FAIRBANKS MORSE
DEFENSE

FEDERAL
EQUIPMENT CO.

Specialized Weapons & Material Handling Equipment Product Catalog

federalequipment.com

Specialized Weapons & Material Handling Equipment

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Federal Equipment Co. Overview

Fairbanks Morse Defense (FMD) and Federal Equipment Company (FEC) are a leading supplier for marine deck machinery and specialized weapons and material handling systems. Through the years the company has emerged into an internationally recognized organization with extensive expertise in marine design/engineering and manufacturing of critical shipboard systems.

Our early projects dealt with re-engineering various deck machinery products with a focus on field service and parts. Over time, FEC has grown into a primary OEM providing deck systems including elevators, conveyors, dumbwaiters, cranes, hoists, lifts, winches, doors, and more. Additionally, our global presence has demanded maintaining service teams capable of being anywhere to ensure our customers fast, efficient, and reliable services.

FMD – Overview

Stacking the decks with best-in-class marine technologies and service solutions. Fairbanks Morse Defense has mastered that balance over more than a century, configuring the delivery of every customer engagement to meet the needs of the moment. We deliver an advantage to the U.S. Fleet with a growing array of best-in-class marine technologies, OEM parts, and turnkey services – all from a single, trusted source.

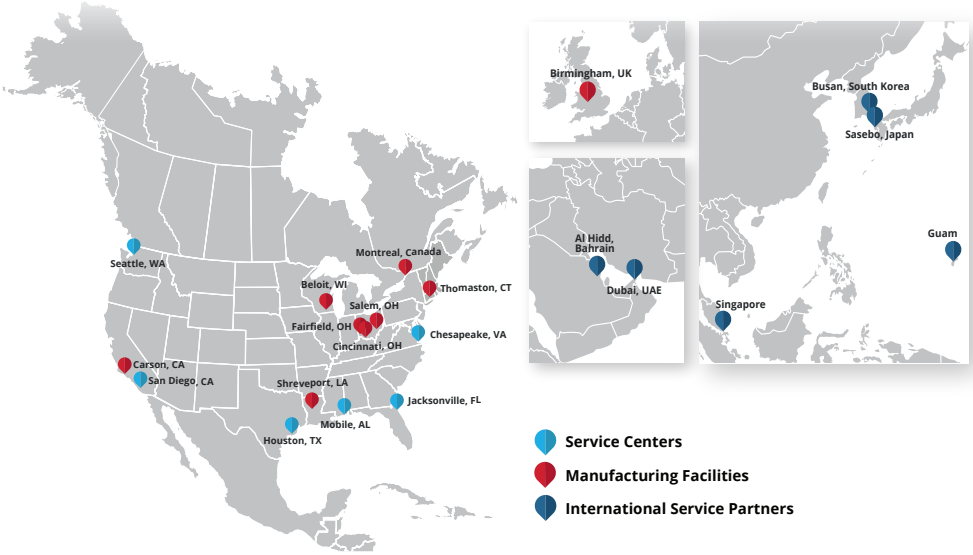
FEC Facilities Overview

- HQ in Cincy 80,000 SF, machine shop, fab shop, high bay, Eng/PM/Admin
- Two 30,000 SF plants, fab shop, high bay, crane access, conveyor/hangar door fab/test
- Additional plant expansions underway, ~50,000+ SF (Assembly) & ~40,000+ SF (Warehouse)
- Complete machining capabilities for milling, turning, grinding, & gear manufacturing
- CNC Lathes, Horizontal/Vertical Machining Centers, Jig Boring, Wire EDM, & OD Grinding Machines
- Fabrication capabilities including welding and metal working (e.g., CRES, Al, Ni-Cu, HY's, HSLA, etc.)
- Multiple state of the art CNC Machining Centers, continuous upgrades with new machine procurements
- Mil-spec qualified welders/NDT (e.g., MIG, TIG, stick, flux core, VT, PT, MT, etc.)
- Sheering, Bending, Punching, Rolling & many other fabrication capabilities
- Quality IAW ISO 9001(QA tools include ZEISS CMM Machine & FARO Laser Tracker)
- Specialized Eng/Design team, from complex developmental systems to BTP (3D modeling, FEA, Shock/DDAM, Controls, FAT quals, etc.)

Primary CNC Machines

- MC1210
- Viper 3150
- Haas EC1600
- Haas VF3
- Haas VF6
- Haas TM 2P
- Doosan DMN 5700
- Vision Wide
- Union Floor Mill

Our Locations



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American Fan
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Federal Equipment Co.
Phone: 1-877-435-4723

Hunt Valve Company
Phone: 1-800-321-2757

Maxim Watermakers
Phone: 1-318-629-2460

Research Tool & Die Works
Phone: 1-310-639-5722

Ward Leonard
Phone: 1-860-283-5801

Welin Lambie
Phone: +44 1384-78294

WEAPONS & MATERIAL HANDLING SOLUTIONS

ADVANCED WEAPONS ELEVATOR (AWE)

The Advanced Weapons Elevator (AWE) was developed collaboratively working with MagneMotion and key stakeholders from Newport News Shipbuilding and NAVSEA. Originating as a concept during the early phases of new aircraft carrier design studies intending to replace the Nimitz class carriers, the design was eventually selected for the CVN 78 Ford Class.

The main goal of the new weapons elevator was to improve the rate of weapons movement on the ship from magazines to the topside and visa-versa, commonly referred to as strike-up and strike-down. The AWE consists of a ropeless elevator system utilizing linear synchronous motors (LSM), advanced control systems, wireless technology, as well as many other innovative subsystems.

