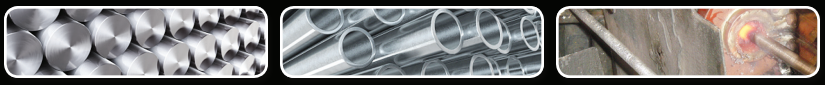
THE STEEL SUPPLY COMPANY



BUYER'S GUIDE

THE STEEL SUPPLY COMPANY

The Steel Supply Company, founded in 1904, is a specialty steel service center providing special finish bar and tube items. We service local, out of state, and international accounts from our location at 5105 Newport Drive, Rolling Meadows, IL 60008. These special finish items include Chrome Plated and Turned, Ground and Polished (TG&P) Carbon, Alloy and Stainless Steel Shafting as well as Carbon Steel Tubing with a Honed I.D., Chrome Plated O.D., Chrome Plated I.D., or, a Chrome Plated O.D. with a Honed I.D.

Located in the northern suburbs of Chicago, Illinois, The Steel Supply Company has access to major highways, airports, and rail services. Most items ship by truck but air and rail service is readily available as well as UPS and other courier services.

This Buyer's Guide is presented as a series of helpful data bulletins to assist you or your engineers in selecting these often hard to find specialty items. Our full stock catalogue is available on the internet at our web site www.steelsupply.com. Other helpful and important information is included in our web site and we encourage you to browse the contents often. An inquiry for any stock item may be made using the web site inquiry page or by calling one of our inside customer service specialists.

The Steel Supply Company is pleased to present this Buyer's Guide. Specific product information such as tolerance and mechanical property data is available from any of our experienced inside customer service representatives. An email or telephone call will result in a prompt reply to your query.

Telephone 800-323-7571, 888-BAR-TUBE or 847-255-2460
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Hard Chrome Plating

The Steel Supply Company, and Precision Chrome Inc., have been pioneers in the process of hard chrome plating, also known as industrial type plating, for more than half a century. This plating process should not be confused with decorative chrome plating which is actually a corrosion protective plating of other metals and an extremely thin plate of hard chrome over this material.

Of the numerous surface treatments available, hard chrome yields a combination of properties that are very unique and not readily provided by other plating processes. This would account for the widespread acceptance of hard chrome plating by numerous industrial applications. Hard chrome plating provides an extremely hard, long wearing surface coupled with a low coefficient of friction. Typical hardness values measure in a range of 800 to 1200 Knoop, and coefficients of friction are typically 25% of the value for steel. These properties make hard chrome plating useful for many applications ranging from hard surface cutting tools, engine cylinders, ways on machines tools, guides and pins, repair of worn parts, ring gauges, elements for computers, and, of course, hydraulic cylinder components.

Years ago it was a common procedure to machine piston rods, grind the surface, and then piece-part chrome plate as a final operation. This entails many parts made at risk of handling damage and poor surface preparation. Currently, it is much more economical to use pre-plated stock and machine parts as a final operation. Parts are now immediately available for assembly and handling is minimized.

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Hard Chrome Plating

The actual mechanisms of hard chrome plating are difficult. Chrome is present in the bath solution in the form of chromic acid. However, for it to plate, a catalyst must be added. There are several ions that will serve this purpose. Two of the most common in regular use are sulfate and fluoride. Plating temperatures are approximately 120 degrees F., and 2 to 3 amps of power per square inch required. Solutions are continuously monitored, measured and documented for compliance.

As chrome is deposited, stresses build up in the plate until a crack develops when those stresses exceed the strength of the deposited chrome. This process continues throughout the plating process. For this reason, and the thousands of tiny cracks continuing to the base metal, hard chrome will not provide protection against corrosion. In actual cylinder use, this is not a problem as a continual film of hydraulic oil is present and provides protection against rusting. Any items not in use, or in extended storage, need to be inspected and oiled on a regular basis.

In machining hard chrome plated rods or tubes that have been plated as much as .002" thickness, the best rule is to use standard machining practices. Although the chrome is extremely hard, it is not actually cut but lifted off with the steel chip. It is possible to "chase" threads directly over a chrome surface and carbide or ceramic tooling is often the best choice when selecting a proper insert.

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Care of Chrome Plated Rod and Tubes After Manufacture

Prevention of corrosion extends beyond just the manufacture of the hard chrome plated rod or tube. Handling and storage of the rod or tube can dramatically affect corrosion resistance.

- Ensure the protective fiber tubing does not get moist or wet with water or other contaminants. Remove any wet fiber tubes from rods or tubes and dry the rods or tubes immediately.
- When transporting chrome plated rods or tubes between operations, do not leave them in contact with surfaces that may contain coolants, lubricants, cleaning agents, or other sulfur or chlorine containing surfaces.
- Do not transport in loose quantities that can contact one another. Point impacts can damage the integrity of the chrome plate and eliminate corrosion resistance.
- Do not leave rods or tubes unprotected between operations or during transfer between buildings, if the transfer is over an extended period of time. A light oil film should be applied.
- Do not place unprotected chrome rods or tubes in contact with wood surfaces for an extended period of time. Moisture from the wood and leachable chlorines could lead to corrosion on the rod or tube where contact is made.
- Coolants and lubricants used for threading, turning, and cutting chrome plated steel bars and tubes can cause a reduction in corrosion resistance. This reduction in corrosion resistance is due to the chemistry of the lubricants. The chemicals contained in the lubricants that can be detrimental to the chrome plate are chlorine, sodium, and sulfur.
- Limit the contact with coolants and lubricants, and remove excess lubricant after machining operations to reduce the potential of corrosion.

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Care of Chrome Plated Rods and Tubes After Manufacture

- If rods or tubes are being machined with the protective cardboard tube in place, the tube could become saturated with coolant. If the tube is not removed, the machined rod or tube sitting in the saturated tube could begin to corrode. Minimizing coolant when machining the rods or tubes in the protective cardboard tube will improve corrosion resistance.
- Sand paper or other abrasives used on the surface of the rod or tube could seriously damage or remove the chrome plate. The damage will effectively eliminate corrosion resistance.
- Store chrome plated rods or tubes in a dry environment in a protective fiber tube or with a light coat of oil. If there are any surface imperfections in the chrome plate, moisture could cause premature corrosion.
- When storing the rods or tubes in the assembled cylinder without oil, it is important to maintain a moisture free atmosphere. Plastic wrapping may cause condensation to build on the rod or tube and, therefore, induce corrosion. Coated paper will break down and should not be used for extended storage.
- When in service, there are several actions that can be performed to improve corrosion resistance.

  Store a cylinder in the retracted position.

  If a cylinder is stored in the extended position, periodically cycle the cylinder.

  If a cylinder must be stored in the extended position without being cycled, use the following procedures.

  1. Using a dry cloth or cloth with appropriate solvent, clean dirt from the exposed rod or tube.
  2. Use an approved rust preventative. MSDS information is available as well as product information.
  3. Inspect and reapply mixture at a 1-3 month interval.

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Electreat 45, 50, and 60®

Electreat is a trade name for a unique group of steels that are produced to meet the demanding physical needs required by industry for extra service piston rods or linear bearing shafts. Our metallurgist worked with the producing mills nearly a half century ago to produce a grade of steel that would take the high heat needed to create a case hardened material while at the same time maintaining machinability.

