

The University of Texas at Arlington



Project Report-2 Machine screw jack

Submitted to:
Dr. Sunand Santhanagopalan

Manufacturing Processes and Systems ME-5326

Project Group-8

- 1) Yash Sudhir Mandal
- 2) Siva Sai Pranav Jogadhenu
- 3) Akhil Sai Varma Kuna
- 4) Hardik Hurenkar
- 5) Abhishek Singh

Introduction

A machine screw jack is a device that converts rotational motion into a “push-pull” linear motion, it is operated by turning the worm screw. It is generally used to lift heavy weights, like to raise and lower stabilizers of an aircraft

Description

A machine screw jack consist of a heavy duty lifting screw made of cold rolled stainless steel, a loading pad mounted on its top made of cast iron, which screws into a worm gear made of bronze alloy on which a thrust bearing is attached to permit jack to bear load on both directions. The worm gear is connected to an input shaft on which a worm and input shaft bearing are connected. The whole mechanism is covered in a housing of cast iron and closed on top by a sleeve cap and a protection table connected at the bottom.

Advantages and Limitations

Screw jacks can have a small size but can lift a good amount of load to their capacity. They can be assembled together to lift more load and multiple units can work together as a system with a single motor.

Screw jacks are limited according to their lifting capacity. A fine pitch can increase the advantage of a screw but can reduce the operating speed of the jack.

Applications

Screw jacks are used in automobile industry to lift up chassis of a car to fit engine or related work. They are also used in aviation to raise or lower stabilizers in an aircraft

The part in screw jack are as follows: -

- 1.Lifting screw
- 2.Worm gear
- 3.Input shaft
4. Housing
- 5.Sleeve cap
- 6.Load pad.

Contents

Introduction.....Error! Bookmark not defined.

Part 1: Lifting Screw 3

Part 2: Worm Gear 4

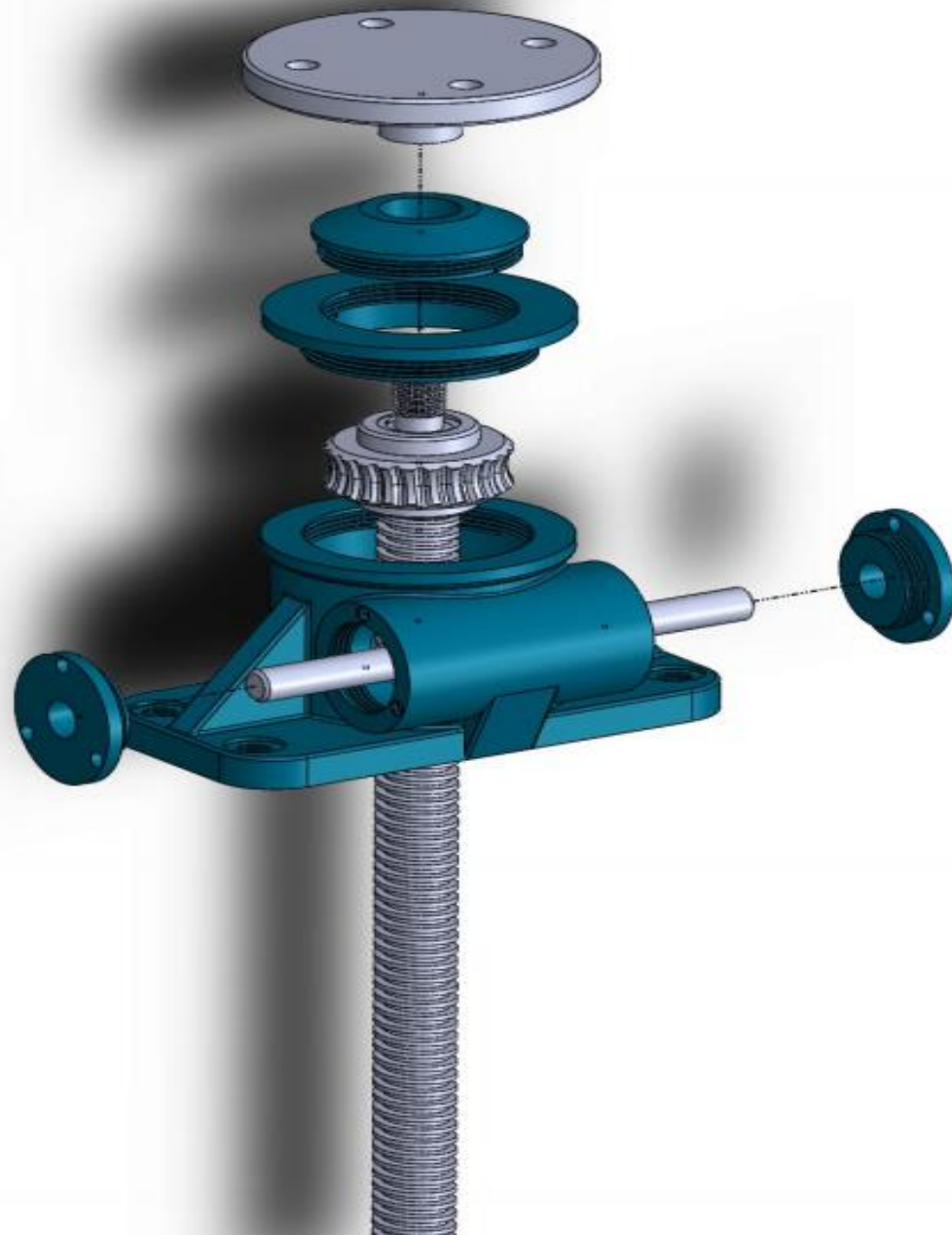
Part 3: Input shaft (Worm)..... 8

Part 4: Housing 11

Part 5: Sleeve & Sleeve caps..... 14

Part 6 Load Pad 18

Part 7: bearings 20



Part 1: Lifting Screw

Part description

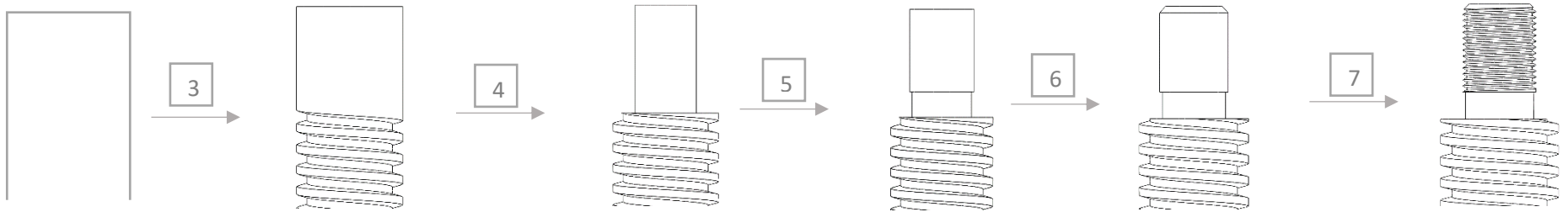
Seq no.	Part	Diameter	Length	Thread dimensions
1.	Lifting Screw	1 in	15 in	5/8-18UNF

