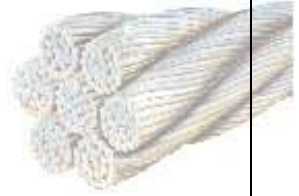




“Haggie Hints”

by George Delorme
Issue 10 B. 2008



Haggie North America - Meeting your hoisting needs!

GEORGE DELORME

Ph: 514-453-1283; Fax: 514-453-0631; Email: georgedelorme@sympatico.ca ;
Toll Free: 1-888-HAGGIE-9 (424-4439)

Rope Attachments - pros/cons, assembly and maintenance

DISCUSSION:

This is the second in a series of technical bulletins that will discuss the various types of Rope Attachments. Issue 10A covered “Thimble & Clips” and “Thimble Type Rope Cappels”.

This bulletin, 10B, will discuss “Wedge Cappels” and “WRC Rope Clamps - (Glands)”.

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.

The Wedge Cappel is most frequently used with Full Locked Coil Hoisting ropes, Half Locked coil Guide Ropes and Tail ropes. While there have been cases where a Wedge Cappel has been used with a stranded Hoist rope, it is not normally recommended because of the extra time to install and/or make length adjustments. The occurrence of broken wires at the wedge entry point is also more likely because of the high pressure at this point. The WRC Rope Clamp is used to suspend and maneuver any type of steel wire rope.

Wedge Type Cappel

1.0 - Description

Wedge type cappel (Fig. # 2 & 3) provide a simple, reliable and safe method of capping wire ropes without the need to bend the rope. 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 Full Locked Coil (FLC) ropes. Half locked Coil (HLC) guide ropes and non-spin balance ropes also use this type of wedge cappel.

Wedge type cappel work on the principle of tapered, self-aligning wedges that produce a gripping action on the rope. The load on the rope drives the wedges on either side of the rope tightly into the tapered cappel frame and causes the wedges to compress against the rope surface. The cappel bands compress the cappel limbs against the wedges. In the unlikely event of rope slippage, a socket or with some type of cappel, a clamp acts as a safety device by forcing the wedges further into the frame taper.

- The long loop cappel is designed for applications where the end of the rope is required to extend beyond the point of fixing as with the bottom end of a guide rope installation. The safety block is a two part, 4-bolt clamp.