Electreat 45 and 50 are produced from 1045/1050 grade carbon steel. Diameters from 3/8" through and including 4-1/2", and metric diameters from 12mm through and including 110mm, are provided as #2 Chrome Piston Steel Electreat 50®. This is a precision ground shafting which is then induction hardened to Rockwell C 50-62 levels with a minimum case depth of .030", polished, hard chrome plated and polished to a 16 maximum RMS (Ra 14.5) finish. All of the diameters in this size range are produced with 100,000 PSI (690 Mpa) minimum yield strength material certified to ASTM specification A311, Class B. Electreat 45 is supplied in diameters 4-3/4" through and including 6", and metric diameters from 115mm through and including 150mm. The process is the same as above but these diameters, due to manufacturing limitations, are supplied with 75,000 PSI (520 Mpa) minimum yield strength certified to ASTM specification A-108. Electreat T45 is provided on larger rounds from 6-1/2" diameter through and including 12" diameter, and metric diameters from 160mm through and including 200mm. Again, the processes are the same as is ASTM A-108, however, the yield strength drops to 40,000 PSI (275 Mpa) on these large rounds.

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Electreat 45, 50 and 60®

Electreat 60 is generally provided using a 1060 base material per ASTM specification A-29 and with a minimum yield strength of 50,000 PSI (345 Mpa). The hardness provided is a minimum of Rockwell C-60 with a case depth of .030" minimum. This product is provided as very close tolerance Turned, Ground and Polished shafting and is rarely chrome plated due to tolerance requirements. The main application for Electreat 60 is linear bearing shafting.

Although all Electreat products are readily machined using tooling and procedures generally accepted, there are some precautions to be observed. The outer case of the material is so hard that tooling and equipment must be rigid and in excellent condition to withstand the pressures involved.

Carbide, CBN, or ceramic inserts are best. A surface feed of approximately 100 SFM, and a feed rate of .004 IPR are considered good starting points. The tool may also be angled to the direction of the cut to spread the forces and wear along the tool edge to affect a much longer tool life.

Threads may be cut on the outside diameter using conventional single point methods. Once beneath the hardened surface, conventional techniques for machining 1045 to 1060 grades of steel should be realized. Consider, too, that all hardened shafting will have a transition area for depth.

Flame hardening is seldom used but may be required in special instances. Induction hardening offers controlled hardness with shallow case and a narrow transition band. Flame hardness reduces this control and offers a high hardness coupled with a much deeper case.

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Steel Heat Treatment Terms

Annealing: The annealing process is intended to optimize the steel's machinability and formability. Quenched and tempered steel may not machine or bend very easily and annealing is often necessary to manufacture components economically. Annealing is used after cold forming operations, since during cold forming, the deformed areas may become work hardened and often fracture.

Normalizing: The process of normalizing consists of heating the steel to 1550° to 1650° F., for most low and medium carbon steels. The parts are then allowed to cool in still room temperature air. Normalizing can be described as a homogenizing or grain-refining treatment.

Quenching: A fully hardened steel is defined as having a 100% martensitic structure since that is the hardest structure obtainable. To ensure austenizing, the appropriate temperature must be reached for a sufficient amount of time. This is followed by rapid cooling (quenching) in water, oil, or air, with or without agitation, depending on the type of steel.

Tempering: This process is generally applied to hardened or quenched steel to improve mechanical properties, for the most part, tensile strength, ductility and toughness. Most steels are tempered between 400° and 1100° F.

Stress Relieving: When metal is heated, expansion occurs which is proportional to the temperature rise. Similarly, upon cooling, contraction occurs. Stresses are then set up. To relieve stresses, plain carbon steel is typically heated to 900° to 1100° F., then slowly cooled back to room temperature. Also known as stress relief annealing.

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Carbon Steel Tubing

Carbon Steel Tubing from The Steel Supply Company is available as Drawn Over Mandrel (DOM ASTM A513, Type 5) or Cold Drawn Seamless Mechanical (CDSM ASTM A519). Processes include Honed Inside Diameter (I.D.), Chrome Plated Outside Diameter (O.D.), Chrome Plated I.D., or a combination of Chrome Plated O.D. and Honed I.D. The basic grades of 1020, 1026, and ST52.3 are carried as standard inventory. Alloy and stainless steels are processed on a special price and lead-time basis only.

The determination of grade and type of material is based on the O.D. and wall thickness. DOM tubing is produced with wall thickness up to and including 5/8", while CDSM tubing is supplied when a heavier wall (3/4" and Larger, with exceptions) is needed. Most DOM items are available, depending on diameter requirements, in grades 1020, 1026, and ST52.3. CDSM is usually only in 1026.

Honed I.D. material ranges in sizes from 0.750" I.D., through and including 14.000" I.D., and in metric diameters from 25mm I.D. through and including 233mm I.D. There are many wall thicknesses available.

Chrome Plated O.D. material begins at 3/8" O.D. and continues through and including 10" O.D., with metric diameters starting at 25mm O.D. and continuing through and including 110mm O.D. Again, various wall thicknesses are stocked.

Chrome I.D. as well as Chrome O.D. with a Honed I.D. are also available with a limited size range in stock. Special diameter requirements are processed using our in-house partnership with Precision Chrome Inc.

THE STEEL SUPPLY COMPANY

Stainless Steel

Stainless steels are more resistant to rusting and staining than plain carbon or low alloy steels. They provide superior and improved corrosion resistance based on the large content of chromium. Other elements, such as copper, aluminum, silicon, nickel, and molybdenum also increase the overall corrosion resistance in many environments and can be used to enhance oxidation resistance.

The first and most important step toward successful use of a stainless or heat resisting steel is selection of a type that is appropriate for the application. There are a large number of standard types that differ from one another in corrosion resistance, mechanical properties, and cost.

The following checklist has bullet points to be considered when selecting stainless steel.

- Corrosion resistance
- Suitability for intended fabrication techniques
- Stability of properties while in service
- Toughness
- Resistance to abrasion and erosion
- Resistance to galling and seizing
- Surface finish and/or reflectivity
- Magnetic properties
- Thermal conductivity
- Rigidity
- Dimensional stability

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#2 Piston Steel ®

Bar stock called #2 Piston Steel, also referred to as Turned, Ground, and Polished (TG&P), is a precision ground shafting produced as Cold Drawn, Ground and Polished; Cold Drawn, Turned Ground and Polished; or Hot Rolled, Turned Ground and Polished. All of the diameters carried are produced using the centerless ground and polished process.

The bars are ground to a very close tolerance and must be kept especially straight. After grinding, they are saw cut on one or both ends to provide uniform lengths necessary for rack plating or bar feeding. Specially manufactured abrasive belt polishing machines are used to provide shafting with a surface finish of 29 Ra (32 RMS) or better.

Commercial tolerances may vary by distributor holding to the range limits set in ASTM specification A-108. The Steel Supply Company also provides closer than standard tolerances on many products. Material can be polished to provide for a bearing fit or conveyor shaft application.

All #2 Chrome Piston Steel ® begins as #2 Piston Steel and is processed using the exacting inspection requirements established over more than a century of providing this type of product.

Special packaging is available and ASTM specification A-700 is used as a guideline along with customer specifications. A general rule for packaging is to expect plain cardboard tubes and wooden crating. Any customized packaging may require an additional charge.

THE STEEL SUPPLY COMPANY

Machine Shop Services

The Steel Supply Company offers in-house machining services to customer supplied engineered drawings only. Assembly and welding is not included in the machine shop area. Prototype and production quantities are produced on specially modified machinery. These modifications limit the possibility of damage to the surface finish. This damage is often caused by a steady rest or fixture and renders a part as rejected.

