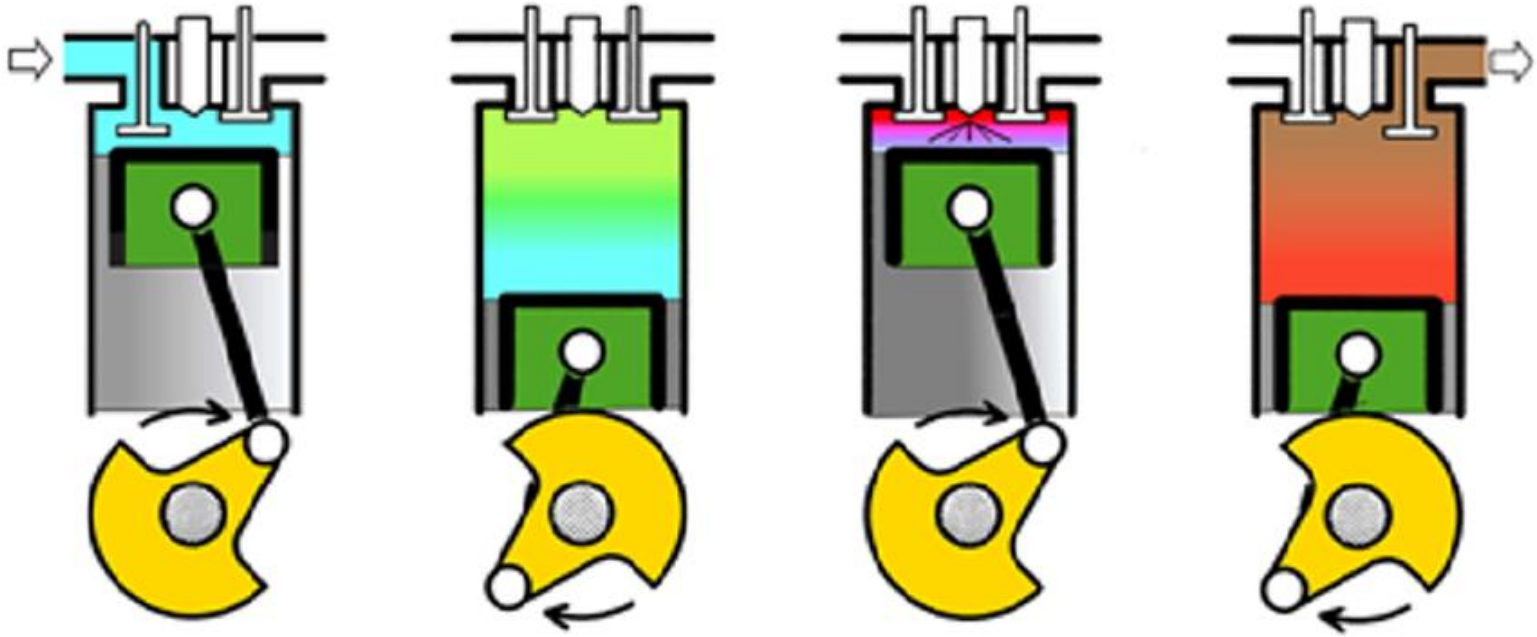
Diesel Engine Basics

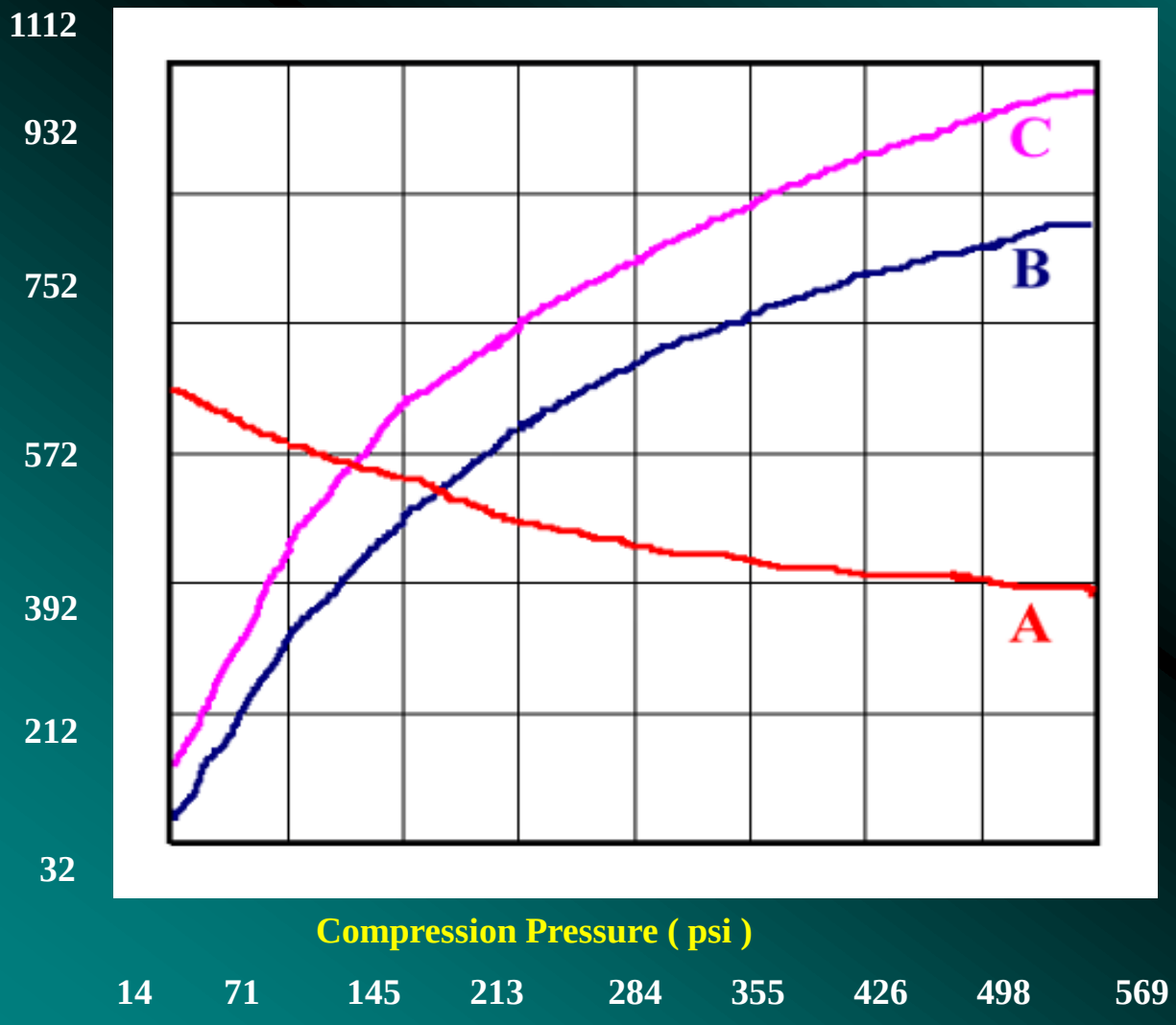
4 Stroke Cycle Engine



Intake Compression Combustion Exhaust

AIR HEATS WHEN COMPRESSED

Compression Temperature & Auto Ignition Temperature



A: Diesel Fuel Auto Ignition Temperature

B: Air Temperature Initial 32 F

C: Air Temperature Initial 100 F

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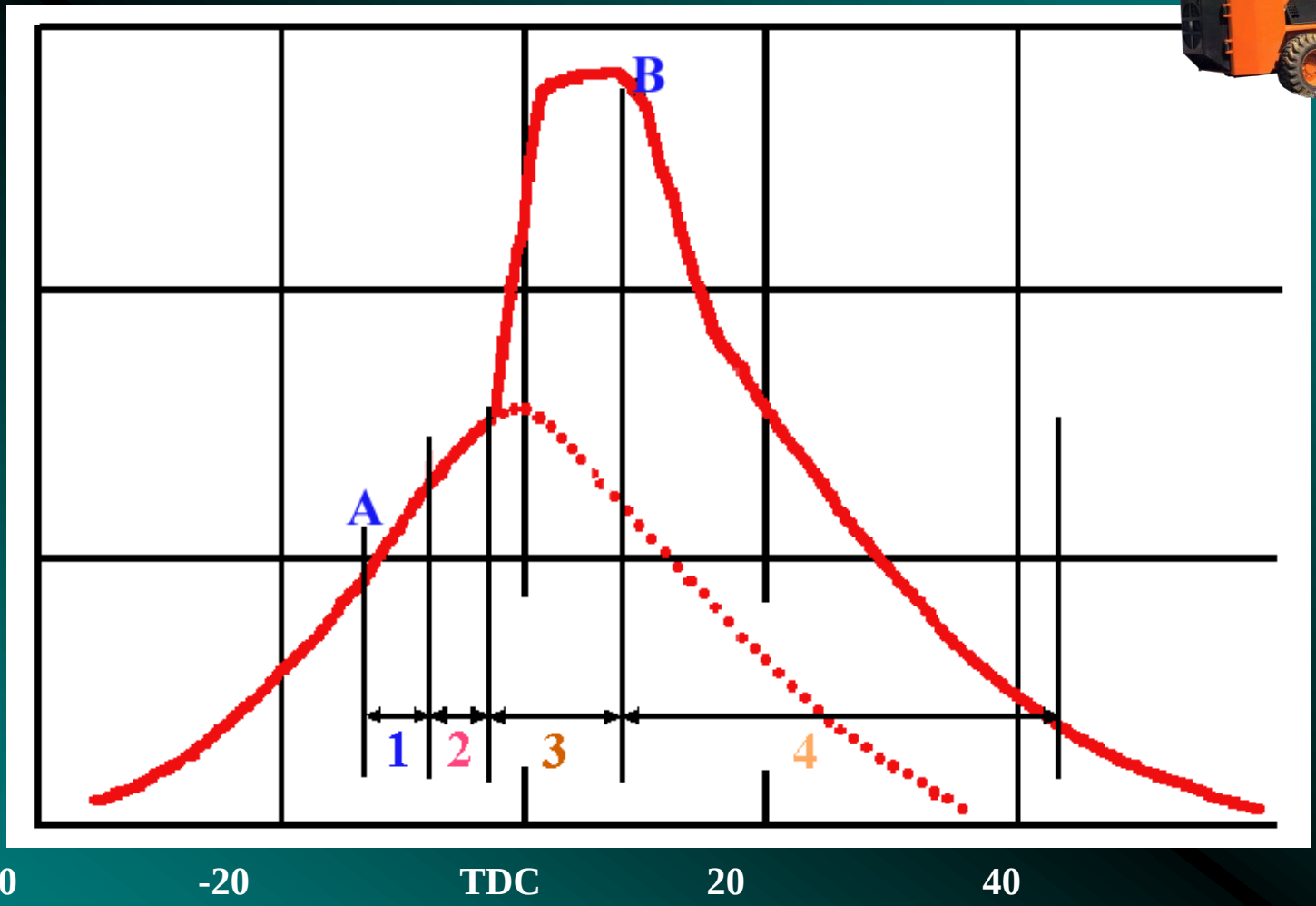
Combustion Pressures



