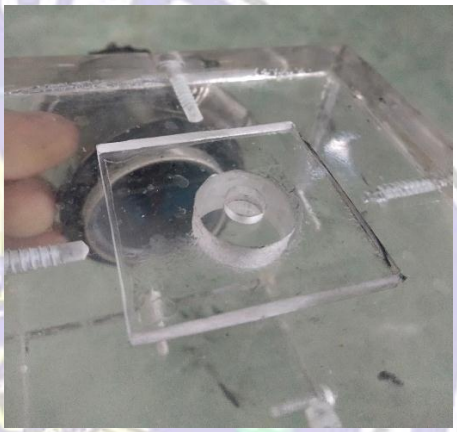
LAMPIRAN

katup yang sudah dimodifikasi

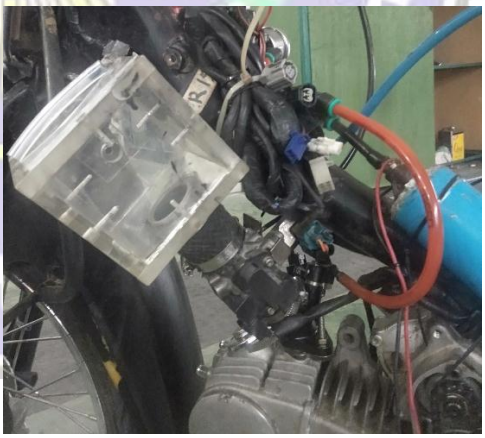
Air Box Meter

Valve seat yang sudah di modif



Plat Orifice

Valve seat yang sudah di modif



Air Box Meter terpasang di mesin

Tachometer

Tool Set

Data Hasil Perhitungan Efisiensi *Head* Standart Dalam %

Pada RPM 2300

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

0,26 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{0{,}26\ Kpa}{(1000\ \mathrm{kg/m3})(9.8\ \mathrm{m/s2})}$$

h = 0,026531 m

sehingga beda ketinggian air pada manometer tabung u 0,026531 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air\ x}\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}026531\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 21,13782 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(21,13782 m/s)

=0,000358 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(2300)2}{60\ s}$$

= 0,001881 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}000358\ {}^{m^3}/_{s}}{0{,}001881\ {}^{m^3}/_{s}} \times 100\%$$

= 19,05712 %

Pada RPM 3000

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

0,72 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{0{,}72\ Kpa}{(1000\ \mathrm{kg/m3})(9.8\ \mathrm{m/s2})}$$

h = 0,073469 m

sehingga beda ketinggian air pada manometer tabung u 0,073469 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air}\ x\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}073496\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 35,17546 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(35,17546 m/s)

=0,000596 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(3000)2}{60\ s}$$

= 0,002453 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}000596\ {}^{m^3}/_{s}}{0{,}002453\ {}^{m^3}/_{s}} \times 100\%$$

= 24,31328 %

Pada RPM 4000

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

0,91 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{0{,}91\ Kpa}{(1000\ \mathrm{kg/m3})(9.8\ \mathrm{m/s2})}$$

h = 0,092857 m

sehingga beda ketinggian air pada manometer tabung u 0,092857 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air}\ x\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}092857\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 39,54524 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(39,54524 m/s)

=0,000671 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(4000)2}{60\ s}$$

= 0,003271 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}000671\ {}^{m^3}/_{s}}{0{,}003271\ {}^{m^3}/_{s}} \times 100\%$$

= 20,50025 %

Pada RPM 5500

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

1,83 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{1{,}83\ Kpa}{(1000\ \mathrm{kg/m3})(9.8\ \mathrm{m/s2})}$$

h = 0,186735 m

sehingga beda ketinggian air pada manometer tabung u 0,186735 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air}\ x\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}186735\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 56,07884 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(56,07884 m/s)

=0,000951 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(5500)2}{60\ s}$$

= 0,004497 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}000951\ {}^{m^3}/_{s}}{0{,}004497\ {}^{m^3}/_{s}} \times 100\%$$

= 21,4274 %

Pada RPM 6500

P_{gauge}=ρ_{air}gh

Dengan ρ_{air} sebesar 1000 kg/m^3

2,11 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{2{,}11\ Kpa}{(1000\ \mathrm{kg/m3})(9.8\ \mathrm{m/s2})}$$

h = 0,215306 m

sehingga beda ketinggian air pada manometer tabung u 0,215306 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air}\ x\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}215306\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 60,21639 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(60,21639 m/s)

