

ON BEHALF OF THE
TECHNICIANS ASSN
OF THE GCSAA...

THANK YOU
FROM RIVER FALLS,
WISCONSIN



“Reel” Science & “Optimum Cut” Technology



Special thanks to Iowa State, Jacobsen,
John Deere, Toro, and others for
material contained
in this program.



United in upping the game.



GRINDING SEMINAR

Elevating Knowledge & Skill - Old to NEW...



Technicians
Maintenance by Tradition



Superintendents
Same Page As My Tech...

United in upping the game.



RATIONALE

- High Cost of Cutting Equipment...
- Staying on cut and making things easier...

"TAKE-AWAY" OBJECTIVES

- Why the manufacturers design the cutting units the way they do...
- Benefits of maintaining units to the way you bought them...
- Knowledge of "tools in the tool bag" ...

United in upping the game.



What Has Ownership Actually Invested In?

- INITIAL INVESTMENT



- SECONDARY INVESTMENT...

United in upping the game.



In Our World Secondary = Primary Investment

Tremendous amount
of
\$\$\$
to make 3 to 5
cutting heads
cut grass...



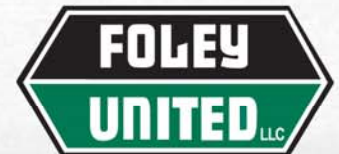
United in upping the game.



So It's Quite Simple...

- 1) There's a great deal of effort put into producing a superior reel type cutting system...
 - John Deere QA 5 & 7's
 - Jacobsen 45 degree relief
 - Toro's new EDGE SERIES Reels
- 2) Assumption...
- 3) Conclusion...

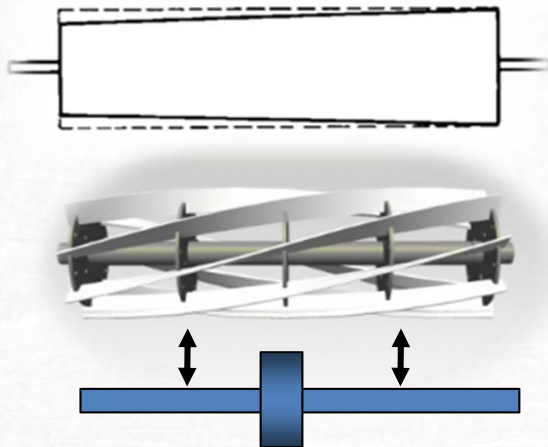
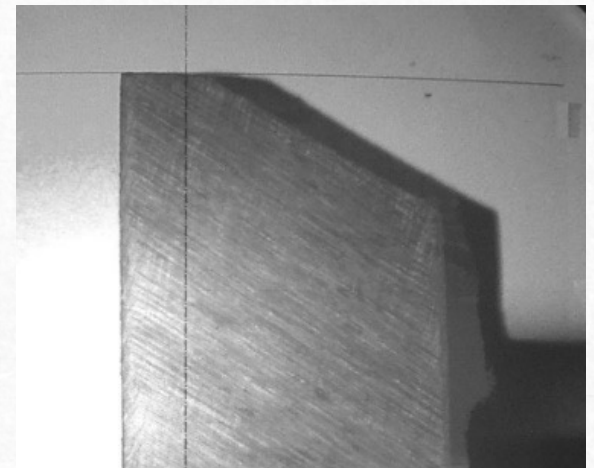
United in upping the game.



Defining the "Standard"

Standard = OEM Design Specifications
"Sharp" & "Shape"

Toro, Jacobsen, John Deere...etc...



A perfect cylinder when new...

An identifiable "Standard" from ALL manufacturers

United in upping the game.



From a
pure grinding perspective,
there is a
“GOOD – BETTER – BEST”
concept...

United in upping the game.



The “REEL” question is what
MAXIMIZES PERFORMANCE
and what
MINIMIZES POTENTIAL
for issues...

United in upping the game.



Reminder of what I'm actually purchasing...



Ultimately Buying 2 Things:
"Quality of Cut" & "Performance"

United in upping the game.

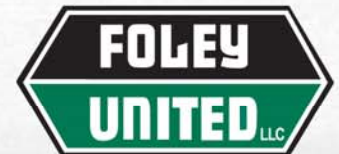


Desires & Expectations

Increased “Clip Rates/FOC” over time has pushed traction, reel rotation, & blade count history

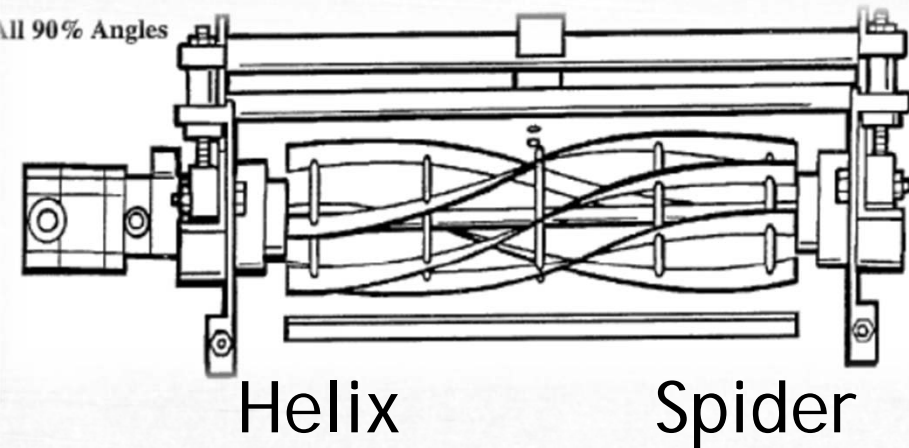


United in upping the game.



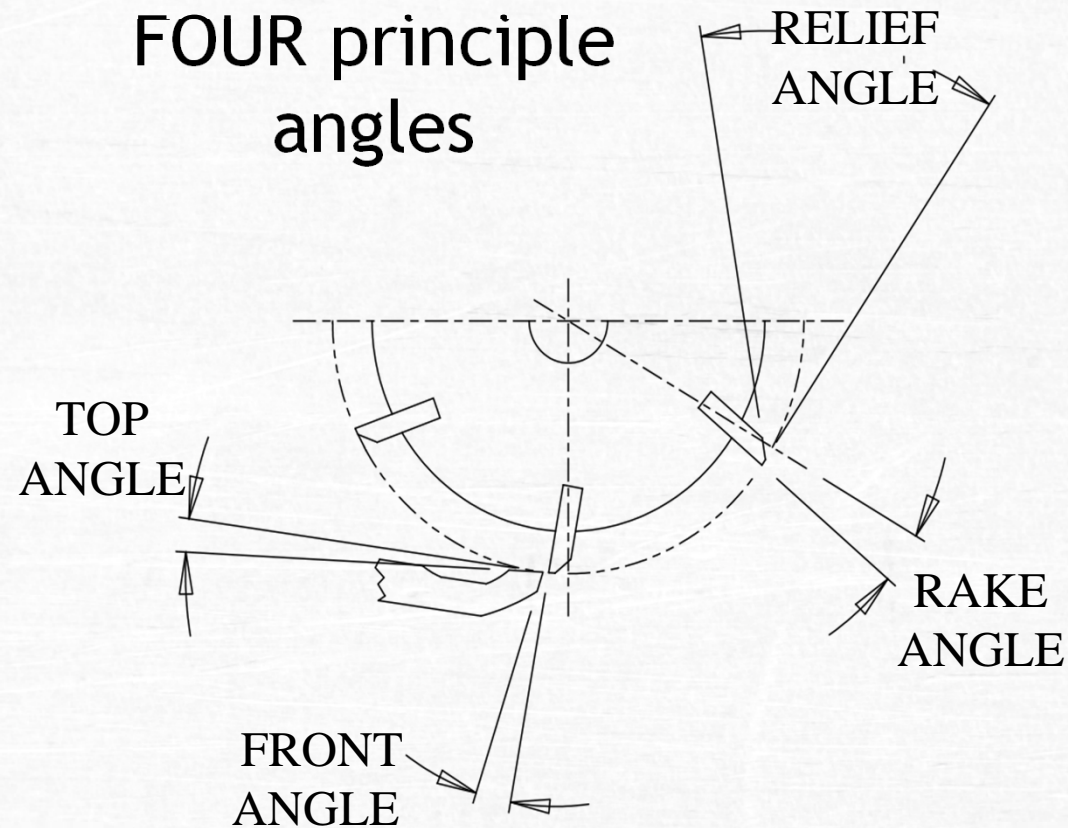
OEM Spec = The "Standard"

Original Equipment Manufacturer Specifications



"Box-like"
construction.

