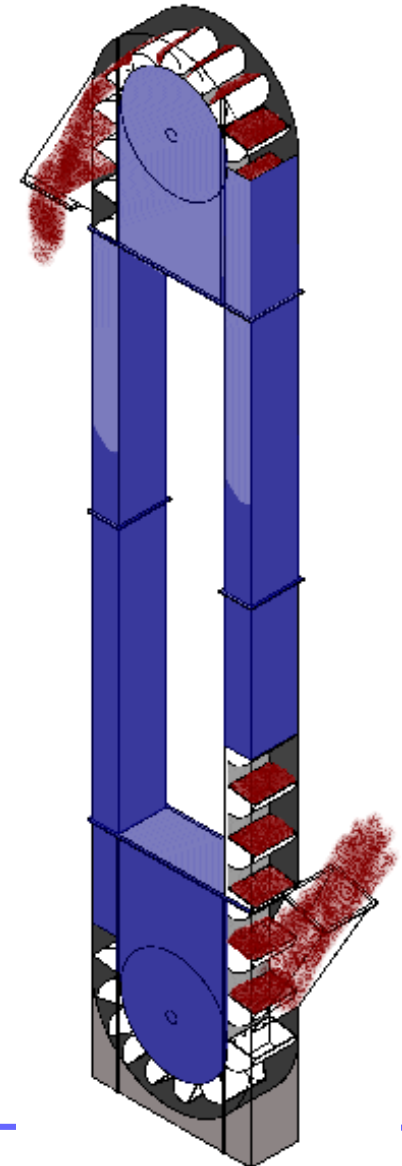


Bucket Elevator



<http://www2.hcmuaf.edu.vn/?ur=danngin>

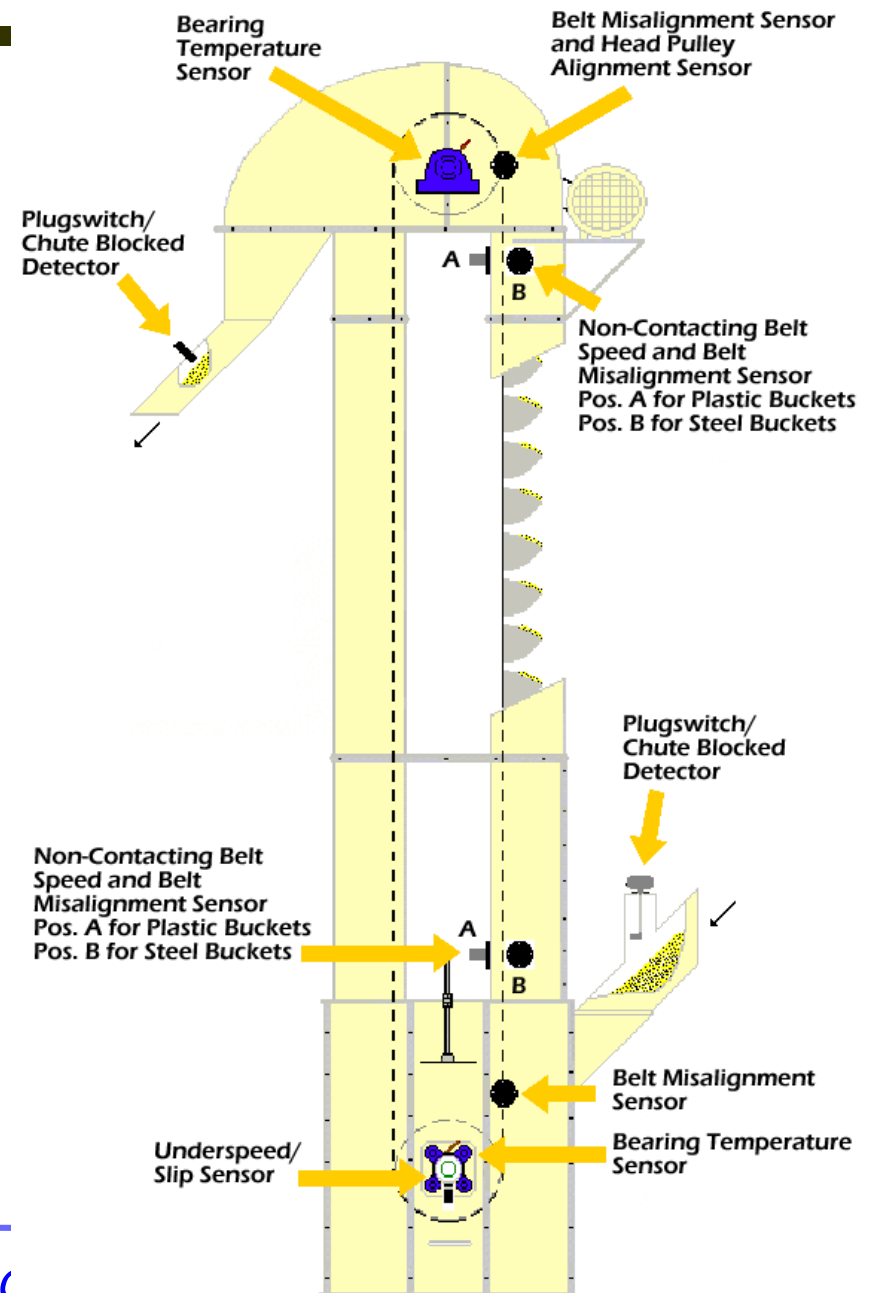
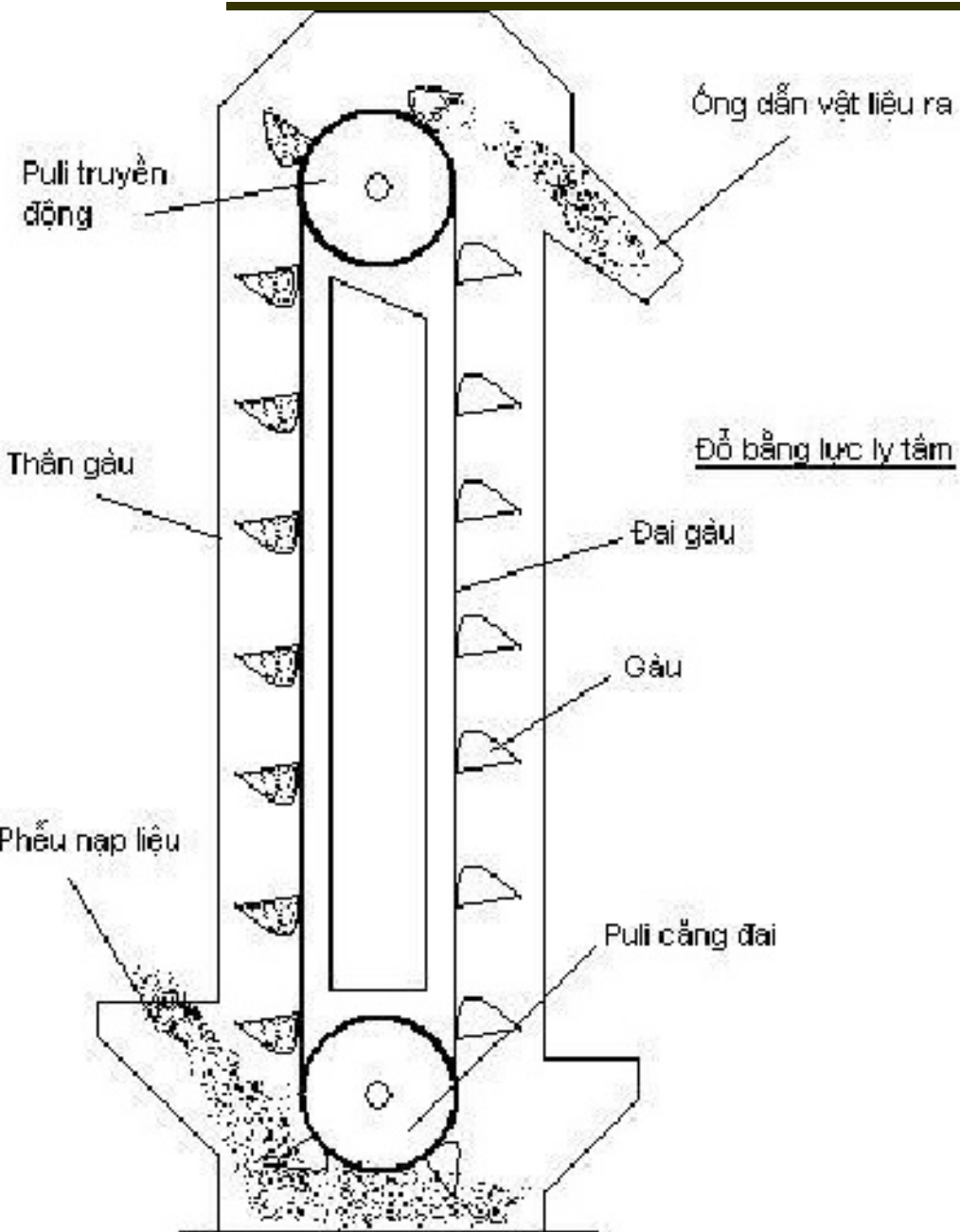
Objectives

