BRAKE REMOVAL AND INSTALLATION

Bleeding the Brake System

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 bleeding the brake system. This module covers the practical skills and procedure of the brake system repair 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 Automotive tradesman skills, and to provide lower income earners to save cost and be able to fix their own car, 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 automotive repair, they will benefit from labour charge and make money for a living or opportunity into starting a small scale workshop.

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)
# Bleeding the brake system

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Bleeding the brake system

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Course: BRAKE SYSTEM REMOVAL AND INSTALLATION
Module code: T017vi
Module name: Bleeding the Brake System

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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
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**CURRICULUM GUIDE**

**Program:** MOTOR VEHICLE MECHANIC  
**Course:** BRAKE SYSTEM REMOVAL AND INSTALLATION  
**Module code:** T017vi  
**Module name:** Bleeding the Brake System  
**Duration:** 12 hour course/ 2 hour theory test/ 3 hours practical test.  
**Purpose:** After successful completion of this module participant should be able to identify components and functions, select and use of hand tools, alert of precautions and observe safety, and demonstrate removal and installation of bleeding the brake system with out damage and with in the expected time of work.  

**Content:**  
**F1. Demonstrate bleeding primary and secondary hydraulic brake system**  
- List and explain the safety precaution of bleeding the brake system  
- List and explain procedure of repair and replacing of the hydraulic system  
- List and explain procedure of bleeding the brake system  
- List and explain procedure of bleeding the primary and secondary hydraulic brake system  

**F2. Identify and explain procedure of bleeding the brake system**  
- Select and use brake hand tools  
- Verify the hydraulic brake components and position of attachment  
- Prepare and demonstrate procedure of bleeding the primary and secondary hydraulic brake system  

**Prerequisite:** The participant of this course should have completed or have experience in the competencies of basic operating principles, brake light switch and master cylinder repair of the brake system from module 1, 2, 3, 4 & 5  

**Suggested delivery method:** 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 frame of motor vehicle Types of spanners (refer to specific learning outcome).  

Overview of elements of competence and performance criteria

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<th>Element</th>
<th>Performance Criteria</th>
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| 1. Identify and explain procedure of bleeding the brake system | 1.1 List and explain the safety precaution of bleeding the brake system  
1.2 List and explain procedure of repair and replacing of the hydraulic system  
1.3 List and explain procedure of bleeding the brake system  
1.4 List and explain procedure of bleeding the primary and secondary hydraulic brake system |
| 2. Demonstrate bleeding the primary and secondary hydraulic brake system | 2.1 Select and use brake bleeding hand tools the brake system  
2.3 Verify the hydraulic brake components and position of attachment  
2.3 Prepare and demonstrate procedure of bleeding the primary and secondary hydraulic brake system |

Instruction for the Trainer/Instructor

Setup the training aids on a workstation.

The trainees must have access to:
- Protective clothing's and equipment — gloves, boot and overall
- Hand tools – spanners (ring and open end, adjustable wrench)
- Practical model frame of motor vehicle

Part one of this module is the curriculum guide.

Learning activities for the trainees relates to four 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 below.

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.**

**Learning outcome F1.1:** Identify and locate the components of bleeding the brake system.

**Teaching strategy:** Learning activities for the trainee must include the instructor to:

1.1 List and explain the safety precaution of bleeding the brake system
1.2 List and explain procedure of repair and replacing of the hydraulic system
1.3 List and explain procedure of bleeding the brake system
1.4 List and explain procedure of bleeding the primary and secondary hydraulic brake system

**Assessment methods:** Written, verbal questioning and observation

**Assessment condition:** Given oral or written test, explain safety precaution and procedure of bleeding the brake system.

**Assessment criteria:** The trainee has correctly:
- listed and explained the safety precaution of bleeding the brake system;
- listed and explained procedure of repair and replacing of the hydraulic system;
- listed and explained procedure of bleeding the brake system;
- listed and explained procedure of bleeding the primary and secondary hydraulic brake system.

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**Task F1:** Identify and explain procedure of bleeding the brake system.
Suggested minimal instructional time: 4 hours

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**APPENDIX 2: Training and Assessment Guide**

**Element 2.**

**Learning outcome F2.2:** List and explain procedure of bleeding the brake system.

**Teaching strategy:** Learning activities for the trainee must include the instructor to:

2.1 Select and use brake bleeding hand tools
2.3 Verify the hydraulic brake components and position of attachment
2.3 Prepare and demonstrate procedure of bleeding the primary and secondary hydraulic brake system

**Assessment methods:** Written, verbal questioning and observation

**Assessment condition:** Given oral or written test, verify components, explain the brake system bleeding procedure and practical test to demonstrate bleeding of the brake set up on a work station.

