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EPIC RING TIPS TABLE OF CONTENTS

Ring Tip	Title	Content Description
1	MAINTAINING INTERNAL RING CLEANLINESS PART 1	Extreme importance of regular chemical cleaning of the ring's internal structure
2	MAINTAINING INTERNAL RING CLEANLINESS PART 2 (ALSO COVERS EXTERNAL CLEANLINESS)	Importance of maintaining internal and external ring cleanliness
3	AVOIDING RING BREAKAGE WITH SINTERED RINGS	Covers the avoidance of ring breakage
4	PREVENTION OF PORE SMEARING, BLEED LINE CLOSURE & CHATTER MARKING (REFACING)	Details best procedures to maintain rings
5	REDUCING RING HEAT AND THE PLANT ELECTRIC BILL	Tips to reduce ring heat and the plant electric bill
6	CONTROLLING RING OIL USAGE WITH SINTERED RINGS	Reviews controlling ring oil usage with sintered rings
7	ADDITION OF "CHEMICAL RING CLEANERS" TO RING OIL - GENERALLY NOT RECOMMENDED	Explains the non-recommended addition of chemical ring cleaners to ring oil
8	PERIODIC WICK REPLACEMENT FOR SINTERED & SOLID STEEL RINGS	Detailed information on wick replacement for sintered and solid steel rings
9	THE IMPORTANCE OF TRAVELER FIT AND WEIGHT IN RING SPINNING AND TWISTING	Summary of the importance of traveler fit and weight in ring spinning and twisting
10	SINTERED RING PORE VOLUME, OIL BLEED RATES, AND OIL VISCOSITY	Covers ring pore volume, oil bleed rates, and oil viscosity for different types of sintered rings
11	RING OIL TYPES AND THEIR EFFECT ON RING SPINNING AND TWISTING PRODUCTIVITY	Detailed information on ring oil types and their effect on ring spinning and twisting productivity
12	RING OIL VISCOSITY AND THE LUBRICATED RING	Covers ring oil viscosity choices as related to yarn type for the lubricated ring
13	THE INDIVIUAL RESERVOIR AND MANIFOLD HOLDER ASSEMBLIES	Discusses types of centralized manifold systems and the individual reservoir ring

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RING MAINTENANCE TIP #1
MAINTAINING INTERNAL RING CLEANLINESS

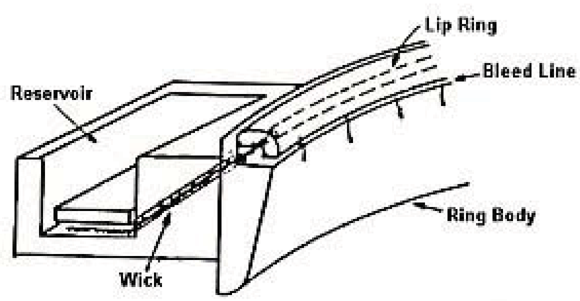
Internal ring plugging, occurring with both sintered and solid steel (Herr type) rings, is progressive and has a very negative effect on production efficiency. Plugging is primarily caused by petroleum ring oil oxidation, but also by particulate matter in the oil and plant air, and by nylon and steel traveler wear debris.

THE PLUGGED RING CAUSES:
1) Tension variation resulting in ends-down, chafed yarn, scrap yarn and a reduction in yarn quality
2) Excessive, wasted electric power use
3) High ring temperatures and an added load on air conditioning
4) Decrease in traveler life
5) Increased oil use and oil on floors
6) Reduced productivity in real lbs/hr
7) Damage to the ring

THE SINTERED RING is a micro porous structure of hardened carbon steel particles. Particle hardness runs Rockwell C 60-62, while apparent mass hardness is about Rockwell C 50.

Although ring wall thickness ranges from about 0.090” to 0.200” typical, the porous structure is like a foam pad many feet in thickness. Any solid matter, or any oil, that oxidizes will quickly and progressively foul or plug a sintered ring.

In general, the sintered ring is the preferred ring, because it can feed oil on demand to the entire ring, as required. When a hot spot develops, oil thins, allowing greater oil flow to the specific heat sources to cool it down. The sintered ring, when internally clean, requires less power (KW) than a solid steel ring, due to evenness of oil delivery.



Passageways of Solid Steel (Herr) Ring

THE SOLID STEEL RING (Herr type) has a higher real hardness, at Rockwell C 60-62, and has larger passageways, to bring oil from the reservoir to the ring face, through the bleed line, so it does not plug quite as rapidly as the sintered ring. The passageways, particularly behind the lip ring and in the bleed line, are very subject to plugging from oxidized petroleum oil and particulate matter in the oil. Fibers caught in the bleed line also block oil flow. Loss of lubrication from internal plugging promotes progressive chatter marking and smearing of the ring steel into the bleed line, further closing the bleed line.

Although the solid steel ring does not have the capability of delivering oil evenly to the entire ring, it does have greater real hardness and, therefore wear resistance when running with steel travelers. This type of ring is therefore used almost exclusively where metal travelers must be used; such as fine count worsted yarns.

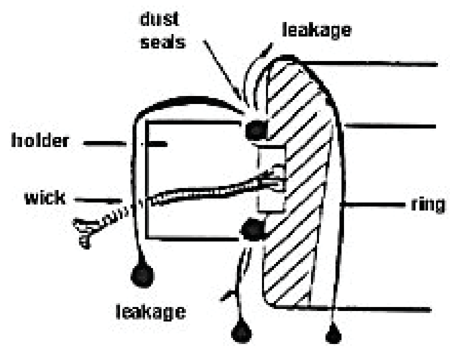
Effect of Ring Cleaning
ref: 100/2 denier 90 mph

CAUSE OF RING PLUGGING: By far the greatest cause of fouling is petroleum ring oil that oxidizes to a hard, impenetrable mass; petroleum also contains about 20 to 25 times more particulate matter than a pure synthetic ring oil. Other contaminants are nylon wear debris from a nylon traveler, steel wear debris from both ring and traveler, and plant environmental particulate matter. Above all, the biggest culprit is petroleum ring oil.

HOW LONG DOES IT TAKE A RING TO COMPLETELY PLUG? Statistically, more than 95% of all sintered rings are 100% plugged by petroleum oil within two years. Likewise, the solid steel ring (Herr type) will exhibit virtually no oil flow after 3 years of running. Even new, unused rings stored with petroleum oil will be almost totally plugged within 3 to 4years, from petroleum oxidation.

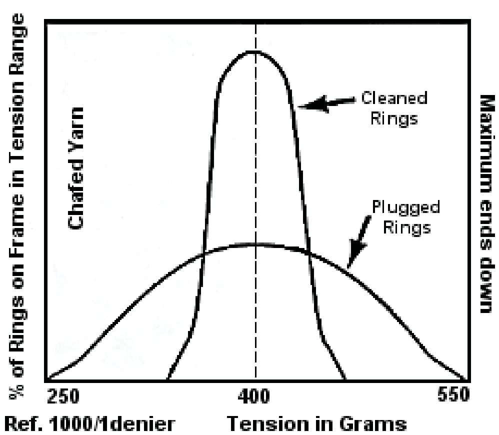
THEN HOW DO MY OLDER RINGS KEEP RUNNING? Oil no longer flows through sintered porosity or through the solid steel ring passageways. Yet there is still some oil on the ring surface. Oil gets to the ring face intermittently by leaking from the reservoir and by back-pressure leakage created by oil within the ring, expanding oil toward both ring ID and OD as heat builds in the ring.

Oil is also pulled to the ring surface by a partial vacuum caused by the rotating bobbin and yarn. This partial vacuum works on the same principle as cigarette smoke being pulled from a moving car once the window is opened.



Back Pressure Leakage

The successful operation of the Herr type solid steel ring, even in a clean state, is highly dependent on this partial vacuum to draw oil to the ring face. Nonetheless, a considerable amount of leaked oil still makes its way onto the frame and down to the floor.



TENSION & TENSION DISTRIBUTION

WHAT ARE THE PRACTICAL CONSEQUENCES OF RING PLUGGING?

They are many and include:

1) **VARIABLE TENSIONS, ENDS-DOWN AND SCRAP YARN:** As a ring plugs, the supply of oil becomes intermittent to the traveler. This causes variable tension from ring to ring, as seen in the diagram on tension distribution. Too high a tension causes ends-down and scrap yarn, while too low a tension may cause yarn chafing; both damage yarn bundle filaments and reduce yarn quality.

2) **EXCESSIVE POWER USE:** Ring spinning and twisting are by far the largest power users in a yarn plant and typically account for 50% or more of all plant KW. Repeated experience in many plants shows that either a new or a cleaned ring will reduce power consumption, typically by 15 to 20%. The annual savings with an Epic cleaned ring for a carpet yarn plant, with 4000 rings, usually exceeds $100,000 per year, and, for a large twisting plant (e.g., tire cord) with 30,000 rings, KW savings run well into many $100,000s per year. On power use alone, the average payback from an Epic cleaned ring runs about 15 weeks.

3) **INCREASED RING TEMPERATURES** usually result from inadequate lubrication of the traveler. With a clean ring and a well-fitting, correct-weight traveler, there is no reason, even with the heaviest yarns, that ring holder temperatures should be more than 10°F (6°C) above surrounding room temperatures. In air-conditioned plants, it is typical that heat generated from the plugged ring/traveler contact can add another 17% KW load onto the air conditioning system. In plants without air conditioning, summer room temperatures can hit 120°F (50°C) and more, making very unpleasant working conditions.

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5) **DECREASED TRAVELER LIFE:** As evidenced by high KW and high ring temperatures, plugged rings with poor traveler lubrication decrease traveler life, usually by 3 to 4 times, causing an added plant expense.

As rings foul, plants must adjust traveler weight downward. The reason is that the loss of lubrication caused added drag, or, in other words, increases the effective weight of the traveler.

6) **REAL PRODUCTIVITY DECREASES:** With internally plugged rings and their uneven tensions, the plant typically reduces frame speed in order to prevent high ends-down frequency and excessive scrap yarn. This means a loss in real lbs/hour production. The highest real productivity rates are obtained on either new, or Epic cleaned, rings.

7) **INCREASED OIL USE:** The internally plugged ring often requires priming (oil pre-swabbing ring prior to start-up). The unclean ring, through backpressure leakage, also means that much of the oil ends up running down the frame and onto the floor. It has often been noted that internal cleaning can reduce oil use by as much as 5 to 10 times.

8) **RING DAMAGE:** Long term, the loss of lubrication promotes sintered ring pore smearing and chatter marking of both sintered and solid steel rings. Avoidance of these problems will be covered in subsequent RING TIPS.

POROSIMETER

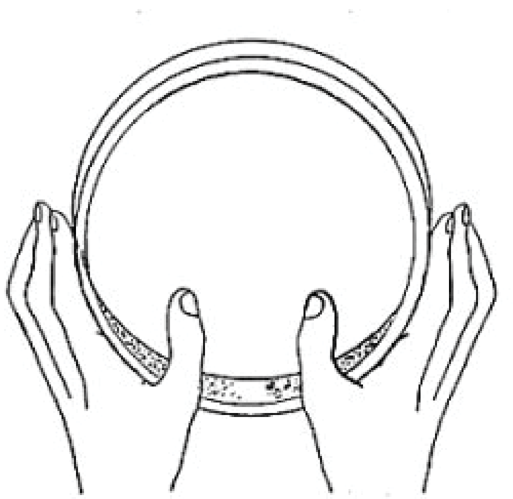
ABOUT RING CLEANING AND RING REBUILDING: Simple solvent washing or ultrasonic cleaning by the plant only cleans the exterior of the ring and does not internally clean the ring. Many plants have attempted internal cleaning and almost none have succeeded; those that have succeeded have abandoned in-house cleaning because of the OSHA requirements on the use of strong reagents and EPA requirements on disposal of contaminants.

The Epic process of internal cleaning involves a complex series of chemical processes resulting in a certified clean, “like-new” ring. Epic Ring Service is the only full service agency in the Americas cleaning rings and certifying its work with the Porosimeter (see photo). Rings are separated from the holders and chemically cleaned to new ring standards. Holders are also disassembled, cleaned and rebuilt with new parts (windows, buttons, springs, wicks, etc.). When required, rings are refaced. Also when required, broken or damaged rings are replaced with good rings, so that the plant receives back a full frame of “like-new” assemblies.

Costs of ring cleaning and rebuilding are about 20% of a new ring or ring assembly, and yield a certified “like-new” condition.

RING MANUFACTURER RECOMMENDATIONS: All sintered ring manufacturers recommend that rings be internally cleaned and rebuilt with new parts every 1.5 to 3 years, if they are run on petroleum ring oil. With pure synthetic ring oil, experience indicates that internal cleaning and rebuilding can be done about every 3 to 5 years.

The solid steel ring manufacturers generally recommend internal cleaning and rebuilding with new parts at the same 1.5 to 3 year interval, if run on petroleum, and again about every 3 to 5 years if run on a pure synthetic ring oil.



HOW DO I KNOW WHEN MY SINTERED RINGS NEED INTERNAL CLEANING? A simple qualitative test is to disassemble a ring from its holder. Hold the ring tightly in the palms of your hands for a minute. If the ring is clean, hundreds of little beads of oil will appear evenly on the ring ID from the heat of your hands. This technique does not work with solid steel rings. The Porosimeter is used to gauge passageway cleanliness for both sintered & solid steel rings.

