

“Haggie Hints”



by George Delorme
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Haggie North America - Meeting your hoisting needs!

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Rope Attachments - pros/cons, assembly and maintenance

DISCUSSION:

Over a series of technical bulletins, I will discuss each commonly used type of rope attachment. The types of attachments that will be discussed are:-

- Thimble and Clips
- Thimble Type Rope Cappel
- Wedge Cappel
- WRC Rope Clamp - (Rope Glands)
- Hoist and Balance Rope Sockets

It is recommended that each mine have some type of training and peer review system in place to ensure that only competent people are doing the appropriate tasks.


In this Haggie Hints # 10 A, I will discuss “Thimble and Clips” and “Thimble Type Rope Cappel”.

These two types of attachments are most commonly used with Stranded ropes and while there have been cases where they have been used with Full Locked Coil hoist ropes, it is not recommended.


Thimble and Clips

To my knowledge, North America is the only location that this type of attachment is used for hoisting ropes. The slide below from our training seminar shows some of the Pros and cons.

Common Type of Stranded Hoist rope Attachment - Thimble & Clips



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- Pros
 - Inexpensive
 - Relatively simple
 - Readily available
- Cons
 - Requires a fair amount of rope
 - » During conveyance end cut
 - » Between dump and headsheave
 - Must be re-torqued several times
 - Although not a problem, the line of clips may form a “spiral” after installation
 - Not suited for left lay or non spin hoist ropes

One of the biggest problems with the thimble and clip arrangement is the application of the correct bolt torque and maintaining it.

The required torque shown by most clip manufacturers is very high and the attachment is rated with an efficiency of 80% for small ropes to a high of 90% for larger ropes.

Tests conducted by INCO in 1980 showed that improved efficiencies can be obtained by adding an additional clip and reducing the applied torque. An INCO Limited paper titled " Report on the Efficiency of Hoist Rope End Attachments" prepared by Largo Albert and Dick McIvor in January 1981 goes into the subject in detail and should be referred to regularly if this type of attachment is used. The attached Figure 1 is taken from this paper and it calls for the torque to be re-applied after two complete trips through the shaft with the conveyance's rated payload. Then with empty conveyance suspended, the torque is verified. I would also suggest that another confirmation of torque integrity is made after a week of hoisting, especially after a new rope is installed when the diameter is reducing as a result of constructional stretch.

The verification of the correct torque on each bolt cannot be overemphasized!

The other issue is when a left hand lay rope is to be used. The saddles of the clips have corrugations that are only designed for 6 strand, right hand lay ropes and when used with a left lay, damage due to cross cutting can occur as well as reduced holding power. A similar situation may apply when clips are used on ropes with greater than 6 strands, i.e. a spin resistant rope hoisting rope. Under these circumstances, either block type clamps should be used that have been engineered for the application or another type of rope attachment should be employed.

Assembling the Thimble

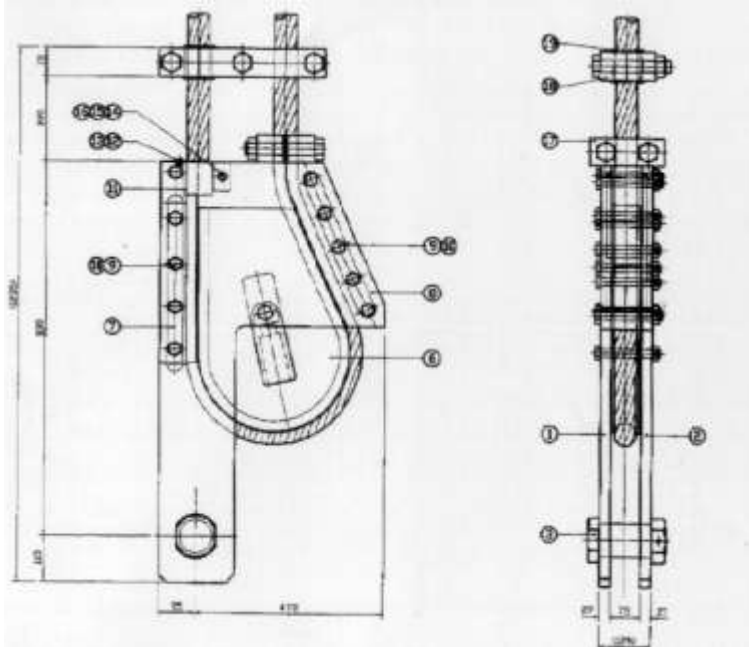
- Accurately measure the rope diameter to ensure that the rope fit is correct to the thimble and clips.
- The thimble must be clean, free of dirt and any burrs in the grooves removed.

