | Doing Lifting differential | 3.1 Terjepit komponen | 3.1.1 Hindari titik jepit |
| | | | 3.1.2 Berhati-hati saat periksa kerusakan. |
| | | 3.2. Menabrak kiang crane | 3.2.1 fokus saat bekerja. |
| | | 3.3 tertimpa komponen | 3.3.1 pastikan COG |
| | | | 3.3.2 Gunakan APD yang sesuai |
| | | 3.4. Terkantur Crane | 3.4.1 Jaga jarak aman dengan crane |
| | | | 3.4.2 Gunakan APD yang sesuai |
| | | 3.5 tangan terjepit peralatan lifting | 3.5.1 Perhatikan titik jepit |
| | | | 3.5.2. Perhatikan kontak jari |
| | | | 3.5.3 Gunakan Safety gloves |
| | | 3.6 Sling tergelincir | 3.6.1. Pastikan ring terpasang dengan benar |
| | | | 3.6.2 Gunakan pengikatan yang benar. |
| | | | 3.6.3 pastikan sling dengan posisi yang benar |
| | | | 3.6.4. Berhati. hati saat bekerja. |

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

**Trakindo** CAT

| Nomor Formulir *Form Number* | SHE.SHE.FRM.005.R03 |
|---|---|

## ANALISIS LINGKUNGAN KESELAMATAN KERJA / JOB SAFETY ENVIRONMENT ANALYSIS

| Pekerjaan *Task* | Lifting Differential a | Nomor JSEA *JSEA 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 | House keeping | 4.1.1 lifting tool bercecaran | 4.1.1 Simpan tool dengan benar |
| | | | 4.1.2. Rapikan tool saat tidak digunakan |
| | | 4.2. lifting tool terkontaminasi. | 4.2.1. Simpan di area bersih dan kering |
| | | | 4.2.2 Bersihkan tool sebelum di simpan |

Bukti sosialisasi / *Evidence of socialization* :

| No | Nama / *Name* | TTD / *Sign* |
|---|---|---|
| 1 | Hamzah Fathurrahman | |
| 2 | Galer rafay R | |
| 3 | Hefriyana Adena C | |
| 4 | | |
| 5 | | |

| No | Nama / Name | TTD / Sign |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

| No | Nama / Name | TTD / Sign |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

03/19/2024 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.





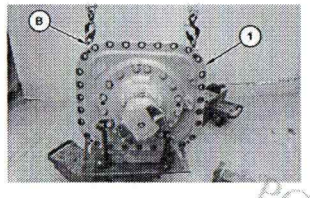


Illustration 1 g03865438

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).

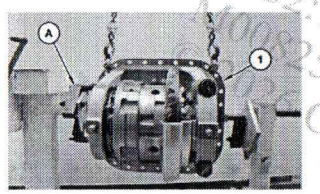


Illustration 2 g03865440

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

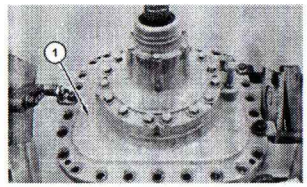


Illustration 3 g03865449

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

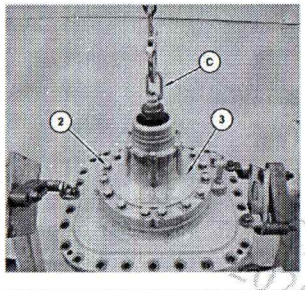


Illustration 4 g03865466

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).

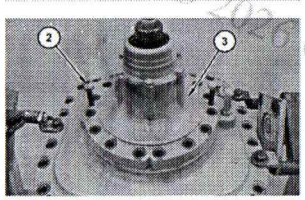


Illustration 5 g03865471

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).







