MODULE CONTENT

| Unit of Competency | **DIAGNOSE AND REPAIR CLUTCH SYSTEM** |
| --- | --- |
| Module Title | **DIAGNOSING AND REPAIRING CLUTCH SYSTEM** |
| Module Descriptor | This unit identifies the competence required to perform basic diagnose and repair the clutch system. |
| Nominal Duration | **hours** |
| Summary of the Learning Outcomes: | |
| Upon completion of this module the student must be able to: | |
| LO1. Prepare to diagnose and repair clutch system | |
| LO2. Diagnose clutch system | |
| LO3. Repair clutch system | |
| LO4. Complete work processes | |

**LEARNING EXPERIENCES**

**LEARNING OUTCOMES NO. 2**

**DIAGNOSE CLUTCH SYSTEM**

| **Learning Activities** | **Special Instructions** |
| --- | --- |
| Read Information Sheet 3.1-1 Diagnose clutch system | If you have some problem with the content of the information sheet don’t hesitate to approach your Trainer.  If you feel that you are now knowledgeable on the content of the information sheet, you can now answer self-check provided in the module. |
| Answer Self-Check 3.1-1 on Diagnose clutch system | Try to answer the Self-check without looking at the Answer Key  Compare your answer to Answer Key 3.1-1 |
| Observe Trainer’s demonstration on Task Sheet 3.1-1 on Diagnose clutch system | Listen carefully and attentively so that you may be able to perform a task correctly  Ask questions if are in doubt for clarification |
| Perform the Task Sheet 3.1-1 on Diagnose clutch system | Remember the step-by-step procedure the Diagnose clutch system |
| Evaluate the performance using the Performance Criteria Checklist 3.1-1 | Repeat the task in case fail to meet the criteria |

**INFORMATION SHEET 1.1-1**

**DIAGNOSE CLUTCH SYSTEM**

**Learning Objectives:**

After reading this **Information Sheet**, you must be able to:

1. Perform diagnostic tests.
2. CarrY out inspection.
3. Compare inspection results.
4. IdentifY faults and determine causes of faults.
5. Report findings and recommendations.
6. Applied safety practices.

**CLUTCH SYSTEM**

**Overview**

An automotive clutch normally provides depend- able service for thousands of miles. However, stop and go traffic will wear out a clutch quicker than highway driving. Every time a clutch is engaged, the clutch disc and other components are subjected to considerable heat, friction, and wear.

Operator abuse commonly causes premature clutch   troubles.   For   instance,   "riding   the   clutch" (over slipping clutch upon acceleration), resting your foot   on   the   clutch   pedal   while   driving,   and   other driving errors can cause early clutch failure.

When a vehicle enters the shop for clutch troubles, you should test-drive the vehicle. While the vehicle is being test-driven, you should check the action of the clutch pedal, listen for unusual noises, and feel for clutch pedal vibrations. Gather  as  much  information  as  you  can  on  the operation  of  the  clutch.  Use this information, your knowledge of clutch principles, and a service manual- troubleshooting chart to determine which components are faulty.

There are five types of clutch problems—slipping, grabbing, dragging, abnormal noises, and vibration. It is important to know the symptoms produced by these problems and the parts that might be the cause.

**Slipping**

Slipping occurs when the driven disc fails to rotate at the same speed as the driving member when the clutch   is   fully   engaged.   This   condition   results whenever the clutch pressure plate fails to hold the disc tight against the face of the flywheel.

If clutch slippage is   severe,   the   engine   speed   will   rise   rapidly   on acceleration, while the vehicle gradually increases in speed.   Slight   but   continuous   slippage   may   go unnoticed until the clutch facings are ruined by excessive temperature caused by friction. Normal  wear  of  the  clutch  lining  causes  the  free travel  of  the  clutch  linkage  to  decrease,  creating  the need  for  adjustment.

Improper  clutch  adjustment  can cause  slippage  by  keeping  the  release  bearing  in contact with the pressure plate in the released position. Even  with  your  foot  off  the  pedal,  the  release mechanism  will  act  on  the  clutch  fork  and  release bearing. Some  clutch  linkages  are  designed  to  allow  only enough  adjustment  to  compensate  for  the  lining  to wear close to the rivet heads. This prevents damage to the flywheel and pressure plate by the rivets wearing grooves in their smooth surfaces.

