www.MINEPORTAL.in

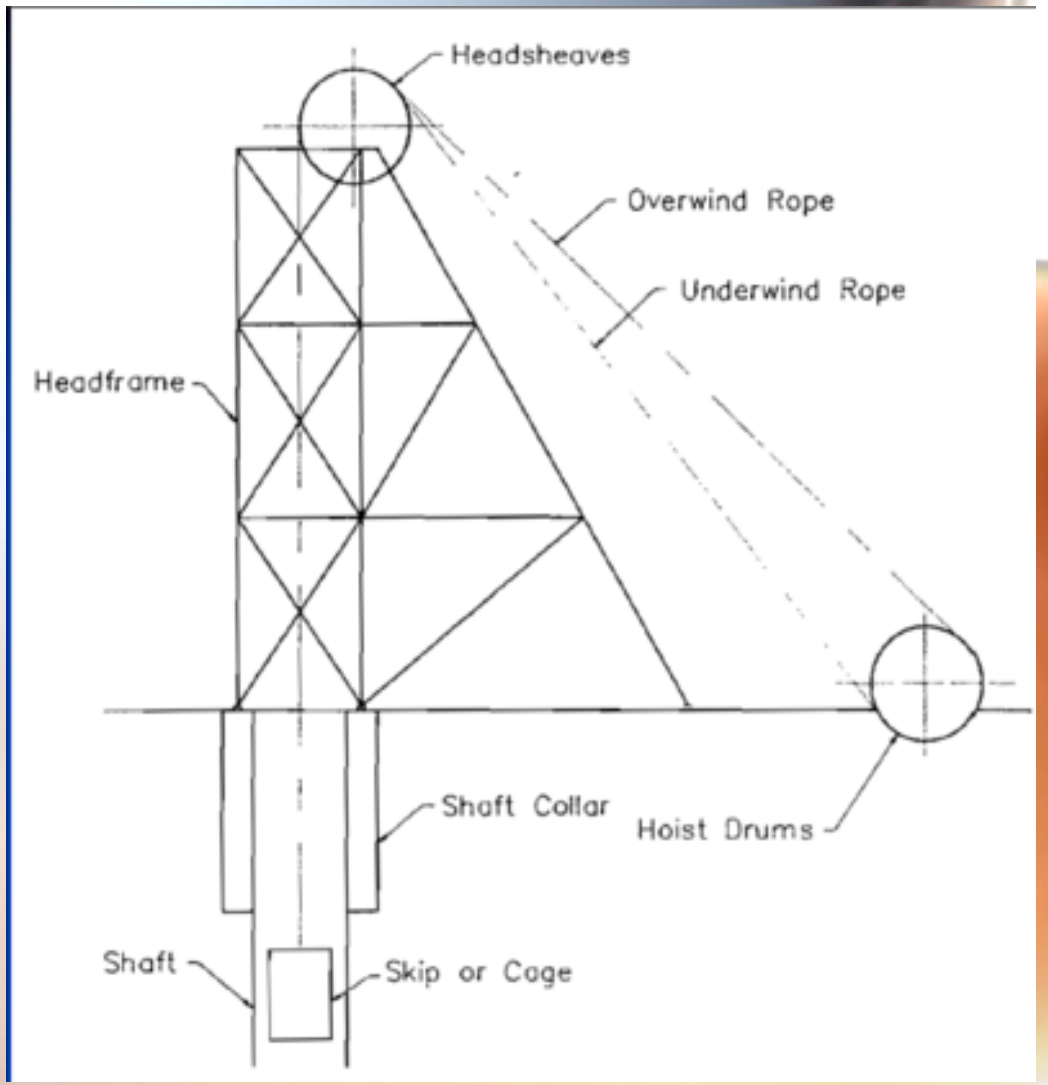
- Online Test Series For DGMS First/Second Class Exam
- GATE Mining Test Series
- Management Trainee Exam Test Series
- Free Study Material
- Free Video Lectures