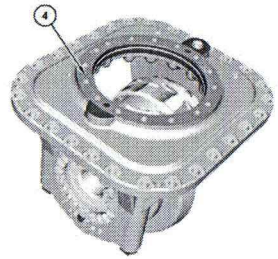


Illustration 6 g03865526

7. Remove shims (4).


Illustration 7 g03865544

8. Remove O-ring seal (5).

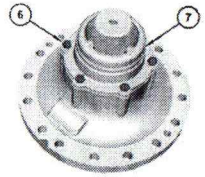

Illustration 8 g03865553

9. Position the pinion housing onto suitable cribbing.

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

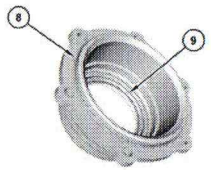


Illustration 9 g03865904

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

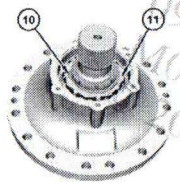


Illustration 10 g03865905

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







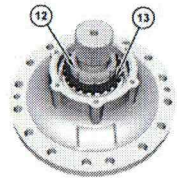


Illustration 11 g03865906

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

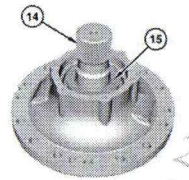


Illustration 12 g03865972

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

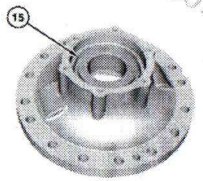


Illustration 13 g03865973

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).

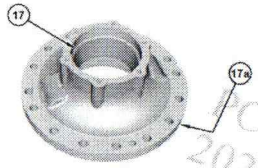


Illustration 15 g03865975

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

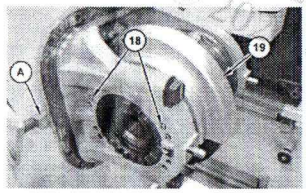


Illustration 16 g03865976





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

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

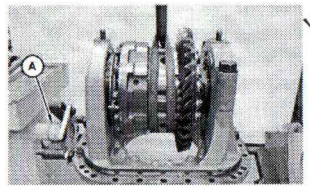


Illustration 17 g03865999

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).

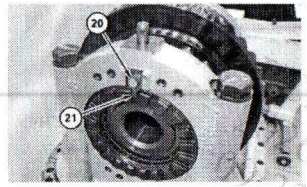


Illustration 18 g03866003

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

letode Choke Hitch

digunakan:

1,6 ton

il di forklift D30
di tempat yang aman, kemudian
Chock wheel agar machine tidak
mundur, kemudian angkat dengan jack stand di area yang aman serta
dah terangkat pasang wheel stand untuk menahan dan mengangkat

ain oli pada forklift D30
di tempat yang amat, dan posisikan gigi pada gear N (netral)
anjal, roda dengan Chock wheel agar machine tidak bergerak maju/mundur
kat dengan jack stand di area yang aman serta rata
terangkat pasang wheel stand untuk menahan dan mengangkat machine.
k oli di bawah drain port
drain port
oli sudah keluar semua, pasang kembali penutup drain port

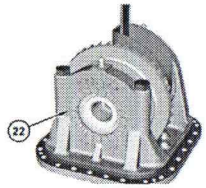


Illustration 19 g03866009

Do not remove suitable lifting device from the carrier and differential assembly.

23. Remove adjusting ring (22). Repeat for the opposite side.

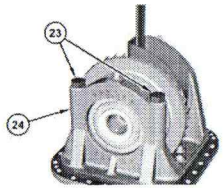


Illustration 20 g03866014

24. Remove bolts (23) and bearing cap (24).

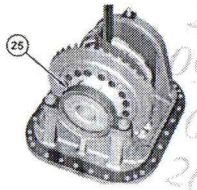


Illustration 21 g03866037

25. Remove bearing cup (25).







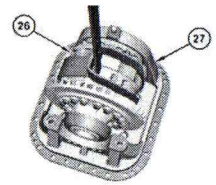


Illustration 22 g03866038

26. Use the suitable lifting device to remove differential assembly and bevel gear (26) from carrier assembly (27). The weight of differential assembly and bevel gear (26) is approximately 115 kg (254 lb).

