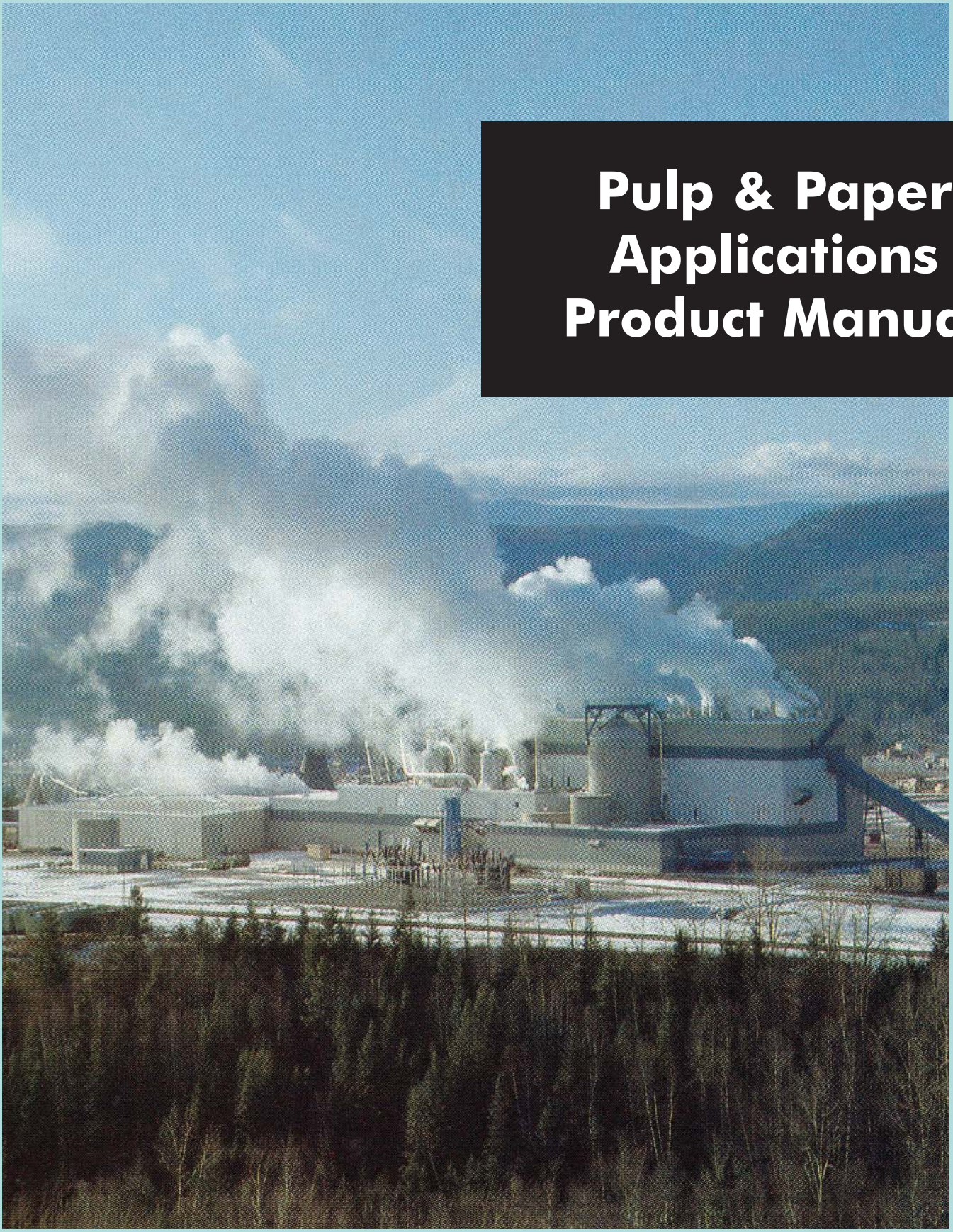
THORDON

THORDON BEARINGS INC.



Pulp & Paper Applications Product Manual

PP2009.1

THORDON

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The information contained in this document is based on Thordon's many years of experience manufacturing and installing Thordon bearings worldwide.

This information is offered as part of our service to customers. It is intended for use by persons having technical training and skill, at their discretion and risk.

The company reserves the right to change or amend any specification without notice.

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Company Profile

Thordon Bearings Inc., a member of the Thomson-Gordon Group of Burlington, Ontario, Canada, designs and manufactures a complete range of high performance, environmentally friendly industrial and marine bearings. Recognized internationally for superior performance in industrial and marine applications, Thordon bearings are sold in over 50 countries throughout the world.

Utilizing Thordon, a unique polymer alloy as the bearing wear surface, Thordon bearing systems offer excellent abrasive resistance, exceptional wear life, a low coefficient of friction and can be easily machined on site. Thor-Flex is an engineered cast elastomer solution to meet your specific requirements from abrasive resistant liners to scrapers to mold design. In-house design engineers consult with customers to provide innovative bearing system designs that meet or exceed the customer's technical requirements.

Since the turn of the century Thordon Bearings' parent company, the Thomson-Gordon Group, has recognized the importance of superior products, precision manufacturing and application engineering support. Thordon Bearings' engineering and quality focus has earned worldwide recognition. Quality procedures are certified to the ISO 9001 Quality System - the most rigorous system in the world. Thordon bearing systems are proven, cost effective, environmentally positive solutions for both industrial and marine applications. Thordon bearings are available worldwide from distributors whose factory trained specialists work with customers from establishing specifications to ensuring correct field installation.

THORDON

Thordon Grades and Configurations

Thordon is a unique elastomeric synthetic polymer blend developed by Thordon Bearings Inc. more than 30 years ago. Thordon is not a thermoplastic or epoxy-based, rather its unique polymer structure gives it basic properties similar to a high performance rubber. It was originally developed for use as a sleeve bearing for pump bearing applications. Through continuous development, several Thordon grades have evolved and Thordon bearing solutions have been successfully developed in many other markets, particularly marine.

Thordon is homogeneous - there are no layers of differing materials, and properties are consistent throughout the wall thickness. Significantly harder, and therefore able to support higher pressures than conventional rubber bearing materials, Thordon is somewhat softer and more compliant than other commonly used non-metallics such as phenolic laminates. As a result, under slight misalignment where edge loading is created, Thordon is able to deform slightly and allow better load distribution over a larger bearing surface. Due to its elastomeric nature, Thordon is also able to withstand higher amounts of vibration and shock loading without permanent deformation.

Thordon is the proven value and performance choice for pulp and paper bearing, sliding wear pad and structural elastomer component applications. Thordon's unique elastomeric polymer alloys offer user benefits not found in other materials. In particular Thordon's abrasive resistance and toughness is superior to other bearing materials commonly used in these applications.

Thordon XL
- low coefficient of friction
- high resistance to shock loading and vibration
- highly abrasion resistant

Thordon SXL
- lower coefficient of friction than XL
- high resistance to shock loading and vibration
- highly abrasion resistant
- dry start-up capability as a vertical pump bearing

Thordon HPSXL
- lowest dry coefficient of friction
- resistance to shock loading and vibration
- moderately abrasion resistant
- highest loading rating

THORDON

Thordon Grades and Configurations

Thordon SXL & HPSXL TRAXL - offers characteristics of SXL and HPSXL polymers in a bronze backed configuration for high pressure applications

Thordon Composite

- lower coefficient of friction than rubber
- higher resilience and stiffness than rubber
- available with either polymer or metal bearing shells
- provides outstanding pump bearing wear life in abrasive operating conditions

Thor-Flex

- high performance elastomer for non-bearing applications
- highest abrasion resistance
- very tough – tear and cut resistant
- lightweight replacement for metals
- reduced noise and high vibration resistance/shock absorption compared to metals
- can be bonded to metal and other polymers
- can be custom formulated to specific applications

Thordon's bearings and high performance elastomer polymers deliver significant savings over traditional materials on a life cycle cost basis and increases Mean Time Between Failures (MTBF).

THORDON

Introduction

Rotating equipment used in pulp and paper processing must function reliably under a variety of extreme operating conditions. From tree harvesting, to wood processing, to the pulping process and finally in the paper mill itself, the equipment used must withstand shock combined with high and often unbalanced loading while processing product that is wet, abrasive and often contains process chemicals. Thordon bearings and bushings, as well as Thor-Flex wear pads and structural wear components, offer solutions proven to dramatically increase Mean Time Between Failures (MTBF). Maintenance costs and related down time can be significantly reduced compared to the conventional products currently in use.

Key Benefits

- ✔ Eliminate grease and associated maintenance costs
- ✔ High abrasion resistance
- ✔ Improved vibration/shock absorption
- ✔ Improved reliability - reduced downtime costs
- ✔ Low operating friction
- ✔ Easily machined and installed
- ✔ Corrosion resistant
- ✔ Reduced noise
- ✔ Accommodates edge loading

Harvesting

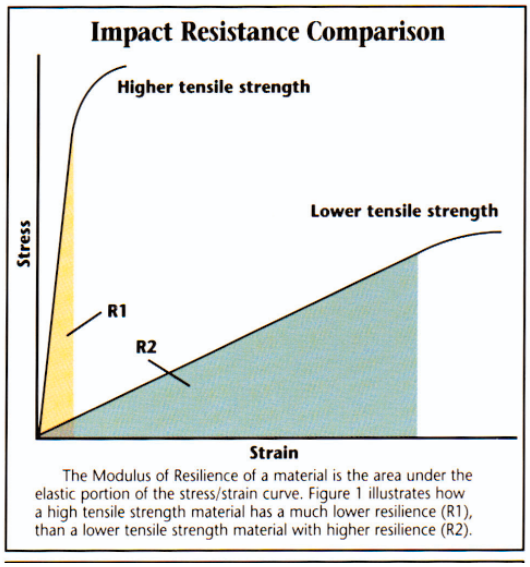
Application: Limited motion pivot bearings
Grade: Thordon SXL TRAXL

The majority of the bearing applications in harvesting equipment including tree harvesters, fellers, de-limbers, skidders, loaders, grapples and stackers involve limited-motion pivotal bearings subjected to high pressures, impact loads and abrasives. The most common bushings used in OEM equipment are bronze, lubricated with grease or sometimes oil. Wear rates are often high due to insufficient greasing resulting in a lack of lubrication as well as a build-up of abrasives. Premature failures often also result from the bronze bearings "pounding out" due to repeated shock loading and the inherent low resilience of bronze.

Timberjack Log Skidder

Thordon SXL TRAXL bearings are recommended as the replacement for bronze or metallic pivot bushings. SXL's low coefficient of friction allows grease free operation resulting in reduced maintenance costs. Environmental pollution resulting from excess grease is also eliminated. Thordon SXL's high Modulus of Resilience compared to bronze makes SXL much more resistant to "pounding out" due to impact loads.

Abrasive wear is also reduced as SXL's elastomeric nature tends to reject abrasive particles allowing them to work their way out of the bearing rather than becoming embedded in the bearing material and causing accelerated wear of both the bearing and the pin.



The Modulus of Resilience of a material is the area under the elastic portion of the stress/strain curve. Figure 1 illustrates how a high tensile strength material has a much lower resilience (R1), than a lower tensile strength material with higher resilience (R2).

Resilience Comparison

Material	Yield Stress psi	Yield Stress MPa	Modulus of Elasticity psi	Modulus of Elasticity MPa	Modulus of Resilience psi	Modulus of Resilience MPa
Thordon SXL	3,500	24.1	20,000	138	306.0	2.11
Bronze C93200	20,000	138.0	14.5×10^6	100×10^3	13.8	0.10

Application: Wear pads and shock absorbing bumbers and pads
Grade: Thordon SXL or Thor-Flex

Other tree harvesting applications where Thordon or Thor-Flex products offer improved service life and increased mean time between failures include wear pads and shock absorbing bumpers and pads.

