

MODELS

WH 12DM2

WR 12DM2

Hitachi Power Tools

**CORDLESS IMPACT DRIVER
WH 12DM2
CORDLESS IMPACT WRENCH
WR 12DM2**

**TECHNICAL DATA
AND
SERVICE MANUAL**



WH 12DM2



WR 12DM2

LIST Nos. WH 12DM2: F887
WR 12DM2: F886

Sep. 2003

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REMARK:

Throughout this TECHNICAL DATA AND SERVICE MANUAL, a symbol(s) is(are) used in the place of company name(s) and model name(s) of our competitor(s). The symbol(s) utilized here is(are) as follows:

WH 12DM2

Symbol Utilized	Competitor	
	Company Name	Model Name
C	MAKITA	6916D
P	DEWALT	DW052

WR 12DM2

Symbol Utilized	Competitor	
	Company Name	Model Name
C1	MAKITA	6918D
P	DEWALT	DW053
C2	MAKITA	BTW150



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1. PRODUCT NAME

Hitachi Cordless Impact Driver, Model WH 12DM2

Hitachi Cordless Impact Wrench, Model WR 12DM2

2. MARKETING OBJECTIVE

Owing to shifts in market demand from nails to screws, especially to long screws, an impact driver that is powerful (high tightening torque), high-speed, compact, easy-to-handle and efficient in operation per charge is sought.

The new cordless impact driver Model WH 12DM2 is the upgraded version of the previous Model WH 12DM, developed under the same concept for a more compact, powerful and convenient model.

The new Model WH 12DM2 is greater than the previous Model WH 12DM in power, function and design.

The Model WH 12DM2 provides the following features to respond to the user requests:

- 20% higher tightening speed than the previous Model WH 12DM
- Class-top torque: 120 N•m (1220 kgf•cm)
- High durability
- Class-top short body: Entire length 155 mm
- New cyber design
- Light equipped hook

The new cordless impact driver Model WH 12DM2 ("Super Impact 12") is the standard model of the Super Impact series. This "Super Impact 12" is expected to expand our market share of the cordless impact products. The new cordless impact wrench Model WR 12DM2 ("Super Wrench 12") is also brought out. The Model WR 12DM2 has the maximum tightening torque of 165 N•m. It is substantially higher than the previous Model WR 12DM and C2 (14.4 V cordless impact wrench).

3. APPLICATIONS

- Tightening/loosening of small screws, tapping screws, wood screws, bolts, nuts, etc.
- Drilling into wood and various other materials (with use of optional accessory drill chuck adapter).

[Applicable Markets]

- Wood-product assembly: Tightening/loosening of wood screws.
- Construction industry: Assembly of scaffolding, roofing, aluminum sashes, fencing, etc.; removal of plastic cones from concrete forms, mounting/removal of form ties; drilling into the wood frames of concrete forms, etc.
- Manufacturing industry: Assembly work for automobiles, rolling stock, shipbuilding, agricultural machinery and tools, industrial machines, steel furniture, etc.
- Utility industry: Assembly and installation of electric equipment, plumbing facilities, air conditioning (duct assembly etc.), sanitary fixtures and various other facilities.
- Service industry: General repair work; installation of advertising aids, automobile repair, assembly of garages and carports storage sheds, etc.
- Various other assembly, construction or repair facilities.

4. STANDARD EQUIPMENT

(1) BLFK specification: One EB 1220BL battery (NiCad, capacity 2.0 Ah), UC 14YF2 or UC 14YFA charger and case

(2) 2BLFK specification: Two EB 1220BL batteries (NiCad, capacity 2.0 Ah), UC 14YF2 or UC 14YFA charger and case

(3) HLFK specification: One EB 1230HL battery (NiMH, capacity 3.0 Ah), UC 14YF2 or UC 14YFA charger and case

(4) 2HLFK specification: Two EB 1230HL batteries (NiMH, capacity 3.0 Ah), UC 14YF2 or UC 14YFA charger and case

5. SELLING POINTS

(1) Cordless impact driver Model WH 12DM2

More powerful

Class-top tightening speed

(20% faster than the previous model, 25% faster than C, 10% faster than P)

Class-top torque 120 N·m (1220 kgf·cm, 1060 in-lbs.)

The same torque in forward/reverse rotation
New rare-earth magnet motor, large hammer and optimum striking mechanism

High durability

- Impact-absorbing damper
- Large fan
- Improved dust resistance:
Ball bearings with contact seals
Labyrinth construction

More convenient

Protector

- Protects workpieces from scratches and stains.
- Resistant to being caught on bracing plates etc.
- Does not get hot even if operated continuously.

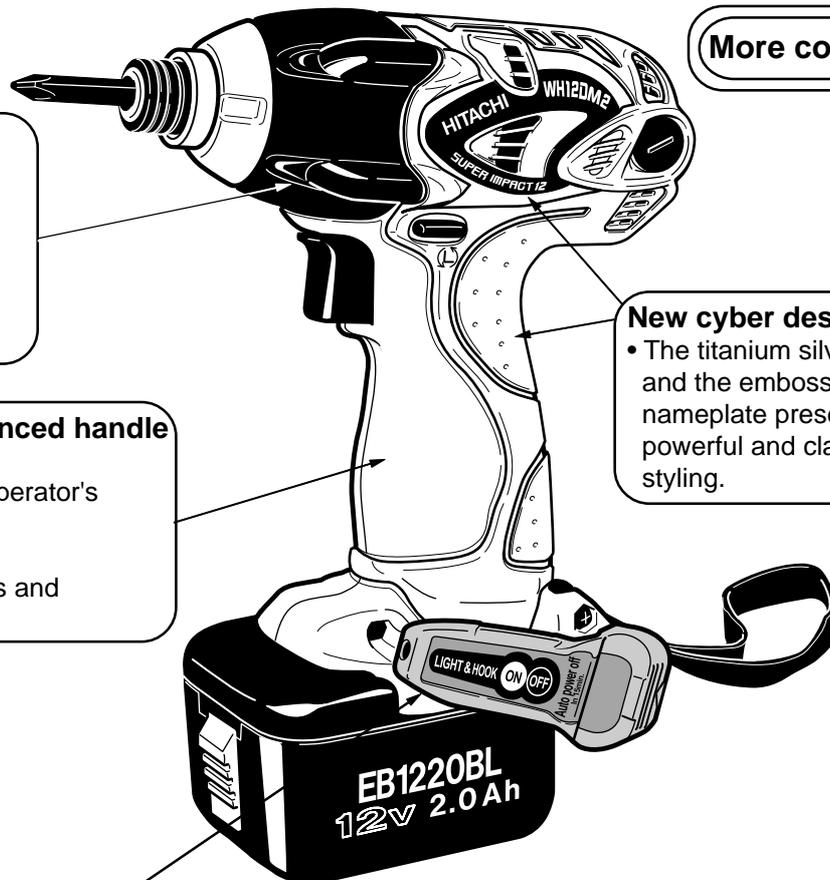
Comfortable and well-balanced handle

- Slip-resistant embossed grip
- Slim tail comfortably fits the operator's thumb.
- Optimally balanced design
- Switch is located near the axis and easy to operate.

More compact

New cyber design

- The titanium silver color and the embossed nameplate present a powerful and classy styling.



Light equipped hook

- Lighting function is usable at any time.
- Lighting in a slant direction allows a clear view of the work area.

Patent applied for

Class-top short body 155 mm (Palm size) (-12 mm with respect to the previous model. C: 168 mm)

- Convenient for working in narrow places

Advanced case

- Equipped with a bit holder
- Thick-walled and sturdy case
- Accommodates many accessories.

Convenient strap

Easily attachable/detachable with a machine screw

(2) Cordless impact wrench Model WR 12DM2

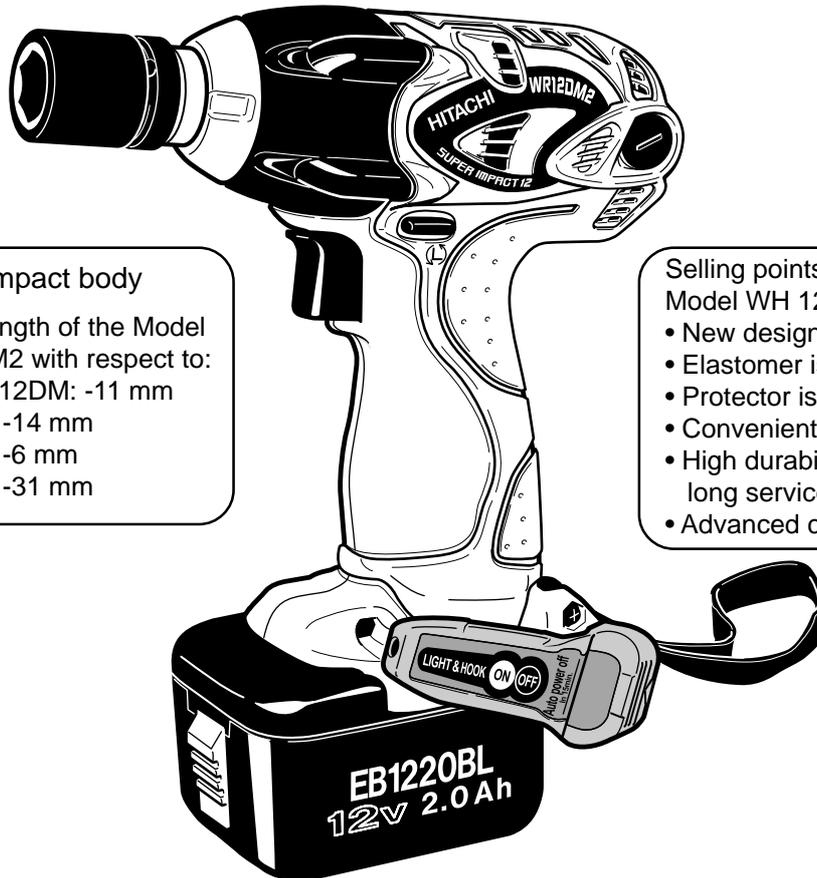
Powerful tightening torque 165 N·m (1685 kgf·cm, 1460 in-lbs.)

WR 12DM: 150 N·m (1530 kgf·cm, 1330 in-lbs.)

C1: 120 N·m (1224 kgf·cm)

P : 160 N·m (1633 kgf·cm, 1420 in-lbs.)

C2: 150 N·m (1530 kgf·cm, 1330 in-lbs.)



Compact body

Overall length of the Model
WR 12DM2 with respect to:

WR 12DM: -11 mm

C1: -14 mm

P : -6 mm

C2: -31 mm

Selling points common to the
Model WH 12DM2

- New design
- Elastomer is new titanium silver color.
- Protector is standard.
- Convenient light equipped hook
- High durability, dust resistance and long service life
- Advanced case (excellent accommodation)

5-1. Selling Point Descriptions

Common selling points (Models WH 12DM2 and WR 12DM2)

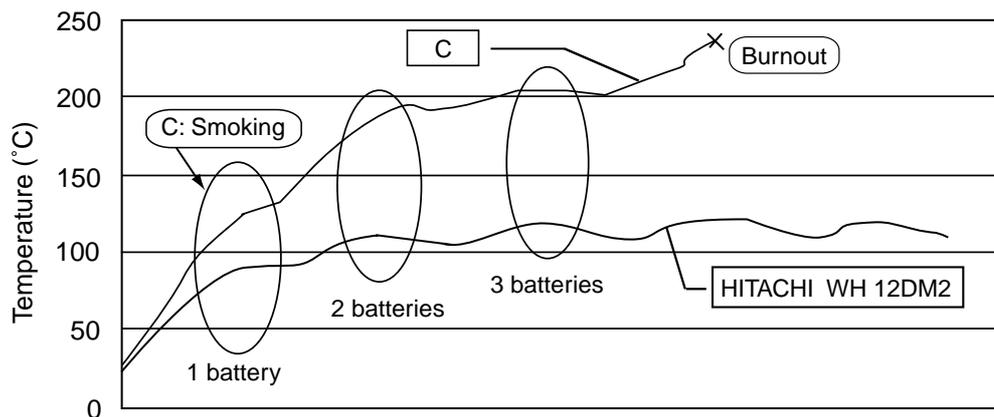
(1) High durability

Owing to the shift of demand from nails to screws and increased demand for long screws, impact drivers having high heat resistance in continuous operation are much sought after. However, there are problems such as heavy noise or vibration of the ball bearings and decrease in power if the impact drivers are used harshly in dusty environments. In addition, higher strength and longer service life are required to continuously tighten and loosen bolts in scaffolding and demolishing works. The Models WH 12DM2/WR 12DM2 have high durability, dust resistance and long service life in continuous operation as described below.

① Enhanced heat resistance of the motor

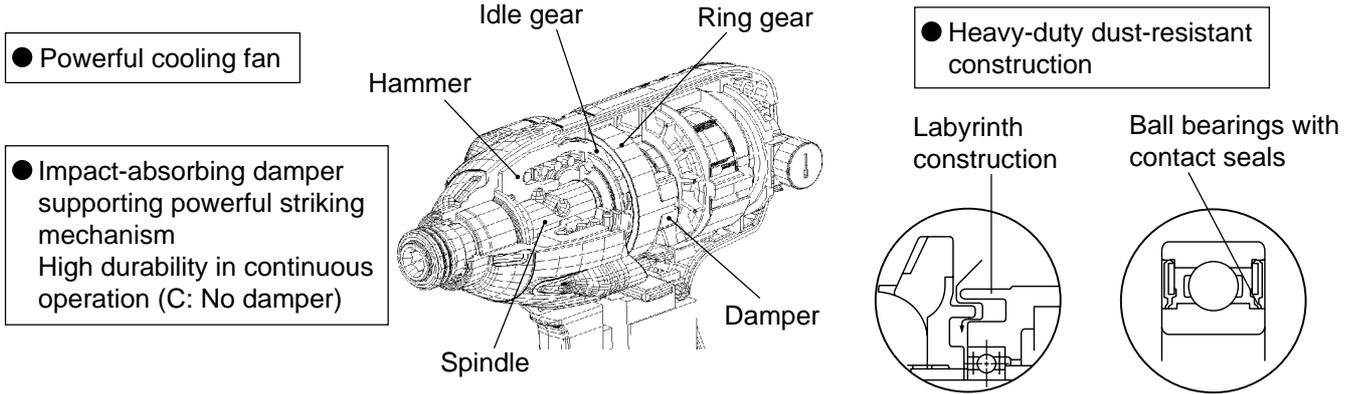
Example: When tightening M12 bolts continuously (Cycle of operation: 5-second impacting and 10-second stopping, 3.0 Ah battery used)

The heat resistance comparison between the Models WH 12DM2/WR 12DM2 and C is shown below. The cooling efficiency is improved thanks to the powerful full-fledged large radial fan and the computer-analyzed air ducts. Thus the Models WH 12DM2/WR 12DM2 are protected from burnout due to long-time continuous use and decrease in speed due to temperature rise.



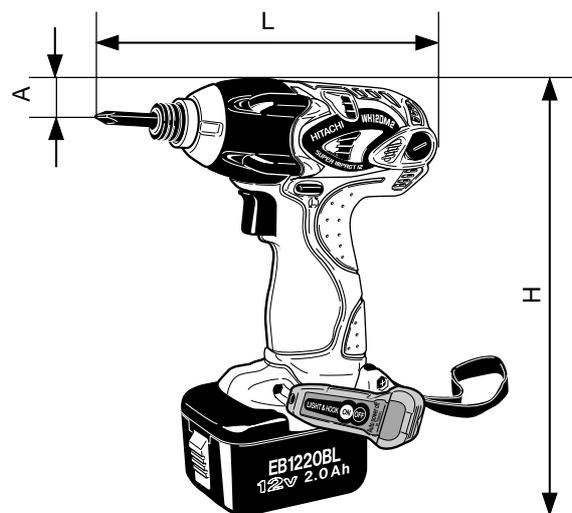
As shown in the above graph, C produces smoke when operating on one battery. When tightening wood screws (5.3 mm diameter and 120 mm long) into a workpiece (hemlock spruce) continuously, it suddenly takes much time to tighten the tenth and the later screws. This is because thin wires used in the armature assembly of C are apt to produce heat and the cooling construction is insufficient to reduce the heat.

② Construction supporting powerful performance and durability



The greater the striking force, the stronger gear section is required. The Models WH 12DM2/WR 12DM2 are equipped with dust-resistant contact seal bearings. Thanks to the new bearings, hermeticity is enhanced because the seals of the bearings always contact the inner rings (C: non-contact bearings). The labyrinth construction is provided between the housing and the fan at the pinion side as shown in the right figure to ensure protection against dust because the pinion side must have high durability against heavy loads. The air inlet is minimized and the powerful fan discharges dust if entered.

(2) The Models WH 12DM2/WR 12DM2 are equipped with a new rare-earth magnet motor that is more compact than the previous model by 20% while providing high power thanks to the 1.2 times greater magnetic force of the motor. The diameters of the striking section and the decelerating section are a little larger than the previous model to shorten the entire length. Thus the Models WH 12DM2/WR 12DM2 realize higher strength and shorter body length (WH 12DM2: 155 mm, WR 12DM2: 162 mm). The entire length of the Model WH 12DM2 is shorter than the previous model by 12 mm and the Model WR 12DM2 is shorter than the previous model by 11 mm.