A better, quantitative procedure is to send a sample of 6 ring assemblies from working frames (not rings that have been lying around as these are subject to oil dry out and petroleum oxide) to Epic. These rings are inspected 100% incoming on the Porosimeter, inspected for faults, cleaned, and rebuilt, 100% porosity checked, and returned with a certified laboratory report on condition compared to a new ring.

HOW DO I KEEP MY NEW OR CLEANED RINGS INTERNALLY CLEAN? All ring manufacturers recommend pure synthetic ring oils, as they virtually do not oxidize and contain about 20 to25 times less particulate matter than petroleum ring oils. Pure, synthetic ring oil, is well justified, because it greatly reduces ring plugging.

Subsequent RING TIPS will cover plant external ring maintenance and a wide variety of subjects including travelers, oil types, oil viscosity, oil flow control methods, regular rebuilding, avoidance of pore smearing & chatter marking, avoidance of oil and black stains, regrinding, etc.

For additional help, contact Epic Ring Service.

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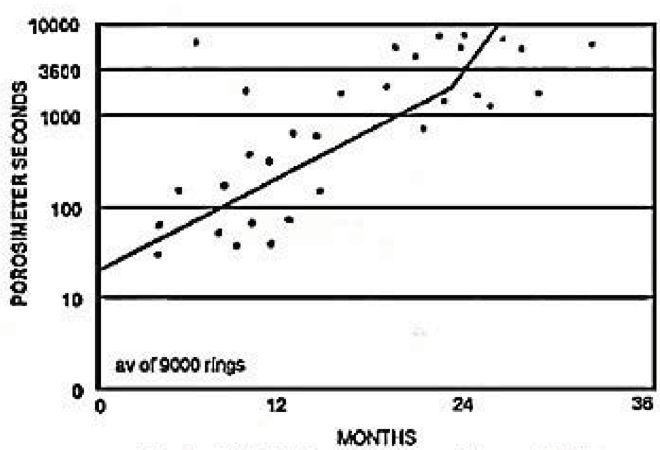
RING MAINTENANCE TIP #2
MAINTAINING INTERNAL RING CLEANLINESS

REVIEW: Ring Maintenance Tip #1 covered the extreme importance of internal ring cleanliness and the need to have the rings chemically cleaned about every two years, if run with petroleum ring oil or about every three to five years, if maintained with a pure synthetic ring oil.

Over 95% of all rings run with petroleum ring oil will internally plug within two years, so that oil only gets to the ring face by leakage around the ring. Some of the loss of efficiencies from plugging include:

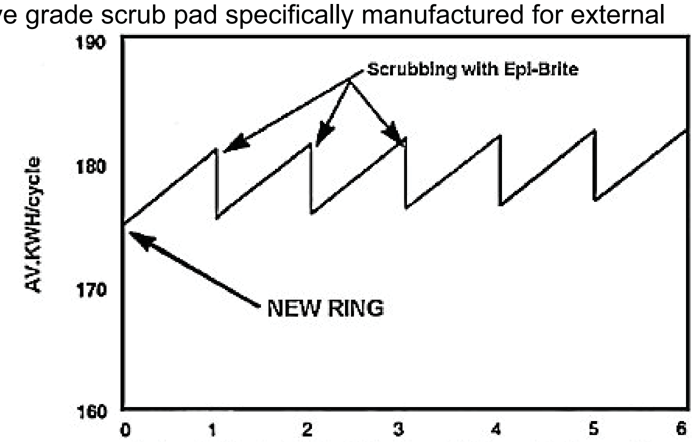
1) uneven tensions, resulting in a high frequency of broken ends and scrap yarn
2) a typical increase in power (KW) consumption of 15-20% on the plant's largest electric user (spinning and twisting)
3) increased ring temperatures
4) reduced speed and real lbs/hour efficiency
5) reduced traveler life



Rate of Petroleum Fouling Measured by Porosimenter (50 psi > 8 psi at 80°F)

Chemical ring cleaning and assembly rebuilding restores rings to their original, new efficiency. Epic Ring Service is the only full service agency performing this work in the Americas.

EXTERNAL RING CLEANING can, and should, be performed by the plant on a regular basis: 1X/month for most rings, and more often with very critical yarns such as glass and fine denier manmade. This takes only minutes per frame, and results in very significant production efficiencies. This is done by scrubbing the ring with a plastic scrub pad, such as Epi-Brite™. Epi-Brite is a mildly abrasive grade scrub pad specifically manufactured for external cleaning of oily rings (sintered and solid steel). Scrubbing with Epi-Brite does not scratch or otherwise harm the ring. It does remove nylon or steel traveler debris, particulate matter in both oil and plant air, and oxidized petroleum that tend to plug sintered ring surface porosity; similarly, Epi-Brite cleans the ring face of the solid steel ring and tends to pull fibers out of the bleed line of a Herr type solid steel ring. The practical effects of regular scrubbing have been observed by several plants to be about a 5-8% frame KW reduction. Results by one plant are shown in the figure. Also observed is a significant reduction in ends-down and scrap yarn.



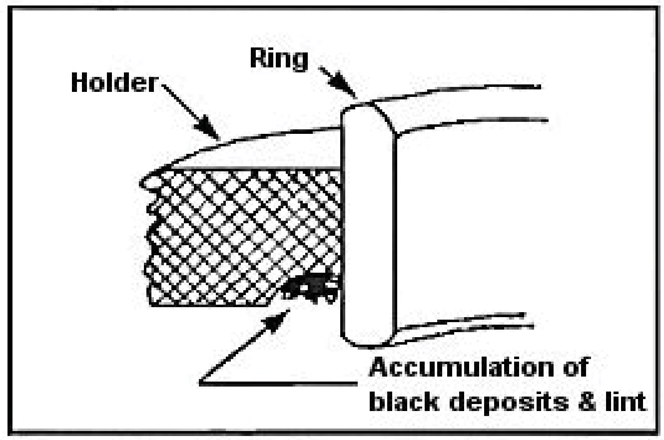
Typical Effect of Monthly Scrubbing of Rings with Epi-Brite on Redusing KWH

EXTERNAL HOLDER CLEANING: Good practice is to remove the ring assembly (ring & holder without disassembly) every 2-3 months and giving it a vigorous scrubbing with petroleum solvent (varsol) and Epi-Brite. This removes built-up sludge, black aluminum oxide from the holder, and accumulated lint. If these accumulated deposits are not removed, they are drawn by the partial vacuum of the rotating bobbin onto the ring surface and cause random broken ends and scrap yarn, as well as foul sintered ring surface porosity or the bleed line of a Herr-type ring. The process of assembly removal does involve several hours of frame downtime.

ALTERNATIVELY, many plants do not remove the assembly, but externally clean it in-place on the frame, using petroleum solvent and Epi-Brite. This is good practice, PROVIDED that the plant takes special care to clean the Hidden underside of the assembly, particularly the deep groove between the ring and holder, which attracts built-up deposits and yarn lint. This groove can be cleaned with a cotton swab on a stick (e.g., a Q-Tip™) and can be seen with a dental mirror.

After cleaning, and before start up, the ring should be swabbed with a clean rag soaked in ring oil, to replace the oil extracted by solvent cleaning.

Epic Ring Service cleaned and rebuilt holders are given a "bright finish"; functionally, the "bright finish" polishes the rough-cast holder so that particulate matter on the holder face is less adherent and more easily cleaned in the future.



Accumulation of black deposits & lint on Hidden Underside of Assembly should be removed monthly

BLACK DEPOSITS AND BLACK YARN STAINS are a concern to all plants and particularly to fine denier manmade plants. The source of these black deposits and stains includes oxidized petroleum ring oil, acidification of petroleum ring oil, that attacks the aluminum holder, producing black aluminum oxide from the holder and black ferrous oxide from the ring and traveler. Regular cleaning of the ring, holder, rail and separators prevents the build-up of black deposits, and consequent black stains on the yarn.

BLACK DEPOSITS AND STAINS IN HOT DRAWTWISTING: This is a very acute, costly problem for fine denier manmade plants. Not only does the plant face the above black deposit problems, but it also faces the vaporization and oxidation of the spin finish (primarily coconut oil) off the hot rolls. The partial vacuum created by the rotating bobbins pulls the blackened, grease-like spin finish into the ring area, and onto the separators. Any contact of the yarn with the ring or separator will produce semi-continuous black stains, or black flecks, on the yarn. The cure to this problem is the maintenance of an extremely clean (internal and external) ring assembly, rail and separator. Many hot drawtwisting plants have found that cleaning of the entire area, after each package build cycle, has greatly reduced the costly losses of downgrading black stained yarn to seconds and scrap.

YELLOW STAINS are primarily related to oil staining, and have their roots in an internally plugged ring, oil type and in controlling oil flow to the ring face. The cause and cure of yellow stains will be covered in a subsequent Ring Maintenance Tip.

If you did not receive Ring Maintenance Tip #1, contact Epic.

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RING MAINTENANCE TIP #3
AVOIDING RING BREAKAGE WITH SINTERED RINGS

THE SINTERED RING, A FINE WATCH

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure every 2 to 3 years if run with petroleum ring oil, and every 3 to 5 years if run with pure synthetic ring oil. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators every 2 to 3 months.

Ring Tip #3 covers the avoidance of ring breakage.

Rather surprisingly, EXPERIENCE SHOWS THAT ABOUT 5 TO 10% OF ALL SINTERED RINGS IN SERVICE ARE CRACKED or otherwise defective. Most defects can be observed while the ring is in the holder. Hair line cracks and other defects are a prime source of ends-down; as the traveler hits these largely unseen defects, the defect causes the traveler to jump, resulting in a momentary variation in tension; if a tension spike coincides with a weak spot in the yarn bundle, there is a broken end. Even if the end does not break, there is filament breakage within the yarn bundle.

Further, a sintered ring crack means that there is a direct flow of oil through the crack, leading to excess oil on the ring (yarn staining) and leakage onto the entire area and floor.

THE SINTERED RING IS, BY NATURE, QUITE BRITTLE AND SUBJECT TO BREAKAGE. The high hardness of the carbon steel ring and its sintered, powder metallurgical structure mean brittleness. The likelihood of breakage increases with narrow cross-section rings, (generally under 0.150" or 4mm wall thickness) and with large diameter, low height rings such as an 8.5" x 3/8" (216mm x 9.5mm) size.

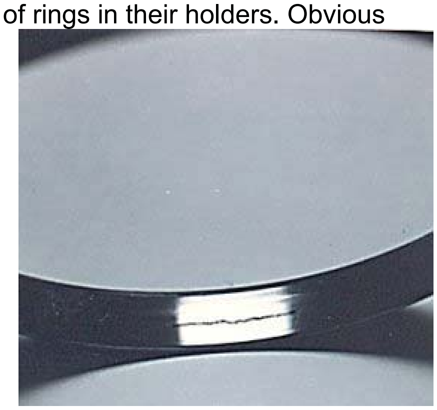

crack, not visible in compression of holder


same ring when removed from holder

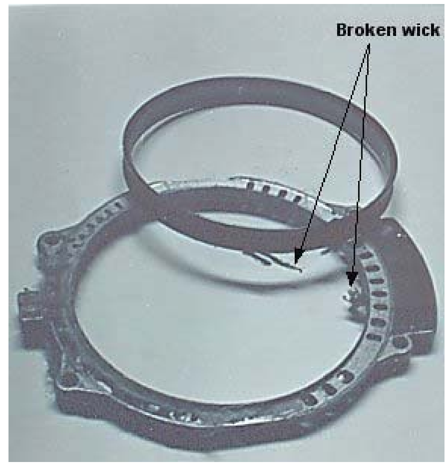
CAUSES OF CRACK AND DEFECTS are many and include:

1) **FAULTS PRIOR TO INSTALLATION AND DURING INSTALLATION**: Somewhat rarely, there are faults resulting from manufacture, where rings delaminate laterally (see photograph) from improper pressing and sintering. Some rings are broken during shipment to the plant, while rough handling during installation breaks many others. Visual inspection in receiving will not reveal hairline cracks of rings in their holders. Obvious cracks, chips, and de-lamination can be seen. Inspect all rings prior to installation; do not install faulty rings. Employees must be made aware that rings are very subject to breakage and that a ring assembly should be handled like a delicate watch.

2) **ROUGH HANDLING DURING USE**: It is almost impossible to avoid a certain amount of accidental breakage or edge chipping when a bobbin or a tool is dropped on the ring. The only way to minimize damage is to train operators, doffers and mechanics that the ring is fragile and highly susceptible to breakage; employees should be encouraged to look carefully at the ring after an unavoidable accident and to report a suspect ring.


delamination fault

2) **THE CASE OF THE SLIPPING RING**: Occasionally, a ring will loosen in its holder and start to rotate. Too often, this is solved by an overly zealous fixer over tightening the holder on the ring with the comment, “that ring will never slip again.” Once the ring had slipped, the wick was broken, thus starving that ring of its oil supply; at the same time, over tightening may either crack the ring, or cause it to go egg-shaped, thus increasing the possibility of broken ends. Employees should immediately report a slipping ring, so that it may be removed for repair.



wick breaks when ring slips in holder

3) **VIBRATION AND RAIL MOUNTED HOLDERS VS BACK MOUNT HOLDERS**: Frame vibration is a primary source of breakage. Back mounted holders do not have the support that rail mounted holders have, and the incidence of both holder and ring breakage about doubles with back mounted holders from vibration. Back mounted assembly breakage can be attenuated, by using front stabilization bars.

