Design of Process Equipment

Screw conveyer

Lecture

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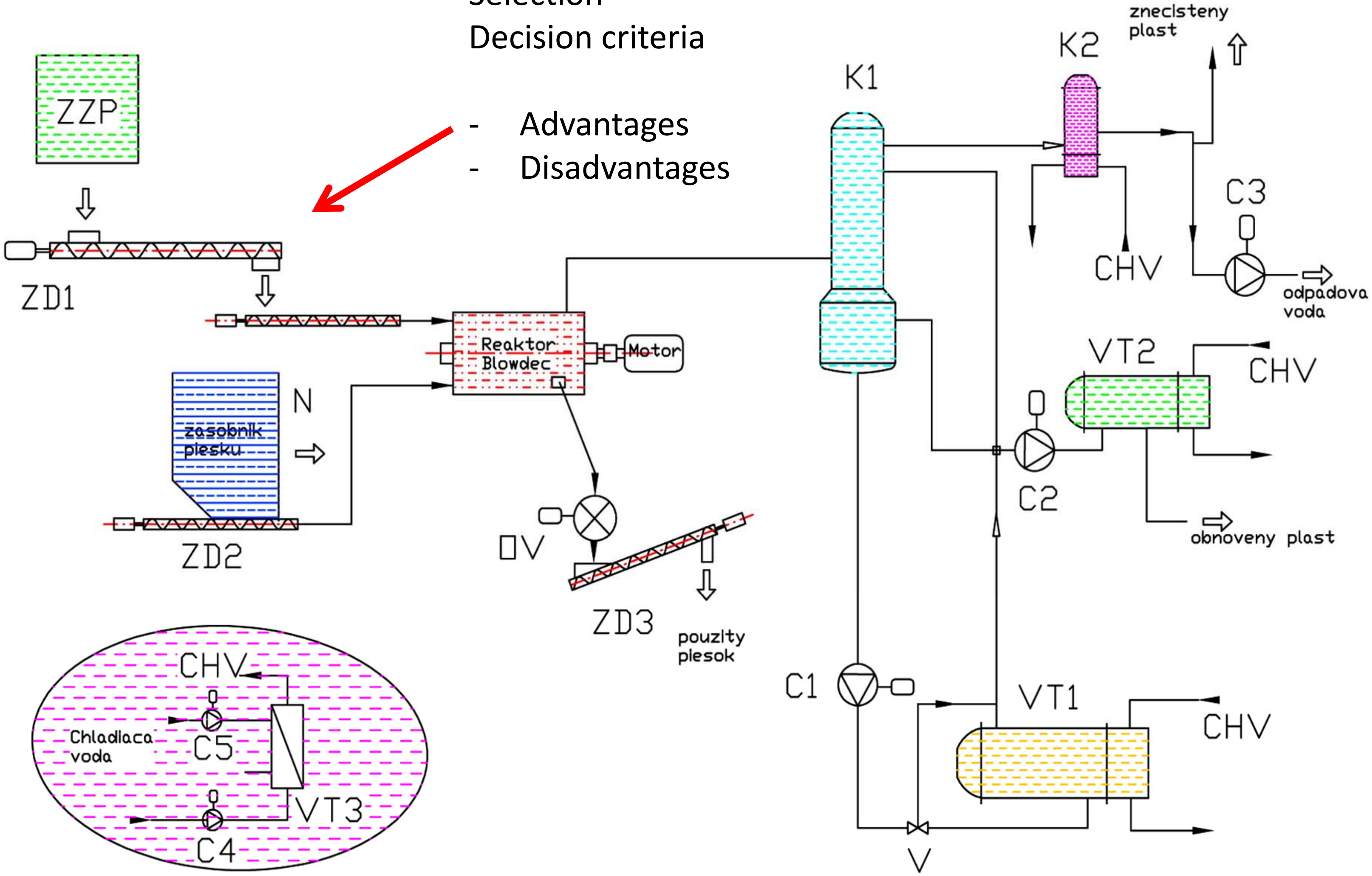
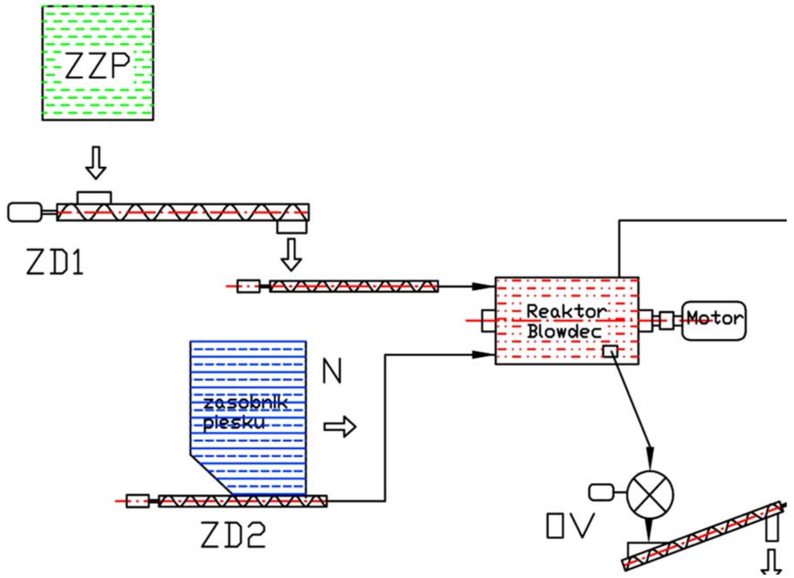
Design of devices

Selection
Decision criteria

- Advantages
- Disadvantages



Process design



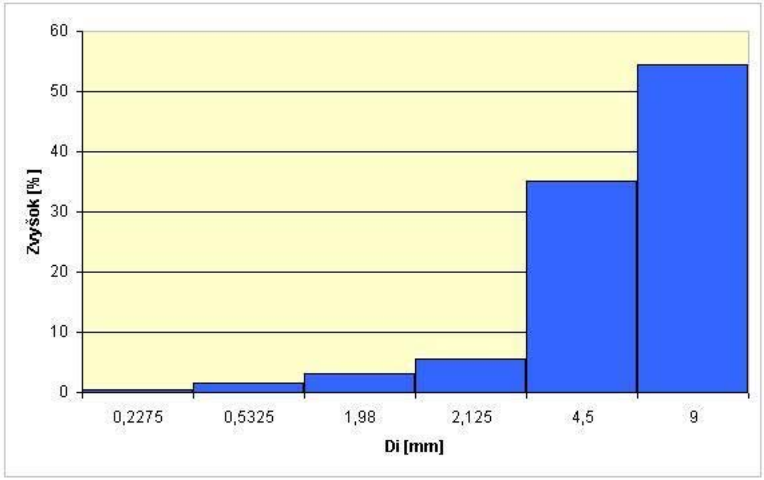
What mode of transport will I use?

Is the choice correct?

Alternatives?

Process design

- Capacity
- Transported material
- Operating conditions /p,T/
- Limitations (procedural, structural)
- operational experience
- maximum built-up space
- MaR
- related apparatus
- etc....



Zloženie zmesných plastov	
Druh plastu	hm %
HDPE	10
LDPE	38
PP	30
PS	15
PA	4
PMMA	1
PUR	2
PVC	0

Process design

Calculation – POWER (Slovak's standard)

$$Q_v = 3600.\frac{\pi.D^2}{4}.D.\psi.n.C_H$$

$$P = \frac{Q_v.\rho_v.g}{3600}.(l_v.w \pm h)$$

Q_v - dopravované množstvo [$m^3.h^{-1}$],

D - menovitý priemer závitovky [m],

S - stúpanie závitovky [m],

volíme s = D, pre menšie D, a

s = 0,8 D, pre väčšie D,

ψ - súčiniteľ plnenia [1],

n - otáčky závitovky [s^{-1}],

C_H – súčiniteľ znižujúci dopravované množstvo vzhľadom ku sklonu dopravníku pri doprave nahor [-],

P - príkon dopravníku [W],

ρ_V - objemová hmotnosť dopravovaného materiálu [$kg.m^{-3}$],

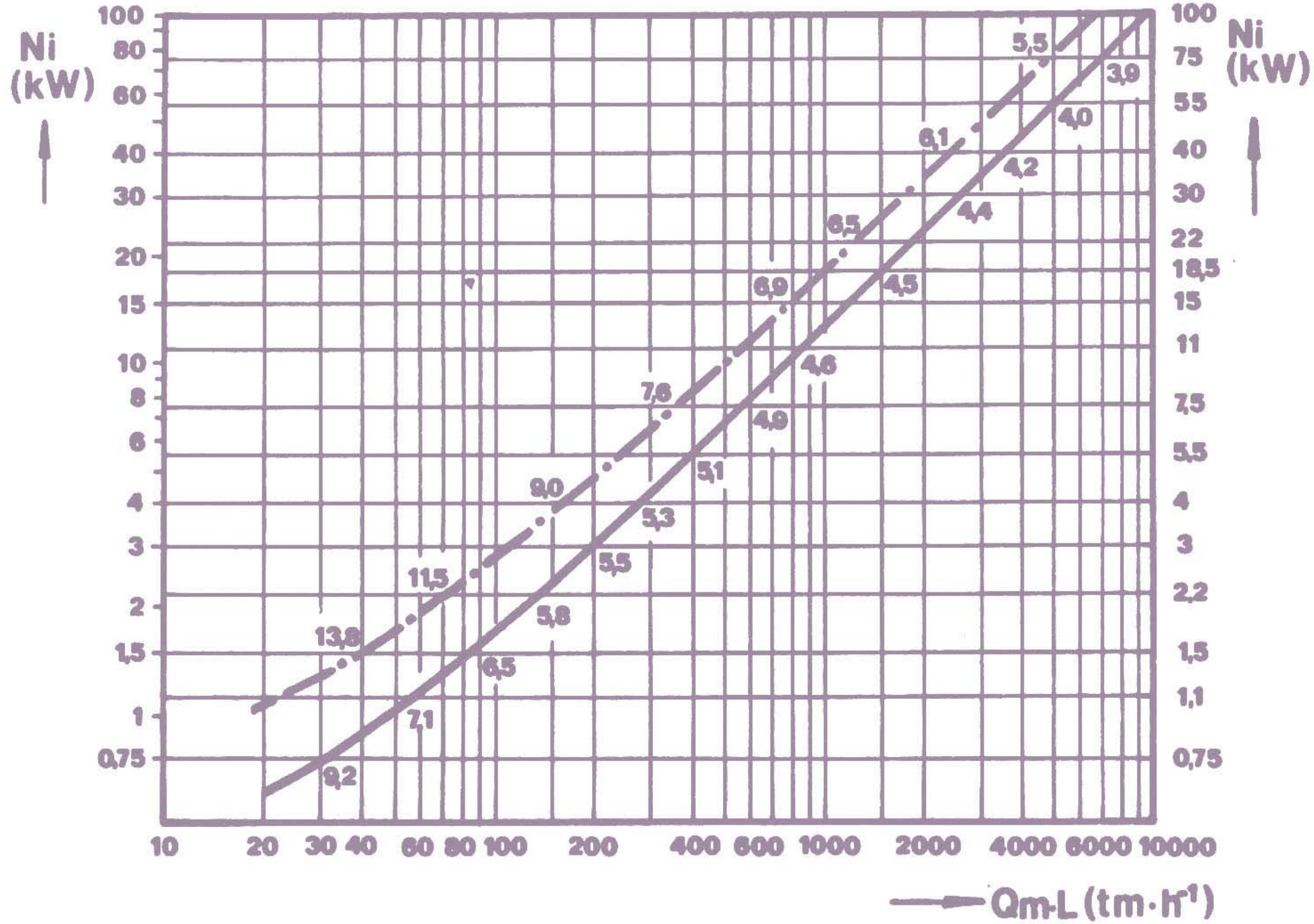
l_V - vodorovná dopravná vzdialenosť [m],

h - dopravná výška [m], (znamienko + platí pri doprave nahor, znamienko – pri doprave dole),

w - celkový súčiniteľ odporu [-].

Process design

Calculation – POWER (Prerovské strojárne)



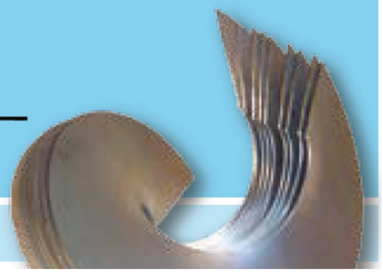
Process design

Calculation – POWER (VAV)

Calculations for screw conveyors

belt speed in m per sec

$$v = \frac{\text{Screw diameter (in meters)} \times 3{,}14 \times \text{Rotations per minute}}{60}$$



v	=	speed in m per sec

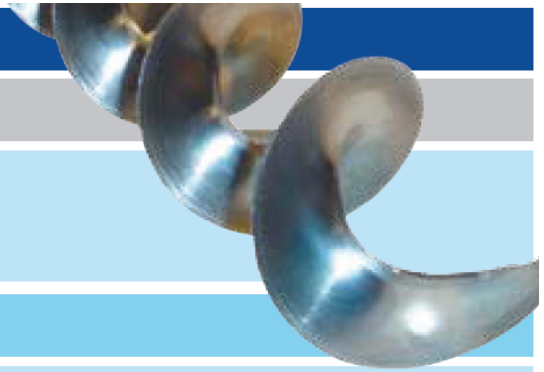
Calculations for screw conveyors

Capacity in kg per hour (Q)

$$Q = \frac{3{,}14 \times D^2}{4} \times s \times n \times sg \times i \times 60$$

Q	=	capacity in kg per hour
D	=	screw diameter in dm
s	=	pitch in dm
n	=	rotations per minute
sg	=	specific weight of the material (see table)
i	=	degree of trough filling

Process design



Calculations for screw conveyors

Power in Kw (P)

$$P = \frac{Q \times L \times K}{407}$$

P	=	power in Kw
Q	=	capacity in 1000 kg per hour
L	=	conveyor screw length
K	=	friction coefficient

Specific weight (in g)

product	sw	product	sw	product	sw
aloin	1,700	earth	1,600	peat	0,410
aluminum	2,800	egg powder	0,250	peat mulch	0,230
amaril	4,000			pit coal	0,860
anthracite	1,700	fish meal	0,900	potatoes, in bulk	0,800
asbestos	2,800	flax seed	0,720	pulp	1,100
ash	0,900	flower, loose	0,500		

Process design

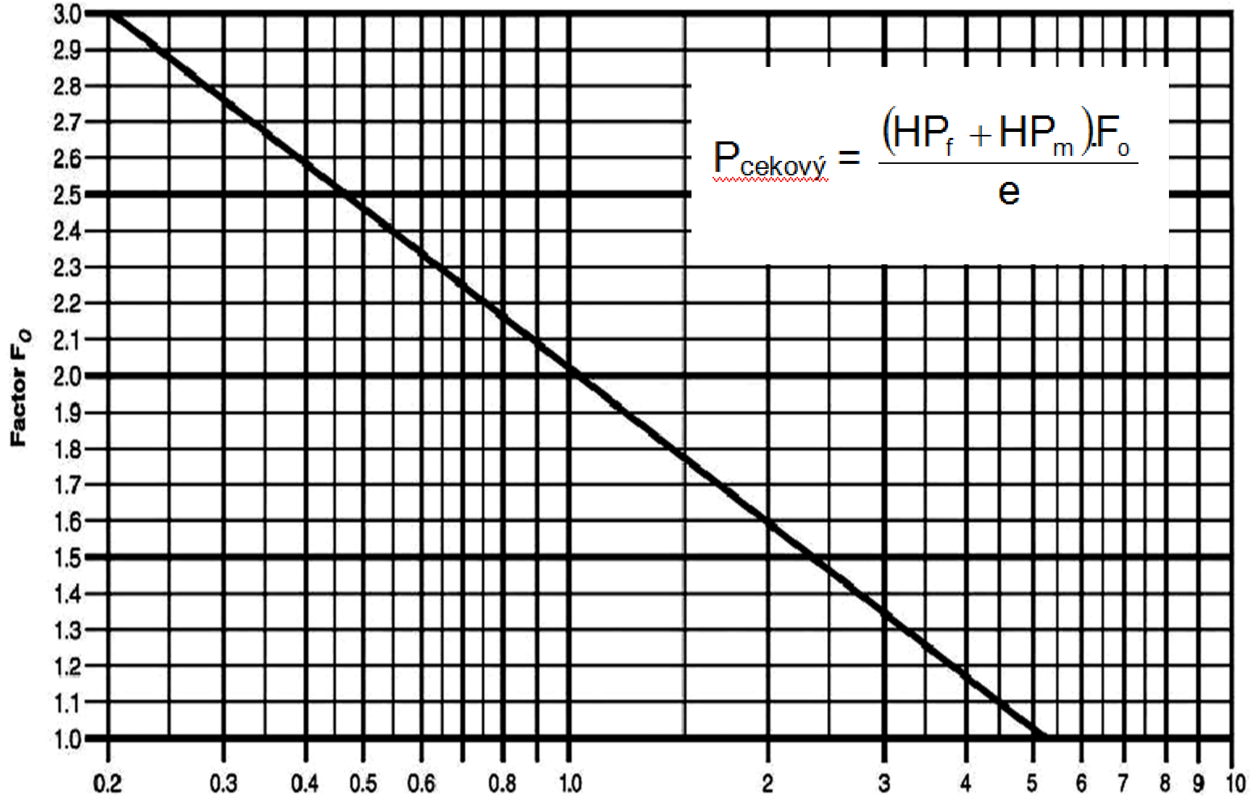
Calculation – POWER (C.E.M.A.)