- **Definition**
- **General Characteristics**
- **Types of Bucket Elevators**
- **Parts of Bucket Elevators**
- **Capacity Calculation**
- **Power Requirement**
- **Gầu tải bang – xích**
- **Others types**

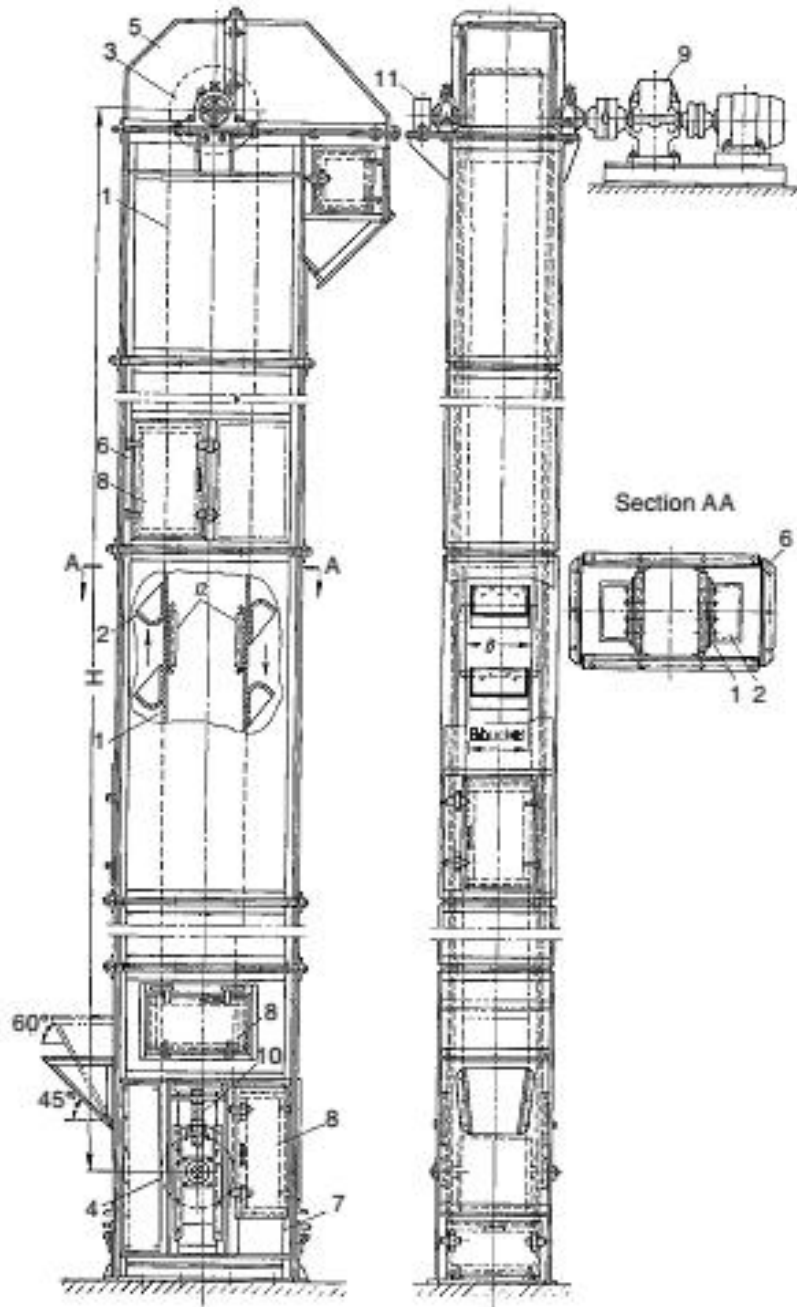
1. Definition/ Description (1)

- These are powered equipment for conveying bulk materials in a vertical or steep inclined path, consisting of an endless belt, or chain/s to which metallic buckets are fixed. With the flexible belt/chain, the buckets move unidirectionally within a casing and collects bulk materials at bottom end of the equipment and delivers it at the top end.
- The vertical lift may be a few meters to more than 50 m.
- Capacity may vary from 2 to 4 t/hour to as much as 25, 50, or even 100 t/hour.

1. Definition (2)



A vertical belt-and-bucket elevator



- 1-belt;
- 2-bucket;
- 3-driving pulley;
- 4-take-up pulley;
- 5-upper casing section;
- 6-intermediate casing sections;
- 7-lower casing section (boot);
- 8-manholes;
- 9-drive unit;
- 10-take-up;
- 11- holdback brake;
- 12-guides.

2. General Characteristics (1)

- i. An endless pulling member- flat belt or chain.**
- ii. Driving and take up pulleys or sprockets at top and bottom respectively, mounted on bearings and blocks.**
- iii. Metal casing covering the entire elevator. It consists of head at the top, boot at the bottom and intermediate sections, all joined at flanges by fasteners.**
- iv. Buckets, generally made out of sheet metal, which are attached at definite pitch to the pulling member by fasteners (screw and nuts, riveted etc.)**

2. General Characteristics (2)

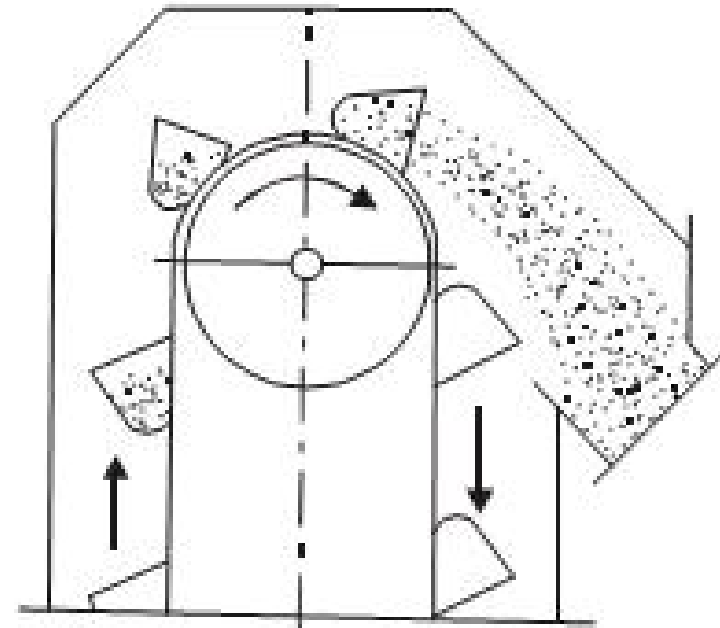
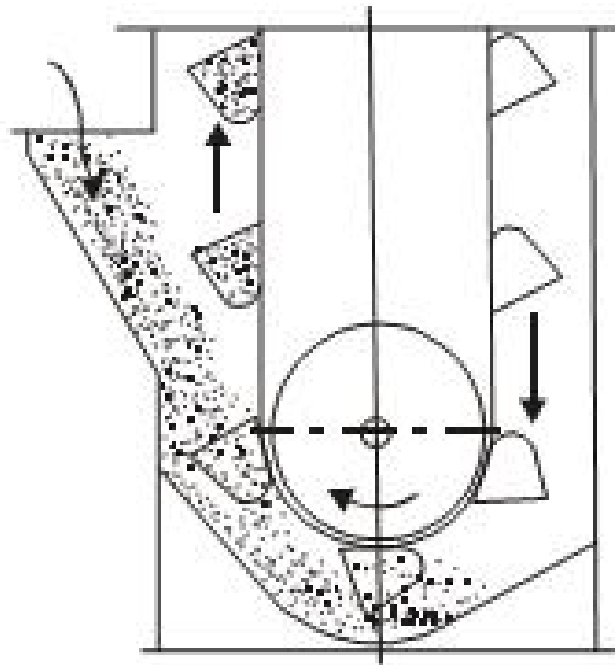
- i. Drive at the top consisting of an electric motor, gearbox, and couplings.**
- ii. Hold back brake attached to the top pulley/sprocket shaft, to prevent reverse motion of the elevator when drive is stopped.**
- iii. Feed hopper attached to the boot for feeding materials to the elevator.**
- iv. Delivery/ discharge spout fixed with the top part of the casing, through which the material is discharged.**
- v. Manholes are provided at the casing to check operations of the elevator.**
- vi. Guides and guide sprockets are provided for belt and chain respectively to keep them in a straight path.**

