

# Bowed Rolls Inc



## A Manual – The Short Version

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# Bowed Rolls, Inc

THE BOWED ROLLS, COMMONLY REFERRED TO AS AN, EXPANDER, BANANA ROLL, OR SPREADER ROLL, IS A DEVICE DESIGNED TO LATERALLY SPREAD (OR CONTRACT) A CONTINUOUSLY TRAVELLING WEB. IT IS A ROLL OF CONSTANT DIAMETER, SYMMETRICALLY CURVED ALONG THE AXLE. THE ROLL SURFACE TURNS FREELY ABOUT THE FIXED AXLE EITHER BY PRESSURE FROM THE TRAVELLING WEB PASSING OVER IT OR BY EXTERNAL POWER APPLIED TO A DRIVE SHEAVE AT ONE END OF THE ROLL.

## SOME BASIC BOW ROLL APPLICATIONS:

1. ELIMINATE WRINKLES
2. ELIMINATE BAGGY CENTERS
3. ELIMINATE SLACK EDGES.
4. CONTROL THE WIDTH, OPENNESS, AND SEAMS.
5. TO REDISTRIBUTE TENSION EVENLY.

BOWED ROLLS ARE CONSTRUCTED WITH A PRECISION BOWED SHAFT, LUBRICATED BALL BEARINGS, AND A FLEXIBLE RUBBER COVER. AS THE ROLL IS TURNED THE BEARINGS ROTATE AROUND THE STATIONARY CURVED SHAFT AND WITHIN THE RUBBER COVER. A SPREADING ACTION IS IMPARTED TO ANY WEB OF MATERIAL RUN OVER THE SURFACE. THIS SPREADING ACTION HELPS TO COMPENSATE FOR VARIATIONS IN TENSIONS ACROSS THE WEB AND VARIATIONS IN WEB THICKNESS.

## GENERAL DEFINITIONS

**AMOUNT OF BOW:** THE DISTANCE FROM THE ARC OF THE SHAFT TO THE CHORD OF THE ARC, MEASURED AT THE CENTER OF THE ROLLER. THE AMOUNT OF BOW SHOULD BE EXPRESSED AS A PERCENTAGE OF THE ROLLER FACE LENGTH SPECIFIED. TO CONVERT FROM A PERCENTAGE TO A SPECIFIC MEASUREMENT, MULTIPLY THE AMOUNT OF BOW REQUIRED BY THE ROLLER FACE LENGTH.

EXAMPLE: .02 ( % OF BOW REQUIRED ) X 70" INCH ROLLER FACE = 1.4" BOW

**BOW DIRECTION:** THE DIRECTION POINTED TO BY THE RADIUS OF THE ARC OF THE CURVED SHAFT AT THE CENTER OF THE ARC. BOWED ROLLS PROVIDES A BOW DIRECTION PLATE AT THE END OF EACH ROLL.

