



# SLING INSPECTION, USE & CARE

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## CHAIN SLINGS

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Columbus McKinnon Corporation assumes no responsibility for the misuse or misapplication of any of its products. Products are provided with the express understanding that the purchaser and/or user are thoroughly familiar with the correct application and proper use of such rigging products. Warnings and definitions are provided as an aid to the user in understanding the correct application and proper use of the product. Chain and rigging products should not be used by personnel unless they are properly trained and/or certified for that application

For instant access to valuable rigging and hoisting application information, check out our portable Rigging Guide. Small enough to fit in your pocket or toolbox, the CM Rigging Guide is full of the tools and specifications that every rigger should have, such as:

- Working Load Limits for Shackles, Hooks and Slings
- Easy to Understand Visual References for Proper Rigging
- Load Angle Charts
- Leverage, Tension & Pull Force Calculators
- And Much More

For more information or to order your copies of the CM Rigging Guides, contact your Columbus McKinnon representative.



Literature code: CMRG



## WARNING

The use of all mechanical equipment presents the possibility of personal injury or property damage if the equipment is not properly installed, operated or maintained. Before using CM chain, accessories, load binders, lifting clamps, or other hardware, users should become thoroughly familiar with application, installation, operation and maintenance requirements.

### **IMPROPER USE OR CARE OF CHAIN & RIGGING ATTACHMENTS CAN RESULT IN BODILY INJURY OR PROPERTY DAMAGE. TO AVOID INJURY:**

#### **CHAIN**

- ▲ Do not exceed the working load limit. Refer to the catalog for product-specific load limit data.
- ▲ Always inspect chain before use. Do not use chains with links that are bent, elongated, nicked, or excessively worn or damaged.
- ▲ Do not impact load or jerk chain. Apply load slowly. Rapid load application can cause overloading.
- ▲ Use only alloy chain and attachments for overhead lifting (Grade 80 or 100).
- ▲ Do not use twisted, knotted or kinked chain. Load should be applied in a straight line fashion.
- ▲ Select the proper grade and size chain for the application.
- ▲ Select attachments such as hooks to match the grade, size, and working load limit of the chain.
- ▲ Be aware of the environment where chain and hardware are being used. Extreme temperatures and corrosive media can affect the working load limit and life of the chain and hardware.
- ▲ Full chain inspection and use information can be found on pages 26 through 28. Refer to product manuals for complete warning and use information if applicable.

#### **RIGGING ATTACHMENTS**

- ▲ Do not exceed the working load limit. Refer to the catalog for product-specific load limit data.
- ▲ Always inspect rigging attachments before use. Do not use equipment with components that are bent, elongated, nicked, or excessively worn or damaged.
- ▲ Center the load in hooks, shackles, rings and other such equipment. Use spacers on bolts and pins as necessary to maintain center loading.
- ▲ Do not move unbalanced loads.
- ▲ Do not tip load or use attachments in any manner for which they were not intended.
- ▲ Do not shock or dynamic load. Rapid load application can cause overloading.
- ▲ Do not apply load to latches. Latches are to retain slack slings.
- ▲ Select attachments to match the grade, size, and working load limit of the chain.
- ▲ Ensure that nuts, bolts pins and other fasteners are tightened and secured.
- ▲ Do not use mechanical coupling links to repair alloy chains used for overhead lifting.
- ▲ Size the master link or ring to fit properly over the crane hook.
- ▲ Do not replace pins or bolts with other than original equipment parts.
- ▲ Wire rope clips are not recommended for fabricating slings for overhead lifting. Reference ASME B30.9 for special applications.
- ▲ Use wire rope clips in conjunction with wire rope thimbles.
- ▲ When using shoulder eyebolts, always apply load in the plane of the eye.
- ▲ When using shoulder eyebolts, make sure shoulder is fully seated.
- ▲ When using hoist rings, verify full 360 degree rotation and 180 degree pivot and re-torque periodically.
- ▲ Make sure plate clamps are functional and capable of lifting the load before use.
- ▲ Product-specific warning and hazard information can be found throughout this catalog. Refer to product manuals for complete warning and use information.

#### **DISCLAIMER**

The manufacturer does not accept any liability for damages which result from the product being used in excess of the working load limit or from abuse or misuse.