Material description

Material code	description
AISI 1020	Stainless steel cold rolled

Operation

Seq. No.	Operation	Machine	Description
1.	Cutting	Band saw machine	cut into desired lengths with a band saw machine. Keeping a
2.	Machining	CNC lathe	The shaft is machined to obtain desired radius for the part
3.	Chamfering	CNC turning machine	Chamfer the bottom end
4.	Threading	Thread rolling machine	Feeding round steel bar (blank) through a cylindrical die roll threader for cold forming of threads
5.	Step cutting	CNC turning machine	Step cut to desired length for the loading pad thread.
6.	Cutoff	CNC turning machine	Making a cutoff with desired dimensions
7.	Chamfering	CNC turning machine	1/16-inch 45° chamfer
8.	Threading	CNC turning machine	5/8-18 UNF 2A threading
9.	Galvanized coating	N/A	For corrosion resistance



Part 2: Worm Gear

Part description

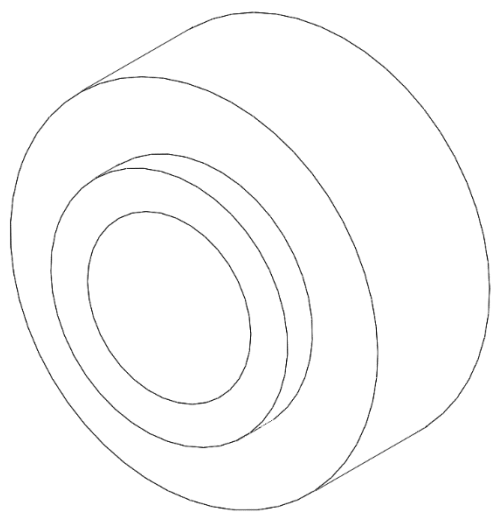
Seq no.	Part	Outer Diameter	Length	Internal Diameter	Internal screw dimension
1.	Worm Gear	2.25 in	1.30 in	1 in	1'' ACME 2C

Material description

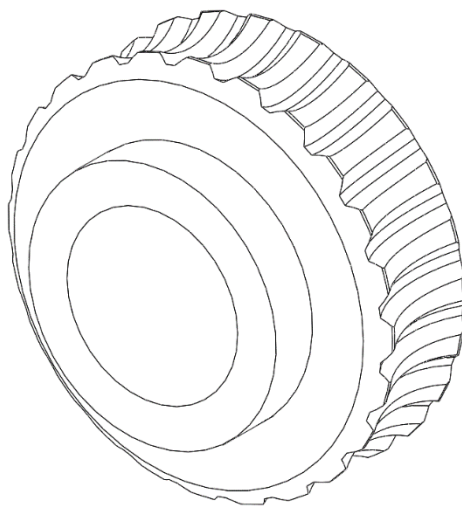
Material code	description
UNS C52400/UNS C95200	aluminum-bronze

Operation process

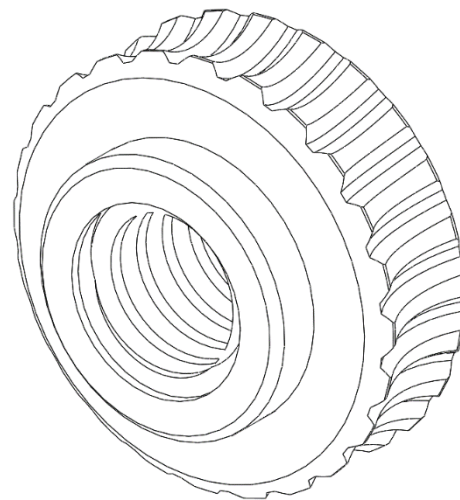
S. No.	Operations	Machines/tools/processes	Description
1.	Preparing mold	N/A	mold is prepared for the following gear profile.
2.	Pouring of wax	N/A	Wax is poured into the die to make wax pattern.
3.	Refractory coating	Ceramic slurry bath	The wax pattern is dipped into the ceramic slurry until uniform and required layer is achieved.
4.	Wax removal	furnace	After the ceramic coating solidifies the pattern is placed inside the furnace and the wax is removed.
5.	Casting	Investment Casting	Gear blanks are produced. Phosphor bronze/aluminum-bronze is used for casting the gear blank.
6.	Removal of shell	Manually	The shell is broken manually using tools.
7.	Post processing	Band saw	Extra parts like sprue and risers are removed
8.	Machining	CNC	Preparing the gear blank to required dimensions by machining
9.	Gashing	Involute cutter	Gear teeth are cut to the required dimension
10.	Hobbing	Gear hobbing tool	Hobbing process mimics the worm to cut it to full depth and proper form
11.	Internal threading	CNC lathe	Internal threading is done.
12.	Heat treatment	furnace	Quenching and tempering to improve the toughness of the gear.