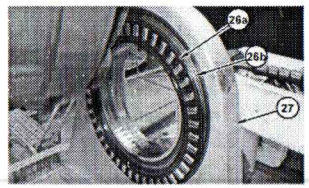


Illustration 23 g03866235

27. Remove bearing (26a) from carrier assembly (27). Remove bearing race (26b).

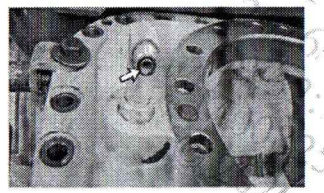

Illustration 24 g03866236

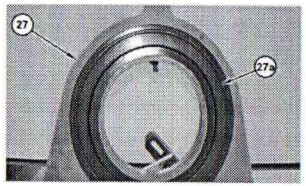


Illustration 25 g03866237

**⚠ WARNING**

**Personal injury can result from air pressure against the piston.**

**The piston can come out of the housing assembly with force when air pressure is applied.**

**To prevent possible personal injury, the piston must be retained in the housing assembly when applying air pressure.**

28. Apply air pressure to remove clutch piston (27a) from carrier assembly (27). Remove clutch piston (27a).

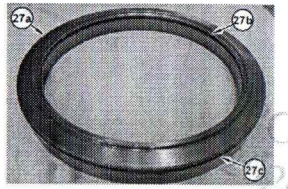


Illustration 26 g03868985

29. Remove D-ring seal (27b) and D-ring seal (27c) from clutch piston (27a).





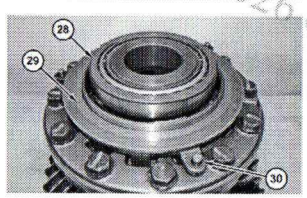


Illustration 27 g06636611

30. Position the differential assembly and bevel gear on suitable cribbing (not shown).

31. Remove bearing cup (28) and O-ring seals (30).

32. Remove thrust ring (29).

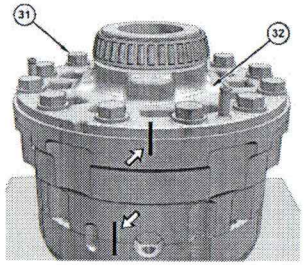


Illustration 28 g06637042

Typical Example

**Note:** Mark the orientation of the housing joints prior to disassembly for the assembly purposes.

33. Remove bolts (31) and top clutch housing (32).

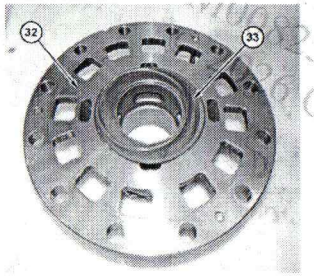


Illustration 29 g06637152

34. Remove thrust washer (33) form back side of top clutch housing (32).

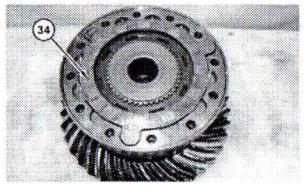


Illustration 30 g03866103

35. Remove thrust plate (34).

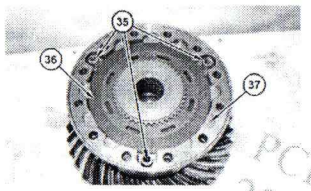






Illustration 31 g03866114

36. Remove springs (35), eight friction discs (36), and eight separator plates (37).

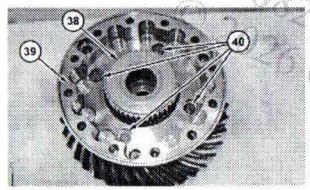


Illustration 32 g03866119

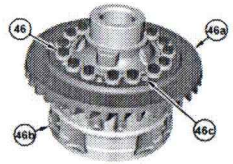


Illustration 33 g03870565

37. Remove gear (38) and bolts (40).

38. Remove spring pins (46c). Remove bolts (46). Remove bevel gear (46a) from differential housing (46b) and separate housing (39).