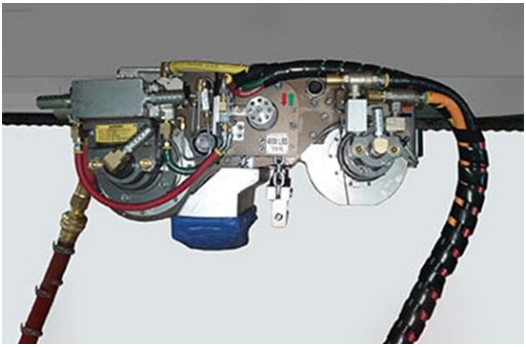
The initial AWE design endured extreme qualification trials including shock, vibration, and EMI tests along with extensive load and reliability testing. Ultimately, the AWE system successfully achieved the 24,000 pound rated load capacity and 150 feet per minute speed requirement exceeding the legacy system capacity and speed by over 200% and 150%, respectively.

HOISTS

FMD has become the Navy's leading choice for specialized hoists utilized for critical handling of various weapons and cargo. Our hoists can be found throughout weapons magazines and aviation maintenance spaces on aircraft carriers and amphibious ships.

Most notably, FEC's development and production of a new concept, low headroom trolley type pneumatic hoist helped to resolve a fleet wide obsolescence issue. These hoists are typically used to facilitate weapons assembly and transfer onboard the ship. As such, they undergo extreme qualification and load testing including shock and vibration testing.

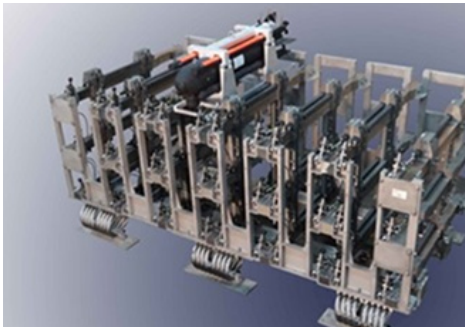
Additionally, we can furnish a variety of hoists for shipboard applications in accordance with customer requirements. Manual chain hoists, electric hoists, wire rope or chain, of varying capacities and lifts can also be provided. Related hoisting accessories such as pendant controls, monorails, turntables, and track clamps can be included upon request. All hoist components whether air, electric, or manual powered are tested and certified in accordance with applicable specifications.



SURFACE MINE NEUTRALIZATION SYSTEMS (SMNS)

To supplement FEC's variety of Navy weapons handling equipment (WHE), our specialized weapons design team developed the storage and handling system for the Surface Mine Neutralization System (SMNS) working with Lockheed Martin Corporation. Implemented on mine counter measure (MCM) vessels such as the Avenger Class ships, the system is utilized to stow the SeaFox unmanned underwater vehicle (UUV). The SeaFox UUV's are deployed primarily for mine disposal as well as intelligence and surveillance missions.

The SeaFox storage and handling system consists of two main components, the rack and the hoist. The rack assembly provides safe and efficient stowage for the SeaFox and is fully shock qualified in accordance with MIL-S-901. The robust design is completely marinized incorporating shock isolation mounts to sustain the extreme forces of a shock event as well as sea states. The hoist assembly is utilized to lift and transport the SeaFox UUV's in preparation for launch. The motors are pneumatically operated with one motor to raise/lower the vehicle and another to traverse the space. The SeaFox drones are stored in two separate spaces so two hoists are required along with 3 unique racks per shipset.

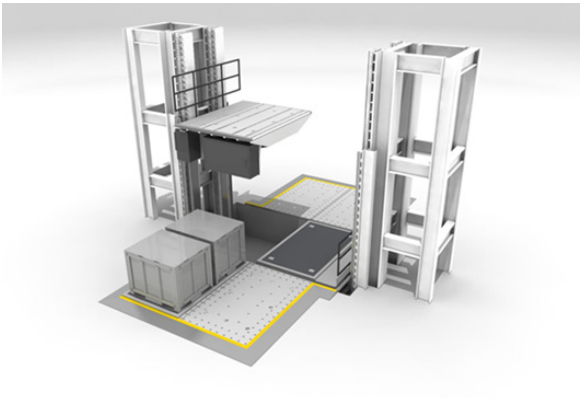


AUTOMATED SHIPBOARD MATERIAL HANDLING

As an innovative leader in shipboard material handling systems, FEC has been a key contributor to an Office of Naval Research (ONR) led consortium focused on automating cargo transfer and stowage onboard the ship with the goals of reducing manpower and improving material flow rates. As part of a five-year program, we designed and developed a working prototype to automate shipboard material handling, referred to as High Rate Vertical to Horizontal Material Movement (HRVHMM).

The HRVHMM system incorporates linear motors for both horizontal and vertical propulsion of an aluminum payload carrier rated to handle loads up to 6,000 pounds. The automated loading and unloading of the elevator coupled with a split elevator platform design helps alleviate many of the bottlenecks experienced by ships force during replenishment operations by smoothly transferring cargo from the storeroom horizontally to the elevator for vertical transport. Along with these additional capabilities, the ship can maintain the benefit of using the system as a conventional elevator as required.

The system consisted of one cantilevered split elevator platform with horizontal material movement in both the fore/aft and athwartship directions. With continued support from the ONR sponsored team, FEC modified and installed the HRVHMM on the USNS Washington Chambers (T-AKE 11) for operational sea trial testing.



