RT FORMULAE

1. Geometrical Unsharpness $U_g = \frac{d.t}{SFD-t}$

   Where,

   d=effective dia. of the source size

   t=thickness of job

   SFD= source to film distance

Minimum SFD calculation:

SFD = $t(1 + \frac{d}{U_g})$

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2. Radiation level $R_L = \frac{Activity\ X\ RHM}{d^2}$

   Where,

   RHM = Rontgen per Hour per Meter. d =distance

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3. Exposure time = $\frac{film\ factor\ X\ SFD^2 X\ 2^n X60}{Ci\ X\ RHM\ X\ 100^2}$

   Where,

   n = $\frac{x}{HVT}$, x = thickness of the job.HVT=Half Value Layer thickness of steel

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4. Allowed working Time = $\frac{Dose\ limit}{Dose\ rate}$

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5. Inverse Square Law: $\frac{I_1}{I_2} = \frac{{d_2}^2}{{d_1}^2}$

Isotopes	Half Life	RHM value	Optimum Working Steel Thickness (mm)
Ir-192	74.4 days	0.55	10-60 mm
Co-60	5.27 years	1.30	50-200 mm
Tm-170	127 days	0.0025	2-10 mm
Cs-137	33 years	0.34	50-125 mm

MT FORMULAE

1. Longitudinal Current Calculation: NI = $\frac{45000}{\frac{L}{D}}$

   Where,

   L = Length of the component

   D = Dia. of the component

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2. For stationary equipment, current calculations:
   Circular magnetization for AC : 500 – 800 Amp/Inch
   Circular magnetization for AC : 800 – 1000 Amp/Inch

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3. A.S.T.M. Recommended Prod Spacings and current Values.

Prod Spacing, Inches	Section Thickeness, Inches	
	Under ¾ inch	¾ inch and over
2 to 4	200 to 300 Amperes	300 to 400 Amperes
Over 4 to less than 6	300 to 400 Amperes	400 to 600 Amperes
6 to 8	400 to 600 Amperes	600 to 800 Amperes

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4. Yoke Calibration checks (Weight lifting capacities):
   For A.C Current: 4.5 Kgs for 2 to 6 inch leg spacing
   For D.C Current: 18 Kgs for 100 to 150 mm leg spacing

UT FORMULAE

1. Wave length $\lambda = \frac{V}{F}$

   Where,

   V = velocity (Km),

   F = frequency (MHz)

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2. Acoustic Impedance Z = ρ.V

   Where,

   ρ = density Kg/m^3,

   v = velocity m/sec,

   Z = $Kg/m^2/sec$

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3. Reflection R(%) = $\frac{(z_2 - z_1)^2}{(z_2 + z_1)^2}$

   Transmission T(%) = $\frac{4 z_2 z_1}{(z_2 + z_1)^2}$

   and T+R=1

   Where,

   Z_1 = Acoustic Impedance – I

   Z_2 = Acoustic Impedance – II

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4. Snell's law : $\frac{Sin\ i}{Sin\ r} = \frac{v_i}{v_r}$

   Where,

   Sin i = incident angle

   Sin r = refracted angle

   v_i = Velocity media-I

   v_r = Velocity media-II

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5. Critical Angle Sinθ = $\frac{v_1}{v_2}$

   Where,

   v_1=Velocity media-I

   V_2=Velocity media-II

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6. Beam spread: Sin θ = $\frac{1.22\lambda}{D}$

   Where,

   θ =Half angle of beam spread

   λ= Wave length

   D=Dia. of the transducer

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7. Near field N= $\frac{D^2 F}{4V}$

   Where,

   D=Dia. of the transducer

F=Frequency of the transducer

V=Velocity of the material

---

8. dB Calculation dB = 20 $\text{Log}_{10}\frac{H_2}{H_1}$

Where,

H_1 = Echo Hight I

H_2 = Echo Hight II

$\frac{H_2}{H_1}$= $10^{N/20}$

Where,

N=dB given

---

9. Echo Height/ Size / distance :

$\frac{H_2}{H_1} = \frac{{x_2}^2}{{x_1}^2}$ x $\frac{{d_1}^2}{{d_2}^2}$

Where,

H_1= Echo Height I

H_2= Echo Height II

x_1= Size of defect I

x_2= Size of defect II

d_1= Distance of defect I

d_2=distance of defect II

---

10. Focal length

R = F $\frac{(n-1)}{n}$

Where,

R = Radius of curvature of the lens

F = Focal length of water

n = the ratio of velocity = V_1/V_2

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11. Attenuation coefficient

$\frac{dB}{M} = \frac{(Hx_1 - Hx_2)dB - 20\, log_{10}\frac{x_2}{x_1}}{2(x_2 - x_1)}$

Where,

$(Hx_1 - Hx_2)dB$= dB difference

x_1 = Echo height I

x_2 = Echo height II

---

12. Focused Probe:

X_m-(f_w-X_w) $\frac{Vw}{Vm}$

Where,

V_w= Velocity of water km/sec

V_m = Velocity of material Km/sec

X_m =Metal distance

F_w = Focal width

θ = Angle unit

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13. Unfocussed probe F_w=N_w

N= $\frac{D^2F}{4V}$

Where,

D=Dia. of the transducer

F=Frequency of transducer

V=Velocity of material

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14. Offset distance

X-R $\frac{Vw}{Vm}$ Sin θ

Where,

X=offset distance, R=Radius of the job

V_w=Velocity in water, θ= Refracted angle

V_m=Velocity in material

---

15. Limiting angle

θ = $\sin^{-1}$ $(\frac{ID}{OD})$ or θ = $Sin\ \frac{2t}{OD}$

Thickness detected T = $\frac{D}{2}$ (1- Sin θ)

Where,

D= Dia. of job

T= Thickness of job

Thickness undetected from ID, T= $\frac{d1-d}{2}$

d_1= D Sin θ

d=ID of job

---

16. Tandom Technique X = 2(t-D) tan θ

Where,

X=Probe spacing (mm)

T=Thickness of job (mm)

D=Depth of defect (mm)

θ=Angle unit

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17. Velocity measurement

$\frac{Actual\ thickness}{Actual\ Velocity} = \frac{Apparent\ Thickness}{Calibrated\ Velocity}$

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18. Automation

a. PRR = $\frac{n\ .\ S}{d_p}$

Where,

PRR = Pulse Repetition Rate

N = No. of Hits
S = Speed (m/s)
D_p = Dia. of probe (mm)
V = Velocity (Km/sec)

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b. PRR = $\frac{V}{2.x.n}$

Where,

X = thickness
N = No. of hits
PRR = Pulse Repetition Rate

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19. Time Taken for plate

T = $\frac{Area\ of\ the\ plate}{W.S}$

Where,

W = Scan width
S = Speed

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20. Surface Speed:

SI = D_m x RPS

Where,

D_m= Metal Dia.
RPS = Revolution Per Seconds
L = Length of the job
W = Scan width

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21. Velocity = $\frac{Distance\ Travelled}{Time}$