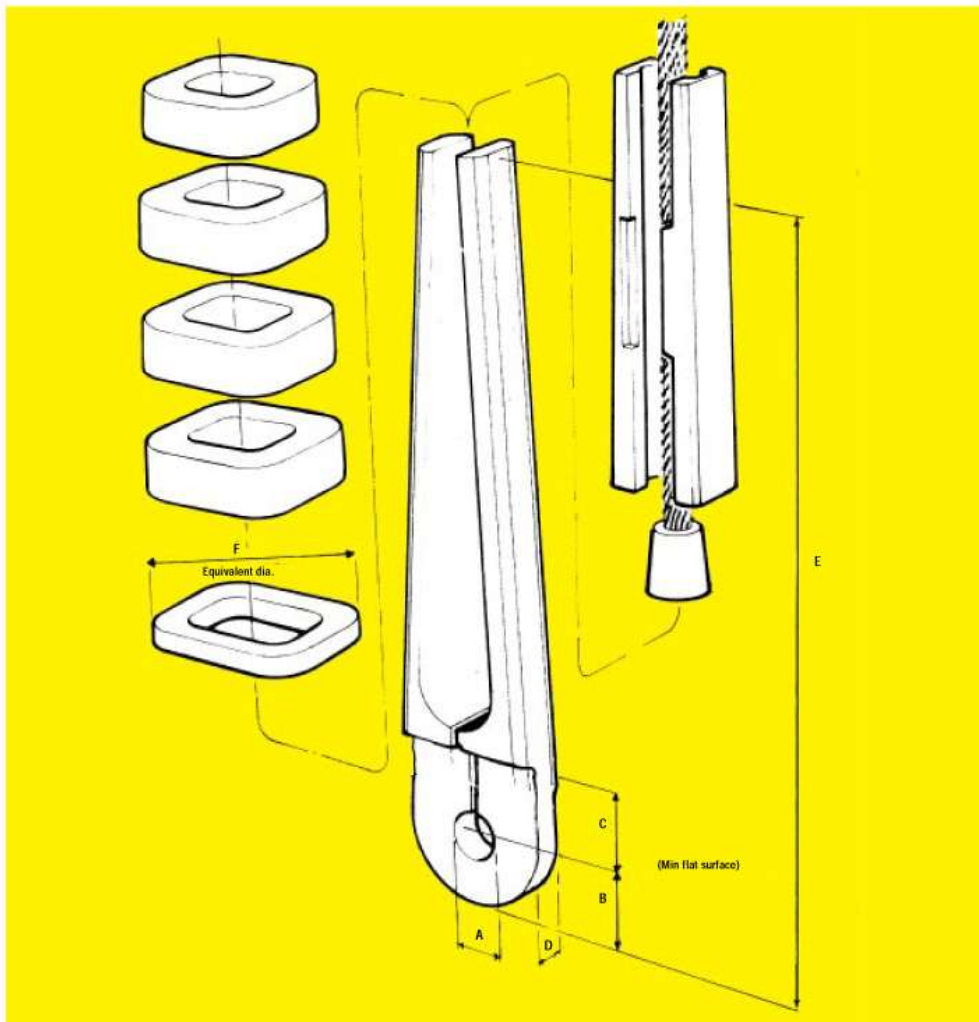
Fig. # 2

- The short loop cappel is designed for capping balance (tail) ropes most commonly seen on friction winding systems. Since the cappel are inverted and working under the conveyance, the bands are supplied with locking screws as a precaution against loosening and the safety block is also a two part, 4 bolt clamp. If plasticized balance ropes are to be fitted with this type of attachment, the outer plastic jacket must be removed.

2.0 - Precautions and Notes

- Cappel wedges are stamped with the rope size for which they are grooved. Wedges 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.
 - When assembling, ensure that the bands are fitted in the correct order and that the arrow on each band points in the direction of the cappel eye.
 - Under no circumstances must the banding pressure be exceeded. The force required to set the bands can be obtained from :- $[(UBS \text{ of rope}) \times 0.386] \div \text{Number of working band}$.
- Table 1 provided includes the allowed loads for cappel and the number of bands required in each case.
- Liners should never be used between the wedges and the rope or at the backs of the wedges
 - Wedges must not be re-grooved or machined.
 - For maximum safety and reliability, the cappel should be examined, cleaned and refitted periodically.

Winding Rope Cappels (Wedge Type)



| TYPE | Safe Working Load (tons) | Max Rope Dia. | A | B | C | D (max) | D (min) | E | F | Approx. Mass (kg) | TYPE | Safe Working Load (tons) | Max Rope Dia. | A | B | C | D (max) | D (min) | E | F | Approx. Mass (kg) |
|--------|--------------------------|---------------|----|-----|-----|---------|---------|-----|-----|-------------------|--------|--------------------------|---------------|-----|-----|-----|---------|---------|------|-----|-------------------|
| BWC-5 | 5 | 19 | 44 | 65 | 68 | 51 | 30 | 600 | 138 | 28 | BWC-20 | 20 | 41 | 83 | 116 | 129 | 91 | 63 | 1050 | 245 | 160 |
| BWC-6 | 6 | 22 | 51 | 69 | 74 | 58 | 38 | 695 | 139 | 32 | BWC-25 | 25 | 45 | 85 | 129 | 133 | 97 | 76 | 1170 | 279 | 210 |
| BWC-8 | 8 | 26 | 53 | 78 | 84 | 62 | 39 | 730 | 162 | 48 | BWC-30 | 30 | 51 | 95 | 143 | 153 | 100 | 85 | 1250 | 304 | 225 |
| BWC-10 | 10 | 29 | 57 | 87 | 92 | 70 | 46 | 800 | 197 | 78 | BWC-40 | 40 | 57 | 98 | 147 | 156 | 100 | 100 | 1406 | 335 | 370 |
| BWC-12 | 12 | 32 | 60 | 90 | 95 | 76 | 52 | 860 | 202 | 80 | BWC-45 | 45 | 64 | 106 | 155 | 165 | 100 | 100 | 1600 | 340 | 370 |
| BWC-15 | 15 | 35 | 70 | 105 | 105 | 81 | 56 | 930 | 238 | 115 | | | | | | | | | | | |