FOUR principle
angles



United in upping the game.



Manufacturers Reel Blade Angles

The REEL BLADE is associated with two angles:

- 1) Rake Angle
- 2) RELIEF ANGLE

FAIRWAY:
Thicker blade
with
"Ground-in"
RELIEF

GROUND
Relief

MILLED &
GROUND Relief



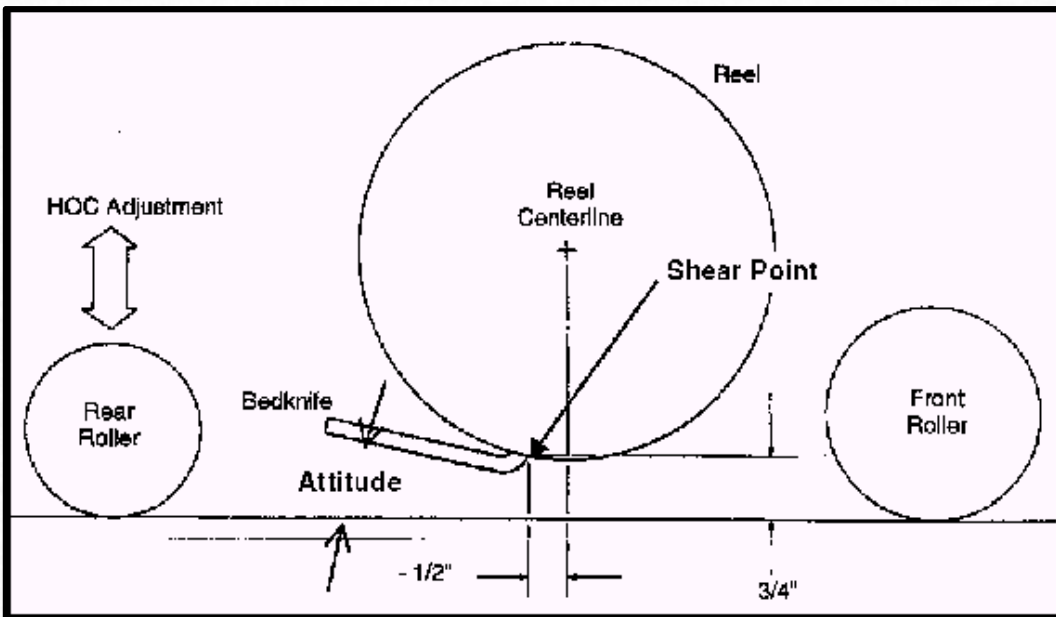
GREENS/TEE
Thinner blades
Hybrid systems
OEM spec
more important

Milled &
Ground
Relief

United in upping the game.



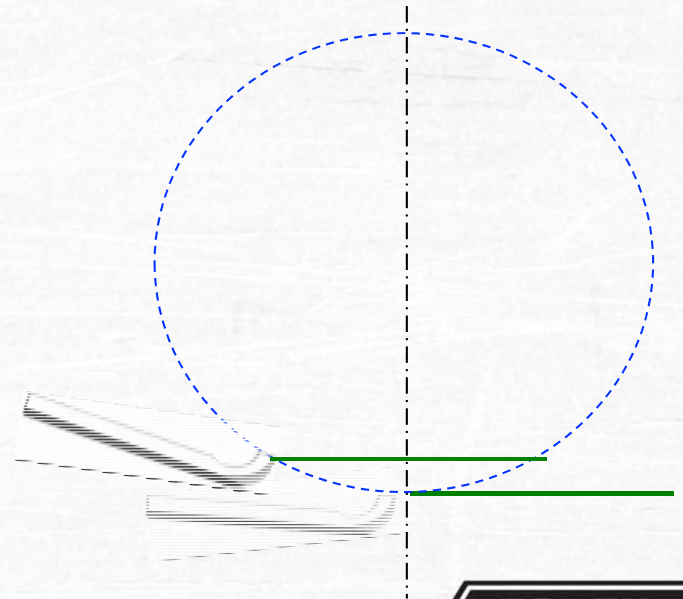
Reel Center-line & Bedknife Relationship



Shear point/center-line dictates aggressiveness...

“ATTITUDE”...the resulting angle of the bedknife.

What happens when the shear point moves farther from the centerline...?