① Impact driver

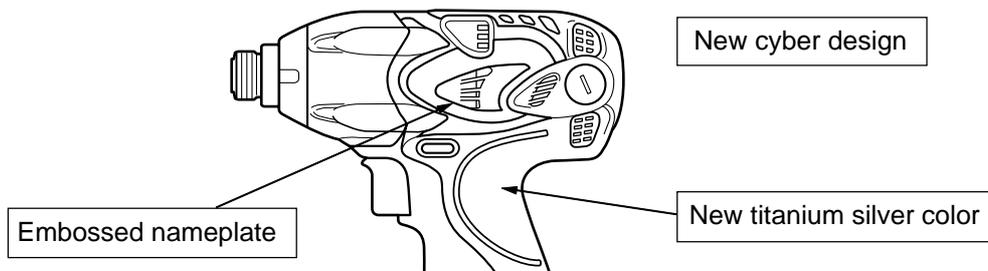
Model		Unit	WH 12DM2	WH 12DM	C	P
L	Entire length	mm	155	167	168	165
A	Center height	mm	26.5	26	26	29
H	Height	mm	226	226	231	233
Weight	Catalog value	kg	1.6	1.6	1.5	1.75
	Measured value	kg	1.67	1.66	1.58	1.75

② Impact wrench

Model		Unit	WR 12DM2	WR 12DM	C1	P	C2
L	Entire length	mm	162	173	176	168	193
A	Center height	mm	26.5	26	26	29	27
H	Height	mm	226	226	231	233	253
Weight	Catalog value	kg	1.6	1.6	1.6	1.75	1.9
	Measured value	kg	1.68	1.67	1.60	1.75	1.95

(3) New cyber design

The Models WH 12DM2/WR 12DM2 have vibrant and cyber looks thanks to the widely adopted soft urethane resin (elastomer) and the complicated 3-D curved surfaces, stirring up curiosity to touch them. The soft urethane resin colored new titanium silver also catches the eye in show windows or working sites. In addition, the model name is embossed on the nameplate to present a powerful and classy styling.



(4) Protector

Although the previous model's hammer case designed for professional use is sturdy and well reputed, a standard protector for the hammer case is desired to protect the surface of a workpiece such as flooring materials from being scratched by the hammer case or the seats of set screws. The Models WH 12DM2/WR 12DM2 are equipped with a protector having the following three functions:

- It protects workpieces from scratches and stains.

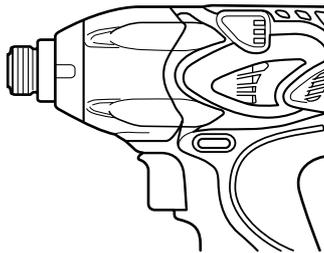
Thanks to the protector, the Models WH 12DM2/WR 12DM2 minimize staining wall cloths or scratching furniture and floor surfaces. As C's hammer case is unprotected and the aluminum base is exposed, black marks may be remained if rubbed.

- It is resistant to being caught on bracing plates etc.
- It does not get hot even if operated continuously.

The hammer case of the Models WH 12DM2/WR 12DM2 does not get hot because it is covered with the protector entirely.

The protector is made of elastomer having high heat resistance, and it does not impair the integrated looking of the Models WH 12DM2/WR 12DM2.

The protector is standard.



Comparison of stains

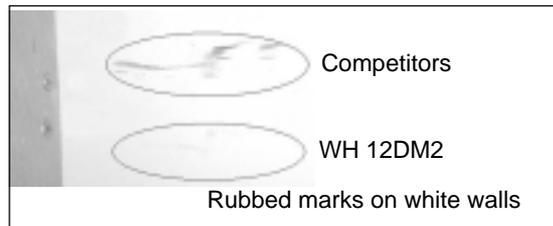


Fig. 7 Comparison of stains on workpieces

(5) Light equipped hook (Patent applied for)

The light equipped hook has the following two functions:

- It can be used as a hook for suspending from a waist belt when required by the nature of the work.
- It can be used as an auxiliary light for such operations as tightening screws in a dark place.

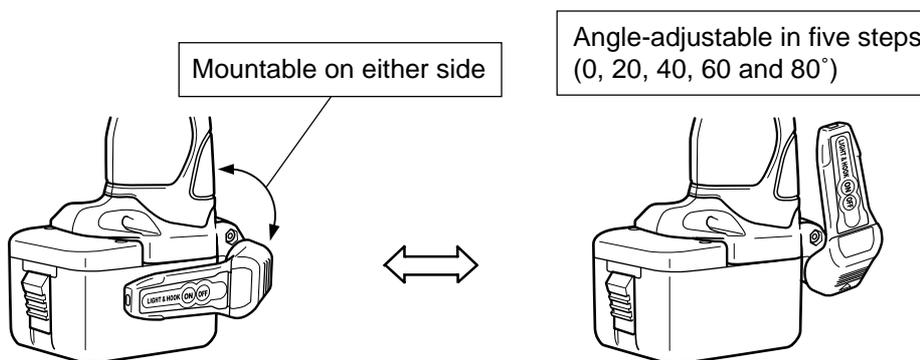
① Using as a hook

A hook is convenient if there is no place to put the impact driver temporarily. Although various kinds of hooks are on the market, the standard accessory hook featuring the following is very convenient.

- The hook can be quickly slid out and in when not needed.
- The hook is mountable on either side to cope with the use by both right-handed and left-handed persons.

This hook can be mounted by using a flat-blade screwdriver or a coin.

- The angle of the hook is adjustable in five steps between 0° and 80°. The hook can be adjusted to the optimum position according to the weight of the bit in use.



② Using as an auxiliary light

When tightening screws in a dark place such as an attic or in the evening, it allows a clear view of the work area by lighting. As the well-reputed one-touch hook doubles as a light, it does not become a hindrance to the operation. In addition, lighting in a slant direction minimizes casting a shadow of the bit or the operator's hand.

- Lighting function is usable at any time:

A switch exclusive to the light is provided.

The light is not glaring in the daytime. It can be lighted without turning the bit.

- Lighting in a slant direction:

It minimizes casting a shadow of the operator's hand when holding a screw.

- Yellow LED: It is easy on the eyes and legible.

- Automatic turning-off circuit is built in:

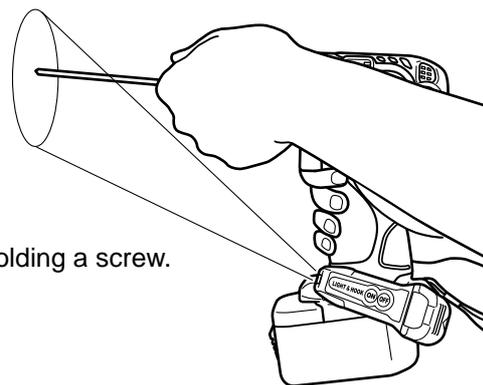
Even if the operator omitted turning off the light, it automatically turns off after 15 minutes. Two N-size 1.5-V manganese batteries come standard with the light.

Nominal life: 300 cycles of 3-minute operation (as a guide)

600 cycles of 3-minute operation when using two alkali batteries on the market (as a guide)

Refer to the Instruction Manual for replacement of the batteries.

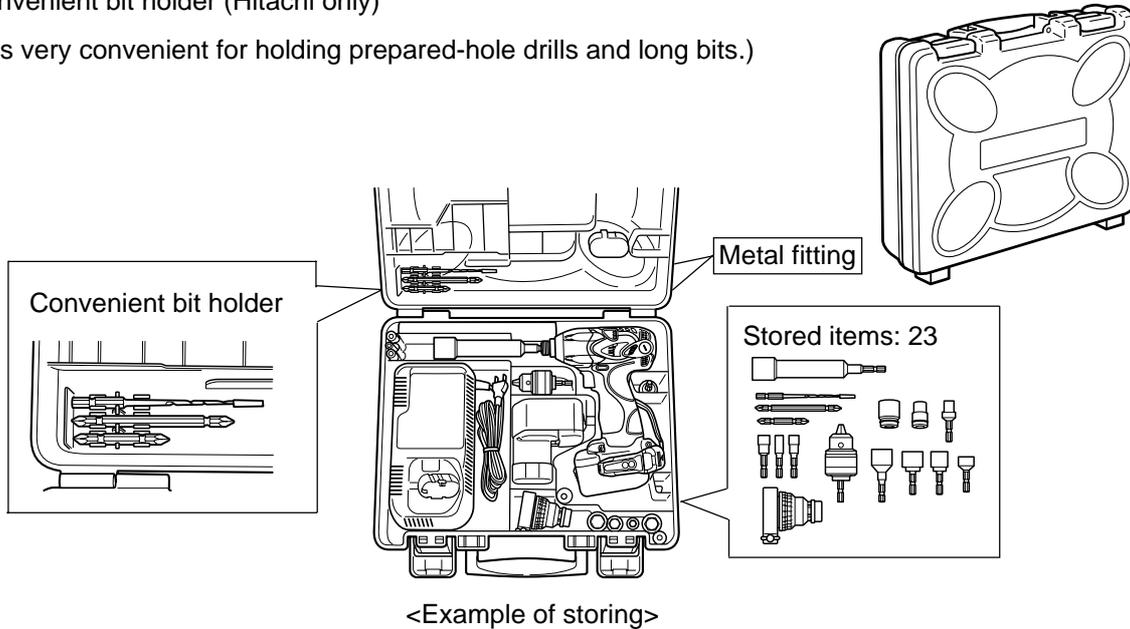
- This hook (battery type) is mountable on either side and the angle is easily adjustable.



(6) Advanced case

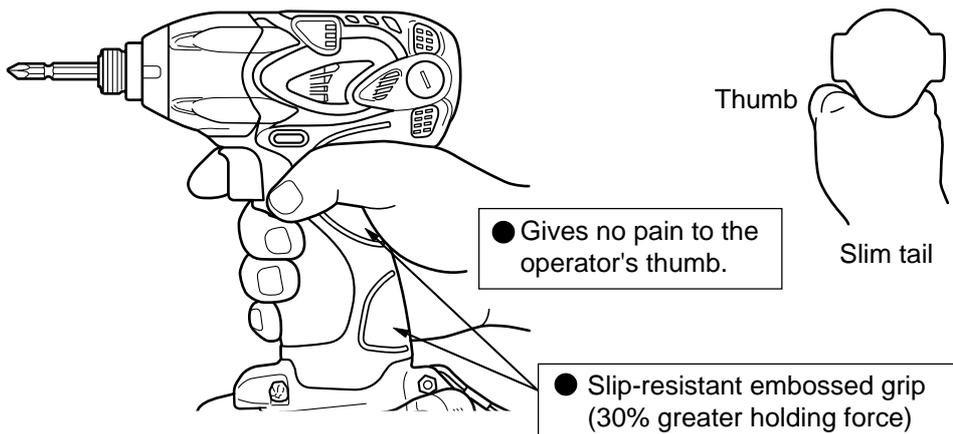
The new case satisfies the following demands.

- Compact and sturdy
- Refined two-tone body design
- Excellent accommodation
(Stored many accessories such as chuck adapter, stopper, long socket, various sockets and bits)
- Convenient bit holder (Hitachi only)
(It is very convenient for holding prepared-hole drills and long bits.)



(7) Comfortable and well-balanced handle

- When an impact driver is continuously operated, the housing tail may rub the base of the operator's thumb and give pain to the operator. To cope with this problem, the Models WH 12DM2/WR 12DM2 are equipped with the separate-type motor without case and the slim tail section with narrow housing tail (the previous Model WH 12DM has the same construction).
- More delicate speed control is required at the start of tightening screws. The Models WH 12DM2/WR 12DM2 have a grip whose circumference at the switch section is shorter than the competitors for ease of operation (grip circumference at the switch section with respect to C: -14 mm P: -13 mm).
- The grip of the Models WH 12DM2/WR 12DM2 is slip-resistant even if held by a sweaty hand and comfortably fits thanks to the soft material and the embossed treatment (holding force: 30% greater than the previous model).



(8) Low operating noise (-1 dB with respect to the previous model)

The operating noise of the Models WH 12DM2/WR 12DM2 is low and dull thanks to the large hammer and the optimized impact timing. Thus the large hammer tightens screws powerfully with lower operating noise than the Model WH 12DM. (Refer to page 26 for details.)

(9) Enhanced maintainability

The carbon brushes are replaceable and the armature is singly replaceable thanks to the separate-type motor like a 100-V motor (the previous model has the same construction).

Selling points of the Model WR 12DM2

- Powerful tightening torque 165 N·m {1685 kgf·cm, 1460 in-lbs.}

The Model WR 12DM2 is equipped with the new rare-earth magnet motor having 20% greater magnetic force. In addition, thanks to the large hammer and the optimized impact timing, the tightening torque is increased as follows.

- The tightening torque is 10% higher than the previous 12-V product Model WR 12DM and 38% higher than C1.
- The tightening torque is 10% higher than C2.

The Model WR 12DM2 is also mechanically strong thanks to the strong components to realize powerful operation. Thus, the service life is 2 or 3 times longer than the competitors in spite of the compact body. Comparison of measured data with the previous models and competitors is shown below.

(1) Tightening torque comparison

Figure 1 shows the torque required for tightening an M16 F10T bolt in 3 seconds with a hexagon socket (40 mm long). The tightening torque of the Model WR 12DM2 is substantially higher than the previous model (12 V) and equivalent to or more than C2.

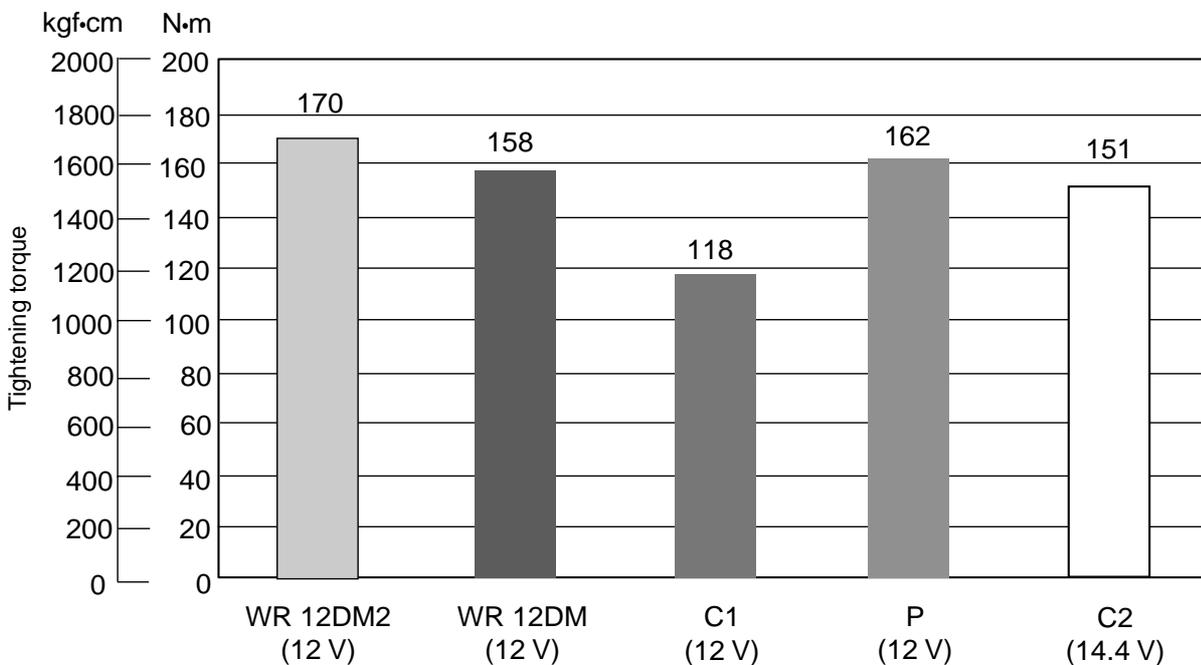


Fig. 1

* The data above are intended for reference purposes only because actual tightening torque will vary depending on tightening conditions.

To describe the merit of high tightening torque, the comparison data are shown in Figures 2 and 3. Figure 2 shows the time required for loosening a high-strength bolt and Figure 3 shows the time required for sinking a square washer into a wood workpiece.

(2) Loosening time comparison (high-strength bolts)

Figure 2 shows the comparison of time required for loosening an M16 bolt that was statically tightened 225 N·m {2300 kgf·cm, 1990 in-lbs.} with a torque wrench. The Model WR 12DM2 can loosen an M16 bolt in a time 25% shorter than the previous model and in a half time of C2. It is very convenient for loosening bolts that secure molding boxes.

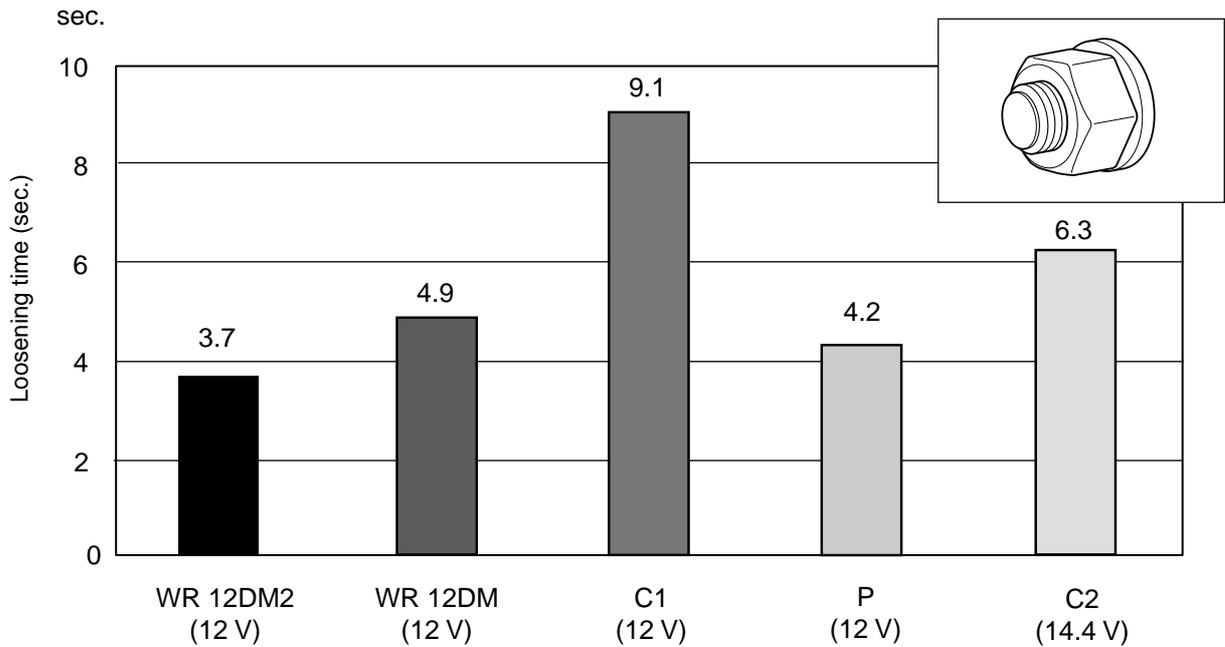


Fig. 2

*The data above are intended for reference purposes only because actual loosening torque will vary depending on tightening conditions.

