SHORT COURSE
For
Papua New Guinea Non-Formal Sector
MOTOR VEHICLE MECHANIC

BRAKE REMOVAL AND INSTALLATION
Practical Guide to Brake Hoses & Lines Repair

RATIONALE

This short course was developed as a resource material for trainer in the non-formal sector to train men, women and youth in the communities of Papua New Guinea. The course developed is demand oriented and aims to provide opportunities for participants to acquire relevant knowledge and skills in brake hoses and lines removal, installation and service. This module covers the practical skills and procedure of brake hoses and lines removal, installation and service. The course is part of a bridging program between the non formal and formal sector to fill up the gap and creates linkages in to motor mechanic tradesman skills, and to provide lower income earners to save cost be able to fix the brake hoses and lines and perform to a skill level where they will do it themselves in repair and maintenance of the brake system.

The trainee will be specialized skilled and while he/she does at home brake system work the benefit comes from labour charge to make money for a living or opportunity into starting a small scale repair shop.

The development of this short course was sponsored by the ADB-PNG EMPLOYMENT ORIENTED SKILLS DEVELOPMENT PROJECT (EOSDP) and produced by curriculum officers at the SKILLS TRAINING RESOURCES UNIT (STRU)
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A practical guide to brake hoses and lines

Program: MOTOR VEHICLE MECHANIC
Course: BRAKE REMOVAL AND INSTALLATION
Module Code: T017v
Module Name: Practical guide to Brake hose and lines

Module 1: Brake system basic
Operating principles

Module 2: Brake light switch

Module 3: Master cylinder

Module 4: Power Booster

Module 5: Brake hoses and lines

Module 6: Bleeding the brake system
# COMPETENCY PROFILE: Brake hoses and lines

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<tr>
<th>Duties/Area of Responsibility</th>
<th>Task/Competencies</th>
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<tr>
<td><strong>A. Brake system basic operating principles</strong></td>
<td><strong>A1. Basic operating principles of the brake system</strong>&lt;br&gt;2 hours&lt;br&gt;&lt;br&gt;<strong>A2. Identify and explain the function of the disc brake system</strong>&lt;br&gt;2 hours&lt;br&gt;&lt;br&gt;<strong>A3. Identify and explain the function of the drum brakes system</strong>&lt;br&gt;2 hour</td>
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<tr>
<td><strong>B. Brake light switch</strong></td>
<td><strong>B1. Identify components of the brake light switch</strong>&lt;br&gt;2 hours&lt;br&gt;&lt;br&gt;<strong>B2. Remove the brake light switch</strong>&lt;br&gt;3 hours&lt;br&gt;&lt;br&gt;<strong>B3. Installation the brake light switch</strong>&lt;br&gt;3 hours</td>
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<tr>
<td><strong>C. Master cylinder</strong></td>
<td><strong>C1. Identify and name components of master cylinder</strong>&lt;br&gt;2 hours&lt;br&gt;&lt;br&gt;<strong>C2. Remove the master cylinder</strong>&lt;br&gt;3 hours&lt;br&gt;&lt;br&gt;<strong>C3. Install the master cylinder</strong>&lt;br&gt;3 hours</td>
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<tr>
<td><strong>D. Power booster</strong></td>
<td><strong>D1. Identify and name the components of power booster</strong>&lt;br&gt;3 hours&lt;br&gt;&lt;br&gt;<strong>D2. Removal of power booster</strong>&lt;br&gt;3 hours&lt;br&gt;&lt;br&gt;<strong>D3. Installation of power booster</strong>&lt;br&gt;3 hours</td>
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<tr>
<td><strong>E. Brake hoses and lines</strong></td>
<td><strong>E1. Brake hoses and lines inspection information</strong>&lt;br&gt;2 hours&lt;br&gt;&lt;br&gt;<strong>E2. Removal of hoses and lines</strong>&lt;br&gt;3 hours&lt;br&gt;&lt;br&gt;<strong>E3. Installation of hoses and lines</strong>&lt;br&gt;3 hours</td>
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<td><strong>F. Bleeding the brake</strong></td>
<td><strong>F1. Demonstrate procedure of bleeding brake</strong>&lt;br&gt;4 hours&lt;br&gt;&lt;br&gt;<strong>F2. Explain procedure of bleeding brake</strong>&lt;br&gt;2 hours</td>
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</table>
Program: MOTOR VEHICLE MECHANIC
Course: BRAKE REMOVAL AND INSTALLATION
Module code: T017v
Module name: A Practical guide to brake hoses and Lines
Duration: 12 Hour Course/2 Hour Theory Test/3 Hour Practical Test
Purpose: After successful completion of this module participant should be able to identify and explain the functions and types of lines, identify and perform task safely and demonstrate removal and installation procedure.
Content:
E1. Identify types of hoses and lines
   • Identify types and uses of hoses and lines
   • Follow and demonstrate safety procedure of hoses and lines maintenance
E2. Remove the hoses and lines
   • Identify procedures of removing the hoses and lines
   • Locate each line and hose assembly and the joints
   • Select and use correct hand tool
   • Follow procedure and demonstrate removal of the hoses and lines
E3. Install the hoses and lines
   • Identify procedure of installing the hoses and lines
   • Installed correct line and hose to match the joint
   • Safety precaution in installation.
   • Follow procedure and demonstrate installation of hoses and lines
Prerequisite:
The participant of this course should have completed or have experience in the competencies from module 1, 2, 3 & 4.
Suggested delivery methods: This module should be delivered using the following teaching methods:
   • Lecture
   • Demonstration
   • Discussion
   • Practical project
Instructor: The ideal instructor will have a trades certificate in Automotive mechanic. New instructors wish to refer to the STRU publication “Trainer Guide”(available free of charge).
Assessment method: A holistic approach is to be taken with assessment of the learning outcome using one or more of the following:
   • Questioning (oral, multiple or matching answers)
   • Demonstration of practical tasks
Assessment condition: Assessment will be conducted in a workshop environment. The condition of assessment includes:
Model of motor vehicle engine brake system hoses and lines and removal and installation hand tools.
(Refer to specific learning outcome)
Reference:
Overview of elements of competence and performance criteria