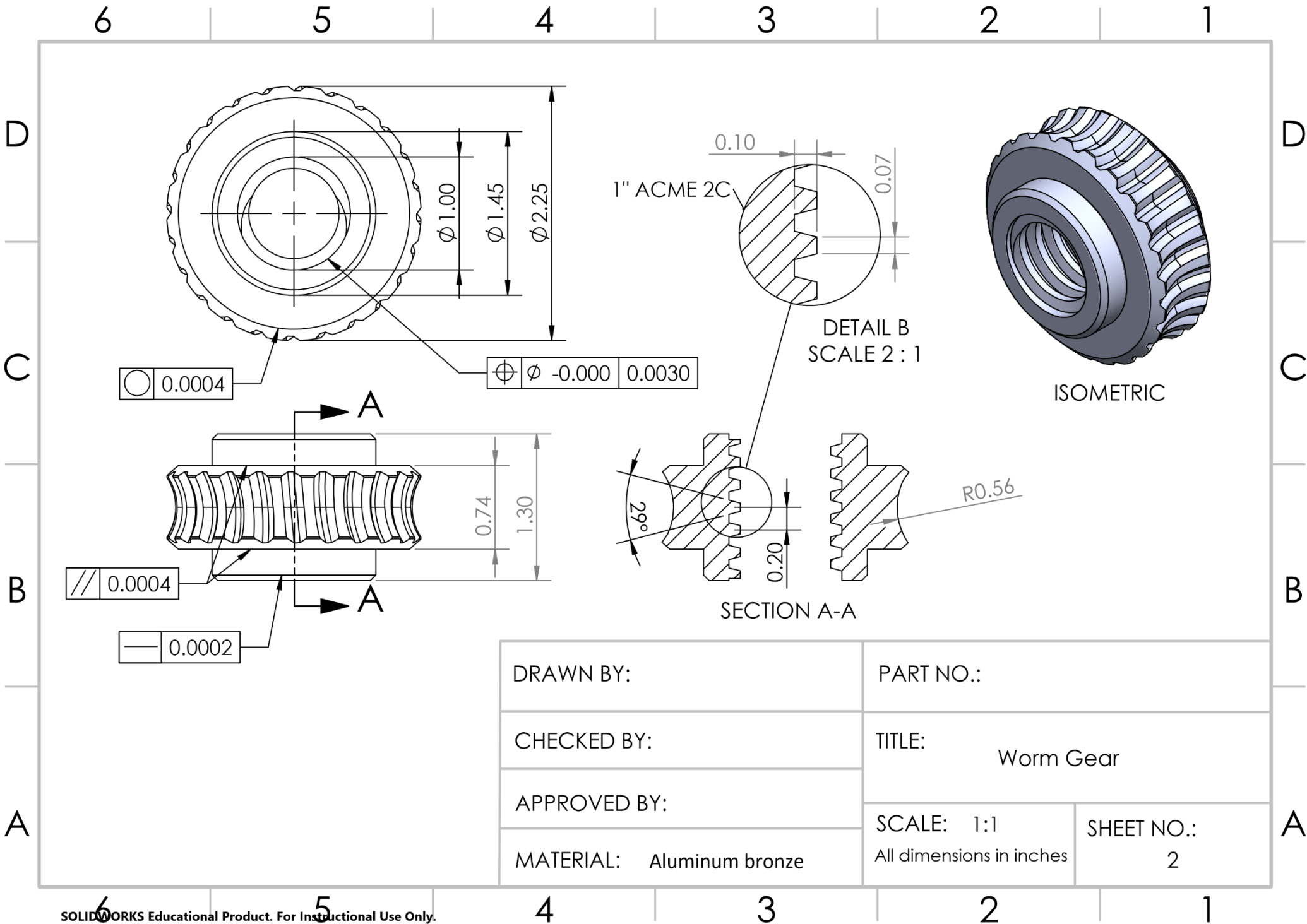


3&4



5





Part 3: Input shaft (Worm)

Part description

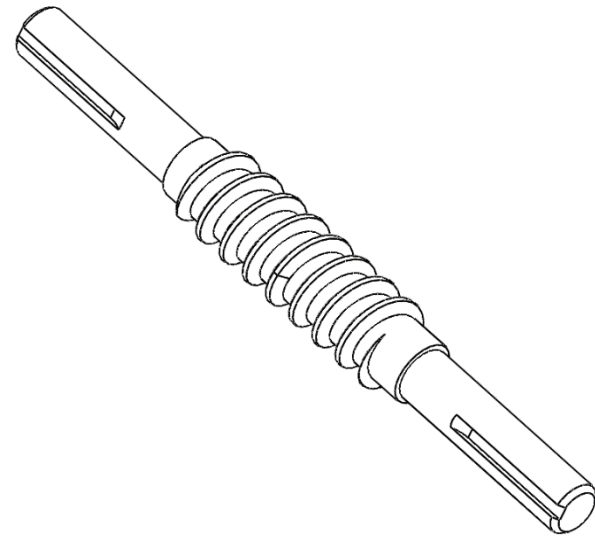
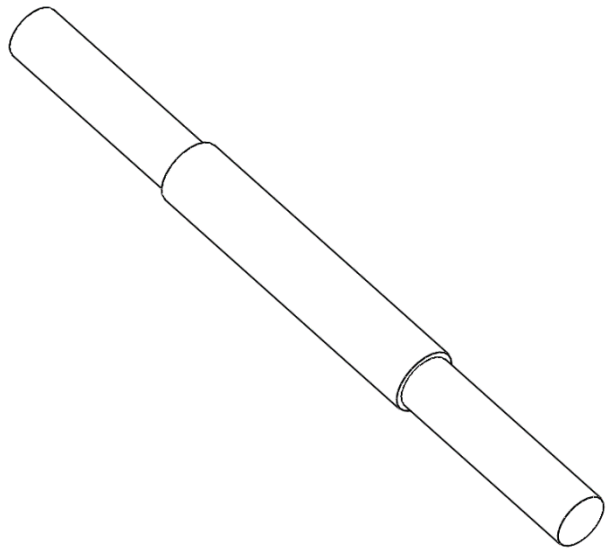
Seq no.	Part	Diameter	Length	Other dimensions
1.	Input Shaft	0.43 in	7 in	Refer 2D drawing