Wood Processing

There are many applications in the wood processing yard where Thordon and Thor-Flex products offer significant advantages. Thordon's toughness and high resistance to abrasive wear and shock loading give it significant performance advantages over greased bronze and other commonly specified bushing and bearing materials. Thordon SXL's low inherent coefficient of friction and self-lubricating properties eliminate the need for grease which can tend to attract and hold abrasive particles in the bearing resulting in increased wear rates.

Chain Transfers and Chain Trough Conveyors

Application: Chain transfer and trough conveyor bearings
Grade: Thordon SXL

Chain transfers and chain trough conveyors used for moving logs or bark/trim ends normally use babbitt or bronze bushings on both the head and tail shafts, although rolling element pillow block bearings are sometimes used as well. Replacement of these bearings with Thordon self-lubricating SXL eliminates grease and significantly improves wear life and resistance to permanent deformation resulting from shock loading. Thordon SXL or Thor-Flex chain wear strips increase MTBF by reducing the wear rate of both the chain guide channels as well as the chain itself.

Hour Glass Roll Conveyors

Application: Hour glass conveyor bearings
Grade: Thordon SXL

Existing rolling element pillow block or greased bronze and babbitt bearings typically fail prematurely due to the wet, abrasive operating environment combined with the impact loads resulting from the logs being dropped on the rolls. Thordon SXL's resilience and abrasion resistance results in greatly increased MTBF rates.


Log Conveyor (Hour Glass Bearings)

Grapples

Application: Grapple pivot point bushings
Grade: Thordon SXL TRAXL

Grease free Thordon SXL TRAXL bearings are the recommended replacement for the greased bronze bushings used in grapple pivot point locations.

Wood Yard Equipment

Jack Ladders

Application: Jack ladder pillow block bearings
Grade: Thordon SXL or HPSXL

Jack ladder lower shaft bearings are usually submerged in water and must be able to withstand high pressures, abrasives and impact. Existing babbitt or bronze pillow block bearings can be replaced by Thordon HPSXL resulting in extended wear life and the eliminating the greasing systems and grease in the water.

BEFORE - Jack Ladder Drum and Bearing

AFTER - Jack Ladder Drum and SXL Pillow Block Bearing Installed

Debarked Logs

De-barking Drums

Application: De-barking drum bearings
Grade: Thordon SXL or HPSXL TRAXL

De-barking drums are rotated by a band type drive, acting on the bands or rings on the outside of drum. Due to the tumbling action and resulting impacts and imbalance from the short logs inside the drums, the bearings for these drives must have low coefficients of friction, be resistant to pounding and have the ability to absorb high pressures. Thordon SXL or HPSXL TRAXL are recommended for this application.

Application: De-barking drum scrapers
Grade: Thor-Flex

Thor-Flex scrapers offer extended life when installed under the de-barking drum to prevent bark from accumulating.

Chip Conveyors

Application: Chip conveyor hanger bearings
Grade: Thordon SXL

As in other conveyor applications in the processing area, Thordon SXL hanger bearings offer reduced wear rates compared to conventional bronze, babbitt or nylon bushings in use.

Chippers and Grinders

Application: Chipper and Grinder Wear Strips
Grade: Thordon SXL or HPSXL

The high levels of abrasives found in way of the guides in the magazine and loading mechanisms of the wood chipper or grinder result in high wear of components in these areas. Typically, grinders use brass wear strips along the side and bottom of the press. As the brass wears and cracks, the loading mechanism caulks and the strips snag and fail. The toughness and high resistance to abrasive wear of Thordon HPSXL and SXL result in significantly improved wear life when installed as a replacement.

Damaged Brass Wear Strip on Double Press Grinder

Double Press Grinder with Grindstone Removed

Pulping and Paper Making

Introduction

The majority of the machines involved in the pulping and paper making process operate under very difficult conditions. The pulp is abrasive and full of water; chemicals and heat are present; there are often heavy shock loads. Unscheduled downtime due to failure is very costly as the process involves many separate stages, each one dependent on the ones preceding it. Although Thordon and Thor-Flex products typically outperform other commonly used products under these conditions, care must be taken to evaluate the application with respect to the temperature and chemical limits of Thordon.

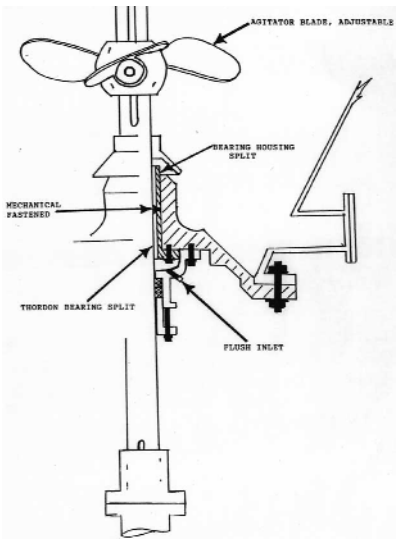
The general application limits for Thordon bearing products with respect to temperature and pH are 140°F (60°C) when operating in water and a pH range from 5 to 10. There are, however, techniques that allow Thordon to operate beyond these limits. If the Thordon bearing can be supplied with a feed of fresh water, the micro operating environment of the bearing is modified favorably allowing the bearing to function at macro temperature and/or pH levels outside the prescribed operating range. Generally Thor-Flex products have the same application limits as those of Thordon, although there are specialized.

Pulping

Agitators and Mixers

Application:	**Agitator and mixer vertical and horizontal shaft bearings** **- stock chest** **- circulator** **- blow tank** **- diffusor**
Grade:	**Thordon SXL**

Both horizontal and vertical shaft agitators and mixers are used at all pulp storage stages of pulp and paper production and are found in circulators, blow tanks, diffusors and stock tanks. Where operating conditions permit, Thordon SXL bearings installed in either lineshaft or spider positions offer significantly increased MTBF in these applications. The phenolic resin materials commonly installed by the OEM manufacturers perform well in the temperatures and pHs encountered, but suffer from rapid wear due to abrasion. The greasing systems that are required for phenolic bearings can also be eliminated when Thordon SXL is installed.



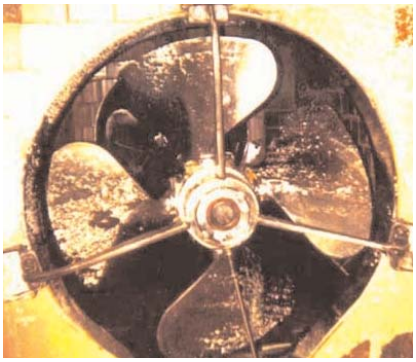
Thordon Split Bearing Agitator Application

Close-up of Circulator

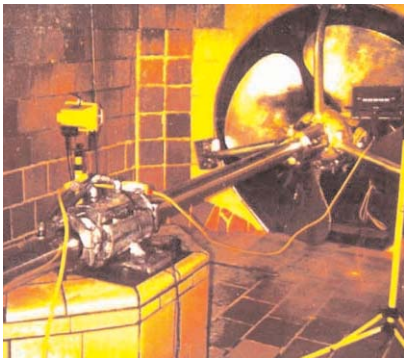
Close-up of Blow Tank - SXL Application

In addition, phenolics are quite stiff and easily damaged, sometimes to the point of disintegration, by shock loads that often occur when the adjustable blade becomes loose and creates an imbalance on the main shaft. Thordon's elastomeric nature allows it to absorb significant vibration without damage, as well as reducing the effect of edge loading, as shaft alignment in these units is often less than optimum after years of operation.

Stock Chest Support Bearings



Spider Assembly

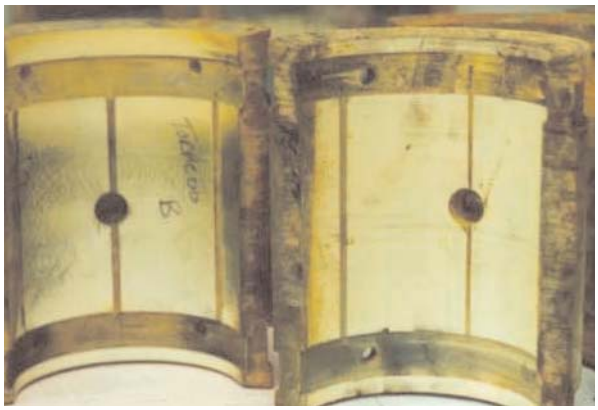


Spider Assembly

Agitators and Mixers

The original stock chest bearings lasted six months. SXL bearings were installed and are still operating after 2 years.

New SXL Stock Chest Bearings



After 2 Years SXL Stock Chest Bearings Still Running

Brown or White Stock Washers and Washer Pulpers

Application:	**Brown or white stock washer trunnion bearings**
Grade: Thordon	**SXL TRAXL**

Thordon SXL is recommended in the stock washer trunnion bearing application while SXL TRAXL is recommended in the top-loaded greased bronze bearing location.

Washer Trunnion Bearings

Washer Operations - Inside

Application: Washer pulper
- pillow block bearings
- split "Cooper-style" bearing
Grade: Thordon SXL

In the washer pulper there are three bearings - two pillow blocks at each end of the shaft and a split "Cooper-style" bearing inside the unit. Thordon SXL is recommended for the outer pillow blocks. The split bearing inside the unit is critical, as the entire pulping process must be shutdown to replace it. Thordon's proven, water lubricated SXL split bearing solution significantly increases MTBF in this application.

Strainers

Application: Kinney strainer wear strips
Grade: Thordon SXL

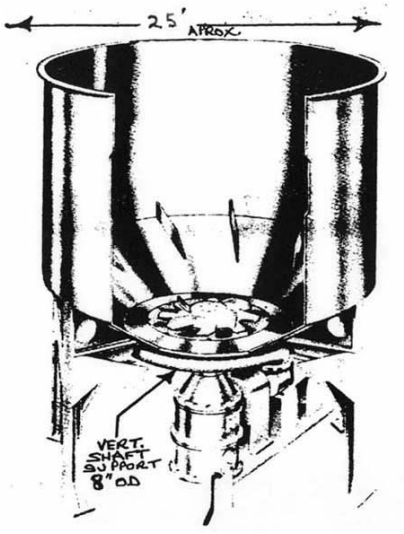
Thordon SXL is recommended as an upgrade for the wear strips on the strainers.

Kinney Strainers

Hydra Pulpers

Application: Hydra pulper shaft bearing and packing
Grade: Thordon SXL and mechanical seal

When bales of pre-made pulp are purchased from other sources, they are loaded into a large Hydra pulper tank to be broken down. Continuous adjustment of the main shaft packing to control leakage is required due to shaft movement that results from shock loading when the bales are dumped in. Thordon's recommended solution for this problem is to replace the packing with a Thordon SXL bearing and mechanical seal combination. The SXL bearing supports the shaft and absorbs the impact, preventing the deflection from being transmitted to the mechanical seal. This solution improves reliability and saves time and money over the long term.



Vertical Shaft of Pulper Unit

Close-up of Pulper

Paper Making

Suction Rolls

Application: Suction roll internal wear strips
Grade: Thordon SXL

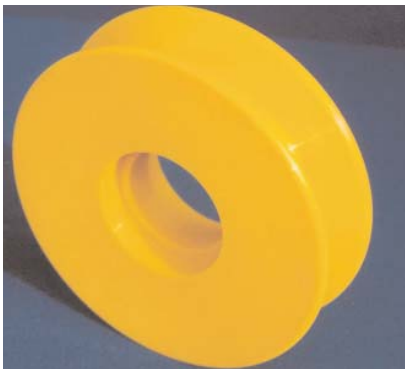
The internal suction rolls have wear strips on the I.D. to centralize the vacuum area to draw water from the sheet prior to drying. Thordon SXL offers improved life when installed to replace suction roll sealing strips. SXL's toughness and abrasion resistance provides significant advantages compared to conventional rubber graphite or kevlar/fiberglass/ graphite strips that tend to be somewhat brittle and easily damaged. Doctor blade bushings can also be upgraded to SXL to improve wear life.

