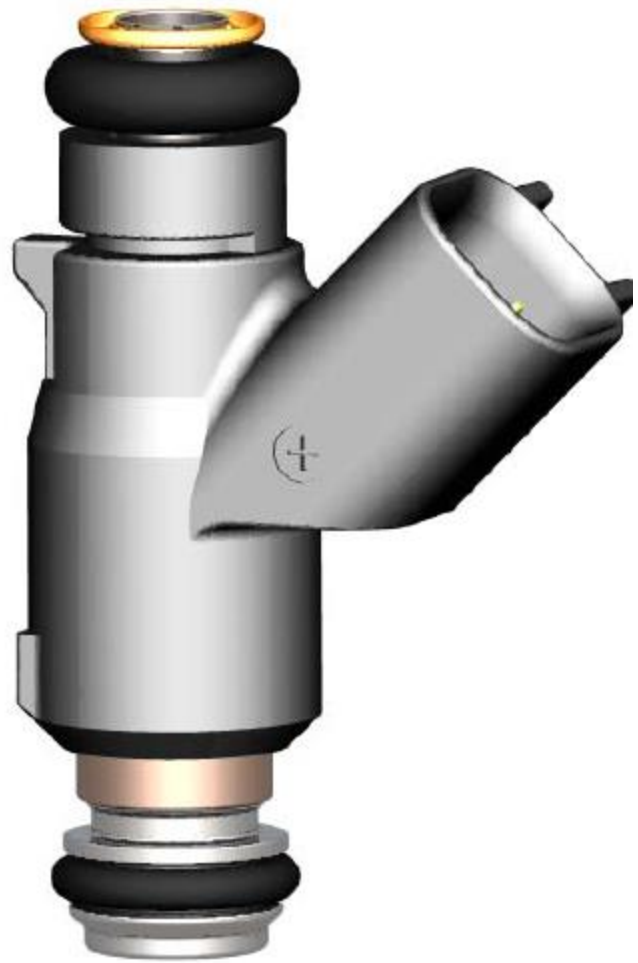
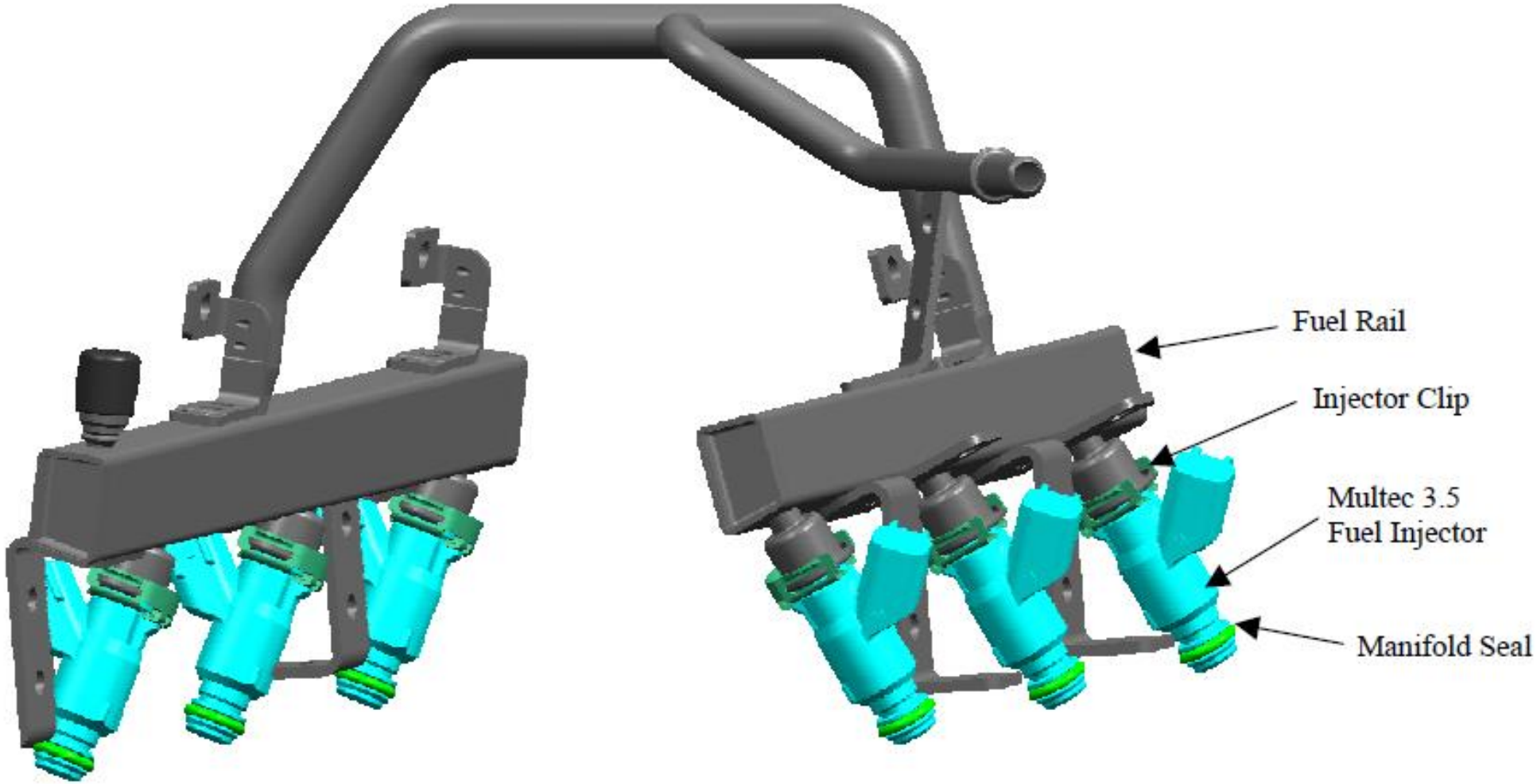
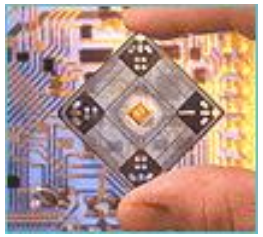
Válvula Injetora de Combustível



FLAUTA


Fuel Rail
Injector Clip
Multec 3.5
Fuel Injector
Manifold Seal

Esquema Simplificado do Sistema de Gerenciamento:



Mede a quantidade de ar admitida pelo motor

Calcula a quantidade de combustível necessária para mistura correta:

$m_{comb}=m_{ar}/$ **Esteq**

Determina o ponto ideal da centelha

f=f(Octanagem)

- **Comanda a Injeção**
- **Comanda disparo da centelha**

Confere o resultado da combustão

Relação estequiométrica: (característica de cada combustível)

Massa **de ar** (gramas) necessária para queimar integralmente 1 grama de combustível;

Lambda: (característica de operação do motor)

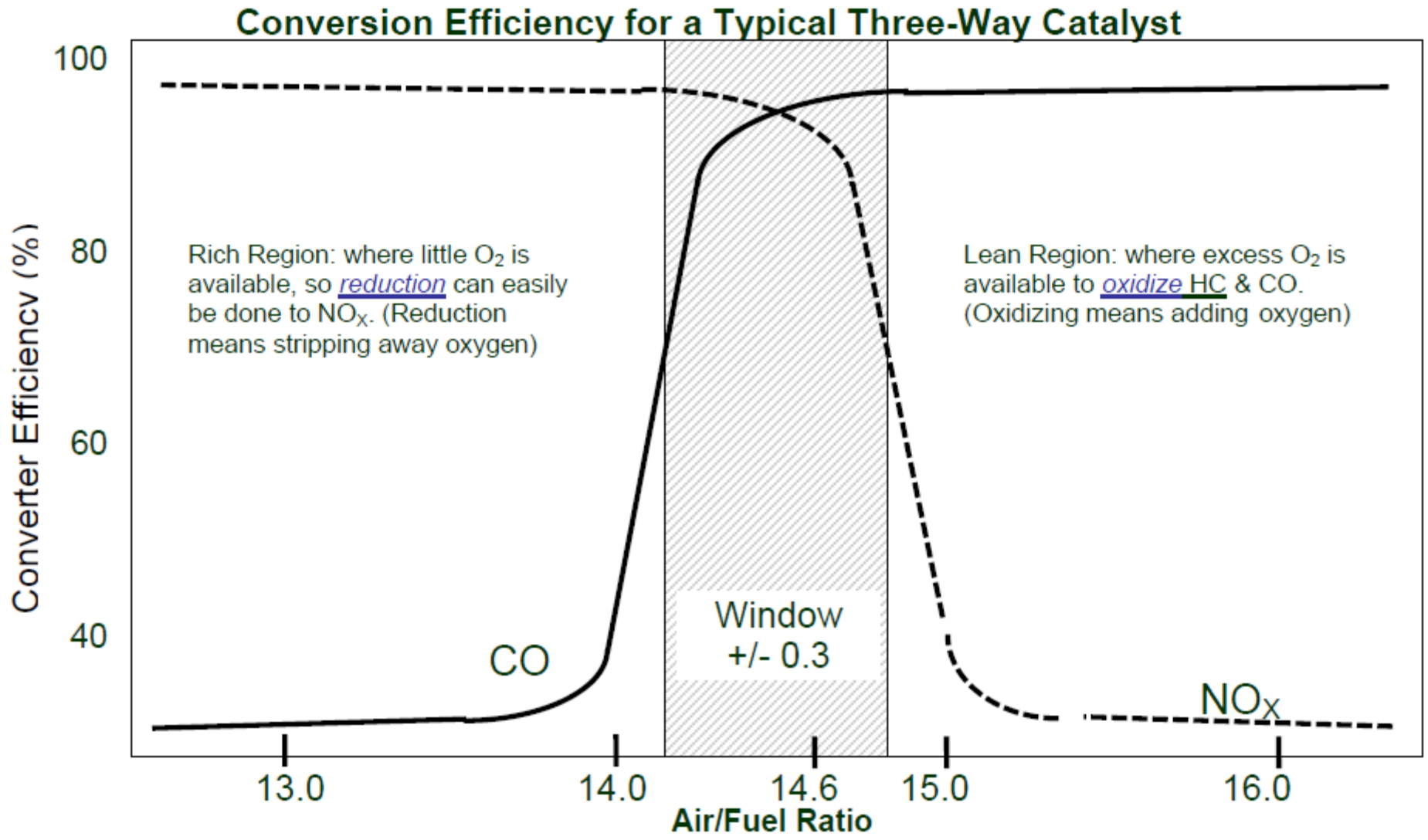
$$\lambda = \frac{\text{[Massa de ar (gramas) / Massa de combustível efetivamente entrando no motor]}}{\text{Relação estequiométrica do combustível utilizado}}$$