Other linkages will allow for adjustment after the disc is worn out.  When in doubt whether the disc is worn excessively, remove the inspection cover on the clutch housing and visually inspect the disc.

Binding  linkage  prevents  the  pressure  plate  from exerting its full pressure against the disc, allowing it to slip.  Inspect  the  release  mechanism  for  rusted,  bent, misaligned, sticking, or damaged components. Wiggle the release fork to check for free play. These problems result in slippage.

A broken motor mount (engine mount) can cause clutch  slippage  by  allowing  the  engine  to  move, binding the clutch linkage. Under load, the engine can lift up in the engine compartment, shifting the clutch linkage and pushing on the release fork. Grease and oil on the disc will also cause slippage. When   this   occurs,   locate   and   stop   any   leakage, thoroughly  clean  the  clutch  components,  and  replace the clutch disc. This is the only remedy.

If  clutch  slippage  is  **NOT**caused  by  a  problem with the clutch release mechanism, then the trouble is normally  inside  the  clutch.  You  have  to  remove  the transmission  and  clutch  components  for  further inspection.  Internal  clutch  problems,  such  as  weak springs and bent or improperly adjusted release levers, will  prevent  the  pressure  plate  from  applying  even pressure. This condition allows the disc to slip.

To test the clutch for slippage, set the emergency brake  and  start  the  engine.  Place  the  transmission  or transaxle  in  high  gear.  Then  try  to  drive  the  vehicle forward by slowly releasing the clutch pedal.

A clutch in good condition should lock up and immediately kill the  engine.  A  badly  slipping  clutch  may  allow  the engine to run, even with the clutch pedal fully released. Partial   clutch   slippage   could   let   the   engine   run momentarily  before  stalling.

**NOTE**

Never  let  a  clutch  slip  for  more  than  a second or two. The extreme heat generated by slippage  will  damage  the  flywheel  and  pressure plate faces.

**Grabbing**

A  grabbing  or  chattering  clutch  will  produce  a  very severe vibration or jerking motion when the vehicle is accelerated  from  a  standstill.  Even when the operator slowly releases the clutch pedal, it will seem like the clutch pedal is being pumped rapidly up and down.

A loud bang or chattering may be heard, as the vehicle body vibrates. Clutch grabbing and chatter is caused by problems with  components  inside  the  clutch  housing  (friction disc,  flywheel,  or  pressure  plate).  Other reasons for a grabbing clutch could be due to oil or grease on the disc facings, glazing, or loose disc facings. Broken parts in the clutch, such as broken disc facings, broken facing springs, or a broken pressure plate, will also cause grabbing. There are several things outside of the clutch that will cause a clutch to grab or chatter when it is being engaged.  Loose  spring  shackles  or  U-bolts,  loose transmission   mounts,   and   worn   engine   mounts   are among  the  items  to  be  checked.  If the clutch linkage binds, it may release suddenly to throw the clutch into quick engagement, resulting in a heavy jerk. However, if all these items are checked and found to be in good condition, the trouble is inside the clutch itself and will have to be removed for repair.

**Dragging**

A  dragging  clutch  will  make  the  transmission  or transaxle  grind  when  trying  to  engage or  shift  gears. This  condition  results  when  the  clutch  disc  does  not completely  disengage  from  the  flywheel  or  pressure plate when the clutch pedal is depressed. As a result, the clutch disc tends to continue turning with the engine and attempts to drive the transmission.

The most common cause of a dragging clutch is too much  clutch  pedal  free  travel.  With  excessive  free travel, the pressure plate will not fully release when the clutch pedal is pushed to the floor. Always check the clutch  adjustments  first.  If  adjustment  of  the  linkage does  not  correct  the  trouble,  the  problem  is  in  the clutch, which must be removed for repair. On  the  inside  of  the  clutch  housing,  you  will generally  find  a  warped  disc  or  pressure  plate,  oil  or grease   on   the   friction   surface,   rusted   or   damaged transmission input shaft, or improper adjustment of the pressure plate release levers causing the problem.

