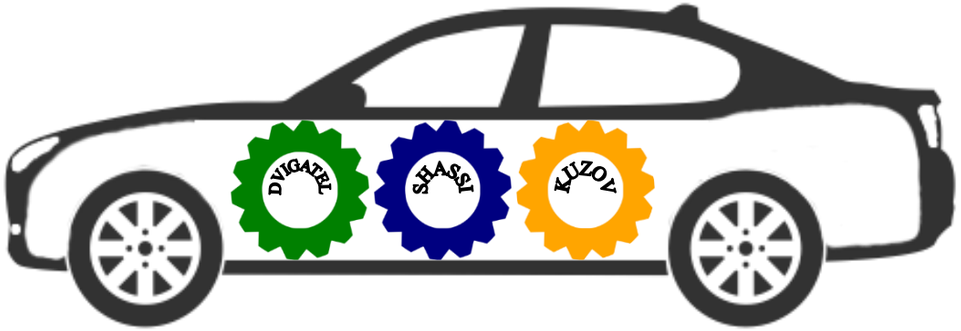
AVTOMOBILLAR KONSTRUKSIYASI



7-8th Topic: Fuel System.

(7-8-Mavzu: Ta’minlash tizimi)

Part 4

Associate Professor: Yusupov Sarvarbek

7-8-Mavzu: Ta’minlash tizimi

(7-8th Topic: Fuel System.)

O‘quv rejasi:

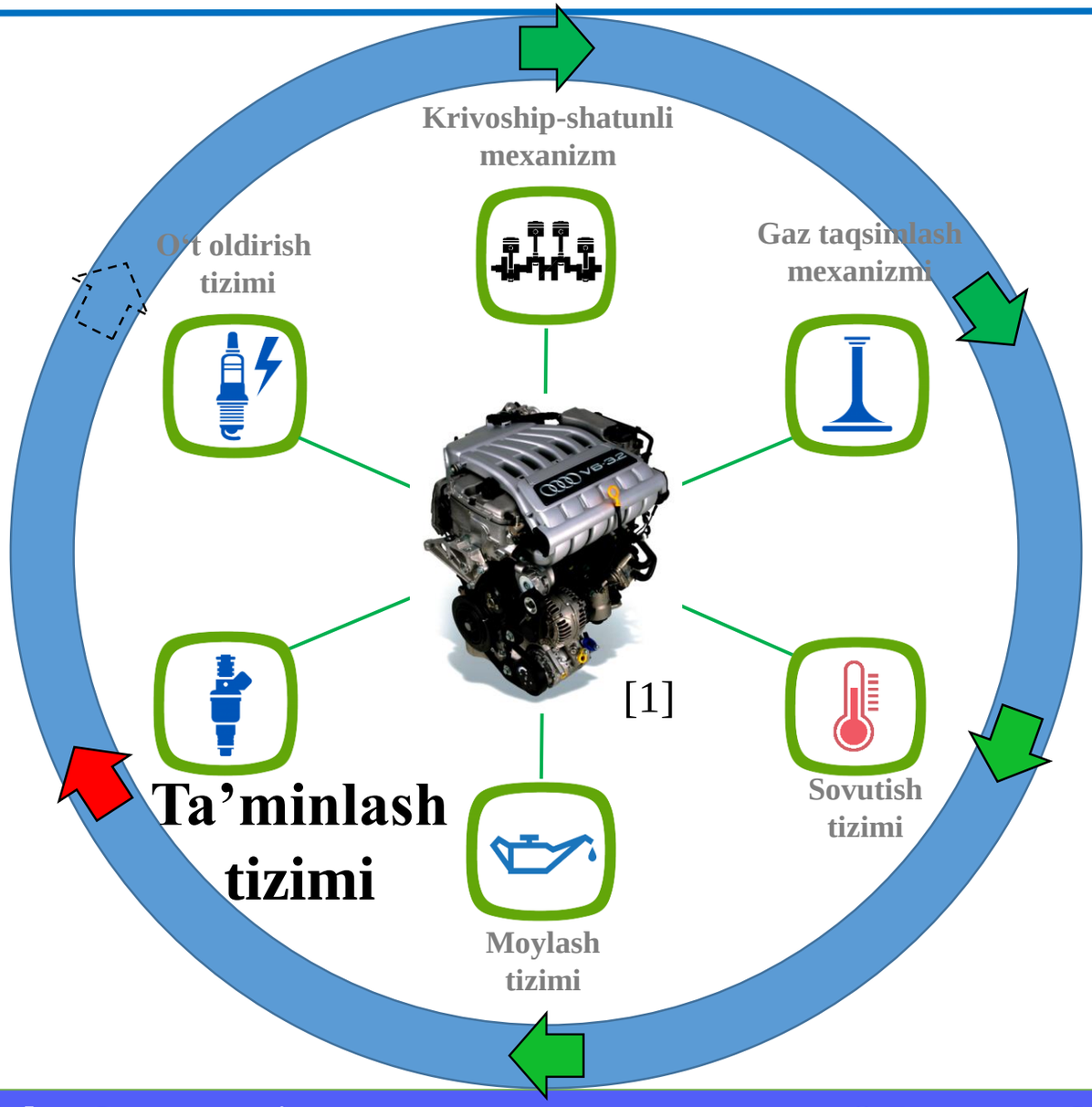
7.5. Gaz bilan ishlaydigan dvigatellarning ta’minlash tizimi.

7.6. Gaz bilan ta’minlash tizimi qismlarining konstruksiyasi va ishlashi.

7.7. Injektorli dvigatellarning zamonaviy yonilg‘i purkash tizimi.

7.8. Injektorli yonilg‘i purkash tizimi qismlarining konstruksiyasi va ishlashi.

- Karbyuratorli dvigatel;
- Dizel dvigatel;
- Gazli dvigatel;
  - **Injektorli dvigatel.**



[1]

7.7. Injektorli dvigatellarning zamonaviy yonilg‘i purkash tizimi.

Ichki yonuv dvigatellarining **ta’minlash tizimida** yonilg‘i aralashmasini tayyorlash sifati:

- **dvigatellarning quvvatiga;**
- **burovchi momentiga;**
- **yonib bo‘lgan chiqindi gazlarning tarkibiga ta’sir ko‘rsatadi.**

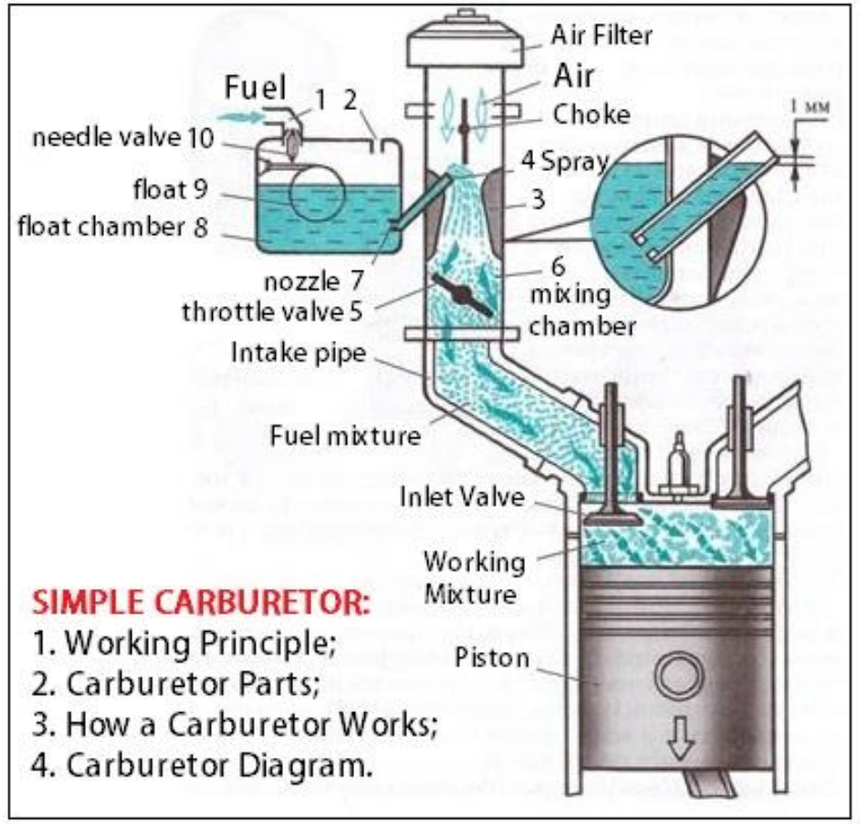
Karbyuratorli yonilg‘i ta’minlash tizimi bir vaqtning o‘zida
- **quvvatni;**
- **momentni;** ⬆ holda **yonilg‘i tejamkorligini** ⬆

va **chiqindi gazlarni** ✕ bo‘yicha qo‘yiladigan talabga javob bera olmaydi.

Karbyuratorli dvigatellarning ta’minlash tizimini asosiy

kamchiligi quyidagilardan iborat:

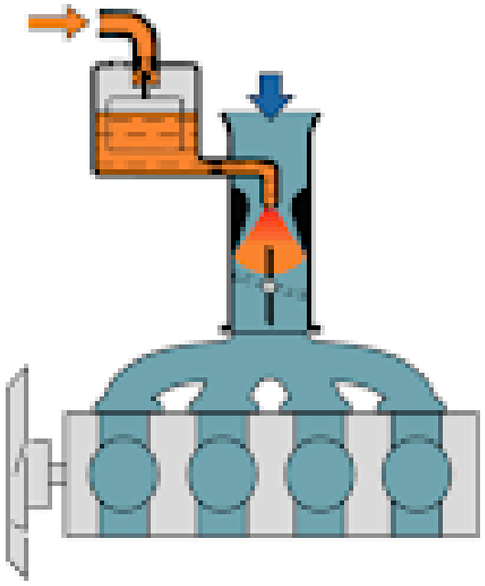
- Silindrlar soni karbyuratordan har xil masofada joylashgan;
- Yonilg‘i aralashmasi karbyuratorda tayyorlanadi va silindrlarga tayyor aralashma uzatiladi.



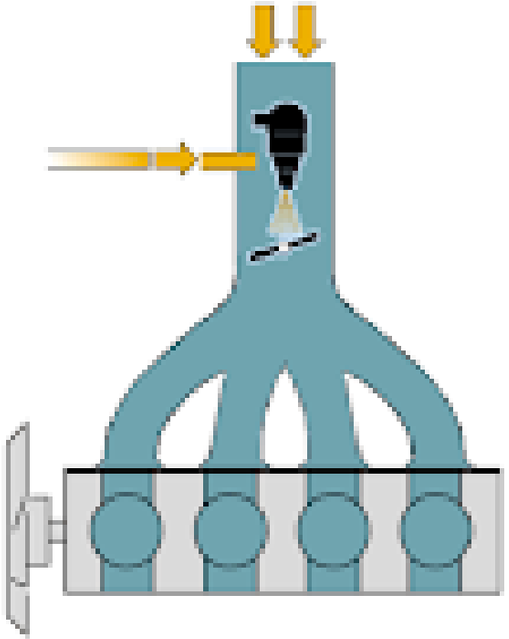
[94]

Bu kamchiliklar natijasida silindrlarga har xil tarkibdagi **yonilg‘i aralashmasi** yetib boradi va **yonilg‘i sarfi oshadi.**

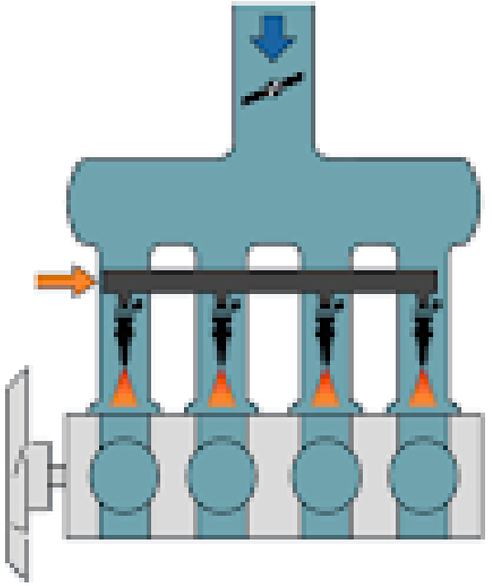
Bu kamchiliklarni yo‘qotish uchun yonilg‘i aralashmasini har bir silindr oldida tayyorlash kerak bo‘ladi.



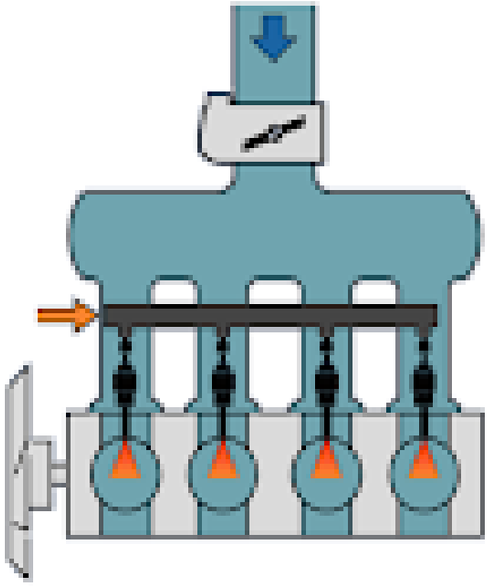
Karbyurator



Drossel ustida purkash



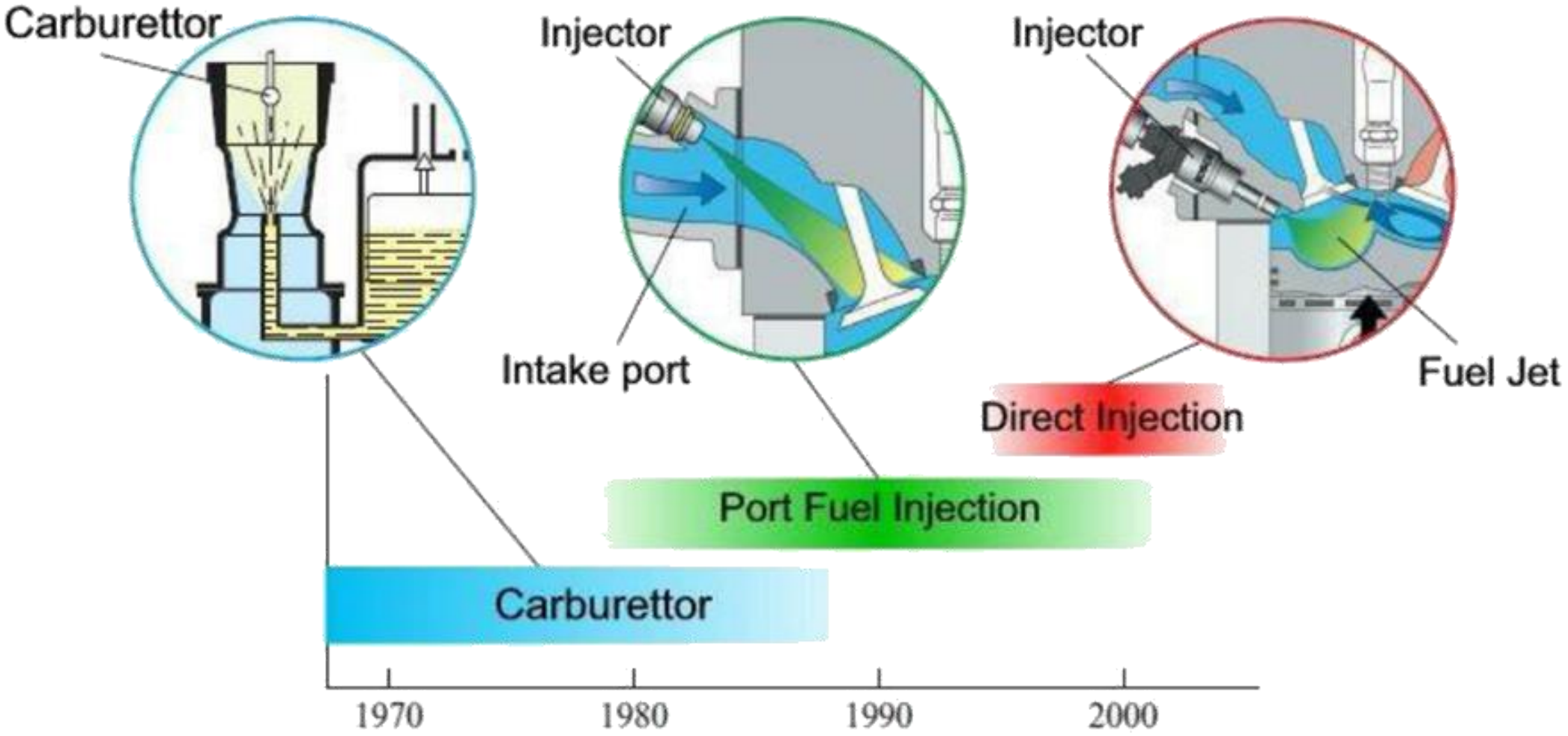
Kiritish quvurida purkash



Silindrlarga to‘g‘ridan-to‘g‘ri purkash

[95]

Yonilg‘i purkash tizimining rivojlanish tarixi.