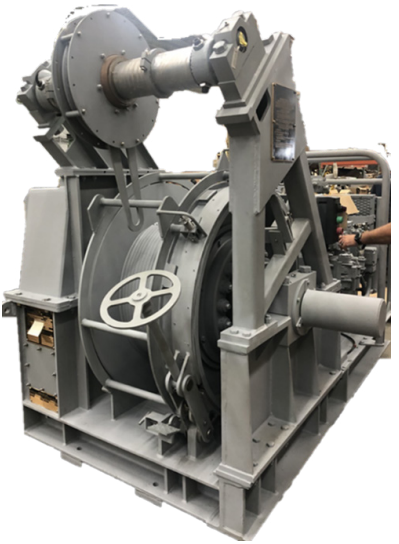
DECK MACHINERY SOLUTIONS

CAPSTANS

Used on the ship for mooring or warping operations, the capstan consists of a vertically mounted capstan head of varying diameters that is rotated usually electromechanically (or hydraulically) in order to apply a load/force on the mooring ropes or cables. FEC has furnished capstans to various shipbuilders for U.S. Navy and Coast Guard vessels and continues to expand this product line having added the Virginia Class Submarine (VCS) capstans to our commodities list.

WINCHES

Similar to capstans in some respects, winches usually involve a rotating drum which also allow stowage of ropes or cables. FEC furnishes a variety of Navy standard winches in accordance with build-to-print NAVSEA drawings including gypsy, saddle, spanwire, anti-slack device (ASD), barricade, and stern dock winch assemblies.



SLIDING PADEYES

Navy standard Underway Replenishment (UNREP) gear such as Sliding Padeyes (SPE's) and/or Kingposts manufactured in accordance with NAVSEA build-to-print (BTP) drawings fit well into FEC's deck machinery catalog. FEC can also manufacture BTP related products to help facilitate UNREP operations (e.g., snatch blocks, special fittings & rigging, etc.)

DUMBWAITERS

FEC is the leading provider of dumbwaiters for Navy shipboard use. Dumbwaiters of a variety of sizes, capacities, and travel lengths can be found on many U.S. Navy ship classes.

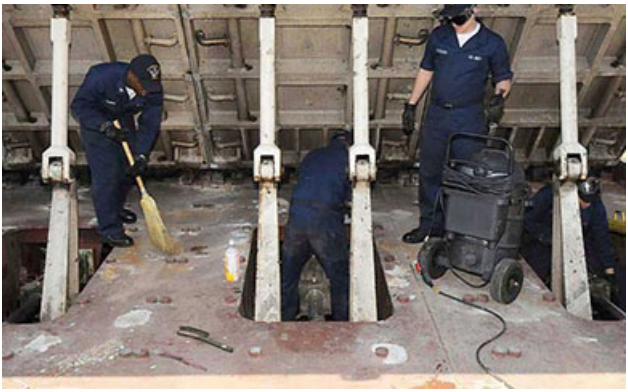
CONVEYORS & ELEVATORS

For decades, FEC has been the go-to supplier for complex cargo handling systems coupled with a long history providing elevator and conveyor field service and parts to the Navy, Coast Guard and shipbuilders. Whether handling pallets of missiles, bombs or beans, FEC is the leading choice to design, develop and meet the customers' lifting requirements. Most noteworthy is FEC's lead role as the primary supplier of the Advanced Weapons Elevator (AWE) for the new Ford Class aircraft carrier (See AWE section). FEC is also actively involved in other various lift systems on different ship platforms including an ammunition lift system for the new DDG Class.

AIRCRAFT LAUNCH & RECOVERY EQUIPMENT (ALRE)/AVIATION SUPPORT

JBD MANIFOLDS

On aircraft carriers, one of the more distinguishable features on the flight deck is the catapult system's JBD. JBDs are deployed during flight operations while launching aircraft from the catapults. The JBD panels are raised and lowered to provide protection to adjacent aircraft and flight deck personnel from jet blast as taxing aircraft await the pending catapult launch. In order to sustain the significant heat generated by the jet blast, the JBDs are outfitted with cooling modules and manifolds that circulate sea water pumped up from below decks. FEC is a key contributor to aircraft launch and recovery equipment (ALRE) as one of only a couple qualified suppliers to manufacture the JBD Manifolds.



AVIATION GROUND SUPPORT EQUIPMENT

Our expertise extends to other branches of the military, having furnished common ground support equipment (GSE) for the US Army and Air Force. Aviation GSE is utilized to assist in the transport, maintenance and service of aircraft in between flights. FEC has manufactured and tested jet engine trailers and helicopter engine maintenance stands consisting of various steel and aluminum weldment assemblies in accordance with the stringent requirements necessary for handling flight critical engines/components.

HULL CLOSURES/DOORS

LITTORAL COMBAT SHIPS (LCS) ROLLER CURTAIN DOORS

FEC designed and manufactured the helicopter hangar doors for the LCS Independence variant. These doors are also manufactured from aluminum and rated for 40 psf wind load. These port and starboard roller curtain door assemblies meet all the LCS specification requirements including shock and EMI qualifications.

“DEEPWATER” NATIONAL SECURITY CUTTERS (NSC) ROLLER CURTAIN DOORS

The NSC Class ships also prominently display FEC helicopter hangar doors on the flight deck. These heavy duty helicopter hangar door systems are an all-aluminum construction rated to sustain a 40 psf wind loading.

T-AKE CLASS SHIPS ROLLER CURTAIN DOORS

FEC furnished all fourteen shipsets of the T-AKE hangar door assemblies. These doors consisted of flight deck/cargo doors with stainless steel roller curtains as well as helicopter hangar door assemblies rated at 60 psf.

