

Passenger cars - Service brake road test procedures

1. Scope

This Standard specifies road test procedures for service brakes for passenger cars operated under normal conditions. This Standard does not apply to two-wheeled vehicles.

2. Applicable Publications

The following publications form a part of this Standard to the extent specified herein.

The latest issue of all publications shall apply.

JIS D0210	General Rules of Brake Test Method of Automobiles and Motorcycles
JASO C428	Parking Brake Test Procedure

3. Definitions

The definitions of main terms used in this Standard conform to **2 (Definition of Terms)** of **JIS D0210** and the following.

a) Initial Brake Temperature The value read within 15 seconds before the start of brake application. Where specified, the initial brake temperature shall be the highest of the mean values for each wheel measured per axle.

4. Test Conditions

4.1 Vehicle Classification

Test vehicles are classified by nominal maximum speed and conform to the provisions of **JIS D0210**.

Category P1	Over 140km/h
Category P2	111km/h to 140km/h
Category P3	91km/h to 110km/h
Category P4	90km/h and under

4.2 Vehicle Condition

Test vehicles shall conform to **4.1 (Condition of Vehicles)** of **JIS D0210**

4.3 Condition of Brake Parts

Each part of the braking device shall conform to **4.3 (Condition of Brake)** of **JIS D0210**.

4.4 Road Surface and Weather Conditions

Conform to **4.2 (Road Surface and Weather Conditions)** of **JIS D0210**.

4.5 Temperature Measurement

Brake temperature shall be measured as specified in **6 (Temperature Measurement)** of **JIS D0210**.

5. Test Procedures

5.1 Braking Operation

- Braking operation shall be performed with a continuous pedal force not exceeding 500N until the vehicle comes to a complete stop.
- In braking operations with constant braking deceleration, when the designated deceleration cannot be attained after pedal force reaches 500N, braking operation shall be performed with pedal force of 500N.
- Braking shall be initiated when the vehicle is at the center of a 3.5m wide lane, and the posture of the test vehicle shall be controlled so that no part of the vehicle leaves the lane.

5.2 Test Items and Sequence

a) Preburnish check

Initial braking speed	50km/h or less
Initial brake temperature	80°C or less
Braking operation	Braking deceleration of 3.0m/s ² or less

Repetitions	10 or less
Record	Pedal force or line pressure, braking deceleration, and initial brake temperature

Remarks: Proceed to the next test item only after this test is completed with test equipment, brakes and vehicle functioning normally throughout the test.

b) First effectiveness test

Initial braking speeds	50km/h, 100km/h for P1 and P2 vehicles 50km/h, 80km/h for P3 vehicles 50km/h, 65km/h for P4 vehicles
Transmission control position	Neutral
Initial brake temperature	80°C
Braking operation	Constant braking deceleration or constant pedal force (line pressure)
Repetitions	Braking applications shall start with the lowest braking deceleration or pedal force for each initial braking speed, and shall be repeated with increasing degrees until wheel lock occurs, the vehicle exceeds the lane boundaries or pedal force reaches 500N. Brake applications should be repeated at least 6 times at appropriate intervals.
Record	Pedal force or line pressure, braking deceleration, wheel lock condition, and deviation of vehicle from lane boundaries.

Remarks: Initial braking speed should be applied sequentially from the lowest specified condition.

c) Burnish

Initial braking speed	65km/h
Transmission control position	Normal driving position
Braking operation	Braking deceleration of 3.5m/s ²
Cooling speed	65km/h
Braking interval	1,500m or 120°C of the initial brake temperature, whichever is attained earlier. Braking shall commence when the temperature reaches 120°C even if the braking interval does not reach 1,500m.
Repetitions	200
Record	Pedal force or line pressure, and initial brake temperature (every first and 20th repetitions)

d) Second effectiveness test

1) Low temperature effectiveness test

Initial braking speed	50km/h
Transmission control position	Neutral
Initial brake temperature	50°C or less
Braking operation	Constant braking deceleration or constant pedal force (line pressure)
Repetitions	Braking shall start with the lowest braking deceleration or pedal force for each initial braking speed, and shall be repeated with increasing degrees until wheel lock occurs, the vehicle exceeds the boundaries, or pedal force reaches 500N. Brake applications shall be repeated at least 3 times at appropriate intervals.
Record	Pedal force or line pressure, braking deceleration, and initial brake temperature

Remarks: When the initial brake temperature does not reach 50°C, braking operation may be performed successively.