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

1 ton = 1000kg

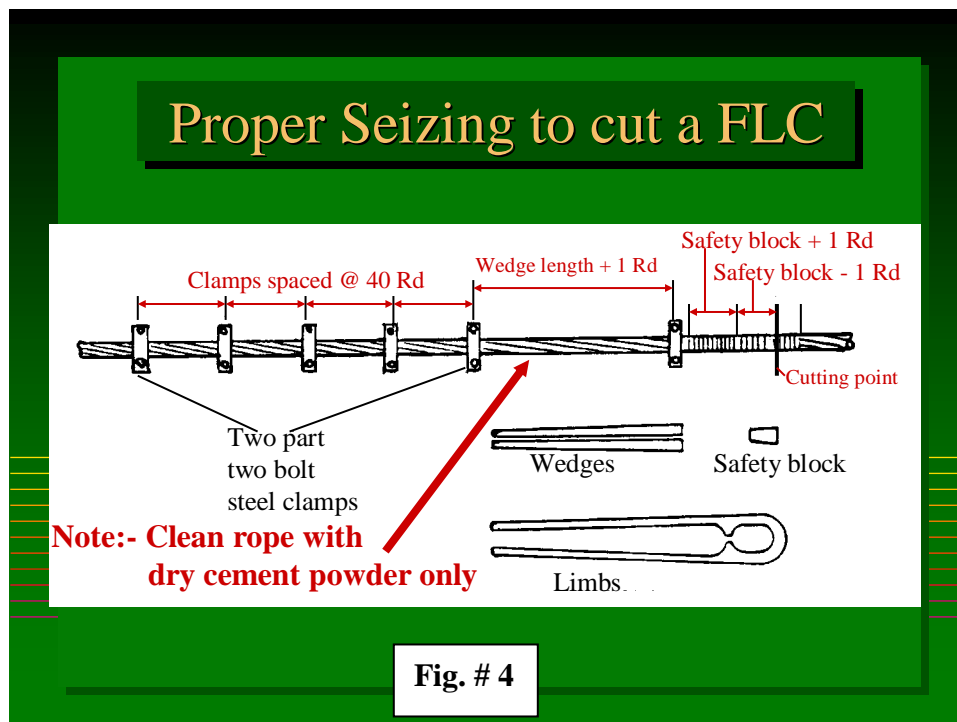
In the interests of product development, Bellambie Mining & Industrial reserves the right to amend specifications without prior notice.

Fig. # 3

3.0 - Assembly

Preparation

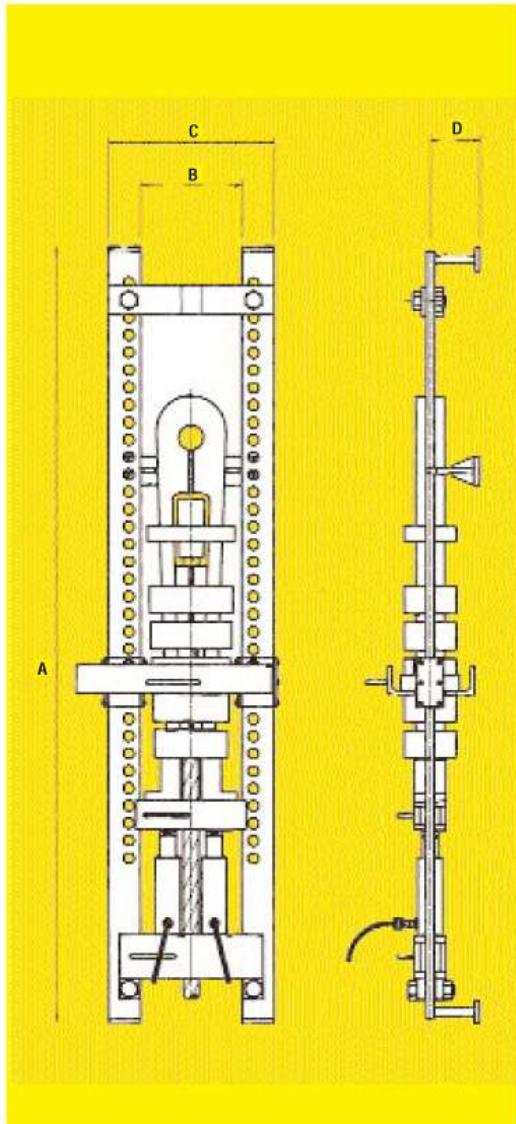
- Remove paint, grease and packing strips from cappel limbs and wedges. Clean back of wedges and inside of cappel limbs.
- The following slide (Fig. # 4) shows the correct fashion to seize or clamp a FLC before it is cut to install the hoist rope type wedge cappel. The socket or safety block is poured before any of the 2-bolt steel clamps are removed. The socket may be capped using white metal or resin as a capping medium.