Always refer to applicable industry standards, specifications and regulations such as OSHA and ASME. Always adhere to any manufacturers recommendations.

# CHAIN & CHAIN SLING INSPECTION GUIDE

To ensure long life and continued strength of CM chain, it is important that the product is properly used, inspected and maintained. This section provides details on chain and chain sling inspection methods as well as the proper use and care of chain or slings. Following these guidelines will ensure safe and long use of CM products.

In addition to what is provided in this section, ASME and OSHA have specific regulations related to chain and chain sling use. For detailed information, refer to ASME B30.9 and OSHA 1910.184

## GENERAL CHAIN & CHAIN SLING INSPECTION

It is important to inspect chain and chain slings regularly and to keep a record of all chain inspections. Follow the steps below when developing your inspection requirements and tracking system. CM will supply chain and sling record cards or sheets as requested.

Before inspection, clean the chain so that marks, nicks, wear and other defects can be seen. Use a non-acid/non-caustic solvent. Each chain link and sling component should be individually inspected for the conditions noted below.

1. Excessive wear and corrosion at chain and attachment bearing points. Refer to page 27, "Wear Allowance chart for Herc-Alloy 800® and 1000 chain". The table should also be used as a guide when inspecting coupling links.
2. Nicks or gouges
3. Stretch or link elongation
4. Twists or bends
5. Distorted or damaged links, master links, coupling links or attachments, especially spread in throat opening of hooks. (Refer to other sections in this catalog for inspection guidelines regarding distortion and wear of hooks, master links and Hammerlocks®.)

When inspecting chain slings specifically, it's important to note that damage is most likely to occur in the lower portion of a sling. Therefore, particular attention should be given to those sections.

Each link or component having any condition listed above is to be marked to clearly indicate rejection. Since any of the above noted conditions can affect chain performance and/or reduce the chain strength, chains and chain slings containing any of the conditions should be removed from service.

A qualified person should examine the chain, assess the damage, and make a decision on whether or not repair is necessary before returning it to service. Extensively damaged chain should be scrapped.

Because of its use in critical lifting applications, repair of alloy chain should only be done by an authorized CM chain sling repair station. Nicks and gouges can be removed from the chain by a qualified person as instructed in the "Nicks and Gouges" section on this page.

## IN-DEPTH CHAIN & CHAIN SLING INSPECTION

Since Grade 80 and 100 chains are used for overhead lifting, and used frequently as part of a sling component, a more detailed and in-depth inspection is necessary.

### TWISTING & BENDING

Twisted and bent links are relatively easy to recognize and affect chain performance significantly. Twisting and bending of links results from use of slings around sharp corners without padding, use of links with grab hooks under certain adverse conditions, and from loading of chain that is twisted, knotted, or kinked. (Refer to Hook Section for a more information on grab hooks.)

Consider that chain is evaluated by applying loads in a pure tensile link end-to-link-end fashion and rated accordingly. Bent or twisted links alter this normal loading pattern significantly and thus alter inner link stresses accordingly. For this reason all chain containing twisted or bent links must be removed from service.

### NICKS & GOUGES

The outsides of links are exposed to contact with foreign objects that can cause damage. Nicks and gouges frequently occur on the sides. Therefore, they usually are located on surfaces under compressive stress and their potentially harmful effects are reduced.

The unique geometry of a chain link tends to protect tensile stress areas against damage from external causes. Figure 1 shows that these tensile stress areas are on the outside of the link body at the link ends where they are shielded against most damage by the presence of interconnected links. Tensile stress areas are located also on the insides of the straight barrels, but these surfaces are similarly sheltered by their location. However, gouges cause localized increases in the link stress. They can be harmful if they are located in areas of tensile stress and particularly so if they are perpendicular to the direction of stress. Refer to Figure 1.

Figure 2 shows nicks of varying degrees of severity. Reading clockwise, at three o'clock there is a longitudinal mark in a compressive stress area. Since it is longitudinal and located in a compressive stress area, its effect is mitigated, but good workmanship calls for it to be ground out. At about five o'clock there is a deep



Figure 1: Pattern of tensile and compression stress shown by a link under load.