3. Types of bucket elevators

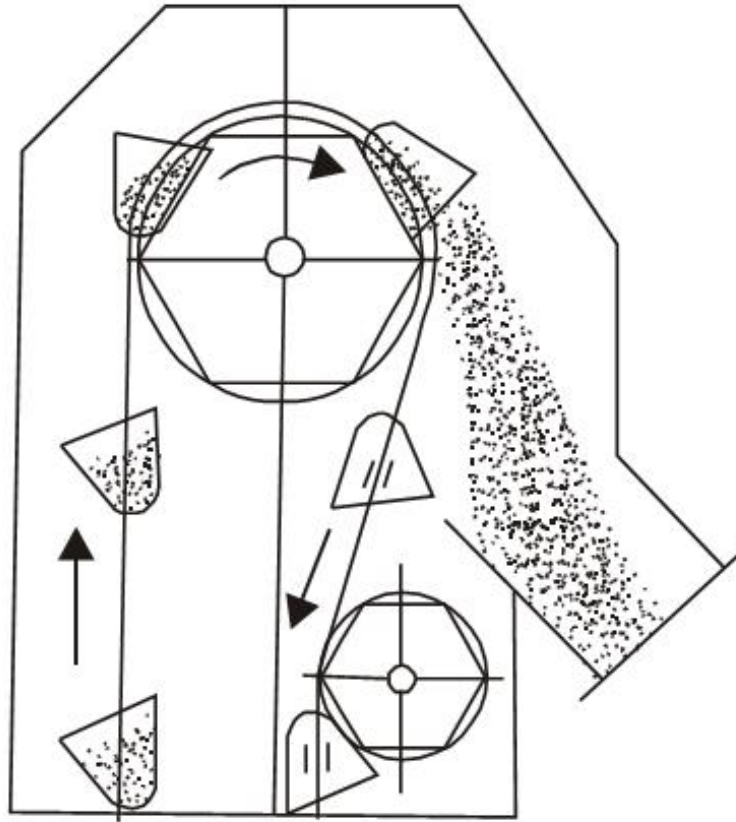
Bucket elevators are classified based on bucket spacing and mode of discharge of materials. As per IS:7167-1974, “Code for Selection and Use of Bucket Elevators,” they are classified into following three basic types.

- 1. Centrifugal discharge elevators
(designated as type I)**
- 2. Positive discharge elevators (designated
as type III)**
- 3. Continuous discharge elevators
(designated as type II)**

