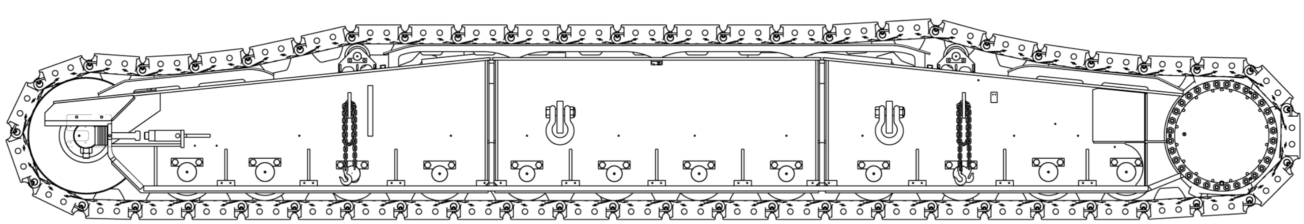
Folio 2212

Reconditioning Crawler Lower Works



Due to continuing product innovation, specifications in this manual are subject to change without notice.

Contents

1.0 Introduction

1.1 Purpose

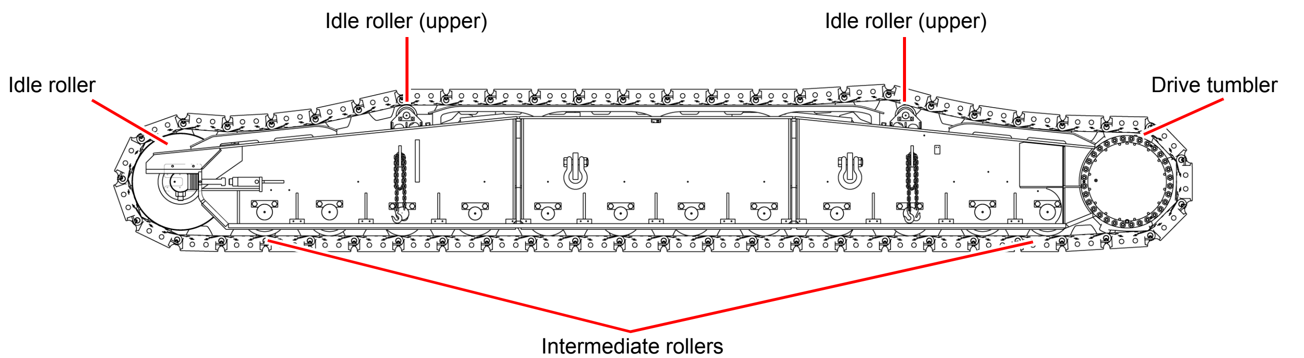
This publication contains information for inspecting and rebuilding drive tumblers, sprockets, intermediate rollers, and idle rollers in order to extend component life.

This publication is NOT intended for use repairing structural damage.

This publication is intended

- to provide crane owners with recommended inspection practices as well as procedures, parameters and welding filler materials to be used when the owner wishes to refurbish rather than replace worn crawler components;
- only for use on surfaces designed to wear during normal use and operation of the equipment;
- for use on only those components or surfaces specifically outlined in this document.

1.2 Parts covered in this manual



	21000	18000	16000	14000	2250	999	888	777	M250	4600	4100W	4000W	3900W	3900
Intermediate roller	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Idle roller	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Idle roller (upper)	—	X	X	—	—	—	—	—	—	—	—	—	—	—
Drive tumbler (no sprocket)	X	X	X	X	X	X	X	X	—	—	—	—	—	—
Drive tumbler (sprocket)	—	—	—	—	—	—	—	—	X	X	X	X	X	X

2.0 Inspection

2.1 Spalling, cracking, and deformation

Prior to performing any buildup operation, all components must be thoroughly inspected for any cracking or spalling. Spalling will appear as a pitted rough surface, an example is shown below:

Any spalled area should be blend ground to match the surrounding surface prior to weld buildup. Any loose or fatigued material must also be removed prior to welding.

Cracks can be located by using the Magnetic Particle Testing (MT) or the Dye Penetrant Testing (PT) methods. MT and PT tests should be performed by qualified personnel. Both MT and PT should only be performed on relatively smooth surfaces in order to prevent false positives. If a crack is located the component should be replaced rather than rebuilt.

Deformation of wear components can appear as a “Mushrooming” effect. This generally occurs over time in rollers due to the constant compressive stress placed on the wear edges. In order for a component to function properly after buildup the mushroomed material must be removed and proper dimensions restored, prior to welding.

In the example below, the mushroomed material is removed and the 45º x 0.25” (6.35mm) bevel is added:

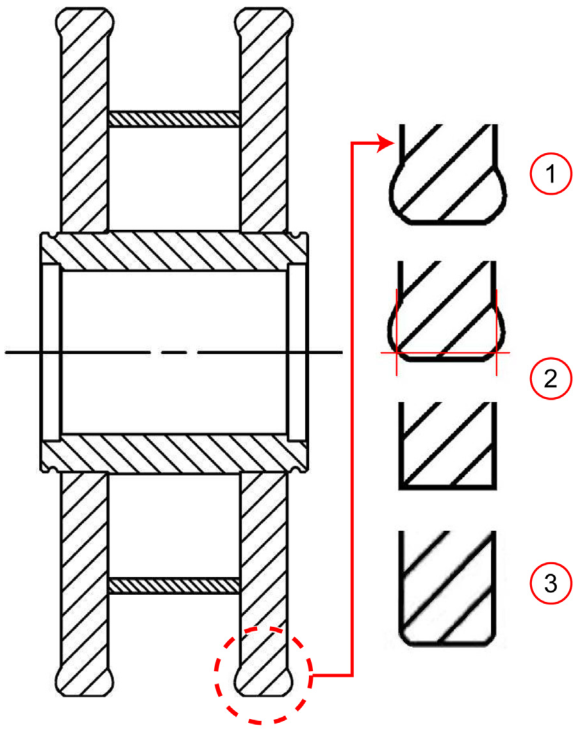


Figure 1: Reconditioning process

2.2 Determining wear depth

Tumblers, rollers, and sprockets are case hardened in high wear areas in order to extend their life. Weld build up should only be conducted after case hardening is fully worn away. If build up will be performed prior to full wear of hardened case, then the surface must be softened by annealing. Annealing can be accomplished by gradually heating the surface to 1000ºF (538ºC) and slow cooling to ambient temperature.

Part	Wear Depth Procedure
Intermediate roller	1. Remove all dirt, grease, oil, and debris from surface of roller. 2. Measure depth of wear (see page 12).
Idle roller	1. Remove all dirt, grease, oil and debris from surface of roller. 2. Measure depth of wear (see page 16).
Drive tumbler (no sprocket)	1. If tumbler is removed from crawler, conduct a visual inspection and MT (magnetic particle testing) inspection of splines for cracking and excessive spalling. If cracks and/or excessive spalling is found on splines, Drive Tumbler should be replaced with a new component. If repair is feasible, based on inspection of splines, go to step 2. 2. Remove all dirt, grease, oil and debris from surface of tumbler. 3. Measure depth of wear using profile gage (see page 22).
Drive tumbler (sprocket)	1. Remove all dirt, grease, oil and debris from surface of tumbler and from sprocket teeth. 2. Measure depth of wear using profile gage (see page 26).
Travel sprockets	1. Remove all dirt, grease, oil and debris from sprocket teeth. 2. Measure depth of wear using profile gage (see page 29).

3.0 Rebuild

3.1 Surface condition and preparation

- All surfaces that will be welded must be relatively smooth and level in order to allow for uniform deposit of weld buildup. Any uneven surfaces should be ground to a clean, smooth finish in order to allow for even weld layers (see Figure 2 on page 8).
- Any surface that will be welded must be clean and free of all dirt, oil, grease, paint and other debris. Any contamination of the weld area can introduce hydrogen into the weld and lead to cracking in the weld or heat affected zone (HAZ).