Figure 2: Location of nicks, gouges, and notches will dictate their severity.

transverse nick in an area of high shear stress. A similar nick is located at six o'clock in the zone of maximum tensile stress. Both of these can create a potentially dangerous escalation of the local stress and must be filed out. A nick that was located at eight o'clock has been filed out properly. Although the final cross section is smaller, the link is stronger because the stress riser effect of the notch has been removed. The remaining cross section can now be evaluated for acceptability by measuring it and applying the criterion for worn chain. See "Wear Allowances Table" below.

### WEAR & CORROSION

Corrosion results in a reduction of link cross-section and can be detected using the same criteria as that for wear. Wear can occur in any portion of a link that is subject to rubbing contact with another surface.

The natural shape of chain confines wear, for practical considerations, to only 2 areas. These are, in order of importance, (a) at the bearing points of interlink contact, and (b) on the outside surfaces of the straight side barrels which may be abraded from dragging chains along hard surfaces or from under loads. Figure 3 illustrates the condition of interlink wear and shows how to inspect for it. Notice how easily such wear can be detected by collapsing the chain to separate each link from its neighbors.

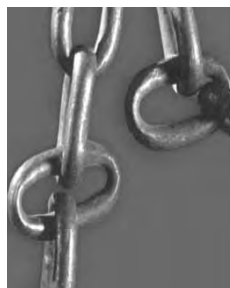
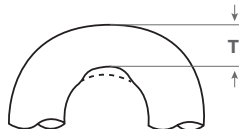


Figure 3 : Inspection for interlink wear can be detected easily by collapsing the chain.

When wear is observed, the next step is to determine how severe the damage is and if the chain can still be safely used. To determine this, make a caliper measurement across the worn section of chain and compare it to the minimum allowable dimension for that chain. See the chart below for minimum section dimensions or wear allowances for Columbus McKinnon Grade 80 and 100 Chain.

### WEAR ALLOWANCES OF HERC-ALLOY 800® & 1000 CHAIN\*



Measure cross section at link ends to determine wear. If chain is worn to less than the minimum allowable thickness, remove from service.

Note: For sizes not listed, the Minimum Allowable Thickness can be calculated as 87% of the original material diameter.

\* May also be used as a guide for CM Grade 63 Alloy Chain

Chain Size		Minimum Allowable Thickness (T)	
(in.)	(mm.)	(in.)	(mm.)
7/32	5.5	0.189	4.8
9/32	7.0	0.239	6.1
3/8	10.0	0.342	8.7
1/2	13.0	0.443	11.3
5/8	16.0	0.546	13.9
3/4	20.0	0.687	17.5
7/8	22.0	0.750	19.1
1	26.0	0.887	22.5
1-1/4	32.0	1.091	27.7

### CHAIN INSPECTION

The strength of welded link chain is relatively unaffected by a moderate degree of wear. The reason for this will be understood better if we take a brief look at the pattern of stress distribution in a chain link supporting an axial tension load.

Figure 4 shows in exaggerated manner the change in shape that takes place under such loading conditions. Note that the ends move farther apart while the side barrels move closer together. If the link were in a neutral stress condition to start with, the loaded link shown in broken outline would contain stresses of compression and tension. This is clearly illustrated in Figure 5 showing an inflated inner tube which is sustaining a load in the manner of a chain link. The wrinkled sections clearly indicate the areas of compression.

Figure 1 on the previous page shows the location of these stresses in a chain link. Tensile stresses are represented by arrows pointing away from each other, and compression stresses are depicted by arrows pointing toward each other. Notice that the bending, which occurs when link elongation takes place, induces compressive stresses at the interlink bearing surfaces and on the outside surfaces of the side barrels. Therefore, we see that these surfaces, which are the potential wear areas, play a lesser role in supporting the tensile load on the chain. For that reason, some amount of interlink or side barrel wear can occur before chain tensile strength decreases significantly.

Corrosion will generally be exhibited in the form of rusting and pitting. Rusted chain with a smooth unpitted surface finish can remain in service provided that the minimal section dimensions or wear allowances published by the chain manufacturer are complied with. However, visually discernible pitting should be carefully inspected using the technique outlined for "Nicks and Gouges", paying particular attention to areas of tensile stress.

Alloy steel sling chain typically exhibits well over 20% elongation before rupture. The combination of elongation and high strength provides energy absorption capacity. However, high elongation or stretch, by itself, is not an adequate indicator of shock resistance or general chain quality and should not be relied upon by riggers to provide advance warning of serious overloading and impending failure. Overloading must be prevented before it happens by selection of the proper type and size of slings.

