1998 XK RANGE - Brake System - General Information - 206-00

Inspection and Verification

NOTE:
Prior to carrying out any diagnosis, make sure that the brake system warning indicator is functional.

Visually examine the front and rear tire and wheel assemblies for damage such as uneven wear patterns, tread worn out or sidewall damage. Verify the tires are the same size, type and, where possible, same manufacture. Replace the damaged wheel or excessively worn tire. For additional information, refer to**<<204-04>>**.

Wheels and tires must be cleared of any foreign matter and tire pressures adjusted to the correct specification.

If the tires exhibit uneven wear or feathering, the cause must be corrected. Check the steering and suspension components for damage or wear and, if necessary, check and adjust front wheel alignment. For additional information, refer to**<<204-00>>**.

Road Test

Visual Inspection Chart

Mechanical	Electrical
Brake master cylinder	Parking brake switch
Brake caliper piston(s)	Damaged or corroded wiring harness
Brake discs	Brake master cylinder fluid level switch
Wheel bearings	
Brake pads	
Power brake booster	
Brake pedal linkage	
Booster vacuum hose	
Tires	
Debris	

Carry out a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparisons and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines to make good comparisons and detect performance concerns.

An experienced brake technician will always establish a route that will be used for all brake diagnosis road tests. The roads selected will be reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Crowned roads should be avoided because of the large amount of weight shifted to the low set of wheels on this type of road. Once the route is established and consistently used, the road surface variable can be eliminated from the test results.

Before a road test, obtain a complete description of the customer concerns or suspected condition. From the description, the technician's experience will allow the technician to match possible causes with symptoms. Certain components will be tagged as possible suspects while others will be eliminated by the evidence. More importantly, the customer description can reveal unsafe conditions which should be checked or corrected before the road test. The description will also help form the basic approach to the road test by narrowing the concern to specific components, vehicle speed or conditions.

Begin the road test with a general brake performance check. Keeping the description of the concern in mind, test the brakes at different vehicle speeds using both light and heavy pedal pressure. To determine if the concern is in the front or rear braking system, use the brake pedal and then use the parking brake control. If the condition (pull, vibration, pulsation) occurs only with the parking brake, the concern is in the rear brake system.

If the concern becomes evident during this check, verify it fits the description given before the road test. If the

concern is not evident, attempt to duplicate the condition using the information from the description.

If a concern exists, use the Symptom Chart in order to isolate it to a specific sub-system and condition description. From this description, a list of possible sources can be used to further narrow the cause to a specific component or condition.

Condition(s):

Brakes noisy

Possible Source(s):
- Brake pads.
- Brake discs.

Action(s) to take:
- GO to <<Pinpoint Test A>>.

Vibration when brakes are applied

Possible Source(s):
- Wheels require balancing.
- Wheel hub nuts.
- Caliper mounting bolts.
- Brake pads.
- Foreign material/scratches/corrosion on brake disc contact surfaces.
- Excessive brake disc thickness variation.
- Excessive brake disc runout.
- Wheel bearing wear or failure.
- Suspension bush wear or failure.
- Steering bush wear or failure.

Action(s) to take:
- Go to <<Pinpoint Test B>>.

The brakes pull or drift

Possible Source(s):
- Tire pressures/wear.
- Calipers.
- Brake pads.
- Brake discs.
- Wheel alignment adjustment.
- Wheel bearing.
- Suspension bushes and ball joints.

Action(s) to take:
- GO to <<Pinpoint Test C>>.

The pedal feels spongy

Possible Source(s):
- Air in brake system.

- Leak in hydraulic system.
- Brake booster/master cylinder.
- Brake pads.

Action(s) to take:
- GO to <<Pinpoint Test D>>.

The pedal goes down fast

Possible Source(s):
- Air in brake system.
- Leak in hydraulic system.
- Brake booster/master cylinder.
- Brake pads.

Action(s) to take:
- GO to <<Pinpoint Test E>>.

The pedal goes down slowly

Possible Source(s):
- Air in brake system.
- Brake booster/master cylinder.

Action(s) to take:
- Go to <<Pinpoint Test F>>.

Excessive brake pedal effort

Possible Source(s):
- Brake pads.
- Brake booster.

Action(s) to take:
- GO to <<Pinpoint Test G>>.

Brake lockup during light brake pedal force

Possible Source(s):
- Brake pads.
- Calipers.

Action(s) to take:
- GO to <<Pinpoint Test H>>.