**Abnormal Noises**

Faulty clutch parts can make various noises. When an operator reports that a clutch is making noise, find out  when  the  noise  is  heard.  Does  the  sound  occur when  the  pedal  is  moved,  when  in  neutral,  when  in gear, or when the pedal is held to the floor? This will assist  you  in  determining  which  parts  are  producing these noises. An  operator  reports  hearing  a  scraping,  clunking, or squeaking sound when the clutch pedal is moved up or down. This is a good sign of a worn or unlubricated clutch release mechanism. With the engine off, pump the pedal and listen for the sound. Once the source of the  sound  is  located,  you  should  clean,  lubricate,  or replace the parts as required. Sounds produced from the clutch, when the clutch is  initially  ENGAGED,  are  generally  due  to  friction disc problems, such as a worn clutch disc facing, which causes a metal-to-metal grinding sound. A rattling or a knocking sound may be produced by weak or broken clutch   disc   torsion   springs.   These   sounds   indicate problems that require the removal of the transmission and clutch assembly for repair. If clutch noises are noticeable when the clutch is DISENGAGED,  the  trouble  is  most  likely  the  clutch release  bearing.  The  bearing  is  probably  either  worn, binding,  or,  in  some  cases,  loses  its  lubricant.  Most clutch   release   bearings   are   factory   lubricated; however,  on  some  larger  trucks  and  construction equipment,  the  bearing  requires  periodic  lubrication. A worn pilot bearing may also produce noises when the clutch is disengaged. The worn pilot bearing can let the transmission input shaft and clutch disc vibrate up and down, causing an unusual noise. Sounds heard in NEUTRAL, that disappear when the  clutch  pedal  is  pushed,  are  caused  by  problems inside the transmission. Many of these sounds are due to   worn   bearings.   However,   always   refer   to   the troubleshooting chart in the manufacturer's manual.

**Pedal Pulsation**

A pulsating clutch pedal is caused by the run out (wobble or vibration) of one of the rotating members of the clutch assembly. A series of slight movements can be felt on the clutch pedal.  These pulsations are noticeable when light foot pressure is applied. This is an  indication  of  trouble  that  could  result  in  serious damage   if   not   corrected   immediately.   There   are several conditions that can cause these pulsations. One possible cause is misalignment of the transmission and engine. If  the  transmission  and  engine  are  not  in  line, detach  the  transmission  and  remove  the  clutch assembly.  Check  the  clutch  housing  alignment  with the   engine   and   crankshaft.   At   the   same   time,   the flywheel   can   be   checked   for   runout,   since   a   bent flywheel   or   crankshaft   flange   will   produce   clutch pedal  pulsation.  If  the  flywheel  does  not  seat  on  the crankshaft flange, remove the flywheel. After cleaning the  crankshaft  flange  and  flywheel,  replace  the flywheel,   making   sure   a   positive   seat   is   obtained between  the  flywheel  and  the  flange.  If  the  flange  is bent, the crankshaft must be replaced. Other causes of clutch pedal pulsation include bent or  maladjusted  pressure  plate  release  levers,  warped pressure  plate,  or  warped  clutch  disc.  If  either  the clutch  disc  or  pressure  plate  is  warped,  they  must  be replaced.

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**Figure 10 – Master Cylinder, Slave cylinder, and connections for a typical hydraulic clutch**

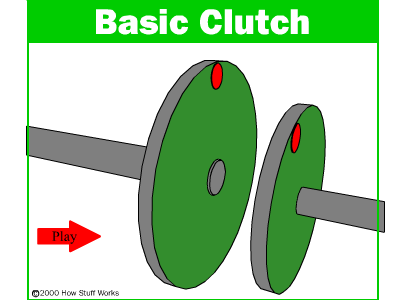
**Clutch Problem/Failure Diagnosis**

If you don't hear any noise during these four steps, then your problem is probably not the clutch. If you hear the noise at idle and it goes away when the clutch is pressed, it may be an issue in the contact point between the fork and pivot ball.