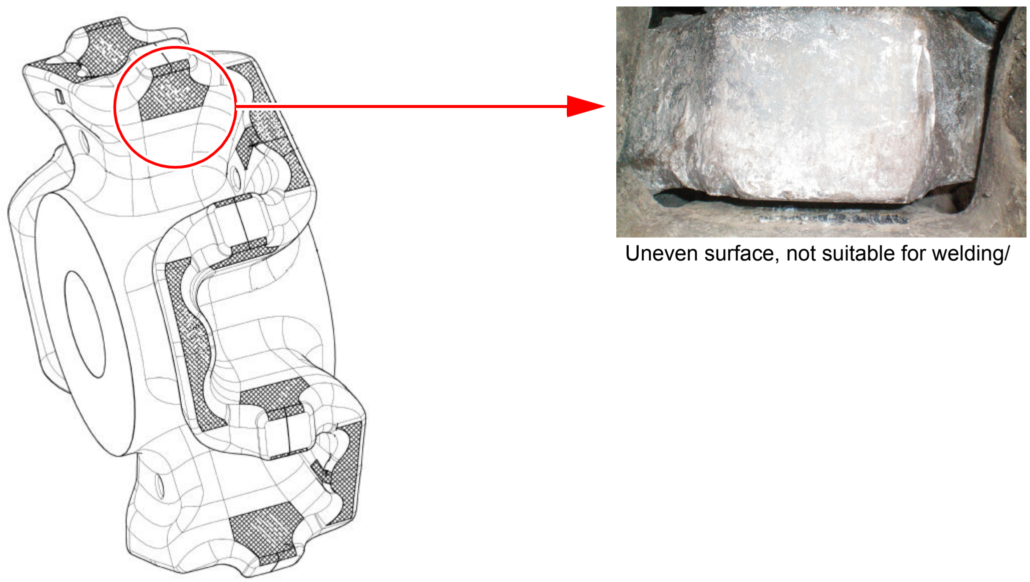


Figure 2: Unsuitable welding surface

3.2 Preheat, interpass, and slow cooling

3.2.1 Preheat

- Preheating is necessary in order to prevent cracking in the weld or HAZ. Preheat reduces the quench rate of the weld and surrounding material, allowing stresses in the material to slowly relax reducing the chance of hot cracking or underbead cracking. Preheat also aids in preventing hydrogen from being introduced into the weld, reducing the chance of delayed cracking.
- Preheat must be closely monitored during the entire weld cycle, preferably through the use of temperature indicating crayons. At the crane owner’s option, touch pyrometers or infrared pyrometers may be substituted. However, these devices must be properly calibrated and used according to the devices operating instructions in order to ensure an accurate reading.

3.2.2 Interpass

- Care must also be taken not to exceed the maximum interpass temperature. Exceeding a materials maximum interpass temperature can have adverse affects on the heat treat condition and metallurgical properties of the component, reducing life cycle and component effectiveness.

3.2.3 Post heat and slow cooling

- Slow cooling is essential to the welding process for any high strength steel material. Slow cooling helps to ensure that stresses in the base material and weld have time to relax, helping to prevent underbead and weld cracking. Slow cooling shall be accomplished by the use of a thermal blanket or other insulating material. Kaowool, Cerawool or comparable ceramic fiber blankets are recommended.
- Slow cooling is of greater importance in cast components than in plate material due to the nature of the casting process and attributes of the material. Cast components must be Post Weld Heated to ensure that cooling occurs at a slow enough rate to prevent cracking.
- Preheat, Interpass and Post Heat temperatures shall conform to Table 1 on page 10.

3.3 Welding electrodes and parameters

- When restoring a wear component to working condition through weld buildup, it is imperative that any filler material match as closely as possible the hardness and wear resistance of the original component. Undermatching or over-matching the wear resistance of the restored component can lead to premature failure of either the wear component or other components with which it comes into contact.
- In order to match the hardness and wear resistance of the original component surface, a high wear resistant hard-surfacing welding electrode must be used for the buildup of tumblers, sprockets, intermediate rollers and idle rollers for model 18000 machines. Idle rollers on other model machines may be reconditioned using alternate electrodes. See “Temperature, electrode, and welding parameters” on page 10 for details.
- The recommended welding process is Self-Shielded Flux Core Arc Welding (FCAW-S). This process can be performed with relative ease in shop or field conditions. In the event that wire feed equipment is not available at the repair site, the Shielded Metal Arc Welding (SMAW) or “Stick Welding” process is the recommended alternative. See “Temperature, electrode, and welding parameters” on page 10 for details and electrode selection for both processes.

3.4 Post weld inspection

- Following slow cooling to ambient temperature, as detailed in “3.2.3 Post heat and slow cooling” on page 9, the welded component must be inspected for cracking or other surface discontinuities.
- Magnetic Particle Inspect the welded surface. Any cracks or other defects found must be repaired according to the parameters and practices previously established in this document.
- The welding electrodes referenced in this folio can be purchased through your local welding supply distributor.

Manufacturer contact information:

The Lincoln Electric Company
22801 Saint Clair Ave
Euclid, OH 44117
http://www.lincolnelectric.com

Postle Industries Inc.
PO Box 42037
Cleveland, OH 44142
(800) 321-2978
http://www.postle.com

Stoody - Thermadyne
16052 Swingley Ridge Rd.
Suite 300
St. Louis, MO 63017
(800) 426-1888
http://www.thermadyne.com/stoody/

4.0 Appendix

4.1 Temperature, electrode, and welding parameters

Table 1: Preheat, interpass, and post heat temperatures

Model	Preheat	Interpass	Post heat
Intermediate rollers			
All	400°F (204°C)	400°F – 600°F (204°C – 316°C)	550°F (288°C)
Idle rollers			
3900	400°F (204°C)	400°F – 600°F (204°C – 316°C)	550°F (288°C)
3900W	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
4000W	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
4100W	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
4600	400°F (204°C)	400°F – 600°F (204°C – 316°C)	550°F (288°C)
M250	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
777	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
888	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
999	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
2250	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
14000	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
16000	300°F (149°C)	400°F – 600°F (204°C – 316°C)	550°F (288°C)
18000	400°F (204°C)	400°F – 600°F (204°C – 316°C)	550°F (288°C)
21000	200°F (93°C)	200°F – 400°F (93°C – 204°C)	n/a
Drive tumblers			
All	400°F (204°C)	400°F – 600°F (204°C – 316°C)	550°F (288°C)
Drive tumblers			
All	400°F (204°C)	400°F – 600°F (204°C – 316°C)	550°F (288°C)

Table 2: Electrode selection

Welding process	Electrode	
FCAW-S	Lincoln Lincore 40-O	5/64” diameter
FCAW-S	Postle MCC-42	1/16” diameter
SMAW	Stoody 1105	5/32” diameter
SMAW	E7018-M (idle rollers only)*	5/32” diameter
SMAW	E11018-M (idle rollers only)**	5/32” diameter
* First layer. Does NOT apply to model 18000. ** Second through fourth layers. Does NOT apply to model 18000.		

Table 3: Welding parameters

Electrode	Polarity	Wire feed Speed/Amps	Volts	Stickout
Lincoln Lincore 40-O	DC+	125 – 185 ipm (3.16 – 4.7 m/min)	24 – 27	1.5 – 2.0 in (38 – 51 mm)
Postle MCC-42	DC–	200 – 300 ipm (5.1 – 7.6 m/min)	24 – 26.5	1.0 – 1.5 in (26 – 38 mm)
Stoody 1105	DC+	150 – 200 Amps	n/a	n/a
E7018-M	DC+	150 – 170 Amps	n/a	n/a
E11018-M	DC+	150 – 170 Amps	n/a	n/a

Table 4: Maximum buildup

Item	Weld layers*
Idle rollers	4 layers
Intermediate rollers	4 layers
Sprockets	2 layers
Tumblers	2 layers
* Maximum layer depth should be approximately 1/8” (3.2 mm).	

4.2 Intermediate roller inspection

Table 5: Intermediate roller nominal dimensions

Model	Dimensions			Drawing reference
	A	B	C	
3900	2.19 in (55.63 mm)	9.00 in (228.60 mm)	18.00 in (457.20 mm)	Figure 4 on page 13
3900W	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
4000W	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
4100W	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
4600	3.50 in (88.90 mm)	7.00 in (177.80 mm)	20.00 in (508.00 mm)	Figure 5 on page 13
M250	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
777	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
888	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
999	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
2250	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
14000	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12
16000	3.62 in (91.95 mm)	7.24 in (183.90 mm)	16.93 in (430.02 mm)	Figure 6 on page 14
16000 (heavy)	3.62 in (91.95 mm)	7.24 in (183.90 mm)	18.00 in (457.20 mm)	Figure 6 on page 14
18000	3.62 in (91.95 mm)	7.24 in (183.90 mm)	18.00 in (457.20 mm)	Figure 7 on page 15
21000	2.19 in (55.63 mm)	4.63 in (117.60 mm)	14.06 in (357.12 mm)	Figure 3 on page 12