(3) Sinking time comparison (square washers)

Figure 3 shows the time required for tightening an M12 bolt into a pine laminated lumber of 105 mm square until the square washers at both sides are sunk into the lumber by 1.3 mm respectively.

The Model WR 12DM2 can tighten strap bolts and corner bracings (used in Japanese wooden buildings) speedily as it can sink washers into a workpiece quickly.

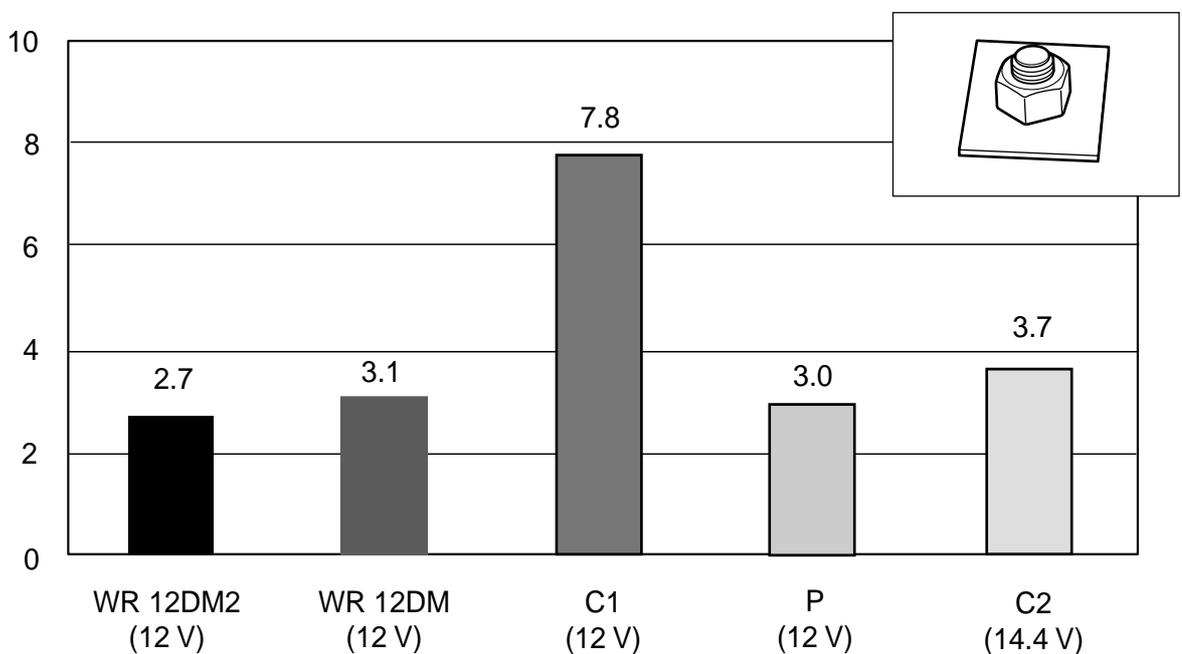


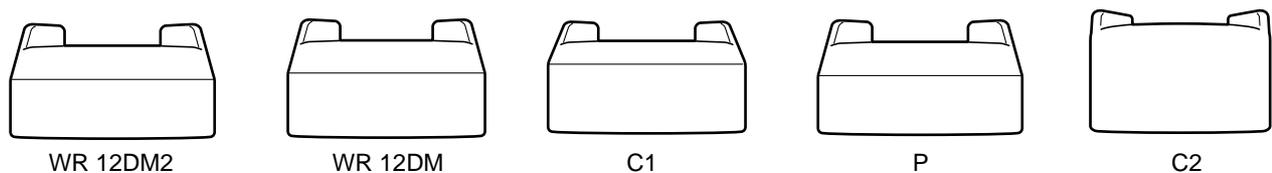
Fig. 3

*The data above are intended for reference purposes only because actual time required for sinking washers will vary depending on tightening conditions.

The 10% higher power motor and the larger hammer are the main factors that increase the tightening torque of the Model WR 12DM2 substantially. Comparison of hammer and number of strokes is shown below.

(4) Comparison of hammer and number of strokes

Thanks to the larger hammer (higher hammer inertia J) than the previous model, the number of strokes (N) of the Model WR 12DM2 is increased. When compared with C2, the hammer size is smaller but the number of strokes is higher. Therefore the tightening torque is equivalent to C2. As a guide, striking force is proportional for $J \times N^2$. Therefore, when the $J \times N^2$ of the Model WR 12DM is 100, the $J \times N^2$ of the Model WR 12DM2 is about 1.1 times larger than the Model WR 12DM and it is equivalent to or more than C2 as shown in the table below.



Model	Unit	WR 12DM2	WR 12DM	C1	P	C2
Voltage	V	12	12	12	12	14.4
Outside diameter of hammer (D)	mm	44	42.6	42	44.2	42
Height of hammer (H)	mm	18.6	20	16.5	18.6	22
Hammer inertia J	kgmm ²	38.4	37.4	31.7	39.7	42.3
Number of strokes (N)	No. of strokes/min.	3240	3140	3070	3120	2920
$J \times N^2$	%	110	100	80	105	100

6. SPECIFICATIONS

6-1. Specifications

Item	Model	Cordless Impact Driver WH 12DM2	Cordless Impact Wrench WR 12DM2
Capacity		Small screw M4 – M8 (5/32" – 5/16")* ¹ Ordinary bolt M5 – M12 (3/16" – 15/32") High-strength bolt M5 – M10 (3/16" – 25/64")	Ordinary bolt M6 – M16 (1/4" – 5/8") High-strength bolt M6 – M12 (1/4" – 15/32")
Tightening torque		120 N·m (1220 kgf·cm, 1060 in-lbs.)* ²	165 N·m (1685 kgf·cm, 1460 in-lbs.)* ³
Tip condition		6.35 mm (1/4") Bit holder	12.7 mm (1/2") Square drive
Type of motor		Fan cooled rare-earth magnet motor	
Enclosure		Main body: Polyamide resin + elastomer Housing Aluminum alloy die casting Hammer case Elastomer Protector Storage battery: ABS resin (black) Charger: ABS resin (black)	
Type of switch		Trigger switch with forward/reverse changeover pushing button (with brake)	
Handle configuration		T-type	
No-load rotational speed		0 – 2,600 /min	
Impact rate		0 – 3,200 /min	
Weight	Main body	1.6 kg (3.5 lbs.) (Includes battery)* ⁴	
	Battery	0.68 kg (1.5 lbs.)	
Overall length x height		155 mm (6-7/64") x 226 mm (8.9")	162 mm (6-3/8") x 226 mm (8.9")
Center height		26.5 mm (1-3/64")	
Battery (Type EB 1220BL)		Sealed cylindrical nickel-cadmium batteries Nominal voltage: DC 12V Nominal life: Charging/discharging approximately 1,000 cycles (in case of Model UC 14YF2, UC 14YFA) Nominal capacity: 2.0 Ah	
Battery (Type EB 1230HL)		Sealed cylindrical nickel-metal hydride batteries Nominal voltage: DC 12V Nominal life: Charging/discharging approximately 500 cycles (in case of Model UC 14YF2, UC 14YFA) Nominal capacity: 3.0 Ah	
Charger (For UC 14YF2)		Charger power source: single-phase AC, 50/60 Hz Voltage: Depending on the order specification Power input: 44 W Charging system: Constant current charge with full wave phase control Overcharge protection system: (1) Battery voltage detection (Δ^2V system) (2) Battery surface temperature detection (thermostat or thermistor) (3) 120-minute timer Output voltage: 7.2 V – 14.4 V Output current: 1.9 A Charging time: Approx. 60 minutes (for BL-type storage battery at 20 °C) Approx. 90 minutes (for HL-type storage battery at 20 °C) Product weight: 1.3 kg Operable ambient temperature range: 0 °C – 40 °C The maximum allowable temperature of the EB 1220BL type battery is 60 °C and the EB 1230HL type battery is 45 °C.	

Charger (For UC 14YFA)	<p>Charger power source: single-phase AC, 50/60 Hz Voltage: Depending on the order specification Power input: 56 W Charging system: Constant current charge with feedback control Overcharge protection system: (1) Battery voltage detection (Δ^2V system) Battery temperature detection (dT/dt system) for Ni-MH battery (2) Battery surface temperature detection (thermistor) (3) 120-minute timer</p> <p>Output voltage: 7.2 V – 14.4 V Output current: 2.6 A Charging time: Approx. 50 minutes (for BL-type storage battery at 20 °C) Approx. 70 minutes (for HL-type storage battery at 20 °C) Product weight: 0.6 kg Operable ambient temperature range: 0 °C – 40 °C The maximum allowable temperature of the EB 1220BL type battery is 55 °C and the EB 1230HL type battery is 45 °C.</p>
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*1: In the case of tapping screws and wood screws, a minimum of M3 (1/8") is possible.

*2: This torque is based on tightening an M14 (9/16") bolt (strength grade: 12.9) for 3 seconds with a hexagonal socket.

*3: This torque is based on tightening an M16 (5/8") bolt (F10T) for 3 seconds with a hexagonal socket.

*4: Main body does not include accessory tools (hexagonal bit, etc.).

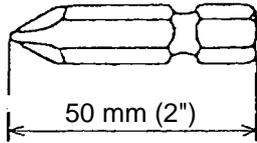
Pilot lamp indications (Models UC 14YF2 and UC 14YFA)

Red pilot lamp remains lit or flashes.	Prior to charging	Blinks	0.5 sec ON, 0.5 sec OFF 	
	During charging	Lit	Stays ON constantly 	
	Charging completed	Blinks	0.5 sec ON, 0.5 sec OFF 	
	Charging not possible	Flickers	0.1 sec ON, 0.1 sec OFF 	Storage battery or charger is faulty.
Green pilot lamp is lit.	High battery temperature	Lit	Stays ON constantly 	Charging not possible because storage battery temperature is too high.

6-2. Optional Accessories

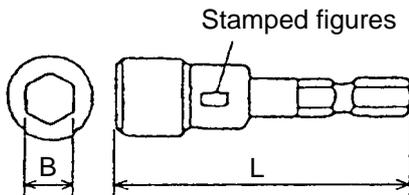
(1) Optional accessories for the Model WH 12DM2

- Plus driver bit



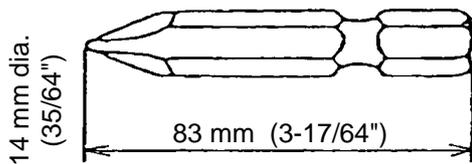
Bit No.	Code No.
No. 2	992671
No. 3	992672

- Hexagon socket



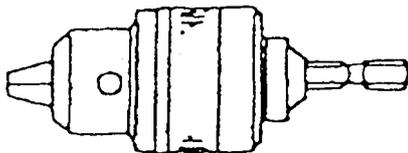
Part name	Stamped figures	L (mm)	B (mm)	Code No.
5 mm Hexagon socket	8	65 (2-9/16")	8 (5/16")	996177
6 mm Hexagon socket	10	65 (2-9/16")	10 (3/8")	985329
5/16" Hexagon socket	12	65 (2-9/16")	12 (15/32")	996178
8 mm Hexagon socket	13	65 (2-9/16")	13 (1/2")	996179
10 mm Hexagon socket (small type)	14	65 (2-9/16")	14 (9/16")	996180
10 mm Hexagon socket	16	65 (2-9/16")	16 (5/8")	996181
10 mm Hexagon socket	17	65 (2-9/16")	17 (21/32")	996182
1/2" Hexagon long socket	21	166 (6-17/32")	21 (53/64")	996197

- Woodworking drill bit (Code No. 959183)



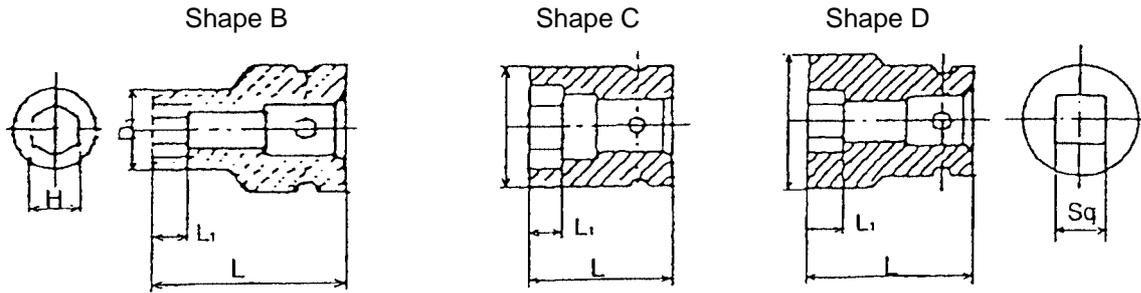
- Drill chuck adaptor set (Code No. 996195)

The drill chuck adaptor set permits mounting of various types of locally-available drill bits for a variety of drilling operations.



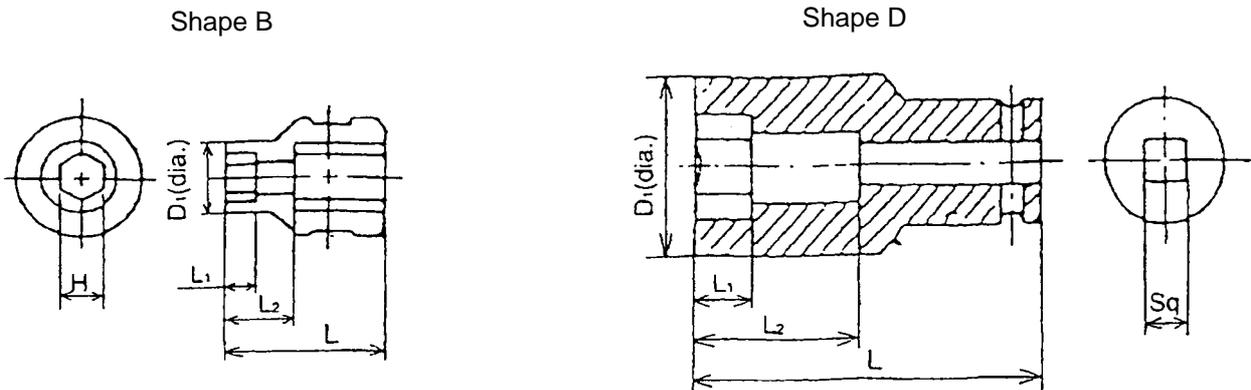
(2) Optional accessories for the Model WR 12DM2

- Each dimension and applicable bolt for each hexagon socket



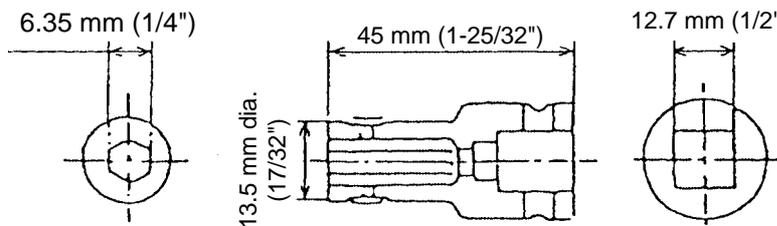
Square drive dimension Sq	Part name	Code No.	Nominal diameter of applicable bolts				Dihedral width H (mm)	Shape	Socket primary dimensions (mm)			
			ISO (High-strength)	ISO (Ordinary)	ISO (Small type)	Inch screw			L	L ₁	D ₁	
12.7 mm (1/2")	Hexagon socket	10 mm	944291	—	M 6 (1/4")	—	—	10 (3/8")	B	40 (1-9/16")	8 (5/16")	18 (23/32")
		12 mm	873632	—	—	M 8 (5/16")	W 5/16"	12 (15/32")	B	40 (1-9/16")	8 (5/16")	20 (25/32")
		13 mm	873539	—	M 8 (5/16")	—	—	13 (1/2")	B	40 (1-9/16")	9 (11/32")	25 (1")
		14 mm	873540	—	—	M 10 (3/8")	—	14 (9/16")	B	40 (1-9/16")	9 (11/32")	25 (1")
		17 mm	873536	—	M 10 (3/8")	M 12 (15/32")	W 3/8"	17 (21/32")	C	32 (1-1/4")	8 (5/16")	28 (1-3/32")
		19 mm	873624	—	M 12 (15/32")	M 14 (9/16")	W 7/16"	19 (23/32")	C	34 (1-11/32")	9 (11/32")	28 (1-3/32")
		21 mm	873626	—	—	—	W 1/2"	21 (53/64")	D	36 (1-13/32")	10 (3/8")	32 (1-1/4")
		22 mm	873627	M 12 (15/32")	M 14 (9/16")	M 16 (5/8")	—	22 (7/8")	D	40 (1-9/16")	14 (9/16")	35 (1-3/8")
		24 mm	873629		M 16 (5/8")	M 18 (23/32")		24 (15/16")	D	40 (1-9/16")	15 (9/16")	38 (1-1/2")

