FAIRBANKS MORSE DEFENSE

Bird-Johnson PROPELLER COMPANY

Power & Propulsion

Product Catalog

POWERING CRITICAL MISSIONS

fairbanksmorsedefense.com

ENGINE PRODUCT CATALOG

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Overview

Located in Beloit, Wisconsin, Fairbanks Morse Defense manufactures, procures, assembles, and distributes heavy-duty, medium-speed reciprocating engines that exceed the stringent standards required by the U.S. military.

Fairbanks Morse Defense manufacturing is conducted in its U.S.-based facility. FMD sells its high-performance engines directly to naval marine customers and shipyards. As a principal supplier of reliable diesel engines to the U.S. Navy, U.S. Coast Guard, and the Canadian Coast Guard, FMD enables the defense industry to complete worldwide mission-critical operations. FMD is a leading provider of reliable marine power solutions

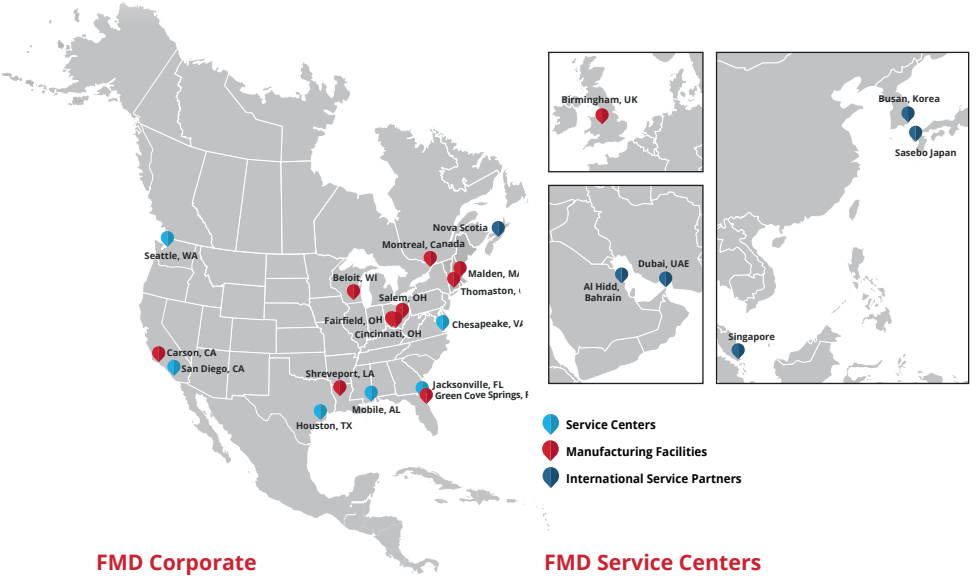
Sales & Service Support

Fairbanks Morse Defense offers an extensive portfolio of services to optimize performance, ensure reliability, and extend your engine's lifecycle – from the day it is commissioned and for the many years that follow. Our support extends from installation through lifecycle maintenance, including rapid mobilization and local shop support. Our OEM certified technicians provide the attention and expertise to take care of every project from beginning to end. With our strategically located service centers, we are committed to supplying genuine OEM parts to meet your operational needs. Through collaborative planning, we proactively identify and create solutions to ensure your operations are not disrupted.

Fairbanks Morse Defense
701 White Ave
Beloit, Wisconsin 53511

OEM Spare Parts & Service
1-800-356-6955

Our Locations



FMD Corporate

Fairbanks Morse Defense Headquarters
Phone: 1-800-356-6955

FMD Manufacturing Sites

American Fan
Phone: 1-866-771-6266

AMMCON Corporation
Phone: 1-904-863-3196

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

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

Maxim Watermakers
Phone: 1-318-629-2460

Montreal Bronze
Phone: +1 450-477-2069

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

Ward Leonard
Phone: 1-860-283-5801

Welin Lambie
Phone: +44 1384-78294

Fairbanks Morse Defense
Phone: 1-800-356-6955

FMD Service Centers

Chesapeake Service Center

San Diego Service Center
Phone: 619-477-3218

Seattle Service Center
Phone: 206-246-8133

Houston Service Center
Phone: 713-896-9455

Mobile Service Center
Phone: 866-453-5874

Jacksonville Service Center
Phone: 904-906-6124

Mayport Mobile Office
Phone: 904-906-6124

www.FairbanksMorseDefense.com

ENGINE SOLUTIONS

POWERING CRITICAL MISSIONS

Reliable Engines For Mission Critical Marine Performance

Located in Beloit, Wisconsin, Fairbanks Morse Defense manufactures, procures, assembles, and distributes heavy-duty, medium-speed reciprocating engines.

