3. Synthetic & Wire Rope Slings

3. Synthetic & Wire Rope Slings

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3.1 Synthetic Slings

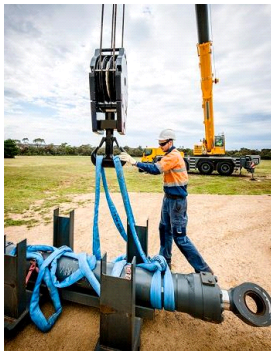
Nobl-O-Tech Round Slings

NOBL-O-TECH Round Slings are manufactured in the Netherlands for Nobles and are fully compliant with Australian Standard 4497. Each sling is proof load tested at manufacture and a test certificate is packaged with the sling.

NOBL-O-TECH round slings feature a "protected tag" with the majority of the sling tag hidden underneath a section of the cover. This ensures the tag is protected during service but the cover can be easily pulled back to check the tag details such as sling load capacities, date of manufacture, date put into service and serial numbers. Round Sling tags have traditionally been exposed and it was common for the tags to become detached during service. In many instances this would lead to the premature retirement of an otherwise serviceable sling.

NOBL-O-TECH round slings also feature our unique polyurethane impregnated high twisted yarn cover for superior abrasion resistance and extended service life.

The table below lists the common size round slings, other capacities and lengths are also held in stock. We stock numerous lengths in the capacities above 10 tonne. Please inquire with our Customer Service Team.



Product Specifications

Name	ITEM #	WLL (tonnes)	Length (m)	Colour	Sleeve Width (mm)	Core Diameter (mm)	Weight (kg)
Round Sling 1t 5m NoblOtech	10405	1	5	Purple	41	12	1.36
Round Sling 1t 3m NoblOtech	11490	1	3	Purple	41	12	0.81
Round Sling 1t 1.5m NoblOtech	12662	1	1.5	Purple	41	12	0.39
Round Sling 1t 0.5m NoblOtech	16330	1	0.5	Purple	41	12	0.13
Round Sling 1t 6m NoblOtech	17508	1	6	Purple	41	12	1.62
Round Sling 1t 1m NoblOtech	18655	1	1	Purple	41	12	0.26
Round Sling 1t 2m NoblOtech	18668	1	2	Purple	41	12	0.55
Round Sling 1t 2.5m NoblOtech	18841	1	2.5	Purple	41	12	0.68
Round Sling 1t 4m NoblOtech	19437	1	4	Purple	41	12	1.1
Round Sling 2t 5m NoblOtech	17752	2	5	Green	51	18	2.2
Round Sling 2t 1.5m NoblOtech	17771	2	1.5	Green	51	18	0.66
Round Sling 2t 2.5m NoblOtech	16992	2	2.5	Green	51	18	1.1
Round Sling 2t 1m NoblOtech	16750	2	1	Green	51	18	0.44

Round Sling 2t 6m NoblOtech	15521	2	6	Green	51	18	2.64
Round Sling 2t 2m NoblOtech	13681	2	2	Green	51	18	0.88
Round Sling 2t 3m NoblOtech	13903	2	3	Green	51	18	1.32
Round Sling 2t 0.5m NoblOTech	14370	2	0.5	Green	51	18	0.22
Round Sling 2t 4m NoblOtech	11060	2	4	Green	51	18	1.76
Round Sling 3t 4m NoblOtech	10397	3	4	Yellow	53	20	2.44
Round Sling 3t 6m NoblOtech	11004	3	6	Yellow	53	20	3.6
Round Sling 3t 1m NoblOtech	14482	3	1	Yellow	53	20	0.58
Round Sling 3t 5m NoblOtech	12588	3	5	Yellow	53	20	3
Round Sling 3t 2.5m NoblOtech	15033	3	2.5	Yellow	53	20	1.5
Round Sling 3t 2m NoblOtech	17475	3	2	Yellow	53	20	1.22
Round Sling 3t 1.5m NoblOtech	18383	3	1.5	Yellow	53	20	1
Round Sling 3t 3m NoblOtech	19116	3	3	Yellow	53	20	1.8
Round Sling 4t 1m NoblOtech	15048	4	1	Grey	69	22	0.76
Round Sling 4t 2.5m NoblOtech	12941	4	2.5	Grey	69	22	1.86
Round Sling 4t 1.5m NoblOtech	14252	4	1.5	Grey	69	22	1.1
Round Sling 4t 6m NoblOtech	11443	4	6	Grey	69	22	4.74

Round Sling 4t 3m NoblOtech	12216	4	3	Grey	69	22	2.37
Round Sling 4t 4m NoblOtech	11091	4	4	Grey	69	22	3.22
Round Sling 4t 5m NoblOtech	11320	4	5	Grey	69	22	3.97
Round Sling 4t 2m NoblOtech	10208	4	2	Grey	69	22	1.61
Round Sling 5t 5m NoblOtech	11386	5	5	Red	76	28	4.73
Round Sling 5t 3m NoblOtech	14814	5	3	Red	76	28	2.82
Round Sling 5t 6m NoblOtech	15212	5	6	Red	76	28	5.64
Round Sling 5t 4m NoblOtech	16755	5	4	Red	76	28	3.82
Round Sling 5t 2m NoblOtech	16895	5	2	Red	76	28	1.91
Round Sling 5t 1m NoblOtech	24901	5	1	Red	76	28	0.91
Round Sling 6t 6m NoblOtech	16937	6	6	Brown	80	30	6.96
Round Sling 6t 8m NoblOtech	19494	6	8	Brown	80	30	9.22
Round Sling 6t 2m NoblOtech	18791	6	2	Brown	80	30	2.35
Round Sling 6t 3m NoblOtech	18644	6	3	Brown	80	30	3.48
Round Sling 6t 4m NoblOtech	13175	6	4	Brown	80	30	4.61
Round Sling 6t 5m NoblOtech	10413	6	5	Brown	80	30	5.83
Round Sling 8t 8m NoblOtech	10010	8	8	Blue	90	32	12.08
Round Sling 8t 3m NoblOtech	12719	8	3	Blue	90	32	4.53

Round Sling 8t 5m NoblOtech	11645	8	5	Blue	90	32	7.55
Round Sling 8t 6m NoblOtech	14294	8	6	Blue	90	32	9.06
Round Sling 8t 4m NoblOtech	16925	8	4	Blue	90	32	6.04
Round Sling 8t 2m NoblOtech	17873	8	2	Blue	90	32	3.02