Suction Roller

Suction Roller Removed for Maintenance

Rope Sheaves

Application: Rope sheave pulleys
Grade: Thor-Flex



Thor-Flex Pulley

Due to the elevated temperatures and high humidity present in the paper making process, the nylon sheaves, over which the wire ropes that drive the paper through the machine run, often have a lifetime of only three to four months.

A sheave made from a specialty Thor-Flex product increases MTBF by three to four times.

Pulleys and Sheaves

Coating Applicator Roll Bushings

Application: Coating applicator roll bushings
Grade: Thordon SXL

Wear life can be extended and grease eliminated by replacing the existing coating applicator roll bushings and rotating sprayer head bearings with Thordon SXL.

Paper Roll Handling Equipment

Application: Paper roll handling pivot point bushings & bottom roll conveyor bearings
Grade: Thor-Flex

The greased bronze or metal pivot point bushings on the paper roll handling equipment can be upgraded to grease free Thordon SXL or SXL TRAXL bearings. The bottom roll conveyor bearings can also be replaced with grease-free Thordon SXL.

SXL Fulcrum Point Bearings

Pumps

Due to the high volumes of water required in the pulp and paper making process, there are many pumps for which Thordon bearings or wear components can be considered.

Assortment of Thordon Pump Bearings

Vertical Pumps

Application: Vertical pump bearings and impeller wear rings
Grade:
- Thordon SXL
- Thordon Composite
- Thordon XL

Thordon pump bearings are highly abrasion resistant and offer exceptional wear life in vertical pump applications. Thordon's low coefficient of friction provides reduced starting torques and, in the case of Thordon SXL, start-up dry running is possible, eliminating the need for pre-lubrication prior to pump startup.

Thordon SXL lined impeller wear rings increase wear life substantially over metal wear rings. In the event of the impeller contacting the wear ring, elastomeric Thordon deflects under the load, preventing metal to metal contact thereby eliminating potential flat spotting of the impeller should incidental contact occur.

Thordon pump bearings are available in three grades and two configurations to allow selection of the optimal bearing for each unique application.

A separate Thordon information kit focused on pump bearings is available from your local Thordon distributor or Thordon Bearings.

Single and Double Ended Suction Horizontal Pumps

Application: Single & double-ended suction horizontal pump impeller wear rings
Grade: Thordon SXL

Thordon SXL lined impeller wear rings increase wear life substantially over metal wear rings. In the event of the impeller contacting the wear ring, elastomeric Thordon deflects under the load, preventing metal to metal contact thereby eliminating potential flat spotting of the impeller should incidental contact occur.

Single End Suction Horizontal Pump

Progressive Cavity Pumps

Application: Progressive cavity pump stators
Grade: Thordon GM2401

Conventional rubber-lined progressive cavity pump stators can be re-lined with Thordon GM2401 or a suitable Thor-Flex product. Typically, wear life in the thick abrasive media being pumped, improves by a factor of two to three times after a conversion to Thordon or Thor-Flex .

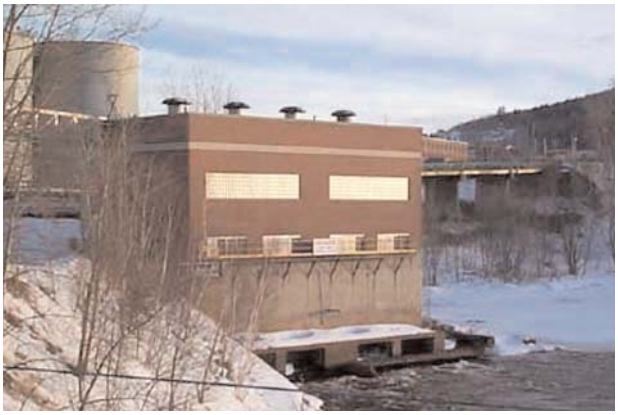
Waste Water Treatment

Due to environmental considerations and awareness, most mills incorporate a waste water treatment plant to enable them to treat water for recycling back into the paper making process or for discharge. There are many waste water treatment applications where Thordon offers extended MTBF solutions and reduced life cycle costs. A separate information kit focused on Waste Water Treatment applications is available from your local Thordon distributor or Thordon Bearings.

Hydro-Electric Power Generation

In the event that hydro-electric power generation is directly associated with the pulp and paper mill, or located nearby, it should be noted that Thordon Bearings has been supplying long wearing, grease free solutions for hydro turbine applications for over 25 years.

A separate brochure focused on Hydro Turbine Applications is available from your local Thordon distributor or Thordon Bearings.



Design and Installation Considerations

Before choosing Thordon or Thor-Flex for an application, the following criteria must be considered:

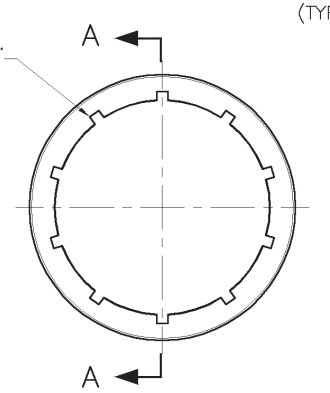
- media temperature
- process temperature
- pH levels
- speeds (rpm)
- type of lubrication
- pressures
- amount of abrasives
- impacts
- friction
- Thordon has produced a Bearing Sizing Calculation computer program to assist designers in the calculations required to correctly size Thordon bearings
- Thordon engineers can help in designing bearing solutions and drawings can be provided

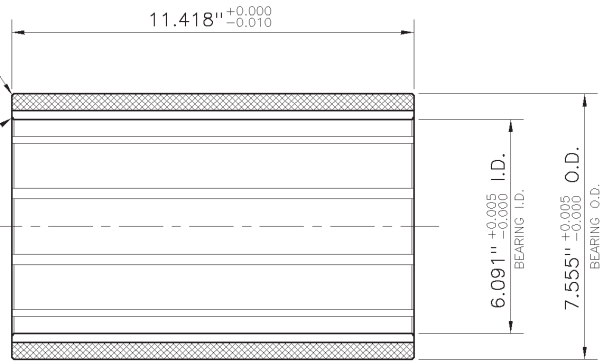
Thordon Bearings

05-Aug-01

Pulp and Paper Plant Applications & References

END USER	COUNTRY	APPLICATION	THORDON MATERIAL	INSTALL. DATE
Mead Paper Compnay - Rumford, ME	USA	Jack Ladder	HPSXL	Jan-96
Mead Paper Compnay - Rumford, ME	USA	Stock Chest Agitator (Vertical and Horizontal)	SXL	Apr-94
Mead Paper Compnay - Rumford, ME	USA	Stock Chest Line Shafting Pillow Blocks in Spiders	SXL	Aug-95
Mead Paper Compnay - Rumford, ME	USA	Vertical Blow Tank Agitator	SXL	Jul-96
Mead Paper Compnay - Rumford, ME	USA	Pressure Diffuser	SXL	Sep-93
Mead Paper Compnay - Rumford, ME	USA	Hydro - Vertical Turbine - Main Guide and Linkage Bearings	SXL	Apr-93
Finch Pruyn & Co., Inc. - Glens Falls, NY	USA	Hydro - Horizontal Turbine - Main Guide and Linkage Bearings	SXL	May-94
Finch Pruyn & Co., Inc. - Glens Falls, NY	USA	WWTP Sludge Screw Conveyors	SXL	Oct-90
International Paper - Bucksport, ME	USA	Stock Chest Agitator (Horizontal)	SXL	New Appli.
International Paper - Jay, ME	USA	Stock Chest Agitator (Horizontal) 4" Shaft	SXL	Apr-94
International Paper - Jay, ME	USA	Vertical Pumps	SXL	May-91
International Paper - Jay, ME	USA	Pressure Diffuser	SXL	Sep-96
Georgia Pacific - Marlow, ME	USA	Screw Conveyor	SXL	New Appli.
Lincoln Pulp and Paper - Lincoln, ME	USA	Stock Chest Agitator	SXL	Aug-95
Lincoln Pulp and Paper - Lincoln, ME	USA	Blow Tank Agitators	SXL	Nov-97
Madison Paper	USA		SXL	
Domtar - Woodland, ME	USA		SXL	
Domtar - Woodland, ME	USA	Hydro - Horizontal Turbine	SXL	Jun-96
Domtar - Woodland, ME	USA		TG-75	
Bowater - Millinocket, ME	USA		SXL	
Bowater - Millinocket, ME	USA	Hydro - Vertical Turbines - Main Guide Bearings	SXL	Sep-91
Bowater - Millinocket, ME	USA	Piston Guide Ring	SXL	May-93
Imerys - Skowhehan, ME	USA		SXL	Feb-01
Lane Supply	USA	Hydro - Thrust Bearings at Bowater	SXL	Nov-91
Sappi - Westbrook	USA	Variety of Industrial Applications	SXL	
Sappi - Westbrook	USA	Horizontal - Stock Chest Agitator	SXL	Jul-95
Sappi - Westbrook	USA	Transfer Dolly's	SXL	Nov-96
Sappi - Westbrook	USA	Stock Chest Line Shafting Pillow Blocks in Spiders	SXL	Jun-93
Sappi - Westbrook	USA	Hypo and Caustic Dump Chest Screws	SXL	Jul-93
Sappi - Westbrook	USA	Hi Density Brown Stock Vertical Agitator	SXL	Feb-94
Sappi - Westbrook	USA	Paper Machine Applicator Roll Bushings	SXL	Nov-94
Sappi - Westbrook	USA	Hydro Appications - Variety	SXL	Jul-96
Dexter Paper - Windsor Locks, CT	USA	Wheels on Carts	Thor-Flex	May-94
Pulp and Paper of America- Berlin, NH	USA	Hydro - Main Guide Staves	SXL	Sep-95
Abitibi-Price - Pine Falls, MB	Canada	Grinder Slides	SXL	Oct-87
Abitibi-Price - Pine Falls, MB	Canada	Threaded Rods	XL	Apr-89
Great Lakes Paper -ON	Canada	Agitator Bearings	SXL	
Great Lakes Paper -ON	Canada	Jack Ladder Bearings	SXL	
Great Lakes Paper -ON	Canada	Roll Handling Bearings	SXL	
McLaren Paper -QC	Canada	Filter staves	XL	
Champion Paper - ON	Canada	Stock Chest Bearings	SXL	
Champion Paper - ON	Canada	Pulper Bearings	SXL	
Trois Rivieres Papier - QC	Canada	Agitator Bearings	SXL	
Trois Rivieres Papier - QC	Canada	Hanger bearings	SXL	
Trois Rivieres Papier - QC	Canada	Jack Ladder bearings	SXL	
Union Camp - SC	USA	Suction Strip Bearings	SXL	
Union Camp - SC	USA	Shower Head Bearings	SXL	





SECTION A–A

MAXIMUM SHAFT DIA.	=	5.999"
HOUSING DIA.	=	7.500" +.002 −.000
HOUSING LENGTH	=	11.500"
TEMPERATURE RANGE	=	−2°C to 30°C
INTERFERENCE	=	0.053"
BORE CLOSURE	=	0.071"
WATER ABSORPTION	=	0.009"
RUNNING CLEARANCE	=	0.009"
THERMAL EXPANSION	=	0.003"

GENERAL NOTES :

1) MAT'L – THORDON SXL
2) ALL DIMENSIONS ARE EXPRESSED IN INCHES UNLESS OTHERWISE SPECIFIED.
3) DO NOT SCALE THIS DRAWING. WORK TO DIMENSIONS SPECIFIED.
4) TOLERANCES FOR ALL DIMENSIONS SHALL BE NONCUMULATIVE.
5) BREAK ALL CORNERS AND DEBURR ALL SHARP EDGES.
6) ALL FILLET, RADII AND CHAMFER DIMENSIONS ARE NOMINAL UNLESS OTHERWISE SPECIFIED.