- Each dimension and applicable bolt for each long socket



Square drive dimension Sq	Part name	Code No.	Nominal diameter of applicable bolts				Dihedral width H (mm)	Shape	Socket primary dimensions (mm)				
			ISO (High-strength)	ISO (Ordinary)	ISO (Small type)	Inch screw			L	L ₁	L ₂	D ₁	
			12.7 mm (1/2")	Long socket	12 mm	955138			—	—	M 8 (5/16")	W 5/16"	12 (15/32")
		13 mm	955139	—	M 8 (5/16")	—	—	13 (1/2")	B	52 (2-3/64")	20 (25/32")	34(1-11/32")	21.5 (53/64")
		14 mm	955140	—	—	M 10 (3/8")	—	14 (9/16")	B	52 (2-3/64")	20 (25/32")	34(1-11/32")	22 (7/8")
		17 mm	955141	—	M 10 (3/8")	M 12 (15/32")	W 3/8"	17 (21/32")	B	52 (2-3/64")	24 (15/16")	34(1-11/32")	25 (1")
		17 mm	955149	—	M 10 (3/8")	M 12 (15/32")	W 3/8"	17 (21/32")	B	75 (2-15/16")	24 (15/16")	57(2-1/4")	25 (1")
		19 mm	955142	—	M 12 (15/32")	M 14 (9/6")	W 7/16"	19 (23/32")	B	52 (2-3/64")	24 (15/16")	34(1-11/32")	28 (1-3/32")
		19 mm	955150	—	M 12 (15/32")	M 14 (9/6")	W 7/16"	19 (23/32")	B	75 (2-15/16")	24 (15/16")	57(2-1/4")	28 (1-3/32")
		21 mm	955143	—	—	—	W 1/2"	21 (53/64")	D	52 (2-3/64")	24 (15/16")	34(1-11/32")	31 (1-7/32")
		21 mm	955151	—	—	—	W 1/2"	21 (53/64")	D	75 (2-15/16")	24 (15/16")	57(2-1/4")	31 (1-7/32")
		21 mm	991480	—	—	—	W 1/2"	21 (53/64")	D	125 (4-47/51")	24 (15/16")	107 (4-7/32")	31 (1-7/32")
		22 mm	955144	M 12 (15/32")	M 14 (9/16")	M 16 (5/8")	—	22 (7/8")	D	52 (2-3/64")	24 (15/16")	34(1-11/32")	32.5 (1-9/32")
		24 mm	955146	—	M 16 (5/8")	M 18 (23/32")	—	24 (15/16")	D	52 (2-3/64")	25 (63/64")	34(1-11/32")	34 (1-11/32")

• Bit adaptor (Code No. 991476)



Part name	Overall length (mm)	Code No.
Plus hd. driver bit No.2	45 (1-25/32")	955229
	70 (2-3/4")	955654
Plus hd. driver bit No.3	45 (1-25/32")	955230
	70 (2-3/4")	955655

- Extension bar [Overall length 100 mm (3-15/16")] (Code No. 873633)
- Universal joint (Code No. 992610)
- Socket ass'y for duct

Dihedral width of applicable bolts	Code No.
12 (15/32")	993658
13 (1/2")	992613
14 (9/16")	992615

- EW-14R corner attachment (Code No. 9329-9001)

7. COMPARISONS WITH SIMILAR PRODUCTS

7-1. Specification Comparisons (Cordless Impact Driver)

Item		Maker		HITACHI		C	P
		Model		WH 12DM2	WH 12DM		
Catalog specifications	Capacity	Small screw		M 4 – M 8 (5/32" – 5/16") *1	M 4 – M 8 (5/32" – 5/16") *1	M 4 – M 8 (5/32" – 5/16")	—
		Ordinary bolt		M 5 – M 12 (3/16" – 15/32")	M 5 – M 12 (3/16" – 15/32")	M 5 – M 12 (3/16" – 15/32")	M 5 – M 12 (3/16" – 15/32")
		High-strength bolt		M 5 – M 10 (3/16" – 3/8")	M 5 – M 10 (3/16" – 3/8")	M 5 – M 10 (3/16" – 3/8")	M 5 – M 10 (3/16" – 3/8")
	Max. tightening torque*2		N·m	120 (1220 kgf·cm, 1060 in-lbs.)	100 (1020 kgf·cm, 885 in-lbs.)	100 (1020 kgf·cm, 885 in-lbs.)	115 (1170 kgf·cm, 1020 in-lbs.)
	No-load rotation speed		/min	0 – 2,600	0 – 2,300	0 – 2,300	0 – 2,400
	Impact rate		/min	0 – 3,200	0 – 3,000	0 – 3,000	0 – 3,000
	Main body weight*3		kg	1.6 (3.5 lbs.)	1.6 (3.5 lbs.)	1.5 (3.3 lbs.)	1.75 (3.9 lbs.)
Measured figures	Max. tightening torque*4		N·m	122 (1140 kgf·cm, 990 in-lbs.)	112 (1070 kgf·cm, 930 in-lbs.)	109 (1110 kgf·cm, 965 in-lbs.)	115 (1170 kgf·cm, 1020 in-lbs.)
	No-load rotation speed		/min	0 – 2,600	0 – 2,390	0 – 2,750	0 – 2,410
	Impact rate		/min	0 – 2,920	0 – 2,850	0 – 2,660	0 – 2,810
	Overall length x height		mm	155 x 226 (6-7/64" x 8.9")	167 x 226 (6-37/64" x 9-21/32")	168 x 231 (6-39/64" x 9-3/32")	165 x 233 (6-1/2" x 9-11/64")
	Center height		mm	26.5 (1-3/64")	26 (1-1/64")	26 (1-1/64")	29 (1-9/64")
	Main body weight*3		kg	1.67 (3.7 lbs.)	1.66 (3.7 lbs.)	1.58 (3.5 lbs.)	1.75 (3.9 lbs.)
	No-load sound pressure level		dB(A)	70	70	71	76
Tool tip mounting system			Driver chuck	Driver chuck	Driver chuck	Driver chuck	
Type of switch			Variable speed switch with forward/reverse changeover lever	Variable speed switch with forward/reverse changeover lever	Variable speed switch with forward/reverse changeover lever	Variable speed switch with forward/reverse changeover lever	
Type of motor			DC magnet	DC magnet	DC magnet	DC magnet	
Voltage		V	12	12	12	12	
Current		A	31	28	26	29	
Battery	Type		EB 1220BL or EB 1230HL	EB 1220BL or EB 1230HL	1222	DW9071	
	Nominal capacity	Ah	EB 1220BL: 2.0 EB 1230HL: 3.0	EB 1220BL: 2.0 EB 1230HL: 3.0	2.0	2.0	
	Nominal voltage	V	12	12	12	12	
	Ambient temperature	°C	0 – 40	0 – 40	—	—	
Charger	Model		UC 14YF2 or UC 14YFA	UC 14YF2	DC1411	DW9107	
	Power input capacity	VA	44	44	—	—	
	Recharging voltage	V	7.2 – 14.4	7.2 – 14.4	7.2 – 14.4	7.2 – 14.4	
Standard accessories			<ul style="list-style-type: none"> • Plastic tool case • Charger (UC 14YF2 or UC 14YFA) 	<ul style="list-style-type: none"> • Plastic tool case • Charger (UC 14YF2) 	<ul style="list-style-type: none"> • Plastic tool case • Charger 	<ul style="list-style-type: none"> • Plastic tool case • Charger 	

*1: In the case of tapping screws and wood screws, a minimum of M3 (1/8") is possible.

*2: WH 12DM2: Max. tightening torque is based on tightening an M14 (9/16") bolt (strength grade: 12.9) for 3 seconds with a hexagon socket.

WH 12DM, C: Max. tightening torque is based on tightening an M12 (5/32") bolt (strength grade: 12.9) for 3 seconds with a hexagon socket.

*3: Main body weight does not include accessory tools (hexagon bit, etc.).

*4: Max. tightening torque is based on tightening an M12 (5/32") bolt (strength grade: 12.9) for 3 seconds with a hexagon socket.

7-2. Specification Comparisons (Cordless Impact Wrench)

Item		Maker		HITACHI		C1	P
		Model		WR 12DM2	WR 12DM		
Catalog specifications	Capacity	Ordinary bolt		M 6 – M 16 (1/4" – 5/8")	M 6 – M 16 (1/4" – 5/8")	M 8 – M 14 (5/16" – 9/16")	M 6 – M 16 (1/4" – 5/8")
		High-strength bolt		M 6 – M 12 (1/4" – 15/32")	M 6 – M 12 (1/4" – 15/32")	M 6 – M 12 (1/4" – 15/32")	M 6 – M 12 (1/4" – 15/32")
	Max. tightening torque		N·m	165* ¹ (1685 kgf·cm, 1460 in-lbs.)	150* ¹ (1530 kgf·cm, 1330 in-lbs.)	120* ² (1224 kgf·cm, 1060 in-lbs.)	160 (1633 kgf·cm, 1420 in-lbs.)
	No-load rotation speed		/min	0 – 2,600	0 – 2,300	0 – 2,300	0 – 2,400
	Impact rate		/min	0 – 3,200	0 – 3,000	0 – 3,000	0 – 3,000
	Main body weight		kg	1.6 (3.5 lbs.)	1.6 (3.5 lbs.)	1.6 (3.5 lbs.)	1.75 (3.9 lbs.)
Measured figures	Max. tightening torque* ¹		N·m	170 (1735 kgf·cm, 1500 in-lbs.)	158 (1612 kgf·cm, 1400 in-lbs.)	118 (1204 kgf·cm, 1040 in-lbs.)	162 (1653 kgf·cm, 1429 in-lbs.)
	No-load rotation speed		/min	0 – 2,600	0 – 2,390	0 – 2,700	0 – 2,410
	Impact rate		/min	0 – 3,240	0 – 3,140	0 – 2,920	0 – 3,120
	Overall length x height		mm	162 x 226 (6-3/8" x 8.9")	173 x 226 (6-13/16" x 8.9")	176 x 231 (6-15/16" x 9-3/32")	168 x 233 (6-39/64" x 9-11/64")
	Center height		mm	26.5 (1-1/64")	26 (1-1/64")	26 (1-1/64")	29 (1-9/64")
	Main body weight* ³		kg	1.68 (3.7 lbs.)	1.67 (3.7 lbs.)	1.60 (3.5 lbs.)	1.75 (3.9 lbs.)
	No-load sound pressure level		dB(A)	70	70	71	76
Tip condition				12.7 mm (1/2") square drive	12.7 mm (1/2") square drive	12.7 mm (1/2") square drive	12.7 mm (1/2") square drive
Tool tip mounting system				Plunger	Plunger	—	—
Type of switch				Variable speed switch with forward/reverse changeover lever	Variable speed switch with forward/reverse changeover lever	Variable speed switch with forward/reverse changeover lever	Variable speed switch with forward/reverse changeover lever
Type of motor				DC magnet	DC magnet	DC magnet	DC magnet
Voltage		V	12	12	12	12	
Current		A	31	28	22	29	
Battery	Type		EB 1220BL or EB 1230HL	EB 1220BL or EB 1230HL	1222	DW9071	
	Nominal capacity	Ah	EB 1220BL: 2.0 EB 1230HL: 3.0	EB 1220BL: 2.0 EB 1230HL: 3.0	2.0	2.0	
	Nominal voltage	V	12	12	12	12	
	Ambient temperature	°C	5 – 40	5 – 40	—	—	
Charger	Model		UC 14YF2 or UC 14YFA	UC 14YF2	DC1411	DW9107	
	Power input capacity	VA	44	44	—	—	
	Recharging voltage	V	7.2 – 14.4	7.2 – 14.4	7.2 – 14.4	7.2 – 14.4	
Standard accessories				<ul style="list-style-type: none"> • Plastic tool case • Charger (UC 14YF2 or UC 14YFA) 	<ul style="list-style-type: none"> • Plastic tool case • Charger (UC 14YF2) 	<ul style="list-style-type: none"> • Plastic tool case • Charger 	<ul style="list-style-type: none"> • Plastic tool case • Charger

*1: Max. tightening torque is based on tightening an M16 (5/8") bolt (F10T) for 3 seconds with a hexagon socket.

*2: Max. tightening torque is based on tightening an M14 (9/16") bolt (strength grade: 12.9) for 3 seconds with a hexagon socket.

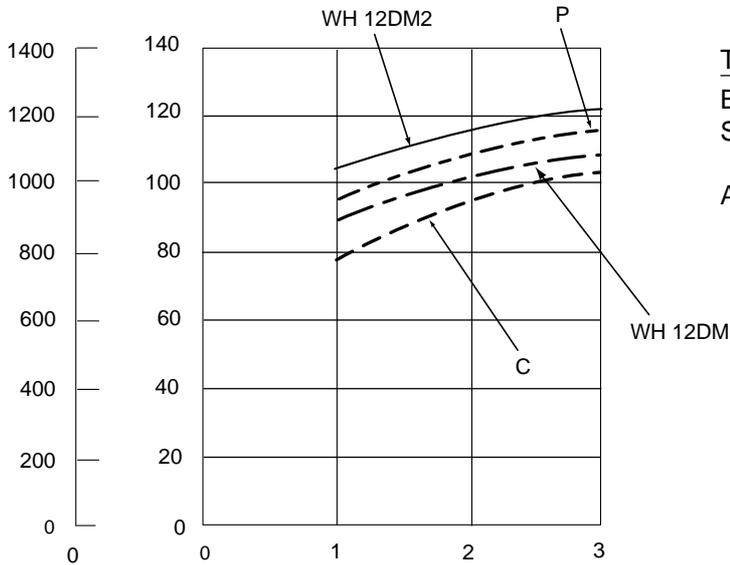
*3: Main body weight does not include accessory tools (hexagon bit, etc.).

7-3. Tightening Torque

7-3-1. Tightening torque characteristic comparisons

Thanks to the high-power rare-earth magnet motor and the larger hammer inertia, the Models WH 12DM2/WR 12DM2 can provide greater tightening torque.

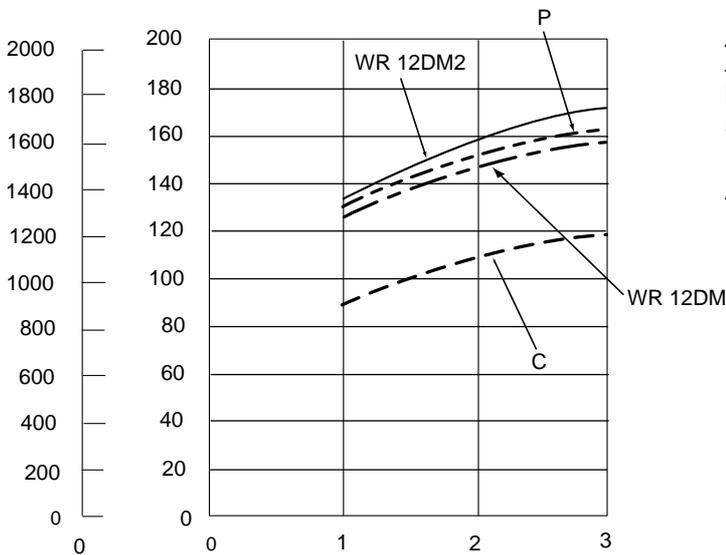
(1) Impact driver



Test conditions

Bolt: M14 x 50 mm, high-strength bolt
 Steel plate: SS34P
 Thickness 25 mm
 Accessory tool: Hexagon socket
 (length: 40 mm,
 width across flat: 19 mm)

(2) Impact wrench



Test conditions

Bolt: M16 x 55 mm (5/8" x 2-5/32") (F10T)
 Steel plate: Mild steel
 Thickness 25 mm
 Accessory tool: Hexagon socket ass'y

7-3-2. Screw diameter and appropriate tightening torque

Generally speaking, the appropriate tightening torque for a screw can be determined by the strength grade of the screw and the material tightened. Tables 1 and 2, and Fig. 5 below list data relative to the strength grade of various screws and the appropriate tightening torque. For further reference, appropriate tightening torque is calculated with the following formula. Study and use this formula for accurate selection of tightening torque.

$$T = k \cdot d \cdot p$$

T: Appropriate tightening torque (kgf·cm)

d: Nominal diameter for the screw (mm)

p: Recommended axial tightening force to be applied to the screw (kgf)

$p = \text{rated axial stress (kgf/cm}^2) \times 0.8 \times \text{effective sectional area of the thread (mm}^2)$

k: Torque coefficient (0.17)

• Strength grade and rated axial stress of threads

Table 1

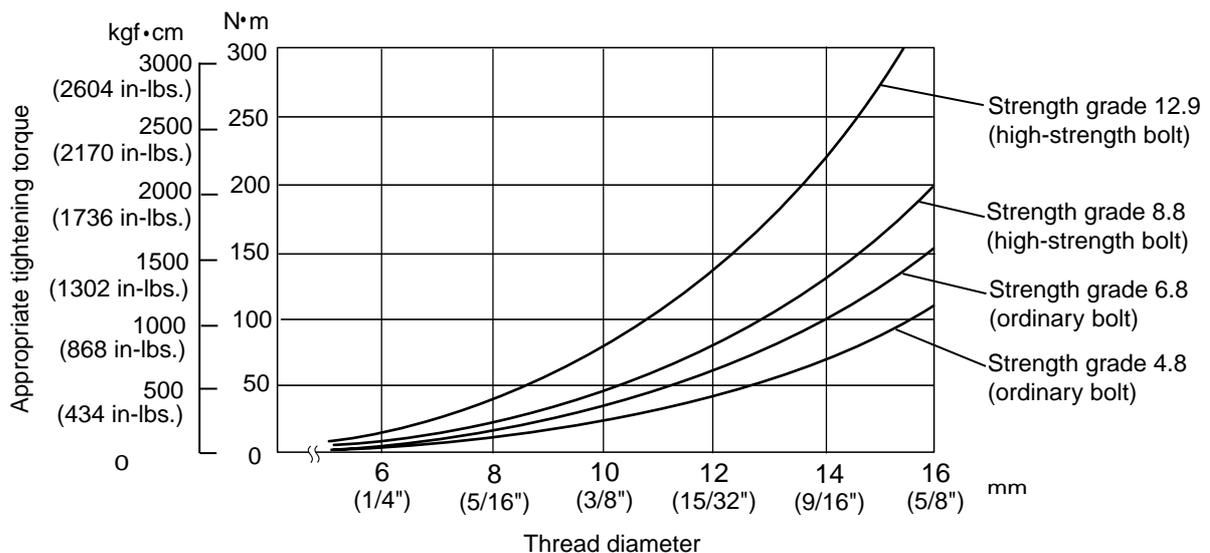
Strength grade	4.8	6.8	8.8	12.9
Rated axial stress (kgf/mm ²)	29.1	43.7	58.2	95
Material	Mild steel		Alloy steel including Ni, Mn, Cr, etc.	
Heat treatment	None		Processed-hard material	

• Diameter and effective sectional areas of threads

Table 2

Kind of thread (x pitch)	M5 x 0.8 mm (3/16")	M6 x 1 mm (1/4")	M8 x 1.25 mm (5/16")	M10 x 1.5 mm (3/18")	M12 x 1.75 mm (15/32")	M14 x 2 mm (9/16")	M16 x 2 mm (5/8")
Effective sectional area of thread (mm ²)	14.2	20.1	36.6	58.0	84.3	115	157

• Thread diameter and appropriate tightening torque

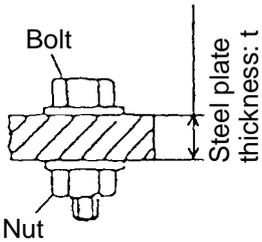


7-3-3. Bolt tightening torque characteristics

Figures. 6-1 and 6-2 show relationships between time and tightening torque for individual bolt types and sizes. While the data are useful for handy reference, actual tightening torque will vary depending on tightening conditions and other variables. For details, please refer to Para. 8-3, "Tightening Torque Variation".

