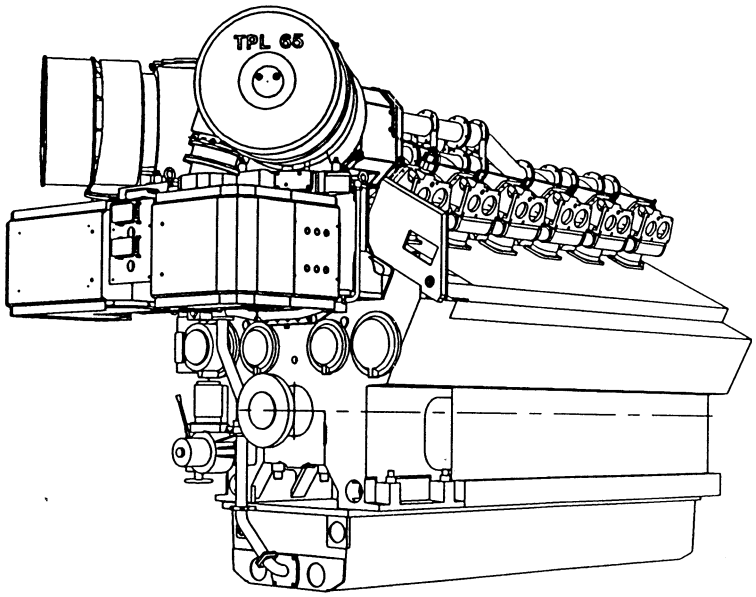
NATURAL FREQUENCY OF A FLUID CARRYING PLATE

Problem: Determination of the effect of the oil on the natural frequencies of a) a clamped rectangular plate carrying oil of different heights and b) a rectangular plate immersed in oil and clamped at three edges and free at the end in air

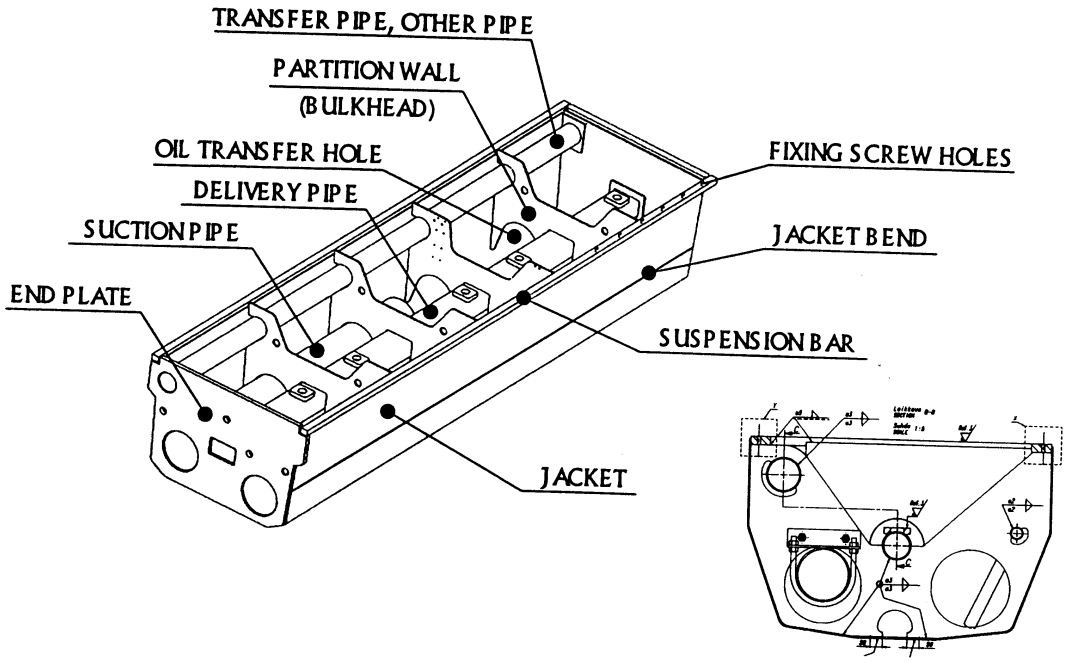
Background:



Harmonic excitations from the engine will influence the plates of the oil sump.

Resonance will occur if the natural frequency of some plate domain coincides with the excitation frequency

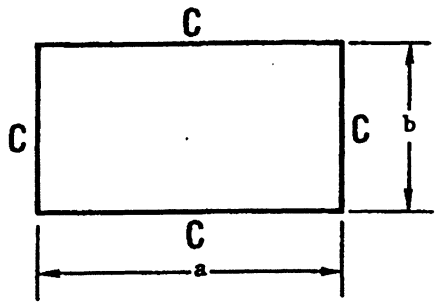
It is difficult to calculate the natural frequencies of these plates immersed in oil!