<table>
<thead>
<tr>
<th>Element</th>
<th>Performance Criteria</th>
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<tr>
<td>1. Identify hoses and lines</td>
<td>1.1 Identify the types of hoses and lines.</td>
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<tr>
<td></td>
<td>1.2 Verify hoses and lines position of attachment and assembly.</td>
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<td></td>
<td>1.3 Identify safety procedure in handling hoses and lines.</td>
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<tr>
<td>2. Remove the lines and hoses</td>
<td>2.1 Describe procedures of removing the lines and hoses.</td>
</tr>
<tr>
<td></td>
<td>2.2 Identify each line and hose assembly and the joints for removal.</td>
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<td></td>
<td>2.3 Select and use removal hand tools.</td>
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<td>2.4 Demonstrate procedure of removing the lines and hoses.</td>
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<tr>
<td>3. Install the lines and hoses</td>
<td>3.1 Describe procedure of installing the lines and hoses.</td>
</tr>
<tr>
<td></td>
<td>3.2 Identify safety precautions in installation.</td>
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<tr>
<td></td>
<td>3.3 Demonstrate procedure of installing lines and hoses.</td>
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Instruction for the Trainer/Instructor

Setup all the training aids on a workstation. The trainees must have access to:
1. Protective clothing’s and equipment - gloves, boot and overall.
2. Hand tools - spanners (ring and open end, adjustable wrench).
3. Practical model frame of motor vehicle brake system lines and hoses.

Part one of this module is the curriculum guide.

Learning activities for the trainees relates to three elements of competence in column one (1) of the overview table. In column two (2) the performance criteria show the required level of performance expected as resultant of each element. In delivery of the module the instructor follows the appendix training and assessment guide.

Part two of this module consists of the training resource kit or instructional materials.

In line with the elements of competence resource information on the skills and knowledge informed have been compiled. The additional support material is provided for both, the instructor to use in discussion and explanation, and the trainee to have additional hand out notes to read or write in exercise books.
APPENDIX 1. Training and Assessment Guide.  
Element 1.

