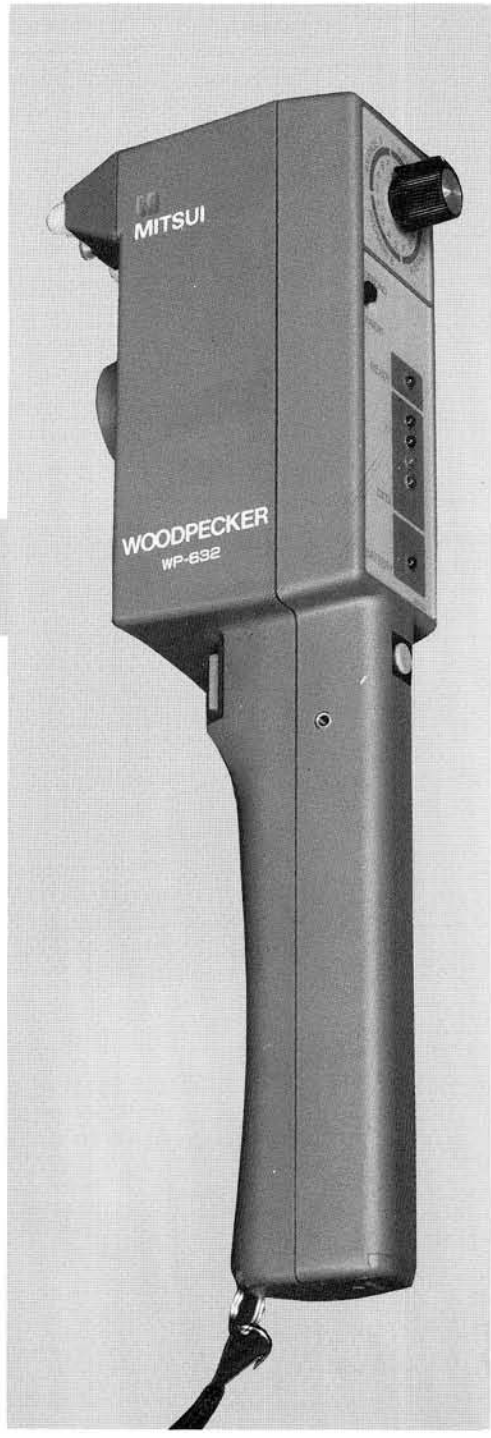
Tapping Exfoliation Detector

MITSUI WOODPECKER WP-632

Instruction Manual



Please read this instruction manual carefully before using the Woodpecker in order to understand its features and make full use of its functions and capabilities.

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1 Features

The detection of debond of honeycomb structures or delamination of laminar have been performed by a skilled inspector, who tap the testing surface with a tapping hammer and detect the debond by the difference in tone. Woodpecker shows this process quantatively.

The tapping hammer is driven by a solenoid, and the degree of the defect is detected by a sensor fitted to the hammer and a microcomputer built into the system. Degree of debond will be displayed by a blinking red or yellow light-emitting diode (LED). A blinking red lamp is accompanied by the sound of a buzzer. The Woodpecker can also detect, (1) the inserts of honeycomb or (2) strength members behind the composite materials. The measured data can be displayed on and stored in the monitoring unit "WP-632M" (available on option) by connecting the Woodpecker to WP-632M.

The Woodpecker represents a revolutionary advance in inspection. Unlike conventional manual tapping, it can quantitatively show the degree of debond even in a noisy environment. The device is accurate, light and compact and requires no particular skill to operate.

