**Doosan Infracore** 



## **Pneumatic tools**

## Encyclopedia

Danny Poelmans Product Service Manager Compressor & Tools



#### **Table of contents**





## **Application**

## **Paving breakers**

Vertically down demolition



#### **Pick hammers**

Horizontal and downward demolition

**Jackhammers** 

rock and concrete

Hole drilling in



#### **Chipping hammers**

All position demolition + Surface work



#### DOOSAN Doosan In Portable P



## Paving breakers



- Construction Road repair, Demolition, Renovation
- Utilities Excavation to install / repair services
- Railways Demolition, ballast tamping, spike driving
- Hire companies

#### Industries and some typical uses :





## **Application**







**Doosan Infracore** Portable Power



Company Confidential

## **Application**



#### Pickhammers

## Industries and some typical uses:

Construction

- Demolition & renovation
- •Tunnelling, underpinning
- •Pile cutting, Surface preparation

•Mining

Material removal

Coal mining

Industrial

- •Foundries (Sand moulds breaking)
- Petrochemical

Maintenance/refurbishment

- Military
- Hire companies





## **Application**





## **Application**





#### Jackhammers

## Industries and some typical uses:

Construction

- •Hole drilling in rock/concrete
- Rock stabilisation / bolting
- Sea defence construction
- •Utilities
- Leak detection / sniffing accessMining & Quarrying
  - •Roof support/blast hole drilling
  - Rock splitting

Railways

Bolting applications / stabilisation

Industrial

Maintenance





#### **Application**







#### Submerged Use

•All pneumatic tools can be used under water if after use they are purged of any residual water and correctly lubricated to assure the protective layer against corrosion is present.





#### **Table of contents**





#### Technology

#### **Operating principle**

- The trigger opens the way for pressurized air inside the tool.
- The air pressure blows the piston down in the cylinder until it hits the chisel.
- At its lowest point, the piston uncovers the exhaust holes that are located in the middle of the cylinder. This drops the pressure in the top part.
- The distribution ring will block the top opening and open the access to the bottom via channel located in the cylinder wall.
- The pressure increase in the bottom chamber will push the piston upward.
- When the piston reaches the top, it is slowed by the air cushion and it uncovers the exhaust, dropping the pressure in the bottom.
- The distribution ring switches and drives the air pressure into the top chamber, pushing the piston to the chisel again.





#### Technology

#### A tool is characterized by:

- Portability and application:
  - Weight
  - Shape
  - Tool bit type
- Performance aspect
  - Piston diameter (related to the weight of the piston)
  - Piston stroke (or traveling distance of the piston)
  - Frequency (number of bumps per minute)
     These elements influences the stroke energy or power of the tool.
- Safety aspects
  - Noise reduction
  - Vibrations dampening



#### Technology

• Materials:

\_\_\_\_

- Handle body: Forged steel with zinc plating
- Cylinder: Machined steel with phosphated surface
- treatment(Carburized)
- Piston:
- Fronthead:
- Muffler:
- Distribution ring:
- Couplings:
- Cylinder cap:

- Machined steel with 0.8 mm carburization
  - Forged steel with zinc platting
- Rubber
  - Hardened steel
  - Brass
  - Polyamide





#### **Table of contents**





#### **Range: Nomenclature**



#### Range

#### BREAKERS







DCT15BS/BV DCT20BS/BV DCT25BS/BV DCT30BS/BV DCT40BS/BV

#### JACKHAMMER



IR 25



#### DCT5JS DCT17JS/JV DCT23JS/JV



Range

#### CHIPPING HAMMERS



DCT2JS DCT3JS DCT5JS

#### PICKHAMMERS





DCT9PS DCT10PV DCT12PS/PV



DCT15	15 kg	Light road demolition, bridge decks
DCT20	21 kg	Medium road demolition
DCT25	28 kg	Concrete and asphalt demolition
DCT30	33 kg	Concrete and asphalt demolition
DCT40	41 kg	Concrete demolition: Thick slabs

All paving breakers are available with or without "Vibration dampening".





#### Heavy breaker

Provides high power but is more difficult to move around.

- $\rightarrow$  Good choice for thick concrete slab demolition (>20 cm).
- $\rightarrow$  Good choice for hard material demolition.

#### Light breaker

Delivers a lower output but can be moved very fast.

- $\rightarrow$  Good choice for thin concrete layers or soft material.
- $\rightarrow$  Good choice for sensitive works like bridge decks.
- When cutting asphalt, a powerful breaker allows using a wider asphalt cutter chisel, providing more productivity





• What is the right chisel size for your tool?