4.2.1 Intermediate roller — 3900W, 4000W, 4100W, M250, 777, 888, 999, 2250, 14000, 21000

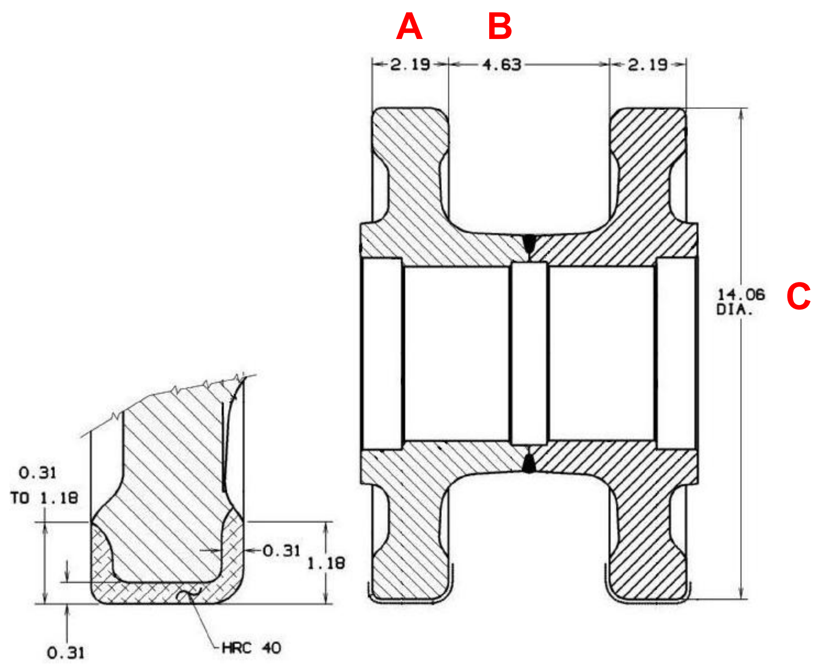


Figure 3: Intermediate roller — 3900W, 4000W, 4100W, M250, 777, 888, 999, 2250, 14000, 21000