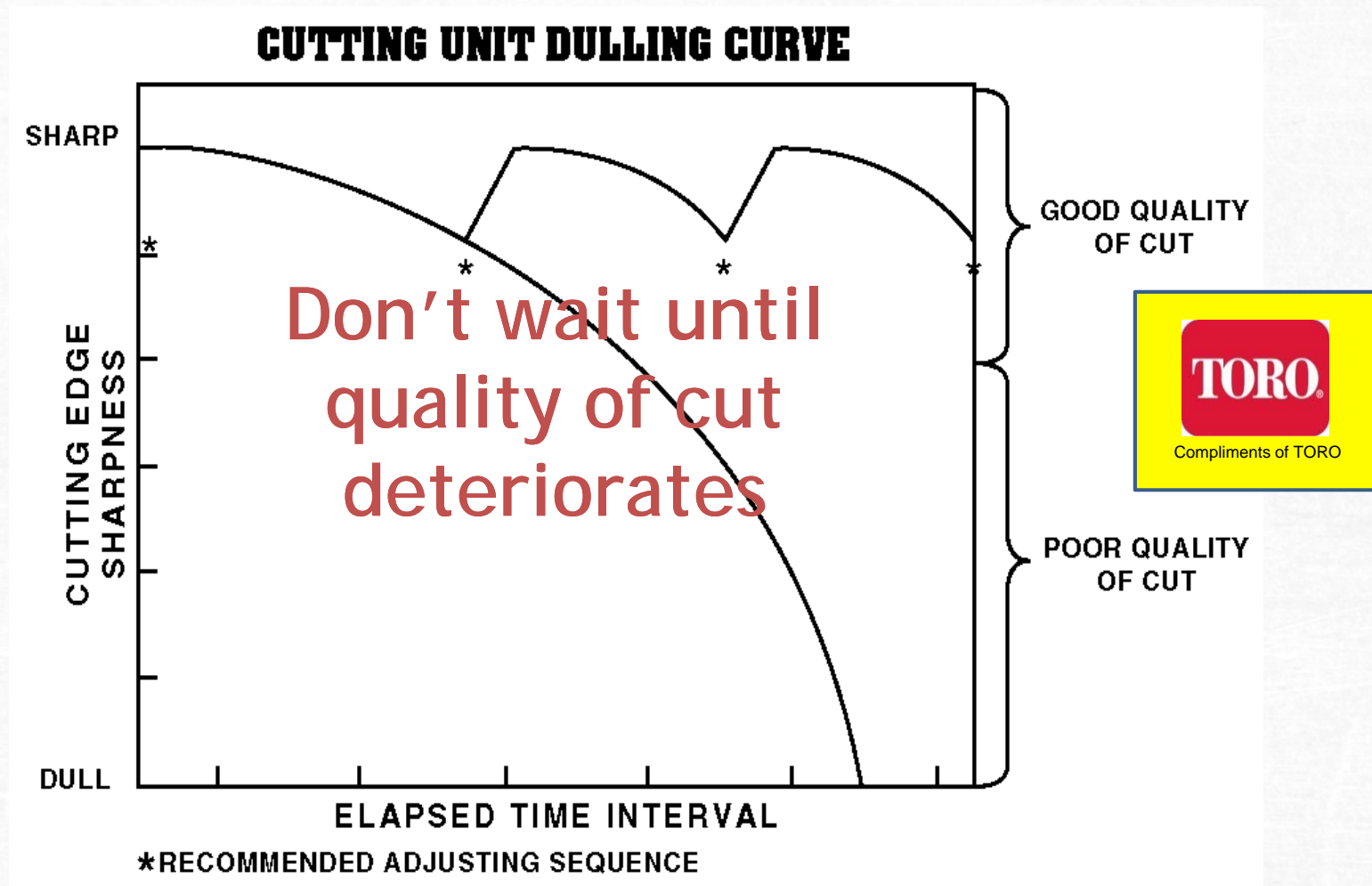


United in upping the game.



The Perfect World - All Parameters 'New'

Performance = Staying on Cut

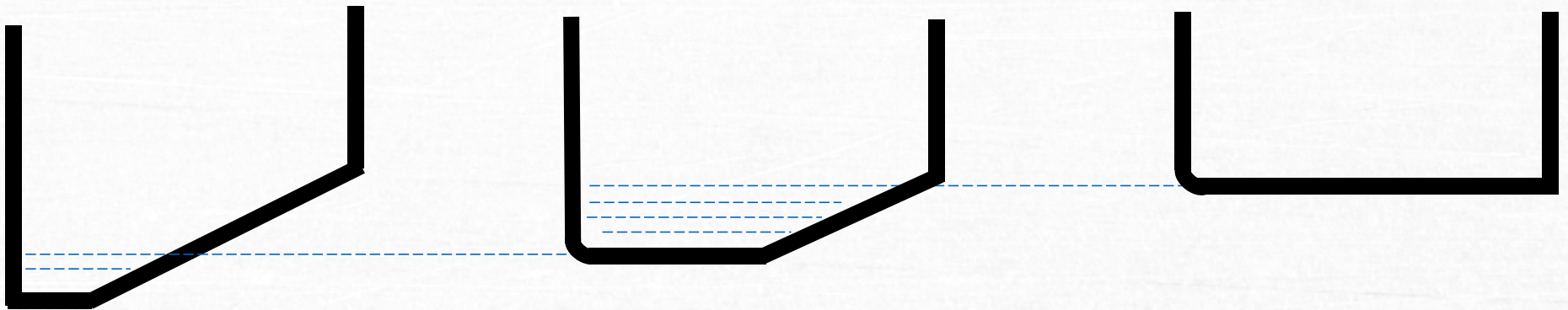


United in upping the game.



Staying on Cut = "PERFORMANCE"

Natural Progression of Losing Shape



Typically, four actions to stay on cut:

- 1) Adjust 2) Backlap 3) Face 4) Grind

Tools in the tool bag to maximize longevity of cut...grinding is a last resort.

United in upping the game.



"ADJUSTMENT"

Cut paper 40 to 50 hours without doing anything...other than proper adjustment.

Continuous degradation of cut - dieback.

The tendency in our industry is over-tightening when units aren't cutting well...rifling result

United in upping the game.



"REEL" Education & the Adjustment Process



Iowa State University
Turfgrass Research

Significance of Light Contact as it
relates to "QUALITY OF CUT"

	<u>Visual Quality</u>	<u>Mowing Injury</u>	<u>Chlorophyll Content</u>	<u>Ethylene Production</u>
--	---------------------------	--------------------------	--------------------------------	--------------------------------

SHARP with
"LIGHT" Contact



8.68

0.83

17.46

0.541

SHARP with
"NO" Contact



8.20

1.85

15.73

0.593

DULL with
"LIGHT" Contact



8.41

1.28

17.12

0.603

DULL with
"NO" Contact



8.07

2.35

16.34

0.669



Figure 1



Figure 2



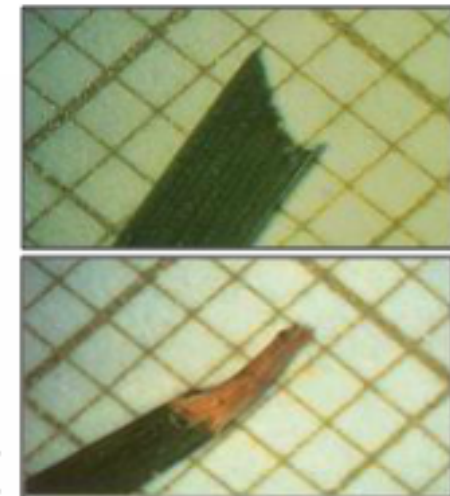
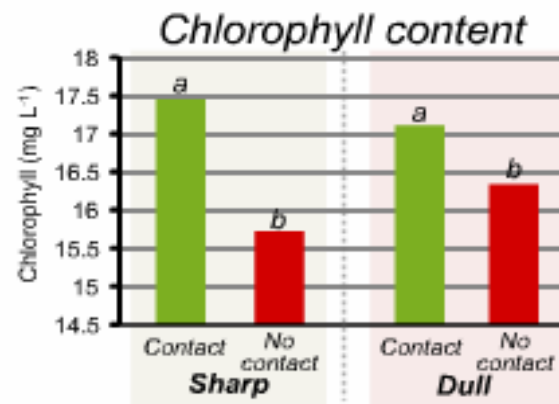
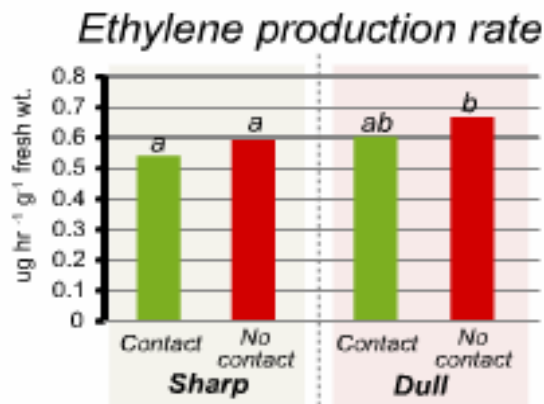
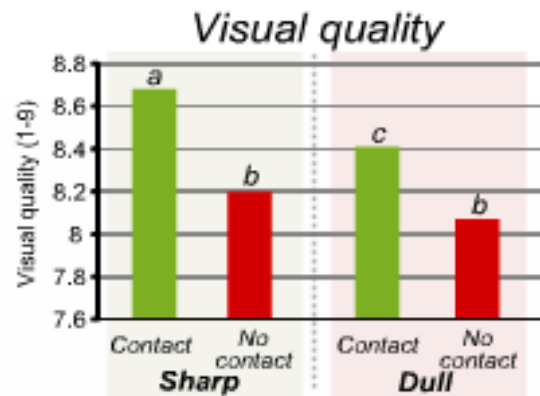
Figure 3



Figure 4

United in upping the game.