- In the case of a short or long loop cappel, the four bolt clamp is installed before the rope is cut. The section of rope that the 4-bolt clamp will cover must be de-greased using cement powder only.

- Thoroughly de-grease and clean the portion of the rope that will be gripped by the wedges using cement powder only - **no solvent of any type**.
- Ensure that the rope is **straight, clean and dry** at the gripping area.
- Remove any damage on wedges and limbs sections (burrs, knocks, rust, etc.)
- Lightly grease the **backs** (not the grooves) of the wedges and the inside of the limbs. Lightly grease the inside of the bands. Greasing of each component should be done immediately before placing it in the assembly. **Do not** use tallow, graphite grease or grease containing molybdenum disulphide or copaslip.
- Thread the bands on the rope in reverse order.
- The taper of the inside of the bands should correspond with the taper of the cappel limbs.
- The wedges are positioned on the rope such that there is a clearance of approximately 20mm between the socket (or the clamp) and the wedges in the final position.
- The limb of the cappel is slid over the rope and wedges ensuring that the 20mm gap still exists between the socket (clamp) and wedges and the end of the limb is flush with the end of the wedges.
- The bands are slid onto the limb.
- A hydraulic banding machine (Fig. # 5) should be used to apply the correct force on each band (see table 1). The band nearest the active rope should be slightly off-level with the top of the wedges/limb and the bands should appear equally spaced along the cappel.
- The spacing between the socket or 4-bolt clamp and wedges can be used as a movement indicator. The spacing distance should be measured and recorded. After loading the rope, the spacing should remain unchanged. If a slight movement occurs, the pressure on the bands should be verified.
- In the event of continued rope movement, the cappel should be re-assembled.

Cappel Banding/Disbanding Machines



| SMALL BANDING MACHINE | | | |
|-----------------------|-----|----------------|-----|
| DIMENSIONS | | | |
| A | B | C | D |
| 2100 | 250 | 470 | 156 |
| RANGE OF CAPPELS | | MAX. ROPE DIA. | |
| 5T BWC | | 19 | |
| 6T BWC | | 22 | |
| 8T BWC | | 26 | |
| 6T LONG & SHORT LOOP | | 26 | |
| 7T LONG & SHORT LOOP | | 29 | |
| 8T LONG & SHORT LOOP | | 36 | |

| MEDIUM BANDING MACHINE | | | |
|------------------------|-----|----------------|-----|
| DIMENSIONS | | | |
| A | B | C | D |
| 2700 | 350 | 570 | 171 |
| RANGE OF CAPPELS | | MAX. ROPE DIA. | |
| 10T BWC | | 29 | |
| 12T BWC | | 32 | |
| 15T BWC | | 35 | |
| 20T BWC | | 41 | |
| 25T BWC | | 45 | |
| 30T BWC | | 51 | |
| 10T LONG & SHORT LOOP | | 41 | |
| 11T LONG & SHORT LOOP | | 45 | |
| 15T LONG & SHORT LOOP | | 51 | |

| LARGE BANDING MACHINE | | | |
|-----------------------|-----|----------------|-----|
| DIMENSIONS | | | |
| A | B | C | D |
| 2950 | 450 | 670 | 171 |
| RANGE OF CAPPELS | | MAX. ROPE DIA. | |
| 20T LONG & SHORT LOOP | | 54 | |
| 30T LONG & SHORT LOOP | | 57 | |
| 40T BWC | | 57 | |
| 45T BWC | | 64 | |

Fig. # 5

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

4.0 - Possible Faults

- Cappel is wrongly assembled.
- Incorrect wedges are being used for the particular rope.
- All components are not of the same set.
- Bands are stretched due to repeated assembly or over-banding.
- Rope contact area is not entirely clean, degreased or straight.
- Wedge grooves are greasy.