2) Normal temperature effectiveness test Repetition of the first effectiveness test specified in b).

The initial braking speeds, however, shall be as follows.

- 50, 100, and 130km/h for P1 vehicles
- 50, 80, and 100km/h for P2 vehicles

50 and 80km/h for P3 vehicles

50 and 65km/h for P4 vehicles

e) First reburnish

Repetition of the burnish specified in **c) Burnish**, except that the number of brake applications shall be reduced to 35 and data shall be recorded for the first, 10th, 25th and 35th repetitions.

f) Light load effectiveness test

Repetition of the first effectiveness test specified in **b) First effectiveness test**. (Not required for vehicles with a capacity of 2 persons or less.)

g) First fade and recovery test

1) Base line check

Initial braking speed	Vmax 0/-20 km/h Upper limit 100km/h Where, Vmax: the nominal maximum speed (km/h)
Transmission control position	Neutral
Initial brake temperature	80°C
Braking operation	Constant braking deceleration of 5.0m/s ²
Repetitions	3
Record	Pedal force or line pressure

2) Fade test

Initial braking speed	$\sqrt{(80\% V_{\max})^2 - (40\% V_{\max})^2}$
	Upper limit 100km/h Where, 80%Vmax: value (km/h) equal to nominal max. speed multiplied by 0.8 40%Vmax: value (km/h) equal to nominal max. speed multiplied by 0.4
Transmission control position	Normal driving gear
Initial brake temperature	60°C for initial application only
Braking operation	Constant braking deceleration of 3.0m/s ² constant (See g of 6.1.)
Cooling speed	Equal to initial braking speed
Accelerating condition	Maximum level immediately following completion of braking
Braking interval	640m
Repetitions	10
Record	Pedal force or line pressure, initial brake temperature, time required for fade test, and atmospheric temperature and wind velocity at the beginning of fade test

Remarks: The test shall continue uninterrupted from the initial to the final braking of the fade test.

3) High temperature effectiveness test

Interval from preceding test	Immediately after the fade test perform maximum acceleration test. Start braking operation when the specified initial braking speed is attained.
Initial braking speed	Same as in 1) Base line check
Transmission control position	Neutral
Braking operation	Constant braking deceleration of 5.0m/s ² constant
Repetitions	1
Record	Pedal force or line pressure and initial brake temperature

4) Cooling effectiveness test

Interval from preceding test	1,500m immediately after completion of high temperature effectiveness test, run vehicle at 50km/h and, upon attaining specified braking interval, start braking operation.
Initial braking speed	50km/h

Transmission control position	Normal driving gear
Braking operation	Constant braking deceleration of 3.0m/s ² constant (See g) of 6.1.)
Cooling speed	50km/h
Braking interval	1,500m
Repetitions	4
Record	Pedal force or line pressure and initial brake temperature

5) Recovery test

Interval from preceding test	1,500m immediately following cooling effectiveness test, run vehicle at initial braking speed and, upon attaining specified braking interval, start braking operation.
Initial braking speed	Same as in 1) Base line check
Transmission control position	Neutral
Braking operation	Constant braking deceleration of 5.0m/s ² constant (See g) of 6.1.)
Cooling speed	Equal to initial braking speed
Repetitions	1
Record	Pedal force or line pressure and initial brake temperature

6) Effectiveness spot check (Optional)

Initial braking speed	Same as in 2) Fade test
Transmission control position	Neutral
Initial brake temperature	80°C
Braking operation	Constant braking deceleration of 3.0m/s ² constant (See g) of 6.1.)
Repetitions	2
Record	Pedal force or line pressure

h) Second rebrinish

Repetition of **e) First rebrinish**.

i) Second fade recovery test

- 1) Base line check** Repetition of **g**), **2) Base line check**. The initial braking speed, however, shall be 50km/h.
- 2) Fade test** Repetition of **g**), **2) Fade test**. The braking deceleration, however, shall be 5.0m/s² constant and the number of repetitions shall be 15.
- 3) High temperature effectiveness test (Optional)** Repetition of **g**), **3) High temperature effectiveness test**.
- 4) Recovery test** Repetition of **g**), **5) Recovery test**. The initial braking speed and cooling speed, however, shall be 50km/h and the number of repetitions shall be 12 or more.
- 5) Effectiveness spot check (Optional)** Repetition of **g**), **6) Effectiveness spot check**. The initial braking speed, however, shall be 5.0m/s² constant.

j) Third rebrinish

Repetition of **First rebrinish** of **e)**

k) Final effectiveness test

Repetition of **d**), **2) Normal temperature effectiveness test**. The initial braking speed, however, shall be optionally changeable to the following values:

150km/h for vehicles with nominal maximum speeds above 160km/h but less than 170km/h.