Task E1: Identify hoses and lines  
Suggested minimal instructional time: 2 hours

Learning outcome E1:  
Identify and locate the brake hoses and lines.

Teaching strategy:  
Learning activities for the trainee must include the instructor to:  
1.1 Identify the types of hoses and lines.  
1.2 Verify hoses and lines position of attachment and assembly.  
1.3 Identify safety procedure in handling hoses and lines.

Assessment methods:  
Written verbal questioning and observation

Assessment condition:  
Given information on brake hoses and lines.

Assessment criteria:  
The trainee has correctly:  
☑ identified the types of hoses and lines;  
☑ verified hoses and lines position of attachment and assembly;  
☑ identified safety procedure in handling hoses and lines.

APPENDIX 2: Training and Assessment Guide.  
Element 2.

Task E2: Remove the lines and hoses  
Suggested minimal instructional time: 2 hours

Learning outcome E2:  
Describe and demonstrate procedure of removal of the brake hoses and lines.

Teaching strategy:  
Learning activities for the trainee must include the instructor to:  
2.1 Describe procedures of removing the hoses and lines.  
2.2 Identify each hoses and lines assembly and the joints for removal.  
2.3 Select and use removal hand tools.  
2.4 Demonstrate procedure of removing the hoses and lines.

Assessment methods:  
Written verbal questioning and observation

Assessment condition:  
• given diagram to identify hoses and lines assembly, the joints and verify on a model brake system.  
• informative test. Filling in blanks of missing words on the procedures to bleed the brake system.  
• given task to demonstrate procedure of hoses and lines removal.

Assessment criteria:  
The trainee has correctly:  
☑ described procedures of removing the hoses and lines;  
☑ identified each hoses and lines assembly and the joints for removal;  
☑ selected and used removal hand tools.  
☑ demonstrated procedure of removing the hoses and lines.

APPENDIX 3: Training and Assessment Guide.  
Element 3.

Task E3: Install the lines and hoses  
Suggested minimal instructional time: 2 hours

Learning outcome E3:  
Describe and demonstrate procedure of installation of the brake hoses and lines.

Teaching strategy:  
Learning activities for the trainee must include the instructor to:  
3.1 Describe procedure of installing the hoses and lines.  
3.2 Identify safety precautions in installation.  
3.3 Demonstrate procedure of installing hoses and lines.

Assessment methods:  
Written verbal questioning and observation

Assessment condition:  
• given diagram to identify hoses and lines assembly and joints and verify on a model brake system;  
• informative test. Filling in blanks of missing words on the procedures to bleed the brake system;  
• given task to demonstrate procedure of hoses and lines removal.
Assessment criteria:
The trainee has correctly:
- described procedure of installing the hoses and lines;
- identified safety precautions in installation;
- demonstrated procedure of installing hoses and lines.

Assessment procedure
1. Do interval testing on each element of competence at the end of one topic session to find out the trainee progress in learning. Test knowledge orally or written. Test skills for mastery of performance standard in a demonstration performing a range of task.
2. Do a summary test of all lessons covered at the end of the course. Practical test at the end of the short course must be conducted to corroborate a trainee competent of the skills trained.
3. Learning Outcome.

To test participants conduct a summary test of the three core learning outcomes written below.

Learning Outcomes E - 1, 2, 3
E1 Identify and locate the brake hoses and lines.
E2 List and demonstrate procedure of removal of the brake hoses and lines.
E3 List and demonstrate procedure of installation of the brake hoses and lines.

Assessing your learning
When you attend a training course, you expect to learn many things. You want to know about your learning and your mind is full of questions like:
- do I really understand what I am being told?
- will I be able to use this new knowledge when I return to my place of work or my community?
- am I doing this new skill correctly?

Assessing your self is about answering these questions. It shows you and your facilitator about your progress. It also tells the facilitator about their teaching. If all participants find a topic difficult, then the facilitators know that they must teach it again or try something new to support the teaching.

Recognized Training
The Employment Oriented Skill Development Project recognizes the training and you will receive a certificate when you have successfully completed this training.