### STRETCH & CHAIN ELONGATION

A visual link-by-link inspection is the best way to detect dangerously stretched links. The smallest sign of binding or loss of clearance at the juncture points of a link indicates a collapse in the links' sides due to stretch. Any amount of stretch indicates overloading, and the chain should be removed from service.

Note that a significant degree of stretch in a few individual links may be hidden by the apparent acceptable length gage of the overall chain. This highlights the importance of link-by-link inspection.

**There is no short-cut method that will disclose all types of chain damage. Safety can only be achieved through proper inspection procedures. There is no adequate substitute for careful link-by-link scrutiny.**

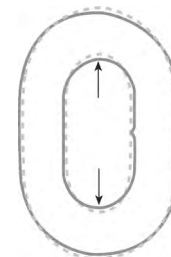


Figure 4 : Changes in link shape that take place under axial tension loading.

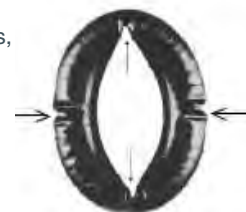


Figure 5 : The tube "under load" shows wrinkles in the areas of compression.



## OSHA CHAIN SLING INSPECTION

Since first published in final form on July 27, 1975, few changes have been made to the OSHA Chain Sling Inspection section. Specifically, the applicable sections of Code of Federal Regulations (29 CFR 1910.184) are quoted as follows:

- (d) INSPECTIONS – Each day before being used, the sling and all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed during sling use where service conditions warrant. Damaged or defective slings shall be immediately removed from service.
- (e) ALLOY STEEL CHAIN SLINGS
  - (3) Inspections (i) in addition to the inspection required by paragraph (d) of this section, a thorough periodic inspection of alloy steel chain steel slings in use shall be made on a regular basis, to be determined on the basis of (A) frequency of slings in use; (B) severity of service conditions; (C) nature of lifts being made; and (D) experience gained on the service life of slings used in similar circumstances. Such inspections shall in no event be at intervals greater than once every 12 months.
  - (ii) The employer shall make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected, and shall make such record available for examination.
  - (iii) The thorough inspection of alloy steel chain slings shall be performed by a competent person designated by the employer, and shall include a thorough inspection for wear, defective welds, deformation and increase in length. Where such defects or deterioration are present, the sling shall be immediately removed from service.”

Note that while the requirements under (d) for daily inspections are not explicit as to scope or maintenance of records, it is possible that individual OSHA inspectors may have different views on conformity. However, the minimum 12-month interval inspections required under (e) call for thorough inspection and written records. It is this thorough type inspection which the procedures recommended in this catalog and in CMCO Training Classes are designed to satisfy. Of course, the fundamentals are equally applicable to the more cursory daily inspections made by the riggers, users, or inspectors (a competent person) and will enable them to fulfill their responsibility efficiently.

## GENERAL CARE & USE

### PROPER CARE

Chain and chain slings require careful storage and regular maintenance.

1. Store chain and chain slings in a clean, dry place.
2. Avoid exposure to corrosive mediums. Oil chain before prolonged storage.
3. Never alter the thermal treatment of chain or chain sling components by heating.
4. Do not plate or change surface finish of chain or components. Contact Columbus McKinnon for special requirements.

### PROPER USE

To protect both operators and materials, observe these precautions when using chain slings.

1. Before use, inspect chain and attachments following the inspection instructions on pages 26 through 28.
2. Do not exceed working load limit as indicated on the chain or chain sling identification tag. Any of the following factors can reduce the strength of the chain or sling and cause failure:
  - Rapid load application can produce dangerous overloading.
  - Variation in the angle of the load to the sling. As the angle decreases, the working load of the sling will increase. (For more information, see page 30 )
  - Twisting, knotting or kinking subjects links to unusual loading, decreasing the working load of the sling.
  - Using slings for purposes other than those for which slings are intended can reduce the working load of the sling.
3. Free chain of all twists, knots and kinks.
4. Center load in hook(s). Hook latches must not support load.
5. Avoid sudden jerks when lifting and lowering.
6. Balance all loads to avoid tipping.
7. Use pads around sharp corners.
8. Do not drop load on chains.
9. Match the size and working load limit of attachments such as hooks and rings to the size and working load limit of the chain.
10. Use only alloy chain and attachments for overhead lifting.