A:Fuel Injection Timing
B:End of Injection
1:Ignition Delay Period
2:Pre-flame
3:Diffuse Combustion
4:After Burning

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Kubota Engine Review

ENGINE MODEL IDENTIFICATION

- **How to read the model name**
  - **Ex.: V1505-E**

  - V=Number of Cylinders

    E= Eine; 1 cylinder engine

    Z= Zwei; 2 cylinder engine

    D= Drei; 3 cylinder engine

    V= Vier; 4 cylinder engine

    F= Funf; 5 cylinder engine

    S= Sechs; 6 cylinder engine

ENGINE MODEL IDENTIFICATION

- **How to read the model number**
- **Ex: V1505-E**
  - 1505=Approximate Displacement (cc.)

662= 656 cc

722= 719 cc

1105= 1123 cc

1505= 1498cc

1903= 1857 cc

2203= 2197 cc

3300= 3318cc

ENGINE MODEL IDENTIFICATION

- How to read the model number
- Series of engines:
  - NSM: Z48<u>2</u>, D66<u>2</u>, D72<u>2</u> (68 mm stroke)
  - 03 Series: D17<u>03</u>, V22<u>03</u> (92.4 mm stroke)
  - 05 Series: D9<u>05</u>, V12<u>05</u> (73.6 mm stroke)
  - 05 Series: D11<u>05</u>, V15<u>05</u> (78.4 mm stroke)

ENGINE MODEL IDENTIFICATION

- **How to read the model number**
- **Ex: V1505-**E

– E=**for Environmental / Ecological [**Clean Engine**]**

- Being Regulated
  - **U.S.A.: CARB; ULGE Reg. Below 25HP**
  - **:EPA; SI Reg. Below 25HP**
  - **:EPA; Non-road CI Reg. 19 to 37kW**
  - **:EPA; Non-road CI Reg. 37 to 75kW**
  - **JAPAN: MOC; Tunnel Construction 7.5 to 260kW**
  - **EU: Non-road CI Reg. Exc. Ag.Tractor 37 to 75kW**
- Under Consideration
  - **JAPAN: EA; Special Vehicles 19 kW & Above**

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INTERCHANGEABILITY

- New Super Mini Series(68 mm stroke)
  - Z482/D662/D722
- 05 Series(73.6/78.4 mm stroke)
  - D905/D1005/V1205/V1305. D1105/V1505
- 03 Series(92.4 mm stroke)
  - D1403/D1703/V1903/V2003-T/V2203
- **Note:** All engine parts will not be interchangeable within an engine stroke family, but approximately 88% will be interchangeable. This benefit allows for parts to be stocked for many popular engines, with lower investment expense.

HOW to Read Serial Number

The **SERIAL NUMBER** is an identified number for the engine.
It is marked after the model number.
New Serial No. has been applied **since January , 1998.**
It indicates month & year of manufacture as follows.

year of manufacture

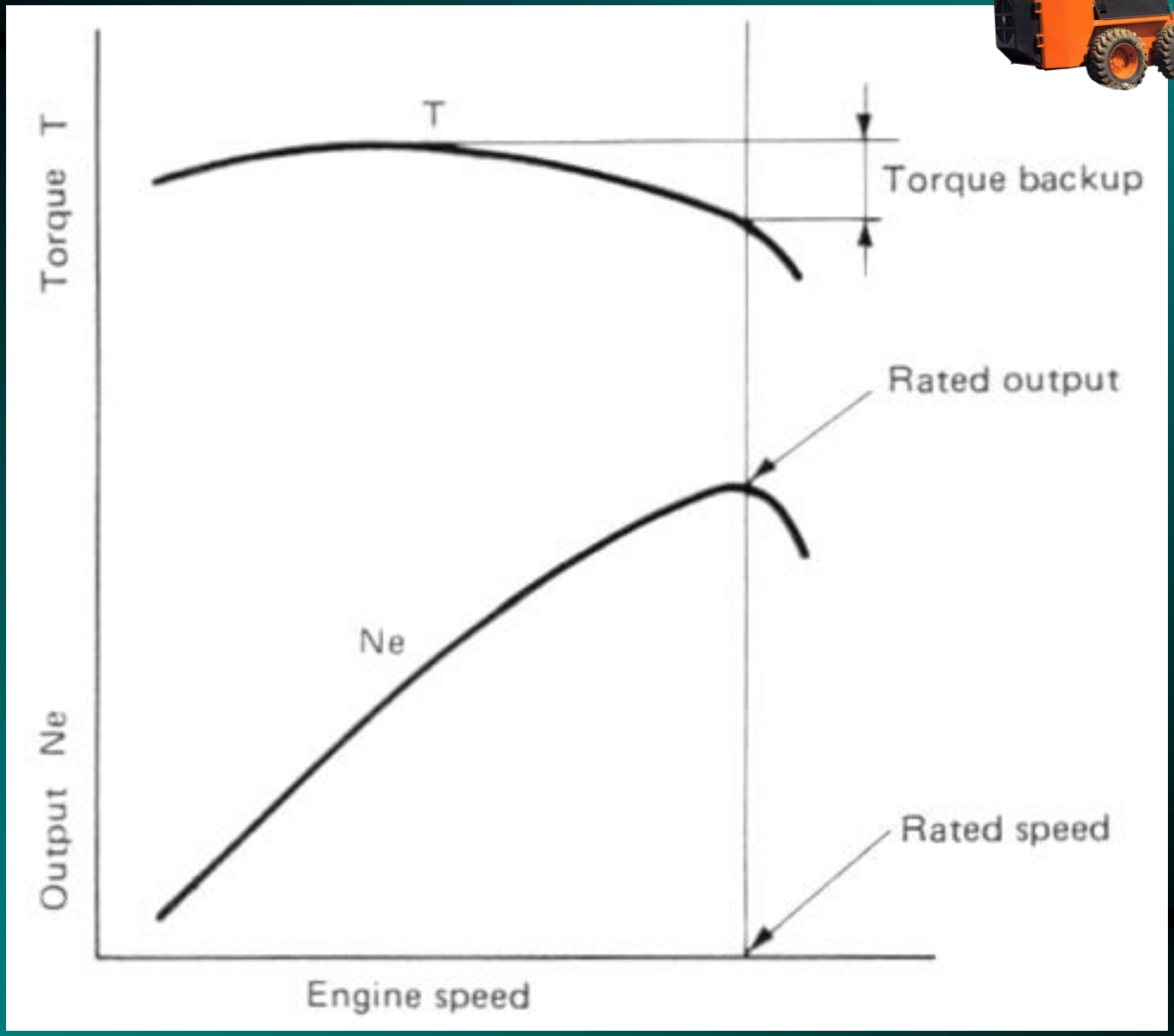
Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Code	W	X	Y	1	2	3	4	5	6	7	8	9

month of manufacture

Serial No.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0001～9999	A	C	E	G	J	L	N	Q	S	U	W	Y
0001～9999 (actually 10000～19998)	B	D	F	H	K	M	P	R	T	V	X	Z