Too <u>small</u> piston vs chisel Too <u>big</u> piston vs chisel



• What are the ratio limits?

30%~	Piston weight	~ 60%
5070≤	Chisel weight	$\leq 0070$

		Shank sizo	<u>22H x 82</u>	<u>25H x 108</u>	<u>28H x 160</u>	<u>32H x 160</u>
		Slidlik Size	<u>7/8'H x 3 1/4'</u>	<u>1'H x 4 1/4'</u>	<u>1 1/8'H x 6 1/2'</u>	<u>1 1/4'H x 6 1/2'</u>
		Chisel weight	1.5 kg	2.1 kg	3.2 kg	4.2 kg
Breaker model	Piston weight					
IR15	0.90 kg		59.6%	43.7%	27.9%	21.3%
IR20	1.00 kg		66.2%	48.5%	31.0%	23.7%
IR25	1.15 kg		76.1%	55.8%	35.6%	27.3%
IR30	1.50 kg		99.3%	72.8%	46.4%	35.5%
IR40	1.75 kg		115.9%	84.9%	54.2%	41.5%

- Ideal combination of breaker and shank size
- Piston is too big compared to chisel.
- Piston is too small compared to chisel.





• Available shank sizes for Doosan paving breakers:

	22H x 82	25H x 108	28H x 160	32H x 160
DCT15				
DCT20				
DCT25				
DCT30				
DCT40				

- Chisel size is related to breaker size for 2 reasons:
  - Energy transmission between the piston and the chisel
  - The weight of the chisel is part of the whole tool balance





DCT9PS	9 kg	Standard
DCT10PV	10 kg	Vibration dampened
DCT12PS	12 kg	Standard
DCT12PV	12 kg	Vibration dampened



All pick hammers are available with either latch or screw retainer

Horizontal and downward demolition



#### **Range: Pick hammers**

- DCT9 and DCT10: short stroke – high freq
- $\rightarrow$  good for all-round demolition



DOOSAN Doosan Infracore Portable Power

- DCT12: long stroke – low freq
- → more power, used for hard material demolition



DCT12PV		
Str: 165 mm		
1260 bpm		

#### **Range: Pick hammers**

#### Screw retainer or Latch retainer?

- <u>Screw</u> is lighter, more handy in horizontal jobs due to better hand position, a dampener ring absorbs energy in case of running out of material contact.
- 22H x 82 and 25R x 75



- <u>Latch</u> provides easier chisel change (clay spades or getting away with jammed bits).
- 22H x 82





DCT2PS	2.6 kg
DCT3PS	3.5 kg
DCT5PS	5 kg

All chipping hammers are also available as a kit with a selection of chisels.

Light demolition in all positions

Surface processing







**Company Confidential** 

#### **Range: Chipping hammers**

- DCT3PS: short stroke – high freq
- → good for cleaning applications

- DCT5PS:
   long stroke low freq
- $\rightarrow$  dedicated to light demolition



**DCT3PS** Str: 37 mm 3850 bpm





DCT5JS	5 kg	Handy tool, max drilling depth: 650 mm
DCT17	17 kg	Heavy duty, low air cons.
DCT23	23 kg	Heavy duty,high torque.Can drill 4 to 6 meter holes

DCT17 and DCT23 exist with and without vibration dampening

#### Hole drilling in rock/concrete







#### **Range: Tool identification**

Model plate contains:

Serial no.	CZ03E00012
Model type	IR30BV
Chuck size	32Hx160
Contact addresses	
CE label	

CZ03E00012 means:

03	Year 2003
E	Month May
00012	Unit number





#### Warranty

 Twelve (12) months from shipment. Ingersoll-Rand will provide a new part or repaired part, at its election, in place of any part which is found to be defective in material or workmanship during the period described above.
 Labour cost to replace the part is the responsibility of the user.