## CHAIN & SLING

# CHAIN SELECTION & WORKING LOAD LIMITS

Understanding the working load limit of chain and chain slings is critical when choosing the best option for your application. This section details the working load limits of chain and chain slings, as well as explains how the working load limit is affected by temperature and lifting angles.

## GENERAL CHAIN WORKING LOAD LIMITS

Below is a chart of the working load limits of Grade 30 through Grade 100 chain.

Trade Diameter (in)	NACM Working Load Limits (lbs.)				
	Grade 30	Grade 43	Grade 70	Grade 80	Grade 100
1/8	400	—	—	—	—
3/16	800	—	—	2,100	2,700
7/32	—	—	—	2,100	2,700
1/4	1,300	2,600	3,150	—	—
9/32	—	—	—	3,500	4,300
5/16	1,900	3,900	4,700	4,500	5,700
3/8	2,650	5,400	6,600	7,100	8,800
7/16	3,700	7,200	8,750	—	—
1/2	4,500	9,200	11,300	12,000	15,000
5/8	6,900	13,000	15,800	18,100	22,600
3/4	10,600	20,200	24,700	28,300	35,300
7/8	12,800	24,500	—	34,200	42,700
1	17,900	—	—	47,700	59,700
1-1/4	—	—	—	72,300	90,400

Only Grade 80 or Grade 100 should be used for overhead lifting.

## CHAIN WORKING LOAD LIMITS UNDER EXTREME TEMPERATURE CONDITIONS

When chain is subject to extreme temperatures, working load limits should be reduced as indicated in the chart below.

Temperature		Grade 80	
(°F)	(°C)	Reduction of Working Load Limit WHILE AT Temperature	Reduction of Working Load Limit AFTER EXPOSURE to Temperature
Below 400	Below 204	NONE	NONE
400	204	10%	NONE
500	260	15%	NONE
600	316	20%	5%
700	371	30%	10%
800	427	40%	15%
900	482	50%	20%
1,000	538	60%	25%
Over 1,000	Over 538	OSHA 1910.184 requires all slings heated to temperatures over 1,000° F to be removed from service	
Temperature		Grade 100	
Below 400	Below 204	NONE	NONE
400	204	15%	NONE
500	260	25%	5%
600	316	30%	15%
700	371	40%	20%
800	427	50%	25%
900	482	60%	30%
1,000	538	70%	35%
Over 1,000	Over 538	OSHA 1910.184 requires all slings heated to temperatures over 1,000° F to be removed from service	

SLING INSPECTION, USE & CARE



# CHAIN SLING SELECTION & WORKING LOAD LIMITS

## HOW TO SELECT THE PROPER CHAIN SLING

1. Determine the weight and configuration of the load(s) to be lifted.
2. Determine the type of chain sling required, according to weight and configuration.
3. Determine the size of the body chain according to the working load limits.  
Be sure to take into consideration the effect of the required angle (see diagram below).
4. Determine the reach required to give the desired angle. This is measured from the upper bearing surface of the master link to the bearing surface of the lower attachment.
5. Know share of load on pick points and location of center of gravity.

## WHAT DETERMINES A SLING'S WORKING LOAD LIMIT

The working load limit of slings is based on the following factors:

- Type of hitch
- Material strength
- Design factor
- Diameter of curvature (D/d)
- Angle of loading