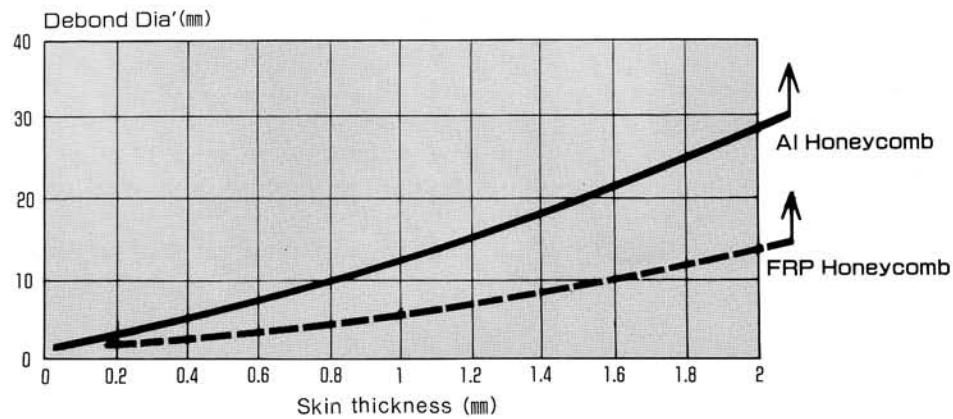
2 Applications

- Detection of debond in honeycomb
- Detection of damage behind honeycomb
- Detection of the position and shape of the inserts of honeycomb structures
- Detection of delamination in laminar
- Detection of delamination of composite in the joints
- Detection of the strength members behind the composite materials
- Detection of delamination in clad steel
- Detection of debond in tiles

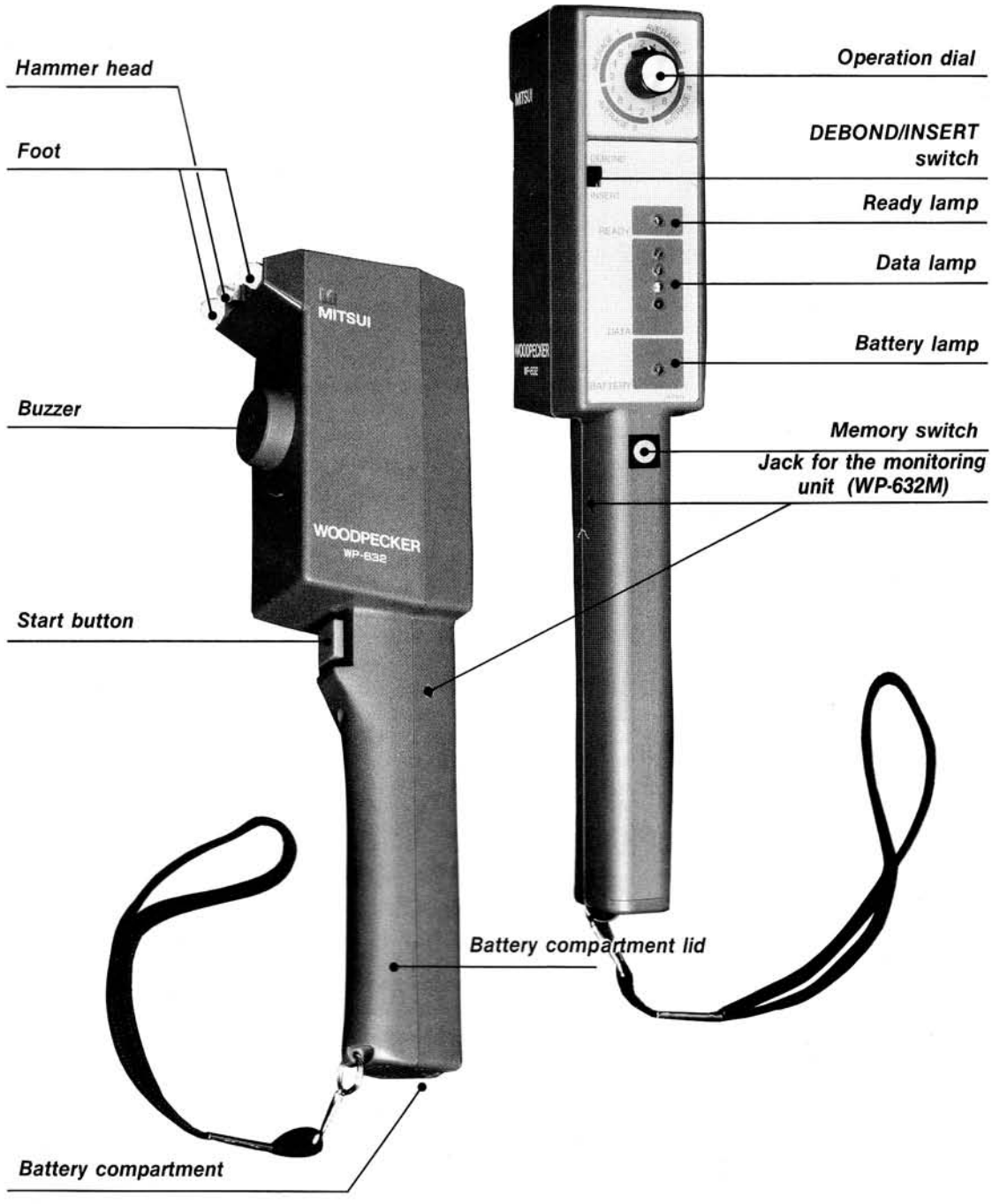
Note: The Woodpecker has been developed mainly for the purpose of debond detection for the materials of airplane industry and therefore suit for honeycomb inspection having thinner skin plate and laminars as FRP or Al etc.

