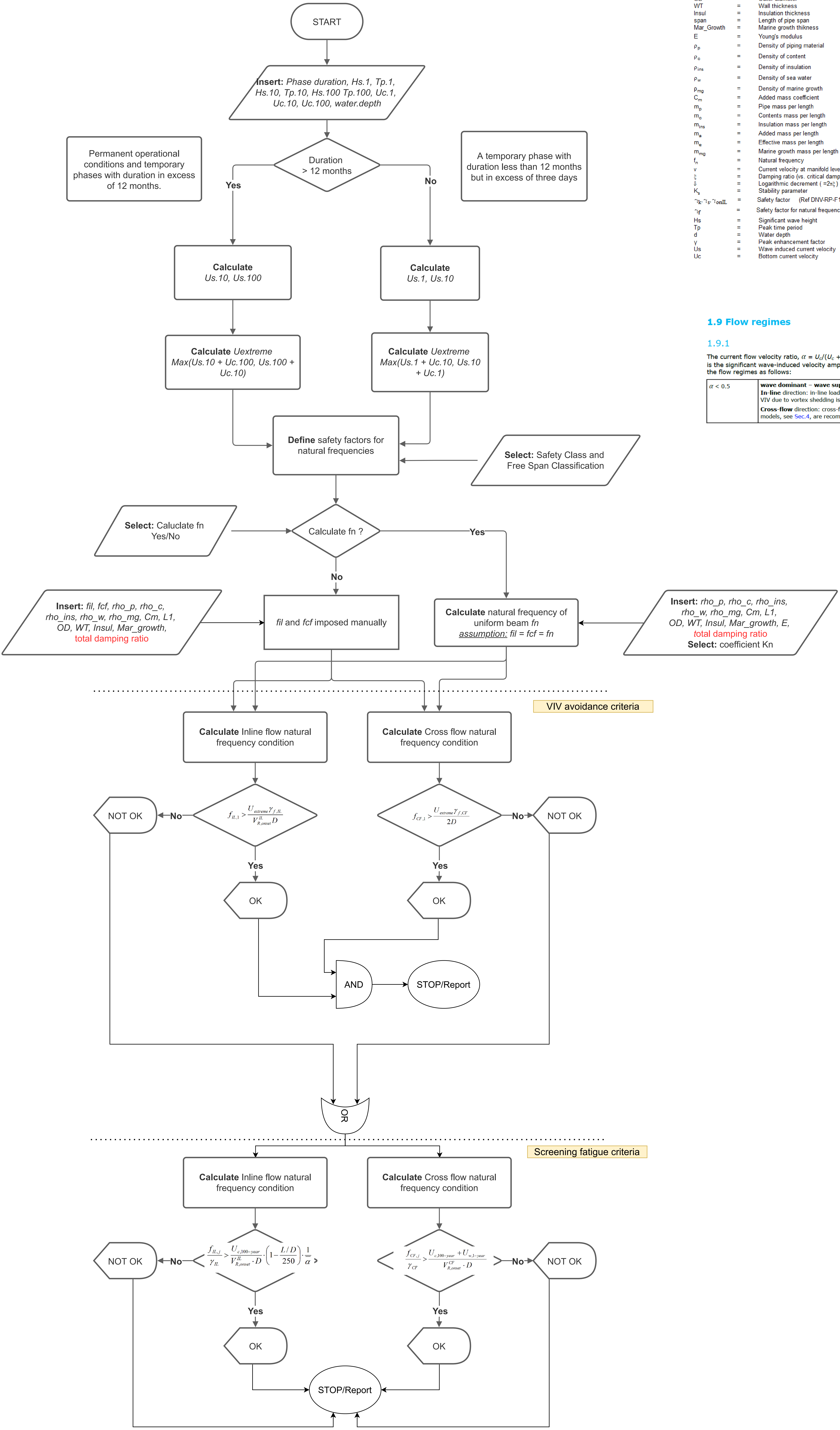

OD	=	Outer diameter	(mm)
WT	=	Wall thickness	(mm)
Insul	=	Insulation thickness	(mm)
span	=	Length of pipe span	(mm)
Mar_Growth	=	Marine growth thikness	(mm)
E	=	Young's modulus	(N/m^2)
ρ_p	=	Density of piping material	(kg/m^3)
ρ_c	=	Density of content	(kg/m^3)
ρ_{ins}	=	Density of insulation	(kg/m^3)
ρ_w	=	Density of sea water	(kg/m^3)
ρ_{mg}	=	Density of marine growth	(kg/m^3)
C_m	=	Added mass coefficient	
m_p	=	Pipe mass per length	(N/m)
m_c	=	Contents mass per length	(N/m)
m_{ins}	=	Insulation mass per length	(N/m)
m_a	=	Added mass per length	(N/m)
m_e	=	Effective mass per length	(N/m)
m_{mg}	=	Marine growth mass per length	(N/m)
f_n	=	Natural frequency	(Hz)
v	=	Current velocity at manifold level	(m/s)
ξ	=	Damping ratio (vs. critical damping)	
δ	=	Logarithmic decrement ($=2\pi\xi$)	
K_s	=	Stability parameter	
$\gamma_k, \gamma_s, \gamma_{onIL}$	=	Safety factor (Ref DNV-RP-F105)	
γ_f	=	Safety factor for natural frequencies	
Hs	=	Significant wave height	(m)
Tp	=	Peak time period	(s)
d	=	Water depth	(m)
γ	=	Peak enhancement factor	
Us	=	Wave induced current velocity	(m/s)
Uc	=	Bottom current velocity	(m/s)

1.9 Flow regimes

1.9.1

The current flow velocity ratio, $\alpha = U_c/(U_c + U_w)$ (where U_c is the current velocity normal to the pipe and U_w is the significant wave-induced velocity amplitude normal to the pipe, see Sec.4), may be applied to classify the flow regimes as follows:

$\alpha < 0.5$	**wave dominant – wave superimposed by current** **In-line** direction: in-line loads may be described according to Morison's equations, see Sec.5. In-line VIV due to vortex shedding is negligible. **Cross-flow** direction: cross-flow loads are mainly due to asymmetric vortex shedding. Response models, see Sec.4, are recommended.