$$HP_f = \frac{L.n.F_d.F_b}{1000000}$$

$$HP_m = \frac{C.L.W.F_f F_m.F_p}{1000000}$$

HP – f
flow

HP – m
material

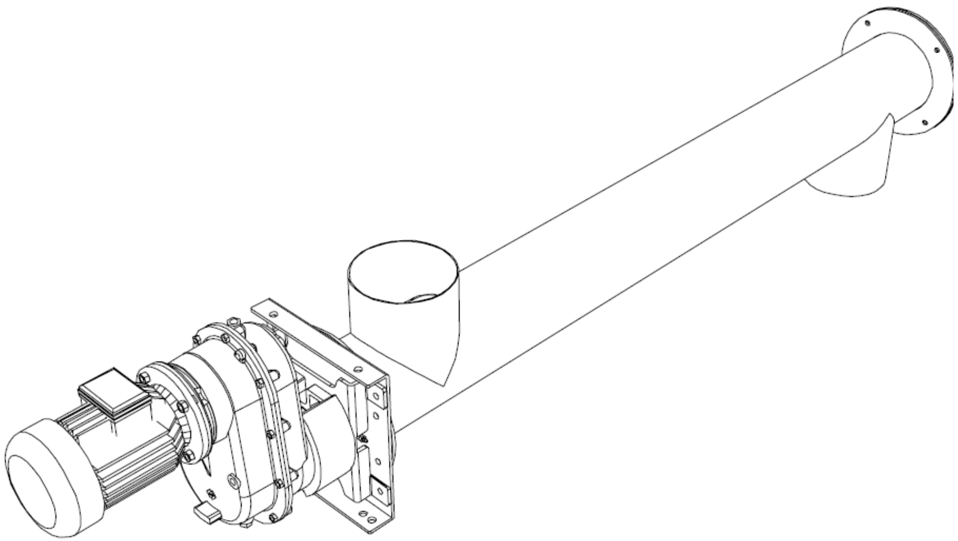


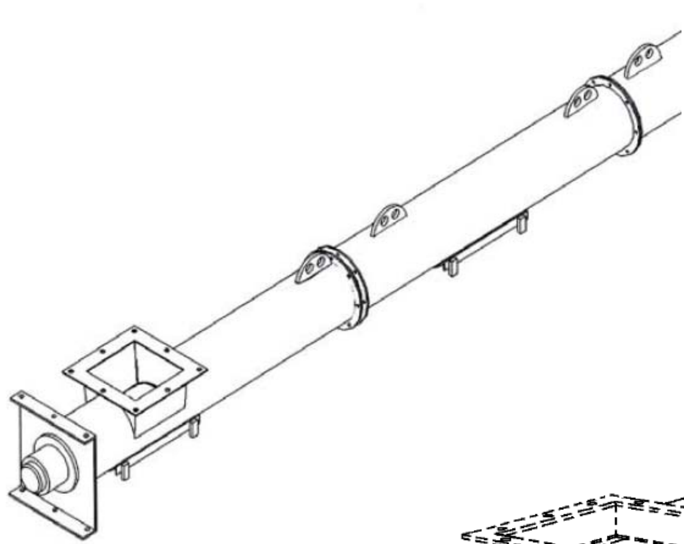
Horsepower $HP_f + HP_m$

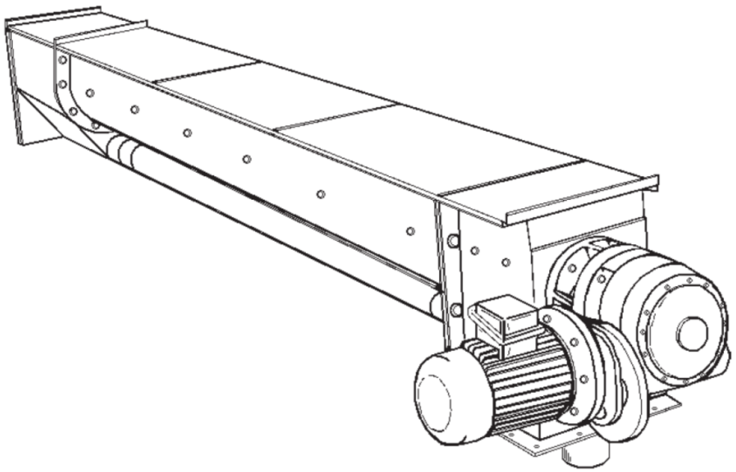
For values of $HP_f + HP_m$ greater than 5.2, F_o is 1.0

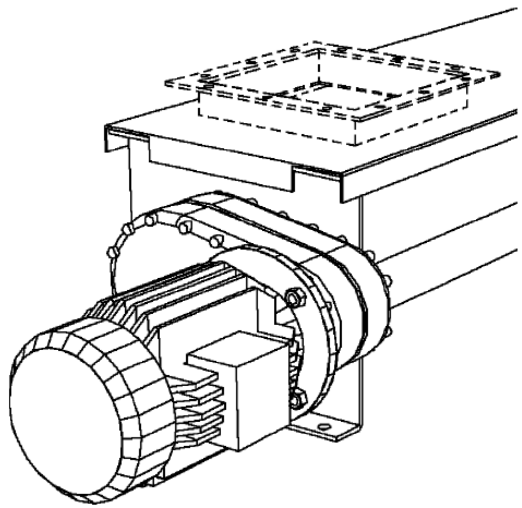
Trace the value of ($HP_f + HP_m$) vertically to the diagonal line, then across to the left where the F_o value is listed.

Construction details









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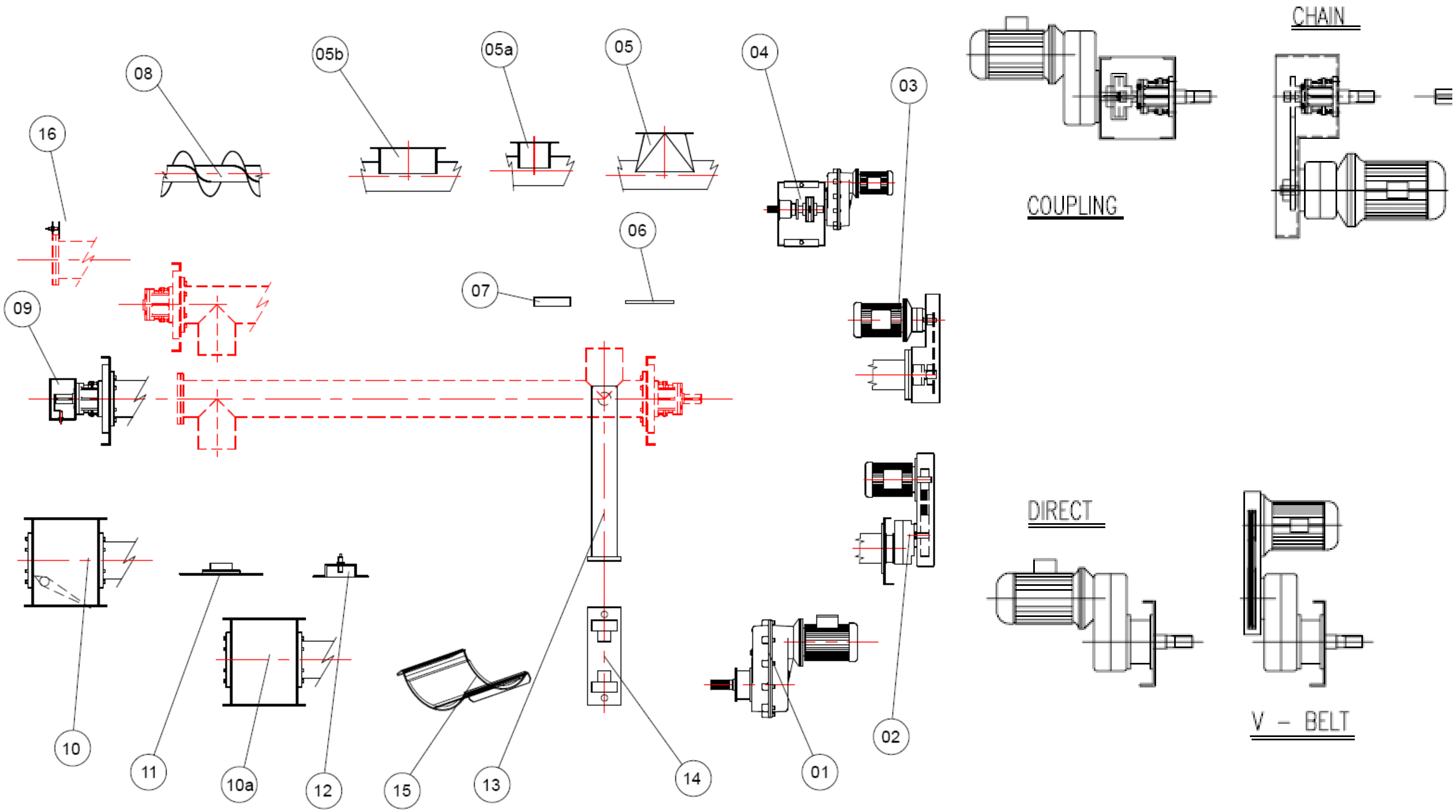

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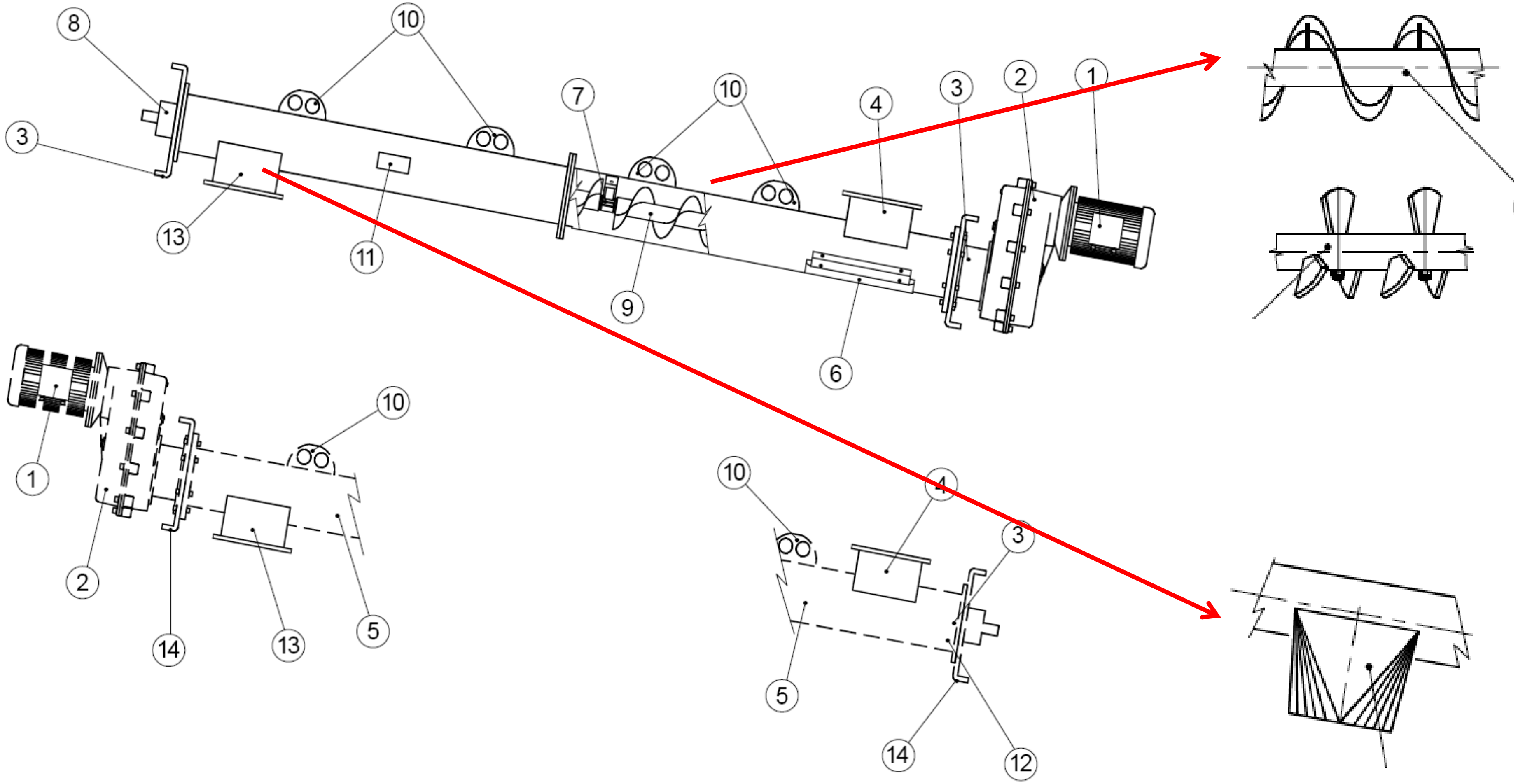

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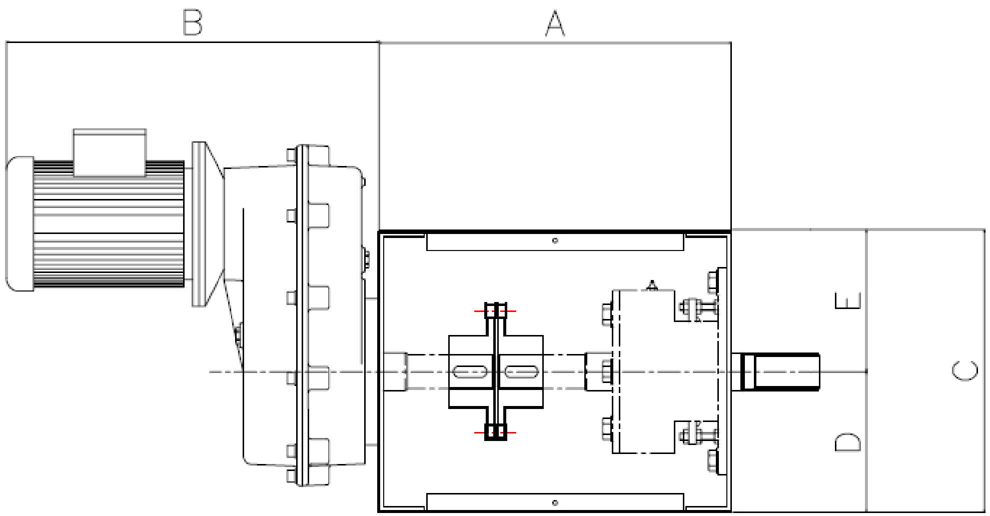

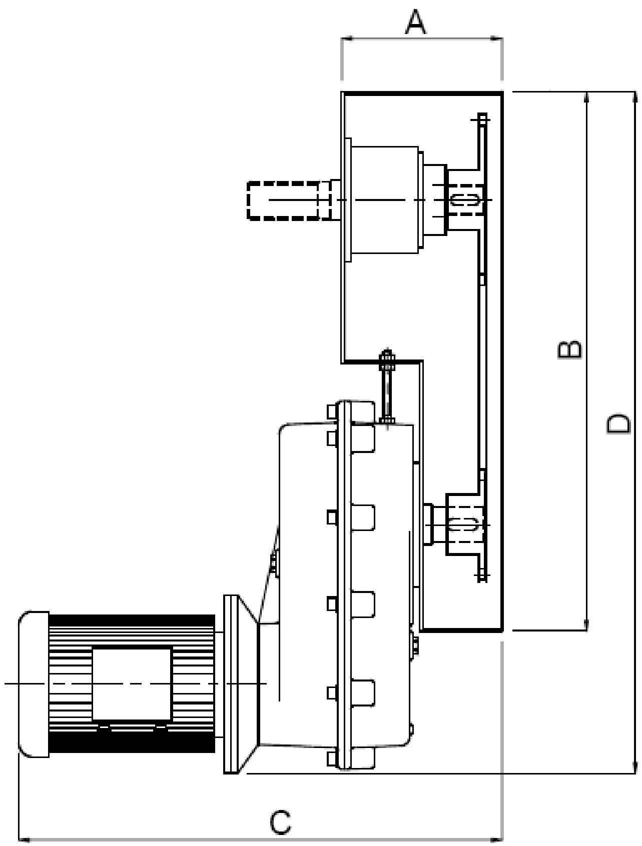

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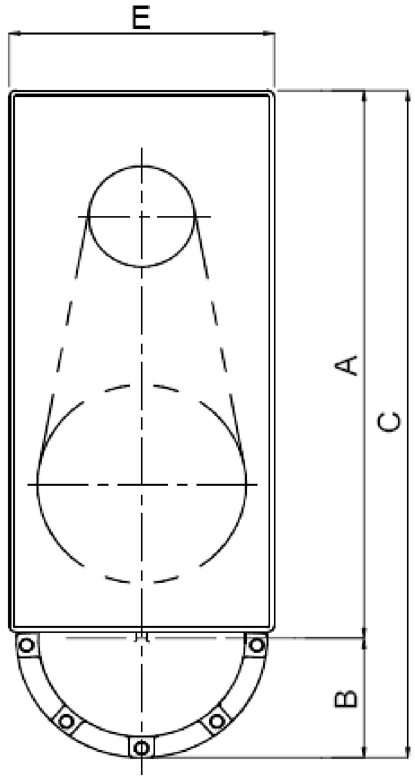