Wire Rope & Synthetic Slings

ROUND SLINGS

TO AS 4497

WLL TONNES

Sling Lifting Configurations	Straight Lift $L = 1$	Choked Lift $L = 0.8$	Basket hitch and 2, 3 & 4 leg slings			
			Parallel $L = 2$	$\beta = 60°$ $L = 1.73$	$\beta = 90°$ $L = 1.41$	$\beta = 120°$ $L = 1$
Sling Colour as per Australian Standards						
Violet	**1.0**	**0.8**	**2.0**	**1.7**	**1.4**	**1.0**
Green	**2.0**	**1.6**	**4.0**	**3.4**	**2.8**	**2.0**
Yellow	**3.0**	**2.4**	**6.0**	**5.1**	**4.2**	**3.0**
Grey	**4.0**	**3.2**	**8.0**	**6.9**	**5.6**	**4.0**
Red	**5.0**	**4.0**	**10.0**	**8.6**	**7.0**	**5.0**
Brown	**6.0**	**4.8**	**12.0**	**10.3**	**8.4**	**6.0**
Blue	**8.0**	**6.4**	**16.0**	**13.8**	**11.2**	**8.0**
Orange	**10.0**	**8.0**	**20.0**	**17.3**	**14.1**	**10.0**
Orange	**15.0**	**9.6**	**24.0**	**20.7**	**16.9**	**12.0**
Orange	**20.0**	**16.0**	**40.0**	**34.6**	**28.2**	**20.0**
Orange	**25.0**	**20.0**	**50.0**	**43.2**	**35.2**	**25.0**
Orange	**30.0**	**24.0**	**60.0**	**51.9**	**42.3**	**30.0**
Orange	**40.0**	**32.0**	**80.0**	**69.2**	**56.4**	**40.0**
Orange	**50.0**	**40.0**	**100.0**	**86.5**	**70.5**	**50.0**

NOTE: *Working Load Limit =* ***L*** *x WLL;* ***L****= Loading Factor;* β *= Included angle between the legs*

General Information

SLINGS - WHICH TYPE SHOULD BE USED?

From the information in this section users can see the wide variety of possibilities available for sling applications.

The following factors should be considered in making a selection.

1. Load - Mass.
2. Headroom.
3. Frequency of use - life of sling.
4. Type of load - steel, machinery, timber, shipping containers, crates, steel fabricated sections, fragile or items subjected to marring.
5. Cost versus efficiency.
6. Length of sling.
7. Method of slinging.
8. Environment - corrosion, heat etc.
9. Available storage for slings.

Some general observations on the above include:

1. Load - Mass

This is the most obvious consideration when choosing a sling to lift a given load. The user must ensure a sling is chosen that has the appropriate WLL (Working Load Limit) in the intended configuration to lift the load. Refer to the appropriate sling WLL charts in this brochure or in the relevant Australian Standard.

2. Headroom

Where minimum headroom is available, a user should consider:

- Using shorter slings.
- If wire rope slings are used, there is a minimum length allowance in AS 1666 for slings using mechanically swaged eyes.
- Double part grommets may be used.
- Chain slings can be kept to very short lengths.
- Using a lifting beam.
- Increasing the included angle of multiple slings.

3. Frequency of Use - Life of Sling

- This will depend on the number of times a sling is used and the manner in which the sling is used.
- Chain slings provide longer life.
- Nobleflex cable laid or Superflex plaited slings reduce kinking in comparison with conventional wire rope slings.
- Synthetic slings have special value in some chemically hazardous applications and for protection of the load to be lifted.

4. Type of Load

- Chain and conventional wire rope slings are the most appropriate for abrasive surfaces.
- Where a positive choking grip is required Superflex plaited slings, Round slings or Webbing slings are the best choice.
- Where marring of items is a problem, Webbing slings, Round slings or covered Flat Woven Wire slings are most satisfactory.

5. Cost Versus Efficiency

- A wire rope sling is an economical sling per tonne of WLL but after several uses in a choking application wire rope slings develop kinks, which make them more difficult to handle.
- For quick, easy and safe handling, Nobleflex or Superflex slings, Grade T chain slings, Round slings and Webbing slings can save many dollars in time and reduce injury.

6. Length of Sling

- Cost per metre is very relevant in long slings and wire rope is generally the most economical option in these circumstances.

7. Method of Slinging

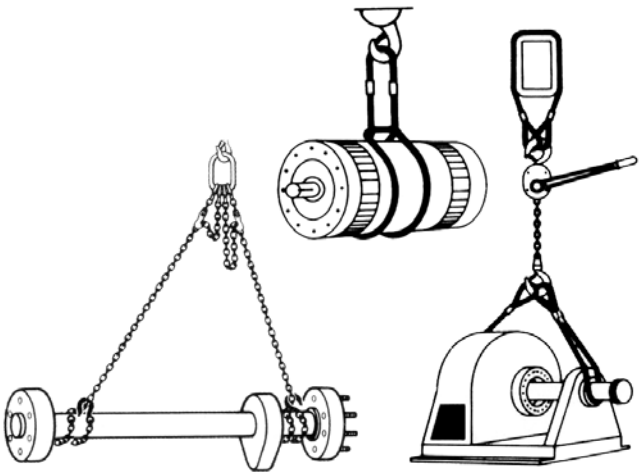
- Where slings are shackled to lifting points in a multi leg application, wire rope and chain slings are the most suitable. Where choking of the load is required Nobleflex or Superflex wire rope slings or synthetic Round and Webbing slings are generally the most efficient, though in special applications where abrasive surfaces are prevalent or in hauling logs Grade T chain slings are much more suitable.
- If shortening of sling legs is required in multi leg applications, Grade T chain slings with grab or shortening hooks are the best option.

8. Environment

- In a corrosive situation ferrule secured flemish eyes should be considered for wire rope slings.
- Aluminium ferrules are not appropriate in some mining areas or alumina refineries.
- Where acids and alkalis are prevalent webbing slings are beneficial. Grade T chain slings will be affected by temperatures above 200° C. Wire rope slings used near heat should have a steel core in the wire rope.

9. Available Storage for Slings

- All slings are best stored vertically so their length and condition can be readily inspected. There is also less chance of water or corrosion damage and mechanical damage. The WLL of each sling can also be readily ascertained.



WARNING

- Slings should always be used in line with good rigging practice and as per the manufacturers recommendations.
- Incorrect sling use could result in a dangerous situation that could cause property damage, serious injury or death.
- Increasing the included angle of multiple leg sling assemblies derates the sling. Therefore higher capacity slings will be required.
- Never use a sling with an included angle in excess of 120 degrees.

General Information

SYNTHETIC SLINGS

Inspection Before Use
- Flat Webbing Slings

The following signs of damage should be looked for during inspections.