Machines are retired with new equipment added on a regular basis. At publication, the following equipment is operational.

Lathes:
1 Haas ST-30 CNC with a 3” diameter capacity.
1 Haas SL-40 CNC with a 6” diameter capacity
1 Haas ST-40L CNC with a 9” dia. capacity (subject to length) and live tooling
1 Haas ST-35 CNC with an 80mm dia. Capacity and live tooling
1 Cincinnati Engine Lathe with a 216” bed
1 Cincinnati Engine Lathe with a 168” bed
1 Acra Lathe with a 12” swing and short bed

Mills:
1 Haas GR-510 CNC Gantry Router with a 10 tool changing attachment
1 Bridgeport Vertical
1 HMT Horizontal
1 Milwaukee Simplex Horizontal

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Certification Terms

Tensile Strength: The maximum load per unit of original cross-sectional area obtained before rupture of a tensile specimen.

Yield Strength: The stress at which a material exhibits a specified deviation from proportionality of stress and strain. An offset of 0.2% is typically used for metals.

Elongation: The increase in length of a test specimen after rupture in a tensile test, expressed as a percentage of the original length.

Reduction of Area: The difference between the original cross-sectional area of a tensile specimen and that of the smallest area at the point of rupture.

Brinell Hardness Test: This test consists of forcing a ball of standard diameter into the specimen being tested under standard pressure, and then judging the hardness of the material by the amount of metal displaced.

Jominy End-Quench Test: This is a hardenability test in which a sample is heated to its proper quenching temperature and subjected to a spray of water at one end; a quenching method which provides a very rapid rate of cooling at the end sprayed, with progressively slower cooling all the way to the other end.

Charpy Test: A test made to determine the notched toughness, or impact strength, of a material. The test gives the energy required to break a standard notched specimen supported at the two ends.

NOTE: Not all of the above information is included on every product MTR.

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Imperfection Terminology

Blister: A raised spot, usually on the surface of a tube or pipe, caused by expansion of gas in a cavity within the wall or diameter.

Crack: A stress-induced separation of the metal which, without any other influence, is insufficient in extent to cause complete rupture of the material.

Dent: A local change in surface contour caused by mechanical impact, but not accompanied by loss of metal.

Gouge: Elongated grooves or cavities caused by mechanical removal of metal.

Inclusion: Foreign material or non-metallic particles entrapped within the metal during solidification.

Pit: A depression in the surface of metal occurring during its manufacture.

Seam: An elongated discontinuity in metal caused by a blowhole or other defect which has been closed by rolling or forging mechanical but not welded.

Lap: Fold of metal which has been rolled or otherwise worked against the surfaces of rolled metal, but has not fused into sound metal.

Lamination: An internal metal separation creating layers generally parallel to the surface.

THE STEEL SUPPLY COMPANY

Surface Finish Data

Certain terms are used when discussing surface finish. The most common term used is “MICRO FINISH”. Micro finish is measured in RMS (Root Mean Squared) or Ra (Arithmetic Average). The instrument used to measure surface finish is called a ‘PROFILOMETER”.

The typical methods of producing the finishes here do not include all possible means of obtaining the desired results. The data shows the Maximum Profilometer Reading in RMS (Ra), the ordinary method of producing the finish, and the relative cost to achieve the finish.

An RMS reading of 6 (Ra 5.4) is generally defined in automatic screw machine applications as a superfinish buff. It is produced by a microhone, lap, or very fine buff. This is very expensive when compared to other finishes listed herein.

A max RMS of 8 (Ra 7.25) is ordinarily produced by grinding or after being lapped, honed, fine honed, fine buffed, etc. By comparison to others this is rated as expensive.

A 16 RMS (14.5 Ra) is obtained by a fine grind, or by being lapped, honed, fine buffed, burnished, etc. It is rated as expensive except where a special machine can be used in mass production processes.

A 32 RMS (29 Ra) is achieved using a fine grind or by processes such as being broached, burnished, buffed, cold pressed, smooth emery buff, etc. This is a fairly inexpensive process for hardened steel on a high production basis. It is impractical on automatics except for burnishing operations.

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Surface Finish Data

A 47 maximum RMS ((Ra 42.6) uses a finish grind, a very fine machine finish, broaching, reaming, shaving, buffing, or finishing with emery cloth, etc. This is very difficult and relatively expensive on automatics. This is relatively inexpensive for cylindrical or surface grinding, especially on hardened steel.

A 63 RMS (57.1 Ra) is achieved by processing with a smooth grind, broaching, rolling, very light machine cutting, shaving, turning, boring, milling, reaming, smooth disc grinding, ball seat swaging, etc. This is possible but difficult even with the best tool practice for automatic screw machine work. It is easily attained in many secondary operations.

94 RMS (85 Ra) is less difficult but requires care and proper tooling in all machining operations. It is obtained with a medium grind, light finish tool cut, reaming, shaving, turning, boring, milling, etc.

A 125 RMS (113.3 Ra) is achieved with a commercial grind, finish tool cut, broach, rolling, reaming, shaving, turning, boring, milling, drilling, spot facing, counter-boring, fine filing, etc., application. This finish should be maintained in most automatic operations.

The above information is only to be used as general information for engineering, shop, and inspection departments as to which finishes can be attained with automatic screw machines and various secondary operations.

Grinding has improved over the years and we are now capable of holding 32 RMS (29 Ra) or better on O.D. grinding, and 20 RMS (18.1 Ra) on I.D. honing.

THE STEEL SUPPLY COMPANY

Standard Diameter Tolerances

Bar Size Range	#2 Piston	#2 Chrome .0005/S	#2 Chrome .001/S
1-1/2" and under	+.0/-.0010"	+.0/-.0020"	+.0/-.0030"
>1-1/2" to <2-1/2"	+.0/-.0015"	+.0/-.0020"	+.0/-.0030"
2-1/2 to 3" Incl.	+.0/-.0020"	+.0/-.0020"	+.0/-.0040"
Over 3 to 4" Incl.	+.0/-.0030"	+.0/-.0030"	+.0/-.0040"
Over 4 to 6" Incl.	+.0/-.0040"	+.0/-.0040"	+.0/-.0050"
Over 6"	+.0/-.0050"	+.0/-.0050"	+.0/-.0060"

For nonresulpherized steels (steels specified to maximum sulfur limits under 0.08%), or

For steels thermally treated (HY items), the tolerance is increased by .001".

DOM Tubing Tolerances

DOM O.D. Size Range	Ovality	I.D. Tolerances Available
<2"	.010"	+.000/-.003" or +.003/-.000"
2.001" < 3.000"	.015"	+.000/-.003" or +.003/-.000"
3.001" < 4.000"	.020"	+.000/-.003" or +.003/-.000"
4.001" < 5.000"	.025"	+.000/-.003" or +.003/-.000"
5.001" < 6.000"	.030"	+.000/-.003" or +.003/-.000"
6.001" < 7.000"	.035"	+.000/-.004" or +.004/-.000"
7.001" < 8.000"	.040"	+.000/-.005" or +.005/-.000"
8.001" < 9.000"	.045"	+.000/-.005" or +.005/-.000"
9.001" < 10.000"	.050"	+.000/-.005" or +.005/-.000"
10.001" < 11.000"	.055"	+.000/-.005" or +.005/-.000"
11.001" < 12.000"	.060"	+.000/-.006" or +.006/-.000"
12.001" < 13.000"	.065"	+.000/-.006" or +.006/-.000"
13.001" < 14.000"	.070"	+.000/-.008" or +.008/-.000"

NOTE: Ovality listed is for DOM Carbon Steel Tubing Only. This chart does not apply to CDSM Tubing. Please call for specifics on ovality and tolerances for CDSM (Seamless).