CONDITIONS – UNLESS OTHERWISE SPECIFIED:/CONDITIONS – SAUF INDICATION CONTRAIRE:

DIMENSIONS ARE IN/DIMENSIONS SONT EN ORIGINAL SCALE/ECHELLE ORIGINALE — IN N.T.S.

TOLERANCES	IMP. (in)	MET. (mm)
SURFACE FINISH/FINIS DE SUEFACES	125	3.2
DECIMAL/DECIMALE – 1 PLACE (X.X)	± 0.1	
DECIMAL/DECIMALE – 2 PLACE (X.XX)	± 0.01	TABLE A
DECIMAL/DECIMALE – 3 PLACE (X.XXX)	± 0.005	
FRACTIONAL	± 1/64	
ANGULAR DECIMAL/ANGULAR DECIMALE	± 0.5°	± 0.5°
HOLE SIZES/DIM DE TROUS	± 1/64	± 0.4
FLAME CUTTING, SHEARING, NIBBLING, FORMING AND WELDING FLAMME DECOUPAGE, CISAILLER, POINTE, FORGEAGE ET SOUDURE AUTOGENE	± 1/16	± 1.6

TABLE A

DIMENSIONS ABOVE AU–DELA DE	DIMENSIONS THROUGH JUSQU'A	TOLERANCE (mm)
	6	± 0.1
6	30	± 0.2
30	100	± 0.3
100	300	± 0.5
300	1000	± 0.8
1000	2000	± 1.2
2000	4000	± 2
4000	8000	± 3
8000	12000	± 4
12000	16000	± 5

THIS IS NOT TO BE CONSIDERED AN APPROVED DRAWING UNLESS IT IS STAMPED BY THORDON BEARINGS INC. IN RED INK AND SIGNED.
CET DESSIN CE N'EST PAS CONSIDERE APPROUVE A MOINS QUE SOIT ESTAMPE' PAR THORDON BEARINGS INC. EN ENCRE ROUGE ET SIGNE'.

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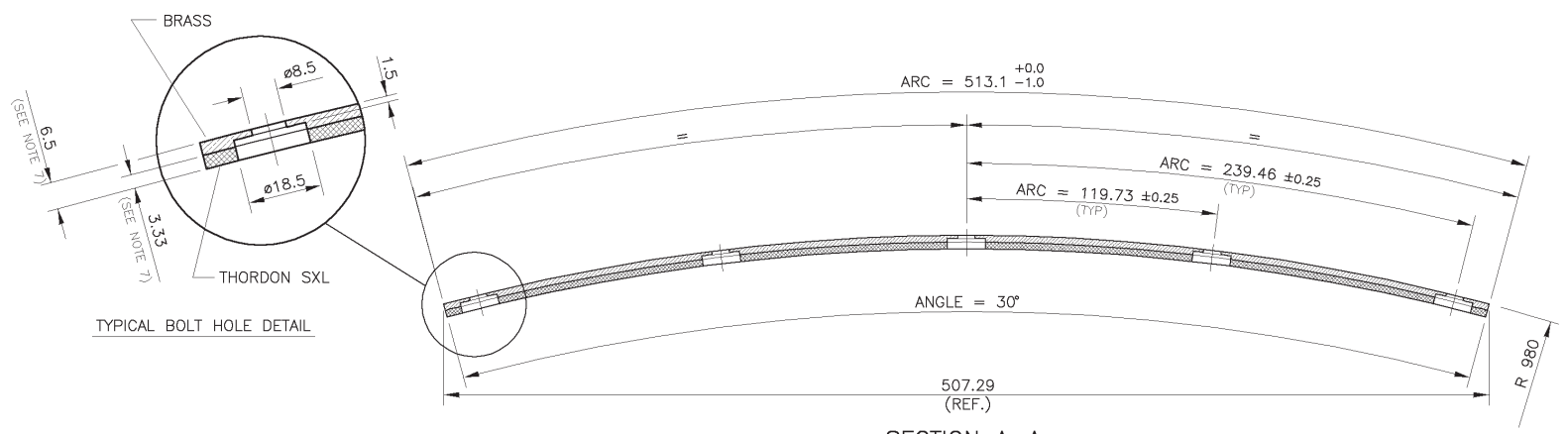
THORDON BEARINGS INC.
BURLINGTON, ONTARIO, CANADA

DWN/DESS	SIGNATURE	APPVL/APP	SIGNATURE
CKD/VER			

CUSTOMER/CLIENT	DRAWING DATE DATE DU DESSIN	MRP NO.	SIZE
			B

TITLE/TITRE	DRAWING NO. DU DESSIN	REV.
SXL PUMP BEARING	TG–12935	
	SHEET FEUILLE	OF DE

Millimeters/Millimetres
Centimeters/Centimetres



GENERAL NOTES :

1) MAT'L – THORDON SXL/BRASS
2) ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
3) DO NOT SCALE THIS DRAWING. WORK TO DIMENSIONS SPECIFIED.
4) TOLERANCES FOR ALL DIMENSIONS SHALL BE NONCUMULATIVE.
5) BREAK ALL CORNERS AND DEBURR ALL SHARP EDGES.
6) ALL FILLET, RADII AND CHAMFER DIMENSIONS ARE NOMINAL UNLESS OTHERWISE SPECIFIED.
7) CUSTOMER TO FULLY FINISH BEARING I.D.

CONDITIONS – UNLESS OTHERWISE SPECIFIED:/CONDITIONS – SAUF INDICATION CONTRAIRE:

DIMENSIONS ARE IN/DIMENSIONS SONT EN
ORIGINAL SCALE/ECHELLE ORIGINALE

TOLERANCES	IMP. (in)	MET. (mm)
SURFACE FINISH/FINIS DE SUEFACES	125	3.2
DECIMAL/DECIMALE – 1 PLACE (X.X)	± 0.1	
DECIMAL/DECIMALE – 2 PLACE (X.XX)	± 0.01	TABLE A
DECIMAL/DECIMALE – 3 PLACE (X.XXX)	± 0.005	
FRACTIONAL	± 1/64	
ANGULAR DECIMAL/ANGULAR DECIMALE		
HOLE SIZES/DIM DE TROUS	± 1/64	± 0.4
FLAME CUTTING, SHEARING, NIBBLING, FORMING AND WELDING	± 1/16	± 1.6
FLAMME DECOUPAGE, CISAILLER, POINTE, FORGEAGE ET SOUDURE AUTOGENE		

TABLE A

DIMENSIONS ABOVE AU–DELA DE	DIMENSIONS THROUGH JUSQU'A	TOLERANCE (mm)
	6	± 0.1
6	30	± 0.2
30	100	± 0.3
100	300	± 0.5
300	1000	± 0.8
1000	2000	± 1.2
2000	4000	± 2
4000	8000	± 3
8000	12000	± 4
12000	16000	± 5

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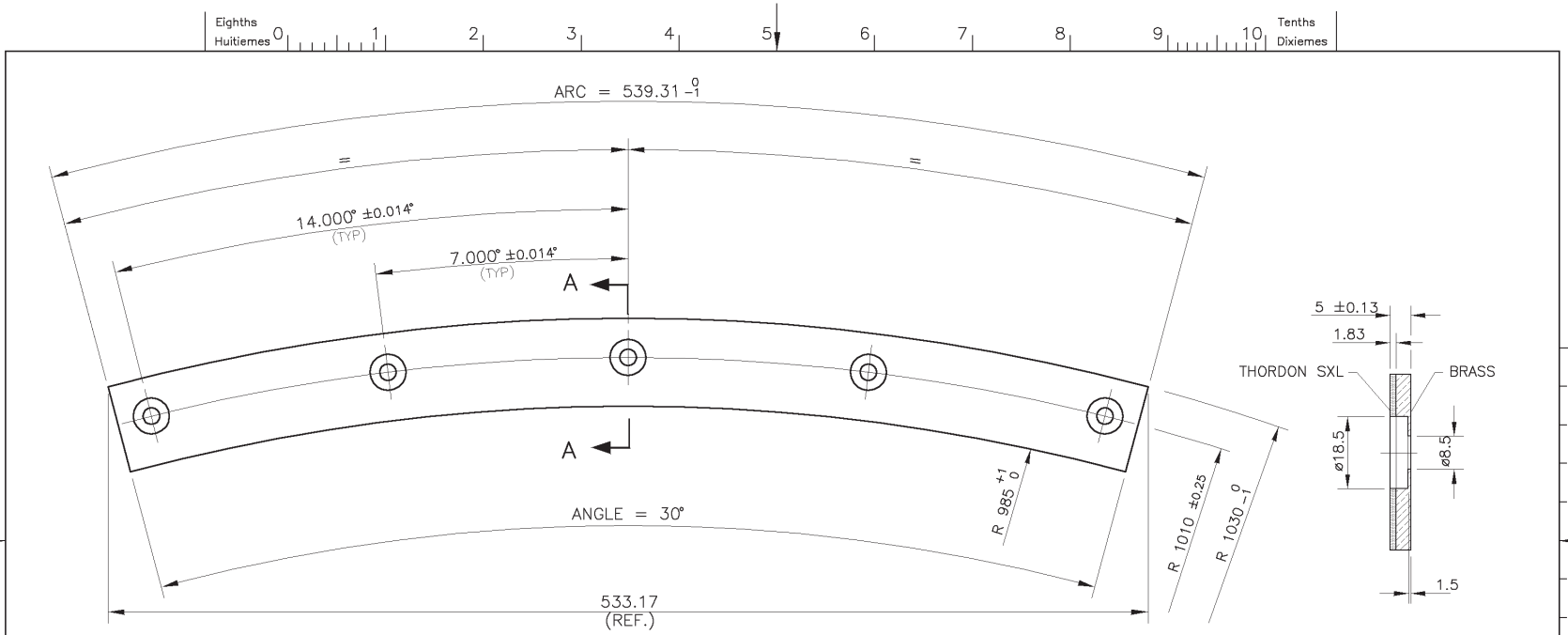
CUSTOMER/CLIENT	DRAWING DATE DATE DU DESSIN	MRP NO.	SIZE
			B

TITLE/TITRE	DRAWING NO. DU DESSIN	REV.
SXL VERTICAL WEAR PAD	TG–14145	
	SHEET FEUILLE	OF DE

Millimeters/Millimetres
Centimeters/Centimetres

18



SECTION A–A

GENERAL NOTES :

1) MAT'L – THORDON SXL/BRASS
2) ALL DIMENSIONS ARE EXPRESSED IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
3) DO NOT SCALE THIS DRAWING. WORK TO DIMENSIONS SPECIFIED.
4) TOLERANCES FOR ALL DIMENSIONS SHALL BE NONCUMULATIVE.
5) BREAK ALL CORNERS AND DEBURR ALL SHARP EDGES.
6) ALL FILLET, RADII AND CHAMFER DIMENSIONS ARE NOMINAL UNLESS OTHERWISE SPECIFIED.

