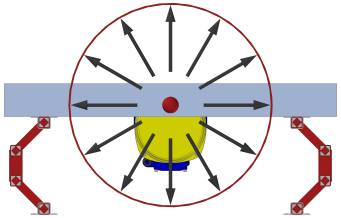
VIBRATION THEORY

METHODS OF VIBRATION

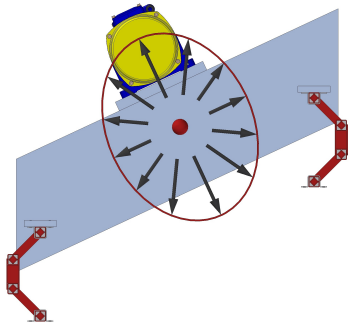
- ROTATIONAL

obtained with
- 1 Electric Vibrator
- 1 eccentric shaft



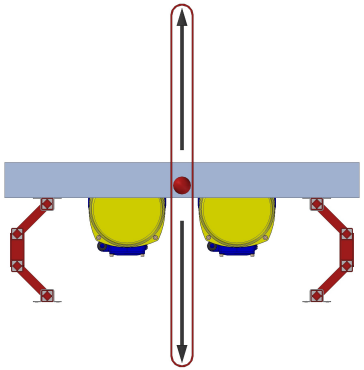
- ELIPTICAL

obtained with
- 1 Electric Vibrator (not in the gravity center)
- 1 eccentric shaft (not in the gravity center)



- LINEAR

obtained with
- 2 Electric Vibrators
- 2 eccentric shafts
- 1 gear box



ROTATIONAL / EXAMPLES

- Silos
- Hoppers
- Bin Discharger
- Filters
- Testing Tables
- Inclined Screen
- Circural Screen
- Leveling Bars
- Precast Mould
- …

LINEAR / EXAMPLES

- Horizontal Screens
- Feeders
- Grizzly Feeders
- Conveyors
- Extractors
- Separetors (milling)
- Tables
- Fluid beds
- Purifiers
- ….

WHAT CHARACTERIZES A VIBRATOR?

- Speed (rpm)
- Static Moment (kg*mm)
- Electric Power (kW)

WHAT CHARACTERIZES A VIBRATING MACHINE?

- Process
- Speed (rpm)
- Stroke (mm)
- Acceleration (Nr of “G” Force)
- Angle of Line of force ()
- Isolation system

FIRST ASSUMPTION

- Type of vibration, speed, amplitude/acceleration, angle of force of vibrating machines depend on:
  - Type of process
  - Type of products
  - Capacity required
- Isolation system of vibrating machines depends of:
  - Type of vibration and speed
  - Installation of vibrating machine
  - Total weight of the vibrating machine (vibrating structure + vibrator)
  - Weight of produc (depending on method of material loading)
  - Dimensions of vibrating machine
  - Characteristics of supporting structure

BASIC INDICATIONS FOR LINEAR MOTION VIBRATING MACHINES

Process	Speed (rpm)		Total Stroke (mm)	Accelerat. (G)	Angle from horiz. (°)
	50Hz	60Hz			
conveying	750-1000-1500	900-1200-1800	4,5 - 7,0	5,0 - 8,0	25 - 30
primary screening	750-1000	900-1200	4,5 - 7,0	4,0 - 7,0	30 - 45
fine screening	1500-3000	1800-3600	4,5 - 7,0	4,0 - 7,0	30 - 45
extracting	1000-1500	1200-1800	4,0 - 6,0	4,0 - 5,0	25 - 30
primary feeding	750-1000	900-1200	6,0 - 11,0	4,0 - 6,0	25 - 35
feeding	1000-1500	1200-1800	6,0 - 11,0	5,0 - 6,0	25 - 35
separating	750-1000	900-1200	5,0 - 8,0	3,0 - 4,5	30 - 45
fluidizing	750-1000	750 – 1000	750 - 1000	5,0 - 8,0	50 - 80

