



**FUEL
INJECTION
EQUIPMENT
TYPE FORMULAE**

**EXPLANATION OF
PRINCIPLE AND
FORMATION**



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EXPLANATION OF TYPE FORMULAE USED ON FUEL INJECTION EQUIPMENT

It is of the utmost importance that the type formula marked either on the type plate or engraved on the unit should be thoroughly understood before any attempt is made either to dismantle or repair any equipment.

1. INTRODUCTION

Before considering the injection pump formula in detail, it must be appreciated that when facing the pump inspection window, the left-hand end of the housing is always referred to as No. 1 end, and the right-hand as No. 2. Also a notch or saw cut will be found marked on the extreme end of one of the coupling threads of the camshaft fitted to 4, 6 and 8 cylinder fuel injection pumps. This notch plays an important part in the assembly, because if the camshaft is reversed from its original position, the firing sequence will be incorrect. On 2, 3, 5 and 7 cylinder camshafts, a notch is not normally provided when the cam profiles are symmetrical, as the firing order remains unchanged whichever way the camshaft is assembled. On certain special pumps using unsymmetrical cam profiles, the notch is retained.

Elements having a left-hand helix are fitted to standard fuel injection pumps, also when a governor, other than hydraulic, is fitted at No. 1 end.

Right-hand helix elements are used when the governor, other than hydraulic, is at No. 2 end or with injection pumps without governors to meet non-standard requirements. In the latter case a special symbol number is always allocated to the pump.

When hydraulic governors are used, right-hand helix elements are fitted when governor is at No. 1 end and left-hand helix elements when governor is at No. 2 end.

Given below are typical type formulae applicable to the various F.I.E. products, set out vertically for the purpose of explanation, with accompanying notes indicating the possible variables and their meanings.

2. 'BPE' & 'BPF' TYPE INJECTION PUMPS

These pumps fall into two main categories—enclosed camshaft pumps (BPE) and flange mounted pumps (BPF). BPE pumps may be fitted with mechanical, pneumatic or combined governors.

(a) Enclosed Camshaft Pumps

A typical symbol is **BPE6B90S420/3S6168XE**

B	..	British made.
P	..	Injection pump.
E	..	Enclosed camshaft type.
6	..	No. of pumping elements.
B	..	Pump size letter (i).
90	..	Element plunger dia.
S	..	Design change letter (iv).
420	..	Assembly numbers (ii).
/3	..	Index number indicating fitment of blanking cover instead of feed pump.
S6168	..	Special features number.
XE	..	Suffix letters (iii).

(i) Pump size letters, and element plunger dias. in tenths of mm.

A	=	7 mm. plunger stroke	40, 50, 60, 65 (iv).
B	=	10 mm. „ „	50, 60, 65, 70, 75, 80, 90, 100.
Z	=	12 mm. „ „	100, 110, 120, 130, 140.
C	=	15 mm. „ „	100, 110, 120, 130, 140, 150, 160, 180.

(ii) Assembly numbers (BPE pumps only).

Hundreds figures :

- 1 = Camshaft notch at No. 1 end. No fuel feed pump flange on pump housing.
- 2 = Camshaft notch at No. 2 end. No fuel feed pump flange on pump housing.
- 3 = Camshaft notch at No. 1 end. Fuel feed pump can be fitted.
- 4 = Camshaft notch at No. 2 end. Fuel feed pump can be fitted.

Tens figures :

- 0 = Without governor.
- 1 = With governor at No. 1 end.
- 2 = With governor at No. 2 end.

Units figures :

- 0 = Without injection advance device.
- 1 = With injection advance device at No. 1 end.
- 2 = With injection advance device at No. 2 end.

(iii) Suffix letters at end of symbol.

X = Fully supported delivery valve washers used in conjunction with reduced volume delivery valves.

E = standard excess fuel device fitted.

EL = non-standard excess fuel device fitted.

M = external components marine finished.

(This suffix is used on all F.I.E. products.)