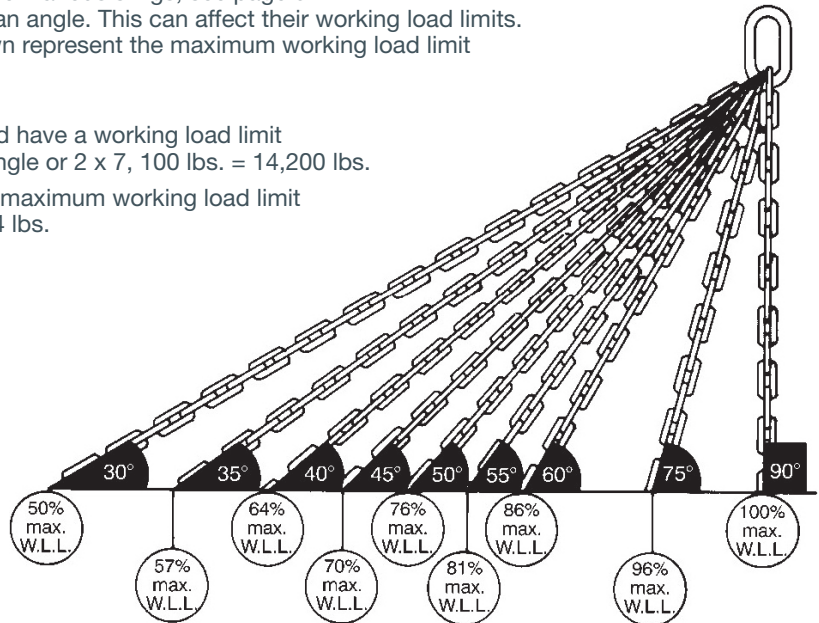
For specific information on the working load limit of various slings, see page 31.

When using a sling, loads are frequently lifted at an angle. This can affect their working load limits. In the diagram to the right, the percentages shown represent the maximum working load limit of the sling when used at the designated angle.

### For example:

One 3/8" Grade 80 double sling used at 90° would have a working load limit of 2 times the working load of a 3/8" Grade 80 single or 2 x 7, 100 lbs. = 14,200 lbs.

The same double sling used at 35° would have a maximum working load limit of 57% of 14,200 lbs. or .57 x 14,200 lbs. = 8,094 lbs.



## WARNING

Improper use, application or care of slings can result in injury or property damage.

To avoid injury or damage:

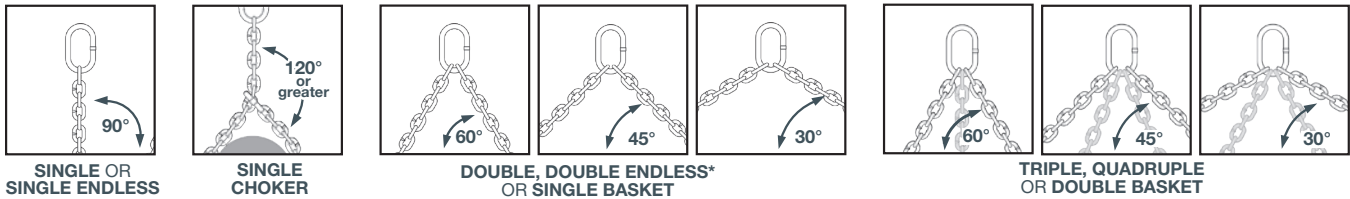
- ▲ Never exceed the working load limit. Confirm the working load limit of all sling components are of equal or greater strength.
- ▲ Always inspect slings before use for wear, damage, and elongation. Refer to ANSI B30.9 and OSHA regulations.
- ▲ Do not impact or shock load. Apply load slowly.
- ▲ Protect from corrosion and high temperatures.
- ▲ Use with alloy chain for overhead lifting.
- ▲ Do not use twisted, knotted or kinked chain.

American National Standard ANSI B30.9, the National Association of Chain Manufacturers, and the Occupational Safety & Health Administration recommend only the use of alloy steel chain for overhead lifting i.e. for sling chain. Slings may be constructed by the user using CM Grades 80 or 100 Chain, CM alloy attachments and CM mechanical coupling links (Hammerlocks®). Columbus McKinnon uses Grade 80 or 100 chain and alloy steel welded coupling links instead of Hammerlocks for construction of welded slings. Refer to this catalog's product overview sections for "Chain," "Hooks" and "Rings and Links" for detailed information on components which may be used in the construction of slings.