BASIC FORMULA

- FORMULA

$e = S / 2$ $\quad e = M_t / W_t$ $\quad a = F_t / W_t$ $\quad W_t = W_s + W_v$

$M_t = W_t \times e$ $\quad F_t = W_v \times a$

- LEGENDA

e = Eccentricity (mm)
s = Total Stroke (pick to pick) (mm)
a = Acceleration (Nr of G's)
M_t = Total Static Moment (Static Moment of Vibrator x Nr of vibrator) (kg*mm)
F_t = Total Centrifugal Force (Centrifugal Force of Vibrator x Nr of vibrator) (kg)
W_t = Total Weight of machine (structure + vibrator/s) (kg)
W_s = Weight of isolated structure (kg)
W_v = Weight of Vibrator (Weight of Vibrator x Nr of vibrator) (kg)

EXAMPLE Nr 01

- Known informations :
  - Type of process = quarry primary feeder
  - Type of vibration = linear (2 Vibrators)
  - Weight of Vibrating structure = 1500 kg
  - Stroke (from a/m table) = 6.0-11.0 mm (say 8.0)
  - Speed (from a/m table) = 1000 rpm
- Rough selection of Vibrator by using the a/m formulas:
  - $e = S / 2$ => $e = 8.0 / 2$ = 4.0 mm
  - $M_t = W_t \times e$ => $M_t = 1500 \times 4.0$ = 6000 kg*mm
  - $M_v = M_t$ / Nr of Vib. => $M_v = 6000 / 2$ = 3000 kg*mm

EXAMPLE Nr 01

From the Visam's catalogue to 6 pole page we find to the Static Moment colomn that the closest model is the SPV 35.5 C wich has a Static Moment of 3551.0 kg*mm and a weight of 189.0 kg

- Checking the selection of Vibrator by using the a/m formulas:
  - $M_t = M_v \times 2$ = 3551.0 x 2 = 7102.0 kg*mm
  - $W_t = W_s + W_v$ = 1500 + (189 x 2) = 1878.0 kg
  - $e = M_t / W_t$ = 7102.0 / 1878.0 = 3.8 mm

In this case we need a bigger unit to get the stroke required; the next model from the catalogue is the SPV 41.5 C wich has a Static Moment of 4227.0 kg*mm and a weight of 206.0 kg

  - $M_t = M_v \times 2$ = 4227.0 x 2 = 8454.0 kg*mm
  - $W_t = W_s + W_v$ = 1500 + (206 x 2) = 1912.0 kg
  - $e = M_t / W_t$ = 8454.0 / 1912.0 = 4.4 mm

EXAMPLE Nr 01

In this case the Vibrator must be set at 90%; a bigger unit is recomended to have a higher stroke available in case on site is needed; the next model from the catalogue is the SPV 50.0 C wich has a Static Moment of 5117.0 kg*mm and a weight of 236.0 kg

- $M_t = M_v \times 2$ $= 5117.0 \times 2$ $= 10234.0$ kg*mm
- $W_t = W_s + W_v$ $= 1500 + (236 \times 2)$ $= 1972.0$ kg
- $e = M_t / W_t$ $= 10234.0 / 1972.0$ $= 5.1$ mm

In this case the Vibrator must be set at 80% wich means that we have a further 20% in case on site is needed

EXAMPLE Nr 01

- Checking the acceleration of the machine by using the a/m formulas:
  - $F_t = F_v \times 2$ = 5721.0 x 2 = 11442.0 kg*mm
  - $W_t = W_s + W_v$ = 1500 + (236 x 2) = 1972.0 kg
  - $a = F_t / W_t$ = 11442.0 /1972.0 = 5.8 G x 80% = 4.6 G

IMPORTANT QUESTIONS TO BE ASKED TO CUSTOMERS

- Is it first time he makes vibrating machines?
- Does he know basic principles of vibration?