Brakes drag

Possible Source(s):
- Parking brake control applied/malfunction.
- Seized parking brake cables.
- Seized caliper slide pins.
- Seized caliper.
- Brake booster.

- Pedal gear.

Action(s) to take:
- GO to <<Pinpoint Test I>>.

Excessive/Erratic brake pedal travel

Possible Source(s):
- Hydraulic system.
- Brake pads.
- Brake discs.
- Hub and bearing assembly.

Action(s) to take:
- GO to <<Pinpoint Test J>>.

The red brake warning indicator is always on

Possible Source(s):
- Fluid level.

Action(s) to take:
- FILL the system to specification. CHECK for leaks.

Possible Source(s):
- Brake fluid level sensor.

Action(s) to take:
- INSTALL a new brake master cylinder fluid reservoir. For additional information, refer to**<<206-06>>**.

Possible Source(s):
- Parking brake control.

Action(s) to take:
- RELEASE and ADJUST the parking brake. For additional information, refer to**<<206-05>>**.

Possible Source(s):
- Electrical circuit.

Action(s) to take:
- For additional information, refer to PDU for analysis/rectification of the concern.

Slow or incomplete brake pedal return

Possible Source(s):
- Brake pedal binding.
- Brake booster/master cylinder.

Action(s) to take:
- GO to <<Pinpoint Test K>>.

A : BRAKES NOISY

A1 : INSPECT BRAKE PADS

1. Inspect the condition of the front and rear brake pads. Check for damage to any anti-squeal shims.

- **Are the brake pads OK?**

-> Yes

Goto **<<A2>>**

-> No

CLEAN the front brake pads or INSTALL new front brake pads if necessary. For additional information, refer to**<<206-03>>**. CLEAN the rear brake pads or INSTALL new rear brake pads if necessary. For additional information, refer to**<<206-04>>**. Test vehicle for presence of brake squeal.

A2 : INSPECT BRAKE DISCS

1. Inspect the brake discs for excessive corrosion, wear or disc thickness variation.

- **Does excessive corrosion, wear or disc thickness variation exist?**

-> Yes

INSTALL new front brake discs and brake pads. For additional information, refer to**<<206-03>>**. INSTALL new rear brake discs and brake pads. For additional information, refer to**<<206-04>>**. TEST the system for normal operation.

-> No

Vehicle is OK.

B : VIBRATION WHEN BRAKES ARE APPLIED

B1 : ROAD TEST VEHICLE

1. Road test the vehicle between 40-80 km/h (25-50 mph) without applying brakes.

- **Is the vibration present?**

-> Yes

TEST for noise vibration and harshness. REPEAT road test if necessary.

-> No

Goto **<<B2>>**

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B2 : CHECK FOR BRAKE VIBRATION

1. Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal.

- **Is a vibration present?**

-> Yes

If the vibration is from the front of the vehicle
Goto **<<B3>>**
If the vibration is from the rear of the vehicle or can not be diagnosed between front or rear of the vehicle
Goto **<<B6>>**

-> No

Vehicle is OK.

B3 : CHECK THE SUSPENSION AND STEERING COMPONENTS

1. Check the condition of the front suspension bushes and ball joints **<<204-01>>** Check the condition of the steering linkage components **<<211-02>><<211-03>>**

- **Do any of the front suspension components or steering components require replacement?**

-> Yes

INSTALL new components as necessary **<<204-01>><<211-02>><<211-03>>** Road test the vehicle between 40-80 km/h (25-50 mph) with light and medium application on the brake pedal. If vibration still exists
Goto **<<B4>>**

-> No

Goto **<<B4>>**

B4 : CHECK THE FRONT BRAKE PADS AND FRONT BRAKE DISCS

1. Check the condition of the front brake pads and front brake discs.

- **Does excessive brake disc runout or brake disc thickness variation exist?**

-> Yes

Goto **<<B5>>**

-> No

Goto **<<B6>>**

B5 : CHECK VEHICLE FOR A HISTORY OF BRAKE VIBRATION PROBLEMS

1. Check to see if the vehicle has recently been repaired for brake vibration problems by the installation of new front brake discs and pads.

- **Has vehicle has recently been repaired for brake vibration problems by the installation of new front brake discs and pads.**

-> Yes

INSTALL new front wheel hubs **<<204-01>>** INSTALL new front brake discs and front brake pads **<<206-03>>** TEST the system for normal operation.