(Note)

- The term "tightening time" indicates the impact time after the lower surface of the bolt has come in contact with the material into which it is being tightened.
- In the tightening conditions shown in Figs. 6-1 and 6-2, the screws are being tightened directly into a steel plate; accordingly, the torque goes up very abruptly in comparison with ordinary bolt tightening conditions.



* The following bolts were utilized:
 Ordinary bolt; strength grade 4.8
 High-strength bolt; strength grade 12.9

Strength grade is read as follows:
 4.8
 Yield point or durable force: (45,500 psi)
 Tensile strength of the bolt: (56,900 psi)

• Model WH 12DM2

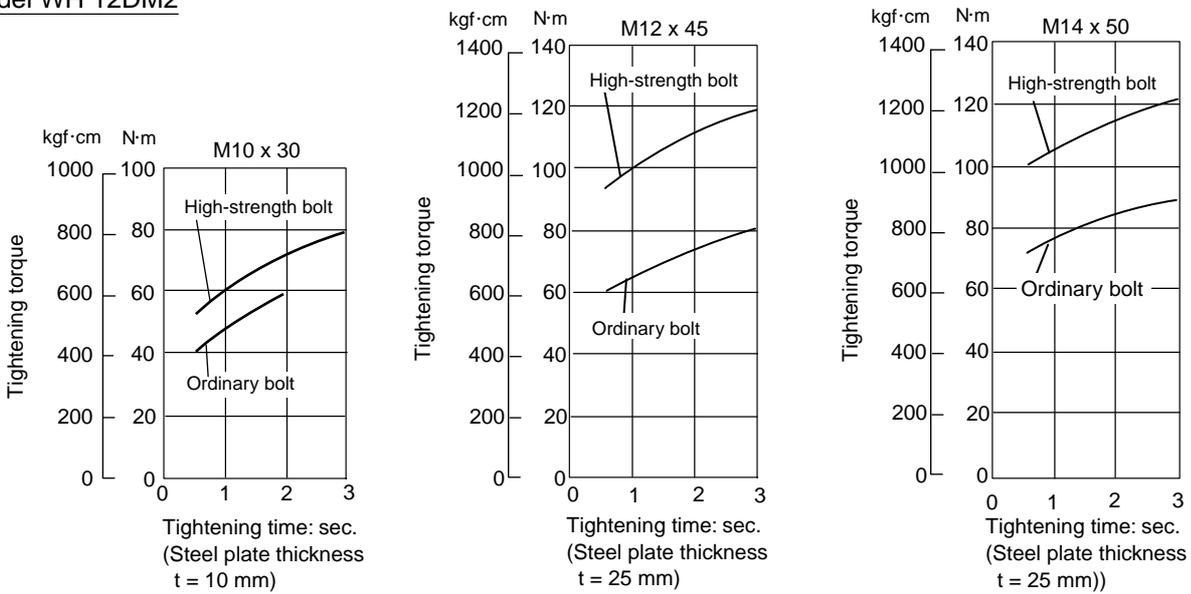


Fig. 6-1

• Model WR 12DM2

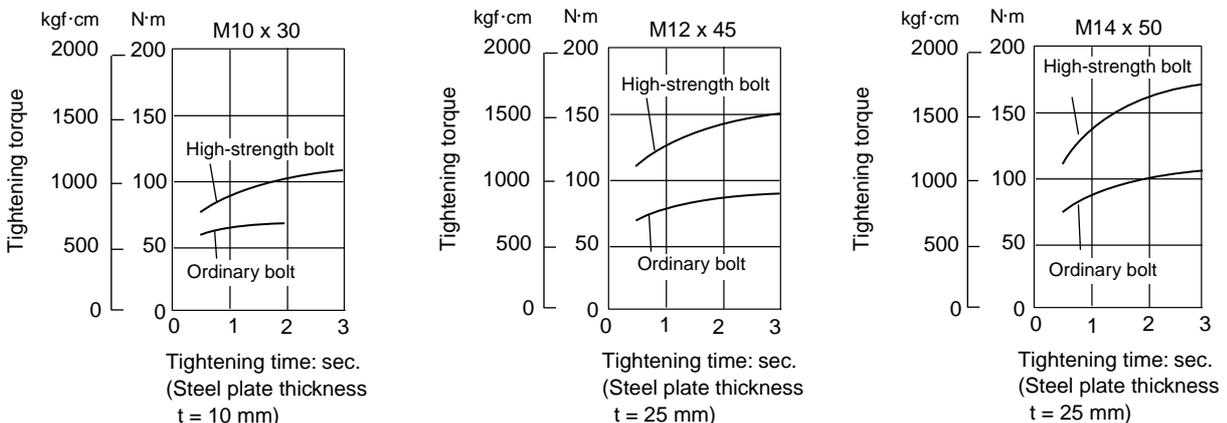


Fig. 6-2

7-5. Number of Screws or Bolts Driven

7-5-1. Per-charge working capacity comparisons

Test data on the number of screws or bolts which can be driven per battery charge by the new models vs. the previous models are shown in the tables below. Please note that the data below are intended for general reference only as the number of screws which can be tightened per charge will vary slightly depending on screw tightening conditions, screw sizes, ambient temperatures and the charging capacity of the battery.

Number of screws or bolts driven (Cordless impact driver)

Tightening condition	Model	HITACHI WH 12DM2	HITACHI WH 12DM	C	C
Battery		EB 1220BL	EB 1220BL	1222 <small>(Corresponding EB 1220BL)</small>	DW9071 <small>(Corresponding EB 1220BL)</small>
Wood screw 4.0 mm dia. x 50 mm (soft wood)		525	575	635	550
Wood screw 4.2 mm dia. x 90 mm (hard wood)		115	115	105	105
Wood screw 5.3 mm dia. x 120 mm (hard wood)		45	45	40	40
Machine screw (M8 x 16 mm)		1,165	1,280	1,475	1,225

Note 1) The Model WH 12DM2 is equipped with the larger hammer and the higher power motor for the higher tightening speed. Although the higher tightening speed is realized, the Model WH 12DM2 has the following disadvantage.

- High startup current

The Model WH 12DM2 consumes higher power than C for driving a short or machine screw because it requires high startup current. Thus the number of machine screws driven per charge is different as shown above.

7.6 Actual Noise When Tightening Wood Screws

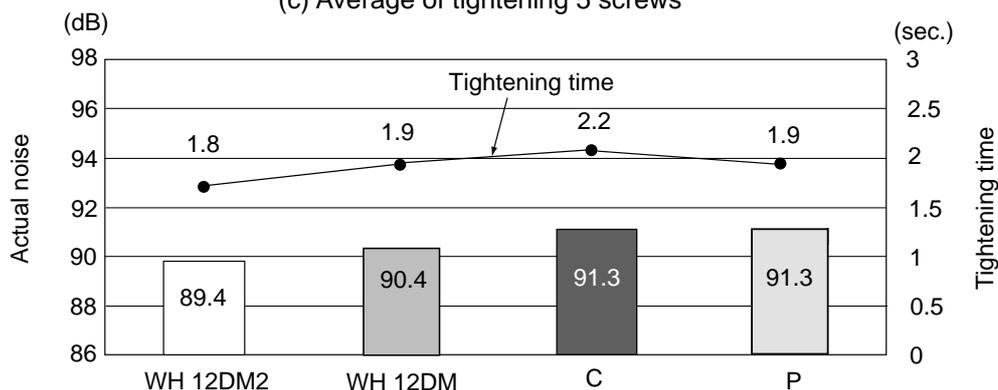
(1) Actual noise when tightening wood screws

The comparison data when tightening a wood screw (4.5 mm in diameter and 90 mm in length) into a cedar workpiece are shown below. The data below are intended for reference purposes only because actual noise will vary depending on the types of workpieces, hardness, etc.

Measuring conditions: (a) Wood screws (4.5 mm in diameter and 90 mm in length) and cedar workpieces

(b) Battery voltage 12 V, A-range, distance 1 m

(c) Average of tightening 5 screws



8. PRECAUTIONS IN SALES PROMOTION

8-1. Safety Instructions

In the interest of promoting the safest and most efficient use of these tools by all our customers, it is very important that at the time of sale the salesperson carefully ensures that the buyer seriously recognizes the importance of the contents of the Handling Instructions, and fully understands the meaning of the precautions listed on the Caution Plate and Name Plate attached to each tool.

A. Handling Instructions

Salespersons must be thoroughly familiar with the contents of the Handling Instructions in order to give pertinent advice to the customer. In particular, they must have a thorough understanding of the precautions in the use of the cordless (battery charger type) electric power tools which are different from those of ordinary electric power tools.

- (1) Before use, ensure that the unit is fully charged.

New units are not fully charged. Even if the units were fully charged at the factory, long periods without use, such as during shipping, cause the storage battery to lose its charge. Customers must be instructed to fully charge the unit prior to use.

- (2) When charging storage batteries, use only the exclusive Model UC 14YF2 or UC 14YFA Charger provided with the tool. Because of the designed rapid-charging feature (UC 14YF2: Approx. 60 min., UC 14YFA: Approx. 50 min.), use of other battery chargers is hazardous.

- (3) Follow prescribed steps in using the charger.

First connect the EB 1220BL Storage Battery to the Model UC 14YF2 or UC 14YFA Charger, then plug the charger into an AC outlet (ensuring that the voltage matches that indicated on the unit). If this order is reversed, the charger may not function properly.

- (4) Ensure the power source voltage is the same as that indicated on the Name Plate of the charger. Use of any other power source (DC outlet, fuel powered generator, etc.) will cause the charger to overheat and burn out.

- (5) Do not use any voltage increasing equipment (transformer etc.) between the power source and the charger.

If the charger is used with voltage over and above that indicated on the unit, it will not function properly.

- (6) Conduct battery charging at an ambient temperature range of 0 °C – 40 °C (32 °F – 104 °F).

Special temperature sensitive devices are employed in the charger to permit rapid charging. Ensure that customers are instructed to use the charger at the indicated ambient temperature range. At temperatures under 0 °C (32 °F), the thermostat will not function properly, and the storage battery may be over-charged. At temperatures over 40 °C (104 °F), the storage battery cannot be sufficiently charged. The optimum temperature range is 20 °C – 25 °C (68 °F – 77 °F).

- (7) The battery charger should not be used continuously.

At high ambient temperatures, if over three storage batteries are charged in succession, the temperature of the coils on the transformer will rise and there is a chance that the temperature fuse inserted in the interior of the transformer will inadvertently melt. After charging one battery, please charge the next battery after about a fifteen-minute interval.

- (8) The charger case is equipped with air vents to protect the internal electronic components from overheating.

Caution the customer not to allow foreign materials, such as metallic or flammable objects, to be dropped or inserted into the air vents. This could cause electric shock, fire or other serious hazards.

(9) Do not attempt to disassemble the storage battery or the charger.

Special devices, such as a thermostat, are built into the storage battery and charger to permit rapid charging. Incorrect parts replacement and/or wiring will cause malfunctions which could result in fire or other hazards. Instruct the customer to bring these units to an authorized service center in the event repair or replacement is necessary.

(10) Disposal of the Type EB 1220BL or EB 1230HL Storage Battery

Ensure that all customers understand that Type EB 1220BL or EB 1230HL Storage Batteries should be turned into any Hitachi power tool sales outlet or authorized service center when they are no longer capable of being recharged or repaired. If thrown into a fire, the batteries may explode, or if discarded indiscriminately, leakage of the cadmium compound contained in the battery may cause environmental pollution.

B. Caution Plates

(1) The following precautions are listed on the Name Plate or Caution Plate attached to the main body of each tool.

For the U.S.A. (excludes French) or Canada

WARNING

- To reduce the risk of injury, user must read and understand Instruction Manual.

AVERTISSEMENT

- Afin de réduire le risque de blessures, l'utilisateur doit lire et bien comprendre le mode d'emploi.

For Oceania

CAUTION

- Read thoroughly HANDLING INSTRUCTIONS before use.

(2) The following cautions are listed on the Name Plate attached to each type EB 1220BL or EB 1230HL storage battery.

For Europe

- ### **CAUTION**
- Read thoroughly HANDLING INSTRUCTIONS before use.
 - Do not disassemble nor throw into fire.

For the U.S.A.

CAUTION

- For safe operation, see Instruction Manual.
- Use HITACHI charger UC 12Y, -14Y, -24Y series for recharging.

(3) The following caution is listed on the Name Plate attached to the Model UC 14YF2 or UC 14YFA Charger.

For the U.S.A.

CAUTION

- For safe operation, see Instruction Manual.
- Charge HITACHI rechargeable batteries Type EB 7, EB 9, EB 12 and EB 14 series. Other types of batteries may burst causing personal injury and damage.
- Charge between 32 and 104 °F.
- Indoor use only.
- Replace defective cord immediately.

8-2. Tightening Torque Inspection Prior to Operation

As described and shown in Para. 7-3-3, the output tightening torque of which the Models WH 12DM2 and WR 12DM2 are capable in excess of the rated tightening torque of certain bolts and screws. Accordingly, if the tightening time is prolonged for such bolts and screws, it could cause damage to their threads or, in the worst case, cause them to be sheared off. (This phenomenon is common to all existing impact drivers.) Particularly when tightening M6 (1/4") or smaller screws, tightening time must be kept extremely short: 0.5 seconds or less. The customer should be advised to carry out several screw tightening operations and adjust the tightening time as necessary by measuring the tightening torque with an appropriate torque wrench or driver before commencing continuous operation.

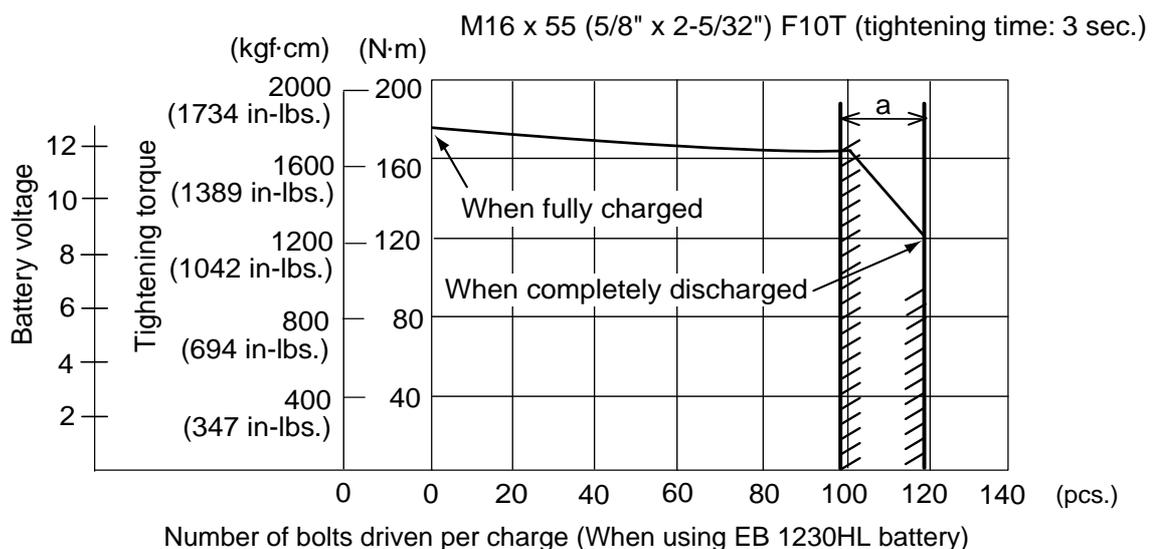
8-3. Tightening Torque Variation

The tightening torque of the cordless impact driver or wrench may vary slightly in accordance with the factors described below. Salespersons are requested to advise the customer to confirm that appropriate tightening torque is obtained by measuring the torque with an appropriate torque wrench or torque driver at the beginning of the tightening operations, and as necessary during the tightening operations. In addition, the torque values shown in Para. 7-3-2 above are useful as a handy reference, and may be utilized as tentative standards.