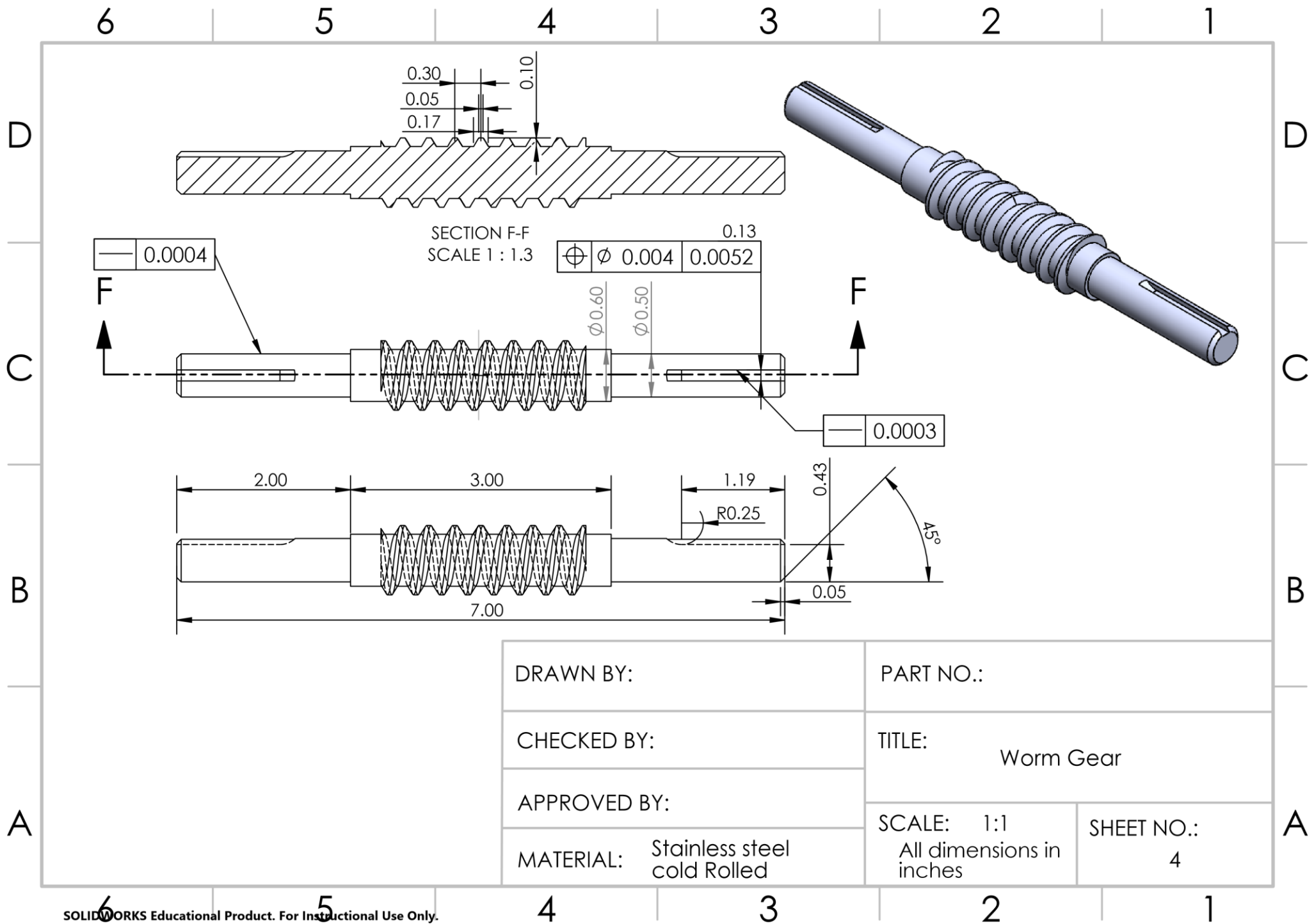
Material description

Material code	description
AISI 1020	Stainless steel cold rolled

Operation process

S. No.	Operations	Machines	Description
1.	Cutting	Band saw machine	Cutting the blank to required length
2.	step cutting	CNC turning machine	setting the component outer radius
3.	Chamfering	CNC turning machine	Chamfering the ends
4.	Hobbing	Gear hobbing machine	Cutting the desired gear using a hobbing tool of required profile
5.	Slot cutting	Slot cutting machine	Cut slots on either end for keys.
6	Heat treatment	Quenching machine	Quenching and tempering to improve the toughness of the gear.
7	carburizing	Carburizing furnace	Carburizing is done to improve surface hardness





Part 4: Housing

Part description

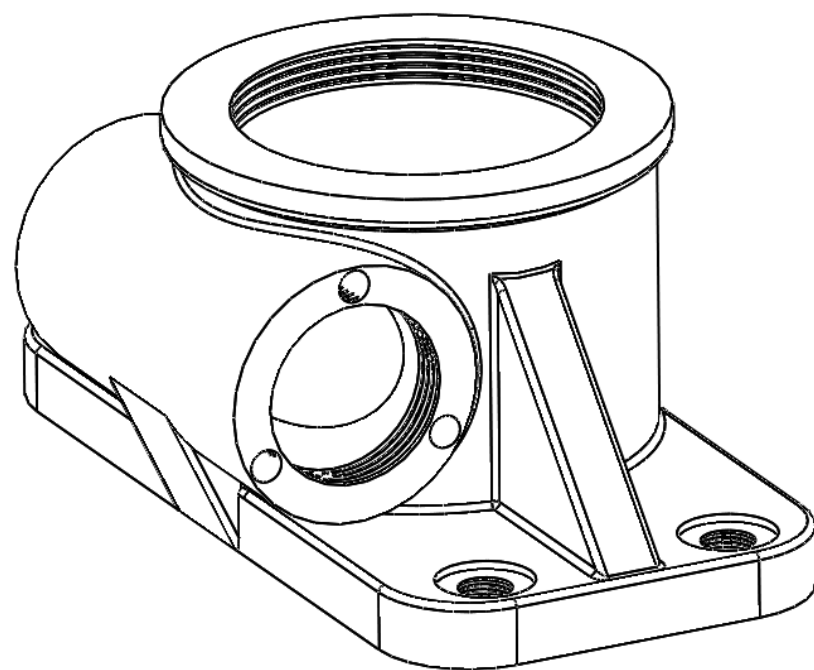
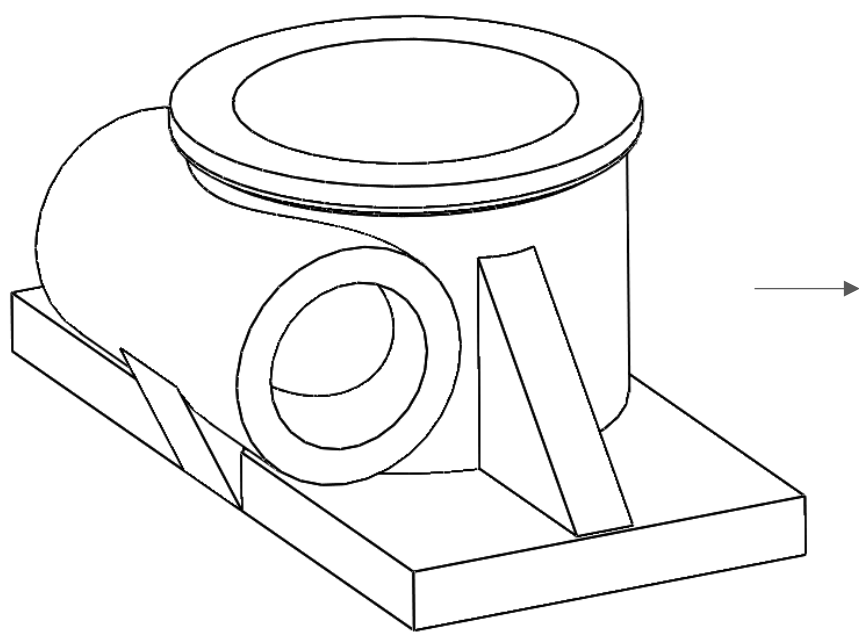
Seq no.	Part	width	Length	Other Dimensions
1.	Housing	3.50 in	7 in	Refer 2D drawing