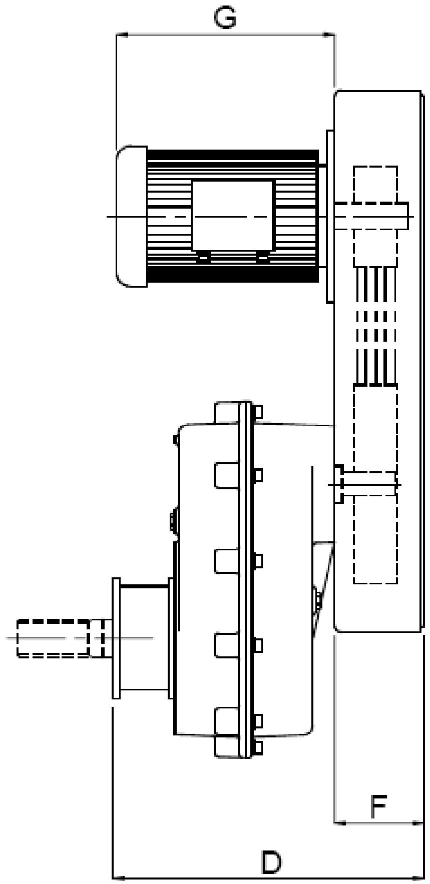

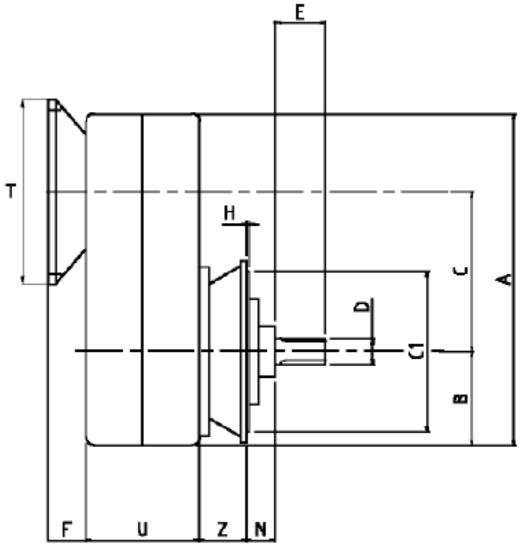

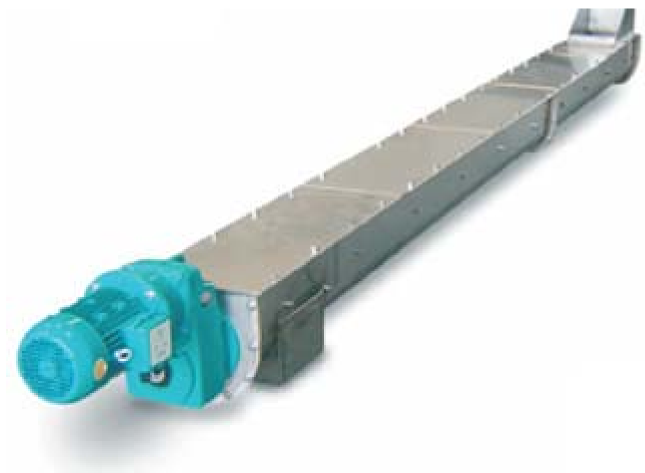

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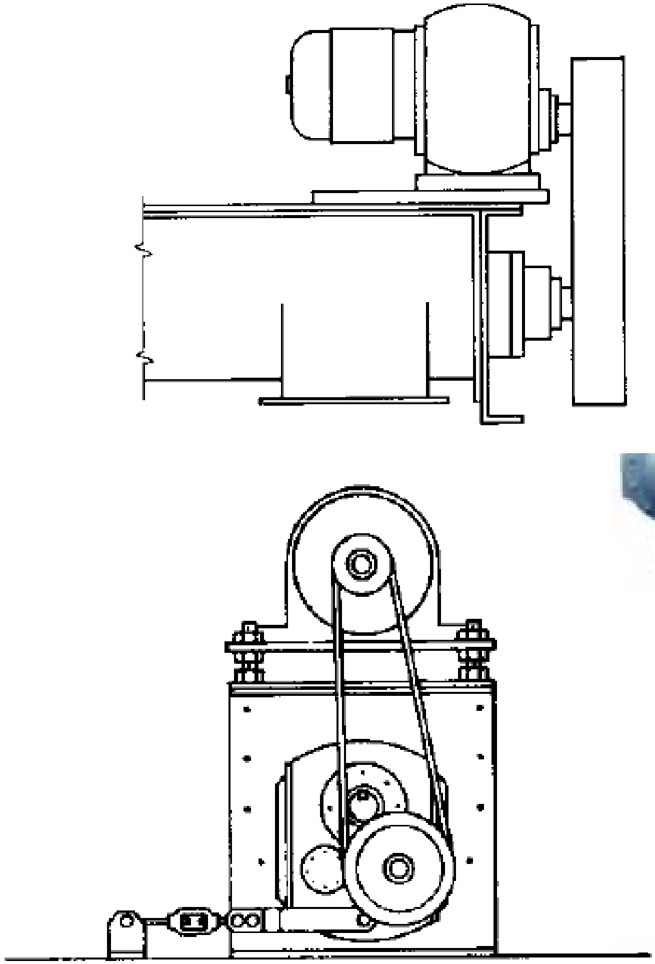

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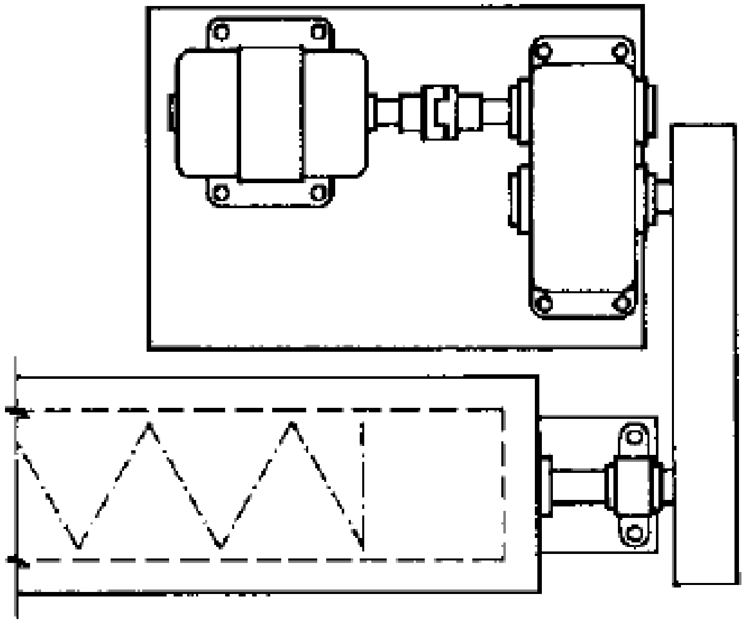

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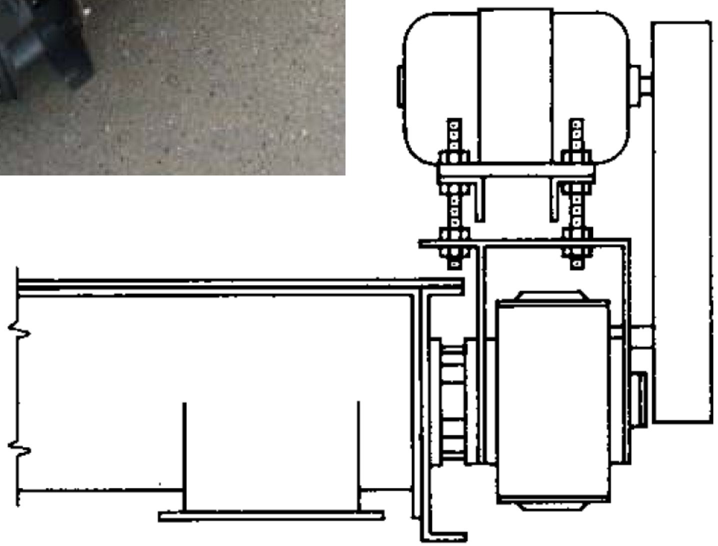

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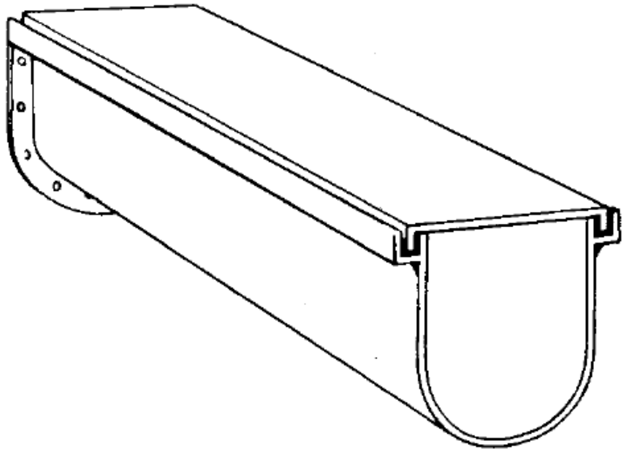

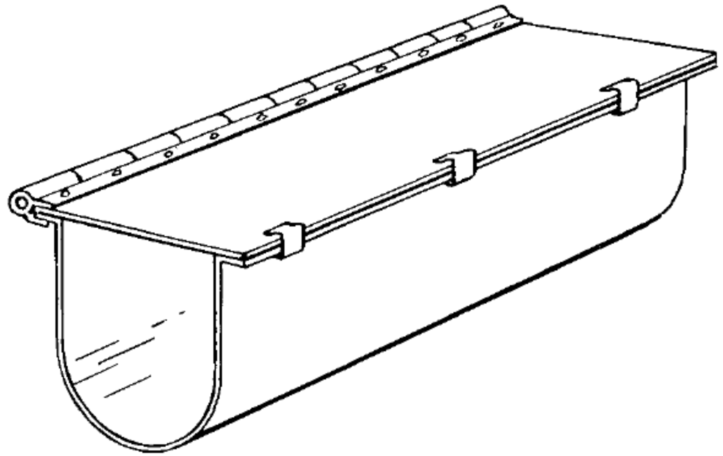

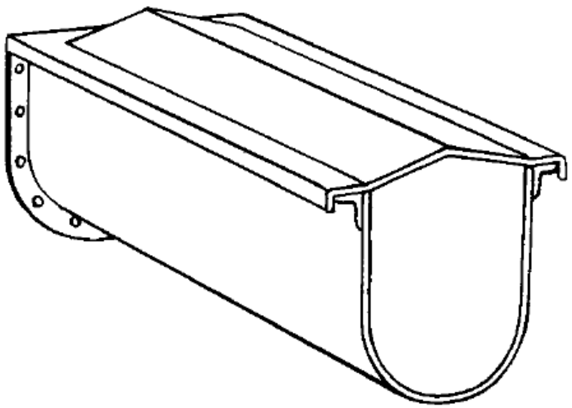

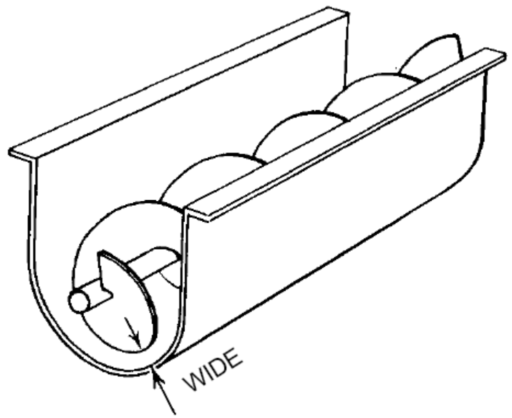

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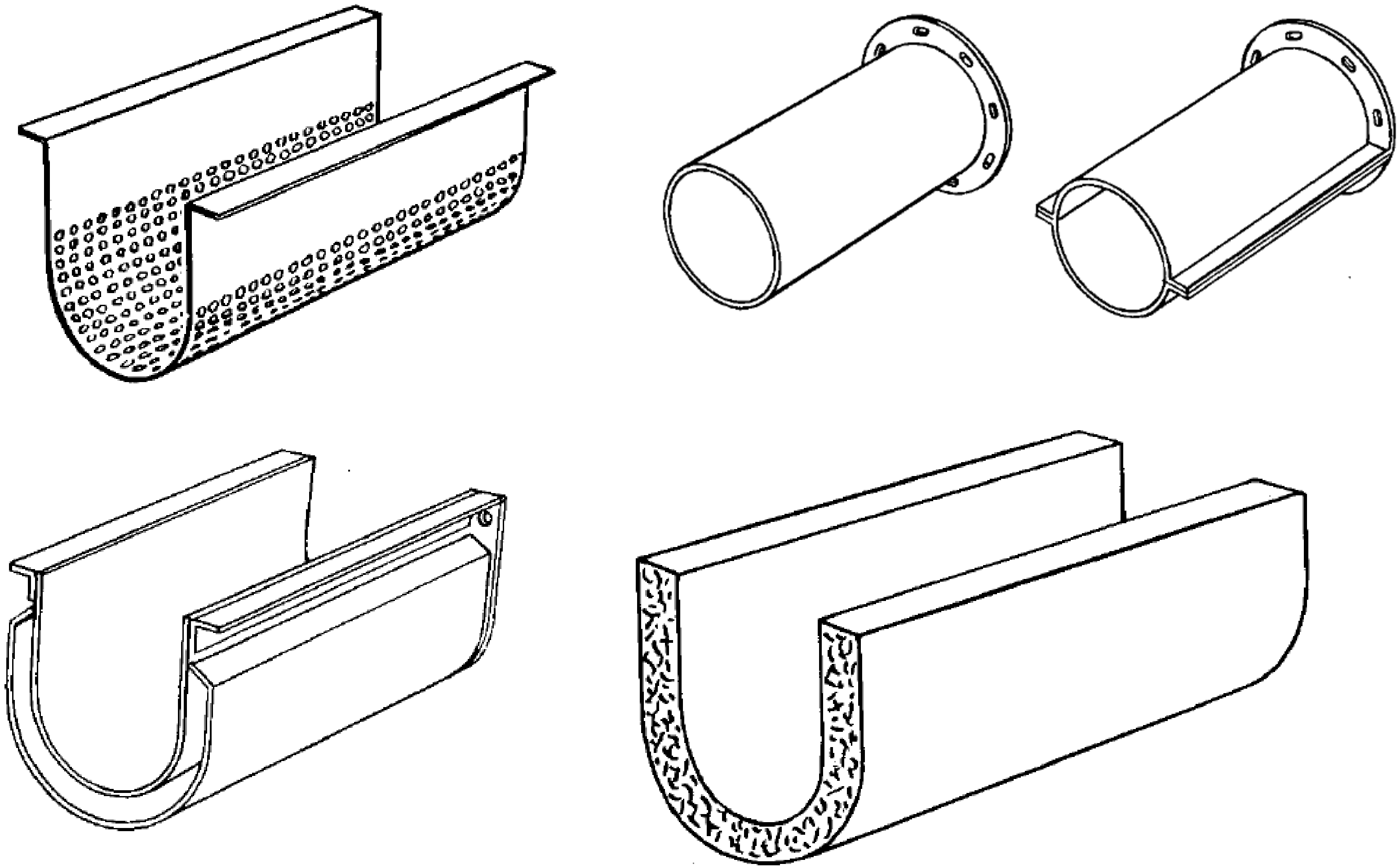