4.2.2 Intermediate roller — 3900

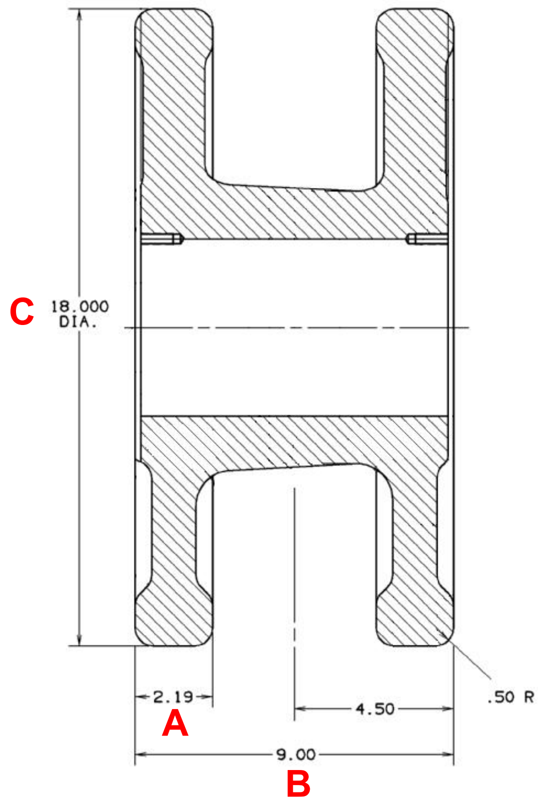


Figure 4: Intermediate roller — 3900

4.2.3 Intermediate roller — 4600

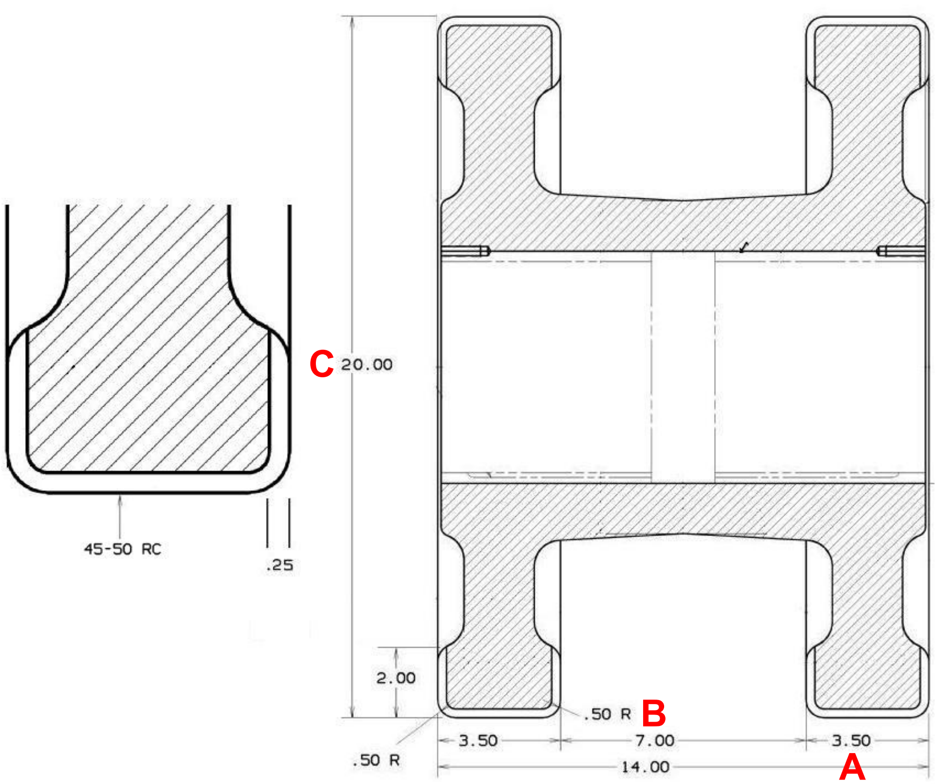


Figure 5: Intermediate roller — 4600

4.2.4 Intermediate roller — 16000

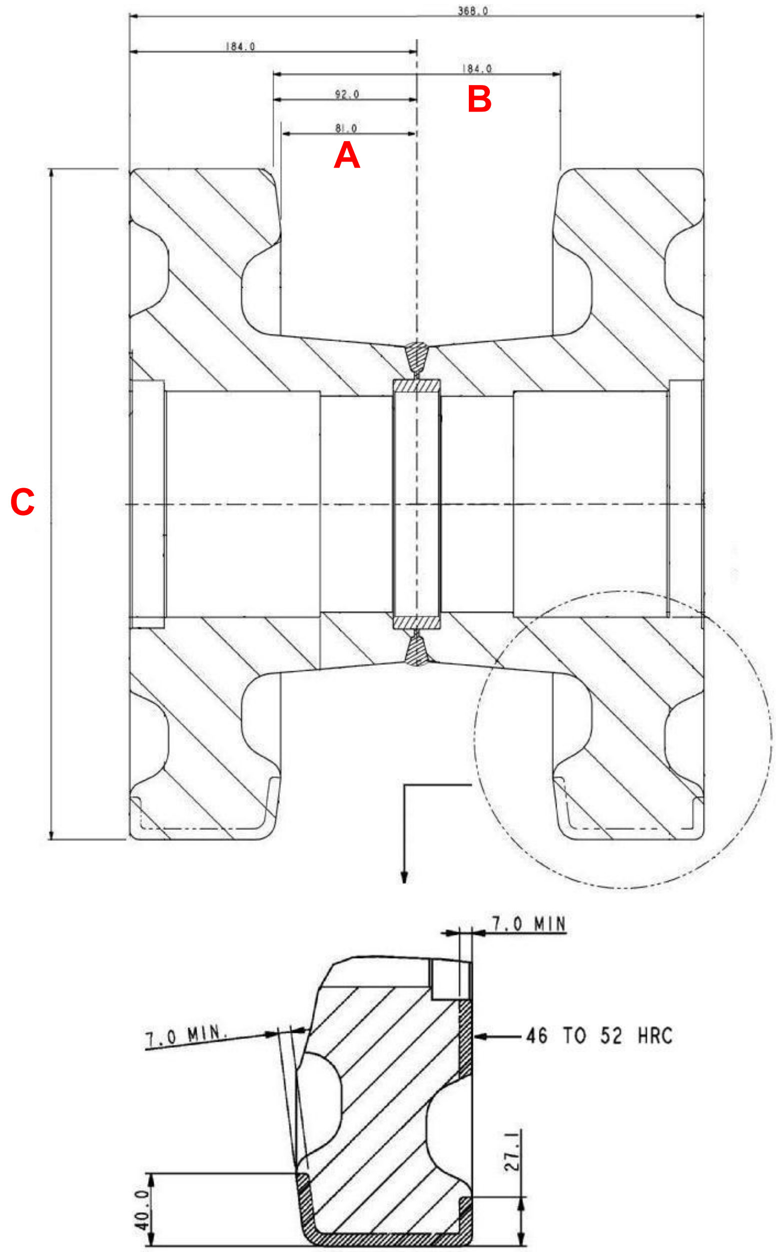


Figure 6: Intermediate roller — 16000

4.2.5 Intermediate roller — 18000

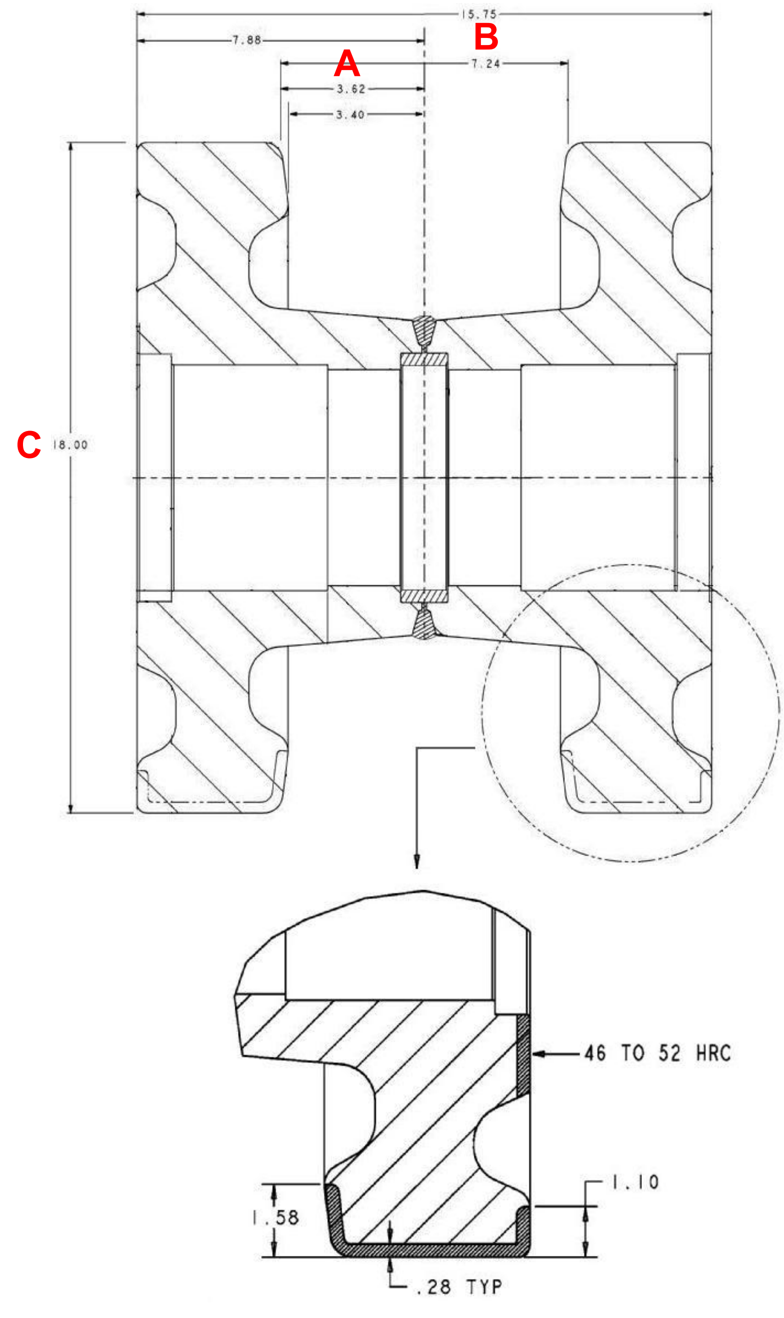


Figure 7: Intermediate roller — 18000

4.3 Idle roller inspection

Table 6: Idle roller nominal dimensions

Model	Dimensions				Drawing reference
	A	B	C	Chamfers	
3900	2.25 in (57.15 mm)	4.50 in (114.30 mm)	29.50 in (749.30 mm)	n/a	Figure 8 on page 16
3900W	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17
4000W	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17
4100W	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17
4600	3.50 in (88.90 mm)	4.50 in (114.30 mm)	36.88 in (936.75 mm)	n/a	Figure 12 on page 20
M250	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17
777	1.75 in (44.45 mm)	4.50 in (114.30 mm)	29.50 in (749.30 mm)	0.25 in (6.35 mm) x 45°	Figure 10 on page 18
888	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17
999	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17
2250	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17
14000	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17
16000	2.50 in (63.50 mm)	7.10 in (180.34 mm)	36.81 in (934.97 mm)	0.25 in (6.35 mm) x 45°	Figure 11 on page 19
16000 (upper)	7.87 in (199.90 mm)	4.00 in (101.60 mm)	n/a	0.79 in (20.07 mm) x 45° 0.20 in (5.08 mm) x 45°	Figure 13 on page 21
18000	3.50 in (88.90 mm)	14.00 in (355.60 mm)	36.88 in (936.75 mm)	n/a	Figure 12 on page 20
18000 (upper)	15.63 in (397.00 mm)	18.00 in (457.20 mm)	n/a	0.13 in (3.30 mm) x 45°	Figure 14 on page 21
21000	2.00 in (50.80 mm)	4.50 in (114.30 mm)	34.00 in (863.60 mm)	0.25 in (6.35 mm) x 45°	Figure 9 on page 17