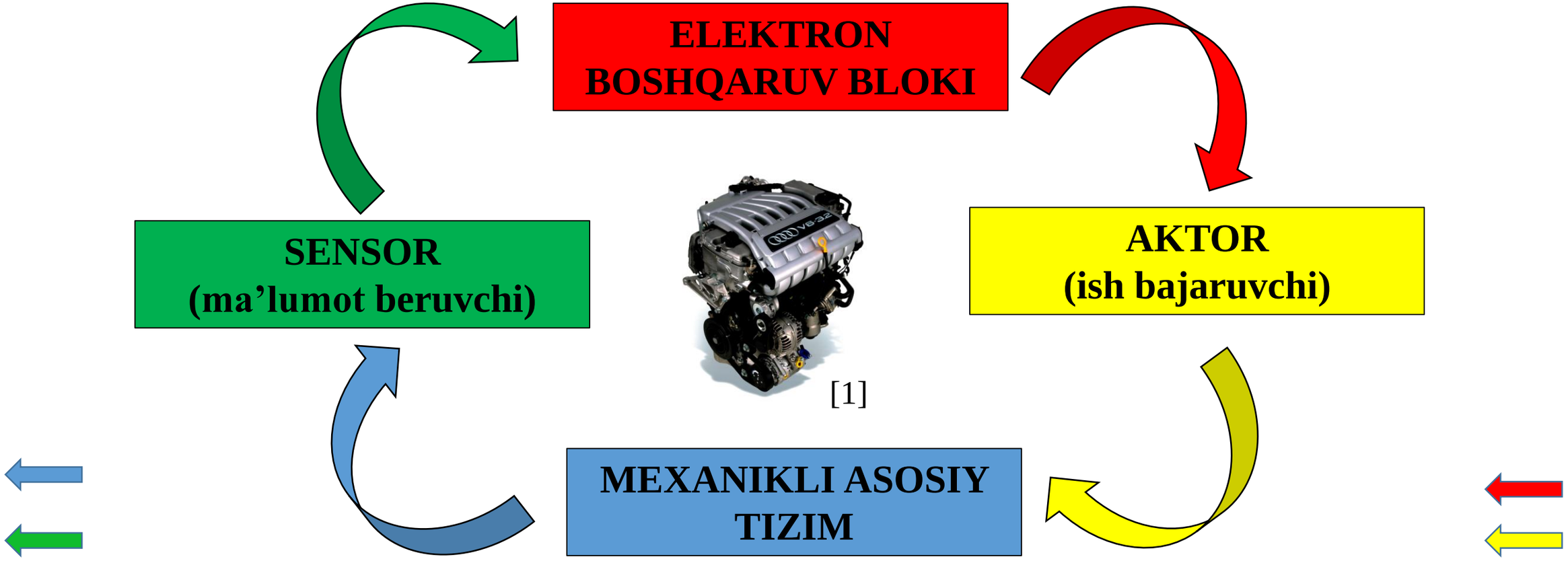
[96]

Zamonaviy avtomobil dvigatellarida har bir silindrning kiritish klapanlari yaqinida yonilg‘i aralashmasini tayyorlaydigan elektron yonilg‘i purkash tizimi qo‘llaniladi.

Elektron yonilg‘i purkash tizimi quyidagi afzalliklarga ega:

- **Tezkor, chunki raqamli mikroprotsessor boshqaradi;**
- **Yonilg‘i aralashmasi aniq tarkibga ega;**
- **Yonilg‘i aralashmasi tarkibini uzoq muddat bir xil ushlab turish mumkin;**
- **Yuqori yonilg‘i tejamkorligini ta’minlaydi;**
- **Chiqindi gazlarning zararli ta’sirini kamaytiradi.**

Zamonaviy avtomobilning barcha tizimlarida ma’lumotlarni almashinishining funksional ko‘rinishi



Elektron boshqaruvli yonilg‘i purkash tizimi.

Zamonaviy avtomobil dvigatellarining ta’minlash tizimida K-jetronik, KE-jetronik, L-jetronik yonilg‘i purkash tizimlari qo‘llaniladi.

Ishlash prinsipiga ko‘ra yonilg‘i purkash tizimlarini quyidagi 5 ta asosiy guruhga bo‘lish mumkin:

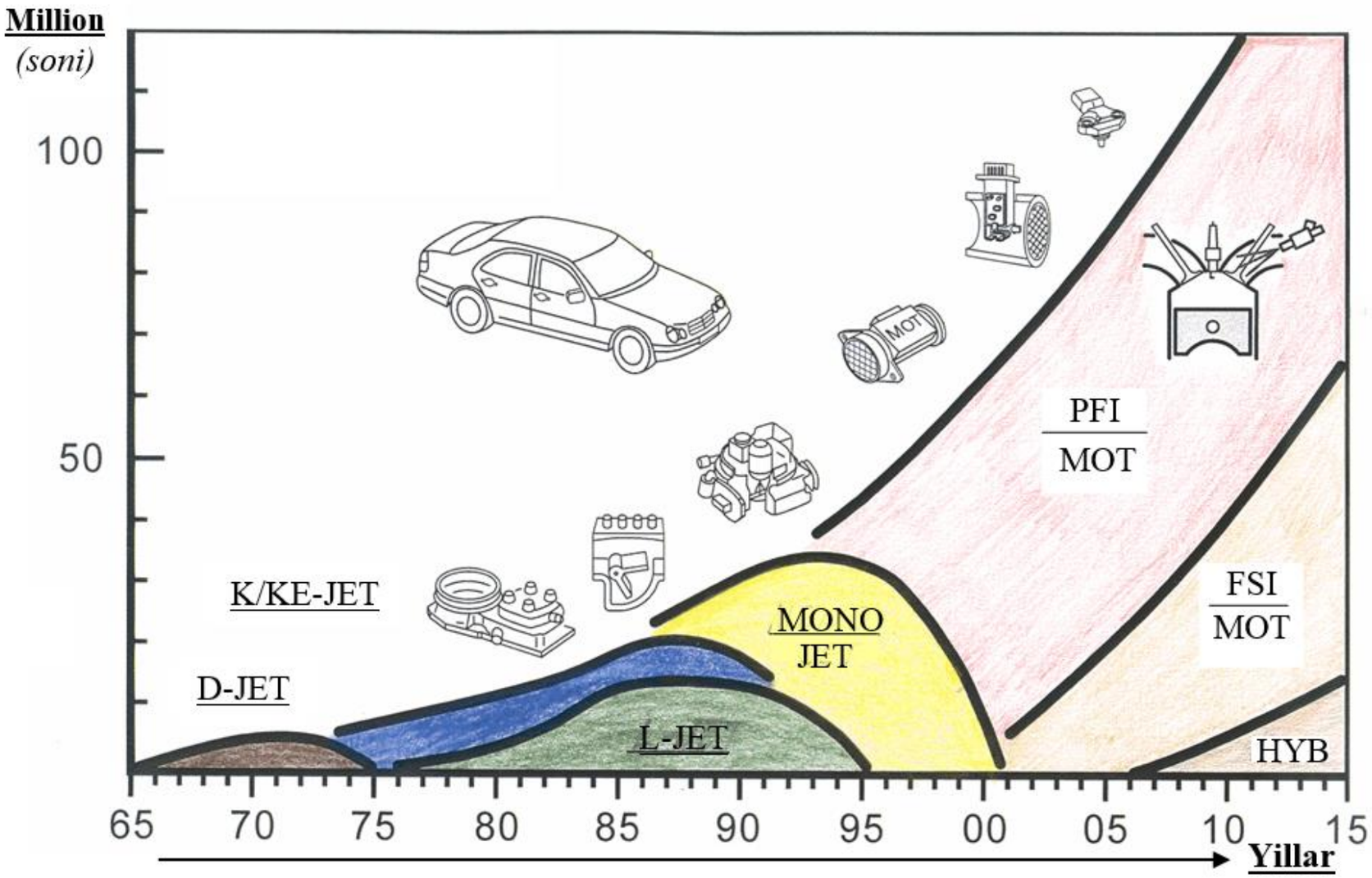
- **“K”;**
- **“Mono”;**
- **“L”;**
- **“M”;**
- **“D”.**

- Jetronik:

K-Jetronik:

- **K**-nemischa kontiniuerlich (uzluksiz);
- **Jet**- ingilizcha oqim;
- **ronik**- zamonaviy texnik atamalarning an’anaviy yakuni sifatida qabul qilingan.

Yonilg‘i purkash tizimiga kiruvchi guruhlarning tendensiyasi.

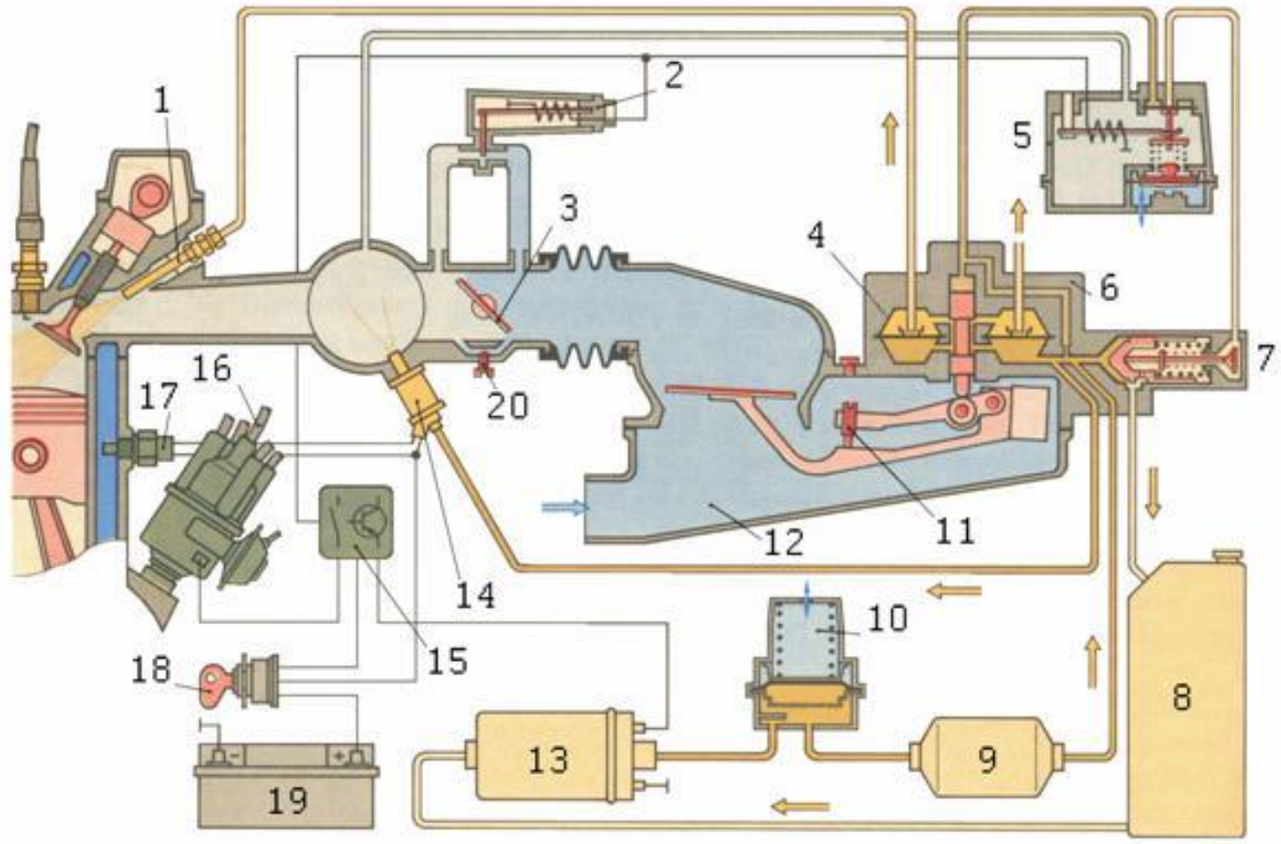


[97]

K - guruhiga ko‘p nuqtali, mexanik uzluksiz yonilg‘i purkash tizimlari kiradi.

K-Jetronik, KE- Jetronik. Bu tizimlar 1989 yilgacha ishlab chiqarilgan.

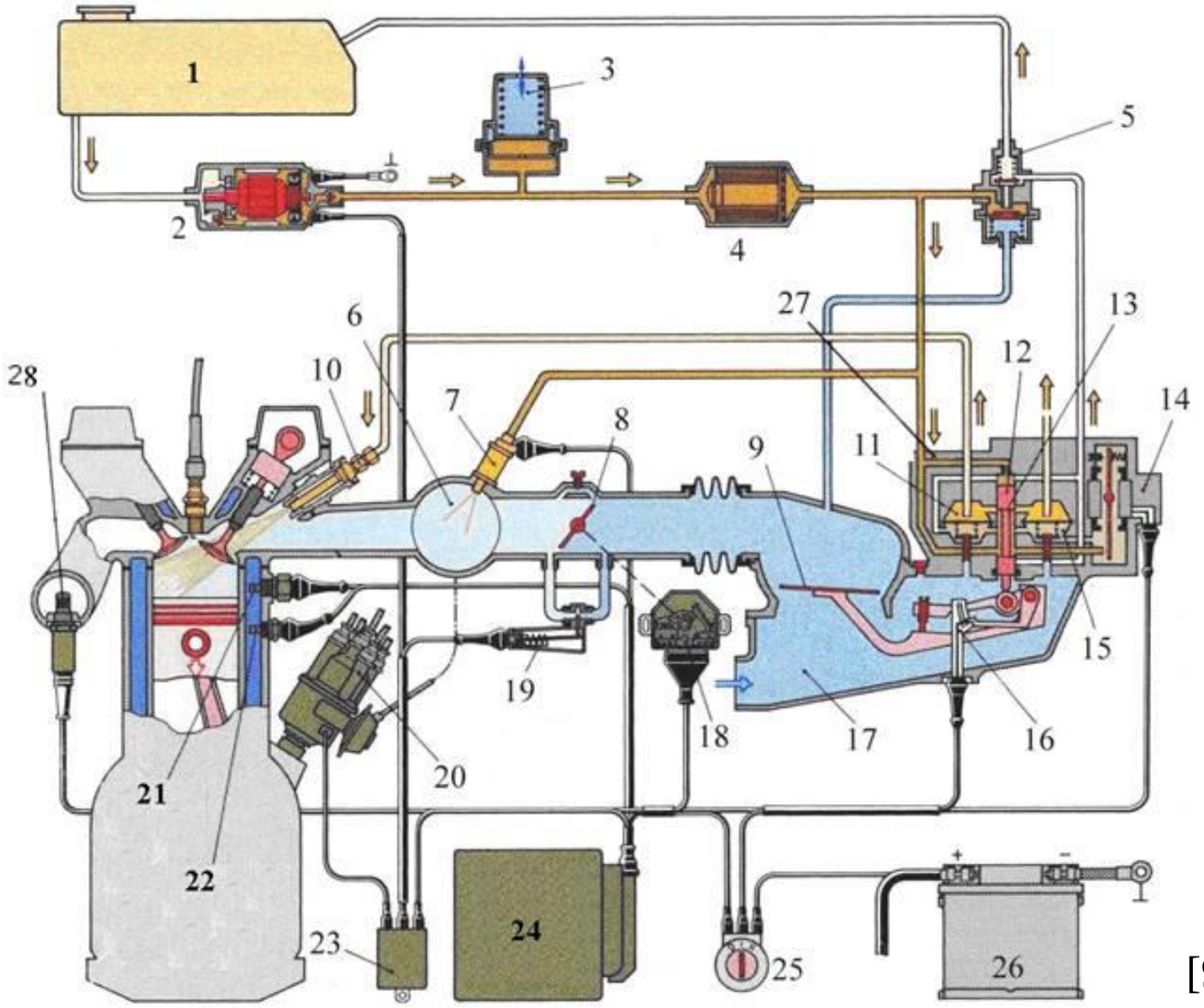
1 – клапанная форсунка; 2 – клапан подачи дополнительного воздуха; 3 – дроссельная заслонка; 4 - дифференциальный клапан; 5 – регулятор управляющего давления; 6 – дозатор топлива; 7 – регулятор давления топлива в системе; 8 – топливный бак; 9 – топливный фильтр; 10 – накопитель топлива; 11 – регулировочный винт качества смеси; 12 – расходомер воздуха; 13 – топливный насос с электрическим приводом; 14 – пусковая форсунка; 15 – реле включения топливного насоса; 16 – прерыватель-распределитель; 17 – термореле; 18 – замок зажигания; 19 - аккумуляторная батарея; 20 – регулировочный винт количества смеси



[98]

KE- Jetronik yonilg‘i purkash tizimi.