(1) Voltage of battery

Tightening torque is affected by the voltage output of the battery. For example, the relationship between tightening torque and the number of M16 x 55 mm (5/8" x 2-5/32") F10T bolts tightened is shown in Fig. 7 below. As can be seen in the graph, tightening torque decreases as the number of bolts tightened increases. This phenomenon is caused by the decline in voltage output of the battery due to the increasing number of bolts tightened. In particular, the tightening torque decreases rapidly just before the battery is fully discharged (range "a" in the graph). As this phenomenon is an inherent drawback in any cordless impact driver, salespersons are requested to ensure that the customer is fully aware of and understands this characteristic.

Model WR 12DM2



(2) Effects of low ambient temperatures

The tightening torque required may be reduced at low ambient temperatures or under the influence of grease and different torque coefficients (dependent on manufacturing and finishing processes, and specified by bolt manufacturers).

(3) Different bolt diameter

Differences in bolt diameter will cause variation of the required levels of tightening torque. Generally speaking, tightening torque is higher for large bolts.

(4) Different materials being tightened

When a bolt is tightened into a soft material such as aluminum, plastic, wood, etc., the tightening torque is considerably less than when the bolt is tightened into a hard material such as steel.

(5) Different tightening conditions

The tightening torque may vary in accordance with bolt torque coefficient (dependent on manufacturing process, and specified by bolt manufactures), bolt grade and bolt length, even though the dimensions of the bolts are the same. Tightening torque may also vary depending on the surface finishing state of tightening materials (steel, aluminum, etc.), and materials to be tightened. In addition, if there is seal packing, clearance, etc. between tightening materials, the tightening torque is decreased.

(6) Wear and looseness of the socket

With extended use, the hexagonal portion of the socket which is fitted to the head of the bolt or drill bit, and/or hexagonal portion of the driver chuck which is fitted onto the anvil in the main body will become worn and loose. Wear and looseness will cause a proportionate loss of tightening torque.

In addition, use of an incorrect size socket (slightly larger than the bolt being tightened) will also result in decreased torque.

(7) Bolt and nut rotate together

Tightening torque that can be achieved will be considerably decreased if the bolt and nut rotate together during the tightening operation. The customer should be advised to carefully observe the operation and ensure this does not occur.

8-4. Suggestions and Precautions for the Efficient Use of the Charger

(1) Batteries may not be rechargeable immediately after use

If the Models EB 1220BL and EB 1230HL Storage Batteries are exposed to direct sunshine for an extended period, or if the temperature of the batteries is 40 °C (104 °F) or higher immediately after they have been used in the tool, the pilot lamp may not light up when the batteries are connected to the Model UC 14YF2 or UC 14YFA Charger. This is because the built-in thermostat functions to stop the charging when the temperature of the storage batteries reach 40 °C (104 °F) or more. In such a case, the customer should be advised to place the batteries in a shaded area with a good airflow, and allow sufficient cooling before recharging.

This phenomenon is common to all existing batteries which employ temperature sensitive overcharge devices. The cooling time required before charging can be accomplished varies from a few minutes to about 30 minutes, depending on the load, duration of use, and ambient temperature.

9. OTHER PRECAUTIONS

(1) Check for cracks or other damage on the socket

Cracks or any other faults on the socket are very hazardous. In addition, cracks or other damage to accessories will cause loss of tightening torque efficiency. Advise the customer to inspect accessories often, and ensure there are no abnormalities.

(2) Socket dimensions

Without fail, utilize an appropriate socket which matches the bolt and/or nut dimensions. If the socket dimensions are larger than the bolts or nuts, it will not only cause insufficient tightening torque, but could also easily cause damage to the socket. Please refer to the tables in Para. 6-2 for appropriate socket dimensions.

(3) Hammering section lubrication

Grease (Molub-Alloy 777-1) is utilized in the hammering section. Frequent or continuous use of the tool will cause excessive temperature rise of the hammering section, resulting in depletion of the grease and subsequent increased wear of components which will, in turn, cause loss of tightening efficiency. Accordingly, it is necessary to periodically replenish the grease in the hammering section to ensure proper lubrication of moving and sliding components.

10. REPAIR GUIDE

WARNING: Without fail, remove the battery from the main body before starting repair or maintenance work. Because the tool is cordless, if the battery is left in and the switch is activated inadvertently, the motor will start rotating unexpectedly, which could cause serious injury.

10-1. Precautions in Disassembly and Reassembly

The **[]** and **<bold>** numbers correspond to the item numbers in the Parts List and the exploded assembly diagram. ([]: WH 12DM2, < >: WR 12DM2)

10-1-1. Disassembly

(1) Removal of Guide Sleeve (B) [4] (Model WH 12DM2 only)

Remove the Retaining Ring [1], Washer (D) [2], Guide Spring (A) [3] and Guide Sleeve (B) [4] in order by following the procedure shown in Figs. 1-1 to 1-4. Be sure not to lose the two Steel Balls D3.5 [9] in Anvil (F) [10].

<p>1</p> <p>Fig. 1-1</p> <p>Hold the body and adjust the gap of the retaining ring to the groove of anvil (F), then insert a small flat-blade screwdriver into the groove at an angle.</p>	<p>2</p> <p>Fig. 1-2</p> <p>Press down washer (D) with the small flat-blade screwdriver.</p>
<p>3</p> <p>Fig. 1-3</p> <p>Slide the small flat-blade screwdriver under one side of the gap of the retaining ring.</p>	<p>4</p> <p>Fig. 1-4</p> <p>Slowly raise the retaining ring using the end face of guide sleeve (B) as a fulcrum.</p>

Then slowly raise the other side of the retainer ring with the small flat-blade screwdriver until it is free. Avoid quickly raising the retainer ring or it may fly out forcefully.

(2) Removal of Front Cap (A) [5] <1> and Protector (A) [6] <2>

Insert a small flat-blade screwdriver between Front Cap (A) [5] <1> and Protector (A) [6] <2> and remove them from the Hammer Case [8] <4>.

(3) Removal of the Hammer Case [8] <4> and the hammer assembly

Remove the four Tapping Screws (W/SP. Washer) D4 x 25 (Black) [7] <3> that connect the Hammer Case [8] <4> with Housing (A). (B) Set [35] <32> and remove the Hammer Case [8] <4> and the hammer assembly from Housing (A).(B) Set [35] <32>.

(4) Disassembly of the hammer assembly

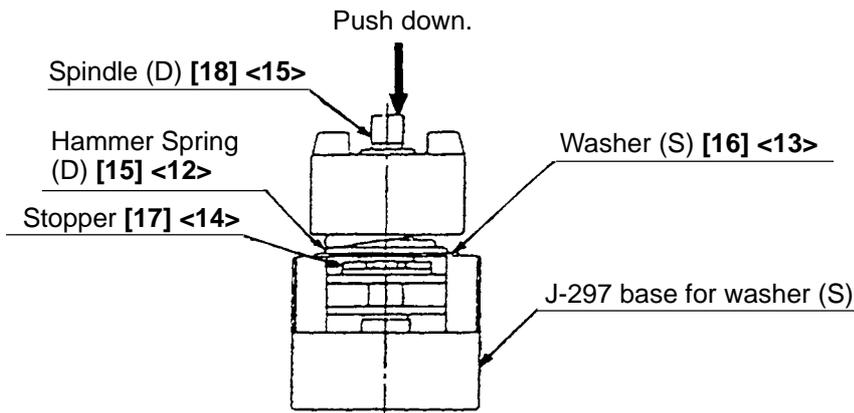


Fig. 2

Mount the hammer assembly onto the J-297 base for washer (S). With a hand press, push down the top of Spindle (D) [18] <15> to compress Hammer Spring (D) [15] <12>. In this position, remove the Stopper [17] <14> with a small flat-blade screwdriver, then release the hand press. (See Fig. 2.)

Remove the hammer assembly from the J-297 base for washer (S) and support the end surface of Spindle (D) [18] <15>. With a hand press, push down either of the raised faces of Hammer (D) [12] <9> to compress Hammer Spring (D) [15] <12>. In this position, extract the two Steel Balls D5.556 [11] <8> from the cam grooves of Spindle (D) [18] <15> and Hammer (D) [12] <9> with a small flat-blade screwdriver. Then, slowly release the hand press and lift Hammer (D) [12] <9> and Washer (S) [16] <13> together to extract them from Spindle (D) [18] <15>. Hammer Spring (D) [15] <12> can then be removed.

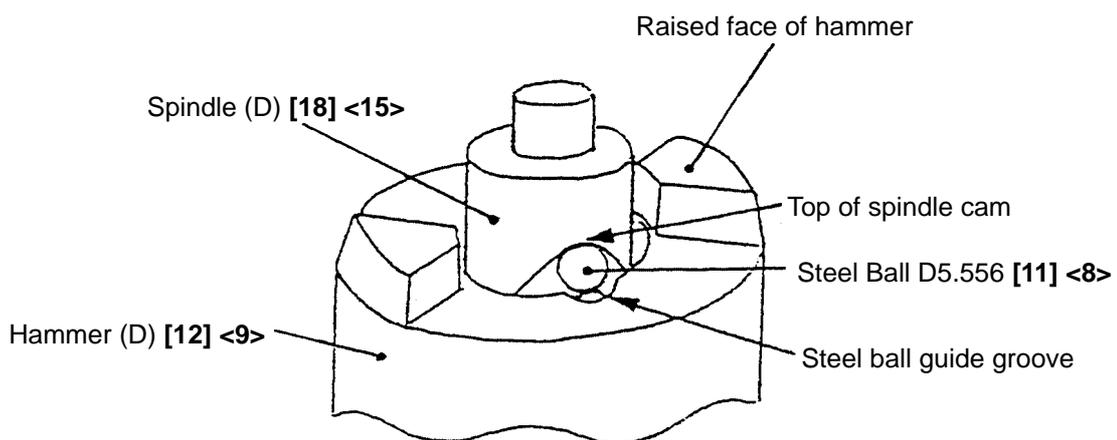


Fig. 3

(5) Removal of the Hook Ass'y [42] <38>

Remove the Special Screw M5 [49] <45> with a flat-blade screwdriver or a coin and remove the Hook Ass'y [42] <38> and the Hook Spring [48] <44>.

(6) Removal of the Carbon Brushes 5 x 6 x 11.5 [31] <28>

Remove the two Brush Caps [32] <29>. Catch the flanges of the Carbon Brushes 5 x 6 x 11.5 [31] <28> with a small flat-blade screwdriver and remove the Carbon Brushes 5 x 6 x 11.5 [31] <28> at both sides.

(7) Removal of housing (B)

Remove the seven Tapping Screws (W/Flange) D4 x 20 (Black) [33] <30> and Machine Screw (W/Washers) M4 x 25 [47] <43> from the main body. The Strap [45] <41> and the Sleeve [46] <42> can be removed by removing the Machine Screw (W.Washers) M4 x 25 [47] <43>. Before removing housing (B), be sure to remove the Brush Caps [32] <29> because housing (B) cannot be removed if the Brush Caps [32] <29> are mounted.

(8) Removal of the switch

The FET of the DC-Speed Control Switch [38] <35> is firmly inserted in the housing. Insert a small flat-blade screwdriver between the FET and housing (B) to raise and remove the FET. Then, Inner Cover (A) [25] <22>, Armature Ass'y DC 12V [26] <23>, Magnet (D) [28] <25>, Brush Block [30] <27> and DC-Speed Control Switch [38] <35> can be removed in a piece. Pushing Button (A) [39] <36> can also be removed.

(Note) Be careful not to break the three legs coming from the FET to avoid malfunction of the switch.

(9) Removal of the switch assembly

Remove the two Machine Screws (W/Sp. Washer) M3 x 5 [37] <34> that secure the flag terminal and then disconnect the internal wires (red and black) of the Brush Block [30] <27> from the DC-Speed Control Switch [38] <35>.

(Note) Do not disconnect the three FET internal wires soldered to the DC-Speed Control Switch [38] <35>.

(10) Removal of Magnet (D) [28] <25>, Dust Guard Fin (A) [29] <26> and Side Yoke [27] <24>

Remove Magnet (D) [28] <25> in the "B" direction (see Fig. 4) holding Inner Cover (A) [25] <22> securely because Magnet (D) [28] <25> has a strong magnetism. Dust Guard Fin (A) [29] <26> and Side Yoke [27] <24> can be easily removed from Magnet (D) [28] <25> by holding Magnet (D) [28] <25> securely and pulling them in the direction of diameter because they are mounted to Magnet (D) [28] <25> magnetically.

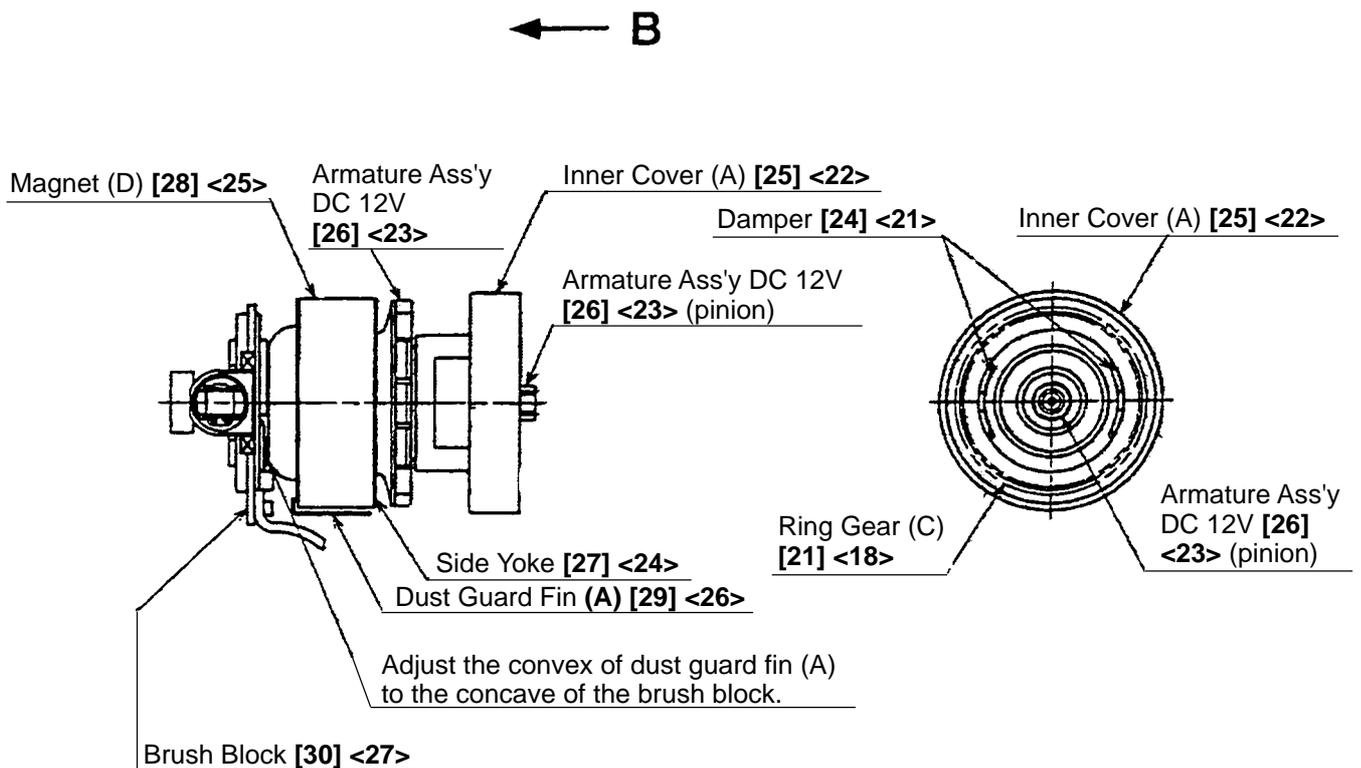


Fig. 4

(11) Removal of the Armature Ass'y DC 12V [26] <23>

Support Inner Cover (A) [25] <22> so that it does not contact the fan of the Armature Ass'y DC 12V [26] <23>. With a hand press, push down the tip portion of the Armature Ass'y DC 12 V [26] <23> (pinion) to remove it.

(12) Removal of Ring Gear (C) [21] <18> and the Damper [24] <21>

Remove Ring Gear (C) [21] <18> from Inner Cover (A) [25] <22> and remove the Damper [24] <21> with a small flat-blade screwdriver. Ring Gear (C) [21] <18> is firmly inserted in Inner Cover (A) [25] <22>. Insert a small flat-blade screwdriver between Ring Gear (C) [21] <18> and Inner Cover (A) [25] <22> to remove Ring Gear (C) [21] <18>. Remove the Damper [24] <21> with a small flat-blade screwdriver.

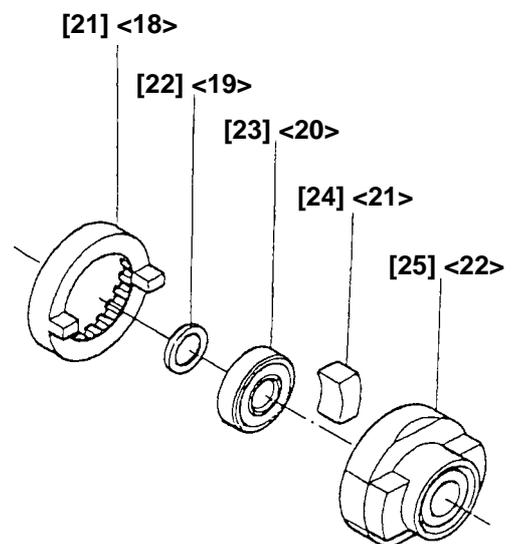


Fig. 5

10-1-2. Reassembly

Reassembly can be accomplished by following the disassembly procedures in reverse. However, special attention should be given to the following items.