-> No

INSTALL front brake discs and front brake pads **<<206-03>>** CHECK for excessive brake disc runout If excessive brake disc runout exists INSTALL new front wheel hubs **<<204-01>>** TEST the system for normal operation.

B6 : CHECK THE REAR BRAKE PADS AND REAR BRAKE DISCS

1. Check the condition of the rear brake pads and rear brake discs.

- **Does excessive brake disc runout or brake disc thickness variation exist?**

-> Yes

INSTALL rear brake discs and rear brake pads **<<206-04>>** CHECK for excessive brake disc runout. If excessive brake disc runout exists INSTALL new rear wheel hubs. TEST the system for normal operation.

-> No

REPEAT road test and re-check for a vibration concern. If vibration exists

Goto **<<B3>>**

C : THE BRAKES PULL OR DRIFT

C1 : ROAD TEST VEHICLE

1. Road test the vehicle and apply the brake pedal.

- **Does the vehicle pull or drift?**

-> Yes
Goto **<<C2>>**

-> No
Vehicle is OK.

C2 : INSPECT TIRE PRESSURE

1. Check for excessive tire wear or incorrect pressures.

- **Are the tires at the correct pressure and in good condition?**

-> Yes
Goto **<<C3>>**

-> No
ADJUST the tire pressures or INSTALL new tires if excessively worn. TEST the system for normal operation.

C3 : CHECK CALIPERS

1. Check the front caliper pistons for binding, leaking or sticking. For additional information, refer to**<<206-03>>**. Check the rear caliper pistons for binding, leaking or sticking. For additional information, refer to**<<206-04>>**.

- **Do the disc brake caliper pistons and pins bind, leak or stick?**

-> Yes
INSTALL new calipers as necessary. TEST the system for normal operation.

-> No
Goto **<<C4>>**

C4 : INSPECT BRAKE DISCS

1. Check the brake discs for excessive damage, thickness variation or runout. For additional information, refer to General Procedures in this section.

- **Does excessive damage or runout exist?**

-> Yes
INSTALL new brake discs and brake pads as necessary. TEST the system for normal operation.

-> No
Goto **<<C5>>**

C5 : INSPECT THE FRONT HUB AND WHEEL BEARING ASSEMBLY

1. Check the front hub and wheel bearing assembly. For additional information, refer to**<<204-00>>**.

- **Are the wheel bearings OK?**

-> Yes
Goto **<<C6>>**

-> No
INSTALL new wheel bearings. For additional information, refer to**<<204-01>>**. TEST the system for normal operation.

C6 : CHECK SUSPENSION BUSHES AND BALL JOINTS.

1. Check all suspension bushes and ball joints.

- **Are the suspension bushes and ball joints OK?**

-> Yes
Vehicle is OK.

-> No
INSTALL new front suspension bushes and ball joints as required. For additional information, refer to**<<204-01>>**. INSTALL new rear suspension bushes and ball joints as required. For additional information, refer to**<<204-02>>**.

D : THE PEDAL FEELS SPONGY

D1 : CHECK FOR SPONGY PEDAL (ENGINE OFF)

1. Check for a firm brake pedal.

- **Is the brake pedal effort and brake pedal travel normal?**

-> Yes
Vehicle is OK.

-> No
Goto **<<D2>>**

D2 : CHECK BRAKE PEDAL RESERVE (ENGINE OFF)

1. Pump the brake pedal 10 times and hold on the final application.

- **Does the brake pedal feel firm on final application?**

-> Yes
Goto **<<D3>>**

-> No
BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation.

D3 : CHECK BRAKE PEDAL RESERVE (ENGINE ON)

1. Engine is idle.
2. Apply the brake pedal lightly three or four times.
3. Wait 15 seconds for the vacuum to recover.

4. Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs.

5. Hold the brake pedal in the applied position while increasing the engine speed to 2000 revs/min.

6. Release the accelerator pedal.

- **Does the brake pedal move downward as the engine speed returns to idle?**

-> Yes

Goto **<<D4>>**

-> No

CHECK the vacuum to brake booster. For additional information, refer to**<<206-07>>**.

D4 : CHECK BRAKE FLUID LEVEL

1. Check the brake master cylinder reservoir fluid level.

- **Is the fluid level OK?**

-> Yes

BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation.

-> No

CHECK brake master cylinder reservoir sealing points. For additional information, refer to Brake Master Cylinder in this section. ADD fluid and BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test if necessary.

E : THE PEDAL GOES DOWN FAST

E1 : ROAD TEST VEHICLE

1. Road test and apply the brake pedal.

- **Is the brake pedal effort and brake pedal travel normal?**

-> Yes

Vehicle is OK.