4.3.1 Idle roller — 3900

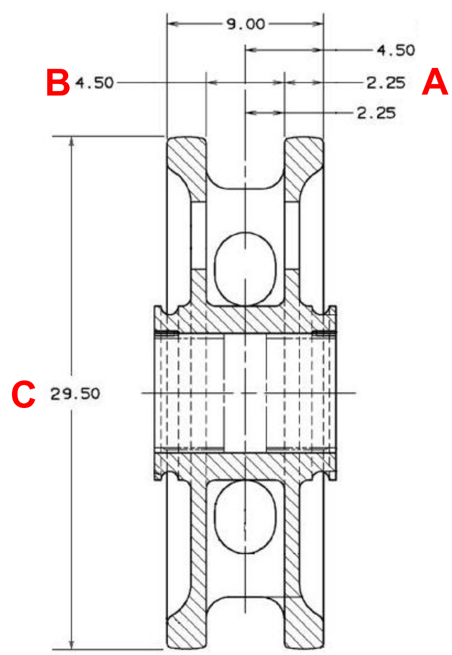


Figure 8: Idle roller — 3900

4.3.2 Idle roller — 3900W, 4000W, 4100W, M250, 888, 999, 2250, 14000, 21000

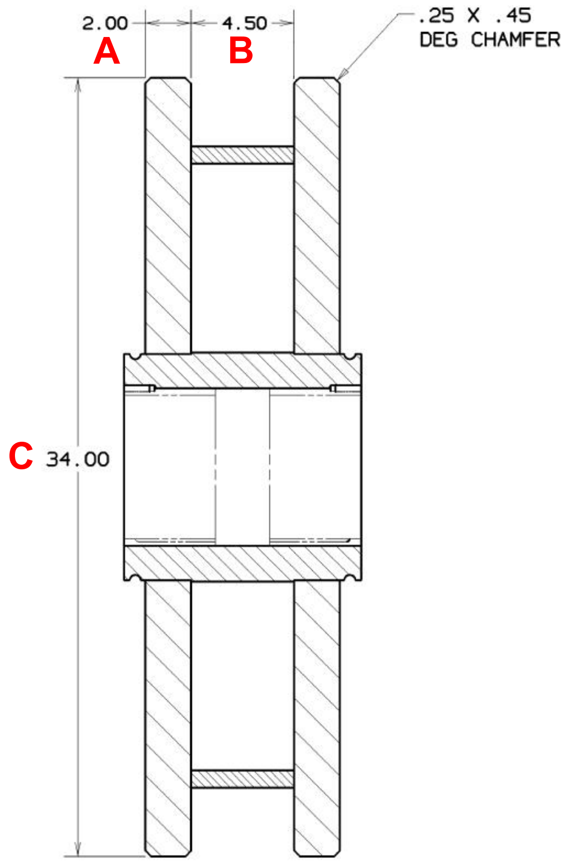


Figure 9: Idle roller — 3900W, 4000W, 4100W, M250, 888, 999, 2250, 14000, 21000

4.3.3 Idle roller — 777

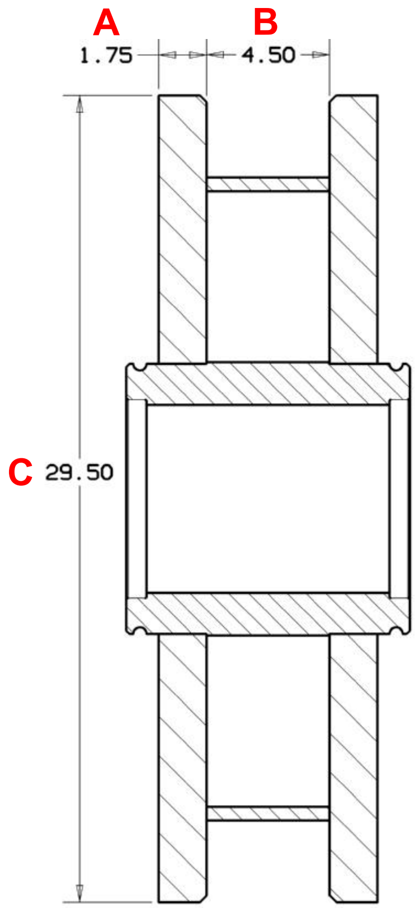


Figure 10: Idle roller — 777

4.3.4 Idle roller — 16000

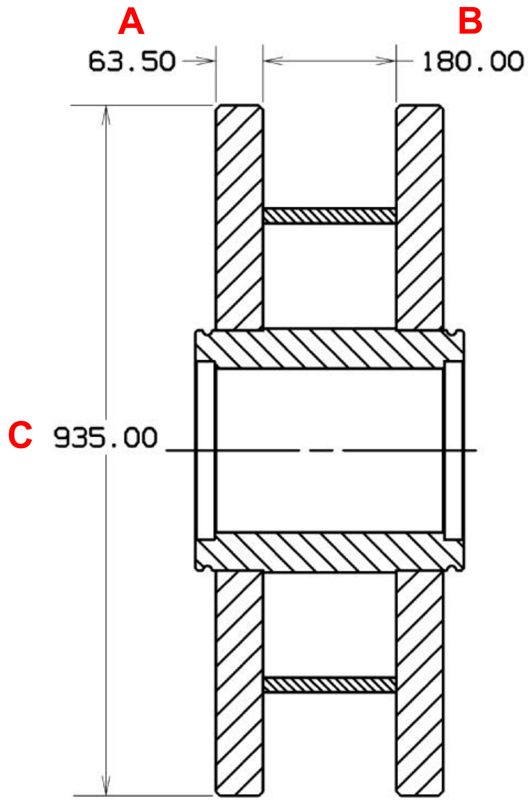


Figure 11: Idle roller — 16000

4.3.5 Idle roller — 4600, 18000

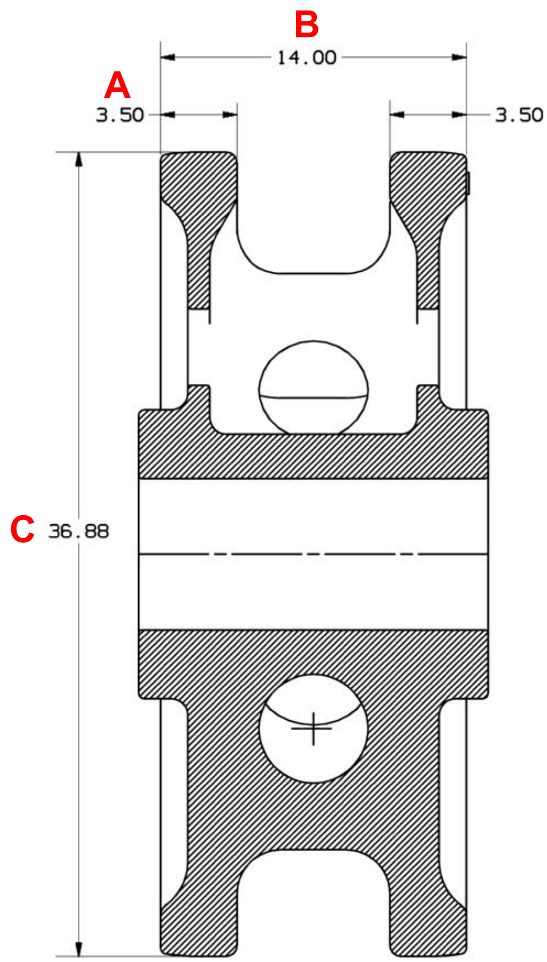


Figure 12: Idle roller — 4600, 18000

4.3.6 Idle roller (upper) — 16000

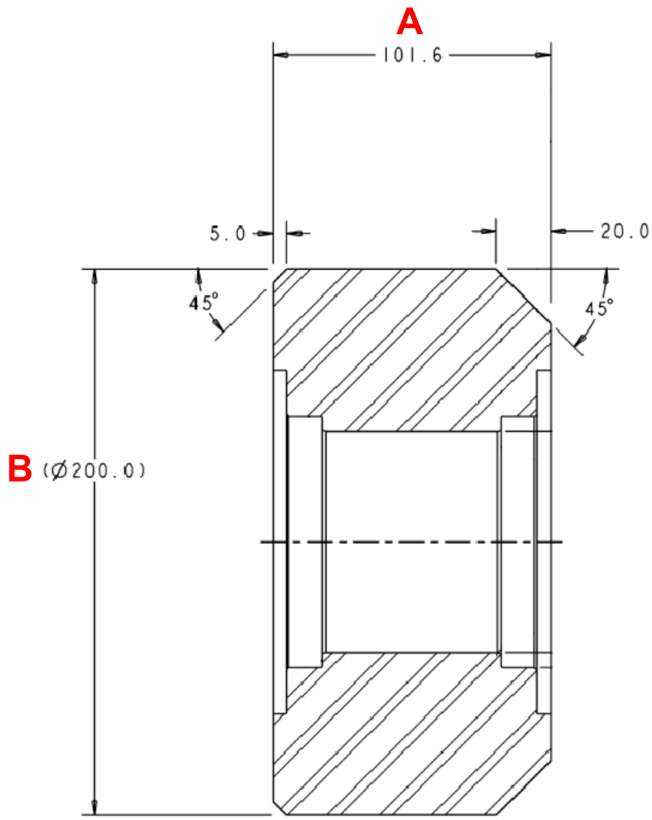


Figure 13: Idle roller (upper) — 16000

4.3.7 Idle roller (upper) — 18000

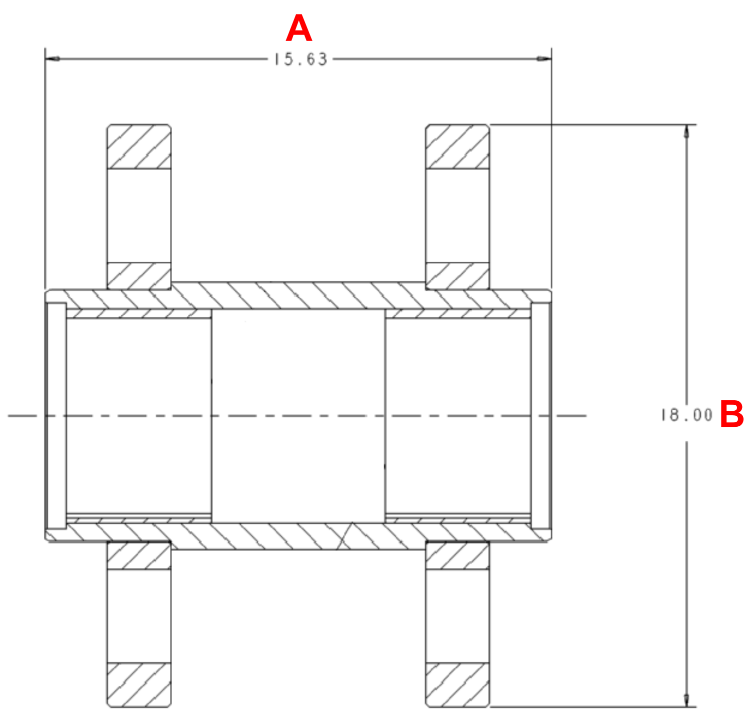


Figure 14: Idle roller (upper) — 18000

4.4 Drive tumbler (no sprocket) inspection

Model	Templates*	Template part #
777	Figure 15 on page 22	81011241 81011242
888 999 14000	Figure 16 on page 23	81011353 81011354
2250 21000	Figure 17 on page 24	81010892 81010893
16000 18000	Figure 18 on page 25	A18290 A18291
* All templates can be purchased through Manitowoc Crane Care.		