(iv) Design change letter "P" or "R" as applied to BP..A pumps only, indicates the use of a pump housing suitable for the "P" range of stepped barrel elements, in dias. 7.0, 7.5, 8.0 and 9.0 mm.

(b) Flange Mounted Pumps

A typical symbol is **BPF1B70B00**

B	..	British made.
P	..	Injection pump.
F	..	Flange mounted.
1	..	No. of pumping elements.
B	..	Pump size letter (i).
70	..	Element plunger dia.
B	..	Design change letter.
00	..	Flange symbol (ii).

(i) Pump size letters, and element plunger dias. in tenths of mm.

A	=	7 mm. plunger stroke	40, 50, 60, 65.
B	=	10 mm. „ „	50, 60, 65, 70, 75, 80, 90, 100.
Z	=	12 mm. „ „	100, 110, 120, 130, 140.
C	=	15 mm. „ „	100, 110, 120, 130, 140, 150, 160, 180.

CC = 15 mm. plunger stroke as **C**, but with increased range of plunger diameters.

X = 22 mm. plunger stroke 120, 140, 160, 170, 180, 200.

D = 30 mm. „ „ 140, 160, 180, 200, 220.

E = 35 mm. „ „ 200, 220, 250, 270, 300.

(ii) There are three standard flange symbols used for single cylinder pumps.

00 = Housing flange parallel to control rod.

03 = Housing flange at right angles to control rod.

04 = Housing vertical flange parallel to control rod, (A and B sizes only).

These may, however, be replaced by a special features number, which would absorb the flange symbol, e.g., **BPF1C140AS6117**.

(iii) Suffix letters "X" and "M" as mentioned for BPE.. pumps can also be applied to BPF.. pumps.

(iv) It will be appreciated that with BPF.. pumps there are no assembly or index numbers in the type formula, as these pumps are not fitted with components necessitating these numbers.

(c) Mechanical Governors

A typical symbol for an idling and maximum speed governor is **BR200/900BH624**

B .. British made.
R .. Regulator.
200 .. Average idling speed (pump r.p.m.).
/ .. Dividing stroke (i).
900 .. Maximum speed (pump r.p.m.).
B .. Size of pump to which governor is fitted.
H .. Design change letter.
624 .. Special features number (ii).

(i) When a letter "X" is substituted for the dividing stroke between speeds, the governor is for single speed applications, where the idling speed is not critical. The dividing stroke or letter "X" indicates no governing between quoted speeds.

(ii) A letter "F" after the special features number indicates the fitment of a gauze filter in the inlet connection.

(iii) When speeds are quoted as,
e.g., **BR250-500/975AJ7**

this represents a "long idling range" governor, idling between 250 and 500 pump r.p.m. and maximum governing at 975 pump r.p.m.

A typical symbol for a variable speed governor is **BRV225-750BD629**

B .. British made.
R .. Regulator.
V .. Variable speed type.
225-750 .. Governed speed range (pump r.p.m.) (i).
B .. Size of pump to which governor is fitted.
D .. Design change letter.
629 .. Special features number (ii).

(i) When governed speed range is quoted as,
e.g., **225/500-1000**

the 225 figure represents average idling speed and 500-1000 is the range within which the governing speed can be selected.

(ii) A letter "F" after the special features number indicates the fitment of a gauze filter in the inlet connection.

(d) Pneumatic Governors

A typical symbol is **BEP/MZ80B116**

B .. British made.
EP .. Pneumatic governor.
/ .. Dividing stroke.
M .. Diaphragm type.
Z .. Idling adjustment symbol (i).
80 .. Diameter of diaphragm in mm.
B .. Size of pump to which governor is fitted.
116. .. Special features number (ii).

(i) Idling adjustment symbol.

N = Cam adjustment.

Z = Set screw adjustment.

A design change letter may be inserted before the letters "MN,"
e.g., **BEP/AMN80B106.**

(ii) The letter "S" after the special features number indicates that screw fixing, of the governor housing to the pump, is employed in place of the now standard stud fixing.