For rigid materials or flexible materials such as rubber, paper or leather products, the impact force of the hammer may be absorbed and detection may be difficult when the board is thick relative to the diameter of the debond, or when the surface has a rough, sandpaper-like texture or is lined with a material such as paper or leather.

Examples of the result of inspection for aluminum honeycomb and laminer, and FRP honeycomb and laminated boards, are shown in the graph below.
The Woodpecker is so designed to suit for the plate with skin thickness below about 2mm.



3 Parts Identification



4 Precautions

(A) Follow battery installation instructions in the battery compartment. Make sure that + and − are correctly set as instructed. Change batteries when the BATTERY lamp illuminates.

(B) Set the DEBOND/INSERT switch to suit for the purpose of testing; DEBOND to detect debond and INSERT for core detection of inserted materials.

(C) Use the strap to prevent drop.

(D) To keep accuracy, memory shall be renewed each time when different material is examined, or thickness of the material varies in great range.

(E) Keep the hammer as perpendicular as possible to the surface being tested. The measuring allowance of inclination of hammer is about ±10°.

(F) Detection may not be accurate if the surface to be tested is rough. In such case, increase the Average mode value of the Operation Dial and operate the Woodpecker with slow speed.

(G) Move the Woodpecker carefully to prevent damage to the foot or hammer head where steps exist on the surface of the object.

(H) Detection may not be accurate and damage may occur to the surface to be tested if the foot or the hammer head is excessively worn. In such case, replace worn parts immediately.

(I) Detection may not be accurate if dust or dirt is on the surface to be tested. Make sure the surface is clean before testing.

(J) Take out the batteries if the Woodpecker will not be used for an extended period.

5 Operation

(A) Starting and stopping
Start button has a function of both start and stop mode.
- Start: Push the start button once.
- Stop: Push the start button again.

(B) Finding the location to memorize reference value
To find a location to be used as the reference value, examine 2-3 areas thought to be correct using the DEBOND and INSERT modes. An area can be used as the reference value if the green lamp illuminates and certified as correct in both modes of DEBOND and INSERT.