Método: Speed Density

$$Massa\_ar = \eta * \frac{Pressão}{R * Temperatura} * Cilindrada * \frac{RPM}{120}$$

Um preciso controle da relação ar-combustível requer o conhecimento do *fluxo de ar* que entra no motor.

$$Fluxo\_Combustível = \frac{Fluxo\_Ar}{\lambda_{desejado} * Stoich}$$


Conversion Efficiency for a Typical Three-Way Catalyst
Converter Efficiencv (%)
100
80
60
40
Rich Region: where little O_2 is available, so reduction can easily be done to NO_X. (Reduction means stripping away oxygen)
Lean Region: where excess O_2 is available to oxidize HC & CO. (Oxidizing means adding oxygen)
CO
Window
+/- 0.3
NO_X
13.0
14.0
14.6
15.0
16.0
Air/Fuel Ratio

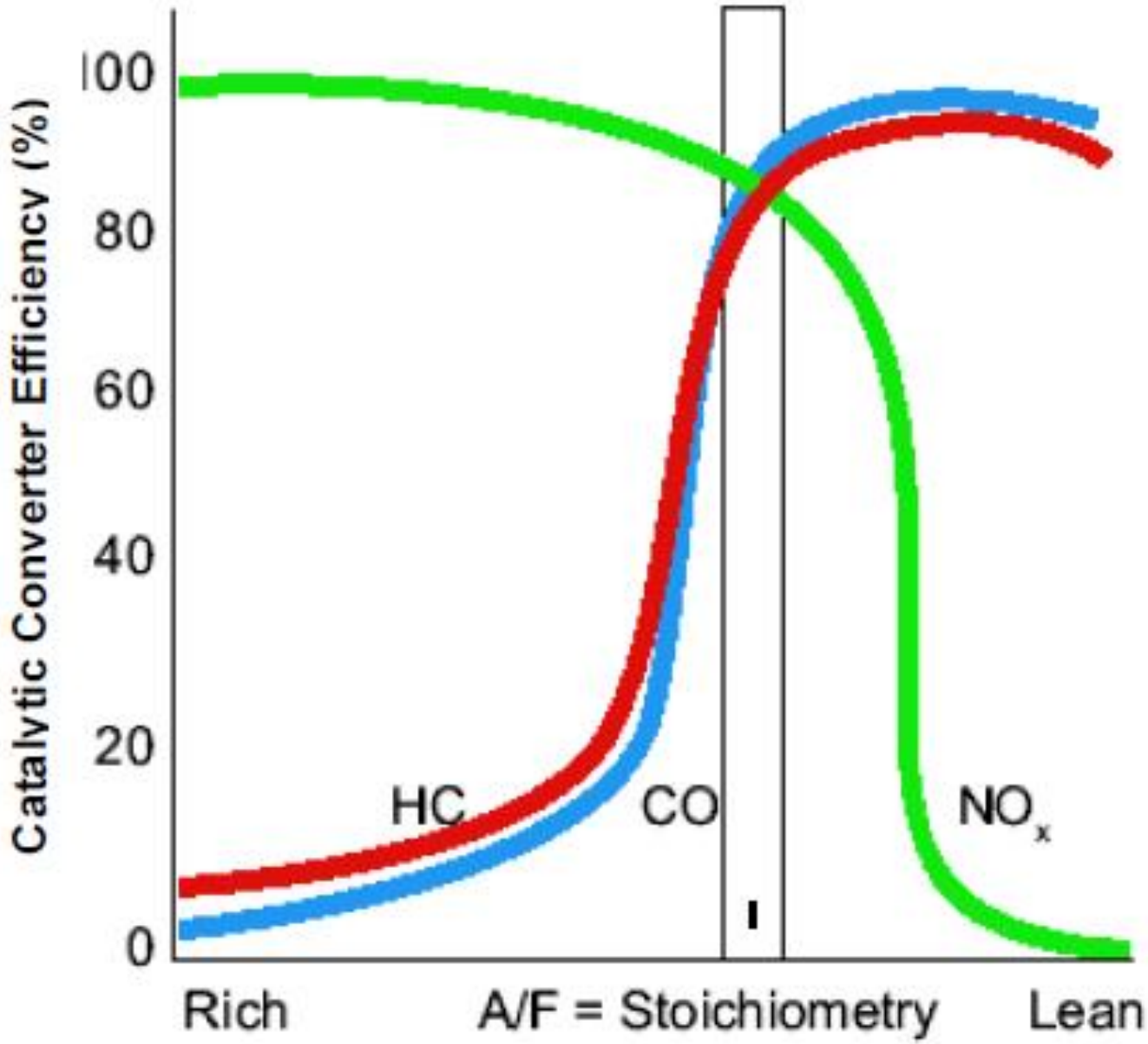
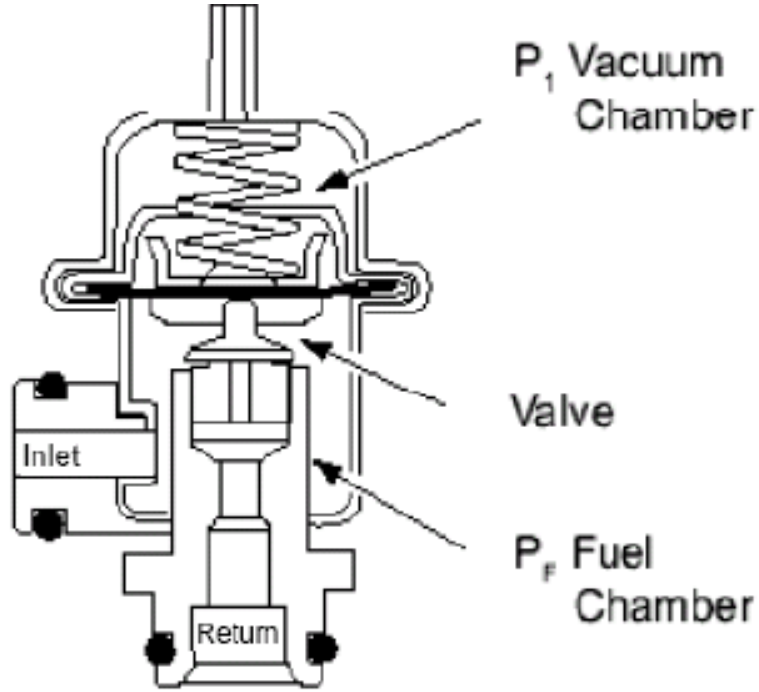