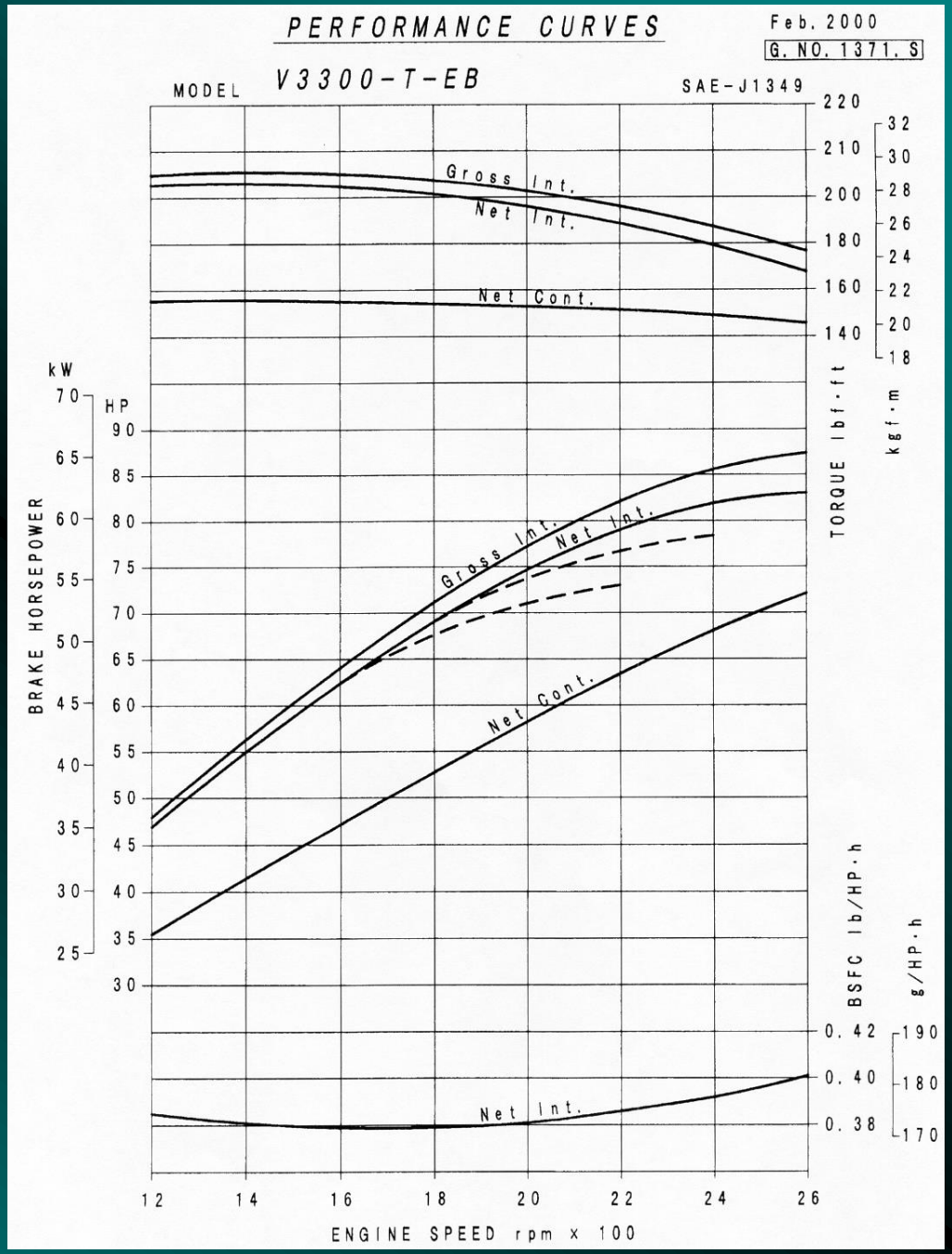
e.g. **D722-WA0001** **“ W ”** indicates **1998** and **“A ”** indicates **January.**
So ,**WA** indicates that the engine was **manufactured on January , 1998.**