The “Skinned Holder” is a special problem and induces breakage. Take the example of a 6” (152mm) gauge frame originally set up with 4.5” (114mm) rings; this is a safe condition because there is adequate holder width on the sides to support the ring, to prevent vibration cracking. The plant decides they can squeeze a 5” (127mm) ring on the frame to build a bigger package and reduce doffing labor. This is done by skinning a 5” holder (see photo), to squeeze it onto the frame; which substantially reduces the support that the holder gives the fragile ring, and leads directly to a very high incidence of vibration fracture of the ring and holder.


the fragility of a “skinned” holder

Further, the skinned holder is forced to rub against the separators, causing drag and bending of the holder and resultant breakage. This rubbing action also causes the holder sides (and separators) to wear over time, leading to a further loss of support for the ring and vibration fracture. Very often, the skinned holder was not equipped with nylon wear studs to prevent both wear of the holder and separator. Epic can add replaceable nylon studs to avoid breakage from wear and bending from holder contact.

The skinned holder should be avoided. Locate and correct sources of vibration. Secure all holders with star washers. Regularly check holders for tightness. Back mounted holders (holding 5.5” or 140 mm or larger rings) with individual reservoir assemblies should be equipped front stabilization bars. Note that front mounted manifold systems serve the same purpose as the front stabilization bar.

5) **REMOVAL FOR REPAIR AND REWICKING**: Generally, it is safe for the plant to remove a manifold type ring assembly (e.g., Centrilube, Eadie-Lube, etc.) for repair and re-wicking because repair is relatively uncomplicated. The individual reservoir assembly is more complicated and involves special tools, seals, sealants, and parts; therefore, it is generally advisable to have an experienced full service agency do this repair work on the individual reservoir assembly. Inexperienced personnel performing ring assembly repair work often causes breakage of ring and/or holder and follow-on problems from incorrect rebuilding.

Epic Ring Service is the only full service agency in the Americas with a stock of thousands of different parts for all ring types; the processing equipment for professional internal and external cleaning; and the specialized tools and fixtures for disassembly and reassembly.

ALWAYS SAVE BROKEN HOLDERS- WIRE THE BROKEN SEGMENT TOGETHER: Holders can be repaired by welding, yielding a stronger holder than the new holder. Welding performed by Epic will be covered in a subsequent Ring Tip.

If you did not receive Ring Maintenance Tips #1 and/or #2, contact Epic.

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RING MAINTENANCE TIP #4
PREVENTION OF PORE SMEARING, BLEED LINE CLOSURE & CHATTER MARKING

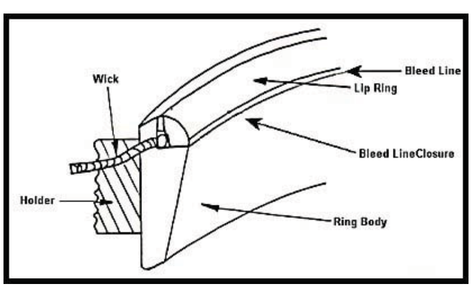
REFACING

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure every 2 to 3 years if run with petroleum ring oil, and every 3 to 5 years if run with pure synthetic ring oil. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators every 2 to 3 months. Ring Tip #3 covered the avoidance of ring breakage.

The most common cause of pore smearing of sintered rings, closure of the bleed line of a Herr-type solid steel ring, or chatter marking of both ring types, is internal plugging of the ring by petroleum oxidation. Particulate matter in the oil and in the plant air, as well as traveler wear debris, are secondary causes. The practical consequences of these conditions is traveler skipping, resulting in broken-ends, scrap yarn, damaged fiber bundle, high ring heat, etc., and progressive destruction of the ring.

PORE SMEARING only occurs with sintered rings and is a direct result of plugging of the internal porous structure of the ring, choking off oil flow to the ring. Pore smearing is the dragging of surface metal particles by the un-lubricated traveler over the ring surface to seal surface porosity. It is observed initially as a shiny band across the dull ring face; gradually this band of smearing broadens. Pore smearing occurs more rapidly with metal travelers. The photomicrograph shows the new (or reground) ring face, and the bright, pore smeared ring face.

good ring with low reflectance | pore smearing ring with high reflectance



Bleed Line Closure

BLEED LINE CLOSURE is common to the Herr-type solid steel ring and is similar to pore smearing. In this case, the plugging of the ring internal passageways results in a loss of traveler lubrication; the traveler drags the surface metal across the ring and progressively seals the bleed line, further blocking oil flow. Solid steel rings are primarily used where steel travelers are used (e.g., fine denier worsted), so that the effect of the hard steel traveler worsens the situation. Bleed line closure is usually found with chatter marking.

CHATTER MARKING, another result of internal plugging, occurs more rapidly with steel travelers than nylon travelers, and is seen with both sintered and solid steel rings. (See photograph) The loss of lubrication causes the traveler to skip. Where the traveler lands, it digs into the ring face and pushes up metal next to it. Gradually, vertical, diagonal, wavy lines appear on the ring face, and the situation leads to progressive ring destruction. Chatter marking may also occur on the lower ring chamfer.

PREVENTING DAMAGE TO THE RING

With a new ring, or a ring that has been chemically cleaned and rebuilt, the best procedure is to use a pure, synthetic ring oil to prevent the onset of plugging. Pure, synthetic, ring oil is almost totally resistant to oxidation. It contains about 1/20th to 1/25th the amount of particulate matter found in petroleum ring oils, and is recommended by all ring manufacturers.

Sintered rings that have already been run with petroleum ring oil will show, in well over 95% of all cases, complete ring plugging, within two years. Herr-type solid steel rings will demonstrate this total plugging from petroleum in about 3 to 4 years. (See Ring Tip #1) Plugged rings cannot be cleaned by solvent washing, ultrasonic cleaning, or by so-called “ring cleaners”. Rings must be chemically cleaned and rebuilt. Epic Ring Service is a full service agency, performing cleaning and rebuilding.

Further, rings should be regularly inspected about every 3 months to detect the tell-tale signs of oncoming, progressive ring damage in terms of pore smearing, bleed line closure, or chatter marking. Alternatively, a ring sampling (usually 6 rings) can be sent to Epic Ring Service to determine internal and external condition with the Porosimeter.

REGRINDING: A COST EFFECTIVE ALTERNATIVE TO REPLACING THE DAMAGED RING

If pore smearing, bleed line closure, or any chatter marking is observed, the rings should be removed at the first opportunity, to prevent progressive damage. These rings can be re-ground, chemically cleaned, and rebuilt with their holders, for a fraction of the cost of a new ring assembly. If damage is caught early, usually only 0.001 to 0.002” (0.03 to 0.06mm) radial must be removed; heavier damage may require removal of 0.010” (0.3mm). Damage as deep as 0.020” usually indicates that the ring should be replaced by a new ring, or a like-new, reconditioned ring. Cost for regrinding runs $1.20/inch ($0.05/mm) of diameter.

Ring regrinding is an art and should not be entrusted to any grinding shop. Epic Ring Service has the experience in regrinding 10,000s of rings. Any regrinding will tend to pore-smear the porosity of a sintered ring, or force metal into the bleed line, of a Herr-type ring. Epic employs a secondary process to restore full porosity, or the full bleed line, after regrinding.

WAVINESS OF BOTTOM CHAMFER: Rings, severely damaged on their faces, may also exhibit a wavy chatter marking of the formed bottom chamfer; again from ring plugging. Epic can remove mild waviness on this chamfer, but very heavy damage is simply too costly to remove, necessitating either a new ring, or a reconditioned, like-new ring.

In conclusion, the best procedure in maintaining rings is:

1) Start new or cleaned, reconditioned rings on pure, synthetic ring oil, to avoid internal plugging.
2) If rings are already plugged with petroleum oxidation and other contaminants, remove them and have them professionally cleaned and rebuilt.
3) Inspect rings every three months for telltale signs of surface damage from internal plugging. If rings show any sign of damage, remove them as soon as possible, for re-grinding, cleaning, and rebuilding. If damage is caught early, the rings can be re-ground and reconditioned many times, so that the effective ring life is almost infinite.

If you did not receive Ring Maintenance Tips #1, #2, and/or #3, contact Epic.

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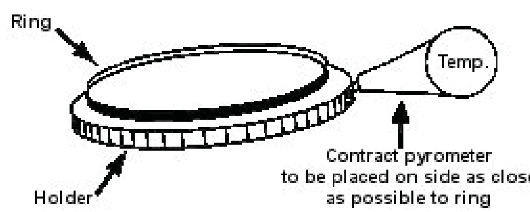
RING MAINTENANCE TIP #5
REDUCING RING HEAT AND THE PLANT ELECTRIC BILL

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered prevention of pore smearing, bleed line closure and chatter marking (refacing).

The two primary sources of high ring heat are found in traveler choice and in the internally unclean ring. Heat is developed from frictional contact of the traveler with the ring. The impact on the electric bill of unnecessarily high ring heat is excessive power (KW) use costing $10,000s/yr for the small plant and $100,000s/yr for the larger plant. There is also a secondary electric power loss for air-conditioned plants in that excessive ring heat forces the plant cooling system to work extremely hard.

WHAT IS EXCESSIVE RING HEAT? We measure ring heat by reading contact temperatures on the ring holder as close to the ring as possible, without touching the traveler. This can be done with a hand-held pyrometer, or a remote infrared sensor. We try to measure temperatures mid to late in the package build cycle, and measure the difference between holder contact temperature and immediate area room temperature as the Delta T. For instance, if the holder reads 120°F and the immediate area temperature is 80°F, then the Delta T is 40°F (25°C).



USE OF PYROMETER TO READ TEMPERATURES

Beyond traveler and ring plugging considerations, ring temperatures depend largely on yarn type and denier (or count). Speed is really only a minor factor. Using a somewhat arbitrary scale:

HOLDER DELTA T TEMPERATURES IN F

Yarn Type	Denier	Ne Count	Excellent	Good	Fair	Poor
Tire Cord	~2000	~3	<9	9-18	19-40	>40
Carpet Yarn	~1500	~4	<8	8-15	16-35	>35
Wool	~800	~8 (Nw10)	<5	5-8	9-15	>15
Worsted	~160	~40 (Nw50)	<2	2-5	6-12	>13
Fine Manmade	<100	>60	<1	1-2	3-7	>7

To convert to Delta T in Celsius, multiply by 0.625

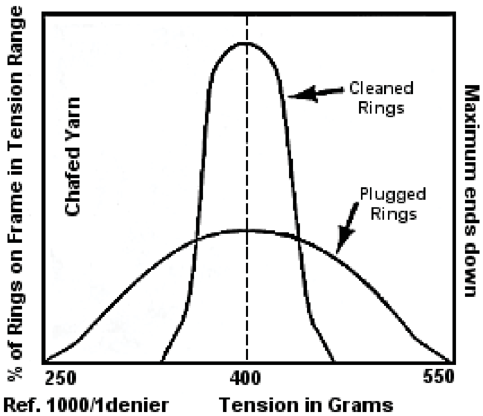
The lowest Delta Ts are almost always found with recently cleaned (or new) rings running with pure, synthetic ring oil and with a very stable traveler. Exceptionally high Delta Ts are found with plugged rings and with very unstable travelers, and often a traveler that is too heavy for conditions.

ELECTRIC BILL IMPACT: Spinning and/or twisting, for example, in a spun carpet yarn plant with 4,000 rings, will generally account for $500,000/yr, or 50%, of the total plant electric bill. In a tire cord plant with 60,000 rings, twisting may account for well over $2,000,000/yr, or 70%, of the total plant electric bill.

(The savings cited are midway in the range of actual results, and assume US $0.045/KWH; individual plants have found/will find greater or lesser savings.)

Cleaning of plugged rings has averaged, from plant to plant, about a 15% power savings; or closer to 20%, if conversion is also made to pure, synthetic ring oil. Likewise, finding the near perfect traveler for the yarn, ring, and running conditions can yield KW savings of about 15%, often more.

Further, and for air-conditioned plants, there is an add-on KW savings caused by reducing ring heat through the right traveler and a clean ring by taking about a 15% load off HVAC. For example, if a 4,000 ring carpet yarn plant through ring cleaning, pure, synthetic ring oil use, and an optimized traveler achieves a 30% frame KW or $150,000/yr savings, then the add-on HVAC savings would be about 15% (x $150,000), or another $22,000/yr. These numbers may be surprising, but are indeed very real.

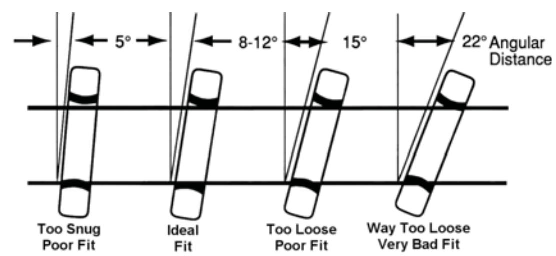


TENSION & TENSION DISTRIBUTION

REDUCING RING TEMPERATURES BY FINDING THE NEAR PERFECT TRAVELER: Too heavy a traveler for the running conditions and/or an unstable, poor fitting traveler are major sources of a high Delta T in rings.