1 – топливный бак; 2 – топливный насос с электрическим приводом; 3 – накопитель топлива; 4 - топливный фильтр; 5 – регулятор давления топлива в системе; 6 – впускной трубопровод; 7 – пусковая форсунка; 8 – дроссельная заслонка; 9 – напорный диск расходомера воздуха; 10 – клапанная форсунка; 11 – верхняя камера дифференциального клапана; 12 – распределитель; 13 – отсечная кромка распределителя; 14 – электрогидравлический регулятор управляющего давления; 15 – нижняя камера дифференциального клапана; 16 – датчик положения напорного диска расходомера воздуха; 17 – расходомер воздуха; 18 – датчик положения дроссельной заслонки; 19 – клапан подачи дополнительного воздуха; 20 – прерыватель-распределитель; 21 – термореле; 22 – датчик температуры охлаждающей жидкости; 23 – реле включения топливного насоса; 24 – электронный блок управления; 25 – замок зажигания; 26 – аккумуляторная батарея; 27 – дозатор топлива; 28 – датчик кислорода в отработавших газах.

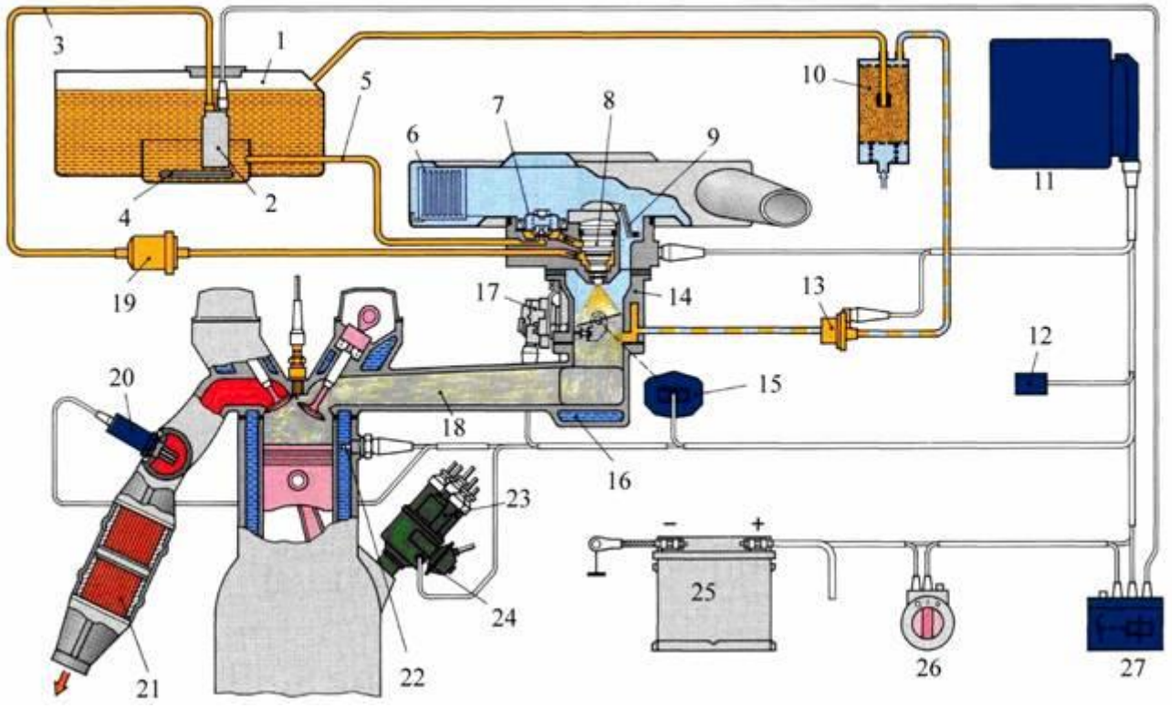


[99]

Mono guruhi markaziy (bir nuqtali), impulsli elektron bloki yordamida boshqariladigan purkash tizimlaridan tashkil topgan.

Mono-Jetronik

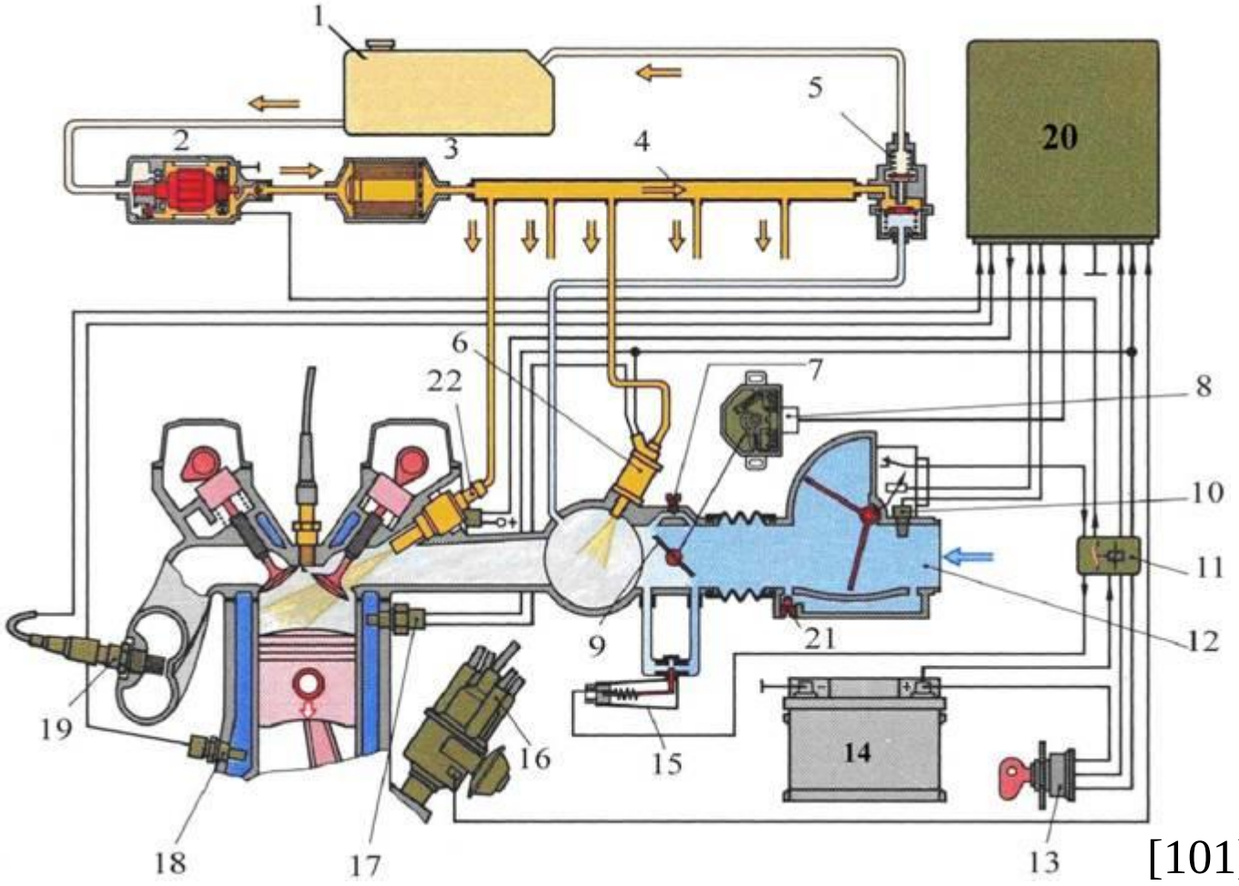
1 – топливный бак; 2 – топливный насос с электрическим приводом; 3 – трубопровод, подающий топливо; 4 - топливозаборник; 5 – сливной трубопровод; 6 – воздушный фильтр; 7 – регулятор давления топлива; 8 – форсунка; 9 - датчик температуры всасываемого воздуха; 10 – резервуар с угольным абсорбентом для сбора паров топлива; 11 – электронный блок управления; 12 – разъем для подключения диагностического оборудования; 13 – продувочный клапан резервуара с угольным абсорбентом; 14 – блок центрального впрыска; 15 – датчик положения дроссельной заслонки; 16 – жидкостный подогреватель впускного трубопровода; 17 – регулятор положения дроссельной заслонки; 18 – впускной трубопровод; 19 – топливный фильтр; 20 – лямбда-зонд; 21 – каталитический нейтрализатор; 22 – датчик температуры охлаждающей жидкости; 23 – распределитель зажигания; 24 – прерыватель зажигания; 25 - аккумуляторная батарея; 26 – выключатель зажигания; 27 – реле топливного насоса.



[100]

L - guruhiga elektron blok yordamida boshqariladigan, ko‘p nuqtali, impulsli yonilg‘i purkash tizimlari kirib, ular zamonaviy avtomobillarda eng keng tatbiq topgan. **L- Jetronik**

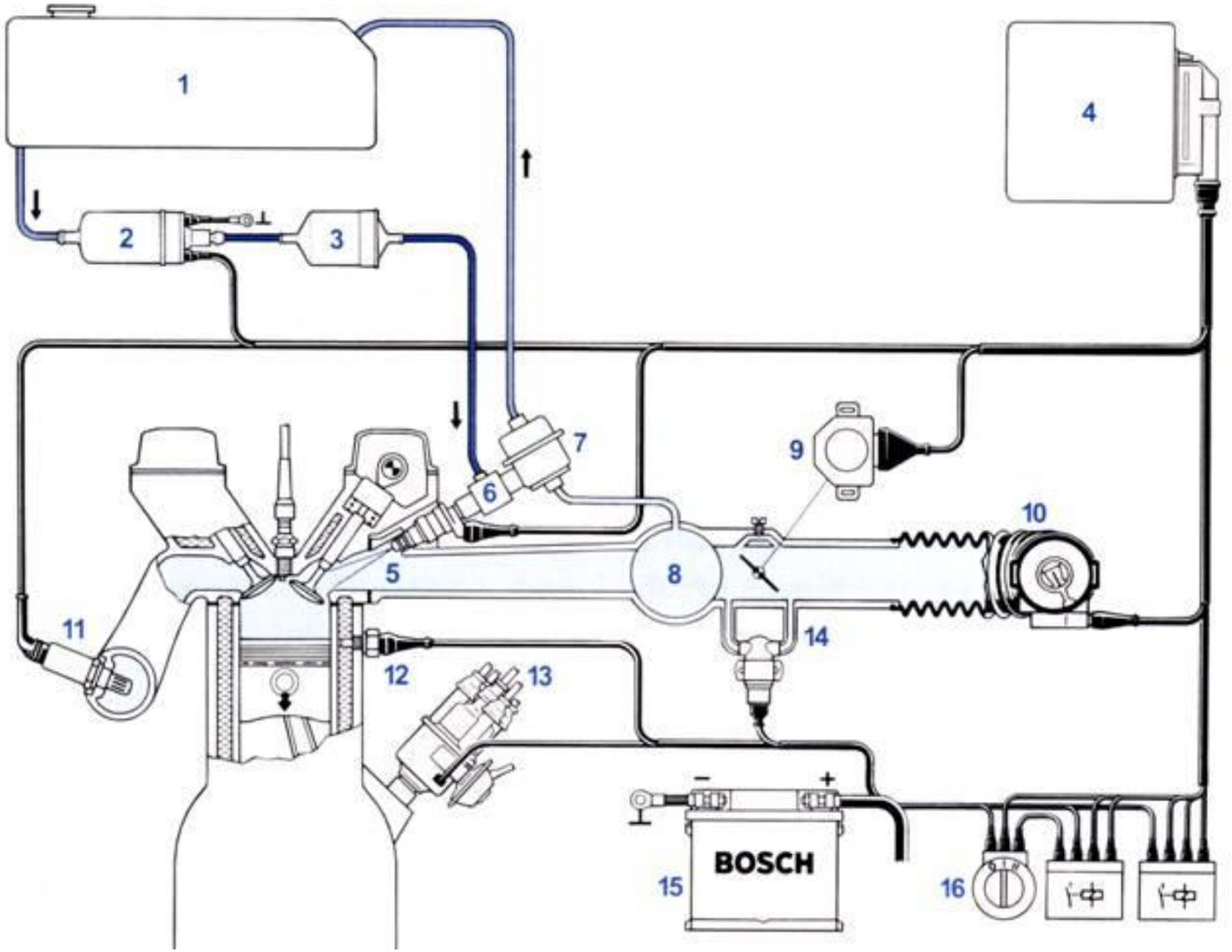
1 – топливный бак; 2 – топливный насос с электрическим приводом; 3 – топливный фильтр; 4 – распределительный трубопровод; 5 – регулятор давления; 6 – пусковая форсунка; 7 – регулировочный винт количества смеси; 8 – датчик положения дроссельной заслонки; 9 – дроссельная заслонка; 10 – датчик температуры воздуха; 11 – реле включения топливного насоса; 12 – расходомер воздуха; 13 – замок зажигания; 14 – аккумуляторная батарея; 15 – клапан подачи дополнительного воздуха; 16 – прерыватель-распределитель; 17 – термореле; 18 – датчик температуры охлаждающей жидкости; 19 – лямбда-зонд; 20 – электронный блок управления; 21 – регулировочный винт качества смеси; 22 – клапанная форсунка



[101]

LH- Jetronik yonilg‘i purkash tizimi.

1 – топливный бак; 2 – топливный насос с электрическим приводом; 3 – топливный фильтр; 4 – электронный блок управления; 5 – клапанная форсунка; 6 – распределительный трубопровод; 7 – регулятор давления топлива; 8 - впускной трубопровод; 9 – датчик положения дроссельной заслонки; 10 – термоанемометрический датчик массового расхода воздуха; 11 – лямбда-зонд; 12 – датчик температуры охлаждающей жидкости; 13 – прерыватель-распределитель; 14 – клапан дополнительной подачи воздуха; 15 – аккумуляторная батарея; 16 – выключатель зажигания



[102]

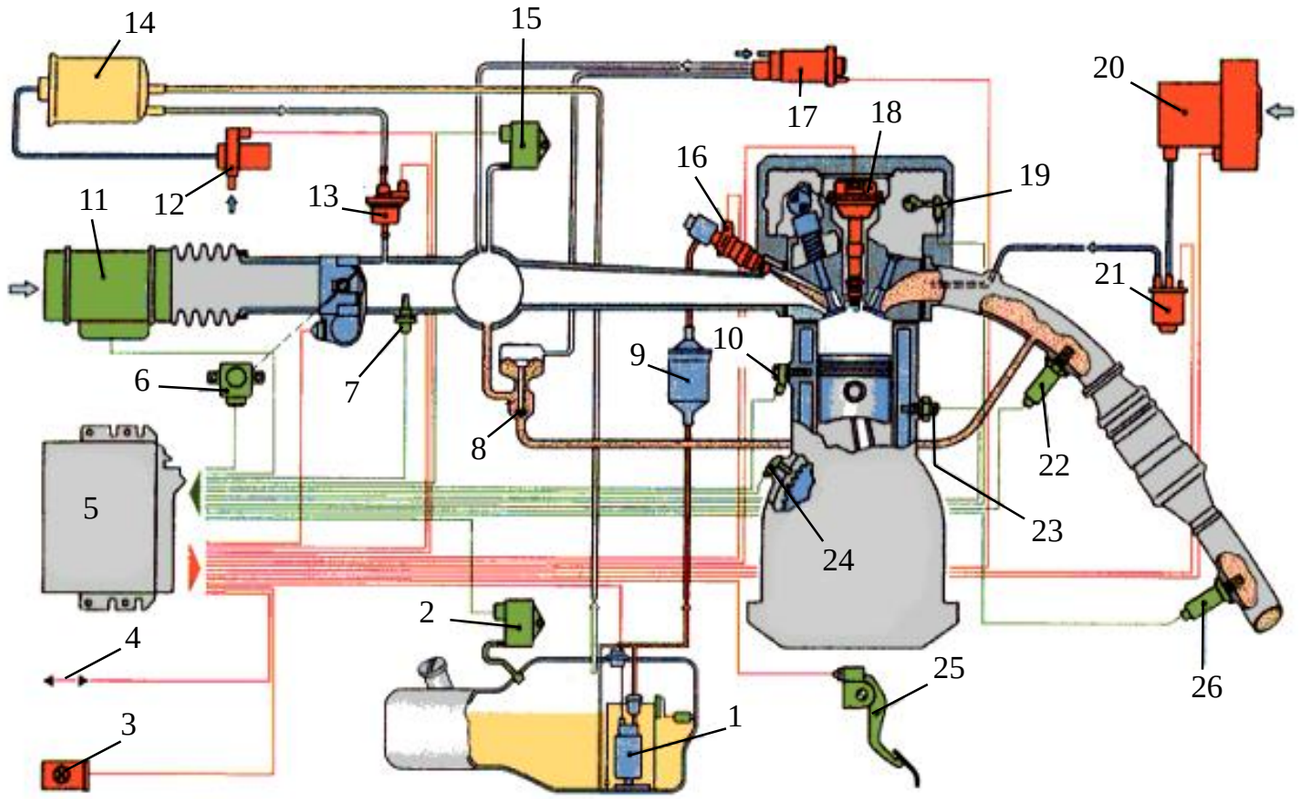
M - guruhi dvigatelni avtomatik boshqarish elektron tizimi tarkibidagi

L yoki **M** guruhining yonilg‘i purkash tizimi.