CONDITIONS – UNLESS OTHERWISE SPECIFIED:/CONDITIONS – SAUF INDICATION CONTRAIRE:

DIMENSIONS ARE IN/DIMENSIONS SONT EN
ORIGINAL SCALE/ECHELLE ORIGINALE

TOLERANCES	IMP. (in)	MET. (mm)
SURFACE FINISH/FINIS DE SUEFACES	125	3.2
DECIMAL/DECIMALE – 1 PLACE (X.X)	± 0.1	
DECIMAL/DECIMALE – 2 PLACE (X.XX)	± 0.01	TABLE A
DECIMAL/DECIMALE – 3 PLACE (X.XXX)	± 0.005	
FRACTIONAL	± 1/64	
ANGULAR DECIMAL/ANGULAR DECIMALE		
HOLE SIZES/DIM DE TROUS	± 1/64	± 0.4
FLAME CUTTING, SHEARING, NIBBLING, FORMING AND WELDING	± 1/16	± 1.6
FLAMME DECOUPAGE, CISAILLER, POINTE, FORGEAGE ET SOUDURE AUTOGENE		

TABLE A

DIMENSIONS ABOVE / AU–DELA DE	DIMENSIONS THROUGH / JUSQU'A	TOLERANCE (mm)
	6	± 0.1
6	30	± 0.2
30	100	± 0.3
100	300	± 0.5
300	1000	± 0.8
1000	2000	± 1.2
2000	4000	± 2
4000	8000	± 3
8000	12000	± 4
12000	16000	± 5

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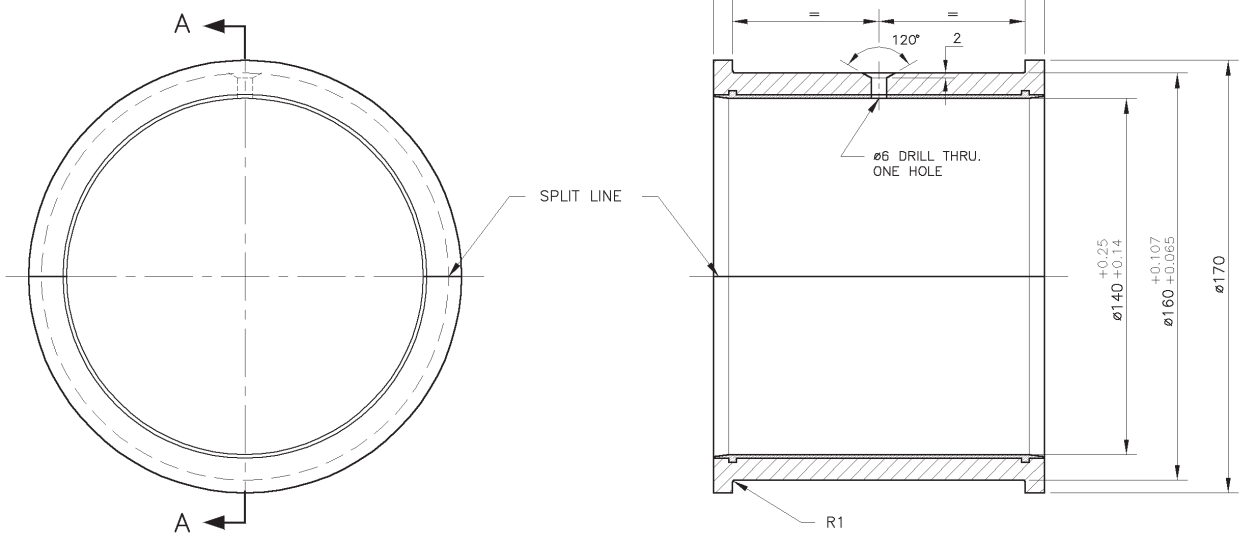
CUSTOMER/CLIENT | DRAWING DATE. DATE DU DESSIN | MRP NO. | SIZE: B

TITLE/TITRE: SXL HORIZONTAL WEAR PAD

DRAWING NO. DU DESSIN: TG–14146 | REV.

SHEET FEUILLE | OF DE

Millimeters/Millimetres 0 1 2 3 4 5 6 7 8 9 10
Centimeters/Centimetres



SECTION A–A

GENERAL NOTES:

01. MAT'L – THORDON SXL/STEEL
02. ALL DIMENSIONS ARE EXPRESSED IN MM UNLESS NOTED OTHERWISE.
03. DO NOT SCALE THIS DRAWING. WORK TO DIMENSIONS SPECIFIED.
04. TOLERANCES FOR ALL DIMENSIONS SHALL BE NONCUMULATIVE.
05. BREAK ALL CORNERS AND DEBURR ALL SHARP EDGES.
06. ALL FILLET AND RADII DIMENSIONS ARE NOMINAL UNLESS NOTED OTHERWISE.

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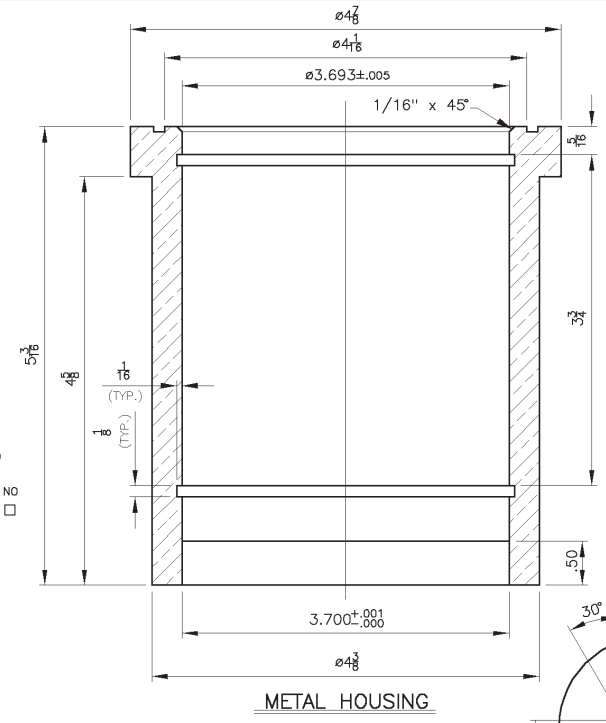
DWN/DESS	SIGN.	CKD/VER	SIGN.		
CUSTOMER/CLIENT		DRAWING DATE DATE DU DESSIN		MRP NO.	SIZE B
TITLE/TITRE	PILLOW BLOCK TRAXL BEARING 140 mm DIA.			DRAWING NO. DU DESSIN TG–14215	REV.
				SHEET FEUILLE	OF DE

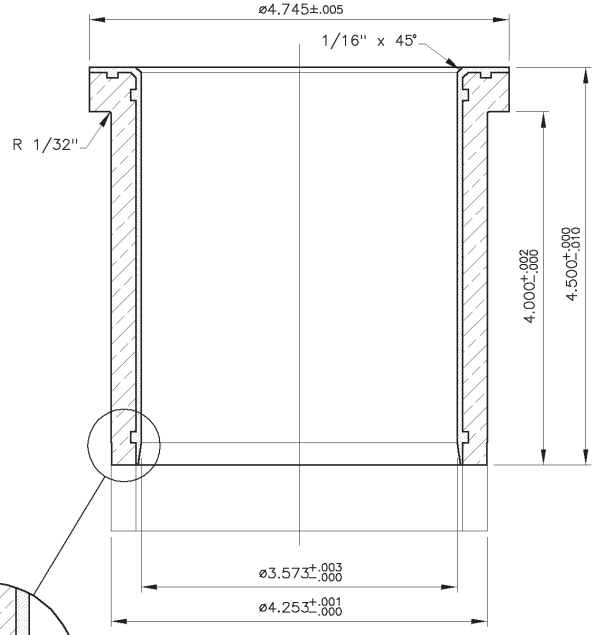
Eighths Huitiemes 0 1 2 3 4 5 6 7 8 9 10 Tenths Dixiemes

Millimeters/Millimetres 0 1 2 3 4 5 6 7 8 9 10
Centimeters/Centimetres

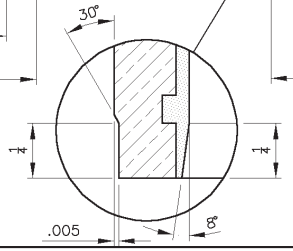
20



METAL HOUSING



TRAXL BEARING



NOTE:
CUSTOMER TO CONFIRM
SHAFT & HOUSING DIMENSIONS
BEFORE FINAL MACHINING

MATERIAL: THORDON HPSXL/BRONZE C93200

CHUCKING ALLOWANCE & RING REQUIRED: YES ☒ NO ☐

SHAFT DIA.	=	3.565 +0 −0.003
HOUSING DIA.	=	4.250 +0 −0.002
O.D.	=	4.253 +0 −0.001
INTERFERENCE	=	0.004
BORE CLOSURE	=	0.004
RUNNING CLEARANCE	=	0.004

INSIDE DIA. (METAL) = 3.565 + 0.004 + 0.004 + 0.120 = 3.693 ±0.005

INSIDE DIA. (SXL) = 3.565 + 0.004 + 0.004 = 3.573 +0 −0.003

NOTES:

1.— BEARINGS TO BE PRESS FIT ONLY
2.— BREAK ALL CORNERS & SHARP EDGES.
3.— DO NOT SCALE THIS DRAWING, WORK TO DIMENSIONS SPECIFIED.
4.— TOLERANCES FOR ALL DIMENSIONS SHALL BE NONCUMULATIVE.
5.— ALL TRAXL GROOVE DIMENSIONS ARE NOMINAL.

DO NOT SCALE THIS DRAWING. WORK TO DIMENSIONS SPECIFIED

UNLESS SHOWN OTHERWISE, MACHINING TOLERANCES ARE:
LINEAR UP TO 1m(40") ±0.5mm(±0.020")
OVER 1m(40") ±1.0mm(±0.040")
ANGULAR ±0.25°
SURFACE FINISH 3.2mmRa (125minch)
THORDON MATERIAL SURFACE FINISH TO BE DETERMINED ONLY BY USE OF COMPARITOR

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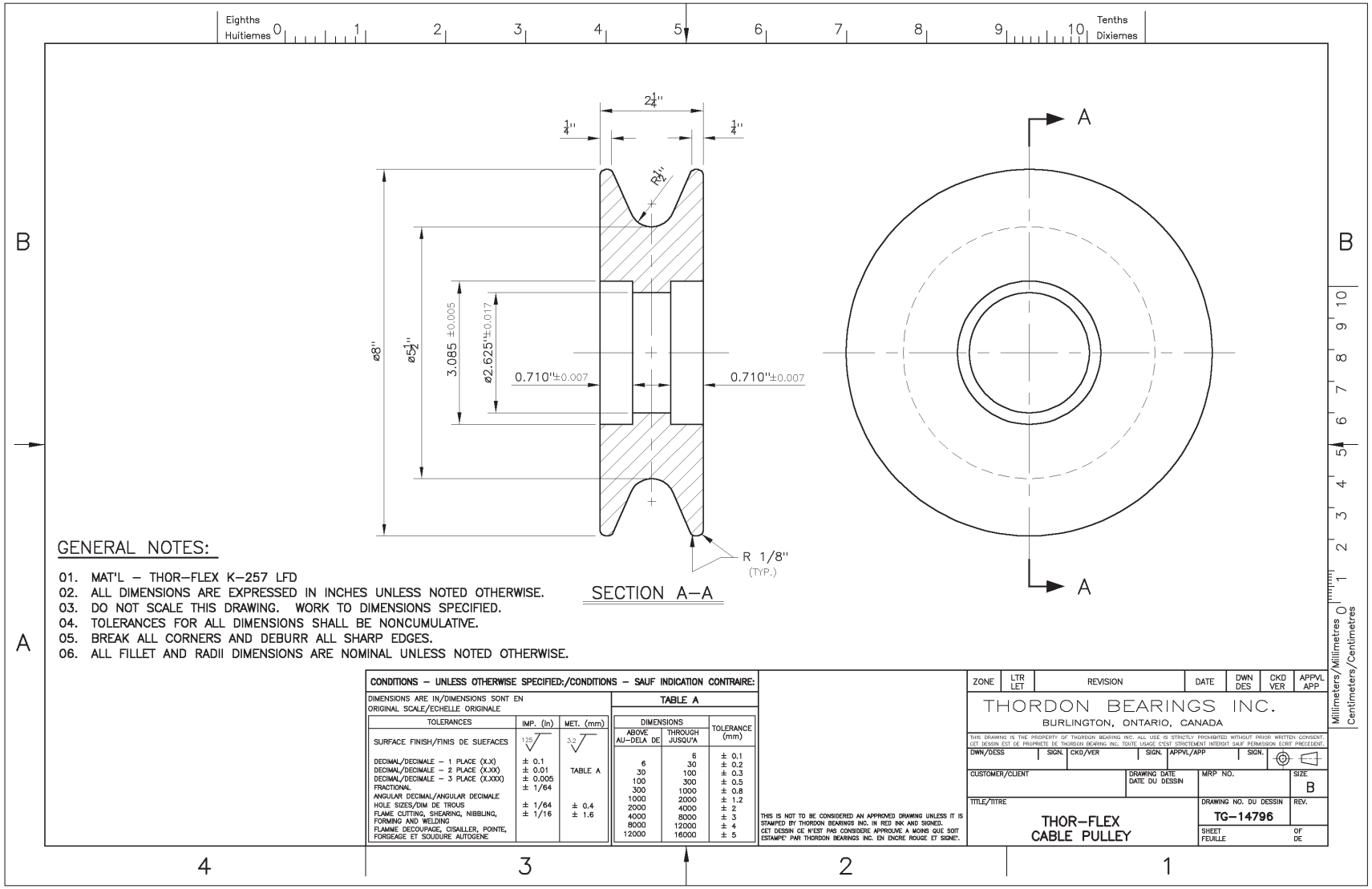
CUSTOMER/CLIENT	DRAWING DATE DATE DU DESSIN	MRP NO.	SIZE
			B