160km/h for vehicles with nominal maximum speeds exceeding 170km/h.

l) Fourth rebrinish Repetition of **e) First rebrinish**. This item may be omitted when not essential.**m) Water recovery test****1) Base line check**

Initial braking speed 50km/h

Transmission control position	Normal driving gear
Initial brake temperature	80°C
Braking operation	Constant braking deceleration of 3.0m/s ² constant (See g) of 6.1.)
Repetitions	3
Record	Pedal force or line pressure

2) Water immersion

The test vehicle shall travel or shuttle back and forth in a trough containing 15cm of water for 2 minutes at an approximately 10km/h with the brake fully released.

2) Recovery test

Interval from the preceding test	Initial braking shall be applied within 1 minute from completion of water immersion.
Initial braking speed	50km/h
Transmission control position	Normal driving gear
Braking operation	Constant braking deceleration of 3.0m/s ² (See g) of 6.1.)
Cooling speed	50km/h
Braking interval	800m or less
Repetitions	15
Record	Pedal force or line pressure

Remarks: Travelling speed shall not exceed 50km/h for the period between completion of water immersion and the start of initial braking. During this period, no braking operation should be performed.

n) Final inspection

Every brake shall be disassembled and inspected, and the results recorded.

5.3 Allowable Modifications of Test Conditions

a) Test braking for the following items shall start when the reading of the calibrated measuring instrument stays within the following range under the specified conditions.

1) Initial braking speed shall be within ± 3 km/h of that specified.

Record the value targeted within this range. Initial braking speed shall not exceed 80% of the vehicle's nominal maximum speed and therefore shall be reduced by increments of 5km/h when required P4 vehicles with low nominal maximum speeds.

2) Initial brake temperature shall be held within $\pm 10^\circ\text{C}$ of that specified. For P3 and P4 and special built vehicles, initial brake temperatures 80°C and 120°C shall be modifiable to 60°C and 80°C respectively.

b) Readings of the calibrated measuring instruments shall be kept within the ranges specified below.

1) Braking deceleration shall be held within $+0.5/0$ m/s² of that specified. Record the value targeted within this range.

2) Cooling speed shall be within ± 3 km/h of that specified. Record the value targeted within this range. Initial braking speed shall not exceed 80% of the vehicle's nominal maximum speed and therefore shall be reduced by increments of 5km/h when required P4 vehicles with low nominal maximum speeds.

c) The braking interval shall be set to a value as close as possible to the specified distance. The braking interval, however, shall be modifiable within the range specified in Table 1 when modification is required. When a particular distance within this range is set as the braking interval, or when the distance involves periodic change, record the value.

Table 1 Allowable Range for Braking Interval

Unit: m

Test Item	Braking Interval (Distance)
Fade Test	640 ± 150
Burnish Cooling Effectiveness Test Cooling Recovery Test (Fade Recovery Test)	1500 ± 300

When P4 vehicles are tested at cooling and initial braking speeds lower than the specified values, the braking interval shall conform to the specified distance interval.

5.4 Unspecified Braking Operations

Any braking operation not specified for the tests shall be avoided. When the brake needs to be heated to the specified temperature, however, the initial braking speed and braking deceleration shall conform to the burnish conditions.

5.5 Modification of Vehicle Classification

Vehicle classification may be modified for vehicles not specified in the vehicle categories.

5.6 Additional Test Items

When the parking brake test (optional) is necessary, a part or all of the test items specified in **JASO C428** may be performed. The test sequence is not specified.

6. Records

6.1 Recording Procedures

The following items shall be monitored, measured and recorded.