5.0 - Precautions (short loop cappel)

- When assembling/dismantling the cappel, back off the screws in the bands so that they do not scratch the cappel limbs.
- Replacement screws must be identical to the original screws supplied with the cappel.

6.0 - Dismantling and Inspection

- Remove the bands using the banding machine (Fig. # 5). Care should be taken not to damage any components when separating them.
- Remove the cappel limbs; then the wedges from the rope.
- 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.
- 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.
- Components should be discarded when the outside surfaces have degraded beyond SVENSK Standard SIS 05 5900-1967 picture DSA 2 $\frac{1}{2}$.

- 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.
- Bands should be inspected for excessive stretch.
- 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.
- The groove in the wedges must be parallel to within 0.25mm from end to end.
- 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.
- After passing all the previous inspections, components must be inspected using NDT following one of the recognized world standards. A paper presented by Largo Albert and the author at the AGM of the CIMM in Quebec city in 1989 titled "Hoist Rope Attachments - Type, Application & Installation Practices" covers the subject of NDT in detail.

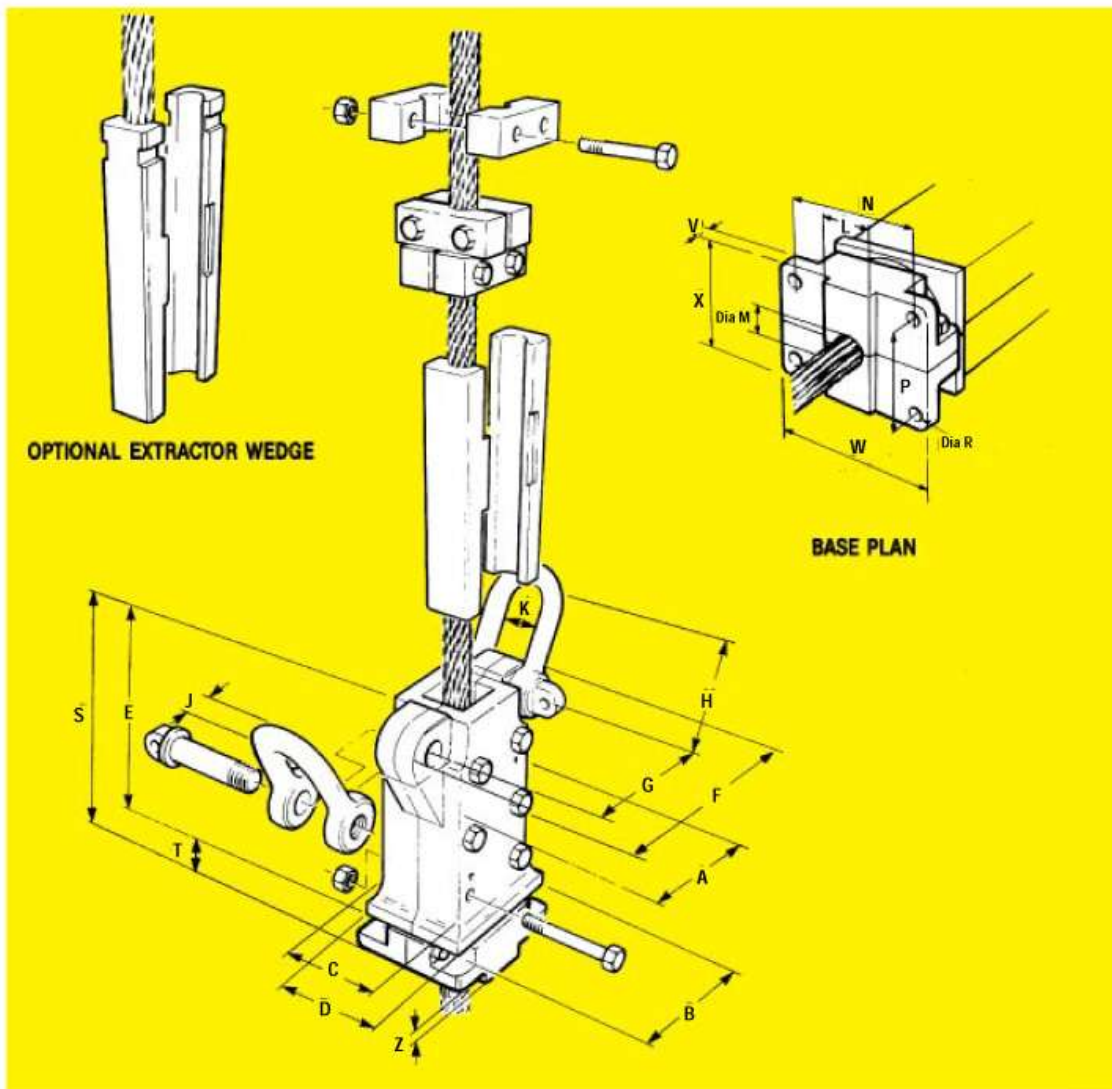
WRC Rope Clamp (Gland)