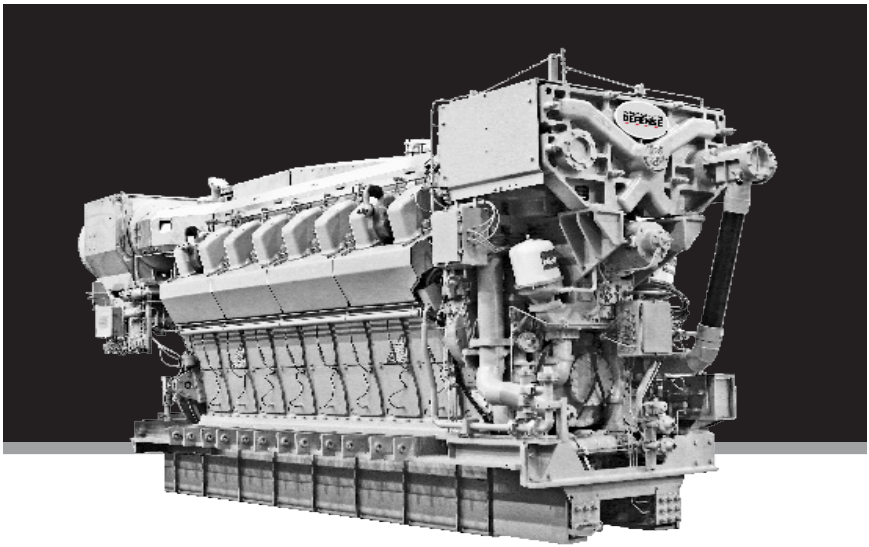
Fairbanks Morse Defense manufacturing is conducted in its U.S.-based facility. FMD sells its high-performance engines directly to naval marine customers and shipyards. As a principal supplier of reliable diesel engines to the U.S. Navy, U.S. Coast Guard, and the Canadian Coast Guard, FMD enables the defense industry to complete worldwide mission-critical operations. Fairbanks Morse Defense is a portfolio company of Arcline Investment and a leading provider of reliable marine power solutions.

Leading engine options manufactured in the U.S.

Fairbanks Morse Defense engines are designed for reliable, efficient performance across a wide range of environments. Representing engine systems built for even the most stringent military requirements, Fairbanks Morse Defense continues to bring to market some of the most durable solutions available.

Fairbanks Morse Defense is an MAN Energy Solutions SE licensee.

FM PA6B & PA6B STC



Power Range 4,200 - 8,100 kWb

With over 840 engines in operation, the FM PA6B diesel engine is respected worldwide for its reliability and its incredibly advanced technology.

Key Advantages

- Excellent fuel efficiency
- Increased reliability and safety
- Simplified installation
- Redesigned connecting rod, crankshaft, cylinder head and liner with anti-bore polishing ring

FM PA6B & PA6B STC

Engine Specifications

Specifications	
Cylinder Configuration	12V, 16V, 18V, 20V
Cylinder Bore-mm (in)	280 (11.02)
Piston Stroke-mm (in)	330 (12.99)
Cycle	4 Stroke
Displacement/Cylinder - L (cu in)	20.3 (1,240)
Fuel Type	MGO, MDO, F-76

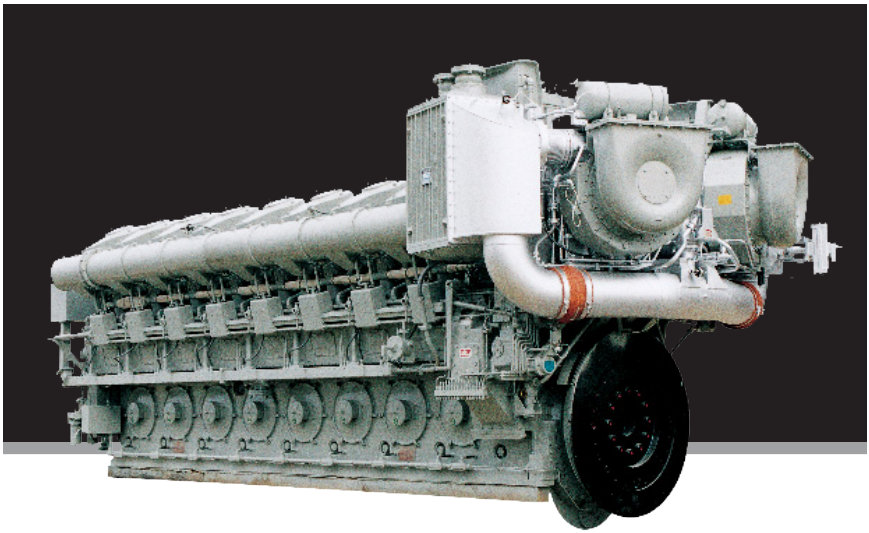
Power Ratings		
Cylinders	PA6B Generator 900 RPM | 60 Hz kWe	PA6B STC Propulsion 1,050 RPM | kWb
12V	4,032	4,860
16V	5,376	6,480
18V	6,048	-
20V	6,720	8,100

* Assuming a 96% generator efficiency

Engine Dimensions				
Cylinders	Length (mm)	Width (mm)	Height (mm)	Dry Weight Tons (Metric)
12V	5,619	2,340	3,130	27.0
16V	6,539	2,340	3,130	35.1
18V	7,398	2,665	3,169	39.1
20V	7,858	2,665	3,169	41.7

Dimensions are for size estimation only. For installation obtain certified prints.