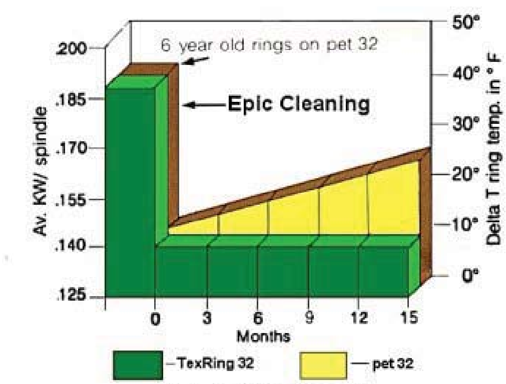
In general, the best traveler weight is the lightest traveler possible, consistent with the constraints of running too soft a package or abrasive damage of the yarn from balloon contact with the separator. With variably plugged rings on the frame, the plant cannot achieve the lowest weight traveler possible, because of the scatter of high tensions (broken ends) and low tensions (chafed yarn) on the frame; with cleaned or new rings, tension variation from position to position is minimal, this allowing the lightest possible traveler. (See figure to the left)

Traveler fit is extremely important in reducing heat and KW. Travelers should be observed with a strobe light. If the traveler is shaking so much that it is blurred, other travelers and traveler styles should be tried, until a nearly clear image of the traveler is observed.



TRAVELER FIT

The running angle of the traveler is also very important. The ideal angle generally lies between 8 to 12 degrees. (See drawing) At angles much less than 8 degrees, the traveler is not free on the ring and causes high traveler wear and heat. At angles greater than 12 degrees, the traveler skips and shakes, also causing high traveler wear and heat. The few hours spent in carefully testing to try and find the best possible traveler for the conditions yields very high dollar rewards.



Effect of Ring Cleaning
ref. 100/2 denier 90 mph

INTERNAL RING CLEANING: In extensive KW testing in many plants, running all yarn types, cleaned and rebuilt ring assemblies (a service provided by Epic Ring Service) yield very large temperature and KW reductions. It is probably safe to say that for most plants, the cleaned ring will show typical KW savings of 10 to 20%. If combined with a switch from petroleum to pure, synthetic ring oil, the KW savings will generally lie in the 15 to 25% range. A somewhat typical example is shown in the figure.

Additionally, pure, synthetic ring oil will maintain an internally clean ring for many years and consequently, keep ring temperatures and KW use low.

A cleaned ring means that ring/traveler dynamics change so that the plant should retest to find the best traveler for the new, clean ring condition. Based on KW savings and not on the many other advantages offered by ring cleaning, most plants calculate the payback from ring cleaning to be 10 to 15 weeks.

In summary, ring temperatures and frame KW usage can be reduced very significantly by:

1) Ring assembly cleaning and rebuilding
2) An effort by the plant to find the near-perfect traveler for the running conditions.

If you did not receive Ring Maintenance Tips #1, #2, 3, and/or #4, contact Epic.

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RING MAINTENANCE TIP #6
CONTROLLING RING OIL USAGE WITH SINTERED RINGS

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered avoiding ring breakage with sintered rings. Ring Tip #5 dealt with reducing ring heat and the plant electric bill.

Oil usage should, in theory, increase with increasing denier, or, more correctly, increasing heat from the heavier travelers and higher tensions found with heavier yarns. The internally clean ring, with its open porosity, should only feed enough oil through the ring to quell a dry or hot spot on the ring.

In practice, this is only very generally the case. Oil use from plant to plant varies greatly.

The chart below gives oil usage, based on empirical observations in many plants. The scale is in US gallons*/year/1000 rings and assumes 120 hours per week of operation, for 50 weeks on a mid-range 5.5" (140mm) ring.

OIL USE IN US GALLONS/YEAR/1000 RINGS

Yarn Type	Denier	Count	Excellent	Good	Fair	Poor
Tire Cord	~2000	~3 Ne	<10	30	125	>250
Carpet Yarn	~1500	~4 Ne	<10	25	100	>200
Wool	~800	~10 Nw	<6	15	50	>100
Worsted	~160	~50 Nw	<4	10	40	>75
Fine Manmade	<100	>60 Ne	<2	6	25	>50

To convert to liters, multiply by 3.76

As can be seen, the difference in oil usage from one plant to another, running the same yarn types, typically varies by a factor of 20 or more. In plants where oil usage is high, the greatest loss is from oil leaking onto the frame and down to the floor, causing housekeeping problems.

THE RIGHT AMOUNT OF OIL ON THE RING: A good scale for judging whether the right amount of oil is present on the ring face is rubbing the finger around the ring ID:

Way Too Much Oil:	Oil droplets observed on the finger
Too Much Oil:	Shiny oil film on the finger
About Right:	Smooth feeling with scarcely observable oil film on finger
Too Dry:	Dry, unsmooth, sticky feeling

CONTROLLING AND REDUCING OIL FLOW:

1) **INTERNAL RING CLEANING**, a service performed by Epic Ring Service, has probably the greatest effect on reducing wasted oil, as it means that oil flows as designed through the ring to exactly where the oil is needed, without the waste from leakage. The internally clean or plugged ring means higher ring heat and oil usage where most of the oil reaching the ring face reaches it through leakage around the ring, pulled there by the partial vacuum created by the rotating package; this also creates leakage onto the frame and onto the floor.

2) **OIL RESERVOIR TYPES**: There are three basic methods used to feed oil to the ring, each with their own separate control problems.

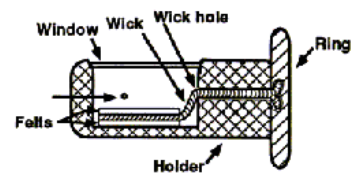
A) **Injected Rings**: There are very few of these systems in North America; the system uses pulsed injections of oil through a pressurized manifold; there is no wick. The greatest problem is maintenance and cleaning of the hundreds of orifices and valves to assure a consistent flow of oil to the ring. The rings plug easily because there is no wick to filter out fine particulate matter in the oil. Oil control can be achieved with frequent internal ring cleaning, close feed system maintenance and selection of oil viscosity.

B) **Manifold Rings**: These rings are fed oil from a central reservoir on the frame, through a carburetor to a manifold; a wick lying in the manifold feeds the oil through capillary action to the ring above. Lowering the level of oil in the manifold does tend to retard oil flow slightly, but the greatest control is found by changing oil viscosity. Heavier oils wick more slowly than light oils. It should be noted that if the wick breaks or becomes fouled by oil oxidation or particulate matter in the oil, oil flow to the ring either totally stops or is severely retarded. Almost all ring manufacturers recommend rewicking every 18 to 36 months; this is a service performed by Epic Ring Service.

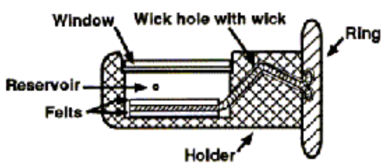
C) **Individual Reservoir Rings**: Holder designs vary here with wick hole location.

a) **Wick Hole Height in Reservoir**: Most wick holes are located at 50% of the height of the reservoir, others at about 75%. WITH A NEW OR INTERNALLY CLEANED RING, THE OIL FILL SHOULD NEVER BE ABOVE THE WICK HOLE HEIGHT. Obviously, if the reservoir is completely filled, this means that oil runs directly through the wick hole and floods the ring with oil and causes leakage; further, the wick's secondary capability to strain particulate matter from the feed oil is bypassed. The individual reservoir was intended to operate with only a moist felt pad or a slight excess of oil in the bottom of the reservoir. Training personnel not to fill new or cleaned ring reservoirs to the top of the reservoir is, indeed, a task. Yet, many plants have succeeded and have reaped rewards not only in reducing oil flow, leakage and housekeeping, but also in reducing ends-down and stained yarn from excess oil on the ring. Note that filling a reservoir to full capacity also means that frame vibration causes oil to be thrown from the overfilled reservoir.

However, there is a safety feature in locating the wick hole part way up the reservoir. When the ring internally plugs from petroleum oxidation or particulate matter, overfilling induces leakage around the ring, so that at least some oil reaches the ring face. Overfilling is an expedient to keep the ring running until the ring can be removed for internal cleaning.



WICK HOLE IN RESERVOIR



OVER-THE-TOP WICKING SYSTEM

b) **Over-the-Top Reservoir**: In this case (see drawing), the wick is fed over the top of the reservoir to the ring. Overfilling does not lead to flooding the ring and excessive oil usage as the oil is still fed by capillary action to the ring. However, this design means that, if the wick breaks or when the wick becomes fouled with ring oil oxidation or particulate matter, oil will no longer reach the ring face.

3) **CONTROL THROUGH OIL VISCOSITY**: With all ring oil feed designs, oil usage can be controlled through changes in oil viscosity. Viscosity is best understood in either ISO Grade or SUS (Sayboldt Universal Seconds at 100°F or 40°C); see chart. The higher the viscosity or ISO Number, the lower the oil usage.

VISCOSITY CONVERSION	
ISO	**SUS**
22	100
32	160
46	215
58	260
68	305
100	465

With a new or internally cleaned ring, most rings are run on ISO 32, 46 or 68. It should be noted that there have been two reactions in North America to a gradually plugged ring. One has been to slowly reduce the oil viscosity or ISO Number because the lighter oils will travel more easily through the partly blocked porosity; the danger here is going too low in viscosity (e.g., to an ISO 10 or 60 SUS) so that film strength is lost and damage (usually chattermarking) occurs to the ring. Conversely, other plants have recognized that the ring is plugged and have gone to higher viscosities to maintain film strength, but this is done at the expense of higher KW usage by forcing the traveler to plow through the heavy oil. The real solution here is to have the ring internally cleaned.

4) **FINDING THE BEST TRAVELER** for the operating conditions has many rewards. One of these rewards is found in reduced oil use. An ill-fitting, shaking traveler causes excessive conditions and also produces high heat. By reducing heat, the ring demands less oil.

5) **PURE SYNTHETIC RING OILS** also reduce oil consumption. Pure synthetic ring oils show about 1/5th the vapor pressure of the same viscosity petroleum ring oil, so almost no oil is lost to vaporization. The pure synthetic oil very significantly reduces the rate of ring plugging and oil loss from leakage; it also contains about 1/20th the amount of fine particulate matter. The synthetic oil is more slippery than petroleum ring oil and reduces running temperature and the demand for oil. Given an internally clean ring, pure, synthetic oil typically reduces ring oil usage 2 to 3 times, which easily justifies its additional cost.

If you did not receive Ring Maintenance Tips #1, 2, 3, 4,and/or 5, contact Epic.

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RING MAINTENANCE TIP #7
ADDITION OF "CHEMICAL RING CLEANERS" TO RING OIL GENERALLY NOT RECOMMENDED

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered avoiding ring breakage with sintered rings. Ring Tip #5 dealt with reducing ring heat and the plant electric bill. Ring Tip #6 reviewed controlling ring oil usage with sintered rings.

The catchword "ring cleaner" is something of a misnomer in that these chemical additions to ring oil do not really internally clean the ring at all. Rather, they tend to soften the mass of petroleum oxidation within the porous structure of a sintered ring, or in the passageways of a solid steel ring. This softening effect does tend to allow some intermittent oil flow through the plugged ring.

Although these "cleaners" have some effect on softening petroleum oxidation sludge within the ring, they have no effect on particulate matter that has entered the ring from plant air or the oil itself, nylon or steel traveler debris, etc.

When petroleum ring oils have been used, it is common for the ring to show serious plugging within 6 to 12 months, and almost invariably (in more than 98% of all cases) the rings are completely plugged within two years, so that no oil flows through the ring as designed. Rather, oil intermittently gets to the traveler face by leakage around the ring, pulled there by the partial vacuum of the rotating package.

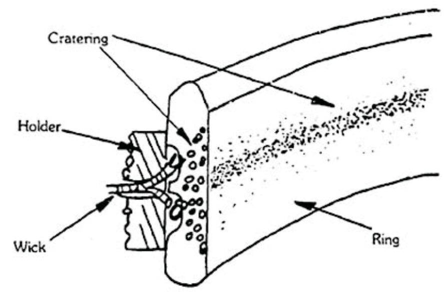
POROSIMETER

In the past, and still today, a somewhat typical reaction to this plugging by North American plants runs the course in the early stages of plugging of adding perhaps 10% of the cleaner every month, or allowing the rings to soak during a shutdown week in almost pure "cleaner". As plugging continues, "cleaner" is added every two weeks, then every week, then is added as a 90% oil- 10% "cleaner" mixture as a continuous feed and often even higher percentages of the "cleaner". And, typically at this point, if the plant stops feeding the "cleaner", oil flow stops completely. The Porosimeter can clearly show that this progressive plugging and that higher dosages of "cleaner" still leave a totally plugged ring and that the "cleaner" is not a cleaner at all, and in fact, contributes to further ring plugging.