Figure 2-7 - Catalytic Converter Efficiency vs Air/Fuel Ratio



Regulator Force Balance

Delta $P_s \cdot A_D = F_S$

$(P_F - P_1) A_D = F_S$

$$P_F - P_1 = \frac{F_S}{A_D}$$

Therefore Regulator Maintains

$P_F - P_1$ (Delta P) across diaphragm

F_S = Spring Force

A_D = Diaphragm Area

P_F = Fuel Pressure

P_1 = Ambient Manifold Vacuum

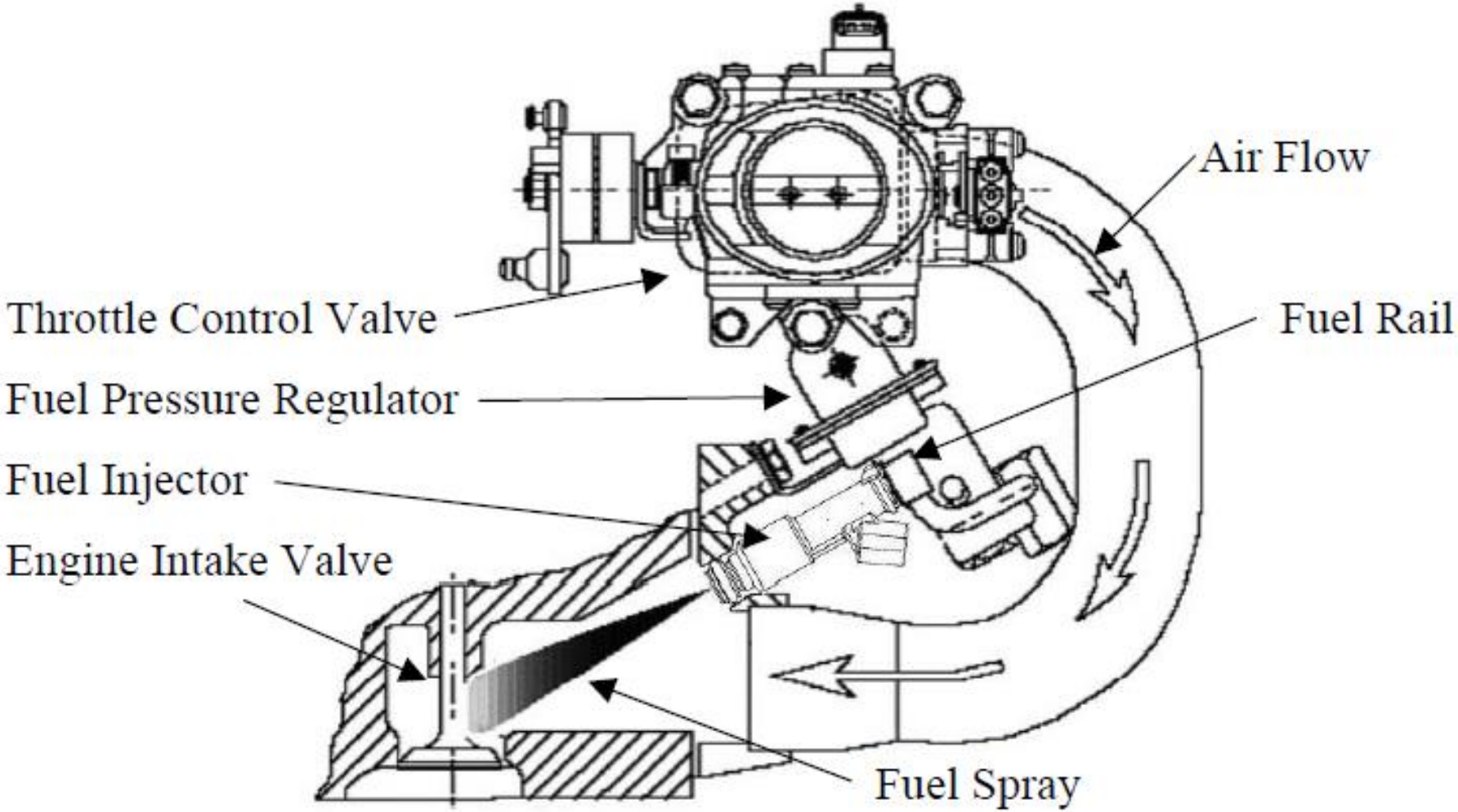
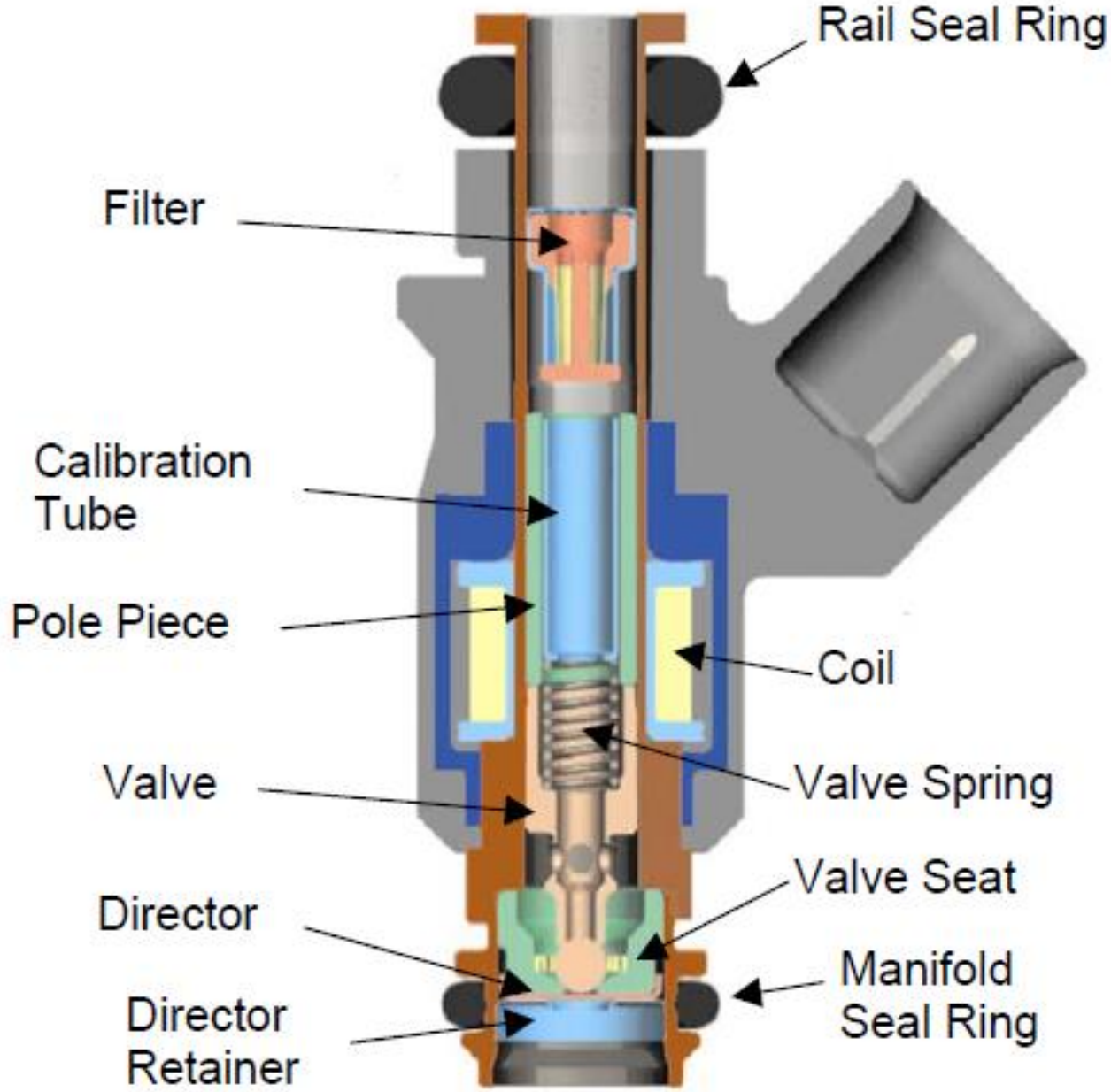
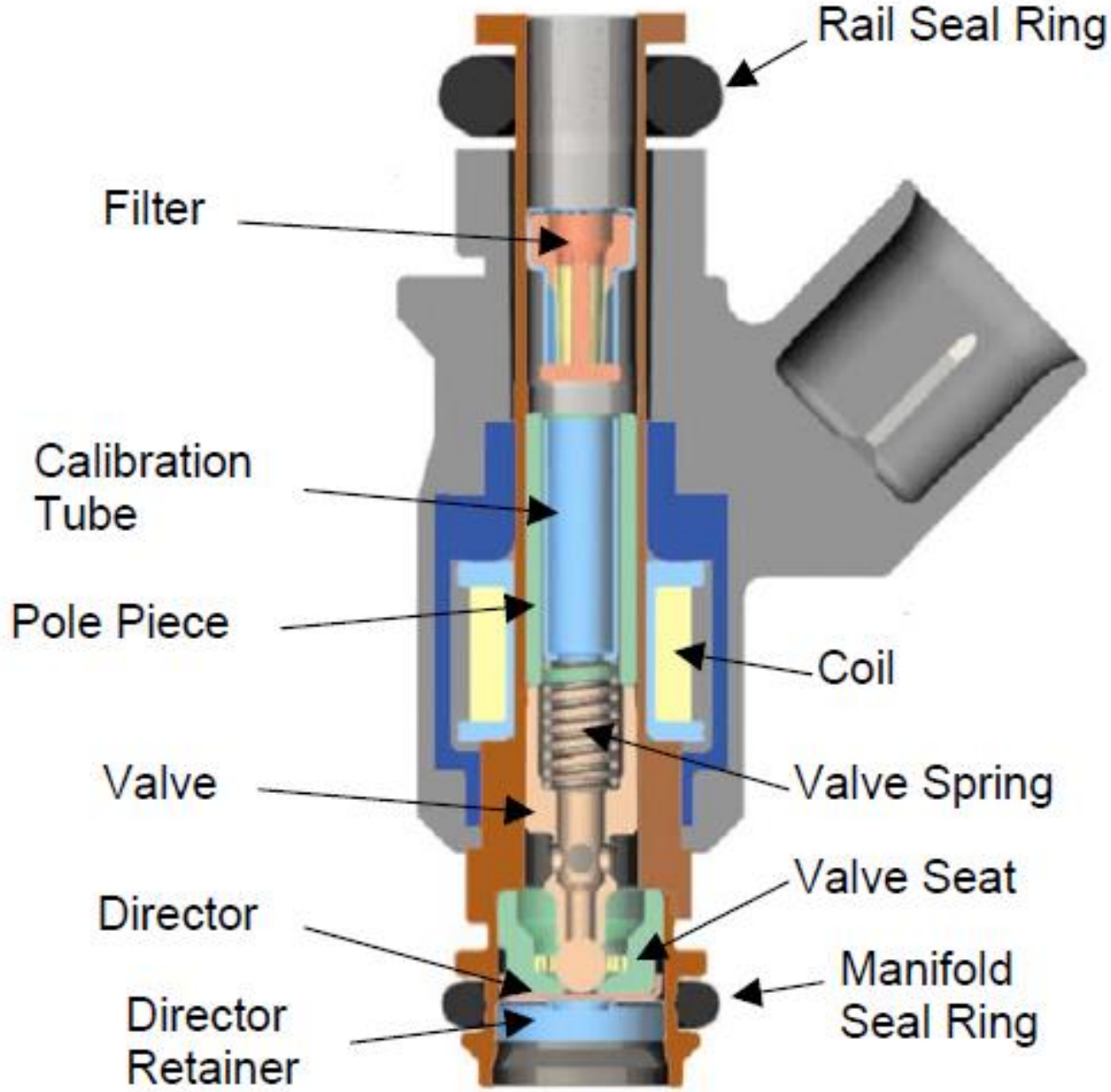


Figure 3-1 - Top Feed Port Fuel Injection


Rail Seal Ring
Filter
Calibration Tube
Pole Piece
Coil
Valve
Valve Spring
Valve Seat
Director
Manifold Seal Ring
Director Retainer


Rail Seal Ring
Filter
Calibration Tube
Pole Piece
Coil
Valve
Valve Spring
Valve Seat
Director
Manifold Seal Ring
Director Retainer