1. *External wear* – caused by dragging over rough surfaces causes an opening out of surface fibres (with a furry appearance). The outer faces of the webbing my become so worn that yarns in the weave are severed. The label may become damaged.
2. *Local abrasion* – Local abrasion will be caused by movement over sharp edges while the sling is under tension, which will result in a loss of strength.
3. *Cuts and contusions* – may be indicated by local rupturing or loosening of the yarns.
4. *Internal wear* – will be caused by repeated flexing, particularly when particles of grit or dirt have penetrated the fibres. The presence of grit or dirt may indicate internal wear.
5. *Damage to protective coating or sleeve* – Any damage to a protective coating or sleeve can allow damage to the sling.
6. *Damage from high temperatures* – High temperatures can result from a hot environment, radiation or friction. High enough temperatures will cause fusing or shrinkage of synthetic webbing. Fusion is able to occur at temperatures approximately equal to the melting point of the polymer from which the fibres have been made.
7. *Sunlight degradation* – Prolonged exposure to ultraviolet radiation (including sunlight) of any textile fibres will weaken the fibres. Degradation may be indicated by a hairy appearance of fibres.
8. *Chemical attack* – Chemical attack is usually indicated by the local weakening or softening of the webbing material. In some cases it may cause some stiffening of the sling. In extreme cases surface fibres are reduced to powder.
9. *Label damage*
10. *Deterioration of stitching*
11. *Damage of any eyes*
12. *Damage at the connection to any terminal attachment*
13. *Damage to any end fittings*

Discard Criteria

Slings shall be immediately discarded if they are found to have any of the following faults:

1. The label of the sling is missing or is illegible, and the sling cannot be positively identified.
2. Whenever a sling has lost 10% or more of its minimum breaking strength. If there is any doubt as to the strength of the sling a method of establishing its loss of strength is given by Clause 9.4.2 of AS 1353.2.
3. Any of the load bearing fibres are damaged. Any damage to a cover indicates potential damage to the load bearing webbing. Such damage may be in the form of surface chafe or cuts in the cover. Any cuts in the cover should raise serious doubts as to the integrity of the load bearing webbing. Fibres of a protective cover that are fused or glazed indicates that the sling has been excessively heated (e.g. by friction in a choke hitch, by externally applied heat).
4. Chemicals have caused any damage (e.g. local weakening, softness of the cover, flaking of surface fibres). In such cases, damage to the load bearing webbing should be assumed.
5. Any coupling components or fittings are distorted, cracked, fractured or excessively worn or corroded.
6. If any other dangerous condition is confirmed.

Inspection Before Use
- Round Slings

Every time a sling is to be used, the user must be satisfied that the sling does not show any signs of damage that could affect its safe use.

Slings shall be withdrawn from service immediately if they sustain any of the following faults:

1. The cover has been damaged.
2. The stitching has been damaged.
3. The label of the sling is missing or is illegible, and the sling cannot be positively identified.
4. Any of the load bearing fibres are damaged. Any damage to a cover indicates potential damage to the load bearing core. Any cuts in the cover should raise serious doubts as to the integrity of the load bearing core. Fibres of a protective cover that are fused or glazed indicates that the sling has been excessively heated (e.g. by friction in a choke hitch, by externally applied heat).
5. Chemicals have caused any damage (e.g. local weakening, softness of the cover, flaking of surface fibres). In such cases, damage to the load bearing core should be assumed.
6. Any coupling components or fittings are distorted, cracked, fractured or excessively worn or corroded.
7. If any other dangerous condition is confirmed.

Care In Use

Evaluation

When a sling has been withdrawn from service because of any doubt about its condition, its safety may be evaluated by a competent person. The competent person may approve of the sling being returned to service, if the concern is considered to not affect the safety of the sling. The competent person may recommend repair of the sling, provided the sling can be identified and it is considered that the load-bearing fibres have not been damaged.

Cleaning

If a sling requires cleaning, refer to Nobles for suitable cleaning methods.

Repairs

Slings having any of the faults listed must be discarded.
The standard does not permit repairs to load-bearing webbing of a sling, but manufacturers may replace labels and repair removable covers. Any repaired slings shall be proof load tested before being returned to service.

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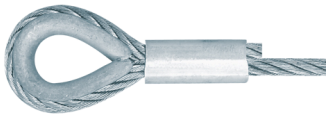
3.2 Wire Rope Slings

Wire Rope Slings

Nobles manufacture wire rope slings to your requirements, whether for regular routine use, or for a one-off lift. Standard 6x36 IWRC B 1960 Grade wire rope slings can be manufactured with thimble or soft eyes in custom lengths across a range of wire rope diameters from 8 to 44mm. See attached WLL table.

We also offer a full range of options for wire rope assemblies and slings including master links, various eye and end terminations with hooks or shackles etc at the bottom. Nobles can also manufacture 4 legged wire rope slings to DNV 2.7-1 and hand spliced and flemish eye slings as required.

For big lift slings, Nobles has 1,000 tonne testing facilities capable of applying a load over 35m in length, and a 2,500 tonne wire rope swaging press for ferrule secured slings up to 75mm wire rope, making us the leaders in large wire rope sling supply in Australia.

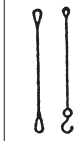


NOBLES
SINCE 1911

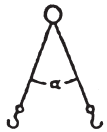
Wire Rope & Synthetic Slings

WIRE ROPE SLINGS

1960 GRADE IWRC Single Leg

Method of Loading	Direct Loaded	Choke Hitch		Basket Hitch			
		Round load	Rectangular load	Round Load		Other than round load	
							
Included Angle a	–	–	–	60°	90°	60°	90°
Loading factors	1	0.75	0.5	1.73	1.41	0.87	0.71
Rope dia. (mm)							
8	0.87	0.65	0.43	1.50	1.22	0.75	0.61
9	1.09	0.82	0.55	1.89	1.54	0.95	0.78
10	1.35	1.01	0.68	2.30	1.91	1.18	0.96
11	1.63	1.23	0.82	2.80	2.30	1.42	1.16
12	1.94	1.45	0.97	3.30	2.70	1.69	1.38
13	2.20	1.71	1.14	3.90	3.20	1.99	1.62
14	2.60	1.99	1.33	4.50	3.70	2.30	1.88
16	3.40	2.60	1.73	6.00	4.80	3.00	2.40
18	4.30	3.20	2.10	7.50	6.10	3.80	3.10
20	5.40	4.00	2.70	9.30	7.60	4.70	3.80
22	6.50	4.90	3.20	11.30	9.20	5.70	4.60
24	7.70	5.80	3.80	13.40	10.90	6.70	5.50
26	9.10	6.80	4.50	15.80	12.80	7.90	6.40
28	10.50	7.90	5.30	18.30	14.90	9.20	7.50
32	13.80	10.30	6.90	23.90	19.50	12.00	9.80
36	17.50	13.10	8.70	30.20	24.60	15.20	12.40
40	21.60	16.20	10.80	37.50	30.50	18.80	15.40
44	26.10	19.60	13.00	45.20	36.80	22.70	18.50
48	31.10	23.30	15.50	53.90	43.90	27.10	22.10
52	36.60	27.40	18.30	63.30	51.60	31.80	25.90
56	42.40	31.80	21.20	73.30	59.80	36.90	30.10
58	47.20	35.40	23.60	81.70	66.60	41.10	33.50
60	48.60	36.40	24.30	84.10	68.50	42.20	34.50

