EXPORT OPFT\_Liquid(Wm,D,Tf,GE,μ,hm)

BEGIN

LOCAL S,Rd,β:=0.5,β1,β1a,β1b,β2,β2a;

LOCAL d,S1,V,d1,βh,Cd,S2,Nf;

LOCAL Re;

PRINT();

CASE

IF Wm<400 THEN

PRINT(" The flow rate must be ≥ 400\_lb/h");

BREAK;

END;

IF Wm>800ᴇ3 THEN

PRINT(" The flow rate must be ≤ 800ᴇ3\_lb/h");

BREAK;

END;

IF Tf<32 THEN

PRINT(" The flowing temperature must be ≥ 32ºF");

BREAK;

END;

IF Tf>1041 THEN

PRINT(" The flowing temperature must be ≤ 1041ºF");

BREAK;

END;

IF D<4 THEN

PRINT(" The inside diameter must be ≥ 4\_in");

BREAK;

END;

IF D>31 THEN

PRINT(" The inside diameter must be ≤ 31\_in");

BREAK;

END;

IF GE<0.68 THEN

PRINT(" The specific gravity must be ≥ 0.68");

BREAK;

END;

IF GE>1.263 THEN

PRINT(" The specific gravity must be ≤ 1.263");

BREAK;

END;

IF μ≤0 THEN

PRINT(" The absolute viscosity must be > 0\_cP");

BREAK;

END;

IF μ>217.7 THEN

PRINT(" The absolute viscosity must be ≤ 217.7\_cP");

BREAK;

END;

IF hm≤0 THEN

PRINT(" The max. differential range must be > 0\_in");

BREAK;

END;

IF hm>2679 THEN

PRINT(" The max. differential range must be ≤ 4,018.6\_in");

BREAK;

END;

DEFAULT

END;

S:=Wm/(D^2\*(2831+0.0567\*Tf)\*sqrt(GE\*hm));

Rd:=4.42\*Wm/(D\*μ);

V:=Wm/3600/(GE\*62.41\*π\*((D/12))^2/4);

Re:=(V\*D/12)\*GE\*62.41/(μ\*6.7196897514ᴇ−4);

CASE

IF Rd>1ᴇ7 THEN

PRINT(" Reynolds number must be ≤ 1ᴇ7");

BREAK;

END;

IF Rd<4ᴇ3 THEN

PRINT(" Reynolds number must be ≥ 4ᴇ3");

BREAK;

END;

DEFAULT

END;

β1:=sqrt((S-0.01\*β^3-0.518\*β^6.425)/0.598);

CASE

IF β1≤0.25 THEN

PRINT(" Review input data");

PRINT(" The beta ratio must be > 0.25");

BREAK;

END;

IF β1≥0.75 THEN

PRINT(" Review input data");

PRINT(" The beta ratio must be < 0.75");

BREAK;

END;

DEFAULT

END;

REPEAT β1:=sqrt((S-0.01\*β1^3-0.518\*β1^6.425)/0.598); β1a:=sqrt((S-0.01\*β1^3-0.518\*β1^6.425)/0.598);

UNTIL β1-β1a<1.5ᴇ−5;

CASE

IF β1a≤0.25 THEN

PRINT(" Review input data");

PRINT(" The beta ratio must be > 0.25");

BREAK;

END;

IF β1a≥0.75 THEN

PRINT(" Review input data");

PRINT(" The beta ratio must be < 0.75");

BREAK;

END;

DEFAULT

END;

S1:=S/0.997;

β2:=sqrt((S1-0.01\*β1a^3-0.518\*β1a^6.425)/0.598);

CASE

IF β2≤0.25 THEN

PRINT(" Review input data");

PRINT(" The beta ratio must be > 0.25");

BREAK;

END;

IF β2≥0.75 THEN

PRINT(" Review input data");

PRINT(" The beta ratio must be < 0.75");

BREAK;

END;

DEFAULT

END;

REPEAT β2:=sqrt((S1-0.01\*β2^3-0.518\*β2^6.425)/0.598); β2a:=sqrt((S1-0.01\*β2^3-0.518\*β2^6.425)/0.598);

UNTIL β2-β2a<1.5ᴇ−5;

CASE

IF β2a≤0.25 THEN

PRINT(" Review input data");