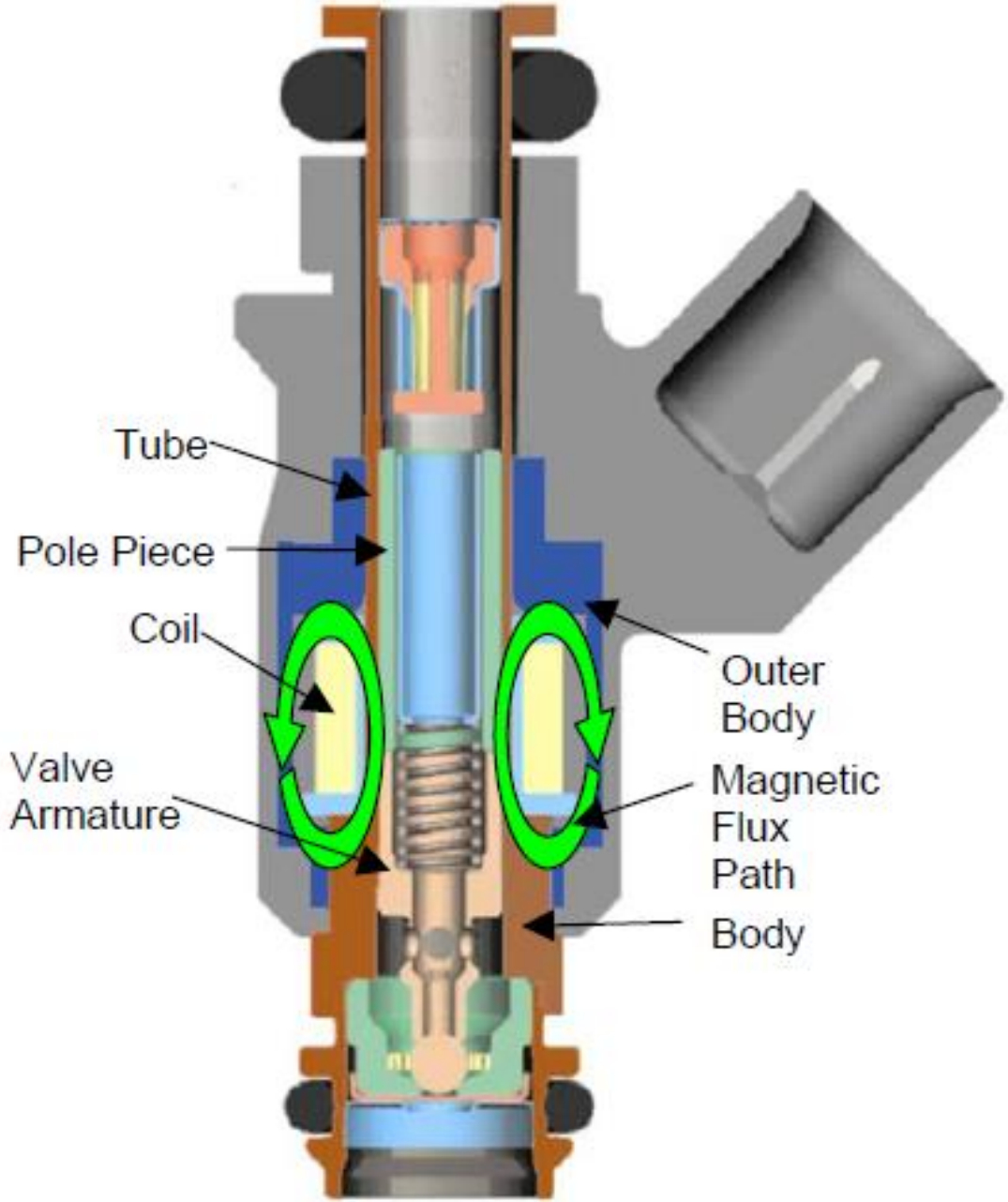


Figure 3-7 - Multec 3.5 Magnetic Circuit

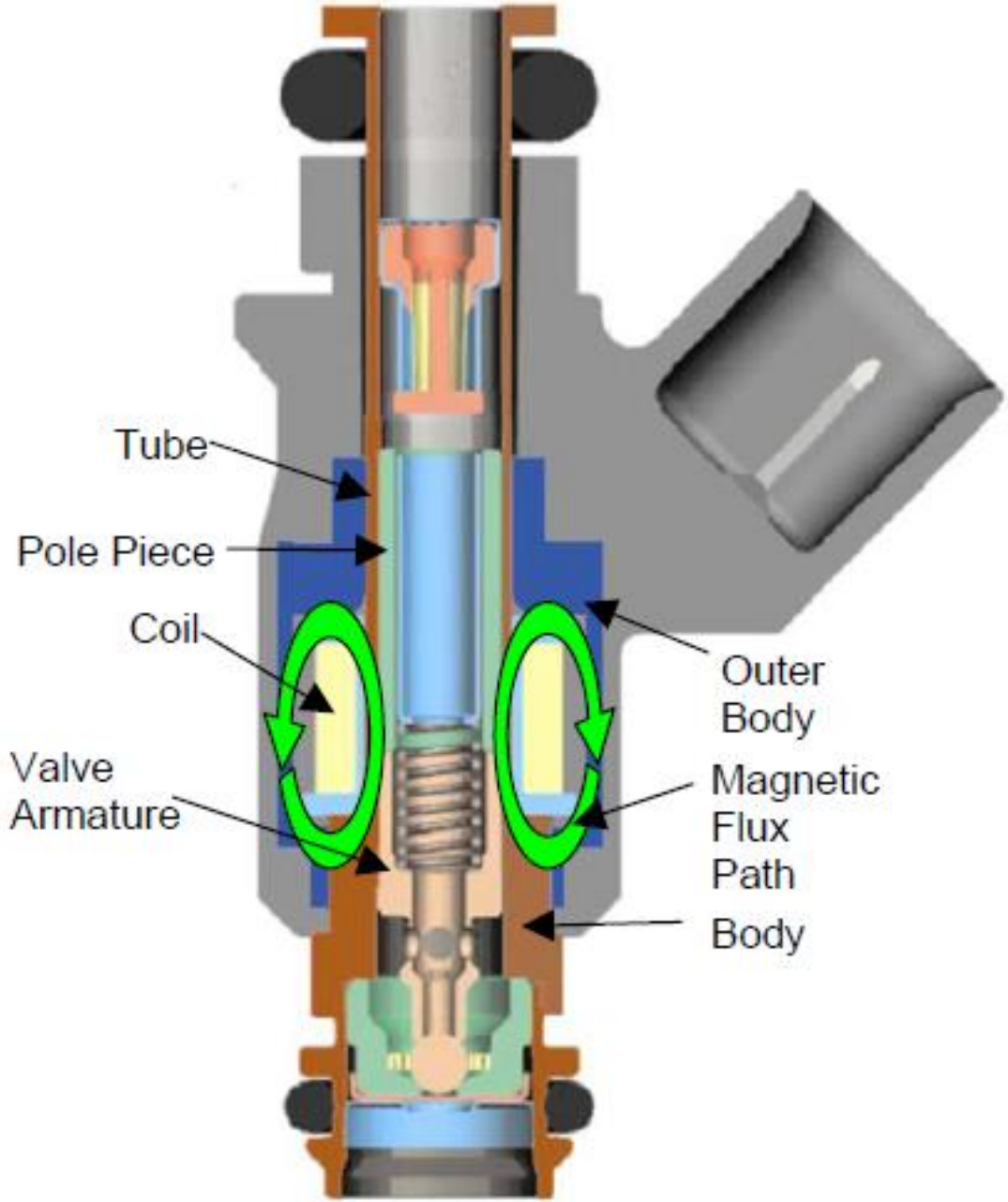
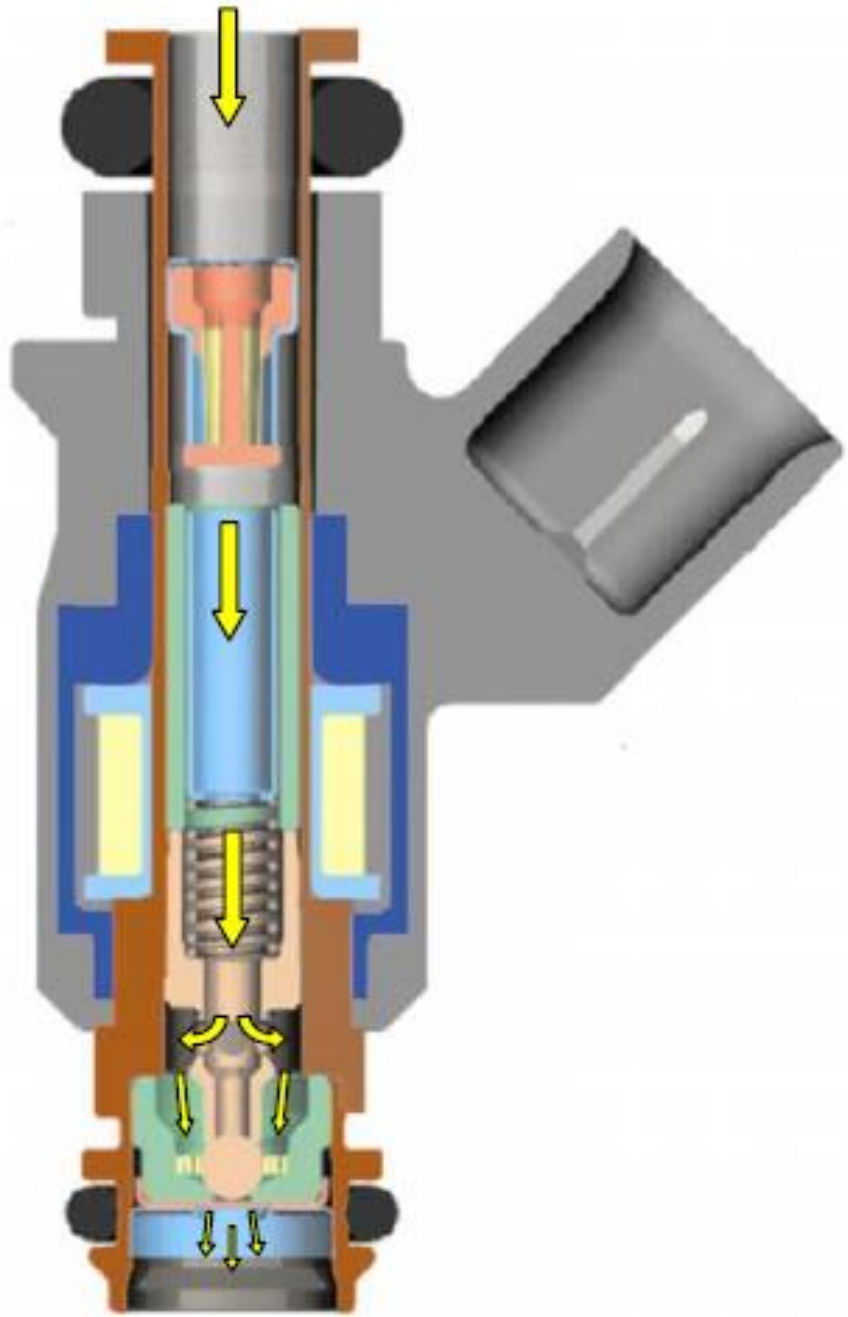
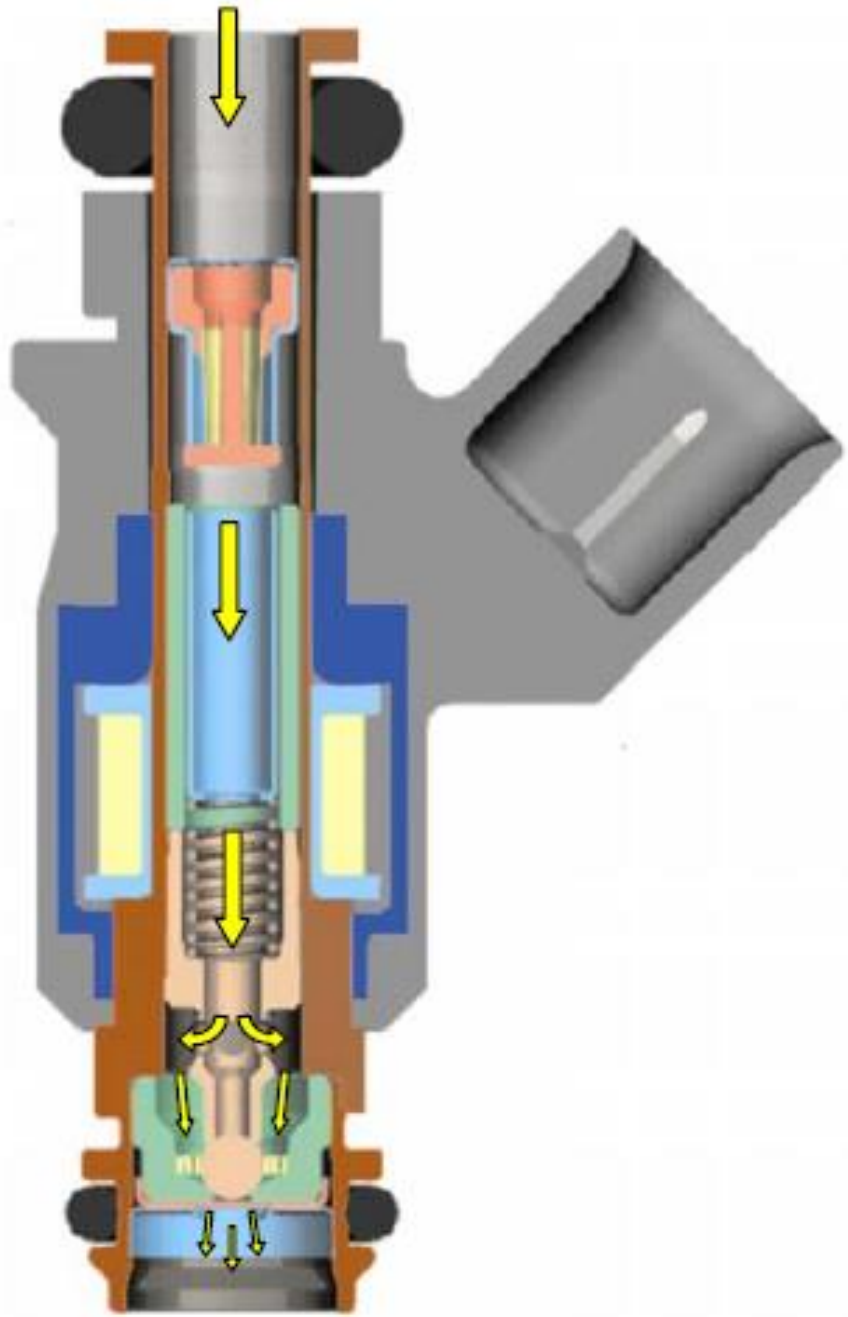