Bu guruhga kirgan tizimlarda yonilg‘i purkash va o‘t oldirish jarayonlari birgalikda boshqariladi.

ME-Motronik

1-elektr yonilg‘i nasosi, 2-bosim farqi datchigi, 3-diagnostika lampasi, 4-diagnostikalash uchun ulash joyi, 5-elektron boshqarish bloki, 6-drossel to‘smaqoqog‘i holati datchigi, 7-havo kiritish quqvridagi absolyut bosim datchigi, 8-chiqindi gazlarni risekulyatsiyalash klapani, 9-yonilg‘i filtri, 10-shovqin datchigi, 11-havoning yalpi sarfi datchigi, 12-havo kiritish klapani, 13-adsorberni uchqunlatish klapani, 14-adsorber, 15-havo kiritiish quvuridagi bosim datchigi, 16-injektor, 17-riserkulyatsiya klapani bosimini sozlagich, 18-o‘t oldirish g‘altagi, 19-taqsimlash val holati datchigi, 20-qo‘shimcha havo nasosi, 21-qo‘shimcha havo klapani, 22-26-kislorod datchigi (λ-zond), 23-dvigatel harorati datchigi, 24-tirsakli val aylanishlar sonini sinxronlash datchigi, 25-gaz pedali.

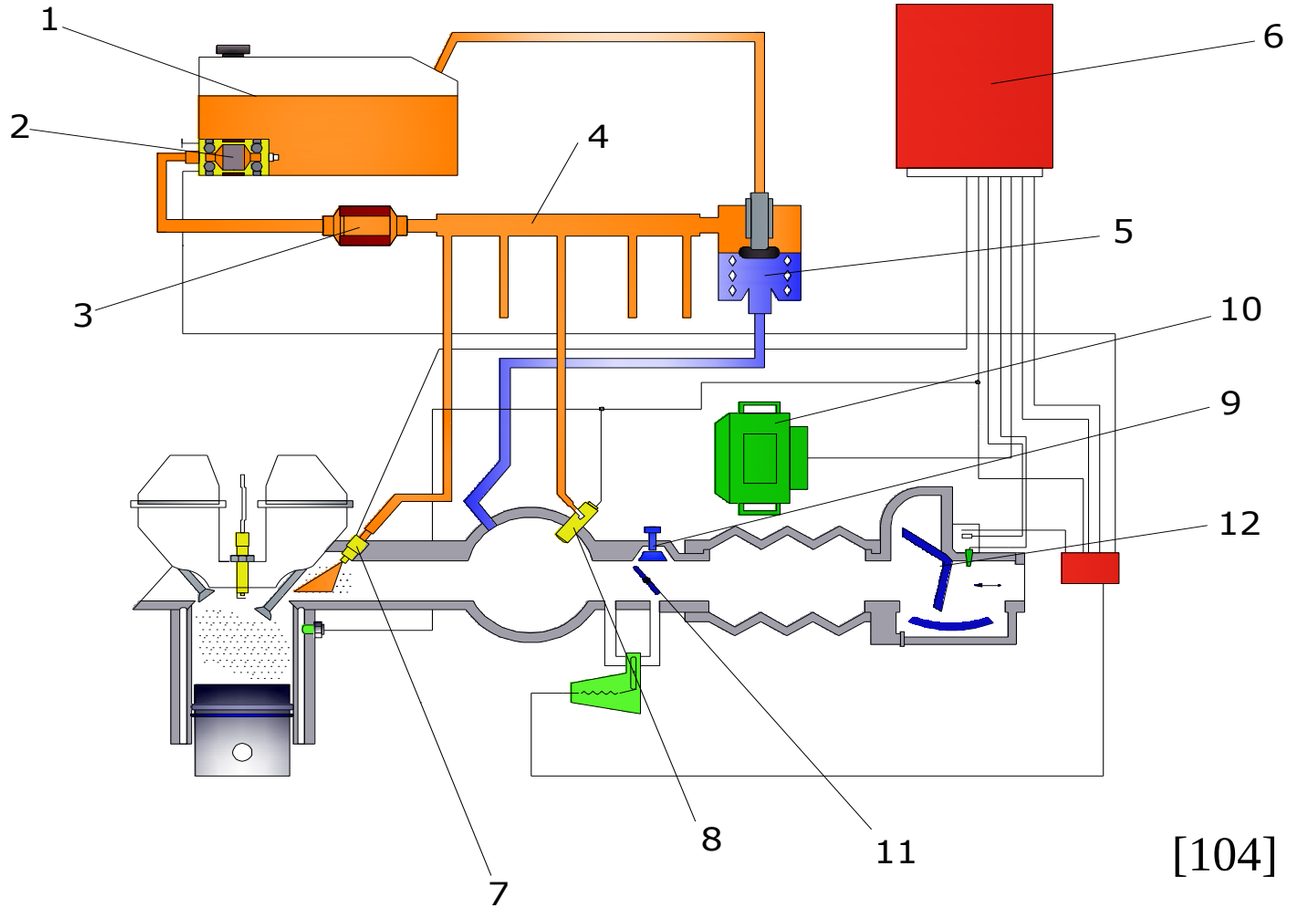


[103]

7.8. Injektorli yonilg‘i purkash tizimi qismlarining konstruksiyasi va ishlashi.

L- Jetronik yonilg‘i purkash tizimining sxemasi

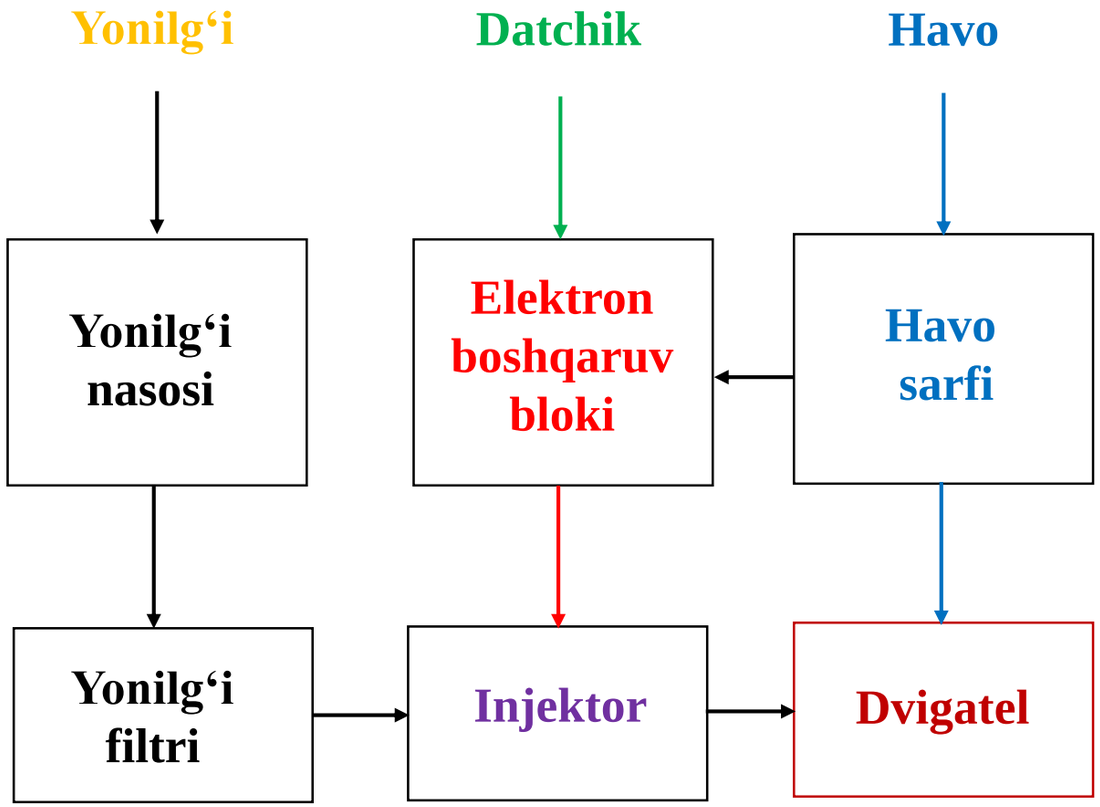
1-yonilg‘i baki, 2-yonilg‘i nasosi, 3-yonilg‘i filtri, 4-rampa, 5-bosim rostlagich, 6-elektron boshqarish bloki, 7-injektor, 8-yurgazib yuborish forsunkasi, 9-salt ishlashni rostlash vinti, 10-drossel zaslonka datchigi, 11-drossel zaslonka, 12-havo sarfini aniqlagich.

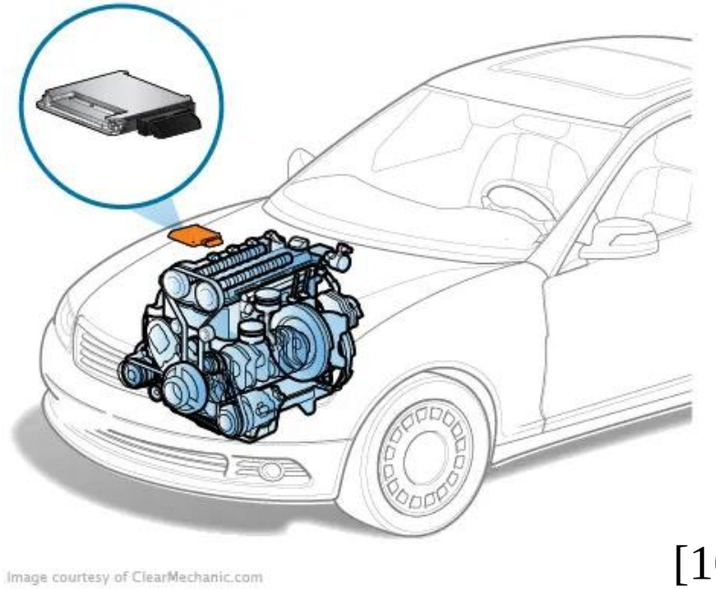


[104]

Yonilg‘i purkash tizimining Elektron Boshqaruv Bloki.

Yonilg‘i purkash tizimining oddiy sxemasi

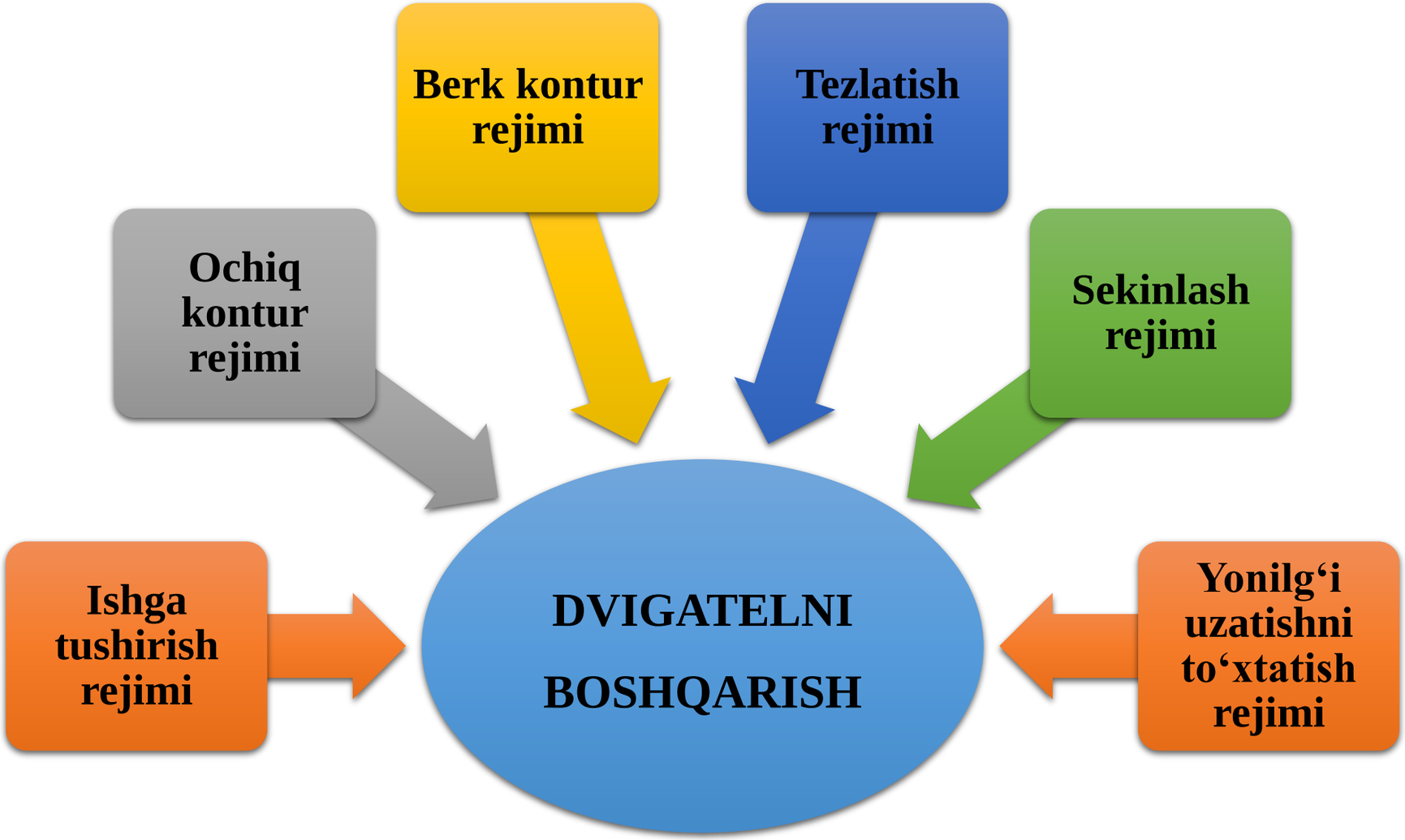




[105]

EBB yordamida dvigatelni boshqarish ikki xil:

- **Ochiq kontur;**
- **Berk kontur rejimlarida olib borilishi mumkin.**



Ishga tushirish tizimi:

U dvigatelga kerakli miqdorda havo uzatib beradi.

Bu tizim havo filtri, kiritish kollektori, drossel zaslonkasi va datchiklardan tashkil topgan.

Datchiklar dvigatel rejimining muhim ko‘rsatkichlarini aniqlab beradi. **Ular:**

- **Dvigatelga uzatilayotgan havo miqdori;**
- **Drossel zaslonkasining holati;**
- **Dvigatel tirsakli valining aylanish chastotasi;**
- **Dvigatel harorati;**
- **Havo harorati.**

➢ Ochiq kontur rejimi:

Dvigatel ishga tushirilib tirsakli valning aylanishlar soni **400 ayl/min dan oshganda,** tizim ochiq kontur rejimida ishlay boshlaydi.

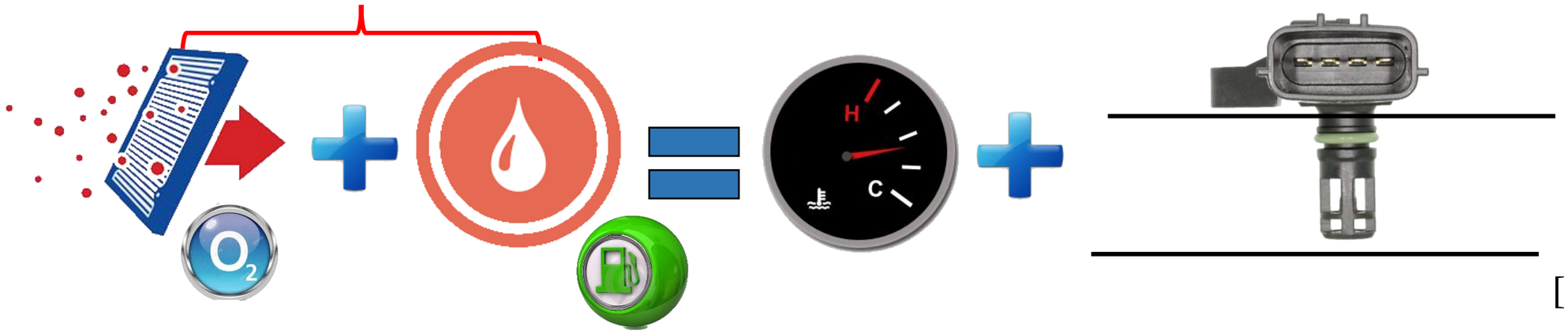
➢ Berk kontur rejimi:

EBB havo-yonilg‘i nisbatini kislorod datchigidan kelayotgan daraklar asosida **14,7:1** nisbatda ushlab turadi.