#### Range

#### **Communication material**

Available on RPC online





#### **Table of contents**





- Depending on the type of accessory, pneumatic tools can be used for
  - Breaking
  - Cutting
  - Digging
  - Compacting
  - Drilling







#### For paving breakers



For chipping hammers and pick hammers









DOOSAN Doosan Infracore Portable Power

For jackhammers Rockdrill IR5JS



• Integral cross bits

or

- Tungsten carbide bits placed on extensions
  - 3 extensions format:
    - Small taper (with holder)
    - Medium taper
    - Large taper





# For jackhammers IR17 and IR23





600

1200

1800

35

34

33

22H x 108

22H x 108

22H x 108

 Integral Drill steel series: Carbon steel bit Start with the short and go one by one to longer. Integral steel series 16

0	
-	

 Tapered Drill steel extension rod size: 19 mm

lack rod extension 10 mm taner	22H v 108	460	10 mm	
Jack fod extension 19 min taper	22H X 100	400	191111	1
All steel cross bit (Fitting on extensions)	19 mm		35	and the second
Fungsten carbide cross bit (Fitting on extensions)	19 mm		35	

Available in 19hex X 108 and 22hex X 108



#### Hoses and couplings

- Hoses in various length configurations
- Couplings
- Whip check
- Lubricator
- Oils







3/4" (19mm) bore coupled hose 4 m length 3/4" (19mm) bore coupled hose 15 m length 3/4" (19mm) bore hose coil 60 m length Hose tail to suit 3/4" (19 mm) hose Hose clamp 3/4" BSP male coupling 3/4" BSP female coupling Coupling seal, rubber IREX coupling (brass) Pressed Hose clamp Hose safety whip check 0.28 Litre/half pint inline lubricator

#### **Table of contents**





## Operating

- Accessory installation: always turn off the air supply and disconnect the hose before installing, removing or adjusting any accessory.
- Before connecting the hose, clear it clean by blowing toward a safe area.
- Never drag the tool on the ground. The air port and other openings will become clogged with dirt and debris.
- Adopt a stable working position, so that you can deal with both normal and unexpected machine movements.

- Do not operate the tool unless the chisel is against the work, otherwise it will destroy the retainer and reduce the vibration isolation.
- On paving breakers, the recommended amount of downforce to apply to the tool is between 15 and 20 kg.
- For chipping hammers, the axial force applied to the tool should be around 5 – 10 kg.
- For pickhammers, axial force should be around 15 kg.
- Always break the material to the point of "give". Clear away rubble before starting again.



## Operating

- Adapt the hammering depth to the size and resistance of the blocks. Don't hammer too deep in one place as you might jam the accessory in the material.
- If the chisel is jammed, don't pry on the tool as it might break the chisel. Disconnect it and use another chisel to free up the first one.
- For the best performance and safety, always work with well sharpened accessories.
   "Mushroom" shaped tips will increase the tool and operator fatigue while tool-hand vibrations will have higher

- Check regularly to make sure that the pneumatic breaker is well lubricated.
- In case of failure to start, check the following:
  - Air supply is failing.
  - The tool bit is not adapted to the shaft.
  - Exhaust blocked by dirt or ice.
  - Too much oil is drowning the inside mechanism.
  - Hose is too long. If >30m, skip from 19 mm to 25 mm hose.





#### Safety rules

- Splinters can be thrown at high speed when working on certain materials. Wear safety goggles and hard hat.
- Compressed air tools create strong air pressure variation that can be harmful for the hearing system. Wear hearing protection.
- Hands must be kept warm to reduce the harming effect of vibrations. Wear gloves.
- Working on some material can create dust, which can be hazardous when inhaled. Wear an approved face mask when working in a dusty environment.

Diagram PP1

- Only use accessories recommended by Doosan
- Keep hands, loose clothing and long hair away from moving end of tool.
- Don't be distracted when operating the tool.
  - Make sure that the tool bit has the correct shank dimension.



#### Safety rules

- Do not operate the tool with broken or damaged parts.
- Be sure all hose connections are tight. A lose hose not only leaks but can come completely off the tool and while whipping under pressure, can injure the operator and others in the area. Use safety cables.
- Know what is underneath the material being worked. Be alert for hidden water, gas, sewer, telephone or electric lines.

- When using models with outside triggers or throttle levers, take care when setting the tool down to prevent accidental operation.
- When using gloves, make sure that it will not prevent you from releasing the throttle.
  - Never start the tool when it is lying on the ground.
- Tool accessories may continue to impact briefly after throttle is released.

Diagram PP1



## Safety rules

- Anticipate and be alert for sudden change in motion during start up and operation of the power tool.
- Keep hands away from the throttle until it is time to operate the tool.
- Never rest the tool or chisel on your foot.
- Never point the tool at anyone.