-> No

Goto **<<E2>>**

E2 : CHECK BRAKE FLUID LEVEL

1. Check the brake master cylinder reservoir fluid level.

- **Is the fluid level within specification?**

-> Yes

Goto **<<E3>>**

-> No

CHECK the brake master cylinder reservoir sealing points. For additional information, refer to Brake Master Cylinder Component Test in this section. ADD fluid and BLEED brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test if necessary.

E3 : CHECK BRAKE PEDAL TRAVEL-PRESSURIZE SYSTEM

1. Pump the brake pedal rapidly (five times).

- **Does the brake pedal travel build up and then hold?**

-> Yes
BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test.

-> No
Goto **<<E4>>**

E4 : CHECK FOR BRAKE SYSTEM LEAKS

1. Check for external brake system leaks. For additional information, refer to Master Cylinder in this section.

- **Are leaks found?**

-> Yes
REPAIR as necessary, ADD fluid and BLEED brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test.

-> No
System is OK.

F : THE PEDAL GOES DOWN SLOWLY

F1 : ROAD TEST VEHICLE - CHECK BRAKE PEDAL OPERATION

1. Check if the condition occurs during actual stopping application by applying the brake pedal while the vehicle is moving.

- **Does the condition occur when the vehicle is moving?**

-> Yes
Goto **<<F2>>**

-> No
Goto **<<F3>>**

F2 : CHECK FOR BRAKE SYSTEM LEAKS

1. Check for external brake system leaks. For additional information, refer to Master Cylinder in this section.

- **Are there any external brake system leaks?**

-> Yes
REPAIR as necessary. ADD fluid and BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation.

-> No
Goto **<<F3>>**

F3 : CARRY OUT A BRAKE MASTER CYLINDER BYPASS TEST

1. Test for brake master cylinder bypass condition. Refer to Brake Master Cylinder Component Test in this section.

- **Are any concerns found?**

-> Yes
INSTALL a new brake master cylinder, ADD fluid and BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation.

-> No
System is OK.

G : EXCESSIVE BRAKE PEDAL EFFORT

G1 : CHECK BRAKE PADS

1. Check the brake pads for wear, contamination, correct installation, damage and type.

- **Are any concerns found?**

-> Yes
INSTALL the front brake pads correctly or INSTALL new front brake pads if necessary. For additional information, refer to**<<206-03>>**. INSTALL the rear brake pads correctly or INSTALL new rear brake pads if necessary. For additional information, refer to**<<206-04>>**. REPEAT road test.

-> No
Goto **<<G2>>**

G2 : CHECK VACUUM

1. Disconnect the vacuum booster hose from the booster.
2. Connect a vacuum/pressure tester to the vacuum hose.
3. Run the engine at normal operating temperature.
4. Record the vacuum reading.

- **Is the reading 40.5kPa (12 in-Hg) or greater?**

-> Yes
Goto **<<G3>>**

-> No
LOCATE and REPAIR the source of low vacuum. TEST the system for normal operation.

G3 : INSPECT SYSTEM

1. Switch the engine off.
2. Reconnect the vacuum hose.
3. Inspect the brake booster, rubber grommet, and all vacuum plumbing for cracks, holes, damaged connections, or missing clamps.
4. Pump the brake pedal several times to exhaust the vacuum. Push down on the brake pedal and hold.

- **Does the brake pedal move down when the engine is started?**

-> Yes
Vacuum system is OK.

-> No

Goto **<<G4>>**

G4 : CHECK POWER BRAKE BOOSTER VALVE

1. Check the brake booster valve. For additional information, refer to Brake Booster in this section.

•Is the power brake booster valve OK?

-> Yes
CHECK the brake booster. For additional information, refer to Brake Booster in this section. INSTALL a new brake booster if necessary. TEST the system for normal operation.

-> No
INSTALL a new brake booster valve. TEST the system for normal operation.

H : BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE

H1 : TEST BRAKE LOCKUP

1. Road test the vehicle and apply the brake pedal lightly.

•Do the brakes lockup?

-> Yes
Goto **<<H2>>**

-> No
Vehicle is OK.

H2 : INSPECT BRAKE PADS

1. Inspect brake pads for contamination, correct installation, damage and type.

•Are any concerns found?

-> Yes
CHECK the front brake pads. For additional information, refer to**<<206-03>>**. CHECK the rear brake pads. For additional information, refer to**<<206-04>>**. INSTALL new brake pads as necessary. REPEAT road test.

