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# **INDUSTRIAL PLANTS**

**Chapter fifteenth:**

**Implement for cranes**

**DOUBLE DEGREE MASTER IN  
“PRODUCTION ENGINEERING AND MANAGEMENT”**

**SEAT OF PORDENONE  
UNIVERSITY OF TRIESTE**

## Implement for cranes

The cranes and bridge cranes with winches or hoists which they are applied one or more cables which, with a system of pulleys, gears and hooks allow the lifting or lowering of loads. The materials in the form of packages or bulk materials can be transported with suitable **implement**.

For the lifting of loads, the attaching means most known and used between the hook and the load itself is the **sling**, which can be of the type:

- simple or chain for lifting of a tract;
- double or chain for lifting two tracts;
- triple or chain for lifting three tracts;
- quadruple or chain for lifting four tracts.

## Implement for cranes

The **chains** used for slinging of loads are generally made of special steel and, compared to the ropes, show a better resistance to corrosion, abrasion and high temperatures, although they are heavier and more noisy, and presenting a sudden breakage or stretches and becomes rigid at high loads. In the case where the chain is heated to a temperature above 450°C on its workload is reduced permanently following the modifications of the structure of the steel.



## Implement for cranes

Chain sling for lifting it to one, two, three and four tracts:



## Implement for cranes

You should not use slings with loads in excess of their maximum working load, and if the identification is doubtful, and replace them when they are worn or damaged.

You should always examine the state before use, if in doubt replace with a new sling, but you must never use damaged slings. Also you should never put your sling to improper heat treatment, and not combine the chains by bolts or shackles or form of nodes.

You should not use slings with vertex angle greater than  $120^\circ$ , but you should always carry out lifts in full compliance with safety regulations, provisions of the "**Law relating to health and safety in the workplace**".

The slings must also be audited quarterly as required by law.

## Implement for cranes

You should also always balance the loads prior to lifting and protect chains from sharp edges that can damage them during lifting.

The lifting and transporting of the loads in the area of influence should be done outside of the areas where they stop people and places in which the eventual fall of the load can create dangerous conditions.



## Implement for cranes

The angle formed by stretches of chain affects the extent of the effort that each section can bear, as to a lesser extent, the operating load depends on the distance between the hook and the load.

Assuming to analyze a sling in two sections and considering the load to be lifted  $Q$ , the effort  $T$  of the two sections increases with the angle  $\alpha$  according to the relation:

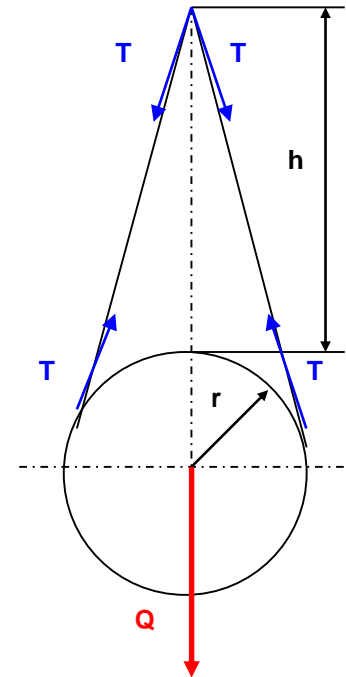
$$T = \frac{Q}{2 \cdot \cos \frac{\alpha}{2}}$$

and taking into account that:

$$\cos \frac{\alpha}{2} = \sqrt{1 - \operatorname{tg}^2 \frac{\alpha}{2}} \quad \operatorname{tg} \frac{\alpha}{2} = \frac{r}{r+h}$$

shows that the stress  $T$  decreases with height  $h$  of the sling according to the relation:

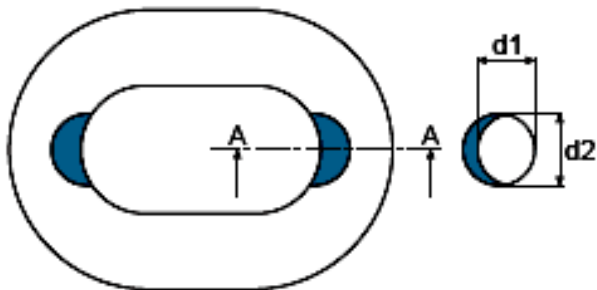
$$T = \frac{Q}{2 \cdot \sqrt{1 - \left(\frac{r}{r+h}\right)^2}}$$



## Implement for cranes

Next to the activities of harness, is used in replacement of cables or chains using the implement different depending on the load to be lifted and transported.