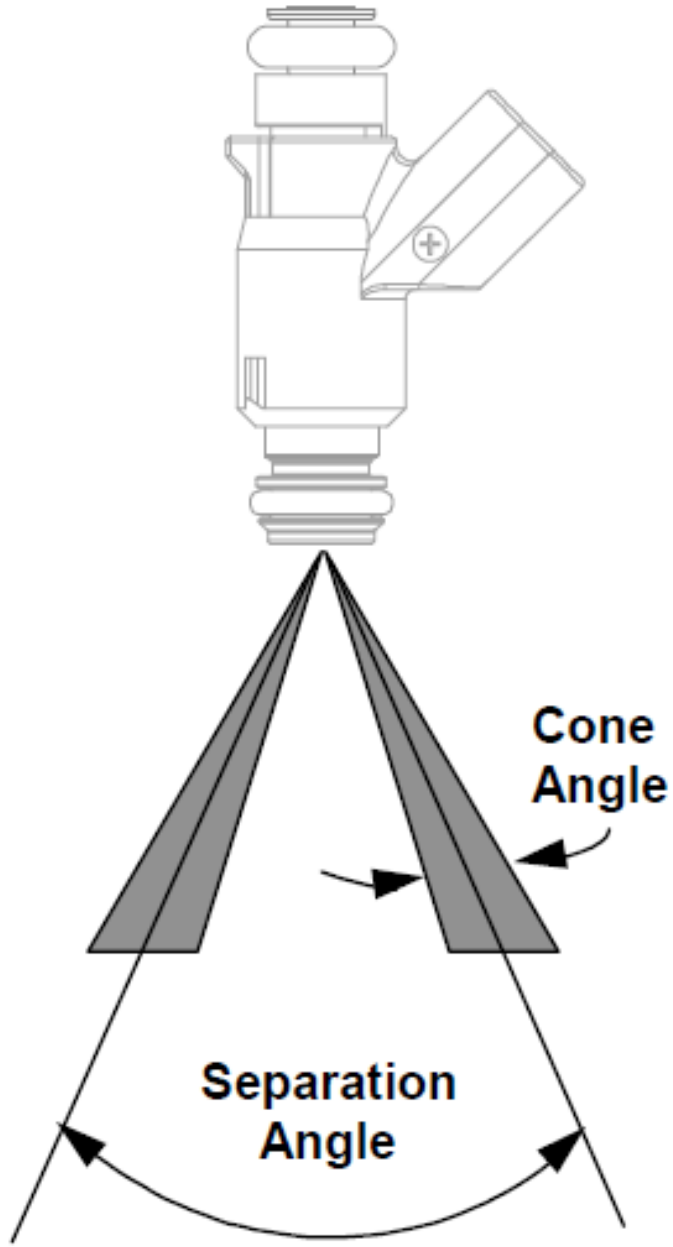
Figure 3-7 - Multec 3.5 Magnetic Circuit