FEC also produced the A-60 rated “Fire Doors” for the T-AKE class ships. The fire doors are electromechanically operated solid panels and are utilized to separate the helicopter hangar area from the interior cargo handling spaces. The doors are fabricated using steel plate with A-60 fire rated insulation applied between the vertical and horizontal door stiffeners. An expandable “fire seal” is present around the perimeter of each door to provide a seal with the adjoining bulkhead to prevent the passing of heat and smoke in the event of fire. These doors have been fully tested and certified to meet the A-60 fire door rating requirements.

HELICOPTER HANGARS

Federal Equipment Company has emerged as a leader in supplying, repairing and installing vertical rolling doors for both the United States Coast Guard and Navy. Federal Equipment Company supplies all repair parts for the helicopter hangar doors either directly from the OEM or manufactured in-house to exceed OEM requirements.

CONTROLS

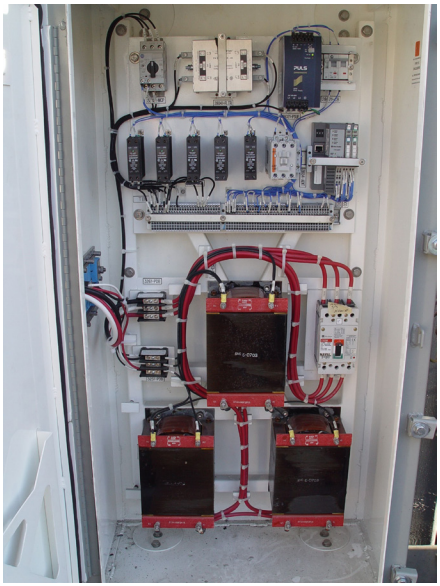
HUMAN MACHINE INTERFACE (HMI)

One of the more notable features on FEC's Advanced Weapons Elevator (AWE) system is the first fully qualified Human Machine Interface (HMI) Operator Stations. These unique panels are the first touchscreens implemented on an aircraft carrier that have successfully undergone all the exhaustive tests to meet EMI, shock, and vibration requirements necessary for use in a shipboard weapons system. The HMI provides a user-friendly multi-screen interface while allowing more panels and data to be displayed at multiple deck locations simultaneously in a much more compact space relative to traditional panels. The software-based HMI application also permits added flexibility, troubleshooting and maintenance capabilities.

Adaptable for use in other material and weapons handling systems, the HMI operator stations increase ship's force control and communication as well as system monitoring and diagnostics to maximize operational functionality and readiness.

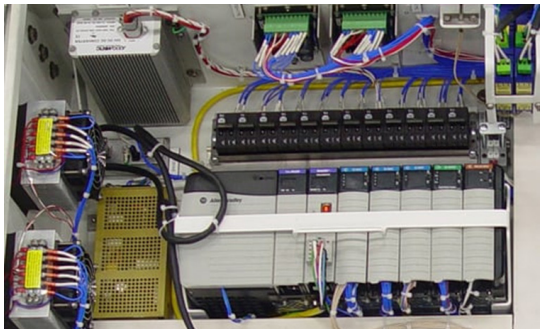
CONTROL PANELS

Motor controllers, operator stations, power panels, disconnect switches/ panels, and junction boxes can all be furnished by FEC in accordance with the invoked electrical system specifications. FEC has significant experience with electrical enclosures of all kinds and can perform the electrical design, assembly and testing required to ensure our deck machinery meets the fit, form and function desired for Navy shipboard use.



PROGRAMMABLE LOGIC CONTROLLERS (PLCs)

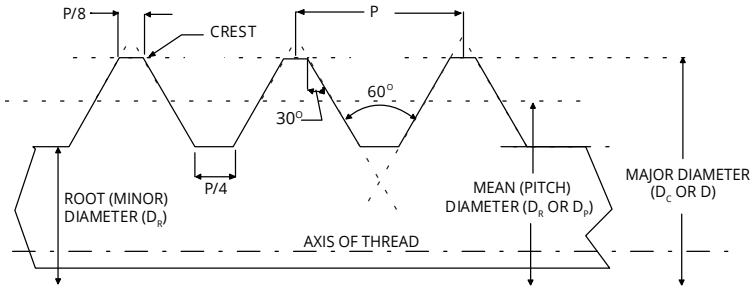
Today many shipboard systems have increased automation requiring digital controls, solid state relays in lieu of electromechanical relays, and invoke PLCs for increased service life, reliability, flexibility, and compatibility with newer technology. FEC has a solid background incorporating PLCs in weapons and material handling systems, particularly in the elevator and conveyor arena.



RESOURCES

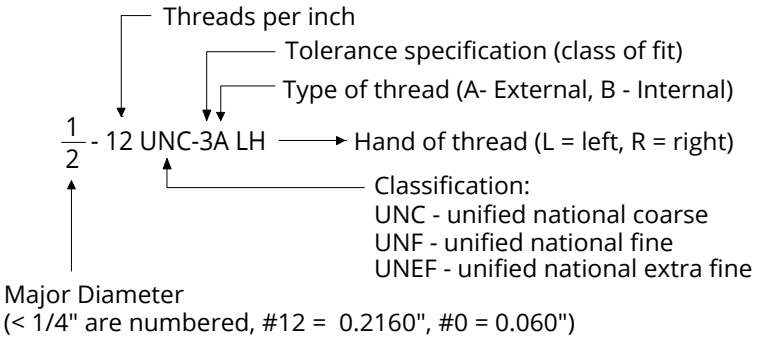
THREAD STANDARDS

UNIFIED AND ISO THREAD GEOMETRY

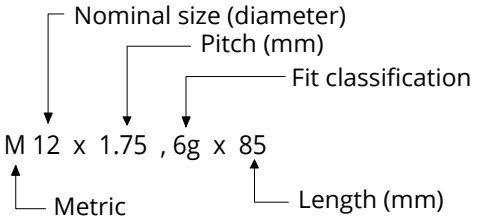


CLASS	UNIFIED EXTERNAL THREAD	UNIFIED INTERNAL THREAD	METRIC EXTERNAL THREAD	METRIC INTERNAL THREAD
LOOSE	1A	1B	8G	7H
STANDARD	2A	2B	6G	6H
CLOSE	3A	3B	4G	5H