Power Curves

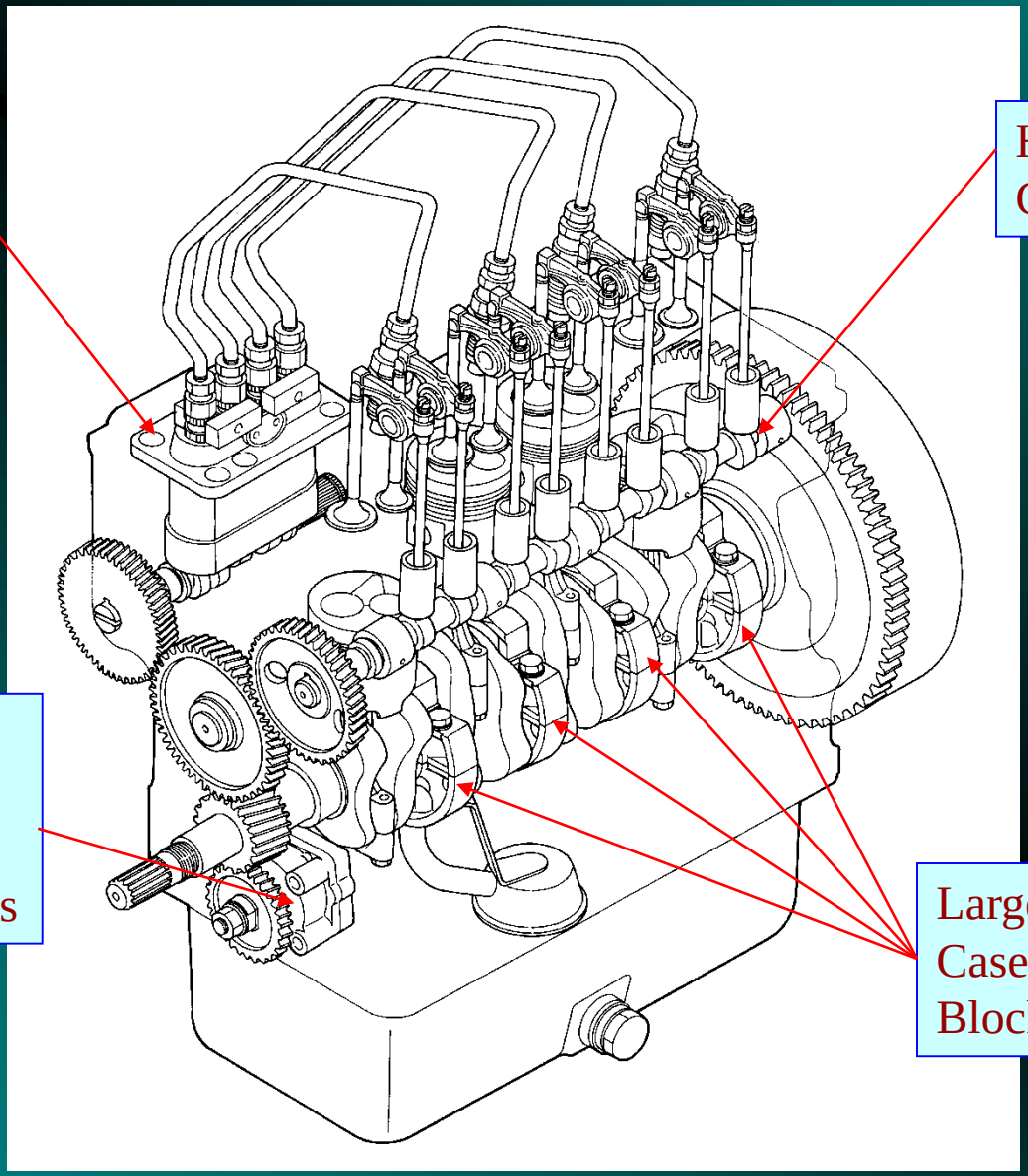


Power Curves

Hp = (t x rpm) / 5252
Torque = (hp x 5252) / rpm



Typical Kubota Engine



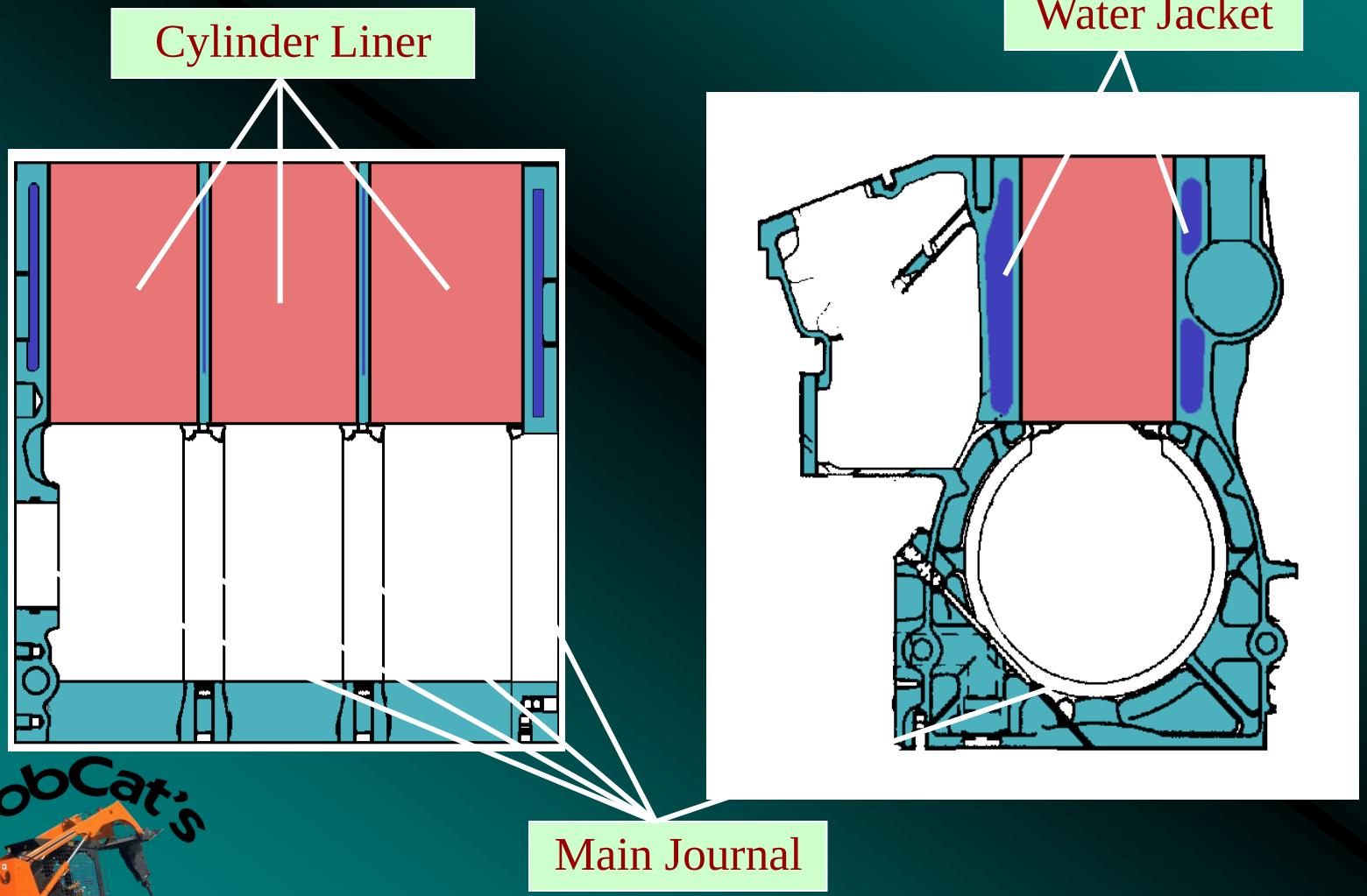
Injection Pump In Block

High Mounted Camshaft

Two Types of Oil Pump Mounting for Kubota Engines

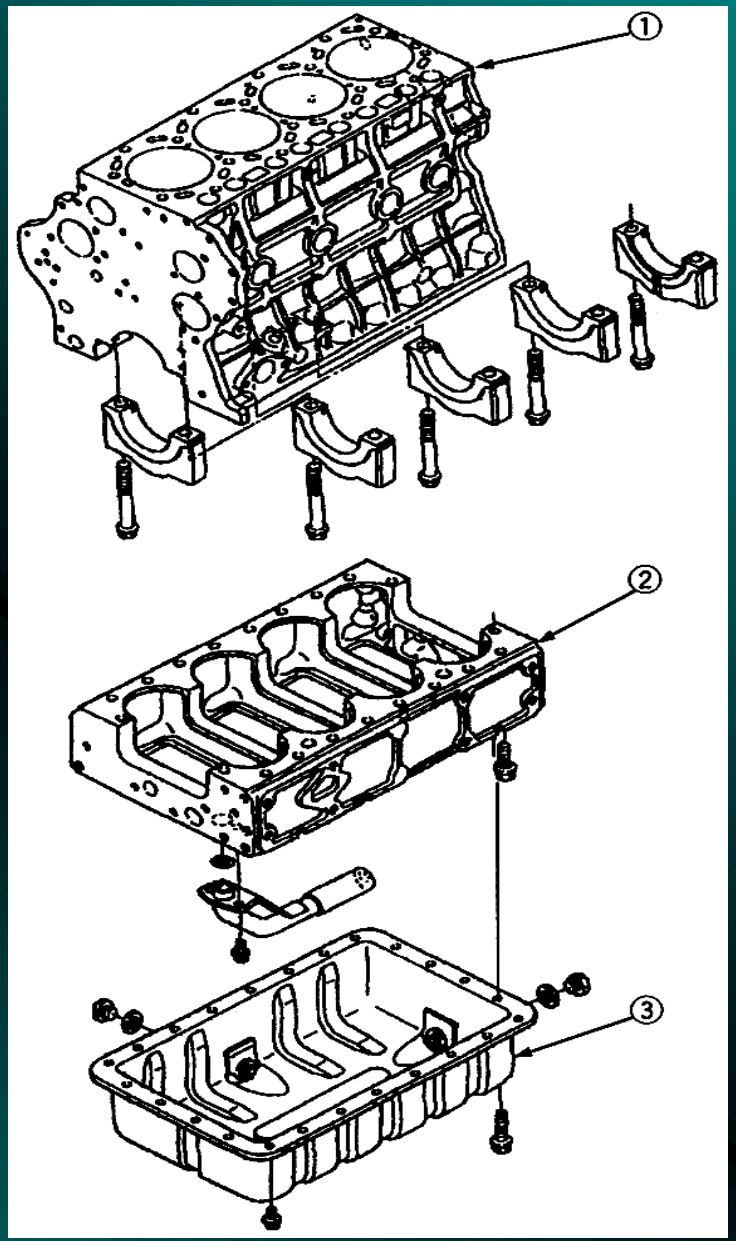
Large Main Bearing Cases for Tunnel Block Design

“Tunnel” type Crankcase

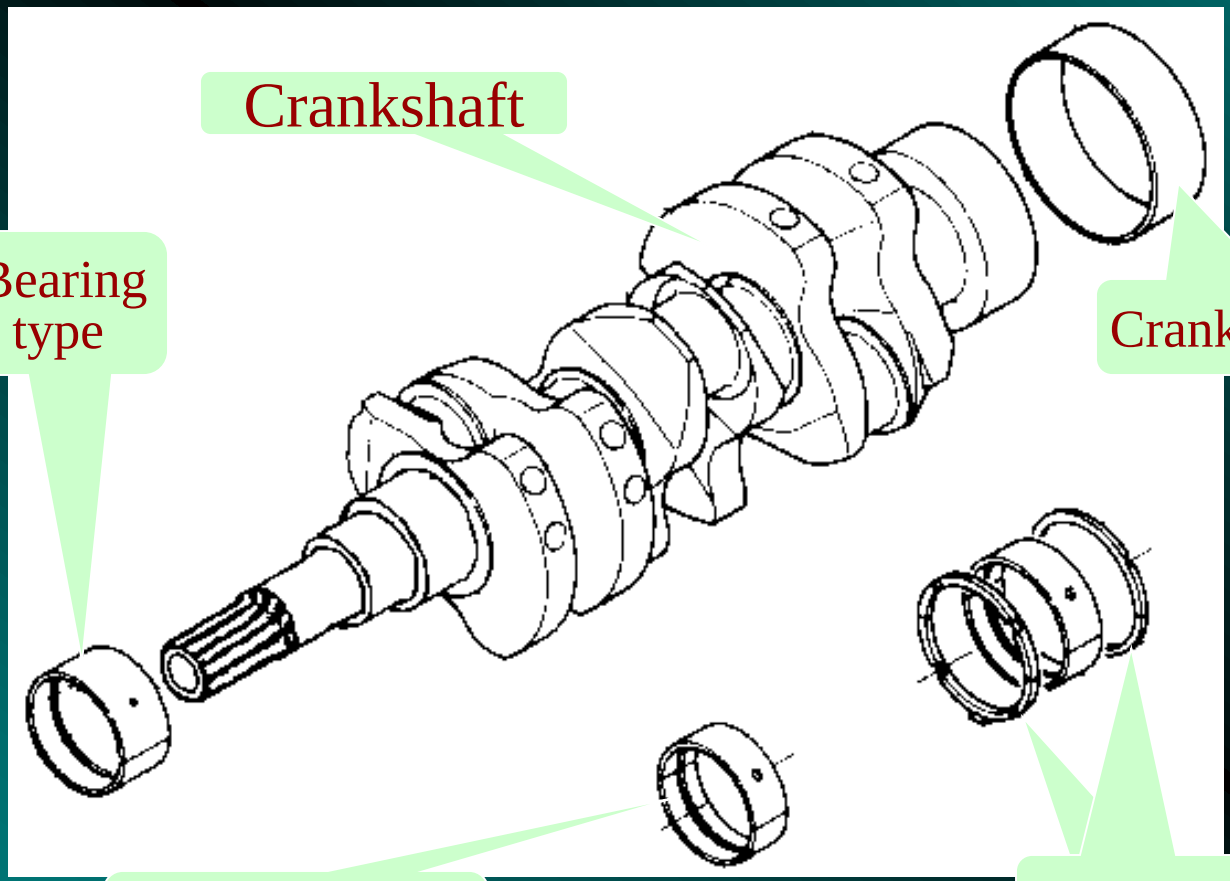


V3300 - Split Crankcase

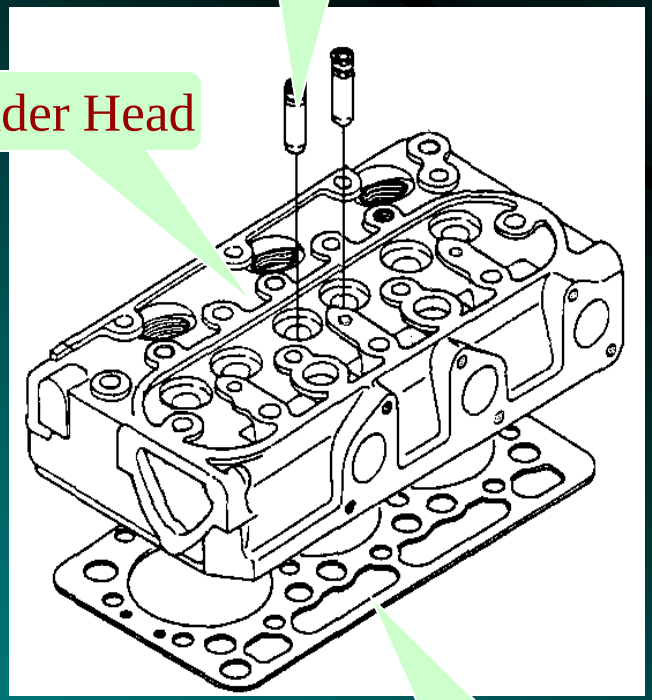
1) Crankcase 1
2) Crankcase 2
3) Oil Pan