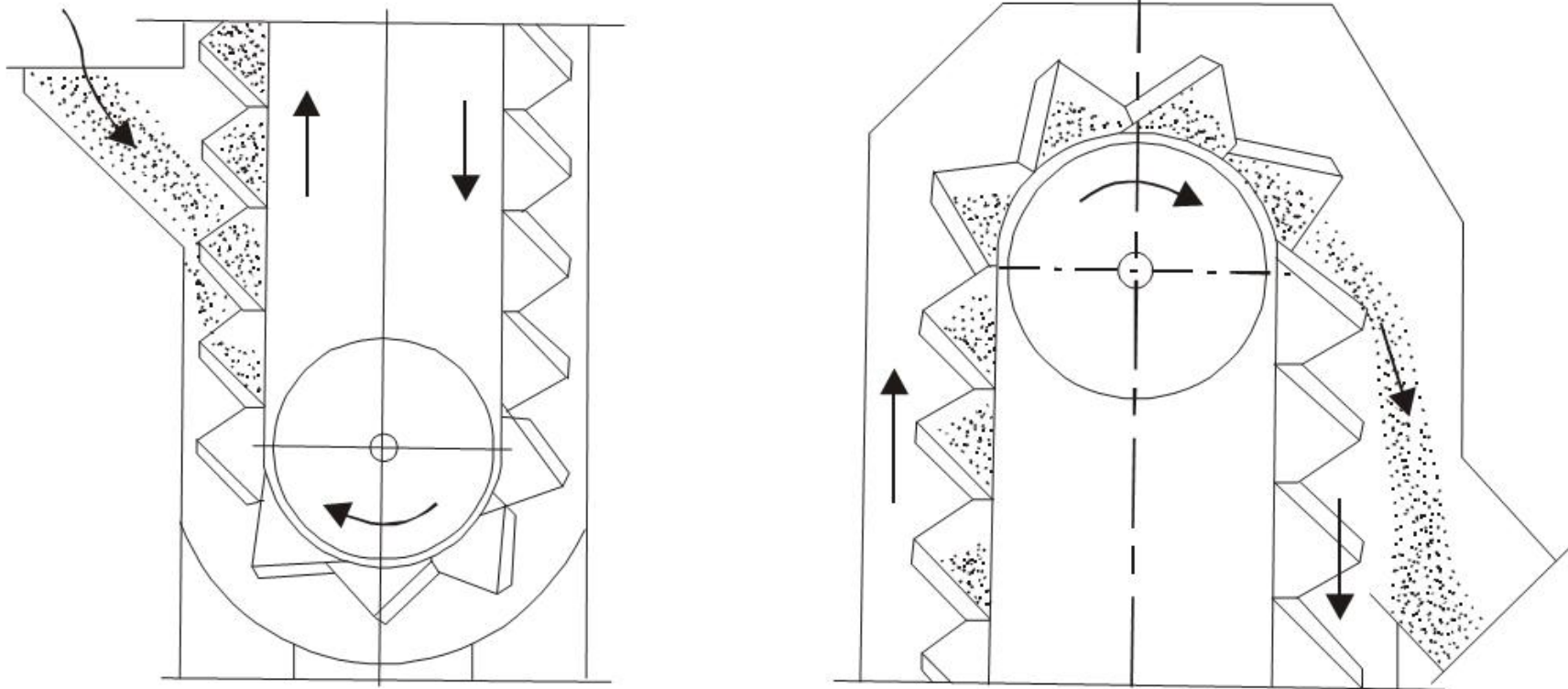
3.1. Centrifugal discharge elevators



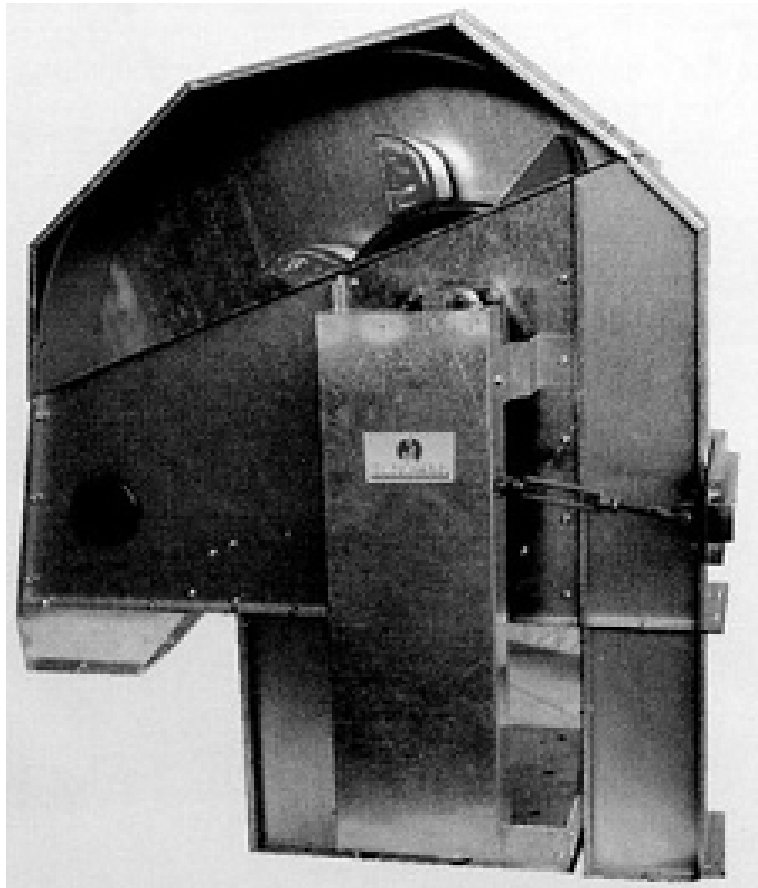
3.2. Positive discharge elevators



3.3. Continuous discharge elevators



Part cover removed head section



3.5. Selection of type of elevator

Table. 8.4.1. Recommendation for Selection of Bucket Elevators

Materials	Bulk density, kg/m ³	Belt /chain	Type of elevator (see note)
Alum, lumpy	800-960	Chain	I, III
Aluminum ore	1200-1350	Chain	I, III
Ashes	560-640	Chain	I
Bauxite, crushed and dry	1200-1350	Chain/belt	I, III
Carbon, black pelletized	320-400	Chain	III
Carbon, black powder	65-100	Chain	II
Cement, Portland	1200-1350	Chain	I, III
Chalk, pulverized	1120-1200	Belt / Chain	III
Coal anthracite	960	Chain/belt	I, III
Coke, loose	370-510	Belt	I
Gypsum calcined	880-960	Chain	I, III
Lime, ground	960	Chain	I, III
Lime, hydrated	560-720	Chain/belt	III
Malt, dry ground	320-335	Belt/ Chain	I, II
Rice, bran	320	Belt/ Chain	I
Salt, dry coarse	720-800	Belt/ Chain	I, III
Sand, damp	1760-2080	Belt/ Chain	I
Sand dry	1440-1760	Belt	I
Sugar raw	880-1040	Chain/belt	I
Talc	800-960	Belt	I

4. Parts of a Bucket Elevator

- 1.HEAD SHAFT: with pulley for belting or sprockets for chain.
- 2.THE DRIVE, gear reducer, and motor drives, which may be V-belt, AN drive chain and sprockets, or direct-coupled with flexible coupling or shaft-mounted reducer.
- 3.FOOT SHAFT: with pulley or sprockets.
- 4.ELEVATOR BUCKETS mounted on belt or chain
- 5.THE ELEVATOR HOUSES the bucket and belting or chain assembly and general provide mounting and enclosure for the rotating machinery.
- 6.PLATFORMS, LADDERS, AND HOIST BEAMS are frequently mounted on elevator housings for maintenance access.

4.1. Bucket of Bucket Elevators

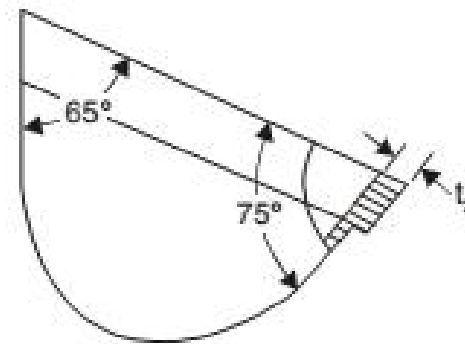
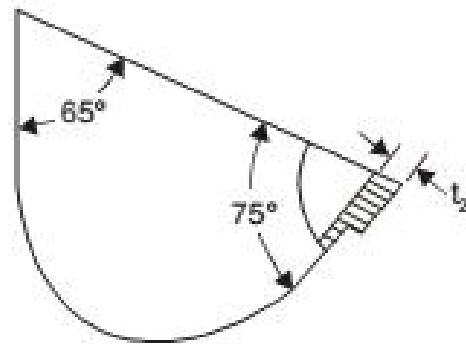
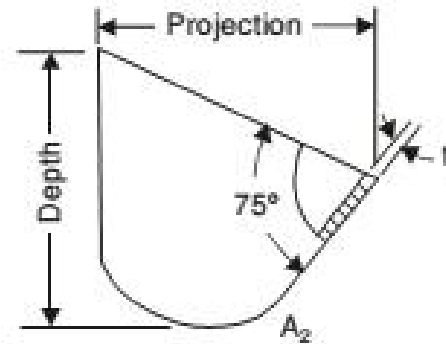
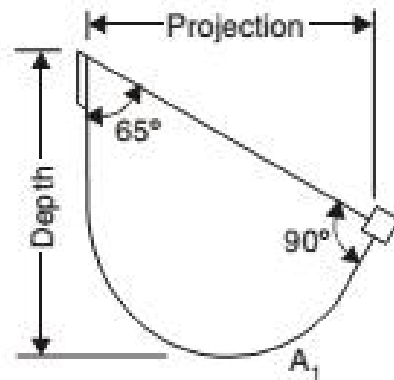
- The different components of a bucket elevator have been mentioned under “descriptive specification” in section 8.4.1 (A). The buckets used in a bucket elevator needs further elaborations
- Buckets are classified into two types from consideration of their shape: Rounded bottom buckets are used in spaced bucket elevators and are classified as A1, A2, A3 and A4 type. V-type buckets are used in continuous bucket elevators, and are classified as B1, B2, B3 and B 4 type. Fig. 8.4.5 illustrates geometrical features of the various types of buckets.
- Specified dimensions of these buckets namely length, projection, depth and capacity of the individual buckets are given in IS:6833-1973. Table 8.4.2 below indicates only the range of recommended dimensions of such buckets

4.1.1 Range of dimensions for buckets

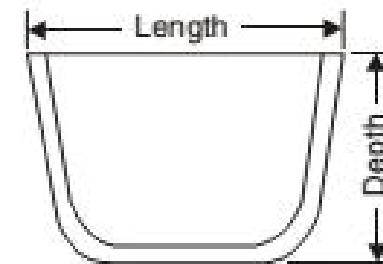
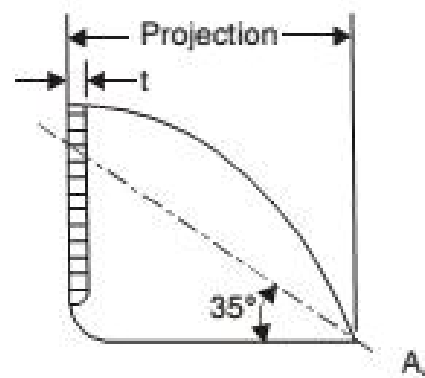
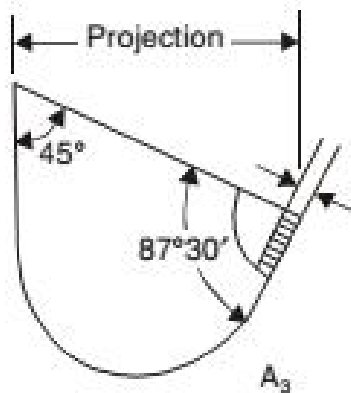
Table 8.4.2. Range of dimensions for buckets.