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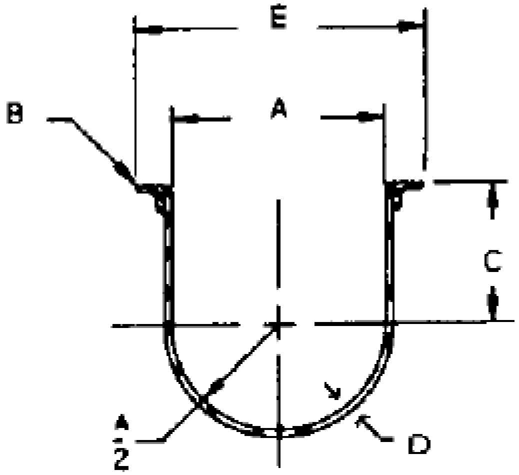

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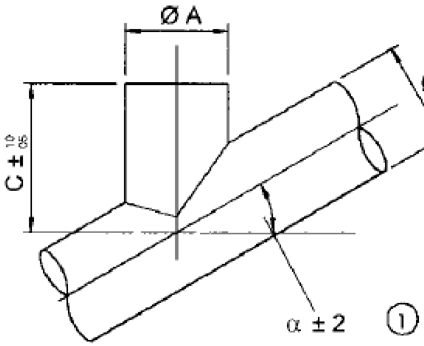
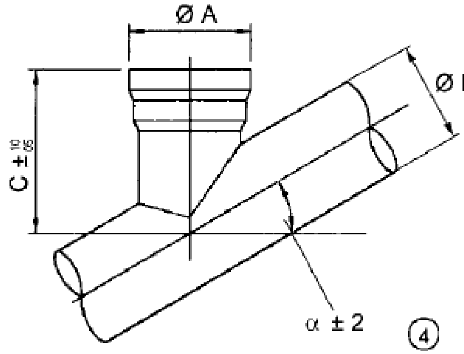




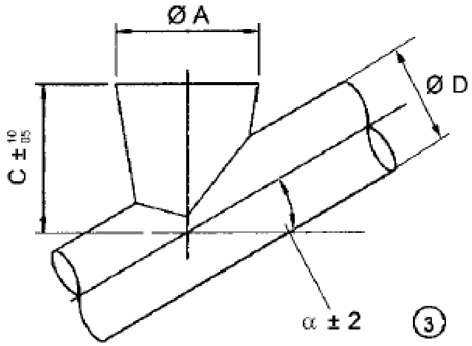
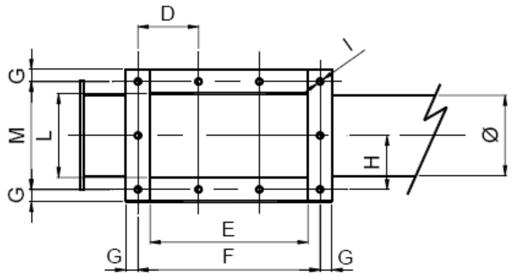


FIG.1



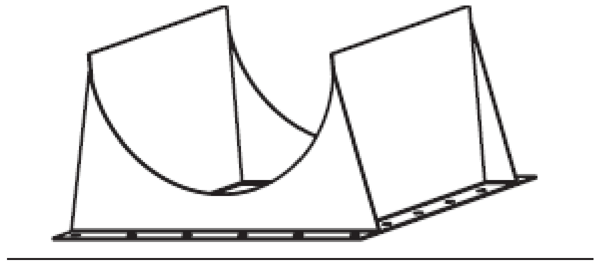
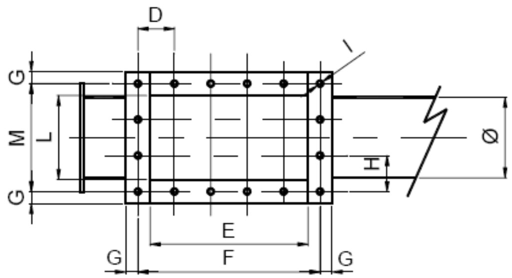
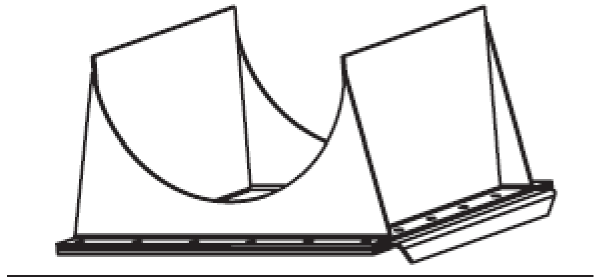


FIG.2





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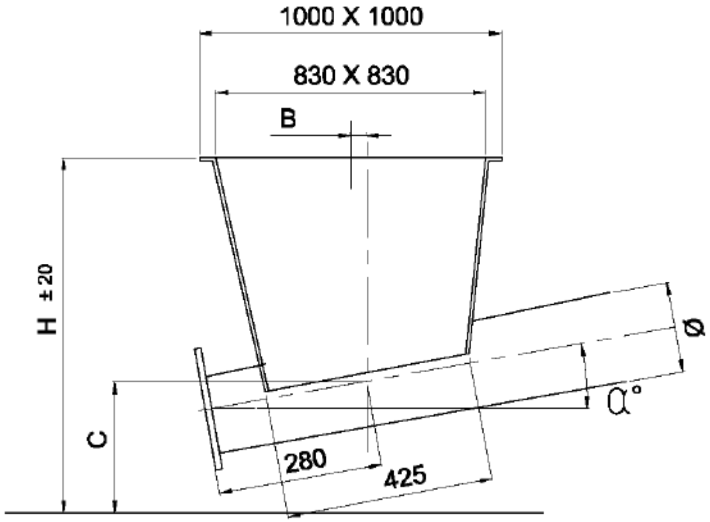

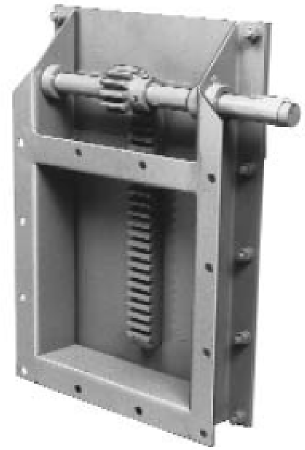

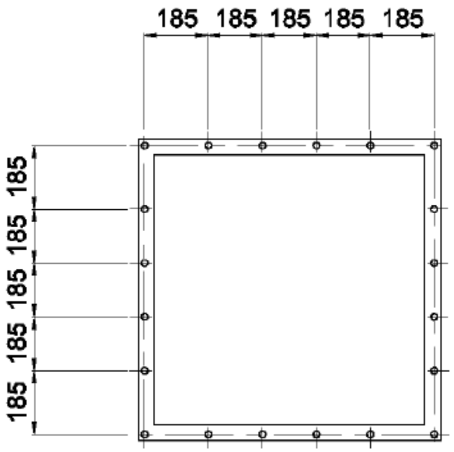

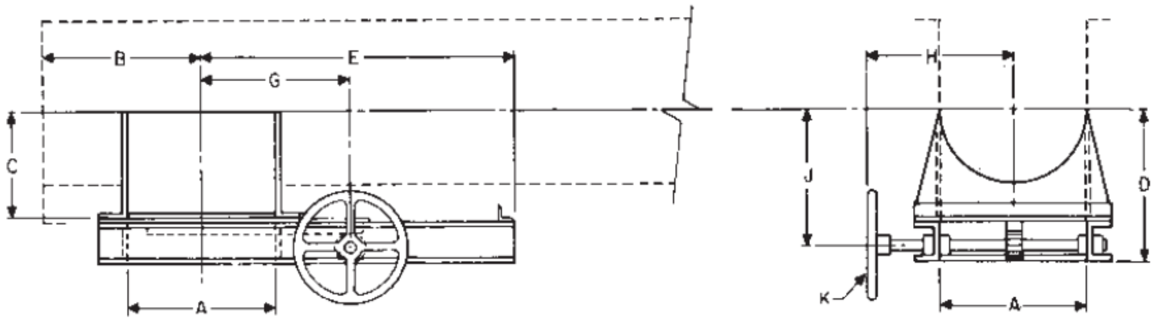

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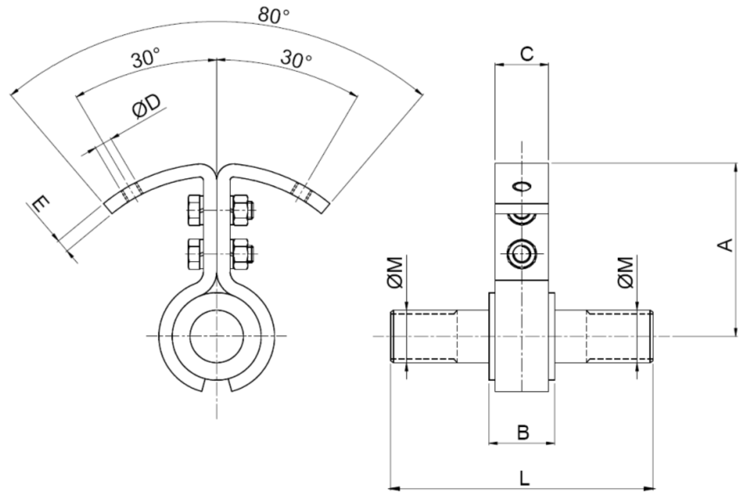

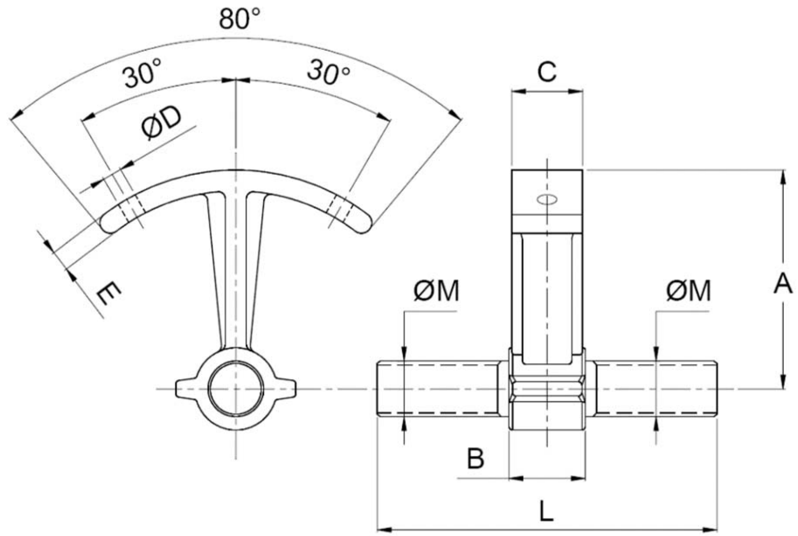

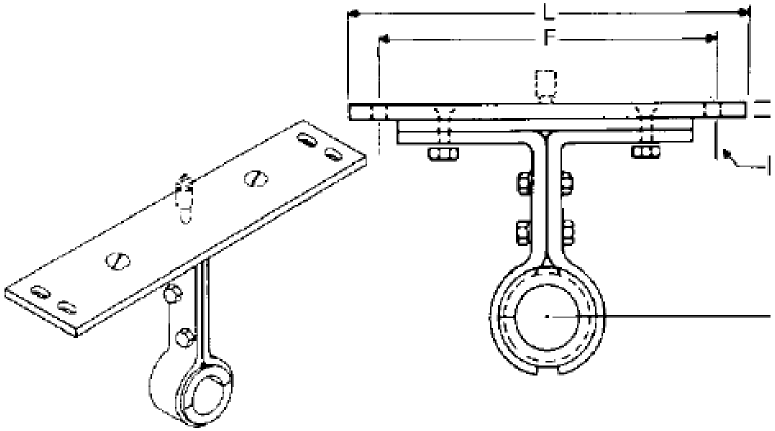

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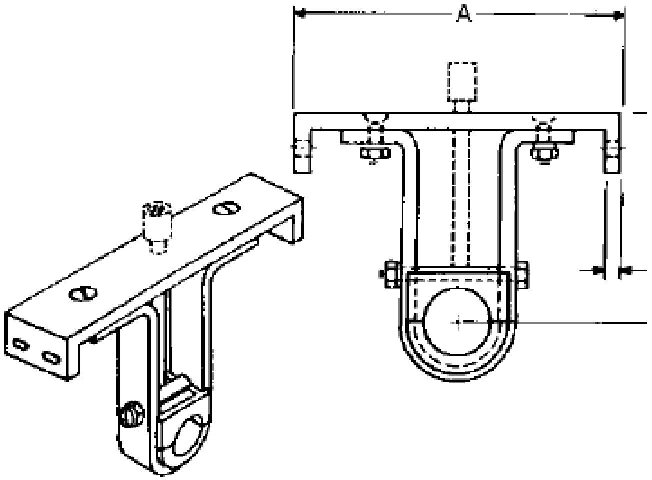

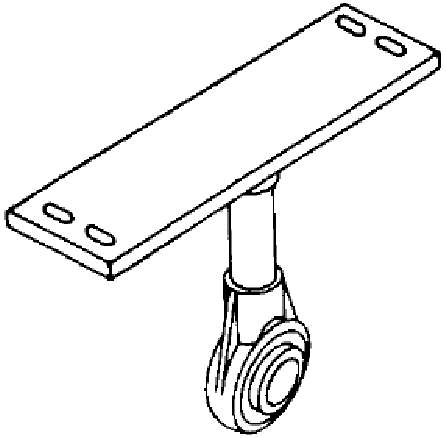

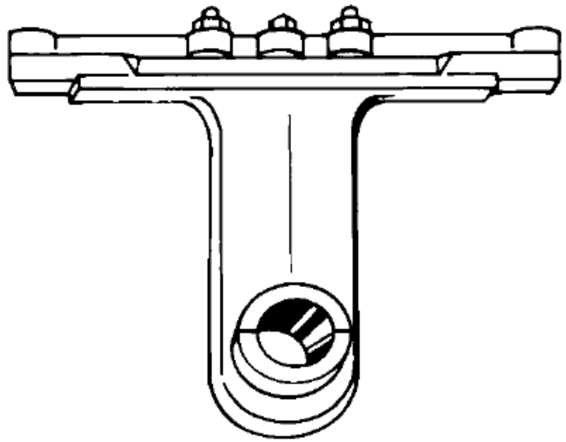

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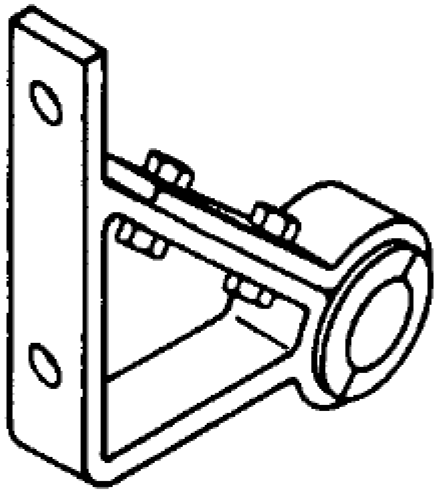
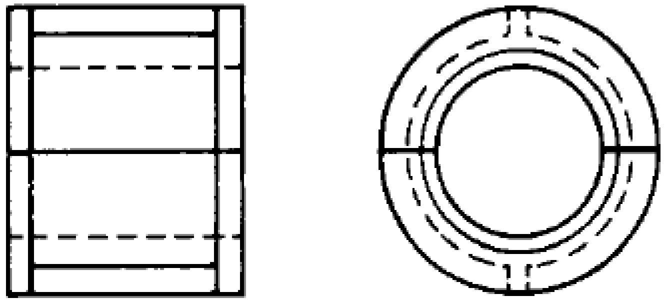
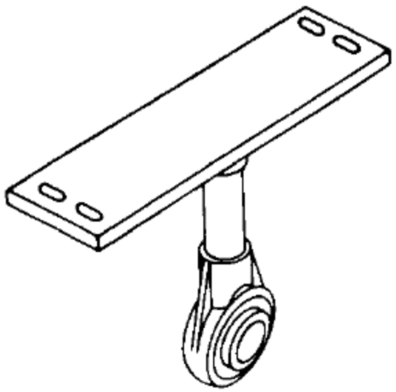
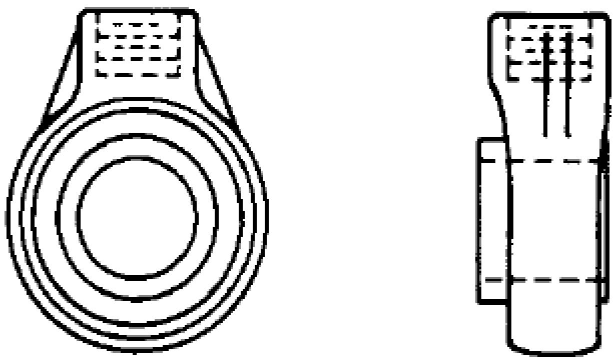
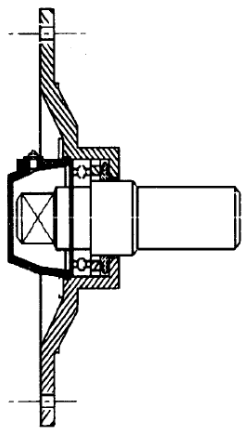