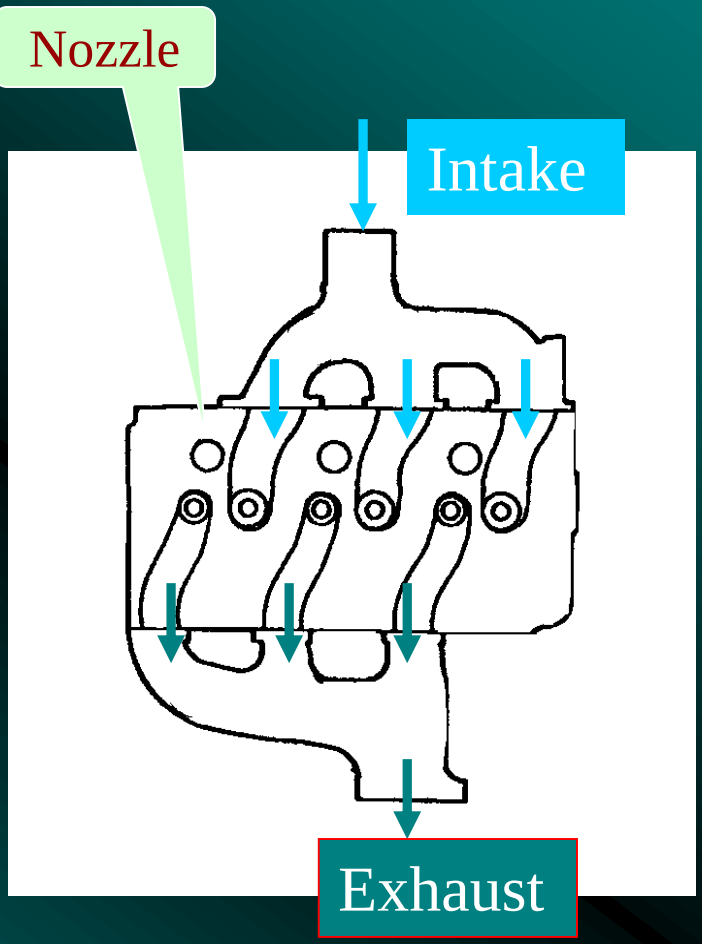


Crankshaft


Crankshaft
Main Bearing solid type
Crankshaft Sleeve
Main Bearing split type
Thrust Bearing

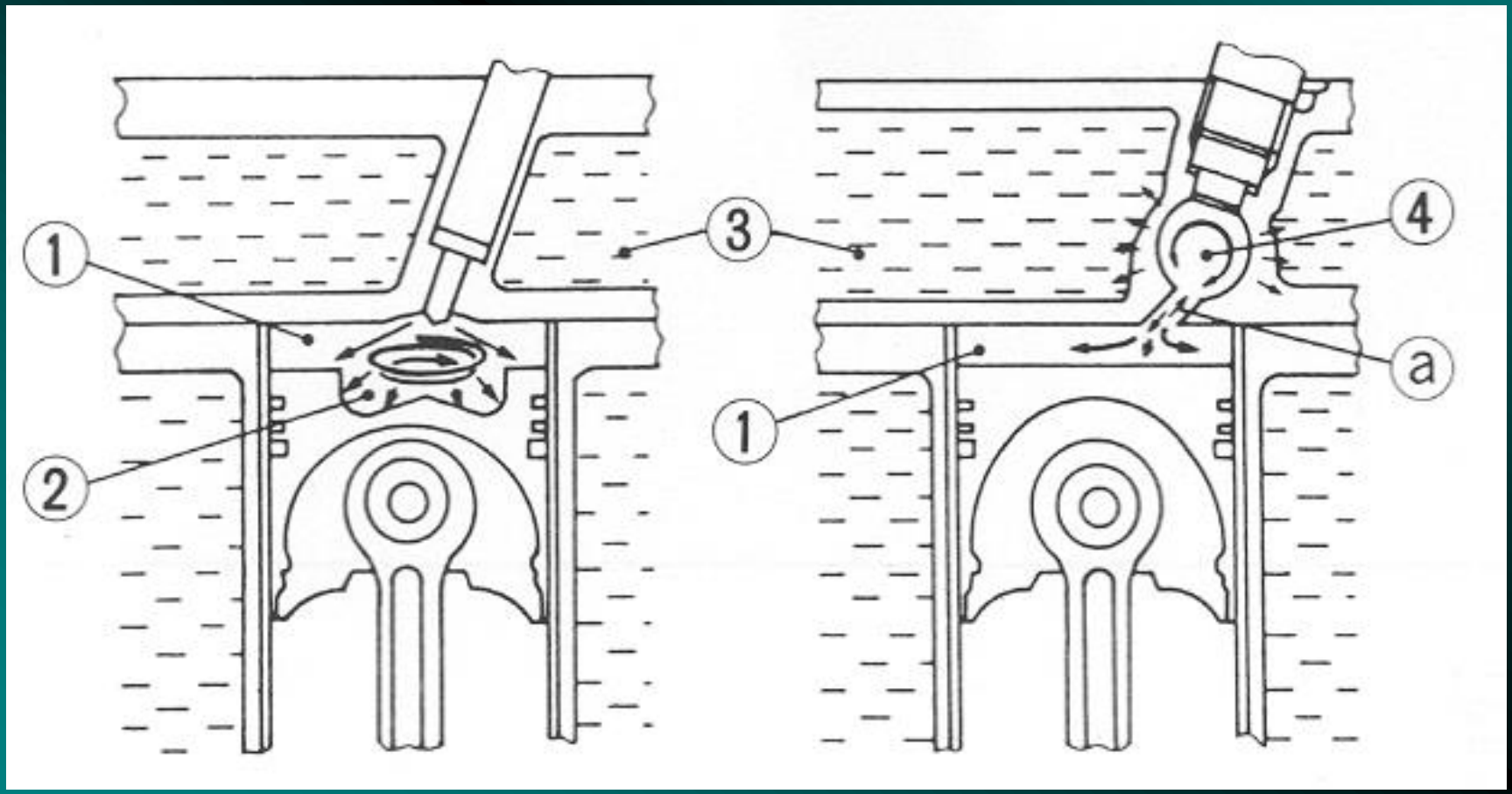
Cylinder Head





DI and IDI

combustion types



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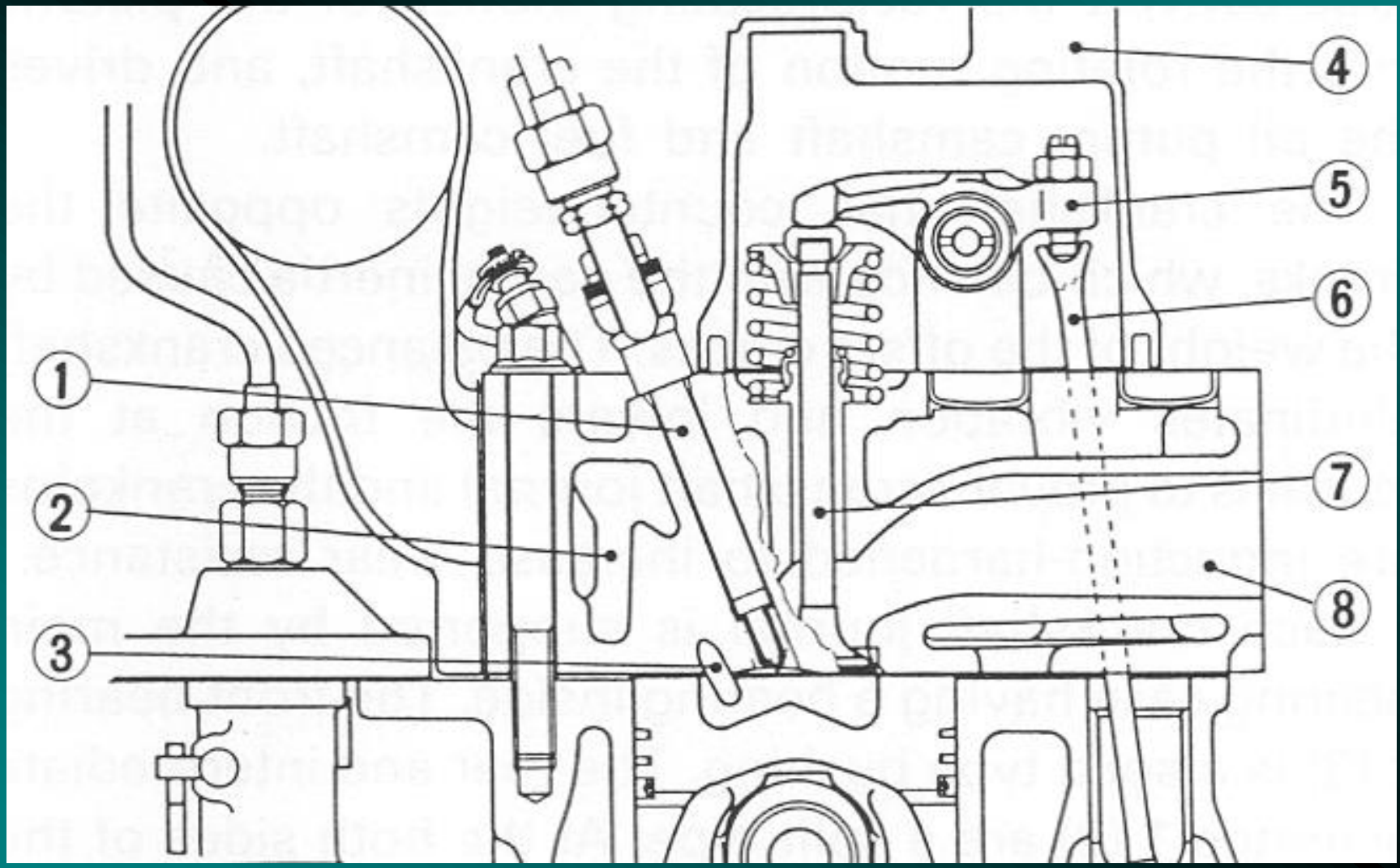
DI