1960 GRADE IWRC Two, Three and Four Leg

Method of Loading	Direct Loaded			Choke Hitch	
				Round load Single Wrap	Other Single Wrap
					
Included Angle a	0° to 60°	90°	120°	0° to 45°	0° to 45°
Loading factors	1.73	1.41	1	1.30	0.87
Rope dia. (mm)					
8	1.50	1.22	0.87	1.13	0.75
9	1.89	1.54	1.09	1.42	0.95
10	2.30	1.91	1.35	1.76	1.18
11	2.80	2.30	1.63	2.10	1.42
12	3.30	2.70	1.94	2.50	1.69
13	3.90	3.20	2.20	2.90	1.99
14	4.50	3.70	2.60	3.40	2.30
16	6.00	4.80	3.40	4.50	3.00
18	7.50	6.10	4.30	5.60	3.80
20	9.30	7.60	5.40	7.00	4.70
22	11.30	9.20	6.50	8.50	5.70
24	13.40	10.90	7.70	10.10	6.70
26	15.80	12.80	9.10	11.80	7.90
28	18.30	14.90	10.50	13.70	9.20
32	23.90	19.50	13.80	18.00	12.00
36	30.20	24.60	17.50	22.70	15.20
40	37.50	30.50	21.60	28.20	18.80
44	45.20	36.80	26.10	33.90	22.70
48	53.90	43.90	31.10	40.50	27.10
52	63.30	51.60	36.60	47.50	31.80
56	73.30	59.80	42.40	55.10	36.90
58	81.70	66.60	47.20	61.40	41.10
60	84.10	68.50	48.60	63.20	42.20

General Information

SLINGS - WHICH TYPE SHOULD BE USED?

From the information in this section users can see the wide variety of possibilities available for sling applications.

The following factors should be considered in making a selection.

1. Load - Mass.
2. Headroom.
3. Frequency of use - life of sling.
4. Type of load - steel, machinery, timber, shipping containers, crates, steel fabricated sections, fragile or items subjected to marring.
5. Cost versus efficiency.
6. Length of sling.
7. Method of slinging.
8. Environment - corrosion, heat etc.
9. Available storage for slings.

Some general observations on the above include:

1. Load - Mass

This is the most obvious consideration when choosing a sling to lift a given load. The user must ensure a sling is chosen that has the appropriate WLL (Working Load Limit) in the intended configuration to lift the load. Refer to the appropriate sling WLL charts in this brochure or in the relevant Australian Standard.

2. Headroom

Where minimum headroom is available, a user should consider:

- Using shorter slings.
- If wire rope slings are used, there is a minimum length allowance in AS 1666 for slings using mechanically swaged eyes.
- Double part grommets may be used.
- Chain slings can be kept to very short lengths.
- Using a lifting beam.
- Increasing the included angle of multiple slings.

3. Frequency of Use - Life of Sling

- This will depend on the number of times a sling is used and the manner in which the sling is used.
- Chain slings provide longer life.
- Nobleflex cable laid or Superflex plaited slings reduce kinking in comparison with conventional wire rope slings.
- Synthetic slings have special value in some chemically hazardous applications and for protection of the load to be lifted.

4. Type of Load

- Chain and conventional wire rope slings are the most appropriate for abrasive surfaces.
- Where a positive choking grip is required Superflex plaited slings, Round slings or Webbing slings are the best choice.
- Where marring of items is a problem, Webbing slings, Round slings or covered Flat Woven Wire slings are most satisfactory.

5. Cost Versus Efficiency

- A wire rope sling is an economical sling per tonne of WLL but after several uses in a choking application wire rope slings develop kinks, which make them more difficult to handle.
- For quick, easy and safe handling, Nobleflex or Superflex slings, Grade T chain slings, Round slings and Webbing slings can save many dollars in time and reduce injury.

6. Length of Sling

- Cost per metre is very relevant in long slings and wire rope is generally the most economical option in these circumstances.

7. Method of Slinging

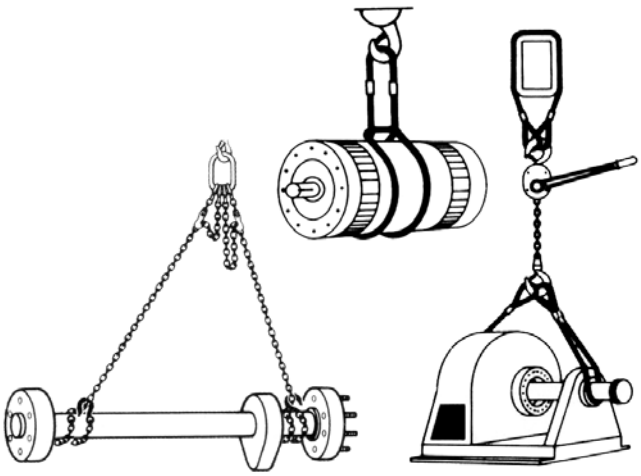
- Where slings are shackled to lifting points in a multi leg application, wire rope and chain slings are the most suitable. Where choking of the load is required Nobleflex or Superflex wire rope slings or synthetic Round and Webbing slings are generally the most efficient, though in special applications where abrasive surfaces are prevalent or in hauling logs Grade T chain slings are much more suitable.
- If shortening of sling legs is required in multi leg applications, Grade T chain slings with grab or shortening hooks are the best option.

8. Environment

- In a corrosive situation ferrule secured flemish eyes should be considered for wire rope slings.
- Aluminium ferrules are not appropriate in some mining areas or alumina refineries.
- Where acids and alkalis are prevalent webbing slings are beneficial. Grade T chain slings will be affected by temperatures above 200° C. Wire rope slings used near heat should have a steel core in the wire rope.

9. Available Storage for Slings

- All slings are best stored vertically so their length and condition can be readily inspected. There is also less chance of water or corrosion damage and mechanical damage. The WLL of each sling can also be readily ascertained.



WARNING

- Slings should always be used in line with good rigging practice and as per the manufacturers recommendations.
- Incorrect sling use could result in a dangerous situation that could cause property damage, serious injury or death.
- Increasing the included angle of multiple leg sling assemblies derates the sling. Therefore higher capacity slings will be required.
- Never use a sling with an included angle in excess of 120 degrees.