UNIFIED NATIONAL:



METRIC:



THREAD DIMENSIONS
AND TAP DRILL SIZES

Size	Threads Per Inch		Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Tap Drill Approx. 75% Full Thread	Decimal Equiv. Of Tap Drill
	NC UNC	NF UNF					
0	—	80	.0600	.0519	.0438	3/64″	.0469
1	64	—	.0730	.0629	.0527	53	.0595
1	—	72	.0730	.0640	.0550	53	.0595
2	56	—	.0860	.0744	.0628	50	.0700
2	—	64	.0860	.0759	.0657	50	.0700
3	48	—	.0990	.0855	.0719	47	.0785
3	—	56	.0990	.0874	.0758	46	.0810
4	40	—	.1120	.0958	.0795	43	.0890
4	—	48	.1120	.0985	.0849	42	.0935
5	40	—	.1250	.1088	.0925	38	.1015
5	—	44	.1250	.1102	.0955	37	.1040
6	32	—	.1380	.1177	.0974	36	.1065
6	—	40	.1380	.1218	.1055	33	.1130
8	32	—	.1640	.1437	.1234	29	.1360
8	—	36	.1640	.1460	.1279	29	.1360
10	24	—	.1900	.1629	.1359	26	.1470
10	—	32	.1900	.1697	.1494	21	.1590
12	24	—	.2160	.1889	.1619	16	.1770
12	—	28	.2160	.1928	.1696	15	.1800
1/4″	20	—	.2500	.2175	.1850	7	.2010
1/4″	—	28	.2500	.2268	.2036	3	.2130
5/16″	18	—	.3125	.2764	.2403	F	.2570
5/16″	—	24	.3125	.2854	.2584	I	.2720
3/8″	16	—	.3750	.3344	.2938	5/16″	.3125
3/8″	—	24	.3750	.3479	.3209	Q	.3320
7/16″	14	—	.4375	.3911	.3447	U	.3680
7/16″	—	20	.4375	.4050	.3726	25/64″	.3906
1/2″	13	—	.5000	.4500	.4001	27/64″	.4219
1/2″	—	20	.5000	.4675	.4351	29/64″	.4531
9/16″	12		.5625	.5084	.4542	31/64″	.4844
9/16″		18	.5625	.5264	.4903	33/64″	.5156
5/8″	11	—	.6250	.5660	.5069	17/32″	.5312
5/8″	—	18	.6250	.5889	.5528	37/64″	.5781
3/4″	10	—	.7500	.6850	.6201	21/32″	.6562
3/4″	—	16	.7500	.7094	.6688	11/16″	.6875
7/8″	9	—	.8750	.8028	.7307	49/64″	.7656
7/8″	—	14	.8750	.8286	.7822	13/16″	.8125
1″	8	—	1.0000	.9188	.8376	7/8″	.8750
1″	—	12	1.0000	.9459	.8917	59/64″	.9219
1 1/8″	7		1.1250	1.0322	.9394	63/64″	.9844
1 l/8″	—	12	1.1250	1.0709	1.0168	1 3/64″	1.0469
1 1/4″	7		1.2500	1.1572	1.0644	1 7/64″	1.1094
1 1/4″	—	12	1.2500	1.1959	1.1418	1 11/64″	1.1719
1 3/8″	6	—	1.3750	1.2667	1.1585	1 7/32″	1.2187
1 3/8″	—	12	1.3750	1.3209	1.2668	1 19/64″	1.2969
1 1/2″	6	—	1.5000	1.3917	1.2835	1 11/32″	1.3437
1 1/2″	—	12	1.5000	1.4459	1.3918	1 27/64″	1.4219
1 3/4″	5	—	1.7500	1.6201	1.4902	1 9/16″	1.5625
2″	4 1/2	—	2.0000	1.8557	1.7113	1 25/32″	1.7812
2 1/4″	4 1/2	—	2.2500	2.1057	1.9613	2 1/32″	2.0313
2 1/2″	4 1/2	—	2.5000	2.3376	2.1752	2 1/4″	2.2500
2 3/4″	4	—	2.7500	2.5876	2.4252	2 1/2″	2.5000
3″	4	—	3.0000	2.8376	2.6752	2 3/4″	2.7500
3 1/4″	4	—	3.2500	3.0876	2.9252	3″	3.0000
3 1/2″	4	—	3.5000	3.3376	3.1752	3 1/4″	3.2500
3 3/4″	4	—	3.7500	3.5876	3.4252	3 1/2″	3.5000
4″	4	—	4.0000	3.3786	3.6752	3 3/4″	3.7500