Havo-yonilg‘i nisbati

Sovitish suyuqlik °C

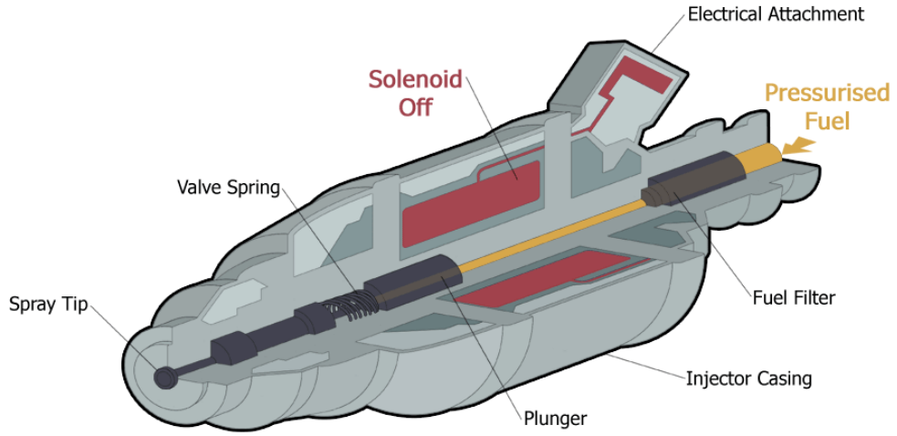
Absolut bosim datchik



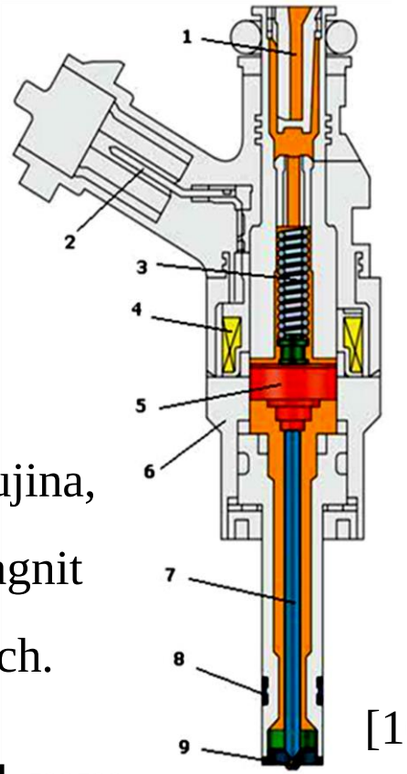
[106]

Injektor:

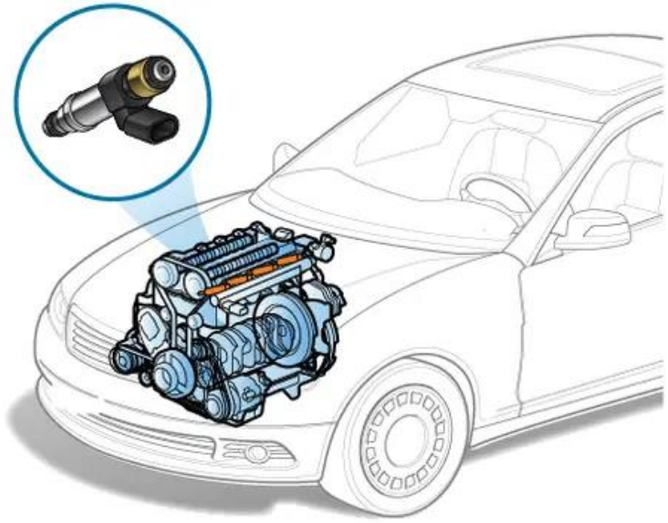
Injektor elektr impulsi yordamida EBBdan boshqariladi.

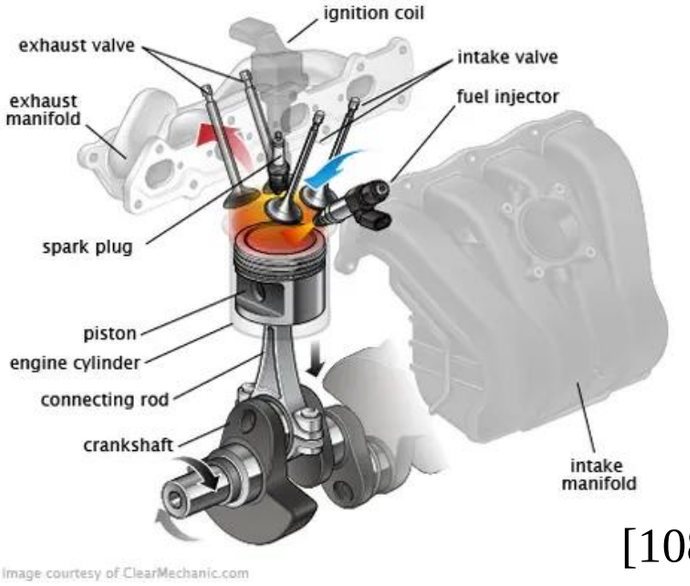


[109]



[107]





[108]

Klapanining ochilish va yopilish vaqti **0,6-2,0 ms**

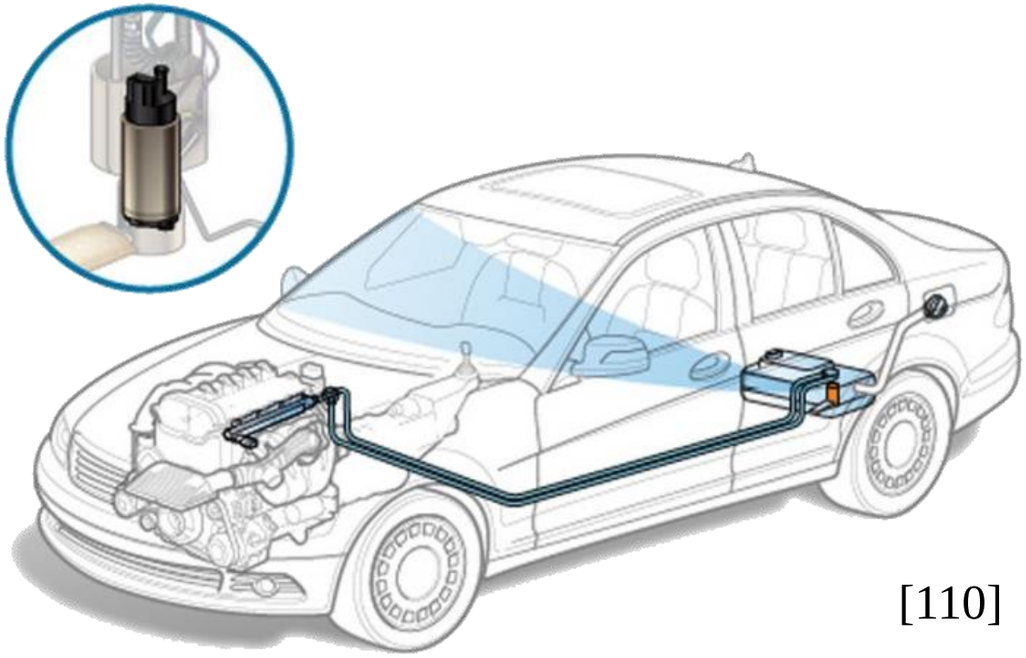
1-yonilg‘i filtri, 2-elektr ulagich, 3-prujina, 4-elektro magnit o‘rami, 5-elektro magnit yakori, 6-korpus, **7-igna,** 8-zichlagich. 9-to‘zitgich plastini.

0,1 mm

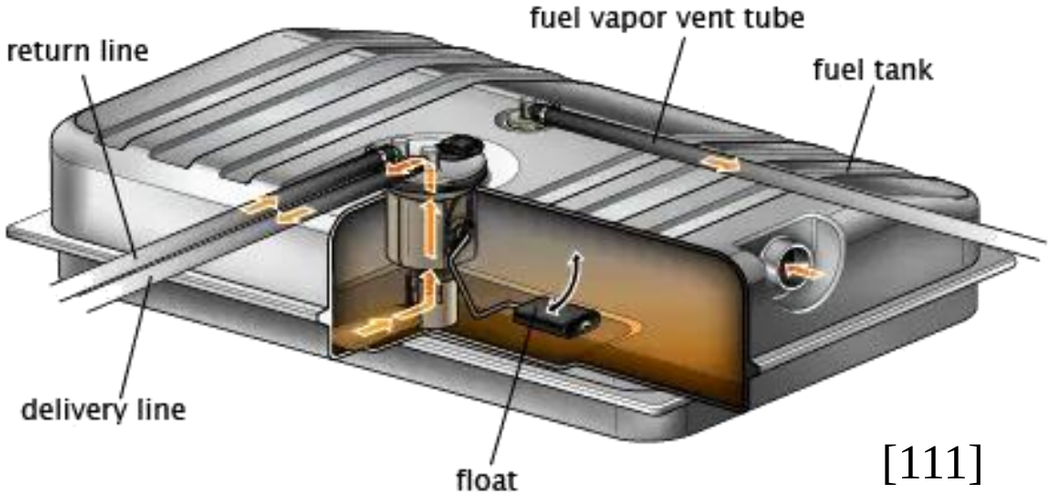
Yonilg‘i nasosi:

U elektr yuritmali bo‘lib, benzinni bakdan to‘xtovsiz haydab beradi.

Yonilg‘i nasosi yonilg‘i baki ichida yoki yonilg‘i bakidan tashqarida joylashgan bo‘lishi mumkin.

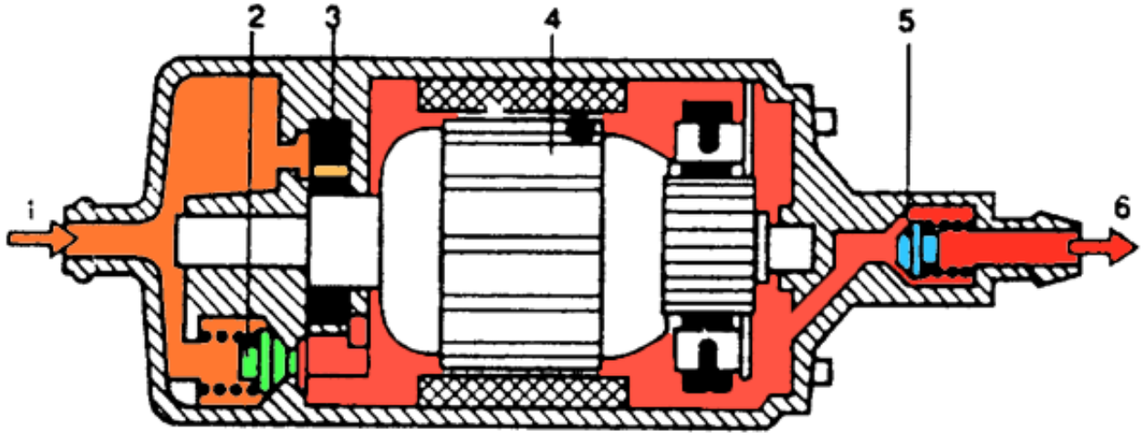


[110]



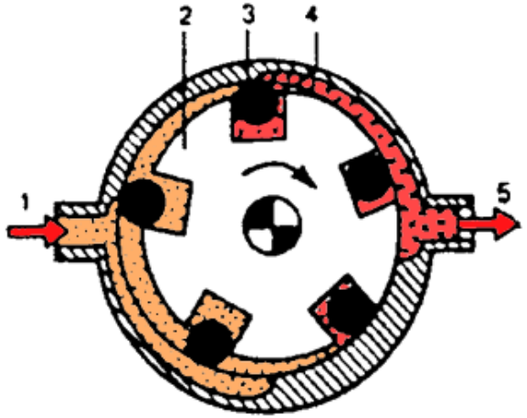
[111]

Elektr yuritmali yonilg‘i nasosi **600 kPa** gacha bosim hosil qilishi mumkin.



1-benzinning kirishi;
2-saqlagich klapan;
3-nasos; 4-yakor;
5-teskari klapan;
6-benzinning
chiqishi.

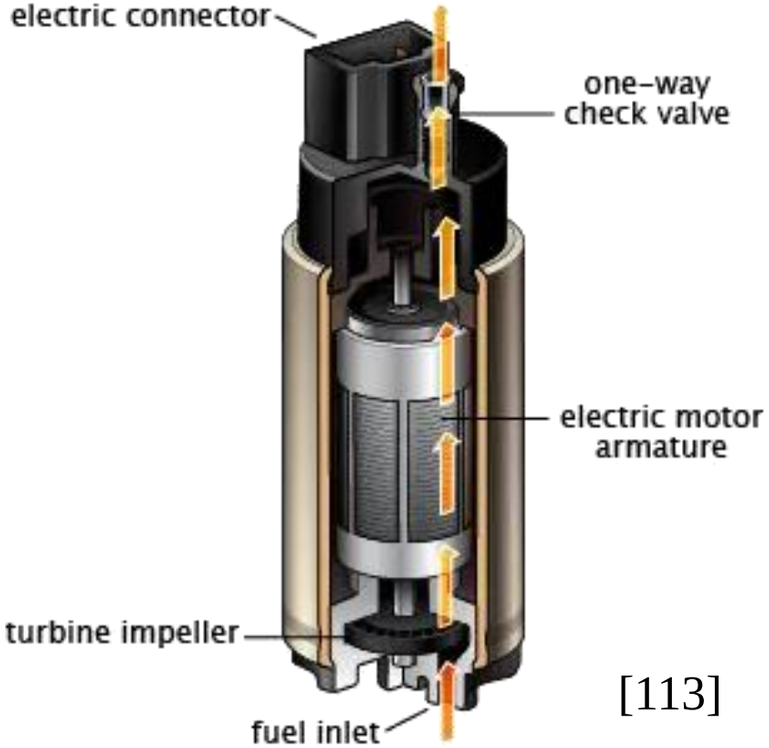
[112]



Benzinni so‘rish;

Haydash;

1-benzinning kirishi;
2-nasos rotori;
3-roliklar;
4-roliklarning tayanch
yuzasi; 5-benzinning
chiqishi.