General Information

WIRE ROPE SLINGS

TO AS 1666

Aluminium Ferrule Secured Slings

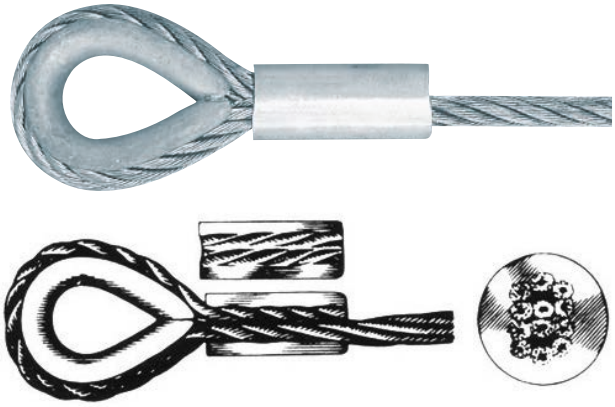
= Ferrule secured splice

+ Proof load testing of each sling

+ WLL markings

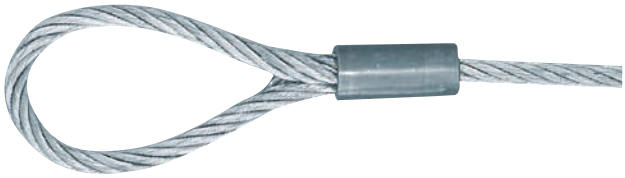
+ Sling production site marking

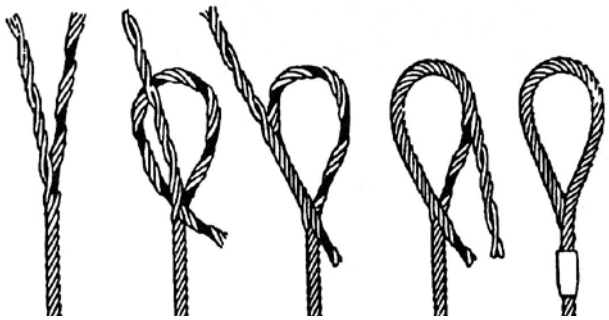
+ Test Number for easy matching with test certificate



Cross section of a splice showing how rope and ferrule form one strong, homogenous mass.

Ferrule Secured Flemish Eye Slings





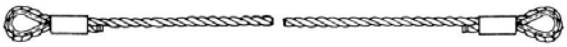
Flemish eyes with steel sleeves are recommended for corrosive conditions where a steel ferrule or sleeve is able to withstand electrolytic reactions, which can affect other metals. In hot working areas the steel retains its strength at higher temperatures.

In abrasive conditions steel can withstand more mechanical stresses than other ferrules. In the above situations the Flemish eyes with steel sleeves have the back up strength of a Flemish eye even if by some means the ferrule is damaged.

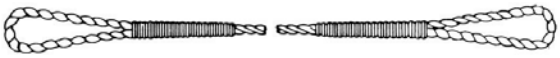
Hand-spliced Slings

Although aluminium ferrule secured has become the most popular type of wire rope sling there is still some demand for Hand-spliced slings which have more flexibility at the splice.

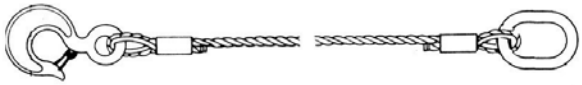
Wire Rope Sling Types



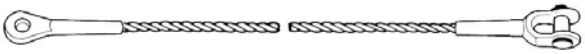
Wire rope sling with ferrule secured thimble eye each end



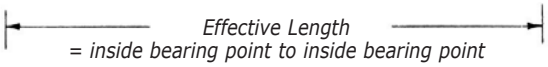
Wire rope sling with hand spliced soft eye each end



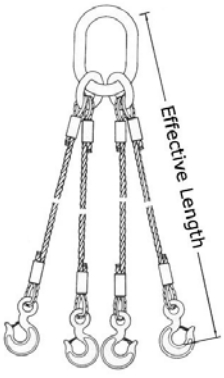
Wire rope sling with ferrule secured thimble eye each end with hook captive one end and master link captive other end



Wire rope assembly with open swage socket one end and closed swage socket other end



Typical 2 Leg Sling



Typical 4 Leg Sling

General Information

WIRE ROPE SLINGS

TO AS 1666

Inspection Before Use

A sling will eventually deteriorate as a result of abrasive wear, wire breaks, loss of lubrication, corrosion and consolidation of the core and rope strands. Damage is not always readily evident. The normal types of damage are described in this section.

The pre-use inspection for wire rope slings shall give particular emphasis to:

1. Check the identification stamp or tag and ensure the WLL of the sling is clearly legible.
2. Check load-bearing points for excessive wear, kinking, broken wires and corrosion.
3. Check each strand along its length, opening the rope as much as practicable to enable examination of the surfaces of the strands towards the inside of the rope.
4. Check end fittings and attachments for any signs of deformation, excessive wear or corrosion.
5. Check the sling for heat damage. This is usually obvious through the discolouration of the wires.

Types of Damage

Wire rope can be damaged in different ways and the resulting damage can take the forms of external wear, local abrasion, broken wires, internal wear, physical deterioration, corrosion, kinking and flattening of eyes.

Severe overloading of wire ropes is evidenced by an increasing rate of fracture of the wires and excessive stretch under load accompanied by marked reduction in diameter.

External wear can be caused by dragging the sling over rough surfaces and is the most readily noticeable cause of weakness, particularly if a new sling is available for comparison. In the extreme, the outer strands become worn as the outer wires within the strands are flattened and worn.

Local abrasion, as distinct from external wear, can be caused by the passage of the sling over sharp edges whilst under tension and can cause a serious loss of strength. It is good economy to protect slings at points where excessive local abrasion can occur. Cuts, bruises and similar damage can be internal as well as external. This type of damage is indicated by local rupturing or loosening of wires or strands. It is caused by lack of care in use such as hammering of the slings and careless placement of the load. Internal wear is caused by repeated flexing of the sling and by particles of grit picked up in service. Internal wear is accelerated by lack of lubrication and by corrosion.

Corrosion is caused by dampness and exposure to acids, alkalis, other chemicals, flue gases, industrial dusts, ashes and similar substances.

High temperatures, such as those found in foundries, steel works and like applications, reduce both the strength and the safety of a sling.

Distortion, permanent set or any physical deformation of end fittings, particularly at load bearing points should be regarded as dangerous and the sling should not be used.

Discarding Slings

The decision whether or not to withdraw a sling from use shall be based on an assessment of the general condition of the sling. After examination, if any doubt exists about the safety of a sling, it shall be withdrawn from service.

Slight damage to the outer wires of a wire rope sling may be disregarded. Serious damage of one strand or somewhat less serious damage to more than one stand however, merits rejection of the sling.

Slings that have been subjected to impact loads, overloaded or loaded in a kinked condition shall be destroyed and discarded.

Where kinking is such that it creates a hazard in taking up loads through hand injuries or causing unevenness or jerking during loading, the kinked slings shall be discarded.