4.4.1 Drive tumbler (no sprocket) templates — 777

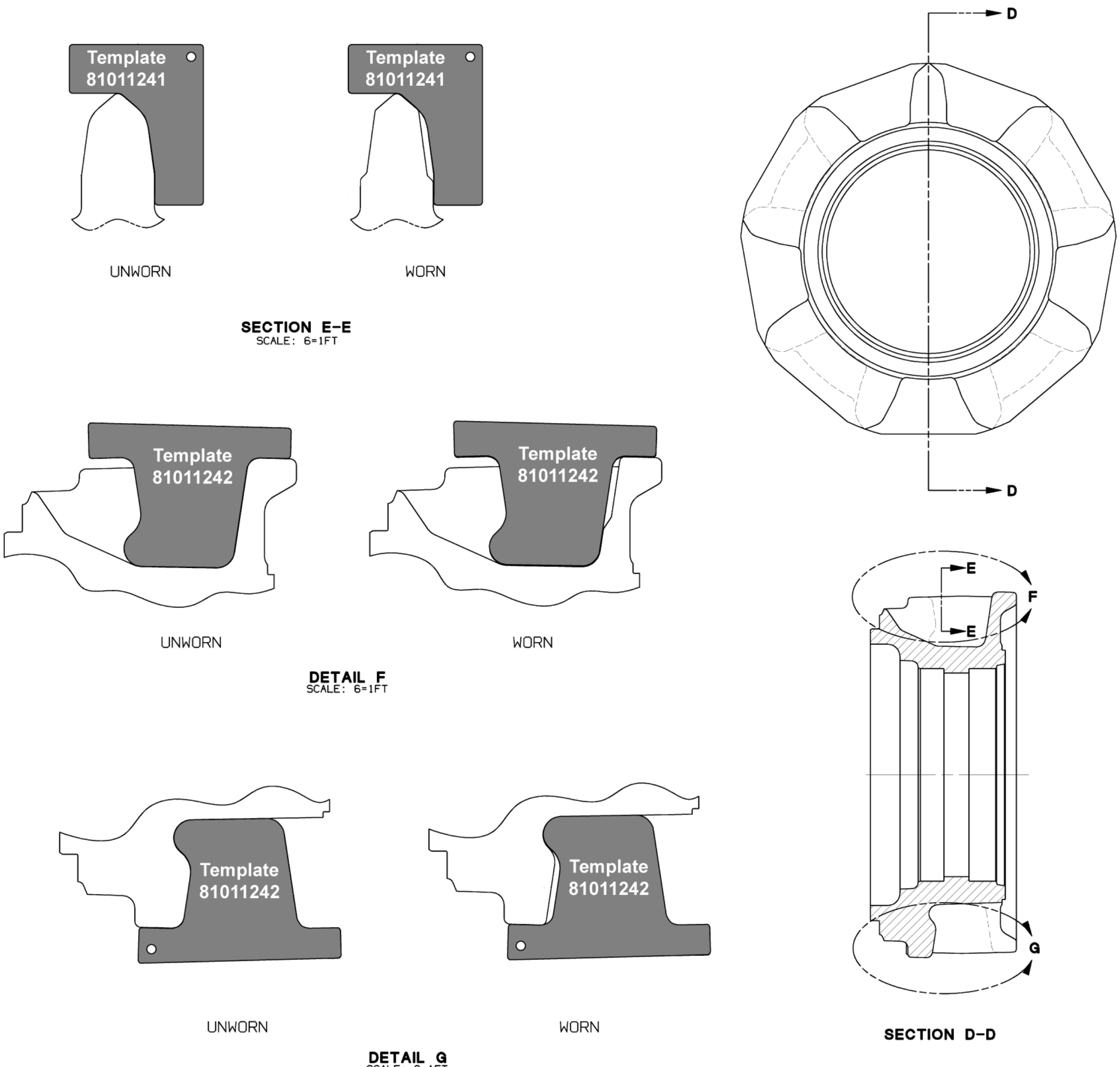


Figure 15: Drive tumbler (no sprocket) templates — 777

4.4.2 Drive tumbler (no sprocket) templates — 888, 999, 14000

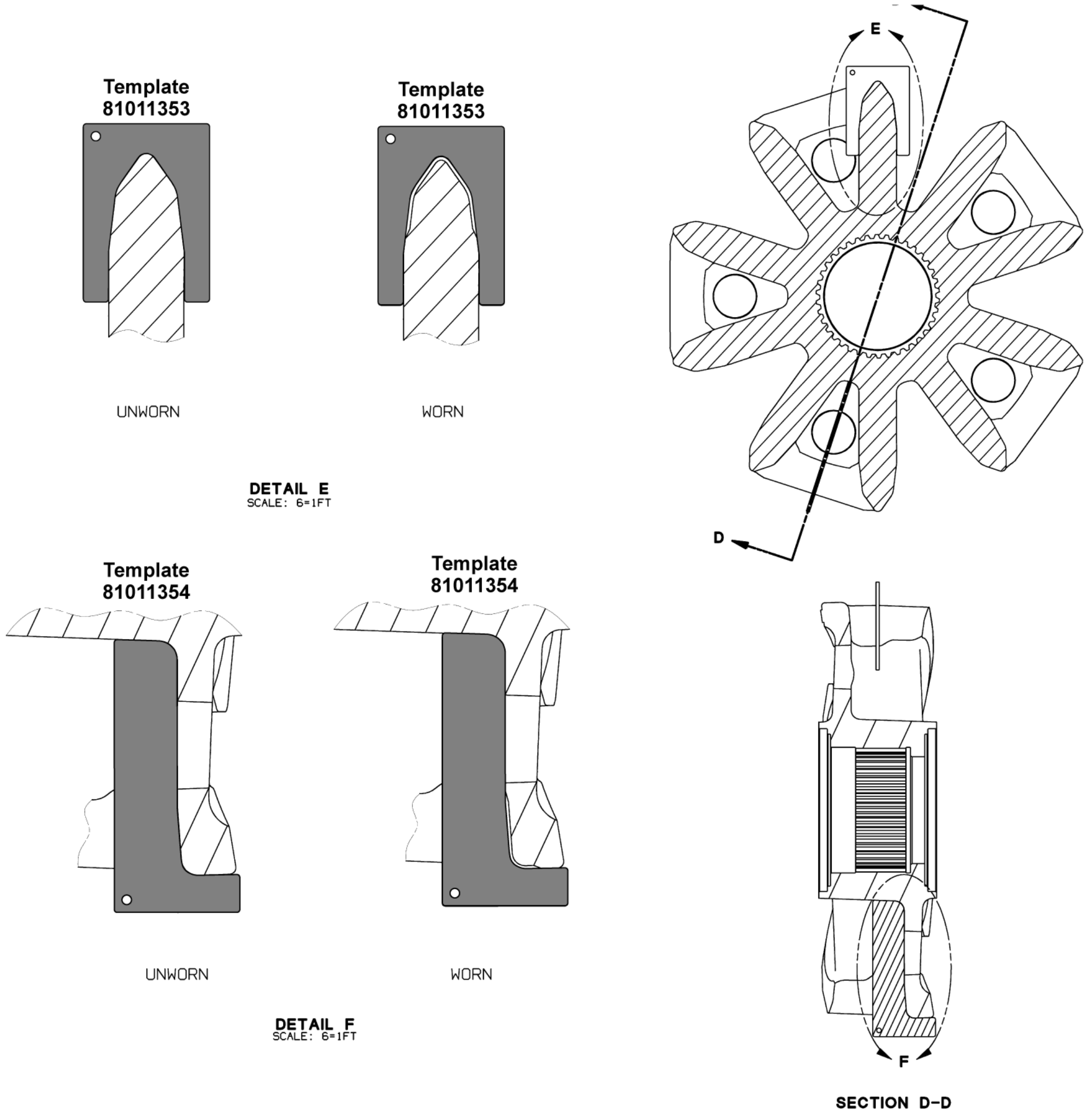


Figure 16: Drive tumbler (no sprocket) templates — 888, 999, 14000

4.4.3 Drive tumbler (no sprocket) templates — 2250, 21000

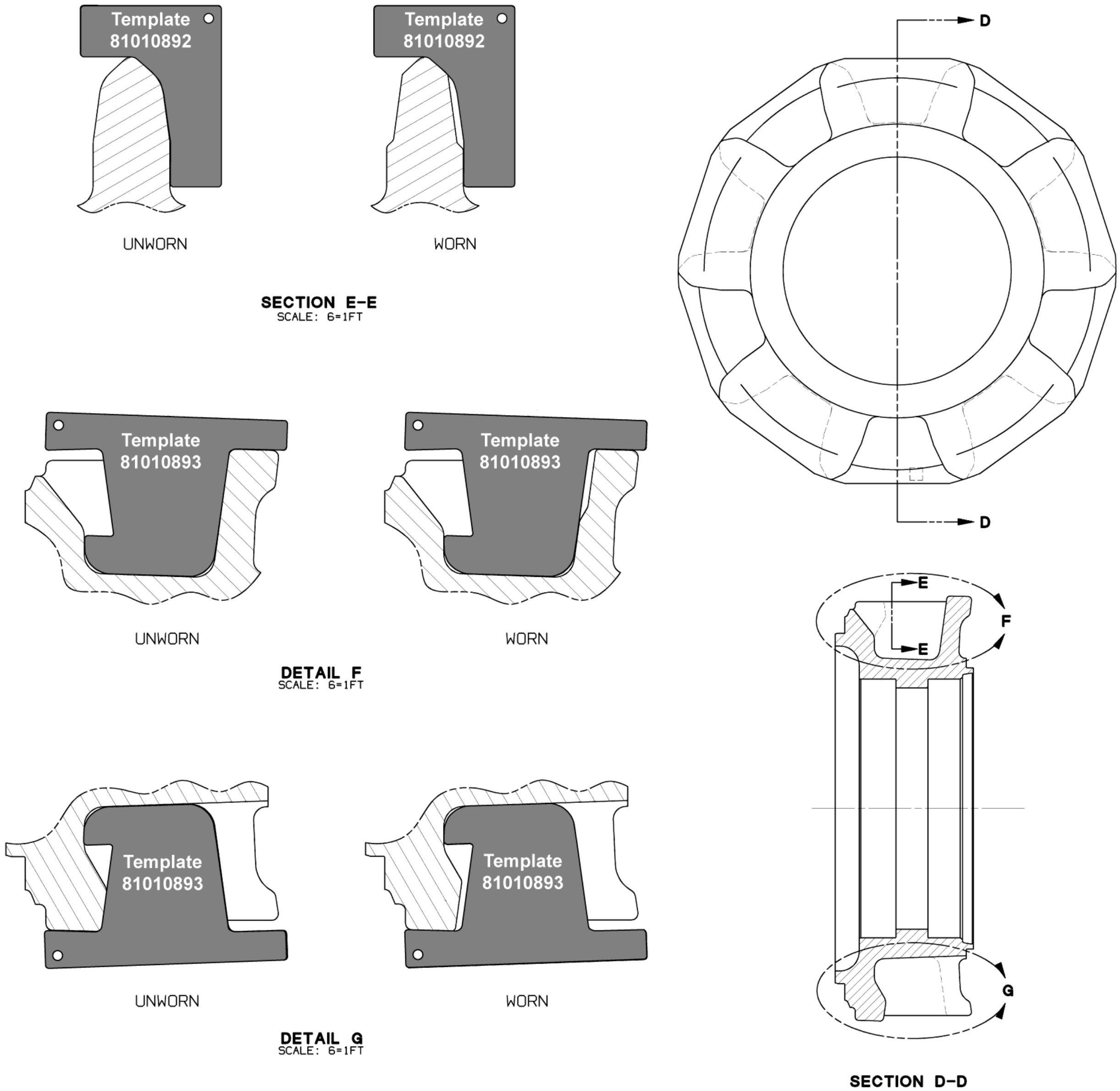


Figure 17: Drive tumbler (no sprocket) templates — 2250, 21000

4.4.4 Drive tumbler (no sprocket) templates — 16000, 18000

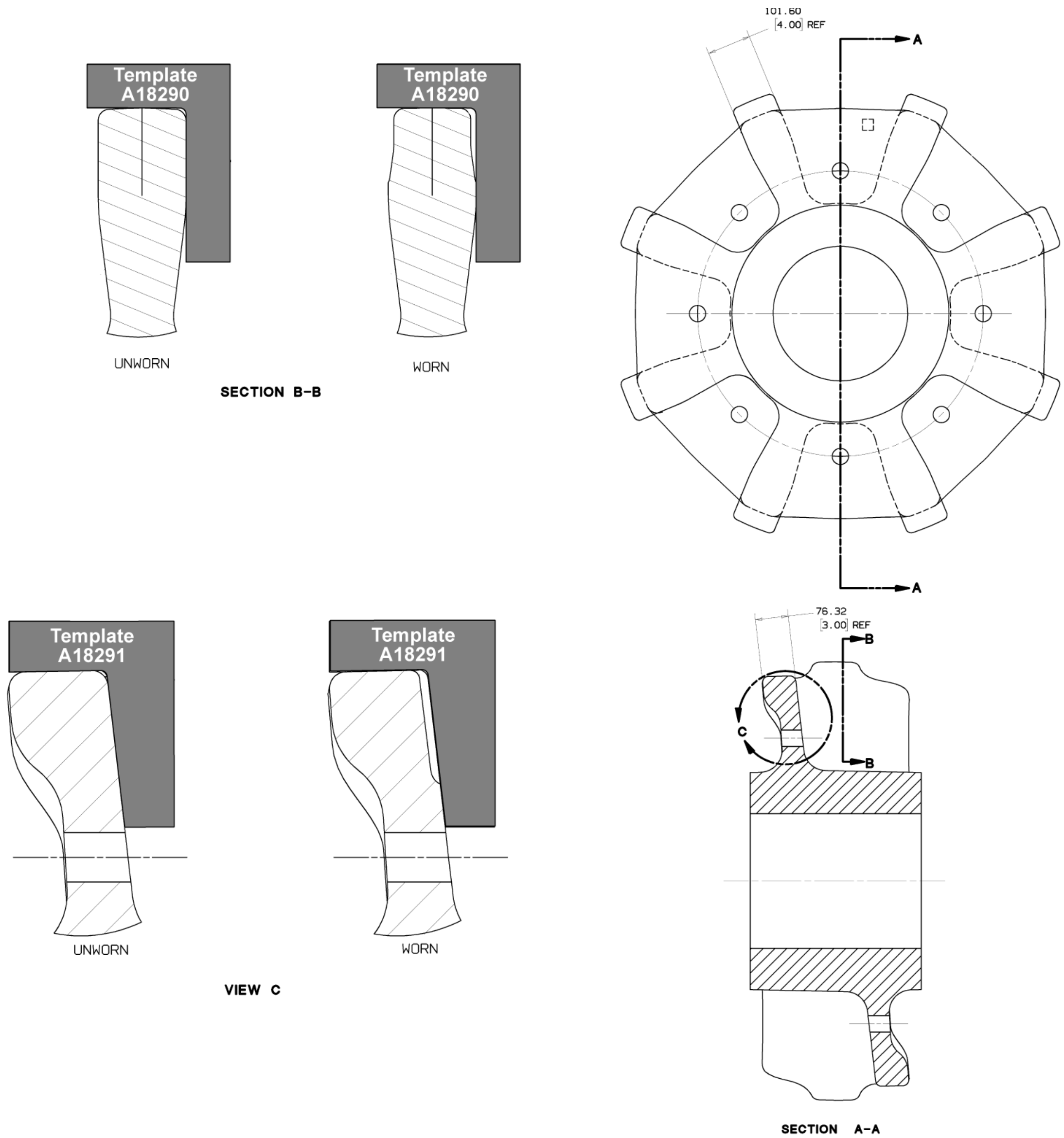


Figure 18: Drive tumbler (no sprocket) templates — 16000, 18000

4.5 Drive tumbler (with sprocket) inspection

Model	Templates*	Template part #
3900	Figure 19 on page 26	81011236
4000W	Figure 19 on page 26	81011233
	Figure 20 on page 27	81011338 81011337
4100W	Figure 19 on page 26	81011234
	Figure 20 on page 27	81011339 81011340
4500 4600	Figure 19 on page 26	81011237
	Figure 21 on page 28	81011343 81011344
M250	Figure 19 on page 26	81011235
	Figure 20 on page 27	81011339 81011340
* All templates can be purchased through Manitowoc Crane Care.		