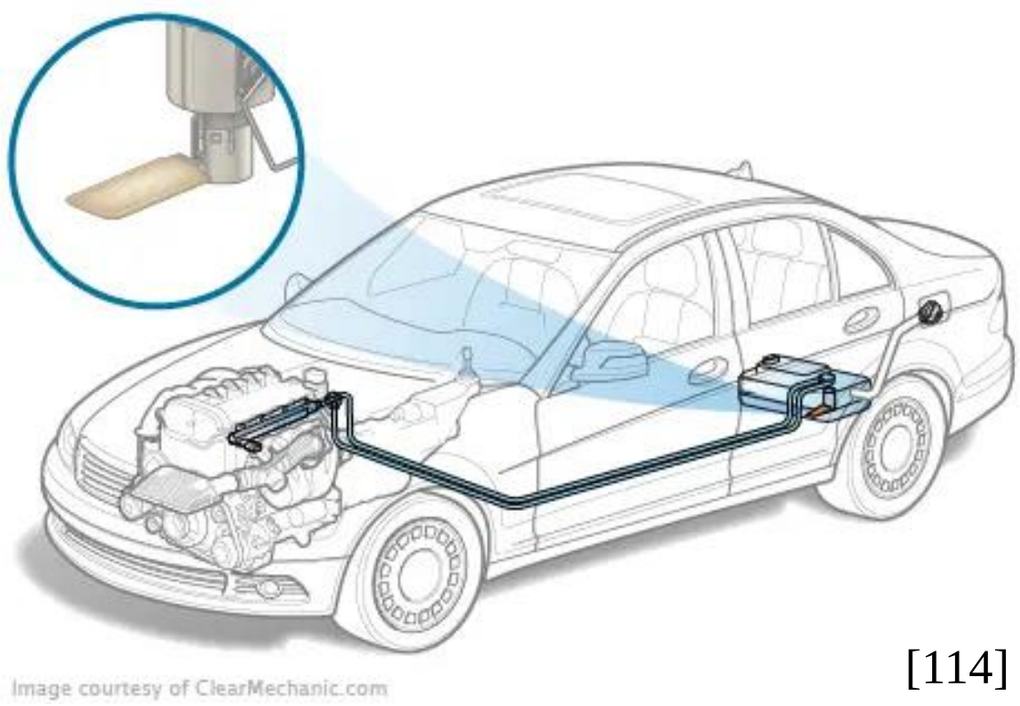


[113]

Yonilg‘i filtri:

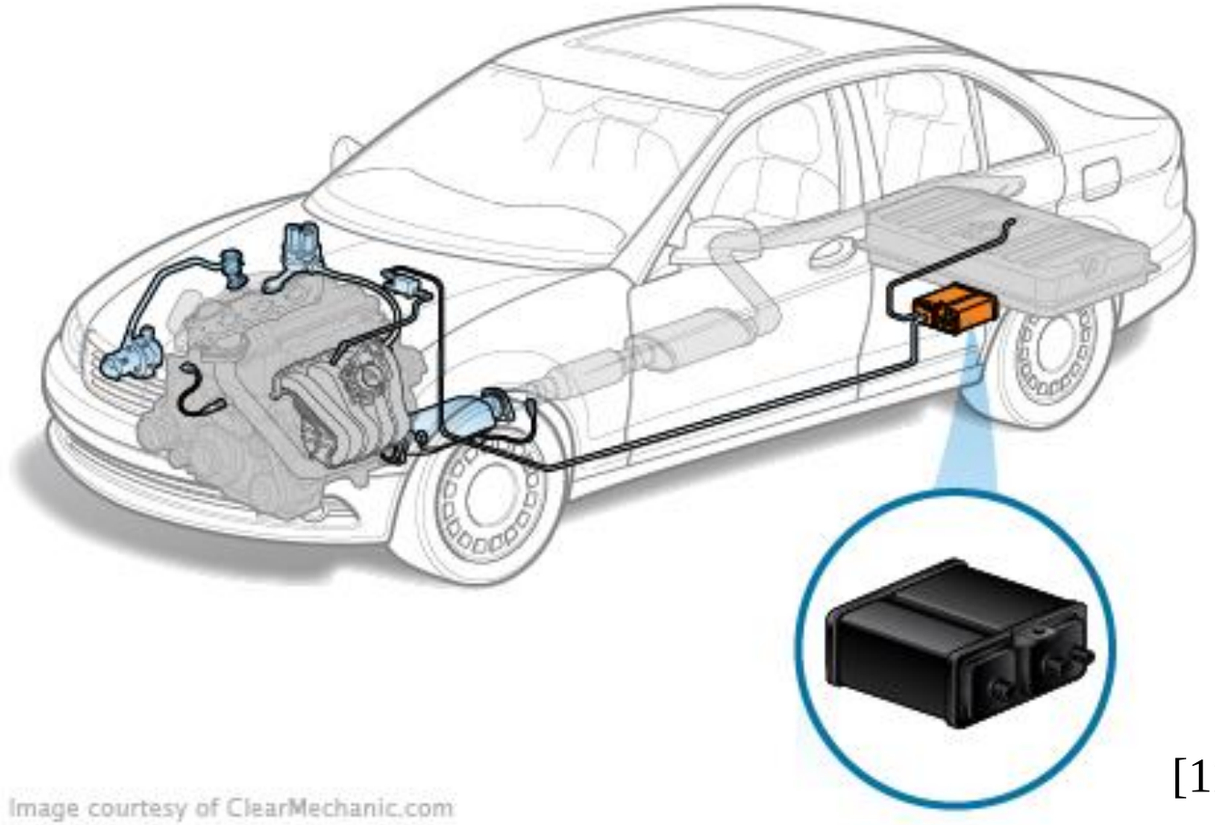
Yonilg‘ini doimo tozalab turish uchun xizmat qiladi.

Tozalanayotgan yonilg‘i o‘tish tirqishga 10 mkm gacha bo‘lish kerak.



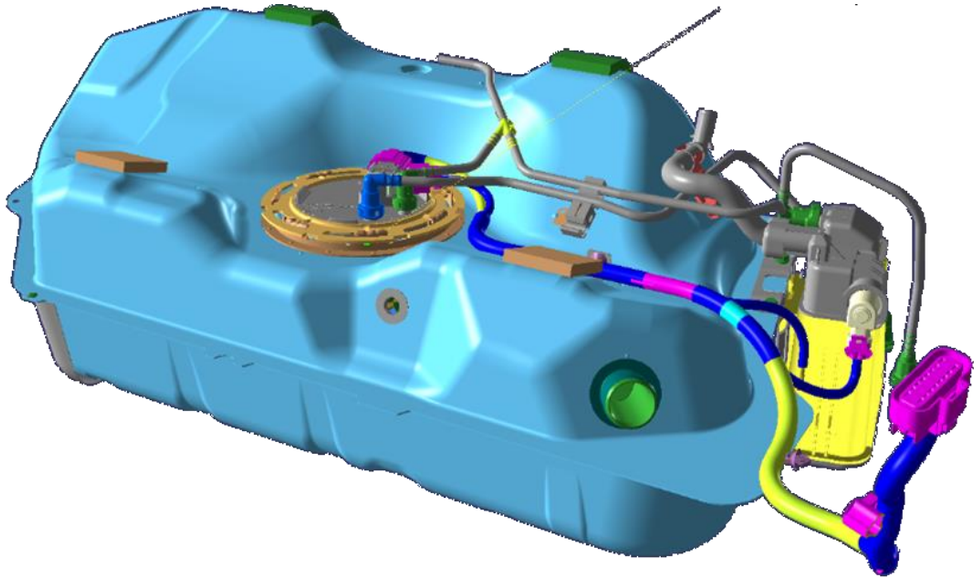
[114]

Bakdagi yonilg‘i bug‘larini tindirish:



[115]

GSVEM modeli uchun FUEL TANK ASS’Y

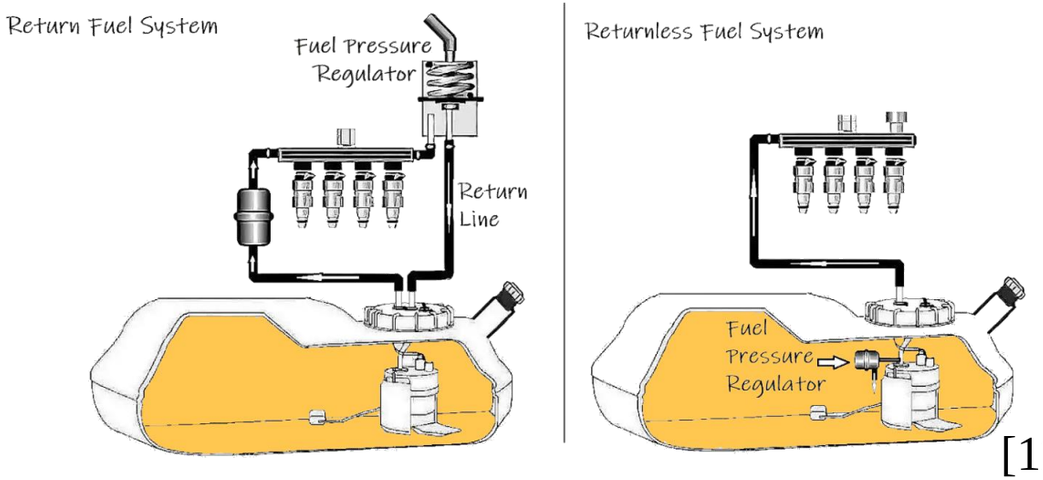


[116]

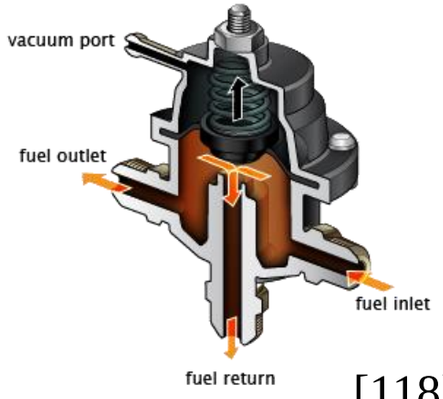
Bosim rostlagich:

Yonilg‘i uzatish tizimida joylashgan bo‘lib, tizimda o‘rtacha 0,5 MPa bosimni ta’minlash uchun xizmat qiladi.

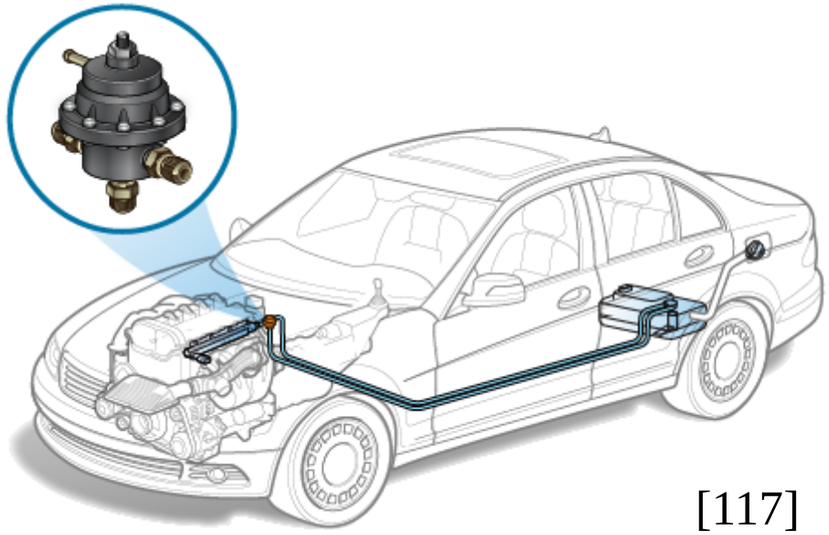
Elektrik yuritmali yonilg‘i nasosi yonilg‘ini keragidan ortiq uzatib beradi va bosim rostlagich ortiqcha yonilg‘ini yonilg‘i bakiga qaytarib yuboradi.



[119]

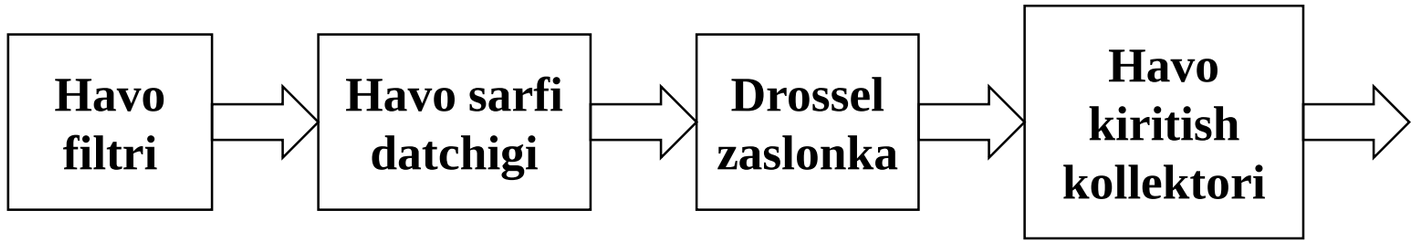


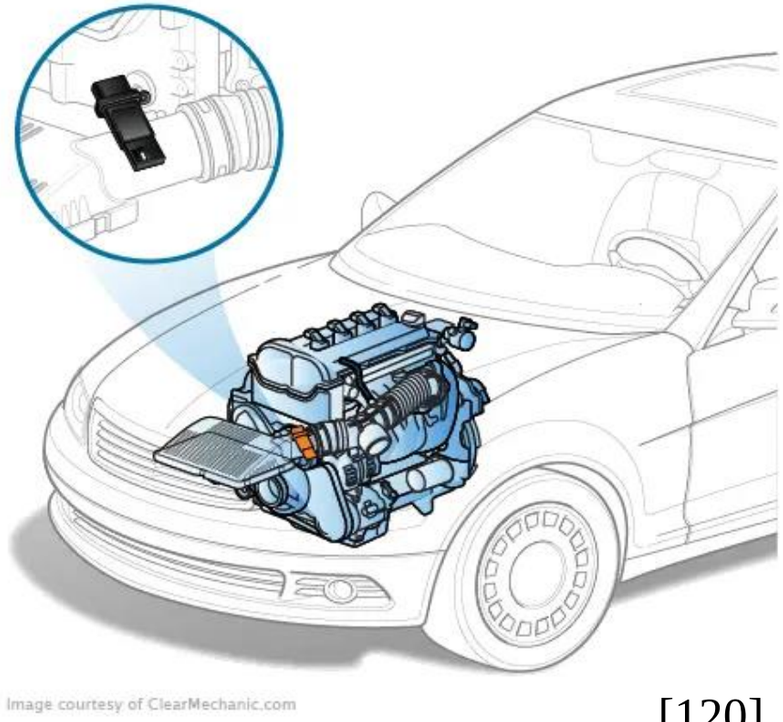
[118]


[117]

Havo miqdorini o‘lchash datchigi - Mass Airflow (MAF) Sensor:

Havo filtri va drossel zaslonkasi oralig‘ida joylashgan bo‘ladi va dvigatelga kirayotgan havo miqdorini o‘lchab beradi. EBBga ma’lumot yuboradi.





[120]

Absolut bosim datchigi - Manifold absolute pressure (MAP):

MAP sensori bosim sensori hisoblanib, havo kiritish quvuridagi bosimga nisbatan o‘zgaruvchan kuchlanish signalini yaratadigan elektron sxemaga ega.

$$U_{MAP} = 1 - 5\ V$$

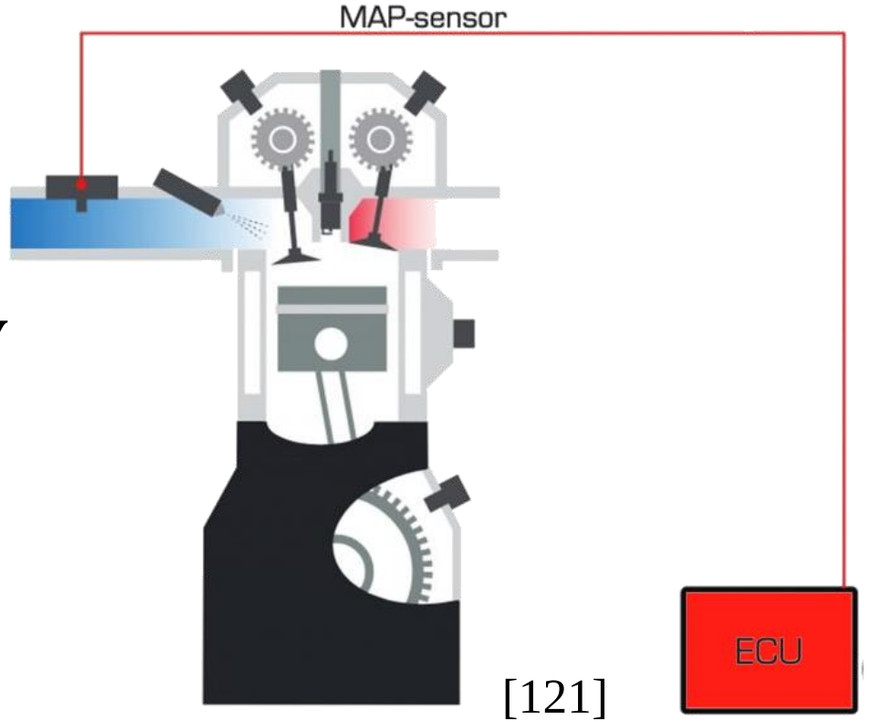
$$P_{dv.salt.i.r} = 20\ kPa$$

$$U_{dv.salt.i.r} = 1 - 2\ V$$

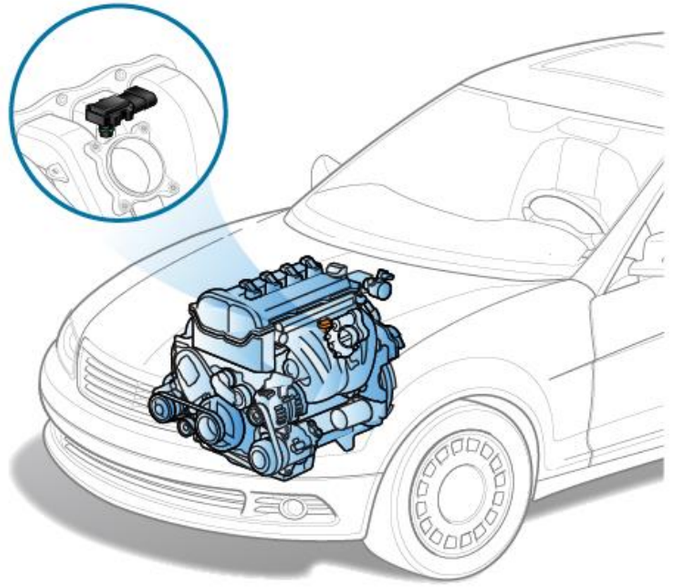
$$U_{dv.yuklamada} = 4,5 - 5\ V$$

$$P_{dv.yuklamada} = 80\ kPa$$

−40 ℃	÷	120 ℃
65 kΩ		100 Ω



[121]