Care in Use

Wire rope slings are particularly susceptible to kinking, local abrasion and mechanical damage and care should be taken to ensure they are protected as much as is practical to prevent or lessen the extent of such damage. Some common safe use practices for wire rope slings are:

1. Never exceed the WLL of a wire rope sling. Always ensure you know the lifting capacity of the sling in the configuration you intend to use it.
2. Ensure that wire rope slings are not used on sharp corners of a load. This will almost certainly kink the sling and render it unusable. If a load with sharp corners is to be lifted the corner should be packed or a protective sleeve placed over the sling.
3. Splices in rope slings shall not be bent around corners or edges whether sharp or curved.
4. The inside radius of any bend in a wire rope around a corner of a load, (except at the point of reeving in choke hitches) shall be not less than the rope diameter where the included angle of the bend of the rope is more than 90 degrees or five times the rope diameter where the included angle of the rope is less than 90 degrees.
5. Practice such as hammering or "battening down" of slings to force the sling down in a choke hitch configuration is dangerous. The wire rope sling should be left to find its natural angle. If positive choking is required a synthetic sling may better serve the application.
6. Never lift a load over people or dangerous parts of plant.
7. Do not use slings that are knotted or kinked.
8. Wire rope slings should not be exposed to welding or cutting operations.
9. Careless placement of the load is a sure way to damage a sling and must be avoided. Loads should always be placed on battens.
10. When using multi leg slings ensure that the load is as evenly balanced as possible in order for all sling legs to take an equal amount of load.
11. Never shorten a sling be tying a knot in it. If the load is unequal and varying leg lengths are required a specially designed wire rope sling shall be used or an alternative slinging method.

⚠ WARNING

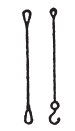
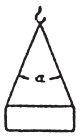
- Weakening effects are more serious on smaller sizes of rope than on larger sizes of rope because of the greater ratio between the diameter and cross-sectional area.
- Good inspection practice will isolate causes of deterioration and enable the detection of damage to wire rope slings and end fittings. This can improve storage, handling and application practices. Advice on discarding slings is also given in this section.
- Slings in storage shall be regularly inspected for deterioration and, when necessary, withdrawn from use and discarded.
- Slings used in circumstances, areas or atmospheres prone to acid, alkali, chemical or other damaging action shall be inspected for possible deterioration prior to reuse.

General Information

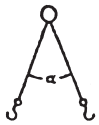
WIRE ROPE SLINGS

WLL TONNES - *AS 1666*

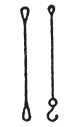
1570 GRADE FC
Single Leg

Method of Loading	Direct Loaded	Choke Hitch		Basket Hitch			
		Round load	Rectangular load	Round Load		Other than round load	
							
Included Angle a	–	–	–	60°	90°	60°	90°
Loading factors	1	0.75	0.5	1.73	1.41	0.87	0.71
Rope dia. (mm)							
8	0.55	0.41	0.27	0.96	0.78	0.48	0.39
9	0.70	0.52	0.35	1.21	0.99	0.61	0.50
10	0.86	0.65	0.43	1.50	1.22	0.75	0.61
11	1.05	0.78	0.52	1.81	1.48	0.91	0.74
12	1.23	0.92	0.61	2.14	1.74	1.07	0.88
13	1.47	1.10	0.73	2.54	2.07	1.27	1.04
14	1.70	1.27	0.85	2.94	2.40	1.48	1.21
16	2.22	1.67	1.11	3.85	3.14	1.93	1.58
18	2.80	2.10	1.40	4.85	3.95	2.44	1.99
20	3.48	2.61	1.74	6.03	4.91	3.03	2.47
22	4.20	3.15	2.10	7.27	5.92	3.65	2.98
24	5.01	3.76	2.50	8.67	7.07	4.36	3.56
26	5.88	4.41	2.94	10.18	8.30	5.12	4.18
28	6.81	5.11	3.40	11.79	9.61	5.93	4.84
32	8.90	6.68	4.45	15.41	12.56	7.75	6.32

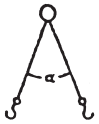
1570 GRADE FC
Two, Three and Four Leg

Method of Loading	Direct Loaded			Choke Hitch	
				Round load Single Wrap	Other Single Wrap
					
Included Angle a	0° to 60°	90°	120°	0° to 45°	0° to 45°
Loading factors	1.73	1.41	1	1.30	0.87
Rope dia. (mm)					
8	0.96	0.78	0.55	0.72	0.48
9	1.21	0.99	0.70	0.91	0.61
10	1.50	1.22	0.86	1.13	0.75
11	1.81	1.48	1.05	1.36	0.91
12	2.14	1.74	1.23	1.61	1.07
13	2.54	2.07	1.47	1.91	1.27
14	2.94	2.40	1.70	2.21	1.48
16	3.85	3.14	2.22	2.89	1.93
18	4.85	3.95	2.80	3.65	2.44
20	6.03	4.91	3.48	4.53	3.03
22	7.27	5.92	4.20	5.46	3.65
24	8.67	7.07	5.01	6.52	4.36
26	10.18	8.30	5.88	7.65	5.12
28	11.79	9.61	6.81	8.86	5.93
32	15.41	12.56	8.90	11.58	7.75

1770 GRADE IWRC
Single Leg

Method of Loading	Direct Loaded	Choke Hitch		Basket Hitch			
		Round load	Rectangular load	Round Load		Other than round load	
							
Included Angle a	–	–	–	60°	90°	60°	90°
Loading factors	1	0.75	0.5	1.73	1.41	0.87	0.71
Rope dia. (mm)							
8	0.78	0.58	0.39	1.35	1.10	0.68	0.55
9	0.99	0.74	0.49	1.71	1.40	0.86	0.70
10	1.22	0.92	0.61	2.10	1.72	1.06	0.87
11	1.48	1.11	0.74	2.60	2.10	1.29	1.05
12	1.76	1.32	0.88	3.00	2.50	1.53	1.25
13	2.10	1.55	1.04	3.60	2.90	1.80	1.47
14	2.40	1.80	1.20	4.20	3.40	2.10	1.71
16	3.10	2.30	1.56	5.40	4.40	2.70	2.20
18	4.00	3.00	1.98	6.80	5.60	3.40	2.80
20	4.90	3.70	2.40	8.40	6.90	4.20	3.50
22	5.90	4.40	3.00	10.20	8.30	5.10	4.20
24	7.00	5.30	3.50	12.20	9.90	6.10	5.00
26	8.30	6.20	4.10	14.30	11.60	7.20	5.90
28	9.60	7.20	4.80	16.60	13.50	8.30	6.80
32	12.50	9.40	6.30	22.00	17.60	10.90	8.90
36	15.80	11.90	7.90	27.00	22.00	13.80	11.20
40	19.60	14.70	9.80	34.00	28.00	17.00	13.90
44	24.00	17.70	11.80	41.00	33.00	21.00	16.80
48	28.00	21.00	14.00	49.00	40.00	24.00	19.90
52	33.00	25.00	16.60	57.00	47.00	29.00	24.00
56	38.00	29.00	19.20	66.00	54.00	33.00	27.00
58	42.00	31.50	21.00	73.00	59.00	36.50	30.00
64	52.00	39.00	26.00	90.00	73.00	45.00	37.00
75	70.00	52.50	35.00	121.00	99.00	61.00	50.00

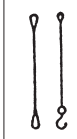
1770 GRADE IWRC
Two, Three and Four Leg

Method of Loading	Direct Loaded			Choke Hitch	
				Round load Single Wrap	Other Single Wrap
					