**DIAMETER:** OUTSIDE DIAMETER (O.D.) OF THE ROLLER.

**END ANGLE:** THE ANGLE FORMED BY THE ARC OF THE CENTERLINE OF THE SHAFT AND THE CHORD OF THAT ARC.

**LEAD-IN:** THE DISTANCE BETWEEN THE SPREADER ROLLER AND IDLER ROLLER JUST PROCEEDING THE SPREADER ROLLER.

**LEAD OUT:** THE DISTANCE BETWEEN THE SPREADER ROLLER AND THE IDLER ROLLER JUST FOLLOWING THE SPREADER ROLLER.

**FACE LENGTH:** THE CHORD OF THE ARC OF THE CENTERLINE OF THE EXPOSED RUBBER COVER. I.e. THE RUBBER FACE.

**MOUNTING CENTER:** THE HORIZONTAL DISTANCE BETWEEN THE CENTERLINE OF THE MOUNTING BRACKETS.

**SHAFT EXTENSION:** (JOURNAL) THE AMOUNT OF SHAFT WHICH EXTENDS BEYOND THE ROLLER FACE ON EITHER ENDS OF THE ROLLER.

**OVERALL LENGTH:** THE CHORD OF THE ARC OF THE SHAFT CENTERLINE. I.e. THE COMPLETE LENGTH OF THE SHAFT.

**WRAP ANGLE:** THE ANGLE SUSPENDED BY THAT PORTION OF THE WEB IN CONTACT WITH THE ROLLER.

## BOW ROLL VS. STRAIGHT ROLL

AS A CONTINUOUS SHEET PASSES OVER A ROLL – A STRAIGHT ROLL- WITH A SUFFICIENT ANGLE OF WRAP, THE TENDENCY OF THE WEB IS TO TRAVEL OVER THE ROLL AT RIGHT ANGLES TO THE ROLL AXIS. NOW IF THIS STRAIGHT ROLL IS ANGLED, THE EFFECT IS THE SAME – i.e. THE WEB TRAVELS OVER THE ROLL TOWARD A PATH PERPENDICULAR TO THE ROLL AXIS AND IS THEREFORE GUIDED AWAY FROM ITS ORIGINAL PATH TO A NEW PATH.

BY SUBSTITUTING A BOW ROLL FOR THE STRAIGHT ROLL, THE WEB WILL GO STRAIGHT ACROSS AT THE CENTER, BUT AT POINTS FURTHER OUT FROM THE CENTER WEB WILL TEND TO TURN AND MOVE OUTWARD. THE RESULT IS A VERY GENTLE, EVEN WIDTH WISE TRAVEL THAT SMOOTHS OUT WRINKLES AND SPREADS THE SHEET TO ITS DESIGNED WIDTH.

### FACTORS EFFECTING THE SPREADING ACTION:

1. LOCATION OF Bowed ROLL.
2. DIRECTION OF APEX OF BOW.
3. AMOUNT OF BOW.
4. AMOUNT OF WRAP.

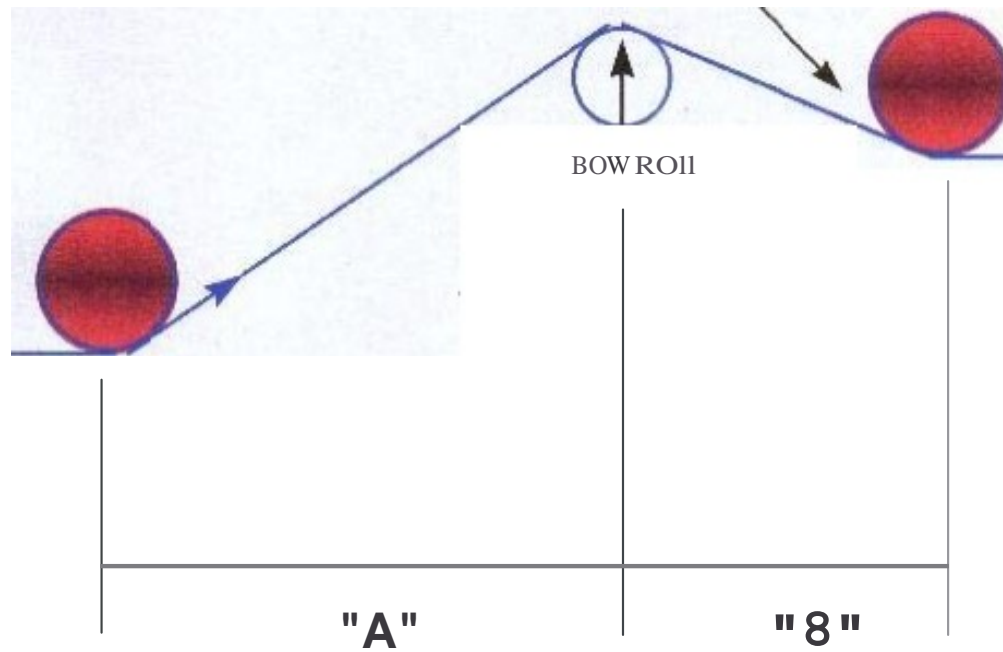
## 1. LOCATION OF BOWED ROLL

THE SPREADING ACTION BEGINS TO OCCUR BEFORE CONTACT WITH THE BOWED ROLL AND IS ENDED VERY SOON AFTER CONTACT IS LOST.