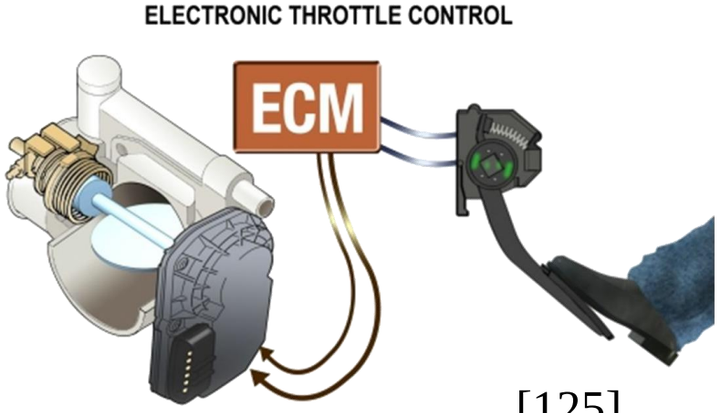


[122]

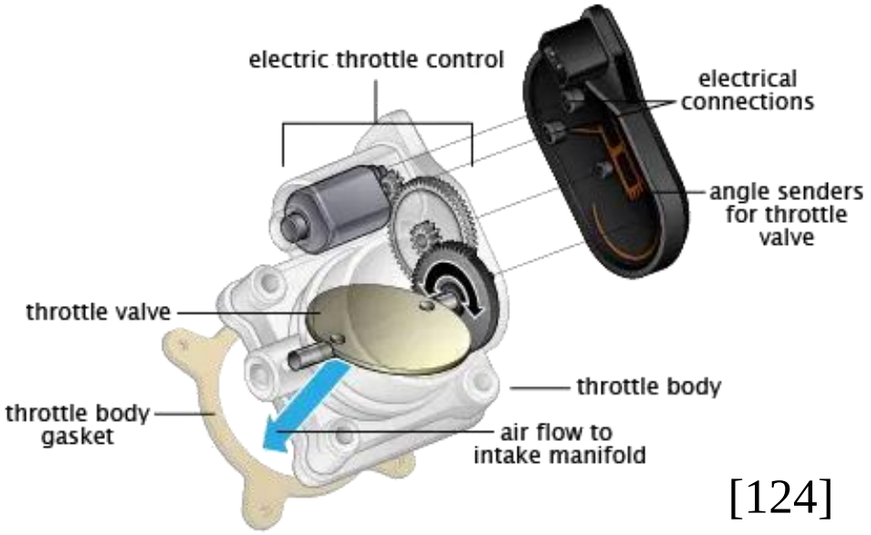
Drossel zaslonkasi holatini aniqlash datchigi:

U drossel zaslonkasi holatini va burilish burchagini aniqlaydi.

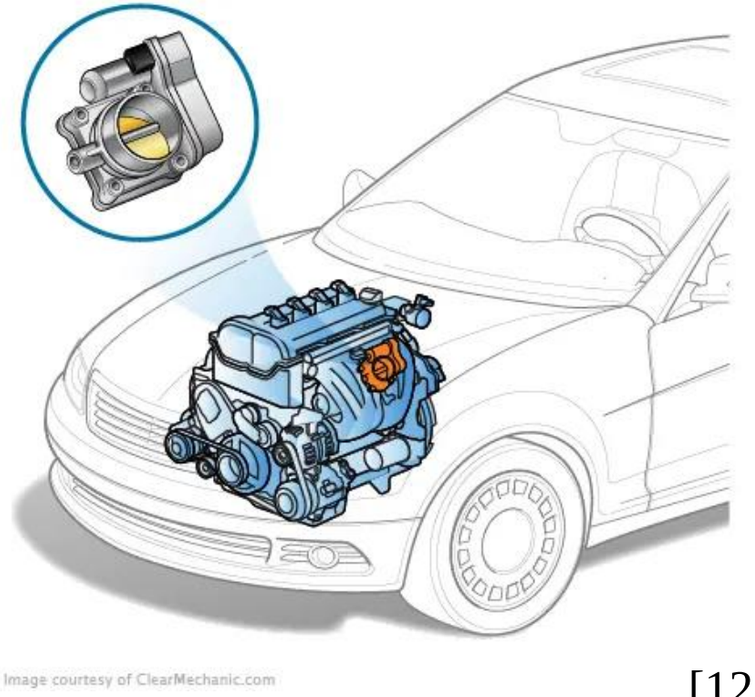
Bu datchik EBBga dvigatelning ish rejimi (**salt yurish**, **to‘liq bo‘lmagan** va **to‘liq yuklanish**) to‘g‘risida ma’lumot berib turadi.



[125]



[124]

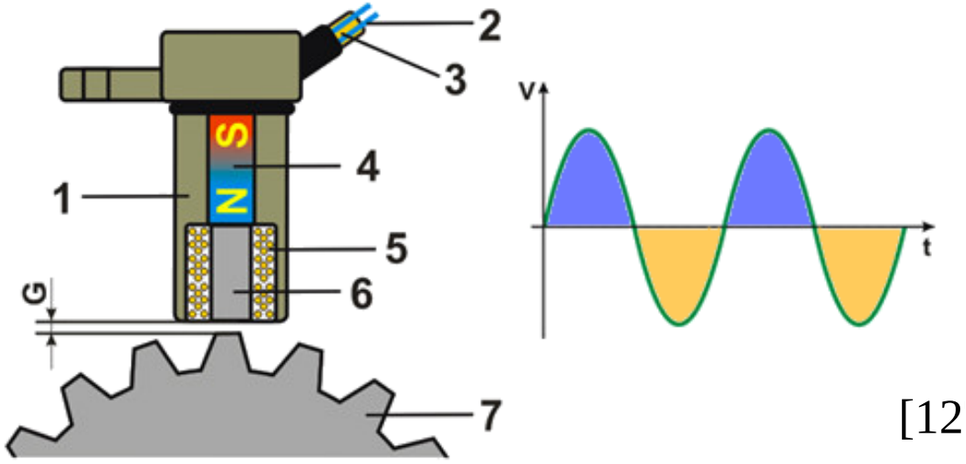


[123]

Tirsakli valning aylanishlar chastotasini aniqlash datchigi:

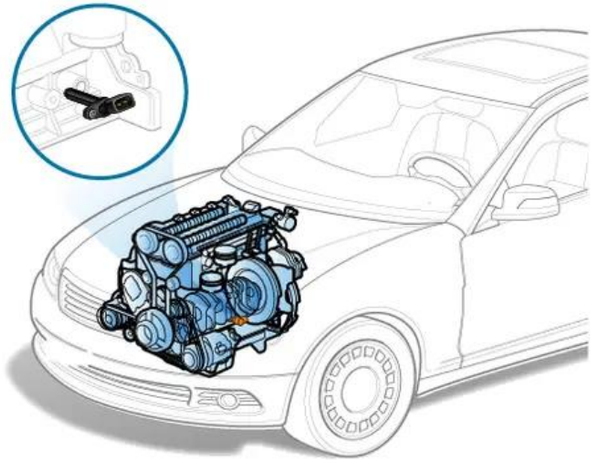
Datchik EBB ga tirsakli valning aylanishlar chastotasi to‘g‘risida ma’lumot uzatib turadi.

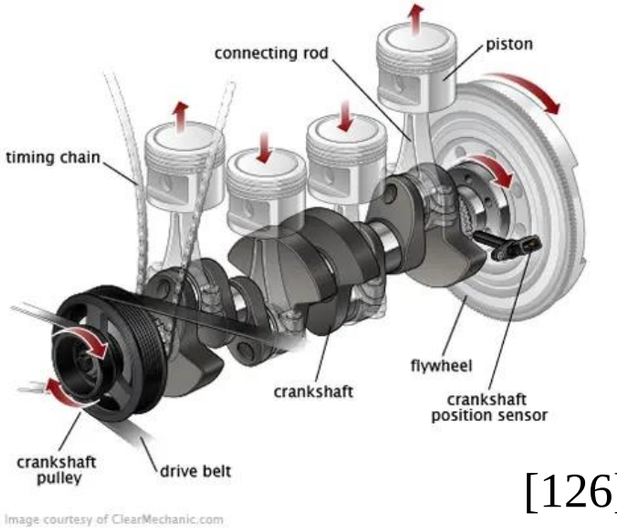
Barcha datchiklardan kelayotgan signallar EBB da qabul qilinib, tahlil qilinadi va shu asosida forsunkalarga impulslar yuboriladi.



[127]

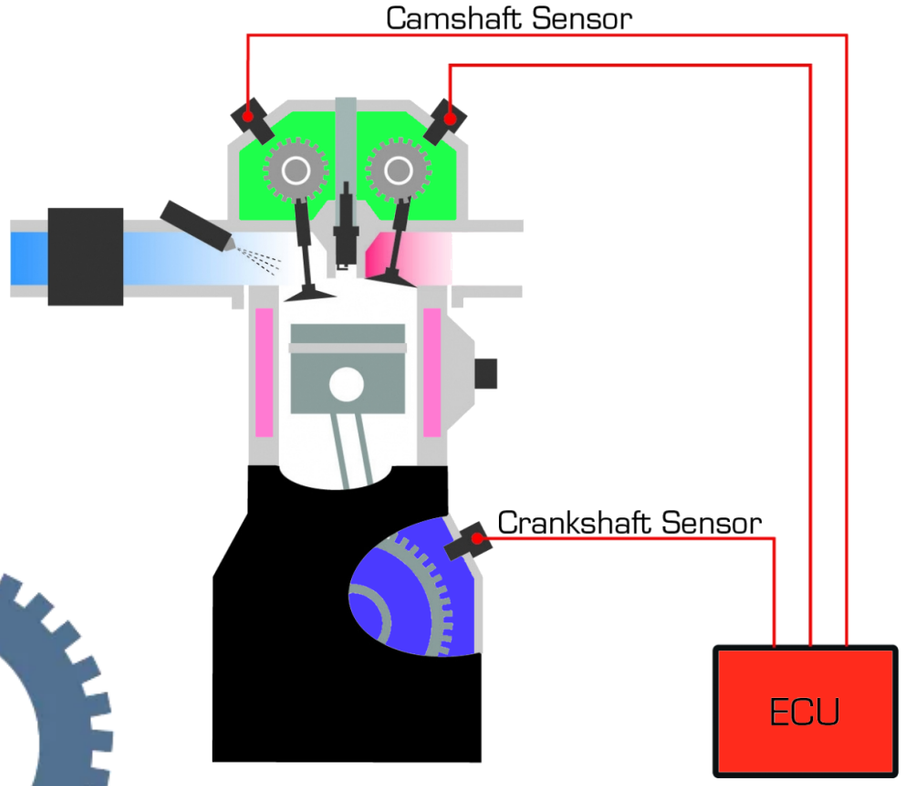
1 – sensor housing; 2-3-impuls cable, 4 – permanent magnet; 5 – inductor; 6 – pole terminal; 7 – impulse wheel with support tag; G – air gap.



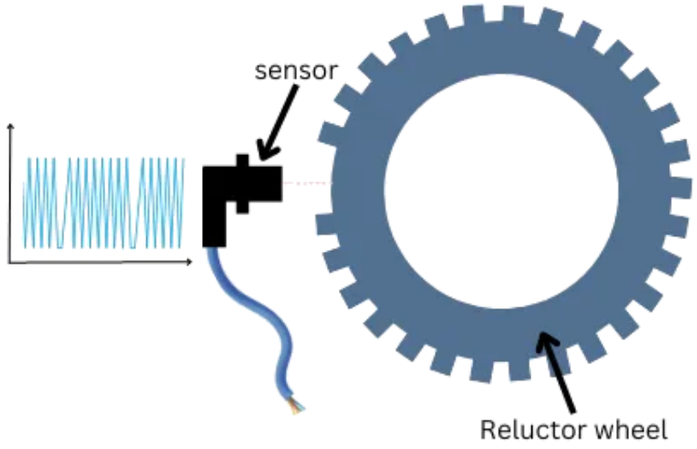


[126]

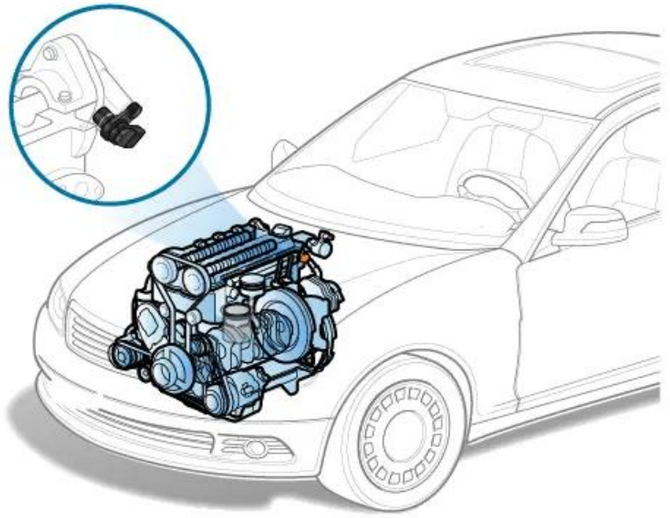
Taqsimlash valning holat datchigi:

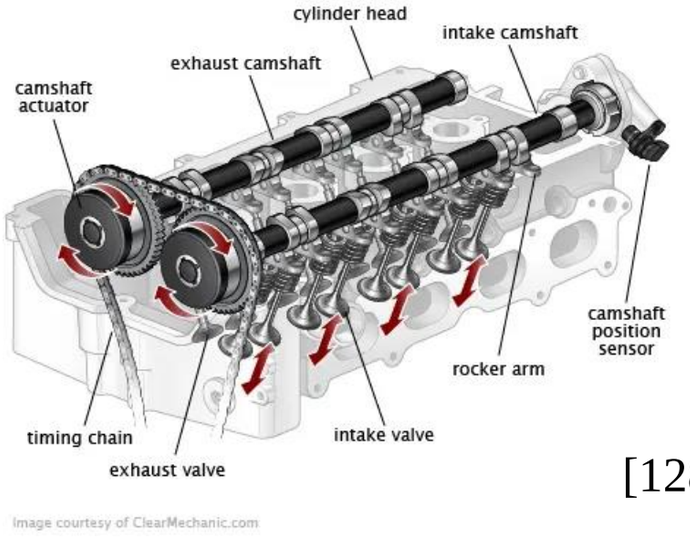


[129]



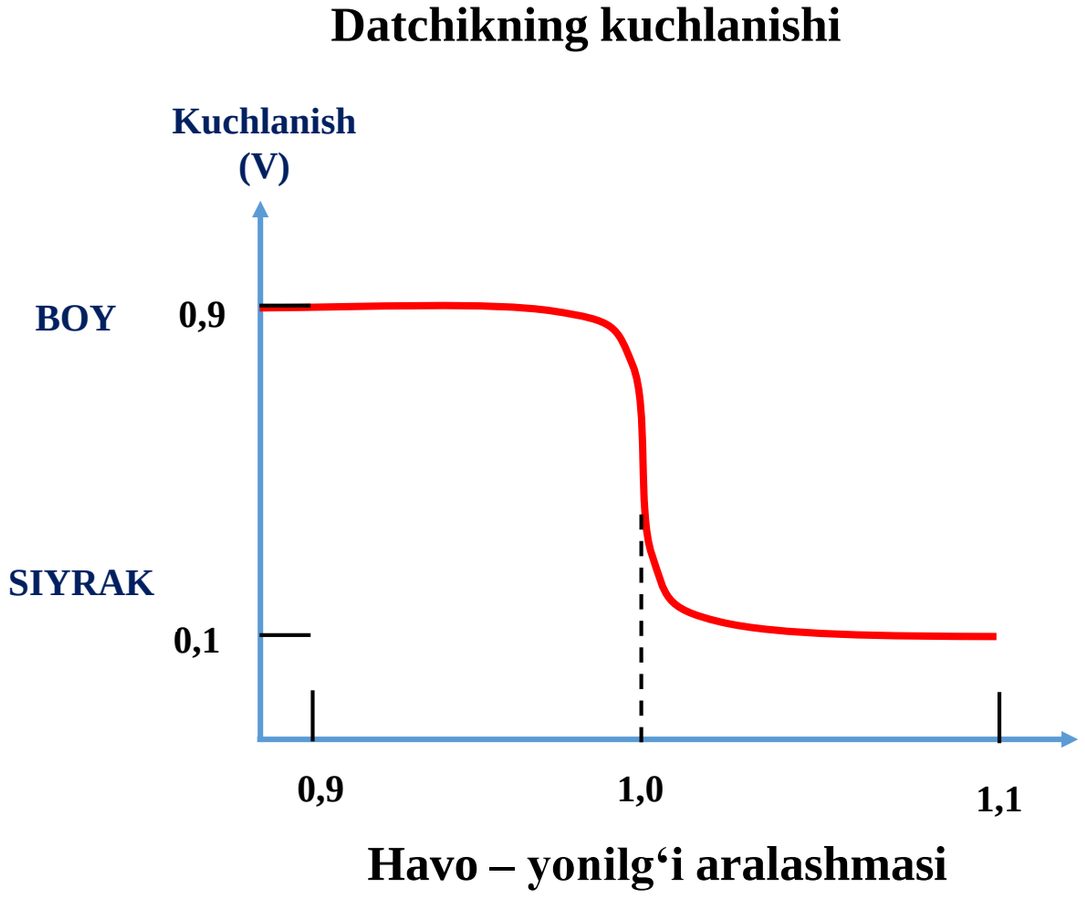
[130]