(1) Reassembly of the housing assembly

- (a) Be sure to follow the wiring diagram (Fig. 6) for proper wiring.
- (b) When connecting the internal wires of the Brush Block [30] <27> to the DC-Speed Control Switch [38] <35>, fasten them with the Machine Screw (W/Sp. Washer) M3 x 5 [37] <34> paying attention to the direction of the flag terminal (Fig. 6).

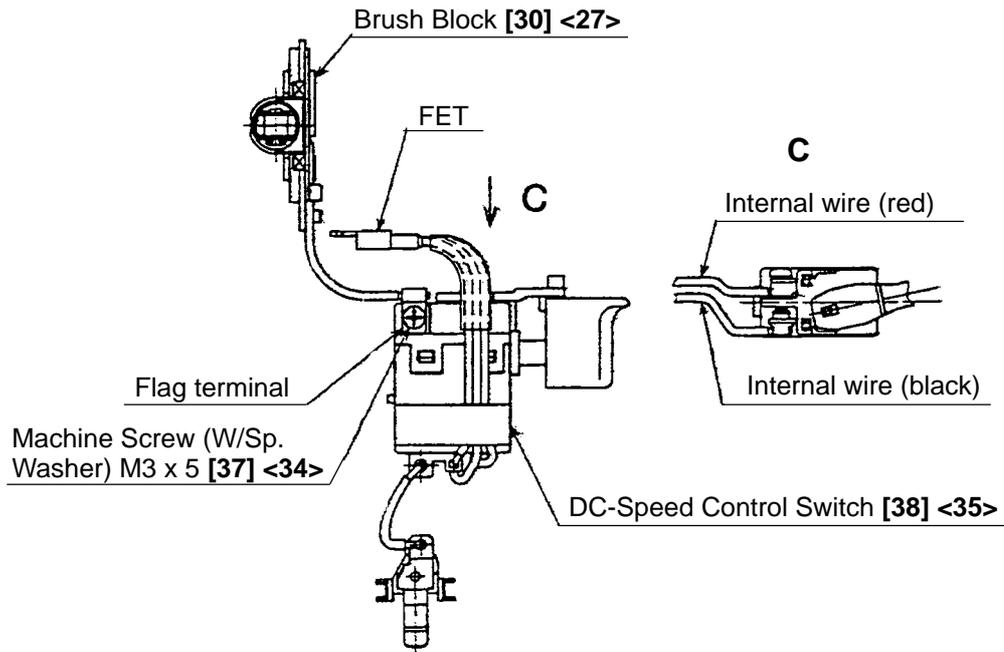


Fig. 6

- (c) Before mounting the parts to housing (A), apply silicone rubber (ThreeBond 1211) to the area illustrated in Fig. 7

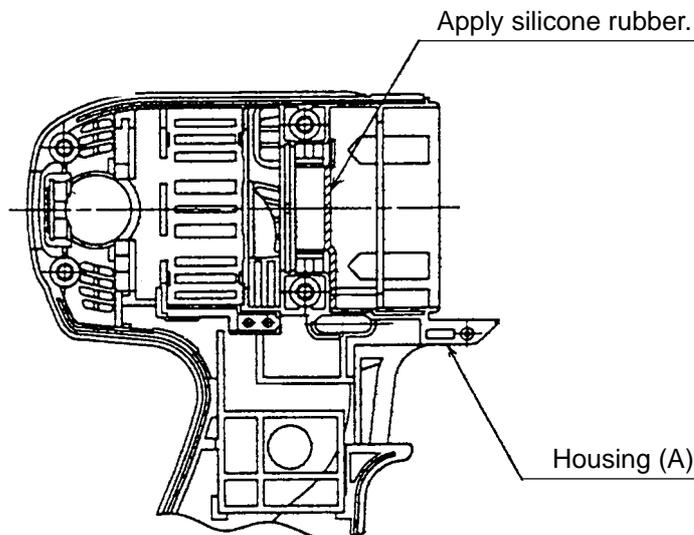


Fig. 7

(d) Mount a unit of Inner Cover (A) [25] <22> (including the Armature Ass'y DC 12 V [26] <23>), Magnet (D) [28] <25> (including Dust Guard Fin (A) [29] <26> and Side Yoke [27] <24>) and Brush Block [30] <27> into housing (A) (See Fig. 11). Pay attention to the following items.

- Adjust the protrusions of Dust Guard Fin (A) [29] <26> to the concave portions of Magnet (D) [28] <25> and also adjust the outside diameter of Dust Guard Fin (A) [29] <26> to the outside diameter of Magnet (D) [28] <25> when mounting Dust Guard Fin (A) [29] <26> to Magnet (D) [28] <25> (See Fig. 8).
- Adjust the protrusions of the Side Yoke [27] <24> to the concave portions of Magnet (D) [28] <25> and also adjust the outside diameter of the Side Yoke [27] <24> to the outside diameter of Magnet (D) [28] <25> when mounting the Side Yoke [27] <24> to Magnet (D) [28] <25> (See Fig. 8).
- Insert the two Dampers [24] <21> so that they fit into Inner Cover (A) [25] <22>. Fit the locking rib of Ring Gear (C) [21] <18> to the concave portion of Damper [24] <21>. Press-fit the Armature Ass'y DC 12V [26] <23> into Inner Cover (A) [25] <22>.
- Adjust the convex portion of Dust Guard Fin (A) [29] <26> to the concave portion of the Brush Block [30] <27> (See Fig. 9).
- Adjust the concave portions (for locking) of Magnet (D) [28] <25> to the protrusions of housing (A) (see Figs. 8 and 10).

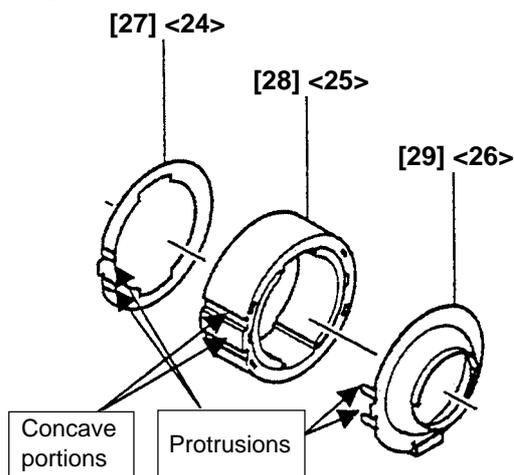


Fig. 8

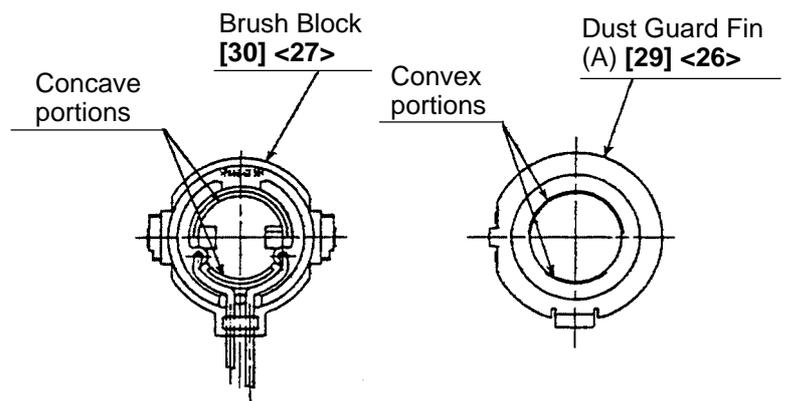


Fig. 9

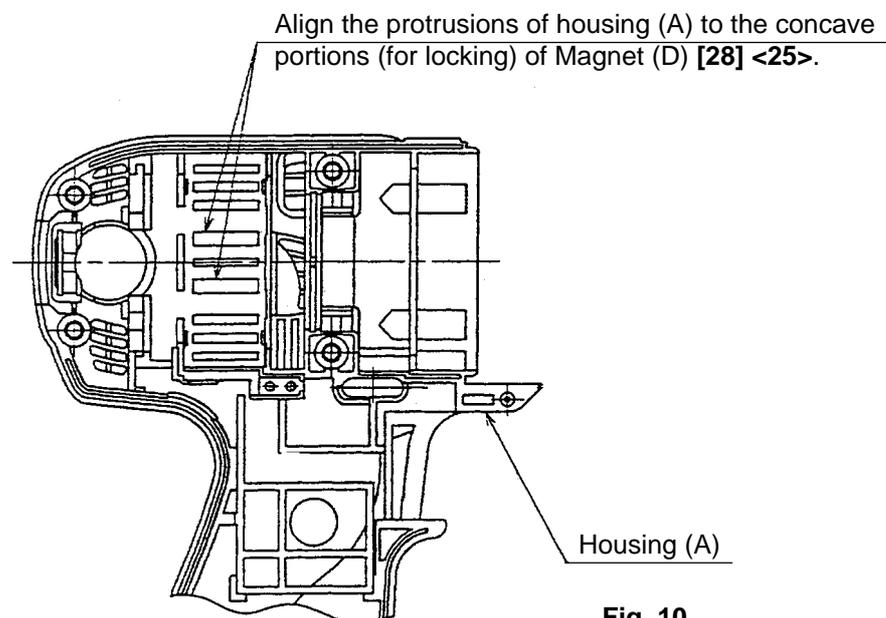


Fig. 10

(e) Mount the DC-Speed Control Switch [38] <35> to housing (A) so that the protrusion of the forward/reverse lever at the top of the switch is inserted into the hole of Pushing Button (A) [39] <36>. Apply silicone grease (KS609, Shin-Etsu Chemical Co., Ltd.) to the contacting surfaces of the FET of the DC-Speed Control Switch [38] <35> and Dust Guard Fin (A) [29] <26> then mount them to housing (A).

(Note) The temperature of the FET may be high if the silicone grease is not applied. Make sure that the three internal wires from the FET are passed above the DC-Speed Control Switch [38] <35> (see Fig. 11).

(2) Apply silicone rubber (ThreeBond 1211) to housing (A) and Inner Cover (A) [25] <22> as shown in Fig. 11. Mount housing (B) and secure them with seven Tapping Screws (W/Flange) D4 x 20 (Black) [33] <30>. Wipe the silicone rubber coming out of the housing with a cloth. Insert the Sleeve [46] <42> into the Strap [45] <41> and tighten the Machine Screw (W/Washers) M4 x 25 [47] <43>.

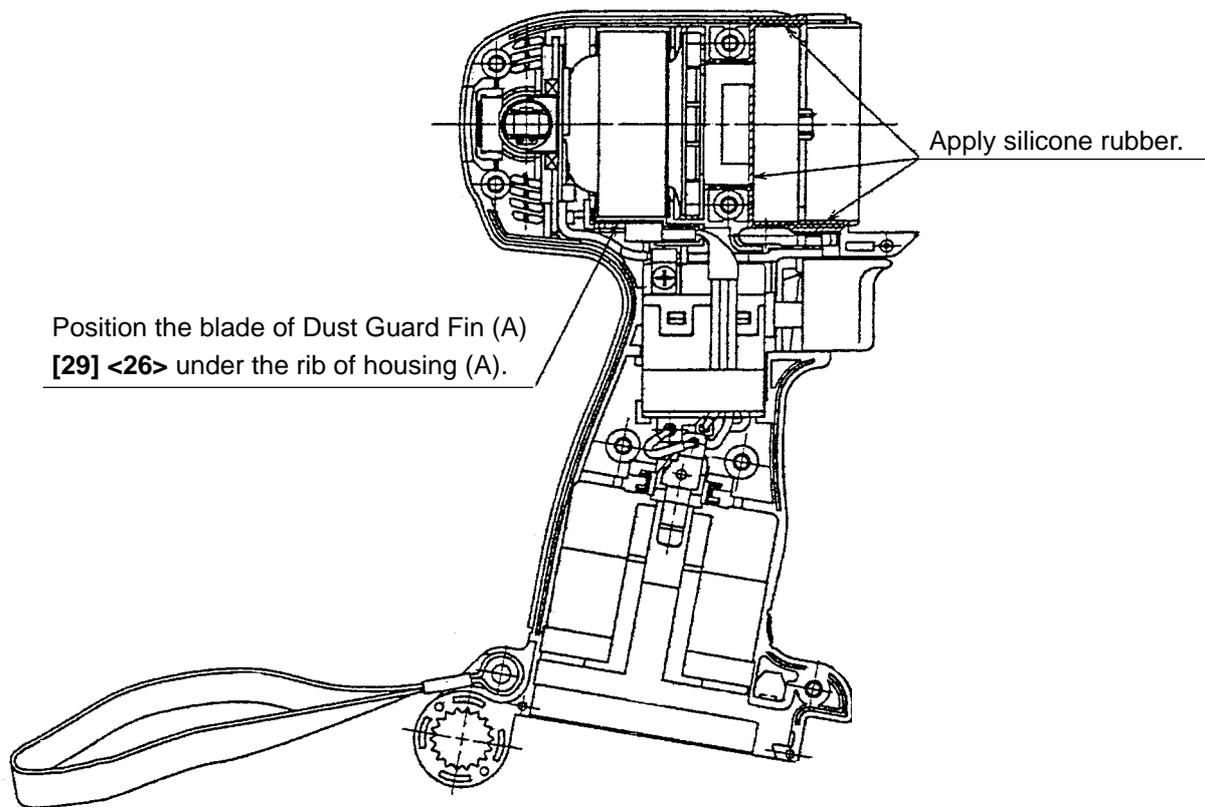


Fig. 11

(3) Mounting the mechanical parts

(a) Mount Hammer (D) [12] <9> containing the twenty-eight Steel Balls D3.175 [13] <10>, Washer (J) [14] <11> and Hammer Spring (D) [15] <12> to Spindle (D) [18] <15>.

(b) Align the top of the cam groove on Spindle (D) [18] <15> with the steel ball guide groove on Hammer (D) [12] <9> as illustrated in Fig. 3. Press down either of the raised faces of Hammer (D) [12] <9> with a hand press to compress Hammer Spring (D) [15] <12> until the end surface of Hammer (D) [12] <9> contacts Spindle (D) [18] <15>.

- (c) Insert the two Steel Balls D5.556 [11] <8> into the steel ball guide groove. Check that the steel balls are properly inserted in the cam groove. Then release the hand press.
- (d) Mount the hammer assembly onto the J297 base for washer (S). With a hand press, push down the top of Spindle (D) [18] <15> to compress Hammer Spring (D) [15] <12>. On this condition, mount the Stopper [17] <14> onto the spindle shaft and then release the hand press.

(4) Mounting the hammer assembly to the housing

Raise the housing assembled in step (2) and mount the hammer assembly to the housing being careful of proper engagement between the Idle Gear Set [19] <16> of the hammer assembly (check that Washer (E) [22] <19> is mounted on Spindle (D) [18] <15>) and Ring Gear (C) [21] <18>. After mounting, check that the hammer assembly turns. If the hammer assembly does not turn, the gears engage improperly.

(5) Mounting the hammer case

Put Anvil (F) [10] or Anvil (R) Ass'y <7> on Spindle (D) [18] <15>. Cover it with the Hammer Case [8] <4> and secure with the four Tapping Screws (W/Sp. Washer) D4 x 25 (Black) [7] <3>.

(6) Mounting Guide Sleeve (B) [4] (WH 12DM2 only)

Insert the two Steel Balls D3.5 [9] into the hole of Anvil (F) [10]. Mount Guide Sleeve (B) [4], Guide Spring (A) [3] and Washer (D) [2] in sequence.

Mount the Retaining Ring [1] into the groove of anvil using the J295 jigs (A) and (B) for retaining ring as illustrated in Fig. 12.

(Note) Be sure to replace the retaining Ring [1] with new one because the Retaining Ring [1] may be deformed and Guide Sleeve (B) [4] may come off if the deformed Retaining Ring [1] is used again.

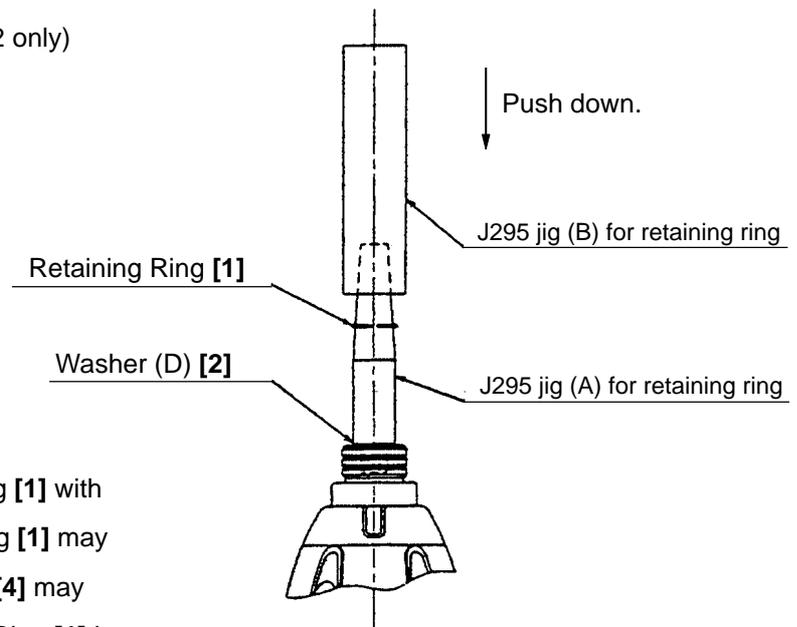


Fig. 12

(7) Reassembly of the hook

Check that the V-Lock Nut M5 [43] <39> is mounted into the Hook Ass'y (W/Light) [42] <38>. Mount the Hook Spring [48] <44> and secure it with the Special Screw M5 [49] <45>. (Make sure to mount the Hook Spring [48] <44> with its larger diameter side pointing inward the housing.)

(8) Checking the direction of rotation

Check whether the direction of rotation of Anvil (F) [10] or Anvil (R) Ass'y <7> coincides with the directional markings on the push-on side of Pushing Button (A) [39] <36>. When Pushing Button (A) [39] <36> is turned to (R) side, the direction of rotation of Anvil (F) [10] or Anvil (R) Ass'y <7> should be clockwise, as viewed from behind.