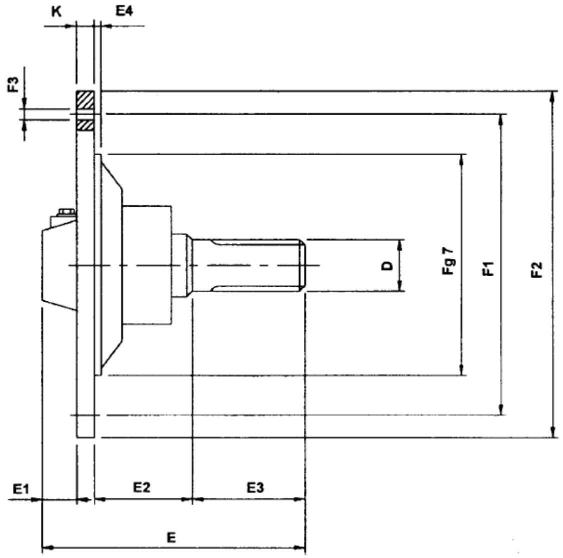


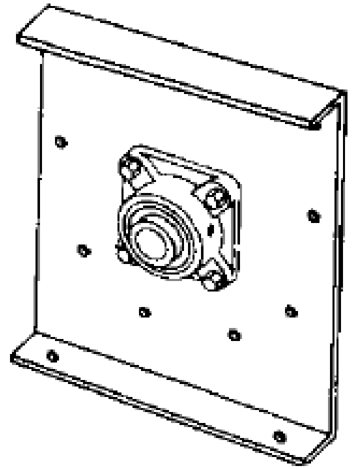




Construction details







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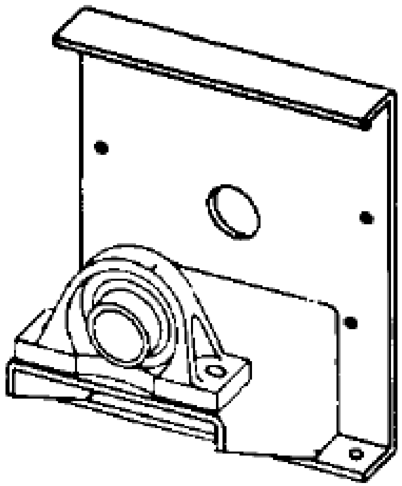
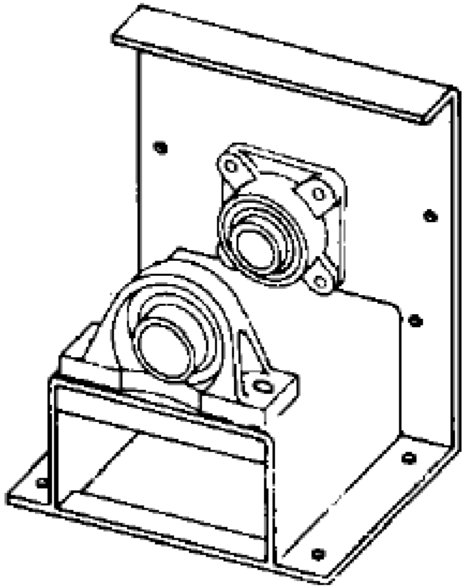
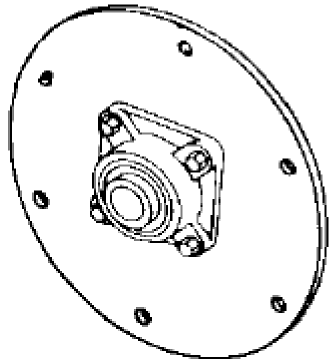
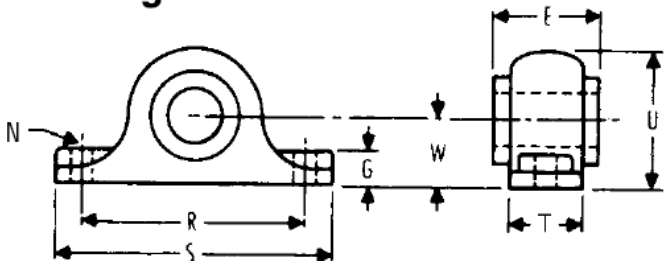


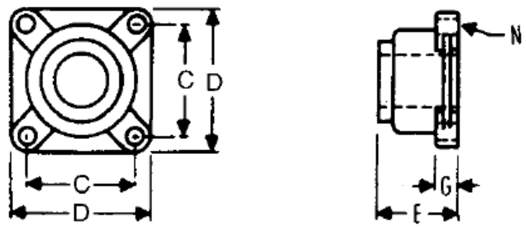




Roller Bearing Pillow Block



Roller Bearing Flange Unit



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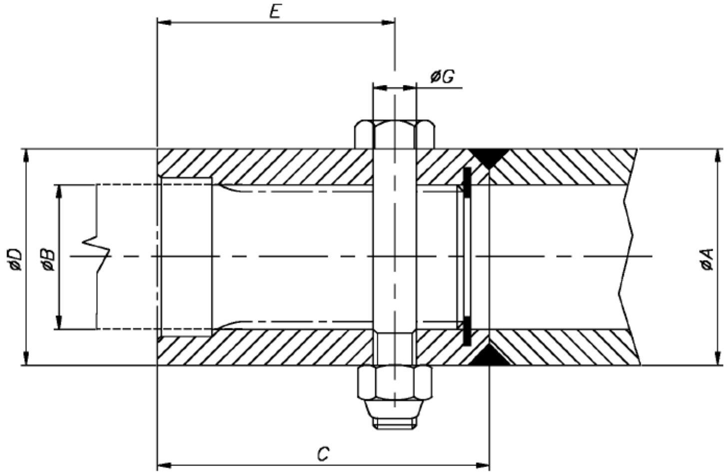

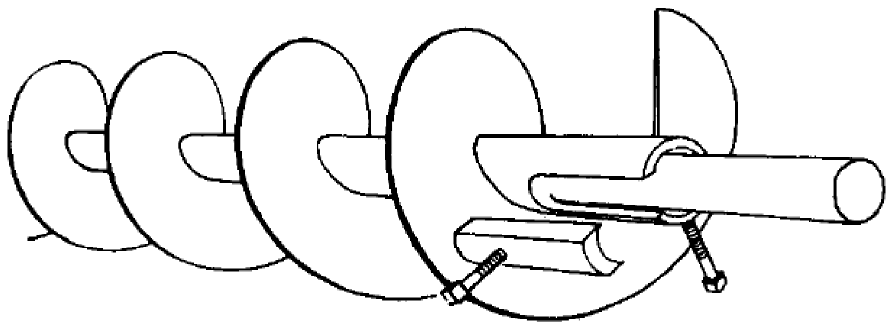

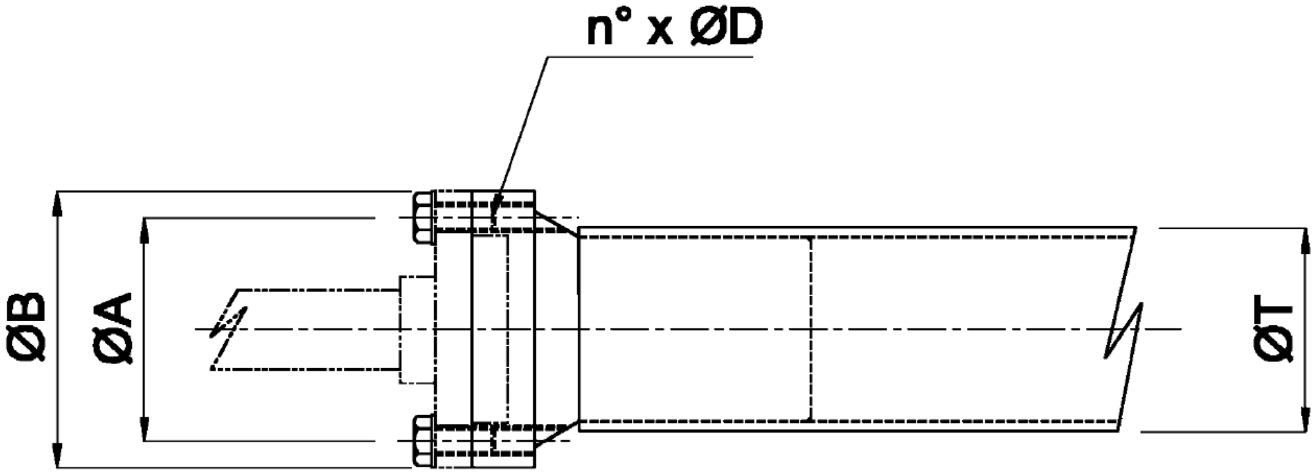

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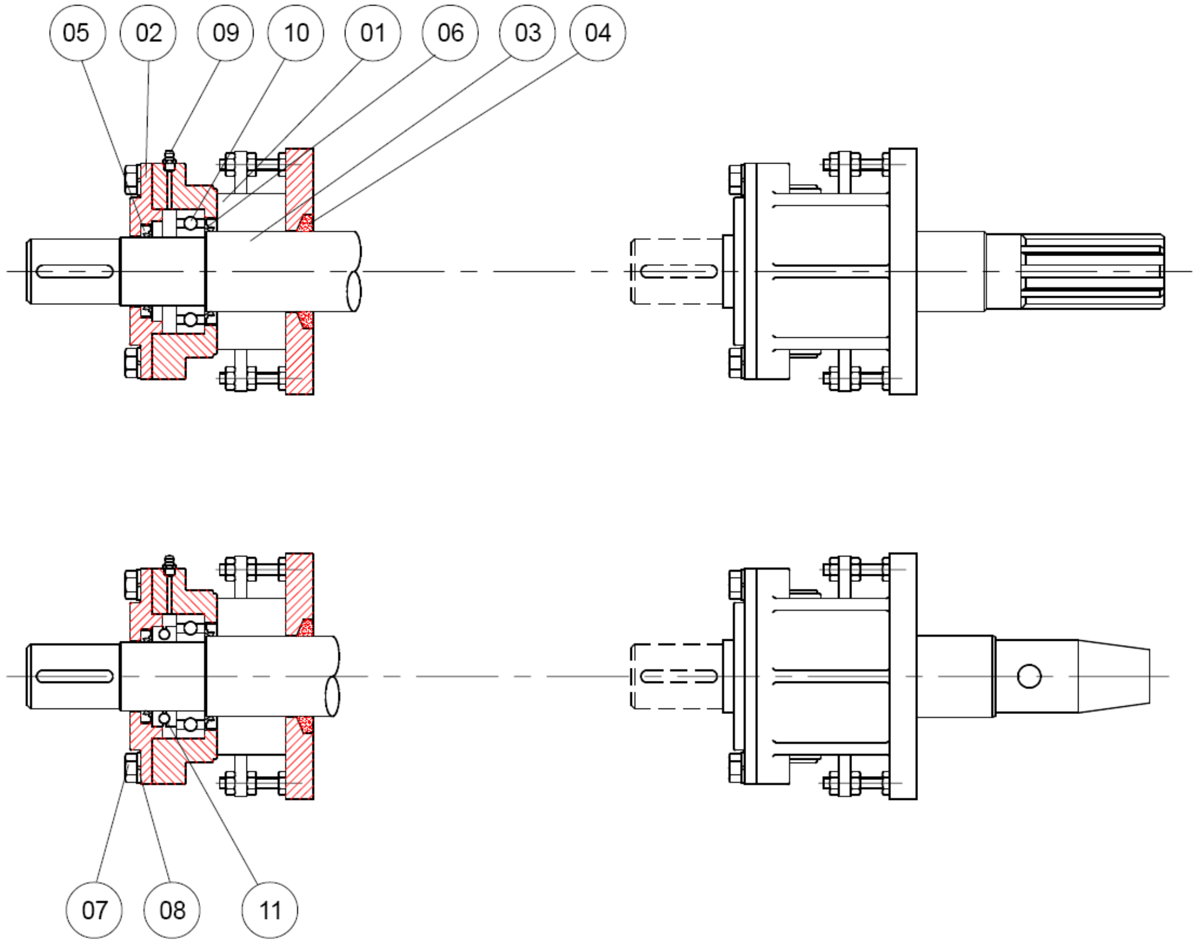

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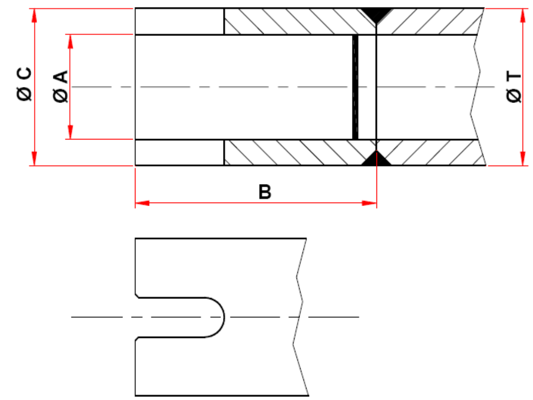
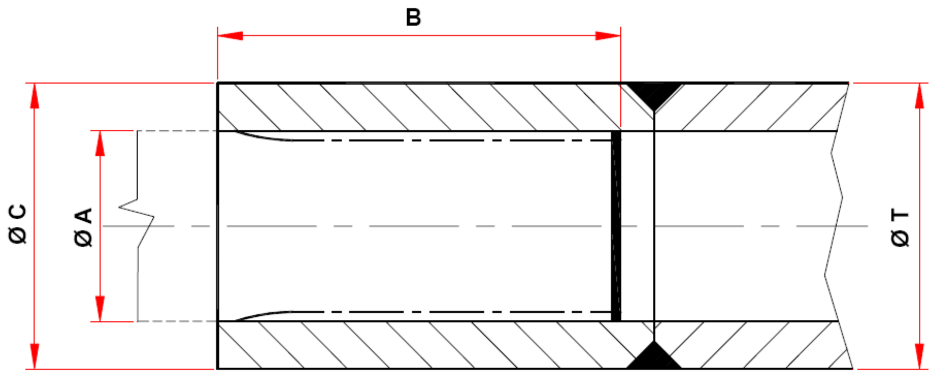
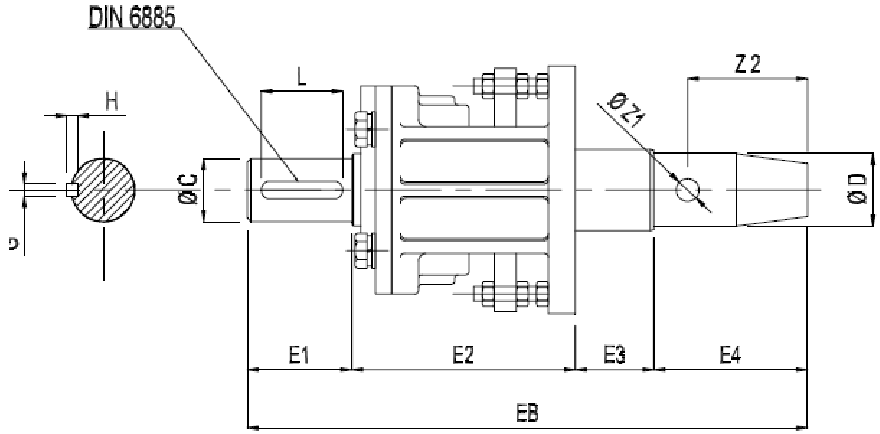
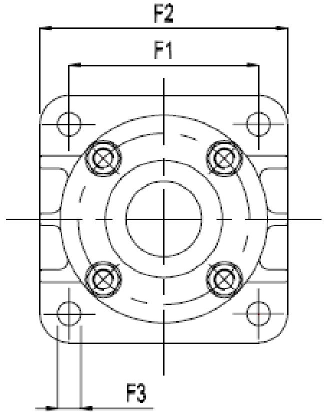
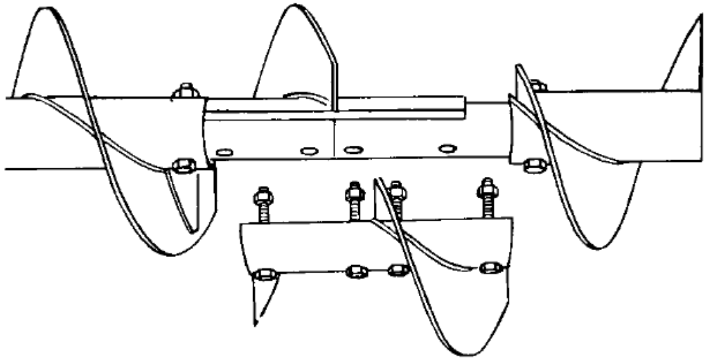