Diagram PP1

- Never point the air hose at yourself or co-workers.
   Compressed air is dangerous.
- Never disconnect a pressurized air hose. Always turn off the air supply and bleed the tool before disconnecting.
  - Use clean, dry, lubricated air. Dust, corrosive fumes and/or excessive moisture can ruin the mechanics.
- Do not remove any labels. Replace if necessary.



#### Safety rules

- Most tools are not designed for working in explosive atmospheres except the pickhammers which are Group 1, Category M2 according to EN 13463-1
- These tools are not insulated against electric shocks.
- Use only proper cleaning solvents to clean parts. Don't use diesel fuel for cleaning: residues will ignite inside the tool, causing damage to internal parts. *Diagram PP1*



#### Lubricating

- Lubricating the tools is compulsory in order to maintain their top performances.
- Use specific nature friendly oil that decays in 3 weeks .
- Through an in-line lubricator or the built-in lubricator when it is available from the tool.

The oil must come to the tool as a spray.

- Check oil level every 2 working hours.
- For prolonged storage only lubricate with mineral oils.





any Confidential

#### Lubricating

 Some compressors are equipped with a 'lubricator'. This solution only performs well if the air hose is not longer than 10 m because the oil will condensate in the pipe before it reaches the tool.

Liquid oil in the pipe will create a heavy flow drowning the tool.

- If there are icing problems at the exhaust (cold temperatures with high moisture), use alcohol mixed with the oil or a specific oil called Killfrost
  Otherwise use an aftercooler mounted on the compressor: it will remove the moisture from the compressed air.
- Do not use flammable or volatile liquids such as kerosene, diesel or jet fuel. It will explode and damage the tool mechanics.
- Do not use hydraulic oil: too thick.



#### Workshop

- Maintenance and service of Doosan tools are made easier because:
  - There are few parts in the assemblies
  - Many parts are common to several models.
  - The tools are designed in such a way that they can be serviced in a workshop with little equipment

• Storage



#### Proceeding

- Don't repair the tool at the work site. Always take the tool to a repair shop.
- Only use genuine Doosan replacement parts. Using other parts will invalidate the warranty.
- List of parts is given in the manuals. (Last page). Use the exploded view and drawings.
- Always use the 8 digits CPNs for communication with Doosan parts department.





#### Typical service operations

- <u>Removing the muffler:</u>
   Use a screwdriver and 4 flat metal pieces for sliding the rubber muffler out of the groove.
- <u>Air coupling:</u>

The pipe coupling is glued with Loctite. In order to unscrew it, heat first at 100-120°C.

- <u>Piston seized:</u>
  Instructions about how to solve it:
- <u>Scratched piston:</u>

If there are scratches due to poor lubrication or dirt, they can be removed with a fine sandpaper 60-80. (More scratches on the front part of the piston as it gets hotter because of higher air compression in the bottom chamber..) Scratched cylinder:

Use fine sand-paper 60-80 wrapped around a broomstick and remove the scratches. They are more important in the centre close to the exhaust.

Chuck or Nozzle:

The chuck (chisel receptacle) is pressed into the cylinder.

Replacement may require a hydraulic press.

#### Mushroomed piston:

If the piston head is worn in the shape of a mushroom, grind it flat and make a 1 mm chamfer. The maximum thickness that can be removed is 0.6 mm.



#### Typical service operations

<u>Pickhammer dampener</u>
 <u>replacement:</u>
 In order to maintain their

absorbing effect, rubber dampeners on screwed retainers must be replaced when worn to 50% of their original thickness.





#### Typical service operations

O-rings replacement: • The 'V' pick hammers have an air-cushion vibration absorption chamber between the handle and cylinder. The stroke is 30mm limited by two big o-rings. The top small o-ring seals the chamber. When sliding the handle air should come off the breathing hole. If not the o-ring should be replaced.





#### Typical service operations

Paving breaker dampener
 <u>springs replacement:</u>

On vibration dampened paving breakers the springs need to be replaced if the handles reach the end of their stroke during normal operation with proper operator downforce.





#### Typical service operations



• Latch:

•

Operating the tool without contact to the work surface will result in a transfer of piston energy not to the chisel but to the latch only thereby damaging it. Replacing the latch is done by disassembling the axle made of 2 concentric spring pins. The pin cuts must be placed opposite.

<u>Fronthead assembly:</u> After repetitive misuse leading to a fatigue breakage, it happens that the fronthead must be replaced.



#### Typical service operations

 Breaker Handle body – cylinder <u>connection</u>

The bolts must be tightened in a cross-pattern way with a maximum torque of 90 N.m.