(C) Mode for detection of debond
Change the DEBOND/INSERT switch to DEBOND

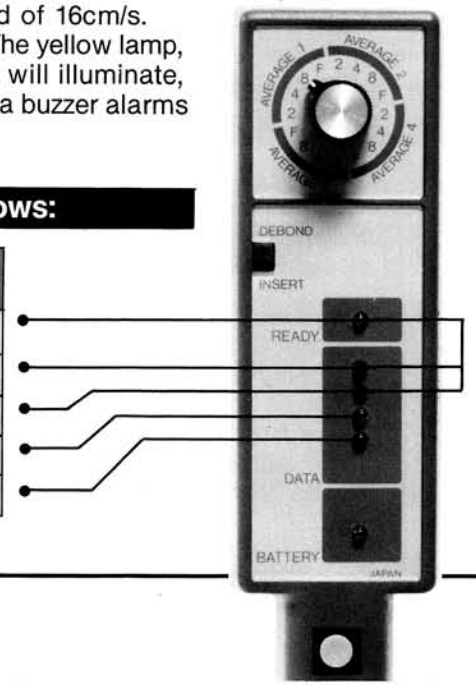
(D) Memory operation
Memory set;
The Woodpecker establishes and retains in the memory a reference value obtained by averaging the values of 8 times of tapping. The READY lamp illuminates when the reference value is retained in the memory.
- Push the start button and place the hammer on the area of the honeycomb board chosen as location having the reference value.
- Hold down and move slightly to pick up the average value of the area until the READY lamp illuminates.
- The reference value is now retained in the memory.

Memory reset;
The memory can be reset while the hammer is operated. To reset, hold down the memory switch until the READY lamp illuminates again. Follow the same procedure as "Memory set" for setting memory.
Memory will be erased when start button is cut or Memory switch is pushed on for next reset.

(E) Detection operation
- Hold the Woodpecker lightly and scan the surface with deadload. To keep accuracy, it is desirable to scan under the speed of 16cm/s.
- The DATA lamp shows the degree of the debond. The yellow lamp, red lamp 1, red lamp 2 or both red lamps 1 and 2 will illuminate, depending on the degree of debond. In addition, a buzzer alarms whenever a red lamp is on.

The DATA lamps are arranged as follows:

Condition of tested area	Data lamp	Spring constant ratio
Debond	$R_1 + R_2$ + Buzzer	0.3
	Red 2 (R_2) + Buzzer	0.5
	Red 1 (R_1) + Buzzer	0.75
	Yellow (Y)	0.85
Sound	Green (G)	1



5

(F) Operation dial

The operation dial sets the measurement values and the tapping speed.

Setting of measurement values

- In the Average 1 mode, the measurement value when the hammer tappes once is compared with the memorized reference value.
- Similarly, in the Average 2, Average 4 and Average 8 modes, the average measurement value of 2, 4 or 8 times tapping, are respectively compared with the reference value.
- Choose the Average mode most appropriate for the structure of the object and the condition of the surface being tested.
- Use low Average modes 1 or 2 for uniform surfaces and high Average modes 4 or 8 for surfaces that are not so uniform.