WHEN SHOULD A RING CLEANER BE USED? If rings start to become plugged from petroleum ring oil during a period when the plant is running at full capacity, so that rings cannot be removed for true chemical cleaning (performed by Epic Ring Service), occasional use (e.g., small additions every two weeks) can carry the plant over to a slacker period, when the rings can be sent to Epic for complete internal (and external) cleaning and rebuilding with new parts. (Note that Epic can often supply loaner rings or assemblies from its available 500,000 assemblies inventory so that downtime is minimized.) The limited exposure over a month or two will not do serious damage to the ring or the holder (but see below). In brief, use of a "cleaner" should only be considered as a SHORT-TERM EXPEDIENT until the rings can be removed for true cleaning by Epic.

WHY SHOULD THE PLANT NOT USE A "RING CLEANER"? The chemical compositions of these "cleaners" vary considerably but usually contain a detergent/emulsifier and sometimes more active agents. One particularly strong active agent that has been used in some formulas is a phosphate ester (check the MSDS with your Safety Officer); we strongly recommend that it not be used. Although it is a strong softening agent, the phosphate ester (not to be confused with a diester or triester) readily breaks down into phosphoric acid and starts rapid acid and severe pitting attack of the carbon steel ring and the aluminum holder. Attack of the holder is seen in surface pitting; attack of the ring is usually not observed on the face of the sintered ring as much as it is seen when regrinding the ring, where large caverns of red ferric oxide (rust) and lesser pockets of gray-black ferrous oxide are found. (See drawing)

Almost all other “cleaners” are not as active as those containing phosphate ester. Yet the oxidized petroleum sludge within the ring is naturally acidic of nature and almost all the active agents and detergents within the “cleaner” have a tendency to promote acidity or be acidic. Long-term, allowing a ring to remain plugged or using of “ring cleaner” produces an acidic condition that will eventually ruin the ring. Using Epic’s Porosimeter as the instrument for gauging porosity reveals that the longer the ring has been exposed to petroleum and these “cleaners”, the more open the structure after Epic cleaning; this is simply the result of long-term acidic attack. Some of the negative effects include:



1) Acidic pitting of the ring internally and externally

2) Formation of red rust or less harmful ferrous oxide

3) Change in effective oil viscosity, either making the oil too thin to protect the ring, or so heavy that oil impedes free motion of the traveler

4) Formation of a hard patina over the surface of a porous sintered ring causing additional plugging and pore smearing

5) Acidic pitting of the holder

6) Severe destruction of the wicking; in some cases traces of wicking can no longer be found

Because of these negative effects, Epic joins the ring manufacturers in not recommending the use of these so-called “ring cleaners”.

OTHER UNSUCCESSFUL IN-PLANT TECHNIQUES FOR CLEANING: Other techniques that have been tried include:

1) **SOLVENT WASHING** does not reach into the internal structure of the sintered ring or even into the passageways of a solid steel ring (e.g., a Herr ring); cannot dissolve traveler debris and particulate matter

2) **BOILING IN OIL**: Boiling in ring oil tends to loose surface contamination, but only hard cooks the mass of petroleum oxidation sludge within the ring. Very negative.

3) **OVEN BAKING OF RING** at high temperatures does tend to burn sludge out of the ring, but the temperatures required are so high that the ring shrinks and distorts so that it cannot be reused.

4) **ULTRASONIC CLEANING** does a good job on superficial surface cleaning, but cannot reach into a plugged or partly plugged sintered structure or solid steel ring passageways.

USING PURE SYNTHETIC RINGS OILS TO CLEAN THE RING: There are two families of synthetic oils used in ring oils as the esters (not phosphate ester) and PAOs (polyalfaolefins). Esters have the advantage in being somewhat stronger natural cleaners than the PAOs; both possess good solvency for built-up internal petroleum sludge, but the yellowish esters tend to become acidic, attacking the ring and holder, and further they fluoresce the yarn. PAOs have virtually no tendency to acidify in operation, are clear, and show no fluorescence even after yarn heat-set.

In a few well-documented instances, particularly where rings are relatively new and have been regularly cleaned externally (using Epi-Brite), pure synthetic ring oil has, in fact, slowly internally cleaned the rings over a period of 1 to 2 years. In these cases of slow cleaning, the frames had to be closely monitored for a gradually increased traveler weight to compensate for the loss of drag from the plugged ring, and to prevent yarn chafing. Obviously, any ring oil containing any amount of petroleum (known as para-synthetic or a semi-synthetic) will totally defeat this cleaning attempt.

However, in the vast majority of cases, the ring that has been exposed to petroleum ring oil for 1 to 2 years or more is so tightly plugged with hardened sludge that synthetic oil cannot penetrate to clean. (Note that even an unused, new sintered ring sitting in the storeroom will show complete plugging from atmospheric petroleum oxidation within 4 to 5 years of manufacture.)

THE ONLY TRUE, PROVEN AND SAFE METHOD OF INTERNAL RING CLEANING involves removal of the ring from the frame and chemical cleaning in a series of processes (performed by Epic Ring Service with certified results). At this time, the normal procedure is not only to clean the ring and holder, but also to rebuild with new parts.

If you did not receive Ring Maintenance Tips #1, 2, 3, 4, 5 and/or 6, contact Epic.

September, 1991
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RING MAINTENANCE TIP #8
PERIODIC WICK REPLACEMENT FOR SINTERED & SOLID STEEL RINGS

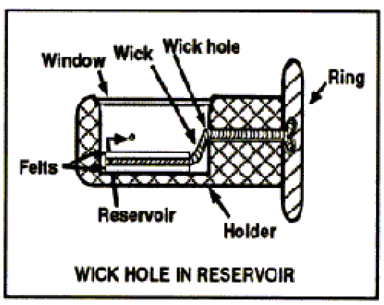
When Rings Should Be Rewicked

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered avoiding ring breakage with sintered rings. Ring Tip #5 dealt with reducing ring heat and the plant electric bill. Ring Tip #6 reviewed controlling ring oil usage with sintered rings. Ring Tip #7 covered the non-recommended addition of chemical ring cleaners to ring oil.

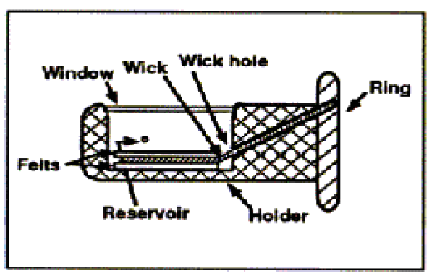
FUNCTIONS OF THE WICK: The wick has a triple function:

1) OIL DELIVERY: Through capillary action, the wick raises oil from either an individual holder reservoir or from a centralized system manifold to the ring. Oil is then pulled to the ring face to lubricate the traveler through the sintered ring porosity or solid steel passageways, assuming a new or cleaned ring, by both heat and partial vacuum created by the rotating package. (Note that injection rings have no wicks.)

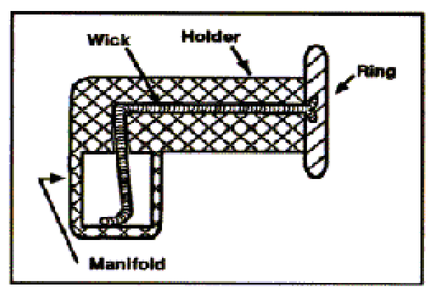
In the case of most individual reservoir sintered rings, the wick hole is located about halfway up the reservoir. It is obvious that, **if the reservoir is filled to capacity or above the wick hole, the wick is bypassed and oil rushes past the wick** and floods the area around the ring and the ring itself; much of the oil leaks onto the frame and onto the floor, creating a housekeeping problem. However, when the porous sintered structure becomes plugged and/or the wick has failed, filling above the wick hole will keep the ring running, at greatly reduced efficiency, as leakage around the ring allows oil to intermittently reach the ring face.



Individual Reservoir
Sintered Type



Individual Reservoir
Solid Steel (Herr)



Manifold Feed
Sintered or Herr

In the case of manifold rings and most solid steel rings (e.g., Herr), the wick feed hole is located above the reservoir, so that over-filling is not a problem. However, if the wick fails to deliver oil for any reason, there is really no way for oil to reach the ring, so the plant must pay very close attention to maintaining the wick's integrity.

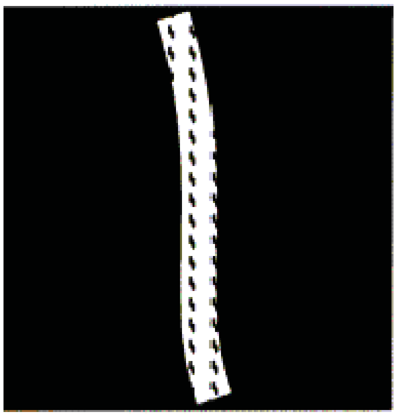
2) CONTROLLING OIL FLOW: The nature (capillarity) of the wicking material, its thickness and density do influence to some degree the amount of oil reaching the ring face, provided the ring has not become internally plugged. Additionally, the fill level either in the manifold or individual reservoir has an effect on the rate of oil delivery.

3) FILTERING THE OIL: All ring oils contain some amount of particulate matter. In general, petroleum oils, including white oils, contain about 20 times the amount of particulate matter that pure synthetic ring oil contains. The wick acts in part as a filter (like an automobile engine filter) to prevent much of this particulate matter from reaching the ring and plugging it. Over time, the wick becomes saturated with particulate matter and, it petroleum is used, hardened petroleum oxidation products.

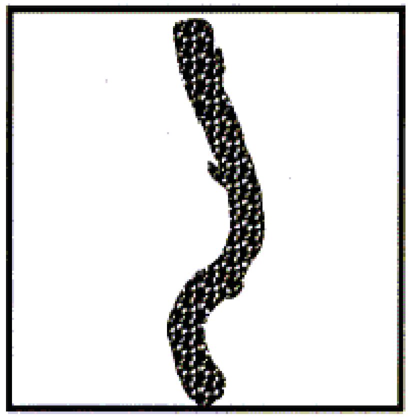
Injection rings are extremely sensitive to ring plugging because there is no wick. It is also obvious that overfilling individual sintered ring reservoirs above the wick hole means that wick filtering capability has been bypassed, resulting in more rapid ring plugging.

CAUSES OF WICK FAILURE: Other than a ring becoming loose in its holder, rotating and causing the wick to break, the other primary enemies of the wick are time, heat from a plugged ring, petroleum oxidation products, and particulate matter. Premature wick degradation can often be traced to frequent or continuous use of the so-called "ring cleaners". (See Ring Maintenance Tip #7)

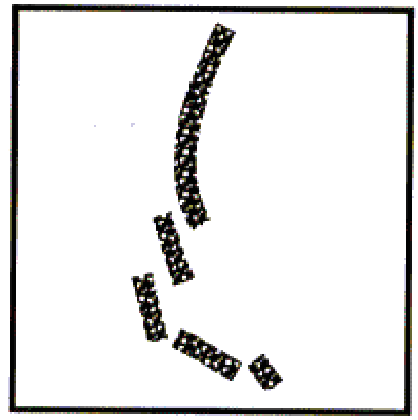
With time and heat, the wick slowly loses its ability to carry oil. At 2 to 3 years on petroleum, most wicks are extremely dirty and have only a limited ability to deliver oil. At about 5 to 10 years, the wick becomes hard and often embrittled with no capability of oil delivery. It is not uncommon to find ring assemblies that have not been rewicked in over ten years to have no wick at all, or if its found only as discontinuous, hardened shreds. The diagrams below show some wick conditions.



New Wick



Dirty Wick



Embrittled Wick

WHEN SHOULD RINGS BE REWICKED? A review of the manufacturers' literature on recommended rewicking points to a frequency as often as every 8 months, to more typically every 2 to 3 years. Our experience at Epic Ring Service, based on cleaning and rebuilding 10,000s of rings, suggests that in most cases rings should be rewicked every 2 to 3 years if run on petroleum or a para-synthetic (some mixture of petroleum and synthetic) and about every 5 years if run on a pure synthetic ring oil. With very critical yarns, such as fine denier man-made, worsted or thread yarns and any fiberglass, rewicking should be more frequent.

In general, the need to rewick occurs at the same time the rings need to be removed for internal cleaning and rebuilding with its holder (a service performed by Epic Ring Service).

REWICKING INDIVIDUAL RESERVOIR RING ASSEMBLIES: Because individual reservoir assemblies are complex, most plants do not have the expertise, special tools or new parts to rewick and rebuild. Epic Ring Service performs this work and also internally and externally cleans both the ring and holder, yielding a like-new assembly at a unit cost generally way below what the plant could hope to achieve.

REWICKING MANIFOLD RING ASSEMBLIES: Manifold assemblies are not complex and are easy to rewick. Although Epic does clean, rewick (and in the case of some ring types, reseal the wick) and rebuild manifold assemblies, many plants can do part of the work themselves, thus saving cost. In this case, the plant removes the entire assembly and separates the ring from the holder. The holder is solvent washed by the plant and the ring is sent to Epic for internal cleaning. Epic cleans and rewicks and returns the ring. It is a relatively easy job for the plant to pull the wick tail through the holder into the manifold. (Note that in re-assembling, the plant should make sure that the wick tail of the ring immediately upstream of a manifold segment should not be left so long as to allow the wick tail to flow into the manifold connection and block it.)

For additional help, contact Epic Ring Service.

If you did not receive Ring Maintenance Tips #1, 2, 3, 4, 5, 6 and/or 7, contact Epic.