1. Start your car, set the parking brake, and put the car in neutral.
2. With your car idling, listen for a growling noise without pushing the clutch in. If you hear something, it's most likely a problem with the transmission. If you don't hear a noise, proceed to step three.
3. With the car still in neutral, begin to push the clutch and listen for noise. If you hear a chirping noise as you press, it's most likely the clutch release, or throw-out bearing. If you don't hear a noise, proceed to step four.
4. Push the clutch all the way to the floor. If you hear a squealing noise, it's probably the pilot bearing or bushing.

**Common Problems**

From the 1950s to the 1970s, you could count on getting between 50,000 and 70,000 miles from your [car's](http://auto.howstuffworks.com/car.htm) clutch. Clutches can now last for more than 80,000 miles if you use them gently and maintain them well. If not cared for, clutches can start to break down at 35,000 miles. Trucks that are consistently overloaded or that frequently tow heavy loads can also have problems with relatively new clutches.



The most common problem with clutches is that the friction material on the disc wears out. The friction material on a clutch disc is very similar to the friction material on the pads of a [disc brake](http://auto.howstuffworks.com/auto-parts/brakes/brake-types/disc-brake.htm) or the shoes of a [drum brake](http://auto.howstuffworks.com/auto-parts/brakes/brake-types/drum-brake.htm) -- after a while, it wears away. When most or all of the friction material is gone, the clutch will start to slip, and eventually it won't transmit any power from the [engine](http://auto.howstuffworks.com/engine.htm) to the [wheels](http://auto.howstuffworks.com/tire.htm).

The clutch only wears while the clutch disc and the flywheel are spinning at different speeds. When they are locked together, the friction material is held tightly against the flywheel, and they spin in sync. It's only when the clutch disc is slipping against the flywheel that wearing occurs. So, if you are the type of driver who slips the clutch a lot, you'll wear out your clutch a lot faster.

Sometimes the problem is not with slipping, but with sticking. If your clutch won't release properly, it will continue to turn the input shaft. This can cause grinding, or completely prevent your car from going into gear. Some common reasons a clutch may stick are:

* **Broken or stretched clutch cable** - The cable needs the right amount of tension to push and pull effectively.
* **Leaky or defective slave and/or master clutch cylinders** - Leaks keep the cylinders from building the necessary amount of pressure.
* **Air in the hydraulic line** - Air affects the hydraulics by taking up space the fluid needs to build pressure.
* **Misadjusted linkage** - When your foot hits the pedal, the linkage transmits the wrong amount of force.
* **Mismatched clutch components** - Not all aftermarket parts work with your clutch.

A "hard" clutch is also a common problem. All clutches require some amount of force to depress fully. If you have to press hard on the pedal, there may be something wrong. Sticking or binding in the pedal linkage, cable, cross shaft, or pivot ball are common causes. Sometimes a blockage or worn seals in the hydraulic system can also cause a hard clutch.

Another problem associated with clutches is a worn throw-out [bearing](http://science.howstuffworks.com/transport/engines-equipment/bearing.htm), sometimes called a **clutch release bearing**. This bearing applies force to the fingers of the spinning pressure plate to release the clutch. If you hear a rumbling sound when the clutch engages, you might have a problem with the throw-out.

**General clutch diagnosis and solution**

**Symptom:   
Clutch drags. It won't release completely and the transmission grinds when shifted**

| **Possible diagnosis** | **Likely solution** |
| --- | --- |
| Linkage out of adjustment or binding | Adjust or repair linkage |
| Release arm too long for the linkage system | Determine the correct ratio (as per instructions above) and shorten the arm |
| Release arm stick out angle incorrect | Change the length of the release nearing, pivot or both, if necessary |
| Release arm hits bell housing opening preventing full travel of the arm | Grind clearance as necessary on the bell housing |
| Engine is shifting on the motor mounts, wasting linkage travel | Repair, rebuild or replace the motor mounts as necessary |
| Pilot bushing binding on the input shaft. Possibly damaged at installation or resulting from a misaligned bell housing | Replace the pilot bushing. Refer to the bell housing alignment procedure in the Novak guide |
| Input shaft pilot is "bottoming out" in the crankshaft bore | Shorten the input shaft by grinding or deepen the bore of the crank by drilling |
| Clutch disc hub is damaged or assembled incorrectly | Replace the disc |
| Pressure plate or cover is warped | Replace the pressure plate assembly |
| Excessive run-out at the face of the flywheel | Check the crank flange for burrs and remove them, or reface the flywheel |
| Incorrect flywheel to crank hub bolts. The bolt heads are driving the disc | Use the correct, special flywheel bolts |
| Clutch disc is installed backwards. The bolt heads are driving the disc | Disassemble and turn the disc around |
| Clutch disc is too large. The edge of the disc is interfering with the pressure plate assembly | Specify a smaller disc or turn down the edge of the existing unit |
| Clutch arm to throw out bearing retaining clip is tweaked on the bearing lip (progressive worsening) | Replace throw out bearing if damaged and reinstall the arm and clips correctly |

