nozzle calculations

based on GDL propep calculated valuses with input data:

oxidizer - N_2O	$mo := 2.409\ kg \quad \rho o := 1222.8\ \frac{kg}{m^3}$	
fuel - ployethylene	$mf := 0.315\ kg \quad \rho f := 941\ \frac{kg}{m^3}$	
O/F ratio (r)	$r := \frac{mo}{mf} = 7.648$	
Propellant mass (mp)	$mp := mo + mf = 2.724$	kg
GDL output data		
Combustion temp K (Tc)	$Tc := 3304$	K
Ratio of specific heats (k)	$k := 1.2462$	
Universal gas constant	$R := 8314.5$	$\frac{J}{mol \cdot 10^3 \cdot K}$
Molecular mass	$M := 26.095$	$\frac{kg}{mol \cdot 10^3}$
Specific gas constant	$Rs := \frac{R}{M} = 318.624$	
Specific impulse (Isp)	$Isp := 239.4$	
Effective thrust coefficent	$Cf := 1.461$	
Characteristic exhaust velocity	C¤ := 1607.15	$\frac{m}{s}$
Experimanetal data	$a := 0.104$	
	$n := 0.352$	
Engine Specifications requirements		
Oxidizer supply pressure (Ps)	$Ps := 5.85 \times 10^6$	Pa
Chamber pressure (Pc)	$Pc := 2.4132 \times 10^6$	Pa
Thrust (Fa)	$Fa := 100$	N
Exit pressure (Pe)	$Pe := 0.101 \cdot 10^6$	Pa
Chamber Mach number (Mc)	$Mc := 0.3$	
Throat Mach number (Me)	$Mt := 1$	
Initial port Mach number (Mp)	$Mp := 0.3$	
Convergence angle (α)	$\alpha := 30 \cdot {}^\circ$	

Divergence angle (β) $\beta := 15\cdot°$

Exit ratio $\frac{Ax}{At} = 4.4$

Standard gravity $g := 9.807$ $\frac{m}{s^2}$

Fuel grain diameter (D) $D := 0.05$ m

Calculations

Throat area (At) $At := \frac{Fa}{Cf\cdot Pc} = 2.836\times 10^{-5}$ m^2

Throat diameter (Dt) $Dt := \sqrt{\frac{4\cdot At}{\pi}} = 6.009\times 10^{-3}$ m

Propellant flow rate (´W) $´W := \frac{g\cdot Pc\cdot At}{0.95C¤} = 0.44$ $\frac{kg}{s}$

Fuel flow rate (´Wf) $´Wf := \frac{´W}{r+1} = 0.051$ $\frac{kg}{s}$

Oxidizer flow rate (´Wo) $´Wo := ´W - ´Wf = 0.389$ $\frac{kg}{s}$

Fuel grain calculations

Grain radius (Rg) $Rg := \frac{D}{2} = 0.025$ m

Initial port area (Api)

$$Api := \frac{At\cdot Mt}{Mp}\cdot\left(\frac{1+\frac{k-1}{2}\cdot Mp^2}{1+\frac{k-1}{2}\cdot Mt^2}\right)^{\frac{k+1}{2\cdot(k-1)}} = 5.854\times 10^{-5} \quad m^2$$

Initial port diameter (Dpi) $Dpi := \sqrt{\frac{4\cdot Api}{\pi}} = 8.634\times 10^{-3}$ m

Initial port radius (Rpi) $Rpi := \frac{Dpi}{2} = 4.317\times 10^{-3}$ m

Initial mass flux (Gi) $Goi := \frac{´Wo}{Api} = 6.642\times 10^{3}$ $\frac{kg}{m^2\cdot s}$

Initial regression rate (´ri) $´ri := a\cdot Goi^{n} = 2.304$ $\frac{mm}{s}$

First second burn area (Sburn) $Sburn := \pi\cdot\left(\frac{Dpi}{2} + ´ri\cdot 10^{-3}\right)^2 - \pi\cdot\left(\frac{Dpi}{2}\right)^2 = 7.917\times 10^{-5}$ m^2

First second burn volume (Vburn) $Vburn := \frac{´Wf}{\rho f} = 5.403\times 10^{-5}$ m^3

Port length (Lp)	$Lp := \frac{Vburn}{Sburn} = 0.682$	m
Exit area (Ae)	$Ae := At \cdot 4.4 = 1.248 \times 10^{-4}$	m^2
Exit diameter (De)	$De := \sqrt{\frac{4 \cdot Ae}{\pi}} = 0.013$	m
Convergent length (Lt)	$Lt := \frac{D - Dt}{2 \cdot atan(30 \cdot deg)} = 0.046$	m
Divergent length (Le)	$Le := \frac{De - Dt}{2 \cdot atan(15 \cdot deg)} = 0.013$	m
Post combustion chamber length (Lpcc)	$Lpcc := D = 0.05$	m
Pre-combustion chamber length (Lprecc)	$Lprecc := 2 \cdot D = 0.1$	m
Chamber length (Lc)	$Lc := Lp + Lpcc + Lprecc = 0.832$	m
Nozzle length (Ln)	$Ln := Lt + Le + 0.01 = 0.068$	m
Engine length (Lengine)	$Lengine := Lc + Ln = 0.901$	m
Oxidizer volume (Vf) Litres	$Vf := \frac{mo}{\rho o} \cdot 10^3 = 1.97$	L