PRINT(" The beta ratio must be > 0.25");

BREAK;

END;

IF β2a≥0.75 THEN

PRINT(" Review input data");

PRINT(" The beta ratio must be < 0.75");

BREAK;

END;

DEFAULT

END;

d:=β2a\*D;

INPUT(d1," Flow Rate for an Orifice Bore"," d = "," Enter New Value for Orifice Bore (in)",STRING(d,2,4,0),d);

CASE

IF d1==0 THEN

d1:=d;

END;

IF d1≤d THEN

d1:=d;

END;

IF d1/D≤0.25 THEN

PRINT(" Beta Ratio Must be:");

PRINT(" 0.25<β<0.75");

BREAK;

END;

IF d1/D≥0.75 THEN

PRINT(" Beta Ratio Must be:");

PRINT(" 0.25<β<0.75");

BREAK;

END;

DEFAULT

END;

βh:=d1/D;

Cd:=0.5959+0.0312\*βh^2.1-0.184\*βh^8+91.71\*βh^2.5/Rd^0.75;

S2:=0.598\*βh^2+0.01\*βh^3+0.518\*βh^6.425;

Nf:=(S2/S)\*Wm;

PRINT(" ORIFICE PLATE DIAMETER FOR LIQUIDS:");

PRINT(" Calculated Beta Ratio, β = "+STRING(β2a,2,3));

PRINT(" Calculated Orifice Bore, d = "+STRING(d\*1\_inch,2,3));

PRINT(" ");

PRINT(" FLOW RATE ADJUSTMENT:");

PRINT(" New Beta Ratio, β' = "+STRING(βh,2,3));

PRINT(" New Orifice Bore, d' = "+STRING(d1,2,3)+"\_inch");

PRINT(" Discharge Coefficient, Cd = "+STRING(Cd,2,4));

PRINT(" New Flow Rate, Wm' = "+STRING(Nf,2,2,0)+"\_lbm/h");

END;

////////////////////////Modelo Para Gas;

EXPORT OPFT\_Gas(Wm,D,P,γf,k,μ,hm,T)

BEGIN

LOCAL KB,β,d,Y,KBa,Fr,KBb,βa;

LOCAL da,db,βb,KBc,Cd,Nf;

PRINT();

CASE

IF Wm<400 THEN

PRINT(" The flow rate must be ≥ 400\_lb/h");

BREAK;

END;

IF Wm>800ᴇ3 THEN

PRINT(" The flow rate must be ≤ 800ᴇ3\_lb/h");

BREAK;

END;

IF D<2 THEN

PRINT(" The inside diameter must be ≥ 2\_in");

BREAK;

END;

IF D>31 THEN

PRINT(" The inside diameter must be ≤ 31\_in");

BREAK;

END;

IF P≤10 THEN

PRINT(" The pressure must be > 10\_psia");

BREAK;

END;

IF P≥1800 THEN

PRINT(" The pressure must be < 1800\_psia");

BREAK;

END;

IF γf≤0 THEN

PRINT(" Gas density must be > 0\_lbm/ft^3");

BREAK;

END;

IF γf≥4 THEN

PRINT(" Gas density must be < 4\_lbm/ft^3");

BREAK;

END;

IF k<1.05 THEN

PRINT(" The isentropic coefficient must be ≥ 1.05");

BREAK;

END;

IF k>1.8 THEN

PRINT(" The isentropic coefficient must be ≤ 1.8");

BREAK;

END;

IF μ≤0 THEN

PRINT(" The dynamic viscosity must be > 0\_cP");

BREAK;

END;

IF μ>0.1 THEN

PRINT(" The dynamic viscosity must be ≤ 0.1\_cP");

BREAK;

END;

IF hm≤0 THEN

PRINT(" The max. differential range must be > 0\_inH2O");

BREAK;

END;

IF hm>2679 THEN

PRINT(" The max. differential range must be ≤ 2679\_inH2O");

BREAK;

END;

IF T<−20 THEN

PRINT(" Temperature must be ≥ −20\_°F");

BREAK;

END

IF T>450 THEN

PRINT(" Temperature must be ≤ 450\_°F");

BREAK;

END;

DEFAULT

END;

//////calculo;

KB:=Wm/(D^2\*(358.5+0.007\*T)\*sqrt(γf\*hm));