Call/Whatsapp-8804777500 www.fb.com/mineportal.in

HEADGEAR

Headgear

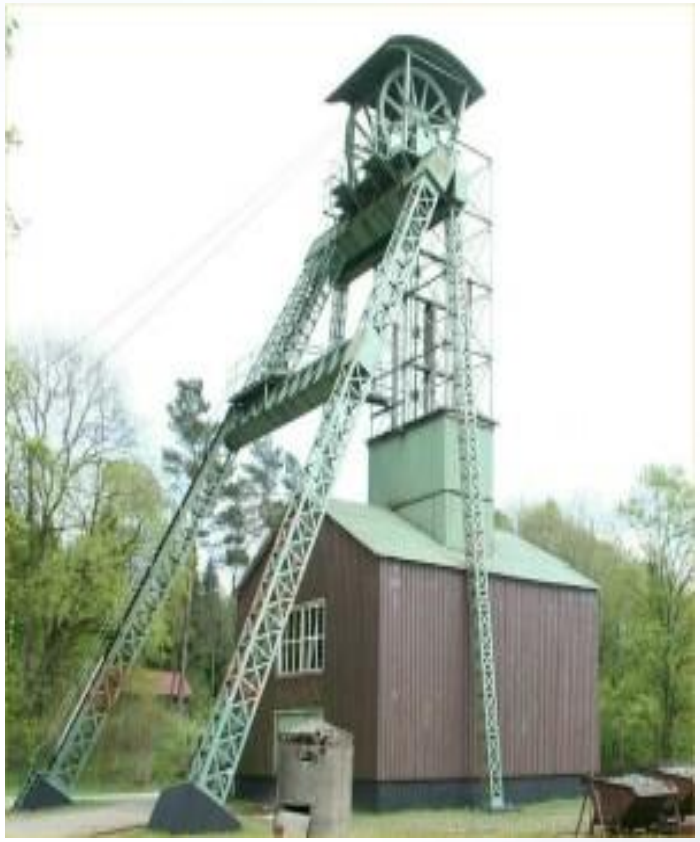
- ✓Structural frame above an u/g mine shaft.
- ✓Consist of hoist tower, drum or friction hoisting.

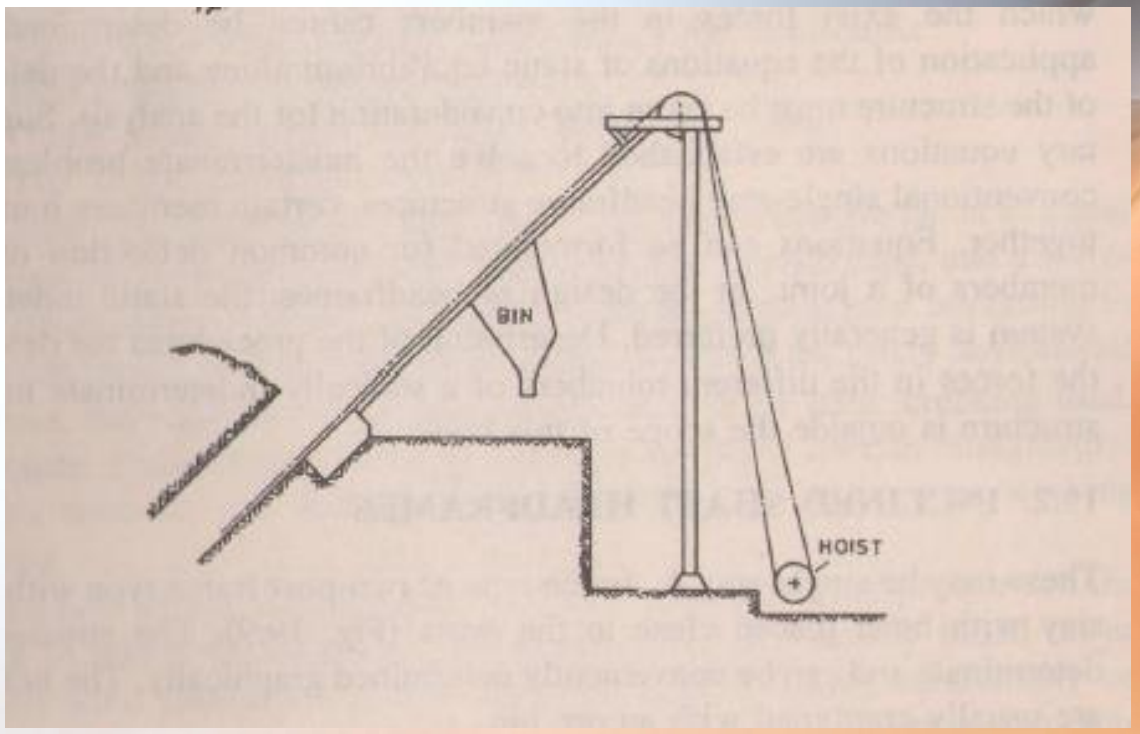


Classifications:

✓Based on mode of main entry

- Vertical(most commonly used)
- Inclined(may be a single A framed type or two frame type)




BIN
HOIST

✓Based on material used

- Timber(not in use)
- Steel
- Concrete

Concrete head gear, Jaduguda

Steal head gear, Narwapahar

STEEL HEADGEAR

ADVANTAGES OF STEEL HEADGEAR

- EASE IN MODIFICATION
- SHOP FABRICATION SAVES TIME
- DEALS WITH UNFAVOURABLE GROUND CONDITION

CONCRETE HEADGEAR

ADVANTAGES

- SLIGHTLY CHEAPER AND NO PAINTING REQUIRED
- CLEAR APPROACH TO SHAFT
- RIGID STRUCTURE CONTROLS VIBRATIONS

DISADVANTAGES

- CONSTRUCTION HAMPERS OTHER OPERATIONS
- DIFFICULT TO MODIFY
- REPAIRING IS DIFFICULT

- ✓Depending on mounting of mine hoists
  - Ground mounted hoists
  - Tower type head frames with ground mounted friction hoists
  - Hoist towers with one or two friction hoists (mounted on them)
  - Tower mounted friction hoist and ground mounted drum hoist

Drum hoist

- Can be used for a single drum
- Less maintenance as rope is attached to drum
- Can be used for both inclined and vertical shafts
- Used in shaft sinking purposes

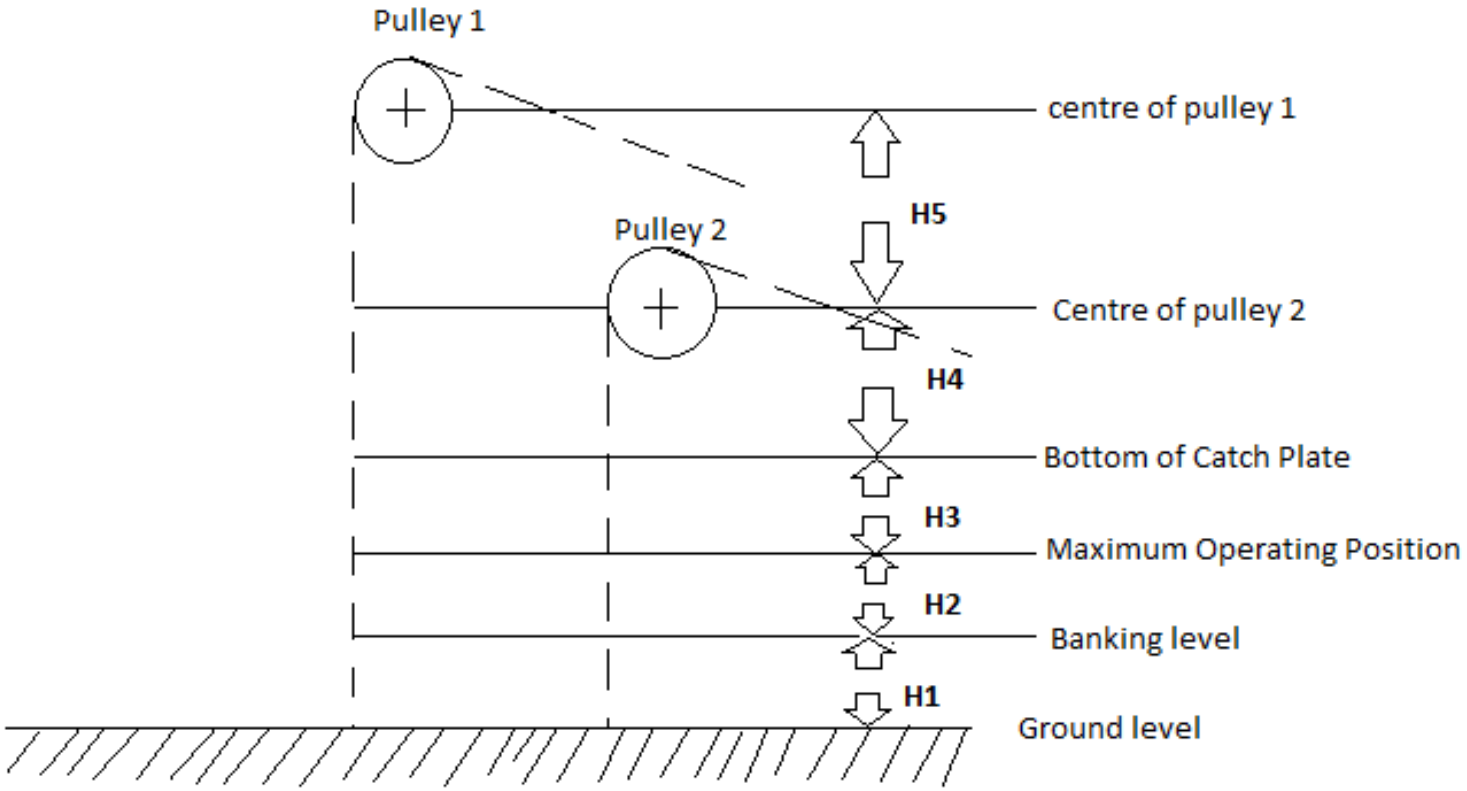
Friction hoist(Koepe)