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RING MAINTENANCE TIP #9
THE IMPORTANCE OF TRAVELER FIT AND WEIGHT IN RING SPINNING AND TWISTING

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered avoiding ring breakage with sintered rings. Ring Tip #5 dealt with reducing ring heat and the plant electric bill. Ring Tip #6 reviewed controlling ring oil usage with sintered rings. Ring Tip #7 covered the non-recommended addition of chemical ring cleaners to ring oil. Ring Tip #8 covered periodic wick replacement for sintered and solid steel rings.

Ranking right behind the importance of achieving an internally and externally clean ring (performed by Epic Ring Service in reconditioning) is the proper traveler fit and weight in obtaining the highest productivity at the lowest electric (KW) cost. Ring spinning and twisting typically account for over 50% of all power usage by the plant. Ring spinning alone will account for just under 40% of all power use in a plant with 2 for 1 twisting. In ring twisting plants (e.g., tire cord), twisting can exceed 70% of all KW usage.

In general, a somewhat typical plant with rings requiring cleaning can expect a power reduction (frame plus air-conditioning) of about 20% from cleaning and rebuilding their lubricated rings, and about a 12% total KW reduction by optimizing traveler fit and weight. Specific results vary from plant to plant.

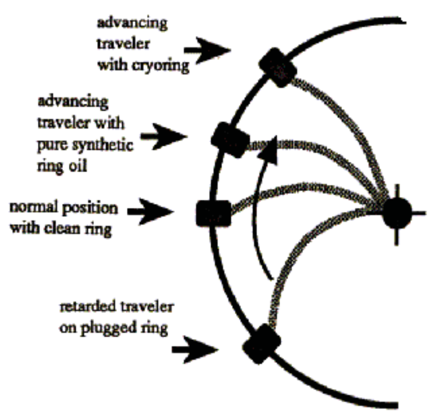
Not only does cleaning/rebuilding and traveler optimization produce large power savings, many productivity gains are obtained, including: **FEWER ENDS DOWN, LONGER RING LIFE, LESS SCRAP YARN, LONGER TRAVELER LIFE, AND HIGHER YARN QUALITY (fewer breaks in bundle)**.

AS THE RING LOSES LUBRICITY FROM PLUGGED PORES/PASSAGEWAYS AND FOULED WICKS, the plant gradually reacts to the loss of lubricity by changing traveler weight. (See diagram) The traveler receives oil only intermittently. This creates a drag on the traveler, making the traveler effectively heavier. The plant reacts by reducing traveler weight to maintain desired tensions.

When the ring is cleaned and rebuilt (restoring even lubrication), the typical action is to increase traveler weight to compensate for the elimination of drag.

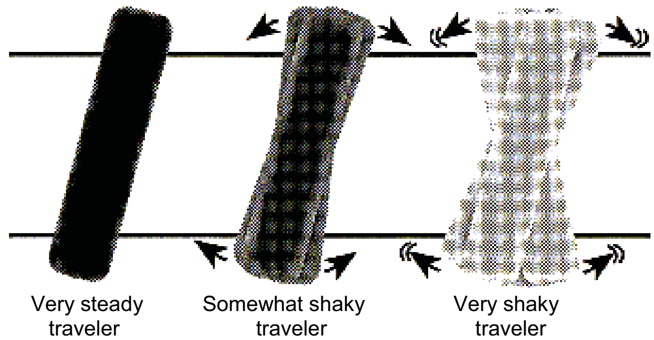
This in not true in all cases, particularly if a pure synthetic ring oil is used. In the case of the synthetic ring oil, which is "slipperier" than petroleum, the traveler tends to advance forward and picks up centrifugal weight. In this case, traveler weight must be reduced to produce the desired tensions.

Thus, traveler weight depends on ring condition in terms of its clean or unclean condition and type of ring oil used.

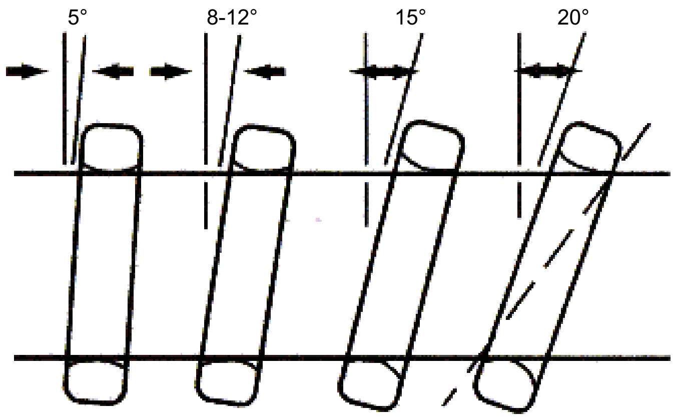


TRAVELER FIT: Not only is weight important, but traveler fit for your particular yarns and running conditions is extremely important to high productivity. There are many yarn styles: A, B, C, metal-inserts, finbacks, etc. See your traveler suppliers. Two major factors involved in finding the near ideal traveler are traveler angle, and obtaining a nearly steady traveler.

TRAVELER STEADINESS: The first step to try to find travelers that, by watching them with a strobe, produce a relatively clear or steady image. Some travelers will show so much shaking (with resultant tension spikes damaging the yarn bundle and eventually leading to breaks) that you cannot really see the traveler. The near perfect traveler will provide a very crisp image under the strobe. (See diagram on right)



TRAVELER RUNNING ANGLE: A traveler that is too tight between the horns will stand upright and the ring will tend to cut into both horns causing low traveler life. A traveler that is too loose on the ring will tend to chatter severely, causing tension spikes and a high frequency of ends-down. (See diagram on left). In most cases, it has been found that a running angle of 8 to 12° is close to ideal. Trying to measure traveler angle involves focusing on the traveler with a strobe and trying to observe traveler angle with a protractor.



A QUICK WAY OF EVALUATING OR SCREENING TRAVELER STYLES, WEIGHTS, FITS AND RUNNING ANGLES in an effort to optimize traveler performance: In general it is best to start a traveler examination from the know quantity of a cleaned (or new) ring. Ask your traveler suppliers to supply perhaps four samples of each style of traveler in quite a few different weights, perhaps +/- 20% to the weight you are now using. You may end up with 30 to 40 sets of 4 travelers. Have a strobe, protractor and tensometer available. A temperature sensor or pyrometer is very helpful in measuring ring temperatures. You can expect that some travelers will be totally unsuitable for your use. So, you will have some scrap yarn, break some ends, and may chafe some yarn.

Going down the frame, put each set of 4 samples on. Start the frame. Immediately, you may get some broken ends and chafed yarn, but most of the positions will probably stay up and running. With those up-positions, try to measure comment on:

- ☞ Tension at that stage in package build, noting that tension will be highest at the start of the cycle
- ☞ Observe with a strobe the relative clarity or shakiness of the traveler
- ☞ Observe with a strobe and protractor the approximate running angle of the traveler. Feel the package for softness and hardness
- ☞ Size of balloon as too small or too great
- ☞ Read ring temperatures at various stages of package build; temperatures will rise fairly rapidly early in cycle and gradually increase toward off

Tabulate your findings. Chances are that you may find perhaps 4 to 8 candidate travelers (in terms of style, fit or weight) that look much better in overall performance than the traveler previously used for that yarn under that set of running conditions.

At that point, you will probably want to get an additional quantity of perhaps 30 to 40 of your best candidates and run another screening on a larger sample to try to reduce your candidate list down to 2 to 3 of the best travelers. You are now ready for whole frame, long-term testing to pick the best possible traveler. You may want to add comparative KW or KVA readings to these final tests.

In summary, the rewards of a clean/rebuilt ring and traveler optimization are extremely high in terms of large KW savings, overall efficiency and productivity.

If you did not receive Ring Maintenance Tips #1, 2, 3, 4, 5, 6, 7 and/or 8, contact Epic.

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RING MAINTENANCE TIP #10
SINTERED RING PORE VOLUME, OIL BLEED RATES, AND OIL VISCOSITY

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered avoiding ring breakage with sintered rings. Ring Tip #5 dealt with reducing ring heat and the plant electric bill. Ring Tip #6 reviewed controlling ring oil usage with sintered rings. Ring Tip #7 covered the non-recommended addition of chemical ring cleaners to ring oil. Ring Tip #8 covered periodic wick replacement for sintered and solid steel rings. Ring Tip #9 summarized the importance of traveler fit and weight in ring spinning and twisting.

HIGH DENSITY RINGS NEED MORE FREQUENT CLEANING

Sintered rings do not all have the same porosity or structure.

1) European style rings (Eadie, Carter/Borgosesia, Reiners & Furst) have relatively thick cross-sections, averaging about 0.180" (4.5mm). The European style ring is formed using a coarser carbon steel powder to produce a more open internal porosity.

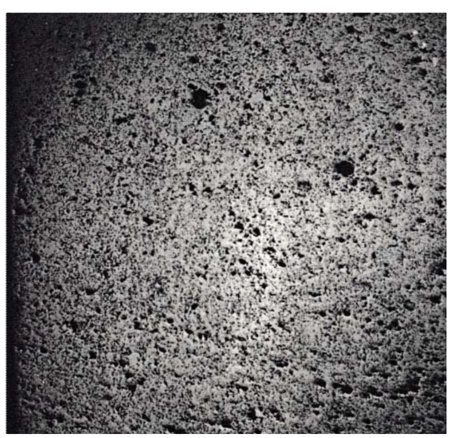
2) American style rings (Merriman and extended to include Kanai) have narrower cross-sections of about 0.100" (2.5mm). These rings are made with a finer carbon steel powder, to produce a tighter pore structure.

Oil flow through the ring is a function of pore size or ring density and the thickness of the ring. Thus a thin, American style ring with higher density can bleed oil at the same rate as a thicker, European ring with lower density.

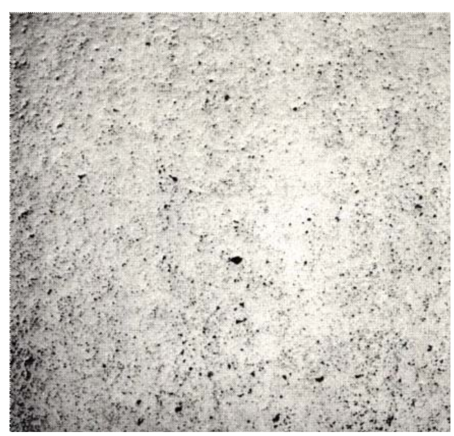
Ring density can also be varied by increasing or decreasing pressures on the ring, when it is pressed into a "green" structure (a structure with very little strength). Ring strength, or integrity, is produced by sintering, or heating, the steel ring very close to its melting point. Sintering basically welds the steel particles together where they contact each other.

Manufacturers vary the pore size to produce rings more suitable for the operating conditions. (See magnified photographs below.)

Open Porosity Ring
(Eadie PSM-40)



Medium Porosity Ring
(Merriman Open or Eadie PSM)



Tight Porosity Ring
(Merriman Tight or Eadie PSM-70)

For demonstration purposes, it is helpful to use the world standard of Eadie rings, because Eadie designates its rings by marks on the OD (outside diameter) of the ring. (See chart)

		Porosity	Void Space	Bleed Secs*	Typical Use
PSM-40	3 Marks	Very Open	~30%	+/-8	Heavy Denier Yarns (Tire Cord, Carpet Yarn)
PSM	1 Mark	Medium	~20%	~55	Medium Denier Yarns (Wool, 250-800 denier yarns)
PSM-70	2 Marks	Very Dense	~15%	~125	Fine Denier Yarns (Worsted, fine denier manmade)

*On Porosimeter

As a standard point of reference, an American style ring, such as a standard Merriman, used in tire cord or carpet yarn will also bleed in about eight seconds (even though it only has about 20% void space). This is because the ring is much narrower than the European style ring.

Heavier denier (>1000) yarns require more oil flow because of high traveler weights and tensions. Rings running finer deniers require much less oil flow because traveler weights and tensions are lower. Heavy denier rings almost invariably are run with nylon travelers which are less abrasive to the ring.

Finer denier yarns (e.g., worsted and manmade) are usually run with steel travelers. The engineering concept behind the tight porosity ring is to provide greater surface or wear area to prevent damage (chatter-marking, scalloping, and pore-smearing) by the steel traveler. The finer porosity also limits oil flow. In theory, this makes sense.

In practice, we see many 10,000s of tight porosity rings being sent to us for refacing because of damage from the steel traveler. Because a tight porosity ring fouls so easily and rapidly from particulate matter and petroleum ring oil oxidation, complete plugging usually occurs within a few months. With a pure synthetic ring oil, total plugging may occur in 1 to 2 years. The loss of lubrication produces chatter-marking, scalloping, and pore-smearing.

Ring plugging can be greatly slowed by use of a pure synthetic ring oil (containing no petroleum). Tight porosity rings should probably be cleaned and rebuilt (a service provided by Epic) yearly to prevent damage to the ring and to maintain even tensions and reduce yarn breaks.

Most fine denier rings run ISO32 (160 SUS) or lighter ring oils in order to get adequate oil flow. Heavier denier rings are typically run with an ISO 46 (215 SUS) or ISO 68 (305 SUS) ring oil.