THIS DICTATES THAT THE BOWED ROLL BE MOUNTED AS CLOSE AS PRACTICAL TO WHERE CORRECTIVE ACTION IS DESIRED, SUCH AS BEFORE ENTERING A NIP. THE LEAD -IN DISTANCE SHOULD BE GREATER THAN LEAD-OUT DISTANCE. THE LEAD IN DISTANCE FROM A FREE TURNING IDLER ROLL OF ABOUT THREE TIMES LEAD-OUT DISTANCE IS USUALLY IDEAL. IN APPLICATIONS WHERE BOW ROLL PROCEEDS A NIP EXTRACTING LIQUID FROM THE WEB, THE APEX OF THE BOW ROLL SHOULD BE LOWER THAN THE NIP TO PREVENT FORMATION OF A PUDDLE OF THE EXTRACTED LIQUID.

FIGURE1.

POINT WHERE CORRECTIVE  
ACTION IS DESIRED



**LEAD-IN DISTANCE, "A", SHOULD BE  
3 TIMES LEAD-OUT DISTANCE "B".**

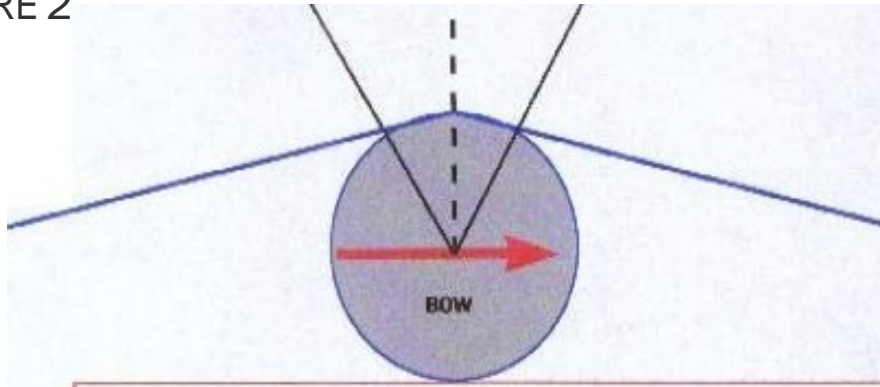
## 2. DIRECTION OF BOW:

THE APEX OF THE BOW SHOULD BE SET AT 90 DEGREES OFF THE BISECTED WRAP ANGLE, TO THE EXIT SIDE OF THE WEB. TO ACHIEVE MAXIMUM SPREADING THE BOWED SHOULD BE ROTATED SO THAT THE WEB ENTERS ON CONVEX PORTION, WITH THE APEX OF THE BOW AT THE BISECTED ANGLE OF WRAP. (TURN THE BOW INTO THE WEB). THIS WILL HELP ELIMINATE BAGGY CENTERS ON THE WEB. TO ELIMINATE BAGGY EDGES, THE ROTATION OF THE ROLL SHOULD BE TOWARDS THE EXIT SIDE OF THE WEB.