- Cannot
- More maintenance
- Suitable for large depth
- Used only for vertical shafts
- Cannot operate when shaft bottom is flooded as tail rope may get damaged
- Less length of rope required
- Less motor power required in comparison
- Not suitable in shafts containing corrosive waters as they can’t be greased similar to drum winding

Ground mounted

Height of Headgear

- It is determined by distance between shaft collar and centre of headgear pulley at highest level. It mainly depend upon many factors such as banking level, maximum over wined allowed up to catch plate, pit-top layout, number of deck on cage etc. It varies in range of 20-60 meters depending on above factors



HEADGEAR ARRANGEMENT

Total height of headgear H = $h_1+h_2+h_3+h_4+h_5$

h_1=height of banking level above shaft collar (h_1=0, if banking level is at shaft collar)

h_2=maximum height of top conveyance when discharging above banking level

h_3=over wind allowance up to bumper beam / catch plate

h_4= vertical distance between bumper beam and centre of pulley

h_5=vertical distance between centres of two pulley in case of two tier arrangement (h_5=0, when either one is used or two pulleys are parallel)

Design of headgear

Factors affecting design

- Height of headgear
- Geological disturbances on shaft mouth

  -Steel headgear is preferred over concrete headgear in geologically disturbed areas
- Geometry of headgear

  -Circular shape gives optimum hoisting due to high factor of safety
- Depth of shaft

  -It impacts duty cycle which directly affects production
- Minimum structure dead load

  -It depends on various factors like structure weight, pulley weight , guide vanes and tensions developed in ropes, internal steel structure supported by headgear etc
- Sufficient rigidity to limit vibrations to their permissible values