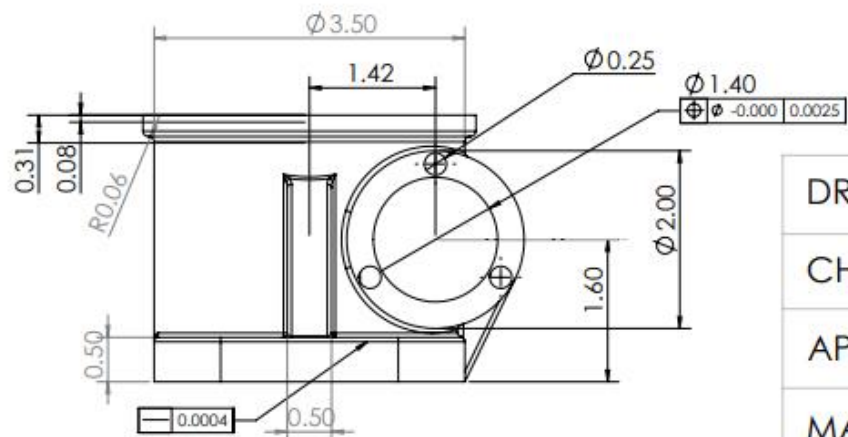
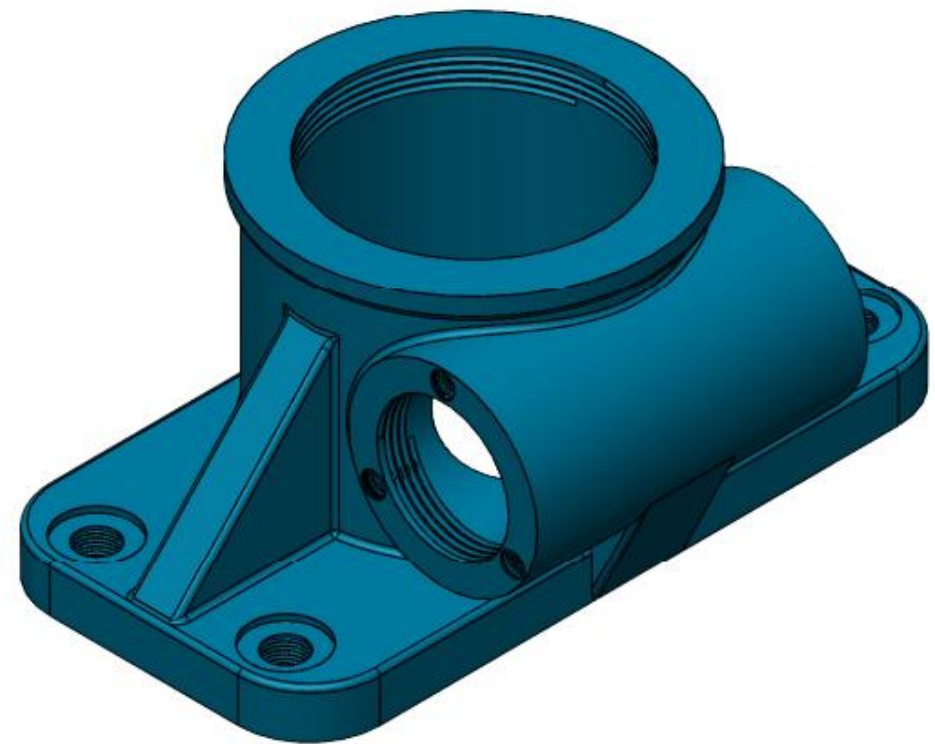
Material description

Material code	description
ASTM A842	Cast Iron

Operation Process

Seq. No.	Operation	Machine	Description
1.	Preparing sand mold	Sand casting	Sand is packed into a box and a pattern of the required part is placed on the sand.
2.	Molten metal pouring	Sand casting	Molten cast iron is poured into the sand mold through the sprue.
3.	Sand removal	Air blaster	After the molten metal is solidified the mold is broken and the extra sand is removed from the part using compressed air or by shaking
4.	Post processing	N/A	Post processing, removal of sprue riser and extra protrusions formed during casting
5.	Sand blasting	Sanding blasting chamber	Sand slating is done to improve surface finish.
6.	Drilling	CNC drilling machine	Holes for bolts are drilled
7.	Threading	CNC Turing machine	Internal threading is done.
8.	coating	Spray painting apparatus	A layer of primer is applied to the surface followed by layer of paint.





MATERIAL: Cast Iron

SHEET NO.:
1

Part 5: Sleeve & Sleeve caps

Part description

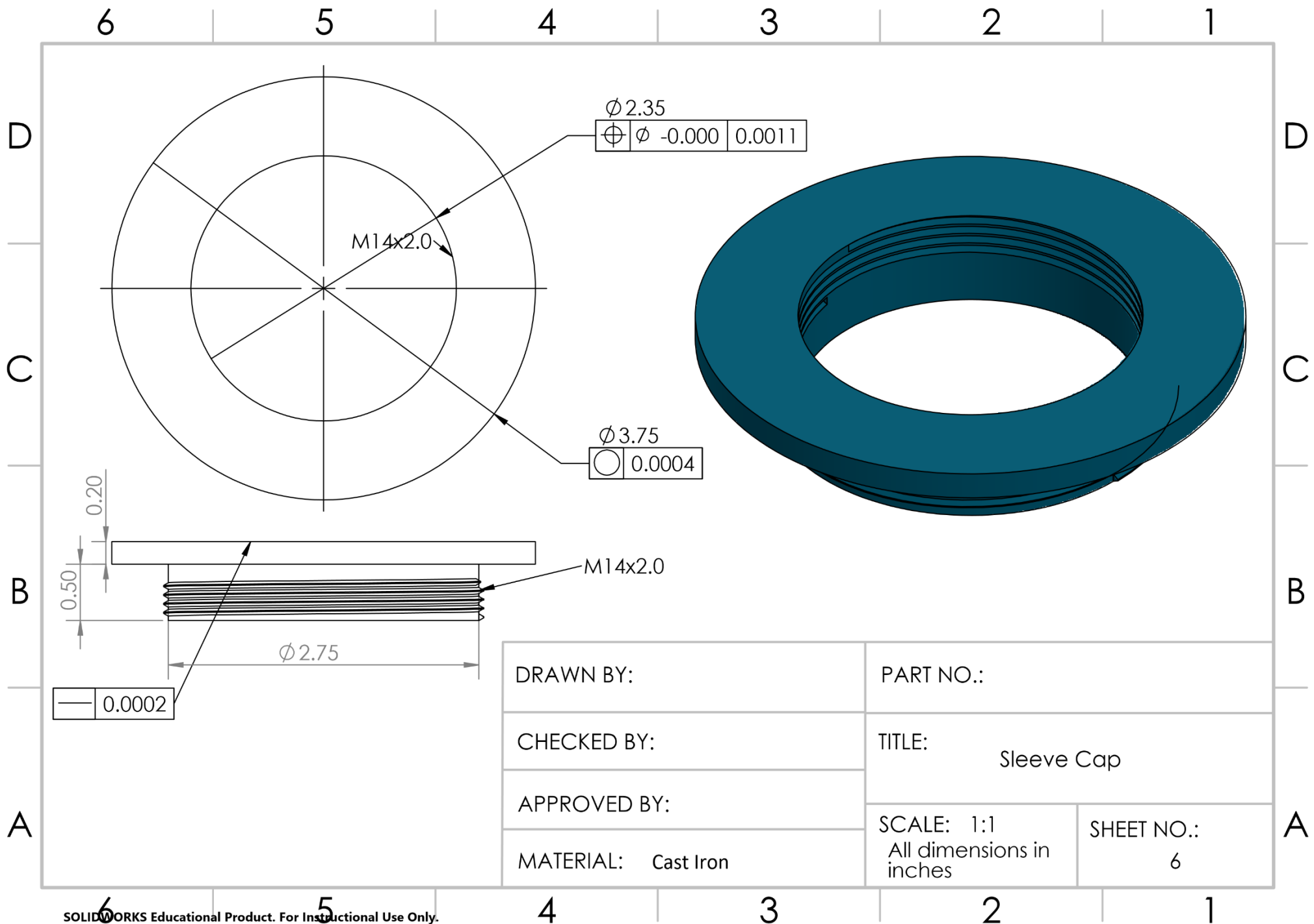
Seq no.	Part	All dimensions
1.	Sleeve	Refer drawing sheet no.
2.	Sleeve cap	Refer drawing sheet no.