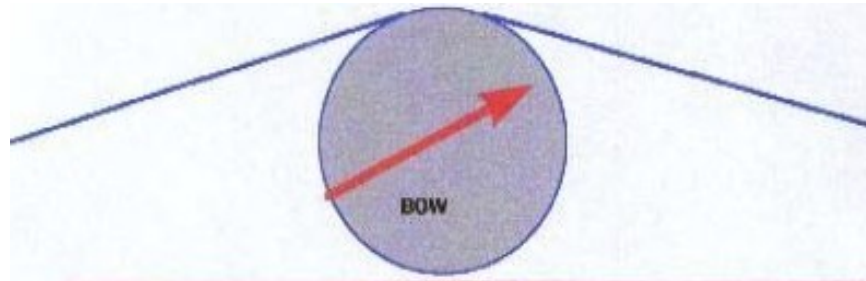
THIS APEX POSITION MAY BE VARIED WITHIN A LIMITED RANGE TO ACHIEVE THE SPREADING ACTION MOST SUITABLE TO THE CUSTOMERS PARTICULAR NEEDS.

THE LIMITING FACTOR OF COURSE IS THAT IF THE ROLL IS MOUNTED SO THAT THE WEB IS ACTED UPON ONLY BY THE CONCAVE PORTION NO SPREADING WILL OCCUR. THE BOWED ROLL IS A CORRECTIVE DEVICE AND MAY BE MOUNTED SO THAT IT CAUSES A VARIATION IN DISTANCE TRAVELED BETWEEN THE CENTER AND EDGES OF THE WEB TRAVELING OVER IT. THIS ALLOWS CORRECTION FOR LEADING OR LAGGING CENTERS IN ADDITION TO ITS PRIMARY PURPOSE OF SPREADING TO ELIMINATE WRINKLES OR GAIN WIDTH.

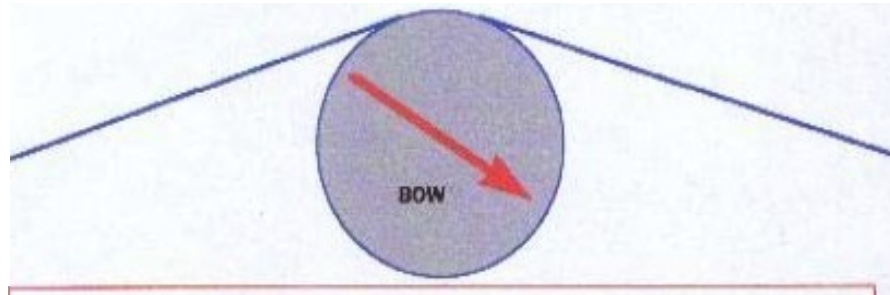
FIGURE 2



NORMAL MOUNTING POSITION EVEN  
TENSION ACROSS ROLL SURFACE  
(RECOMMENDED START UP POSITION)



BOW POSITION UP  
TO TIGHTEN CENTER OF WEB



BOW POSITION DOWN  
TO TIGHTEN SLACK OR SELVAGE EDGES



### 3. AMOUNT OF BOW:

MANY FACTORS INFLUENCE THE AMOUNT OF BOW NEEDED. AMONG THESE ARE SPEED, DIMENSIONAL STABILITY OF WEB, MOISTURE CONTENT, WEB TENSION, AMOUNT OF WRAP, PURPOSE OF INSTALLATION (GAIN WIDTH OR ELIMINATE WRINKLES). UNLESS PAST EXPERIENCE HAS SHOWN THE DESIRABLE AMOUNT OF BOW FOR A PARTICULAR APPLICATION, IT IS SUGGESTED THAT ABOVE INFORMATION BE SUPPLIED SO THAT PROPER BOW CAN BE CALCULATED.

