

auxano

Hydraulic Bolts
For the Maritime Industry

www.auxano-tech.com



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Auxano Technologies was formed in August 2009 and are based in Manchester, England. The company specialises in manufacturing and supplying equipment to the shipbuilding and ship repair sectors. We offer a variety of products and brands from critical propulsion equipment to bridge and accommodation furniture.

Our management and staff have over 40 years experience in the design and manufacture of sleeve type expansion bolts such as those used on ships' propulsion shafts. With this experience, Auxano was established with the intention of providing the industry with a unique product and service to serve both the new building and ship repair markets.

In support of our international customer base, we have developed a global infrastructure of sales and technical service centre's to provide our clients with locally based contacts able to provide commercial and technical advice when required.

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Hydraulic shaft bolts

Auxano bolts are most frequently used to connect propeller, intermediate and crankshaft / main engine shafts. They are an alternative to standard reamer bolts which are often associated with time consuming and costly problems. Bolting problems are most often encountered during a scheduled dry dock but can also arise at sea.

Technically superior, hydraulic shaft bolts have been widely used in the shipbuilding sector for over 30 years. In recent years, hydraulic shaft bolts are used more frequently on all types of ocean going vessels. Auxano Technologies has played a large part in effecting that change as we became the first hydraulic bolt supplier in the world to have a type approved standard range of bolts. We christened this the **f-series** range. This standard range of bolts with type approval means that we can offer our bolts from stock with short delivery times. Our production facility manufactures bolts in greater quantities, driving down the cost of producing each bolt. At Auxano we are therefore able to offer much lower prices whether the bolts are needed now or next year.

Landmark Dates

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- July 2009:** Formation of Auxano Technologies. Headquarters; Bury, Greater Manchester, England.
- September 2010.** Auxano officially launches at SMM in Hamburg, Germany
- June 2011.** Production begins with first batch of f-series bolts. A quantity of 72 bolts of each of the 7 sizes in the range to be manufactured and made available from stock.
- September 2011.** Type approval granted by LRS. Auxano becomes first hydraulic bolt supplier in the world to receive type approval on a standard range of bolts.
- September 2012.** Auxano receives its first order for retro fitting bolts, using f-series bolts on a class NK vessel for a Japanese ship owner.
- November 2012.** ABS grant Auxano type approval certificate for our range of f-series bolts.
- December 2012.** Auxano provides training to our representative offices in China and United Arab Emirates. Offices to offer locally based on site supervision to benefit ship yard staff.
- December 2012.** Auxano production facility receives ISO:9001 quality assurance certificate for producing hydraulic shaft bolts. Certificate granted by DNV.
- May 2013.** Auxano agrees its first multi vessel / multi project agreement with an internationally recognised and renowned Greek ship owner. Their project list includes several series' of Bulk Carriers and Container vessels.
- May 2013.** Due to expansion, Auxano relocates to its current headquarters and new administrative offices in Middleton, Manchester, England.
- September 2013.** Auxano receives its first order for bolts to be supplied on a series of 38,000 dwt Bulk Carriers owned by the German ship owner, Reederei Nord.
- February 2014.** Auxano production facility is assessed by Bureau Veritas and receives certification as an approved manufacturer of sleeve type expansion hydraulic coupling bolts.

Benefits of hydraulic bolts over traditional reamer bolts

- Bolts that last for the lifetime of the vessel. Long term warranties offered as standard.
- Compared with traditional reamer bolts, fewer Auxano bolts are required to satisfy class society regulations.
- Not necessary to buy and maintain a quantity of spare bolts on-board.
- Improves health and safety in the ship yard.
- Provides assurance that a true fitted condition has been achieved.
- Provides a known and consistent bolt load.
- No ongoing maintenance programme necessary.
- Reusable. Can be installed, removed and re-installed as often as necessary.
- Installation: quick, easy and safe.
- Removal: quick, easy and safe allowing for predictable and accurate time planning.
- Eliminates damage to bolt holes during installation and removal.

Additional benefits of f-series Auxano bolts:

- Type approved and in stock for immediate shipment.
- Supplies held in strategic locations in Asia and Europe.
- Significantly lower in cost.



Auxano f-series bolt costs

Sleeve type expanding bolts are often considered to be a lot more expensive than standard reamer bolts. At Auxano we conducted a detailed analysis, generating an accurate comparison.