Included Angle a	0° to 60°	90°	120°	0° to 45°	0° to 45°
Loading factors	1.73	1.41	1	1.30	0.87
Rope dia. (mm)					
8	1.35	1.10	0.78	1.01	0.68
9	1.71	1.40	0.99	1.29	0.86
10	2.10	1.72	1.22	1.59	1.06
11	2.60	2.10	1.48	1.92	1.29
12	3.00	2.50	1.76	2.30	1.53
13	3.60	2.90	2.10	2.70	1.80
14	4.20	3.40	2.40	3.10	2.10
16	5.40	4.40	3.10	4.10	2.70
18	6.80	5.60	4.00	5.10	3.40
20	8.40	6.90	4.90	6.30	4.20
22	10.20	8.30	5.90	7.70	5.10
24	12.20	9.90	7.00	9.10	6.10
26	14.30	11.60	8.30	10.70	7.20
28	16.60	13.50	9.60	12.40	8.30
32	22.00	17.60	12.50	16.30	10.90
36	27.00	22.00	15.80	21.00	13.80
40	34.00	28.00	19.60	25.00	17.00
44	41.00	33.00	24.00	31.00	21.00
48	49.00	40.00	28.00	37.00	24.00
52	57.00	47.00	33.00	43.00	29.00
56	66.00	54.00	38.00	50.00	33.00
58	74.00	60.00	42.00	54.00	36.50
64	90.00	73.00	52.00	67.00	45.00
75	121.00	99.00	70.00	91.00	50.00

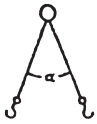
General Information

WIRE ROPE SLINGS

1960 GRADE IWRC Single Leg

Method of Loading	Direct Loaded	Choke Hitch		Basket Hitch			
		Round load	Rectangular load	Round Load		Other than round load	
							
Included Angle a	–	–	–	60°	90°	60°	90°
Loading factors	1	0.75	0.5	1.73	1.41	0.87	0.71
Rope dia. (mm)							
8	0.87	0.65	0.43	1.50	1.22	0.75	0.61
9	1.09	0.82	0.55	1.89	1.54	0.95	0.78
10	1.35	1.01	0.68	2.30	1.91	1.18	0.96
11	1.63	1.23	0.82	2.80	2.30	1.42	1.16
12	1.94	1.45	0.97	3.30	2.70	1.69	1.38
13	2.20	1.71	1.14	3.90	3.20	1.99	1.62
14	2.60	1.99	1.33	4.50	3.70	2.30	1.88
16	3.40	2.60	1.73	6.00	4.80	3.00	2.40
18	4.30	3.20	2.10	7.50	6.10	3.80	3.10
20	5.40	4.00	2.70	9.30	7.60	4.70	3.80
22	6.50	4.90	3.20	11.30	9.20	5.70	4.60
24	7.70	5.80	3.80	13.40	10.90	6.70	5.50
26	9.10	6.80	4.50	15.80	12.80	7.90	6.40
28	10.50	7.90	5.30	18.30	14.90	9.20	7.50
32	13.80	10.30	6.90	23.90	19.50	12.00	9.80
36	17.50	13.10	8.70	30.20	24.60	15.20	12.40
40	21.60	16.20	10.80	37.50	30.50	18.80	15.40
44	26.10	19.60	13.00	45.20	36.80	22.70	18.50
48	31.10	23.30	15.50	53.90	43.90	27.10	22.10
52	36.60	27.40	18.30	63.30	51.60	31.80	25.90
56	42.40	31.80	21.20	73.30	59.80	36.90	30.10
58	47.20	35.40	23.60	81.70	66.60	41.10	33.50
60	48.60	36.40	24.30	84.10	68.50	42.20	34.50

1960 GRADE IWRC Two, Three and Four Leg

Direct Loaded			Choke Hitch	
			Round load Single Wrap	Other Single Wrap
				
0° to 60°	90°	120°	0° to 45°	0° to 45°
1.73	1.41	1	1.30	0.87
1.50	1.22	0.87	1.13	0.75
1.89	1.54	1.09	1.42	0.95
2.30	1.91	1.35	1.76	1.18
2.80	2.30	1.63	2.10	1.42
3.30	2.70	1.94	2.50	1.69
3.90	3.20	2.20	2.90	1.99
4.50	3.70	2.60	3.40	2.30
6.00	4.80	3.40	4.50	3.00
7.50	6.10	4.30	5.60	3.80
9.30	7.60	5.40	7.00	4.70
11.30	9.20	6.50	8.50	5.70
13.40	10.90	7.70	10.10	6.70
15.80	12.80	9.10	11.80	7.90
18.30	14.90	10.50	13.70	9.20
23.90	19.50	13.80	18.00	12.00
30.20	24.60	17.50	22.70	15.20
37.50	30.50	21.60	28.20	18.80
45.20	36.80	26.10	33.90	22.70
53.90	43.90	31.10	40.50	27.10
63.30	51.60	36.60	47.50	31.80
73.30	59.80	42.40	55.10	36.90
81.70	66.60	47.20	61.40	41.10
84.10	68.50	48.60	63.20	42.20

Notes on Wire Rope Sling Tables

(a) The tables apply to slings with ferrule-secured eyes and the WLL values include a reduction factor of 0.95.

(b) The tables are based on general conditions of use with an M3 group classification of crane mechanisms as specified in AS 1418.1.

(c) The tables apply to slings used for general purposes and are based on a design factor of 5.

(d) Where the sling is subject to unusual dynamic loading, the sling shall be derated.

(e) These loading factors and values are based on single part sling legs. The WLL values may be increased by 50% for double-part sling legs.

(f) Ropes shall be effectively protected from contact with sharp corners.

(g) Splices shall not be bent around edges or sharp corners.

(h) For slings with other types of termination, the relevant factor for terminations shall be used.

(i) Where an endless sling or soft eye of a sling interfaces with a fitting the supporting surface of the fitting shall have a diameter not less than the rope diameter. Where the diameter of such a fitting is less than two rope diameters the sling shall be derated by 50%.

On 2, 3 and 4 leg sling tables.

This method of rating general-purpose multi-leg slings follows the principle that loads could be supported by only two legs, the other legs only balancing the load. It makes allowance for adverse conditions, such as unequal leg lengths, an uneven load shape, a rigid load and an off-centred centre of gravity.

The WLL for a multi-leg sling having an included angle of 60 degrees between the legs is the maximum WLL for the sling, even when the included angle between the legs is less than 60 degrees. Under no circumstances should the included angle between the legs of a multi-leg sling be allowed to exceed 120 degrees. The WLL of lifting components and end fittings of a multi-leg sling should be considered when determining the maximum WLL of the sling.