- If previously used clips are to be considered, they should be closely inspected for damaged threads and cracks, preferably using Magnetic Particle testing.
- It is not necessary to remove the grease from the rope but the section inserted in the thimble and clips must be free of dirt and debris.
- The correct number of clips must be available with the recommended torque known. See Figure #1
- The tail or dead end length (after the rope is wrapped around the thimble) is based on the number of clips and the recommended distance between each clip. Remember the saddle is applied to the live side - "DON'T SADDLE A DEAD HORSE".
- The clip closest to the working end (furthest from the conveyance) is applied first. Then the one closest to the thimble is applied with light torque. The other clips are applied at the recommended spacing.
- Once the correct torque is applied to each bolt, an immediate verification is necessary. As the INCO paper suggests, after two loaded trips are made through the shaft, a further torque verification must be made. Good practice would call for a further verification after a week of hoisting.

Thimble Type Rope Cappel

Many mines have switched from the thimble and clip to the Thimble Type Cappel and the slide below shows a few of the advantages. Thimble cappel attachments weigh more than the thimble and clip attachments and the user should confirm that the additional weight will not cause any problems with the rating of the hoist or conveyances.

Common Type of Stranded Hoist rope Attachment - Wedge Thimble



- Conveyance end cuts performed quickly
- Minimal rope wasted
- No re-torquing
- Short overall length - headsheave to dump clearance
- Any lay direction or type of stranded rope
- 100% efficiency

While this bulletin is directed towards the "Bellambie" type of rope attachment, the principles can be applied to any brand of rope fitting. However, it is only a broad outline and the specific installation and maintenance procedures can be obtained from the attachment supplier.

In each case, the assembly and stripping (disassembly) plus the basic maintenance procedures is briefly described.

Thimble Type Rope Cappel

1.0 - Description

Thimble type cappel (Ref. # 1) provide a simple, reliable and safe method of capping wire ropes. The cappel act as a connecting device between the rope and a conveyance and are most commonly used on drum winders or friction hoists that utilize stranded ropes. They can replace thimble & clips and offer many advantages.

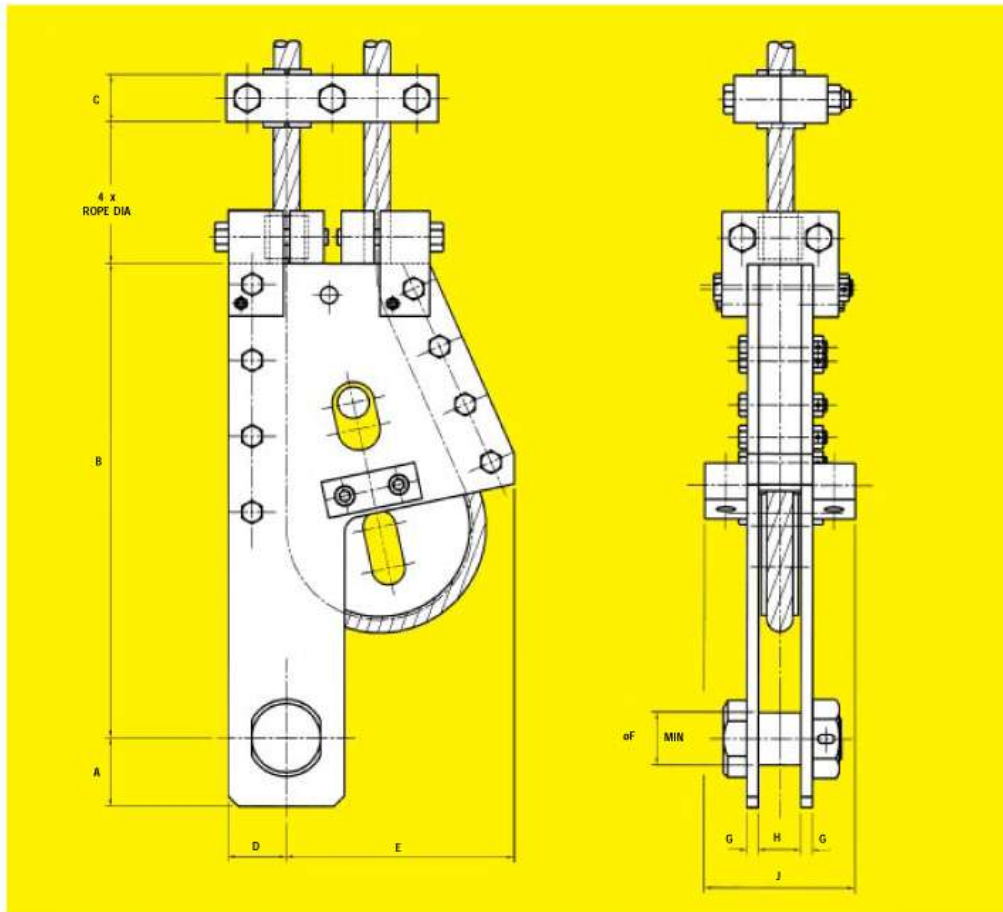
Thimble type cappel work on the principle of a tapered, self-aligning thimble that produce a gripping action on the rope between itself and the tapered shoes.