We considered a Capesize Bulk Carrier with two flanged connections; Propeller-Intermediate shaft and Intermediate shaft-Thrust shaft. The existing design specified 10 off reamer fit bolts to suit a hole size of $\varnothing 100\text{mm}$. These were fitted by the yard using dry ice. In addition to the installed bolts, the yard would supply 4 spare bolts per flange as standard. When carrying out bolt diameter calculations in compliance with class society regulations, Auxano was able to offer just 6 f-series bolts per flange, as an alternative.

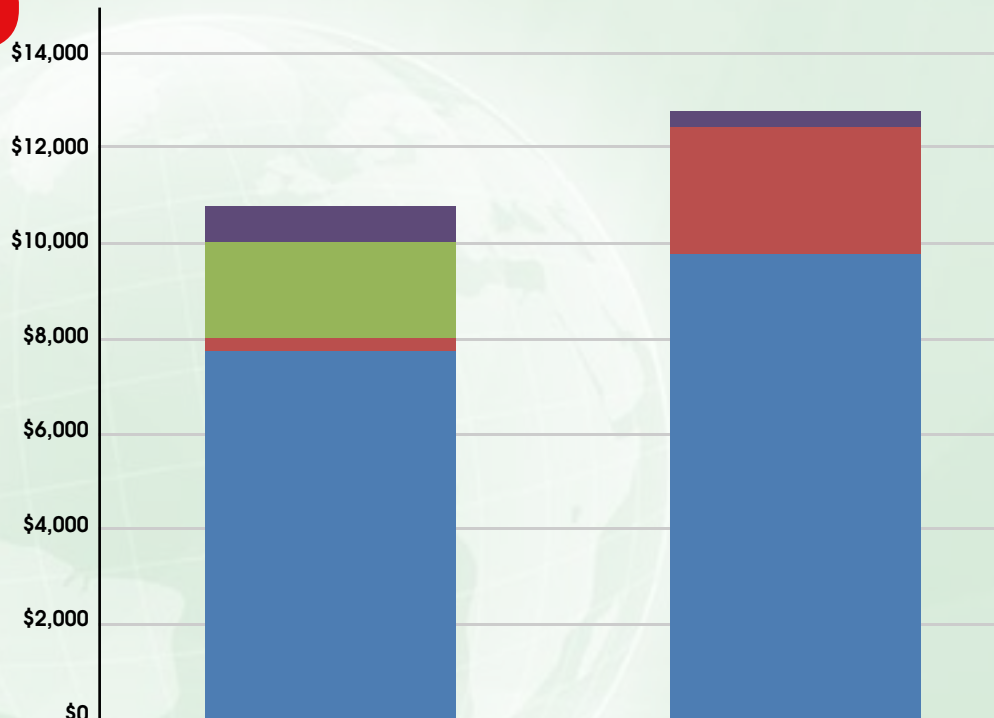
All costs relating to the standard reamer bolts are supplied by a major shipyard in Asia, with more than 80 years experience in shipbuilding.

From the data and graph, it can be seen that in this example the additional cost to the yard was just \$2000 USD. A minimal amount that justifies itself many times over, on the first occasion that the bolts are to be removed.

	REAMER	AUXANO
Number of bolts connecting shafts	20	12
Number of spare bolts requested	8	0
Total number of bolts	28	12
Cost per bolt	\$280	\$800
	REAMER	AUXANO
Total cost of all bolts	\$7,840	\$9,600
Tools/Equipment for installation	\$220	\$2,800
Classification costs	\$2,000	\$0
Installation - labour cost	\$704	\$270
TOTAL COST	\$10,764	\$12,670

Graph detailing costs

Cost based on flanged connections
Propeller/Intermediate Shaft
Intermediate Shaft/Thrust Shaft



Installation - Labour Cost
Classification Costs
Tools/Equipment for Installation
Total costs of all bolts

REAMER
\$704
\$2,000
\$220
\$7,480

AUXANO
\$270
\$0
\$2,800
\$9,600

Ship Owner / Operator : Newbuildings

We have seen in the previous section that the difference in cost between Auxano f-series bolts and freeze fitted reamer bolts is minimal. It should be noted however that a preference for f-series bolts should be relayed to the design house and shipyard at the earliest possible opportunity. This will prevent a larger number of holes, intended for reamer bolts to be specified and machined. Auxano works with design companies and yards when producing the bolt diameter and quantity calculations. From these we are very often able to offer a significant reduction in the number of bolts required to satisfy class requirements.

Conventional reamer bolts: A risk worth taking?