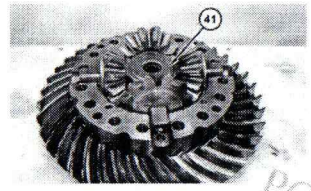

Illustration 34 g03866124

39. Remove spider gear assembly (41).

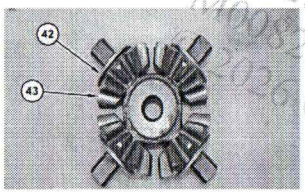


Illustration 35 g03866131

40. Remove thrust washers (42) and gears (43).

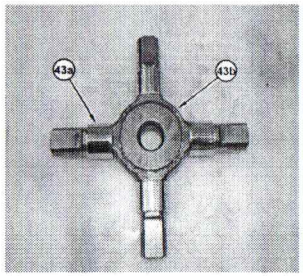


Illustration 36 g03870010

41. Remove gear sleeves (43a) from spider (43b).







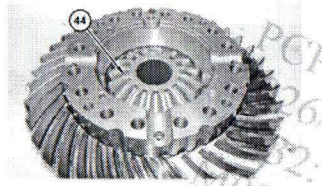


Illustration 37 g03866169

42. Remove gear (44).

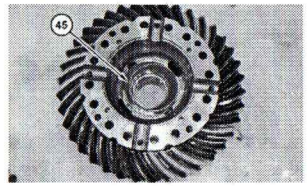


Illustration 38 g03866175

43. Remove thrust washer (45).

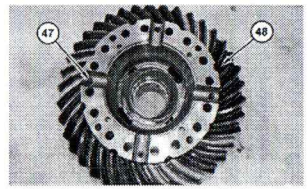


Illustration 39 g03866231

44. Remove roll pins (47) and bevel gear (48).

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i06233843

10/24/2023 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).

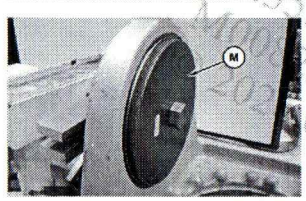


Illustration 2 g03866988

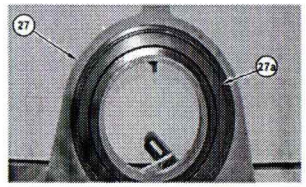


Illustration 3 g03866237

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

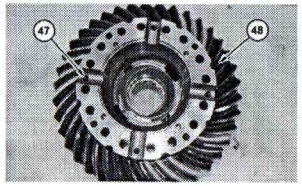


Illustration 4 g03866231

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

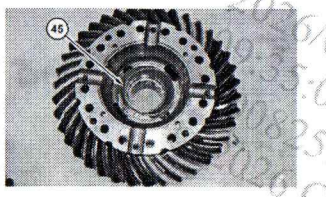


Illustration 5 g03866175

4. Install thrust washer (45).

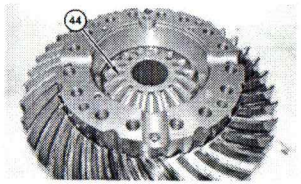


Illustration 6 g03866169

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







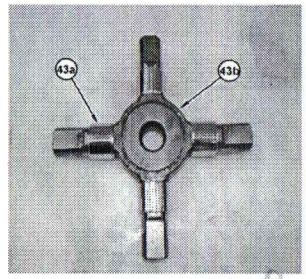


Illustration 7 g03870010

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).

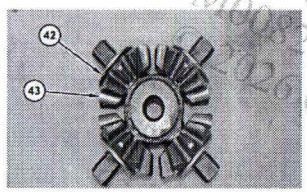


Illustration 8 g03866131

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.

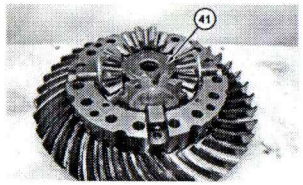


Illustration 9 g03866124

8. Install spider gear assembly (41).

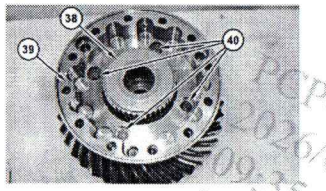


Illustration 10 g03866119

**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:

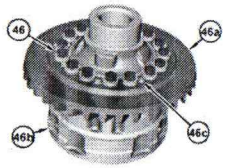


Illustration 11 g03870565







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

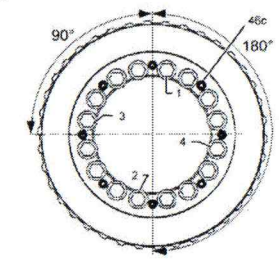


Illustration 12 g03870679

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.