THE STEEL SUPPLY COMPANY

Keyseats in Shafting

Where required, The Steel Supply Company can provide shafting with a full length keyway or multiple keyways throughout the work piece. Unless otherwise specified, all keyways will be produced with Cutter Runouts per the ANSI Keyseat in Shafting Specification. Round End Keyways will be furnished only when designated.

Shaft Diameter	Standard Keyway
¼" and 3/8"	3/32 x 3/64"
½" and 9/16"	1/8 x 3/64"
5/8" through and including 7/8"	3/16 x 3/32"
15/16" through and including 1-1/4"	¼ x 1/8"
1-5/16" through and including 1-3/8"	5/16 x 5/32"
1-7/16" through and including 1-3/4"	3/8 x 3/16"
1-13/16" through and including 2-1/4"	½ x ¼"
2-5/16" through and including 2-3/4"	5/8 x 5/16"
2-7/8" through and including 3-1/4"	¾ x 3/8"
3-3/8" through and including 3-3/4"	7/8 x 7/16"
3-7/8" through and including 4-1/2"	1 x ½"
4-3/4" through and including 5-1/2"	1-1/4 x 5/8"
5-3/4" through and including 6"	1-1/2" x ¾"

Other diameters produced per your drawings

Metric keyways are also available – a drawing is required.

THE STEEL SUPPLY COMPANY

Quality System

The Steel Supply Company is committed to providing quality products and services. This commitment runs through every part of the order process and is updated at least annually during an in-house Quality Planning session. At publication, The Steel Supply Company is certified to ISO 9001:2015 using ABS Quality Evaluations as a registrar.

The basics of our Quality Systems include, but are not limited to, the following:

- Quality Policy
- Quality Objectives
- Sales
- Purchasing
- Production
- Gauge Calibration
- Customer Satisfaction
- Customer Complaints
- Customer Returns
- Key Performance Indicators

Process Maps, many with videos and still photographs, are used extensively throughout all operations.

The Steel Supply Company also maintains U. S. Department of State registration pursuant to ITAR Part 122.

THE STEEL SUPPLY COMPANY

Tubing Material Specification 1020

Produced Per ASTM A513, Type 5

Chemical Composition Limits

Carbon	0.18-0.23
Manganese	0.60-0.90
Phosphorous	0.025
Sulfur	0.025

Mechanical Properties of 1020

Tensile Strength, PSI	80,000 Min.
Tensile Strength Mpa	551
Yield Strength, PSI	70,000 Min.
Yield Strength Mpa	482
Elongation %	18 Min.
Hardness HRb	75 Min.

*Mpa is the abbreviation for Megapascals.

1020 is the most common grade for small diameter with thin wall carbon steel DOM tubing. This material is offered with a chrome plated O.D., or a honed I.D.

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Tubing Material Specification 1026

Produced Per ASTM A513, Type 5 (DOM) and ASTM A519 (CDSM)

Chemical Composition Limits

Carbon	0.22-0.28
Manganese	0.60-0.90
Phosphorous	0.025
Sulfur	0.025

Mechanical Properties of 1026

	DOM	CDSM
Tensile Strength, PSI	85,000 Min.	75,000 Min.
Tensile Strength Mpa	586	517
Yield Strength, PSI	75,000 Min.	65,000 Min.
Yield Strength, Mpa	517	448
Elongation %	15	5
Hardness HRb	80	80

*Mpa is the abbreviation for Megapascals.

1026 DOM (wall thicknesses through and including .625") and 1026 CDSM (wall thicknesses .750" and larger, and certain small diameters not made per the DOM process) items include Honed I.D Tubing, Chrome Plated O.D. Tubing, Chrome Plated I.D. Tubing, and a combination of Chrome Plated O.D. with a Honed I.D.

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Tubing Material Specification ST52.3

Produced Per ASTM A513, Type 5

Chemical Composition Limits

Carbon	0.13-0.18
Silicon	0.15-0.30
Manganese	1.20-1.40
Phosphorous	0.025
Sulfur	0.010

Mechanical Properties of ST52.3

Tensile Strength, PSI	85,000 Min.
Tensile Strength Mpa	586
Yield Strength, PSI	75,000 Min.
Yield Strength Mpa	517
Elongation %	15
Hardness HRb	80
Impact Energy ft-lb.	20 (-4° F. 10 x 10mm)

*Mpa is the abbreviation for Megapascals.

ST52.3 is commonly used in the U.S. Fluid Power Industry. This grade is easily formed, machined, and welded, and this carbon-manganese steel grade has exceptional impact energies.

THE STEEL SUPPLY COMPANY

Bar Material Specification 1045

Produced Per ASTM A-108

Chemical Composition Limits

Carbon	0.43-0.50
Manganese	0.60-0.90
Phosphorous	.040 Max.
Sulfur	.050 Max.

Mechanical Properties of 1045

	Cold Drawn	Micro Alloy*	Hot Rolled
Tensile Strength, PSI	100,000	95,000	90,000
Tensile Strength, Mpa	690	655	620
Yield Strength, PSI	75,000	75,000	40,000
Yield Strength, Mpa	520	520	275
Elongation %	10	10	15
Reduction of Area %	25	15	35
Brinell Hardness	195	185	190

*Micro Alloy 1045 uses Vanadium as a grain refiner. Mpa is an abbreviation for Megapascals.

1045 has a very good heat treatment response. It is the most commonly used, and most economical, grade of shafting in use for hydraulic cylinder components, blower shafts, and mandrels. Items of 1045 are stocked from ¼" diameter through and including 14" diameter, and in metric diameters from 10mm through and including 250mm.

THE STEEL SUPPLY COMPANY

Bar Material Specification HY-1045/1050

Produced Per ASTM A311, Class B

Chemical Composition Limits

Carbon	0.43-0.55
Manganese	0.60-0.90
Phosphorous	.040 Max.
Sulfur	.050 Max.

Mechanical Properties of HY-1045/1050

Tensile Strength, PSI	115,000 Min.
Tensile Strength, Mpa	795
Yield Strength, PSI	100,000 Min.
Yield Strength, Mpa	690
Elongation %	10
Reduction of Area %	20
Brinell Hardness	200

*Mpa is the abbreviation for Megapascals.

HY-1045/1050 is a stress relief annealed grade used when higher strength material is recommended. Items are stocked from ¼" diameter through and including 4-1/2" diameter, and metric diameters from 6mm through and including 110mm diameter. It should be noted that 4-1/2" is the maximum diameter currently being produced to ASTM A311, Class B specifications.

THE STEEL SUPPLY COMPANY

Bar Material Specification 1141

Produced Per ASTM A-108

Chemical Composition Limits

Carbon	0.37-0.44
Manganese	1.35-1.65
Phosphorous	0.040 Max.
Sulfur	0.08-0.13

Mechanical Properties of 1141 (Cold Drawn G&P)

Tensile Strength, PSI	100,000
Tensile Strength, Mpa	690
Yield Strength, PSI	75,000
Yield Strength, Mpa	520
Elongation %	10
Reduction of Area %	25
Brinell Hardness	190

*Mpa is the abbreviation for Megapascals.