**Assessment criteria:** The trainee has correctly:
- selected and used brake bleeding hand tools
- verified the hydraulic brake components and position of attachment
- prepared and demonstrated procedure of bleeding the primary and secondary hydraulic brake system.
Assessment procedure and testing
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
You attend a training course to learn new information and gain new skills that you can use in your workplace or community.
For this course a set assessment guide evidently supports your learning of the skills in training. Find in the assessment guide the topic elements have one learning outcome. The core-learning outcome is a resultant of one-element performance criteria. To measure your learning the core learning outcome becomes the mastery test of skills and objectives of the performance criteria. Participants upon successful completion of each element performance criteria should demonstrate the task of each learning outcome of the element.
In this topic there are three elements and each has a core-learning outcome. These two core-learning outcomes make up a checkpoint or summary test to be conduct on completion of training of the topic bleeding the brake system. To participants conduct a summary test of the three core learning outcomes written below.
Learning Outcomes F-1, 2, 3
F1 Identify and locate the components of the power booster
F2 List and demonstrate procedure of removal of the power booster
F3 List and demonstrate procedure of installation of the power booster
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?
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 3: Instructional Notes

Introduction
A process of removing trapped air in the brake system. The air trapped is detected by a brake system failure when the pedal is force down by the foot does not exert pressure. The master cylinder and hydraulic control unit are the components which bleeding of the brake system is done.
When bleeding the brake system, bleed one brake cylinder at a time, beginning at the cylinder with the longest hydraulic line (farthest from the master cylinder) first.
Bleeding of the brake system is categories into two sections following the bleeding operations and procedure. Brake system is categories into two parts. First part is the secondary bleeding operation and the other one is the primary.
The primary and secondary hydraulic brake systems are individual systems and are bled separately.

Check list of brake hand tools

F-1. Demonstrate bleeding primary and secondary hydraulic brake system

Read carefully the instructions before you carry out bleeding of the primary and secondary hydraulic brake system.
Use correct hand tools, support tools and material for removal. Follow procedure outline below and complete the task working step by step:
1. Clean all dirt from around the master cylinder fill cap, remove the cap and fill the master cylinder with brake fluid until the level is within 1/4 in. (6mm) of the top edge of the reservoir.
2. Clean off the bleeder screws at all 4 wheels. The bleeder screws are located on the inside of the brake backing plate, on the backside of the wheel cylinders and on the front brake calipers.
3. Attach a length of rubber hose over the nozzle of the bleeder screw at the wheel to be done first. Place the other end of the hose in a glass jar, submerged in brake fluid.
Bleeding the brake system

4. Open the bleeder screw valve 1/2-3/4 turn.
5. Have an assistant slowly depress the brake pedal. Close the bleeder screw valve and tell your assistant to allow the brake pedal to return slowly. Continue this pumping action to force any air out of the system. When bubbles cease to appear at the end of the bleeder hose, close the bleeder valve and remove the hose.
6. Check the master cylinder fluid level and add fluid accordingly. Do this after bleeding each wheel.
7. Repeat the bleeding operation at the remaining 3 wheels, ending with the one closet to the master cylinder. Fill the master cylinder reservoir.

1.1 Safety precaution

WARNING

Vehicles with 4-wheel anti-lock brakes require an Anti-lock Brake Adapter (T90P-50-ALA) and Jumper (T93T-50-ALA) in order to bleed the master cylinder and the Hydraulic Control Unit (HCU). Failure to do so will trap air in the HCU unit, eventually causing a spongy pedal. The tools are not required for caliper or wheel cylinder bleeding procedures.

See Figures 1 and 2

1.2 Hydraulic system

When any part of the hydraulic system has been disconnected for repair or replacement, air may get into the lines and cause spongy pedal action (because air can be compressed and brake fluid cannot). To correct this condition, it is necessary to bleed the hydraulic system after it has been properly connected to be sure all air is expelled from the brake cylinders and lines.

1.3 Bleeding the brake system

When bleeding the brake system, bleed one brake cylinder at a time, beginning at the cylinder with the longest hydraulic line (farthest from the master cylinder) first. ALWAYS Keep the master cylinder reservoir filled with brake fluid during the bleeding operation. Never use brake fluid that has been drained from the hydraulic system, no matter how clean it is.

It will be necessary to centralize the pressure differential value after a brake system failure has been corrected and the hydraulic system has been bled.

1.4 Primary and secondary hydraulic brake systems

The primary and secondary hydraulic brake systems are individual systems and are bled separately. During the entire bleeding operation, do not allow the reservoir to run dry. Keep the master cylinder reservoir filled with brake fluid.
Glossary of Terms and Definitions

1. Appendix 1
2. Appendix 2
3. Appendix 3
4. Hydraulic control unit
5. Master cylinder
6. Force
7. Secondary bleeding
8. Primary bleeding
9. Brake fluid

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:

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<th>NAME</th>
<th>ORGANIZATION</th>
<th>LOCATION</th>
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<tr>
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<td>Niu Ford</td>
<td>Waigani</td>
</tr>
<tr>
<td>Tau Kalogo</td>
<td>Boroko Motor</td>
<td>Waigani</td>
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<tr>
<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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The development of this short course was sponsored by the ADB-PNG EMPLOYMENT SKILLS DEVELOPMENT PROJECT (EOSDP) and produced by curriculum officers at the SKILLS TRAINING RESOURCES UNIT (STRU).