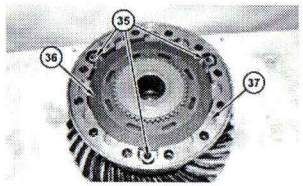


Illustration 13 g03666114

**⚠ 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).

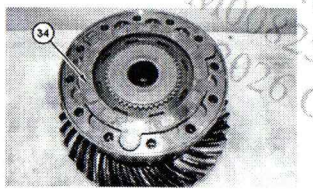


Illustration 14 g03866103

14. Install thrust plate (34).





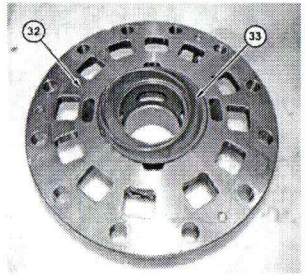


Illustration 15 g06637152

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

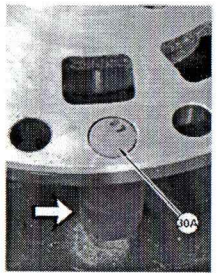


Illustration 17 g06783403

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

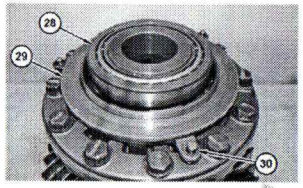


Illustration 18 g06789571

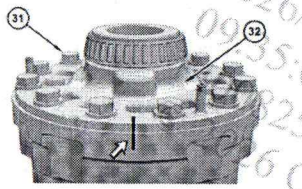


Illustration 19 g06637164







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).

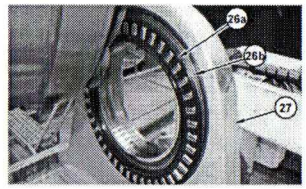


Illustration 20 g03866235

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

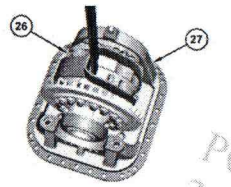


Illustration 21 g03866038

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).

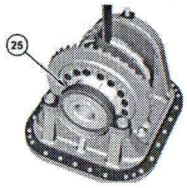


Illustration 22 g03866037

23. Install bearing cup (25).

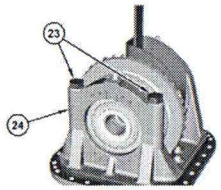


Illustration 23 g03866014

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).

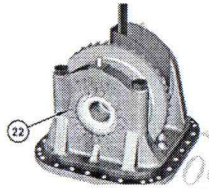


Illustration 24 g03866009







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

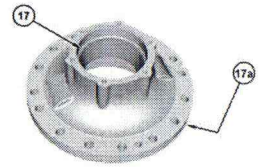


Illustration 25 g03865975

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

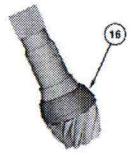


Illustration 26 g03865974

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

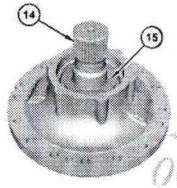

Illustration 27 g03865972

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.

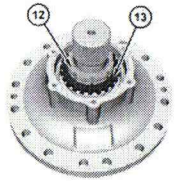


Illustration 28 g03865906

    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.

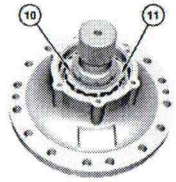


Illustration 29 g03865905

    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).

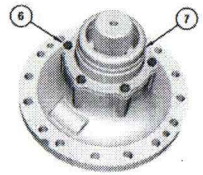


Illustration 31 g03865553

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

Illustration 32 g03865544

32. Install O-ring seal (5).

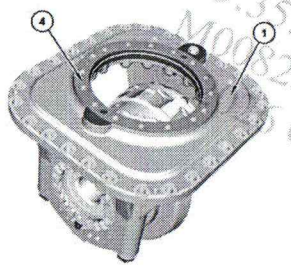


Illustration 33 g03867030

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).