4.5.1 Sprocket template — 3900, 4000W, 4100W, 4500/4600, M250

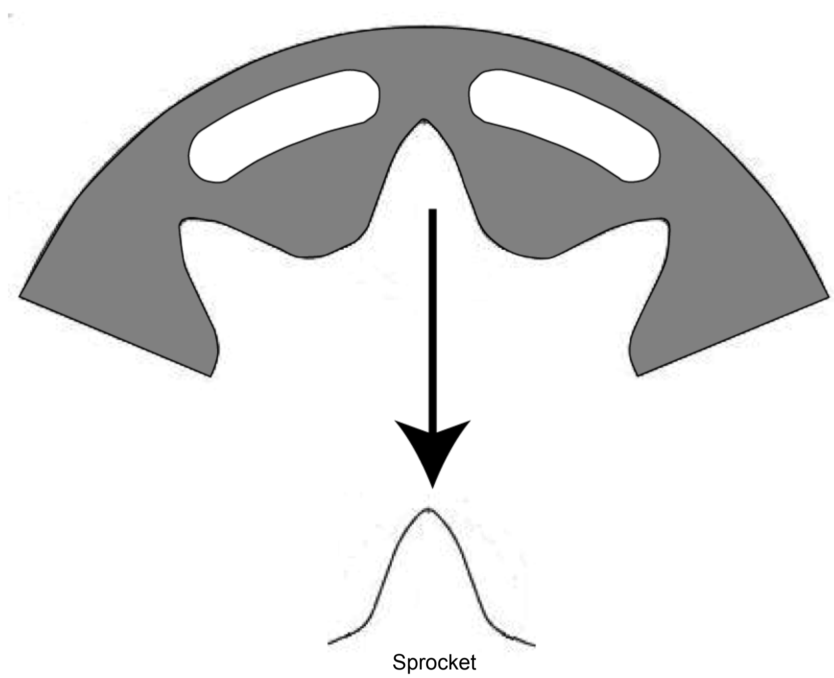


Figure 19: Drive tumbler (with sprocket) templates — 3900

4.5.2 Tumbler template — 4000W, 4100W, M250

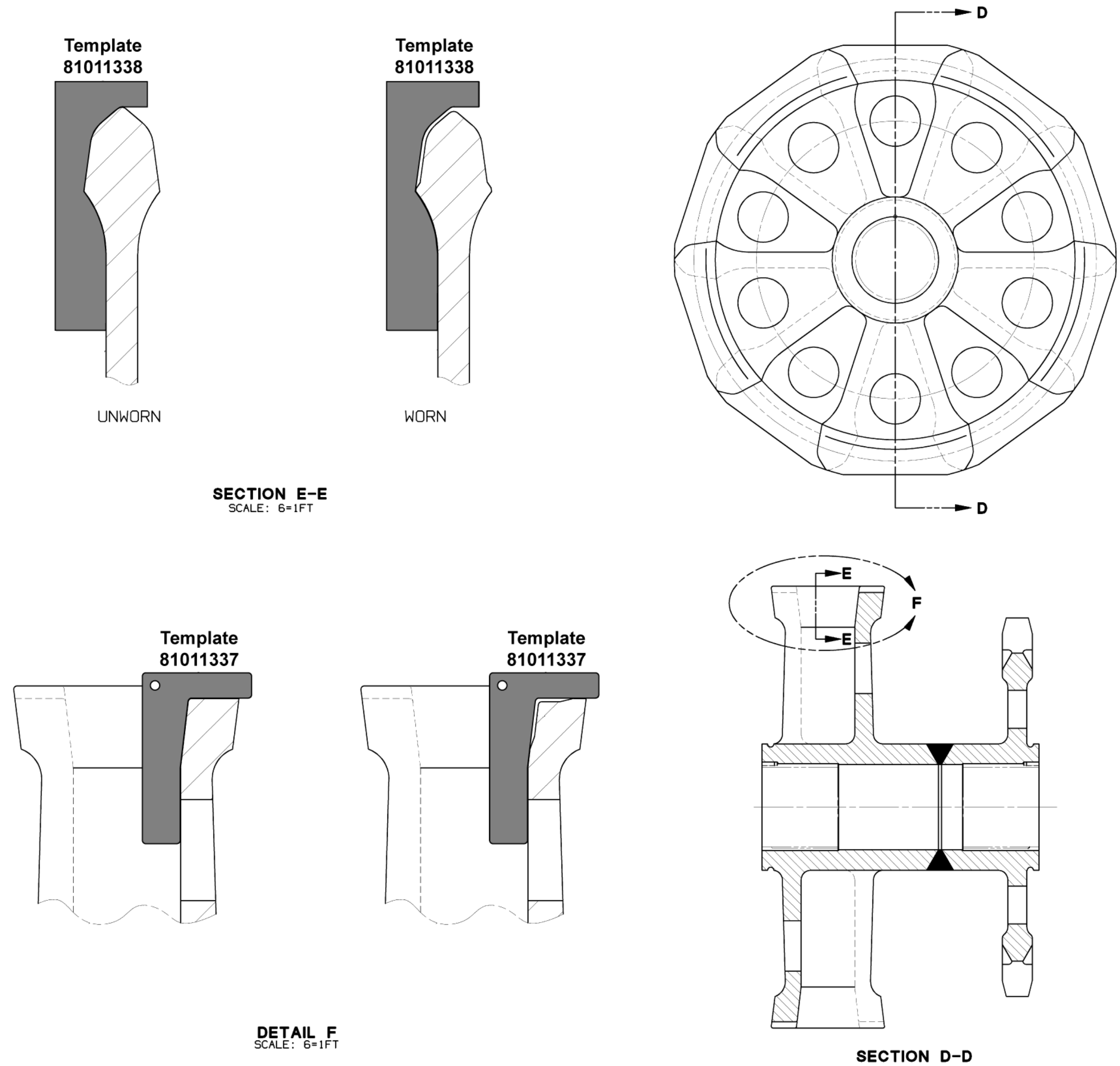


Figure 20: Tumbler template — 4000, 4100W, M250

4.5.3 Tumbler template — 4500/4600

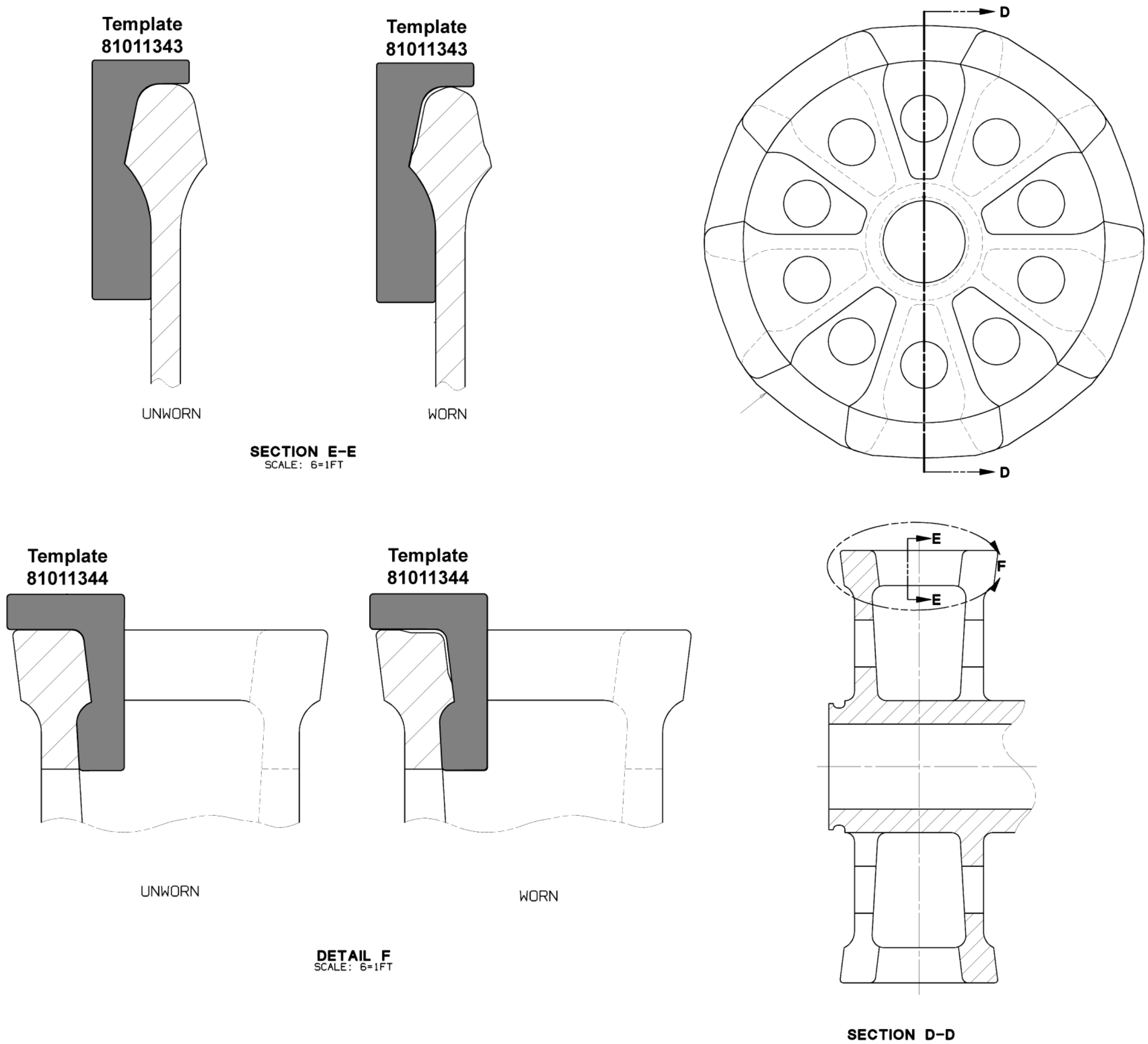


Figure 21: Tumbler template — 4500/4600

4.6 Inspection of travel sprockets

Model	Templates*	Template part #
3900	n/a	n/a
3900W	Figure 22 on page 29	81011246
4000W	n/a	n/a
4100W	n/a	n/a
4600	Figure 22 on page 29	81011232
M250	n/a	n/a
* All templates can be purchased through Manitowoc Crane Care.		

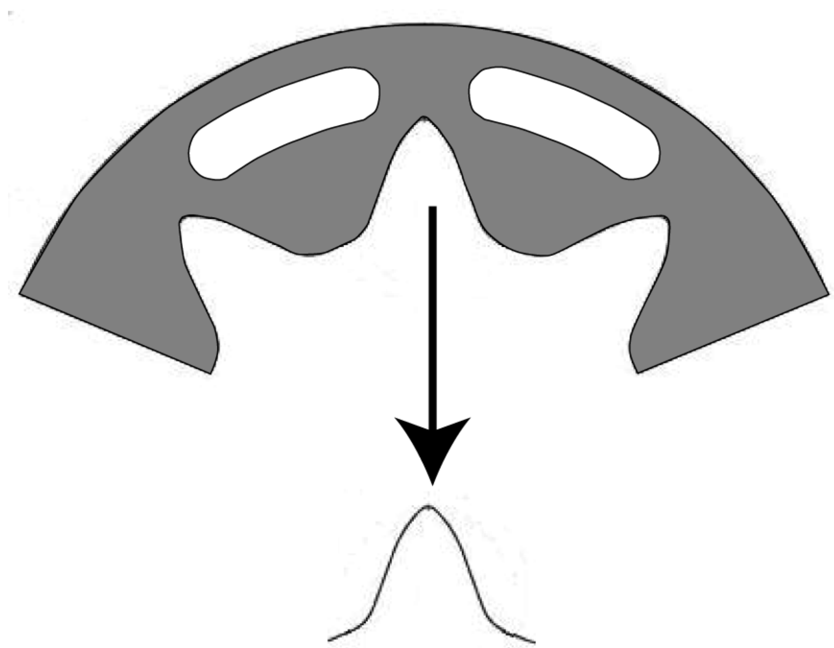


Figure 22: Travel sprocket inspection — 3900W, 4600

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