(e) Combined Governors

A typical symbol for combined pneumatic and mechanical governors is **BEP/LB900DS21**

B .. British made.
EP .. Pneumatic governor.
/ .. Dividing stroke.
L .. Combined type.
B .. Size of pump to which governor is fitted.
900 .. Maximum speed (pump r.p.m.).
D .. Design change letter.
S21 .. Special features number.

3. VENTURI UNITS

These are of two main types, square flange and oval flange.

(a) Square Flange Type

A typical symbol is **BEP/KE64/96**

B .. British made.
EP .. Pneumatic governor.
/ .. Dividing stroke.
KE .. Venturi unit, square flange type.

- 64 .. Bore of throat at valve in mm.
- / .. Dividing stroke (i).
- 96 .. Individual features number.

(i) A letter "D," "E" or "F" inserted after the throat diameter indicates the use of a standard type housing :

- D for throats 40-48 mm. dia.
- E ,, ,, 46-56 ,, ,,
- F ,, ,, 56-68 ,, ,,

This may also be followed by a design change letter, e.g., **BEP/KE66FA64**.

(b) Oval Flange Type

A typical symbol is **BEP/K62 48 54**

- B** .. British made.
- EP** .. Pneumatic governor.
- / .. Dividing stroke.
- K** .. Venturi unit oval flange type.
- 62 .. Bore of intake in mm.
- / .. Dividing stroke.
- 48 .. Bore of throat in mm.
- / .. Dividing stroke.
- 54 .. Individual features number.

4. FUEL FEED PUMPS

There are two main types of feed pump, plunger type and diaphragm type. With the diaphragm type, hand priming device is incorporated.

(a) Plunger Type Feed Pumps

A typical symbol is **BFP/K22P66**

- B** .. British made.
- FP** .. Fuel feed pump.
- / .. Dividing stroke.
- K** .. Plunger type.
- 22 .. Plunger dia. in mm.
- P** .. Design change letter.
- 66 .. Individual features number.

(b) Hand Priming Devices

One symbol only is used at present **BFPUE2/54Z**

- B** .. British made.

- FP** .. Fuel feed pump.
- UE2** .. Hand priming device.
- / .. Dividing stroke.
- 54Z** .. Individual features number.

(c) Pre-Filter Units

A typical symbol is **BFJSJ1/501**

- B** .. British made.
- FJSJ1** .. Feed pump pre-filter unit.
- / .. Dividing stroke.
- 501** .. Individual features number.

(d) Diaphragm Type Feed Pumps

A typical symbol is **DFP3/2**

- D** .. Diaphragm type.
- FP** .. Fuel-feed pump.
- 3 .. Basic type number (1 = suitable for "B" type pump).
(3 = suitable for "N" type pump).
- / .. Dividing stroke.
- 2 .. Individual features number.

5. 'N' TYPE INJECTION PUMPS

(a) A completely different type symbol formula has been introduced for this range of pumps. The pump nameplate bears a long symbol giving the full pump symbol and also the governor symbol. The governor nameplate bears the governor symbol only, with the addition of a speed range symbol in the case of mechanical governors.

Typical symbols are **NL6E80/8GRHD4C1**
NL6E90/65MGLVW3M
NL4E75/80GRP4
NR6E80/74GLWA3

(b) Pump Symbols

NL6E80/8G..

- N** .. Basic type of pump.
- L** .. Camshaft assembly (i).
- 6 .. No. of pumping lines.
- E** .. Design change letter.
- 80 .. Element plunger dia. (ii).
- / .. Dividing stroke.
- 8 .. Individual features number.
- G..** .. Governor fitted (iii).

(i) Camshaft assembly letters "L" or "R" indicate :

"L" = notched end of camshaft at L.H. end.

"R" = " " " " " " R.H. "

Looking on inspection cover side of pump.

(ii) Element plunger diameters in tenths of mm.

50, 60, 65, 70, 75, 80, 90 or 100.

(iii) The letter "G" is not strictly part of the pump formula but is inserted to separate the pump from the governor symbol.