The theory of the tight porosity for fine denier yarns is, in our opinion, defeated by rapid pore plugging. The plant is better off with a more open pore structure that keeps the traveler lubricated and resists wear damage of the ring surface. Oil flow can be controlled by changing oil viscosity. As the ring plugs, oil viscosity can be reduced to an ISO 22 (100 SUS) oil to increase oil flow. Going lighter than an ISO 22 ring oil can easily result in loss of film strength and damage to the ring.

WITH A NEW OR RECENTLY CLEANED RING, THE PLANT CAN ALSO CONTROL OIL FLOW THROUGH LEVELS IN THE RESERVOIR:

INDIVIDUAL RESERVOIR: Oil level should always be kept below the wick hole (usually half way up in the reservoir). With fine denier yarns, the fill of the reservoir should only be a moist felt pad and perhaps a slight excess of oil in the bottom of the reservoir. When the ring becomes plugged, it is necessary to fill above the wick hole in order to flood the ring OD in hopes that oil will leak around the ring and get to the ring face. The ring however, should be removed for internal cleaning.

MANIFOLD RESERVOIR: Oil level can be reduced in the manifold to slow oil flow. Alternatively, it should be raised to increase flow as the ring plugs. When the ring becomes completely plugged, raising the level to the top of the manifold does nothing; the ring must be removed for internal cleaning.

It is worth noting that rings with high porosity are relatively easier to internally clean than low porosity rings, because the chemical reagents used in cleaning can more readily enter the rings to effect cleaning.

If you did not receive Ring Maintenance Tips #1, 2, 3, 4, 5, 6, 7, 8 and/or 9, contact Epic.

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RING MAINTENANCE TIP #11
RING OIL TYPES AND THEIR EFFECT ON RING SPINNING AND TWISTING PRODUCTIVITY

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered avoiding ring breakage with sintered rings. Ring Tip #5 dealt with reducing ring heat and the plant electric bill. Ring Tip #6 reviewed controlling ring oil usage with sintered rings. Ring Tip #7 covered the non-recommended addition of chemical ring cleaners to ring oil. Ring Tip #8 covered periodic wick replacement for sintered and solid steel rings. Ring Tip #9 summarized the importance of traveler fit and weight in ring spinning and twisting. Ring Tip #10 covered sintered ring pore volume, oil bleed rates, and oil viscosity.

GENERAL: The ability of a ring oil to prevent ring pore or passageway plugging and contamination of wicks and felts has a very pronounced effect on ring spinning and twisting productivity. The plugged ring typically increases frame KW consumption by 15% and ring temperature significantly, while reducing traveler life. The plugged ring causes ring leakage and a resultant housekeeping problem, and wasted oil. Some of the leaked oil reaches the ring face intermittently, causing variation in tensions up and down the frame. It is one of the major sources of broken ends (and/or chafed yarn). The varying tensions also cause damage to the fibers within the yarn bundle. As soon as oil stops flowing through the ring as designed, the ring becomes subject to chatter-marking, scalloping, and fretting corrosion, and in the case of the sintered ring, pore-smearing. These damaging effects are progressive and, if not corrected early by refacing and internal cleaning, will ultimately lead to destruction of the ring. Ring oil choice is extremely important to maintaining high productivity.

Ring oils may be divided into three categories:
1) Pure Synthetic Ring Oils
2) Petroleum Ring Oils
3) Parasynthetic Ring Oils

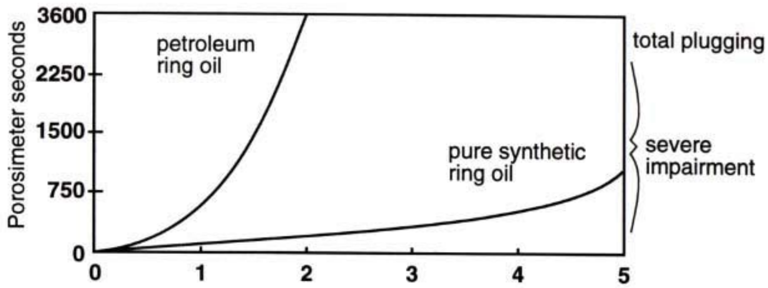
PURE SYNTHETIC RING OILS: A PURE synthetic oil is a reacted, manmade product that contains NO petroleum. It is formed by controlled reaction. It can be synthesized from various hydrocarbons including wood, corn, and surprisingly, petroleum feed stocks. A pure synthetic ring oil is about 2.5 to 3.0 times as expensive as petroleum ring oil.

- The primary reason for using a synthetic is to avoid ring plugging in sintered and Herr-type solid steel rings and fouling of wicks and felts in all ring types.
- Pure synthetics contain about $1/20^{th}$ the amount of particulate matter found in petroleum ring oils.
- A pure synthetic for all practical purposes does not oxidize or decompose to form gummy deposits both on the ring and almost more importantly within ring pores or passageways.

Although there are many different types of synthetic lubricants, there are only two types that are used today and both are fully compatible and miscible with petroleum ring oils:

1) **POLYAFAOLEFINS (PAOS)** are clear oils with good solvency of petroleum decomposition products, virtually no tendency to breakdown and form harmful deposits. Yarns stained with PAOs show no fluorescence.
2) **DIESTERS** are straw colored oils whose primary advantage is strong solvency for petroleum decomposition products. Yarns stained with diester do, unfortunately, fluoresce. A long-term drawback to diesters is their tendency to hydrolyze and form weak acids. These acids, over many years, attack both the carbon steel ring, the copper content of a sintered ring and holders, and other parts in the immediate area of the ring. Diesters also attack O-ring seals.

In general, an open porosity ring (e.g., PSM-40) run with a pure synthetic in a relatively clean plant environment only needs cleaning and rebuilding about every 4 to 5 years; a ring run with petroleum ring oil needs internal cleaning at least every two years. Fine porosity rings, which are more susceptible to plugging (see Ring Tip 10) and usually used with fine denier manmade fibers and worsted need more frequent internal cleaning, typically yearly on petroleum and every 2 to 3 years with synthetic.



Typical Rate of Plugging of Sintered and Herr-Type Rings
Pure Synthetic vs Petroleum

Other reasons for using a pure synthetic is that they are a little more slippery than petroleum; in KW tests on both plugged and cleaned rings, power consumption is about 5% less with a pure synthetic. Black stains on the yarn from oxidized petroleum ring oil are avoided.

WHEN SHOULD A PURE SYNTHETIC BE USED? It is almost imperative to use a pure synthetic in fine porosity rings. Pure synthetic should be used with either a new ring, or an internally clean ring. The plant should not expect that a pure synthetic would gradually clean a plugged ring. At Epic, we are only aware of one case where this happened, as measured by KW meter and Porosimeter when cleaning took place over two years. We do not recommend using a pure synthetic until the ring has been internally cleaned, because the plugged ring leaks, making the added cost of synthetic a waste of money.

PETROLEUM RING OILS are divided into two categories:

1) **PARAFFINIC PETROLEUM OILS**, including **WHITE OILS**, are used but are not recommended by Epic. The chief drawback of paraffinic oil is its tendency to oxidize easily and to form heavy gummy, and/or rock-hard ring plugging deposits. Yarns stained with paraffinic oils fluoresce.

White oils are simply paraffinic oils that have been refined to remove color; most of the particulate matter within the oil still remains. Yarns stained with white oils show only mild fluorescence. Our work at Epic Ring Service in cleaning and rebuilding rings on a somewhat qualitative basis strongly suggests that white oils will plug rings faster than their unrefined paraffinic parents.

2) **NAPHTHENIC PETROLEUM OILS** are a light straw color and do show a mild tendency to fluoresce on yarn. In comparison to paraffinic oils, the naphthenic oils show a significantly lower tendency to oxidize and form gummy, ring plugging deposits. They do not approach the pure synthetic oil in their ability to reduce oxidization and the formation of deposits. If a petroleum is to be used, it is our opinion that a naphthenic oil is clearly the best choice.

PARASYNTHETIC OILS are widespread and use petroleum oil to dilute a pure synthetic oil in order to reduce the cost. The most typical combination is a large percentage of white oil added to a low concentration of PAO because it makes the oil look like pure PAO synthetic. It is unfortunate that the ASTM has not defined the words “synthetic oil” to mean a pure synthetic oil containing no petroleum; the result is that some vendors are selling at a premium price ring oils, labeled as synthetic, with little or no synthetic in it other than additives.

Our experience at Epic Ring Service in cleaning and rebuilding rings is that any addition of a petroleum oil to a pure synthetic base means that very little is gained in avoiding ring plugging. The typical parasynthetic with a high concentration of white oil in the ring oil means very rapid ring plugging.

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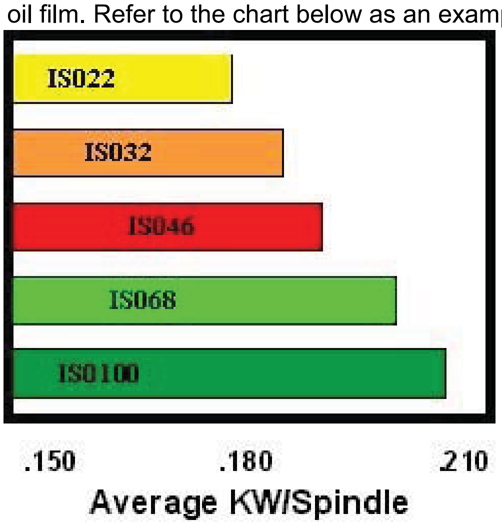
RING MAINTENANCE TIP #12
RING OIL VISCOSITY AND THE LUBRICATED RING

REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered avoiding ring breakage with sintered rings. Ring Tip #5 dealt with reducing ring heat and the plant electric bill. Ring Tip #6 reviewed controlling ring oil usage with sintered rings. Ring Tip #7 covered the non-recommended addition of chemical ring cleaners to ring oil. Ring Tip #8 covered periodic wick replacement for sintered and solid steel rings. Ring Tip #9 summarized the importance of traveler fit and weight in ring spinning and twisting. Ring Tip #10 covered sintered ring pore volume, oil bleed rates, and oil viscosity. Ring Tip #11 covered ring oil types and their effect on ring spinning and twisting productivity.

CORRECT OIL VISCOSITY CHOICE for a lubricated ring depends on such factors as ring type (sintered and sintered porosity, Herr-type solid steel or wicked solid steel), yarn denier or count and related running tensions, internal ring cleanliness in the case of sintered or Herr type rings, and average plant temperatures. The choice also depends on oil type, pure synthetic, naphthenic petroleum (e.g., Naptex) or paraffinic petroleum; white oil is a paraffinic oil.

DESIGNATION OF VISCOSITY: Although there are several different standards used worldwide to designate oil viscosity, ISO (or International Standards Organization) viscosities is becoming the most standard. The conversion in approximate values is shown in the chart below (right).

AXIOMS ON VISCOSITY CHOICE: Oil viscosity should be as low as possible to permit easy, low friction sliding of the traveler, but heavy enough to provide long-term film strength to protect the ring from abrasion of a steel traveler or a nylon traveler with particulate matter trapped between it and the ring. TOO LOW A VISCOSITY* will result in ring damager and excessive oil waste through leakage. TOO HIGH A VISCOSITY* can mean too low an oil flow and certainly wastes an enormous amount of electricity (KW) by forcing the traveler to plow through a viscous oil film. Refer to the chart below as an example.



ISO GRADE or Centistokes @ 40°C or 104°F	Sayboldt or SSU "seconds"	Redwood #1	Engier Degrees
22*	100	88	3.0
32	150	130	4.3
46	220	180	5.5
58	270	235	7.7
68	310	270	8.8
100*	460	400	13.0

*Use of these two viscosities generally indicates a severe problem. See text.

VISCOSITY INDEX is the resistance of the oil to breakdown under increasing heat. Most plants have an average room temperature of 80°F (30°C).

The running of FINE DENIER yarns (e.g., manmade draw twisting, worsted and glass) will generally exhibit ring temperatures no more than 10°F or 6°C above room temperature, so viscosity index is not important. HEAVIER DENIER yarns (carpet yarn, tire cord, twine, etc) will often exhibit ring temperatures 35°F or 21°C above room temperature. IF TEMPERATURES ARE HIGHER, THIS INDICATES THAT A PROBLEM EXISTS WITHER WITH THE TRAVELER (excessive weight or an unsteady traveler) OR THE LUBRICATION OF THE RING (usually the need to clean the ring internally and rebuild with new wick/felt/seals or reface the ring-services performed by Epic Ring Service).

PURE SYNTHETIC RING OIL has a very high viscosity index, or a very high resistance to thinning, under increasing heat so that, for all practical purposes, high heat either in the plant or heat produced by high tensions or a plugged ring is rather unimportant. However, PETROLEUM RING OILS do have a lower viscosity index or a greater tendency to thin under increasing heat. Paraffinic petroleum oils (including white oil) have a slightly better resistance to thinning than a naphthenic oil, but these paraffinic oils should be avoided because of their wax content and tendency to oxidize and form ring plugging deposits. If petroleum oil is to be used, naphthenic oils are preferred. Although there are additives to improve viscosity index and/or alter the basic viscosity of petroleum ring oils, these additives all induce rapid ring plugging and should be avoided. Check with your ring oil supplier to make sure they are NOT USING ADDITIVES to either increase viscosity index or to alter base oil viscosity. Synthetic oil viscosity should only be achieved by blending two synthetic base stocks, and not by using long chain additives to artificially produce the desired viscosity.