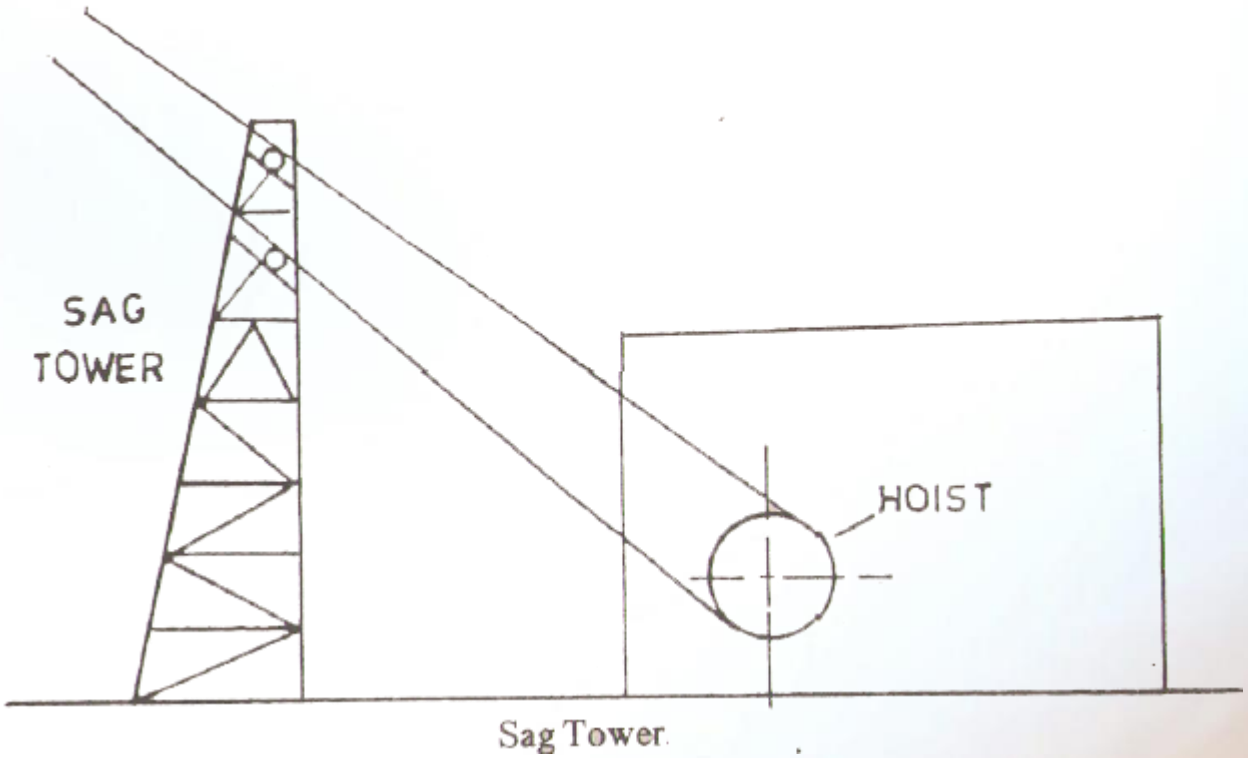
  Vibrations are caused by

  - Translational vibration of ropes
  - Longitudinal vibrations of ropes

- Strength to withstand stress developed in various parts of headgear under adverse loading conditions
- Construction and maintenance cost
  -Steel headgear is more economic in maintenance than any other type of headgear
- Durability of frame
  -It depends upon material used and overall production for long time
- Structural and functional requirement to suit the shaft

Rope Lead - Introduction

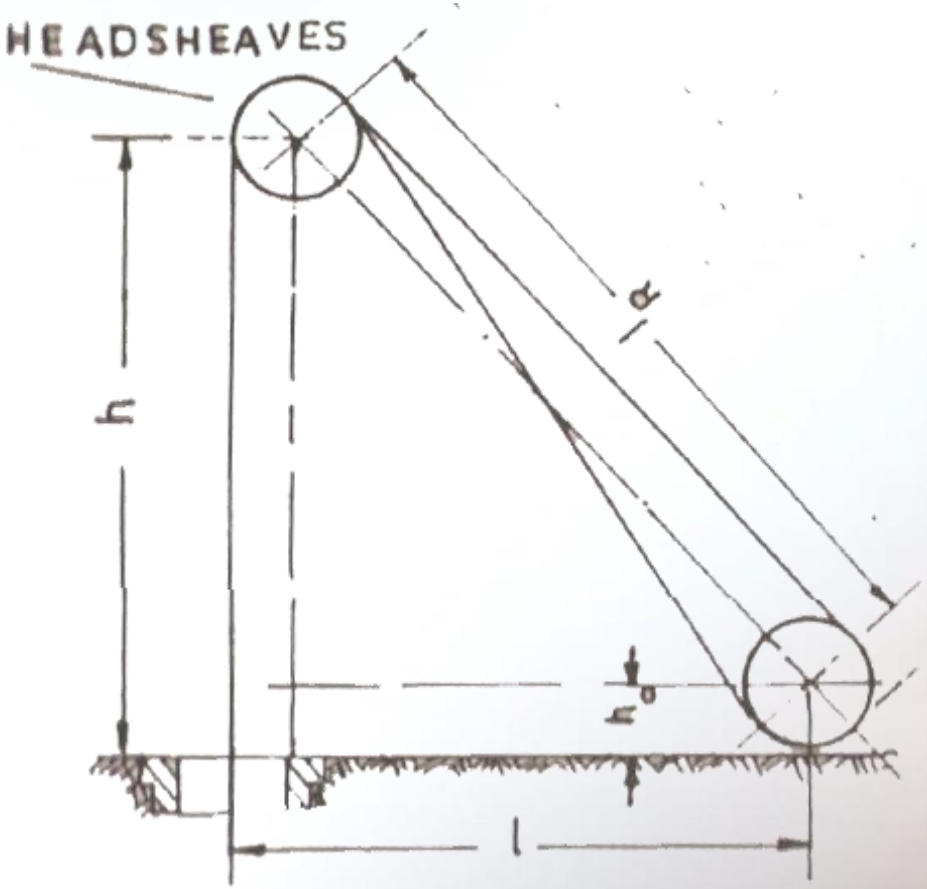
- Length of rope (underlay/overlay) between hoist and head sheave
- Determines maximum allowable distance between hoist and shaft
- Should not exceed 60m so as to avoid large sags and harmful rope whip
- Guide rollers should be installed near opening of hoistroom if Rope plane exceeds 60m
- If it exceeds 75m installation of a sag tower between hoistroom and head frame, preferably at 1/3rd distance of rope length away from drum should be installed