One major classification society estimates that each year, at least one of their vessels loses total propulsion as a result of bolt fatigue failure. Their research suggests that other class societies would report a similar figure. Bolt fatigue failure is often caused by high bending stresses in the bolt. This is a particular risk if a fitted condition has not been achieved. Whilst this is possible using conventional reamer bolts, with Auxano bolts a fitted condition is achieved in every bolt.

Ship Owner / Operator: Fleet management

At Auxano, we have been made aware of a number of instances in which conventional bolts have been the source of problems during a dry-docking period. Typical of those encountered are:

- Unknown period of time required to remove the bolts, causing delays.
- Bolts being damaged during the removal process.
- Additional costs incurred for repair of the damaged bolt holes.
- New bolts required to replace the damaged bolts.
- Delays waiting for delivery of the replacement bolts needing class approval

A dry-docking period is the perfect opportunity to upgrade from conventional reamer bolts to the Auxano f-series bolt range. As vessels age, scheduled surveys and non-scheduled maintenance work occurs more frequently. Potential problems associated with conventional bolting can arise on every occasion.

Owners that decide to upgrade their bolts benefit from:

- Auxano Bolts supplied from stock without delay. Class approved in advance.
- Eliminating the risk of delays due to reamer bolt removal/ installation on all future maintenance work.
- Eradicating future costs on bolt hole repairs and replacement bolts.
- Assurance that all bolts are installed and have achieved a true fitted condition





Ship design

Often when considering the drive shaft and bolting method, it is assumed that conventional reamer bolts will be used by the yard. If, after this assumption is made, a ship owner specifies a preference for sleeve type hydraulic bolts, Auxano will often calculate and conclude that fewer bolts are necessary. This is an advantage of using hydraulic sleeve type bolts over conventional reamer bolts. However this advantage is utilised best by selecting the bolt type during the design stage.

Benefits: Shipyard

- Fewer holes in each shaft section
- Fewer holes to be reamed after assembly
- Fewer bolts to be installed
- Hole form and tolerance requirements are the same for Auxano bolts as conventional bolts
- Installation method much easier and quicker.
- Eliminate the use of liquid nitrogen or 'dry ice'
- Eliminate the need for heavy duty hammering of bolts with potential risk of damage to the shaft.
- Guarantee that a true fitted condition has been achieved
- Easy to remove bolts (if required after sea trials) that are reusable.

Cutter Suction Dredgers

During any maintenance work on a cutter suction dredger, it may be necessary to split the cutter ladder at any flange. This involves removal of the bolts and if those bolts are conventionally fitted bolts, this will create problems which are likely to increase costs and cause possible delays.

Down time can be affected and costs invariably increase. Auxano hydraulic bolts are a cost effective solution to the problem.

CSD Owners: Benefits

- Reusable bolts that last the lifetime of the vessel
- Quick and easy to remove and install, allowing predictable time planning
- Eliminate the danger of compromising the shaft design when holes need repairing and become enlarged.
- Choose f-series bolts from stock as a low cost alternative.
- Receive accurate torque transmission calculations, based on the bolt load applied. This provides our clients with a known factor of safety above and beyond the torque generated.
- Select from a choice of debris and seawater protection methods in our bolt design. Traditionally, stainless steel nuts have been used. Auxano offers a low cost, effective alternative as well as this traditional method.



Why Choose Auxano?

We believe that ship yards and owners should demand the following from their hydraulic bolt suppliers:

- Good quality
- Competitive price
- Excellent service
- Efficient after sales technical support



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Quality

- Auxano Technologies manufacturing facility is DNV certified to ISO 9001:2008
- Manufacturing assessment certificate, approved by Bureau Veritas.
- Quality assurance system reviewed and approved by both LRS and ABS as part of our type approval application.
- Auxano has a 100% testing policy. All bolts are individually tested as standard procedure.
- All bolt and sleeve material is ultrasonically tested as standard.

Price

- The price of hydraulic bolts has drastically reduced since around 2010. This is in part due to Auxano driving down the price through its type approved f-series range.
- Auxano producing bolts in larger quantities has also allowed us to pass on cost savings during the manufacturing process.
- Pre type approved bolts do not require us to pass on high class society compliance costs. These are usually high for suppliers that design and manufacture bolts on a contract by contract basis.
- Low delivery costs due to bolts being stored across Europe and Asia.