APPENDIX 4. INSTRUCTIONAL NOTES

E1: Identify and locate the brake hoses and lines

1. Identify and locate the brake hoses and lines
Metal lines and rubber brake hoses should be checked frequently for leaks and external damage. Metal lines are particularly prone to crushing and kinking under the vehicle. Any such deformation can restrict the proper flow of fluid and therefore impair braking at the wheels. Rubber hoses should be checked for cracking or scraping; such damage can create a weak spot in the hose and it could fail under pressure.

Any time the lines are removed or disconnected, extreme cleanliness must be observed. Clean all joints and connections before disassembly (use a stiff bristle brush and clean brake fluid); be sure to plug the lines and ports as soon as they are opened.
New lines and hoses should be flushed clean with brake fluid before installation to remove any contamination.

**E2: List and demonstrate procedure of removal of the brake hoses and lines**

2. **Hoses and lines removal**
   1. Disconnect the negative battery cable.
   2. Raise and safely support the vehicle on jack-stands.
   3. Remove any wheel and tire assemblies necessary for access to the particular line you are removing.
   4. Thoroughly clean the surrounding area at the joints to be disconnected.
   5. Place a suitable catch pan under the joint to be disconnected.
   6. Using two wrenches (one to hold the joint and one to turn the fitting), disconnect the hose or line to be replaced.
   7. Disconnect the other end of the line or hose, moving the drain pan if necessary. Always use a back-up wrench to avoid damaging the fitting.
   8. Disconnect any retaining clips or brackets holding the line and remove the line from the vehicle.

If the brake system is to remain open for more time than it takes to swap lines, tape or plug each remaining clip and port to keep contaminants out and fluid in.

**Fig. 1:** Use a brush to clean the fittings of any debris

**Fig. 2:** Use two wrenches to loosen the fitting. If available, use flare nut type wrenches

**Fig. 3:** Any gaskets/crush washers should be replaced with new ones during installation

**Fig. 4:** Tape or plug the line to prevent contamination
3. List and demonstrate procedure of installation of the brake hoses and lines

9. Install the new line or hose, starting with the end farthest from the master cylinder. Connect the other end, then confirm that both fittings are correctly threaded and turn smoothly using finger pressure. Make sure the new line will not rub against any other part. Brake lines must be at least 1/2 in. (13mm) from the steering column and other moving parts. Any protective shielding or insulators must be reinstalled in the original location.

10. Using two wrenches as before, tighten each fitting.

11. Install any retaining clips or brackets on the lines.

12. If removed, install the wheel and tire assemblies, then carefully lower the vehicle to the ground.

13. Refill the brake master cylinder reservoir with clean, fresh brake fluid, meeting DOT 3 specifications. Properly bleed the brake system.

14. Connect the negative battery cable.

**WARNING**

Make sure the hose is NOT kinked or touching any part of the frame or suspension after installation. These conditions may cause the hose to fail prematurely.

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**Glossary of Terms and definitions.**

1. Competency profile
2. Curriculum guide
3. Appendix 1
4. Appendix 2
5. Appendix 3
6. Appendix 4
7. Element
8. Performance criteria.
9. Metal lines.
10. Brake hoses
11. Deformation
12. Jack stand
13. wrenches
14. Port
15. Steering column
16. Brake actuating rod
17. kinked

**Note:** The trainer/instructor before or during training should explain clearly the definition of each term to the students.
METHODOLOGY
This short course module, developed in Papua New Guinea, based on the competency-standard training model. The program was developed by a STRU curriculum officer, assisted by an international curriculum specialist and validated by a group of experience practitioners.

Their names are:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
<th>LOCATION</th>
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<tbody>
<tr>
<td>Camilus Boage</td>
<td>Niu Ford</td>
<td>Waigani</td>
</tr>
<tr>
<td>Tau Kalogo</td>
<td>Boroko Motor</td>
<td>Waigani</td>
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<td>Allan Hebei</td>
<td>Ela Motors</td>
<td>Badili</td>
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<tr>
<td>Allan Kauri</td>
<td>Koki Vocational</td>
<td>Koki</td>
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CONSULTANTS
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Mr. Chris Develin    Community Certificate Specialist (International)
Mr. Misiel Puarit    Trades Curriculum Specialist (National)
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