- a) Any phenomenon indicating abnormal brake performance; noise, vibration, etc. taking place during the test.
- b) Occurrence of any wheel lock during the test including the position of the wheel involved, the conditions in which wheel lock occurs, etc. and the use of the anti-lock device.
- c) Failure of the test vehicle to be kept within the test lane boundaries.
- d) Advance measurement of the correlation between line pressure and pedal force when the line pressure is adopted
- e) For tests with constant braking deceleration; Initial, intermediate (continuous), and final values of pedal force or line pressure and the time they approach the maximum value. Values shall be measured before vehicle speed drops below 10km/h to avoid build up influence on the reading incidental to the period immediately before the stopping moment.
- f) For tests with constant braking pedal force; Initial, intermediate (continuous), and final values of the braking deceleration and the time they approach the maximum value. Values shall be measured before the vehicle speed drops below 10km/h to avoid build up influence on the reading incidental to the period immediately before the stopping moment.
- g) When the average value of braking deceleration does not stay within $\pm 15\%$ that specified where constant application is required the deviated values and the respective values of pedal force or line pressure shall be recorded.
- h) Any modification in specified values including those specified in **5.3 Test Conditions**.
- i) Measurement of the atmospheric temperature and wind velocity is recommended before starting the all tests.
- j) The reading sequence of the initial brake temperature of each wheel shall be the same throughout the tests.

6.2 Recording Forms

- a) Record formats shall be as follows:

- 1) Summary Sheet of Service Brake Data and Road Performance (Passenger Cars); (**Attached Table 1**)

Average braking deceleration and average pedal force entered in this table shall be calculated as in **Attached Fig. 1**. They are replaceable with the mean values of the initial, intermediate, and final braking deceleration and pedal force respectively. The average value of pedal force at average braking deceleration of 6.0m/s^2 in the effectiveness tests shall be calculated as in **Attached Fig. 2**.

2) Summary Graphs of Service Brake Road Performance (Passenger Cars); (**Attached Table 2**)

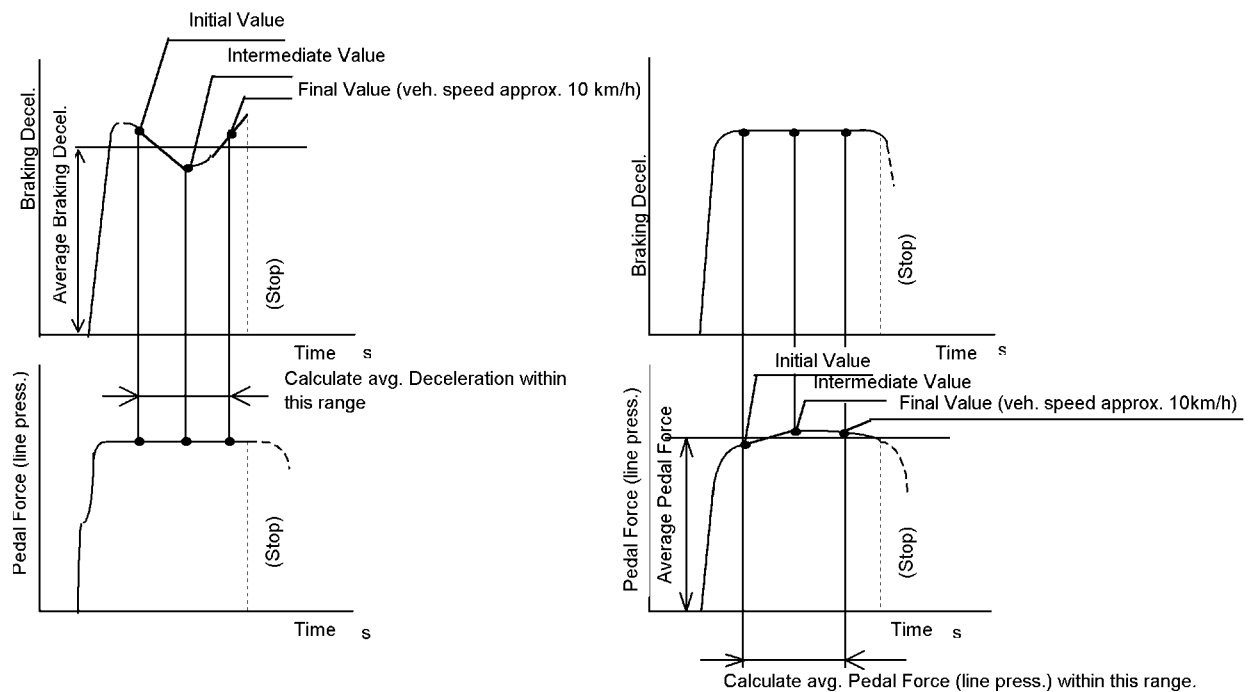
3) Recording format by test item; **Attached Tables 3 to 8**