Natural Frequency (hertz), $f_{ij} = \frac{\lambda_{ij}^2}{2\pi a^2}\left[\frac{Eh^3}{12\gamma(1-\nu^2)}\right]^{1/2}$; i=1,2,3...; j=1,2,3...

Description	λ_{ij}^2 and (ij)

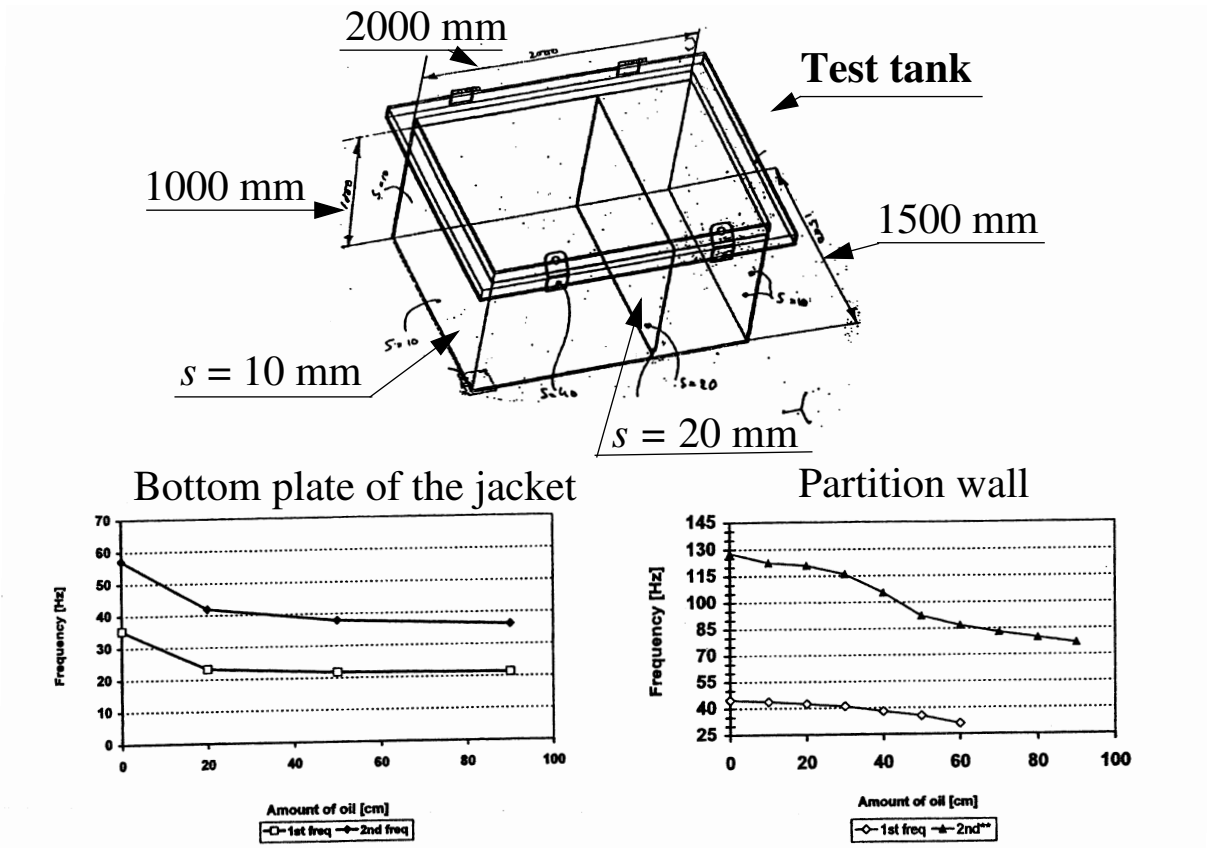
21. Clamped-Clamped - Clamped-Clamped



a/b	Mode Sequence 1	2	3	4	5	6
0.4	23.65 (11)	27.82 (12)	35.45 (13)	46.70 (14)	61.55 (15)	63.10 (21)
2/3	27.01 (11)	41.72 (12)	66.14 (21)	66.55 (13)	79.85 (22)	100.9 (14)
1.0	35.99 (11)	73.41 (21)	73.41 (12)	108.3 (22)	131.6 (31)	132.2 (13)
1.5	60.77 (11)	93.86 (21)	148.8 (12)	149.74 (31)	179.7 (22)	226.9 (41)
2.5	147.80 (11)	173.9 (21)	221.5 (31)	291.9 (41)	384.7 (51)	394.4 (12)

λ is independent of ν.

Natural frequencies of a clamped plate without oil.



Measured influence of the oil on the two lowest natural frequencies of the bottom plate and the partition wall.