The load on the rope drives the thimble tightly into the tapered cappel frame. This causes a wedging action between the thimble and the shoes. In the unlikely event of rope slippage, a clamp acts as a safety device by forcing the thimble further into the frame taper.

2.0 - Precautions and Notes

- Cappel are stamped with the rope size for which they are grooved and should only be fitted to ropes corresponding to the specified size.
- All cappel components are stamped with an identification number. Check that all components have the same identification number.
- Thimble cappel must not be used on drum winder systems that utilize detaching hooks due to the inability of the cappel to pass through the catch plate hole.
- Liners should never be used between the shoes and the rope or in the thimble grooves.
- Thimble or shoes must not be re-grooved or machined.
- Thimble type cappel are not suitable for use with full locked coil ropes.
- For maximum safety and reliability, the cappel should be examined, cleaned and refitted periodically.

Winding Rope Cappels (Thimble Type)



TYPE	Safe Working Mass Load (tons)	Max Rope Dia.	Dimensions (mm)								Est. Mass (kg)	
			A	B	C	D	E	F	G	H		J
WB-20	3,5	20	60	390	40	50	175	45	9	35	133	31
WB-25	5	25	65	450	45	55	215	50	11	40	142	48
WB-30	7	30	75	510	45	65	255	55	13	45	161	65
WB-35	9	35	85	585	50	75	295	65	15	50	170	97
WB-40	12	40	90	680	50	80	340	70	18	60	186	148
WB-45	15	45	95	735	60	85	380	75	21	65	197	193
WB-50	19	50	110	850	60	90	420	85	24	70	206	255
WB-55	23	55	115	930	70	95	470	90	27	75	219	330
WB-60	27	60	120	1000	70	100	500	100	30	80	230	420

* Design incorporates a safety factor in excess of 10:1 on safe working mass load.

1 ton = 1 000kg

In the interests of product development, Bellambie Mining & Industrial reserves the right to amend specifications without prior notice.

Ref. # 1

3.0 - Assembly

Preparation

- Remove paint, grease and packing strips from cappel shoes and thimble.
- Remove excess grease from the rope surface.
- Remove any damage on thimble and shoe sections i.e. burrs, knocks, rust etc.
- Lightly grease internal components that will be subject to corrosion. DO NOT use tallow, graphite grease or grease containing molybdenum disulphide or copaslip.

Assembling the Thimble type cappel

- Accurately measure the rope diameter to ensure that the rope to cappel fit is correct.
 - Check that the safe working load (SWL) stamped on the cappel is not less than the static load that will be imposed on the rope.
 - Check that the assembly number stamped on the thimble is the same as the cappel housing.
 - The thimble must be fitted into the housing in the correct direction - see drawing for correct positioning.
 - The cappel must be clean, free of dirt and any burrs on the grooves of the inside shoes and thimble removed.
 - It is not necessary to remove the grease from the rope but the section inserted in the cappel must be free of dirt and debris.
- NOTE: - The cappel can be assembled either horizontally on the collar or vertically in the shaft as described.
- The conveyance must be chaired at the collar and the cappel and linkages fitted to the conveyance in an upright position.

- The thimble should be partially fitted into the cappel housing and a bar inserted into the thimble jacking hole to support it in this position. This should allow sufficient gap to allow the rope to pass around the thimble located between the two opposite shoes mounted between the two side plates. The vertical shoe ensures the rope centre line corresponds with the centre of the cappel connecting pin.
- The free end of the rope can now be drawn by means of a chain block until it is tight. The portion of the hoist rope within the thimble cappel should be lubricated with the hoist rope field dressing to allow the rope to seat into the attachment. Do not apply dressing to the portion of the hoist rope that fits into the 2 bolt clamp.
- The bar can now be removed to allow the thimble to seat between the two shoes.
- The 2-bolt clamp on the free end of the rope must be fitted . The section of rope that will be clamped must be de-greased and cleaned thoroughly using cement powder only - no solvent of any type.
- The conveyance is then un-chaired.
- The shock absorber is then fitted and the additional three bolt clamp is positioned across the live and free end approximately four rope diameters above the cappel body.