Top: leaf cut with sharp, light contact
Bottom: dull without contact

Sharp with contact:

- Caused less injury to leaves
- Produced higher visual quality rating
- Resulted in higher chlorophyll concentration
- Resulted in less ethylene produced
- Light contact was as or more important than sharpness

Results were published in GCM:
Mark Howison & Nick Christians.
2001. Mower setting, PGRs affect
turfgrass quality. Golf Course
Management. June 2001.

Light contact was as or more important than sharpness

United in upping the game.

ADJUSTMENT - Iowa State Study & Longevity of Cut

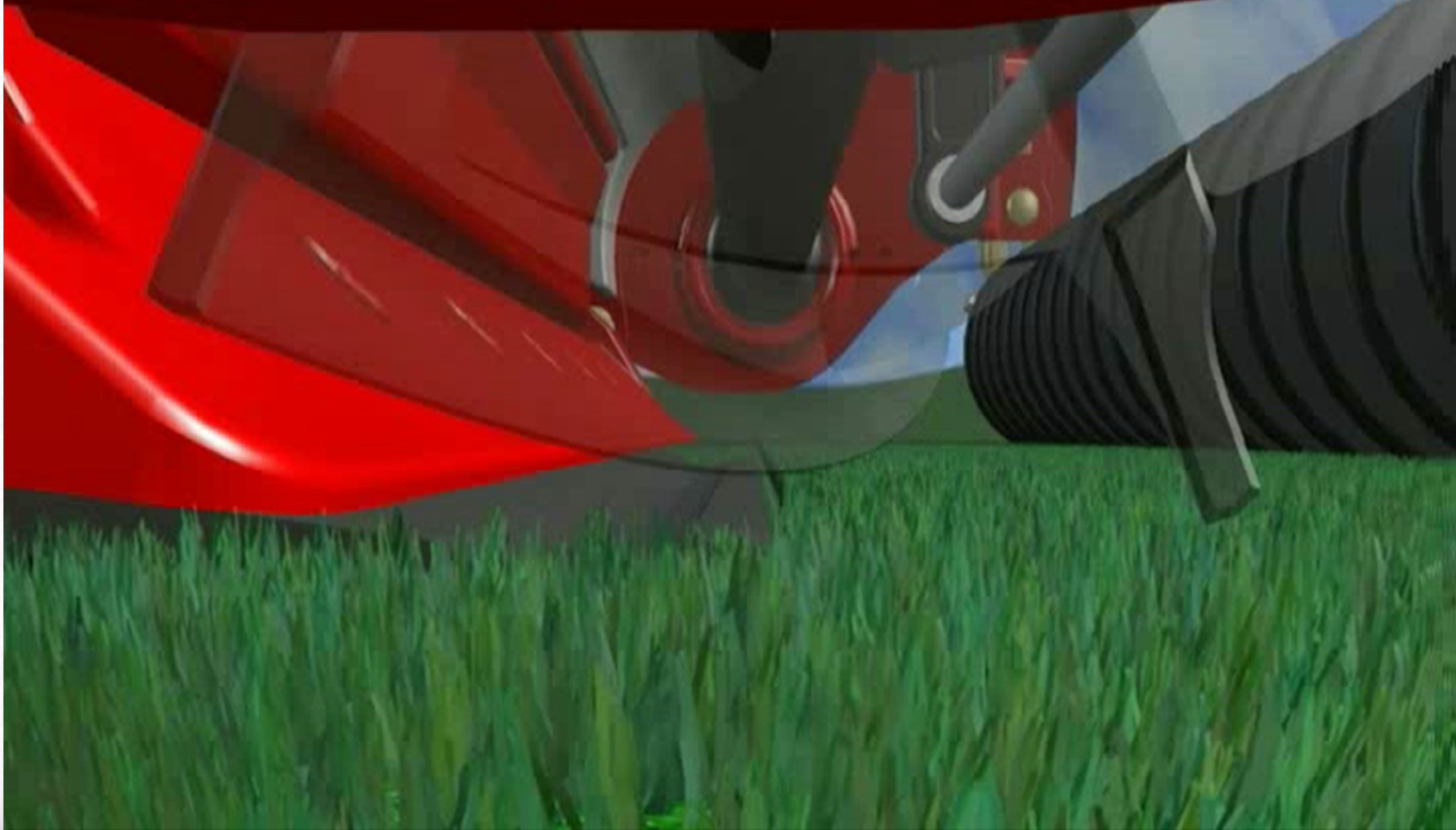
(Compliments of Mark Howieson)

- **OBJECTIVES:** To quantify mower sharpness and mowing injury over time and estimate how frequently reel-type mowers should be sharpened to achieve the best possible cut quality.
- **EQUIPMENT:** This study used three 18-inch walking greens mowers, with each mower ground by three different grinder manufacturers:
 1. Single Blade Carbide Milling - Light Contact
 2. Cylindrical - NO Contact
 3. Cylindrical with Relief - Light Contact

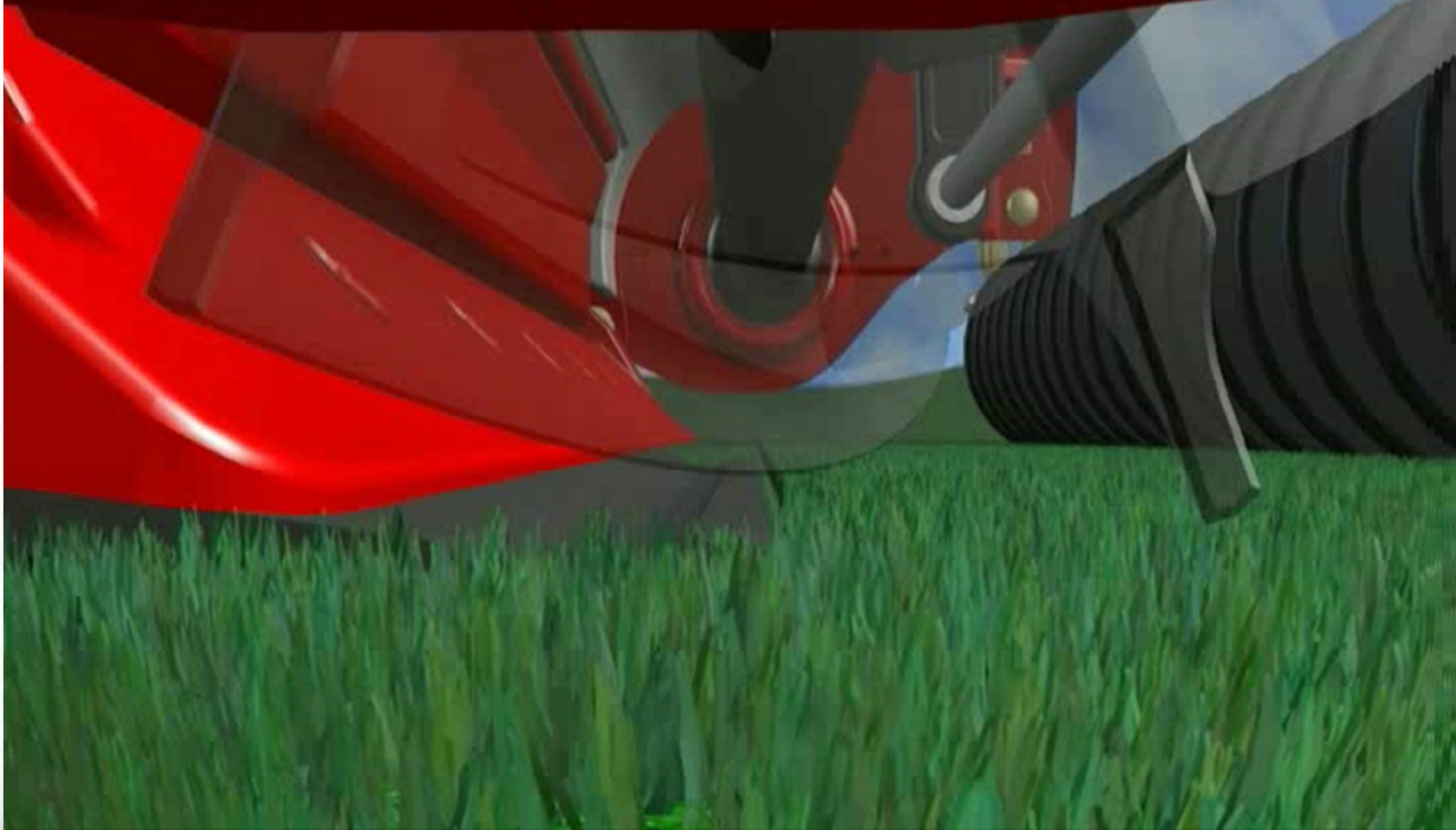
United in upping the game.