PIPE DIMENSIONS

US AND METRIC

NOMINAL PIPE SIZE	OD	SCHEDULE DESIGNATIONS			WALL THICKNESS		WEIGHT		ID	
IN. MM	IN. MM	ASME			IN.	MM	LBS/ FOOT	KG/ METER	IN.	MM
1/8	0.405	10		10S	0.049	1.24	0.19	0.28	0.307	7.82
6	10.3	STD	40	40S	0.068	1.73	0.24	0.37	0.269	6.84
		XS	80	80S	0.095	2.41	0.31	0.47	0.215	5.84
1/4	0.540	10		10S	0.065	1.65	0.33	0.49	0.410	10.40
8	13.7	STD	40	40S	0.088	2.24	0.43	0.63	0.364	9.22
		XS	80	80S	0.119	3.02	0.54	0.80	0.302	7.66
3/8	0.675	10		10S	0.065	1.65	0.42	0.63	0.545	13.80
10	17.1	STD	40	40S	0.091	2.31	0.57	0.84	0.493	12.48
		XS	80	80S	0.126	3.20	0.74	1.10	0.423	10.70
1/2	0.840	5		5S	0.065	1.65	0.54	0.80	0.710	18.00
15	21.3	10		10S	0.083	2.11	0.67	1.00	0.674	17.08
		STD	40	40S	0.109	2.77	0.85	1.27	0.622	15.76
		XS	80	80S	0.147	3.73	1.09	1.62	0.546	13.84
		160			0.188	4.78	1.31	1.95	0.464	11.74
		XX			0.294	7.47	1.72	2.55	0.252	6.36
3/4	1.050	5		5S	0.065	1.65	0.69	1.03	0.920	23.40
20	26.7	10		10S	0.083	2.11	0.86	1.28	0.884	22.48
		STD	40	40S	0.113	2.87	1.13	1.69	0.824	20.96
		XS	80	80S	0.154	3.91	1.48	2.20	0.742	18.88
		160			0.219	5.56	1.95	2.90	0.612	15.58
		XX			0.308	7.82	2.44	3.64	0.434	11.06
1	1.315	5		5S	0.065	1.65	0.87	1.29	1.185	30.10
25	33.4	10		10S	0.109	2.77	1.41	2.09	1.097	27.86
		STD	40	40S	0.133	3.38	1.68	2.50	1.049	26.64
		XS	80	80S	0.179	4.55	2.17	3.24	0.957	24.30
		160			0.250	6.35	2.85	4.24	0.815	20.70
		XX			0.358	9.09	3.66	5.45	0.599	15.22
1-1/4	1.660	5		5S	0.065	1.65	1.11	1.65	1.530	38.90
32	42.2	10		10S	0.109	2.77	1.81	2.69	1.442	36.66
		STD	40	40S	0.140	3.56	2.27	3.39	1.380	35.08
		XS	80	80S	0.191	4.85	3.00	4.47	1.278	32.50
		160			0.250	6.35	3.77	5.61	1.160	29.50
		XX			0.382	9.70	5.22	7.77	0.896	22.80
1-1/2	1.900	5		5S	0.065	1.65	1.28	1.90	1.770	45.00
40	48.3	10		10S	0.109	2.77	2.09	3.11	1.682	42.76
		STD	40	40S	0.145	3.68	2.72	4.05	1.610	40.94
		XS	80	80S	0.200	5.08	3.63	5.41	1.500	38.14
		160			0.281	7.14	4.86	7.25	1.338	34.02
		XX			0.400	10.15	6.41	9.55	1.100	28.00
2	2.375	5		5S	0.065	1.65	1.61	2.39	2.245	57.00
50	60.3	10		10S	0.109	2.77	2.64	3.93	2.157	54.76
		STD	40	40S	0.154	3.91	3.66	5.44	2.067	52.48
		XS	80	80S	0.218	5.54	5.03	7.48	1.939	49.22
		160			0.344	8.74	7.47	11.11	1.687	42.82
		XX			0.436	11.07	9.04	13.44	1.503	38.16
2-1/2	2.875	5		5S	0.083	2.11	2.48	3.69	2.709	68.78
65	73.0	10		10S	0.120	3.05	3.53	5.26	2.635	66.90
		STD	40	40S	0.203	5.16	5.80	8.63	2.469	62.68
		XS	80	80S	0.276	7.01	7.67	11.41	2.323	58.98
		160			0.375	9.53	10.02	14.92	2.125	53.94
		XX			0.552	14.02	13.71	20.39	1.771	44.96
3	3.500	5		5S	0.083	2.11	3.03	4.52	3.334	84.68
80	88.9	10		10S	0.120	3.05	4.34	6.46	3.260	82.80
		STD	40	40S	0.216	5.49	7.58	11.29	3.068	77.92
		XS	80	80S	0.300	7.62	10.26	15.27	2.900	73.66
		160			0.438	11.13	14.34	21.35	2.624	66.64
		XX			0.600	15.24	18.60	27.68	2.300	58.42
3-1/2	4.000	5		5S	0.083	2.11	3.48	5.18	3.834	97.38
90	101.6	10		10S	0.120	3.05	4.98	7.41	3.760	95.50
		STD	40	40S	0.226	5.74	9.12	13.57	3.548	90.12
		XS	80	80S	0.318	8.08	12.52	18.64	3.364	85.44
		XX			0.636	16.15	22.87	34.03	2.728	69.30
4	4.500	5		5S	0.083	2.11	3.92	5.84	4.334	110.08
100	114.3	10		10S	0.120	3.05	5.62	8.37	4.260	108.20
					0.156	3.96	7.24	10.78	4.188	106.38
					0.188	4.78	8.67	12.91	4.124	104.74
		STD	40	40S	0.237	6.02	10.80	16.08	4.026	102.26
		XS	80	80S	0.337	8.56	15.00	22.32	3.826	97.18
		120			0.438	11.13	19.02	28.32	3.624	92.04
		160			0.531	13.49	22.53	33.54	3.438	87.32
		XX			0.674	17.12	27.57	41.03	3.152	80.06
4-1/2	5.000	STD	40	40S	0.247	6.27	12.55	18.67	4.506	114.46
115	127.0	XS	80	80S	0.355	9.02	17.63	26.24	4.290	108.96
		XX			0.710	18.03	32.56	48.45	3.580	90.94