β:=ITERATE(sqrt(1/(((0.5993+(0.007/D)+(0.364+(0.076/sqrt(D)))\*β^4+0.4\*(1.6-(1/D))^5\*(0.07+(0.5/D)-β)^(5/2)\*(0.009+(0.034/D))\*(0.5-β)^(3/2))/(1+0.000015\*(830-5000.\*β+9000.\*β^2-4200\*β^3+(530/sqrt(D)))))\*1/KB)),β,0.7,10);

CASE

IF β≠ABS(β) THEN

PRINT(" 1st iteration for β was not possible");

PRINT(" Check input data");

BREAK;

END;

IF β<0 THEN

PRINT(" Beta Ratio Must be:");

PRINT(" 0.1<β<0.7");

BREAK;

END;

IF β>0.7 THEN

PRINT(" Beta Ratio Must be:");

PRINT(" 0.1<β<0.7");

BREAK;

END;

DEFAULT

END;

d:=β\*D;

Y:=1-(0.41+0.35\*β^4)\*hm/(39.6\*k\*P);

KBa:=KB/Y;

Fr:=1+(830-5e3\*β+9e3\*β^3-4.2e3\*β^3+(530/sqrt(D)))\*((D\*β)^2\*μ/(4.42\*Wm));

KBb:=KBa/Fr;

βa:=ITERATE(sqrt(1/(((0.5993+(0.007/D)+(0.364+(0.076/sqrt(D)))\*βa^4+0.4\*(1.6-(1/D))^5\*(0.07+(0.5/D)-βa)^(5/2)\*(0.009+(0.034/D))\*(0.5-βa)^(3/2))/(1+0.000015\*(830-5000.\*βa+9000.\*βa^2-4200\*βa^3+(530/sqrt(D)))))\*1/KBb)),βa,0.7,10);

CASE

IF βa≠ABS(βa) THEN

PRINT(" 2nd iteration for β was not possible");

PRINT(" Check input data");

BREAK;

END;

IF βa<0 THEN

PRINT(" Beta Ratio Must be:");

PRINT(" 0.1<β<0.7");

BREAK;

END;

IF βa>0.7 THEN

PRINT(" Beta Ratio Must be:");

PRINT(" 0.1<β<0.7");

BREAK;

END;

DEFAULT

END;

da:=βa\*D;

///////ajuste da vazão;

INPUT(db," Flow Rate for an Orifice Bore"," d = "," Enter New Value for Orifice Bore (in)",STRING(da,2,4,0),da);

CASE

IF db==0 THEN

db:=da;

END;

IF db≤da THEN

db:=da;

END;

IF db/D<0.1 THEN

PRINT(" Beta Ratio Must be:");

PRINT(" 0.1<β<0.7");

BREAK;

END;

IF db/D>0.7 THEN

PRINT(" Beta Ratio Must be:");

PRINT(" 0.1<β<0.7");

BREAK;

END;

DEFAULT

END;

βb:=db/D;

KBc:=βb^2\*(0.5993+(0.007/D)+(0.364+(0.076/sqrt(D)))\*βb^4+0.4\*(1.6-(1/D))^5\*(0.07+(0.5/D)-βb)^(5/2)\*(0.009+(0.034/D))\*(0.5-βb)^(3/2))/(1+0.000015\*(830-5000.\*βb+9000.\*βb^2-4200\*βb^3+(530/sqrt(D))));

Cd:=KBc/βb^2;

Nf:=(KBc/KB)\*Wm;

//////plotagem;

PRINT(" ORIFICE PLATE DIAMETER FOR GAS & STEAM:");

PRINT(" Calculated Beta Ratio, β = "+STRING(βa,2,4));

PRINT(" Calculated Orifice Bore, d = "+STRING(da,2,4)+"\_in");

PRINT(" ");

PRINT(" FLOW RATE ADJUSTMENT:");

PRINT(" New Beta Ratio, β' = "+STRING(βb,2,4));

PRINT(" New Orifice Bore, d' = "+STRING(db,2,4)+"\_in");

PRINT(" Coeff. of Discharge, Cd = "+STRING(Cd,2,4));

PRINT(" New Flow Rate, Wm' = "+STRING(Nf,2,1,0)+"\_lbm/h");

END;