=0,001021 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(6500)2}{60\ s}$$

= 0,005315 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}001021\ {}^{m^3}/_{s}}{0{,}005315\ {}^{m^3}/_{s}} \times 100\%$$

= 19,20996 %

Data Hasil Perhitungan Efisiensi *Head* Modifikasi Dalam %

Pada RPM 2300

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

1,34 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{1{,}34\ Kpa}{(1000\ \text{kg/m3})(9.8\ \text{m/s2})}$$

h = 0,136735 m

sehingga beda ketinggian air pada manometer tabung u 0,136735 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air\ X}\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ ^{m}/_{s^2})\ (0{,}136735\ m)(1000\ ^{kg}/_{m^3})}{1{,}165\ ^{kg}/_{m^3}}}$$

C = 47,98725 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(47,98725 m/s)

=0,000814 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(2300)2}{60\ s}$$

= 0,001881 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}000814\ ^{m^3}/_{s}}{0{,}001881\ ^{m^3}/_{s}} \times 100\%$$

= 43,26364 %

Pada RPM 3000

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

1,53 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{1{,}53\ Kpa}{(1000\ \text{kg/m3})(9.8\ \text{m/s2})}$$

h = 0,156122 m

sehingga beda ketinggian air pada manometer tabung u 0,156122 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air}\ x\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}156122\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 51,2766 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(51,2766 m/s)

=0,000869 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(3000)2}{60\ s}$$

= 0,002453 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}000869\ {}^{m^3}/_{s}}{0{,}002453\ {}^{m^3}/_{s}} \times 100\%$$

= 35,44239 %

Pada RPM 4000

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

1,97 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{1{,}97\ Kpa}{(1000\ \mathrm{kg/m3})(9.8\ \mathrm{m/s2})}$$

h = 0,20102 m

sehingga beda ketinggian air pada manometer tabung u 0,20102 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air}\ x\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}20102\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 58,18441 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(50,18441 m/s)

=0,000987 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(4000)2}{60\ s}$$

= 0,003271 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}000987\ {}^{m^3}/_{s}}{0{,}003271\ {}^{m^3}/_{s}} \times 100\%$$

= 30,1628 %

Pada RPM 5500

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

2,42 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{2{,}42\ Kpa}{(1000\ \mathrm{kg/m3})(9.8\ \mathrm{m/s2})}$$

h = 0,246939 m

sehingga beda ketinggian air pada manometer tabung u 0,246939 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air}\ x\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}246939\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 64,48834 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(64,48834m/s)

=0,001093 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(5500)2}{60\ s}$$

= 0,004497 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}001093\ {}^{m^3}/_{s}}{0{,}004497\ {}^{m^3}/_{s}} \times 100\%$$

= 24,31328 %

Pada RPM 6500

$P_{gauge}=\rho_{air}gh$

Dengan ρ_{air} sebesar 1000 kg/m^3

3,12 Kpa = (1000 kg/m^3)(9.8 m/s^2)(h)

$$h = \frac{3{,}12\ Kpa}{(1000\ \mathrm{kg/m3})(9.8\ \mathrm{m/s2})}$$

h = 0,318367 m

sehingga beda ketinggian air pada manometer tabung u 0,318367 m

Dengan ρ_{udara} sebesar 1,165 kg/m^3

$$C = \sqrt{\frac{2\ g\ (H_{air}\ x\ \rho_{air})}{\rho_{udara}}}$$

$$C = \sqrt{\frac{2\ (9{,}8\ {}^{m}/_{s^2})\ (0{,}318367\ m)(1000\ {}^{kg}/_{m^3})}{1{,}165\ {}^{kg}/_{m^3}}}$$

C = 73,2235 m/s

Q_{act} = Cd.A.C

= (0,6)(3,14 x (0,006m)^2 / 4)(73,2235 m/s)

=0,001242 m^3/s

$$Q_{swept} = \frac{(\frac{\pi}{4}D^2.L.N.n)2}{60\ s}$$

$$= \frac{\left(\frac{\pi}{4}\right)(0{,}05\ m)^2(0{,}05\ m)(1)(6500)2}{60\ s}$$

= 0,005315 m^3/s

$$\eta_v = \frac{laju\ aliran\ udara\ sebenarnya(Q_{act})}{laju\ aliran\ udara\ teoritis(Q_{swept})}\ x100\%$$

$$= \frac{0{,}001242\ {}^{m^3}/_{s}}{0{,}005315\ {}^{m^3}/_{s}} \times 100\%$$

= 23,35944 %