General Information

WIRE ROPE SLINGS

TO AS 1666

Marking

Each sling assembly must be stamped or have an identification tag including the following information as a minimum:

- Identification of manufacturer or supplier
- WLL for single leg slings or WLL for applicable angles of multi-leg slings
- Test certification number and date

Minimum Length of Leg

The effective length of a sling shall be not less than;

(a) Hand-spliced single-part spliced leg: 70 rope diameters

(b) Mechanically spliced

With thimble reinforced eyes: 36 rope diameters

With soft eyes (minimum length): 46 rope diameters

Ferrule-secured sling legs shall have a distance between the ferrules securing the eyes of the sling leg of not less than 12 rope diameters.

Internal Length of Soft Eyes

For general use, the internal length of soft eyes in their natural unloaded shape should be not less than 12 times the diameter of the rope.

For specified applications, the internal length of soft eyes in their natural unloaded shape should not be less than three times the width of the support (e.g. width of hook, diameter of supporting pin).

Factors for Terminations

Type of Termination	Rope Diameter (mm)	Termination Factor
Double-part slings and grommets	All	1.5
Ferrule-secured slings	≤ 80	0.95
	> 80	0.9
Hand-spliced slings	≤ 20	0.9
	> 20	0.8
Spelter socket (poured)	All	1
Swage socket	All	1

General Information

WIRE ROPE SLINGS

Nobles Big-Lift Division, based in Adelaide, has the capability to produce very large lifting slings in varying configurations.

End Connection Factors

Type of End Connection	Max. Rope Diameter mm	Loss Due to End Connection %
Grommet (Endless)	305	25
Hand Splice (Cable Laid)	305	10 - 25*
Flemish Eye (Steel Sleeves)	128	5**
Aluminium Ferrule Secured	76	5**
Steel End Socket (Swaged)	76	0
Resin or Zinc Socket	160	0

** Depending on rope diameter and construction.*
*** AS 1666 Specifies 10% loss for wire ropes above 80mm dia.*

Rope Bending Diameter
(Cable laid / round strand ropes)

Small bending diameters reduce the load capacity. The suggested respective reductions are listed in the tables.

Suggested Minimum Bending Diameter For Eyes

Type of Sling	Normal Application	Special Application
In the eye of single leg ropes		
Round strand ropes	3 x d	2 x d
Cable laid / 3 part rope	4 x d	2 to 3 x d
- absolute minimum		1 x d
In the bend of grommets		
Round strand grommets	7 x d	4 to 6 x d
Cable laid grommets	8 x d	4 to 6 x d

Suggested Minimum Bending Diameter For Body of Rope

Type of Sling	Normal Application	Special Application
Round strand ropes	4 x d	3 x d
Cable laid	6 x d	4 x d

Nobles Big-Lift slings in use for this 370 tonne lift during the construction of Darwin's LNG plant

3 Part Slings

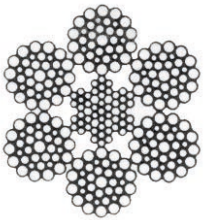
Rope Construction
= 3 Part Rope

Special Feature
= rotation resistant under load

Approximate Diameter mm	Unit Rope Diameter mm	*Aggregate 3 Parts kN	Mass kg/m	MBL Sling kN
88	44	3,660	24.3	3,095
96	48	4,350	28.9	3,681
104	52	5,130	33.9	4,338
114	58	6,600	41.7	5,328
128	64	8,073	51.9	6,546
152	75	10,866	70.8	9,000
184*	92	17,730	105.4	15,070
208*	104	23,550	136.3	20,017

Det Norske Veritas approved. Certificate No. S-608
** A 15% deration is applied to arrive at the MBL of the sling*
** Unit ropes are 8 stranded G1960.*

Rope Construction
Round Strand Wire Rope



Nobles Big Lift Division can manufacture aluminium ferrule secured slings or grommets to 75mm diameter

Nominal Rope Diameter mm	1770 Grade MBL kN	Mass Weight kg/m
26	426	2.83
28	494	3.28
32	646	4.28
36	817	5.42
40	1,010	6.69
44	1,220	8.1
48	1,450	9.64
52	1,710	11.3
58	2,200	13.9
64	2,691	17.3
75	3,622	23.6
92*	5,910	35.1
104*	7,850	45.4

**These ropes are 8 strand construction and 1960 grade*

General Information

WIRE ROPE SLINGS

Cable Laid Slings

Diameter mm	Weight kg/m	Calculated Rope Breaking Load tonnes	Calculated Sling Breaking Load tonnes
120	43	600	450
142	63	900	675
164	87	1,200	900
188	115	1,500	1,125
212	147	1,800	1,350
224	166	2,100	1,575
240	187	2,400	1,800
262	218	2,700	2,025
270	264	3,000	2,250
288	270	3,300	2,475
300	290	3,600	2,700
314	320	3,900	2,925
328	356	4,200	3,150
337	380	4,500	3,375
352	412	4,800	3,600
361	432	5,100	3,825
376	465	5,400	4,050
382	474	5,700	4,275
398	514	6,000	4,500
406	523	6,300	4,725
424	579	6,600	4,950
434	605	6,900	5,175
440	632	7,200	5,400
453	672	7,500	5,625
460	696	7,800	5,850
470	705	8,100	6,075

The calculated rope breaking load of the cable laid rope is the sum of the individual breaking force of the component ropes multiplied by a spinning loss coefficient of 0.85.

For slings this result is multiplied by a termination efficiency for hand splice of 0.75.

For slings and grommets the WLL is the maximum mass that a sling may raise, lower or sustain under specific working conditions.

Body of Rope Bending Factor (Cable Laid)

Bending Ratio: Bending Diameter to Nominal Rope Diameter $1=\frac{D}{d}$	Loss Due to Bending Ratio %
5	25
7.5	20
10	16
15	10
20	7
25	5
30	4
35	2
40	0

Cable Laid Grommets

Diameter mm	Weight kg/m	Calculated Grommet Breaking Load tonnes
78	21	450
96	32	675
114	45	900
126	55	1,125
138	65	1,350
150	78	1,575
156	79	1,800
162	89	2,025
168	96	2,250
171	100	2,475
180	111	2,700
192	124	2,925
201	137	3,150
204	143	3,375
216	160	3,600
222	170	3,825
228	179	4,050
240	193	4,275
249	209	4,500
252	210	4,725
258	225	4,950
267	242	5,175
276	259	5,400
282	265	5,625
288	277	5,850
294	296	6,075
306	315	6,763
312	342	6,865
324	369	7,446
336	396	7,803
342	413	8,211
360	448	8,843
381	502	9,874
399	553	10,812
438	668	12,852

Note:

For the above calculated sling or grommet breaking load, no loss has been deducted for D/d ratio at the bearing points for grommets. This also applies for slings used "on the double". The bending loss factor (EB) should be calculated as follows:

$$EB = 1 - \frac{0.5}{\sqrt{D/d}}$$

d = the single part sling/grommet diameter

D = diameter over which the sling/grommet is bent