Fuel Flow Path



Fuel Flow Path




Cone
Angle
Separation
Angle

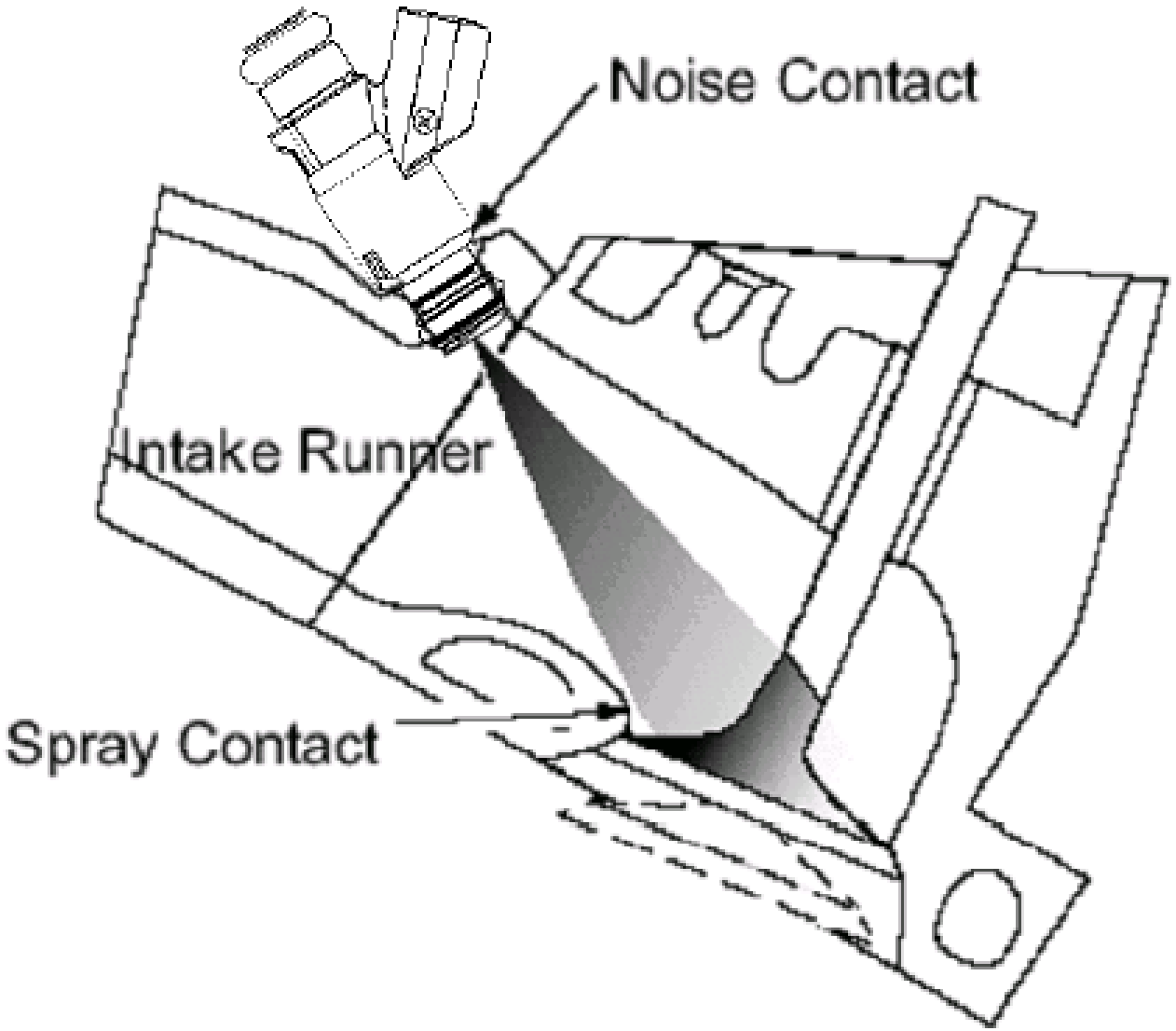
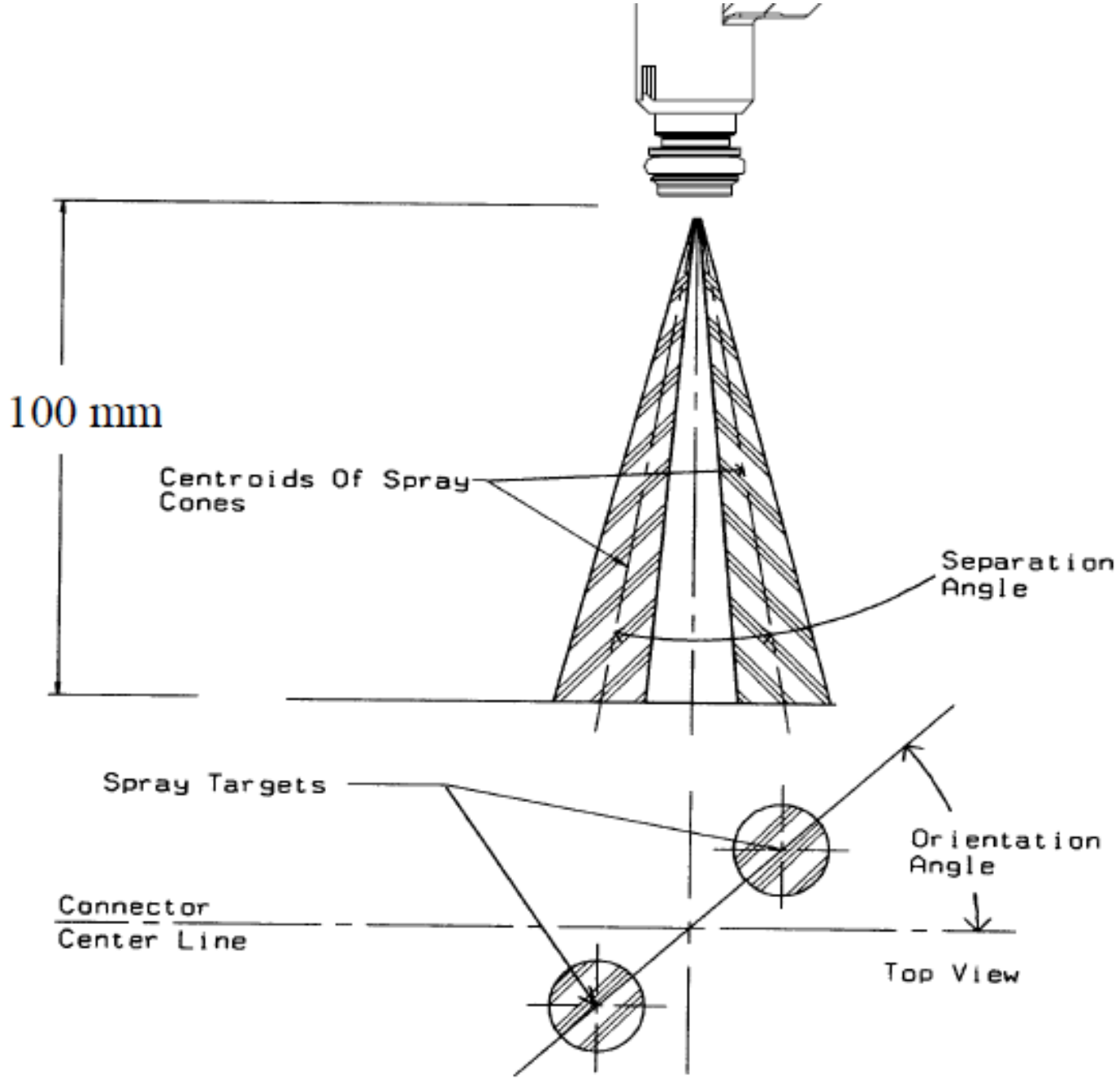
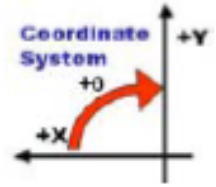


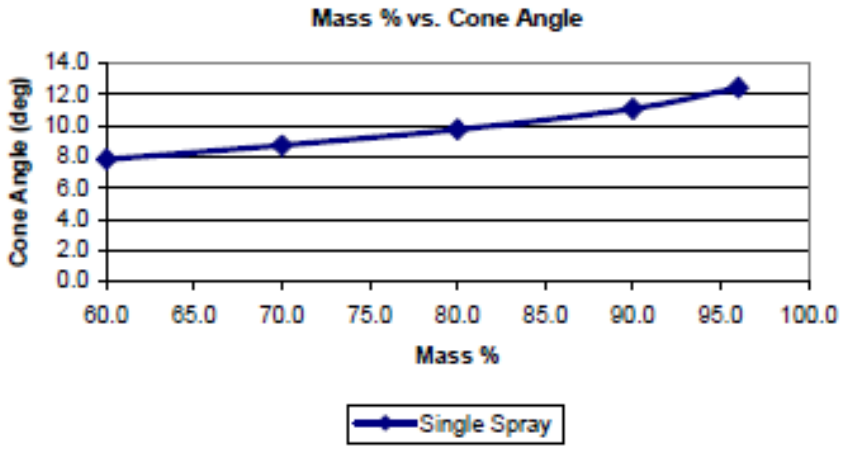
Figure 3-10 - Injector Targeting


100 mm
Centroids Of Spray Cones
Separation Angle
Spray Targets
Orientation Angle
Connector Center Line
Top View

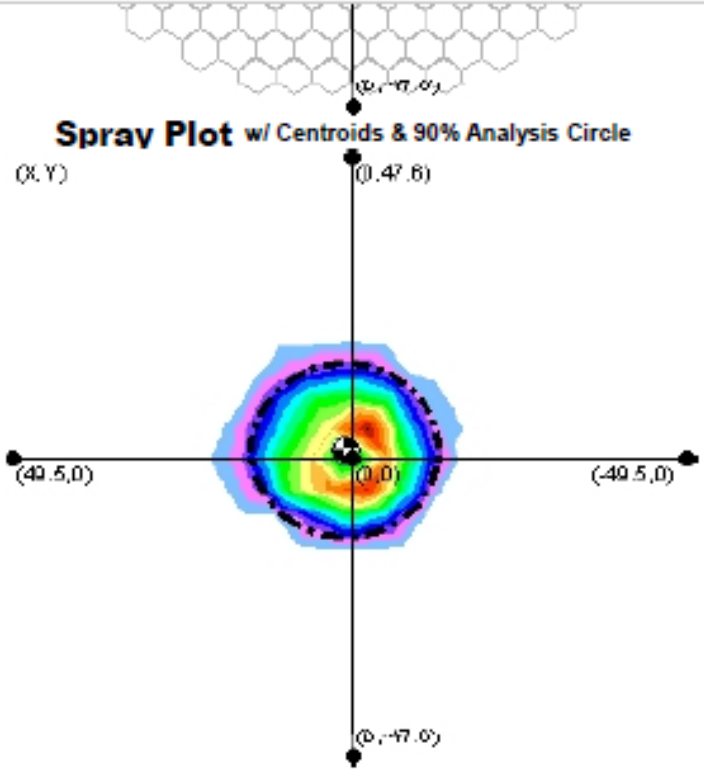
Mass % vs. Cone Angle

Mass%	Cone Angle
60.0	7.8
70.0	8.7
80.0	9.8
90.0	11.1
96.0	12.4





(% Transducer Volume)			
	0.0	to	6.3
	6.3	to	12.5
	12.5	to	18.8
	18.8	to	25.0
	25.0	to	31.3
	31.3	to	37.5
	37.5	to	43.8
	43.8	to	50.0
	50.0	to	56.3
	56.3	to	62.5
	62.5	to	68.8
	68.8	to	75.0
	75.0	to	81.3
	81.3	to	87.5
	87.5	to	93.8
	93.8	to	100.0



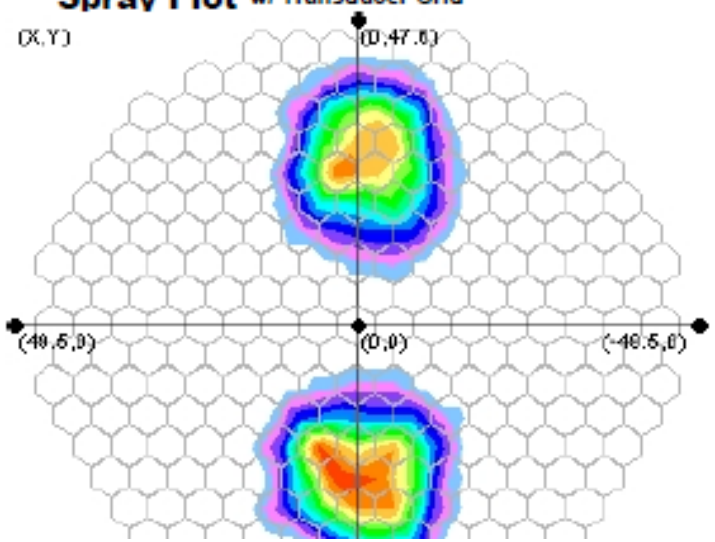
DELPHI

Test Description

Test EWO # :
Part # :
Serial # :
Fuel Type : N-HEPTANE
Part Descriptor : M3.5 Dual Spray

Spray Parameters

Injector Height : 100 mm (SLANT)
Connector Angle (θ) : 0°
Fuel Pressure : 380 kPa
Pulse Width : 5 ms
# of Pulses : 835
Captured Volume : 15.4 ml
Cone Angle 1 (α1) : 15.5° @ 90%
Cone Angle 2 (α2) : 15.0° @ 90%
Separation Angle (γ) : 26.6°
Volume Split (St. 1 / St. 2) : 48.0% / 52.0%
Centroid Location 1 (x,y) : (-1.7 mm, 25.5 mm)
Centroid Location 1 (r,θ) : (25.6 mm, 93.9°)
Centroid Location 2 (x,y) : (-0.8 mm, -23.0 mm)
Centroid Location 2 (r,θ) : (23.0 mm, 267.9°)