#### GENERAL APPLICATIONS ARE AS FOLLOWS:

BOWED "T" (TEXTILE) = 2 - 3 % OF FACE LENGTH

BOWED "Q" (PAPER) = .05 - 2 % OF FACE LENGTH

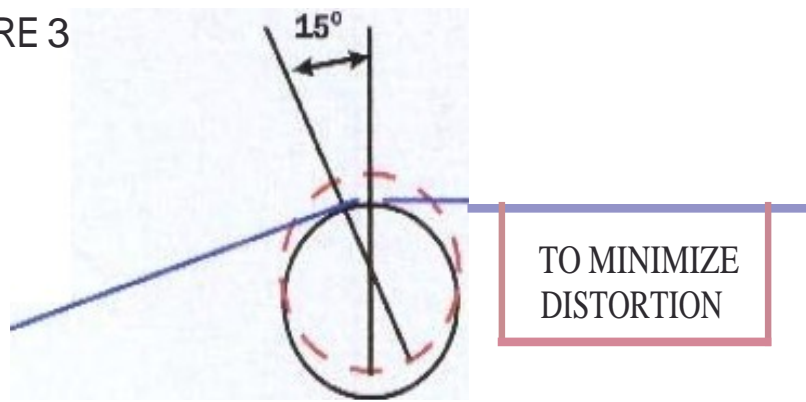
## IN SUMMARY:

THE SPREADING ACTION OF A BOWED ROLL IS A FUNCTION OF THE **DIAMETER** OF THE ROLL, THE **WRAP ANGLE** OF THE WEB CONTACTING THE ROLL, THE DIRECTION OF THE BOW, AND THE **AMOUNT OF BOW** IN THE AXLE. AN INCREASE IN ANY OF THESE FACTORS WILL RESULT IN AN INCREASE IN THE SPREADING ACTION. THE **TENSION** OF THE WEB AND THE **LOCATION** OF THE BOWED ROLL WILL ALSO EFFECT PERFORMANCE. AS AN EXAMPLE, INSUFFICIENT WEB TENSION MAY CAUSE SCUFFING (SLIPPAGE) AT THE EDGES AND EXCESSIVE TENSION MAY CAUSE THE WEB TO CONTRACT IN THE CROSS-MACHINE DIRECTION.

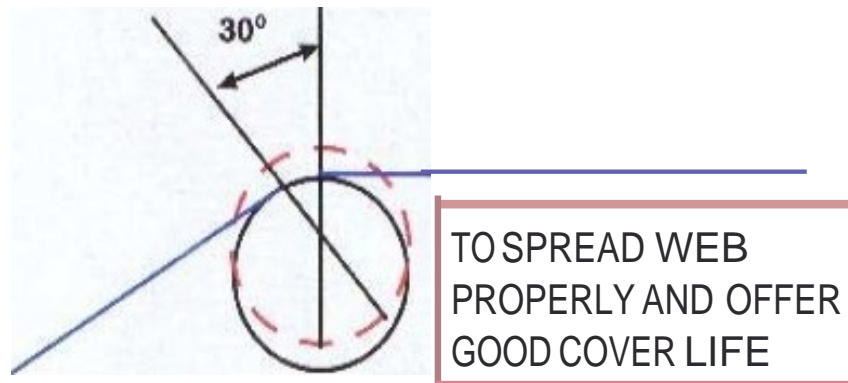
#### 4. AMOUNT OF WRAP

AMOUNT OF WRAP MAY VARY OVER A WIDE RANGE DEPENDING UPON THE APPLICATION. IN GENERAL, ABOUT 30 DEGREES HAS PROVEN TO OFFER SUFFICIENT SPREADING ACTION AND GREATLY INCREASED RUBBER COVER LIFE. THIS FIGURE MAY BE INCREASED OR DECREASED AS PRACTICAL APPLICATION DICTATES. A LARGER ANGLE MAY BE NECESSARY TO INSURE TURNING AN UNDRIVEN BOWED, OR A SMALLER WRAP ANGLE MAY REDUCE DISTORTED WEB ON MATERIAL WITH LOW DIMENSIONAL STABILITY;