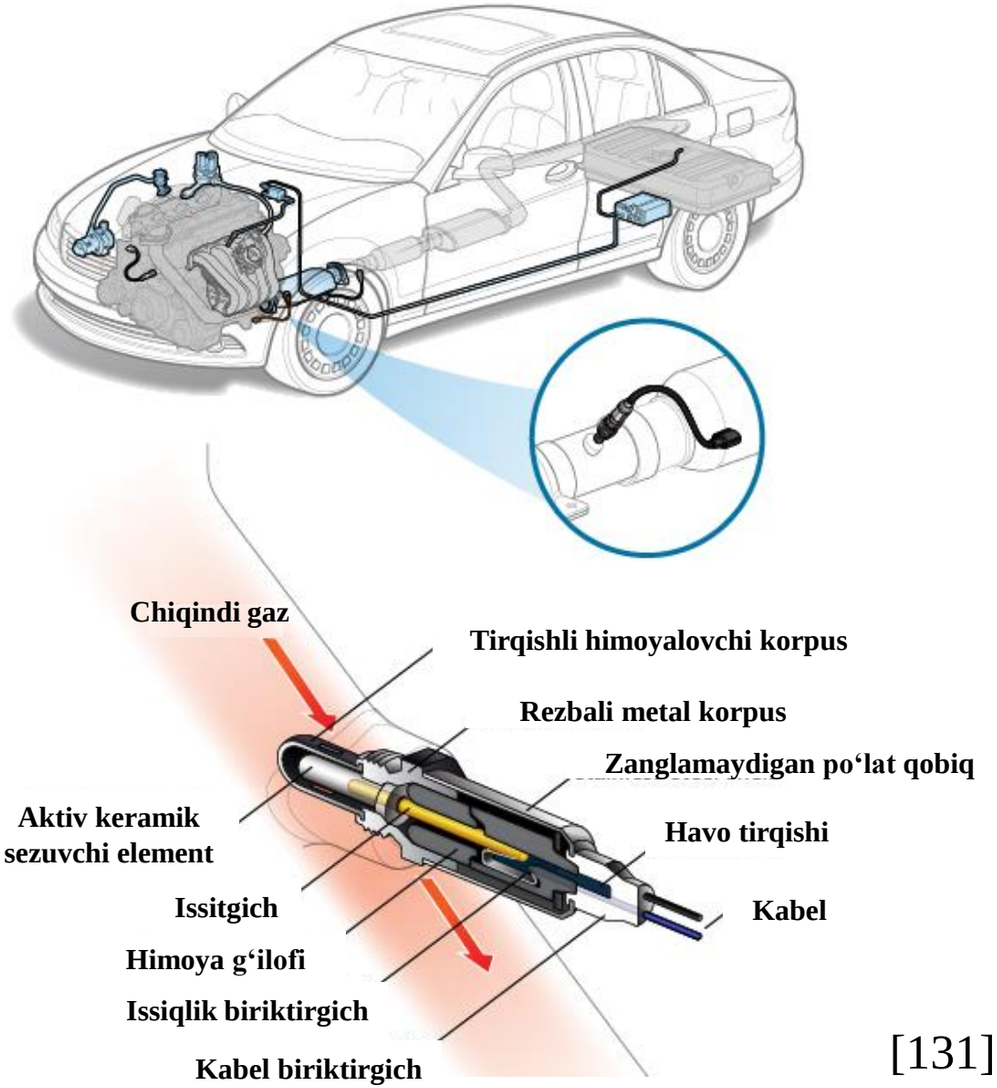




[128]

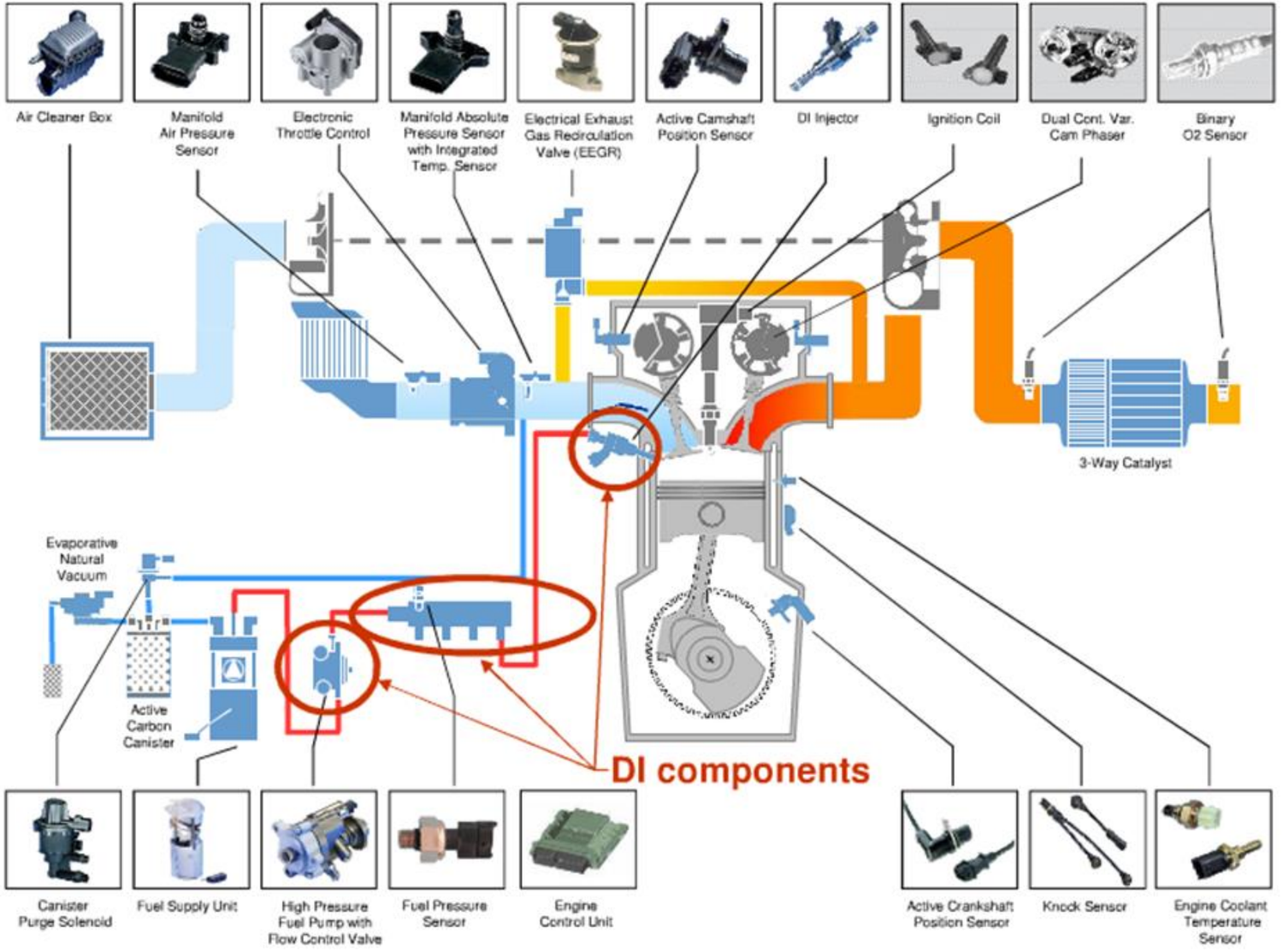
Kislorod datchigi (λ-zond):





[131]

Benzinli Turbonadduv yonilg‘i purkash tizimi.



[132]

FOYDALANILGAN ADABIYOTLAR

94. Simplest Carburetor working principle. [Online image] [Accessed on October 2019]. https://www.newkidscar.com/wp-content/uploads/2019/10/xsimple-carburetor.jpg.pagespeed.ic.0l-5WZAASS.webp
95. Системы впрыска топлива бензиновых двигателей. [Online image] [Accessed on 30 June 2020]. https://pro-sensys.com/upload/medialibrary/716/71678e4b0ac9461d50601100bffb3b3a.png
96. Introduction to engine fuelling systems. [Online image] [Accessed on May 2013]. https://www.car-engineer.com/wp-content/uploads/2013/05/Gasoline-fuelling-history.png
97. Yusupov S. “Avtomobillar konstruksiyasi” 1-qism. O‘quv-uslubiy majmua. A.: AndMI. 2019 yil, -b. 147 (493).
98. Система впрыска «К-Джетроник». [Online image] [Accessed on 27 October 2023]. http://dvfokin.narod.ru/auto_ych/Benzin/k-jetronic.files/image001.jpg
99. Система впрыска КЕ-Джетроник. [Online image] [Accessed on 27 October 2023]. http://dvfokin.narod.ru/auto_ych/Benzin/ke-jetronic.files/image001.jpg
100. Система впрыска Моно-Джетроник. [Online image] [Accessed on 27 October 2023]. http://dvfokin.narod.ru/auto_ych/Benzin/mono-jetronic.files/image001.jpg
101. Система впрыска L-Джетроник. [Online image] [Accessed on 27 October 2023]. http://dvfokin.narod.ru/auto_ych/Benzin/l-jetronic.files/image002.jpg
102. Система впрыска LH-Джетроник. [Online image] [Accessed on 27 October 2023]. http://dvfokin.narod.ru/auto_ych/Benzin/lh-jetronic.files/image001.jpg
103. С.С. Юсупов, Ж.Ш. Иноятходжаев. Инновацион интеллектуал транспорт тизимларини маҳаллий шароитда синергиясини асослаш. Монография. –Т.: “Adast poligraf.” нашриёти, 2023. -65 бет.
104. E.Fayzullayev. Transport vositalarining konstruksiyasi. Darslik. I-qism. -T.: “Yangi asr avlodi”, -2006 yil, 178 bet.
105. Car's Engine Control Unit. By Mia Bevacqua. [Online image] [Accessed on 29 June 2018]. https://storage.googleapis.com/rp-production-public-content/2uyyTCszsmRbo289W5pwT3H6
106. Yusupov S. “Avtomobillar konstruksiyasi” 1-qism. O‘quv-uslubiy majmua. A.: AndMI. 2019 yil, -b. 149 (493).
107. E.Fayzullayev. Transport vositalarining konstruksiyasi. Darslik. I-qism. -T.: “Yangi asr avlodi”, -2006 yil, 179 bet.
108. Fuel Injector. By Alex Palmeri. [Online image] [Accessed on 16 March 2018]. https://storage.googleapis.com/rp-production-public-content/5QASHw8MmMZPbm4tvbYAeK9d
109. Fuel Injector gif. [Online gif] [Accessed on 12 August 2010]. https://upload.wikimedia.org/wikipedia/commons/2/29/Injector3.gif
110. Fuel Pump. By Mia Bevacqua. [Online image] [Accessed on 14 January 2022]. https://storage.googleapis.com/rp-production-public-content/t5YTn6pBbk2cyxm9iTwDGjEU
111. Fuel Tank. [Online image] [Accessed in 2020]. https://storage.googleapis.com/rp-production-public-content/Z26w37cvVHyBtDDc3tw1x8J3
112. Yusupov S. “Avtomobillar konstruksiyasi” 1-qism. O‘quv-uslubiy majmua. A.: AndMI. 2019 yil, -b. 153 (493).
113. Fuel Pump. By Mia Bevacqua. [Online image] [Accessed on 14 January 2022]. https://storage.googleapis.com/rp-production-public-content/yG4aEbdnreGpnc2ZhKALkEth
114. Fuel Filter. By Stephen Fogel. [Online image] [Accessed on 26 October 2023]. https://storage.googleapis.com/rp-production-public-content/bNEr37GLfefrdymWwo7uCcb4

FOYDALANILGAN ADABIYOTLAR

115. Fuel Evaporative Canister. [Online image] [Accessed in 2018]. https://storage.googleapis.com/rp-production-public-content/MbNuXKYU8XjotaH7W8CYYqL8
116. Yusupov S. “Avtomobillar konstruksiyasi” 1-qism. O‘quv-uslubiy majmua. A.: AndMI. 2019 yil, -b. 105 (493).
117. Fuel Pressure Regulator. By Mia Bevacqua. [Online image] [Accessed on 6 August 2018]. https://storage.googleapis.com/rp-production-public-content/mEehYHdgQzPjNiRV35o8rh3n
118. Fuel Pressure Regulator. By Mia Bevacqua. [Online image] [Accessed on 6 August 2018]. https://storage.googleapis.com/rp-production-public-content/1KwMk7qKPgF3kkXpfTxVGVBV
119. The Function and Common Symptoms of a Faulty Fuel Return Line. Reviewed by Richard McCuistian, ASE Certified Master Automobile Technician. [Online image] [Accessed on 3 October 2023]. https://www.carparts.com/blog/wp-content/webp-express/webp-images/doc-root/wp-content/uploads/2023/06/diagram-multi-point-fuel-injection-systems-1536x703.jpg.webp
120. Mass Airflow (MAF) Sensor. By Mia Bevacqua. [Online image] [Accessed on 11 April 2019]. https://storage.googleapis.com/rp-production-public-content/7mTAwZQMNiYaTg8Nb3XMCy1P
121. Technical info MAP-Sensors. [Online image] [Accessed on 31 January 2023]. https://innovationdiscoveries.space/wp-content/uploads/2023/01/Technical-info-MAP-Sensors-1-1140x641.jpg
122. The manifold absolute pressure (MAP) sensor. By Alex Palmeri. [Online image] [Accessed on 6 April 2018]. https://storage.googleapis.com/rp-production-public-content/xNyFrdiDk3iYfAzKmiauJs4W
123. Electronic Throttle Unit. [Online image] [Accessed in 2018]. https://storage.googleapis.com/rp-production-public-content/V4M9jhe7oN6hx2PH58AXSJGp
124. Throttle. [Online image] [Accessed on 26 October 2023]. https://storage.googleapis.com/rp-production-public-content/fGxwy97emDZnKpPPAyViS2MW
125. Electronic Throttle Control. [Online image] [Accessed on 9 July 2017]. https://slideplayer.com/10881828/39/images/slide_1.jpg
126. Crankshaft Position Sensor. By Mia Bevacqua. [Online image] [Accessed on 15 May 2018]. https://storage.googleapis.com/rp-production-public-content/u4WhkzdDyLLBSDhmRsUh9co7
127. How To Test A Hall Effect Crankshaft Sensor. [Online image] [Accessed in 2017]. https://media.licdn.com/dms/image/C5612AQHyLr9cSsKQcw/article-inline_image-shrink_400_744/0/1520232553430?e=1701907200&v=beta&t=Q0Qv5x8cR4yI2-H60y4ZAe3d64qFPQmIpf9wMGMaUd4
128. Camshaft Position Sensor. By Mia Bevacqua. [Online image] [Accessed on 13 May 2018]. https://storage.googleapis.com/rp-production-public-content/8zCz53LVJ3YB1vAKt6fthLz4
129. NEW – camshaft and crankshaft position sensors. [Online image] [Accessed in 2016]. https://triscan.dk/sites/default/files/import/cmp_ckp_system_gb.jpg
130. Camshaft position sensor. [Online image] [Accessed on August 2023]. https://mechcontent.com/wp-content/uploads/2023/07/camshaft-sensor-principle.webp?ezimgfmt=ng:webp/ngcb3
131. Oxygen Sensor. By Mia Bevacqua. [Online image] [Accessed on 8 March 2018]. https://storage.googleapis.com/rp-production-public-content/FYZhcoXq8tiqdiBKw96JmUrj
132. Introduction to engine fuelling systems. [Online image] [Accessed on May 2013]. https://www.car-engineer.com/wp-content/uploads/2013/05/gasoline-direct-injection-control-system.png

E'TIBORINGIZ UCHUN RAHMAT!!!