(c) Governor Symbols

There are three main types of governor suitable for fitment to the "N" type pump, hydraulic (H), pneumatic (P) and flyweight (W).

Their type formulae are derived as follows :

(d) Hydraulic Governor

A typical symbol is **RHD4C1**

R .. L or R indicates end of pump to which governor is fitted.

H .. Governor type.

D .. Design change letter.

4 .. Individual features number.

C .. C = Clockwise. A = Anti-clockwise.

(Rotation looking on driving end of pump.)

1 .. Test data code number.

(e) Pneumatic Governor

RP4

R .. L or R indicates end of pump to which governor is fitted.

P .. Governor type.

4 .. Individual features number.

(f) Mechanical Governor

LWA3

L .. L or R indicates end of pump to which governor is fitted.

W .. Governor type (i).

A .. Design change letter.

3 .. Individual features number.

(i) "W" indicates an idling and maximum speed governor.

"VW" indicates a variable speed governor.

(ii) Governed speed range is quoted separately on governor type label (see notes on BR and BRV governors re speed ranges).

(g) Excess Fuel Device Symbols

A special excess fuel device was developed for the "N" pump for use in conjunction with the hydraulic governor.

A typical symbol is **MR2**

M .. Manually operated excess fuel device.

R .. L or R indicates end of pump to which fitted.

2 .. Individual features number.

This excess fuel device is not used in conjunction with pneumatic or flyweight governors. Its type symbol only appears on its own label and not on the pump label.

6. NOZZLE HOLDERS

Nozzle holder type symbols fall into three main categories :

(a) normal range.

(b) standardised range.

(c) special types.

(a) Normal Nozzle Holder Range

A typical symbol is **BKB50S24**

B .. British made.

KB .. Nozzle holder type (ii).

50 .. Barrel length in mm.

S .. Size letter (i).

24 .. Individual features number.

(i) Size letters :

"R" = To suit a nozzle head dia. of 16 mm.

"S" = " " " " " " " " 17 mm.

"T" = " " " " " " " " 22 mm.

"U" = " " " " " " " " 30 mm.

"V" = " " " " " " " " 42 mm.

(ii) Letters "KB" flange or clamp mounted type.

Letters "KC" instead of "KB" indicate "screw-in" type holder, e.g., **BKC50S526**.

(iii) A letter "L" inserted after "KB" indicates a cap nut to suit a long stem nozzle is fitted, e.g., **BKBL102S617**.

(iv) A letter "D" inserted after the size letter indicates that a special spring for use with Delay type pintle nozzles is fitted, e.g., **BKB50SD5**.

(v) A small letter "b" inserted at the end after the individual feature number, e.g., **BKB50S19b**, indicates the fitting of an edge type filter.

(vi) A letter "M" at the end of the symbol indicates marine finish, e.g., **BKBL97S632M**.

(vii) A letter "C" at the end of a BKC nozzle holder symbol indicates a design change, e.g., **BKC45SD21C**. This suffix was used as a temporary measure to assist in service identification on early releases.

(b) Standardised Nozzle Holder Range

A typical symbol is **N36S8**

N .. New range nozzle holder.

36 .. Barrel length in mm.

S .. Size letter (as normal range).

8 .. Individual features number.

(i) A letter "A" inserted after "N" indicates that dowels are fitted, e.g., **NA55S8**.

(ii) A letter "D" inserted after the size letter indicates that a special spring for use with Delay type pintle nozzles is fitted, e.g., **N36SD8**.

(iii) A letter "L" inserted after "N" indicates a cap nut to suit a long stem nozzle is fitted, e.g., **NL97S7**.

(c) Special Nozzle Holders

A typical symbol is **YNH6**

Y .. Special type letter (i).

NH .. Nozzle holder.

6 .. Individual features number.

(i) "Y" indicates special combined nozzle holder and poppet nozzle.
"Z" indicates special pilot injection nozzle holder for use with ZP nozzle.

"P" indicates special nozzle holder to suit PN poppet nozzle, e.g., **PNH2**.