The mechanical characteristics of the steels for the manufacture of the chains are controlled for each individual casting in order to define which cycles and to which temperatures make the heat treatment necessary to achieve the requirements specified by the standards:



Nominal diameter (mm)	Minimum diameter $(d_1+d_2)/2$ (mm)
7	6,3
8	7,2
10	9,0
13	11,7
16	14,4
20	17,1
22	20,7
26	23,4
32	28,0



## Implement for cranes

The maximum load of use depending on the diameter of the chain and the angle formed between the sections of the sling is:

Maximum operating load (kN)					
Diameter of the chain (mm)	Sling at chain to a tract	Sling at chain to two tracts		Sling at chain to three tracts	
		$0^\circ < \alpha < 90^\circ$	$90^\circ < \alpha < 120^\circ$	$0^\circ < \alpha < 90^\circ$	$90^\circ < \alpha < 120^\circ$
6	1,12	1,60	1,12	2,36	1,70
7	1,50	2,12	1,50	3,15	2,24
8	2,00	2,80	2,00	4,25	3,00
10	3,15	4,25	3,15	6,70	4,75
13	5,30	7,50	5,30	11,20	8,00
16	8,00	11,20	8,00	17,00	11,80
19	11,20	16,00	11,20	23,60	17,00
20	12,50	17,00	12,50	26,50	19,00
22	15,00	21,20	15,00	31,50	22,40
26	21,20	30,00	21,20	45,00	31,50
32	31,50	45,00	31,50	67,00	47,50

## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### a) **games or sling**

To lift in an optimal way the loads of considerable length is possible to interpose between the load and the lifting means a sling, in order to avoid, in the cables or chains of the angles  $\alpha$  higher than those eligible or in the case of spread over two hooks corresponding to two crane or a crane load is too heavy for one alone. Can support a load of 500 kN and 2 MN.

## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### a) games or sling



Traverse at sling - 3 armsi



Traverse at sling with central swivel hook

## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### b) tongs or pliers

The grippers are used to grasp different packages (drums, coils, sheets, packages etc.) and their shape depends on the nature and type of load being lifted and transported



Gripper for lifting of drums



Gripper for lifting of cois

## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### b) tongs or pliers



Gripper for lifting of sheets



Gripper for lifting of packages

## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### c) buckets

The buckets are suitable for handling bulk materials in the pile and of no great size (sand, gravel, crushed stone, coal, cement, ore etc.) with a capacity expressed in volume

We can distinguish:

- ***buckets with two valves or mordant***



## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### c) buckets

We can distinguish:

- *bruckets at openable bottom*



## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### c) buckets

We can distinguish:

- ***buckets at grapple***





## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### **d) electromagnets or magnetic platters**

The electromagnets are the most common means for moving ferrous materials, either loose (scrap in various forms), is regular in shape (ingots, blooms, profiles, plates etc.). In fact, it generates a magnetic field and a flow that is closed between the electromagnet, energized with direct current, and the casing of iron, which contains the material to be handled. The interruption of the magnetic field and the consequent release and fall of the ferrous material is obtained by de-energizing the magnet interrupting the emission of current in the winding which encloses the core or with a weak current of opposite polarity.

## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### **d) electromagnets or magnetic platters**

They allow the rapidity and simplicity of handling operations, especially in the sampling operations and unloading.

The lifting capacity of an electromagnet depends on the type of material being handled. In the case of light residues or scrap residues from the processing of the removal of chips, the handling capacity becomes very low compared to the weight of the magnet, reducing the useful capacity of the crane.

The electromagnets are used singly hanging from the crane hook for handling of loose material or in blocks, or hung in the batteries by a cross member for handling metal sheets and profiles.

## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### d) **electromagnets or magnetic platters**

Is necessary to provide of backup batteries to avoid that intervene automatically to any accidental interruption of the direct current in order to avoid the release of the load.



## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### e) **pneumatic elevators**

Are used in the handling of materials in the form of slabs or homogeneous surfaces. It realizes a depression between the load and the equipment by means of a compressor. This creates a secure and fast system for the coupling and the release of the pieces.



## Implement for cranes

For lifting and load handling by crane and the bridge crane the implement are:

### f) forks

Must be used when handling materials that are forklift. The forks can oscillate about a horizontal axis; in the upper part of the forks, there are springs that in the presence of the load allow to tilt the forks upwards avoiding any slippage of the load.



## Implement for cranes

These implement analyzed do not exhaust all the devices for gripping the crane or bridge cranes. Others, such as the charger for cupola furnaces, can be studied, but for those who have been illustrated are the ones that are used in industrial reality.