FM PC2.5 CR STC



Power Range 5,816 - 8,725 kWb

The FM PC2.5 CR STC engine is well suited for marine applications with high torque at low speeds, and delivers excellent power production in relation to installed weight.

Key Advantages

- Low fuel consumption
- Ease of maintenance
- Improved low-load operation
- Lower emissions
- High reliability and availability

FM PC2.5 CR STC

Engine Specifications

Specifications	
Cylinder Configuration	12V, 14V, 16V, 18V
Cylinder Bore-mm (in)	400 (15.75)
Piston Stroke-mm (in)	460 (18.11)
Cycle	4 Stroke
Displacement/Cylinder - L (cu in)	57.8 (3,528)
Output/Cylinder - kWm (HP)	485 (650)
Fuel Type	MGO, MDO, F-76

Power Ratings			
Cylinders	RPM	HP/Cyl.	kWb
12V	520	650	5,816
14V	520	650	6,786
16V	520	650	7,755
18V	520	650	8,725

Engine Dimensions				
Cylinders	Length (mm)	Width (mm)	Height (mm)	Dry Weight Tons (Metric)
12V	6,854	5,076	3,775	67
14V	7,594	5,816	3,775	76
16V	8,334	6,555	3,775	84
18V	9,074	7,295	3,775	91

Dimensions are for size estimation only. For installation obtain certified prints.

FM 28/33 D STC

Power Range 5,460 - 10,000 kWb

The FM 28/33D STC combines world-class engineering and state-of-the-art technology to produce the most powerful and fuel-efficient 1,000 rpm diesel engine in the world.

Key Advantages

- Reduced component count eases installation and maintenance
- 52 Degree Vee angle minimizes width and facilitates installation
- Electronically controlled injection system improves SFC, performance and transient response
- Sequential turbo charging improves SFC, reduces soot
- Best-in-class fuel efficiency
- Industry-leading power rating

FM 28/33 D STC

Engine Specifications

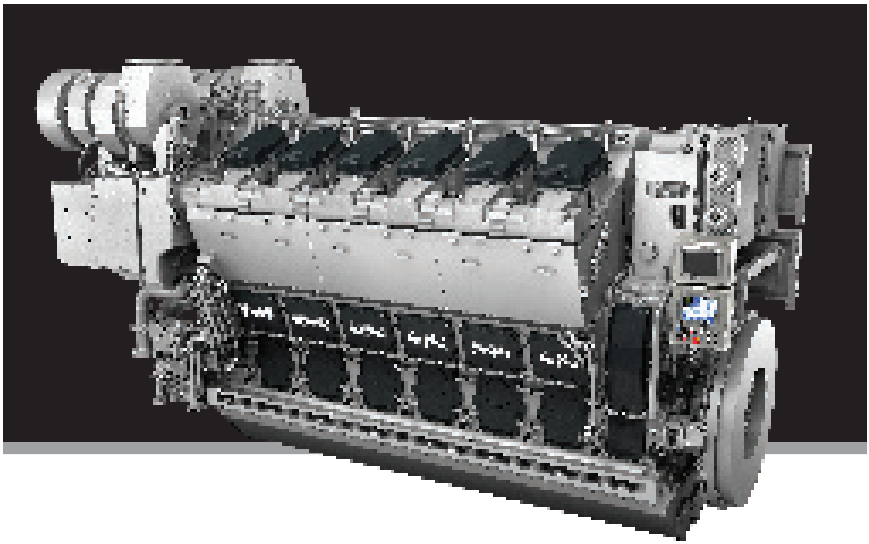
Specifications	
Cylinder Configuration	12V, 16V, 20V
Cylinder Bore-mm (in)	280 (11.0)
Piston Stroke-mm (in)	330 (13.0)
Cycle	4 Stroke
Displacement/Cylinder - L (cu in)	20.3 (1,240)
Fuel Type	MGO, MDO, F-76

Power Ratings		
Cylinders	FERRY 1,000 RPM | kWb	NAVY 1,032 RPM | kWb
12V	5,460	6,000
16V	7,280	8,000
20V	9,100	10,000

Engine Dimensions				
Cylinders	Length (mm)	Width (mm)	Height (mm) Deep Oil Sump	Weight with Flywheel (t)
12V	6,217	2,473	3,682	36.4
16V	7,137	2,473	3,682	43.9
20V	8,057	2,473	3,682	51.6

Dimensions are for size estimation only. For installation obtain certified prints.