**There's specific testing that dictates
why Toro recommends their
preferred settings.**

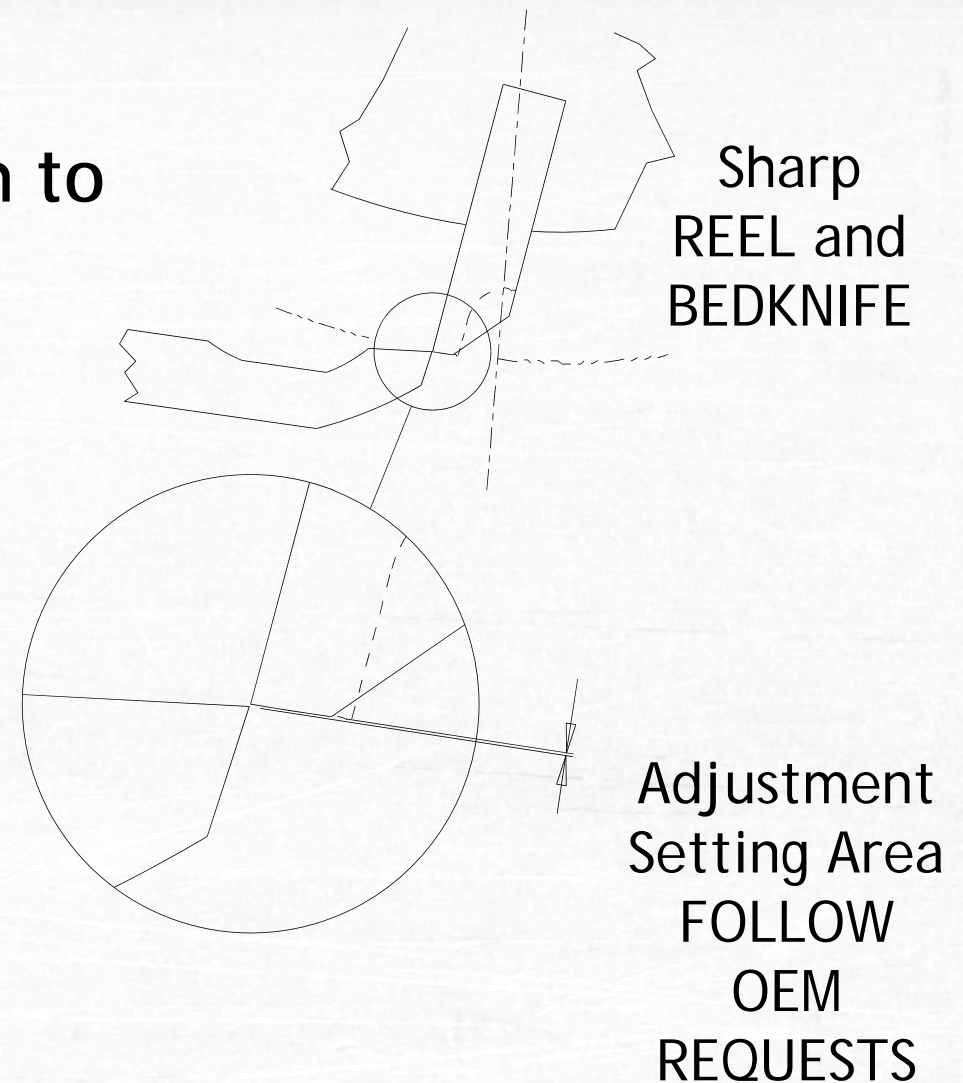


**There's specific testing that dictates
why Toro recommends their
preferred settings.**



- As we know, Jacobsen .025mm to .075mm (.001" - .003")

- We also know that John Deere .025mm to .05mm (.001" - .002") adjustment gap setting



United in upping the game.



GCSAA & John Deere



GCSAA & John Deere



Reality when units are put on the turf?

Recommended bench settings may
change when put to use...

- Reel “start-up surge” ...
- Centrifugal inertia and weight of the reel...
- Ground pressure pushes up...
- Cutting in dry conditions...
- Torsion load & reel flex over the length of the reel...

DO NOT “OVER-ADJUST” OUT OF THE SHOP

If not cutting properly with recommended bench settings
Lap, Face, or Grind

United in upping the game.



"Contact/Touching" Related to Performance

REQUIRED HORSEPOWER & REEL ROTATION

0.05mm to 0.125mm GAP - Ensuring NO Operational Contact

- OEM Relief .75 hp per cutting unit
- "NO" Relief .87 hp per cutting unit

CONTACT/"Touch"

- OEM Relief .88 hp per cutting unit
- "NO" Relief 2.59 hp per cutting unit

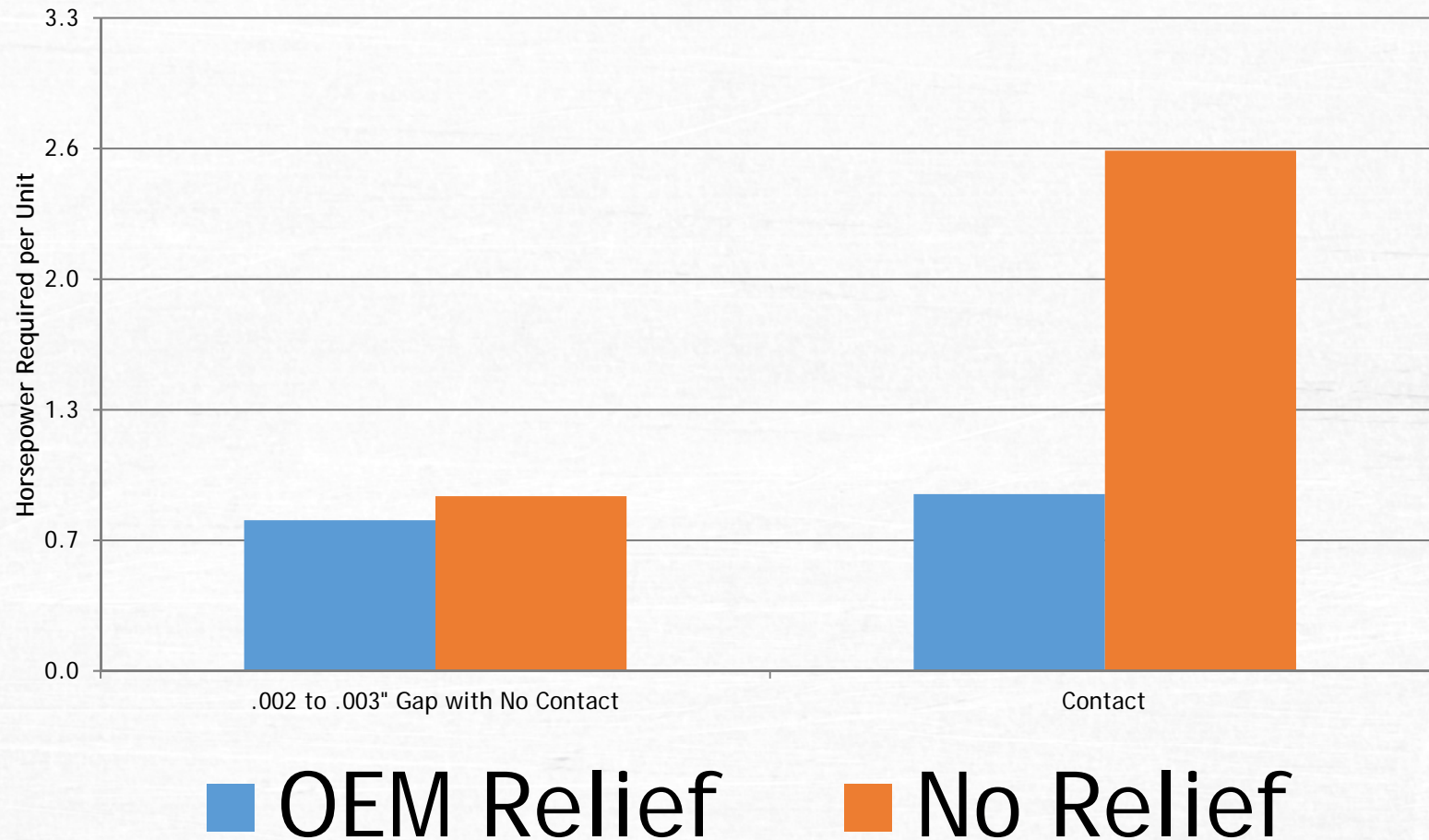
NOTE RELIEFED/CONTACT & NO RELIEF/NO CONTACT...