03 series



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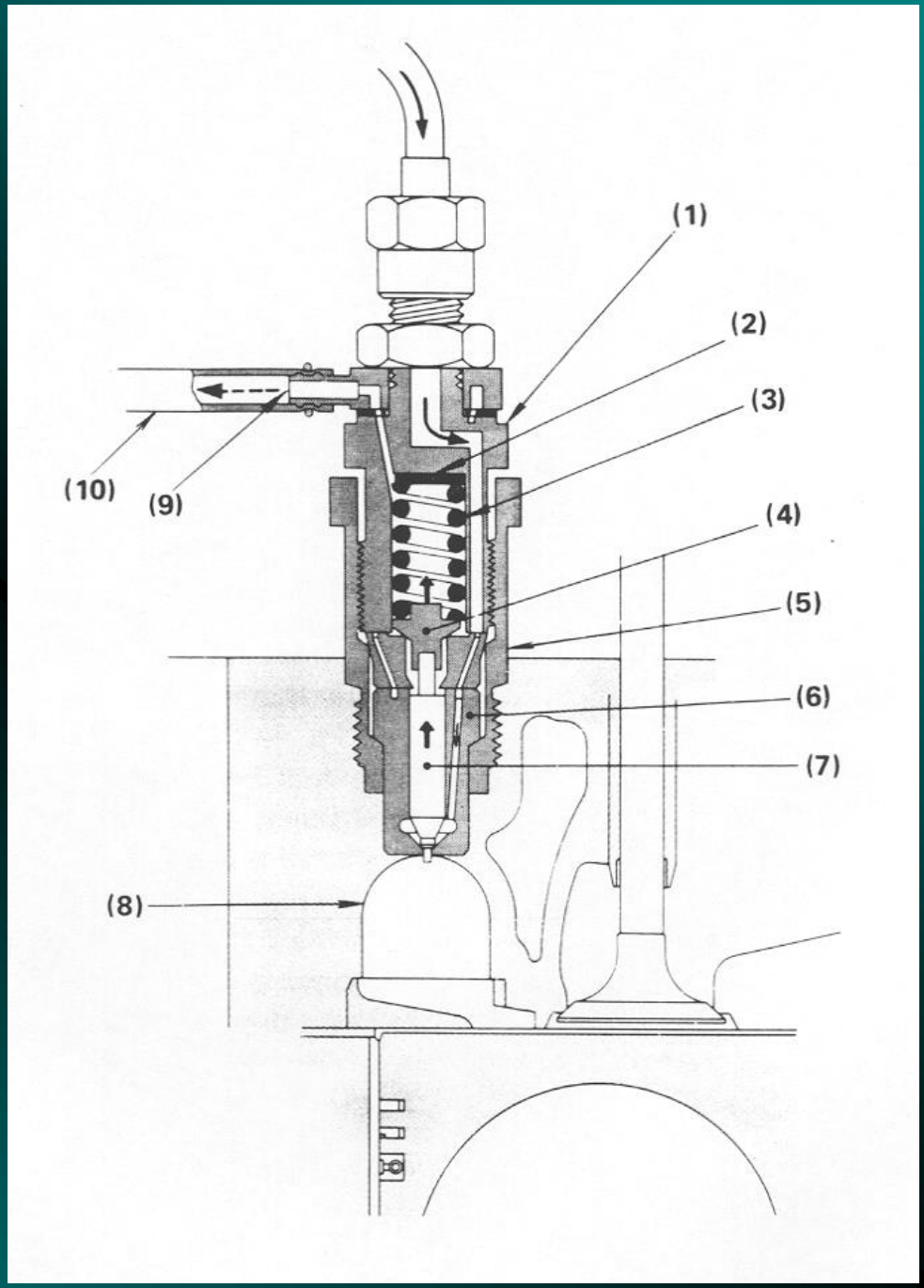
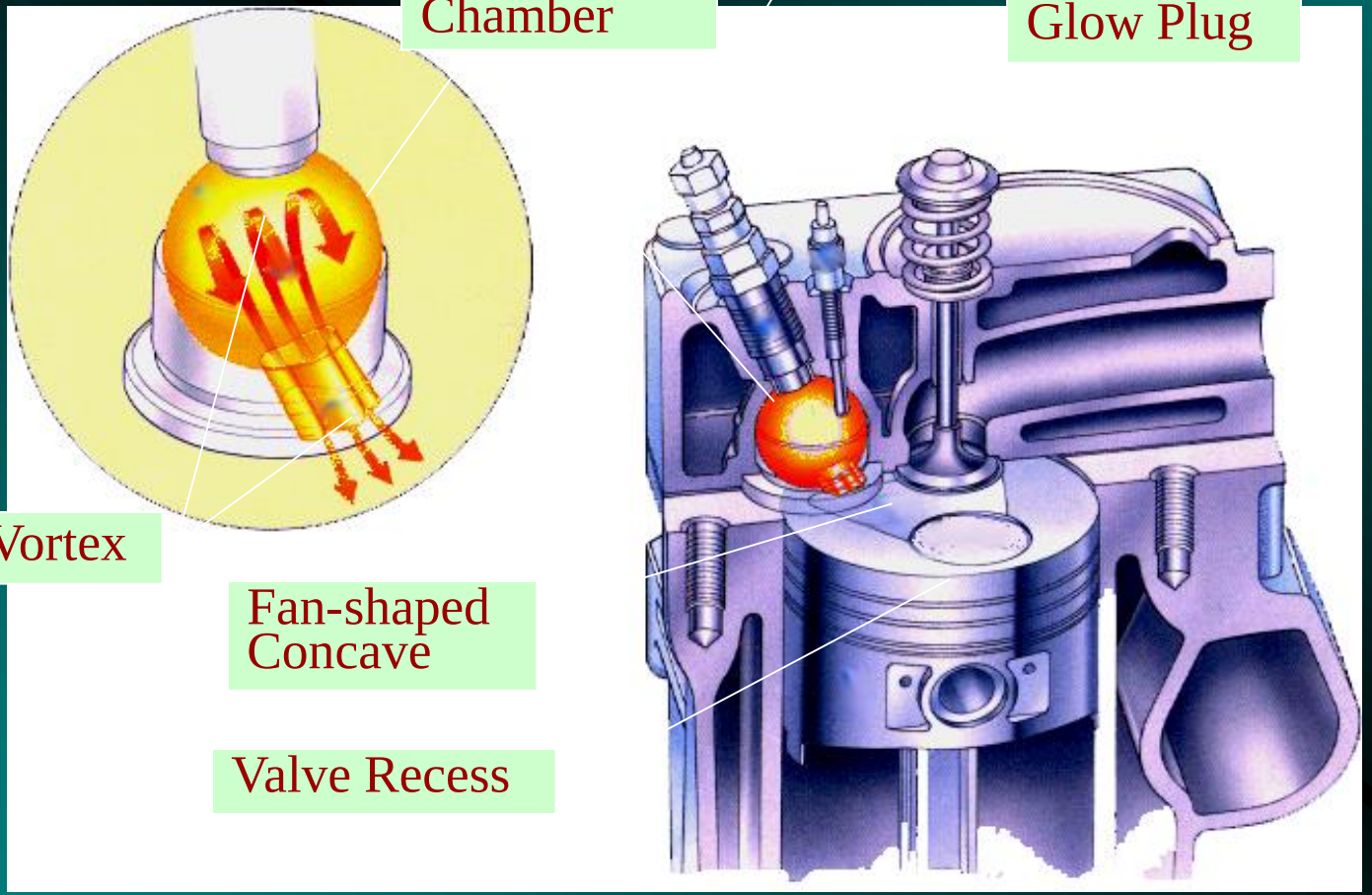
I D I

70mm and 82mm families

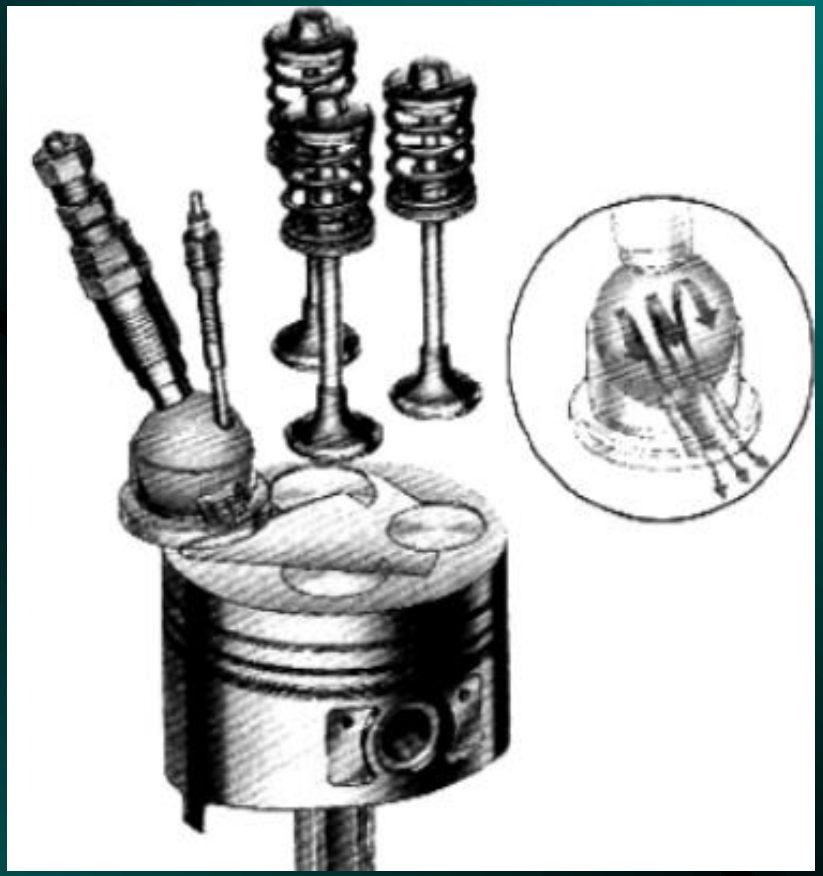


E-TVCS


Combustion Chamber
Nozzle
Glow Plug
Three Vortex
Fan-shaped Concave
Valve Recess

V3300 - 3 Valves per Cylinder

- 2 Intake Valves per Cylinder
- 2 Intake Ports per Cylinder for reduced turbulence in ports
- Significant increase in combustion efficiency