Service

- With a truly global presence, Auxano is able to provide excellent service to its clients around the world. Auxano uses a network of strategic locations for storage of its f-series bolts. This means that bolts and spare parts are never more than a day or so away.
- Our partners in Asia are carefully selected by their performance and reputation in that region. All our representatives have sufficient resources to deal with our clients' needs, operating in their time zone and language.
- On-site supervision provided to yards with little or no experience of hydraulic bolting. Supervision is provided by our locally based partners.



After sales

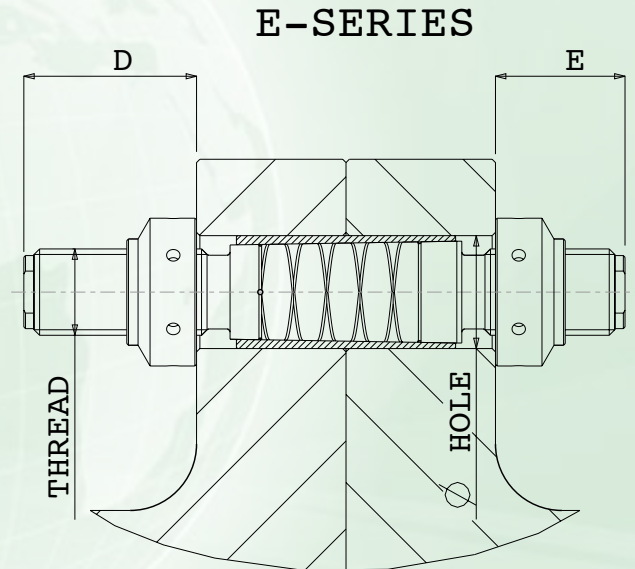
- Auxano maintains a large stock of spare f-series parts. This includes taper sleeves, a component supplied oversize to the yard for machining on site. In the event of machining error, Auxano are able to provide replacement parts from stock. This also eliminates the need to buy spare sleeves in advance.
- In Asia, our technical support is provided locally by well trained and professional representatives as an alternative to contacting Auxano in the UK.
- In Europe, we are perfectly positioned to provide support to ship owners and management companies as and when necessary.

Our commitment to the future:

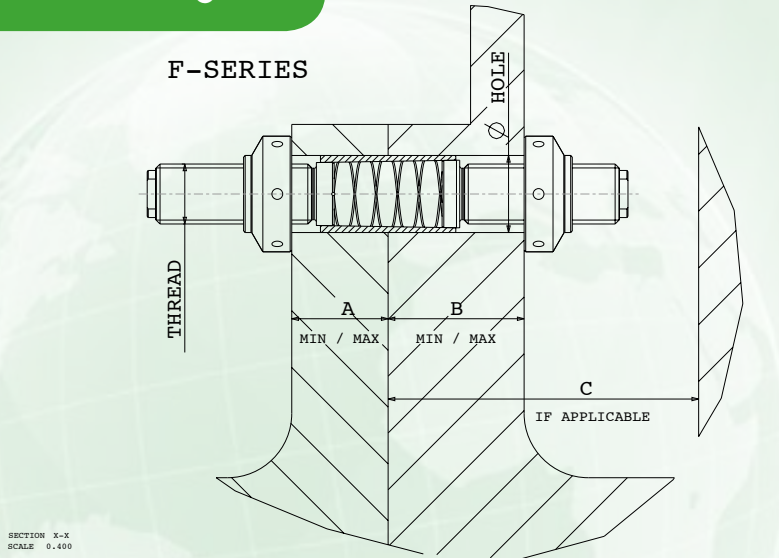
At Auxano, we have laid the foundations to establish the company as a long term supplier of hydraulic shaft bolts. Unlike other suppliers that design and supply bolts on a vessel by vessel basis, Auxano have committed itself financially to the marine industry through our investment in obtaining type approval certificates for our f-series bolts. We are dedicated to serving the marine industry. Despite our achievements in developing a standardised range of bolts, Auxano will continue with our research and development to further serve the industry.