(ii) With ZNH holders the barrel length in mm. is inserted after "NH," and followed by a dividing stroke, e.g., **ZNH102/1**.

7. NOZZLES

Nozzle type symbols fall into two categories :

(a) Normal range.

(b) Special types.

(a) Normal Nozzle Range

A typical symbol is **BDL110S6036**

B .. British made.

DL .. Nozzle type (i).

110 .. Spray/hole angle.

S .. Size letter (ii).

6036 .. Individual features number.

- (i) "DL" = hole type nozzle.
"DLL" = hole type nozzle, long stem.
"DLP" = hole type, flat seat nozzle.
"DN" = pintle type nozzle (see (iii) and (iv)).

(ii) Size letters. Five sizes are included in the standard range, the letter indicating the diameter of the nozzle head, as detailed in Nozzle Holder section above.

(iii) A letter "D" inserted after the size letter of a BDN nozzle indicates a Delay type nozzle, e.g., **BDN12SD12**.

(iv) A letter "P" inserted after the size letter of a BDN nozzle indicates a Pintaux (auxiliary hole) nozzle, e.g., **BDN12SP6**.

(b) Special Nozzles

A typical symbol is **ZP150/1**

ZP .. Special type letters (i).

150 .. Spray angle.

.. Dividing stroke.

1 .. Individual features number.

- (i) "ZP" = special pilot injection nozzle.
"PN" = special poppet nozzle.

8. FILTERS

(a) Standard Range

Downflow and crossflow types.

A typical symbol for a downflow type is **BFA11P1**

B .. British made.

F .. Filter.

A .. Downflow type.

11 .. Capacity of container in tenths of litres.

P .. Element type letter (i).

1 .. Individual features number ;

and for a crossflow type is **BF11BS9**

- B** .. British made.
- F** .. Filter.
- 11** .. Capacity of container in tenths of litres.
- B** .. Design change letter.
- S** .. Element type letter (i).
- 9** .. Individual features number.

(i) Element type letters.

- "P" = Felt element.
- "S" = Cloth element.
- "G" = Gauze element (no longer in production).
- "PS" = Cloth and felt element combined.

(ii) A letter "T" inserted before the "F" in crossflow filters indicates a twin unit, e.g., **BTF11BS563**.

(b) Duplex Filters

A typical symbol is **DA3S**

- D** .. Duplex type filter.
- A** .. Design change letter.
- 3** .. Individual features number.
- S** .. Element type letter (i).

(i) Element type letter "P" or "S" are used to indicate Felt or Cloth elements respectively, as above.

(c) Paper Element Filter

A typical symbol is **F2/1**

- F** .. Paper element filter.
- 2** .. Basic type number.
- /** .. Dividing stroke.
- 1** .. Individual features number.

(i) When a number 2 or 3 is inserted before the letter "F" this indicates a multi-bowl, parallel flow filter having that number of bowls, e.g., **3F3/2**.. is a triple-bowl filter.

9. COUPLINGS

There are three categories of couplings in use, namely:

- (a) Standard BZKG range.
- (b) New CN range.
- (c) Flywheel range.

(a) Standard Couplings

A typical symbol is **BZKG31/538**

- B** .. British made.
- ZKG** .. Coupling.
- 31/** .. Basic type number (i).
- 538** .. Individual features number.

(i) Basic type numbers.

- 31/ = for use on A or B type pumps.
- 47/ = for use on Z type pumps.
- 1B = for use on C type pumps.

NOTE: Although 31 is used for both A and B pump couplings, these are not interchangeable owing to different camshaft tapers.

(b) New CN Range Couplings

A typical symbol is **CN2**

- C** .. Coupling.
- N** .. New (standardised) range.
- 2** .. Individual features number.

(c) Flywheel Couplings

A typical symbol is **FCB1**

- F** .. Flywheel.
- C** .. Coupling.
- B** .. Type letter (i).
- 1** .. Individual features number.

(i) Type letters.

- "A" = suitable for A type pump.
- "B" = suitable for B or N pump.
- "N" = special fabricated flywheel type.