TITLE/TITRE	DRAWING NO. DU DESSIN	REV.
HPSXL TRAXL BEARING BOTTOM RING	TG-14952	
	SHEET FEUILLE	OF DE



GENERAL NOTES:

01. MAT'L – THOR–FLEX K–257 LFD
02. ALL DIMENSIONS ARE EXPRESSED IN INCHES UNLESS NOTED OTHERWISE.
03. DO NOT SCALE THIS DRAWING. WORK TO DIMENSIONS SPECIFIED.
04. TOLERANCES FOR ALL DIMENSIONS SHALL BE NONCUMULATIVE.
05. BREAK ALL CORNERS AND DEBURR ALL SHARP EDGES.
06. ALL FILLET AND RADII DIMENSIONS ARE NOMINAL UNLESS NOTED OTHERWISE.

CONDITIONS – UNLESS OTHERWISE SPECIFIED:/CONDITIONS – SAUF INDICATION CONTRAIRE:

DIMENSIONS ARE IN/DIMENSIONS SONT EN
ORIGINAL SCALE/ECHELLE ORIGINALE

TOLERANCES	IMP. (in)	MET. (mm)
SURFACE FINISH/FINIS DE SUEFACES	125	3.2
DECIMAL/DECIMALE – 1 PLACE (X.X)	± 0.1	
DECIMAL/DECIMALE – 2 PLACE (X.XX)	± 0.01	TABLE A
DECIMAL/DECIMALE – 3 PLACE (X.XXX)	± 0.005	
FRACTIONAL	± 1/64	
ANGULAR DECIMAL/ANGULAR DECIMALE		
HOLE SIZES/DIM DE TROUS	± 1/64	± 0.4
FLAME CUTTING, SHEARING, NIBBLING, FORMING AND WELDING FLAMME DECOUPAGE, CISAILLER, POINTE, FORGEAGE ET SOUDURE AUTOGENE	± 1/16	± 1.6

TABLE A

DIMENSIONS ABOVE / AU–DELA DE	DIMENSIONS THROUGH / JUSQU'A	TOLERANCE (mm)
	6	± 0.1
6	30	± 0.2
30	100	± 0.3
100	300	± 0.5
300	1000	± 0.8
1000	2000	± 1.2
2000	4000	± 2
4000	8000	± 3
8000	12000	± 4
12000	16000	± 5

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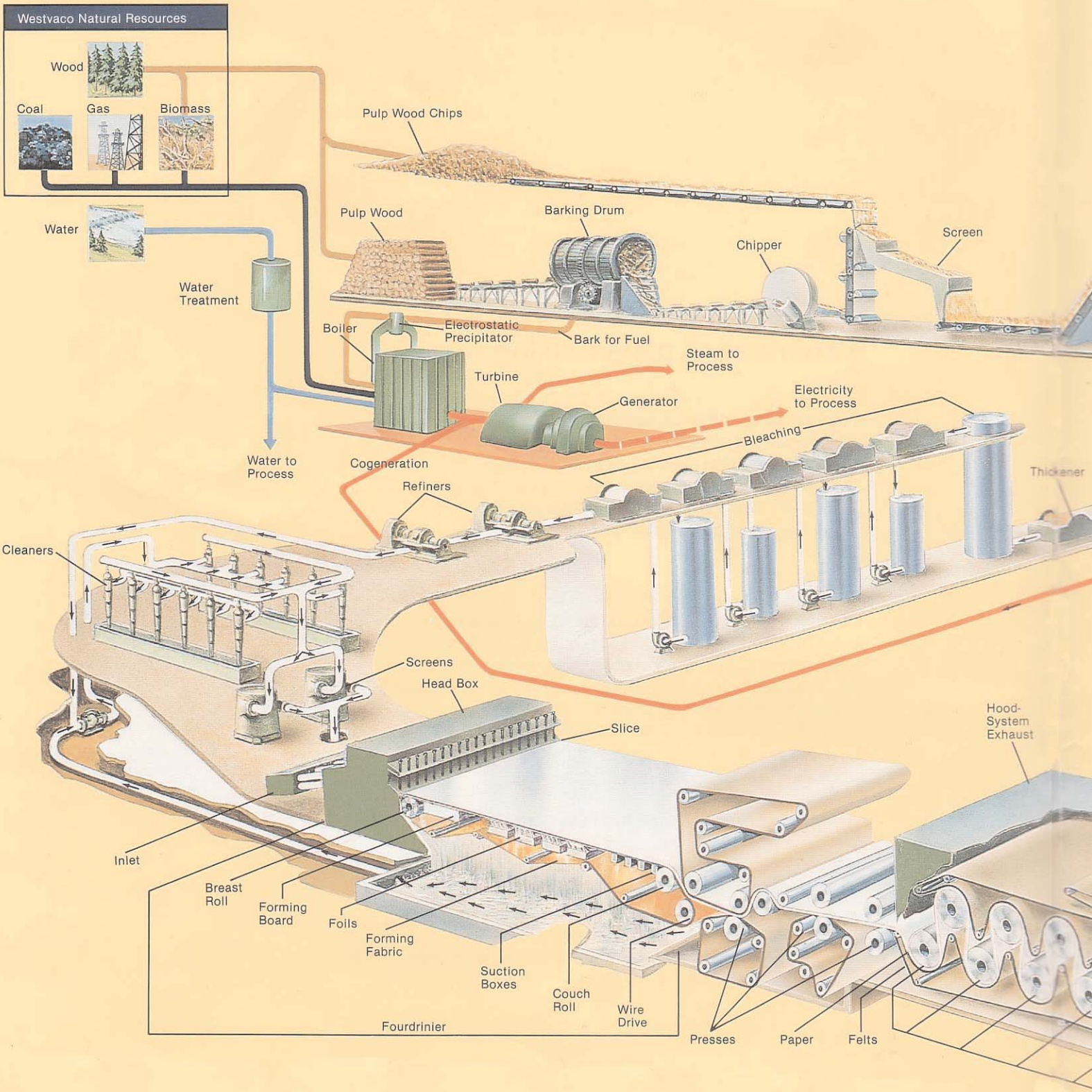
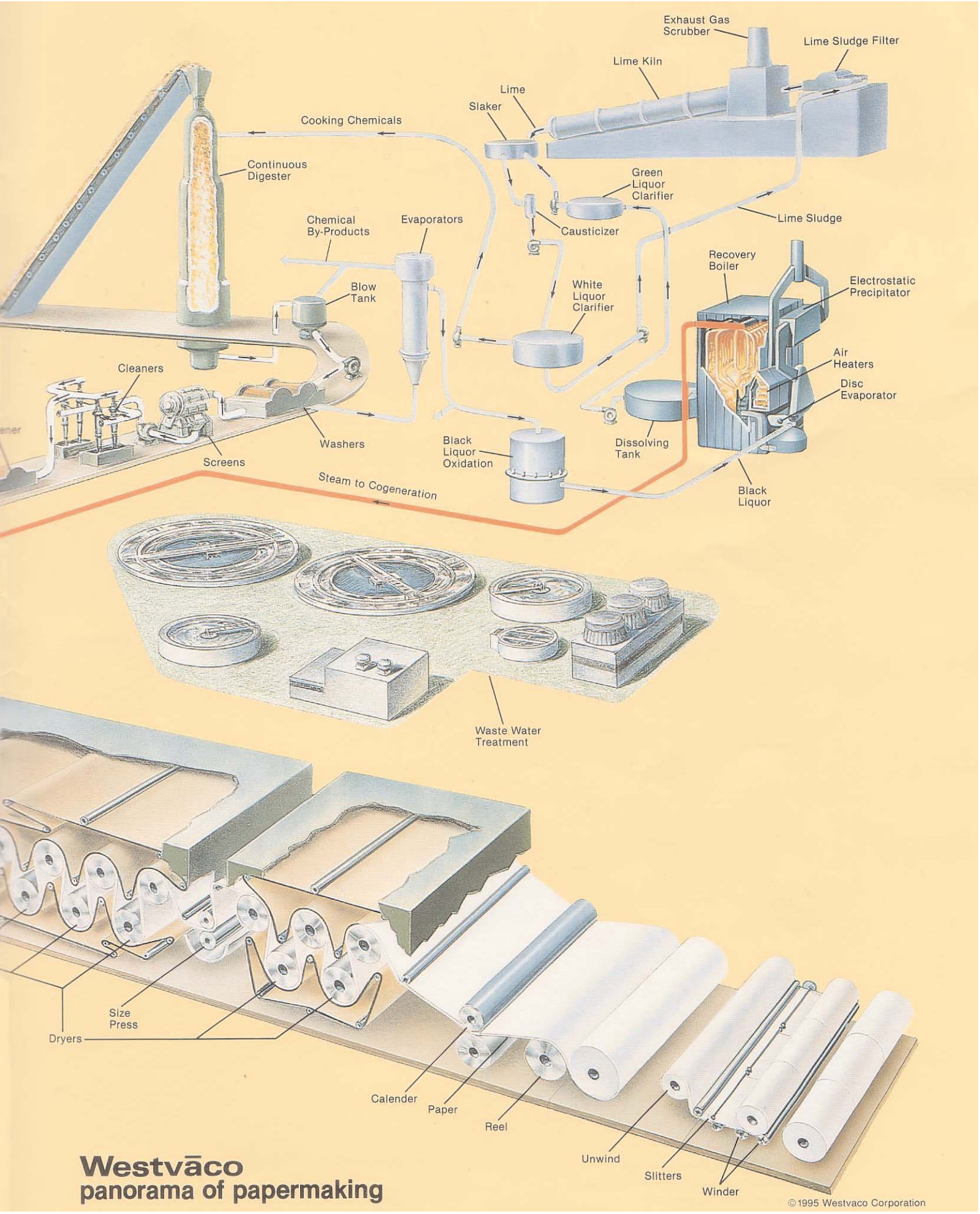
CUSTOMER/CLIENT | DRAWING DATE / DATE DU DESSIN | MRP NO. | SIZE: B

TITLE/TITRE: THOR–FLEX CABLE PULLEY

DRAWING NO. DU DESSIN: TG–14796 | REV.