FM 32/44 CR



Power Range 3,600 - 12,000 kWb

The FM 32/44 CR engine boasts the newest technologies in the area of medium speed diesel engines. Using electronic injection, high efficiency turbochargers, electronic hardware and variable valve timing, the FM 32/44 CR is a synthesis of the most advanced large engine technologies available. The common rail technology permits this engine to achieve the highest levels of flexibility for all load ranges and yields significantly better results than any engine with the conventional injection system.

Key Advantages

- Advanced electronic common rail injection system
- High specific power output
- High efficiency
- Low operating and life cycle costs
- Long maintenance intervals and service life

FM 32/44 CR

Engine Specifications

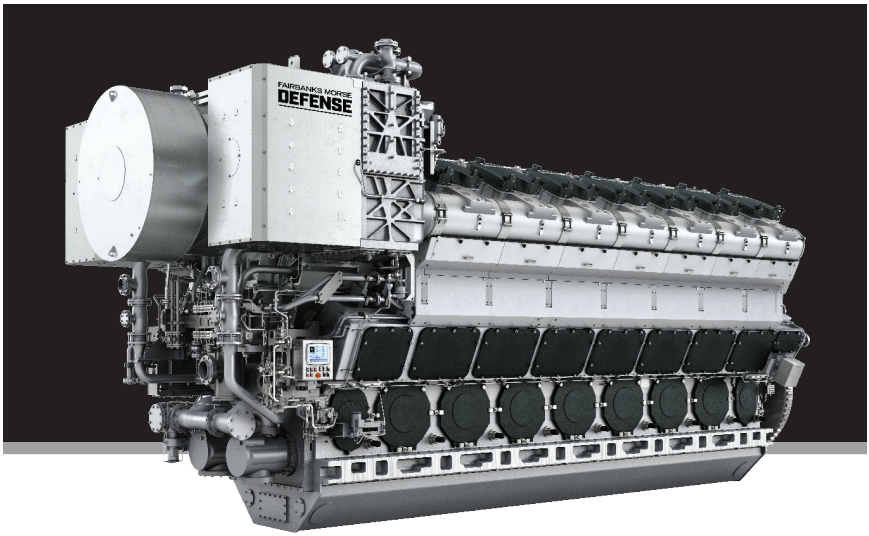
Specifications	
Cylinder Configuration	6L, 7L, 8L, 9L, 10L, 12V, 14V, 16V, 20V
Cylinder Bore-mm (in)	320 (12.6)
Piston Stroke-mm (in)	440 (17.3)
Cycle	4 Stroke
Displacement/Cylinder - L (cu in)	35.4 (2,159)
Fuel Type	MGO, MDO, F-76

Power Ratings			Engine Dimensions			
Cyl.	Generator 720 RPM kWe*	Propulsion 750 RPM kWb	Length (mm)	Width (mm)	Height (mm)	Dry Weight Tons (Metric)
6L	3,492	3,600	5,265	2,174	4,163	39.5
7L	3,938	4,060	5,877	2,359	4,359	44.5
8L	4,656	4,800	6,407			49.5
9L	5,238	5,400	6,937			53.5
10L	5,820	6,000	7,556			58
12V	6,984	7,200	5,795	3,100	4,039	70
14V	7,876	8,120	6,425		4,262	79
16V	9,312	9,600	7,055			87
20V	11,640	12,000	8,315			104

* Assuming a 97% generator efficiency

Dimensions are for size estimation only. For installation obtain certified prints.

FM 48/60 CR



Power Range 7,200 - 19,200 kWb

This reliable, high-output engine is the four-stroke heart of medium and large diesel power, which makes it a versatile engine for both propulsion and auxiliary applications.

Key Advantages

- Excellent fuel efficiency and low emissions
- Integrated self-diagnosis functions
- Extremely quick and accurate reaction times of the injection system

FM 48/60 CR

Engine Specifications

Specifications	
Cylinder Configuration	6L, 7L, 8L, 9L, 12V, 14V, 16V
Cylinder Bore-mm (in)	480 (18.9)
Piston Stroke-mm (in)	600 (23.6)
Cycle	4 Stroke
Displacement/Cylinder - L (cu in)	108.6 (6,627)
Fuel Type	MGO, MDO, F-76