E-series table and 2D drawing

MODEL	HOLE SIZE		THREAD	THREAD STANDOUT		APPLIED LOAD (KN) AT 1300 BAR
	FROM	TO		D	E	
E1	40	44	M33x3,5	67	51	321
E2	45	47	M36x4	72	54	346
E3	48	51	M39x4	79	60	474
E4	52	54	M42x4,5	84	63	498
E5	55	58	M45x4,5	89	67	584
E6	59	63	M48x5	96	72	645
E7	64	68	M52x5	104	78	805
E8	69	72	M56x5,5	110	82	973
E9	73	78	M60x5,5	115	88	1066
E10	79	83	M64x6	123	94	1186
E11	84	87	M68x6	129	98	1463
E12	88	93	M72x6	137	104	1585
E14	94	97	M76x6	143	108	1771
E15	98	103	M80x6	152	116	2039
E16	104	109	M85x6	161	123	2250
E17	110	116	M90x6	170	129	2600
E18	117	121	M95x6	179	136	3114
E19	123	129	M100x6	187	142	3229
E20	130	135	M105x6	199	152	3734
E21	136	140	M110x6	208	158	4086
E22	141	146	M115x6	217	165	4481
E23	147	150	M120x6	225	171	4989

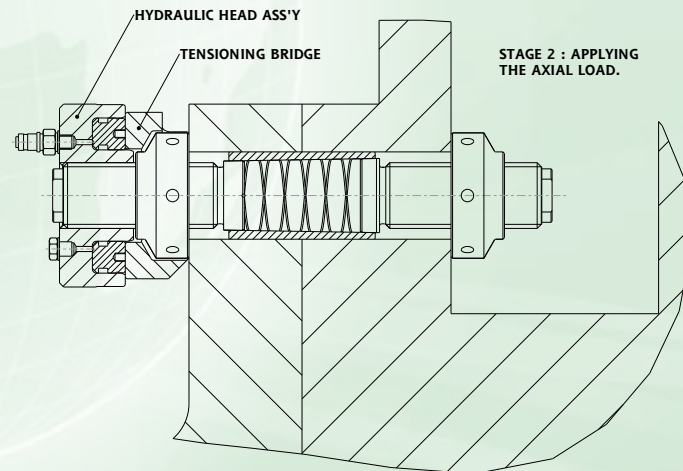
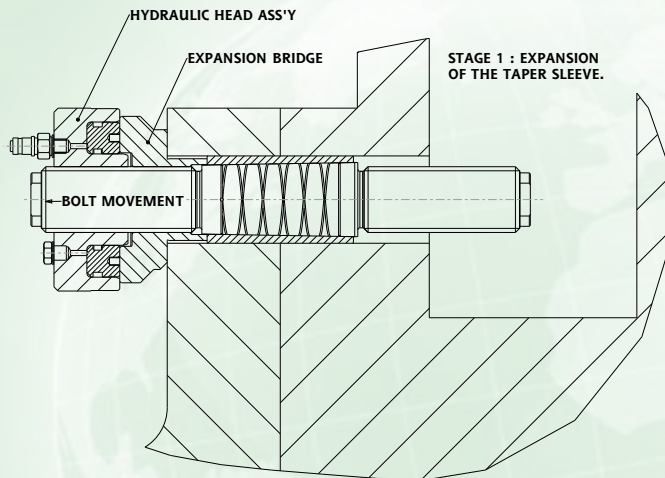


F-series table and 2D drawing

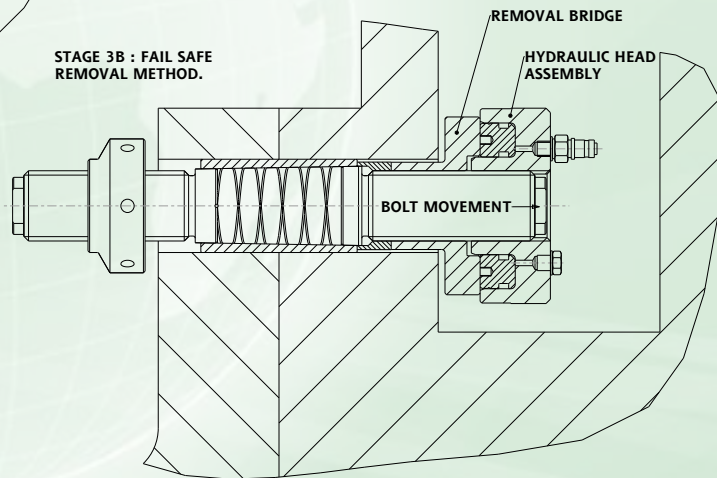
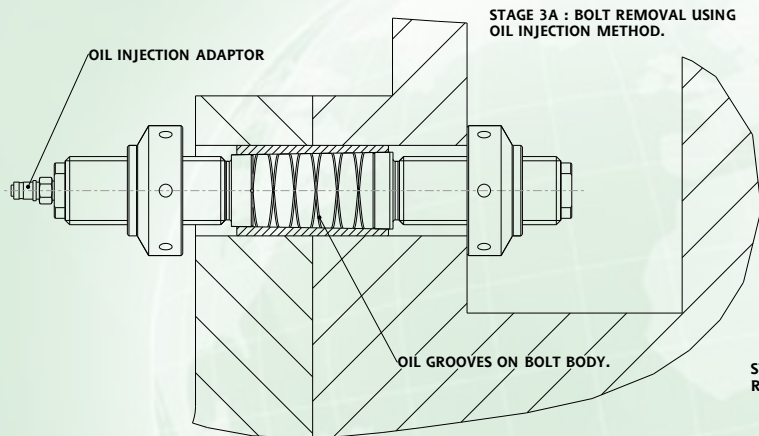