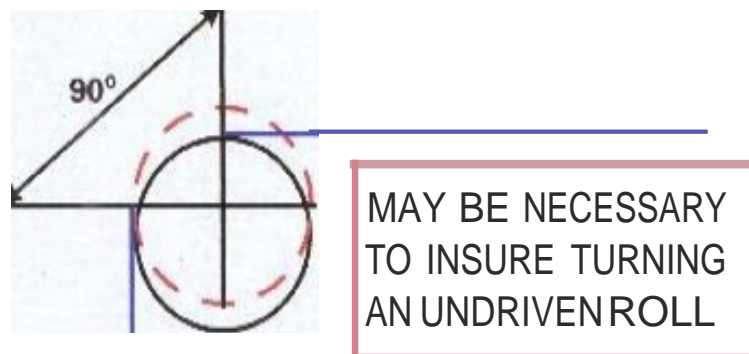
FIGURE 3



SMALL WRAP ANGLE



AVERAGE WRAP ANGLE



LARGE WRAP ANGLE

## FEATURES

### AXLE:

SELECTION OF ROLL SIZE SHOULD BE BASED ON THE SIZE OF THE AXLE. THE AXLE SUPPORTS THE WEB / SHEET AND PROVIDES THE NECESSARY STIFFNESS FOR SMOOTH TURNING ROLLS.

### SLEEVES:

NITRILE IS STANDARD. OTHER COMPOUNDS ARE AVAILABLE DEPENDING ON THE CUSTOMERS REQUIREMENTS FOR APPLICATION.

### REINFORCED SLEEVES:

DEPENDING ON THE SPEED, CORD REINFORCED OR WIRE REINFORCED SLEEVES ARE AVAILABLE. REINFORCEMENT IS RECOMMENDED FOR SPEEDS GREATER THAN 1200 FPM.

CORD	=	1200 FPM – 2000 FPM
WIRE	=	> 2000 FPM

### END CAPS:

END CAPS OR END PLATES OF VARIOUS MATERIALS CAN BE USED. SPECIAL END CAPS CAN BE FABRICATED TO MEET CUSTOMERS' REQUIREMENTS.

### SEALING:

THE BOWED UNIQUE SEAL ARRANGEMENT PROVIDES MAXIMUM SEALING THAT REQUIRES NO ADDITIONAL LUBRICATION. THE PRECISION FIT OF THE SEAL AND ITS' HOUSING ASSURES CONSTANT PRESSURE BETWEEN THE SEAL AND SEAL RACE.

### INTERNAL SPOOLS:

PRECISION CNC MACHINED SPOOLS ASSURE A RUGGED, WELL BALANCED, FREE TURNING ROLL. DOUBLE BEARING END SPOOLS ASSURES PERFECT ALIGNMENT OF ALL SEALING PARTS.

### BEARINGS:

BEARINGS USED ARE SPECIFICALLY DESIGNED FOR BOWED. BEARINGS MEET OR EXCEED INDUSTRY RATINGS FOR SPEED AND PRECISION.

### MOUNTING:

THREE MOUNTING BRACKETS ARE OFFERED FOR THE BOWED ROLL. THE BOWED CAN BE MOUNTED PILLOW BLOCK, SIDE MOUNT, OR ROTATOR STYLE. OUR ROTATOR BRACKETS ARE DESIGNED FOR PILLOW BLOCK OR SIDE MOUNT.

## TOLERANCES

EACH MANUFACTURER OF BOWED ROLLS SET THEIR OWN IN HOUSE TOLERANCE SPECIFICATIONS. Bowed Rolls Inc TOLERANCES ARE AS FOLLOWS:

AXLE LENGTH.....± .125"

FACE LENGTH.....± .250"

AMOUNT OF BOW.....± .0625"

SLEEVE T.I.R.....± .005"

DIAMETER VARIANCE.....± .032"

BEARINGS.....PRESS FIT

## PART LIST

BEARNINGS

SPOOLS

SPACER KEYS

RUBBER SLEEVE

END CAPS

END PLATES

LOCK COLLARS

BRACKETS

SHAFT

ROPE IDLER

SEALS