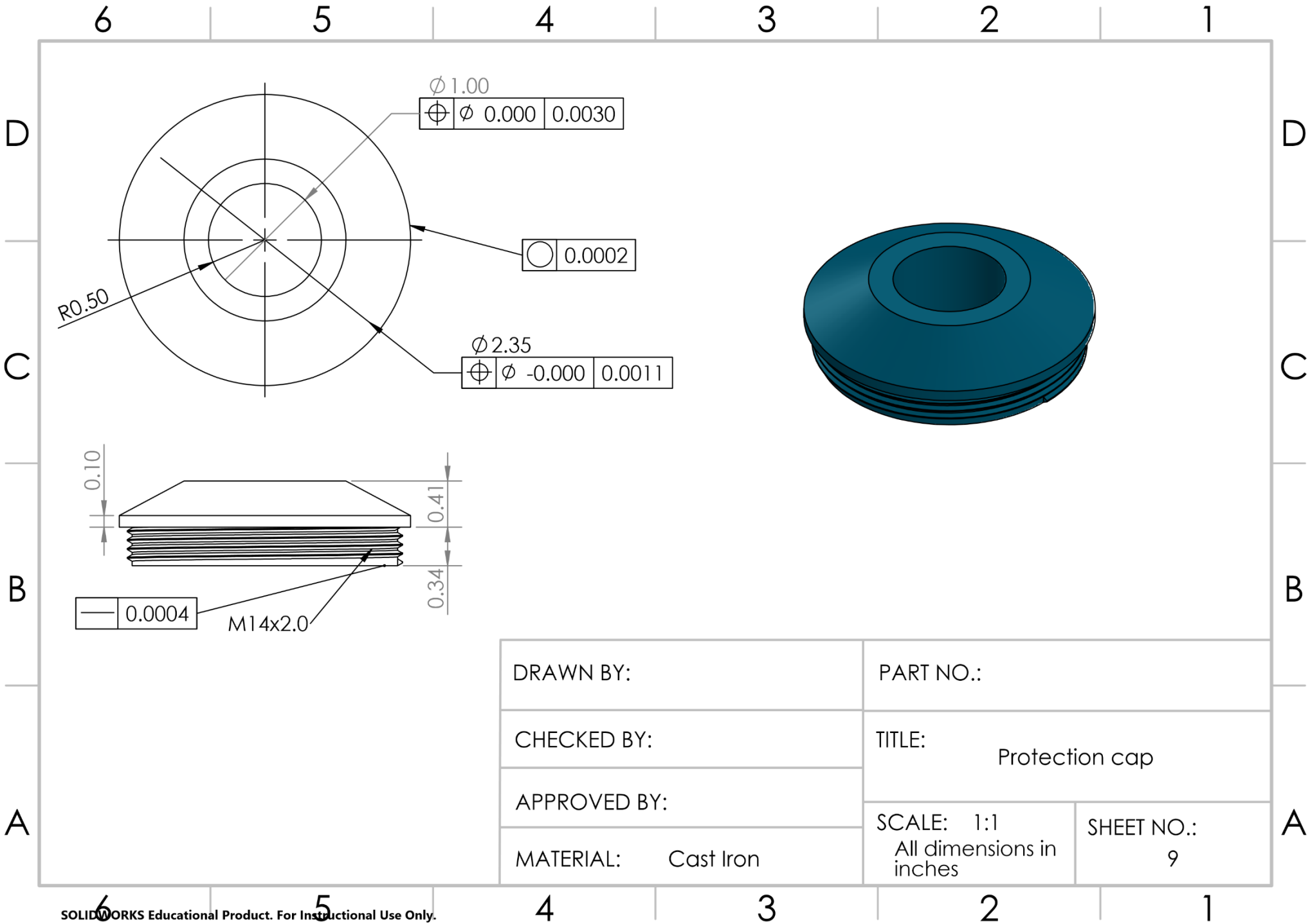
Material description

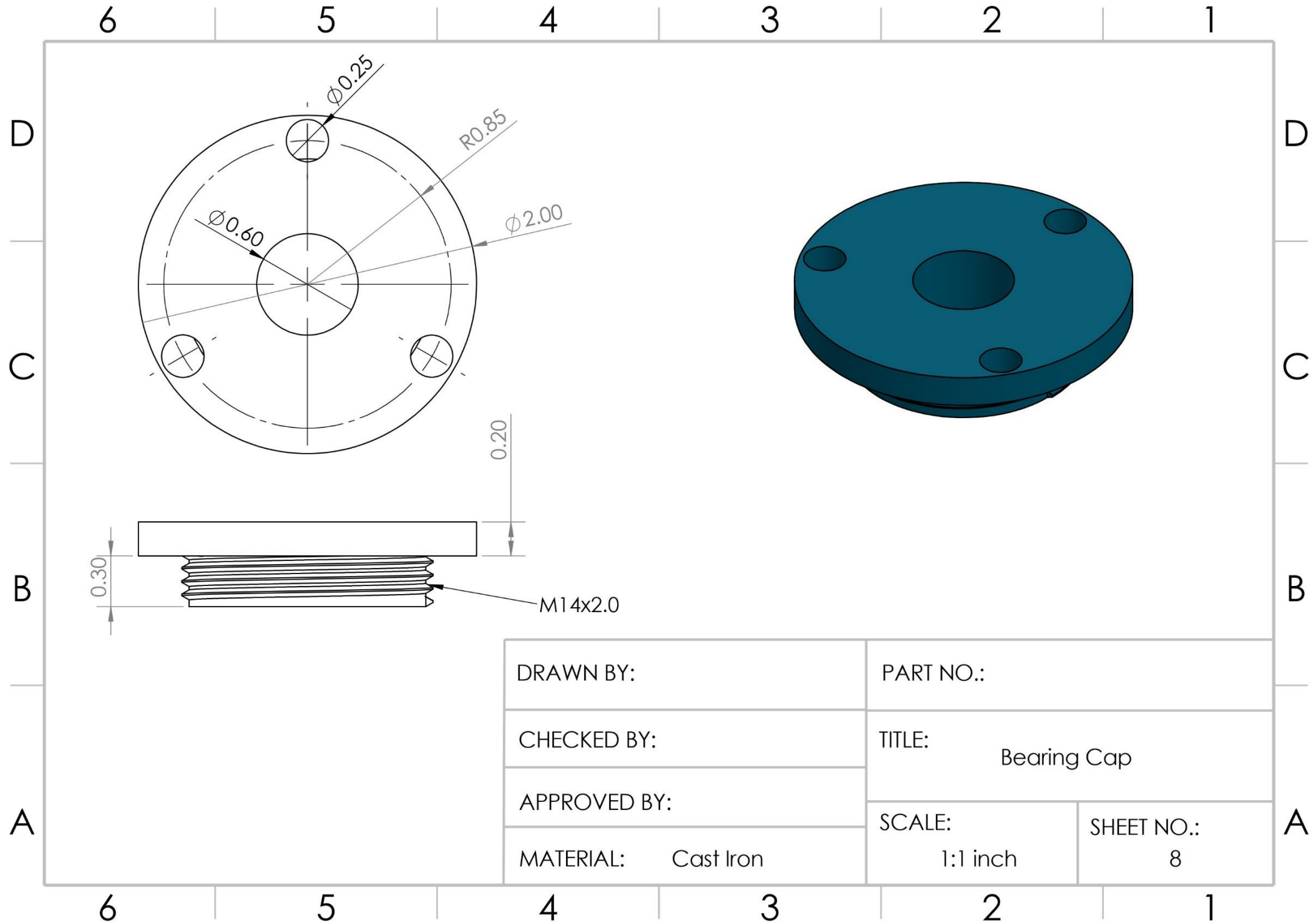
Material code	description
ASTM A842	Cast Iron

operation

Seq. No.	Operation	Machine	Description
1.	Preparing sand molds	Sand casting	The sand is filled into a box and is rammed to make it compact. Pattern is placed between the molds.
2.	Pouring molten metal	Sand casting	Liquid iron is poured into the mold through sprue.
3.	Breaking of mold	N/A	The mold is broken once the metal solidifies