1.0 - Description

Wedge type rope clamps, sometimes referred to as glands (Fig. # 6), provide a convenient, positive and fail safe method of anchoring, suspending or maneuvering wire ropes. The clamps can be used for permanent rope anchoring, for tensioning of or suspending guide ropes or for maneuvering or pre-tensioning ropes during installation or maintenance.

Rope clamps work on the principle of tapered, self-tightening interlocking wedges similar to the gripping action of the wedge cappel. Split construction allows for assembly at any required point on the rope.

Spherically Seated WRCS Clamps



| TYPE | Safe Working Mass Load (tons) | Max. Rope Dia. | Dimensions (mm) | | | | | | | | | | | | | | | | | | No. of 2 Bolt Clamps | Approx. Mass (kg) | | | |
|---------|-------------------------------|----------------|-----------------|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|----|-----|-----|----|-----|-----|----|----------------------|-------------------|----|---|-----|
| | | | A | B | C | D | E | F | G | H | J | K | L | M | N | P | R | S | T | V | | | W | X | Z |
| WRCS-3 | 3 | 24 | 110 | 140 | 70 | 100 | 185 | 180 | 130 | 73 | 16 | 32 | 40 | 34 | 140 | 80 | 11 | 250 | 60 | 12 | 180 | 110 | 6 | 2 | 26 |
| WRCS-6 | 6 | 32 | 152 | 194 | 110 | 140 | 320 | 270 | 200 | 109 | 25 | 51 | 55 | 46 | 200 | 110 | 17 | 396 | 76 | 18 | 240 | 150 | 6 | 2 | 70 |
| WRCS-10 | 10 | 41 | 172 | 220 | 128 | 160 | 360 | 314 | 234 | 132 | 32 | 60 | 60 | 52 | 220 | 130 | 22 | 450 | 90 | 20 | 290 | 180 | 10 | 2 | 114 |
| WRCS-15 | 15 | 46 | 190 | 250 | 144 | 172 | 400 | 345 | 255 | 145 | 35 | 67 | 75 | 65 | 250 | 130 | 22 | 492 | 92 | 22 | 302 | 190 | 15 | 3 | 160 |
| WRCS-20 | 20 | 51 | 210 | 270 | 158 | 190 | 440 | 378 | 278 | 156 | 38 | 70 | 75 | 65 | 270 | 140 | 22 | 532 | 92 | 22 | 320 | 200 | 15 | 3 | 203 |
| WRCS-30 | 30 | 60 | 270 | 270 | 190 | 234 | 480 | 470 | 340 | 213 | 51 | 98 | 85 | 75 | 320 | 190 | 26 | 595 | 115 | 30 | 380 | 240 | 20 | 4 | 360 |
| WRCS-40 | 40 | 76 | 330 | 330 | 250 | 317 | 540 | 576 | 426 | 239 | 57 | 108 | 105 | 95 | 400 | 250 | 26 | 655 | 115 | 30 | 460 | 320 | 25 | 4 | 590 |

* Design incorporates a safety factor in excess of 6:1 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.