1141 is a free machining medium carbon steel. This grade is suitable for applications where fair strength and faster, clean machining is required. This is a limited grade available in diameters ¼" through and including 1-3/8" diameter only. Metric diameters are not stocked in grade 1141.

THE STEEL SUPPLY COMPANY

Bar Material Specification HY-1144

Produced Per ASTM A311, Class B

Chemical Composition Limits

Carbon	0.40-0.48
Manganese	1.35-1.65
Phosphorous	0.040 Max.
Sulfur	0.24-0.33
Silicon	0.15-0.30

Mechanical Properties of HY-1144

Tensile Strength, PSI	115,000 Min.
Tensile Strength, Mpa	795
Yield Strength, PSI	100,000 Min.
Yield Strength, Mpa	690
Elongation %	10
Reduction of Area %	20
Brinell Hardness	190

*Mpa is the abbreviation for Megapascals.

HY-1144 offers wearability without case hardening. Rods made from this grade offer added resistance to fatigue and stress. Items stocked include ¼" diameter through and including 4-1/2" diameter, and metric diameters from 6mm through and including 70mm diameter.

THE STEEL SUPPLY COMPANY

Bar Material Specification HY-130 (4140-4150 QTSRA)

Produced Per ASTM A434 B, C

Chemical Composition Limits

Carbon	0.38-0.53
Manganese	0.75-1.00
Phosphorous	0.35 Max.
Sulfur	0.040 Max.
Chromium	0.80-1.10
Molybdenum	0.15-0.25

Mechanical Properties of HY-130 (4140-4150 QTSRA)

Tensile Strength, PSI	120,000
Tensile Strength, Mpa	830
Yield Strength, PSI	90,000
Yield Strength, Mpa	620
Elongation %	8
Reduction of Area %	20
Brinell Hardness	269

*Mpa is the abbreviation for Megapascals.

HY-130 is an alloy grade 4140/4150 quench and tempered, machine straightened, and stress relief annealed shafting grade providing toughness, strength, and ductility. Diameters start at ¼" and continue through and including 8" diameter, and metric diameters from 10mm through and including 100mm diameter.

4140/4150 annealed only items are not available from stock.

THE STEEL SUPPLY COMPANY

Bar Material Specification Stainless Steel 303 (Non-Magnetic)

Produced Per ASTM A-582

Chemical Composition Limits

Carbon	0.15 Max.
Chromium	17.00-19.00
Nickel	8.00-10.00
Manganese	2.00 Max.
Silicon	1.00 Max.
Phosphorous	0.20 Max.
Sulfur	0.15 Max.

Mechanical Properties of Stainless Steel 303

Tensile Strength, PSI	90,000
Tensile Strength, Mpa	620
Yield Strength, PSI	35,000
Yield Strength, Mpa	240
Elongation %	45
Reduction of Area %	50
Brinell Hardness	150

*Mpa is the abbreviation for Megapascals.

Stainless steel 303 is a free machining grade of stainless steel. It is non-magnetic and well adapted in many machining applications. Diameters stocked range from 1/8” through and including 5” diameter, and metric diameters from 6mm through and including 100mm diameter.

THE STEEL SUPPLY COMPANY

Bar Material Specification Stainless Steel 304 (Non-Magnetic)

Produced Per ASTM A276/479

Chemical Composition Limits

Carbon	0.08 Max.
Chromium	18.00-20.00
Nickel	8.00-10.50
Manganese	2.00 Max.
Silicon	1.00 Max
Phosphorous	0.045 Max.
Sulfur	0.030 Max.

Mechanical Properties of Stainless Steel 304

Tensile Strength, PSI	85,000
Tensile Strength, Mpa	585
Yield Strength, PSI	35,000
Yield Strength, Mpa	240
Elongation %	50
Reduction of Area %	60
Brinell Hardness	140

*Mpa is the abbreviation for Megapascals.

Stainless Steel 304 is one of the most popular non-magnetic stainless steels. It has a wide range of applications in the food and dairy industries. This grade is often used when a passivate process is required. Limited stock includes diameters from ¼" through and including 2-15/16" diameter, and metric diameters only in 14mm, 20mm and 25mm.

THE STEEL SUPPLY COMPANY

Bar Material Specification Stainless Steel 316 (Non-Magnetic)

Produced Per ASTM A276/479

Chemical Composition Limits

Carbon	0.08 Max.
Chromium	16.00-18.00
Nickel	10.00-14.00
Manganese	2.00 Max.
Silicon	1.00 Max.
Phosphorous	0.045 Max.
Sulfur	0.030 Max.
Molybdenum	2.00-3.00

Mechanical Properties of Stainless Steel 316

Tensile Strength, PSI	80,000
Tensile Strength, Mpa	550
Yield Strength, KSI	35,000
Yield Strength, Mpa	240
Elongation %	50
Reduction of Area %	60
Brinell Hardness	140

*Mpa is the abbreviation for Megapascals.

Stainless Steel 316, a non-magnetic steel, is often used in chemical, medical, or military application. This grade offers increased corrosion resistance at higher elevated temperatures. Available in diameters 3/8” through and including 4” diameter. Metric diameters are limited to 20mm, 22mm and 25mm diameters only.

THE STEEL SUPPLY COMPANY

Bar Material Specification for Stainless Steel 630 (17-4PH H-1150) (Magnetic)

Produced Per ASTM A-564

Chemical Composition Limits

Carbon	0.07 Max.
Manganese	1.00 Max.
Phosphorous	0.04 Max.
Sulfur	0.03 Max.
Silicon	1.00 Max.
Chromium	15.50-17.00
Nickel	3.00-5.00
Copper	3.00-5.00
Columbium + Tantalum	0.45

Mechanical Properties of Stainless Steel 630 (17-4PH H-1150)

Tensile Strength, PSI	130,000
Tensile Strength, Mpa	900
Yield Strength, PSI	100,000
Yield Strength, Mpa	690
Elongation %	15
Reduction of Area %	40
Brinell Hardness	275
Charpy Ft-Lb	30

*Mpa is the abbreviation for Megapascals.

Stainless 630 (17-4PH H-1150) is magnetic and offers high strength and hardness compared to other stainless steels. Diameters stocked are 1/8” through and including 6” diameter, and metrics from 12mm through and including 70mm diameter.

