PFD

Safety Integrity Level	PFD Probability of failure on demand per year (Demand mode of operation)	1/PFD Risk Reduction Factor
SIL 4	>=10^{-5} to <10^{-4}	100000 to 10000
SIL 3	>=10^{-4} to <10^{-3}	10000 to 1000
SIL 2	>=10^{-3} to <10^{-2}	1000 to 100
SIL 1	>=10^{-2} to <10^{-1}	100 to 10

PFD Calculation : Simple Math

Full Stroke Testing Only

Assumptions: DC is 100% and TI is 1x / yr

$$PFD_{avg} = [(DC)(\lambda_d)(TI/2)] = (1)(\lambda_d)(1/2) = 0.5\ (\lambda_d)$$

Adding Partial Stroke Testing

Assumptions: DC is 70% for partial stroke and 100% for full stroke

TI is 4x/yr for partial and 1x/3 yrs for full

$$PFD_{avg} = [(DC)(\lambda_d)(TI/2)]_P + [(1\text{-}DC)(\lambda_d)(TI/2)]_F$$

$$= [(0.7)(\lambda_d)(0.25/2)] + [(1\text{-}0.7)(\lambda_d)(3/2)]$$

$$= 0.09\ (\lambda_d) + 0.45\ (\lambda_d) = 0.54\ (\lambda_d)$$

Conclusion: Partial Stroke Testing enables extending the full-stroke testing interval to 3 years and still maintaining the same PFD!