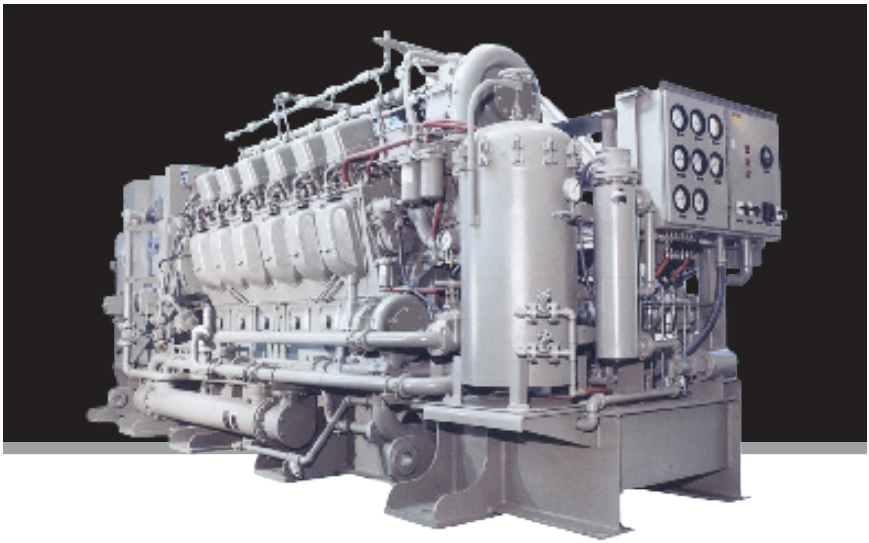
Power Ratings		
Cylinders	Generator 514 RPM 60 Hz kWe	Propulsion 500 RPM kWb
6L	6,984	7,200
7L	8,148	8,400
8L	9,312	9,600
9L	10,476	10,800
12V	13,968	14,400
14V	16,296	16,800
16V	18,624	19,200

Engine Dimensions

Cyl.	Length (mm)	Width (mm)	Height (mm)	Dry Weight Tons (Metric)
6V	8,760	3,165	5,300	108
7V	9,540			119
8V	10,540	3,280		135
9V	11,360			148
12V	10,790	4,730 mm	5,500	189
14V	11,790			213
16V	13,140			240

Dimensions are for size estimation only. For installation obtain certified prints.

FM 251F



Power Range 730 - 2,937 kWe

The FM 251F engine is renowned worldwide for efficient and reliable power in the most demanding stationary applications. Featuring a durable cylinder head casting, this rugged engine option offers exceptional commonality of components, and affords high specific output with low specific fuel consumption.

Key Advantages

- Strong, durable cylinder head casting for increased life of critical components
- Commonality of components
- Well established workhorse engine to accommodate multiple applications
- Known for reliability, high specific output and low specific fuel consumption
- Quality iron alloy makes cylinder heads resist high temperatures and pressures

All ratings subject to factory approved application. Ratings are based on: 90°F (32.2°C) ambient temp. 28.25 in Hg (71.8 cm Hg) barometric pressure (min). 1,500 ft (457 m) altitude (max). Standby ratings available.

FM 251F

Engine Specifications

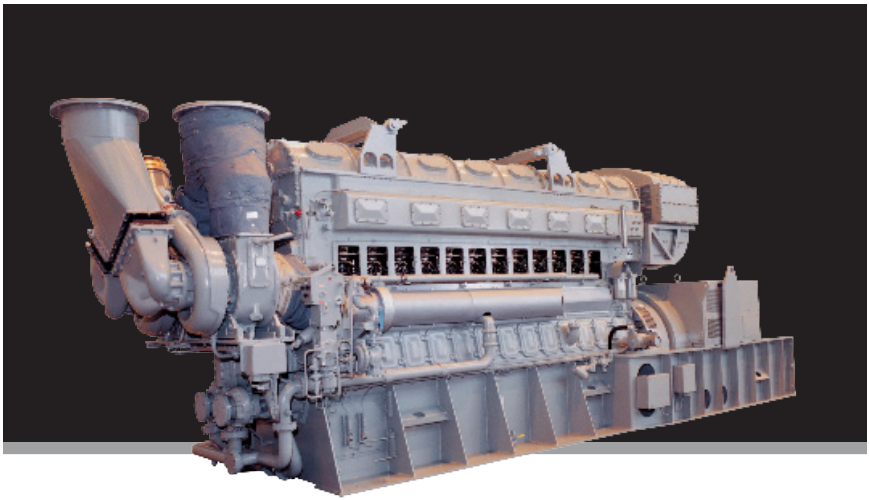
Specifications	
Cylinder Configuration	6L, 8V, 12V, 16V, 18V
Cylinder Bore-mm (in)	229 (9.0)
Piston Stroke-mm (in)	267 (10.5)
Cycle	4 Stroke
Displacement/Cylinder - L (cu in)	10.9 (668)
Fuel Type	MGO, MDO, F-76