Sag Tower

- Sag tower provides a pair of light-weight idlers (<=500mm) with renewable rope treads or rubber covered rollers.

Calculation of Rope plane and rope slope



l_R is Rope lead or Rope plane, given by

$$l_R = \text{sqrt}[\ (h-h_o)^2 + (l-R_s)^2\ ]$$

h = calculated value of head frame height

l = horizontal distance between axis of drum shaft and center of shaft section

h_o = height of axis of drum shaft above shaft collar level

R_s = radius of head sheaves

Rope slope, α given by

$$\tan \alpha = (h-h_o)/(l-R_s)$$

When head sheaves are arranged in same vertical plane on separate platforms, length of Rope planes are given by

$l_{R1} = \text{sqrt}[\ (h-h_o)^2 + (l-R_s)^2\ ]$

$l_{R2} = \text{sqrt}[\ (h-\Delta h-h_o)^2 + (l-l_s)^2\ ]$

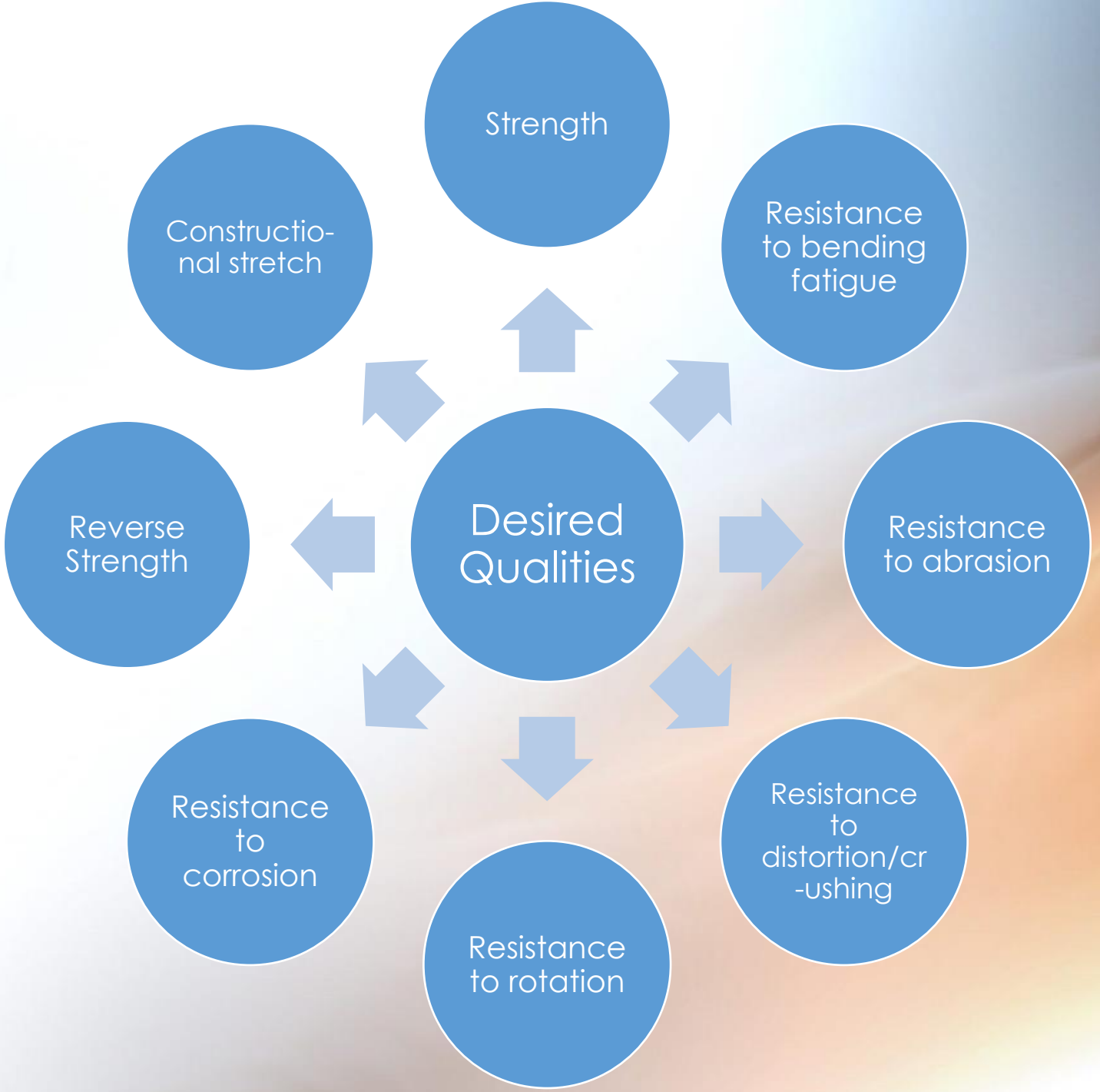
Δh = difference in elevation of head sheaves' centers,

l_s = horizontal distance between head sheaves' centers

Rope fleet angle

- Determined by relative positions of mine hoist and head sheaves
- Should not exceed a definite permissible value for satisfactory rope coiling and longer rope life
- Friction sheave – one or no fleet angle
- Drum Hoist – outer and inner fleet angles
- Max Permissible fleet angle is 1°30´ for friction sheaves and smooth faced drums & 2° for grooved drums