4.	Sand removal	N/A	Part is thoroughly cleaned using compressed air.
5.	Post processing	N/A	Post processing, removal of sprue riser and extra protrusions formed during casting.
6.	Machining	Machining tool	Surface finishing is done
7.	Drilling	CNC drilling machine	Holes for bolts are drilled
8.	Threading	CNC Turing machine	External threading is done.







Part 6 Load Pad

Part description

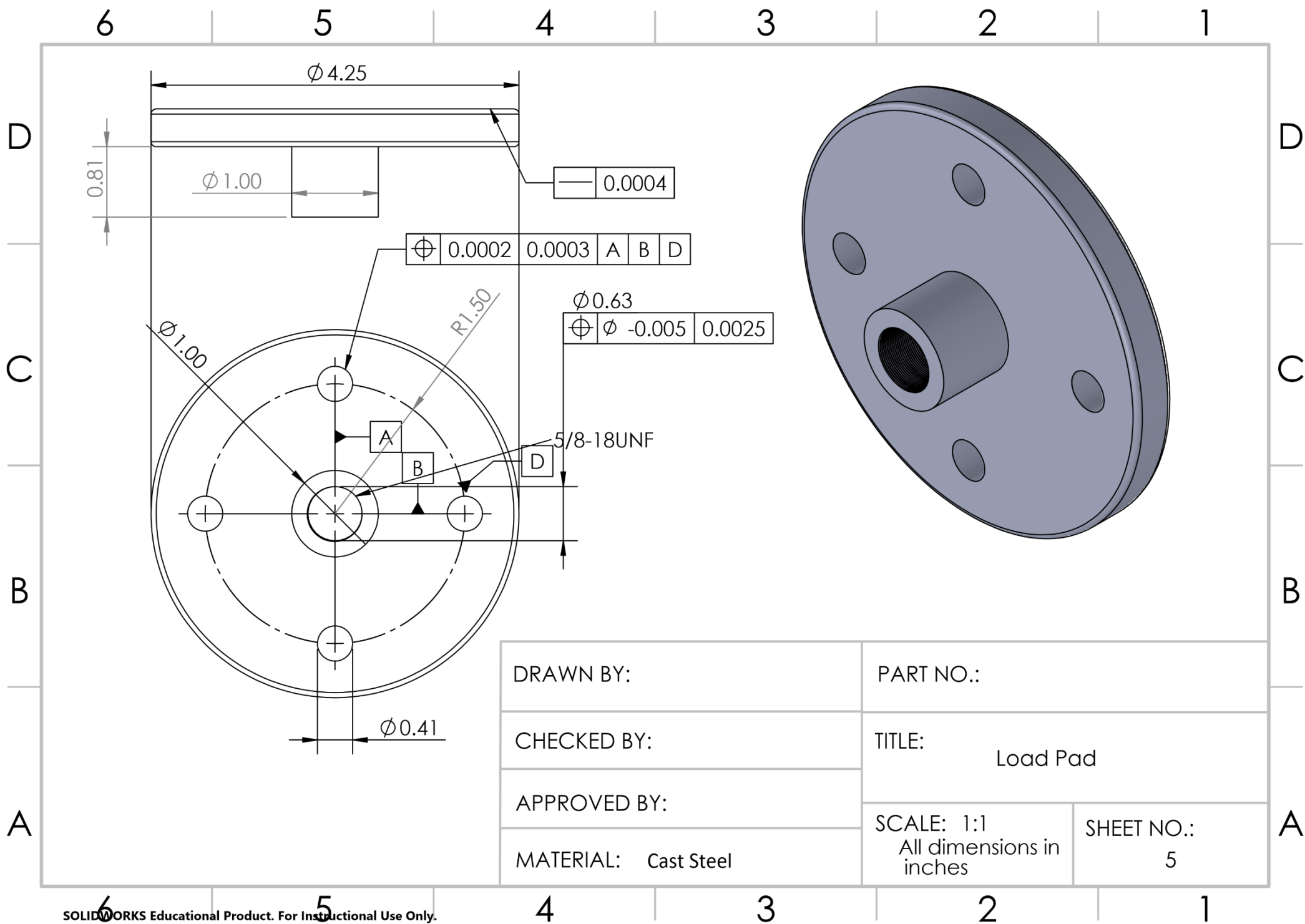
Seq no.	Part	All dimensions
1.	Load Pad	<u>Refer 2D Drawing</u>