Bucket Type	Range of Bucket Size, mm			Capacity, litres	
	Length, mm	Projection, mm	Depth, mm		
A ₁	150 to 1000	95 to 250	100 to 260	0.87 to 36.50	
A ₂	150 to 1000	100 to 255	110 to 270	0.85 to 38.00	
A ₃	150 to 410	90 to 165	130 to 230	0.71 to 6.80	
A ₄	150 to 410	115 to 180	100 to 140	0.735 to 4.47	S dimension
B ₁ and B ₄	150 to 610	75 to 300	145 to 460	0.81 to 41.0	20 to 50 for B ₁
B ₂	150 to 610	75 to 300	145 to 460	0.81 to 41.0	20 to 50
B ₃	150 to 610	75 to 300	145 to 460	0.93 to 45.6	

4.1.2. Geometrical features of various types of buckets (1)

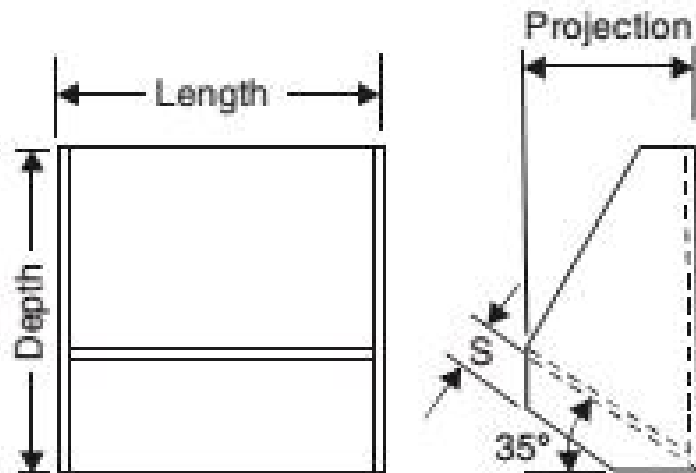


A_2 with reinforcement of rim

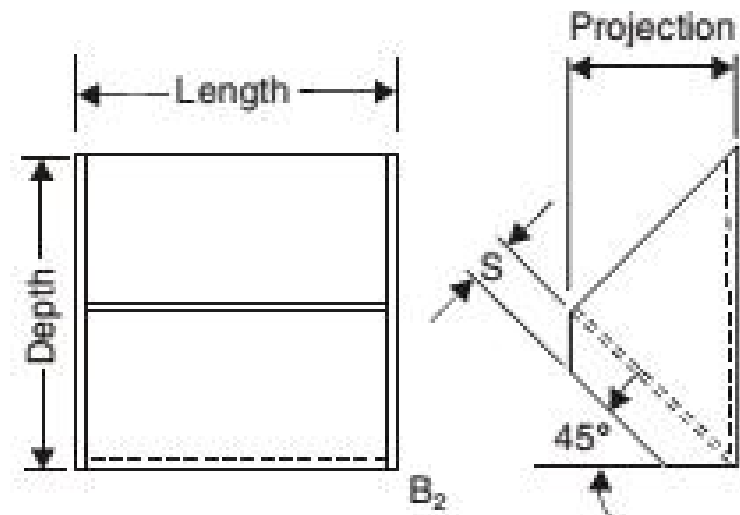


h

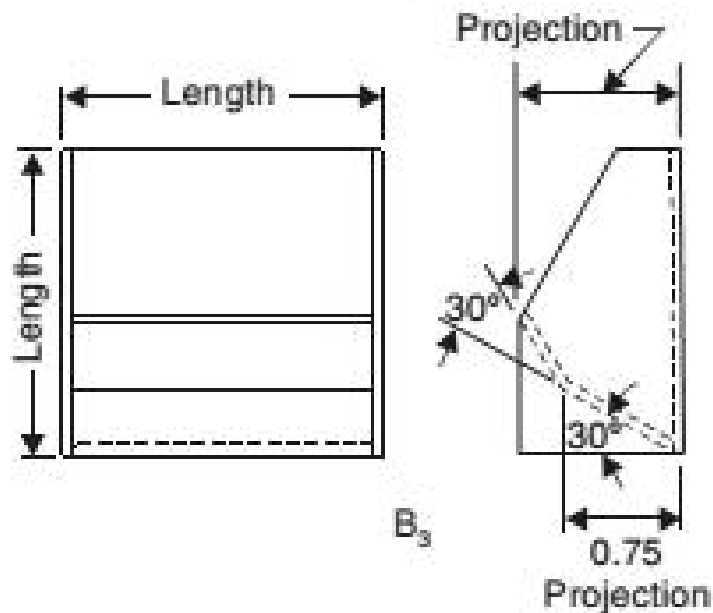
4.1.2. Geometrical features of various types of buckets (2)