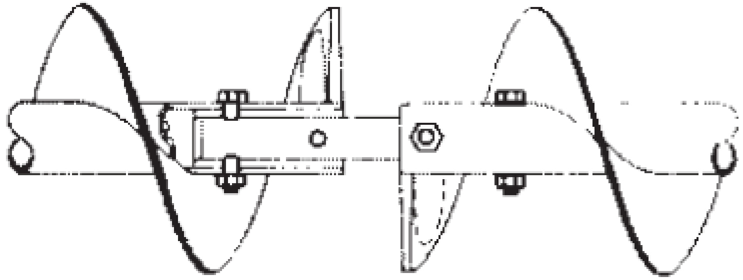


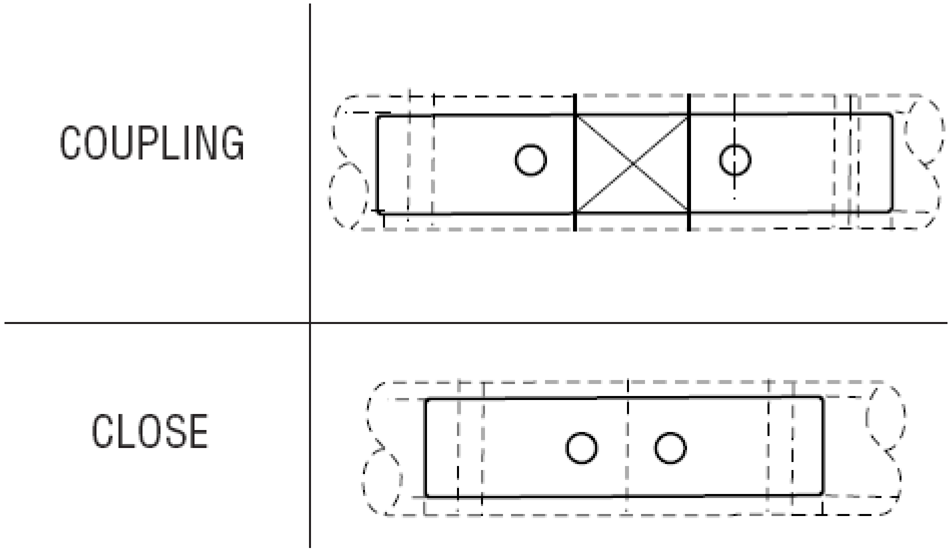




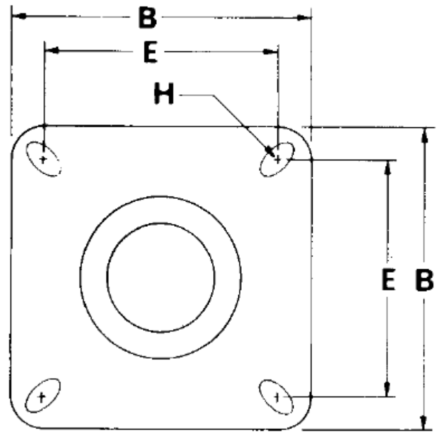
Construction details

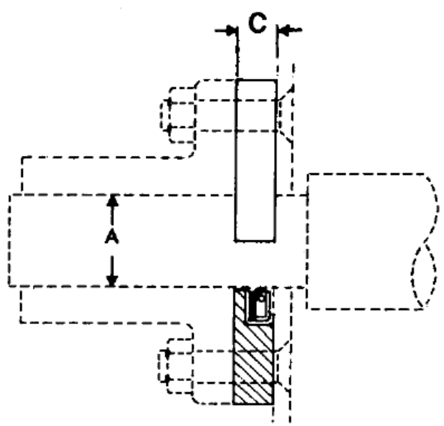


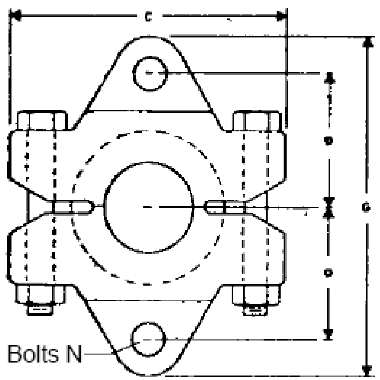


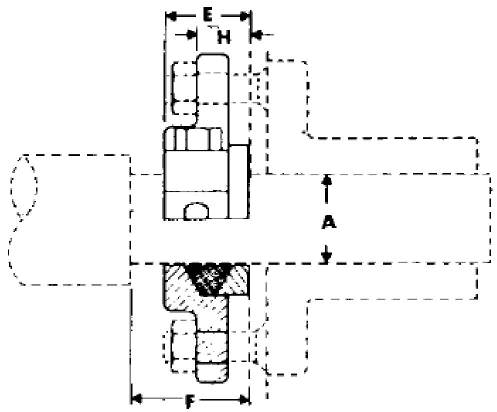


Construction details









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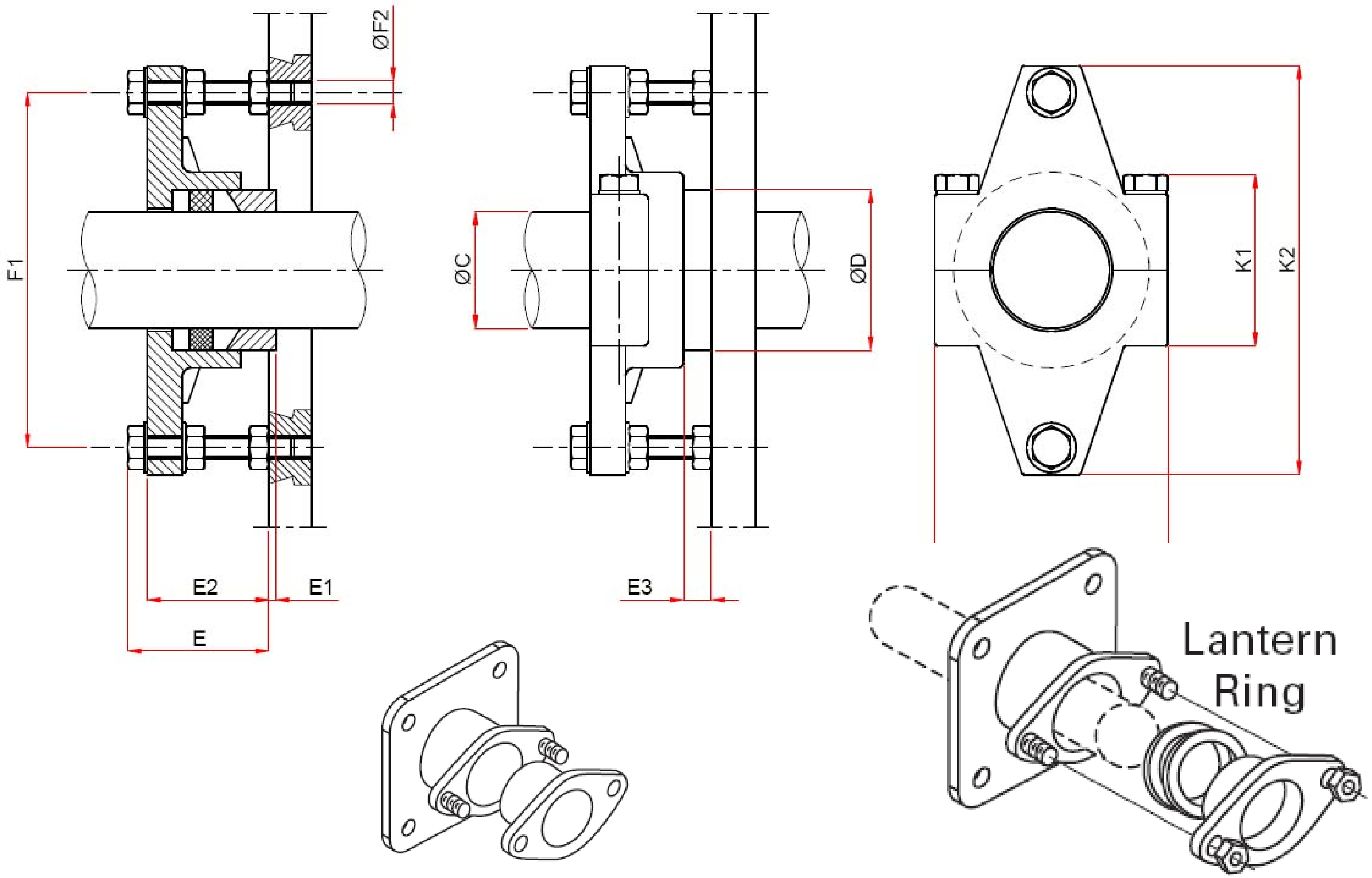
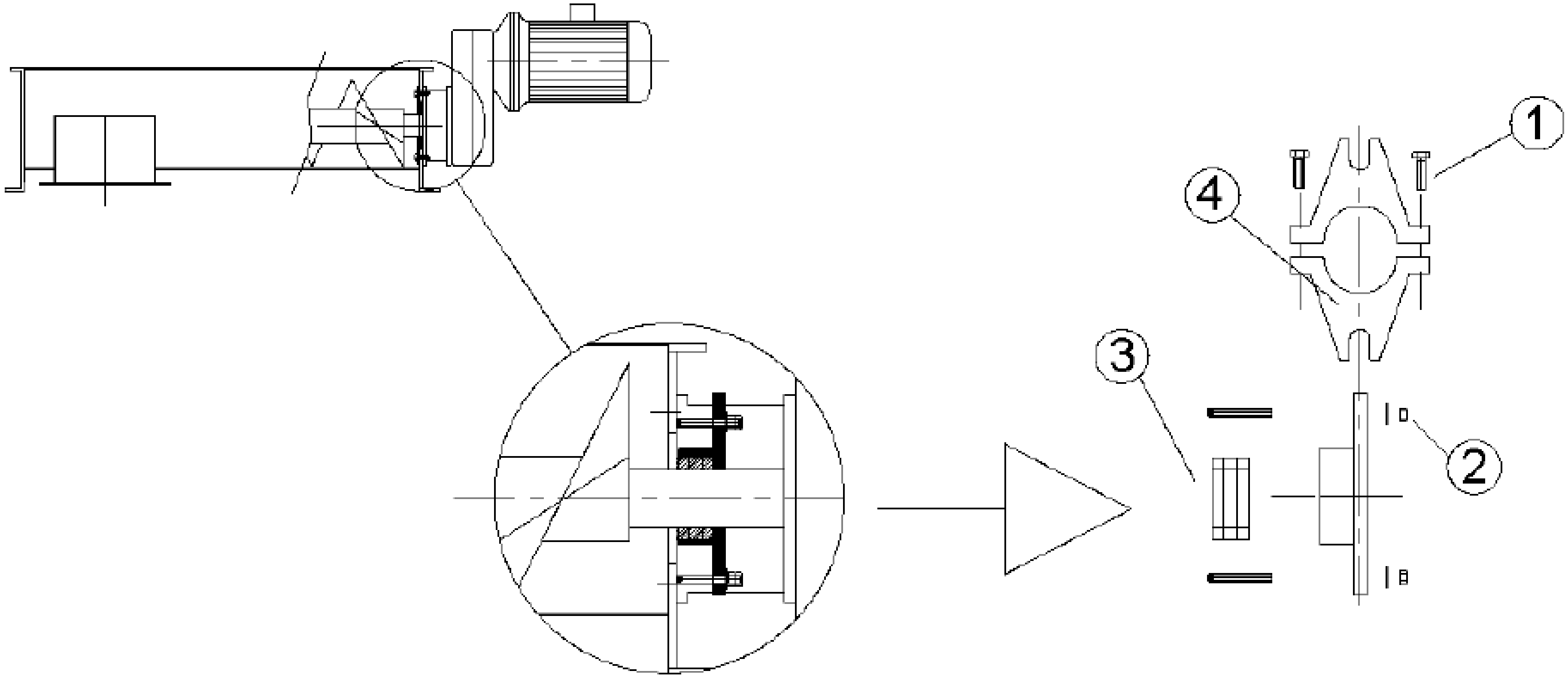


Construction details

fig. 1



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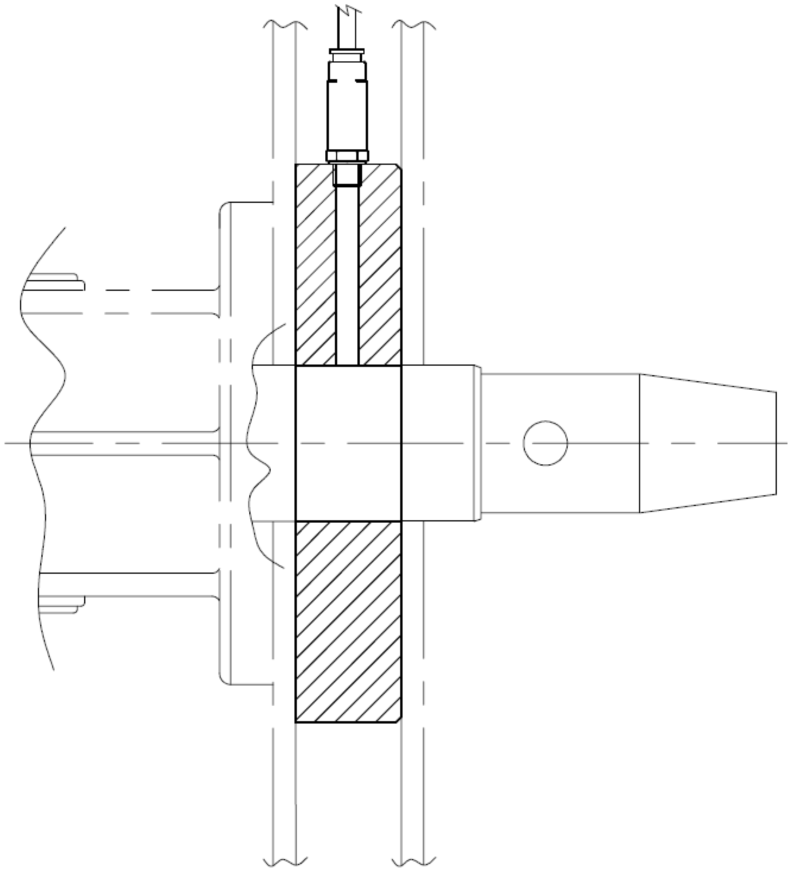

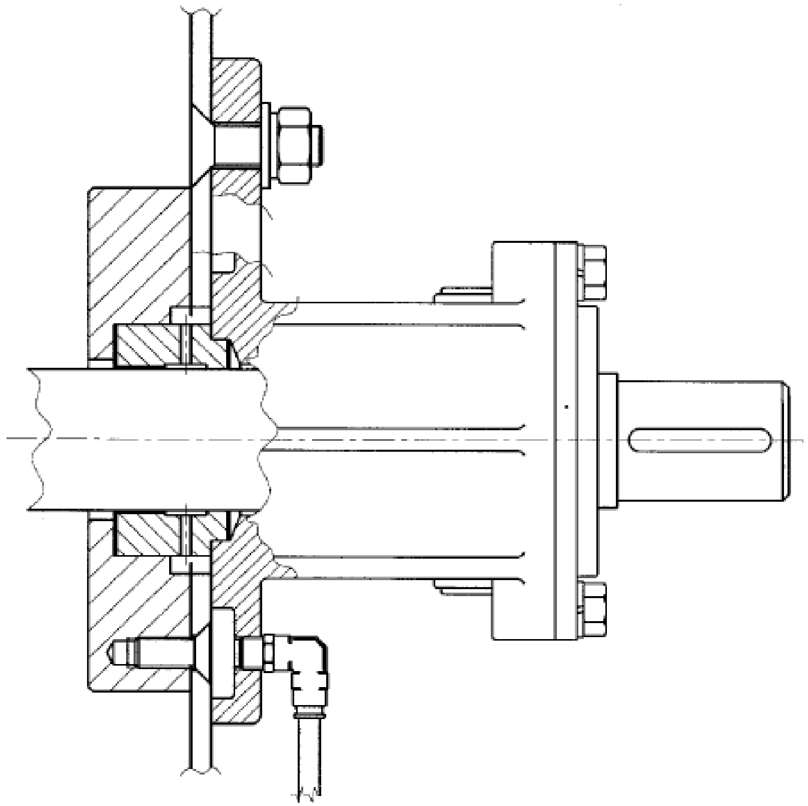

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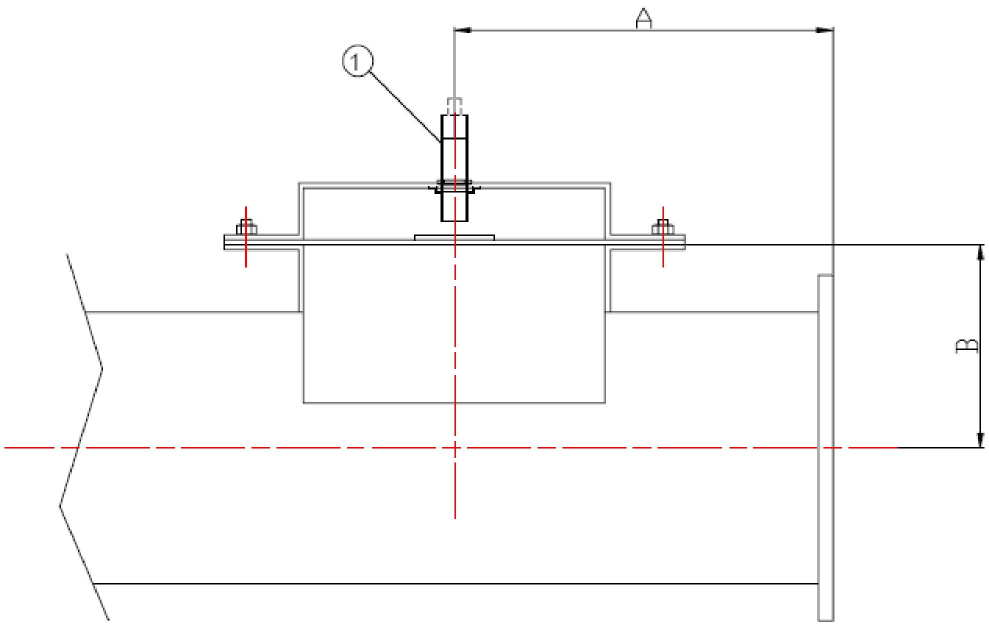