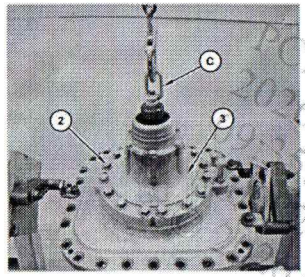


Illustration 34 g03865468

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.

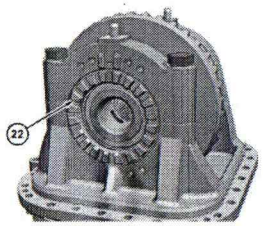


Illustration 35 g06588820

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.

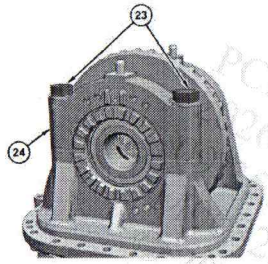


Illustration 36 g06588826

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.

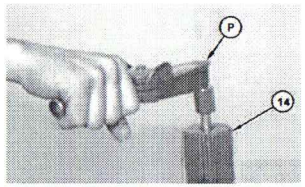


Illustration 37 g03872142

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 .

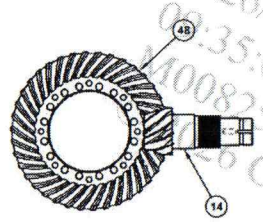


Illustration 38 g03871700

(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.

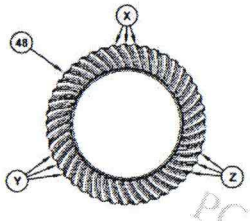


Illustration 39 g03871429

(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).

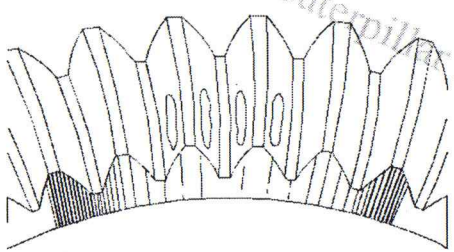

Illustration 40 g02659550

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 .





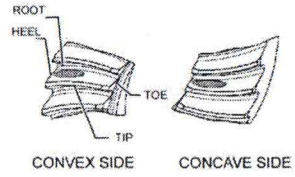


Illustration 41 g03871720

Unacceptable tooth contact pattern

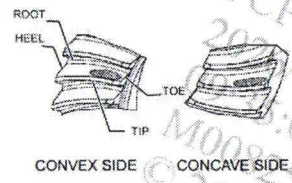


Illustration 42 g03871722

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 .

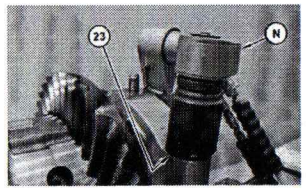

Illustration 43 g03869469

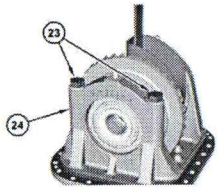


Illustration 44 g03866014

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.

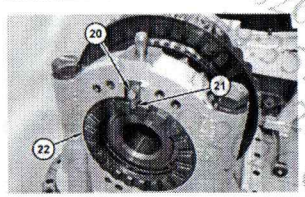


Illustration 45 g03870871

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).





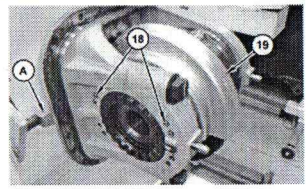


Illustration 46 g03865976

Illustration used for bolt locations.

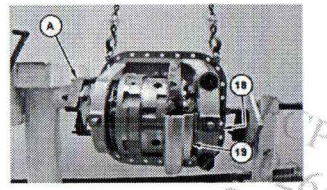


Illustration 47 g07615705

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 (Front and Rear) - Remove and Install .

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