Fig. # 6

2.0 - Assembly

- Remove all protective paint, grease and packing strips.
- Thoroughly de-grease and clean the portion of the rope that will be gripped by the wedges using cement powder only - **no solvent of any type**.
- Ensure that the rope is **straight, clean and dry** at the gripping area.
- The casing halves can now be bolted securely around the rope and the correct torque applied to the bolts (see table 2). Dowels are fitted in the casing halves to ensure alignment of the tapered faces.
- Lightly grease the **backs** (not the grooves) of the wedges. A good quality automotive grease should be used. **Do not** use tallow, graphite grease or grease containing molybdenum disulphide or copaslip.
- The wedges are inserted and firmly driven into place using copper drifts suitably shaped to fit the wedge tops.
- The correct number of 2-bolt clamps are fitted adjacent and at 90° to each other with the bottom clamp in contact with the top of the wedges. The section of rope that the two-bolt clamps will cover must be de-greased using cement powder only.
- The clamp should then be loaded gently so that the 2-bolt clamps press the wedges into their final position. After the wedges have taken the final load and are firmly gripping the rope, an extra auxiliary 2-bolt clamp may be fitted with a gap of 25mm to act as a rope movement indicator.

3.0 - Possible Faults

- All burrs must be removed from casings and wedges before use.
- Ensure the casing dowels are fitted at all times.
- If the clamp or spherical seat is supported by girders, the joint in the casing halves should be at right angles to the girders.
- Ensure that the space between the girders (or aperture in the base plate) is sufficient to allow the wedges to protrude should this become necessary.
- Dismantling should preferably be done using a special hydraulic wedge extractor.
- Never use incorrectly grooved wedges.
- Under no circumstances should liners be used in the grooves or behind the wedges.
- Handles must not be fitted to standard wedges. Special wedges are available from the O.E.M. with handles fitted.

4.0 - Dismantling

- Make sure the suspended load (i.e. end load and rope weight) is properly secure and that slack rope is evident beneath the gland.
- Remove the 2-bolt clamps.
- Raise the gland approximately 75mm above the supporting structure.
- Loosen the gland body bolts.
- Strike the gland case downwards with a sharp blow but avoid striking the wedges. To prevent burring, a suitably shaped brass or copper set should be used in conjunction with the hammer.
- Remove the wedges. With some models of glands, the wedges have threaded holes into which "eye" bolts can be threaded. This allows the wedges to be tied off so they will not fall.

- Remove the bolts from the gland case, split the case and set it aside. If the gland is to be stored, all parts should be thoroughly protected with a rust preventative grease.
- If the gland is fitted with slotted wedge extensions, then the wedges can be removed and the clamp dismantled using the special hydraulic wedge extractor (Fig. # 7).



Fig. # 7

TABLE 1
BAND PRESSURE

| Cappel Type | S.W.L. Metric Tons | # of Working Bands | Force Required on Bands - Metric Tons | Force Required on Bands - lbs. |
|--------------------|---------------------------|---------------------------|--|---------------------------------------|
| BWC 5 | 3 | 3 | 6.5 | 14,333 |
| BWC 6 | 6 | 3 | 7.8 | 17,199 |
| BWC 8 | 8 | 3 | 10.3 | 22,712 |
| BWC 10 | 10 | 4 | 9.7 | 21,389 |
| BWC 12 | 12 | 4 | 11.6 | 25,578 |
| BWC 15 | 15 | 4 | 14.5 | 31,973 |
| BWC 20 | 20 | 4 | 19.5 | 42,998 |
| BWC 25 | 25 | 5 | 19.5 | 42,998 |
| BWC 30 | 30 | 5 | 23.0 | 50,715 |
| BWC 40 | 40 | 7 | 22.0 | 48,510 |
| BWC 45 | 45 | 7 | 24.5 | 54,023 |
| Cappel Type | S.W.L. Metric Tons | # of Working Bands | Force Required on Bands - Metric Tons | Force Required on Bands - lbs. |
| BSC & BLC 6 | 6 | 3 | 7.5 | 16,538 |
| BSC & BLC 7 | 7 | 3 | 9.0 | 19,845 |
| BSC & BLC 8 | 8 | 3 | 10.5 | 23,153 |
| BSC & BLC 10 | 10 | 4 | 9.5 | 20,948 |
| BSC & BLC 11 | 11 | 4 | 10.5 | 23,153 |
| BSC & BLC 15 | 15 | 5 | 11.5 | 25,358 |
| BSC & BLC 20 | 20 | 5 | 15.5 | 34,178 |
| BSC & BLC | 30 | 6 | 19.5 | 42,998 |

Note:- With each type of wedge cappel, 1 metric ton or 2205 lbs less force must be applied to the top band (closest to the working rope).