Power Ratings				
Cylinders	**Rating**	**900 RPM 60 kWe**	**1,000 RPM 50 Hz kWe**	**1,200 RPM 50 & 60 Hz kWe**
6L	Continuous	730	870	1,000
	2000 hr/yr	762	906	1,043
	2 hr/yr	812	956	1,097
8V	Continuous	1,040	1,160	-
	2000 hr/yr	1,082	1,205	-
	2 hr/24 hr	1,142	1,275	-
12V	Continuous	1,566	1,740	2,000
	2000 hr/yr	1,630	1,811	2,082
	2 hr/24 hr	1,713	1,912	2,200
16V	Continuous	2,100	2,310	2,670
	2000 hr/yr	2,183	2,400	2,780
	2 hr/24 hr	2,310	2,540	2,937
18V	Continuous	2,350	2,600	-
	2000 hr/yr	2,450	2,714	-
	2 hr/24 hr	2,584	2,863	-

Engine Dimensions				
Cylinders	**Length (mm)**	**Width (mm)**	**Height (mm)**	**Dry Weight Tons (Metric)**
6L	7,036	2,616	2,870	19.4
8V	6,528	2,692	3,486	21.7
12V	8,573	2,692	3,486	25.4
16V	9,712	2,692	3,486	34.1
18V	10,465	2,692	3,486	38.7

Dimensions are for size estimation only. For installation obtain certified prints.

FM 38 D 8 1/8



Power Range 1,506 - 3,165 kWe

The FM 38D 8-1/8 engine combines time-tested design features with modern advances including Enviro-Design® dual-fuel technology. The result is an engine proven to be efficient and reliable, with a long history of satisfied customers.

Key Advantages

- Designed & developed for a wide array of electrical power generation and heavy industrial applications
- 40+ year service life
- Seismically-qualified for multiple configurations
- Base load (110% overload 2/24 hrs)

FM 38 D 8 1/8

Engine Specifications

Specifications	
Cylinder Configuration	6L, 9L, 12L
Cylinder Bore-mm (in)	206 (8.1)
Piston Stroke-mm (in)	254 (10.0)
Cycle	2 Stroke
Displacement/Cylinder - L (cu in)	17.0 (1037)
Fuel Type	MGO, MDO, F-76

Power Ratings		
Cylinders	**Aspiration**	**900 rpm 60 Hz & 1,000 rpm 50 Hz kWe**
6L	Turbo-Blower Turbocharged	1,506 1,580
9L	Turbo-Blower Turbocharged	2,260 2,370
12L	Turbo-Blower Turbocharged	3,013 3,165

Engine Dimensions				
Cylinders	**Length (mm)**	**Width (mm)**	**Height (mm)**	**Dry Weight Tons (Metric)**
6L	6,262	2,471	3,307	25
9L	8,186	2,407	3,239	33
12L	9,304	2,662	3,239	38

All ratings subject to factory approved application. Ratings are based on: 90°F (32.2°C) ambient temp. 28.25 in Hg (71.8 cm Hg) barometric pressure (min). 1,500 ft (457 m) altitude (max). Standby ratings available.

Dimensions are for size estimation only. For installation obtain certified prints.

nFORCER® FM 175D

Power Range 1,800 – 4,400 kWb

The new nForcer® FM 175D engine boasts a clear and compact design intended to deliver continuous, reliable performance. Maximum power output at lowest weight makes the nForcer® FM 175D the superior choice. Whether you're patrolling in low-load mode or cruising at full power, the easy handling and high availability of the nForcer® FM 175D allows you to focus entirely on your mission.

Key Advantages

- Advanced electronic common rail injection system
- Engine-mounted control system
- High efficiency turbocharger
- Low operating and life cycle costs
- Four auxiliary power take-offs
- Long maintenance intervals and service life

Engine Specifications

Specifications	
Cylinder Configuration	12V, 16V, 20V
Cylinder Bore-mm (in)	175 (6.89)
Piston Stroke-mm (in)	215 (8.46)
Cycle	4 Stroke
Displacement/Cylinder - L (in^3)	5.17 (315.49)
Fuel Type	MGO, MDO, F-76