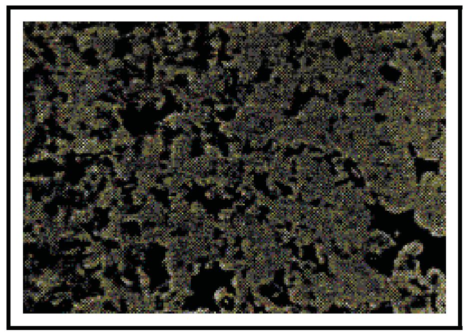
PURE SYNTHETIC RING OIL AXIOM: Pure synthetic ring oil has about 1/14th the vapor pressure of petroleum ring oil. Unlike petroleum ring oil, almost no synthetic is vaporized from the ring face and lost into the plant air. Very little synthetic is required to maintain an oil film on the ring face. For this reason, the plant generally uses one higher ISO viscosity than with petroleum to maintain an adequate film on ring faces.

YARN TYPES AND DESIRED VISCOSITY:

FINER DENIER YARNS (generally under 800 denier, such as glass, draw twisted manmade and worsted) should generally be run with lighter viscosity oils (for example, ISO 32 if a petroleum, or ISO 46 if a pure synthetic). Because tensions are low, there is not the need for the high film strength of heavy oil; the lighter viscosity permits easy traveler siding. The traveler does not have to plow through a heavy oil.

HEAVIER DENIER YARNS (generally over 800 denier or under 8 Ne Cotton Count, such as carpet yarn, tire cord and twine) in spinning or twisting mean higher tensions and therefore require a heavier oil to provide film strength to protect the ring. Typically, this will be an ISO 46 or 58 if a petroleum, or and ISO 58 or 68 if a synthetic.

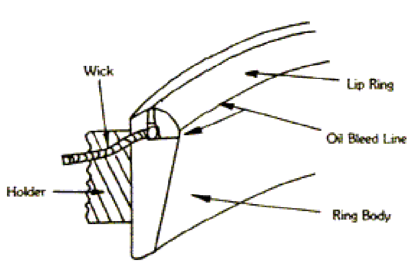
SINTERED RINGS: Most sintered rings in service are of the open porosity type (e.g., Eadie PSM-40 or standard Merriman) and when either new or cleaned should generally be run, depending on denier, with an ISO 32 or 46 petroleum, or an ISO 46 or 68 synthetic. Denser sintered rings (often used in worsted or fine denier manmade or, for example, Eadie PSM or PSM-70) should run lighter oils such as an ISO 32 petroleum or ISO 46 synthetic. These higher density rings plug rapidly and should be internally cleaned more frequently.



Internal Sintered Ring Structure (25X)

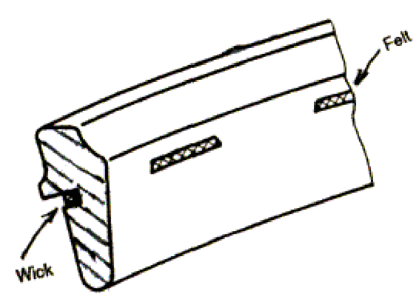
However, most sintered rings that have not been professionally cleaned within 2 to 3 years, if run on petroleum, or 3 to 5 years if run on pure synthetic become completely plugged internally. Ring faces only receive oil intermittently from leakage around the ring. Some plants, instead of having the rings cleaned internally and rebuilt, have wrongly dropped viscosities down to ISO 10 and ISO 22 viscosities in order to get some oil flow through the ring. This has resulted in high leakage and its housekeeping problems; long term, there is insufficient film strength so that permanent ring damage occurs.

SOLID STEEL RINGS are of two types, the Herr ring (a two part ring with internal passageways and a bleed line) and the European style with a wick and/or felt which is woven into the face of the ring. Although the solid steel ring was widely used in producing almost all yarn types, it has been replaced in the last 20 to 30 years by the more efficient (when internally clean) sintered ring, except when running worsted, where a steel traveler is used. Film strength is extremely important in order to prevent ring damage by the steel traveler.



HERR TYPE RINGS (left) are just as subject to internal plugging and need for internal cleaning and rebuilding as the sintered ring and should generally be run with an ISO 46 or 58 petroleum or an ISO 58 or 68 synthetic.

EUROPEAN STYLE RINGS (right) require frequent wick replacement in order to maintain ring efficiency and generally run on ISO 32 to ISO 46 petroleum or ISO 46 or ISO 58 synthetic.



The above is intended to guide the plant toward the best viscosity for the given conditions and does not replace a certain amount of experimentation to find the best viscosity for the given conditions.

If you did not receive Ring Maintenance Tips #1, 2, 3, 4, 5, 6, 7, 8, 10 and/or 11, contact Epic.

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RING MAINTENANCE TIP #13
THE INDIVIUAL RESERVOIR AND MANIFOLD HOLDER ASSEMBLIES

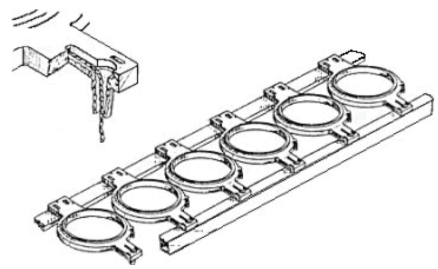
REVIEW: Ring Tip #1 covered the extreme importance of regular chemical cleaning of the ring's internal structure. Ring Tip #2 covered the importance of the external cleaning of the surfaces of the ring, holder, rails, and separators. Ring Tip #3 covered the avoidance of ring breakage. Ring Tip #4 covered avoiding ring breakage with sintered rings. Ring Tip #5 dealt with reducing ring heat and the plant electric bill. Ring Tip #6 reviewed controlling ring oil usage with sintered rings. Ring Tip #7 covered the non-recommended addition of chemical ring cleaners to ring oil. Ring Tip #8 covered periodic wick replacement for sintered and solid steel rings. Ring Tip #9 summarized the importance of traveler fit and weight in ring spinning and twisting. Ring Tip #10 covered sintered ring pore volume, oil bleed rates, and oil viscosity. Ring Tip #11 covered ring oil types and their effect on ring spinning and twisting productivity. Ring Tip #12 covered ring oil viscosity and the lubricated ring.

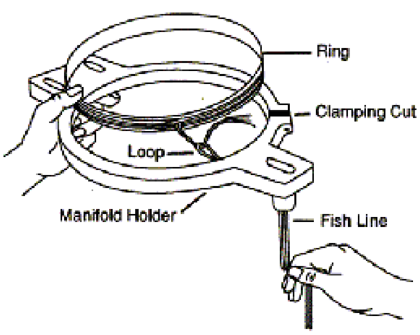
GENERAL: With heavy denier yarns (carpet yarn, tire cord, wool and twines) where oil usage is higher than with finer denier yarns, the trend is toward centralized lubrication or manifold oil delivery systems. With finer denier yarns such as worsted, there is also a move toward the manifold type system because of the number of positions on a frame that require hand filling of individual reservoirs. The move toward manifold systems has been largely prompted by the labor savings.

Because fine denier twisting or draw twisting uses so little oil, and also because ring assemblies are often removed for repair or replacement, there has been almost no need for a centralized manifold system.

TYPES OF CENTRALIZED MANIFOLD SYSTEMS: There are basically three types of manifold systems:

1) **Gravity-Fed Manifold Systems** are probably the most widely used and are common to Merriman and most Eadie systems. A variation of this system is small diameter tubing connecting holders to one another such as used with Merriman HVT and Herr rings. This involves an oil reservoir at the end(s) of the frame, feeding oil through a carburetor to manifold piping segments. These segments are mounted inboard or outboard for rail mounted ring assemblies, or outboard on back mounted rings along the length of the frame. The ring assembly allows the wick to drop into the manifold segment. (See drawing at right)

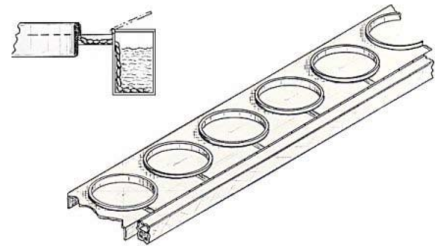




Other than labor savings of centralized lubrication, the primary advantage of this type of assembly is that the ring can be easily removed from the holder, cleaned (a service provided by Epic Ring Service) and reinstalled by the plant. The plant simply solvent washes the holder and pulls the wick tails of the cleaned ring through the manifold with looped fishing line. (See drawing at left) The cost of regular ring cleaning is low when compared to the more complex individual reservoir assembly.

The primary disadvantage of this type of centralized system is that, once the ring and wick become plugged, there is no way that oil can reach the ring to provide lubrication by leakage around the ring. Generally, this system is fairly leak-proof. This type of ring must be cleaned and rewicked regularly, every 2 to 3 years and at least every 3.5 years. Failure to do this means poor yarn quality and can result in ring face damage, requiring either refacing or, in the worst case, ring replacement.

2) **Felt Pad Manifold Systems** are becoming more common in worsted spinning and in many types of heavy denier European frames. A U-shaped section of sheet metal with a lid is mounted outboard to the ring rail. Each segment will feed many rings. In each segment there is a full felt pad. To re-oil, the lid is opened and the felt is saturated with oil. Oil is carried to the ring by capillary action of a connecting wick through the ring rail. (See drawing) (A variation on this is to interconnect the segments so that a reservoir on the end(s) of the frame fed through a carburetor can lubricate all frame positions.)

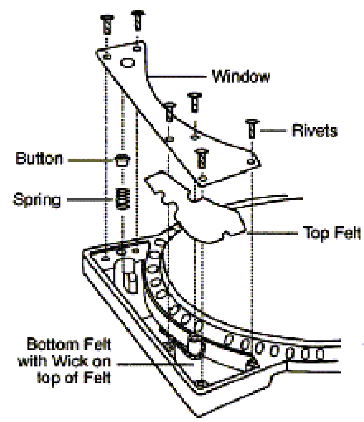


In its basic form, the felt pad manifold is simpler and less costly than the full gravity system, and may feed from 6 to 24 rings per segment, and is virtually leak-proof. In most systems (Gaudino being one exception where mounting screws are not easily accessible), the rings can easily be removed for cleaning and rewicking. The cleaned & rewicked ring is then reinstalled by the plant.

The felt pad ring assembly, like the full gravity system, depends on capillary action to bring oil to the ring. In heavy denier spinning or twisting, rings should be cleaned every 2 to 3 years and certainly every 3.5 years to maintain production efficiency and prevent ring damage. With finer denier (e.g., worsted yarns with solid steel rings and steel travelers), the ring should be removed at least every two years for surface inspection (refacing may be necessary), rewicking and cleaning. Many manufacturers recommend rewicking as frequently as every 9 to 12 months.

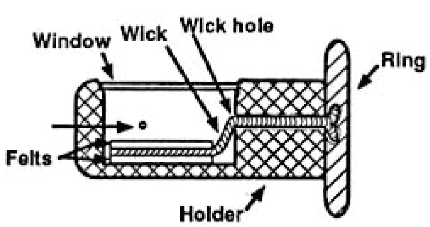
3) **Injection Manifold Systems**: Very few of these systems are in existence in North America and they are generally rare in Europe and elsewhere. The primary drawback is high system maintenance. The system depends on pressure to inject oil to the ring or ring face. The system is subject to plugging of feed lines, connections and injector orifices. If the system is not closely maintained, the ring receives no oil and will soon be damaged.

THE INDIVIDUAL RESERVOIR RING: Each ring assembly is a self-contained unit with its own oil reservoir, wicking and delivery system. There are typically many parts to a ring holder assembly, including windows, felts, rivets, buttons, springs, seals and sealants. See drawing of a Merriman individual reservoir assembly at right.



The disassembly for ring cleaning and reassembly in rebuilding is complex. It requires having not only all the parts available, but also special tools and skills for rebuilding. It is not economical or recommended that the plant attempt its own assembly rebuilding. The complete assembly should be sent to Epic Ring Service for ring and holder cleaning and rebuilding.

The obvious disadvantage of the individual reservoir assembly is that considerable labor is used in refilling each reservoir. It also can be a source of oil leakage and housekeeping problems when compared to centralized systems.



WICK HOLE IN RESERVOIR

Most individual reservoir holders have a wick hole that is about halfway up the reservoir. (See drawing) When the ring is either new or cleaned, the reservoir should NEVER be filled above the wick hole. Filling above the wick hole bypasses the filtering action of both wick and felt and hastens ring plugging from particulate matter in the oil. Further, the wick also acts to meter oil to the ring. Bypassing the wick by overfilling means excess oil on the face of the ring and leakage from the ring to the floor.

The saving grace of the individual reservoir is that when the ring and wick become blocked, the reservoir can be overfilled in order to intentionally induce leakage. Some of the leaked oil reaches the ring face to keep the ring running, but the intermittent nature of oil supply means tension variations up and down the frame, a high frequency of broken ends, and lower yarn quality. The assembly should be removed as soon as possible, cleaned and rebuilt.

If you did not receive Ring Maintenance Tips #1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and/or 12, contact Epic.