THE STEEL SUPPLY COMPANY

Theoretical Weights of Carbon Steel Bars

Diameter	Decimal Equivalent	12’ Bar	24’ Bar
1/8”	00.1250	0.50	N/A
3/16”	00.1875	1.13	N/A
¼”	00.2500	2.00	N/A
5/16”	00.3125	3.13	N/A
3/8”	00.3750	4.51	N/A
7/16”	00.4375	6.13	N/A
½”	00.5000	8.01	N/A
9/16”	00.5625	10.1	N/A
5/8”	00.6250	12.5	N/A
11/16”	00.6875	15.1	N/A
¾”	00.7500	18.0	36.0
13/16”	00.8125	21.2	N/A
7/8”	00.8750	24.5	N/A
15/16”	00.9375	28.2	N/A
1”	01.0000	32.0	64.0
1-1/16”	01.0625	36.2	72.3
1-1/8”	01.1250	40.6	81.1
1-3/16”	01.1875	45.2	90.4
1-1/4”	01.2500	50.1	100
1-5/16”	01.3125	55.2	110
1-3/8”	01.3750	60.6	121
1-7/16”	01.4375	66.2	132
1-1/2”	01.5000	72.0	144
1-9/16”	01.5625	78.2	156
1-5/8”	01.6250	84.6	169
1-11/16”	01.6875	91.2	182
1-3/4”	01.7500	98.1	198

THE STEEL SUPPLY COMPANY

Theoretical Weights of Carbon Steel Bars

Diameter	Decimal Equivalent	12’ Bar	24’ Bar
1-7/8”	01.8750	113	225
1-15/16”	01.9375	120	241
2”	02.0000	128	256
2-1/8”	02.1250	145	289
2-3/16”	02.1875	153	307
2-1/4”	02.2500	162	324
2-3/8”	02.3750	181	361
2-7/16”	02.4375	190	381
2-1/2”	02.5000	200	401
2-5/8”	02.6250	221	442
2-11/16”	02.6875	231	463
2-3/4”	02.7500	242	485
2-7/8”	02.8750	265	530
2-15/16”	02.9375	276	553
3”	03.0000	288	577
3-1/8”	03.1250	313	626
3-3/16”	03.1875	326	651
3-1/4”	03.2500	338	677
3-3/8”	03.3750	365	730
3-7/16”	03.4375	378	757
3-1/2”	03.5000	392	785
3-5/8”	03.6250	421	842
3-11/16”	03.6875	436	871
3-3/4”	03.7500	451	901
3-15/16”	03.9375	497	993
4”	04.0000	513	1025
4-3/16”	04.1875	562	1124

THE STEEL SUPPLY COMPANY

Theoretical Weights of Carbon Steel Bars

Diameter	Decimal Equivalent	12’ Bar	24’ Bar
4-1/4”	04.2500	631	1262
4-1/2”	04.5000	649	1298
4-11/16”	04.6875	704	1408
4-3/4”	04.7500	723	1446
4-15/16”	04.9375	781	1562
5”	05.0000	801	1602
5-1/4”	05.2500	883	1766
5-7/16”	05.4375	947	1895
5-1/2”	05.5000	969	1938
5-3/4”	05.7500	1059	2119
5-15/16”	05.9375	1130	2259
6”	06.0000	1153	2307
6-7/16”	06.4375	1328	N/A
6-1/2”	06.5000	1354	2707
6-15/16”	06.9375	1542	3084
7”	07.0000	1570	3140
7-7/16”	07.4375	1772	3545
7-1/2”	07.5000	1802	3605
7-15/16”	07.9375	2019	4037
8”	08.0000	2051	4101
8-1/2”	08.5000	2315	4630
9”	09.0000	2595	5190
10”	10.0000	3204	6408
11”	11.0000	3876	N/A
12”	12.0000	4614	N/A
14”	14.0000	6280	N/A

THE STEEL SUPPLY COMPANY

Theoretical Weights of Carbon Steel Bars – MM Diameters

MM Diameter	Decimal Equivalent	12’ Bar	24’ Bar
6	00.2362	1.79	N/A
8	00.3150	3.18	N/A
10	00.3937	4.97	N/A
12	00.4724	7.15	N/A
13	00.5118	8.39	N/A
14	00.5511	9.73	N/A
15	00.5906	11.1	N/A
16	00.6299	12.7	N/A
17	00.6693	14.4	N/A
18	00.7087	16.1	N/A
19	00.7480	17.9	N/A
20	00.7874	19.9	N/A
22	00.8661	24.0	N/A
25	00.9843	31.0	N/A
28	01.1024	38.9	77.9
30	01.1811	44.7	89.4
31	01.2205	47.7	95.5
32	01.2598	50.9	101
33	01.2992	54.0	108
35	01.3780	60.8	122
36	01.4173	64.4	129
40	01.5748	79.5	159
42	01.6535	87.6	175
45	01.7716	101	201
48	01.8900	114	229
50	01.9685	124	248

THE STEEL SUPPLY COMPANY

Theoretical Weights of Carbon Steel Bars – MM Diameters

MM Diameter	Decimal Equivalent	12' Bar	24' Bar
52	02.0472	134	269
55	02.1654	150	300
60	02.3622	179	358
65	02.5591	210	420
70	02.7559	243	487
75	02.9528	279	559
80	03.1496	318	636
85	03.3465	359	718
90	03.5433	402	805
95	03.7402	448	896
100	03.9370	497	993
105	04.1339	548	1095
110	04.3307	601	1202
115	04.5276	657	1314
120	04.7244	715	1430
125	04.9213	776	1552
130	05.1181	839	1679
135	05.3150	905	1810
140	05.5118	973	1947
145	05.7087	1044	2088
150	05.9055	1117	2235
160	06.2992	1271	2543
170	06.6929	1435	2870
180	07.0866	1609	3218
190	07.4803	1793	3586
200	07.8740	1986	3973

THE STEEL SUPPLY COMPANY

Calculations

TUBING WEIGHT PER FOOT is calculated by taking the O.D. and subtracting the wall thickness. This figure is then multiplied by the wall thickness with that result again multiplied by 10.68 to determine the tube weight per foot. Example: 2" O.D. tube with a ¼" (0.250") wall. Start with 2.000 minus .250, then multiply by .250, then multiply again by 10.68. The result should be 4.6725 pounds per foot.

MILLIMETERS TO INCHES is determined by multiplying the MM diameter by .03937" Example: 12mm. Start with 12 and multiply by .03937". The result is 0.4724" which is the conversion from metric to standard U.S. measurement.

KILOGRAMS TO POUNDS can be determined by multiplying the kilograms by the number 2.2046. Example: 5 kilogram. Multiply 5 by 2.2046. The result is 11.023 pounds.

METRIC TONNES TO U.S. TONS can be determined by multiplying the metric tonnes by 1.1023. Example: 4 metric tonnes. Multiply 4 by 1.1023. The result is 4.4092 U.S. tons, or 8,818.4 pounds.

BARLOW'S THEORETICAL BURSTING AND BULGING PRESSURE FOR TUBING: For theoretical bursting pressures, use tensile values; for theoretical bulging pressures, use yield values. The formula is P=2ST/D where P = Internal Pressure in PSI; S = fiber stress of tube in PSI; T = wall thickness in inches; and D = Outside diameter in inches.

THE STEEL SUPPLY COMPANY

Hardness Conversion Tables

(Approximate)

Brinell Hardness	Rockwell B Scale	Rockwell C Scale	Prox Tensile PSI
653	N/A	62	324,000
627	N/A	60	311,000
578	N/A	57	290,000
555	N/A	56	284,000
534	N/A	54	270,000
477	N/A	50	243,000
415	N/A	45	211,000
375	N/A	40	182,000
331	N/A	36	162,000
321	N/A	34	153,000
311	N/A	33	148,000
302	N/A	32	144,000
285	N/A	30	136,000
269	N/A	28	129,000
255	N/A	25	120,000
241	100	23	115,000
235	99	22	112,000
229	98	21	110,000
223	97	20	108,000
207	95	N/A	101,000
202	94	N/A	98,000
183	90	N/A	89,000
149	81	N/A	75,000