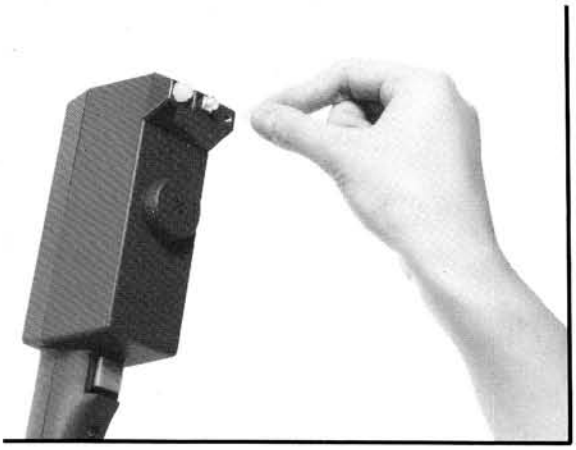
Setting of tapping speed

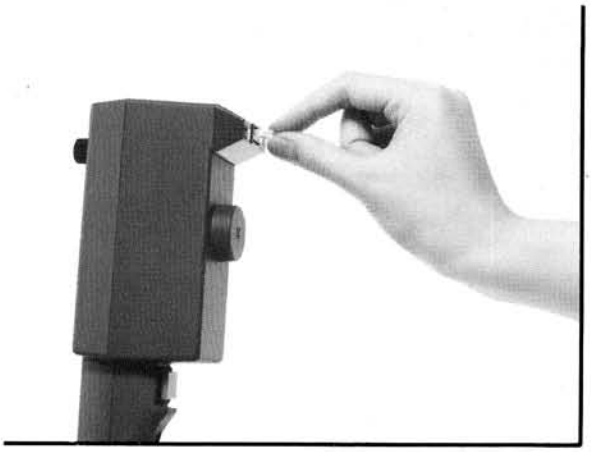
- Four kinds of setting mode can be chosen for each Average mode: 2Hz, 4Hz, 8Hz and F (Fast-16Hz).
- For quick scanning, set the tapping speed to F, using low Average mode 1 or 2.
- To increase accuracy by scanning slowly, perform the reverse operation, i.e., a high Average mode with a slow tapping speed.

6 Parts replacement

Foot and hammer are consumable parts to prevent damage to the surface of object and shall be replaced timely when they become excessively worn as per following instructions.

- Replace the foot using fingers and do not use spanners or other tools so as not to damage main unit with unnecessary force.
- To remove the hammer head, hold the upper portion of the hammer with a pliers or similar tool and turn the hammer head counterclockwise with your fingers.
- Two sets of replacement foot are enclosed as spares.
- Extra foot and hammer head are sold separately.





7 Care and cleaning

Clean the surface of the case with an alcohol-based substance. Do not use the following solvents which may damage the surface of the case.

- alkali or alkaline salt solvents
- amines
- ketones (acetone methy-ethy-ketone)
- esters
- halogen based solvents (carbon tetrachloride trichlene, dioxane, methylene-chloride, chloroform)

8 After service

- Warranty card (included separately)
  Take note of the warranty period and the clause in Warranty card.
- Warranty period—One year from the date of shipment from Japan.
  The warranty does not cover consumable parts (hammer head, foot, batteries).
- Service during the warranty period
  If a problem cannot be solved though WP632 is operated in accordance with the instruction manual, send the Woodpecker and the warranty card to Mitsui for repair. Please include the following information:
  - **Your name, address and telephone number**
  - **Date of purchase**
  - **A full description of the problem**
- Service after the warranty period
  Upon request, Mitsui offers a repair service for a fee.

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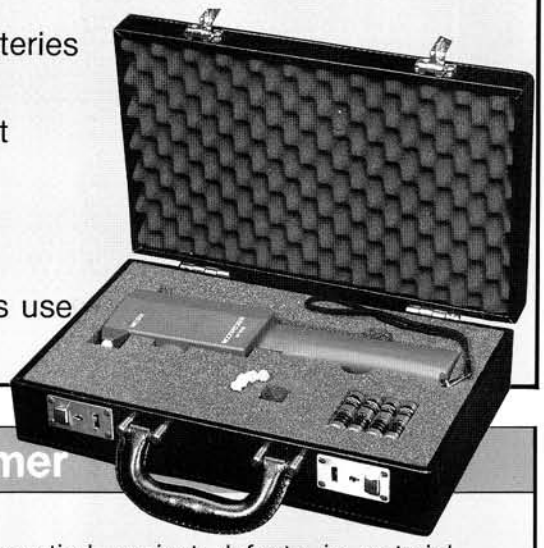
9 Particulars

Size	100mmH × 46mmW × 276mmL
Weight	470g
Power	Four size AA batteries
Power consumption	1.0 watt

Battery life

Size AA alkaline batteries:
approx. 10 hours continuous use



10 Warranty and disclaimer

The Product described herein is warrantied against defects in material, design and workmanship for a period of one year following the date of their shipment from Japan.

All other express, statutory and implied warranties including, without limitation, all implied warranties of merchantability, are hereby disclaimed with respect to said product.

The importers and distributers are required to give appropriate instructions to thier customers and purchasers for the use of said product, such as those contained herein.

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