Cone Angle (α) vs. Mass %

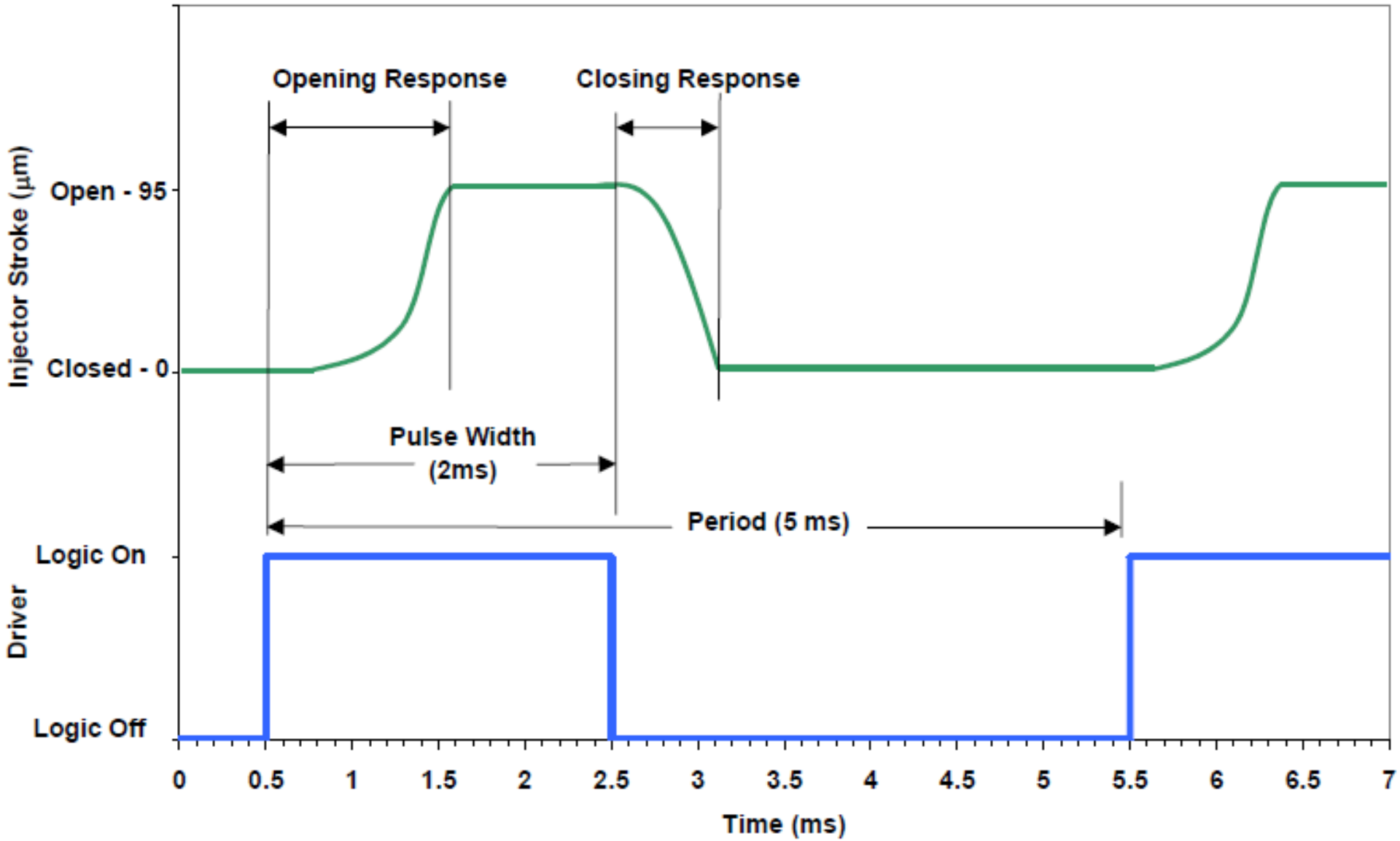
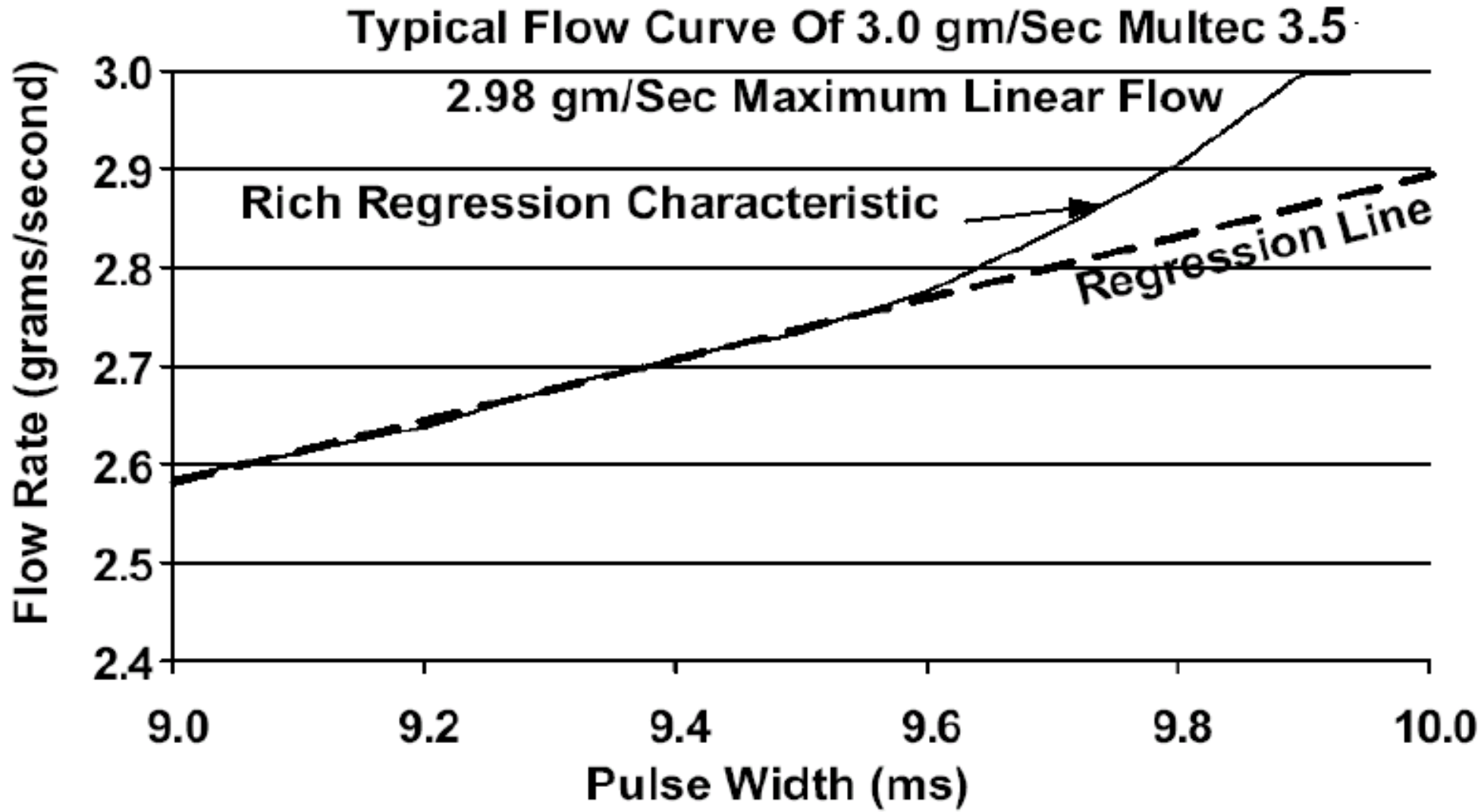
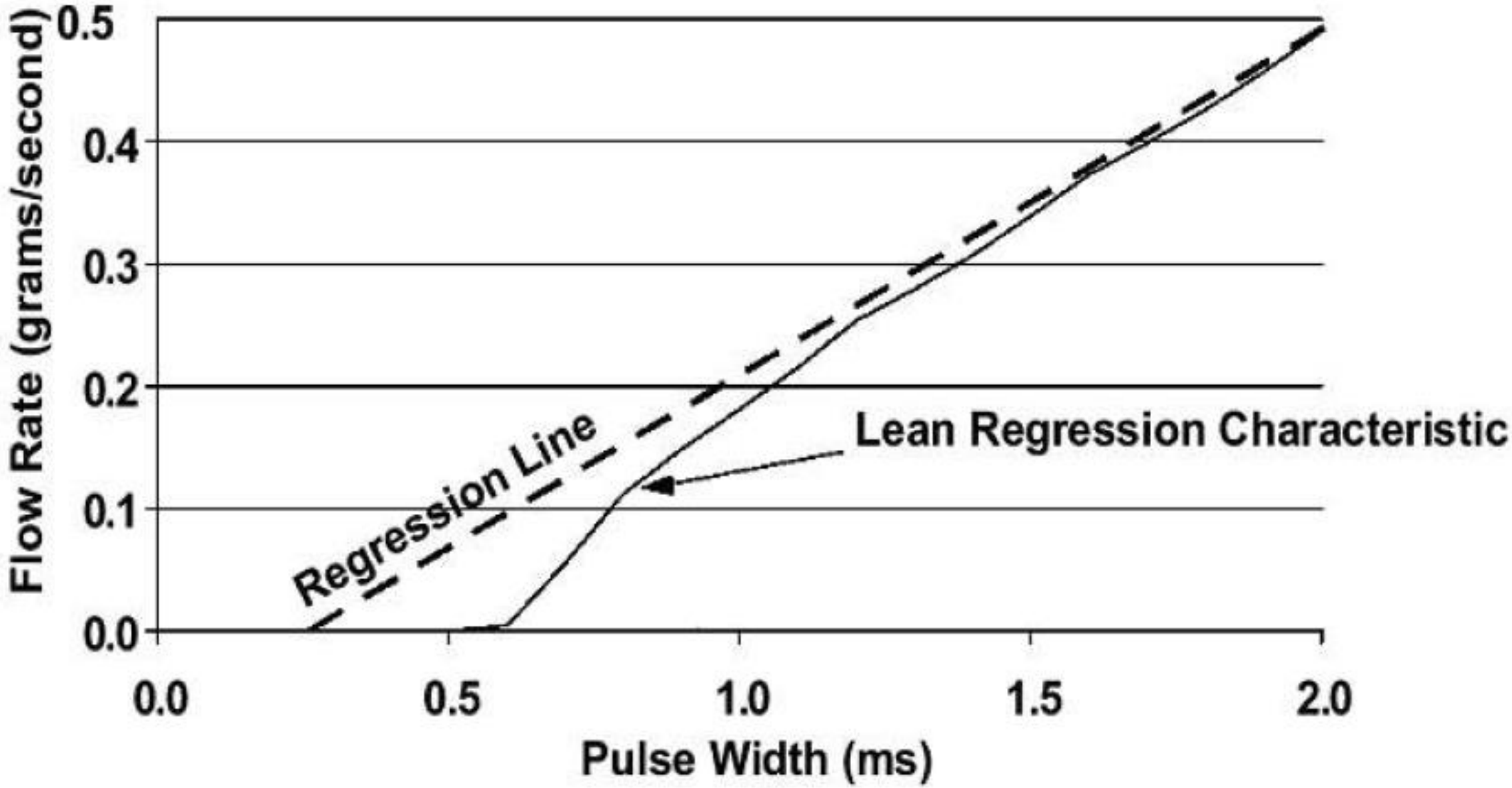
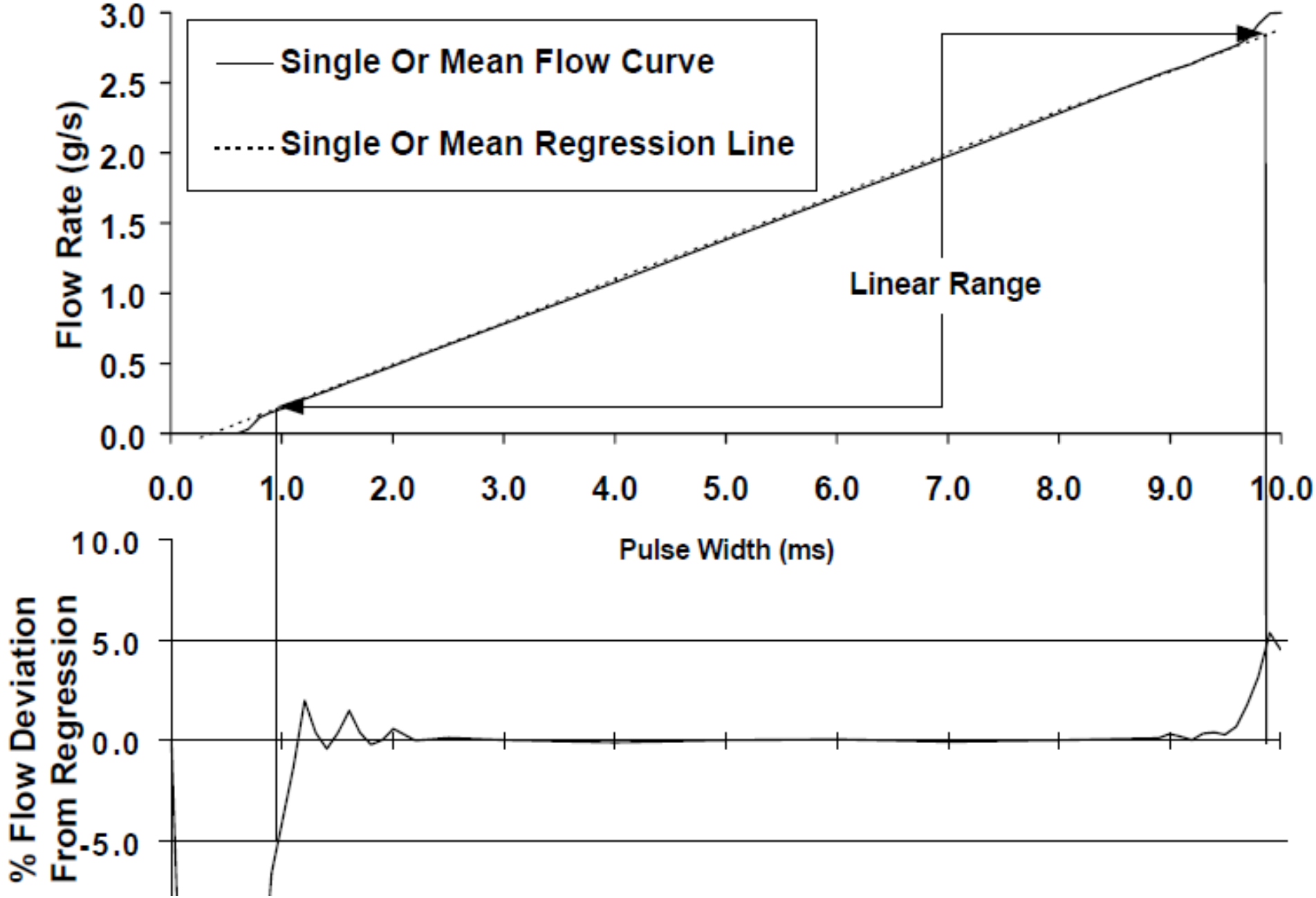