THE STEEL SUPPLY COMPANY

Metric Tolerance Designations – English Equivalents

		Nominal diameter in mm							
Tolerance	**Deviation**	**Over 6**	**Over 10**	**Over 18**	**Over 30**	**Over 40**	**Over 50**	**Over 65**	**Over 80**
Zone		**incl. 10**	**incl. 18**	**incl. 30**	**incl. 40**	**incl. 50**	**incl. 65**	**incl. 80**	**incl. 100**
a12	upper	-0.0110	-0.0011	-0.0118	-0.0122	-0.0126	-0.0134	-0.0142	-0.0150
a12	lower	-0.0170	-0.0185	-0.0201	-0.0220	-0.0224	-0.0252	-0.0260	-0.0287
a13	upper	-0.0110	-0.0114	-0.0118	-0.0122	-0.0126	-0.0134	-0.0142	-0.0150
a13	lower	-0.0197	-0.0228	-0.0248	-0.0276	-0.0280	-0.0315	-0.0323	-0.0362
c12	upper	-0.0031	-0.0037	-0.0043	-0.0047	-0.0051	-0.0055	-0.0059	-0.0067
c12	lower	-0.0091	-0.0108	-0.0126	-0.0146	-0.0150	-0.0173	-0.0181	-0.0205
d6	upper	-0.0016	-0.0020	-0.0026	-0.0031	-0.0031	-0.0039	-0.0039	-0.0047
d6	lower	-0.0019	-0.0024	-0.0031	-0.0039	-0.0039	-0.0047	-0.0047	-0.0056
e6	upper	-0.0010	-0.0013	-0.0016	-0.0020	-0.0020	-0.0024	-0.0024	-0.0028
e6	lower	-0.0013	-0.0017	-0.0021	-0.0027	-0.0027	-0.0031	-0.0031	-0.0037
e7	upper	-0.0010	-0.0013	-0.0016	-0.0020	-0.0020	-0.0024	-0.0024	-0.0028
e7	lower	-0.0016	-0.0020	-0.0024	-0.0030	-0.0030	-0.0035	-0.0035	-0.0042
e12	upper	-0.0010	-0.0013	-0.0016	-0.0020	-0.0020	-0.0024	-0.0024	-0.0028
e12	lower	-0.0069	-0.0083	-0.0102	-0.0118	-0.0118	-0.0142	-0.0142	-0.0166
f5	upper	-0.0005	-0.0007	-0.0008	-0.0010	-0.0010	-0.0012	-0.0012	-0.0014
f5	lower	-0.0007	-0.0009	-0.0011	-0.0014	-0.0014	-0.0017	-0.0017	-0.0020
f6	upper	-0.0005	-0.0006	-0.0008	-0.0010	-0.0010	-0.0012	-0.0012	-0.0014
f6	lower	-0.0009	-0.0011	-0.0013	-0.0016	-0.0016	-0.0019	-0.0019	-0.0023
f7	upper	-0.0005	-0.0006	-0.0008	-0.0010	-0.0010	-0.0012	-0.0012	-0.0014
f7	lower	-0.0011	-0.0013	-0.0016	-0.0020	-0.0020	-0.0024	-0.0024	-0.0028
g5	upper	-0.0002	-0.0002	-0.0003	-0.0004	-0.0004	-0.0004	-0.0004	-0.0005
g5	lower	-0.0004	-0.0006	-0.0006	-0.0008	-0.0008	-0.0009	-0.0009	-0.0011
g6	upper	-0.0002	-0.0002	-0.0003	-0.0004	-0.0004	-0.0004	-0.0004	-0.0005
g6	lower	-0.0006	-0.0007	-0.0008	-0.0010	-0.0010	-0.0011	-0.0011	-0.0013
g7	upper	-0.0002	-0.0002	-0.0003	-0.0003	-0.0003	-0.0004	-0.0004	-0.0005
g7	lower	-0.0008	-0.0009	-0.0011	-0.0013	-0.0013	-0.0016	-0.0016	-0.0019

All tolerances listed to the plus (+) side unless indicated with a minus (-) sign.

THE STEEL SUPPLY COMPANY

Metric Tolerance Designations – English Equivalents

		Nominal diameter in mm							
Tolerance	**Deviation**	**Over 6**	**Over 10**	**Over 18**	**Over 30**	**Over 40**	**Over 50**	**Over 65**	**Over 80**
Zone		**incl. 10**	**incl. 18**	**incl. 30**	**incl. 40**	**incl. 50**	**incl. 65**	**incl. 80**	**incl. 100**
h5	upper	0	0	0	0	0	0	0	0
h5	lower	-0.0002	-0.0003	-0.0004	-0.0004	-0.0004	-0.0005	-0.0005	-0.0006
h6	upper	0	0	0	0	0	0	0	0
h6	lower	-0.0004	-0.0004	-0.0005	-0.0006	-0.0006	-0.0007	-0.0007	-0.0009
h7	upper	0	0	0	0	0	0	0	0
h7	lower	-0.0006	-0.0007	-0.0008	-0.0010	-0.0010	-0.0012	-0.0012	-0.0014
h8	upper	0	0	0	0	0	0	0	0
h8	lower	-0.0009	-0.0011	-0.0013	-0.0015	-0.0015	-0.0019	-0.0019	-0.0021
h9	upper	0	0	0	0	0	0	0	0
h9	lower	-0.0014	-0.0017	-0.0020	-0.0024	-0.0024	-0.0029	-0.0029	-0.0034
h10	upper	0	0	0	0	0	0	0	0
h10	lower	-0.0023	-0.0028	-0.0033	-0.0039	-0.0039	-0.0047	-0.0047	-0.0055
h11	upper	0	0	0	0	0	0	0	0
h11	lower	-0.0035	-0.0043	-0.0051	-0.0059	-0.0059	-0.0075	-0.0075	-0.0087
h13	upper	0	0	0	0	0	0	0	0
h13	lower	-0.0087	-0.0106	-0.0130	-0.0154	-0.0154	-0.0181	-0.0181	-0.0213
j5	upper	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
j5	lower	-0.0001	-0.0001	-0.0002	-0.0002	-0.0002	-0.0003	-0.0003	-0.0004
j6	upper	0.0003	0.0003	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005
j6	lower	-0.0001	-0.0001	-0.0002	-0.0002	-0.0002	-0.0003	-0.0003	-0.0004
j7	upper	0.0004	0.0005	0.0005	0.0006	0.0006	0.0007	0.0007	0.0008
j7	lower	-0.0002	-0.0002	-0.0003	-0.0004	-0.0004	-0.0005	-0.0005	0.0006
js5	upper	0.0001	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003
js5	lower	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0003	-0.0003	-0.0003
js6	upper	0.0002	0.0002	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004
js6	lower	-0.0002	-0.0002	-0.0003	-0.0003	-0.0003	-0.0004	-0.0004	-0.0004

All tolerances listed to the plus (+) side unless indicated with a minus (-) sign.