**Symptom:  
Clutch Slippage**

| **Possible Diagnosis** | **Likely Solution** |
| --- | --- |
| Linkage out of adjustment or binding | Adjust the linkage to create proper amount of slack in the system |
| Release bearing is too long, holding the clutch in a slightly disengaged position | Use a shorter release bearing. See the chart in the text |
| The friction surface on the flywheel, pressure plate or disk is glazed (usually from heat) | Resurfacing and replacement of clutch assembly |
| The clutch is too small and/or the spring load is too light | Use a larger clutch or a heavier spring. The former is often preferable. Extreme cases may require both |
| Oil on the clutch disc | Repair the oil leak (typically the engine rear main or oil pan if not the transmission from seal) and replace the disc |
| Broken or fatigued springs | Replace the pressure plate |

**Symptom:   
Clutch chatters when engaging**

| **Possible diagnosis** | **Likely solution** |
| --- | --- |
| Damper springs in the clutch disc hub or the marcel spring between the facings is fatigued | Replace the clutch disc |
| Friction surface on the flywheel or pressure plage is glazed from the heat | Resurface or replace as necessary |
| Clutch disc is running out on the input gear (hub problem) | Replace the clutch disc |
| The flywheel or pressure plate surface is running out | Reface or replace as required |
| Oil on friction surfaces | Repair the oil leak (typically the engine rear main or oil pan if not the transmission from seal) and replace the disc. Avoid parts contamination upon reassembly |
| Linkage works erratically | Inspect the linkage, paying special attention to the holes in each lobe. Repair or change the linkage as required |
| Play in the motor mounts allowing for shifting of the powertrain, relative to the linkage | Change or repair the motor mounts |

**Symptom:   
Pedal pulsates when pushed to floor (3-finger coil spring type only)**

| **Possible diagnosis** | **Likely solution** |
| --- | --- |
| Clutch is over-releasing and the release fingers are hitting the disc hub damper springs | Reduce linkage travel (see above text) |

**Symptom:   
Pedal pulsates at start of release**

| **Possible diagnosis** | **Likely solution** |
| --- | --- |
| Flywheel run-out | Check for burrs on clutch and flywheel mounting flanges |
| If a three-finger type, fingers may not all be the same height | Have the pressure plate readjusted by a rebuilder or replace the pressure plate |
| Excessive clearance between release bearing and retainer | Replace the retainer or on mismatched parts, sleeve retainer up to the release bearing size, plus slip fit |

**Symptom:   
Noise; clicking or rattling at idle RPM with the pedal released**

| **Possible diagnosis** | **Likely solution** |
| --- | --- |
| Broken spring(s) | Replace the pressure plate |

**Symptom:   
Noise; whirring or grinding when clutch is released (pedal depressed)**

| **Possible diagnosis** | **Likely solution** |
| --- | --- |
| Failing clutch release bearing | Replace |

**Symptom:   
Noise; chattering or "buzzing" when clutch is released**

| **Possible diagnosis** | **Likely solution** |
| --- | --- |
| Excessive pilot bushing to input gear clearance. Often resultant of bellhousing misalignment | Replace pilot bushing. Clearance should be .001 to .004 |

**Symptom:   
Pedal is hard to push and hold down**

| **Possible diagnosis** | **Likely solution** |
| --- | --- |
| Improperly set-up linkage system | Change as required (see text) |
| Pressure plate spring load excessive for linkage | Reduce spring load, or, if high pressure clutch is required then modify the linkage to give the minimum travel that will still release (i.e., provide the required .025 air gap) and leave a finger clearance of 1/16" |