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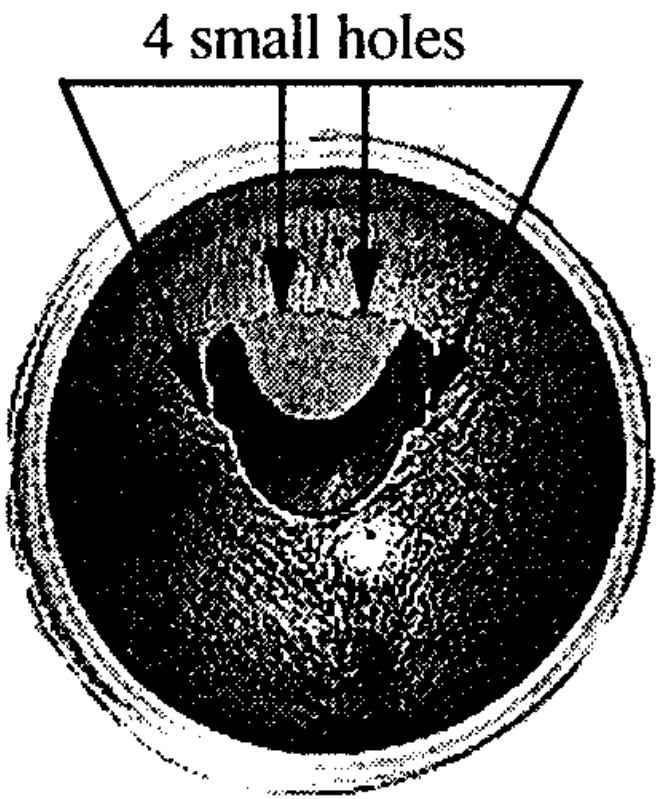
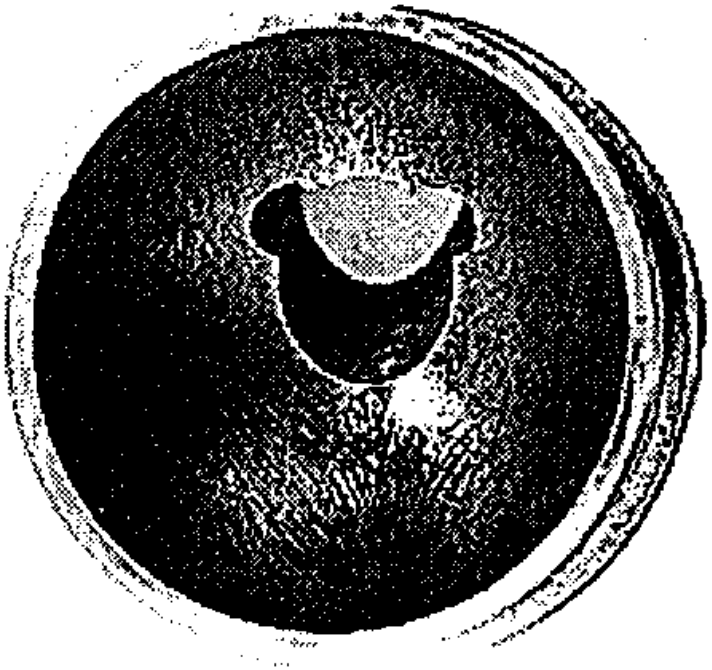
BobCat's

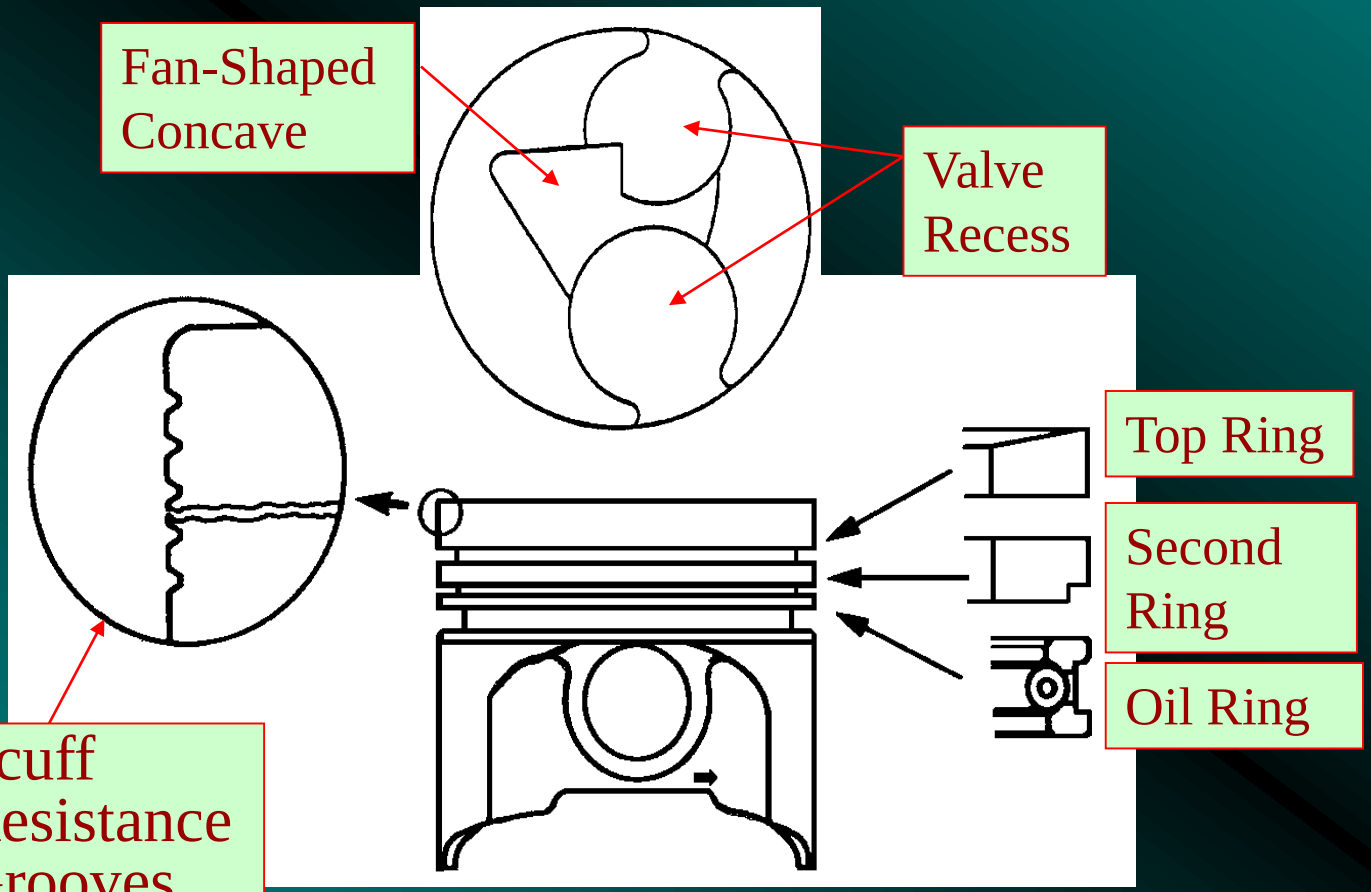


Extra 4 small holes type



3 holes type

Piston & Piston Ring



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I.D.I. (Indirect Injection - swirl chamber)

D.I. (Direct injection)

T.V.C.S. (Three Vortex Combustion System)

Introduced a combustion chamber with Three intense air flow swirls(Vortexes)

N.T.V.C.S. (New Three Vortex Combustion System)