AMERICAN WIRE GAUGE

CONDUCTOR SIZE TABLE

AWG	Diameter [inches]	Diameter [mm]	Area [mm2]	Resistance [Ohms/1000 ft]	Resistance [Ohms / km]	Max Current [Amperes]	Max Frequency
0000 (4/0)	0.46	11.684	107	0.049	0.16072	302	125 Hz
000 (3/0)	0.4096	10.40384	85	0.0618	0.202704	239	160 Hz
00 (2/0)	0.3648	9.26592	67.4	0.0779	0.255512	190	200 Hz
0 (1/0)	0.3249	8.25246	53.5	0.0983	0.322424	150	250 Hz
1	0.2893	7.34822	42.4	0.1239	0.406392	119	325 Hz
2	0.2576	6.54304	33.6	0.1563	0.512664	94	410 Hz
3	0.2294	5.82676	26.7	0.197	0.64616	75	500 Hz
4	0.2043	5.18922	21.2	0.2485	0.81508	60	650 Hz
5	0.1819	4.62026	16.8	0.3133	1.027624	47	810 Hz
6	0.162	4.1148	13.3	0.3951	1.295928	37	1100 Hz
7	0.1443	3.66522	10.5	0.4982	1.634096	30	1300 Hz
8	0.1285	3.2639	8.37	0.6282	2.060496	24	1650 Hz
9	0.1144	2.90576	6.63	0.7921	2.598088	19	2050 Hz
10	0.1019	2.58826	5.26	0.9989	3.276392	15	2600 Hz
11	0.0907	2.30378	4.17	1.26	4.1328	12	3200 Hz
12	0.0808	2.05232	3.31	1.588	5.20864	9.3	4150 Hz
13	0.072	1.8288	2.62	2.003	6.56984	7.4	5300 Hz
14	0.0641	1.62814	2.08	2.525	8.282	5.9	6700 Hz
15	0.0571	1.45034	1.65	3.184	10.44352	4.7	8250 Hz
16	0.0508	1.29032	1.31	4.016	13.17248	3.7	11 k Hz
17	0.0453	1.15062	1.04	5.064	16.60992	2.9	13 k Hz
18	0.0403	1.02362	0.823	6.385	20.9428	2.3	17 kHz
19	0.0359	0.91186	0.653	8.051	26.40728	1.8	21 kHz
20	0.032	0.8128	0.518	10.15	33.292	1.5	27 kHz
21	0.0285	0.7239	0.41	12.8	41.984	1.2	33 kHz
22	0.0254	0.64516	0.326	16.14	52.9392	0.92	42 kHz
23	0.0226	0.57404	0.258	20.36	66.7808	0.729	53 kHz
24	0.0201	0.51054	0.205	25.67	84.1976	0.577	68 kHz
25	0.0179	0.45466	0.162	32.37	106.1736	0.457	85 kHz
26	0.0159	0.40386	0.129	40.81	133.8568	0.361	107 kHz
27	0.0142	0.36068	0.102	51.47	168.8216	0.288	130 kHz
28	0.0126	0.32004	0.081	64.9	212.872	0.226	170 kHz
29	0.0113	0.28702	0.0642	81.83	268.4024	0.182	210 kHz
30	0.01	0.254	0.0509	103.2	338.496	0.142	270 kHz
31	0.0089	0.22606	0.0404	130.1	426.728	0.113	340 kHz
32	0.008	0.2032	0.032	164.1	538.248	0.091	430 kHz
33	0.0071	0.18034	0.0254	206.9	678.632	0.072	540 kHz
34	0.0063	0.16002	0.0201	260.9	855.752	0.056	690 kHz
35	0.0056	0.14224	0.016	329	1079.12	0.044	870 kHz
36	0.005	0.127	0.0127	414.8	1360	0.035	1100 kHz
37	0.0045	0.1143	0.01	523.1	1715	0.0289	1350 kHz
38	0.004	0.1016	0.00797	659.6	2163	0.0228	1750 kHz
39	0.0035	0.0889	0.00632	831.8	2728	0.0175	2250 kHz
40	0.0031	0.07874	0.00501	1049	3440	0.0137	2900 kHz

Current (ampacity) Notes: *The current ratings shown in the table are for power transmission and have been determined using the rule of 1 amp per 700 circular mils, which is a very conservative rating*

FRACTION - DECIMAL

CONVERSION CHART

	IN	MM
1/64	.015625	.3969
1/32	.03125	.7938
3/64	.046875	1.1906
1/16	.0625	1.5875
5/64	.078125	1.9844
3/32	.09375	2.3813
7/64	.109375	2.7781
1/8	.125	3.1750
9/64	.140625	3.5719
5/32	.15625	3.9688
11/64	.171875	4.3656
3/16	.1875	4.7625
13/64	.203125	5.1594
7/32	.21875	5.5563
15/64	.234375	5.9531
1/4	.250	6.3500
17/64	.265625	6.7469
9/32	.28125	7.1438
19/64	.296875	7.5406
5/16	.3125	7.9375
21/64	.328125	8.3344
11/32	.34375	8.7313
23/64	.359375	9.1282
3/8	.375	9.5250
25/64	.390625	9.9219
13/32	.40625	10.3188
27/64	.421875	10.7157
7/16	.4375	11.1125
29/64	.453125	11.5094
15/32	.46875	11.9063
31/64	.484375	12.3032
1/2	.500	12.7001