Material description

Material code	description
ASTM A27	Cast steel

operation

Seq. No.	Operation	Machine	Description
1.	Preparing sand molds	Sand casting	The sand is filled into a box and is rammed to make it compact. Pattern is placed between the molds.
2.	Pouring molten metal	Sand casting	Liquid steel is poured into the mold through sprue.
3.	Breaking of mold	N/A	The mold is broken once the metal solidifies
4.	Sand removal	N/A	Part is thoroughly cleaned using compressed air.
5.	Machining	CNC machining	Surface finishing is done
6.	Drilling	CNC drilling machine	Holes for bolts are drilled
7.	Threading	CNC Turing machine	External threading is done.
8.	Heat treatment	N/A	Tempering is done to improve the toughness of the part.



Part 7: bearings

Part description

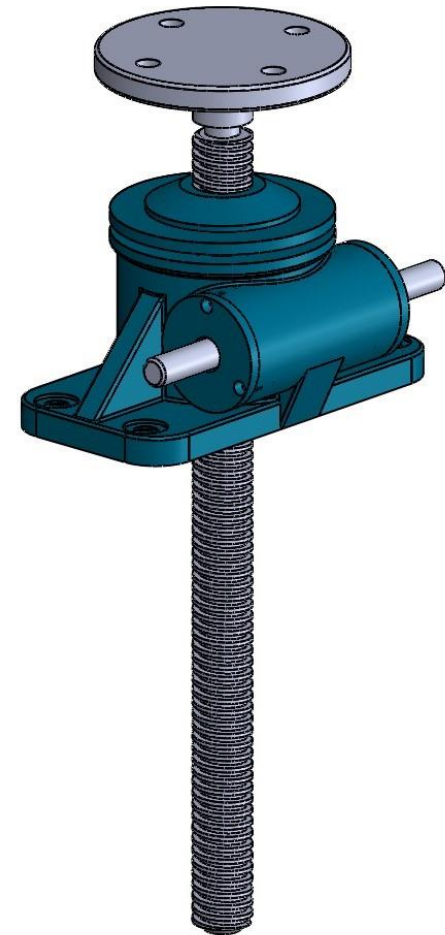
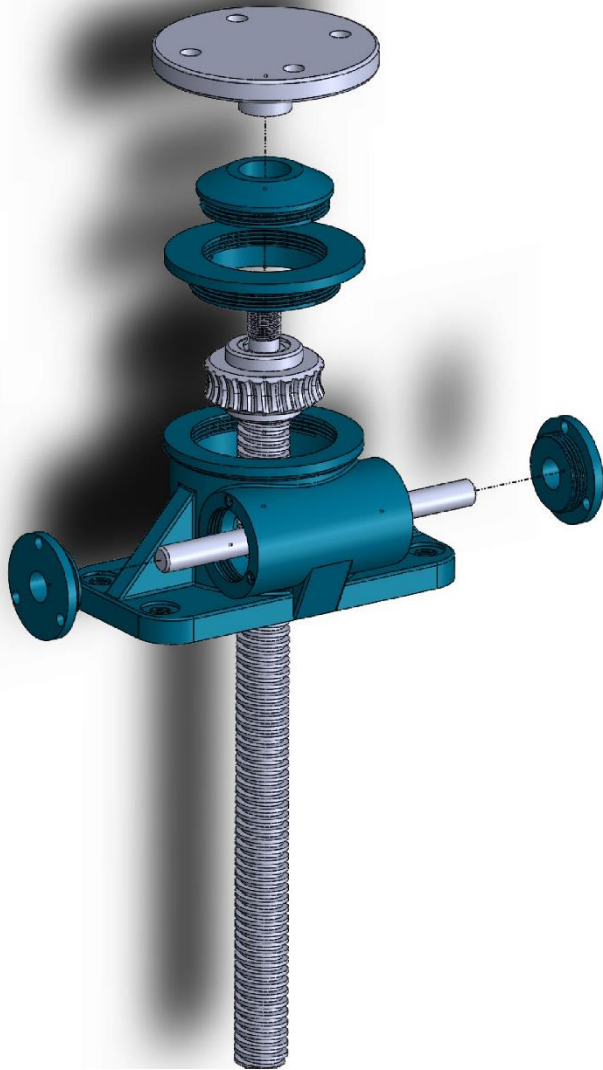
Seq no.	Part	quantity	dimensions
1.	Bearing 1	2	Bore Ø 15 mm, Outside Ø 32 mm
2.	Bearing 2	2	Bore Ø 30 mm, Outside Ø 55 mm

Material description

Material code	description
N/A	Buy

Assembly

<u>Sequence</u>		<u>components</u>	<u>Instruction</u>
1.	Assembly 1	Worm gear and thrust bearing	the overall assembly first starts with assembling the bearings and on both the sides of the worm gear.
2.	Assembly 2	Assembly 1 and housing	The previously assembled components which contain the gear and bearing are placed inside the housing. The bearing rest on shoulders created inside the housing
3.	Assembly 3	Housing and sleeve	The sleeve is screwed onto the housing.
4.	Assembly 4	Sleeve and sleeve cap	The sleeve cap is bolted on to the sleeve for perfect fit. It holds the bearing in its place.
5.	Assembly 5	The lifting screw and worm gear	The lifting screw mated with the internal threads of the worm gear.
6.	Assembly 6	Worm and bearings	The bearings are assembled on both sides of the worm shaft.
7.	Assembly 7	Assembly 6 and housing	The parts assembled in assembly 6 are then inserted in the housing and the caps are bolted on both sides for tight fit.



DRAWN BY:	PART NO.:	
CHECKED BY:	TITLE: Machine Jack	
APPROVED BY:	SCALE:	SHEET NO.:
MATERIAL:		