4) Graphic sheets by test item; **Attached Tables 9 to 13**

Reference Standards

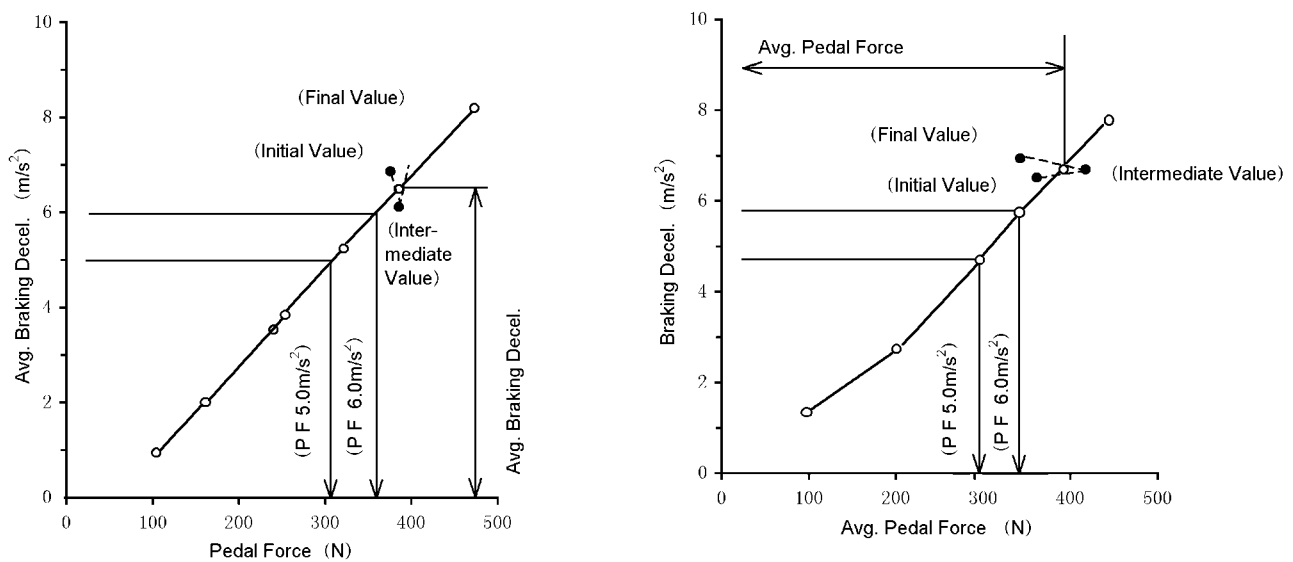
JIS D0106

Road Vehicles - Brake Types, Braking Mechanics and Brake Operation



a) Braking Operation at Constant Pedal Force (line pressure) b) Braking Operation at Constant Braking Deceleration

Attached Fig. 1 Calculation of Average Deceleration and Pedal Force (line pressure)



a) Braking Operation at Constant Pedal Force (line pressure) b) Braking Operation at Constant Braking Deceleration

Attached Fig. 2 Summary of Effectiveness

Attached Table 1 Summary Sheet of Service Brake Data and Road Performance (Passenger Cars)

Reference No.			
Test Date	Day	Month	Year
Test Site			
Tested by			

Vehicle Specifications

Car Make _____		Model _____		Chassis No. _____		Year _____	
Eng. model _____		Displacement _____ cm ³		Max. speed (nom) _____ km/h		Vehicle class _____	
Transmission model _____		T/M _____ T/C _____		Forward _____ steps		Reverse _____ steps	
						Final reduction gear _____	
Veh. weight (mass) _____		Nominal load/() empty _____		Front shaft load() kN _____		Rear shaft load() kN _____	
		Specified load/() light _____		Front shaft load() kN _____		Rear shaft load() kN _____	
						Total () kg _____	
						Total () kg _____	
O/all Dimensions _____		L _____ mm		W _____ mm		H _____ mm	
Disc wheel Model _____		Rim size _____		Tire model _____		Size _____	
						Static load radius _____	
						Suspension system _____	
						Front _____ Rear _____	

Brake Specifications

Front Model: Drum Disc Cylinder dia. _____ mm Friction material maker _____

Size Inner dia. (effect dia.) _____ mm × Outer dia. _____ mm × Thick _____ mm Swept area (both wheels) _____ cm²

Lining (pad) (Rotate dir.) L _____ mm × W _____ mm × Thick _____ mm Total area (both wheels) _____ cm²

Rear Model: Drum Disc Cylinder dia. _____ mm Friction material maker _____

Size Inner dia. (effect dia.) _____ mm × Outside dia. _____ mm × Thick _____ mm Swept area (both wheels) _____ cm²