SHEET / FEUILLE | OF / DE


Westvaco Natural Resources
Wood
Coal
Gas
Biomass
Water
Water Treatment
Water to Process
Pulp Wood Chips
Pulp Wood
Barking Drum
Chipper
Screen
Boiler
Electrostatic Precipitator
Bark for Fuel
Steam to Process
Turbine
Generator
Electricity to Process
Cogeneration
Bleaching
Thickener
Refiners
Cleaners
Screens
Head Box
Slice
Hood-System Exhaust
Inlet
Breast Roll
Forming Board
Foils
Forming Fabric
Suction Boxes
Couch Roll
Wire Drive
Fourdrinier
Presses
Paper
Felts


Exhaust Gas Scrubber
Lime Sludge Filter
Lime Kiln
Lime
Slaker
Cooking Chemicals
Continuous Digester
Green Liquor Clarifier
Lime Sludge
Causticizer
Chemical By-Products
Evaporators
Recovery Boiler
Electrostatic Precipitator
Blow Tank
White Liquor Clarifier
Air Heaters
Disc Evaporator
Cleaners
Washers
Screens
Black Liquor Oxidation
Dissolving Tank
Steam to Cogeneration
Black Liquor
Waste Water Treatment
Size Press
Dryers
Calender
Paper
Reel
Unwind
Slitters
Winder
Westvaco
panorama of papermaking
©1995 Westvaco Corporation

Pulp and Paper Making Process

Although specific processes may vary somewhat from one mill to another, the following provides a basic outline of the various stages involved in pulp and paper making.

Wood Mill

1. The logs are fed into a sluiceway, or otherwise conveyed to the de-barking drums,where the bark is mechanically removed from the logs.

2. The removed bark is conveyed to the steam boilers to be used as fuel and, if necessary, the de-barked logs are sawed into shorter lengths for processing into chips in the chippers.

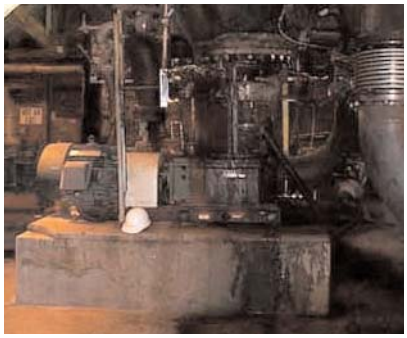
3. The wood chips may be screened to remove the larger pieces before being conveyed into storage prior to entering the pulp mill.

Pulp Mill (Sulphate - Kraft Process)

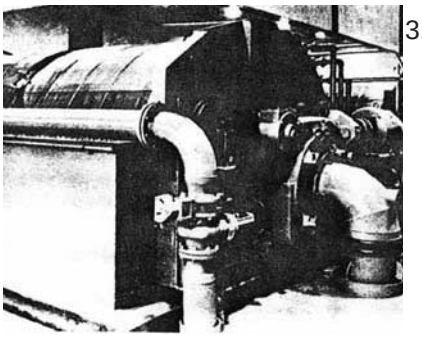
Batch Digester

1. From storage (or possibly from a remote chip mill) the wood chips are conveyed tothe digesters. In the digester, the chips are cooked under high pressure in a combination of steam and white liquor (a solution of sodium hydroxide and sodium sulfide supplied from the lime kiln) until the wood fibers have separated. The digester process may be continuous (referred to as a Kamyr digester) or batched.

2. Once the pulp is processed it is sent through a blow-line into the blow tank where the high pressure is relieved and the digested chips meshed into cellulose fibers by an agitator. At this point in the process the pulp is dark from the cooking process and is known as "brown stock".



Blow Tank



Brown or White Stock Washers

3. After leaving the blow tank, the mixture of pulp fibers and black liquor (spent white liquor that has now turned dark from the cooking process - brown stock) passes over screens that remove knots and uncooked chips on the way to the washers. The pulp must be "washed", generally in three or four stages in a chlorine solution, to remove as much of the black liquor as possible. The washers are usually a series of covered wire screen revolving drums to which a vacuum is applied to help draw the black liquor from the pulp that then forms into thick sheets on the screens.

4. The black liquor is sent to the evaporators where it is stored to begin the liquor recovery process. After most of the water is evaporated, the resulting by-product is burned in the recovery boilers along with biomass, sludge, used tires and any other suitable waste materials. Process steam to provide heat for the digesters and other processes in the mill, green liquor and co-generated electricity are produced from this process. The green liquor is mixed with lime mud in the lime kiln and then cooked and clarified to produce white liquor which is then fed back into the process at the digester.

5. The washed pulp then moves through a flat screen as well as rotary filters to remove any remaining unsaturated fibres on its way to the stock chest where it is further purified and mechanically agitated.

6. From the stock chest the pulp goes for bleaching if white paper is being produced or directly to the paper plant if brown or unbleached paper is being produced.

7. The pulp is bleached chemically in a multistage process using sequential chemical and washing treatments.

8. After bleaching, the bleached stock is further processed through beaters and/or refiners to provide cutting and rubbing and flattening action to the wood fibers designed to give them the best possible characteristics for matting together on the paper machine. Any paper to be recycled is processed and added as the stock comes from the bleaching process.

Pulper

9. Paper making uses the same basic process that was invented over 150 years ago by Fourdrinier. Newer twin wire machines form the paper vertically as opposed to horizontally on the Fourdrinier units but otherwise the process remains the same. The paper machine consists of two main sections. The web of paper is formed in the wet end. In the dry end the paper is dried, smoothed and cut into the required roll size. At the wet end the pulp is diluted by 90% water or more and pumped into the head box. From the head box the pulp may be sprayed or allowed to flow through a control gate (slice) onto a high speed, endless wire mesh belt.

Paper Machine

Paper Machine Foils

10. The water drains through the mesh leaving the fibers on top of the moving belt, which also shakes from side to side to further interlock the fibers into one consistent mass. After the water drains naturally, suction boxes under the wire belt are used to draw out more water. As the wet paper mat leaves the belt at the final roll (couch roll) it is transported by the jockey roll over felt belts and through suction press rolls where more water is removed.

11. From the press rolls the paper moves into the dry end of the paper mill on felt belting as it passes around large steam heated cylinders (dryers) where the residual moisture is removed.

12. The dry paper is then threaded through a number of polished, heated rolls (calendar stack) to further smooth the surface and squeeze it down to the required thickness.

13. Once the paper is dry, a coating can be applied if required and the sheet dried again.

14. The completed roll of paper is removed for slitting and rewinding into smaller rolls.

PROVEN BENEFITS FOR PLANT SUPERVISORS AND MAINTENANCE ENGINEERS

Thordon non-metallic bearings have been used in a wide range of industries and various applications such as in pumps, pivot points, screw conveyors, hydro turbine wicket gates, agitators and flocculator paddle wheels.
Thordon bearings are designed to work under the most extreme conditions: abrasive, corrosive, high impact load, high humidity and infrequent maintenance periods.

TYPICAL INDUSTRIAL APPLICATIONS:

- **WASTE WATER AND SEWAGE TREATMENT**
  (aerators, traveling screen, drum screens, scum collectors, chain conveyors)
- **GRAPPLES OR GRABS**
  (pivot linkage bushings)
- **VERTICAL PUMP BEARINGS**
- **HYDRO TURBINE BEARINGS**
  (operating mechanism bearings, wicket gate bearings, main guide bearings)
- **MINING**
  (crushers and feeders, materials handling bearings, mine car rocker arm and wheel bearings, skip pivots)
- **BUTTERFLY VALVES**
- **LOCK AND DAM GATE BEARINGS**
- **AGRICULTURE**
  (conveyor shaft bearings, sugar cane harvesting and processing equipment bearings, fish farm bearings)
- **PULP & PAPER/FORESTRY**
  (doctor bushings, mixer bushings, grapple bearings, roller chain bushings)
- **CRANES AND HOISTS**
  (boom slides, sheave wheel bushings)
- **STACKERS**
- **RECLAIMERS AND BUCKET SCOOPS**
- **GATE AND DOOR BUSHINGS**
- **MARINE DECK EQUIPMENT BEARINGS**

SELF-LUBRICATING

With a low inherent coefficient of friction, Thordon bearings typically do not require grease lubrication. This results in reduced maintenance costs and safety issues. Environmental and product contamination concerns associated with grease lubrication are eliminated. Thordon bearings are homogeneous polymers with built-in lubricants. The lubricants, being dispersed throughout the bearing material, continue to provide low friction throughout the life of the bearings.

LONG WEAR LIFE

Based on over 40 years experience supplying bearings to industry, Thordon bearings have been proven to provide longer wear life than the bearings they replace. Longer life in any one specific application may be the result of Thordon's low friction, superior abrasion resistance, high resilience and impact resistance or a combination of several of the above. The end result, however, is the same... improved reliability and reduced life cycle costs.

HIGH RESILIENCE AND IMPACT RESISTANCE

Elastomeric Thordon bearings exhibit a Modulus of Resilience many times that of bronze. As a result, Thordon elastomeric bearings can absorb impact or shock loads encountered during operation without permanent deformation to a much greater degree than bronze or other non-metallic bearings.

LOW OPERATING FRICTION

Thordon bearings have lower static and dynamic coefficients of friction than most other materials commonly used for industrial bearings. This is the case whether the bearing is dry or submerged in liquid. A low bearing coefficient of friction is important in minimizing adhesive bearing wear and providing smooth, stick-slip free start-up and operation.

CORROSION RESISTANCE

Thordon's corrosion resistance is superior to metallic bearing materials commonly used in industrial applications. As an electrical insulator, Thordon will not participate in a galvanic reaction.

NOISE REDUCTION

A quieter workplace can be one of the added bonuses of specifying Thordon bearings. Thordon bearings tend to dampen and reduce operating noise compared to metallic bearings, which can transmit, and even amplify, noise.

HIGH TEMPERATURE AND IMPROVED CHEMICAL RESISTANCE

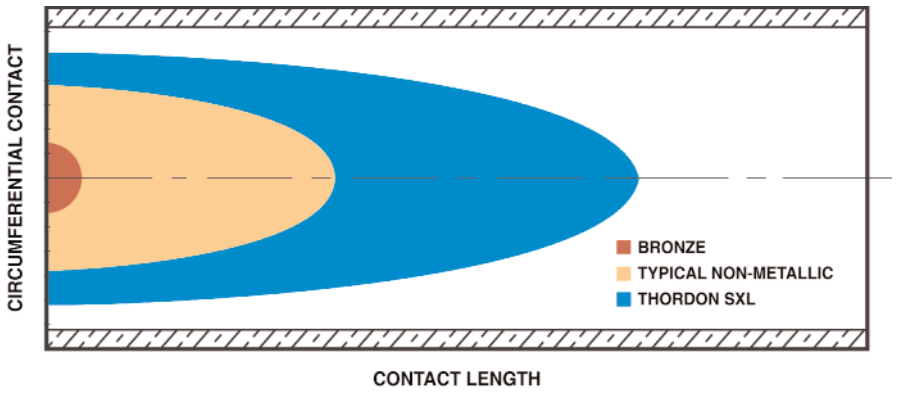
ThorPlas bearings can be used in industrial applications with water temperatures up to 80°C (176°F) extending the temperature range from other Thordon grades. ThorPlas has improved chemical resistance versus Thordon elastomers and performs well where minimal initial running clearances are required.

EASILY MACHINED TO SIZE

Thordon bearings can be easily machined to exact finished dimensions in the field. Costly sleeve or shaft replacement can often be avoided by machining the bearing to compensate for existing wear or damage.