• <u>Storage:</u>

Put a teaspoon of oil in the air pipe, connect and run the hammer for a few stroke in order to spread the oil. Store in a dry place.



#### **Table of contents**





#### **Nuisance: Vibrations**

#### Coping with vibrations

- HAV (Hand Arm Vibrations) are recognized to be responsible for major disabilities in many countries.
- Workers who have not been protected against high levels of vibrations are suffering today with 'white fingers' disease.
  - Blood vessels damage
  - Nerves damage
- Vibrations can never be completely eliminated but can be reduced.
   2 ways:
  - Reducing working time
  - Reduce the amount of vibrations on the tools



- The CE authorities set up a process to limit the amount of HAV that a worker is undergoing.
- Workers should calculate their vibration exposure on a daily basis.
- Other information is found on the web:



#### **Nuisance: Vibrations**

#### Coping with vibrations

- Doosan "V" tools feature among the lowest vibration values with regard to their output. (Measured in [m/s<sup>2</sup>] with a 3 axis device)
- Paving breakers: e.g.
  - DCT30 Fixed handle: 11.9 m/s<sup>2</sup>
     Max trigger time: 1h 31m
  - DCT30 Flex handle: 5.3 m/s<sup>2</sup>
     Max trigger time: 7h 07m
- The mass of the tool acts like a backstroke absorber thanks to its inertness.

Still, it is moving up and down but, because the handles are mounted on springs, the operator hands don't move as much.



 The proper downforce to apply to the tool is 15 – 20 kg. Pushing with all the operator weight will not improve the output: it will only increase the HAV amount since the handle springs are compressed.





#### **Nuisance: Vibrations**

#### Coping with vibrations

- <u>Pickhammers:</u> e.g.
  - IR12 Fixed handle: 9.1 m/s<sup>2</sup>
     Max trigger time: 1h 06m
  - IR12 Absorb handle: 5.6 m/s<sup>2</sup>
     Max trigger time: 6h 23m
- Pickhammers are even more sensitive tool than breakers regarding HAV. When working horizontally, unlike the paving breakers, the weight of the tool does not contribute to the action.

Therefore the effort requested to the user is more important.

• Doosan "V" Pickhammers feature both a spring and an air cushion for vibration absorption in the body, not in the handle.





#### Effects that aggravate vibrations

- Cold temperature: cold fingers are more sensitive to HAV.
   Wearing gloves allows maintaining temperature.
- Blunt points: the accessory will rebound on the material instead of breaking it. The backstroke will be higher as will vibration.

Always use well sharpened accessories.

• Bad posture at work will increase the risk.

Always stand firm holding the tool with both hands and pushing steadily.

- Badly maintained equipment will work less efficiently, thus increasing the exposure time.
- Worn out flex handles will not perform anymore and vibration is transferred to the user.
   Control the quality of the springs and air cushion seals from time to time.



#### **Nuisance: Noise**

• Norm EN ISO 3744 in accordance with the directive 2000/14/EC

Type of equipment	Net installed power P (in kW) Electric power $P_{el}^{(1)}$ in kW Mass of appliance m in kg Cutting width L in cm	Permissible sound power level in dB/1 pW	
		Stage I as from 3 January 2002	Stage II as from 3 January 2006
Hand-held concrete- breakers and picks	<i>m</i> ≤15	107	105
	15 < m < 30	94 + 11 1g m	$92 + 11 \lg m^{(2)}$
	$m \ge 30$	96 + 11 1g m	94 + 11 1g m

These Regulations amend the Noise Emission in the Environment by Equipment for Use Outdoors Regulations 2001 (S.I. 2001/1701), as amended by S.I. 2001/3958.

These Regulations implement European Parliament and Council Directive 2005/88/EC (OJ No. L344, 27.12.2005, p44) which amends European Parliament and Council Directive 2000/14/EC (OJ No. L162, 3.7.2000, p1) on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors.



#### **Nuisance: Noise**

• Norm EN ISO 3744 in accordance with the directive 2000/14/EC



#### 2000/14/EC noise directive

#### **Nuisance: Noise**

Machine models represented in this manual may be used in various locations world-wide. Machines sold and shipped into European common market countries requires that the machine display the EC Mark and conform to various directives. In such cases, the design specification of this machine has been certified as complying with EC directives. Any medification to any part is absolutely prohibited and would result in the CE certification and marking being rendered invalid. A declaration of that conformity follows:



• Declaration of conformity