**SINGLE LEG (VERTICAL)**    **SINGLE LEG (CHOKER)**    **DOUBLE (2 LEGS)**    **TRIPLE (3 LEGS)**    **QUADRUPLE (4 LEGS)**    **BASKET TYPE**    **DOUBLE BASKET TYPE**



Chain Size (in.)	Working Load Limits for Sling Types Show Above														
	Single (1 leg)	Single Choker	Double (2 legs)			Triple (3 legs)			Quad (4 legs)			Single Basket	Double Basket	Single Endless	Double Endless*
	90° (lbs.)	90° (lbs.)	60° (lbs.)	45° (lbs.)	30° (lbs.)	60° (lbs.)	45° (lbs.)	30° (lbs.)	60° (lbs.)	45° (lbs.)	30° (lbs.)	60° (lbs.)	60° (lbs.)	90° (lbs.)	60° (lbs.)
<b>GRADE 80 CHAIN SLINGS</b>															
7/32	2,100	1,700	3,600	2,100	5,500	4,400	3,200	5,500	4,400	3,200	3,600	5,500	2,100	3,600	
9/32	3,500	2,800	6,100	4,900	3,500	9,100	7,400	5,200	9,100	7,400	5,200	6,100	9,100	3,500	6,100
5/16	4,500	3,600	7,800	6,400	4,500	11,700	9,500	6,800	11,700	9,500	6,800	7,800	11,700	4,500	7,800
3/8	7,100	5,700	12,300	10,000	7,100	18,400	15,100	10,600	18,400	15,100	10,600	12,300	18,400	7,100	12,300
1/2	12,000	9,600	20,800	17,000	12,000	31,200	25,500	18,000	31,200	25,500	18,000	20,800	31,200	12,000	20,800
5/8	18,100	14,500	31,300	25,600	18,100	47,000	38,400	27,100	47,000	38,400	27,100	31,300	47,000	18,100	31,300
3/4	28,300	22,600	49,000	40,000	28,300	73,500	60,000	42,400	73,500	60,000	42,400	49,000	73,500	28,300	49,000
7/8	34,200	27,400	59,200	48,400	34,200	88,900	72,500	51,300	88,900	72,500	51,300	59,200	88,900	34,200	59,200
1	47,700	38,200	82,600	67,400	47,700	123,900	101,200	71,500	123,900	101,200	71,500	82,600	123,900	47,700	82,600
1-1/4	72,300	57,800	125,200	102,200	72,300	187,800	153,400	108,400	187,800	153,400	108,400	125,200	187,800	72,300	125,200
<b>GRADE 100 CHAIN SLINGS</b>															
7/32	2,700	2,100	4,700	3,800	2,700	7,000	5,700	4,000	7,000	5,700	4,000	4,700	7,000	2,700	4,700
9/32	4,300	3,500	7,400	6,100	4,300	11,200	9,100	6,400	11,200	9,100	6,400	7,400	11,200	4,300	7,400
5/16	5,700	4,500	9,900	8,100	5,700	14,800	12,100	8,500	14,800	12,100	8,500	9,900	14,800	5,700	9,900
3/8	8,800	7,100	15,200	12,400	8,800	22,900	18,700	13,200	22,900	18,700	13,200	15,200	22,900	8,800	15,200
1/2	15,000	12,000	26,000	21,200	15,000	39,000	31,800	22,500	39,000	31,800	22,500	26,000	39,000	15,000	26,000
5/8	22,600	18,100	39,100	32,000	22,600	58,700	47,900	33,900	58,700	47,900	33,900	39,100	58,700	22,600	39,100
3/4	35,300	28,300	61,100	49,900	35,300	91,700	74,900	53,000	91,700	74,900	53,000	61,100	91,700	35,300	61,100
7/8	42,700	34,200	74,000	60,400	42,700	110,900	90,600	64,000	110,900	90,600	64,000	74,000	110,900	42,700	74,000
1	59,700	47,800	103,400	84,400	59,700	155,100	126,600	89,600	155,100	126,600	89,600	103,400	155,100	59,700	103,400
1-1/4	90,400	72,300	156,600	127,800	90,400	234,900	191,700	135,600	234,900	191,700	135,600	156,600	234,900	90,400	156,600

Do not use double endless slings at angles less than 60°. Based on OSHA and ASME B30.9 standards – Always use the sling tag for the working load limits. Factory assembled HERC-ALLOY 800® or HERC-ALLOY® 1000 chain slings have the “HERC-ALLOY 800®” or “HERC-ALLOY® 1000” trademark on serial number tags and on the sling hooks. On chain sizes 7/32” through 1-1/4” (7/32” through 3/4” for HA1000), links are embossed with grade symbol “HA-800” or “HA-1000”. This data applies to Herc-Alloy 800® & Herc-Alloy® 1000 chain only. Ratings apply to both factory assembled slings and slings assembled with Hammerlok® coupling links, Clevlok® hooks, or Lodelok® hooks.