This is not possible with many competitive bearings that are moulded to 'standard' sizes and do not provide overbuild for machining on site as required. Plant and Maintenance Managers find that machining bearings to size from pre-grooved or standard Thordon tubes reduces their industrial bearing inventory and repair turn around times. The Thordon Bearing Sizing Calculation Program offers easy computer-based dimension calculations.

TYPICAL EDGE LOADING PROFILE



HIGH ABRASION RESISTANCE

When operating in abrasives, Thordon's elastomeric grades offer superior wear life due to their elastomeric nature. Thordon rejects abrasive particles allowing them to pass through the running clearance between the shaft and the bearing without becoming embedded. Wear of the bearing and shaft due to third particle abrasion is minimal. For severely abrasive applications, Thordon Composite operating with continuous lubrication is recommended. It will often outwear other bearings by a factor of two or more.

ACCOMMODATES EDGE LOADING

Edge loading conditions often occur as a result of minor misalignment or shaft deflection. Thordon elastomeric grades deflect slightly, effectively spreading the load. The localized bearing pressure is reduced as a result, and wiping of the bearing, a common occurrence with more rigid bearing materials, is eliminated.

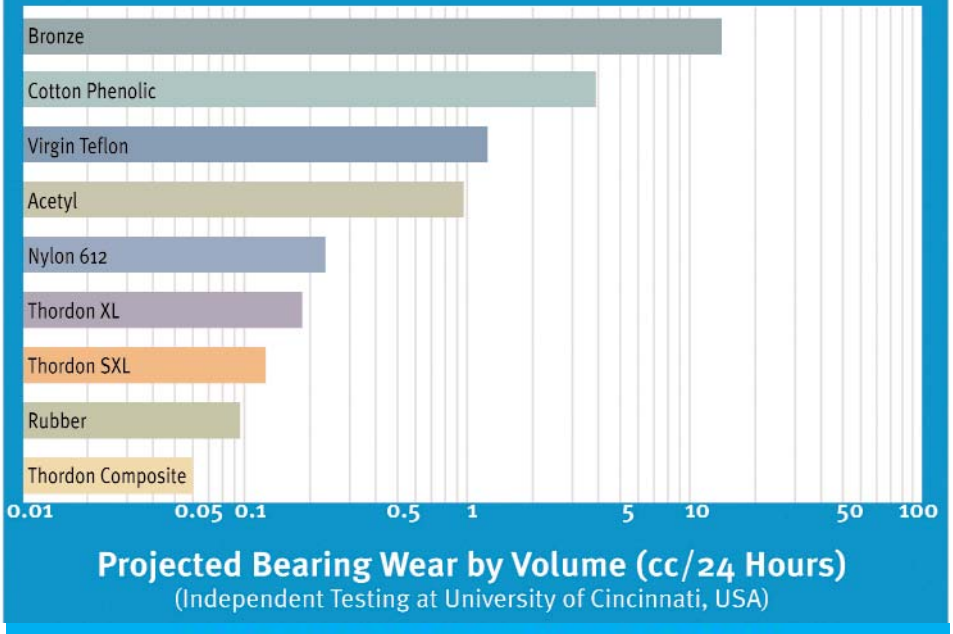
CONVERSION OF EXISTING BEARINGS

Worn metallic or metal backed bearings can be re-lined with Thordon elastomeric bearings. Field bonding Thordon into the metal shell of the worn bearing can often reduce cost. Fitting of the re-lined bearing remains unchanged.

EASILY INSTALLED

After machining to the proper dimensions for an interference fit, Thordon bearings can be easily fit into place by press or freeze fitting. Thordon elastomeric bearings may be cooled in dry ice or liquid nitrogen. ThorPlas bearings may be cooled with dry ice, but must **not** be immersed in liquid nitrogen. Once the bearings are placed in position and warm they will assume the design interference fit. Expensive and labour intensive pressing equipment and fixtures are not necessary.

TYPICAL BEARING ABRASIVE WEAR RATES



NOTE: Wet third particle abrasion.
Shaft material: carbon steel; Bearing I.D.: 2.5cm (1 in.); Abrasive slurry mixture: 2% bentonite, 6% sand, 6% clay, 86% water.

THORDON GRADES AND CONFIGURATIONS

ThorPlas® (blue) is a non-elastomeric, homogeneous material developed by Thordon specifically as a full form high pressure bearing.

- maximum dynamic working pressure to 31.0 MPa (4500 psi); static pressures to 45.0 MPa (6500 psi)
- easily machined without affecting low coefficient of friction (typically 0.10 – 0.17)
- very low wear in non-abrasive environments
- maximum continuous service temperatures of 80°C (176°F) in water and 110°C (230°F) dry
- excellent dry start capability as a vertical pump bearing
- reasonable abrasion resistance - less than Thordon elastomer grades, but better than bronze, epoxy phenolics and many other non-metallic bearing materials
- improved chemical resistance in most chemical product categories compared to elastomeric grades

Thordon SXL (off-white) has excellent dry start capability and a lower coefficient of friction than the other Thordon elastomeric grades.

- low coefficient of friction (typically 0.10-0.20)
- higher dry PV (Pressure Velocity) rating than XL
- higher resistance to abrasion than XL in wet applications; good abrasion resistance operating dry
- dry start-up capability as a vertical pump bearing
- high resistance to shock loading and vibration

NOTE: *When SXL is used in vertical pumps where dry startup is a consideration, consult with Thordon Bearings regarding bearing design. Thordon will recommend a maximum dry running time based on the peripheral velocity of the shaft and the load on the bearing.*

Thordon XL (black) is used in a variety of industrial applications and has similar abrasion resistance compared to SXL.

- low coefficient of friction (typically 0.20-0.25)
- high resistance to abrasion in dry applications
- high resistance to shock loading and vibration

Thordon HPSXL (grey) is designed for higher pressure applications as the bearing component in HPSXL TRAXL bearings (HPSXL bonded in a metallic shell).

- maximum dynamic working pressure to 15.0 MPa (2175 psi) in limited motion as a homogeneous material
- HPSXL TRAXL has maximum dynamic working pressure to 55.0 MPa (8000 psi) in limited motion
- lowest coefficient of friction (typically 0.06-0.12)
- moderately abrasion resistant (lower abrasion resistance than XL or SXL)
- high resistance to shock loading and vibration

Thordon Composite (yellow shell, black wear surface is GM2401) is a two-component bearing formulated specifically for use in very abrasive environments.

- used in rotating applications in abrasive water conditions such as pump and dredge bearings
- outstanding abrasion resistance - two or more times that of rubber
- significantly lower coefficient of friction than rubber
- higher resilience and stiffness than rubber
- available with either yellow polymer or metal bearing shells

APPLICATION AND DESIGN INFORMATION

The success of any bearing application depends not only on the selection of superior products but also on the correct design and use of such materials for each specific application. A set of guidelines, found in the table below, has been prepared to assist designers in choosing the best Thordon material for the application at hand. Some of the application and design considerations to take into account when specifying Thordon for any industrial bearings include:

FLUID COMPATIBILITY

Thordon bearings can be used in a wide range of chemicals and process products that would typically affect metallic bearings. A comprehensive chemical compatibility chart for both Thordon elastomeric and thermoplastic materials is available to determine the best bearing product for the application.

TEMPERATURE

For Thordon elastomeric grades, the maximum operating temperature in water is 60°C (140°F). The thermoplastic ThorPlas material has an operating limit of 80°C (176°F) in water.

ENVIRONMENT

The choice of material and the configuration of the bearing are highly dependent on the operating conditions to which the bearing is exposed. All Thordon bearings (except Composite) can be installed with or without axial grooves (all Composite bearings are grooved). The grooves are recommended whenever a bearing is operating in a flow of liquid (as in a vertical pump). Grooves facilitate flow of the fluid through the bearing to provide cooling and removal of abrasive particles, thus extending life of both bearing and shaft. Grooves are not required when there is no flow of fluid past the bearing. For high pressure bearings which may be exposed to dirty environments, especially those with oscillating motion and no flow of fluid, Thordon recommends the use of tough Thorseal lip seals in recessed grooves near the ends of the bearing to prevent abrasive ingress. Other environmental factors such as intermittent exposure to higher temperatures, chemicals, restriction on flow, dry running, etc. should also be considered when designing a Thordon bearing.

BEARING DESIGN

Engineering manuals and a computer-based bearing sizing calculation program are available to assist in the design of Thordon bearings. The input information required, whether using manual calculations or the computer program, includes housing diameter (maximum & minimum), shaft diameter, operating temperatures (maximum, minimum and machine shop ambient), type of lubrication, shaft RPM and the duration for dry start period for vertical pump bearings, if applicable. Accurate input information ensures that the final bearing design is optimal. Some of the bearing parameters to consider during the design stages include:

• **Minimum Installed Clearances** This value is the sum of the bearing running clearance (based on shaft diameter), the thermal allowance and absorption allowance. The latter two are dependent on wall thickness. Minimum installed clearances can be reduced by using different grades of Thordon or by choosing a bonded bearing configuration that allows reduction of the wall thickness. The Thordon Bearing Sizing Program can be used to determine which configuration achieves the required installed clearance.

• **L/D Ratios** Typical ratios for length to diameter when using Thordon bearings can range from 1 to 1.5. The bearing length can be reduced by up to 50% compared to rubber bearings because Thordon grades have a higher load carrying capability.

• **Type of Installation** Thordon bearings can be freeze or press fitted. Elastomeric grades may be bonded to the clean surface of an existing or new metal shell. Where possible, bonded installations can reduce the bearing wall thickness allowing for tighter installed clearances.

NOTE: *For more detailed information on bearing design parameters, please refer to the Thordon Engineering Manual or the ThorPlas Bearing Engineering Manual.*

THORDON MATERIAL SELECTION GUIDE FOR INDUSTRIAL APPLICATIONS

LUBRICATION/ OPERATING PRESSURE	RECOMMENDED THORDON GRADES		
DRY (sealed or minimal abrasives)	★★★★★	★★★★	★★★
0-10 MPa (0-1450 psi)	SXL	ThorPlas®	
10-15 MPa (1450-2175 psi)	HPSXL	ThorPlas®	
15-31 MPa (2175-4500 psi)	HPSXL TRAXL	ThorPlas®	
31-55 MPa (4500-8000 psi)	HPSXL TRAXL		
DRY (abrasives present)			
0-5.5 MPa (0-800 psi)	XL	SXL	ThorPlas®
5.5-10 MPa (800-1450 psi)	SXL	ThorPlas®	
10-15 MPa (1450-2175 psi)	HPSXL	ThorPlas®	
15-31 MPa (2175-4500 psi)	ThorPlas®		
WET (sealed or minimal abrasives)			
0-10 MPa (0-1450 psi)	SXL	ThorPlas®	
10-15 MPa (1450-2175 psi)	HPSXL	ThorPlas®	
15-31 MPa (2175-4500 psi)	HPSXL TRAXL	ThorPlas®	
31-55 MPa (4500-8000 psi)	HPSXL TRAXL		
WET (abrasives present)			
0-3 MPa (0-500 psi)	GM2401	SXL	ThorPlas®
3-10 MPa (500-1450 psi)	SXL	ThorPlas®	
10-15 MPa (1450-2175 psi)	HPSXL	ThorPlas®	
15-31 MPa (2175-4500 psi)	ThorPlas®		

NOTE: *The maximum pressures given for the various products are based on maximum dynamic working pressures for intermittent, limited motion. For applications involving continuous rotary motion, PV limits of the materials will significantly reduce the maximum allowable pressures stated above.*

This is a general guide for technical reference only. Other critical applications that are close to pressure or temperature limits, or subjected to non-standard environments should also be reviewed and approved by Thordon Bearings.

THORDON

THORDON BEARINGS INC.

ZERO POLLUTION | HIGH PERFORMANCE | BEARING SYSTEMS

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