PIPE DAMAGE IMPACTED STRESS CALCULATION

1. CALCULATION PURPOSE

This calculation was prepared to find that how to impact damaged pipe with physical material when it dropped in gravity speed from assumed distance.

The calculation method complied with engineering practice and general theory.

Especially, this calculation was performed based on destruction theory of deformation energy.

2. DESIGN CONDITION

2-1 Design reference

JIS, ASTM, ASD

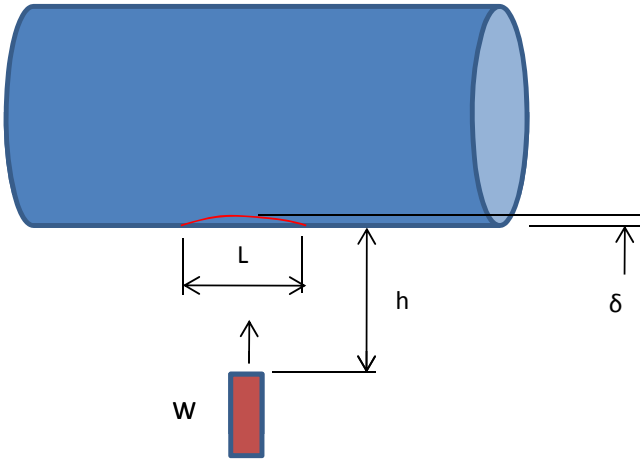
2-2 Applied Load

1) Pipe weight, W	387.2	Kgf
for 12" Sch. 10S-11m (35.2Kg/m, 4.5T for S.S Pipe)		

2-3 Material

1) Material	A312-TP304	
2) Modulus of Elasticity, E	1,989,688.0	kg/cm^2
3) Yield strength,Ys	1757.7	kg/cm^2
4) Allowable tensile stress, Sat	1174.1	kg/cm^2
5) Allowable stress for bending, Sb=0.66*Sat	774.9	kg/cm^2
6) Shape profile calculation		
b	15.0	cm
h	0.45	cm
** y, Distance from neutral axis to extreme fiber, T/2	0.23	cm
** I, Moment of inertia, bh^3/12	0.11	cm^4
** Z, Section modulus, bh^2/6	0.51	cm^3

IMPACT CONFIGURATION OF PIPE DEFORMATION ENERGY



3. DEFORMATION ENERGY CALCULATION

1) Pipe location Energy=W(h+δ)

2) Absorber engrgy in Pipe=(σ^2*A*ℓ)/2*E

Pipe location energy is equal to pipe absorber energy

ie, W(h+δ) = (σ^2*A*ℓ)/2*E

δ = W*ℓ/A*E = σ*ℓ/E

A*ℓ/2E/σ^2 - W*ℓ*σ/E - W*h = 0

σ^2 - 2W*σ/A - 2*E*W*h /A*ℓ= 0

Therefore,

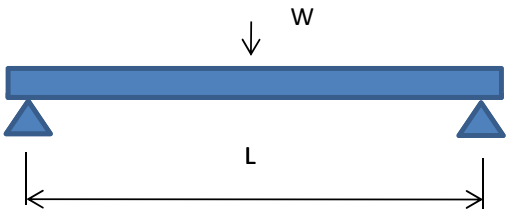
Impact stress in Pipe will be calculated as follows.

σ = W/A +-((W/A)^2+(2*E*W*h/A*ℓ))^0.5

3-1 Damaged area in Pipe (OD 15cm, Circular type)

1) Area, A	176.7	cm^2
2) Pipe weight, W	387.2	Kgf
3) ℓ=Thickness	0.45	cm
4) Gravity dropping height, h	17.69	cm
5) Impacted stress, σ	18,516	kgf/cm^2

4. Assumed gravity dropping height, H



1) Yield strength of material,Ys	1757.7	kgf/cm^2
2) Modulus of Elasticity, E	1,989,688.0	kg/cm^2
3) Applied unsupported length, L	15	cm
4) Assumed impacted Force, Wf	2500.0	Kgf
5) Bending moment, Mb=Wf*L/4	9375	kgf-cm
6) Sectional modulus, Z	0.51	cm^3
7) Stress at center in pipe, Sc=Mb/Z	18,519	kg/cm^2
8) Deflection at center, Df=Wf*L^3/48*E*I	0.78	cm
9) Required section modulus, Za=Mb/Wf	3.75	cm^3
10) Exceedig ration comparing sectional modulus, Rat=Za/Z	7.4	times

5. CALCULATION RESULT

We may assumed that this pipe dropped at 176.9 mm height in a gravity acceleration
And impacted with rigidity physical material like as steel structure at ground floor.

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Prepared By Ryu-ChangMyong/
Professional Engineer in Mechanical
http://www.pes21.com
wine@pes21.com