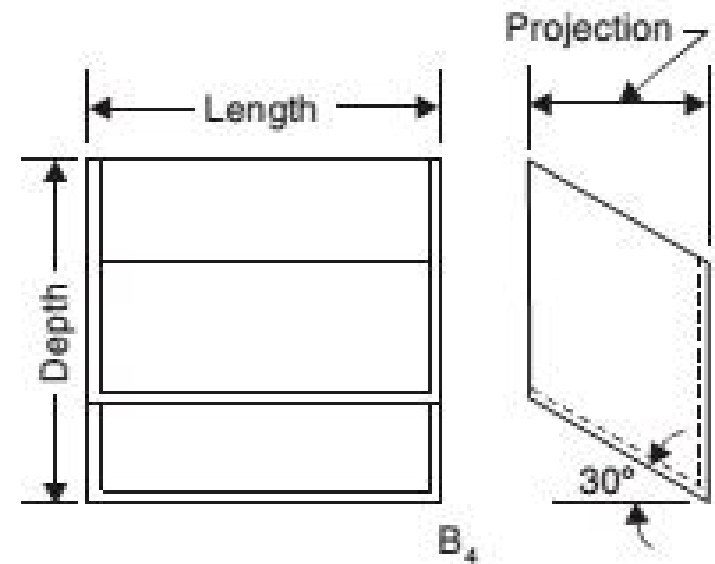
B_1



B_2

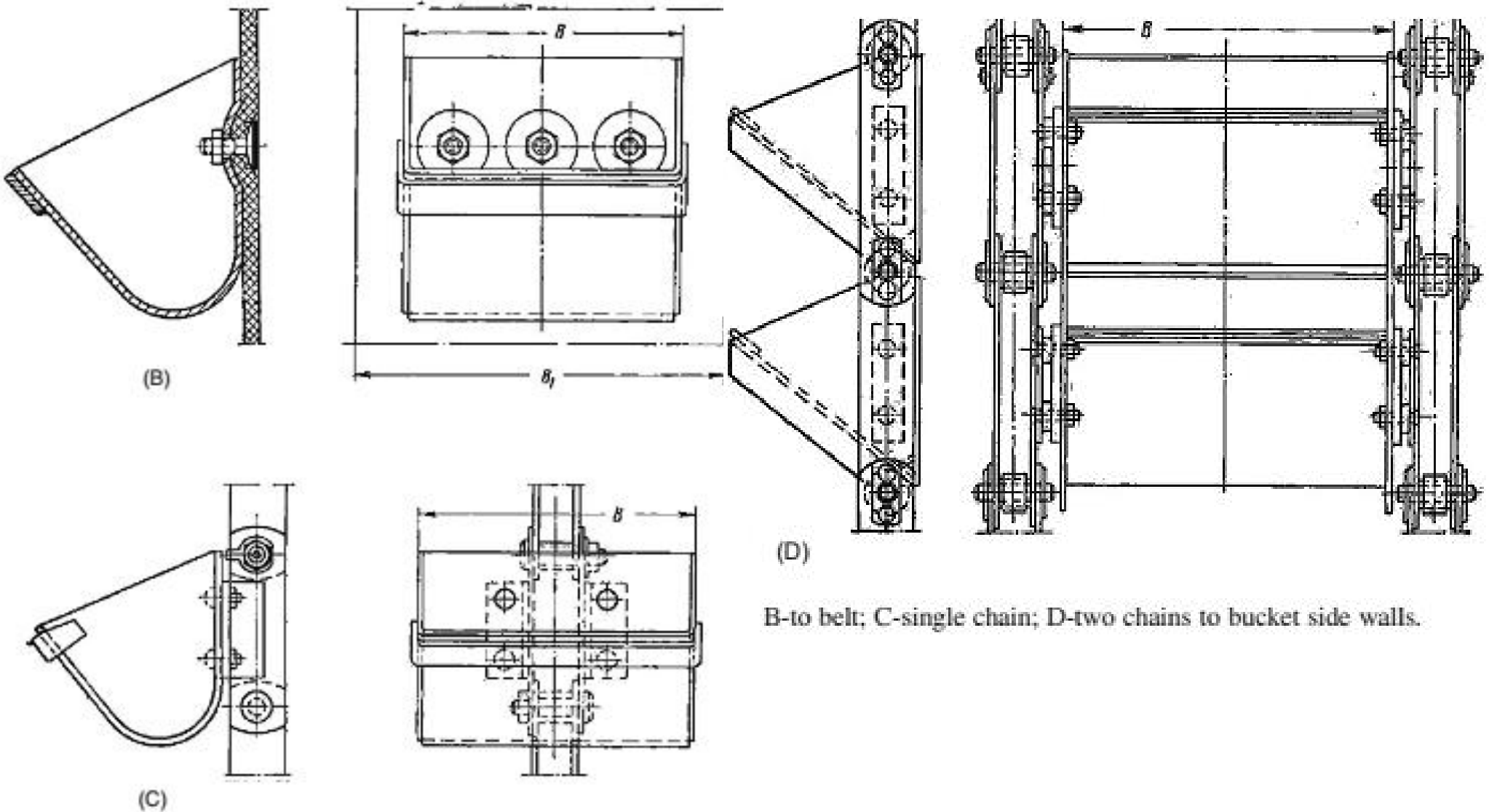


B_3



B_4

4.1.3. Typical bucket fixing arrangement



4.1.4. Fixing arrangement of buckets

- Fixing of buckets to belt - B.
 - Fixing of buckets to chains passing through back of buckets – C
 - Fixing of buckets to chains passing through side of buckets - D
- Typical bucket fixing arrangements are shown in Fig. 8.4.6.

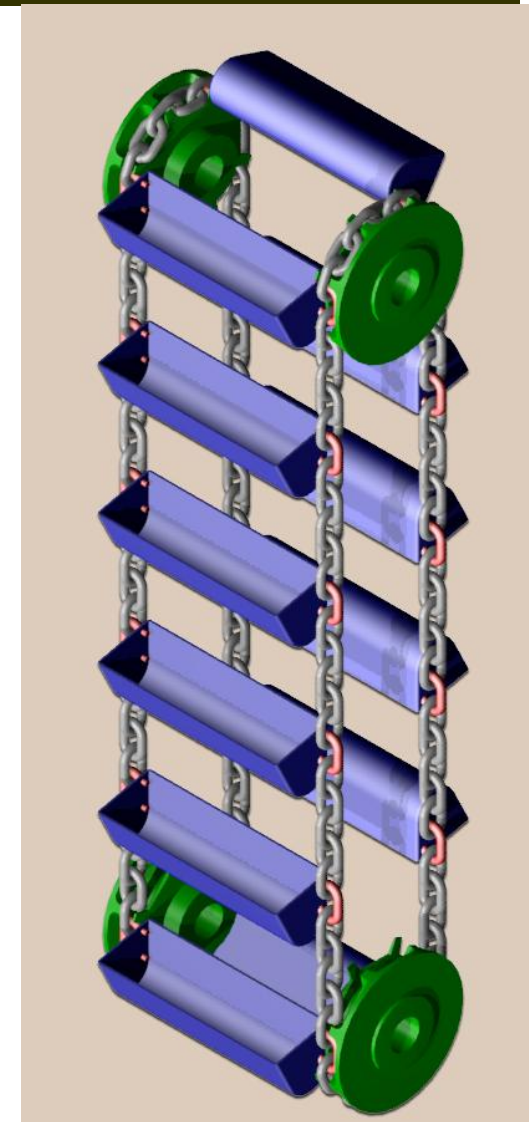
4.1.5. Selection of Bucket

Table 8.4.3. Selection of Bucket

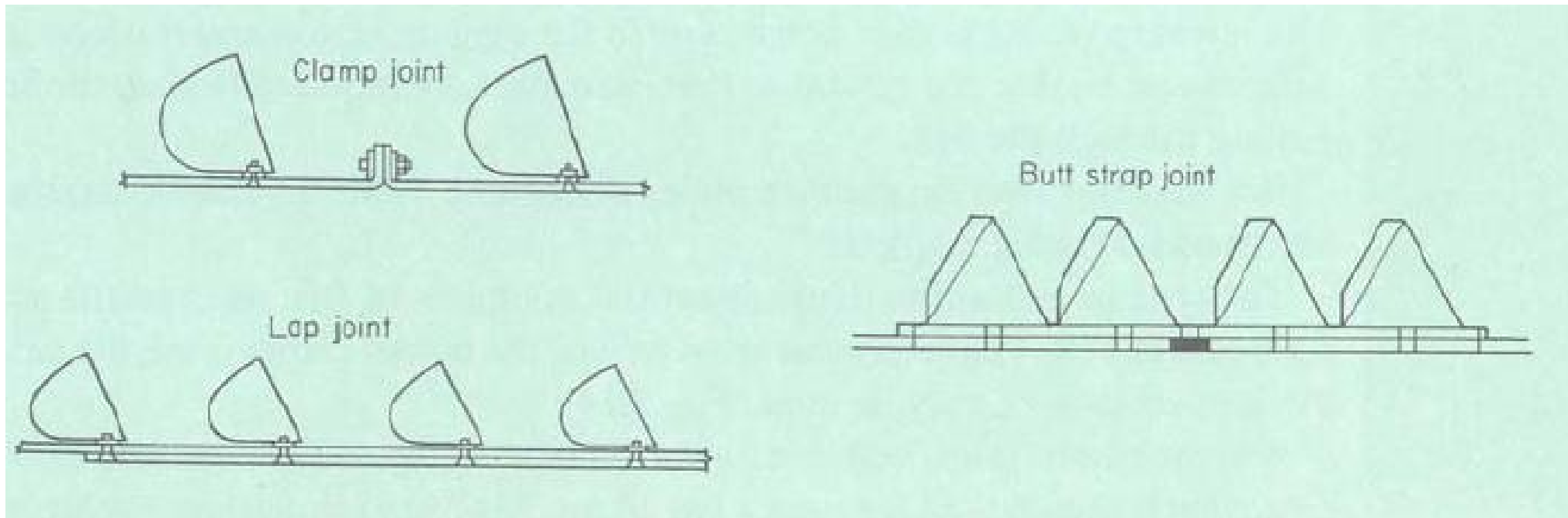
Type of elevator discharge	Type of bucket IS:6833	Recommended Application
Centrifugal and positive discharge	A ₁	For powdered and free flowing material.
	A ₂	For cement, coal, sand, gravel, stone, ores, fertilisers.
	A ₃	For wet, sticky materials. Also for coarse broken materials.
	A ₄	Sugar, clay, salt, wet ores.
Continuous discharge	B ₁	For pulverized and sluggish materials that stick.
	B ₂	For average materials.
	B ₃	For large lumps and extra capacity.
	B ₄	For inclined elevators.