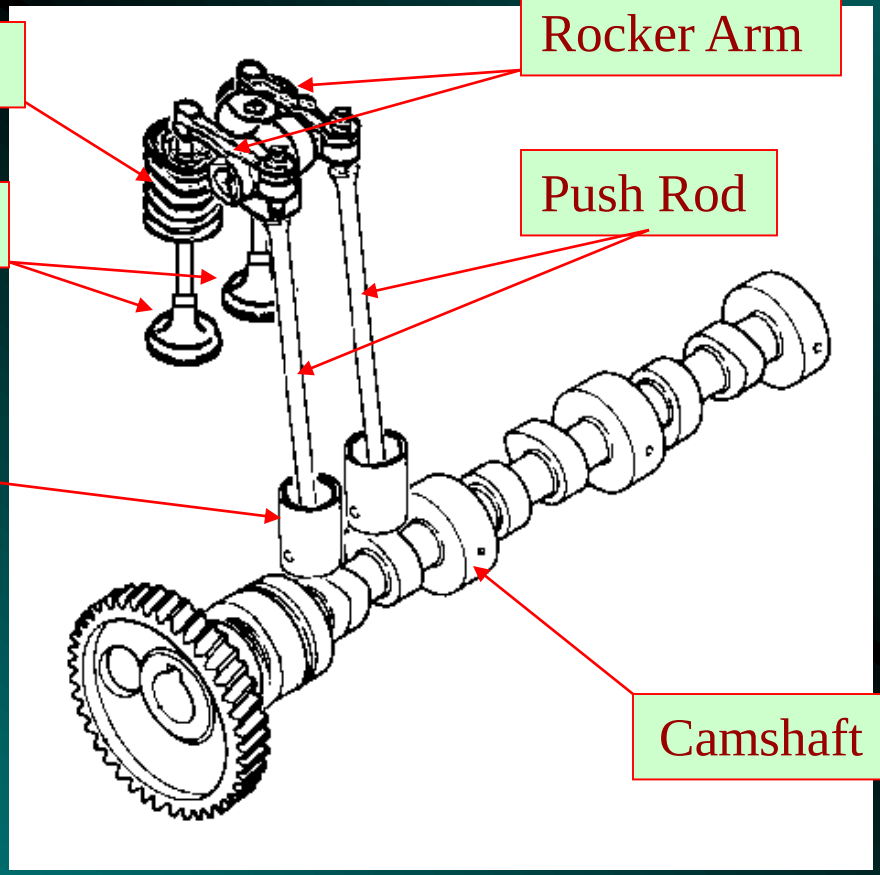
Added to the T.V.C.S. special concave recess on the piston crown.

E.T.V.C.S. (Environment Three Vortex Combustion System)

Modification of the N.T.V.C.S. to drastically reduce exhaust emissions.

E-Series E.T.V.C.S. engines will be identified with a new label on the cylinder head cover with the "E" character (eg. D1105-E).

Valve Mechanism



I D I

70mm and 82mm families combustion chamber caps

Replacement caps

70mm stroke series

15261-03142

(D650 15281-03142)

82mm stroke series

15521-03143

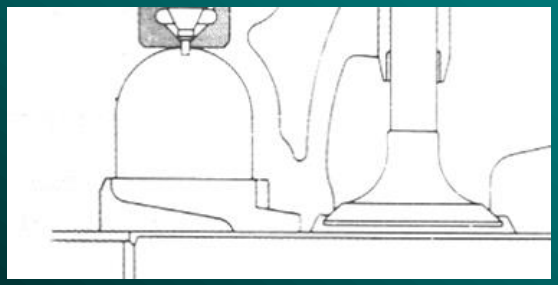
D1402, V1902, S2800

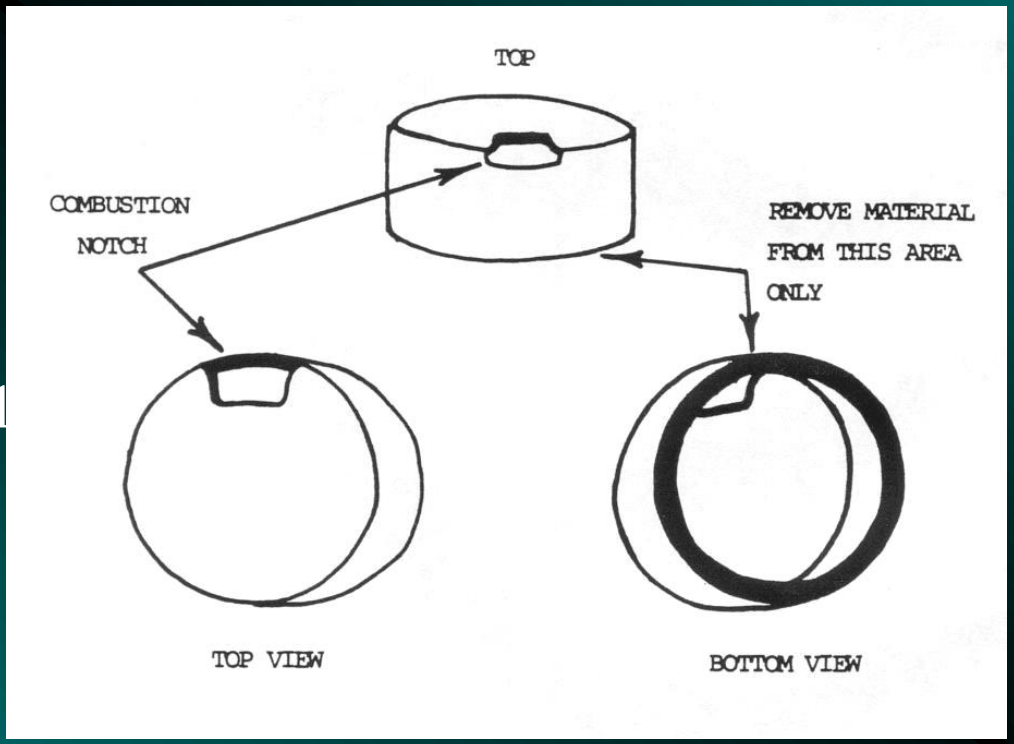
15291-03143

Z751, Z851, D1101, D1301

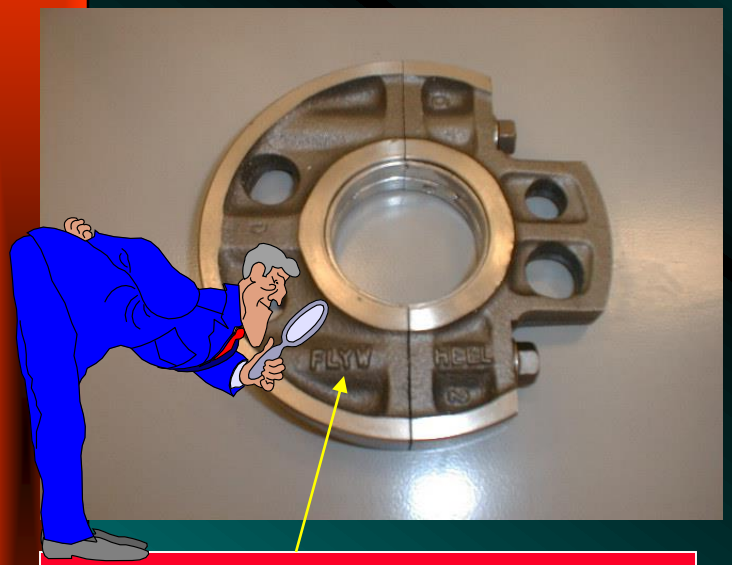
D1102, D1302, V1502,

V1702, S2200, S2600





Kubota Engine Overhaul Marks

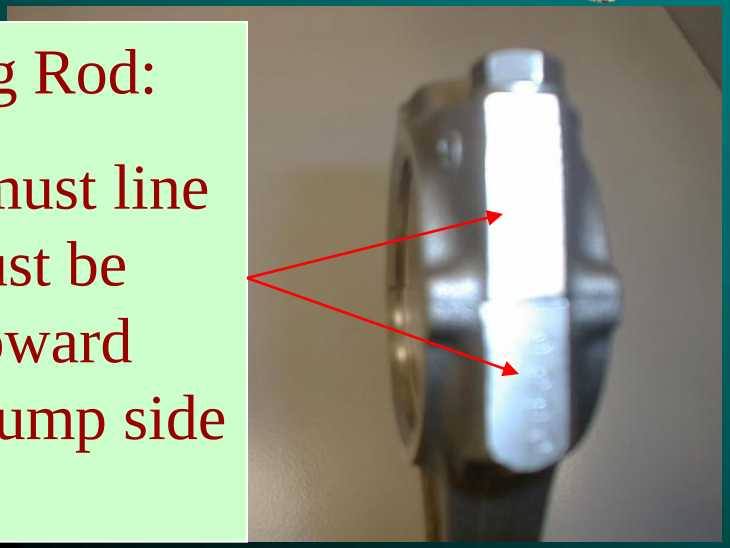


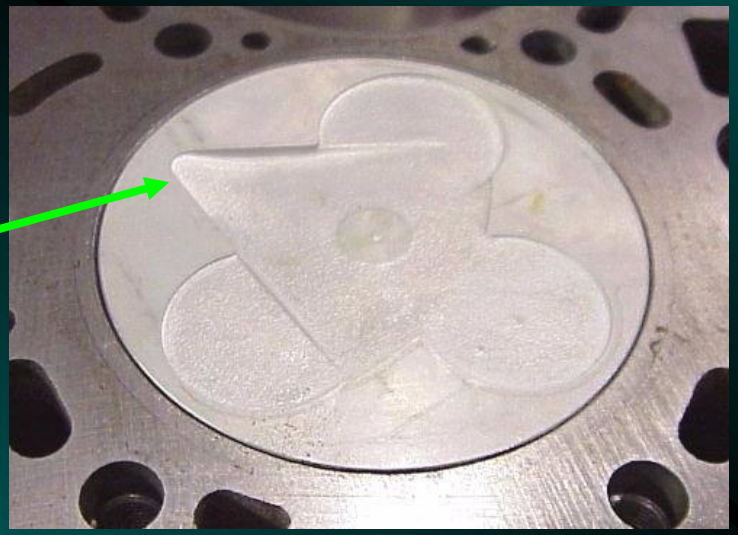
Main Bearing Cases:

Marked “Flywheel” on flywheel side of case

Connecting Rod:

Numbers must line up, and must be installed toward injection pump side





Pistons: Indentation on piston must be toward injection pump side of engine.