MODEL	HOLE SIZE		THREAD SIZE	FLANGE A		FLANGE B		C	APPLIED LOAD (KN) AT 1100 BAR
	FROM	TO		MIN	MAX	MIN	MAX		
F1	55	61	M45x4.5	55	85	55	106	232	606
F2	62	69	M48x5	62	97	62	120	256	726
F3	70	79	M56x5.5	70	110	70	138	290	963
F4	80	89	M64x6	80	125	80	154	324	1288
F5	90	99	M72x6	90	138	90	171	363	1610
F6	100	111	M80x6	100	154	100	190	402	2175
F7	112	125	M90x6	112	172	112	213	447	2771

Installation Procedure



Removal Procedure



Hand-Pumps

As part of our bolting package, Auxano will provide a lightweight, reliable and easy to operate unit. The pump weighs just 8.3 Kgs, making it extremely portable and therefore ideal for use in any shipyard.

Auxano 2-stage hand pumps come with a pressure gauge as standard. This enables a precise and safe control of the work carried out. The gauge is directly mounted on the pump and well protected by a designed pump lever.

- Oil return connections on all pumps.
- Robust design.
- Aluminium tank.
- Low weight & maintenance friendly.
- Needle release valve - offers full control lowering the load.
- Easy to refill oil and with optional overflow valve
- Mounting holes for fixed installations.

Every pump is also supplied with a quick connect coupling and flexible hose, also with quick connect/release fittings. Our standard length of hose is 2 metres.



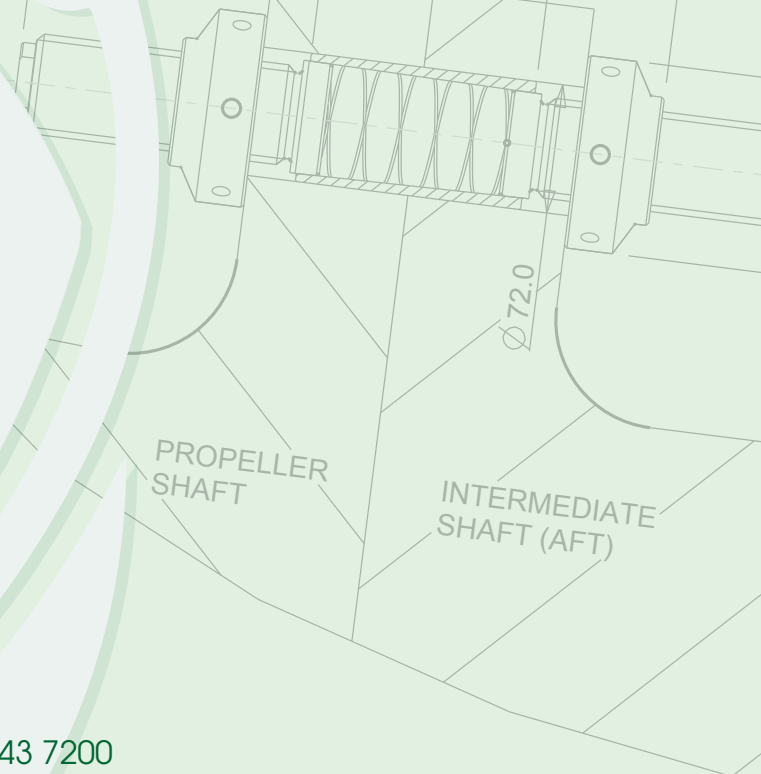


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SECTION
SCALE

ALL DIMENSIONS IN mm
UNLESS STATED

MATERIAL

DO NOT SCALE

SPECIFICATION

REMOVE ALL BURRS