Lining (pad) (Rotate dir.) L _____ mm × W _____ mm × Thick _____ mm Total area (both wheels) _____ cm²

Pedal ratio _____ Master cylinder size _____ Master cylinder model _____

Servo unit Yes · No Model _____ Warn device Yes · No Operate Pressure _____ MPa

Pressure control device Yes · No Model _____

Other brake device _____

Preburnish check	Pedal force	N at initial braking speed of 50km/h or less and braking deceleration of 3.0m/s ² or less.
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Effectiveness Test Average pedal force at average braking deceleration of 6.0 m/s^2

Initial Braking Speed					
Item		km/h	km/h	km/h	km/h
1st Effectiveness		N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²
2nd Effectiveness	Low Temp.	N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²
	Normal Temp.	N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²
Final Effectiveness		N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²
Light Load Effectiveness		N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²	N at 6.0m/s ²

Fade and Recovery Test

A Condition of wheel lock in effectiveness test (circle the lock position).

B Indicate whether or not the test vehicle crosses the 3.5m lane margins at an average deceleration of 6m/s^2

Initial Braking		km/h				km/h				km/h				km/h				km/h							
Speed		A		B		A		B		A		B		A		B		A		B					
		Locked	m/s ² on	Yes	No	Locked	m/s ² on	Yes	No	Locked	m/s ² on	Yes	No	Locked	m/s ² on	Yes	No	Locked	m/s ² on	Yes	No				
Item	Wheel	Occurrence				Wheel	Occurrence				Wheel	Occurrence				Wheel	Occurrence				Wheel	Occurrence			
1st	FL RL					FL RL					FL RL					FL RL					FL RL				
Effectiveness	FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²			
2nd	FL RL					FL RL					FL RL					FL RL					FL RL				
Effectiveness	FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²			
Final	FL RL					FL RL					FL RL					FL RL					FL RL				
Effectiveness	FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²			
Light Load	FL RL					FL RL					FL RL					FL RL					FL RL				
Effectiveness	FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²				FR RR	m/s ²			

Fade and

Recovery Test

Pedal force denotes the average value

Division	Fade Test																High Temp.		Recovery Test		
	time required: min. sec.																min. sec.				
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	Max. Temp.	Effe.	1st - 5th	6th on		
	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	Front	Rear	P.F.	Max. P.F.	Max. P.F.	
1st Fade																					
Recovery																°C	°C				
2nd Fade																					
Recovery																°C	°C				

Water

Pedal force in base line check _____	N	Max. pedal force in 4th to 6th recovery tests _____	N
Max. average pedal force in 7th to 14th recovery tests _____	N	Average pedal force in 15th recovery test and after _____	N

Recovery Test

Final Inspection (Describe Condition)

(Describe Condition)

Friction Material _____

Drum or Disc _____

Mechanical Elements _____

Hydraulic Circuit _____

Comments

Prepared by _____

The figure consists of three separate graphs, each with a grid. The y-axis for all graphs is 'Pedal Force (N)' ranging from 0 to 121. The x-axis for the first two graphs is 'Repetitions'.

- Graph 1: Repetitions (1st Fade Recovery)**
 - X-axis: 1, 2, 3, 4, 5, 10, 15, 50, 100, 200
 - Y-axis: 0 to 121
 - Legend: Preburnish Check (solid line), Burnish (dashed line)
 - The solid line starts at approximately 100 N at 1 repetition and decreases to about 10 N at 200 repetitions.
 - The dashed line starts at approximately 100 N at 1 repetition and decreases to about 10 N at 200 repetitions.
- Graph 2: Repetitions (2nd Fade Recovery)**
 - X-axis: 1, 2, 3, 4, 5, 10, 15, 50, 100, 200
 - Y-axis: 0 to 121
 - Legend: Preburnish Check (solid line), Burnish (dashed line)
 - The solid line starts at approximately 100 N at 1 repetition and decreases to about 10 N at 200 repetitions.
 - The dashed line starts at approximately 100 N at 1 repetition and decreases to about 10 N at 200 repetitions.
- Graph 3: Preburnish Check**
 - X-axis: 1, 2, 3, 4, 5, 10, 15, 50, 100, 200
 - Y-axis: 0 to 121
 - Legend: Preburnish Check (solid line), Burnish (dashed line)
 - The solid line starts at approximately 100 N at 1 repetition and decreases to about 10 N at 200 repetitions.
 - The dashed line starts at approximately 100 N at 1 repetition and decreases to about 10 N at 200 repetitions.