Genset Power Ratings

	Engine Model	MCR (kW)	El. Output (kWe)*	Speed (rpm)	Average Load [%]
Diesel – Electric 60 Hz	12V175D-MEM	1800	1728	1800	75%
	12V175D-MEL	1800	1728	1800	50%
	12V175D-MEM	1920	1843	1800	50%
	12V175D-MEL	1980	1900	1800	50%
	12V175D-MEL	2100	2016	1800	50%
	16V175D-MEM	2160	2073	1800	50%
	12V175D-MEL	2280	2189	1800	50%
	16V175D-MEM	2400	2304	1800	75%
	16V175D-MEM	2560	2458	1800	50%
	20V175D-MEM	3000	2880	1800	75%
	20V175D-MEL	3000	2880	1800	50%
	20V175D-MEM	3200	3072	1800	50%
	20V175D-MEL	3300	3168	1800	50%
	20V175D-MEL	3500	3360	1800	50%
	20V175D-MEL	3800	3648	1800	50%
Diesel – Electric Variable Speed 36 - 60 Hz	12V175D-MEV	1860	1786	1080 - 1800	75%
	12V175D-MEV	2040	1958	1080 - 1800	50%
	12V175D-MEV	2280	2189	1080 - 1800	50%
	16V175D-MEV	2480	2381	1080 - 1800	75%
	16V175D-MEV	2720	2611	1080 - 1800	50%
	16V175D-MEV	3040	2918	1080 - 1800	50%
	20V175D-MEV	3100	2976	1080 - 1800	75%
	20V175D-MEV	3400	3264	1080 - 1800	50%
	20V175D-MEV	3800	3648	1080 - 1800	50%

* Assuming a 96% generator efficiency

Engine Dimensions

Cylinders	Length (mm)	Width (mm)	Height (mm)	Dry Weight Tons (Metric)
12V	2,900	1,661	2,295	8.7
16V	3,420	1,661	2,316	10.8
20V	3,940	1,647	2,297	13

Note: Dimensions and weights for Standard Mechanical applications.

Dimensions are for size estimation only. For installation obtain certified prints.

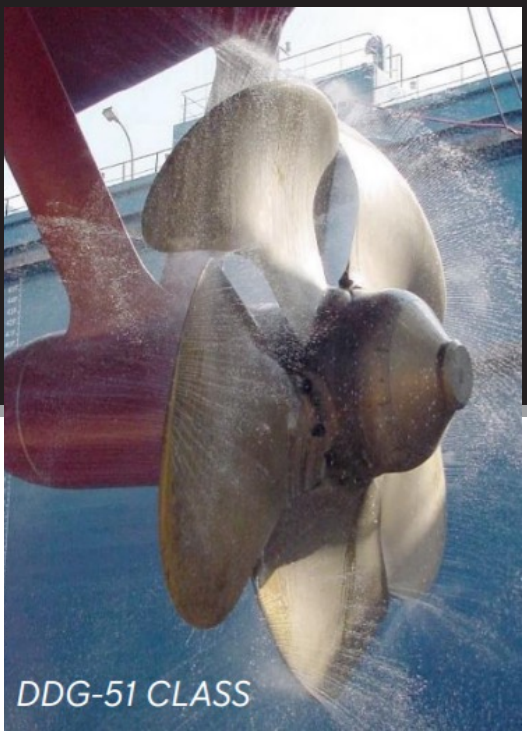
nFORCER® FM 175D

Mechanical Propulsion			
Engine Model	**MCR (kW)**	**Speed (rpm)**	**Average Load [%]**
12V175D-MH	1740	1800	85%
12V175D-MM	1860	1800	80%
12V175D-MM	1920	1800	75%
12V175D-MM	2040	1800	70%
12V175D-MM	2220	1800	40%
12V175D-MM	2220	1900	65%
12V175D-MM	2400	1800	40%
12V175D-ML	2400	2000	60%
12V175D-ML	2580	2000	60%
16V175D-MM	2480	1800	80%
16V175D-MM	2720	1800	70%
16V175D-MM	2960	1800	40%
16V175D-MM	2960	1900	65%
16V175D-ML	3200	2000	60%
20V175D-MM	3200	1800	80%
20V175D-MM	3400	1800	70%
20V175D-MM	3700	1800	40%
20V175D-MM	3700	1900	65%
20V175D-ML	4000	2000	60%
20V175D-ML	4400	2000	60%

MH: Mechanical Propulsion Heavy Duty
MM: Mechanical Propulsion Medium Duty
ML: Mechanical Propulsion Light Duty