THE STEEL SUPPLY COMPANY

Metric Tolerance Designations – English Equivalents

		Nominal diameter in mm							
Tolerance	**Deviation**	**Over 6**	**Over 10**	**Over 18**	**Over 30**	**Over 40**	**Over 50**	**Over 65**	**Over 80**
Zone		**incl. 10**	**incl. 18**	**incl. 30**	**incl. 40**	**incl. 50**	**incl. 65**	**incl. 80**	**incl. 100**
js7	upper	0.0003	0.0004	0.0004	0.0005	0.0005	0.0006	0.0006	0.0007
js7	lower	-0.0003	-0.0004	-0.0004	-0.0005	-0.0005	-0.0006	-0.0006	-0.0007
k5	upper	0.0003	0.0004	0.0004	0.0005	0.0005	0.0006	0.0006	0.0007
k5	lower	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
k6	upper	0.0004	0.0005	0.0006	0.0007	0.0007	0.0008	0.0008	0.0010
k6	lower	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
k7	upper	0.0006	0.0007	0.0009	0.0011	0.0011	0.0013	0.0013	0.0015
k7	lower	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
m5	upper	0.0005	0.0006	0.0007	0.0008	0.0008	0.0009	0.0009	0.0011
m5	lower	0.0002	0.0003	0.0003	0.0004	0.0004	0.0004	0.0004	0.0005
m6	upper	0.0006	0.0007	0.0008	0.0010	0.0010	0.0012	0.0012	0.0015
m6	lower	0.0002	0.0003	0.0003	0.0004	0.0004	0.0004	0.0004	0.0005
m7	upper	0.0008	0.0010	0.0011	0.0013	0.0013	0.0016	0.0016	0.0019
m7	lower	0.0002	0.0003	0.0003	0.0004	0.0004	0.0004	0.0004	0.0005
n5	upper	0.0006	0.0008	0.0010	0.0011	0.0011	0.0013	0.0013	0.0015
n5	lower	0.0004	0.0005	0.0006	0.0007	0.0007	0.0008	0.0008	0.0009
n6	upper	0.0007	0.0009	0.0011	0.0013	0.0013	0.0015	0.0015	0.0018
n6	lower	0.0004	0.0005	0.0006	0.0007	0.0007	0.0008	0.0008	0.0009
n7	upper	0.0010	0.0012	0.0014	0.0017	0.0017	0.0024	0.0024	0.0026
n7	lower	0.0004	0.0005	0.0006	0.0007	0.0007	0.0008	0.0008	0.0009
p5	upper	0.0008	0.0010	0.0012	0.0015	0.0015	0.0018	0.0018	0.0020
p5	lower	0.0006	0.0007	0.0009	0.0010	0.0010	0.0013	0.0013	0.0015
p6	upper	0.0009	0.0011	0.0014	0.0017	0.0017	0.0020	0.0020	0.0023
p6	lower	0.0006	0.0007	0.0009	0.0010	0.0010	0.0013	0.0013	0.0015
p7	upper	0.0012	0.0014	0.0017	0.0024	0.0024	0.0024	0.0024	0.0028
p7	lower	0.0006	0.0007	0.0009	0.0010	0.0010	0.0013	0.0013	0.0015

All tolerances listed to the plus (+) side unless indicated with a minus (-) sign.

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Miscellaneous Helpful Information

GUN DRILLING: The Steel Supply Company offers gun drilling services on through or blind drill requirements. The standard tolerances for gun drilling require .001" of concentricity/drift per 1" of depth. When items are drilled from both ends, there is the possibility of a slight mismatch at the center of the shaft. All bar materials, including Electreat products, may be gun drilled. A drawing is generally required for quotation purposes.

TUBE OVALITY: Ovality is defined in ASTM A513 for DOM tubular products and in A519 for Seamless tubular products. It should be noted also that when the wall thickness is less than 3% of the diameter additional ovality should be expected. This is especially apparent in thin wall Chrome Plated I.D. tube products.

HARDNESS: Alloy bars are only offered in the quench & temper, stress relief annealed condition. Annealed only items are not carried. Precipitation Hardness is limited to Type 630 Stainless Steel – also known as 17-4PH, and is carried only in Condition H-1150.

STRAIGHTNESS: The producing mills will only produce materials to the applicable ASTM straightness limits. As a processor, we require closer than standard straightness in order to grind or hone. Operations that affect bar straightness include induction hardening and certain milling operations such as keyways. Tube straightness exceeds bar tolerances and often requires a straightness process in order to properly process the material. While we do our best to offer special straight material, we can only guarantee those limits established by the ASTM or Producing Mill specifications.

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Limitations of Inspection and Testing

There are many essential features in steel making. These also would apply to machining or processing. Some of these processes may alter or change the properties of the steel bar or tube. This results in being unable to offer unconditional assurance that each and every bar or tube, even if from the same heat lot, will be in exact conformance with another bar or tube.

Processes that might alter the properties include welding, machining, heat treating, grinding, and many others. Perhaps the most damage to a bar or tube occurs during assembly, loads not intended for the specific grade, or just misuse.

Quality issues should always be addressed prior to any fabrication. This includes conformance to purchase order requirements, straightness, finish, tolerance, etc. Industry standards do not allow for a claim against materials once cut or otherwise processed which could alter the properties defines on the material test report.

Responsibility for all items must remain with the end user who is more knowledgeable of the fabricating processes, end use, and operation of the part.

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Terms and Conditions of Sale: General Trade Customs.

Rejection of Materials/Services: Special finish material requires immediate inspection upon receipt. This includes unpacking and oiling, if necessary. Acceptance of materials/services by Customer shall automatically occur after receipt, by Customer, of purchase order goods. Claims must be presented to Seller in writing within 10 days of receipt. After 10 calendar days, claims will be denied.

Quotations: All quotations are subject to change without notice, subject to prior sale, and unless agreed are binding only for immediate acceptance. All sales are made subject to strikes, accidents, or other causes beyond our control. We reserve the privilege to cancel contracts upon which full specifications have not been given within reasonable time.

Confirmation Orders: Confirming orders should be marked "CONFIRMING" or similar. Orders not so marked may be duplicated. In such cases we will not be responsible for expenses incurred.

Deliveries: Promise of shipment is estimated as carefully as possible and although we do our best to ship within the time mentioned, we cannot guarantee to do so. ***SPECIAL PROCESSED MATERIAL IS NOT SUBJECT TO CANCELLATION WITHOUT OUR WRITTEN CONSENT.***

Technical Advice: Our employees, representatives or agents have no authority to bind us to any representation or warranty other than descriptions detailed on the packing list of invoice. Any technical advice furnished is provided at no charge and we assume no liability or obligation for advice offered to results obtained. All advice is accepted at Customer's risk. By placing an order with us, Customer affirms no reliance on the skill or judgment of any employee.

Payment: Invoices are due thirty (30) days from date of issue. Visa, MasterCard, Discover, C.O.D., and C.I.A. options are offered. Customer is responsible for any related collection costs or legal fees. All credit card sales are final.

Warranty: There are no warranties, expressed or implied, except that all goods shall conform to the description contained on our sales order form and further defined by the producing mill test report or certificate of compliance. By placing an order with us, Customer affirms no reliance on the skill or judgment of any employee, sales representative or agent of The Steel Supply Company. Customer is responsible for the final selection of all material or service.

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Conclusion

Thank you for your interest in the products and services offered by The Steel Supply Company.

The information and data in this Buyer's Guide are values obtained on typical lots of material and are accurate to the best of our knowledge and belief. They are meant to, and should only, be used for general information purposes. The actual utilization of this information is the sole responsibility of the user of this Buyer's Guide or the purchaser of these products and services. The data listed has been collected using standard or accepted testing methods. They are not guarantees.

Why Choose The Steel Supply Company?

- 11,000 individual SKUs in many grades and finishes.
- In stock availability above 95%.
- Same day shipping on orders in the early morning.
- International service.
- Export packaging when required.
- Metric and Imperial diameters and wall thicknesses.
- All products may be cut to length.
- More than a century of product integrity and customer service.
- Winner of many service awards and honors.

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Notes

This data book is subject to a $10.00 per copy charge.

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