4.1.6. Belts for bucket elevator

- Belts
- Chains

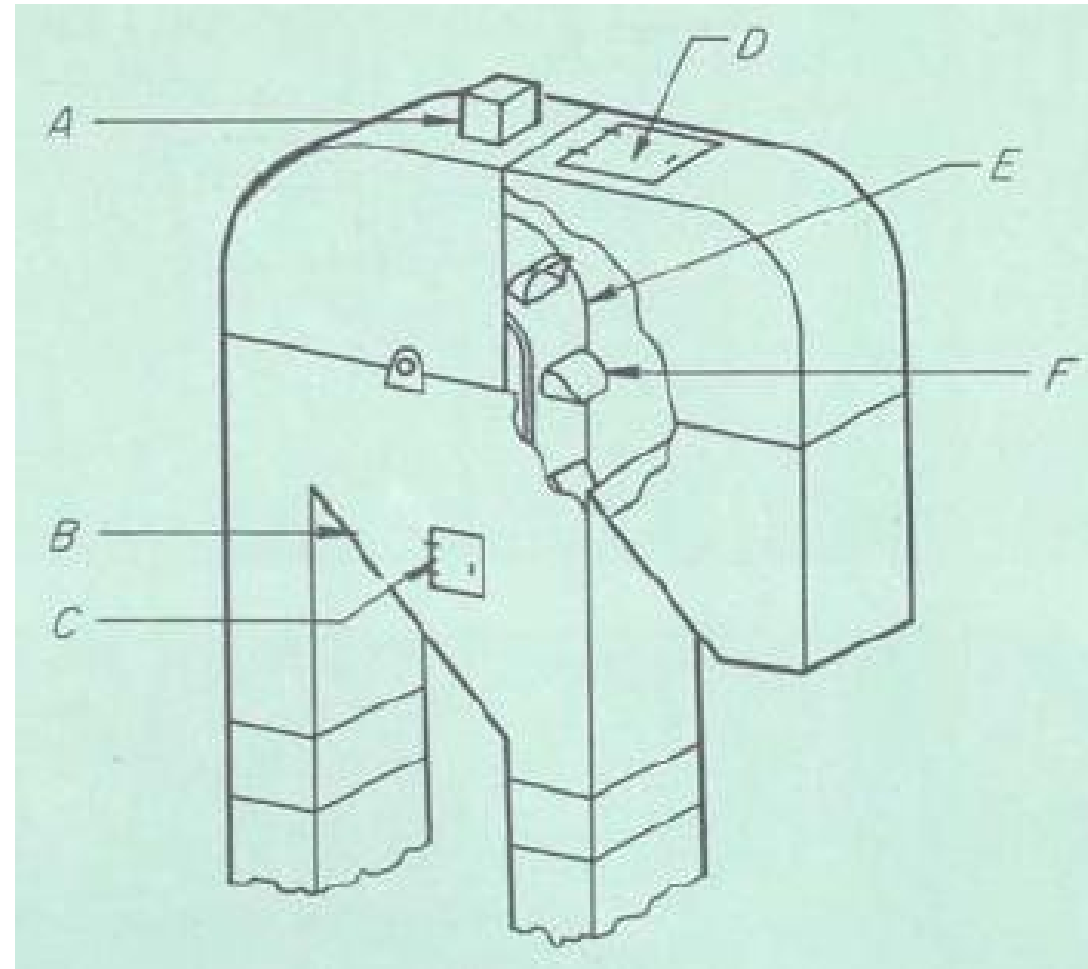


4.1.7. Splicing elevator belts.

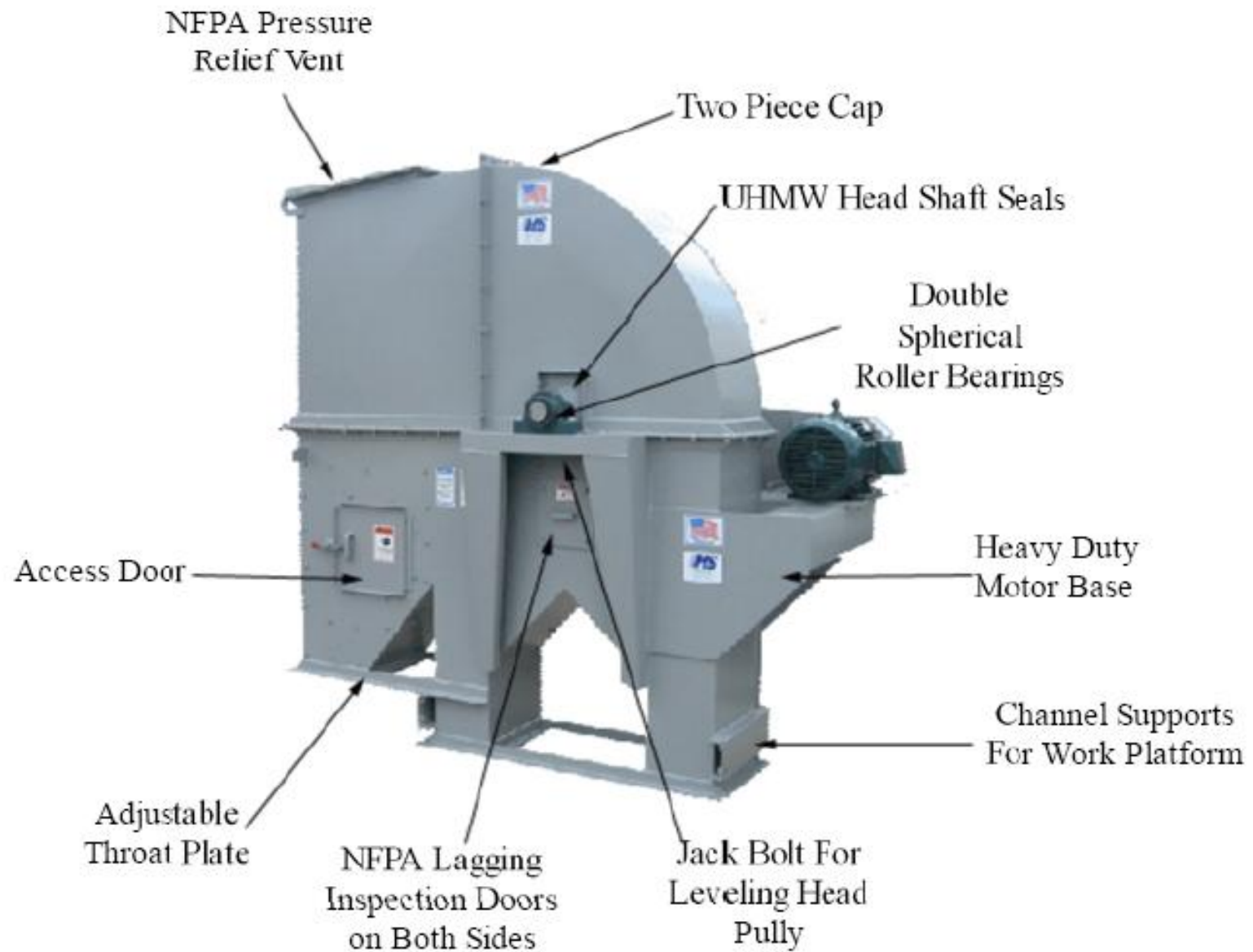


4.2. Elevator Head Section (1)

A, sprinkler head and alarm;
B, strut slanted to down leg;
C, cleanout opening;
D, inspection door;
E, lagged head pulley;
F, buckets. Belt should be
2.5 cm wider than buckets,
pulley should be 2 cm wider
than belt.