United in upping the game.



Horsepower Study

As the reel wears flat and loses shape, more stress and strain will be put on the cutting systems.



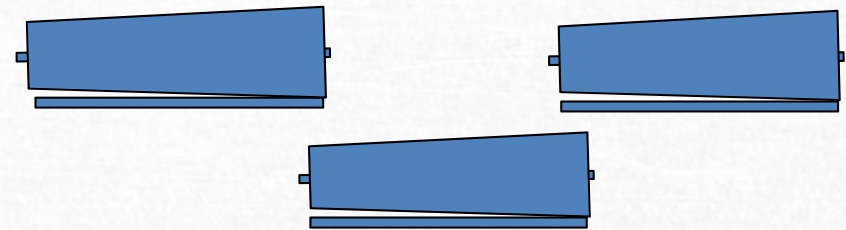
United in upping the game.



LOSING SHAPE & OPERATIONAL WEAR

WHAT EFFECT DOES TAPER HAVE ON ADJUSTMENTS?

Take rollers out of parallel and twist the bedknife to compensate for taper...



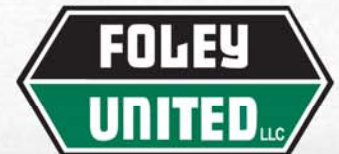
Undue load on the bearings & induces torque on the bedknife and housing assembly...



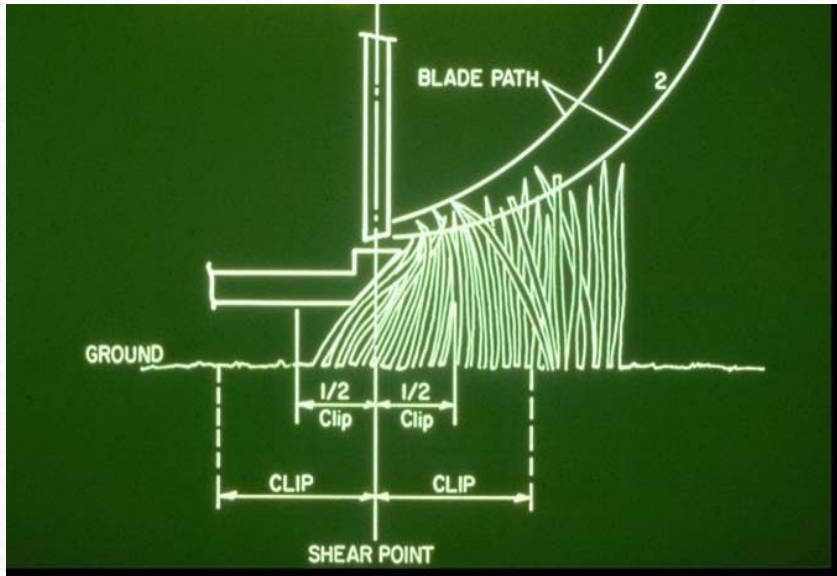
.010" of an inch of taper can start to effect after-cut appearance...

Rocking Motion?
A surface plate is the solution

United in upping the game.



