

CLUTCH FRICTION EVALUATION**Application**

This test method evaluates the durability of clutch friction plates by measuring wear, breakaway torque, coefficients of friction, and speed coefficient ratios during varying test cycle operations.

Materials and Apparatus Required

Friction Plates - No. XP-192219 (BW-4400) and XP-142976 (SD-1777)

Source: Borg Warner Corp.
700 25th Ave.
Bellwood, IL 60104-1908
(708) 547-2600

Separator Plates - No. XP-143218

Source: Steel Part Corp.
P.O. Box 700
Tipton, IN 46072-0620
(317) 523-4248

Heptane

Cleaning solvent.

Non-Metallic Brush or Scouring Pad**Micrometer****Depth Micrometer**

Test Fluid - Candidate Fluid

Thermocouple - size 0.58 +/- .02 mm diameter

O-Rings

Precision Seal No. 265 and 272.

Temperature Recorder

Date	Action	Revisions
2001 07 24	Revised	Editorial – no technical change A. Cockman
1995 05 15		

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Timer

Print - 134 - D8

Source: Greenings & Associates, Inc.
18465 Mt. Elliot Ave.
Detroit, MI 48224

Conditioning and Test Conditions

All test values indicated herein are based on material conditioned in a controlled atmosphere of 23 +/- 2 °C and 50 +/- 5 % relative humidity for not less than 24 h prior to testing and tested under the same conditions unless otherwise specified.

Procedure

General Operation

Using friction plates with waffle-groove SD-1777 and BW-4400 friction material, run twelve 4-plate packs, 200 cycles each, for evaluations and three 4-plate packs, 20,000 cycles for durability, according to the procedure below. One pack is considered to be four steels and two friction plates arranged according to Figure 1 and referred to as the 4-plate pack. All torque trace information must be obtained using digitized data acquisition and must be acquired at no less than 1000 points per second.

Cleaning Procedure

Prior to each durability test, the fixture must be cleaned. After removing the front cover, the spacer, retainer ring and hub are removed. These parts are cleaned with heptane, scrubbed with a non-metallic bristle brush or non-metallic scouring pad and rinsed. The inside of the test housing, attached ports and thermocouple connections are flushed with heptane using a squeeze bottle. Thoroughly clean all crevices and ports in the housing where lubricant is likely to be trapped. Air blow dry the cleaned parts and test housing.

Assembly Procedure

1. Inspect rotating shaft seal (National No. 4471887) for deterioration and replace if necessary. Indication of seal failure or loss of flexibility is the escape of air past the seals. If this seal is replaced, also replace lip seals No. 1366236 and 3-21196 (both supplied by Greening & Associates, Inc.).
2. Install clutch plate hub, snap ring, and clutch plate retainer.
3. Inspect clutch plates prior to testing using the following procedure.
 - (a) Find the thickest spot of each plate and arrange the plates so the thick spots are distributed around the pack, for minimum thickness.

- (b) Identify each plate by marking the top tooth with a number, one through six in the sequence shown in Figure 1. This number will be at the top when each plate is installed for test.
 - (c) Mark a tooth at approximately 120° each way around from the numbered tooth on each plate.
 - (d) Measure and record average overall pack thickness under a 14 kg load.
 - (e) Measure plate thickness as follows:

At each of the three locations, 120° apart, measure at two places, one near the inside, and one near the outside diameter. These measurements will be labeled "initial".
 - (f) Use micrometer, and keep the entire anvil within the friction contact area for each measurement.
 - (g) After the durability test repeat these measurements in the same order and at the same places, beginning at the numbered tooth. These measurements are labeled "final".
 - (h) Subtract the "final" measurements from the "initial" measurements. Wear limit at any of the six places is 0.1524 mm. Average wear per plate is not to exceed 0.0762 mm.
- 4. Presoak clutch plates in test fluid for 5 minutes minimum and then install clutch plates in the test head in the order prescribed with plate rounded side facing operator.
 - 5. Install packs into test head. Thermocouple is to be located at the mid point of the back to back plates of the 4-plate pack.
 - 6. Install two spacers only between the cover and the outermost clutch plate to locate the thermocouple at the center of the test pack.
 - 7. Check clutch plate pack free movement. Clearance is 0.70 +/- 0.13 mm. This measurement, conveniently made with a depth micrometer, is made between the head and outermost clutch plate while the pack is pressed into the head with finger pressure (about 1 kg) at the sites of measurements.
 - 8. Install thermocouple between the 4 and 5 o'clock position to within 1.0 mm of steel clutch plate annulus O.D. (without touching clutch plate).
 - 9. Install new O-rings on cover, if necessary. Print 134-D8 O-rings are Precision Seal No. 265 and No. 272 or equivalent.
 - 10. Attach cover and fasten with ring-bearing support and cover retainer, print 134-D18.