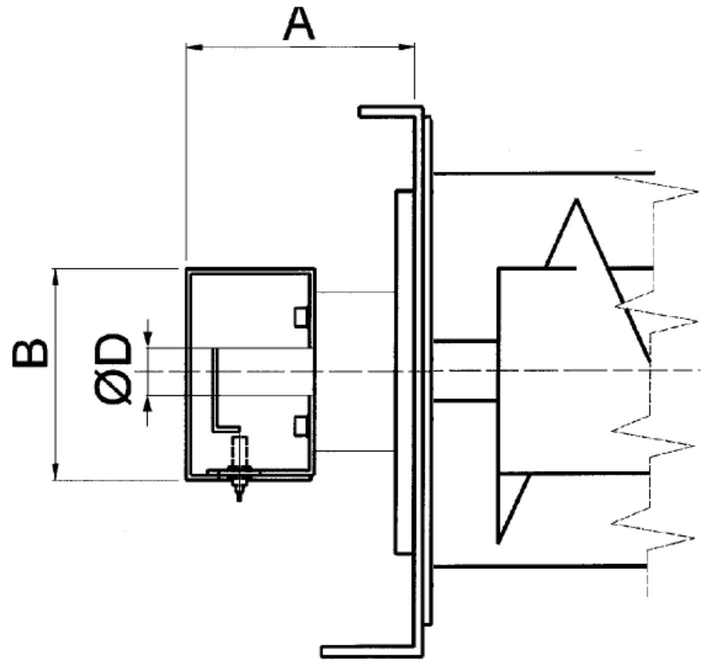

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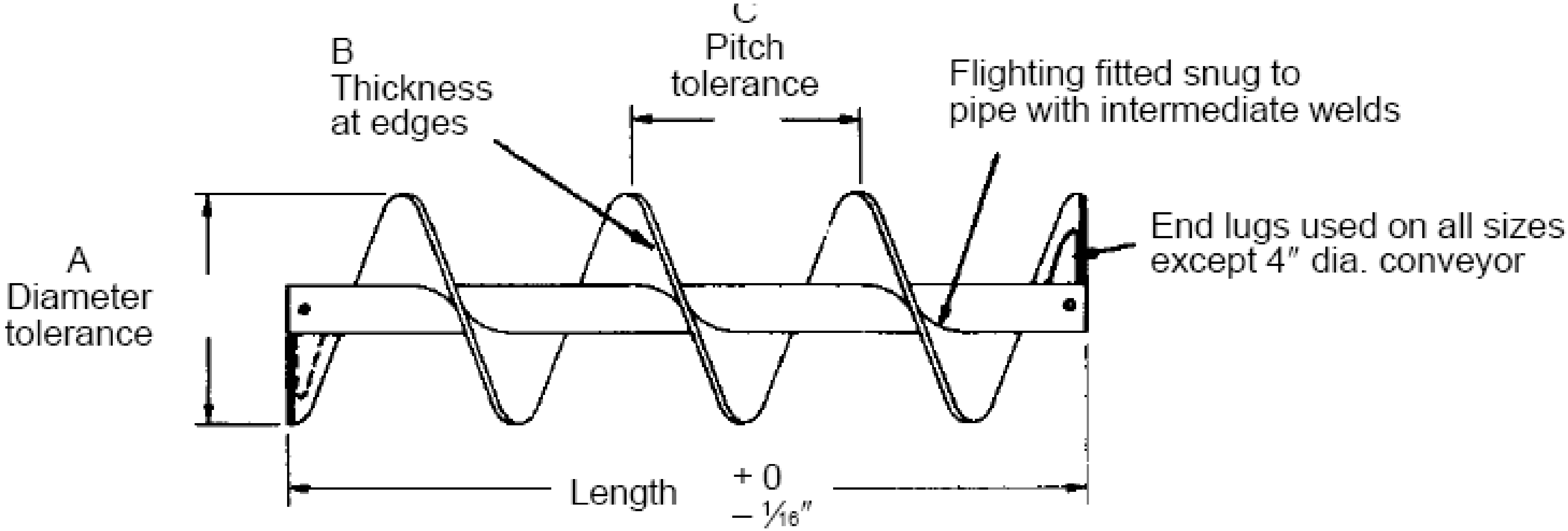

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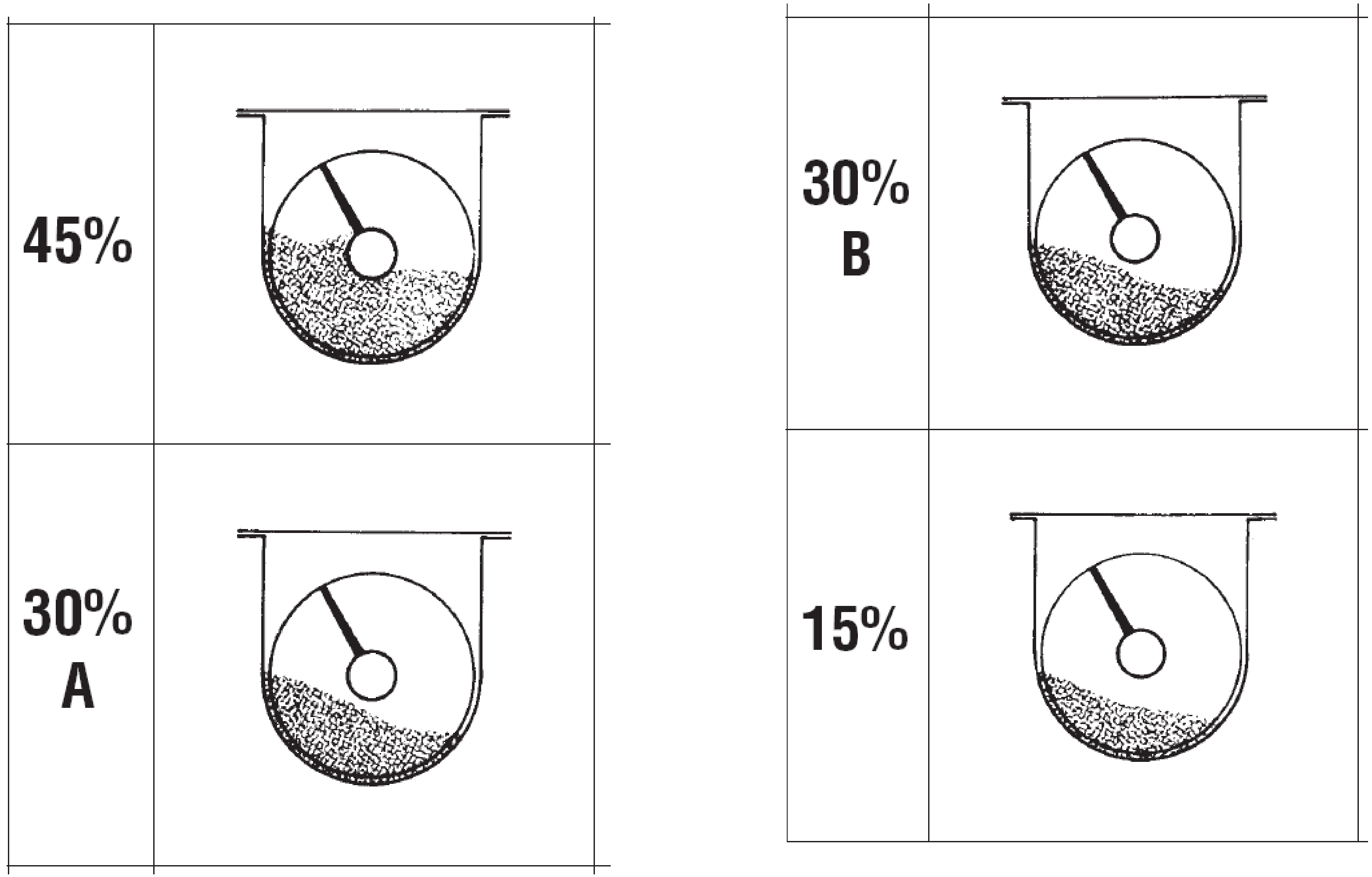

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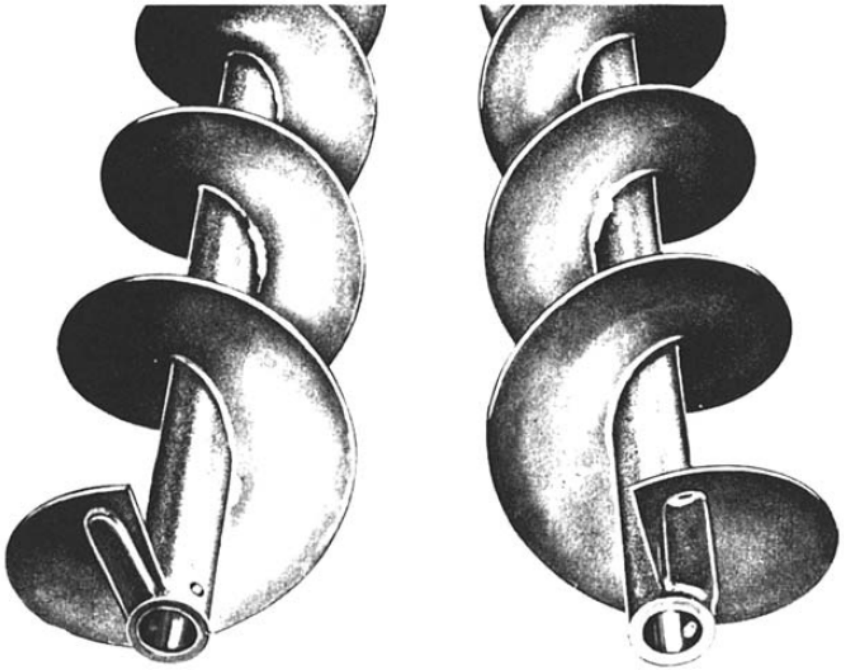
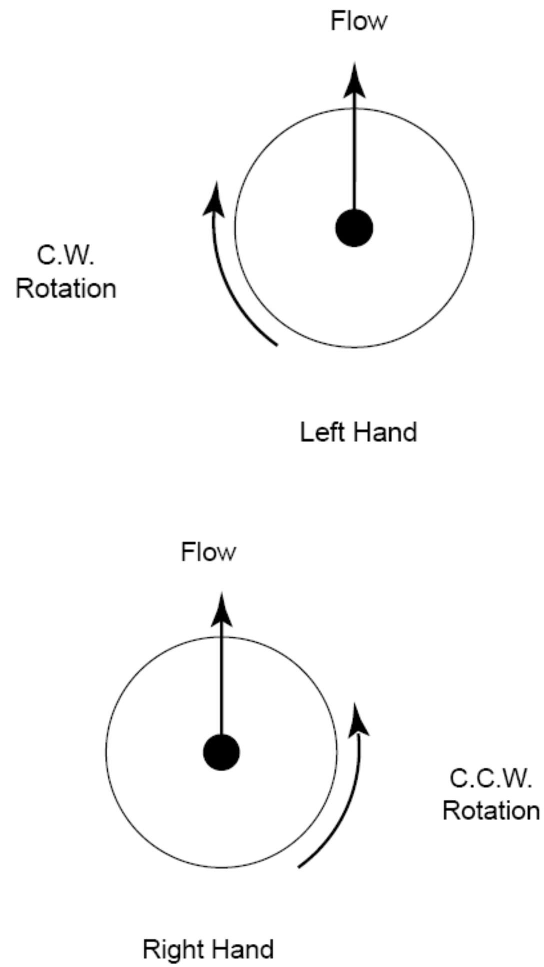
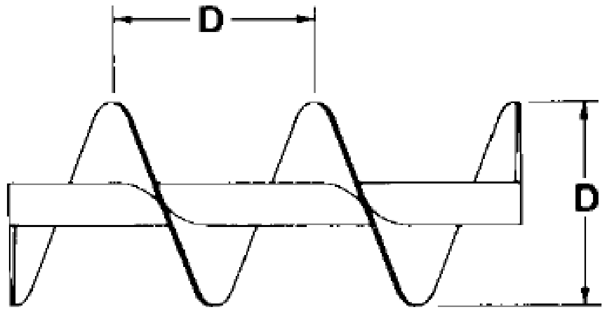




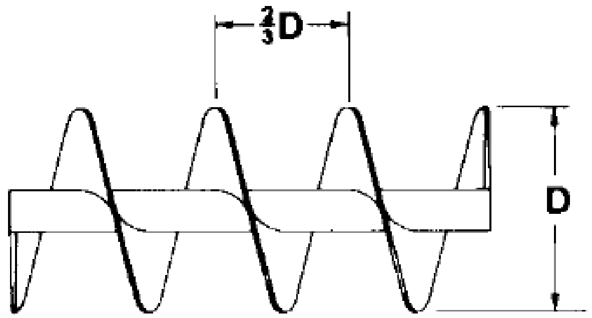
Construction details

Standard Pitch, Single Flight



Conveyor screws with pitch equal to screw diameter are considered standard. They are suitable for a wide range of materials in most conventional applications.

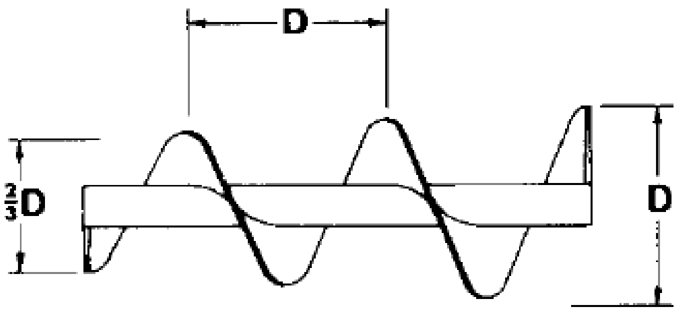
Short Pitch, Single Flight



Flight pitch is reduced to ⅔ diameter. Recommended for inclined or vertical applications. Used in screw feeders. Shorter pitch retards flushing of materials which fluidize.

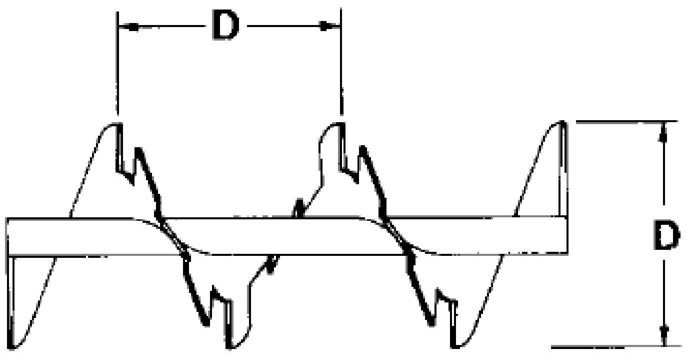
Construction details

Tapered, Standard Pitch, Single Flight



Screw flights increase from ⅔ full diameter. Used in screw feeders to provide uniform withdrawal of lumpy materials. Generally equivalent to and more economical than variable pitch.