(9) Lubrication

(a) ATTOLUB MS No. 2

- Oil groove and claw of Hammer (D) [12] <9>
- 8 mm dia. hole of Anvil (F) [10] or Anvil (R) Ass'y <7>, sliding section between Anvil (F) [10] or Anvil (R) Ass'y <7> and the metal, and upper surface of the claw
- Two Steel Balls D5.556 [11] <8>
- Pinion tooth flanks of the Armature Ass'y DC 12V [26] <23>, tooth flanks of Ring Gear (C) [21] <18>, tooth flanks of the Idle Gear Set [19] <16>
- Metal oil groove of the Hammer Case [8] <4>

(b) HITACHI MOTOR GREASE No. 29 (WH 12DM2 only)

- Two Steel Balls D3.5 [9]
- Sliding section between Anvil (F) [10] and Guide Sleeve (B) [4]

(c) MOLUB-ALLOY 777-1

- Cam groove and oil groove of Hammer (D) [12] <9>
- Cam groove and sliding section of Spindle (D) [18] <15>
- 5 mm diameter hole of Idle Gear Set [19] <16>
- All around the Needle Roller [20] <17>
- Twenty-eight Steel Balls D3.175 [13] <10>

(10) Screw tightening torque

- Tapping Screw (W/Sp. Washer) D4 x 25 (Black) [7] <3> ... 1.96 ± 0.49 N·m (20 ± 5 kgf·cm, 17.4 ± 4.3 in-lbs.)
- Tapping Screw (W/Flange) D4 x 20 (Black) [33] <30> 1.96 ± 0.49 N·m (20 ± 5 kgf·cm, 17.4 ± 4.3 in-lbs.)
- Machine Screw (W/Washers) M4 x 25 [47] <43> 1.27 ± 1.96 N·m (13 to 20 kgf·cm, 2.6 to 3.5 in-ibs.)
- Machine Screw (W/Sp. Washer) M3 x 5 [37] <34> 0.29 to 0.39 N·m (3 to 4 kgf·cm, 2.6 to 3.5 in-lbs.)
- Special Screw M5 [49] <45> 1.96 ± 0.49 N·m (20 ± 5 kgf·cm, 17.4 ± 4.3 in-lbs.)
- Brush cap [32] <29> 0.78 ± 0.10 N·m (8 ± 1 kgf·cm, 6.9 ± 0.9 in-lbs.)

10-2. Precautions in Disassembly and Reassembly of Battery Charger

Refer to the Technical Data and Service Manual for precautions in disassembly and reassembly of the Model UC 14YF2 or UC 14YFA Battery Charger.

11. STANDARD REPAIR TIME (UNIT) SCHEDULES

For WH 12DM2

MODEL	Variable		10	20	30	40	50	60 min.
	Fixed							
WH 12DM2		Work Flow						
			DC-Speed Control Switch Hook Ass'y	Inner Cover (A) Armature Ass'y Magnet (D) Brush Block	Housing (A).(B) Set			
	General Assembly	Guide Sleeve (B)	Hammer Case Anvil (F) Ring Gear (C)	Hammer (D) Steel Ball Hammer Spring (D) Spindle (D) Idle Gear Set Needle Roller Ball Bearing (6901VV)				

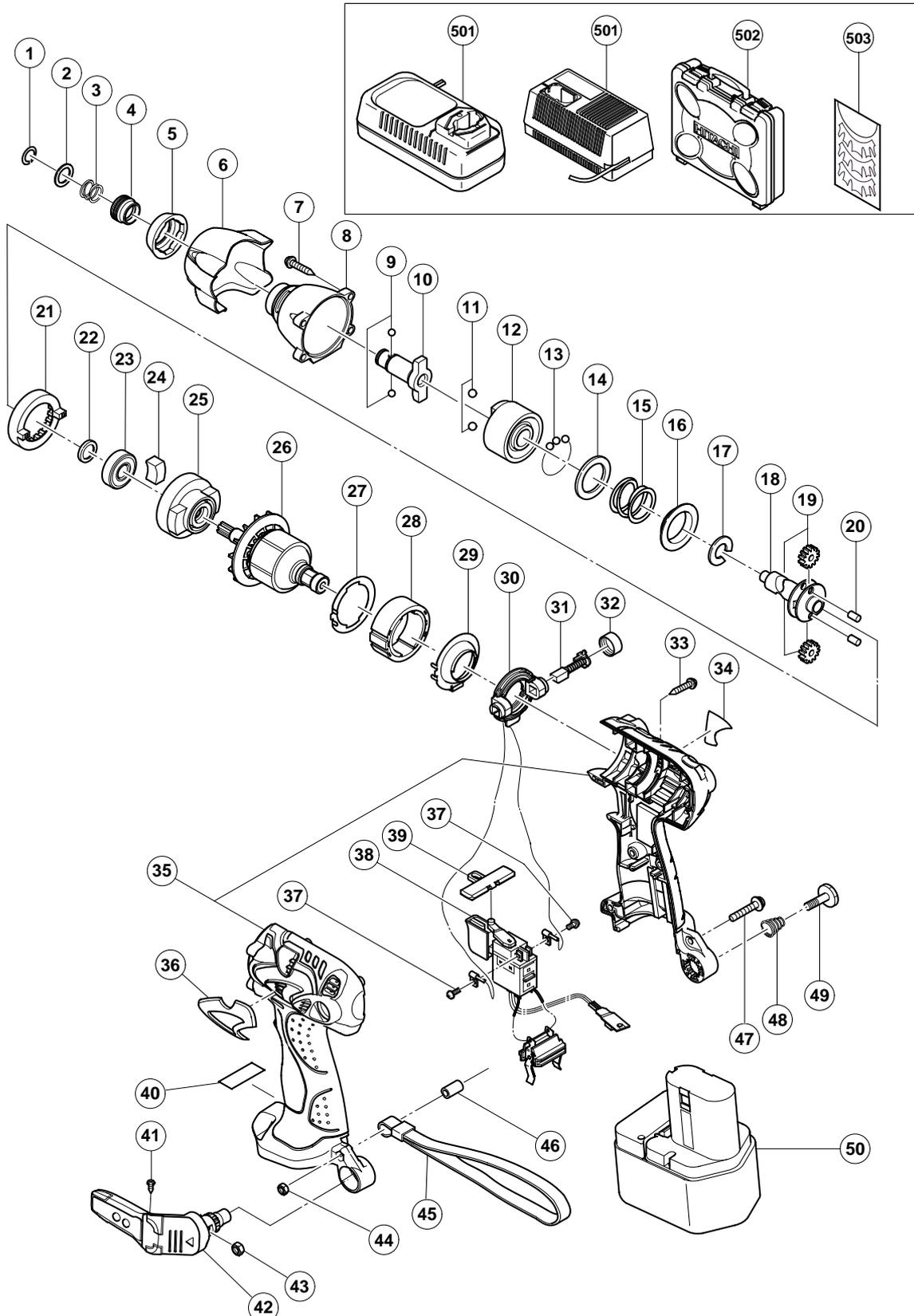
For WR 12DM2

MODEL	Variable		10	20	30	40	50	60 min.
	Fixed							
WR 12DM2		Work Flow						
		<p>DC-Speed Control Switch Hook Ass'y</p> <p>Inner Cover (A) Armature Ass'y Magnet (D) Brush Block</p> <p>General Assembly</p>		<p>Housing (A).(B) Set</p> <p>Hammer Case Anvil (R) Ass'y Ring Gear (C)</p>	<p>Hammer (D) Steel Ball Hammer Spring (D) Spindle (D) Idle Gear Set Needle Roller Ball Bearing (6901VV)</p>			

ELECTRIC TOOL PARTS LIST

■ CORDLESS IMPACT DRIVER
Model WH 12DM2

2003 • 8 • 20
(E1)



PARTS

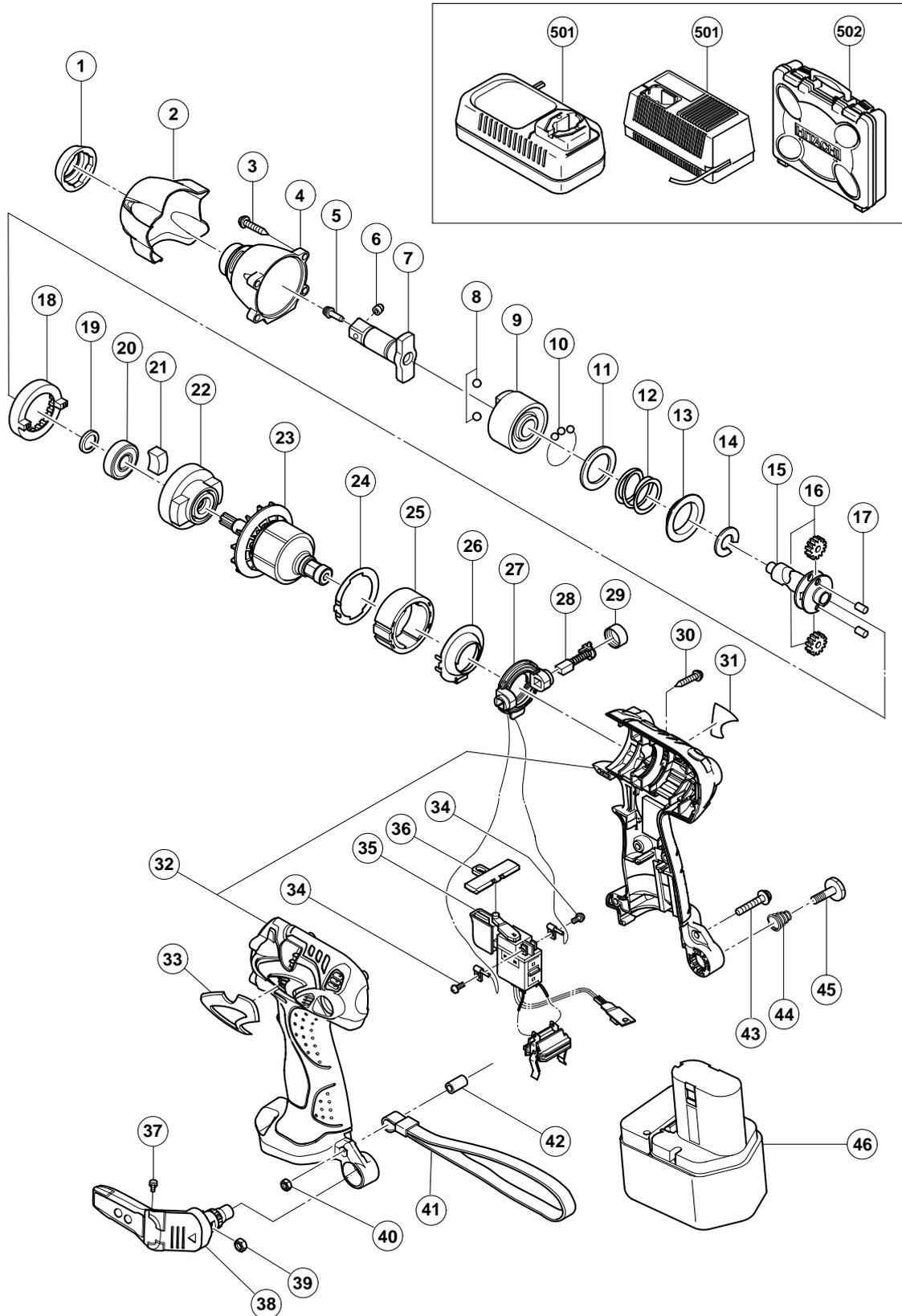
WH 12DM2

ITEM NO.	CODE NO.	DESCRIPTION	NO. USED	REMARKS	
1	315-984	RETAINING RING	1		
2	315-983	WASHER (D)	1		
3	321-657	GUIDE SPRING (A)	1		
4	321-658	GUIDE SLEEVE (B)	1		
5	322-249	FRONT CAP (A) (GREEN)	1		
*	6	321-676	PROTECTOR (A)	1	
*	6	321-937	PROTECTOR (A)	1	FOR USA, CAN
7	319-917	TAPPING SCREW (W/SP. WASHER) D4X25 (BLACK)	4		
8	321-674	HAMMER CASE	1		
9	319-535	STEEL BALL D3.5 (10 PCS.)	2		
10	322-248	ANVIL (F)	1		
11	959-154	STEEL BALL D5.556 (10 PCS.)	2		
12	321-656	HAMMER (D)	1		
13	959-148	STEEL BALL D3.175 (10 PCS.)	28		
14	315-978	WASHER (J)	1		
15	321-660	HAMMER SPRING (D)	1		
16	316-172	WASHER (S)	1		
17	316-171	STOPPER	1		
18	321-666	SPINDLE (D)	1		
19	321-667	IDLE GEAR SET (2 PCS.)	2		
20	319-914	NEEDLE ROLLER	2		
21	320-877	RING GEAR (C)	1		
22	319-911	WASHER (E)	1		
23	690-1VV	BALL BEARING 6901VVCMP2L	1		
24	319-909	DAMPER	2		
25	321-664	INNER COVER (A)	1		
26	360-599	ARMATURE ASS'Y DC 12V	1		
27	321-659	SIDE YOKE	1		
28	321-668	MAGNET (D)	1		
29	321-663	DUST GUARD FIN (A)	1		
30	321-662	BRUSH BLOCK	1		
31	999-054	CARBON BRUSH 5X6X11.5 (1 PAIR)	2		
32	319-918	BRUSH CAP	2		
33	302-086	TAPPING SCREW (W/FLANGE) D4X20 (BLACK)	7		
34		NAME PLATE	1		
35	322-174	HOUSING (A).(B) SET (GREEN)	1		
36	322-247	HITACHI PLATE	1		
37	994-532	MACHINE SCREW (W/SP. WASHER) M3X5	2		
38	319-906	DC-SPEED CONTROL SWITCH	1		
39	321-661	PUSHING BUTTON (A)	1		
*	40	CAUTION PLATE (A)	1	FOR USA, CAN	
41	321-672	TAPPING SCREW D2X6	2		
42	321-918	HOOK ASS'Y (W/LIGHT)	1	INCLUD. 41, 43	
43	320-288	V-LOCK NUT M5	1		
44	949-565	LOCK NUT M4 (10 PCS.)	1		
45	306-952	STRAP (BLACK)	1		
46	320-882	SLEEVE	1		
47	676-386	MACHINE SCREW (W/WASHERS) M4X25	1		
48	319-926	HOOK SPRING	1		
49	319-927	SPECIAL SCREW M5	1		
*	50	320-388	BATTERY EB 1230HL (W/ENGLISH N.P.)	2	

ELECTRIC TOOL PARTS LIST

CORDLESS IMPACT WRENCH
Model WR 12DM2

2003 · 7 · 30
(E1)



PARTS

WR 12DM2

ITEM NO.	CODE NO.	DESCRIPTION	NO. USED	REMARKS
1	322-243	FRONT CAP (A) (BLACK)	1	
* 2	321-676	PROTECTOR (A)	1	
* 2	321-937	PROTECTOR (A)	1	FOR USA, CAN
3	319-917	TAPPING SCREW (W/SP. WASHER) D4X25 (BLACK)	4	
4	322-172	HAMMER CASE	1	
5	985-209	PIN RETAINER	1	
6	985-208	PLUNGER	1	
7	322-173	ANVIL (R) ASS'Y	1	INCLUD. 5, 6
8	959-154	STEEL BALL D5.556 (10 PCS.)	2	
9	321-656	HAMMER (D)	1	
10	959-148	STEEL BALL D3.175 (10 PCS.)	28	
11	315-978	WASHER (J)	1	
12	321-660	HAMMER SPRING (D)	1	
13	316-172	WASHER (S)	1	
14	316-171	STOPPER	1	
15	321-666	SPINDLE (D)	1	
16	321-667	IDLE GEAR SET (2 PCS.)	2	
17	319-914	NEEDLE ROLLER	2	
18	320-877	RING GEAR (C)	1	
19	319-911	WASHER (E)	1	
20	690-1VV	BALL BEARING 6901VVCMP52L	1	
21	319-909	DAMPER	2	
22	321-664	INNER COVER (A)	1	
23	360-599	ARMATURE ASS'Y DC 12V	1	
24	321-659	SIDE YOKE	1	
25	321-668	MAGNET (D)	1	
26	321-663	DUST GUARD FIN (A)	1	
27	321-662	BRUSH BLOCK	1	
28	999-054	CARBON BRUSH 5X6X11.5 (1 PAIR)	2	
29	319-918	BRUSH CAP	2	
30	302-086	TAPPING SCREW (W/FLANGE) D4X20 (BLACK)	7	
* 31		NAME PLATE	1	
32	322-174	HOUSING (A).(B) SET (GREEN)	1	
33	322-242	HITACHI PLATE	1	
34	994-532	MACHINE SCREW (W/SP. WASHER) M3X5	2	
35	319-906	DC-SPEED CONTROL SWITCH	1	
36	321-661	PUSHING BUTTON (A)	1	
37	321-672	TAPPING SCREW D2X6	2	
38	321-918	HOOK ASS'Y (W/LIGHT)	1	INCLUD. 37, 39
39	320-288	V-LOCK NUT M5	1	
40	949-565	LOCK NUT M4 (10 PCS.)	1	
41	306-952	STRAP (BLACK)	1	
42	320-882	SLEEVE	1	
43	676-386	MACHINE SCREW (W/WASHERS) M4X25	1	
44	319-926	HOOK SPRING	1	
45	319-927	SPECIAL SCREW M5	1	
* 46	320-388	BATTERY EB 1230HL (W/ENGLISH N.P.)	2	
* 46	320-387	BATTERY EB 1220BL (W/ENGLISH N.P.)	2	
* 46	320-386	BATTERY EB 1220BL (W/ENGLISH N.P.)	2	FOR USA, CAN