Hoist Ropes


Strength
Resistance to bending fatigue
Resistance to abrasion
Resistance to distortion/cr-ushing
Resistance to rotation
Resistance to corrosion
Reverse Strength
Constructio-nal stretch
Desired Qualities

Ropes Used for Different Purposes

- ✓ Winding Ropes
  - 6x7 Lang Lay, F.C.
  - 6x19 Seale Regular or Lang Lay, F.C.
  - 6x21 Filler Wire Regular or Lang Lay, F.C.
  - 6x25 Filler Wire Regular or Lang Lay, F.C.
  - 6x27 Flattened Strand Lang Lay, F.C.
  - 6x30 Flattened Strand Lang Lay, F.C.
  - Locked coil hoist Rope
- ✓ Guide Rope
  - Half Locked Coil Guide Rope

Why rope diameter should be less?

- Drum Diameter >= 100 x Rope diameter
- Required torque = Load Torque + Rope Torque + Frictional Torque + Travelling Torque + Rotating Torque
- And all the above components are directly proportional to Drum Radius.
- This implies that lesser the rope radius, lesser will be the drum radius which in turn corresponds to lower torque requirement and hence lower power requirement.

Prepared by Group 1

Amit Tiwari 11108EN001
P. Rahul Bharadwaj 11108EN002
Anirudh Singh 11108EN003
Deepu Jha 11108EN004
Alok Rai 11108EN005
Ravi Raj Dwivedi 11108EN006
Ravi Agrawal 11108EN007
Shwetab Suman 11108EN008
Dushyant Saraswat 11108EN009
Prasoon Garg 11108EN010
Atish Kumar 11108EN011