	IN	MM
33/64	.515625	13.096
17/32	.53125	13.493
35/64	.546875	13.890
9/16	.5625	14.287
37/64	.578125	14.684
19/32	.59375	15.081
39/64	.609375	15.478
5/8	.625	15.875
41/64	.640625	16.271
21/32	.65625	16.668
43/64	.671875	17.065
11/16	.6875	17.462
45/64	.703125	17.859
23/32	.71875	18.256
47/64	.734375	18.653
3/4	.750	19.050
49/64	.765625	19.447
25/32	.78125	19.843
51/64	.796875	20.240
13/16	.8125	20.6375
53/64	.828125	21.0345
27/32	.84375	21.431
55/64	.859375	21.8282
7/8	.875	22.2251
57/64	.890625	22.6220
29/32	.90625	23.0188
59/64	.921875	23.4157
15/16	.9375	23.8126
61/64	.953125	24.2095
31/32	.96875	24.6063
63/64	.984375	25.0032
1	1.000	25.4001

SHEET METAL
GAUGE CHART

Gauge	Steel	Galvanized Steel	Stainless Steel	Aluminium	Electrical Steel
	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
3	0.2391 (6.07)	—	—	—	—
4	0.2242 (5.69)	—	—	—	—
5	0.2092 (5.31)	—	—	—	—
6	0.1943 (4.94)	—	—	0.162 (4.1)	—
7	0.1793 (4.55)	—	0.1875 (4.76)	0.1443 (3.67)	—
8	0.1644 (4.18)	0.1681 (4.27)	0.1719 (4.37)	0.1285 (3.26)	—
9	0.1495 (3.80)	0.1532 (3.89)	0.1563 (3.97)	0.1144 (2.91)	—
10	0.1345 (3.42)	0.1382 (3.51)	0.1406 (3.57)	0.1019 (2.59)	—
11	0.1196 (3.04)	0.1233 (3.13)	0.1250 (3.18)	0.0907 (2.30)	—
12	0.1046 (2.66)	0.1084 (2.75)	0.1094 (2.78)	0.0808 (2.05)	—
13	0.0897 (2.28)	0.0934 (2.37)	0.094 (2.4)	0.072 (1.8)	—
14	0.0747 (1.90)	0.0785 (1.99)	0.0781 (1.98)	0.0641 (1.63)	—
15	0.0673 (1.71)	0.0710 (1.80)	0.07 (1.8)	0.057 (1.4)	—
16	0.0598 (1.52)	0.0635 (1.61)	0.0625 (1.59)	0.0508 (1.29)	0.0625 (1.59)
17	0.0538 (1.37)	0.0575 (1.46)	0.056 (1.4)	0.045 (1.1)	0.0560 (1.42)
18	0.0478 (1.21)	0.0516 (1.31)	0.0500 (1.27)	0.0403 (1.02)	0.0500 (1.27)
19	0.0418 (1.06)	0.0456 (1.16)	0.044 (1.1)	0.036 (0.91)	0.0453 (1.15)
20	0.0359 (0.91)	0.0396 (1.01)	0.0375 (0.95)	0.0320 (0.81)	0.0375 (0.952)
21	0.0329 (0.84)	0.0366 (0.93)	0.034 (0.86)	0.028 (0.71)	0.0340 (0.860)
22	0.0299 (0.76)	0.0336 (0.85)	0.031 (0.79)	0.025 (0.64)	0.0310 (0.787)
23	0.0269 (0.68)	0.0306 (0.78)	0.028 (0.71)	0.023 (0.58)	0.0280 (0.711)
24	0.0239 (0.61)	0.0276 (0.70)	0.025 (0.64)	0.02 (0.51)	0.0250 (0.635)
25	0.0209 (0.53)	0.0247 (0.63)	0.022 (0.56)	0.018 (0.46)	0.0220 (0.559)
26	0.0179 (0.45)	0.0217 (0.55)	0.019 (0.48)	0.017 (0.43)	0.0185 (0.470)
27	0.0164 (0.42)	0.0202 (0.51)	0.017 (0.43)	0.014 (0.36)	0.0170 (0.432)
28	0.0149 (0.38)	0.0187 (0.47)	0.016 (0.41)	0.0126 (0.32)	0.0155 (0.394)
29	0.0135 (0.34)	0.0172 (0.44)	0.014 (0.36)	0.0113 (0.29)	0.0140 (0.356)
30	0.0120 (0.30)	0.0157 (0.40)	0.013 (0.33)	0.0100 (0.25)	0.0125 (0.318)
31	0.0105 (0.27)	0.0142 (0.36)	0.011 (0.28)	0.0089 (0.23)	0.0100 (0.254)
32	0.0097 (0.25)	—	—	—	—
33	0.0090 (0.23)	—	—	—	—
34	0.0082 (0.21)	—	—	—	—
35	0.0075 (0.19)	—	—	—	—
36	0.0067 (0.17)	—	—	—	—
37	0.0064 (0.16)	—	—	—	—
38	0.0060 (0.15)	—	—	—	—
33	0.0071	0.18034	0.0254	206.9	678.632
34	0.0063	0.16002	0.0201	260.9	855.752
35	0.0056	0.14224	0.016	329	1079.12
36	0.005	0.127	0.0127	414.8	1360
37	0.0045	0.1143	0.01	523.1	1715
38	0.004	0.1016	0.00797	659.6	2163
39	0.0035	0.0889	0.00632	831.8	2728
40	0.0031	0.07874	0.00501	1049	3440

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