PROPULSION SOLUTIONS

Controllable Pitch Propellers

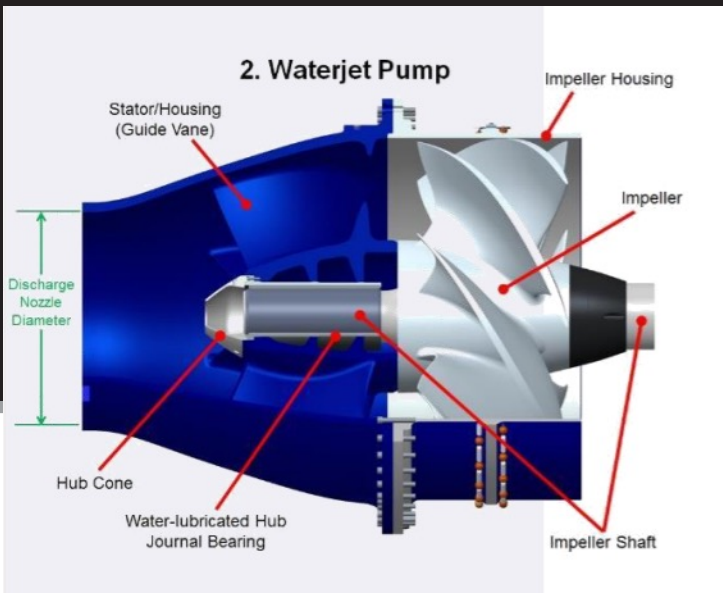


Controllable Pitch Propeller (CPP) enables vessels to rapidly control the direction of propulsion in-water via hydraulic controls. The CPP system has the ability to change blade pitch angle continuously to allow generation of thrust forces from ahead to astern without a change shaft rotation direction and independent of shaft speed.

Key Advantages

- MIL-spec shock qualified
- Complete live spin tests

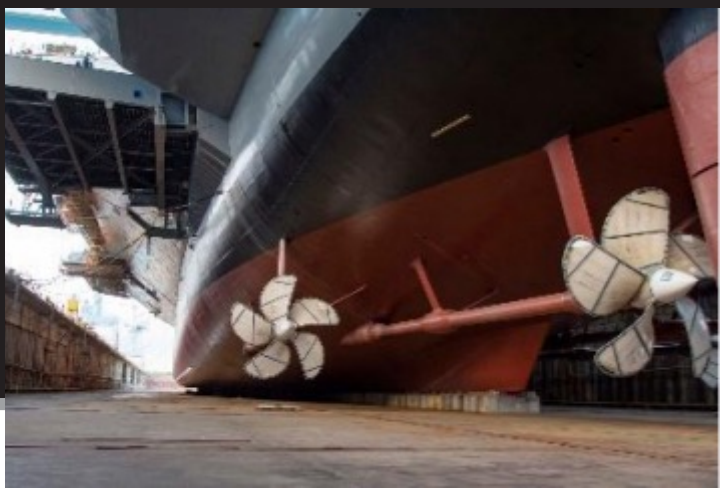
Axial Waterjets



Waterjets are a highly efficient propulsion system that uses an impeller and stator to send an axial flow of water to create thrust for use in shallow water or high speed. Our Waterjets are specialized for naval applications and can be built for special requirements such as signature, shock etc.

The U.S. Navy's Littoral Combat Ship Freedom-variant features four of our advanced Axial Mk1 waterjets, each rated to absorb 22MW of power.

Fixed Pitch Propeller (FPP)

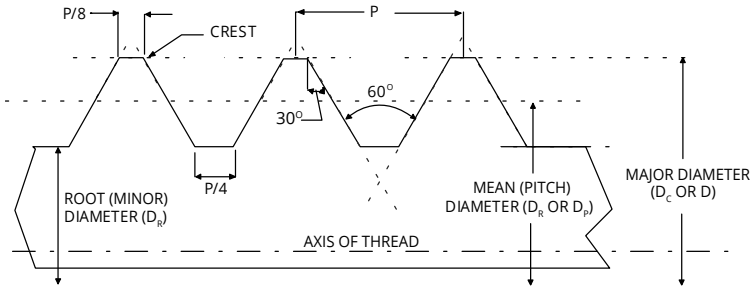


Fixed Pitch Propeller provides proven propulsion performance in a quiet, reliable, and durable system. This type of propellor does not articulate.

RESOURCES

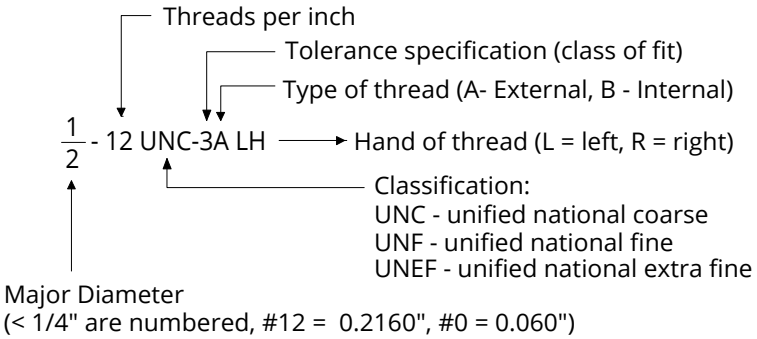
THREAD STANDARDS

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:



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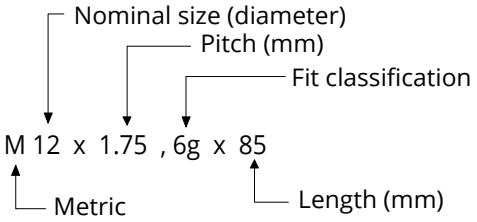

THREAD DIMENSIONS
AND TAP DRILL SIZES

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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