-> No
Goto **<<H3>>**

H3 : INSPECT BRAKE CALIPERS

1. Inspect brake calipers for binding, leaking or sticking.

•Are any concerns found?

-> Yes
CHECK the front brake calipers. For additional information, refer to**<<206-03>>**. CHECK the rear brake calipers. For additional information, refer to**<<206-04>>**. INSTALL the brake calipers correctly or INSTALL new brake calipers as necessary. TEST the system for normal operation. REPEAT road test if necessary.

-> No
Vehicle is OK.

I : BRAKES DRAG

I1 : ROAD TEST VEHICLE

1. Road test the vehicle and apply the brakes.

- **Are the brakes functioning correctly?**

-> Yes
Vehicle is OK.

-> No
Goto **<<I2>>**

I2 : CHECK CALIPERS

1. Check the front caliper pistons for binding, leaking or sticking. For additional information, refer to**<<206-03>>**. Check the rear caliper pistons for binding, leaking or sticking. For additional information, refer to**<<206-04>>**.

- **Do the disc brake caliper pistons and pins bind, leak or stick?**

-> Yes
INSPECT the brake calipers and parking brake cables. INSTALL new components as necessary. Road test vehicle.

-> No
Goto **<<I3>>**

I3 : CHECK BRAKE BOOSTER

1. Check the brake booster connecting rod alignment and travel. For additional information, refer to**<<206-07>>**.

- **Is the connecting rod OK?**

-> Yes
Vehicle is OK.

-> No
INSTALL a new brake booster. For additional information, refer to**<<206-07>>**. TEST the system for normal operation.

J : EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL

J1 : TEST ON ROUGH ROAD

1. Road test the vehicle on rough road conditions.
2. Apply the brakes slowly.

- **Is the brake pedal effort and brake pedal travel normal?**

-> Yes
Vehicle is OK.

-> No
Goto **<<J2>>**

J2 : CHECK BRAKE FLUID LEVEL

1. Check the brake master cylinder reservoir fluid level.

•Is the fluid level OK?

-> Yes
Goto **<<J3>>**

-> No
CHECK brake master cylinder reservoir sealing points. For additional information, refer to Brake Master Cylinder in this section. ADD brake fluid and BLEED the brake system. For additional information, refer to General Procedures in this section. TEST the system for normal operation. REPEAT road test if necessary.

J3 : CHECK BRAKE PEDAL RESERVE

1. Engine is idle.
2. Apply the brake pedal lightly three or four times.
3. Wait 15 seconds for the vacuum to replenish.
4. Push down on the brake pedal until it stops moving downward or an increased resistance to the brake pedal travel occurs.
5. Hold the brake pedal in the applied position while increasing the engine speed to 2000 revs/min.
6. Release the accelerator pedal.

•Does the brake pedal move downward as the engine speed returns to idle?

-> Yes
Goto **<<J4>>**

-> No
CHECK the vacuum to the brake booster. For additional information, refer to**<<206-07>>**.

J4 : CHECK THE FRONT HUB AND BEARING ASSEMBLY

1. Check the front hub and bearing assembly. For additional information, refer to**<<204-01>>**.

•Are the front wheel bearings loose?

-> Yes
INSTALL a new front wheel bearing if damaged. For additional information, refer to**<<204-01>>**. TEST the system for normal operation.

-> No
CHECK the front brake discs for thickness variances. For additional information, refer to General Procedures in this section.

K : SLOW OR INCOMPLETE BRAKE PEDAL RETURN

K1 : CHECK FOR BRAKE PEDAL RETURN

1. Run the engine at fast idle while making several brake applications.
2. Pull the brake pedal rearward with approximately 44.5 N (10lb) force.

3. Release the brake pedal and measure the distance to the toe board.

4. Make a hard brake application.

5. Release the brake pedal and measure the brake pedal to toe board distance. The brake pedal should return to its original position.

- **Does the brake pedal return to its original position?**

-> Yes
Vehicle is OK.

-> No
Goto **<<K2>>**

K2 : CHECK FOR BRAKE PEDAL BINDING

1. Check the brake pedal to make sure it is operating freely.

- **Is the brake pedal operating freely?**

-> Yes
INSTALL a new brake booster. For additional information, refer to**<<206-07>>**. TEST the system for normal operation.

-> No
REPAIR or INSTALL new brake pedal. TEST the system for normal operation.