Operational Wear & Blade Path



New Reel

Worn Reel

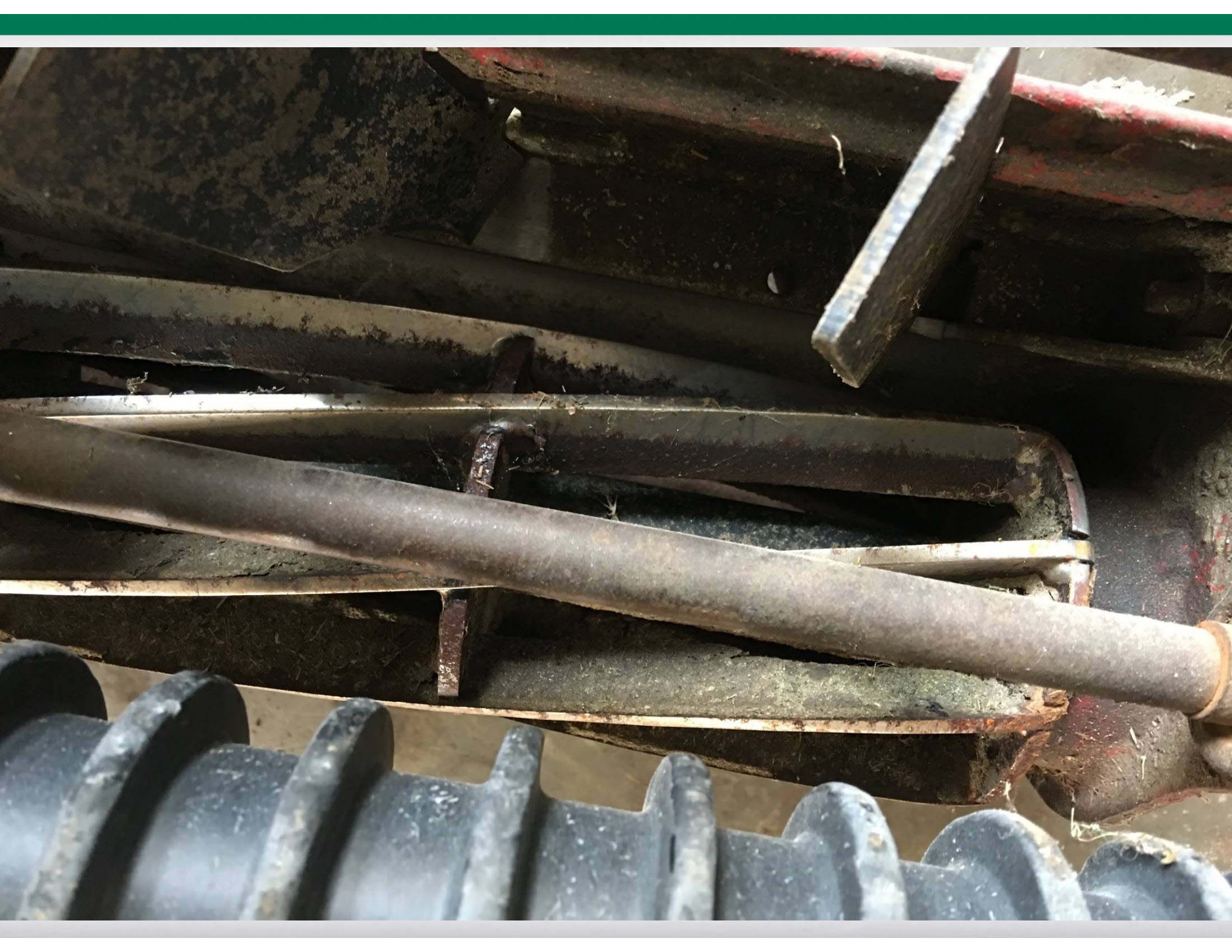
Worn Reel

- Travels slower
(blade tip speed)
- Bedknife cutting edge moves further behind the reels centerline and attitude is increased

Compliments of Jim Nedin

United in upping the game.



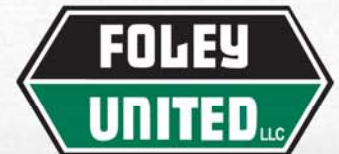


BACKLAPPING

One of the most misunderstood
&
miscommunicated maintenance
practices there is...

Lapping is a preventive maintenance
process to maintain an edge, it's
not meant to create one.

United in upping the game.



BACKLAPPING



Relief on blades provides an area for the compound to adhere to...

Less surface and less metal to remove, minimizing time, and saving wear on the bedknife...

United in upping the game.



FACING BEDKNIVES

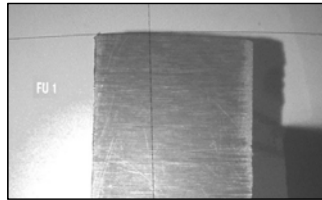
- Provides one good edge to pull grass into...
- Try to be consistent with speed and angle...
- Do not grind back too far during the life...

United in upping the game.

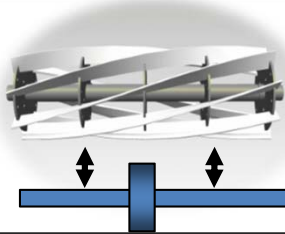
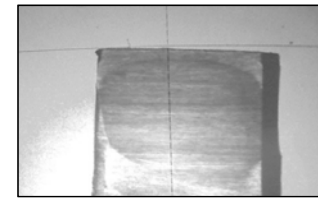


REEL GRINDING BASICS "101"

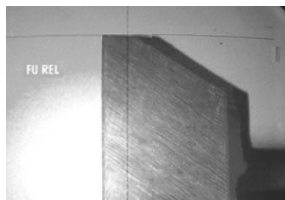
Three objectives to make it "LIKE NEW"



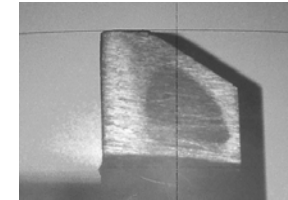
Produce a
SHARP EDGE



**REMOVE
TAPER**



RELIEF GRIND
To the Reel Manufacturer Specifications



United in upping the game.





1926 to mid-90's
"Upright" Reel
Grinders



Early to mid
70's
"Tabletop"
Design

1994

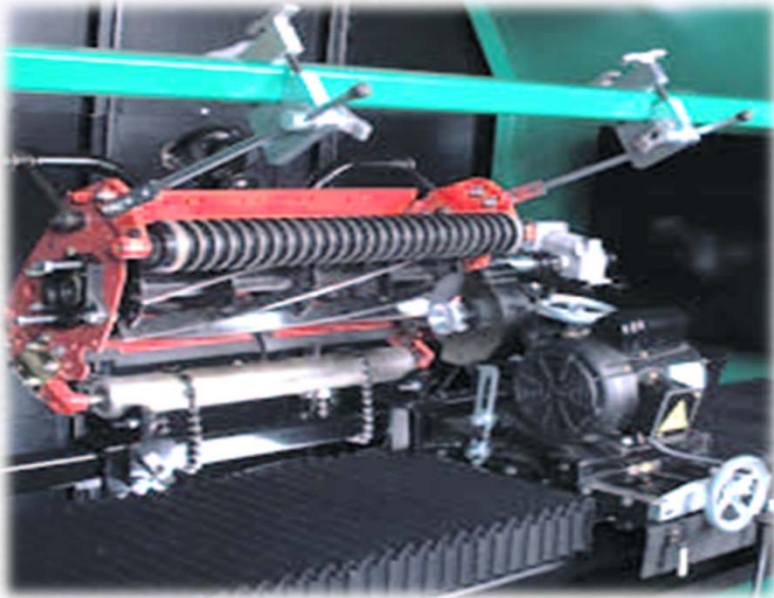


United in upping the game.

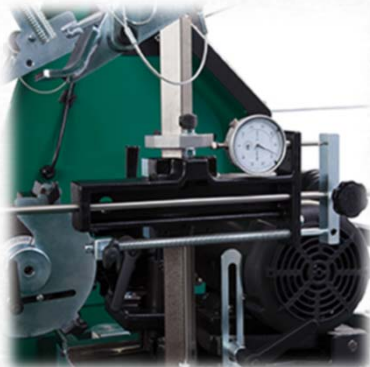


"Upright" Style Spin/Relief Grinders

Reels are placed in an
"upright" position



Spin, auto-index relief, and
gauging capability

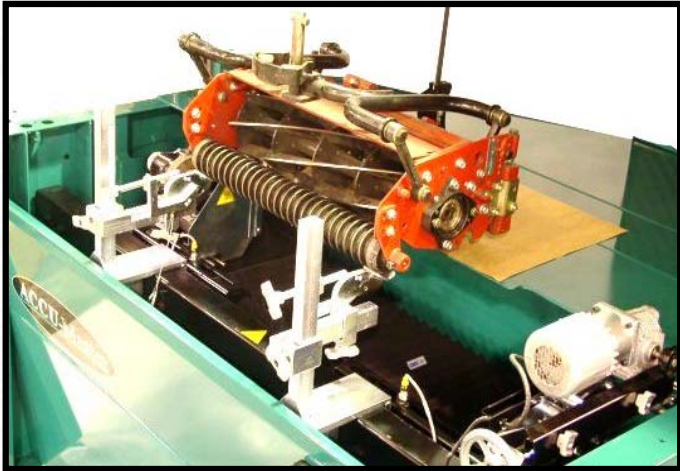


United in upping the game.

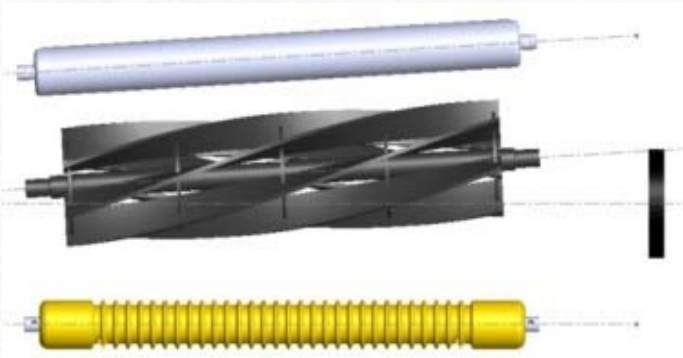


Table-top Units

3 Step Process

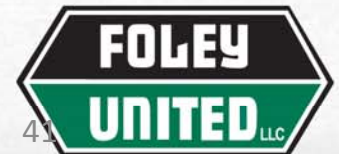


Placement
Gauge or Touch-off
Grind



Middle step must take place
before making sparks...