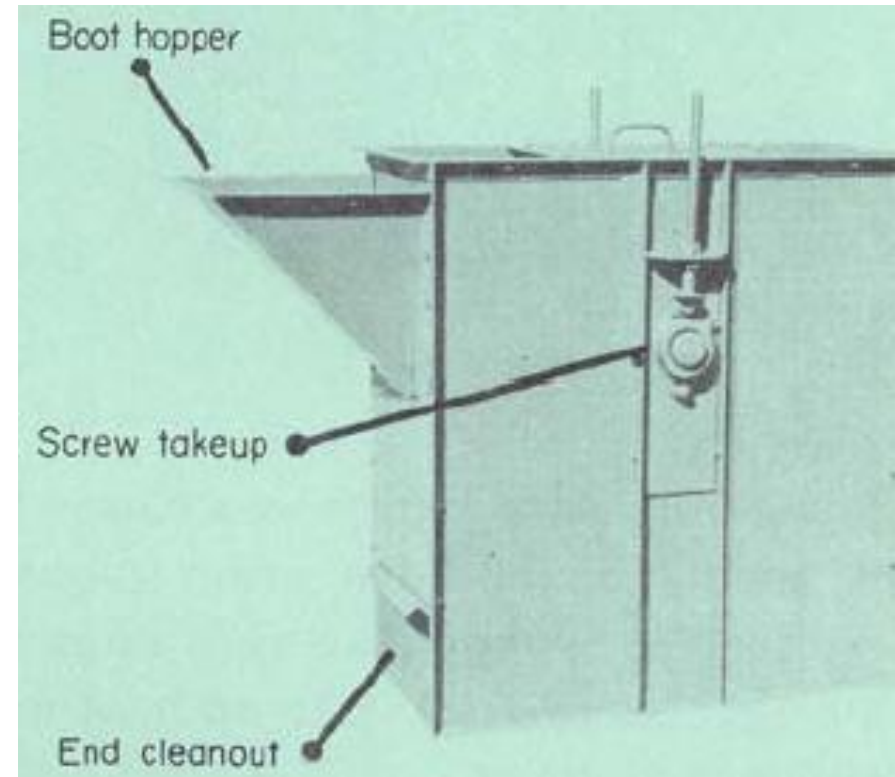


4.2. Elevator Head Section (2)

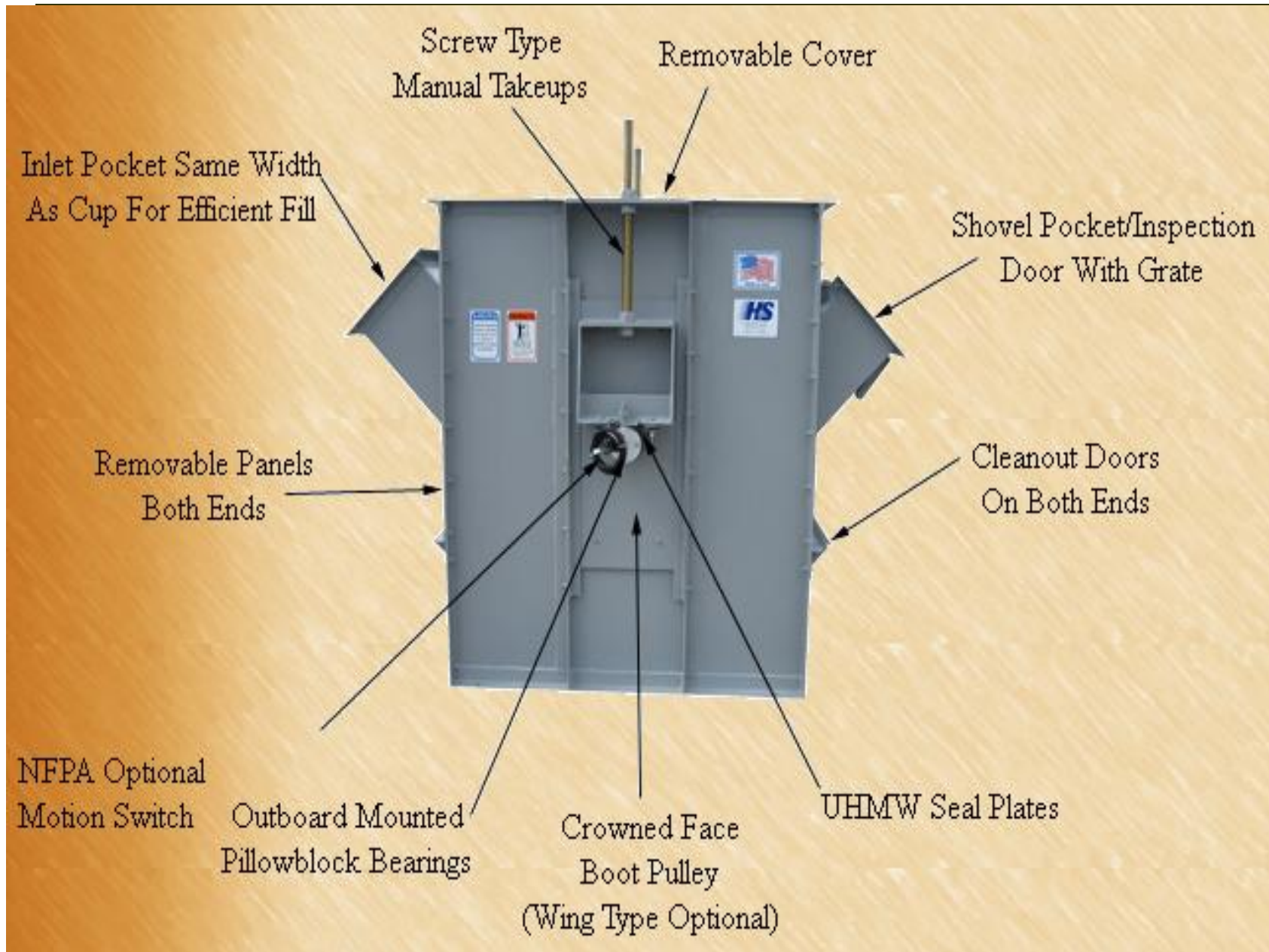


4.3. Elevator boot section (1)

Most bucket elevators provide in the boot section a belt take-up device to tighten the belt as required and to train it so that it runs true and does not rub on either side of the boot. A manual screw-type takeup is most often used. On tall, heavy-capacity legs an automatic take-up boot pulley is used. This provides the correct belt tension at all times



4.3. Elevator boot section (2)



<http://www.homedepot.com/...>

5. Capacity Calculation

$$Q = \frac{C \times F}{1000} \times \frac{3600v}{s} \times \frac{\rho}{1000} \text{ tph}$$

where, C = capacity of each bucket, litres

F = bucket filling factor, a constant.

v = elevator speed, m/sec

s = bucket spacing, m

ρ = material bulk density, kg/m³.

Bucket Filling Factor

Table 8.4.4. Bucket Filling Factor, F

Material Characteristics	Type of Bucket Elevator	F
Powdered (ground) <i>e.g.</i> coal dust, cement, chalk, phosphate fertiliser etc.	Positive discharge Centrifugal discharge	0.85 0.75
Granular and small lumped (60 mm) mildly abrasive <i>e.g.</i> saw dust, dry clay in lumps, coal peat, grain, etc.	Centrifugal discharge	0.7 to 0.8
Granular and small lumped (60 mm) highly abrasive <i>e.g.</i> gravel, ore, slag, sand, ash, earth, rock, etc.	Continuous discharge Centrifugal discharge	0.7 to 0.85 0.5 to 0.7
Medium and large lumped (60 mm) highly abrasive <i>e.g.</i> crushed ore, stone, slag	Continuous discharge	0.6 to 0.8
Lumped, fragile, down graded by crushing <i>e.g.</i> charcoal, coke etc.	Continuous discharge	0.6
Sluggish, powdered and granular, moist <i>e.g.</i> moist chemicals, fluffed peat, earth, wet sand, wet powdered chalk etc.	Positive discharge Centrifugal discharge	0.4 to 0.6 0.4 to 0.6

6. Power requirements

$$hp = \frac{Q H F}{4562}$$

Q: capacity (kg/min)

H: Lift (meter)

F = 1,5 for elevators loaded on the down side of the boot,
= 1,2 for elevators loaded on the up side of the boot.

Actual horsepower requirements are 10 to 15% higher than this theoretical value because of friction, power transmission, and drive losses.

7. Gầu tải băng – Gầu tải xích:

- Vận chuyển vật liệu dạng bột, hạt, cục nhỏ, khô.
 - Dễ nạp và tháo liệu.
 - Làm việc êm, tốc độ chuyển động của băng từ 0,8 – 3,5m/giây.
 - Năng suất đến 80m³/giờ.
 - H = 50m.
 - Hạn chế về độ bền của băng.
- Vận chuyển vật liệu dạng cục to, ẩm.
 - Khó xúc.
 - Làm việc nặng, tốc độ chuyển động của băng từ 0,4 – 1,6m/giây.
 - Năng suất đến 300m³/giờ.
 - Gầu 1 xích có bề rộng 160 – 250 mm, gầu 2 xích làm việc với gầu rộng hơn.

8. Ưu nhược điểm của gầu tải

- Kích thước bao trong hình chiếu bằng nhỏ, dải năng suất từ 5 – 30 m³/h. Chiều cao nâng lớn, cá biệt có thể đạt đến 75m.
- Không cho phép quá tải, cấp liệu một cách điều hòa. Trường hợp quan trọng cần đặt thêm một gầu tải phụ.

9. Other types



10. Bài tập 06

- 1. Vẽ hình miêu tả cấu tạo của gầu tải và nguyên lý hoạt động**
- 2. Trình bày lại các chú thích bằng tiếng việt của hình 8.4.1.**
- 3. Gầu tải được phân loại dựa vào chỉ tiêu nào? Được phân làm mấy loại? Trình bày nguyên lý các loại gầu tải?**