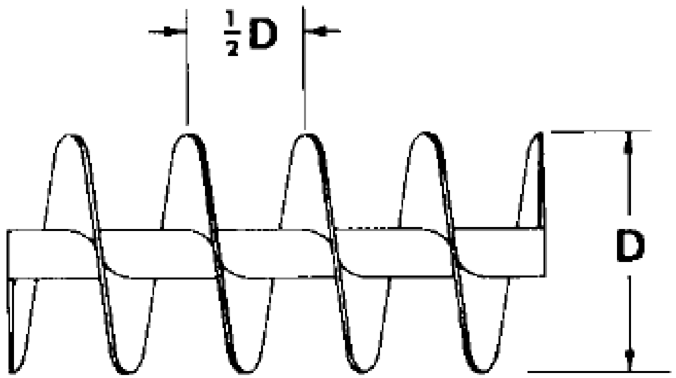
Single Cut-Flight, Standard Pitch



Screws are notched at regular intervals at outer edge. Affords mixing action and agitation of material in transit. Useful for moving materials which tend to pack.

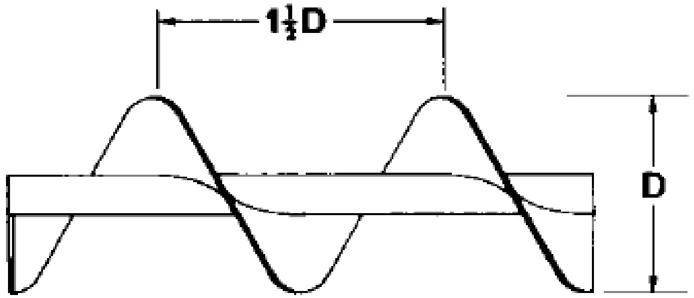
Construction details

Half Pitch, Single Flight



Similar to short pitch, except pitch is reduced to ½ standard pitch. Useful for vertical or inclined applications, for screw feeders and for handling extremely fluid materials.

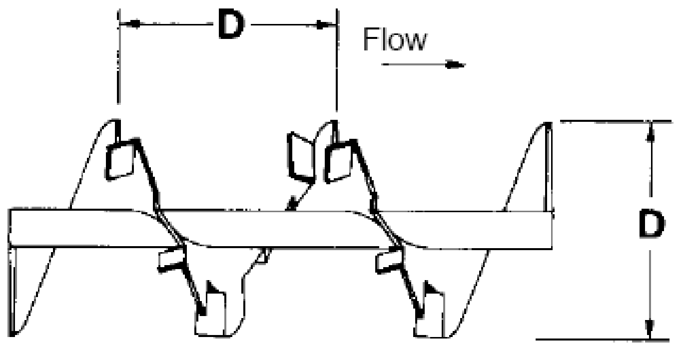
Long Pitch, Single Flight



Pitch is equal to 1½ diameters. Useful for agitating fluid materials or for rapid movement of very free-flowing materials.

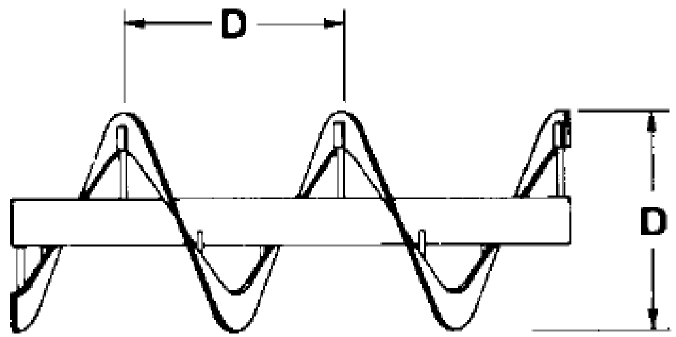
Construction details

Cut & Folded Flight, Standard Pitch



Folded flight segments lift and spill the material. Partially retarded flow provides thorough mixing action. Excellent for heating, cooling or aerating light substances.

Single Flight Ribbon

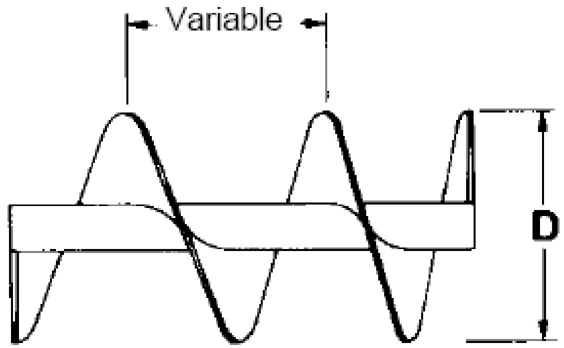


Excellent for conveying sticky or viscous materials. Open space between flighting and pipe eliminates collection and build-up of the material.

Available in post type or integral leg.

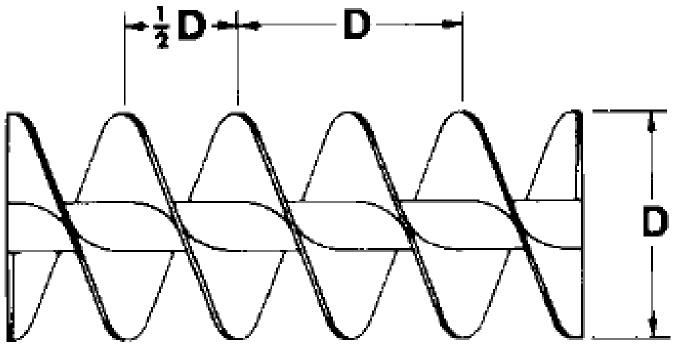
Construction details

Variable Pitch, Single Flight



Flights have increasing pitch and are used in screw feeders to provide uniform withdrawal of fine, free-flowing materials over the full length of the inlet opening.

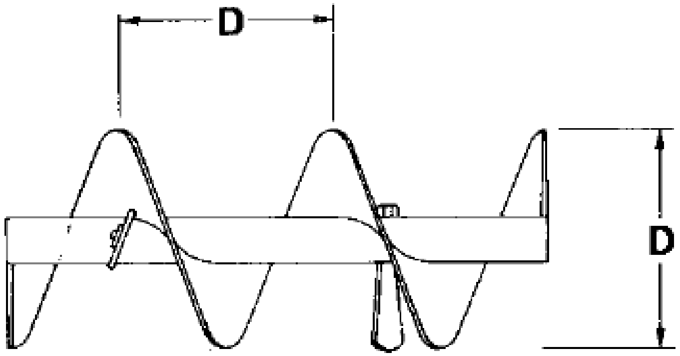
Double Pitch, Single Flight



Double flight, standard pitch screws provide smooth, regular material flow and uniform movement of certain types of materials.

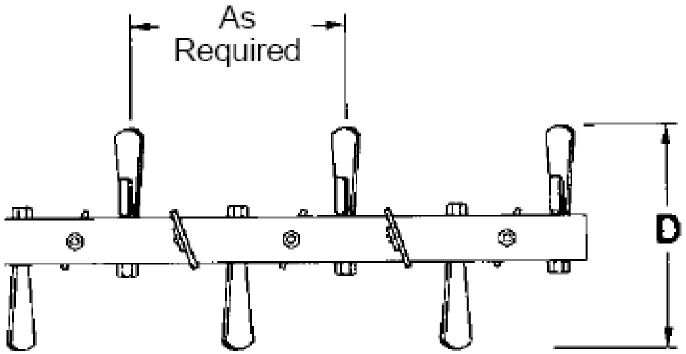
Construction details

Standard Pitch with Paddles



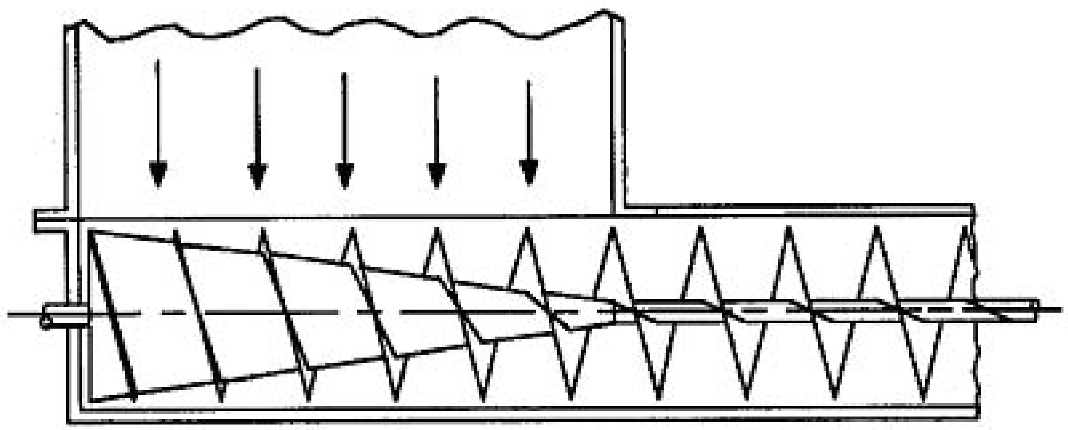
Adjustable paddles positioned between screw flights oppose flow to provide gentle but thorough mixing action.

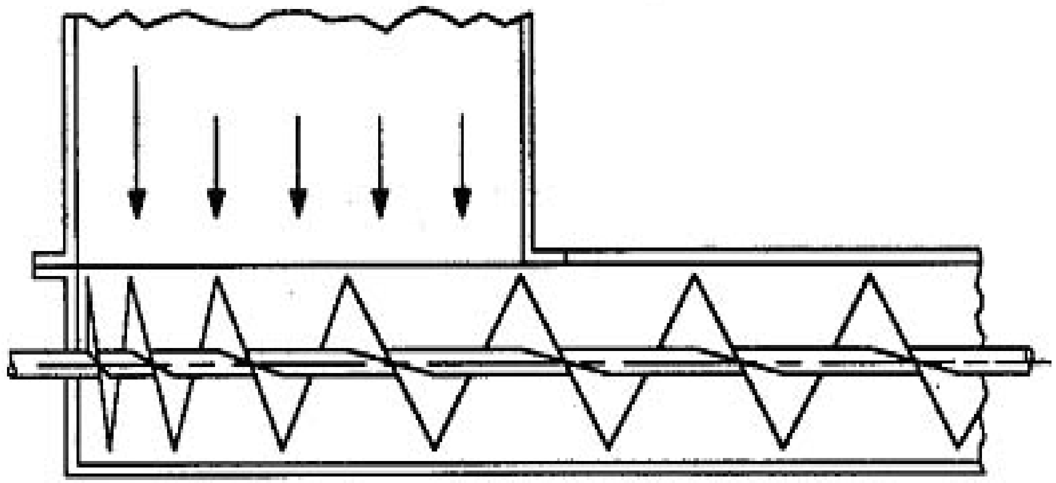
Paddle



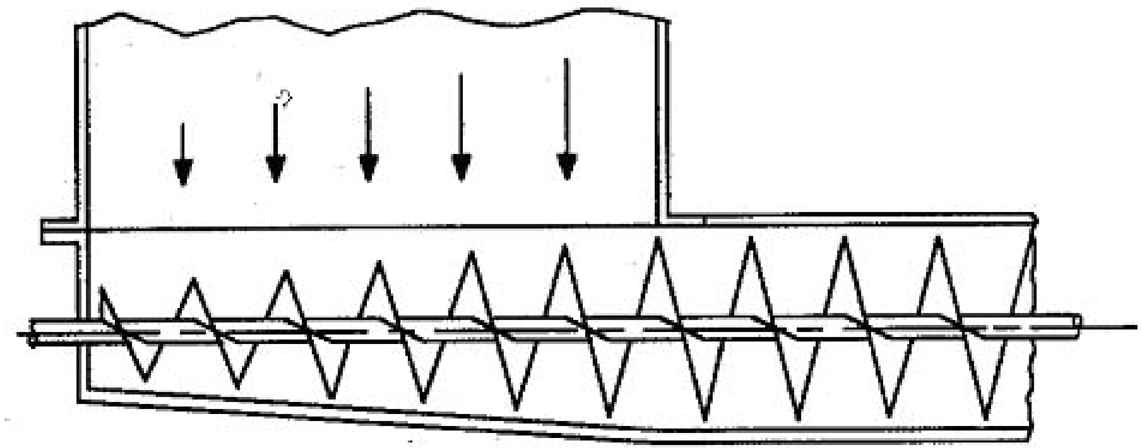
Adjustable paddles provide complete mixing action, and controlled material flow.

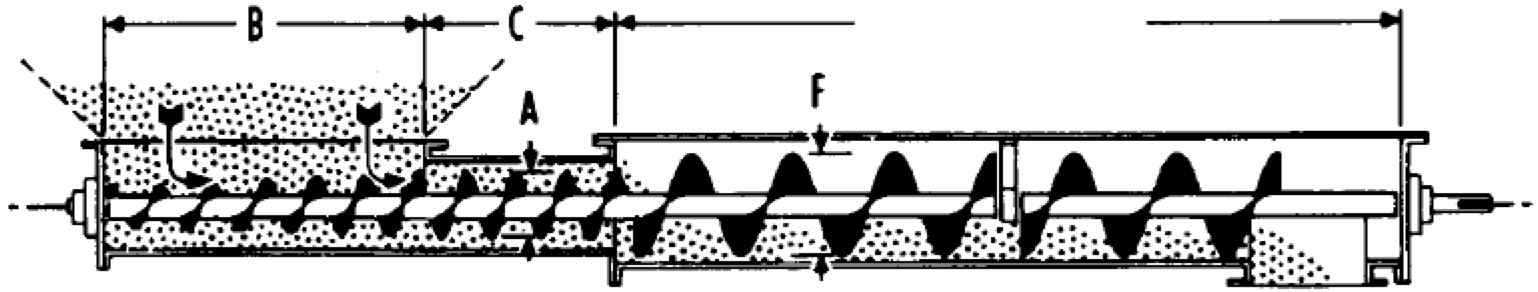
Construction details



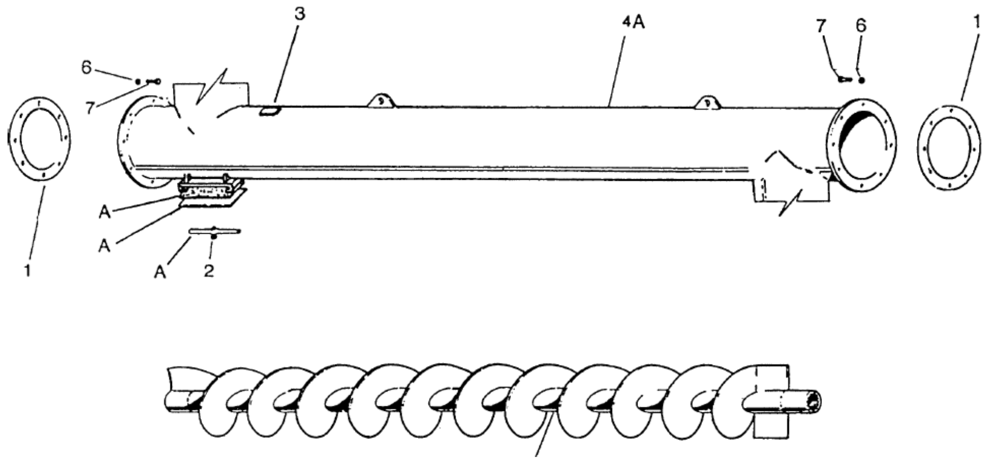


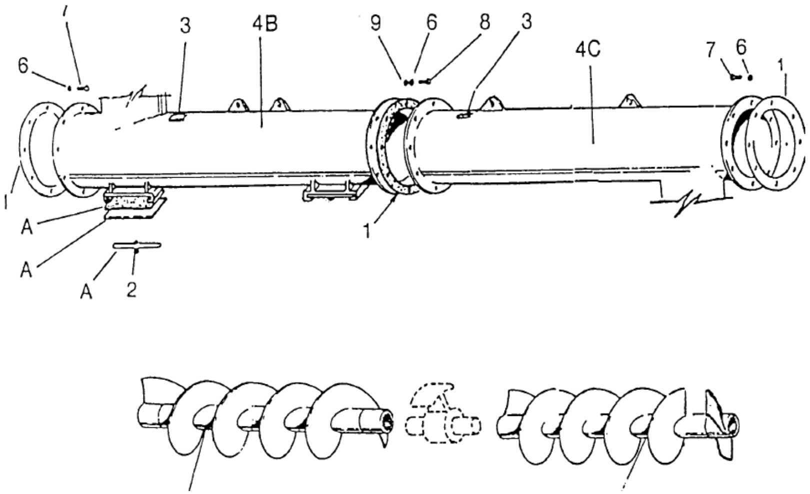
Construction details





Construction details





Construction details