United in upping the game.



NEW Technology for “Table-top” Placement Locates the Reel by the Rear Roller



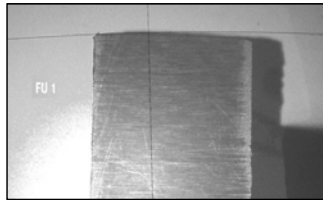
United in upping the game.



REEL GRINDING BASICS

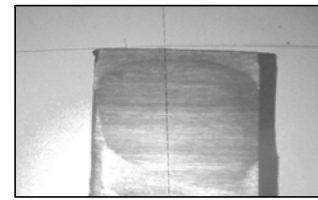
“Spin Grind” to produce a sharp edge,
but only 1/3 of the process...

OBJECTIVE #1



SHARP EDGE

Spin Grind

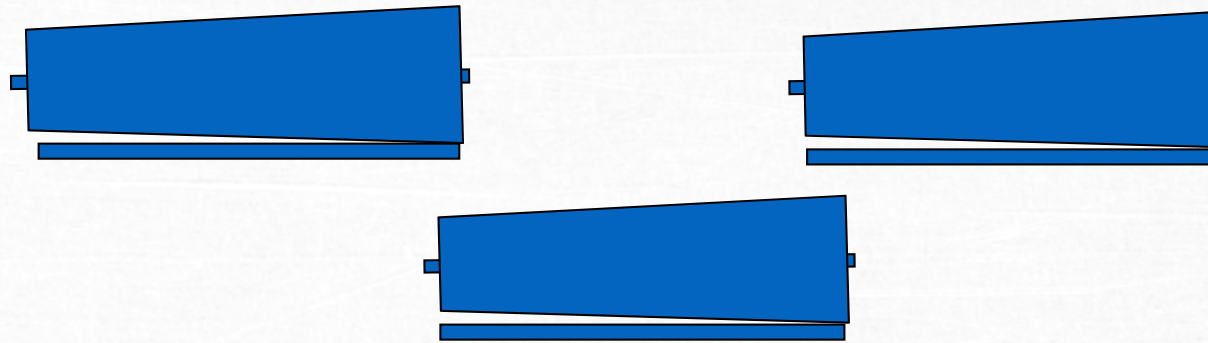


Typically 5 to 15 minutes...
Depends on how dull the reel is and how much taper

Sharp is
'GOOD'

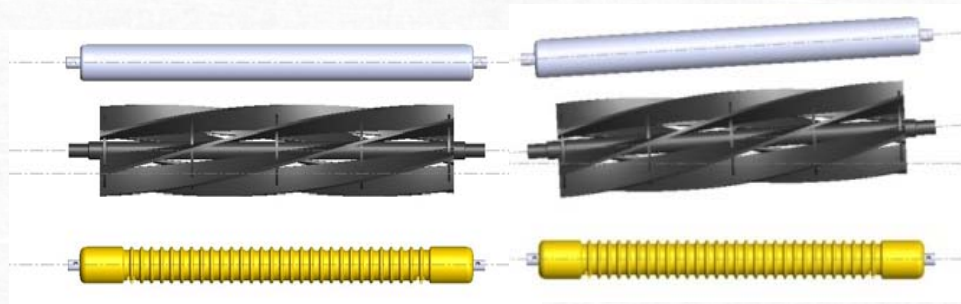
United in upping the game.





Sharp is
'GOOD'

"Sharp & re-shaped to remove taper" is
'BETTER'

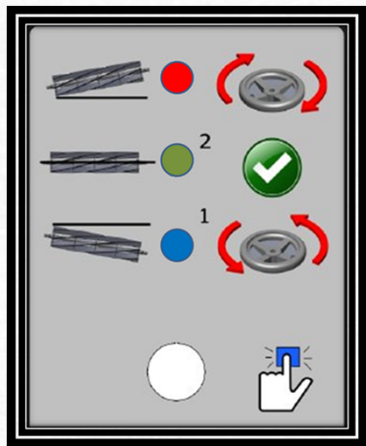
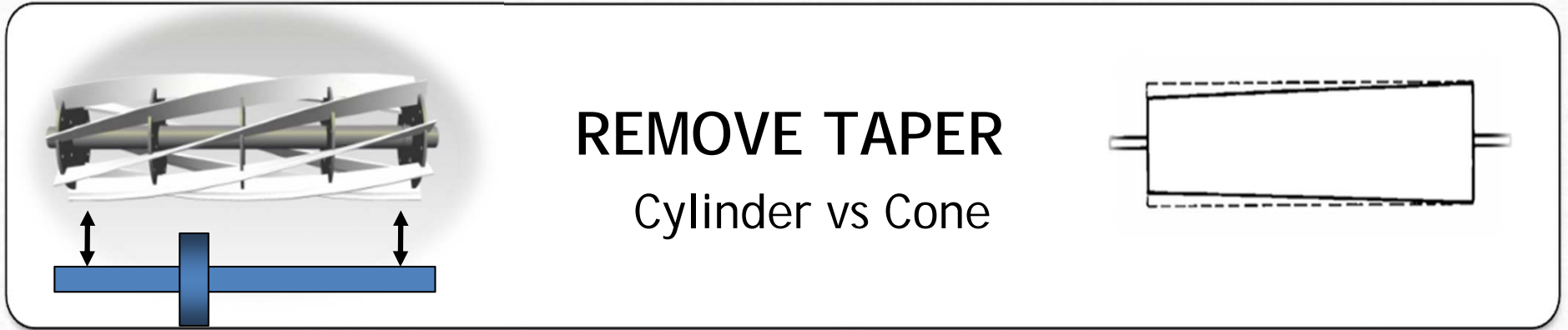


United in upping the game.



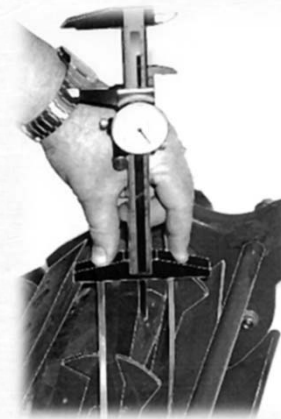
REEL GRINDING BASICS

OBJECTIVE #2

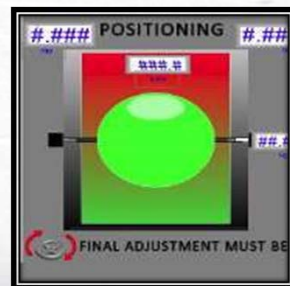


NEW
Technology
& Gauging
Systems
All Visual

Taper Measurement
Tool..



Pi-Tape
measuring
tool...

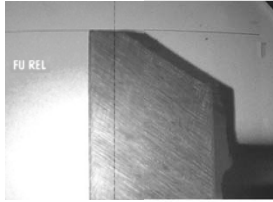


United in upping the game.



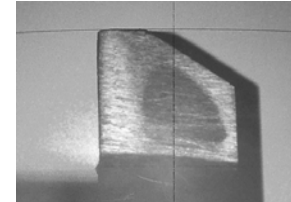
REEL GRINDING BASICS

OBJECTIVE #3



RELIEF GRIND

Final step to OEM Spec



Sharp is
'GOOD'

"Sharp & Re-shaped to Remove Taper" is
'BETTER'

Sharp, Re-shaped & Relieved to OEM is
'BEST'

United in upping the game.