Figure 3-13 Injector Opening and Closing Response


Typical Flow Curve Of 3.0 gm/Sec Multec 3.5
2.98 gm/Sec Maximum Linear Flow
Rich Regression Characteristic
Regression Line
Flow Rate (grams/second)
3.0
2.9
2.8
2.7
2.6
2.5
2.4
9.0
9.2
9.4
9.6
9.8
10.0
Pulse Width (ms)


Flow Rate (grams/second)
0.5
0.4
0.3
0.2
0.1
0.0
Regression Line
Lean Regression Characteristic
0.0
0.5
1.0
1.5
2.0
Pulse Width (ms)


Single Or Mean Flow Curve
Single Or Mean Regression Line
Linear Range
Flow Rate (g/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Pulse Width (ms)
% Flow Deviation From Regression
10.0
5.0
0.0
-5.0

DRIVER

PS = Power Supply
FMD = Fuel Mode Device
SD = Sequential Driver

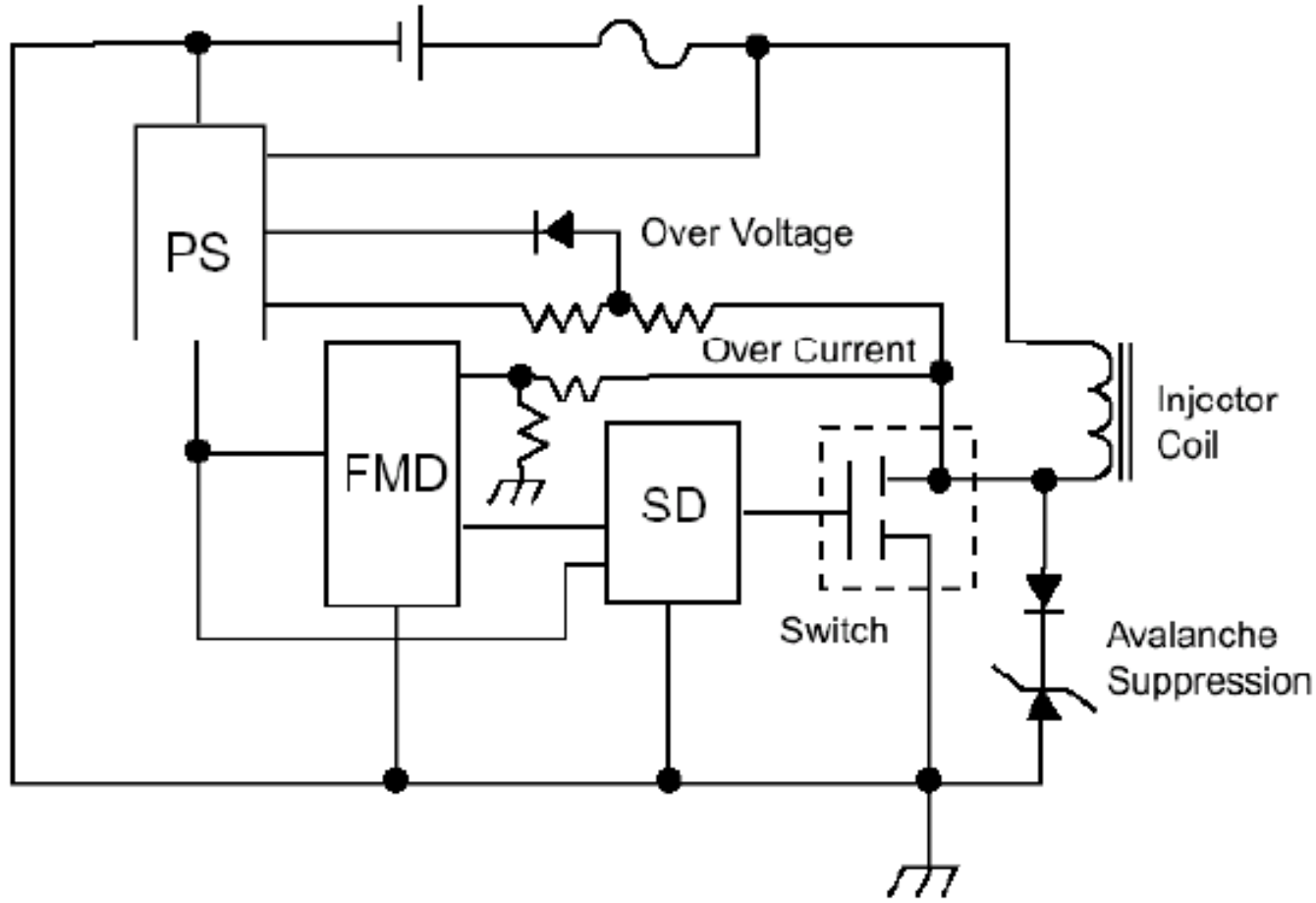


Figure 4-9 - Electrical schematic of saturated switch injector driver circuit