# CHAIN SLING SELECTION & WORKING LOAD LIMITS

## SLING SAFETY: LOADING, ANGLES & CHOKING

When choosing a sling for your rigging application, specifically a sling, you need to be aware of the load that will be imposed on the sling and select the proper size chain for the job.

All chain manufacturers publish working load ratings for single chain slings in straight tension and for double, triple and quad-branch slings when used at various angles. Figure 1 illustrates how such tables would rate the capacity of a commercial Grade 80 sling made from 5/8 inch alloy chain. (See a full working load limit chart on page 31)

However, it is often overlooked that a single strand sling may be rigged to be a double branch sling and as such would create sharp loading angles. This is the reason that chain damage and overloading are usually localized in the lower portion of the sling near the load. Figure 2 illustrates this issue.

### OVERLOAD EXAMPLE:

On the left side of Figure 2, we see a double branch sling used in the conventional manner. Unfortunately, such idealized rigging, where sling hooks are neatly seated in eyebolts or clevises and all portions of the chain are in straight tension, is not always possible. A more typical and frequent rigging arrangement is shown in the illustration on the right of Figure 2.

In the right-side image of the diagram, a single sling equipped with a hook is being used in a choke hitch format. Above the crotch, the chain tension is 9 tons – the same tension as shown in the illustration on the left. Let us assume that 9 tons is an acceptable load for this size chain in straight tension. In many cases, one would assume that the load is rigged correctly and the load can be safely moved, but that is not the case. If you look below the hook, you see a double branched sling. Also, typical of the flat branch angles in tight choke hitches, the legs are at angles of only 15 degrees from the horizontal. At those angles the tension load in each leg of our 9 ton capacity is 17.4 tons — an overload of nearly 100%. This is why it is important to fully understand the tension and loads that your rigging will be under. This greatly depends on the rigging configuration and the materials used to create the sling. (See the chart on the effect angles have on the working load limit of slings on pg. 30)

## SHOCK LOADING

Shock loading can also damage a sling. If a load is raised with a jerk or permitted to fall and be snubbed by slack chain, the dynamic load applied to the chain can vastly exceed the static weight being lifted.

### SHOCK LOADING EXAMPLE:

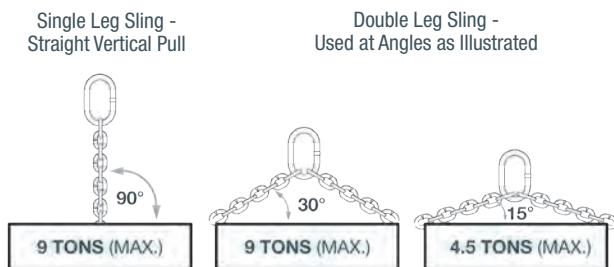
For example, 1/2" Herc-Alloy 800® has a working load rating of 12,000 lbs. It will sustain this amount of total load for a long period time if used correctly. However, a payload weighing considerably less than 12,000 lbs. can break the chain in a one-time situation if permitted to drop and produce high dynamic stresses.

This Herc-Alloy 800 1/2" chain has a rupture work capacity (impact strength) capacity of about 9,000 ft.lbs./ft. This means that if a 9-foot-long sling were being used to raise a 12,000 lb. payload and the load snagged and dropped onto the slack chain hook, a drop of about 7 feet would break the chain. Ex. 9,000 ft. lbs./ft x 9 ft. approximately equals 12,000 lbs. x 7 ft.

The amount of dynamic load imposed on a chain in such a situation cannot be planned for. Although the cited example is rather extreme, it can happen.

Therefore, it is important to ensure you do not overload your chain, whether it be from an improper rigging configuration that decreases the working load limit of the materials used or a shock loading situation.

**FIGURE 1**  
WORKING LOAD LIMITS FOR 5/8"  
CM Herc-Alloy 800® ALLOY STEEL CHAIN SLINGS



Working load limits for 5/8 inch alloy steel chain slings, (single and double leg configurations.)

**FIGURE 2**  
5/8" CM Herc-Alloy 800® ALLOY STEEL CHAIN SLINGS

