cold-working of the metal

Wrought iron chain (commonly called iron crane or dredge chain) used to be the accepted material for slings, hoists, cranes, power shovels, and marine purposes where human life or property would be endangered by failure However, since the introduction of alloy chain in 1933, the use of wrought iron has declined steadily and has nearly disappeared Because of this lack of commercial importance, it is not considered here

Heat-treated carbon steel is sometimes used for sling chains It has high strength, high impact resistance, and good abrasion resistance

Special purpose alloy chains are made from stainless steel, monel metal, bronze, and other materials They are designed for use where resistance to corrosive substances is required, or where their other special properties are desirable

Proof coil chain (also known as common or hardware chain) is used for miscellaneous purposes where failure of the chain would not endanger human life or result in serious damage to property or equipment Proof coil chain should never be used for slings

Properties of alloy chain

Alloy chain is produced from heat-treatable alloy steel in conformance with ASTM specifications A391-58 Types and amounts of the alloying elements may vary according to requirements of the individual chain manufacturer Chain after heat treatment has typical mechanical properties as follows

Tensile Strength	125,000 psi minimum
Elongation	15 per cent minimum

Table 23-J shows the recommended working load limits, proof test loads, and the minimum breaking strengths of alloy steel chain

The working load limit (safe load strength) is arrived at by dividing the breaking strength (ultimate strength) by a specified safety factor

The values shown in Table 23-J represent the *maximum loads that should ever be* applied in direct tension to a length of alloy chain All alloy chain is proof-tested in direct tension under the proof test loads shown, prior to final inspection and shipment The data for other types of chain may be obtained from the National Association of Chain Manufacturers specification No 3001

TABLE 23-J

WORKING LOAD LIMITS, PROOF TEST LOADS AND MINIMUM BREAKING LOADS FOR ALLOY STEEL CHAIN

Nominal Size of chain (in)	*Working Load limit (lb)*	*Proof Test (lb)*	*Minimum Break (lb)*
1/4	3,250	6,500	10,000
3/8	6,600	13,200	19,000
1/2	11,250	22,500	32,500
5/8	16,500	33,000	50,000
3/4	23,000	46,000	69,500
7/8	28,750	57,500	93,500
1	38,750	77,500	122,000
1 1/8	44,500	89,000	143,000
1 1/4	57,500	115,000	180,000
1 3/8	67,000	134,000	207,000
1 1/2	80,000	160,000	244,000
1 3/4	100,000	200,000	325,000

SOURCE *Specification for Alloy Chain*, American Society for Testing and Materials, A-391-65 *Alloy Steel Chain Specifications, No 3001*, National Association of Chain Manufacturers

Stress on each leg of a multi-branch sling is increased appreciably when the angle between the chain and the horizontal is decreased The effects of angle of loading on the working load limit of a two-leg alloy sling are shown in Fig 23-8

The tensile strength of alloy steel chain increases in proportion to its hardness (produced by heat treating) Resistance to abrasion also increases proportionately with hardness

Impact conditions caused by faulty hitches, bumpy crane tracks, and slipping hook-ups can materially add to the stress in the chain If severe impact loading may be encountered, a lower working load limit should be used, regardless of the chain type

Alloy steel chains are suitable for high temperature operations However, continuous operation at a temperature of 800 F (the highest temperature for which continuous operation is recommended) requires a reduction of 30 per cent in the regular working load limit These chains may be used at temperatures up to 1000 F at 50 per cent of