Inspection of removed cappel

- Clean all parts thoroughly. Blast cleaning, incorporating a system of wet blast with glass beads and a rust inhibitor is preferred. All stamping must be retained. The surface finish should not exceed 2.4mm Ra on contact surfaces and 3.4mm Ra on other surfaces (surface roughness standard).
- All identification numbers must be noted.
- Components not marked with a proper ID number, original manufacturer, material type, cast number and job number must be discarded.
- If the parts are to be stored, they should be coated with a corrosion preventative grease.

- Any burrs, steps or knocks must be removed by light grinding. Pitting marks should be removed by sanding.
- Components should be discarded when the outside surfaces have degraded beyond SVENSK Standard SIS 05 5900-1967 picture DSA 2 $\frac{1}{2}$.
- **Any** deformation on a component must lead to the discard of that particular component.
- It is important to examine the rope grooves in the wedge. Indentations in the groove due to rope pressure should not exceed 0.2mm in depth, otherwise the cappel should be returned to the manufacturer for refurbishment or discarded.
- Pins used with the cappel should be discarded if material loss is greater than 0.2mm per 10mm of pin diameter with a maximum loss of 1.0mm when used in single line suspension trains.
- Pins should be discarded when material loss is greater than 0.3mm per 10mm of pin diameter with a maximum loss of 1.5mm in components in multi-rope attachments.
- Recertification, usually after 6 years, must be performed by the manufacturer or a recognized facility outfitted with the proper equipment including proof loading capabilities.

CONCLUSION:

Many mines have already adopted the thimble type cappel and with the many advantages and added safety features, this is definitely a move in the right direction.

REFERENCES:

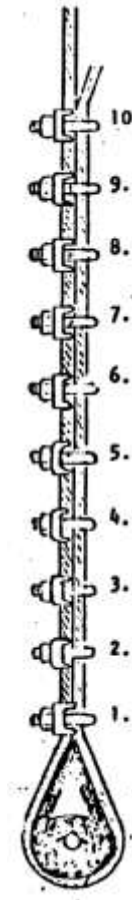
INCO Report on the Efficiency of Hoist Rope End Attachments, L. Albert and R, McIvor, January 1981

"The Installation, Maintenance and Risk Analysis for Rope Attachments" George Delorme, CIM 2003

HOIST ROPE RECAPS

SPECIFICATIONS FOR INSTALLATION OF CROSBY “U” BOLT CLIPS

Rope Size	Construction	Number of clips	Clip Spacing	Torque (lbs ft) Clip #1	Torque (lbs/ft) Clips #2+
3/4"	6 x 27 F.S.	7	5"	55	65
7/8"	6 x 19 R.S.	7	6-1/4"	100	120
1"	6 x 27 F.S.	7	7"	100	120
1-1/8"	6 x 27 F.S.	8	9"	100	120
1-1/4"	6 x 27 F.S.	8	10"	150	180
1-3/8"	6 x 27 F.S.	8	10"	150	180
1-3/4"	6 x 19 R.S.	9	10-1/2"	150	300
1-7/8"	6 x 27 F.S.	9	12"	200	375
2"	6 x 27 F.S.	9	12"	200	375
2-1/16"	6 x 27 F.S.	9	12"	200	375
2-1/4"	6 x 27 F.S.	10	12"	200	375



PROCEDURE FOR INSTALLATION OF CROSBY “U” BOLT CABLE CLIPS ON HOIST ROPE RECAPS

1. Allow 6 rope diameters for each clip – center to center- for the tail end plus length of the thimble.
2. Install all clips with the “U” bolt against the tail end of the rope.
3. Install the number of clips as specified (Inco Standard).
4. Tighten all clips uniformly to the torque values measured by Williams torque wrench NO. HTW-4RCF Series C or equal.
5. Install the attachment to the conveyance drawhead and then make two complete trips through the shaft with the conveyance’s rated payload as per Regulation 229-4 (1) (2) (3) of the Ontario OSHA Reg. 854.
6. Remove the payload only and re-torque cable clips to recommended values with torque wrench.
7. Restore hoist to service.

Figure -1-